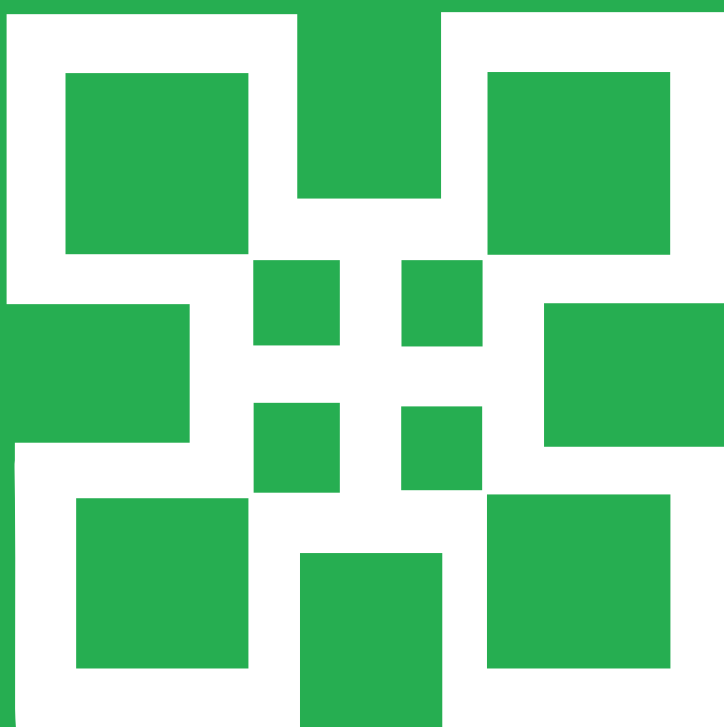


Departmental Professional Learning Community Handbook

SCIENCE

HANDBOOK FOR COORDINATORS



Wisdom, Knowledge
and Prudence



Ghana Education
Service (GES)



NATIONAL COUNCIL FOR
CURRICULUM & ASSESSMENT





GOVERNMENT OF GHANA



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**DEPARTMENTAL PROFESSIONAL LEARNING
COMMUNITY HANDBOOK**

SCIENCE

Coordinator Version

DEPARTMENTAL PROFESSIONAL LEARNING COMMUNITY HANDBOOK

This Departmental Professional Learning Community Handbook will help teachers to familiarise themselves with the details of the new Senior High School (SHS), Senior High Technical (SHTS) and Science, Technology, Engineering and Mathematics (STEM) curriculum ahead of national roll-out in 2024/25.

Professional Learning Community (PLC) sessions were introduced across all SHS and SHTS in Ghana in June 2023 and the first two PLC Handbooks were designed to be used by teachers in mixed departmental groups.

This Departmental Professional Learning Community Handbook signals a shift in approach as we focus on providing more detailed information and guidance to teachers ahead of the roll-out of the new SHS, SHTS and STEM curriculum. This Handbook is therefore intended to be used by teachers working in departmental groupings and should be used in conjunction with subject-specific Year One Teacher Manuals.

The Handbook will guide teachers and help to familiarise them with the Weekly Learning Planner and Teacher Manuals as they develop their own Learning Plans for each subject.

The Handbook contains a total of 13 Sessions covering all 24 weeks in Year One of the new SHS, SHTS and STEM curriculum. In each Session of the Handbook teachers will be expected to collectively prepare 2 weeks of Learning Plans using the information provided in their subject-specific Teacher Manuals. The structure of this Handbook is:

Session 1: Reviewing Knowledge on previous PLC sessions

Session 2: Learning Plans for weeks 1 & 2

Session 3: Learning Plans for weeks 3 & 4

Session 4: Learning Plans for weeks 5 & 6

Session 5: Learning Plans for weeks 7 & 8

Session 6: Learning Plans for weeks 9 & 10

Session 7: Learning Plans for weeks 11 & 12

Session 8: Learning Plans for weeks 13 & 14

Session 9: Learning Plans for weeks 15 & 16

Session 10: Learning Plans for weeks 17 & 18

Session 11: Learning Plans for weeks 19 & 20

Session 12: Learning Plans for weeks 21 & 22

Session 13: Learning Plans for weeks 23 & 24

Schools must ensure that they complete all 13 Sessions within a maximum of 16 weeks so that the Handbook has been completed by the end of the 2023/24 academic year.

The Handbook will ensure that teachers continue to enhance their professional practice skills and competencies, familiarising themselves with the details of the new curriculum, enabling them to help learners develop the 21st Century skills and competencies that will prepare them for further studies, the world of work and adult life.

This Handbook also provides opportunities for peer-to-peer transfer of knowledge and encourages teachers to use their subject specialisms and unique experiences to make connections between the subjects within their departments, enhancing learning experiences.

Prof Edward Appiah

Director-General

National Council for Curriculum and Assessment (NaCCA)

ACKNOWLEDGEMENTS

Special thanks to Professor Edward Appiah, Director-General of the National Council for Curriculum and Assessment (NaCCA) and all who contributed to the successful writing of the Departmental Professional Learning Community Handbooks for the new Senior High School (SHS), Senior High Technical School (SHTS) and Science Technology, Engineering and Mathematics (STEM) curriculum.

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CONTENTS

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DPLC Session 1: Reviewing concepts and skills acquired in previous DPLC sessions			
<i>The sections below provide the frame for what is to be done in the session.</i>	<i>Guidance notes on leading the session. What the DPLC Coordinator will have to say during each stage of the session</i>	<i>Guidance Notes on Teacher Activity during the DPLC Session. What teachers will do during each stage of the session</i>	<i>Time in session</i>
<i>Introduction: Review of previous learning using ideas from the last DPLC session</i>	1.1 Introduce the session with an icebreaker. 1.2 Ask teachers to share their expectations regarding what they hope to gain from the Departmental Professional Learning Community (DPLC) activities (NTS 1a, 1b). E.g. a) <i>The teacher will be able to understand how to use the DPLC Handbook and the Teacher Subject Manual</i> b) <i>How to effectively plan the lesson using the weekly planner, and work collaboratively in order to improve their professional practice, etc.</i> 1.3 Ask a teacher to read the purpose of the DPLC Handbook. Purpose: The Departmental Professional Learning Community (DPLC) Handbook is intended to serve as the 'bridge' between the	1.1 Introduce the session with an icebreaker. 1.2 Share your expectations regarding what you hope to gain from the Departmental Professional Learning Community (DPLC) activities (NTS 1a, 1b). E.g. <i>The teacher will be able to understand how to use the DPLC Handbook and the Teacher Subject Manual, etc.</i> 1.3 Read the purpose of the DPLC Handbook. Purpose: The Departmental Professional Learning Community (DPLC) Handbook is intended to serve as the 'bridge' between the	20mins

	Handbook on introduction to the Senior High School (SHS), Senior High Technical School (SHTS) and Science, Technology, Engineering and Mathematics (STEM) curriculum and the subject-based Handbook supporting all teachers to plan and teach the year one subjects in the SHS, SHTS and STEM curriculum. The main purposes of DPLC are to: <i>A) Build on Session 12 on the learning planner of the DPLC Handbook on the introduction of the SHS, SHTS and STEM curriculum to enable teachers to consolidate their understanding and application of the learning planner</i> <i>B) Support teachers to use the year one teacher manual to develop learning plans for all year one lessons in the SHS, SHTS and STEM curriculum using the learning planner</i> <i>C) Provide opportunities for teachers to discuss the year one learning planner and align them with the year one teacher manual</i> <i>D) To give teachers enough time to study the year one subjects in the SHS, SHTS and</i>	Handbook on introduction to the Senior High School (SHS), Senior High Technical School (SHTS) and Science, Technology, Engineering and Mathematics (STEM) curriculum and the subject-based Handbook supporting all teachers to plan and teach the year one subjects in the SHS, SHTS and STEM curriculum. The main purposes of DPLC are to: <i>A) Build on Session 12 on the learning planner of the DPLC Handbook on the introduction of the SHS, SHTS and STEM curriculum to enable teachers to consolidate their understanding and application of the learning planner</i> <i>B) Support teachers to use the year one teacher manual to develop learning plans for all year one lessons in the SHS, SHTS and STEM curriculum using the learning planner</i> <i>C) Provide opportunities for teachers to discuss the year one learning planner and align them with the year one teacher manual</i> <i>D) To give teachers enough time to study the year one subjects in the SHS, SHTS and</i>	

	<i>STEM curriculum and how these will be taught effectively and efficiently, etc.</i> Note: a) <i>The Handbook is thus principally aimed at helping science teachers to continue to enhance their professional practice skills and competencies. It will guide them to help learners to develop 21st century skills and competencies that will prepare them for further studies, the world of work and adult life</i> b) <i>The Handbook will provide opportunities for peer-to-peer transfer of knowledge. It will encourage science teachers to use their subject specialization and context specific teaching experiences to make connections between the teaching and learning of the related subjects in their department</i> c) <i>The Handbook contains 13 topics which cover all the 24 weekly learning planners in year one as follows:</i> i. <i>Reviewing of knowledge and</i>	<i>STEM curriculum and how these will be taught effectively and efficiently, etc.</i> Note: a) <i>The Handbook is thus principally aimed at helping science teachers to continue to enhance their professional practice skills and competencies whilst guiding them to help learners to develop 21st century skills and competencies that will prepare them for further studies, the world of work and adult life</i> b) <i>The Handbook will provide opportunities for peer-to-peer transfer of knowledge. It will encourage science teachers to use their subject specialization and context specific teaching experiences to make connections between the teaching and learning of the related subjects in their department</i> c) <i>The Handbook contains 13 topics which cover all the 24 weekly learning planners in year one as follows:</i>	

	<i>skills acquired from previous DPLC Sessions</i> <i>ii. Learning planners for weeks 1 & 2</i> <i>iii. Learning planners for weeks 3 & 4</i> <i>iv. Learning planners for weeks 5 & 6</i> <i>v. Learning planners for weeks 7 & 8</i> <i>vi. Learning planners for weeks 9 & 10</i> <i>vii. Learning planners for weeks 11 & 12</i> <i>viii. Learning planners for weeks 13 & 14</i> <i>ix. Learning planners for weeks 15 & 16</i> <i>x. Learning planners for weeks 17 & 18</i> <i>xi. Learning planners for weeks 19 & 20</i> <i>xii. Learning planners for weeks 21 & 22</i> <i>xiii. Learning planners for weeks 23 & 24</i>	<i>i. Reviewing of knowledge and skills acquired from previous DPLC Sessions</i> <i>ii. Learning planners for weeks 1 & 2</i> <i>iii. Learning planners for weeks 3 & 4</i> <i>iv. Learning planners for weeks 5 & 6</i> <i>v. Learning planners for weeks 7 & 8</i> <i>vi. Learning planners for weeks 9 & 10</i> <i>vii. Learning planners for weeks 11 & 12</i> <i>viii. Learning planners for weeks 13 & 14</i> <i>ix. Learning planners for weeks 15 & 16</i> <i>x. Learning planners for weeks 17 & 18</i> <i>xi. Learning planners for weeks 19 & 20</i> <i>xii. Learning planners for weeks 21 & 22</i> <i>xiii. Learning planners for weeks 23 & 24</i>	
2. Planning for teaching, learning and assessment activities, promoting national values, GESI, SEL, ICT, 21st century skills and differentiation	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. Purpose: The purpose of this session is to assist science teachers in revisiting the acquired knowledge, skills, and values from previous DPLC sessions in the planning of lessons using the learning planner. LO 1: Apply the knowledge and understanding of the previous DPLC sessions to effectively	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. Purpose: The purpose of this session is to assist science teachers in revisiting the acquired knowledge, skills, and values from previous DPLC sessions in the planning of lessons using the learning planner. LO 1: Apply the knowledge and understanding of the previous DPLC sessions to effectively	30mins

	integrate GESI, SEL and other cross-cutting issues in the planning of science lessons. LI 1.1 Discuss at least three pedagogies teachers have used in science lessons delivered as a result of knowledge gained from previous DPLC sessions, taking into consideration GESI, SEL, ICT, 21st century skills, Differentiation and National values. LI 1.2 Explain at least three assessment strategies teachers have applied in science lessons delivered as a result of knowledge gained from previous DPLC sessions, taking into consideration GESI, SEL, ICT, 21st century Skills, Differentiation and National values. LI 1.3 Identify at least four teaching and learning resources used in the previous DPLC sessions and how they were used to support lessons delivered. LI 1.4 Discuss at least three cross cutting issue that teachers have incorporated into their science lessons as a result of knowledge gained from previous DPLC sessions. 2.2 Ask teachers to discuss at least three pedagogies used in science lessons delivered based on knowledge gained from previous DPLC sessions that impacted learning.	integrate GESI, SEL and other cross-cutting issues in the planning of science lessons. LI 1.1 Discuss at least three pedagogies teachers have used in science lessons delivered as a result of knowledge gained from previous DPLC sessions, taking into consideration GESI, SEL, ICT, 21st century skills, Differentiation and National values. LI 1.2 Explain at least three assessment strategies teachers have applied in science lessons delivered as a result of knowledge gained from previous DPLC sessions, taking into consideration GESI, SEL, ICT, 21st century Skills, Differentiation and National values. LI 1.3 Identify at least four teaching and learning resources used in the previous DPLC sessions and how they were used to support lessons delivered. LI 1.4 Discuss at least three cross cutting issues that teachers have incorporated into their science lessons as a result of knowledge gained from previous DPLC sessions. 2.2 Discuss at least three pedagogies used in science lessons delivered based on knowledge gained from previous DPLC sessions that impacted learning.	

	<i>E.g.</i> a) <i>Experiential Learning: The approach where emphasis is placed on hands-on, practical experiences as a way of acquiring knowledge, skills and understanding. It involves engaging actively with real-world situations that help to enhance retention and understanding when theory is connected to practice</i> b) <i>Collaborative Learning: The learning practice where learners work together in groups to achieve common, shared learning goals. This approach encourages interaction, cooperation and communication among learners that promotes critical thinking, problem-solving, exchange of various perspectives and real-world teamwork</i> c) <i>Talk for Learning: This is the practice of using discussions and conversations as a tool to promote learning. This encourages learners to share ideas, ask questions, and explore</i>	<i>E.g.</i> <i>Experiential Learning: The approach where emphasis is placed on hands-on, practical experiences as a way of acquiring knowledge, skills and understanding. It involves engaging actively with real-world situations that help to enhance retention and understanding when theory is connected to practice, etc.</i> .	

	<i>different views, to develop their skills in communication and deepen their understanding of the subject matter</i> <i>d) Digital Learning: Learners use ICT tools to assess information in relation to the lesson and make presentations using ICT tools, etc.</i> 2.3 Ask teachers to explain at least three assessment strategies they have applied in their science lessons which incorporate GESI, SEL, ICT, 21st century skills, Differentiation, and National values. <i>E.g.</i> <i>a) Multiple Choice Tests: These are tests in which each item has a stem followed by options (alternatives) from which the respondent selects what she/he considers as the option that best completes or answers the stem. The multiple-choice questions were composed of four parts. These are stem (question or incomplete statement), options (suggested answers or completions), distractors/Foils (incorrect responses)</i>	2.3 Explain at least three assessment strategies you applied in your science lessons which incorporate GESI, SEL, ICT, 21st century skills, Differentiation, and National values. <i>E.g.</i> <i>Multiple Choice Tests: These are tests in which each item has a stem followed by options (alternatives) from which the respondent selects what she/he considers as the option that best completes or answers the stem. The multiple-choice questions were composed of four parts. These are stem (question or incomplete statement), options (suggested answers or completions), distractors/Foils (incorrect responses) and the Key (correct responses). Learners were asked to answer at</i>	

	<i>and the Key (correct responses). Learners were asked to answer at least five out of ten questions. This was to allow for differentiation. The questions were projected on a screen for all learners to see. After marking, the highly proficient learners together with the teacher assisted the weaker learners. They were also encouraged that they could do it and not to give up. Learners show kindness and respect to one another in mixed ability groups; learners accommodate one another during reflections; Learners become independent thinkers but also show respect to one another and acknowledge their strengths and weaknesses</i> <i>b) Project based assessment: In a graphic design class session, learners undertook a project to design a gift card for a fictional boutique coffee shop. This project aimed to apply graphic design principles, emphasize branding and design</i>	<i>least five out of ten questions. This was to allow for differentiation. The questions were projected on a screen for all learners to see. After marking, the highly proficient learners together with the teacher assisted the weaker learners. They were also encouraged that they could do it and not to give up. Learners show kindness and respect to one another in mixed ability groups; learners accommodate one another during reflections; Learners become independent thinkers but also show respect to one another and acknowledge their strengths and weaknesses, etc.</i>	

	consistency, develop technical skills, and encourage effective collaboration among learners. The key objectives of the project were outlined, including the application of graphic design principles to create an appealing gift card, understanding the significance of branding and design consistency, developing proficiency in industry-standard software tools, and fostering effective teamwork and collaboration. The process began with a comprehensive project briefing that provided learners with essential information and guidelines. It involved research and brainstorming, where learners explored design styles and collaborated in small groups. The process also included design and software training, prototyping with peer feedback, final design presentations, and rubric/metric for reporting. The outcomes included the enhancement of design skills, effective collaboration, the application of real-world skills with		

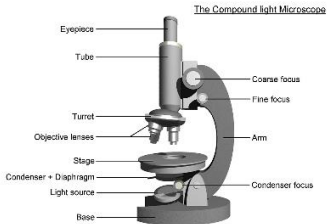
	<i>design software, encouragement of creativity and critical thinking, and the assessment of learning through self-reflection</i> <i>c) Problem Solving Approach: In mixed ability groups learners were tasked to perform calculations involving the amount of substance, number of entities and molar quantities and make a presentation in any mode. Learners were encouraged to notice individuals of different backgrounds as they collaborate to plan and work together to solve the problem</i> <i>d) Practical: learners were asked to demonstrate their practical measurement skills by measuring various instruments. In mixed-ability groups learners were tasked to measure a meter rule using a standard tape measure. The learners carefully noted down the length, ensuring precision in their readings. This task not only assessed their ability to use basic measuring tools but also emphasized the importance of</i>		

	<i>accuracy in scientific measurements. Learners were then tasked with measuring the dimensions of a small object using the Vernier calipers. They recorded both the inner and outer dimensions to understand how to use the instrument effectively for precise measurements. This exercise allowed the teacher to assess their comprehension of using advanced measuring equipment. Finally, learners were asked to determine the mass of various objects. Each learner carefully placed the object on the balance pan, adjusted the weights, and recorded the readings. This activity not only assessed their skill in measuring mass but also their understanding of the principles of balance operation, etc.</i>		
	2.4 Ask teachers in their (mixed-ability, gender and social-inclusions, where applicable) groupings to identify at least four (4) resources used in their previous lessons and share how they used them to support their lessons.	2.4 In your (mixed-ability, gender and social-inclusions, where applicable) groupings identify at least four (4) resources used in their previous lessons and share how they used them to support their lessons.	

	<i>E.g. Resources Used to Support the Lessons:</i> a) <i>Biology (Microscope Slide, Coverslip, Dissecting kits, Microscope etc.)</i> i. <i>Microscope slide: A dropping pipette was used to place a drop of water on the specimen in order to prepare a wet mount slide. A cover slip is placed at the edge of the slide, and with the help of toothpick or hypotonic needle, the cover slip was gently lowered onto the slide (This will prevent air bubbles from being trapped under the cover slip). Finally, the slide was placed on the stage of the microscope for observation using the adjustment knobs, etc.</i>  ii. <i>Compound Microscope: The revolving Turret was turned so that the power objective lens (e.g. 4x) was clicked</i>	<i>E.g. Resources Used to Support the Lessons:</i> a) <i>Biology (Microscope slide, Coverslip, Dissecting kits, Microscope etc.)</i> <i>Microscope slide: A sample specimen was placed on the slide. A dropping pipette was used to place a drop of water on the specimen in order to prepare a wet mount slide. A cover slip is placed at the edge of the slide, and with the help of toothpick or hypotonic needle, the cover slip was gently lowered onto the slide (This will prevent air bubbles from being trapped under the cover slip). Finally, the slide was placed on the stage of the microscope for observation using the adjustment knobs, etc.</i> 	

	into position. The microscope slide was placed on the stage and fastened with the stage clips. The objective lens and the stage were looked at from the side and the coarse focus turned so that the stage moved up. The stage was moved up as far as it could go without letting the objective lens touch the coverslip. The image was brought into focus by moving the fine focus whilst looking through the eyepiece. In order to get the greatest amount of light, the condenser and diaphragm were adjusted. Additionally, the microscope slide was moved round until the sample was in the centre of the field of view (what you see) and clipped onto the stage. The sample is placed into focus by using the coarse focus and the fine focus readjusted to		

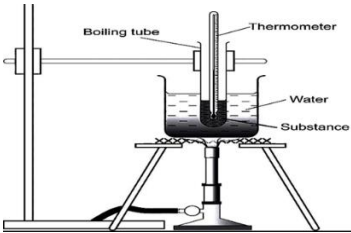
	<i>obtain a very clear image.</i> Note: a) <i>When you have a clear image of your sample with the lowest power objective, you can change to the next objective lenses. You might need to readjust the sample into focus and/or readjust the condenser and light intensity. If you cannot focus on your specimen, repeat steps 3 through 5 with the higher power objective lens in place. Do not let the objective lens touch the slide!</i> b) <i>When finished, lower the stage, click the low power lens into position and remove the slide</i> c) <i>Do not touch the glass part of the lenses with your fingers. Use only special lens paper to clean the lenses</i> d) <i>Always keep your microscope covered when not in use</i> e) <i>Always carry a microscope with</i>	Note: a) <i>When you have a clear image of your sample with the lowest power objective, you can change to the next objective lenses. You might need to readjust the sample into focus and/or readjust the condenser and light intensity. If you cannot focus on your specimen, repeat steps 3 through 5 with the higher power objective lens in place. Do not let the objective lens touch the slide!</i> b) <i>When finished, lower the stage, click the low power lens into position and remove the slide</i> c) <i>Do not touch the glass part of the lenses with your fingers. Use only special lens paper to clean the lenses.</i> d) <i>Always keep your microscope covered when not in use.</i> e) <i>Always carry a microscope with</i>	

	<i>both hands. Grasp the arm with one hand and place the other hand under the base for support, etc.</i> <i>The Compound Microscope</i>  <i>b) Chemistry (Pipette, volumetric flask, burette, chemical balance, organic models, gas preparation kits, goggles etc.)</i> <i>I. Pipette: The pipette was used to measure a fixed volume of distilled water from a beaker into a conical flask</i> <i>II. Chemical balance: The chemical balance was used to measure 25g of NaCl (table salt) for the preparation of salt solution, etc.</i> <i>c) Physics (meter rule, vernier calliper, electronic balance, micrometer screw gauge etc.)</i> <i>i. Meter rule: The meter rule was</i>	<i>both hands. Grasp the arm with one hand and place the other hand under the base for support, etc.</i> <i>b) Chemistry (Pipette, volumetric flask, burette, chemical balance, organic models, gas preparation kits, goggles etc.)</i> <i>Pipette: The pipette was used to measure 25cm³ volume of distilled water from a beaker into a conical flask, etc.</i> <i>c) Physics: meter rule, etc.</i> <i>Meter rule: The meter rule was explained as a versatile measuring</i>	

	<i>explained as a versatile measuring instrument used for determining length and distance. It was employed by placing one end at the starting point of an object and extending it to measure the object's length accurately, using the markings in centimetres (cm) and millimetres (mm). The meter rule was used to compare lengths, draw straight lines, measure dimensions of objects and calculate perimeters of shapes. The meter rule was demonstrated as a fundamental tool for precise measurements which extends across a wide range of professional fields and everyday activities where precise lessons and distance measurements are essential, etc.</i>	<i>instrument used for determining length and distance. It was employed by placing one end at the starting point of an object and extending it to measure the object's length accurately, using the markings in centimetres (cm) and millimetres (mm). The meter rule was used to compare lengths, draw straight lines, measure dimensions of objects and calculate perimeters of shapes. The meter rule was demonstrated as a fundamental tool for precise measurements which extends across a wide range of professional fields and everyday activities where precise lessons and distance measurements are essential, etc.</i>	
	<i>d) ICT / Computing: Projector, Laptop, Smartphones,</i>	<i>d) ICT / Computing: Projector, etc.</i>	

	<i>Notepad, Open Educational Resources e.g., YouTube, etc.</i> i. <i>Projector: The Projector was used to display images and videos, show demonstrations, simulations and interactive content of the lesson</i>  ii. <i>Laptop: They were used to prepare presentations such as videos, PowerPoints, simulations, etc.</i>  e) <i>General science (Heat source (e.g., Bunsen burner or electric stove), a metal pot or beaker, thermometer, water, stopwatch or timer) Experiment to show that science is empirical Procedure:</i>	<i>Projector: The Projector was used to display images and videos, show demonstrations, simulations and interactive content of the lesson, etc.</i> 	

	i. <i>Fill the metal pot or beaker with a fixed amount of water (e.g., 500 ml)</i> ii. <i>Insert the thermometer into the water without touching the bottom of the container</i> iii. <i>Place the pot on the heat source (Bunsen burner or electric stove).</i> iv. <i>Gradually increase the heat and monitor the temperature using the thermometer</i> v. <i>As the water temperature rises, observe and record the changes in temperature</i> vi. <i>When the water boils, read the temperature and start the timer</i> vii. <i>Continue boiling the water and monitor the temperature every 30 seconds for a few minutes</i> viii. <i>Repeat the experiment at least three times to ensure consistency and accuracy of results</i> • <i>Expected Results: According to the hypothesis, the boiling point of water at sea level is expected</i>		

	to be 100 degrees Celsius (212 degrees Fahrenheit). Therefore, during the experiment, we should observe that the water reaches its boiling point around this temperature range and remains relatively constant as long as it continues to boil, etc.  2.5 Ask teachers to think-pair and share with the larger group three cross-cutting issues that they incorporated in their lessons as a result of knowledge gained from the previous DPLC sessions: E.g., a) <i>ICT</i> <i>Integration: Teacher used laptop and projector to deliver his/her lessons, used smartphone to access information from the internet in relation to the lesson. Learners were also given the opportunity to use ICT devices to access</i>	2.5 Think-pair and share with the larger group three cross-cutting issues that they incorporated in their lessons as a result of knowledge gained from the previous DPLC sessions: E.g., <i>ICT</i> <i>Integration: Teacher used laptop and projector to deliver his/her lessons, used smartphone to access information from the internet in relation to the lesson. Learners were also given the opportunity to use ICT devices to access</i>	

	<i>information and watch YouTube videos in relation to the lesson as well as make presentations</i> <i>b) Differentiation: Learners performed tasks in mixed ability groups and were assessed using the various DOK levels. Teachers provided learners with different paths for learning and support learners' academic growth and achievement, so as to help them reach their full potential</i> <i>c) Social and Emotional Learning: Learners were encouraged to manage their emotions, create positive relationships with others, develop empathy, build resilience and tolerate one another's views in their discussions, etc.</i>	<i>information and watch YouTube videos in relation to the lesson as well as make presentations, etc.</i>	
	<i>Refer to Appendix 1 for a sample learning plan ner</i>	<i>Refer to Appendix 1 for a sample learning planner</i>	

4. Evaluation and review of the session: Noting that teachers need to identify critical friends to observe lessons and report at the next session	4.1 Ask teachers in groups to reflect, write and share what they have learned from all the DPLC sessions and how they feel, with the larger group (NTS 1a,). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to DPLC Session 1 and provide feedback to them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 1 and 2 of the teacher manual ahead of time and the DPLC Handbook Session 2 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 In groups, reflect, write and share what you have learned from all the DPLC sessions and how you feel, with the larger group (NTS 1a). 4.2 Where possible, identify a critical friend to observe your lesson in relation to DPLC Session 1 and provide feedback to you (NTS 3I). 4.3 Remember to read the contents of Weeks 1 and 2 of the teacher manual ahead of time and the DPLC Handbook Session 2 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10 mins

DPLC Session 2: Developing learning plans for Weeks 1 and 2			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 1, <i>reviewing concepts and skills acquired in previous DPLC Sessions</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 1, <i>reviewing concepts and skills acquired in previous DPLC Sessions</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 1, <i>reviewing concepts and skills acquired in previous DPLC Sessions</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 1, <i>reviewing concepts and skills acquired in previous DPLC Sessions</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to support science teachers to use the teacher manual to develop learning plans for lessons in Weeks 1 and 2 of the teacher manuals. Science teachers will develop learning plans for the following lessons: A. <i>General Science: Characteristics of science in nature and its application to design a project</i> B. <i>ICT: Create multimedia documents using appropriate computing tools</i> C. <i>Biology: The importance and branches of biology, and the scientific method and its application to everyday life</i> D. <i>Chemistry: Introduction to chemistry, chemical processes and safety as well as chemical storage and the scientific method of enquiry</i> E. <i>Physics: Application of physics in some sectors of the global economy,</i>	Purpose: The purpose of this session is to support science teachers to use the teacher manual to develop learning plans for lessons in Weeks 1 and 2 of the teacher manuals. Science teachers will develop learning plans for the following lessons: A. <i>General Science: Characteristics of science in nature and its application to design a project</i> B. <i>ICT: Create multimedia documents using appropriate computing tools</i> C. <i>Biology: The importance and branches of biology, and the scientific method and its application to everyday life</i> D. <i>Chemistry: Introduction to chemistry, chemical processes and safety and chemical storage and the scientific method of enquiry</i> E. <i>Physics: Application of physics in some sectors of the global</i>	

	<i>units and measurement</i> <i>F. Computing: Apply computer Architecture concepts related to the design of modern processors, memories, Input and Output to manipulate data, etc.</i> LO 1: Review a subject-specific learning plan for teaching week 1 and develop a subject-specific learning plan for teaching Week 2 in the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3k and 3o). LI 1.1 Relate the important aspects in Weeks 1 and 2 science lessons of the teacher manual including content standards, LOs, LIs, key concepts, essential questions, pedagogical exemplars and assessment strategies to the sections of the learning planner template. LI 1.2 Complete the learning planner templates for week 2 Science lessons in the teacher manual taking into consideration cross-cutting issues, responsive pedagogical and assessment strategies,	<i>economy, units and measurement</i> <i>F. Computing: Apply computer Architecture concepts related to the design of modern processors, memories, Input and Output to manipulate data, etc.</i> LO 1: Review a subject-specific learning plan for teaching week 1 and develop a subject-specific learning plan for teaching Week 2 in the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3k and 3o). L1.1 Relate the important aspects in Weeks 1 and 2 science lessons of the teacher manual including content standards, LOs, LIs, key concepts, essential questions, pedagogical exemplars and assessment strategies to the sections of the learning planner template. LI 1.2 Complete the learning planner templates for week 2 Science lessons in the teacher manual taking into consideration cross-cutting issues, responsive pedagogical and assessment	

	essential questions and resources proposed in the teacher manual. LO 2: Review the learning plans for Week 2 of the subject based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, teaching and learning activities, assessment and closure) of learning plans for Week 2 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Week 2 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects for week 2. Refer to Appendix 2.1 and Appendix 2.2 of the DPLC Handbook (NTS 1a, 1b, 2a and 2c). 2.3 Ask teachers to discuss at least two essential questions in preparation towards the lessons in week 2 (NTS 1a, 2b, 2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week 1)</i>	strategies, essential questions and resources proposed in the teacher manual. LO 2: Review the learning plans for Week 2 of the subject based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, teaching and learning activities, assessment and closure) of learning plans for Week 2 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Week 2 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subjects in week 2 of your teacher manual. Refer to Appendix 2.1 and Appendix 2.2 of the DPLC Handbook (NTS 1a, 1b, 2a and 2c). 2.3 Discuss at least two essential questions in preparation towards the lessons in week 2 (NTS 1a, 2b, 2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week 1)</i>	

	i. <i>How do I apply knowledge of the characteristics of science to design science-based projects?</i> ii. <i>How do I use experiments to demonstrate and explain the characteristics of science?, etc.?</i> b) <i>ICT (Week 1)</i> i. <i>How is software, hardware and other computing features used to create a document?</i> ii. <i>What is the best approach to teach creating documents with hardware, software and other computing features?, etc.</i> c) <i>Biology (Week 1)</i> i. <i>How relevant is biology to everyday life?</i> ii. <i>How can learners use the knowledge of biological concepts to make life easier?, etc.</i> d) <i>Chemistry (Week 1)</i> i. <i>How will I relate the content, introduction to chemistry, chemical processes and safety to real life situations for</i>	<i>How do I apply knowledge of characteristics of science to design science-based project?, etc.</i> b) <i>ICT (Week 1)</i> <i>How are software, hardware and other computing features used to create a document?, etc.</i> c) <i>Biology (Week 1)</i> <i>How relevant is biology to everyday life?, etc.</i> d) <i>Chemistry (Week 1)</i> <i>How will I relate the content, introduction to chemistry, chemical processes and safety to real life situations</i>	

	<i>learners to understand?</i> ii. <i>What is the best approach to teach introduction to chemistry to meet the varied needs of learners?, etc.</i> e) <i>Physics (Week 1)</i> i. <i>How does physics contribute to technological advancements and everyday applications?</i> ii. <i>What is the best approach to teach the role of physics for all learners to benefit from the lesson, etc.</i> f) <i>Computing (Week 1)</i> i. <i>How can bit pattern be useful in everyday life?</i> ii. <i>How are bit patterns represented in computing?, etc.</i> g) <i>General Science (Week 2)</i> i. <i>In what ways can the knowledge of characteristics of science be applied in everyday life?</i> ii. <i>How do I create a concept map on the characteristics of science?, etc.</i> h) <i>ICT (Week 2)</i> i. <i>In what ways can the cross-cutting</i>	<i>for learners to understand?, etc.</i> e) <i>Physics (Week 1)</i> <i>How does physics contribute to technological advancements and everyday applications?, etc.</i> f) <i>Computing (Week 1)</i> <i>How can bit pattern be useful in everyday life?, etc.</i> g) <i>General Science (Week 2)</i> <i>In what ways can the knowledge of characteristics of science be applied in everyday life?, etc.</i> h) <i>ICT (Week 2)</i> <i>In what ways can the cross-cutting themes</i>	

	<i>themes - 21st century skills, GESI, SEL, and National values be integrated in teaching the creation of documents with hardware, software and other computing features?</i> <i>ii. How are software, hardware and other computing features used in other subject areas such as math, English, biology?, etc.</i> <i>i) Biology (Week 2)</i> <i>i. How will I help learners to use the scientific method to solve everyday problems?</i> <i>ii. How can I use the knowledge of scientific method to help learners think critically?, etc.</i> <i>j) Chemistry (Week 2)</i> <i>i. How will the knowledge and understanding of the scientific method of enquiry encourage learners to be critical thinkers?</i> <i>ii. How will the knowledge and understanding of safety foster a</i>	<i>- 21st century skills, GESI, SEL, and National values be integrated in teaching the creation of documents with hardware, software and other computing features?, etc.</i> <i>i) Biology (Week 2)</i> <i>How will I help learners to use the scientific method to solve everyday problems?, etc.</i> <i>j) Chemistry (Week 2)</i> <i>How will the knowledge and understanding of the scientific method of enquiry encourage learners to be critical thinkers?</i>	

	<i>culture of safety among learners?, etc.</i> <i>k) Physics (Week 2)</i> <i>i. How can I connect measurements to real-life situations and applications?</i> <i>ii. How can I make connections to other subjects' area, such as math and technology to demonstrate the interdisciplinary nature of measurement?, etc.</i> <i>l) Computing (Week 2)</i> <i>i. How can bit patterns be used to represent different types of data, such as numbers, characters, and images?</i> <i>ii. What is the best approach to teach data representation as bit patterns for all learners to benefit from the lesson?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 1 and 2. Inform teachers to see the teacher manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j).	<i>k) Physics (Week 2)</i> <i>How can I connect measurements to real-life situations and applications?, etc.</i> <i>l) Computing (Week 2)</i> <i>How can bit patterns be used to represent different types of data, such as numbers, characters, and images?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 1 and 2. See teacher manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j).	

	<i>E.g.</i> a) <i>General Science (Week 1)</i> i. <i>Learning Tasks</i> • <i>Write at least three situations in life where characteristics of science are evident</i> • <i>Identify at least four characteristics of science in nature</i> • <i>Explain at least four characteristics of science in nature, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Learners think about the importance of science and discuss their ideas with a peer. The teacher asks learners to present their ideas to the whole class. The teacher presents videos, charts, pictures, and demonstrations on the characteristics of science to learners and learners in mixed-ability groups discuss the</i>	<i>E.g.</i> a) <i>General Science (Week 1)</i> i. <i>Learning Tasks</i> <i>Write at least three situations in life where characteristics of science are evident, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Learners think about the importance of science and discuss their ideas with a peer. The teacher asks learners to present their ideas to the whole class. The teacher presents videos, charts, pictures, and demonstrations on the characteristics of science to learners and learners in mixed-ability groups discuss the characteristics of science, considering the meaning, importance, and</i>	

	<i>characteristics of science, considering the meaning, importance, and real-life applications</i> • <i>Learners in mixed ability groups perform an experiment as shown in fig. 1, 2, 3 to demonstrate the characteristics of science such as replicability, predictability (the ability of scientific investigations to make accurate and reliable predictions about future events), empirical (relies on observations and data gathered)</i> • <i>Learners reflect and share their views of different situations in life where the characteristics of science are evident with peers for critique</i> • <i>Group learners create a poster showing the key characteristics</i>	<i>real-life applications, etc.</i>	

	<i>of science /definitions, significance, and application in daily life for a whole class gallery walk and presentation, etc.</i> iii. Key Assessments (DoK): • Level 1: Identify at least four (4) characteristics of science • Level 2: Explain four (4) characteristics of science • Level 2: Explain at least any four (4) characteristics of science in everyday life • Level 2: Explain the need to study the characteristics of science • Level 2: Describe how the scientific processes can be used to make predictions, etc. b) ICT (Week 1) i. Learning Task: • The teacher should start the	iii. Key Assessments (DoK): Level 1: Identify at least four (4) characteristics of science, etc. b) ICT (Week 1) i. Learning Task: The teacher should start the	

	<i>lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners brainstorm about the computer and what it requires to work efficiently</i> • <i>Teachers can ask learners in their groups to individually think-write-share with their group members the definition of a computer and agree on one definition. Teachers can then ask each group to present their definition</i> • <i>Teachers should task learners in their groups to brainstorm the purpose of computers in everyday life and ask each group to share their write up with the class using tell-it-all</i>	<i>lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners brainstorm about the computer and what it requires to work efficiently, etc.</i>	

	• <i>Teachers can ask learners in their groups to individually think-write-share with their group members the definition of computer hardware and software based on the outcome of the purposes of a computer. Teachers can then ask each group to present their definition</i> • <i>Using a projector, teachers project a designed puzzle of names of hardware and software components and ask learners to write out words from the puzzle. Teachers ask members in each group to read out their words and ask other groups to write computer related words down. Teachers ask each group to regroup their written words under hardware and software components of a computer and present their</i>		

	<i>responses to the class</i> • <i>Teachers tasked each group to discuss the categories of hardware and software components with examples and present their results with the class. Teachers guide the whole class to draw the relations between hardware and software components, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Think Pair Share: Using mixed-ability/mixed gender groups, learners think, write and discuss the definition of a computer and its purposes, software and hardware components addressing inclusivity and equity. For example, input devices should be discussed to address accessibility issues for</i>	ii. <i>Pedagogical Exemplars:</i> <i>Think Pair Share: Using mixed-ability/mixed gender groups, learners think, write and discuss the definition of a computer and its purposes, software and hardware components addressing inclusivity and equity. For example, input devices should be discussed to address accessibility issues for learners with disabilities such as visual</i>	

	<i>learners with disabilities such as visual impairment, dyslexia, and dysgraphia</i> • <i>Tell-it-all: In small groupings, (ability, language, background, gender, etc.), learners list some hardware and software related words from a puzzle and group the words into hardware and software components. One group gives examples of hardware from their write up. Other groups repeat examples given by others and add their examples. This activity is repeated for examples of software as well</i> • <i>Ink-Pair-Share: In pairs, learners write the relationship between hardware and software components using pen and paper and exchange their</i>	<i>impairment, dyslexia, and dysgraphia, etc..</i>	

	<i>write ups with their colleagues. The teachers randomly select a few learners to read what colleagues wrote. Teacher then guides learners to draw a clear relationship between software and hardware components of a computer system, etc.</i> iii. Key Assessments (DoK): • Level 1: What is a computer? • Level 2: The external and internal devices and equipment that enable you to perform major functions such as input, output, storage, communication, processing, and more is known as • Level 3: Distinguish between application software and systems software • Level 4: It is the hardware part of the computer that makes the computer	iii. Key Assessments (DoK): Level 1: What is a computer?, etc.	

	<i>intelligent and not the software. True or False. (Explain your answer), etc.</i> c) <i>Biology (Week 1)</i> i. <i>Learning Task:</i> • <i>Explain the term Biology. Limit content expectation to the definition of Biology</i> • <i>Describe at least four ways in which the knowledge of Biology is useful in everyday life. Extend content expectation to the discussion /explanation of how useful the knowledge of Biology is in the following areas of food production, gardening, home hygiene, human, animal, and plant health as well as conservation of natural resources</i> • <i>Discuss the importance of Biology in the production of Honey, Dry fish/ "Kobi", and bottled fruit juice. Extend</i>	c) <i>Biology (Week 1)</i> i. <i>Learning Task:</i> <i>Explain the term Biology. Limit content expectation to the definition of Biology, etc.</i>	

	<i>content response to the importance of Biology in the following areas</i> <i>Honey production, dried fish / “koobi” and bottled juice, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>• Learners in mixed ability, gender-balanced groups, observe pictures and videos of specimens relating to Biology (e.g., honey and dried Tilapia, etc.) and share ideas with peers and accept feedback</i> <i>• Learners in mixed-ability groups learn from each other and provide emotional support to one another to achieve targets</i> <i>• Learners in pairs discuss, analyse and share the contribution of biologists in the development of society; learners learn from each other and improve upon</i>	<i>ii. Pedagogical Exemplars:</i> <i>Learners in mixed ability, gender-balanced groups, observe pictures and videos of specimens relating to Biology (e.g., honey and dried Tilapia, etc.) and share ideas with peers and accept feedback, etc.</i>	

	<i>their communication skills.</i> • <i>Learners speak politely and clearly as they share ideas on the video and pictures they watched with their peers and accept constructive feedback from their peers, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: What is Biology?</i> • <i>Level 2: How is the knowledge of Biology applied in everyday life?</i> • <i>Level 3: Discuss the importance of Biology in the production of Honey, dried fish/ “koobi” and bottled fruit juice.</i> • <i>Level 4: Describe briefly how you will use the knowledge gained in Biology to reclaim degraded land, etc.</i> d) <i>Chemistry (Week 1)</i> i. <i>Learning Tasks:</i> • <i>Discuss and distinguish</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: What is Biology?, etc.</i> d) <i>Chemistry (Week 1)</i> i. <i>Learning Tasks:</i> <i>Discuss and distinguish</i>	

	<i>between the traditional branches of chemistry</i> • <i>Discuss the centrality of chemistry as a science discipline which is related to other science subjects</i> • <i>Draw flowcharts and pictures to summarise ways in which chemistry affects daily lives under the following headings: (Food and nutrition, Agriculture, Medicine, Transportation, Energy, etc.)</i> ii. <i>Pedagogical Exemplars:</i> • <i>Divide learners into mixed ability groups and show them video or slide/pictures on varieties of natural and artificial phenomena that can be explained by chemistry. Visually impaired learners should be considered and alternative</i>	<i>between the traditional branches of chemistry, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Divide learners into mixed ability groups and show them video or slide/pictures on varieties of natural and artificial phenomena that can be explained by chemistry. Visually impaired learners should be considered and alternative plans made for them, etc.</i>	

	<i>plans made for them</i> • <i>Guide learners to discuss and distinguish among the traditional branches of chemistry. Ask questions and encourage all learners to talk in the group</i> • <i>Using mixed ability groups, guide learners to draw flowcharts and pictures to summarise ways in which chemistry affects daily lives under the following headings: (Food and nutrition, Agriculture, Medicine, Transportation, Energy, etc.), etc.</i> <i>Note: SEN learners should be considered and alternative plans made for them</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: State three careers that are related to chemistry</i> • <i>Level 2: State and explain at least three benefits of chemistry to the</i>	<i>Note: SEN learners should be considered and alternative plans made for them.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: State three careers that are related to chemistry, etc.</i>	

	<i>Ghanaian society</i> • <i>Level 3: Undertake research on the importance of chemistry to the Ghanaian society in the field of agriculture and present your findings using PowerPoint or flipcharts, etc.</i> e) <i>Physics (Week 1)</i> i. <i>Learning Tasks:</i> • <i>Identify Physics-related careers across the various sectors of the economy</i> • <i>Identify a selection of branches of Physics</i> • <i>Give further explanation as to the scope of some of the branches of Physics</i> • <i>Link the branches of Physics to examples of careers, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Learners could watch a documentary that illustrates how physics plays a vital role in shaping the</i>	e) <i>Physics (Week 1)</i> i. <i>Learning Tasks: Identify Physics-related careers across the various sectors of the economy, etc.</i> ii. <i>Pedagogical Exemplars: Learners could watch a documentary that illustrates how physics plays a vital role in shaping the</i>	

	<i>world. Let learners identify Physics-related careers linking to branches of physics that the learner may have met before e.g. mechanics, electricity, waves</i> <i>• In groups, learners should be given a list of Physics-oriented careers, cutting across indigenous careers (such as masonry, welding, vulcanising, etc), education, engineering, health and allied sciences, geophysics, materials science, metallurgy, laser physics, astrophysics, meteorology, climate science, computing, etc. Learners discuss the relation of these careers with Physics, the required education and inclusivity</i> <i>• Organise a career panel with guest speakers from various Physics-</i>	<i>world. Let learners identify Physics-related careers linking to branches of physics that the learner may have met before e.g. mechanics, electricity, waves, etc.</i>	

	<i>related professions. Learners should prepare questions and engage in discussions with the panellists</i> • <i>Learners could do a research task to find out more about one of the careers mentioned previously and could be asked to volunteer to present their finding in a short oral presentation (or could alternatively produce a written piece of work). Note that more able learners should be encouraged to research a job that links to a branch of Physics which may be new to them (electromagnetism, nuclear physics, astronomy, etc) whereas less able learners may find the task more accessible if a more recognisable branch of</i>		

	<i>Physics or career is suggested to them, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Identify at least five Physics related careers in your community</i> • <i>Level 2: Describe at least three branches of Physics and give examples of careers which utilise the study of these</i> • <i>Level 1: Discuss the application of the principles of Physics in any industry of your choice, etc.</i> f) <i>Computing (Week 1)</i> i. <i>Learning Task:</i> • <i>Play an activity ball game with the learners for the binary numbers' conversion. Write down a list of decimal numbers for the conversion (e.g.: 1-9 these varied numbers will cater for differentiation) and passing the activity ball to any learner randomly, the</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: Identify at least five Physics related careers in your community, etc.</i> f) <i>Computing (Week 1)</i> i. <i>Learning Task:</i> <i>Play an activity ball game with the learners for the binary numbers' conversion. Write down a list of decimal numbers for the conversion (e.g.: 1-9 these varied numbers will cater for differentiation) and passing the activity ball to any learner randomly, the learner with the</i>	

	<i>learner with the ball converts one of the decimal numbers of their choice in their books). Another activity may be to have a hat containing numbers on paper, learners pick random numbers to convert to binary</i> • <i>Use the answers of the learners to categorise the learners into proficiency levels and proceed to the differentiated tasks, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>The teacher should build on the learners understanding by playing flash cards games (or related) with the learners in their mix-ability groupings before proceeding to the binary number conversions to decimal numbers and decimal numbers to binary numbers</i>	<i>ball converts one of the decimal numbers of their choice in their books). Another activity may be to have a hat containing numbers on paper, learners pick random numbers to convert to binary, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>The teacher should build on the learners understanding by playing flash cards games (or related) with the learners in their mix-ability groupings before proceeding to the binary number conversions to decimal numbers and decimal numbers to binary numbers, etc.</i>	

	• <i>Team teaching is recommended for the conversion activities. The teacher(s) should emphasise on how computers understand only binary numbers (“0s” and “1s”). The teacher can invite a mathematics teacher to support him/her on the delivery of this content before doing some of the suggested activities above), etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Convert decimal numbers into their binary representations</i> • <i>Level 2: Given the binary number 101101, divide it into groups of three bits starting from the right. Add leading zeros if necessary. Convert each group into its decimal representation, etc.</i>		
		iii. <i>Key Assessments (DoK):</i> <i>Level 1: Convert decimal numbers into their binary representations, etc.</i>	

	<i>g) General science (Week 2)</i> <i>i. Learning task:</i> <i>Identify three steps involved in designing science projects</i> <i>Describe how to design science-based projects using the characteristics of science. Design a science-based project using characteristics of science</i> <i>Give an example of designing science-based projects where the characteristics of science can be identified, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Provide videos, charts, diagrams, and pictures for learners on designing science-based projects using the characteristics of science in nature</i> <i>In mixed-ability groups, learners discuss the step-by-step science characteristics</i>	<i>g) General science (Week 2)</i> <i>i. Learning task:</i> <i>Identify three steps involved in designing science projects, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Provide videos, charts, diagrams, and pictures for learners on designing science-based projects using the characteristics of science in nature, etc.</i>	

	<i>used in videos, charts, diagrams, and pictures to design the project</i> • <i>Demonstrate how the characteristics of science (empiricism, systematic observation, objectivity, tentativity) are used in designing a project for the learners</i> • <i>In mixed-ability groups, provide hands-on experimentation for learners on characteristics of science. Allow learners to explain the characteristics of science demonstrated in the experiment. For example, an experiment to show the empirical nature of science</i> • <i>Learners present their findings from the experiment to the class for peer review or critique</i> • <i>Encourage learners to seek</i>		

	<i>feedback from peers and teachers, iterate on their designs, and reflect on the iterative design process to enhance learning outcomes, etc.</i> iii. <i>Key Assessments (DOK):</i> • <i>Level 2: Describe the characteristics of science when designing a scientific project</i> • <i>Level 3: Identify three characteristics of science and discuss how each can enhance the effectiveness of a scientific project's design</i> • <i>Level 4: Why is gathering and analysing data during the design process essential? Provide examples of how empirical evidence can influence design decisions, etc.</i> h) <i>ICT (Week 2)</i> i. <i>Learning task:</i> • <i>Creating a new document using a word processing</i>	iii. <i>Key Assessments (DOK):</i> <i>Level 2: Describe the characteristics of science when designing a scientific project, etc.</i> h) <i>ICT (Week 2)</i> i. <i>Learning task:</i> <i>Creating a new document using a word processing software (Google</i>	

	<i>application (Word or Office 365) and saving it using the “save as” command”</i> • <i>Creating and saving a word processing document on the desktop, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Engage in project-based learning and practical sessions to create, save, edit and format educational artefacts using word processing software (e.g., MS Word, Google Docs), taking into consideration the groupings under the Home tab and the features under each group of the Microsoft office word window. Use these features such as cut, copy, paste, using thesaurus, spelling and grammar check. Ensure inclusivity and equity in using ICT tools</i>	<i>Docs, MS Word or Office 365) and saving it using the “save as” command”, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Engage in project-based learning and practical sessions to create, save, edit and format educational artefacts using word processing software (e.g., MS Word, Google Docs), taking into consideration the groupings under the Home tab and the features under each group of the Microsoft office word window. Use these features such as cut, copy, paste, using thesaurus, spelling and grammar check. Ensure inclusivity and equity in using ICT tools, etc.</i>	

	<i>In small groups, practically use the options under paragraph grouping, to change position of text (text alignment), increase and decrease indent, make a list in their created document and sort the list in both ascending and descending order and guide learners to save the changes made to the document</i> <i>Identify the various tools under style grouping and use them to create a table of content for your document, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Identify the basic features of a Word document, such as font styles, sizes, and formatting options</i> <i>Level 2: Demonstrate how to use formatting tools in Word to change text</i>		

	alignment, font colour, and paragraph spacing • Level 3: Evaluate the effectiveness of using styles and templates in Word to maintain consistency and streamline document creation • Level 4: Predict how advancements in artificial intelligence and natural language processing will impact the future of document editing in Word, etc. <i>i) Biology (Week 2)</i> <i>i. Learning Task:</i> • <i>Explain the scientific method</i> • <i>Examine the importance of using the scientific steps in solving problems</i> • <i>Briefly explain inductive reasoning and deductive reasoning as used by biologists in</i>	<i>i) Biology (Week 2)</i> <i>i. Learning Task:</i> <i>Explain the scientific method, etc.</i>	

	<i>applying the scientific method to solve problems</i> • <i>Give examples of inductive reasoning and deductive reasoning methods in Biology, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Learners in mixed-ability, research-based learning, research to understand the basis on which the scientific method is built, and how it is employed in solving problems in the school environment and community at large. Learners learn to be team players in groups research activities, and feel valued in contributing to lessons.</i> • <i>Learners in research group presentations, identify and explain some common problems in the environment, and the</i>	ii. <i>Pedagogical Exemplars:</i> <i>Learners in mixed-ability, research-based learning, research to understand the basis on which the scientific method is built, and how it is employed in solving problems in the school environment and community at large. Learners learn to be team players in groups research activities, and feel valued in contributing to lessons, etc.</i>	

	<i>processes leading to the identification of these problems. By this, learners become critical thinkers and observers</i> • <i>Learners employ individual-based learning methods to individually research, problem identification and try to independently identify some common problems. They develop individual learning capabilities, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: By which technique do biologists and other scientists solve problems identified in their environment?</i> • <i>Level 2: Explain why the biology learner should learn to use the scientific method in solving problems encountered in everyday life</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: By which technique do biologists and other scientists solve problems identified in their environment?, etc.</i>	

	• <i>Level 3: Describe the two methods of thinking associated with the use of the scientific method, and give one example of each</i> • <i>Level 4: Create a typical scenario that uses inductive and deductive reasoning abilities and relate these to the scientific method, etc.</i>		
	<i>j) Chemistry (Week 2)</i> <i>i. Learning Tasks:</i> • <i>List at least two key rules to follow when storing chemicals in the laboratory</i> • <i>State at least two reasons why chemicals should be stored by compatibility method and not in alphabetical order</i> • <i>Explain how to extinguish small fires in the laboratory using equipment such as a fire blanket and a fire extinguisher, etc.</i>	<i>j) Chemistry (Week 2)</i> <i>i. Learning Tasks:</i> <i>List at least two key rules to follow when storing chemicals in the laboratory, etc.</i>	

	ii. <i>Pedagogical Exemplars:</i> • <i>Using field trip as a strategy, support learners to visit the school chemical store or chemistry laboratory to observe how chemicals are stored</i> • <i>In mixed ability groups ask learners to explain why chemicals should be stored by compatibility and not alphabetically in the laboratory</i> • <i>Show a video to learners on a violent reaction between chemicals as a result of them being stored right next to each other (e.g., hydrogen peroxide and hydrazine, or, oxidising materials and flammable materials, acetic acid and nitric acid or reaction between potassium permanganate and glycerol).</i>	ii. <i>Pedagogies and Exemplars:</i> <i>Using field trip as a strategy, support learners to visit the school chemical store or chemistry laboratory to observe how chemicals are stored, etc.</i>	

	<i>Lead a whole class discussion related to the key concepts demonstrated in the video</i> • <i>Use think-pair-share approach to lead discuss on how to put out small fire using fire blanket and fire extinguisher</i> • <i>Guide learners in pairs to demonstrate how to put out small fire using fire blanket and fire extinguisher, etc.</i> <i>Note: Take all the necessary precautions to prevent accidents and burns. Make provision for first aid. Also, be mindful of learners who may be allergic to smoke.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: State at least one (1) type of fire that can be extinguished using a carbon dioxide fire extinguisher</i> • <i>Level 2: Explain why potassium permanganate should not be stored near a bottle</i>		
		<i>Note: Take all the necessary precautions to prevent accidents and burns. Make provision for first aid. Also, be mindful of learners who may be allergic to smoke.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: State at least one (1) type of fire that can be extinguished using a carbon dioxide fire extinguisher, etc.</i>	

	containing ethanol - Level 3: Design a chemical storage compatibility chart using the following chemicals in the laboratory: HCl, HNO₃, CH₃COOH, NaOH, H₂O₂, CH₃CH₂OH, etc. k) Physics (Week 2) i. Learning Tasks - Determine fundamental units of quantities using dimensions - Evaluate the usefulness of dimensional analysis, etc ii. Pedagogical Exemplars - Opportunity for some lesson interactivity/quiz; “if this is the formula, what is the quantity?” Or “if this is the definition, what is the quantity?”. Help learners to recall relationships that they already know as a starting point for their work on dimensional analysis	k) Physics (Week 2) i. Learning Tasks Determine fundamental units of quantities using dimensions, etc. ii. Pedagogical Exemplars: Opportunity for some lesson interactivity/quiz; “if this is the formula, what is the quantity?” Or “if this is the definition, what is the quantity?”. Help learners to recall relationships that they already know as a starting point for their work on dimensional analysis, etc.	

	• <i>Put pupils into mixed-ability groups, so that more able learners can support less able learners, with a list of quantities to write down the formula for, including units</i> • <i>Teacher-led demonstration of how to find the unit for a quantity in terms of fundamental units, followed by the students practising the skill</i> • <i>Less able learners should be given the worksheet of simple examples to try but also should be provided with a worked solution to the first example and a list of relevant formulae</i> • <i>Some learners should be given the sheet of questions but are expected to recall the relevant formulae</i> • <i>More able learners should</i>		

	<i>be encouraged to 'skip' to more challenging questions and should be asked to show that different quantities have the same fundamental units e.g. Gravitational Potential Energy, Kinetic Energy and work done, pressure and stress, work done and moment</i> • <i>Introduce fundamental constants (e.g. speed of light [c], gravitational constant [G]) and ask learners to determine their dimensions and units. Learners should be provided with formulae or definitions of the constants named above.</i> • <i>Pair/group discussions about the benefits of dimensional analysis in Physics, etc.</i> •		

	iii. Key Assessments (DoK) • Level 1: Give three uses of dimensional analysis. • Level 2: Use dimensions to determine the fundamental units of the quantities including Acceleration, Force, Energy, Power, etc • Level 3: Evaluate the usefulness of dimensional analysis, etc. I) Computing (Week 2) i. Learning Task: • The teacher should guide learners with simple logic expressions involving AND, OR, and NOT operators • With little assistance, ask learners to fill logic truth tables and determine the output for all possible combinations of input values • Give learners a series of binary inputs to apply the AND operator and	iii. Key Assessments (DoK) Level 1: Give three uses of dimensional analysis, etc. z I) Computing (Week 2) i. Learning Task: The teacher should guide learners with simple logic expressions involving AND, OR, and NOT operators etc. With little assistance, ask learners to fill logic truth tables and determine the output for all possible combinations of input values, etc.	

	<i>predict the outcome before verifying with a truth table</i> • <i>Create a quiz where learners must use the OR operator on given binary inputs and select the correct outcome from multiple choices</i> • <i>Give learners a list of binary values and must apply the NOT operator, flipping each bit, and compare results with peers, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Ask students in their mix-ability groups to create truth tables for each logic operation (AND, OR, NOT) from scratch and explain their significance in computing</i> • <i>Design puzzles that require applying a combination of AND, OR, and NOT operations to solve the puzzles. Share the puzzles among groups</i>	<i>ii. Pedagogical Exemplars:</i> <i>Ask students in their mix-ability groups to create truth tables for each logic operation (AND, OR, NOT) from scratch and explain their significance in computing, etc.</i>	

	<i>for an extra challenge, etc.</i> iii. Key Assessments (DoK): • What does the AND operation do if both input values are 1? • Level 2: Given the binary inputs $A = 1010$ and $B = 1100$, what is the result of the A OR B operation? Analyse the following statement: "Using the OR operation on any binary number with 1111 will always result in 1111." Is this statement true or false, and why?, etc.	iii. Key Assessments (DoK): What does the AND operation do if both input values are 1?, etc.	
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Week 2. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Week 2. Include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	
3. Peer-review of learning planners.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same	3.1 Exchange one of your learning plans with a colleague in the same	10mins

• Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, National values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning planner</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, National values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b)	

4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 3 and 4 of the teacher manuals ahead of time and the DPLC Handbook Session 3 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 3 and 4 of the teacher manuals ahead of time and the DPLC Handbook Session 3 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10mins

DPLC Session 3: Developing learning plans for Weeks 3 and 4

<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 2, <i>developing learning plans for Weeks 1 and 2</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 2, <i>developing learning plans for Weeks 1 and 2</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 2, <i>developing learning plans for Weeks 1 and 2</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 2, <i>developing learning plans for Weeks 1 and 2</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (Los), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

teacher manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 3 and 4. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Application of characteristics of science and uses of solids in life.</i> B. <i>ICT: Create multimedia documents using appropriate computing tools.</i> C. <i>Biology: Orientation, body symmetry, sectioning of specimen and safe use of the microscope, and the application of biological concepts in fish farming: the sustainable management and exploitation of wild stock to improve fish production.</i> D. <i>Chemistry: The structure of the atom as well as Bohr's</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 3 and 4. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Application of characteristics of science and uses of solids in life.</i> B. <i>ICT: Create multimedia documents using appropriate computing tools.</i> C. <i>Biology: Orientation, body symmetry, sectioning of specimen and safe use of the microscope, and the application of biological concepts in fish farming: the sustainable management and exploitation of wild stock to improve fish production.</i> D. <i>Chemistry: The structure of the atom as well as Bohr's theory and</i>	

	<i>theory and the filling of electrons in orbitals.</i> E. <i>Physics:</i> <i>Matter and Classification of quantities into fundamental, derived, scalars and vectors.</i> F. <i>Computing:</i> <i>Apply computer architecture concepts related to the design of modern processors, memories, Input and Output to manipulate data.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 3 and 4 lessons using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 3 and 4 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template.	<i>the filling of electrons in orbitals.</i> E. <i>Physics:</i> <i>Matter and Classification of quantities into fundamental, derived, scalars and vectors.</i> F. <i>Computing:</i> <i>Apply computer architecture concepts related to the design of modern processors, memories, Input and Output to manipulate data.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 3 and 4 lessons using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 3 and 4 science lessons in the teacher manual including content standards, Los, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template.	

	LI 1.2 Complete the learning planner templates for Weeks 3 and 4 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 3 and 4 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 3 and 4 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 3 and 4 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 3 and 4.	LI 1.2 Complete the learning planner templates for Weeks 3 and 4 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 3 and 4 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of learning plan for Weeks 3 and 4 in line with the Los, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 3 and 4 in line with the Los, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, Los, LIs and pedagogical exemplars for your subject in Weeks 3 and 4 in your teacher manual.	

	2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 3 and 4 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (Week 3)</i> i. <i>How is the application of characteristics of science important in everyday lives such as health, and agriculture, education?</i> ii. <i>How will the knowledge of solids and its uses be applied in the field of work such as construction, industry?, etc.</i> b) <i>ICT (Week 3)</i> i. <i>How are computing tools used responsibly to create multimedia documents containing text, images, etc. in everyday life?</i> ii. <i>What is the best approach to teach the use of computing tools to responsibly create multimedia documents containing text, images?, etc.</i> c) <i>Biology (Week 3)</i> i. <i>Based on the features of biological</i>	2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 3 and 4 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (Week 3)</i> <i>How is the application of characteristics of science important in everyday lives such as health, agriculture, education?, etc.</i> b) <i>ICT (Week 3)</i> <i>How are computing tools used responsibly to create multimedia documents containing text, images, etc. in everyday life?, etc.</i> c) <i>Biology (Week 3)</i> <i>Based on the features of biological drawings,</i>	

	<i>drawings, how do learners make good diagrams?</i> <i>ii. How would learners use the microscope to observe a specimen of pond water from the surrounding?, etc.</i> <i>d) Chemistry (Week 3)</i> <i>i. How will the knowledge and understanding of the content, the structure of the atom, help learners appreciate why different materials have different properties?</i> <i>ii. How will the knowledge and understanding of the content, the structure of the atom, help learners to predict physical properties of substances such as melting and boiling points, reactivity?, etc.</i> <i>e) Physics (Week 3)</i> <i>i. What real-life examples or scenarios can I use to illustrate the concepts of scalars and vectors?</i> <i>ii. In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and</i>	<i>how do learners make good diagrams?, etc.</i> <i>d) Chemistry (Week 3)</i> <i>How will the knowledge and understanding of the content, the structure of the atom, help learners to predict physical properties of substances such as melting and boiling points, reactivity?, etc.</i> <i>e) Physics (Week 3)</i> <i>What real-life examples or scenarios can I use to illustrate the concepts of scalars and vectors?, etc.</i>	

	<i>national values in teaching the differentiation between scalars and vectors?, etc.</i> <i>f) Computing (Week 3)</i> <i>i. How is control bus, address bus, data bus and the internal clock, Machine cycle Fetch–Decode–Execute–Store cycle used in everyday life?</i> <i>ii. What is the best approach to teach the characteristics of control bus, address bus, data bus and the internal clock, Machine cycle Fetch –Decode – Execute–Store cycle for all learners to benefit from the lesson?, etc.</i> <i>g) General Science (Week 4)</i> <i>i. How do I explain concepts of rusting using experiment and its application in construction?</i> <i>ii. Using the periodic table, how do I differentiate metals from non-metals?, etc.</i> <i>h) ICT (Week 4)</i> <i>i. In what ways can I integrate the cross-cutting themes -</i>	<i>f) Computing (Week 3)</i> <i>How are control bus, address bus, data bus and the internal clock, Machine cycle Fetch–Decode–Execute–Store cycle used in everyday life?, etc.</i> <i>g) General Science (Week 4)</i> <i>How do I explain concepts of rusting using experiments and its application in construction?, etc.</i> <i>h) ICT (Week 4)</i> <i>In what ways can I integrate the cross-cutting themes –</i>	

	<i>21st century skills, GESI, SEL, and national values in teaching the using of computing tools to responsibly create multimedia documents containing text, images?</i> <i>ii. How are computing tools used in other subject areas such as maths, English, biology?, etc.</i> <i>i) Biology (Week 4)</i> <i>i. Assuming learners are given four fish, describe four different ways you will preserve them?</i> <i>ii. Which of the fishing management systems will you prefer in fish farming to boost yield to feed the nation?, etc.</i> <i>j) Chemistry (Week 4)</i> <i>i. What is the best approach of teaching the content, Bohr's theory and the filling of electrons in orbitals to meet the varied needs of all learners?</i> <i>ii. How do I make connections between what is been taught, filling of electrons in</i>	<i>21st century skills, GESI, SEL, and national values in teaching the using of computing tools to responsibly create multimedia documents containing text, images?, etc.</i> <i>i) Biology (Week 4)</i> <i>Assuming learners are given four fish, describe four different ways you will preserve them?, etc.</i> <i>j) Chemistry (Week 4)</i> <i>What is the best approach of teaching the content, Bohr's theory and the filling of electrons in orbitals to meet the varied needs of all learners?, etc.</i>	

	<i>orbitals and real-life experiences?, etc.</i> <i>k) Physics (Week 4)</i> <i>i. How can I convey the real-world significance of understanding matter to motivate my learners?</i> <i>ii. How can I connect the concept of matter to what learners have previously learned in other subjects?, etc.</i> <i>l) Computing (Week 4)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching the characteristics of control bus, address bus, data bus and the internal clock, Machine cycle Fetch-Decode-Execute-Store cycle?</i> <i>ii. What resources in the locality can the learner use to simulate the fetch - decode-execute - store cycle?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 3 and 4. Inform teachers to see the	<i>k) Physics (Week 4)</i> <i>How can I convey the real-world significance of understanding matter to motivate my learners?, etc.</i> <i>l) Computing (Week 4)</i> <i>In what ways can I integrate the cross-cutting themes – 21st century skills, GESI, SEL, and national values in teaching the characteristics of control bus, address bus, data bus and the internal clock, Machine cycle Fetch-Decode-Execute-Store cycle?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 3 and 4. See teacher manual for more	

	teacher manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week 3)</i> i. <i>Learning Tasks:</i> <i>Explain how characteristics of science can be applied in everyday life, such as in education</i> <i>Summary report on the field trip to the local industries, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Put learners in mixed-ability groups. Using think-pair-share lets learners search for the applications of the characteristics of science (empirical evidence, systematic observation, objectivity, tentativity) in everyday life, such as agricultural science, health, education, and home and reflect on their findings.</i>	examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week 3)</i> i. <i>Learning Tasks:</i> <i>Explain how characteristics of science can be applied in everyday life, such as in education, etc.</i> ii. <i>Pedagogical Exemplars: Put learners in mixed-ability groups. Using think-pair-share lets learners search for the applications of the characteristics of science (empirical evidence, systematic observation, objectivity, tentativity) in everyday life, such as agricultural science, health, education, and home and reflect on their findings.</i>	

	<i>Learners discuss their findings on the applications of the characteristics of science in everyday life</i> • <i>Let learners assess each other's contributions during group activities, presentations, and experiments</i> • <i>Organise a visit or field trip to a local industry or school farm where learners can observe the applications of the characteristics of science first-hand. During field trips to local industries or school farms, teachers can monitor students' engagement, note-taking, and interactions with industry professionals to assess their understanding of the applications of the characteristics of science</i> • <i>Learners write a summary report about what they</i>	<i>Learners discuss their findings on the applications of the characteristics of science in everyday life, etc.</i>	

	<i>learnt from the field trip, etc.</i> iii. Key Assessments (DoK): • <i>Level 2: Identify at least three areas where characteristics of science are applied</i> • <i>Level 2: Explain how empirical evidence as a characteristic of science is applied in Agriculture</i> • <i>Level 2: Explain how the characteristics of science are applied in health and school</i> • <i>Level 3: Analyse at least two situations or areas where the characteristics of science can be applied, etc.</i> b) <i>ICT (Week 3)</i> i. <i>Learning Tasks:</i> • <i>Steps for creating a Bulleted List</i> • <i>Position the cursor where you want to insert the bullet list</i> • <i>On the Home tab, under paragraph grouping, click the bullet list button to</i>	iii. Key Assessments (DoK): <i>Level 2: Identify at least three areas where characteristics of science are applied, etc.</i> b) <i>ICT (Week 3)</i> i. <i>Learning Tasks:</i> • <i>Steps for creating a Bulleted List</i> • <i>Position the cursor where you want to insert the bullet list</i> • <i>On the Home tab, under paragraph grouping, click the bullet list button to</i>	

	<i>display the bullet library</i> • <i>Choose a desired bullet</i> • <i>Type any text and press enter key to create the bulleted list</i> • <i>Press Enter key on the keyboard twice to deactivate the selected bullet</i> • <i>Steps for creating a Numbered List</i> • <i>Position the cursor where you want to insert the bullet list</i> • <i>On the Home tab, under paragraph grouping, click the Numbering button and choose a desired numbered list</i> • <i>Type any text and press enter key to create the numbered list</i> • <i>Press Enter key on the keyboard twice to deactivate the selected bullet, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Put learners in groups of at least 4 and ask them to write 5 of their best dining meals and 5 things they can see in class individually. Ask learners to share</i>	<i>display the bullet library</i> • <i>Choose a desired bullet</i> • <i>Type any text and press enter key to create the bulleted list</i> • <i>Press Enter key on the keyboard twice to deactivate the selected bullet, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Put learners in groups of at least 4 and ask them to write 5 of their best dining meals and 5 things they can see in class individually. Ask learners to share</i>	

	<i>their write up with members in the group, observe the individual lists and describe how the lists were made. Learners share their responses with the larger group</i> <i>• In small groups, practically guide learners to explore the options under paragraph grouping, to make ordered and unordered list, (bullets list, Numbered List and Multilevel List), increase and decrease indent and sort the list and tables in their document in any preferred order</i> <i>• Learners further explore the formatting styles under style grouping of the home tab and use some of the styles in a document. Guide learners to apply different heading styles to text in their document and also modify the styles to suit their desires.</i> <i>• Ask Learners to share with their colleagues how to make ordered list,</i>	<i>their write up with members in the group, observe the individual lists and describe how the lists were made. Learners share their responses with the larger group, etc.</i>	

	<i>unordered list, multilevel list, sort list in order of magnitude and change heading styles and modify them in their document, etc.</i> iii. Key Assessments (DoK): • <i>Level 1: Identify the different types of lists that can be created in Word, such as bulleted lists and numbered lists</i> • <i>Level 2: Demonstrate how to create a multilevel list in Word with different levels of indentation</i> • <i>Level 3: Evaluate the effectiveness of using custom bullets or numbering formats to enhance the visual appeal of a list in Word</i> • <i>Level 4: Predict how advancements in artificial intelligence and machine learning could automate the process of organising and renumbering lists in Word, etc.</i> c) <i>Biology (Week 3)</i> i. <i>Learning Tasks:</i>	iii. Key Assessments (DoK): <i>Level 1: Identify the different types of lists that can be created in Word, such as bulleted lists and numbered lists, etc.</i> c) <i>Biology (Week 3)</i> i. <i>Learning Tasks:</i>	

	• <i>State the parts of the light microscope and their functions. Limit content expectation to the identification of various parts and relate each part of the light microscope to its functions of the light microscope</i> • <i>Demonstrate at least five safe ways to use the light microscope to observe specimens. Extend content expectation to the correct handling of the microscope to observe specimens and make labelled drawings of what was observed</i> • <i>Describe how to care for a light microscope and slides, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>In a mixed-ability, socially inclusive, task-based groups, learners examine the various parts of the microscope (with emphasis on the eyepiece lens, objective lens, stage, clips, revolving</i>	<i>State the parts of the light microscope and their functions. Limit content expectation to the identification of various parts and relate each part of the light microscope to its functions of the light microscope, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>In a mixed-ability, socially inclusive, task-based groups, learners examine the various parts of the microscope (with emphasis on the eyepiece lens, objective lens, stage, clips, revolving</i>	

	<i>nosepiece, diaphragm, limb, base/foot)</i> <i>• Learners critically observe and examine each part of the microscope in relation to its function and share their observations in group discussions</i> <i>• In mixed-ability, task-based groups, learners mount different types of slides provided on the stage of the microscope and observe the specimen on the slide</i> <i>• Learner gains first-hand personal experience with the use of the microscope and can relate lessons to real-world situations, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Level 1: List the two types of microscopes and state at least two importance of each</i> <i>• Level 2: Describe briefly how each part of the light microscope contributes to its</i>	<i>nosepiece, diaphragm, limb, base/foot), etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: List the two types of microscopes and state at least two importance of each, etc.</i>	

	<i>effective functioning</i> • <i>Level 3: Manipulate the microscope to achieve sharp, bright images of the slides provided. Sketch and label what was observed, etc.</i> d) <i>Chemistry (Week 3)</i> i. <i>Learning Tasks:</i> • <i>State at least one postulate of Dalton's atomic theory</i> • <i>State at least two postulates of Dalton's atomic theory that were modified</i> • <i>State at least two postulates of Dalton's atomic theory that were modified and give the reasons for their modification, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>In a whole class discussion, guide learners to review the description of the atom and its sub-atomic particles from JHS syllabus</i> • <i>Learners in mixed-ability groups discuss the postulates of</i>	d) <i>Chemistry (Week 3)</i> i. <i>Learning Tasks:</i> <i>State at least one postulate of Dalton's atomic theory, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>In a whole class discussion, guide learners to review the description of the atom and its sub-atomic particles from JHS syllabus, etc.</i>	

	<i>Dalton's atomic theory. Moderate the discussion in such a way that every learner can state at least one of the main postulates of Daltons atomic theory</i> <i>Evaluate and criticize each of the postulates of Dalton's atomic theory with the aid of relevant charts or other resources. Encourage learners in their groups to explain the basis upon which some postulates of Dalton's atomic theory were modified, etc.</i> iii. Key Assessments (DoK): <i>Level 1: In your own words, state the main postulates of Dalton's atomic theory</i> <i>Level 4: State at least one strength and one weakness of Dalton's atomic theory</i> <i>Level 2: Explain at least one strength and one weakness of Dalton's atomic theory</i>		
		iii. Key Assessments (DoK): <i>Level 1: In your own words, state the main postulates of Dalton's atomic theory, etc.</i>	

	• <i>Level 3: How relevant is Dalton's atomic theory to the evolution of modern chemistry?, etc.</i> e) <i>Physics (Week 3)</i> i. <i>Learning Tasks:</i> • <i>Determine fundamental units of quantities using dimensions</i> • <i>Evaluate the usefulness of dimensional analysis, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Opportunity for some lesson interactivity/quiz; "if this is the formula, what is the quantity?" Or "if this is the definition, what is the quantity?". Help learners to recall relationships that they already know as a starting point for their work on dimensional analysis</i> • <i>Put pupils into mixed-ability groups, so that more able learners can support less able learners, with a list of quantities</i>	e) <i>Physics (Week 3)</i> i. <i>Learning Tasks:</i> <i>Determine fundamental units of quantities using dimensions, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Opportunity for some lesson interactivity/quiz; "if this is the formula, what is the quantity?" Or "if this is the definition, what is the quantity?". Help learners to recall relationships that they already know as a starting point for their work on dimensional analysis, etc.</i>	

	to write down the formula for, including units • <i>Teacher-led demonstration of how to find the unit for a quantity in terms of fundamental units, followed by the students practising the skill: Less able learners should be given the worksheet of simple examples to try but also should be provided with a worked solution to the first example and a list of relevant formulae, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Give three uses of dimensional analysis</i> • <i>Level 2: Use dimensions to determine the fundamental units of the following quantities:</i> ○ <i>Acceleration</i> ○ <i>Force</i> ○ <i>Energy</i> ○ <i>Power</i> • <i>Level 3: Evaluate the usefulness of dimensional analysis, etc.</i>		
		iii. <i>Key Assessments (DoK):</i> <i>Level 1: Give three uses of dimensional analysis, etc.</i>	

	f) <i>Computing (Week 3)</i> i. <i>Learning task</i> <i>In mixed-ability groupings, the teacher should give learners a project to create a short video explaining what CPU is, how it functions, and why it's important for computer processing speed (They can use simple animations or diagrams to illustrate the concept) and submit for marks. It is important to take note of differentiation in the response to the project of the learners</i> <i>Share some resource links (online CPU simulators) to help learners in the project, etc.</i> ii. <i>Pedagogical exemplars:</i> <i>The teacher leads learners to brainstorm by comparing the CPU to the brain of a computer, with different parts performing specific functions like thinking</i>	f) <i>Computing (Week 3)</i> i. <i>Learning task</i> <i>In mixed-ability groupings, the teacher should give learners a project to create a short video explaining what CPU is, how it functions, and why it's important for computer processing speed (They can use simple animations or diagrams to illustrate the concept) and submit for marks. It is important to take note of differentiation in the response to the project of the learners, etc.</i> ii. <i>Pedagogical exemplars:</i> <i>The teacher leads learners to brainstorm by comparing the CPU to the brain of a computer, with different parts performing specific functions like</i>	

	<i>(processing) and coordinating actions (control unit)</i> • <i>The teacher should relate CPU concepts to everyday experiences or familiar technology. For example, discuss how mobile phones, Television sets, or even kitchen appliances contain CPUs and illustrate how they function in these devices to deepen understanding</i> • <i>Teachers should then provide hands-on activities (project) where learners can interact with virtual CPUs. This can include online CPU simulators (scan code for sample, etc.</i> <i>iii. Key Assessments (DoK)</i> • <i>Level 1: The CPU is also known as the brain of the computer. True or False?</i> • <i>Level 2: Name the three main</i>	<i>thinking (processing) and coordinating actions (control unit), etc.</i> <i>iii. Key Assessments (DoK)</i> <i>Level 1: The CPU is also known as the brain of the computer. True or False?, etc.</i>	

	<i>components of a CPU</i> • <i>Level 3: How does increasing the clock speed of a CPU affect its performance and heat generation?, etc.</i> <i>g) General science (Week 4)</i> <i>i. Learning task</i> • <i>Enumerate three properties each of metals, non-metals, and semi-metals</i> • <i>In tabular form, outline four differences between metals and nonmetals</i> • <i>Explain why metal objects should be kept dry and clean?, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Learners can be grouped in mixed-gender and mixed-ability groups to explore the uses of various solid materials in different structures and substances within their community during a walk around their community (e.g., buildings,</i>	<i>g) General science (Week 4)</i> <i>i. Learning task</i> <i>Enumerate three properties each of metals, non-metals, and semi-metals, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Learners can be grouped in mixed-gender and mixed-ability groups to explore the uses of various solid materials in different structures and substances within their community during a walk around their community (e.g., buildings,</i>	

	<i>vehicles, litter, glass, plastic, construction materials etc.)</i> <i>• Learners can use the internet to research these different solid materials and classify them based on specific criteria using concept maps. Teacher ensures learners classify solid materials into metals, non-metals, semi-metals. Note: there will be some that cannot as they are compounds or mixtures</i> <i>• In groups, discuss the classification of solids into metals, non-metals, semi-metals using their properties. Groups can present their conclusions</i> <i>• Using samples of metals, semi-metals and non-metals, guide learners in pairs to research and distinguish between their properties such as lustre, electrical and thermal</i>	<i>vehicles, litter, glass, plastic, construction materials etc.), etc.</i>	

	conductivity, malleability, ductility, and sonority • Assign learners in separate groups to perform the different practical activities. Learners can present their results to the rest of the class • Working in small groups, learners can create a poster which shows the findings from their practical activities, etc. iii. Key Assessments (DoK) • Level 1: Identify three substances which are solids at room temperature • Level 2: Explain why gold and platinum do not corrode • Level 2: Describe an experiment to explain the conditions necessary for corrosion of iron • Level 3: Describe and explain the differences between metals and non- metals, etc.	iii. Key Assessments (DoK) Level 1: Identify three substances which are solids at room temperature, etc.	

	<i>h) ICT (Week 4)</i> <i>i. Learning Tasks</i> • <i>Define the key elements involved in formatting the overall appearance of a page using word processing software</i> • <i>Demonstrate how to apply various formatting techniques to enhance the visual appeal and readability of a document</i> • <i>Evaluate the impact of different formatting choices on the overall presentation and accessibility of content</i> • <i>Design a visually appealing and user-friendly template for a specific type of document using advanced formatting features, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Provide a list of formatting options such as font styles, sizes, colours, alignment, spacing, and margins, and ask students to</i>	<i>h) ICT (Week 4)</i> <i>i. Learning Tasks</i> <i>Define the key elements involved in formatting the overall appearance of a page using word processing software, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Provide a list of formatting options such as font styles, sizes, colours, alignment, spacing, and margins, and ask students to</i>	

	<i>identify and explain each one</i> • <i>Create a step-by-step tutorial or video guide that shows students how to format a page by adjusting font styles, inserting images, creating headers and footers, and utilizing page layout options</i> • <i>Assign a task where students compare and contrast two versions of a document with different formatting styles and layouts, analysing how each choice affects readability, organization, and visual appeal</i> • <i>Challenge students to create a customized template for a resume, newsletter, brochure, or report that showcases their understanding of advanced formatting tools like styles, themes, tables, and graphics., etc.</i>	<i>identify and explain each one ,etc.</i>	

	iii. Key Assessments (DoK): • Level 1: Write the basic features and functions of formatting tools in word processing software • Level 2: Apply knowledge of formatting concepts to effectively design and present information in a professional manner • Level 3: Assess the effectiveness of various formatting strategies in achieving communication goals and engaging the audience, etc. i) Biology (Week 4) i. Learning Tasks • Name at least three tools that are required in the nursery and grow-out stages to improve fish production • State one function each of the tools that are required in nursery and grow-out stages to improve fish production, etc.	iii. Key Assessments (DoK): Level 1: Identify the different font styles available in Word, such as bold, italic, and underline, etc. i) Biology (Week 4) i. Learning Tasks Name at least three tools that are required in nursery and grow-out stages to improve fish production, etc.	

	<i>Note: Limit content expectation to identification and discussion of at least three tools used in harvesting fish.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using think-pair-share, assist learners to identify and discuss the functions of at least three tools and equipment used in harvesting fish</i> • <i>Using task-based learning, place learners in mixed-ability, all-inclusive groups, to watch videos and documentaries on fish farming or embark on field trips to fish rearing and research centres, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List the tools that are required in nursery and grow-out stages to improve fish production. Accept at least two tools used in harvesting fish</i> • <i>Level 2: Describe the function of at least two tools for</i>	<i>Note: Limit content expectation to identification and discussion of at least three tools used in harvesting fish</i> ii. <i>Pedagogical Exemplars:</i> <i>Teacher should consider the following activities: Using think-pair-share, assist learners to identify and discuss the functions of at least three tools and equipment used in harvesting fish., etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: List the tools that are required in nursery and grow-out stages to improve fish production. Accept at least two tools used in harvesting fish, etc.</i>	

	<i>harvesting fish, etc.</i> j) <i>Chemistry (Week 4)</i> i. <i>Learning Tasks:</i> • <i>Describe Bohr's planetary model of the atom</i> • <i>Investigate how Bohr's model explains the stability of the atom</i> • <i>Create a comparative analysis detailing the differences and similarities between continuous and line spectra while delving into the fundamental principles that govern each of them, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>Collaborative Learning: In small mixed ability or mixed-gender (where applicable) groups,</i> • <i>Provide learners with diagrams or models illustrating the planetary structure of the atom, highlighting the fixed orbits and energy levels as proposed by Bohr.</i>	j) <i>Chemistry (Week 4)</i> i. <i>Learning Task:</i> <i>Describe Bohr's planetary model of the atom, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Collaborative Learning: In small mixed ability or mixed-gender (where applicable) groups,</i> a) <i>Provide learners with diagrams or models illustrating the planetary structure of the atom, highlighting the fixed orbits and energy levels</i>	

	• <i>Provide text books, or have learners' surf the internet for articles on Bohr's theory and the stability of the atom, followed by structured writing tasks such as summarising each postulate or composing explanations in their own words.</i> • <i>Facilitate a discussion on continuous and line spectra. Assign roles within the group such as group leader, note-taker and presenter and have them create a table of differences and similarities between continuous and line spectra and have them do group presentation</i> • <i>Provide additional readings or extension of tasks for advanced learners to explore deeper aspects of spectral analysis and offer additional support to struggling learners</i>	<i>as propose by Bohr, etc.</i>	

	• <i>Demonstrative Learning:</i> ○ <i>Begin the lesson with a hands-on demonstration using physical models to illustrate the concept of quantum numbers. Use tangible objects to represent electrons and their energy levels within the atom</i> ○ <i>Utilize visual aids such as diagrams to visually represent the relationship between quantum numbers and electron orbitals. Provide worked examples on assigning quantum numbers to electrons in different energy levels and provide opportunities for learners to practice</i> ○ <i>Scaffold the calculations processes of the quantum numbers by providing step by step guidance. Start with simple examples and gradually increase the</i>		

	<i>complexity as learners becomes more comfortable with the calculation</i> ○ <i>Conclude the concept by stressing the importance of quantum numbers to the electron structure of the atom</i> ● <i>Project-based learning:</i> ○ <i>In a whole class discussion, explain the characteristics and properties of s and p orbital verbally proving real- life examples</i> ○ <i>In small a mix-ability groups have learners build orbital models using clay, balloons or materials in their environment. This will help them visualize and understand the spatial arrangement of s and p orbitals</i> ○ <i>Offer extension activities for advanced learners and scaffold tasks for struggling learners, etc.</i>		

	iii. Key Assessments (DoK): • Level 1: What was the name of Bohr's model of the atom • Level 2: Briefly describe how Bohr's model of the atom contributed to our understanding of the stability of the atom • Level 3: Evaluate the possible values of the magnetic quantum number (m_l) for an electron in an orbital with • Level 4: Compare and contrast the properties of s and p in terms of shape, orientation energy level. Justify your reasoning with relevant examples, etc. k) Physics (Week 4) i. Learning Tasks • State the four states of matter • Give examples of substances in the various states of matter • Explain plasma as a state of matter	iii. Key Assessments (DoK) Level 1: What was the name of Bohr's model of the atom, etc. k) Physics (Week 4) i. Learning Tasks State the four states of matter., etc.	

	• Use the formula $\rho=m/V$ to calculate the density of regular and irregular solid objects, etc. ii. Pedagogical Exemplars • Have learners participate in a think-pair-share activity where learners list the states of matter and classify the objects into the three primary states of matter, e.g. ice cube, water, helium in a balloon, wooden block, pencil lead • Learners should delve into the fourth state of matter, 'plasma', researching its definition and exploring diverse examples • Explain the term 'density' to the class and ask them to 'vote' and justify which states of matter are likely to be the densest • In groups, provide learners with the	ii. Pedagogical Exemplars Have learners participate in a think-pair-share activity where learners list the states of matter and classify the objects into the three primary states of matter, e.g. ice cube, water, helium in a balloon, wooden block, pencil lead, etc. This should be a quick activity and accessible for all learners., etc.	

	equipment needed to measure the density of some regular and irregularly shaped objects. The volume of the irregularly shaped objects can be measured through the displacement of water method. Lumps of plasticine(play dough) are suitable for both. Results should be obtained in a) kgm^{-3} and b) gcm^{-3}. Learners measure the mass of their respective objects and, using the formula $\rho = m/V$, obtain the density, etc. iii. Key Assessments (DoK) • Level 1: List the three primary states of matter, commonly found in our surroundings • Level 1: Match examples of substances to their corresponding states of matter		
		iii. Key Assessments (DoK) Level 1: List the three primary states of matter, commonly found in our surroundings, etc.	

	• <i>Level 1: Provide examples of naturally occurring plasmas and their significance in the universe, etc.</i> <i>I) Computing (Week 4)</i> <i>i. Learning Tasks</i> • <i>Learners watch video as in the scan code to see how the CPU works</i> • <i>Or teacher shows to learners and explains the working of the CPU to them</i> • <i>Divide students into groups, assigning each group a specific role in the FDES cycle (e.g., CPU, memory, instruction, data), etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>The teacher should begin by introducing each stage of the cycle separately, such as fetch, decode, execute, and store. This approach helps learners understand</i>	<i>I) Computing (Week 4)</i> <i>i. Learning Tasks</i> <i>Learners watch video as in the scan code to see how the CPU works, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>The teacher should begin by introducing each stage of the cycle separately, such as fetch, decode, execute, and store. This approach helps learners understand each step before</i>	

	<i>each step before moving on to the next</i> • <i>Using open class discussion, the teacher should cautiously help deepen understanding by providing real-world examples to demonstrate the machine cycle and show its relevance in everyday technology. Teachers can give these examples</i> • <i>Personal Computers: Almost every modern personal computer, from laptops to desktops, utilises CPUs that perform machine cycles to execute various processes. To process user applications, like opening a web browser or running a video game, the CPU fetches the relevant instructions, decodes them, executes the</i>	<i>moving on to the next, etc.</i>	

	<i>required operation, and stores the data if necessary</i> • <i>Smartphones: Smartphones are equipped with processors (CPUs) that are responsible for running applications, managing the device's operating system, and carrying out multiple tasks seamlessly. The speed and efficiency of a smartphone's performance depend on its processor's capability to execute machine cycles quickly and efficiently</i> • <i>Again, the teacher should relate the machine cycle to tasks performed by computers, such as opening a program and performing calculations. (online videos can be adopted to supplement this), etc.</i> <i>iii. Key Assessments (DoK):</i>		

	• <i>Level 2: List the steps involved in the Fetch phase in the Fetch-Decode-Execute-Store cycle</i> • <i>Level 3: Learners to research and prepare PowerPoint slides to explain in class how the Fetch-Decode-Execute-Store cycle functions within a computer processor, illustrating the interaction between its various stages and their impact on program execution efficiency, etc.</i>	<i>iii. Key Assessments (DoK):</i> <i>Level 2: List the steps involved in the Fetch phase in the Fetch-Decode-Execute-Store cycle, etc.</i>	
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 3 and 4. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 3 and 4. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	

3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10 mins

DPLC Session 4: Developing learning plans for Weeks 5 and 6

<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction : Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 3, <i>developing learning plans for Weeks 3 and 4</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 3, <i>developing learning plans for Weeks 3 and 4</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 3, <i>developing learning plans for Weeks 3 and 4</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 3, <i>developing learning plans for Weeks 3 and 4</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 5 and 6. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Explain the properties and functions of solids in life.</i> B. <i>ICT: Create multimedia documents using appropriate computing tools.</i> C. <i>Biology: Specialised cells, cellular organisation in living things, the concept of cell membrane and on the significance of the various processes involved in the movement of substances in and out of the cell and the factors affecting them, and the application of the knowledge of biological keys to identify living things.</i> D. <i>Chemistry: Radioactivity and its applications in everyday</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 5 and 6. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Explain the properties and functions of solids in life.</i> B. <i>ICT: Create multimedia documents using appropriate computing tools.</i> C. <i>Biology: Specialised cells, cellular organisation in living things, the concept of cell membrane and on the significance of the various processes involved in the movement of substances in and out of the cell and the factors affecting them, and the application of the knowledge of biological keys to identify living things.</i> D. <i>Chemistry: Radioactivity and its applications in</i>	

	<i>life and the mole concept.</i> <i>E. Physics: Equations of motion and Newton's law of motion.</i> <i>F. Computing: Explain the relationships between the components of a computer and how data are transferred among the components.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 5 and 6 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 5 and 6 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner for Weeks 5 and 6 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical	<i>everyday life and the mole concept.</i> <i>E. Physics: Equations of motion and Newton's law of motion.</i> <i>F. Computing: Explain the relationships between the components of a computer and how data are transferred among the components.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 5 and 6 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). L1.1 Discuss the important aspects in Weeks 5 and 6 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner for Weeks 5 and 6 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical	

	exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 5 and 6 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 5 and 6 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 5 and 6 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 5 and 6. 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 5 and 6 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 5)</i>	exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 5 and 6 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of learning plan for Weeks 5 and 6 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 5 and 6 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 5 and 6 in your teacher manual. 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 5 and 6 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 5)</i>	

	i. <i>How do I explain concepts of rusting using experiment and its application in construction?</i> ii. <i>How is the knowledge of electrical conductivity of metals applied in the field of work?, etc.</i> b) <i>ICT (Week 5)</i> i. <i>How can using the appropriate computing tools for multimedia documents make working with computers easy?</i> ii. <i>What is the best approach to teach multimedia documents and appropriate computing tools to use in creating multimedia documents?, etc.</i> c) <i>Biology (Week 5)</i> i. <i>How would I explain the cell membrane as an essential component of the living cell?</i> ii. <i>How would I depict the occurrence of bulk transport in cells?, etc.</i> d) <i>Chemistry (Week 5)</i> i. <i>How do I make connections between the content, radioactivity and</i>	<i>How do I explain concepts of rusting using experiment and its application in construction?, etc.</i> b) <i>ICT (Week 5)</i> <i>How are computing tools used responsibly to create multimedia documents containing text, images, etc. in everyday life?, etc.</i> c) <i>Biology (Week 5)</i> <i>How would I explain the cell membrane as an essential component of the living cell?, etc.</i> d) <i>Chemistry (Week 5)</i> <i>How do I make connections between the content, radioactivity and applications to the</i>	

	<i>applications to the industry (nuclear power)?</i> <i>ii. How is radioactivity and its applications important to the learner?, etc.</i> <i>e) Physics (Week 5)</i> <i>i. How can I adapt my teaching methods to meet the diverse needs and abilities of my learners when teaching equations of motion?</i> <i>ii. What strategies can I employ to ensure that learners are actively participating and thinking during the lesson on equations of motion?, etc.</i> <i>f) Computing (Week 5)</i> <i>i. How are data transferred among the computer components?</i> <i>ii. What is the best approach to teach how data are transferred among computer components?, etc.</i> <i>g) General Science (Week 6)</i> <i>i. How do ionic and covalent compounds conduct electricity, and what are the reasons behind their electrical conductivity?</i>	<i>industry (nuclear power)?, etc.</i> <i>e) Physics (Week 5)</i> <i>What strategies can I employ to ensure that learners are actively participating and thinking during the lesson on equations of motion?, etc.</i> <i>f) Computing (Week 5)</i> <i>How are data transferred among the computer components?, etc.</i> <i>g) General Science (Week</i> <i>How do ionic and covalent compounds conduct electricity, and what are the reasons behind their electrical conductivity?, etc.</i>	

	ii. <i>How do I use practical-based activity to explain conductivity of ionic and covalent compounds?, etc.</i> h) <i>ICT (Week 6)</i> i. <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching multimedia documents and appropriate computing tools to use in creating multimedia documents?</i> ii. <i>How can multimedia documents be used in other subject areas such as maths, English, biology?, etc.</i> i) <i>Biology (Week 6)</i> i. <i>Why do I think a good understanding in the principles of classification is still necessary in a modern society?</i> ii. <i>What tool would I use to make identification of organisms in my community easier for learners?, etc.</i> j) <i>Chemistry (Week 6)</i> i. <i>What is the best approach to teaching mole whilst integrating the cross-</i>	h) <i>ICT (Week 6)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching multimedia documents and appropriate computing tools to use in creating multimedia documents?, etc.</i> i) <i>Biology (Week 6)</i> <i>What tool would I use to make identification of organisms in my community easier for learners?, etc.</i> j) <i>Chemistry (Week 6)</i> <i>What is the best approach to teaching mole whilst integrating the cross-</i>	

	<i>cutting themes- 21st century skills, GESI, SEL and national values?</i> <i>ii. What prior knowledge do learners have that will help them understand mole concept?, etc.</i> <i>k) Physics (Week 6)</i> <i>i. What real-life examples or scenarios can I use to illustrate the relevance of Newton's Laws of Motion?</i> <i>ii. In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching the Newton's laws of motion?, etc.</i> <i>l) Computing (Week 6)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how data are transferred among computer component?</i> <i>ii. What is the best approach to teach Computer Hardware and types of Software?, etc.</i>	<i>cutting themes- 21st century skills, GESI, SEL and national values?, etc.</i> <i>k) Physics (Week 6)</i> <i>What real-life examples or scenarios can I use to illustrate the relevance of Newton's Laws of Motion?, etc.</i> <i>l) Computing (Week 6)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how data are transferred among computer component?, etc.</i>	

	2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 5 and 6. Inform teachers to see the Teacher Manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General science (Week 5)</i> i. <i>Learning Task:</i> • <i>State three uses of solid metals</i> • <i>Explain the relationship between the properties of solid metals and their uses</i> • <i>Write four properties of solid metals</i> • <i>How will you determine the density of different solid materials, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Learners' research on how the features of different solids connect to their daily uses from various cultural viewpoints. Learner reflects and cross share their views</i> • <i>Guide learners to develop concept maps to visualize the relationship between solids,</i>	2.4 Discuss at least two key notes on differentiation for Weeks 5 and 6. See Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week 5)</i> i. <i>Learning Task:</i> <i>State three uses of solid metals, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Learners' research on how the features of different solids connect to their daily uses from various cultural viewpoints. Learner reflects and cross share their views, etc.</i>	

	<i>their qualities, and uses</i> • <i>Put learners into mixed ability groups to demonstrate their understanding of how various solids are employed based on their qualities through practical activities e.g. electrical conductivity using simple electric circuits</i> • <i>Assign roles, based on individual strengths, such as researcher, presenter, visual maker, or group facilitator, to encourage active participation and contribution from all learners during the demonstration of practical activities</i> • <i>Learners discuss their results with the class through a variety of presentation alternatives, such as oral presentations, poster displays, multimedia slideshows, or performances, so they can select a format that best suits their strengths and interests, etc.</i>		

	iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Provide examples of everyday products that use the electrical conductivity of metals</i> • <i>Level 2: Explain how the high tensile strength of steel contributes to its usefulness in constructing bridges and buildings</i> • <i>Level 2: Discuss the importance of corrosion resistance in selecting materials for outdoor structures and marine environments, etc.</i> b) <i>ICT (Week 5)</i> i. <i>Learning Tasks:</i> • <i>Launching Microsoft PowerPoint Application Window using the Start Menu Button</i> • <i>Saving a PowerPoint document using the "Save As" command, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Engage in project-based learning and practical sessions to create, save, edit and format</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: Provide examples of everyday products that use the electrical conductivity of metals, etc.</i> b) <i>ICT (Week 5)</i> i. <i>Learning Tasks:</i> <i>Launching Microsoft PowerPoint Application Window using the Start Menu Button, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Engage in project-based learning and practical sessions to create, save, edit and</i>	

	<i>educational artefacts using Microsoft PowerPoint software taking into consideration the features of Microsoft PowerPoint application window most especially the Menu Bar. Use the tabs on the menu bar to create a multimedia slide with text, shapes and images Ensure inclusivity and equity in using ICT tools</i> <i>• In small groups, practically use the options under the home tab, to insert text and format it, buttons under the insert tab to import pictures and draw basic shapes, Explore the options under the format tab to make desirable changes to drawn shapes and inserted pictures. Guide learners to save the changes made to the document, etc.</i> iii. Key Assessments (DoK): <i>• Level 1: Identify the steps involved in creating a new</i>	<i>format educational artefacts using Microsoft PowerPoint software taking into consideration the features of Microsoft PowerPoint application window most especially the Menu Bar. Use the tabs on the menu bar to create a multimedia slide with text, shapes and images Ensure inclusivity and equity in using ICT tools, etc.</i> iii. Key Assessments (DoK): <i>Level 1: Identify the steps involved in creating a new</i>	

	<i>slide in a presentation</i> • <i>Level 2: Demonstrate how to insert different types of shapes (e.g., rectangles, circles) into a presentation slide</i> • <i>Level 3: Evaluate the effectiveness of using shapes to visually enhance key points in a presentation</i> • <i>Level 4: Predict how advancements in artificial intelligence could automate the creation and formatting of shapes and images in presentation slides, etc.</i> c) <i>Biology (Week 5)</i> i. <i>Learning Task:</i> • <i>Briefly explain the essential components of cell theory. Limit content to explaining the three cardinal issues raised in the cell theory. Allow fast learners to contribute to learning to support slow learners</i> • <i>Explain the significance of the cell theory. Accept at least three</i>	<i>slide in a presentation, etc.</i> c) <i>Biology (Week 5)</i> i. <i>Learning Task:</i> <i>Briefly explain the essential components of cell theory. Limit content to explaining the three cardinal issues raised in the cell theory. Allow fast learners to contribute to learning to support slow learners, etc.</i>	

	<i>importance of the cell theory</i> • <i>Mention the main types of cells, and give at least five structures/organelles found in them. Limit content expectation to identifying the two main types of cells and some organelles found in them, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Use an individual learning approach to search for information on the cell and cell theory and eukaryotic cell; learners acquire the skill of independent thinking and confidence</i> • <i>Employ group-project learning method to bring together, information on cell theory and eukaryotic cells obtained individually by learners</i> • <i>Talk-for-learning approach is used by learners to express their findings on lesson; this allows learners to develop confidence and be articulate in communication</i>	ii. <i>Pedagogical Exemplars:</i> <i>Use an individual learning approach to search for information on the cell and cell theory and eukaryotic cell; learners acquire the skill of independent thinking and confidence, etc.</i>	

	• <i>Demonstrational Learning strategy is used to teach learners about the various structures in a eukaryotic cell. This can be done in the lab or classroom, where model cells with various structures are clearly shown to learners so that they can see models of these, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Define the cell and give the main types of cells</i> • <i>Level 2: Explain the main parts of the cell theory and how it was developed</i> • <i>Level 3: Explain the significance of the cell theory. Accept at least three correctly explained importance of the cell theory</i> • <i>Level 4: Compare a eukaryotic cell and a prokaryotic cell, and indicate how knowledge on these types of cells may be used to improve life, etc.</i> d) <i>Chemistry (Week 5)</i> i. <i>Learning Tasks:</i> • <i>List at least three uses of radioisotopes</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: Define the cell and give the main types of cells, etc.</i> d) <i>Chemistry (Week 5)</i> i. <i>Learning Tasks:</i> <i>List at least three uses of</i>	

	• Explain at least two uses of radioisotopes • Determine how to complete and balance simple nuclear reactions, etc. ii. Pedagogical Exemplars: • Collaborative learning, guide learners in pairs to discuss radioactivity and distinguish between nuclear reactions and chemical reactions. Learners present their responses in a power point or flow charts or any appropriate format of their choice • In mixed-ability groupings, support learners to use the internet to investigate and present the descriptions of the properties of alpha, beta and gamma radiations to the whole class • In ability groupings, guide learners to complete and balance simple nuclear reaction equations • Guide learners in pairs to discuss	radioisotopes, etc. ii. Pedagogical Exemplars: Collaborative learning, guide learners in pairs to discuss radioactivity and distinguish between nuclear reactions and chemical reactions. Learners present their responses in a power point or flow charts or any appropriate format of their choice, etc.	

	<i>and present their findings on why certain nuclei are unstable in terms of neutron-to-proton ratio and binding energy per nucleon to the whole class., etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List at least three (3) uses of radioisotopes.</i> • <i>Level 2: Explain at least two uses of radioisotopes.</i> • <i>Level 3: Explain how to complete and balance simple nuclear reactions</i> <i>Complete and balance the equation below:</i> ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + X$ <i>, etc.</i> e) <i>Physics (Week 5)</i> i. <i>Learning Tasks:</i> • <i>Define the terminologies associated with rectilinear motion (s, u, v, a and t).</i> • <i>Establish the equations of motion</i> • <i>Solve problems associated with the equations of motion, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>In mixed-ability groups, learners</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: List at least three (3) uses of radioisotopes, etc.</i> e) <i>Physics (Week 5)</i> i. <i>Learning Tasks:</i> <i>Define the terminologies associated with rectilinear motion (s, u, v, a and t), etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>In mixed-ability groups, learners</i>	

	<i>should brainstorm and define the terminologies; distance, displacement, speed, velocity, acceleration, average velocity and instantaneous velocity and collaboratively distinguish between them</i> • <i>The teacher presents the derivations of the equations of motion step-by-step, using algebraic principles. Encourage learners to understand each step of the derivation and the algebraic principles used by asking targeted questions throughout the explanation (e.g. 'learner 1, how would I read off the initial velocity of the object from this graph?' Or 'learner 2, how can you tell from the shape of this graph that the object is accelerating uniformly', etc)</i> • <i>Discuss the physical meaning</i>	<i>should brainstorm and define the terminologies; distance, displacement, speed, velocity, acceleration, average velocity and instantaneous velocity and collaboratively distinguish between them, etc.</i>	

	<i>of each equation and how they relate to the motion of objects under constant acceleration</i> • <i>Provide a set of problems involving different motion scenarios, such as uniformly accelerated motion and free fall. Ask learners to apply the equations of motion to solve these problems and calculate the unknown quantities. These mathematical problems could be differentiated according to a level of challenge, with the more able learners having to consider objects reversing direction (and therefore the use of negative values), etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Define acceleration</i> • <i>Level 1: Distinguish between average velocity and instantaneous velocity</i> • <i>Level 1: Name the four quantities</i>		

	associated with the linear motion equations • Level 2: A race car accelerates uniformly from 18 m s⁻¹ to 45 m s⁻¹ in 2 seconds. Determine the acceleration of the car and the distance travelled • Level 1: Show that for a uniformly accelerated motion, $s = ut + \frac{1}{2}at^2$, etc. f) Computing (Week 5) i. Learning Task: • Learners in their mix-abilities groupings are giving a device (desktop/laptop/s martphone) connected to the internet to research and make comparisons of HDDs vs SDDs, CDs vs DVDs, Keyboards vs Mouse • Learners are required to complete a table template (column headings: device, typical use(s), main features, average cost, image) with their research findings. (scan code sample		
		f) Computing (Week 5) i. Learning Task: Learners in their mix-abilities groupings are giving a device (desktop/laptop/s martphone) connected to the internet to research and make comparisons of HDDs vs SDDs, CDs vs DVDs, Keyboards vs Mouse, etc.	

	• <i>Learners who need more support can watch this video for clarification., etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using direct interaction, the teacher should introduce the week's learning indicator and focal area and then use GESI, Learners Research proficiency (e.g.: Ask learners to show by hand how many of them have used google search engine for research), Writing Speed and Communication clarity to form the mix-ability groupings</i> • <i>Using a research method, ask learners to do activity numbers (2 and 3)</i> • <i>Teachers pay attention to differentiation in this research task, some learners groups may not be able to complete the task</i> • <i>Teachers are to make conscious effort to find out what the</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using direct interaction, the teacher should introduce the week's learning indicator and focal area and then use GESI, Learners Research proficiency (e.g., Ask learners to show by hand how many of them have used google search engine for research), Writing Speed and Communication clarity to form the mix-ability groupings, etc.</i>	

	challenges where to the learners and provide them with assistance, etc. iii. Key Assessments (DoK): • Level 1: Learners should each be able to identify at least three (3) input devices and output devices each • Level 2: Learners should each be able to state and explain the functions of each of their selected devices • Level 3: Analyse how the introduction of SSDs has changed the performance of computers compared to HDDs. Consider factors such as speed, durability, and energy consumption, etc., etc. g) General science (Week 6) i. Learning Tasks: • Explain the chemical composition of a binary compound • Give an example and explain the bonding of ionic compound	iii. Key Assessments (DoK): Level 1: Learners should each be able to identify at least three (3) input devices and output devices each, etc. g) General science (Week 6) i. Learning Tasks: Explain the chemical composition of a binary compound, etc.	

	• Explain how the chemical formulae for binary compounds can be written, etc. ii. Pedagogical Exemplars: • Guide learners to revise from the JHS curriculum B9.1.1.1.1 about the nature of compounds. Provide opportunities for students to practice respecting others using the talk-for-learning strategies • Using models, videos, charts, and the internet, learners discuss the relationship between binary compounds (such as CO_2, NO_2, etc.), their composition, and chemical equations • With the help of visuals, define each term: element, molecule, ion, and compound • Have learners categorise a list of chemical examples such as H_2O, NaCl, Fe, Ca^{2+} under the correct headings: element,	ii. Pedagogical Exemplars Guide learners to revise from the JHS curriculum B9.1.1.1.1 about the nature of compounds. Provide opportunities for students to practice respecting others using the talk-for-learning strategies, etc.	

	<i>molecule, ion, or compound.</i> <i>Review and clarify misconceptions</i> • <i>Explain what binary compounds are, focusing on their formation</i> • <i>Use a Venn diagram or a chart, modelling kits or craft materials like coloured balls (for atoms) and sticks or Molymod (for bonds). Learners working in pairs can compare the properties of different binary chemical compounds, such as solubility, conductivity, and melting point</i> • <i>Engage learners in small group discussions about why certain compounds share properties and some differ vastly, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Identify at least four examples of binary compounds</i> • <i>Level 2 - Describe how magnesium oxide is formed</i> • <i>Level 3: Explain the role of</i>		
		<i>iii. Key Assessments (DoK):</i> <i>Level 1: Identify at least four examples of binary compounds, etc.</i>	

	<i>electron transfer in the formation of binary ionic compounds</i> • <i>Level 3: Explain how covalent compounds are different from ionic compounds. Give precise examples to support your explanation, etc.</i> <i>h) ICT (Week 6)</i> <i>i. Learning Tasks:</i> • <i>Using the Start Menu Button to open the MS Excel application</i> • <i>Using the “Save As” command to save an MS Excel document, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Engage in project-based learning and practical sessions to create, save, edit and format educational artefacts using Microsoft Excel application taking into consideration the features of Microsoft Excel application window most especially the Ribbon Tabs. Use the tabs on the ribbon tabs to create a multimedia</i>	<i>h) ICT (Week 6)</i> <i>i. Learning Tasks:</i> <i>Using the Start Menu Button to open the MS Excel application, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Engage in project-based learning and practical sessions to create, save, edit and format educational artefacts using Microsoft Excel application taking into consideration the features of Microsoft Excel application window most especially the Ribbon Tabs. Use the tabs on the ribbon tabs to create a multimedia</i>	

	<i>worksheet with text, shapes and charts Ensure inclusivity and equity in using ICT tools</i> <i>• In small groups, practically use the options under the home tab, to insert text and format it, use buttons under the insert tab to import pictures and draw basic shapes and use options under the charts group to generate a bar used from a typed data. Explore the options under the format tab to make desirable changes to drawn shapes, inserted pictures and charts. Guide learners to save the changes made to the document, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Level 1: Identify the steps involved in creating a new worksheet in Excel</i> <i>• Level 2: Demonstrate how to insert, delete, and format rows and columns in an Excel worksheet</i>	<i>worksheet with text, shapes and charts Ensure inclusivity and equity in using ICT tools, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: Identify the steps involved in creating a new worksheet in Excel, etc.</i>	

	• <i>Level 3: Evaluate the effectiveness of using data validation rules to ensure data accuracy in Excel</i> • <i>Level 4: Predict how advancements in machine learning could automate data analysis and visualisation tasks in Excel, etc.</i> <i>i) Biology (Week 6)</i> <i>i. Learning Tasks:</i> • <i>Explain the term biological keys. Limit content expectation to explanation of biological keys</i> • <i>Construct a dichotomous and numbered key with at least three organisms. Extend content expectation to the construction of dichotomous and numbered keys</i> • <i>Discuss the importance of biological keys. Extend content expectation to the discussion of at least three importance of biological keys, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using differential project-based</i>	<i>i) Biology (Week 6)</i> <i>i. Learning Tasks:</i> <i>Explain the term biological keys. Limit content expectation to explanation of biological keys, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using differential</i>	

	<i>learning, guide learners in mixed-ability groups collect different samples of organisms within the school community and apply the acquired knowledge in biological keys to group the sampled organisms, assigning reasons in each case for the identified organisms</i> • <i>Using talk for learning approach, learners in mixed-ability groups analyse and discuss the nature of dichotomous keys and numbered keys. Learners use interactive discussion at the group level to develop a simple dichotomous and numbered key for the identification of the specimen gathered, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: List between five to ten sets of morphological features you will require to create</i>	<i>project-based learning, guide learners in mixed-ability groups collect different samples of organisms within the school community and apply the acquired knowledge in biological keys to group the sampled organisms, assigning reasons in each case for the identified organisms, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: List between five to ten sets of morphological features you will require to create</i>	

	<i>a dichotomous key and use them to identify and classify three organisms. Accept a list of at least five morphological features for the construction of a dichotomous key</i> • <i>Level 2: Examine the two different forms of dichotomous keys and give one instance under which each of them is suitable in the identification of living organisms. Accept one instance listed for the use of either dichotomous/numbered key in the identification of organisms</i> • <i>Level 3: Discuss the importance of biological keys in the following areas:</i> <i>a. Discovery of new species.</i> <i>b. Education and research</i> <i>c. Ecology and conservation.</i> <i>Accept at least one point listed for the importance of biological keys under the following</i>	<i>a dichotomous key and use them to identify and classify three organisms. Accept a list of at least five morphological features for the construction of a dichotomous key, etc.</i>	

	<i>themes; discovery of new species, education and research, ecology and research</i> • <i>Level 4: Study a collection of organisms you have sampled; select a set of morphological features and use it to create your biological keys. Use the keys to identify living things you have sampled. Accept at least one biological key properly constructed and used to identify a minimum of three organisms, etc.</i>		
	<i>j) Chemistry (Week 6)</i> <i>i. Learning Tasks:</i> • <i>Explain how the atomic mass unit (a.m.u) of an individual particle (atom or molecule) is obtained, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using talk-for-learning strategy and in mixed ability groups, guide learners to explain how the atomic mass unit, (amu) of an</i>	<i>j) Chemistry (Week 6)</i> <i>i. Learning Tasks:</i> <i>Explain how the atomic mass unit (a.m.u) of an individual particle (atom or molecule) is obtained, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Using talk-for-learning strategy and in mixed ability groups, guide learners to explain how the atomic mass unit, (amu) of an</i>	

	<i>individual particle (atom or molecule) is obtained by using a video or power point presentation. Encourage slow learners to talk by directing questions to them, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Level 1: a. Explain atomic mass unit, (a.m.u)</i> <i>• Level 1: State the expression for calculating the relative atomic mass of elements</i> <i>• Level 2: a. The atomic mass unit of Carbon –12 is 1.6603×10^{-24} g. If the average mass of an atom X is 6.63310×10^{-23} g. Determine its relative atomic mass</i> <i>• Level 3: Explain how the relative atomic mass can be used to calculate the empirical formula of a substance, etc.</i> <i>k) Physics (Week 6)</i> <i>i. Learning Tasks</i> <i>• State Newton's first law of motion and</i>	<i>individual particle (atom or molecule) is obtained by using a video or power point presentation. Encourage slow learners to talk by directing questions to them, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: Explain atomic mass unit, (a.m.u), etc.</i> <i>k) Physics (Week 6)</i> <i>i. Learning Tasks</i> <i>State Newton's first law of motion and explain the</i>	

	<i>explain the concept of inertia</i> • <i>State Newton's second law of motion</i> • <i>Explain Newton's third law of motion</i> • <i>Identify the application of Newton's first, second and third laws in daily life, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using talk for learning, collaboratively and inclusively, let learners discuss the situations below to establish a) what forces are acting on the object and b) the object's motion. They should draw diagrams to represent the magnitude and direction of the forces they identify, as well as the direction of motion of the object (if any). They should then share their ideas with the class</i> • <i>A vehicle has broken down, and as responsible citizens, you know that it needs to be moved off the</i>	<i>concept of inertia, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Using talk for learning, collaboratively and inclusively, let learners discuss the situations below to establish a) what forces are acting on the object and b) the object's motion. They should draw diagrams to represent the magnitude and direction of the forces they identify, as well as the direction of motion of the object (if any). They should then share their ideas with the class, etc.</i>	

	road to prevent other cars from crashing into it. (1st and 2nd laws) • Learners build simple paper boats and place them in a bowl of water. Using made-up paddles, try to move the paper boats. (3rd law) • The teacher should then summarise the laws of motion so the class can answer questions about the factors that affect inertia • Watch videos (a good example is on YouTube: Veritasium - Best Film on Newton's Third Law. Ever.) or use interactive simulations (a good example is the PHeT simulation: Forces and Motion) to observe the effect on an object when it is a) already in motion and then experiences a resultant force, b) already in motion and experiences no resultant force, c) is stationary and experiences a		

	<i>resultant force and d) is stationary and experiences no resultant force</i> <i>• Learners should research and discuss various situations in daily life where Newton's laws of motion are applied. Allow students to leave the classroom and take photos of nature/objects that they can present to the class and describe/explain the forces at play, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Level 1: Explain inertia and state the factors that affect the inertia of a body</i> <i>• Level 2: Account for changes that will occur in the motion of bodies of different masses that experience the same force</i> <i>• Level 2: Identify some daily activities and explain how at least two of the 3 laws of motion is applied in each situation</i>	<i>iii. Key Assessments (DoK): Level 1: Explain inertia and state the factors that affect the inertia of a body, etc.</i>	

	• <i>Level 3: Design an experiment with simple materials in the environment to verify Newton's third law of motion (E.g. throwing a tennis ball against a wall), etc.</i> <i>I) Computing (Week 6)</i> <i>i. Learning Tasks:</i> • <i>Learners in their mix- abilities should be giving a device connected to the internet</i> • <i>To research and make brief notices on "Network-Attached Storage (NAS), Cloud Storage, Storage Area Networks (SANs), Data Redundancy and RAID, Storage Capacity and Performance, Communication Hardware Devices, Network Interface Cards (NICs), Modems, Routers, Switches, Hubs, Wireless Access Points (WAPs) and Repeaters and Extenders"</i> • <i>Each group should be given the opportunity to present on at</i>	<i>I) Computing (Week 6)</i> <i>i. Learning Tasks:</i> <i>Learners in their mix- abilities should be giving a device connected to the internet, etc.</i>	

	<i>least one device, explaining its function and importance</i> • <i>Learners who are finding it difficult to understand should be assisted by peers or teachers for clearer explanation, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using direct interaction, the teacher should introduce the week's learning indicator and focal area</i> • <i>Then use GESI, Learners Research proficiency (e.g.: Ask learners to show by hand how many of them have used google search engine for research), Writing Speed and Communication clarity to form the mix-ability groupings</i> • <i>Using the Research method, ask learners to do activity number (3).</i> • <i>The teacher is required to supervise the learners while they work in their groups</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using direct interaction, the teacher should introduce the week's learning indicator and focal area, etc.</i>	

	• <i>Using whole class discussion, the teacher should guide learners in understanding the devices the learners have challenges with, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Learners should each be able to identify at least three (3) input devices and output devices each</i> • <i>Level 2: Learners should state and explain the functions of each device selected in question in DoK Level 1 above, etc.</i>		
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 5 and 6. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 5 and 6. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	

3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan.</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning planner</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10mins

4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 7 and 8 of the teacher manual ahead of time and the DPLC Handbook Session 5 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 7 and 8 of the teacher manual ahead of time and the DPLC Handbook Session 5 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10mins

DPLC Session 5: Developing learning plans for Weeks 7 and 8			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 4, <i>developing learning plans for Weeks 5 and 6</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 4, <i>developing learning plans for Weeks 5 and 6</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 4, <i>developing learning plans for Weeks 5 and 6</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 4, <i>developing learning plans for Weeks 5 and 6</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 7 and 8. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Explain the properties, and functions of solids in life and appreciate the movement of substances in biotic and abiotic media.</i> B. <i>ICT: Learners should be able to explain and apply ethics to digital and Social Media platforms.</i> C. <i>Biology: Principles of classification of living things, and life processes and economic importance of lower organisms (amoeba, euglena and spirogyra).</i> D. <i>Chemistry: The mole concept and its related quantities and</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 7 and 8. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Explain the properties, and functions of solids in life and appreciate the movement of substances in biotic and abiotic media.</i> B. <i>ICT: Learners should be able to explain and apply ethics to digital and Social Media platforms.</i> C. <i>Biology: Principles of classification of living things, and life processes and economic importance of lower organisms (amoeba, euglena and spirogyra).</i> D. <i>Chemistry: The mole concept and its related quantities and</i>	

	<i>mole ratio and its applications.</i> E. <i>Physics:</i> <i>Thermometers, Pascal's principle and operation of hydraulic press and brake system in vehicles.</i> F. <i>Computing:</i> <i>Explain the relationships between the components of a computer and how data are transferred among the components.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 7 and 8 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 7 and 8 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template.	<i>mole ratio and its applications.</i> E. <i>Physics:</i> <i>Thermometers, Pascal's principle and operation of hydraulic press and brake system in vehicles.</i> F. <i>Computing:</i> <i>Explain the relationships between the components of a computer and how data are transferred among the components.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 7 and 8 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). L1.1 Discuss the important aspects in Weeks 7 and 8 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template.	

	LI 1.2 Complete the learning planner templates for Weeks 7 and 8 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 7 and 8 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 7 and 8 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 7 and 8 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks and 8.	LI 1.2 Complete the learning planner templates for Weeks 7 and 8 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 7 and 8 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of learning plan for Weeks 7 and 8 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 7 and 8 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 7 and 8 in your teacher manual.	

	2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 7 and 8 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (Week 7)</i> i. <i>Using balance chemical equations, how do I differentiate between covalent and ionic compounds as binary compounds?</i> ii. <i>With the aid of videos, how would I explain the composition of binary compounds and IUPAC naming of compounds?, etc.</i> b) <i>ICT (Week 7)</i> i. <i>How to apply ethics to digital and Social Media platforms?</i> ii. <i>What is the best approach to teach application of ethics to digital and Social Media platforms?, etc.</i> c) <i>Biology (Week 7)</i> i. <i>Why should lower organisms such as the Amoeba and Euglena be considered living organisms, although</i>	2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 7 and 8 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>))))))))))))))))))</i> b) c) d) e) f) g) h) i) j) k) <i>General Science (Week 7)</i> l) <i>Using balance chemical equations, how do I differentiate between covalent and ionic compounds as binary compounds?, etc.</i> b) <i>ICT (Week 7)</i> <i>How to apply ethics to digital and Social Media platforms?, etc.</i> c) <i>Biology (Week 7)</i> <i>Why should lower organisms such as the Amoeba and Euglena be considered living organisms, although they are</i>	

	<i>they are made up of only one cell?</i> <i>ii. How necessary should it be that biologists continue to study and gain more insights into knowledge on lower organisms?, etc.</i> <i>d) Chemistry (Week 7)</i> <i>i. How will the knowledge and understanding of the content, mole concept and its related quantities help learners to appreciate its importance in their daily lives?</i> <i>ii. How will I make connections between the content, the mole concept and its related quantities to the industry (medicine, battery making, plastics making, combustion)?, etc.</i> <i>e) Physics (Week 7)</i> <i>i. How does Pascal's principle serve as the fundamental concept behind the operation and advantages of hydraulic systems in various applications?</i> <i>ii. In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching Pascal's principle and</i>	<i>made up of only one cell?, etc.</i> <i>d) Chemistry (Week 7)</i> <i>How will the knowledge and understanding of the content, mole concept and its related quantities help learners to appreciate its importance in their daily lives?, etc.</i> <i>e) Physics (Week 7)</i> <i>How does Pascal's principle serve as the fundamental concept behind the operation and advantages of hydraulic systems in various applications?, etc.</i>	

	<i>operation of hydraulic press and brake system in vehicles?, etc.</i> <i>f) Computing (Week 7)</i> <i>i. How does a motherboard communicate with other computer components?</i> <i>ii. How does Computer Network work?, etc.</i> <i>g) General Science (Week 8)</i> <i>i. How is the knowledge of osmosis applied in the field of work such as the food industry, treatment of water, etc.?</i> <i>ii. How do I use experiments to explain the principles of osmosis?, etc.</i> <i>h) ICT (Week 8)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching the application of ethics to digital and Social Media platforms?</i> <i>ii. How can digital and Social Media platforms be used in other subject areas such as maths, English, biology?, etc.</i>	<i>f) Computing (Week 7)</i> <i>How does a motherboard communicate with other computer components?, etc.</i> <i>g) General Science (Week 8)</i> <i>How is the knowledge of osmosis applied in the field of work such as the food industry, treatment of water?, etc.</i> <i>h) ICT (Week 8)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching the application of ethics to digital and Social Media platforms?, etc.</i>	

	i) <i>Biology (Week 8)</i> i. <i>Why should lower organisms such as the Amoeba and Euglena be considered as living organisms, although they are only one cell thick?</i> ii. <i>With your basic knowledge in the principles of classification, will you consider organisms such as the Euglena as plants or animals? Which factors inform your decision?, etc.</i> j) <i>Chemistry (Week 8)</i> i. <i>How will the knowledge and understanding of mole ratio help learners calculate how much a product can be obtained from a given number of moles of reactant?</i> ii. <i>How do I make connections between what is been taught, mole ratio and its application and the previous lesson mole concept?, etc.</i> k) <i>Physics (Week 8)</i> i. <i>How can I teach learners to use thermometers responsibly and ethically,</i>	i) <i>Biology (Week 8)</i> <i>Why should lower organisms such as the Amoeba and Euglena be considered as living organisms, although they are only one cell thick?, etc.</i> j) <i>Chemistry (Week 8)</i> <i>How will the knowledge and understanding of mole ratio help learners calculate how much a product can be obtained from a given number of moles of reactant?, etc.</i> k) <i>Physics (Week 8)</i> <i>How can I teach learners to use thermometers responsibly and ethically,</i>	

	<i>considering issues like privacy and safety in healthcare, industry, or research settings where temperature measurements are crucial?</i> <i>ii. How can I help learners understand the real-world applications of thermometers in various fields, such as weather forecasting, medicine, and cooking?, etc.</i> <i>I) Computing (Week 8)</i> <i>i. What is the best approach to teach Computer Networks and how they work for all learners to benefit from the lesson?</i> <i>ii. In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching Computer Networks and how they work?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 7 and 8. Inform teachers to see the Teacher Manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j).	<i>considering issues like privacy and safety in healthcare, industry, or research settings where temperature measurements are crucial?, etc.</i> <i>I) Computing (Week 8)</i> <i>What is the best approach to teach Computer Networks and how they work for all learners to benefit from the lesson?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 7 and 8. See Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j).	

	<i>E.g.</i> a) <i>General science (Week 7)</i> i. <i>Learning Tasks:</i> • <i>A compound is formed by burning magnesium in air</i> • <i>What is the chemical name of the resulting compound and its chemical formula?</i> • <i>Explain how the compound is formed, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Discuss with learners on the basic concepts of binary compound naming. Use leading questions to engage learners in conversations about the patterns and rules involved in naming binary compounds. Encourage them to share their prior knowledge and build on it collaboratively.</i> • <i>Create a concept map on the board illustrating the connections between elements, ions, and naming conventions for</i>	<i>E.g.</i> a) <i>General Science (Week 7)</i> i. <i>Learning Tasks:</i> • <i>A compound is formed by burning magnesium in air, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Discuss with learners on the basic concepts of binary compound naming. Use leading questions to engage learners in conversations about the patterns and rules involved in naming binary compounds. Encourage them to share their prior knowledge and build on it collaboratively, etc.</i>	

	<i>binary compounds. Encourage learners to contribute to the map throughout the lesson.</i> • <i>Provide models representing different elements and ions, demonstrating how they combine to form binary compounds. Use interactive simulations or animations to illustrate the formation and naming processes.</i> • <i>Incorporate real-world examples, such as common household compounds, to illustrate the application of naming rules. For example, table salt, caustic soda, and baking soda.</i> • <i>In mixed groups, learners can research and prepare short presentations on specific aspects of binary compound naming.</i> • <i>Provide a set of binary</i>		

	<i>compounds for learners to name, encouraging them to work through the naming rules independently or in groups. Offer feedback and discuss solutions collectively to reinforce learning, etc.</i> iii. Key Assessments (DoK) • <i>Level 1: Write the chemical formula of one compound formed between each of the following elements: Magnesium and Chlorine; Sodium and Bromine; Carbon and Oxygen</i> • <i>Level 3: Compare a compound formed between Sodium and Chlorine with one formed between Hydrogen and Nitrogen. Use this information to answer the question below: Write down the name of each compound. Write the chemical formula for each of the compounds you have named</i>	iii. Key Assessments (DoK) <i>Level 1: Write the chemical formula of one compound formed between each of the following elements: Magnesium and chlorine; Sodium and bromine; Carbon and oxygen, etc.</i>	

	<i>above. Identify the type of bond in each compound and three differences between the compounds, etc.</i> <i>b) ICT (Week 7)</i> <i>i. Learning Tasks</i> <i>• The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the computer</i> <i>• Teachers can ask learners in their groups to individually think-write-share with their group members the definition of a digital device and agree on one definition. Teachers can then ask each group to present their definition for whole class discussion, etc.</i> <i>ii. Pedagogical Exemplars:</i>	<i>b) ICT (Week 7)</i> <i>i. Learning Tasks</i> <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the computer, etc.</i> <i>ii. Pedagogical Exemplars:</i>	

	• <i>Using Project-Based Learning: Engage in individual and mixed-ability/gender-sensitive group work to brainstorm and explain the importance of digital devices (e.g., desktop computers, laptop computers, mobile phones, tablet computers, e-readers, storage devices, input devices, and output devices)</i> • <i>With Think Pair Share strategy, put learners in groups of at least 4 and ask them to write at least 5 digital devices they see around them both in school and at home. Ask learners to share their answers with members in the group. Learners share their responses with the larger group, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Mention 3 examples of digital devices; how do digital devices help us in</i>	<i>Using Project-Based Learning: Engage in individual and mixed-ability/gender-sensitive group work to brainstorm and explain the importance of digital devices (e.g., desktop computers, laptop computers, mobile phones, tablet computers, e-readers, storage devices, input devices, and output devices), etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Mention 3 examples of digital devices;</i>	

	<i>our everyday life?; how has the use of digital devices changed the way we communicate?</i> • <i>Level 2: What does the increase in mobile device usage indicate about modern communication trends?</i> • <i>Level 3: Evaluate the impact of digital devices on personal privacy, etc.</i> c) <i>Biology (Week 7)</i> i. <i>Learning Tasks</i> • <i>Discuss the background of classification, linking it to simple living organisms, and the factors that are considered in classifying them. Limit content expectation to discussing the background of classification briefly before Linnaeus, and listing at least three factors used in the process</i> • <i>Discuss the various forms of classification among living things. Content should cover brief discussions on at least three forms of classification and how these are done</i>	<i>how do digital devices help us in our everyday life?, etc.</i> c) <i>Biology (Week 7)</i> i. <i>Learning Tasks</i> • <i>Discuss the background of classification, linking it to simple living organisms, and the factors that are considered in classifying them, etc.</i>	

	• <i>Examine the differences between natural and artificial classification of simple living things. Limit content to listing and describing at least three basic differences between natural and artificial forms of classification, etc.</i> • <i>Analyse the steps to be taken to classify a newly discovered simple living organism, hence discuss why it is necessary to classify living things. Limit content to discussing the major steps that taxonomists follow to classify and name newly discovered species, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using an experiential learning approach, put learners in mixed-ability, gender-balanced groups to embark on tours around the school community to observe and collect data on some simple living things (e.g. lower plants and common invertebrates)</i>		
		ii. <i>Pedagogical Exemplars:</i> • <i>Using an experiential learning approach, put learners in mixed-ability, gender-balanced groups to embark on tours around the school community to observe and collect data on</i>	

	• <i>Use research-based learning to put learners in mixed-ability groups to research from textbooks and available sources (e.g. audio and video documentaries) to understand the basis of classifying lower living things into various taxa. Research exercises keep all learners focused on participating in learning, as there are differentiated roles</i> • <i>Use project-based learning groups to assign learners into mixed-ability groups, give each group a project exercise on simple living things and their classification, and ask them to submit these for feedback to be provided. This strategy ensures that every learner has a significant role to play and, hence, feels important in the lesson, etc.</i>	<i>some simple living things (e.g. lower plants and common invertebrates), etc.</i>	
	iii. <i>Key Assessments (DoK)</i> • <i>Level 1: Identify the key factors required in creating a system for the identification and</i>	iii. <i>Key Assessments (DoK)</i> <i>Level 1: Identify the key factors required in creating a system</i>	

	<i>classification of simple living things</i> • <i>Level 2: Explain why you think it is important that a Biology learner should have a good basis in classifying living thing</i> • <i>Level 3: discuss the strengths and limitations of natural and artificial classification</i> • <i>Level 4: Collect samples (10-20 specimens) from your school community and group them under their various taxa as far as possible, assigning reasons as to why a particular organism is placed in a specific group. Accept project up to at least specimens and their identification and classification, including reasons for their classification, etc.</i> d) <i>Chemistry (Week 7)</i> i. <i>Learning Tasks</i> • <i>Calculate the number of oxide ions contained in 0.5 mol of Al_2O_3 [$N_A = 6.02 \times 10^{23}$]</i> • <i>Calculate the mass of 0.25mol of Na_2SO_4</i>	<i>for the identification and classification of simple living things, etc.</i> d) <i>Chemistry (Week 7)</i> i. <i>Learning Tasks</i> <i>Calculate the number of oxide ions contained in 0.5 mol of Al_2O_3 [$N_A = 6.02 \times 10^{23}$], etc.</i>	

	• Calculate the number of sodium ions present in 2.5 g of Na_2SO_4. [$\text{Na} = 23$, $\text{S} = 32$, $\text{O} = 16$, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$] • Calculate the number of moles contained in 250 cm^3 of carbon dioxide gas at s.t.p., etc. ii. Pedagogical Exemplars: • Using Problem-based approach; describe how the amount of substance (n) can be used to determine the number of entities (atoms, molecules or ions), mass (m) of a substance, volume (V) of a gas using mathematical equations that represent their interconversions, provide clear definitions and explanations of key terms, such as Avogadro's number and molar mass. Use gradual instructions to guide learners through simple mole calculations, support learners who are struggling with scaffolded worksheet. • Practice calculations involving amount of substance, number of entities and molar		

ii. Key Assessments (DoK)
 Level 1: Calculate the number of sodium ions in 16g of Na_2CO_3 . [$\text{Na} = 23$, $\text{O} = 16$, $\text{C} = 12$, $N_A = 6.02 \times 10^{23} \text{ particles/mol}$], etc.

	quantities. Give more opportunities for learners to practice and review to help reinforce the basic concepts, etc. iii. Key Assessments (DoK) - Level 1: Calculate the number of sodium ions in 16g of Na_2CO_3. [Na = 23, O = 16, C = 12, $N_A = 6.02 \times 10^{23}$ particles/mol] - Level 2: The molar mass of CO_2 is 44 g/mol. How many moles of CO_2 are present in 124 g sample of CO_2 - Level 3: What is the mass of 5.0×10^{23} molecules of NO_2? ,etc. e) Physics (Week 7) i. Learning Tasks - Define the term pressure - Explain factors that cause pressure to vary with depth - Demonstrate how pressure varies with depth - Derive the equation from $P=F/A$, etc. ii. Pedagogical Exemplars: - Give each learner a piece of graph paper and ask them to draw around their foot. By counting squares to estimate the area of their foot. They then	e) Physics (Week 7) i. Learning Tasks Define the term pressure ii. Pedagogical Exemplars: Give each learner a piece of graph paper and ask them to draw around their foot. By counting squares to estimate the	

	calculate the pressure exerted on the area under their foot based on their weight on a weighing scale and the area of their foot. This could be differentiated by asking learners to give their results in various units (e.g. Nm^{-2}, Ncm^{-2}, etc.) or to provide a written summary of the effect of wearing stilettos or doing a handstand • Give learners some mathematical problems using the $P=F/A$ formula involving different units and rearrangements of the equation (solving for different quantities). Increase the level of challenge as the worksheet progresses and encourage higher-ability learners to 'skip' to more complex questions. They could go around the room when they finish to support lower-ability learners • Groups of learners should be given large plastic bottles with holes made at various heights. Learners fill their bottles with water to	area of their foot. They then calculate the pressure exerted on the area under their foot based on their weight on a weighing scale and the area of their foot. This could be differentiated by asking learners to give their results in various units (e.g. Nm^{-2}, Ncm^{-2}, etc.) or to provide a written summary of the effect of wearing stilettos or doing a handstand, etc.	

	<i>the brim and close them with their lids. Learners are asked to explain or comment on their observations when the lid is taken off with respect to the path of the water at various heights. Lower-ability learners could be given keywords to help prompt them: can they use the terms radius, depth, force, pressure, particles, etc, in their explanations?</i> • <i>Combining the $P=F/A$ formula with the formula $\rho=m/V$, guide the learners to derive the formula. Note that learners may be unfamiliar with the density formula or may not have more profound knowledge of it, so the teacher will need to do more explanation on the quantity ρ (rho)</i> • <i>Give learners some mathematical problems to solve using the formula, involving different units and rearrangements of the equation (solving for different quantities). As mentioned above, Increase the level of challenge as the</i>		

	<i>worksheet progresses and encourage higher-ability learners to 'skip' to more complex questions. If they finish, they could circulate the room to support lower-ability learners, etc.</i> iii. <i>Key Assessments (DOK)</i> • <i>Level 1: Identify two systems that produce forces from fluid pressure</i> • <i>Level 1: What factors influence the pressure in a fluid, and how do these factors affect the fluid's pressure?</i> • <i>Level 2: Calculate the pressure at 70 m below the water's surface. [$g = 10 \text{ m s}^{-2}$, density of water $= 1000 \text{ kg m}^{-3}$], etc.</i> f) <i>Computing (Week 7)</i> i. <i>Learning Tasks :</i> • <i>Using online simulations, videos or photos, link learners' understanding from weeks 5 and 6 to the role of a motherboard, its parts and features</i> • <i>Provide learners with labelled diagrams of the components of the motherboard and have them research to discuss features and</i>	iii. <i>Key Assessments (DOK)</i> <i>Level 1: Identify two systems that produce forces from fluid pressure, etc.</i> f) <i>Computing (Week 7)</i> i. <i>Learning Tasks :</i> <i>Using online simulations, videos or photos, link learners' understanding from weeks 5 and 6 to the role of a motherboard, its parts and features, etc.</i>	

	<i>importance of the components such as CPU socket, RAM slots, expansion slots, chipset, and I/O ports in their mix-ability groups, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using an online simulation or photos (ICT tools), the teacher can teach the learners using direct instruction and open class discussion to discuss the components of the motherboard, its features and roles.</i> • <i>The teacher can print/project or use a virtual whiteboard to give learners these tasks (motherboard with/out labels) in their mix-ability groupings</i> • <i>The teacher can give learners assignments asking them to identify or mark parts like the CPU socket, RAM slots, and others, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: What is the role of a motherboard in a computer system?.</i> • <i>Level 1 Identify at most five (5) components of the motherboard from the photo gallery</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using an online simulation or photos (ICT tools), the teacher can teach the learners using direct instruction and open class discussion to discuss the components of the motherboard, its features and roles, etc.</i> iii. <i>Key Assessments (DoK)</i> <i>Level 1:What is the role of a motherboard in a computer system?, etc.</i>	

	<i>and write the names in your exercise books</i> • <i>Level 2: Explain the function of the CPU socket on a motherboard</i> • <i>Level 3: Compare and contrast the roles of the chipset and the CPU in a computer system, etc.</i> <i>g) General science (Week 8)</i> <i>i. Learning Tasks:</i> • <i>Explain diffusion in everyday life</i> • <i>Give at least three examples of diffusion in everyday life</i> • <i>How does temperature affect the rate of diffusion?</i> • <i>How does diffusion play a role in biological systems?, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using collaborative learning, Group learners based on mixed-ability and gender to encourage collaborative learning. Assign roles within each group to ensure equitable participation</i> • <i>Introduce the concept of diffusion and explain its use in domains such as</i>		
		<i>g) General science (Week 8)</i> <i>i. Learning Tasks:</i> <i>Explain diffusion in everyday life, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Using collaborative learning, Group learners based on mixed-ability and gender to encourage collaborative learning. Assign roles within each group to ensure equitable participation, etc.</i>	

	<i>chemistry, biology, and physics</i> • <i>Give each group a transparent container/beaker half-filled with water and potassium permanganate crystals</i> • <i>Let learners drop potassium permanganate crystals into the beaker containing water and observe what happens. Ensure all learners actively participate in the activity and support learners with difficulties</i> • <i>Ask learners to reflect and cross share their findings for discussion through peer review</i> • <i>Encourage groups to use the think-pair-share strategy to explain the diffusion process, etc.</i> <i>iii. Key Assessments (DoK)</i> • <i>Level 2: How does temperature affect the rate of diffusion?</i> • <i>Level 3: How does the molecular weight of particles influence the diffusion rate?</i> • <i>Level 4: In a lab experiment, two identical containers are filled with</i>	<i>iii. Key Assessments (DoK)</i> <i>Level 2: How does temperature affect the rate of diffusion?, etc.</i>	

	<i>water, and a drop of ink is added to each container. Container A is kept at room temperature while Container B is placed in a refrigerator. Predict and explain the difference in the diffusion rate between the two containers, etc.</i> <i>h) ICT (Week 8)</i> <i>i. Learning Tasks</i> <i>• The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the computer</i> <i>• Where there are available resources (a range of digital devices such as smartphones, tablets and laptops, Internet access and Research tools such as educational websites, online journals, e-books) Divide learners into small groups. Assign each group a specific area to</i>	<i>h) ICT (Week 8)</i> <i>i. Learning Tasks</i> <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the computer, etc.</i>	

	<i>research (e.g., communication, education, entertainment, health, business).</i> • <i>Ask each group to research how digital devices are used in their assigned area (communication, education, entertainment, health, business) focusing on benefits. Learners identify and use specific applications or software relevant to their research area on their digital devices. They should document their findings and experiences, noting how the device enhances the activity they are engaged in</i> • <i>Groups prepare a presentation to share their findings with the class. Encourage creative presentation methods, such as digital slideshows, videos, or live demonstrations</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using Blended Learning, teacher is expected to combine traditional classroom methods with online activities, allowing</i>		
		<i>ii. Pedagogical Exemplars:</i> <i>Using Blended Learning, teacher is expected to combine traditional classroom</i>	

	learners to pace their own learning and access resources beyond the classroom • Using Project-Based Learning, integrate digital devices in projects where learners can research, create presentations, and collaborate with peers, fostering critical thinking and problem-solving skills, etc. iii. Key Assessments (DoK): • Level 1: Name three common features found in most smartphones. List two advantages of using a tablet for reading eBooks compared to a traditional paperback book • Level 2: Explain how smart watches utilise sensors to track fitness activities and monitor health metrics, etc. i) Biology (Week 8) i. Learning Tasks • Name at least three life processes of Amoeba and the special adaptations for these processes. Limit content expectation to the identification at	methods with online activities, allowing learners to pace their own learning and access resources beyond the classroom, etc. iii. Key Assessments (DoK): Level 1: Name three common features found in most smartphones. List two advantages of using a tablet for reading eBooks compared to a traditional paperback book, etc. i) Biology (Week 8) i. Learning Tasks Name at least three life processes of Amoeba and the special adaptations for these processes. Limit content	

	<i>least three life processes in Amoeba, and the adaptive features to perform these life processes</i> <i>Describe how Amoeba undergoes movement and nutrition. Limit content to describing how Amoeba moves around in its habitat, and how it obtains its food in the water. Provide extra support for struggling learners</i> <i>Discuss the economic importance of Amoeba in its habitat. Limit content to the beneficial and harmful sides of the presence of Amoeba in a habitat, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Use task-based Learning for learners to observe the Amoeba under the light microscope from temporary slides prepared from freshly fetched water from a ditch or pond; make diagrams of these in sketch books. Learners acquire critical observation skills; learners</i>	<i>expectation to the identification at least three life processes in Amoeba, and the adaptive features to perform these life processes, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Use task-based Learning for learners to observe the Amoeba under the light microscope from temporary slides prepared from freshly fetched water from a ditch or pond; make diagrams of these in sketch books.</i>	

	<i>develop their technological skills through the use of the microscope</i> • <i>Use talk for learning approach for learners in mixed-ability groups to Amoeba describe their observations and findings and record them. The more confident and outspoken learners should describe their observation to reinforce understanding learners that learn slowly, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: List at least three life processes of Amoeba, briefly explaining each.</i> • <i>Level 2: Describe at least one of the following processes in Amoeba: nutrition, movement, excretion, reproduction</i> • <i>Level 3: Examine the economic importance of Amoeba in a named ecosystem. Accept discussion on the beneficial and harmful aspects of Amoeba in any named ecosystem, etc.</i>	<i>Learners acquire critical observation skills; learners develop their technological skills through the use of the microscope, etc.</i> iii. <i>Key Assessments (DoK)</i> <i>Level 1: List at least three life processes of Amoeba, briefly explaining each, etc.</i>	

	j) Chemistry (Week 8) i. Learning Tasks - Naming compounds based on the IUPAC system of naming using the following examples: AlBr_3, CrCl_3, HBr, H_3PO_3, NaHCO_3, Al_4C_3, Na_3N, SO_2, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, etc. ii. Pedagogical Exemplars: - In small groups, research and give class presentations on the IUPAC rules for naming various groups of inorganic compounds - Support learners to touch on the core principles of IUPAC nomenclature, emphasizing the importance of systematic naming in chemistry - Assist learners to make visually appealing diagrams or infographics that highlight the main ideas of the IUPAC naming guidelines, etc. iii. Key Assessments (DoK) - Level 2: Write the chemical formulae of the following compounds; Potassium chloride, Iron (II) bromide, Copper (II) tetraoxosulphate(VI),	j) Chemistry (Week 8) i. Learning Tasks Naming compounds based on the IUPAC system of naming using the following examples: AlBr_3, CrCl_3, HBr, H_3PO_3, NaHCO_3, Al_4C_3, Na_3N, SO_2, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, etc. ii. Pedagogical Exemplars: In small groups, research and give class presentations on the IUPAC rules for naming various groups of inorganic compounds, etc. iii. Key Assessments (DoK) Level 2: Write the Chemical formulae of the following compounds; Potassium chloride, Iron (II)	

	<i>Sodium carbonate decahydrate, etc.</i> k) <i>Physics (Week 8)</i> i. <i>Learning Tasks</i> • <i>Define thermometric substances.</i> • <i>List thermometric substances.</i> • <i>Explain the characteristics of some thermometric substances, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using a class discussion approach, learners are encouraged to recall their knowledge of heat and temperature, laying the foundation for the upcoming hands-on activities and allowing learners to connect new knowledge with existing knowledge.</i> • <i>Provide a list of common thermometric substances such as mercury, alcohol, water and bimetallic strips. Ask learners in groups to research and identify the unique properties of each substance that make them suitable for measuring</i>	<i>bromide, Copper (II) tetraoxosulphate (VI), Sodium Carbonate decahydrate, etc.</i> k) <i>Physics (Week 8)</i> i. <i>Learning Tasks</i> <i>Define thermometric substances.</i> ii. <i>Pedagogical Exemplars:</i> <i>Using a class discussion approach, learners are encouraged to recall their knowledge of heat and temperature, laying the foundation for the upcoming hands-on activities and allowing learners to connect new knowledge with existing knowledge, etc.</i>	

	<i>temperature changes. These experiments can also be demonstrated by the teacher or shown in videos</i> <i>• Provide learners with thermometers to measure the temperature of substances to enable them to observe the expansion and contraction of some thermometric substances, etc.</i> <i>iii. Key Assessments (DOK)</i> <i>• Level 1: Define thermometric substances</i> <i>• Level 1: List at least three thermometric substances</i> <i>• Level 2: State the characteristics of at least two thermometric substances, etc.</i> <i>I) Computing (Week 8)</i> <i>i. Learning Tasks</i> <i>• In direct instruction, learners are to listen attentively to the explanation of Operating Systems, Device Drivers, Utility Software, Application Software and their importance sequentially</i> <i>• Learners are to watch from visual aids or printed</i>	<i>iii. Key Assessments (DOK)</i> <i>• Level 1: Define thermometric substances, etc.</i> <i>I) Computing (Week 8)</i> <i>i. Learning Tasks</i> <i>In direct instruction, learners are to listen attentively to the explanation of Operating Systems, Device Drivers, Utility Software, Application Software and their importance sequentially, etc.</i>	

	<i>materials how system software acts as an intermediary between hardware and application software</i> • <i>Learners in their group watch a video demonstration on how a printer driver works with the operating system to print a document on one laptop but not on the other</i> • <i>Teachers can list examples of utility software and their uses and also learners to share their experiences, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Teachers can start the lesson with direct instruction to explain the key terms, System Software, Operating Systems, Device Drivers, Utility Software, Application Software in the process of note making</i> • <i>Using printed materials, online boards, projections or diagrams on the boards, teachers are required to show learners how these terms interact with each other, etc.</i>	<i>ii. Pedagogical Exemplars:</i> <i>Teachers can start the lesson with direct instruction to explain the key terms, System Software, Operating Systems, Device Drivers, Utility Software, Application Software in the process of note making, etc.</i>	

	iii. <i>Key Assessments (DoK)</i> • <i>Level 1: What is the purpose of an operating system?. List the components of a typical operating system. List four examples of device drivers</i> • <i>Level 2: List the components of a typical operating system and summarise the role of each in a single phrase. What is the difference between application software and utility software?, etc.</i> 2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 7 and 8. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	iii. <i>Key Assessments (DoK)</i> <i>Level 1: What is the purpose of an operating system?, etc.</i> 2.5 In your subject groups or individually, complete learning planners for Weeks 7 and 8. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	

3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning planner</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10mins

4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 9 and 10 of the teacher manual ahead of time and the DPLC Handbook Session 6 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 9 and 10 of the teacher manual ahead of time and the DPLC Handbook Session 6 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10mins

DPLC Session 6: Developing learning plans for Weeks 9 and 10			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction : Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 5, <i>developing learning plans for Weeks 7 and 8</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 5, <i>developing learning plans for Weeks 7 and 8</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 5, <i>developing learning plans for Weeks 7 and 8</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 5, <i>developing learning plans for Weeks 7 and 8</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 9 and 10. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Principles of reproduction and movement of substances in biotic and abiotic media.</i> B. <i>ICT: Create multimedia documents using appropriate computing tools.</i> C. <i>Biology: The application of the knowledge of ecological terms and the significance of ecological concepts, and the interdependency of living organisms for the sustenance of life.</i> D. <i>Chemistry: Calculations involving stoichiometric relationship and the kinetic theory of matter and its applications.</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 9 and 10. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Principles of reproduction and movement of substances in biotic and abiotic media.</i> B. <i>ICT: Create multimedia documents using appropriate computing tools.</i> C. <i>Biology: The application of the knowledge of ecological terms and the significance of ecological concepts, and the interdependency of living organisms for the sustenance of life.</i> D. <i>Chemistry: Calculations involving stoichiometric relationship and the kinetic theory of matter and its applications.</i>	

	<i>E. Physics: Temperature scales and its conversion, Image formation in plane mirror and laws of reflection.</i> <i>F. Computing: Use skills and knowledge to identify and differentiate between the different types of Network Systems.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 9 and 10 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 9 and 10 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 9 and 10 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual.	<i>E. Physics: Temperature scales and its conversion, Image formation in plane mirror and laws of reflection.</i> <i>F. Computing: Use skills and knowledge to identify and differentiate between the different types of Network Systems.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 9 and 10 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 9 and 10 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 9 and 10 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual.	

	LO 2: Review the learning plans for Weeks 9 and 10 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 9 and 10 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 9 and 10 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 9 and 10. 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 9 and 10 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 9)</i> i. <i>In what ways can the knowledge of principles of reproduction in both plants and mammals be</i>	LO 2: Review the learning plans for Weeks 9 and 10 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of learning plan for Weeks 9 and 10 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 9 and 10 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 9 and 10 in your teacher manual. 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 9 and 10 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 9)</i> <i>In what ways can the knowledge of principles of reproduction in both plants and mammals be applied in everyday</i>	

	<i>applied in everyday lives such as health, and agriculture?</i> <i>ii. How can I apply principles of diffusion and osmosis in everyday lives?, etc.</i> <i>b) ICT (Week 9)</i> <i>i. How can using the appropriate computing tools for multimedia documents make working with computers easy?</i> <i>ii. What is the best approach to teach multimedia documents and appropriate computing tools to use in creating multimedia documents?, etc.</i> <i>c) Biology (Week 9)</i> <i>i. How can learners understand their environment through ecological concepts?</i> <i>ii. What knowledge on types of habitats would I want my learners to know?, etc.</i> <i>d) Chemistry (Week 9)</i> <i>i. What prior knowledge do learners have about stoichiometry that will help them understand calculations</i>	<i>lives such as health, and agriculture?, etc.</i> <i>b) ICT (Week 9)</i> <i>How can using the appropriate computing tools for multimedia documents make working with computers easy?, etc.</i> <i>c) Biology (Week 9)</i> <i>How can learners understand their environment through ecological concepts?, etc.</i> <i>d) Chemistry (Week 9)</i> <i>What prior knowledge do learners have about stoichiometry that will help them understand calculations involving</i>	

	<i>involving stoichiometric relationships?</i> <i>ii. How will I relate the content, stoichiometric relationship with the chemical industry such as production of soap, fertilizer, and gasoline for learners to link the content with their daily life?, etc.</i> <i>e) Physics (Week 9)</i> <i>i. What is the best approach to teach the temperature scales and its conversion in everyday life for all learners to benefit from the lesson?</i> <i>ii. Are there typical errors that learners tend to make when converting between temperature scales, and how can I help them avoid these?, etc.</i> <i>f) Computing (Week 9)</i> <i>i. How does Computer Network work affect everyday life?</i> <i>ii. What is the best approach to teach Computer Networks and how they work for all learners to benefit from the lesson?, etc.</i>	<i>stoichiometric relationships?, etc.</i> <i>e) Physics (Week 9)</i> <i>What is the best approach to teach the temperature scales and its conversion in everyday life for all learners to benefit from the lesson?, etc.</i> <i>f) Computing (Week 9)</i> <i>How does Computer Network work affect everyday life?, etc.</i>	

	<i>g) General Science (Week 10)</i> <i>i. How can the knowledge in concept of reproduction in plants applied in crop production?</i> <i>ii. How do I use experiment to explain the principles of diffusion?, etc.</i> <i>h) ICT (Week 10)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching multimedia documents and appropriate computing tools to use in creating multimedia documents?</i> <i>ii. How can multimedia documents be used in other subject areas such as maths, English, biology?, etc.</i> <i>i) Biology (Week 10)</i> <i>i. How would learners explain interdependency of living organisms in various habitats?</i> <i>ii. How can learners apply their knowledge of</i>	<i>g) General Science (Week 10)</i> <i>How can the knowledge in concept of reproduction in plants applied in crop production?, etc.</i> <i>h) ICT (Week 10)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching multimedia documents and appropriate computing tools to use in creating multimedia documents?, etc.</i> <i>i) Biology (Week 10)</i> <i>How would learners explain interdependency of living organisms in various habitats?, etc.</i>	

	<i>habitats to everyday life?, etc.</i> j) <i>Chemistry (Week 10)</i> i. <i>How do I relate the content, kinetic theory of matter to the existence of matter in different phases?</i> ii. <i>How relevant is the content, kinetic theory of matter to learners' daily lives?, etc.</i> k) <i>Physics (Week 10)</i> i. <i>How can I convey the real-world significance of understanding image formation in mirrors and the laws of reflection to motivate my learners?</i> ii. <i>What opportunities will I give learners to apply their knowledge of image formation and the laws of reflection in real-world situations, such as designing reflective devices or explaining optical illusions?, etc.</i> l) <i>Computing (Week 10)</i> i. <i>In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching Computer Networks</i>	j) <i>Chemistry (Week 10)</i> <i>How do I relate the content, kinetic theory of matter to the existence of matter in different phases?, etc.</i> k) <i>Physics (Week 10)</i> <i>How can I convey the real-world significance of understanding image formation in mirrors and the laws of reflection to motivate my learners?, etc.</i> l) <i>Computing (Week 10)</i> <i>In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching Computer Networks</i>	

	<i>and how they work?</i> ii. <i>What is the best approach to teach Computer Networks and how they work for all learners to benefit from the lesson?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 9 and 10. Inform teachers to see the Teacher Manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). E.g. a) <i>General science (Week 9)</i> i. <i>Learning task</i> • <i>Define osmosis</i> • <i>Describe how osmosis is apparent in everyday life</i> • <i>Design an experiment to investigate osmosis. etc.</i> ii. <i>Pedagogical exemplars</i> • <i>Research and Discussion</i> ○ <i>Put learners into pairs and assign them the task of researching osmosis from books/internet/s science journals etc. Facilitate student research on osmosis through guiding</i>	<i>and how they work?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 9 and 10. See Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). E.g. a) <i>General Science (Week 9)</i> i. <i>Learning task</i> <i>Define osmosis. etc.</i> ii. <i>Pedagogical exemplars</i> <i>Research and Discussion</i> • <i>Put learners into pairs and assign them the task of researching osmosis from books/internet/ science journals etc. Facilitate student research on</i>	

	<i>questions and reliable sources</i> ○ <i>Encourage discussions on the meaning and significance of osmosis based on their findings</i> ○ <i>Facilitate a whole-class discussion to consolidate key points and address any queries</i> ○ <i>Encourage participation and collaboration among students, ensuring diverse perspectives are valued.</i> ● <i>Activity-based learning/ Collaborative learning</i> ○ <i>Put learners in mixed-ability groups and guide them in designing an experiment to investigate osmosis</i> ○ <i>Provide support and resources for students to plan and execute their experiments</i> ○ <i>Encourage students to document their experimental procedures, observations, and results</i>	<i>osmosis through guiding questions and reliable sources. etc.</i>	

	○ <i>Organize mixed-sex and mixed-ability groups to prepare presentations on the practical applications of osmosis. Offer feedback and evaluation of student presentations to reinforce learning outcomes.</i> ○ <i>Emphasize the involvement of female students in key roles during the presentation</i> ○ <i>Encourage discussions on how osmosis is utilized in everyday scenarios like cooking, plant hydration, or medical processes. etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 2: Explain three factors that affect osmosis</i> • <i>Level 2: Describe three ways osmosis can be applied in the domestic setting</i> • <i>Level 3: Design a model to explain the process of</i>		

	<i>osmosis and report on it. etc.</i> <i>b) ICT (Week 9)</i> <i>i. Learning Tasks:</i> <i>Here are some tasks to help learners explore and understand the various uses of digital devices (wearable, mobile devices, and Wireless Devices Connection) in different aspects of life and their importance in modern society. Kindly note that some tasks here are based on differentiated learning, the teacher can use them when applicable</i> <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the previously discussed digital</i>	<i>b) ICT (Week 9)</i> <i>i. Learning Tasks:</i> <i>Here are some tasks to help learners explore and understand the various uses of digital devices (wearable, mobile devices, and Wireless Devices Connection) in different aspects of life and their importance in modern society. Kindly note that some tasks here are based on differentiated learning, the teacher can use them when applicable. etc.</i>	

	<i>devices (laptop, tablet, phablet and smartphones)</i> • <i>Where there are available resources (a range of digital devices such as wearable, mobile devices, and Wireless Devices Connection, Internet access and Research tools such as educational websites, online journals, e-books)</i> <i>Divide learners into small groups. Assign each group a specific area to research (e.g., communication, education, entertainment, health, business)</i> • <i>Ask Each group to research how digital devices are used in their assigned area (communication, education, entertainment, health, business) focusing on benefits. Learners identify and use specific applications or software relevant to their research area on their digital devices. They should document their</i>		

	<i>findings and experiences, noting how the device enhances the activity they are engaged in</i> • <i>Groups prepare a presentation to share their findings with the class. Encourage creative presentation methods, such as digital slideshows, videos, or live demonstrations. etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Project-Based Learning: Integrate digital devices in projects where students can research, create presentations, and collaborate with peers, fostering critical thinking and problem-solving skills</i> • <i>Collaborative Learning: Facilitate group work using digital tools that enable communication and collaboration among students, such as shared documents and discussion forums</i> • <i>Blended Learning: Teacher is expected to combine</i>	<i>ii. Pedagogical Exemplars:</i> <i>Project-Based Learning: Integrate digital devices in projects where students can research, create presentations, and collaborate with peers, fostering critical thinking and problem-solving skills, etc.</i>	

	<i>traditional classroom methods with online activities, allowing students to pace their own learning and access resources beyond the classroom</i> • <i>Digital Literacy Skills: Assist learners to effectively and responsibly use digital devices, including internet research, digital citizenship, and online safety, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Identify the primary purpose of smartphones and digital media players</i> • <i>Level 2: Demonstrate how to navigate and access different functions on a smartphone or digital media player</i> • <i>Level 3: Evaluate the role of smartphones and digital media players in facilitating communication, productivity, entertainment, and information access</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: Identify the primary purpose of smartphones and digital media players, etc.</i>	

	• <i>Level 4: Predict how emerging technologies like augmented reality or artificial intelligence could revolutionise the functionality of smartphones and digital media players, etc.</i> c) <i>Biology (Week 9)</i> i. <i>Learning tasks:</i> • <i>Explain the term ecology. Limit content expectation to the definition or brief explanation of ecology</i> • <i>Explain at least four ecological terms. Extend content expectation to correct explanation of at least four ecological terms</i> • <i>Distinguish between any two closely related ecological terms. Encourage learners to distinguish between closely related ecological terms, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Individual-based learning: Learners individually research textbooks, the internet and</i>	c) <i>Biology (Week 9)</i> i. <i>Learning tasks:</i> <i>Explain the term ecology. Limit content expectation to the definition or brief explanation of ecology, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Individual-based learning: Learners individually research textbooks, the</i>	

	<i>other relevant sources to understand the meaning of various ecological terms (e.g., ecology, biosphere, environment, ecosystems, community, population, habitat, biome, biotic and abiotic factors)</i> • <i>Using group-based learning: learners in mixed-ability groups discuss the various ecological terms and note down the correct explanation for each. Learners become analytical and critical thinkers through systematic examination and differentiation of closely related ecological terms. Learners learn to accept peers from different social, emotional, psychological and economic backgrounds. They also learn from one another and accept the contributions of others during group work, etc.</i> iii. Key Assessments (DoK): • <i>Level 1: Explain briefly the term ecology. Accept an explanation with</i>	<i>internet and other relevant sources to understand the meaning of various ecological terms (e.g., ecology, biosphere, environment, ecosystems, community, population, habitat, biome, biotic and abiotic factors), etc.</i> iii. Key Assessments (DoK): <i>Level 1: Explain briefly the term ecology. Accept an explanation with</i>	

	<i>any three keywords:</i> ○ <i>Branch of biology</i> ○ <i>Study</i> ○ <i>Interaction between</i> ○ <i>Living organisms and</i> ○ <i>Environment</i> • <i>Level 1: List ecological terms you are familiar with and explain any two. Accept at least any four terms listed and any two correctly explained</i> • <i>Level 3: Distinguish between the following:</i> ○ <i>Environment and ecosystems</i> ○ <i>Niche and habitat</i> ○ <i>Biosphere and biome</i> ○ <i>Food chain and food web</i> ○ <i>Primary succession and secondary succession, etc.</i> <i>d) Chemistry (Week 9)</i> <i>i. Learning tasks:</i> • <i>Balance the chemical equation and determine the mole ratio of hydrogen to oxygen in the reaction</i> • <i>Balance the chemical equation and determine the mole ratio of to in the reaction</i>	<i>any three keywords:</i> ○ <i>Branch of biology</i> ○ <i>Study</i> ○ <i>Interaction between</i> ○ <i>Living organisms and</i> ○ <i>Environment, etc.</i> <i>d) Chemistry (Week 9)</i> <i>i. Learning tasks:</i> <i>Balance the chemical equation and determine the mole ratio of hydrogen to oxygen in the reaction, etc.</i>	

	- Consider the reaction, $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$. If 25cm^3 of 0.25 mol dm^{-3} HCl reacts completely with excess sodium hydroxide, calculate the mass of sodium chloride produced. $[\text{Na} = 23, \text{Cl} = 35.5]$ - Consider the reaction, $2\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$. Calculate the volume of KOH of concentration 0.1 mol dm^{-3} required to completely neutralise 20 cm^3 of a 0.25 mol dm^{-3} H_2SO_4 solution, etc. ii. Pedagogical Exemplars - Start the lesson by assessing learners' prior knowledge in basic chemistry concepts such as balancing of chemical equations from the JHS syllabus - Put learners into ability groupings and offer various instructional materials such as written instructions, reagents, hands-on demonstrations to the groups - Guide learners in their ability groupings to carry out simple reactions based on the materials provided		
		ii. Pedagogical Exemplars Start the lesson by assessing learners' prior knowledge in basic chemistry concepts such as balancing of chemical equations from the JHS syllabus, etc.	

	and have them follow strictly the written instructions • Have the groups write down and balanced the equations they have carried out and present • While maintaining the groups, let learners write out the mole ratio of the species in each of the balanced reactions and use them to calculate the following quantities. Provide support to groups that are struggling and allow for more independence for advance groups. ○ Number of entities ○ Amount of substance ○ Mass of substance ○ Concentrations in g dm⁻³, mol dm⁻³ and ppm ○ Volume of substance, etc. iii. Key Assessments • Level 1: Write a balance chemical equation for the reaction between Zn and HCl • Level 2: Zinc metal reacts with hydrogen chloride according to the reaction $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$.		
		iii. Key Assessments Level 1: Write a balance chemical equation for the reaction between Zn and HCl, etc.	

	<i>Calculate the mass of zinc required to produce 2 moles of hydrogen gas</i> <i>Level 3: Calculate the mass of CO₂ produced when 2 moles of propane (C₃H₈) reacts with excess oxygen. (C = 12, H = 1, O = 16), etc.</i> <i>e) Physics (Week 9)</i> <i>i. Learning tasks:</i> <i>Identify types of temperature scales</i> <i>Describe various temperature scales and the construction of their corresponding thermometers, etc.</i> <i>ii. Pedagogical exemplars:</i> <i>Have learners research the origin, historical context and critical reference points (freezing and boiling points of water for all temperature scales (Celsius, Fahrenheit, Kelvin)</i> <i>Using role play, learners act as particles in a gaseous state. Instruct learners to move randomly, pretend to be particles in a gas, and then ask them to behave as though their temperature</i>	<i>e) Physics (Week 9)</i> <i>i. Learning tasks:</i> <i>Identify types of temperature scales, etc.</i> <i>ii. Pedagogical exemplars:</i> <i>Have learners research the origin, historical context and critical reference points (freezing and boiling points of water for all temperature scales (Celsius, Fahrenheit, Kelvin), etc.</i>	

	<i>decreases until they form a solid and eventually stop moving. This helps demonstrate and understand the zero kinetic energy of particles and why no temperatures are colder than absolute zero</i> • <i>The same activity could be extended to understanding the Celsius scale; learners behave as particles in water as it increases in temperature from (e.g.) -20 degrees to 120 degrees. Can they pinpoint precisely when they have reached 0 degrees and 100 degrees?</i> • <i>If available, learners should construct their thermometers. This can be done by providing a bucketful of iced water (0 degrees Celsius) and a kettle on a rolling boil (100 degrees Celsius). Learners are given liquid in glass thermometers with no scale or with the scale blanked out using stickers or permanent markers. They mark the height of the</i>		

	<i>thermometric liquid on their thermometers at 0 degrees and 100 degrees before dividing the scale into 10-degree increments. They could then remove the sticker covering the accurate scale and compare their experimental results with the true values, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: What is a temperature scale?</i> • <i>Level 1: Name two commonly used temperature scales</i> • <i>Level 2: Describe the Kelvin temperature scale and its significance in scientific measurements</i> • <i>Level 2: Explain the concept of absolute zero and its relevance to the Kelvin temperature scale</i> • <i>Level 2: Explain why the temperature of an object cannot be -50K, etc.</i> f) <i>Computing (Week 9)</i> i. <i>Learning tasks:</i> • <i>Teachers can start the lesson by having an open class discussion with the learners about how networks work and</i>	iii. <i>Key Assessments (DoK)</i> <i>Level 1: What is a temperature scale?, etc.</i> f) <i>Computing (Week 9)</i> i. <i>Learning tasks:</i> <i>Teachers can start the lesson by having an open class discussion with the learners about how networks work and</i>	

	<i>its importance, touching on relatable networks available in the community</i> • <i>The teacher can present real objects or photos of the network devices to be taught and ask learners to identify the devices they know and their functions</i> • <i>Teachers should diagnose learners' understanding and group them in their mix-ability groupings</i> • <i>Teachers should guide learners in their groupings to research on the importance of computer networks</i> • <i>In the same groupings teachers should guide learners to further look at the different types of network components</i> • <i>Each group should be given the opportunity to present on at least one component</i> • <i>The teacher should take cautious note of the areas learners are finding it difficult to understand and give clearer explanation and clarification, etc.</i>	<i>its importance, touching on relatable networks available in the community, etc.</i>	

	ii. <i>Pedagogical Exemplars:</i> • <i>Using an inquiry based learning approach, teachers should introduce the week's learning indicator and focal area "Computer Networking"</i> • <i>Consciously integrate GESI, learners research proficiency and pace of grasping concepts to form groupings</i> • <i>Teachers can use any presentation medium (like photos on several phones) to facilitate visual learning</i> • <i>Task the groups to search on the importance of networking and the components</i> • <i>The teacher is required to supervise the learners while they work in their groups</i> • <i>Give each group the chance to present using a whole class discussion</i> • <i>Teachers should pay close attention to the presentation and make inputs where needed</i> • <i>Teachers should diagnose areas where learners are finding it difficult to understand and</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using an inquiry based learning approach, teachers should introduce the week's learning indicator and focal area "Computer Networking", etc.</i>	

	give clarity to it, etc. iii. Key Assessments (DoK): • Level 1: What is the primary purpose of computer networking? • Level 2: Describe the main difference between a switch and a router, and determine which device is best suited for a given network scenario, etc. g) General science (Week 10) i. Learning Task: • Analyse the differences between the types of reproduction in plants • Describe the stages of sexual reproduction in flowering plants • Describe vegetative propagation practices such as layering, grafting, cutting, etc. using hands-on experiment, etc. ii. Pedagogical Exemplars: • Research and Collaborative Method ○ Put learners in groups to research and discuss the meaning of reproduction and types of	iii. Key Assessments (DoK): Level 1: What is the primary purpose of computer networking?, etc. g) General science (Week 10) i. Learning Task: Analyse the differences between the types of reproduction in plants, etc. ii. Pedagogical Exemplars: • Research and Collaborative Method ○ Put learners in groups to research and discuss the meaning of reproduction and types of	

	<i>reproduction in plants</i> ○ <i>Encourage reflection and sharing of findings with the class for a discussion on different reproductive strategies in plants. Facilitate research activities, discussions, and presentations within mixed-ability groups</i> • <i>Nature Walk and Observations</i> ○ <i>Lead students on a nature walk to observe various plant species and identify reproductive parts</i> ○ <i>In groups, students can write down their observations and discuss their findings with the class, focusing on the diversity of plant reproductive structures. Provide guidance during the nature walk and encourage meaningful observations</i>	<i>reproduction in plants.</i> ○ <i>Encourage reflection and sharing of findings with the class for a discussion on different reproductive strategies in plants. Facilitate research activities, discussions, and presentations within mixed-ability groups, etc.</i>	

	• <i>Research method</i> ○ <i>Put learners in mixed-ability groups to search for information on sexual reproduction in plants, including pollination and its role in plant reproduction.</i> ○ <i>Learners cross-share findings through presentations and facilitate group discussions to reflect on key themes and encourage critical thinking about pollination and sexual reproduction in plants. Encourage critical thinking, reflection, and peer interaction during group discussions</i> ○ <i>Utilize a research-based learning approach where learners research and present on asexual reproduction in plants using vegetative parts like corms, rhizomes, suckers, stem cuttings, and bulbs</i> • <i>Activity-based Learning Approach</i> ○ <i>Engage students in hands-on</i>		

	<i>activities related to asexual reproduction to reinforce learning through active participation. Support hands-on activities and promote engagement through experiential learning, etc.</i> iii. Key Assessments (DoK) • <i>Level 1: Explain the importance of reproduction</i> • <i>Level 2: Describe the process of fertilization in flowering plants</i> • <i>Level 3: write a report on a hand-on activity of at least two artificial propagation methods from the lesson, etc.</i> h) ICT (Week 10) i. Learning tasks: • <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the previously discussed digital devices</i>	. iii. Key Assessments (DoK) • <i>Level 1: Explain the importance of reproduction, etc.</i> h) ICT (Week 10) i. Learning tasks: • <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online aside from the</i>	

	• <i>Where there are available resources (a range of digital devices such as laptop, tablet, phablet, smartphones, wearables, mobile devices, and Wireless Devices Connection, Internet access and Research tools such as educational websites, online journals, e-books) Divide learners into small groups. Assign each group two digital devices to research on their differences and share their findings with the larger class</i> • <i>Teacher Print out pictures or icons of various digital devices along with separate cards containing descriptions of their functions and uses and share them to the groups. Learners match each digital device picture with the correct description card</i> • <i>After the matching activity, learners discuss why each digital device is suited for its specific functions and how they differ from one another</i>	<i>previously discussed digital devices, etc.</i>	

	• Ask learners to think of scenarios where one device might be more beneficial to use than another in groups and explain their reasoning with the whole class, etc. ii. Pedagogical exemplars: • Facilitate group discussions where students can share their experiences and insights about using different digital devices • Assign research projects where students investigate the evolution of digital devices and their impact on society • Teacher Print out pictures or icons of various digital devices along with separate cards containing descriptions of their functions and uses and share them to the groups. Learners match each digital device picture with the correct description card • Present real-world scenarios where different digital devices are used. Discuss why certain devices are preferred over others in specific situations • Provide students with the opportunity	ii. Pedagogical exemplars: Facilitate group discussions where students can share their experiences and insights about using different digital devices, etc.	

	<i>to use various digital devices. This direct interaction can help solidify their understanding of the differences, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: Name one major difference between a desktop computer and a laptop computer</i> • <i>Level 2: How does the form factor of a desktop computer differ from that of a laptop computer, and how does it impact usability?</i> • <i>Level 3: Evaluate the advantages and disadvantages of using a desktop computer in a professional setting compared to a laptop computer, etc.</i> i) <i>Biology (Week 10)</i> i. <i>Learning tasks</i> • <i>Explain the interdependency of living things</i> • <i>List the forms of the interdependency of living things in a named habitat</i> • <i>Describe the interdependency of living things in different habitats, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>In mixed ability, gender-responsive groups, learners, under the guide of the teacher</i>	iii. <i>Key Assessments (DoK)</i> <i>Level 1: Name one major difference between a desktop computer and a laptop computer, etc.</i> i) <i>Biology (Week 10)</i> i. <i>Learning tasks</i> <i>Explain the interdependency of living things, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>In mixed ability, gender-responsive groups, learners, under the guide of</i>	

	<i>undertake a nature walk on the school compound to identify some of the interdependency of living things within the community such as pollination, predation, decomposition, provision of food and oxygen through photosynthesis, parasitism other symbiotic associations, recycling of nutrients by decomposers and several feeding relationships, etc.</i> iii. Key Assessments- DoK • <i>Level 1: Name a given habitat and make a list of five living things and five non-living things that interact together and are interdepend on one another</i> • <i>Level 3: Predict at least three possible consequences of each of the following human activities on ecological systems.</i> ○ <i>Illegal mining</i> ○ <i>Bush fires</i> ○ <i>Disposal of sewage into water bodies</i>	<i>the teacher undertake a nature walk on the school compound to identify some of the interdependency of living things within the community such as pollination, predation, decomposition, provision of food and oxygen through photosynthesis, parasitism other symbiotic associations, recycling of nutrients by decomposers and several feeding relationships, etc.</i> iii. Key Assessments- DoK <i>Level 1: Name a given habitat and make a list of five living things and five non-living things that interact together and are interdepend on one another, etc.</i>	

	• <i>Level 3: Construct a food chain and a food web and use each to demonstrate how living things in an ecosystem depend on one another for their survival</i> • <i>Level 4: Mr Manu observed that his maize yield decreased yearly over a four-year farming period. He was advised to apply organic manure and carry out irrigation, after which he had a good harvest. Describe the kind of interactions that occurred between the living and non-living things that allowed a change in the soil components and made way for a good harvest, etc.</i> <i>j) Chemistry (Week 10)</i> <i>i. Learning tasks:</i> • <i>Provide learners with different materials such as water and ice. Ask them to observe and describe the properties of each state of matter (solids and liquids) based on their shape, volume, density. Guide learners to understand how the kinetic theory of</i>	<i>j) Chemistry (Week 10)</i> <i>i. Learning tasks:</i> <i>Provide learners with different materials such as water and ice. Ask them to observe and describe the properties of each state of matter (solids and liquids) based on their shape, volume, density. Guide learners to understand how the kinetic theory</i>	

	<i>matter explains the behaviour of particles in each state. For example, they can discuss how particles in a solid are closely packed and vibrate in fixed positions, while particles in a liquid move freely and rapidly</i> <i>• Provide learners with ice cubes, a heat source, and a thermometer. Ask them to measure the temperature of the ice, observe what happens as it melts into water, and record the temperature changes. Guide learners to analyse their observations in terms of kinetic theory, explaining how heat energy causes particles to gain kinetic energy and transition from a solid to a liquid state, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• In mix-ability groupings, use visual aids such as diagrams, illustrations, and animations to introduce the kinetic theory of matter. Use simple representations to depict the arrangement and</i>	<i>of matter explains the behaviour of particles in each state. For example, they can discuss how particles in a solid are closely packed and vibrate in fixed positions, while particles in a liquid move freely and rapidly, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>In mix-ability groupings, use visual aids such as diagrams, illustrations, and animations to introduce the kinetic theory of matter. Use simple representations to depict the</i>	

	<i>motion of particles in solids and liquids. For example, show how particles in a solid are tightly packed and vibrate in fixed positions, while particles in a liquid are more loosely arranged and can slide past each other. Use colourful graphics to make the concepts clearer to learners</i> • <i>Still maintaining the groups, engage them with activities to investigate the properties of solids and liquids in more depth and present their findings. Encourage critical thinking by asking students to relate their observations to the principles of kinetic theory and draw conclusions about the behaviour of particles in solids and liquids</i> • <i>In ability groups, conduct hands-on demonstrations to illustrate the behaviour of particles in solids and liquids. Provide learners with materials such as marbles, beads, and water, and ask them to observe and manipulate the substances to</i>	<i>arrangement and motion of particles in solids and liquids. For example, show how particles in a solid are tightly packed and vibrate in fixed positions, while particles in a liquid are more loosely arranged and can slide past each other. Use colourful graphics to make the concepts clearer to learners, etc.</i>	

	<i>simulate the behaviour of particles. For solids, demonstrate how the particles maintain their shape and volume but can be rearranged by external forces. For liquids, show how the particles can flow and take the shape of their container. Encourage learners to ask questions and make observations to deepen their understanding, etc.</i> iii. Key Assessments (DoK): • <i>Level 2: Draw a simple diagram illustrating the arrangement and motion of particles in a solid and a liquid</i> • <i>Level 3: Compare and contrast the behaviour of particles in solids and liquids according to the kinetic theory of matter</i> • <i>Level 4: In a laboratory experiment, students investigate the effect of temperature on the viscosity of a liquid. Describe how the kinetic theory of matter can be applied to explain the observed changes in viscosity</i>	iii. Key Assessments (DoK): <i>Level 2: Draw a simple diagram illustrating the arrangement and motion of particles in a solid and a liquid, etc.</i>	

	<i>as temperature increases, etc.</i> k) <i>Physics (Week 10)</i> i. <i>Learning Tasks</i> • <i>Describe reflection</i> • <i>State the laws of reflection</i> • <i>Draw the ray diagram showing the reflection process, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>Set up a plane mirror on a table and place an object before it. Ask learners to observe the reflection and draw the incident ray (from the object to the mirror) and the reflected ray (from the mirror to the observer's eye), for different object positions. Encourage them to look for patterns in the angles of incidence and reflection</i> • <i>Provide learners with a protractor and a light source (such as a laser pointer). Guide them in drawing a normal to the surface and measuring the angles of incidence and reflection for light rays hitting the mirror at different positions. Learners should</i>	k) <i>Physics (Week 10)</i> i. <i>Learning Tasks</i> <i>Describe reflection, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Set up a plane mirror on a table and place an object before it. Ask learners to observe the reflection and draw the incident ray (from the object to the mirror) and the reflected ray (from the mirror to the observer's eye), for different object positions. Encourage them to look for patterns in the angles of incidence and reflection, etc.</i>	

	<i>discuss their findings and any observations related to the angles. Note that some students will find it difficult to a) draw a normal perpendicular to the surface and b) use a protractor to measure angles, and in this case, they should be given more one-to-one support either by the teacher or by a more proficient student</i> <i>• In the absence of practical equipment, use interactive virtual lab simulations or online tools that allow learners to adjust the incident angle and observe the corresponding reflection angles for situations where laboratory equipment is unavailable. This will give them more data points to deduce the reflection laws, etc.</i> <i>iii. Key Assessments (DOK)</i> <i>• Level 1: Define reflection</i> <i>• Level 1: State the laws of reflection</i> <i>• Level 2: A light ray is incident on a mirror at an angle</i>		
		<i>iii. Key Assessments (DOK)</i> <i>Level 1: Define reflection, etc.</i>	

	<i>of 38° to the normal; what is the reflected angle?</i> • <i>Level 2: A light ray is incident on a mirror at an angle 38o to the normal. What total angle is the ray deviated from?, etc.</i> <i>l) Computing (Week 10)</i> <i>i. Learning tasks:</i> • <i>Teachers can start with a class discussion emphasising again on the importance and why computer networks are essential in modern computing</i> • <i>Using visual representation provide learners with diagrams, or models of each the network types and topologies</i> • <i>Teachers can create matching activities from the content for learners to match the types of networks and topologies</i> • <i>Using pick-from-hat-and-explain, teachers should task learners in mixed-ability groupings to explain in their own words the acronyms PAN, LAN, MAN, WAN and CAN</i>	<i>l) Computing (Week 10)</i> <i>i. Learning tasks:</i> <i>Teachers can start with a class discussion emphasising again on the importance and why computer networks are essential in modern computing, etc.</i>	

	• <i>Same activity in item 4, should be repeated for the types of topologies, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using talk for learning, teachers should have an open class discussion with the learners in the introduction process</i> • <i>Teachers can use the visual images provided or create similar ones to facilitate the learning in the classroom</i> • <i>Teachers should cautiously integrate GESI, SEL and SEN when doing activities 4 and 5.</i> • <i>Teachers are expected to diagnose learners' responses and guide them to reflect on their responses to improve on their responses, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: What devices are connected directly to the central hub in a star topology?</i> • <i>Level 2: Explain why a mesh topology might be more</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using talk for learning, teachers should have an open class discussion with the learners in the introduction process, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: What devices are connected directly to the central hub in a star topology?, etc.</i>	

	<i>reliable than a ring topology, etc.</i> 2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 9 and 10. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 9 and 10. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	
3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> a) <i>Alignment among teacher manual and learning plan</i> b) <i>Innovativeness of pedagogical choices</i> c) <i>Incorporation of GESI, SEL, national values and 21st century skills</i>	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> a) <i>Alignment among teacher manual and learning planner</i> b) <i>Innovativeness of pedagogical choices</i> c) <i>Incorporation of GESI, SEL, national values and 21st century skills</i>	10 mins

	<i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	<i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	
4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3l). 4.3 Remind teachers to read the contents of Weeks 11 and 12 of the teacher manual ahead of time and the DPLC Handbook Session 7 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3l). 4.3 Remember to read the contents of Weeks 11 and 12 of the teacher manual ahead of time and the DPLC Handbook Session 7 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10 mins

DPLC Session 7: Developing learning plans for Weeks 11 and 12			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 6, <i>developing learning plans for Weeks 9 and 10</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 6, <i>developing learning plans for Weeks 9 and 10</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 6, <i>developing learning plans for Weeks 9 and 10</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 6, <i>developing learning plans for Weeks 9 and 10</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation , 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 11 and 12. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Principles of reproduction and how they are applied to address sexually related societal problems</i> B. <i>ICT: Classify network types and topologies</i> C. <i>Biology: The use of ecological devices and methods (such as quadrats, pitfall traps, pooter and Lincoln's index) to study the population of living organisms, and the relevance of direct counting, gut examination and radioactive tracer method for determining energy flow in an ecosystem</i> D. <i>Chemistry: Calculations involving the various gas laws</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 11 and 12. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Principles of reproduction and how they are applied to address sexually related societal problems</i> B. <i>ICT: Classify network types and topologies</i> C. <i>Biology: The use of ecological devices and methods (such as quadrats, pitfall traps, pooter and Lincoln's index) to study the population of living organisms, and the relevance of direct counting, gut examination and radioactive tracer method for determining energy flow in an ecosystem</i> D. <i>Chemistry: Calculations involving the various</i>	

	<i>and analysis of their graphs including Graham's law of diffusion/effusion and Dalton's law of partial pressures</i> <i>E. Physics: Spherical mirrors and Refraction</i> <i>F. Computing: Apply knowledge of data structures to explain their real-life applications effectively.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 11 and 12 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 11 and 12 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, key notes on differentiation, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks	<i>gas laws and analysis of their graphs including Graham's law of diffusion/effusion and Dalton's law of partial pressures</i> <i>E. Physics: Spherical mirrors and Refraction</i> <i>F. Computing: Apply knowledge of data structures to explain their real-life applications effectively.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 11 and 12 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 11 and 12 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, key notes on differentiation, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for	

	11 and 12 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 11 and 12 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 11 and 12 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 11 and 12 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 11 and 12 (NTS 1a, 2c, 2f and 3d-3g). 2.3 Ask teachers to discuss at least two essential questions	Weeks 11 and 12 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 11 and 12 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of learning plan for Weeks 11 and 12 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 11 and 12 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 11 and 12 in your teacher manual (NTS 1a, 2c, 2f and 3d-3g). 2.3 Discuss at least two essential questions that will	

	that will guide the lesson activities for Weeks 11 and 12 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (Week 11)</i> i. <i>How can the knowledge in concept of male and female reproductive systems help address sexually related problems such as STIs, infertility, in real-life scenarios?</i> ii. <i>How do I determine menstrual cycle using calendar method?, etc.</i> b) <i>ICT (Week 11)</i> i. <i>How can I classify network types and topologies to make the use of the computer less stressful?</i> ii. <i>What is the best approach to teach classification of network types and topologies?, etc.</i> c) <i>Biology (Week 11)</i> i. <i>What would be the need to use some simple ecological tools for estimating populations of species (e.g., pooter, sweep net, pitfall trap, etc)?</i> ii. <i>How important is the estimation of species population</i>	guide the lesson activities in Weeks 11 and 12 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (Week 11)</i> <i>How can the knowledge in concept of male and female reproductive systems help address sexually related problems such as STIs, infertility, in real-life scenarios?, etc.</i> b) <i>ICT (Week 11)</i> <i>How can I classify network types and topologies to make the use of the computer less stressful? etc.</i> c) <i>Biology (Week 11)</i> <i>What would be the need to use some simple ecological tools for estimating populations of species (e.g., pooter, sweep net, pitfall trap, etc.)?, etc.</i>	

	<i>in an ecological system? Which factors are considered in this process?, etc.</i> d) Chemistry (Week 11) i. <i>How will I relate the content, Graham's law of diffusion/effusion to real life to help learners appreciate the content?</i> ii. <i>How will the knowledge and understanding of Graham's law of diffusion/effusion help learners understand how oxygen diffuses into our bloodstream of biological organisms when inhaled?, etc.</i> e) Physics (Week 11) i. <i>What real-life examples or scenarios can I use to illustrate the relevance of spherical mirrors in everyday life and scientific applications?</i> ii. <i>What pedagogical approach can I use to teach the Spherical mirrors in everyday life for all learners to benefit from the lesson?, etc.</i>	d) Chemistry (Week 11) <i>How will I relate the content, Graham's law of diffusion/effusion to real life to help learners appreciate the content?, etc.</i> e) Physics (Week 11) <i>What real-life examples or scenarios can I use to illustrate the relevance of spherical mirrors in everyday life and scientific applications?, etc.</i>	

	<i>f) Computing (Week 11)</i> <i>i. How does a motherboard communicate with other computer components?</i> <i>ii. What safety precautions should be taken when working with a motherboard?, etc.</i> <i>a) General Science (Week 12)</i> <i>i. How can the knowledge in concept of menstrual cycle address sexually related problems such as teenage pregnancy in real-life scenarios?</i> <i>ii. How do I design possible solutions to address sexually related societal problems?, etc.</i> <i>b) ICT (Week 12)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century, GESI, SEL, and National values in teaching how to classify network types and topologies?</i> <i>ii. How can the concepts of network types and topologies be applied to other subject areas such as mathematics,</i>	<i>f) Computing (Week 11)</i> <i>How does a motherboard communicate with other computer components?, etc.</i> <i>a) General Science (Week 12)</i> <i>How can the knowledge in concept of menstrual cycle address sexually related problems such as teenage pregnancy in real-life scenarios?, etc.</i> <i>b) ICT (Week 12)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century, GESI, SEL, and National values in teaching how to classify network types and topologies?, etc.</i>	

	<i>English, biology?, etc.</i> c) <i>Biology (Week 12)</i> i. <i>Why must learners know how flows of energy in an ecosystem?</i> ii. <i>How would the knowledge of energy flow in an ecosystem impact the choices that learners make to sustain life?, etc.</i> d) <i>Chemistry (Week 12)</i> i. <i>How will the knowledge and understanding of Dalton's law of partial pressures help learners to calculate pressure of gases over the surface of a liquid?</i> ii. <i>How do I make connections between what is been taught, Dalton's law of partial pressures and real life experiences?, etc.</i> e) <i>Physics (Week 12)</i> i. <i>How can I convey the real-world significance of understanding refraction to motivate my learners?</i> ii. <i>What feedback mechanisms can I put in place to help learners reflect on</i>	c) <i>Biology (Week 12)</i> <i>Why must learners know how flows of energy in an ecosystem?, etc.</i> d) <i>Chemistry (Week 12)</i> <i>How will the knowledge and understanding of Dalton's law of partial pressures help learners to calculate pressure of gases over the surface of a liquid?, etc.</i> e) <i>Physics (Week 12)</i> <i>How can I convey the real-world significance of understanding refraction to motivate my learners?, etc.</i>	

	<i>their learning on refraction and adjust as needed?, etc.</i> <i>f) Computing (Week 12)</i> <i>i. What is the best approach to teach data storage and manipulation for all learners to benefit from the lesson?</i> <i>ii. What local resources can I use to simulate the functions of the motherboard?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 11 and 12. Inform teachers to see the Teacher Manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General Science (Week 11)</i> <i>i. Learning Task:</i> <i>• Draw the structure of male reproductive system and label at least five parts</i> <i>• Describe the structure of female reproductive system and give at least one function of at least five parts</i> <i>• Describe the processes of reproduction in</i>	<i>f) Computing (Week 12)</i> <i>What is the best approach to teach data storage and manipulation for all learners to benefit from the lesson?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 11 and 12. See Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General Science (Week 11)</i> <i>i. Learning Task:</i> <i>Draw the structure of male reproductive system and label at least five parts, etc.</i>	

	<i>humans from copulation to birth, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Engage learners to observe models, videos, pictures, or charts of female and male reproductive systems. Encourage learners to document their observations</i> • <i>Assign roles within the mixed-ability groups to help learners present their observations from the videos, pictures, and charts. Use open-ended questions through talk for learning to encourage all learners to participate actively</i> • <i>Offer scaffolding or additional support for learners who may struggle with vocabulary or concepts</i> • <i>Let learners describe the parts of the female and male</i>	<i>ii. Pedagogical Exemplars:</i> <i>Engage learners to observe models, videos, pictures, or charts of female and male reproductive systems. Encourage learners to document their observations, etc.</i>	

	<i>reproductive systems, provide visual aids and diagrams to help learners visualize the parts, etc.</i> iii. Key Assessments (DoK): • Level 2: Draw and label the structure of the female reproductive system • Level 2: Describe any 3 parts of the female reproductive system and their function • Level 2: Describe the structure of male reproductive system and its function, etc. b) ICT (Week 11) i. Learning Tasks: • The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online	iii. Key Assessments (DoK): Level 2: Draw and label the structure of the female reproductive system, etc. b) ICT (Week 11) i. Learning Tasks: The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners list other computing devices in their environment or research online	

	<i>aside from the previously discussed digital devices</i> • <i>Where there are available resources (a range of digital devices such as laptop, tablet, phablet, smartphones, wearables, mobile devices, and Wireless Devices Connection, Internet access and Research tools such as educational websites, online journals, e-books) Divide learners into small groups. Assign each group two digital devices to research on their differences and share their findings with the larger class</i> • <i>Teacher Print out pictures or icons of various digital devices along with separate cards containing descriptions of their functions and uses and share them to the groups. Learners match each digital</i>	<i>aside from the previously discussed digital devices, etc.</i>	

	<i>device picture with the correct description card</i> • <i>After the matching activity, learners discuss why each digital device is suited for its specific functions and how they differ from one another</i> • <i>Ask learners to think of scenarios where one device might be more beneficial to use than another in groups and explain their reasoning with the whole class, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Facilitate group discussions where students can share their experiences and insights about using different digital devices</i> • <i>Assign research projects where students investigate the evolution of digital devices and their impact on society</i> • <i>Teacher Print out pictures or icons of various digital devices along</i>		
		<i>ii. Pedagogical Exemplars:</i> <i>Facilitate group discussions where students can share their experiences and insights about using different digital devices, etc.</i>	

	<i>with separate cards containing descriptions of their functions and uses and share them to the groups. Learners match each digital device picture with the correct description card</i> • <i>Present real-world scenarios where different digital devices are used. Discuss why certain devices are preferred over others in specific situations</i> • <i>Provide students with the opportunity to use various digital devices. This direct interaction can help solidify their understanding of the differences, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Name one major difference between a desktop computer and a laptop computer</i> • <i>Level 2: How does the form factor of a desktop computer differ</i>		
		iii. <i>Key Assessments (DoK):</i> <i>Level 1: Name one major difference between a desktop computer and a laptop computer, etc.</i>	

	<i>from that of a laptop computer, and how does it impact usability?</i> • <i>Level 3: Evaluate the advantages and disadvantages of using a desktop computer in a professional setting compared to a laptop computer</i> • <i>Level 4: Design a desktop computer model tailored to meet the needs of graphic designers, considering both performance and aesthetics, etc.</i> c) <i>Biology (Week 11)</i> i. <i>Learning Tasks:</i> • <i>Identify and discuss the importance of at least five ecological tools used in the estimation of the population size of organisms in a habitat</i> • <i>Describe vividly how the named ecological tools can be used to estimate the population size of different plant and animal species</i>		
		c) <i>Biology (Week 11)</i> i. <i>Learning Tasks:</i> <i>Identify and discuss the importance of at least five ecological tools used in the estimation of the population size of organisms in a habitat, etc.</i>	

	• <i>After random sampling, 200 catfishes are captured, tagged and released. A week later, 180 untagged and 20 catfishes were captured. Use the Lincoln index to estimate the total catfish population, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Watch a video or listen to a presentation on the estimation of population size and density of organisms in a habitat using the Lincoln Index and other tools. Submit a written report on the steps involved in the process</i> • <i>Select areas in the school compound or nearby community to estimate the population of various organisms using a quadrat, pitfall trap, sweep net and pooter. The teacher should consider the following activities; In a mixed ability, gender-</i>	ii. <i>Pedagogical Exemplars:</i> <i>Watch a video or listen to a presentation on the estimation of population size and density of organisms in a habitat using the Lincoln Index and other tools. Submit a written report on the steps involved in the process, etc.</i>	

	<i>sensitive and all-inclusive group employ talk for learning to help learners identify and discuss the importance of at least five ecological tools used in the estimation of population size in a named habitat.</i> <i>Pair strategic partners (more confident learners) with less able learners to provide needed support with the task at hand. Give extra time for struggling students to finish the task and to enable advanced learners to think through the task at hand deeply. Use a gamified program or an audiovisual aid (resource) and allow learners to watch /listen to a short video/audio on how to use a named ecological tool to estimate the population size of organisms in a named habitat</i>		

	<i>using the Lincoln index, etc.</i> iii. Key Assessment (DoK) • <i>Level 1: What is the primary function of a quadrant in ecological study?</i> • <i>Level 2: Describe a pitfall trap and what it is used for</i> • <i>Level 2: Describe how the pooper is used in estimating the population of organisms</i> • <i>Level 3: Describe how you will use a named ecological tool to estimate the population size and species diversity effectively</i> • <i>Level 3: After random sampling, 200 catfishes are captured, tagged and released. A week later, 180 untagged and 20 catfishes were captured. Use the Lincoln index to estimate the total catfish population, etc.</i> d) Chemistry (Week 11) i. Learning Tasks: • <i>State at least one (1) of the</i>	iii. Key Assessment (DoK) <i>Level 1: What is the primary function of a quadrant in ecological study?, etc.</i> d) Chemistry (Week 11) i. Learning Tasks: <i>State at least one (1) of the</i>	

	<i>following gas laws: Boyles' law, Charles' law, Gay-Lussac's law and the Combined gas law</i> • <i>Express any two (2) of the gas laws mathematically taking into consideration the conditions associated with each law</i> • <i>Identify the variable that are related to each law</i> • <i>Illustrate the relationships among the various variables of the law</i> • <i>Explain how Boyles' law can be applied in real life situation</i> • <i>Derive the combined gas law from Boyle's, Charles' and Gay-Lussac's laws, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Exploratory Learning: In small mixed-ability groups, research from the internet, library, books, and other resources about the various gas</i>	<i>following gas laws: Boyles' law, Charles' law, Gay-Lussac's law and the Combined gas law, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Exploratory Learning: In small mixed-ability groups, research from the internet, library, books, and other resources about the various gas</i>	

	<i>laws (Boyle's law, Charles' law, Avogadro's law and Gay-Lussac's law) in terms of: The formulae, variables and conditions required</i> • <i>Use simulation (PhEt) or charts to illustrate the relationships among the various variables</i> • <i>Sketch graphs of the relationship and deduce the mathematical relationship between the variables</i> • <i>Based on Boyle's, Charles' and Gay-Lussac's laws, determine the expression for the combined gas law</i> • <i>Guide learners to carryout calculations based on the gas laws making references to the mathematical expressions of the laws, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: State Boyle's law</i> • <i>Level 2: A 250 cm³ sample of a gas has a pressure of 20</i>	<i>laws (Boyle's law, Charles' law, Avogadro's law and Gay-Lussac's law) in terms of: The formulae, variables and conditions required, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: State Boyle's law, etc.</i>	

	<i>Pa. What will be its volume if the pressure is raised to 45 Pa at the same temperature?</i> • <i>Level 3: A balloon can hold 800 cm³ of air before bursting. If the balloon contains 500 cm³ of air at 10 °C, determine whether or not the balloon would burst when it is taken into a room of temperature of 20 °C, assuming that the pressure of the gas in the balloon is kept constant, etc.</i>		
	<i>e) Physics (Week 11)</i> <i>i. Learning Tasks:</i> • <i>Differentiate between convex and concave mirrors</i> • <i>Explain various terminologies associated with spherical mirrors, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Provide learners with diagrams of concave and convex mirrors. Ask them to label the different parts, such as the pole,</i>	<i>e) Physics (Week 11)</i> <i>i. Learning Tasks:</i> <i>Difference between concave and convex spherical mirror, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Provide learners with diagrams of concave and convex mirrors. Ask them to label the different parts, such as the pole,</i>	

	<i>principal axis, focal point, centre of curvature and mirror surface. Learners should be tasked with conducting independent research using the internet and reference books to find the meanings and definitions of the terms related to mirrors</i> • <i>Alternatively, for a more hands-on approach, provide a variety of spherical mirrors (concave and convex) along with labels indicating the different parts (pole, focal point)</i> • <i>Use simple language for some learners to explain each term as they label the parts of the mirrors with provided stickers or markers</i> • <i>Ask some learners to label mirrors independently, using provided diagrams and descriptions as references</i>	<i>principal axis, focal point, centre of curvature and mirror surface. Learners should be tasked with conducting independent research using the internet and reference books to find the meanings and definitions of the terms related to mirrors, etc.</i>	

	• <i>Provide advanced scenarios or optical systems involving spherical mirrors and ask some learners to analyse and determine the relevant terminology</i> • <i>Provide learners with a piece of flexible reflective material and ask them to hold it/position it to form a) a convex mirror and b) a concave mirror. Shine narrow beams of light at the surface of the mirror in a direction parallel to the principal axis and use this to measure the focal length. Discuss whether the focal length is the same or different for convex and concave mirrors of the same radius of curvature. How does the focal length compare to the magnitude of the radius?</i> • <i>Create a quiz game with questions about the</i>		

	<i>terminologies associated with spherical mirrors. Learners can answer individually or in teams, promoting friendly competition, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: What is a spherical mirror?</i> • <i>Level 1: Provide two examples of everyday objects that use spherical mirrors, etc.</i> f) <i>Computing (Week 11)</i> i. <i>Learning Tasks:</i> • <i>Divide learners into small mixed-ability groups and assign each group a specific network architecture type (e.g., client-server, peer-to-peer, cloud architecture)</i> • <i>Have them research the architecture types, create a presentation, explaining its characteristics, advantages, and use cases as a project (this activity may take an hour)</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: What is a spherical mirror?, etc.</i> f) <i>Computing (Week 11)</i> i. <i>Learning Tasks:</i> <i>Divide learners into small mixed-ability groups and assign each group a specific network architecture type (e.g., client-server, peer-to-peer, cloud architecture), etc.</i>	

	• Give each group the chance to present their findings, etc. ii. Pedagogical Exemplars: • In the research based project, guide learners to find relevant information (such as scalability, reliability, security, and cost-effectiveness) and assist them in creation of presentation (if projection materials or virtual boards are available) • Encourage learners' communication skills when they are presenting by cautiously integrating SEL • It is important to enforce classroom management rules during the presentation, to enable all learner groups to learn from each other, etc. iii. Key Assessments (DoK): • Level 1: What is the primary purpose of network	ii. Pedagogical Exemplars: In the research based project, guide learners to find relevant information (such as scalability, reliability, security, and cost-effectiveness) and assist them in creation of presentation (if projection materials or virtual boards are available), etc. iii. Key Assessments (DoK): Level 1: What is the primary purpose of network architecture in	

	<i>architecture in computer networking?</i> • <i>Level 2: Compare and contrast client-server and peer-to-peer architectures, highlighting their differences and use cases</i> • <i>Level 3: Evaluate the security implications of various network architecture designs, identifying potential vulnerabilities and recommending mitigation strategies, etc.</i> <i>g) General science (Week 12)</i> <i>i. Learning Tasks:</i> • <i>Explain menstrual cycle and identify at least two stages involved</i> • <i>Describe the phases of menstrual cycle</i> • <i>Describe at least three (3) ways reproduction-related issues can be addressed by an understanding of the menstrual cycle</i> • <i>Analyse the differences</i>	<i>computer networking, etc.</i> <i>g) General science (Week 12)</i> <i>i. Learning Tasks:</i> <i>Explain menstrual cycle and identify at least two stages involved, etc.</i>	

	<i>among the phases of menstrual cycle, etc.</i> <i>ii. Pedagogical Exemplars</i> • <i>Think-Pair-Share</i> <i>Provide charts, diagrams, videos/ animations illustrating and explaining the menstrual cycle</i> • <i>Use colour-coded calendars to represent separate phases of the menstrual cycle</i> • <i>Present a scenario related to menstrual health and hygiene to the entire class</i> • <i>Have learners individually respond to the scenario. Pair learners to discuss their ideas and perspectives. Learners share understandings and solutions with the larger group, fostering cross-learning and peer learning, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Briefly explain the menstrual cycle</i>	<i>ii. Pedagogical Exemplars</i> <i>Think-Pair-Share</i> <i>Provide charts, diagrams, videos/ animations illustrating and explaining the menstrual cycle, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: Briefly explain the</i>	

	• <i>Level 2: Explain the term menstrual hygiene</i> • <i>Level 2: Describe at least four (4) ways good menstrual hygiene can be practiced</i> • <i>Level 2: Describe how the menstrual cycle can be determined using ovulation predictor kits</i> • <i>Level 3: Compare and contrast luteal phase and follicular phase of menstrual cycle, etc.</i> <i>h) ICT (Week 12)</i> <i>i. Learning Tasks:</i> • <i>Exploring the World Wide Web: Identify and group images into web browsers, web pages, and search engines</i> • <i>Learn about key components: browsers, servers, web pages, and search engines</i> • <i>Explore the difference between HTTP and HTTPS protocols</i>	<i>menstrual cycle, etc.</i> <i>h) ICT (Week 12)</i> <i>i. Learning Tasks:</i> <i>Exploring the World Wide Web: Identify and group images into web browsers, web pages, and search engines, etc.</i>	

	• <i>Understand URLs and their structures</i> • <i>Discuss the domain name system and the relationship between IP addresses and domain names</i> • <i>Identify the type of organization based on website URLs</i> • <i>Determine when websites should use HTTP or HTTPS, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using Project-Based Learning engage learners in mixed-ability/gender-sensitive group to brainstorm the meaning of the internet, evolution, world wide web</i> • <i>Engage learners in their mixed-ability groupings to discuss the internet, world wide web and their impact on socio-economic development as well as hands-on activities searching information on the internet, etc</i>		
		ii. <i>Pedagogical Exemplars:</i> <i>Using Project-Based Learning engage learners in mixed-ability/gender-sensitive group to brainstorm the meaning of the internet, evolution, world wide web, etc.</i>	

	iii. Key Assessments (DoK): • Level 1: Identify the key differences between the internet and the World Wide Web • Level 2: Explain how data is transmitted over the internet using TCP/IP protocols • Level 3: Evaluate the impact of cybersecurity threats on individuals and organisations using the internet • Level 4: Predict how emerging technologies like blockchain or quantum computing will shape the future of the internet, etc. i) Biology (Week 12) i. Learning Tasks • Identify at least two different techniques used to study and determine the flow of energy in an ecosystem • Guidance should be given to learners who may struggle with the identification of different techniques used to study and	iii. Key Assessments (DoK): Level 1: Identify the key differences between the internet and the World Wide Web, etc. i) Biology (Week 12) i. Learning Tasks Identify at least two different techniques used to study and determine the flow of energy in an ecosystem, etc.	

	<i>determine the flow of energy in an ecosystem</i> • <i>Explain at least two different techniques used to study and determine the flow of energy in an ecosystem</i> • <i>Describe the three techniques used to the study and determine the flow of energy in an ecosystem and provide justification for your selection of one of the methods as the best technique, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using shower thoughts assist learners to identify at least two techniques used to study and determine the flow of energy in an ecosystem. Support should be given to learners who may strive with the identification of different techniques used to study and determine the flow of energy in an ecosystem</i> • <i>Orally, learners explain at least</i>	<i>ii. Pedagogical Exemplars:</i> <i>Using shower thoughts assist learners to identify at least two techniques used to study and determine the flow of energy in an ecosystem. Support should be given to learners who may strive with the identification of different techniques used to study and determine the flow of energy in an ecosystem, etc.</i>	

	<i>two different techniques used to study and determine the flow of energy in an ecosystem. Acknowledge learners' progress and provide support where applicable</i> • <i>Using inquiry-based learning strategy: Ask learners in small mixed-ability groups to research or listen to presentations on the various methods of determining energy flow in an ecosystem</i> • <i>Using radio reporter strategy: Ask learners to describe the three techniques used to the study and determine the flow of energy in an ecosystem and provide justification for selecting one of the methods as the best technique to be used, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Identify three different techniques used to study and determine the</i>		
		<i>iii. Key Assessments (DoK):</i> <i>Level 1: Identify three different techniques used to study and determine the</i>	

	<i>flow of energy in an ecosystem.</i> Accept identification of at least two different techniques used to study and determine the flow of energy in an ecosystem • Level 3: Briefly describe each of the methods used in determining energy flow in a named ecological habitat. A response on at least two techniques used to study and determine the flow of energy should be accepted from learners, etc. j) Chemistry (Week 12) i. Learning Tasks: • Discuss Graham's law of diffusion/effusion • Use Graham's law of diffusion/effusion to describe and explain the effect of relative molecular mass and density on the rate of diffusion/effusion of gases • Design an experiment to investigate the	<i>flow of energy in an ecosystem.</i> Accept identification of at least two different techniques used to study and determine the flow of energy in an ecosystem, etc. j) Chemistry (Week 12) i. Learning Tasks: Discuss Graham's law of diffusion/effusion, etc.	

	rate of diffusion of ammonia gas and hydrogen chloride gas. Make deductions from the results of the experiment, etc. ii. <i>Pedagogical Exemplars</i> • <i>Using talk for learning approach, guide learners to discuss the Graham's law of diffusion/effusion. Encourage each learner to play an active role in the discussions by asking questions</i> • <i>In ability groups guide learners to use the Graham's law of diffusion/effusion to describe and to explain the effect of relative molecular mass and density on the rate of diffusion/effusion of gases. Encourage each learner to play an active role in the discussions by asking questions</i> • <i>Experiential Learning: In mixed ability groups, guide learners to design an experiment to</i>	ii. <i>Pedagogical Exemplars</i> <i>Using talk for learning approach, guide learners to discuss the Graham's law of diffusion/effusion. Encourage each learner to play an active role in the discussions by asking questions, etc.</i>	

	<i>investigate the rate of diffusion of ammonia gas and hydrogen chloride gas. Offer enough support to learners who may be experiencing some difficulty. Guide learners to make deductions from the result of the experiments</i> • <i>Problem solving approach: Guide learners to perform calculations on Graham's law of diffusion/effusion by solving sample questions with them to understand</i> • <i>In ability groups, give the learners questions on the Graham's law of diffusion/effusion to solve. Offer enough support to learners who may be slow in solving these questions, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: State Graham's law of diffusion or effusion</i> • <i>Level 2: Given that 100 cm³ of ethane (C₂H₆) diffuses through a membrane in 40</i>		

	s, what time will it take 80 cm³ of propane (C₃H₈) to diffuse through the same membrane at the same temperature and pressure? [C = 12, H = 1] • Level 4: Given a cylindrical glass tube, stoppers, two retort stands, cotton wool, concentrated NH₃, concentrated HCl, and tweezers, design an experiment to determine the rate of diffusion of a gas, etc. k) Physics (Week 12) i. Learning Tasks: • Determine the characteristics of the image using the mirror formula and magnification formula • Perform experiments on simple problems to prove the mirror formula and magnification formula, etc. ii. Pedagogical Exemplars: • Present the mirror formula to the class and emphasise the		
		k) Physics (Week 12) i. Learning Tasks: Determine the characteristics of the image using the mirror formula and magnification formula, etc. ii. Pedagogical Exemplars: Present the mirror formula to the class and emphasise the	

	<i>significance of the formula in understanding the behaviour of spherical mirrors and how it is used to predict the position of the image formed by such mirrors</i> <i>Learners should use data from diagrams drawn in the previous lesson to calculate/confirm the focal length of the mirror given</i> <i>Provide learners with various mirror formula problems involving concave and convex mirrors. Ask them to calculate the image distance (v) using the given focal length (f) and object distance (u). Discuss the nature (virtual or real) and characteristics (inverted or upright) of the image formed, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 2: An object is placed 15 cm from a concave mirror of a focal length of 20 cm. If</i>	<i>significance of the formula in understanding the behaviour of spherical mirrors and how it is used to predict the position of the image formed by such mirrors, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 2: An object is placed 15 cm from a concave mirror of a focal length of 20 cm. If</i>	

	<i>the height of the object is 7 cm,</i> ○ <i>Calculate the position of the image</i> ○ <i>What is the nature of the image?</i> ○ <i>Calculate the height of the image, etc.</i> <i>I) Computing (Week 12)</i> <i>i. Learning Tasks:</i> • <i>In small groups of mixed abilities, let learners research on specific network transmission medium (UTP, STP, Coaxial Cable, Fiber Optic Cable, Wireless Transmission, PLC, Satellite Communications)</i> • <i>Each group is to create a presentation outlining their medium's characteristics, advantages, disadvantages, and common use cases</i> • <i>The Groups are to demonstrate how their assigned transmission medium works, using videos, models, or diagrams</i> • <i>Let each learner write in their</i>	<i>the height of the object is 7 cm,</i> ○ <i>Calculate the position of the image, etc.</i> <i>I) Computing (Week 12)</i> <i>i. Learning Tasks:</i> <i>In small groups of mixed abilities, let learners research on specific network transmission medium (UTP, STP, Coaxial Cable, Fiber Optic Cable, Wireless Transmission, PLC, Satellite Communication), etc.</i>	

	<i>words a reflection on what they learned about the diversity and application of network transmission media to make up their notice, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Guide learners through the research and preparation of presentations</i> <i>• Encourage learners who do not speak much in class to share their presentations or demonstrations with the class</i> <i>• Additionally, encourage all learners to write reflective essays on the content taught to enhance their writing communication skills, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Level 2: Briefly define the following data transmission media: twisted pair cables, coaxial cables, fibre optic cables, and wireless communication technologies</i>	<i>ii. Pedagogical Exemplars:</i> <i>Guide learners through the research and preparation of presentations, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 2: Briefly define the following data transmission media: twisted pair cables, coaxial cables, fibre optic cables, and wireless communication</i>	

	• <i>Level 2: Compare and contrast the physical properties, transmission characteristics, and applications of different types of data transmission media</i> • <i>Level 3: Evaluate the advantages and disadvantages of different data transmission media types in terms of their suitability for specific network architectures, such as LANs, WANs, and MANs, etc.</i>	<i>technologies, etc.</i>	
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 11 and 12. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 11 and 12. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	

3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10 mins

4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 13 and 14 of the teacher manual ahead of time and the DPLC Handbook Session 8 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 13 and 14 of the teacher manual ahead of time and the DPLC Handbook Session 8 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10 mins

DPLC Session 8: Developing learning plans for weeks 13 & 14			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 7, <i>developing learning plans for Weeks 11 and 12</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 7, <i>developing learning plans for Weeks 11 and 12</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on the DPLC Session 7, <i>developing learning plans for Weeks 11 and 12</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 7, <i>developing learning plans for Weeks 11 and 12</i>, supported learning (NTS 1a-1c).	10 mins

2. Planning for teaching, learning and assessment activities, using the teacher manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b). Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during weeks 13 & 14. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Explain form and sources of energy, and their generation.</i>	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b). Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during weeks 13 & 14. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Explain form and sources of energy, and their generation.</i>	60 mins

	<i>B. ICT: Connect and use wired and wireless networks.</i> <i>C. Biology: The efficiency of energy flow in an ecosystem with emphasis on ecological pyramids, and the application of the knowledge of common disease- causing organisms to prevent their effects on humans and their environment.</i> <i>D. Chemistry: The ideal gas equation and its deviations from ideal behaviour and laboratory preparation of some gases.</i> <i>E. Physics: Refractive index</i>	<i>B. ICT: Connect and use wired and wireless networks.</i> <i>C. Biology: The efficiency of energy flow in an ecosystem with emphasis on ecological pyramids, and the application of the knowledge of common disease- causing organisms to prevent their effects on humans and their environment.</i> <i>D. Chemistry: The ideal gas equation and its deviations from ideal behaviour and laboratory preparation of some gases.</i> <i>E. Physics: Refractive index</i>	

	<i>and Charge carriers.</i> <i>F. Computing: Apply knowledge of data structures to explain their real-life applications effectively.</i> LO 1: Develop subject-specific learning plans for teaching weeks 13 and 14 lessons using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in weeks 13 and 14 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template.	<i>and Charge carriers.</i> <i>F. Computing: Apply knowledge of data structures to explain their real-life applications effectively.</i> LO 1: Develop subject-specific learning plans for teaching weeks 13 and 14 lessons using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). L1.1 Discuss the important aspects in weeks 13 and 14 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template.	

	LI 1.2 Complete the learning planner templates for weeks 13 and 14 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for weeks 13 and 14 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g 3j and 3o). LI 2.1 Critique the content (such as essential questions, key note on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for weeks 13 and 14 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for weeks 13 and 14 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and	LI 1.2 Complete the learning planner templates for weeks 13 and 14 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 3 and 4 weeks 13 and 14 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g- 3j and 3o). LI 2.1 Critique the content (such as essential questions, key note on differentiation, teaching and learning activities, assessment, and closure) of learning plan for weeks 13 and 14 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for weeks 13 and 14 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your	

	pedagogical exemplars for their subjects in weeks 13 and 14. (NTS 1a, 2c, 2f and 3d-3g). 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for weeks 13 and 14 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 13)</i> i. <i>In real-life situations, how do I apply the knowledge of forms of energy?</i> ii. <i>How can locally available materials be used to generate energy?, etc.</i> b) <i>ICT (Week 13)</i> <i>How to Connect and use wired and wireless networks?</i> <i>What is the best approach to teach Connect and use wired and wireless networks?, etc.</i> c) <i>Biology (Week 13)</i> i. <i>Why is a pyramid an effective model for energy flow?</i> ii. <i>How does energy get into an ecosystem?, etc.</i> d) <i>Chemistry (Week 13)</i> i. <i>How will I make</i>	subject in weeks 13 and 14 in your teacher manual. (NTS 1a, 2c, 2f and 3d-3g). 2.3 Discuss at least two essential questions that will guide the lesson activities in weeks 13 and 14 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 13)</i> <i>In real-life situations, how do I apply the knowledge of forms of energy?, etc.</i> b) <i>ICT (Week 13)</i> <i>How to Connect and use wired and wireless networks?, etc.</i> c) <i>Biology (Week 13)</i> <i>Why is a pyramid an effective model for energy flow?, etc.</i> d) <i>Chemistry (Week 13)</i> <i>How will I</i>	

	<i>connections between the content, the ideal gas equation and its deviations from ideal behaviour and real-life experiences?</i> ii. <i>How will the understanding of the ideal gas equation and its deviations from ideal behaviour help learners become effective in using it to solve real-life problems?, etc.</i> e) <i>Physics (Week 13)</i> i. <i>How can I convey the real-world significance of understanding refractive index to motivate my learners?</i> ii. <i>What is the best approach to teach the refractive index for all learners to benefit from the lesson?, etc.</i> f) <i>Computing (Week 13)</i> i. <i>How can learners use data structures to manipulate data efficiently?</i> ii. <i>What is the best approach to teach the concepts of data structures and their</i>	<i>make connections between the content, the ideal gas equation and its deviations from ideal behaviour and real-life experiences?, etc.</i> e) <i>Physics (Week 13)</i> <i>How can I convey the real-world significance of understanding refractive index to motivate my learners?, etc.</i> f) <i>Computing (Week 13)</i> <i>How can learners use data structures to manipulate data efficiently?, etc.</i>	

	<i>importance in organising and manipulating data efficiently?, etc.</i> <i>g) General Science (Week 14)</i> <i>i. How do I help learners to design and build solar panel using locally available materials?</i> <i>ii. How do I help learners understand function of locally available materials used in designing solar panel/cell?, etc.</i> <i>h) ICT (Week 14)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how to connect and use wired and wireless networks?</i> <i>ii. How can wired and wireless networks be used in other subject areas such as maths, English, biology?, etc.</i> <i>i) Biology (Week 14)</i> <i>i. How would you use your knowledge of the</i>	<i>g) General Science (Week 14)</i> <i>How do I help learners to design and build solar panel using locally available materials?, etc.</i> <i>h) ICT (Week 14)</i> <i>In what ways can I integrate the cross-cutting themes – 21st century skills, GESI, SEL, and national values in teaching how to connect and use wired and wireless networks ?, etc.</i> <i>i) Biology (Week 14)</i> <i>How would you use your knowledge of the description of</i>	

	<i>description of cholera based on causative agent, mode of transmission, symptoms, control/preventive measures and treatment to provide education on cholera to the people of your community to prevent an outbreak?</i> <i>ii. How would you avoid infection in your immediate surroundings using the knowledge gained from learning about infectious diseases?, etc.</i> <i>j) Chemistry (Week 14)</i> <i>i. How will I make connections between the content, laboratory preparation of gases and industrial preparation of gases?</i> <i>ii. How will the Knowledge and understanding of the content, laboratory preparation of gases help learners appreciate the importance of gases in</i>	<i>cholera based on causative agent, mode of transmission, symptoms, control/preventive measures and treatment to provide education on cholera to the people of your community to prevent an outbreak?, etc.</i> <i>j) Chemistry (Week 14)</i> <i>How will I make connections between the content, laboratory preparation of gases and industrial preparation of gases? etc.</i>	

	<i>firefighting and in medicine? etc.</i> k) <i>Physics (Week 14)</i> i. <i>Which activities can I design to allow all learners to apply what they have learned in the lesson on mobile charge carriers in a meaningful way?</i> ii. <i>How are mobile charge carriers demonstrated in everyday life?, etc.</i> l) <i>Computing (Week 14)</i> i. <i>In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching Computer Networks and how they work?</i> ii. <i>What resources in the locality can the learner use to simulate a Computer Networks?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 13 and 14. Inform teachers to see the teacher manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j).	k) <i>Physics (Week 14)</i> <i>Which activities can I design to allow all learners to apply what they have learned in the lesson on mobile charge carriers in a meaningful way?, etc.</i> l) <i>Computing (Week 14)</i> <i>In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching Computer Networks and how they work?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 13 and 14. See teacher manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j).	

	<i>E.g.</i> a) <i>General Science (Week 13)</i> i. <i>Learning Task</i> • <i>Explain the electricity</i> • <i>Describe how solar cells works.</i> • <i>Describe the generation of electricity from solar cells/panels., etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>Engage learners in a structured discussion by revising various forms of electricity generation from the junior high school curriculum (B7.4.2.1.1) related to solar energy.</i> • <i>Encourage active participation, question and answer sessions, and peer-to-peer explanations to consolidate understanding and enhance retention.</i> • <i>Organize learners into groups to prepare and deliver presentations on the topic of solar energy.</i> • <i>Provide</i>	<i>E.g.</i> a) <i>General Science (Week 13)</i> i. <i>Learning Task</i> <i>Explain the electricity, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Engage learners in a structured discussion by revising various forms of electricity generation from the junior high school curriculum (B7.4.2.1.1) related to solar energy, etc.</i>	

	<i>guidelines on content, format, and presentation skills to ensure clarity and engagement.</i> • <i>Guide learners to use the diamond nine strategy to brainstorm about the meaning, advantages, and disadvantages of solar energy in relation to life and the environment.</i> • <i>Encourage critical thinking, collaboration, and prioritization of ideas within the group.</i> • <i>Support learners in creating concept maps, videos, pictures, charts, and diagrams to visually represent their findings and understanding of solar energy.</i> • <i>Introduce internet resources for research and exploration, allowing learners to deepen their knowledge and expand their perspective.</i> • <i>Provide flexibility in the group formation to cater to different learning and</i>		

	abilities, ensuring each group is balanced in terms of skill levels. • Offer alternative presentation formats for students who may struggle with traditional methods, such as creating digital presentations or interactive posters. • Tailor guidance and support according to individual needs, offering additional explanations, resources, or examples as required., etc. iii. Key Assessment (DoK): • Explain the process of electricity generation in solar panels. • What are photovoltaic cells, and how do they contribute to generating electricity • Describe sunlight's role in converting solar energy into electricity., etc. b) ICT (Week 13) i. Learning Tasks:	iii. Key Assessment (DoK): Explain the process of electricity generation in solar panels, etc. b) ICT (Week 13) i. Learning Task:	

	• <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners brainstorm the definition of a computer network and its importance. Each group comes out with a definition of and computer with at least three importance of computer networks in writing. Each group read their write ups with the larger group. Teacher t should briefly summarise learners' presentation on definition of computer networks and the importance of computer networks.</i> • <i>Task learners in their GESI and SEL responsive groups to write down names of common computing tools that they think</i>	<i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners brainstorm the definition of a computer network and its importance. Each group comes out with a definition of and computer with at least three importance of computer networks in writing. Each group read their write ups with the larger group. Teacher t should briefly summarise learners' presentation on definition of computer networks and the importance of computer networks, etc.</i>	

	can be used on a computer network. Each group should be task to list not less than eight. • Using matching activity, the teacher Provides learners with pictures or models of network devices (if available) and labels with their names and functions. Learners match each device with its correct label. After identifying the devices and their names, task learners cross check from the list they made in task 1 and cross out what they could not find. ii. Pedagogical Exemplars: • Interactive Lectures: Use multimedia presentations to introduce different network devices and their functions. Incorporate real-world examples to illustrate how these devices interact within computer networks. • Group Projects: Encourage		

	<i>collaborative learning by having learners work in groups to draw and map network devices and their functions. This can foster discussion and deepen understanding through peer-to-peer education</i> • <i>Visualisation: use pictures, diagrams and visual aids to illustrate the structure of a computer network and the roles of various network devices</i> • <i>Flipped Classroom: Assign video tutorials or readings on network devices as homework and use class time for discussion and practical exercises. This approach allows learners to learn at their own pace and apply knowledge during interactive sessions.</i> • <i>Case Studies: Analyse real-life scenarios that involve network device</i>		

	<i>deployment and management. Discuss the decisions made and their outcomes, and explore alternative approaches, etc.</i> iii. Key Assessment (DoK): • <i>Level 1: What is a computer network? Name two devices that are commonly used in a computer network</i> • <i>Level 2: How does a router function differently than a switch in a computer network? What role does a modem play in connecting to the Internet?</i> • <i>Level 3: Analyse the impact of network devices on the performance and security of a network and design a network layout for a small office, specifying the network devices needed</i>	iii. Key Assessment (DoK): <i>Level 1: What is a computer network? Name two devices that are commonly used in a computer network., etc.</i>	

	<i>and their roles</i> • <i>Level 4: Develop a plan to upgrade an existing network infrastructure with modern network devices to improve efficiency and security, etc.</i> <i>c) Biology (Week 13)</i> <i>i. Learning Task:</i> • <i>What does the pyramid of numbers represent in an ecosystem? Limit content expectation to the definition of the pyramid of numbers</i> • <i>Define biomass and explain its significance in ecological studies. Extend content expectation to the definition of biomass and its importance in ecological studies</i> • <i>Describe the direction of energy flow in a pyramid of energy. Extend content expectation to the discussion on the direction of energy flow in</i>	<i>c) Biology (Week 13)</i> <i>i. Learning Task:</i> <i>What does the pyramid of numbers represent in an ecosystem? Limit content expectation to the definition of the pyramid of numbers, etc.</i>	

	<i>the pyramid of energy, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Group-based Learning: Watch a video or a presentation on the methods of determining the various ecological pyramids. Using field observations, allow students to observe and count different organisms at different locations of the school compound to construct their own pyramid of numbers, biomass, and energy</i> • <i>Interactive discussion: students in their mixed ability gender sensitive groups, learners define and discuss the importance of biomass in ecological studies. learners think critically and deepen their understanding of ecological pyramids, etc.</i> iii. <i>Key Assessment (DoK):</i> • <i>Level 1: What does the pyramid</i>	ii. <i>Pedagogical Exemplars:</i> <i>Group-based Learning: Watch a video or a presentation on the methods of determining the various ecological pyramids. Using field observations, allow students to observe and count different organisms at different locations of the school compound to construct their own pyramid of numbers, biomass, and energy, etc.</i> iii. <i>Key Assessment (DoK):</i> <i>Level 1: What does the pyramid of</i>	

	<i>of numbers represent in an ecosystem? Accept the correct definition for the pyramid of numbers. Define biomass and explain its significance in ecological studies. Accept the definition of biomass and explanations of the importance of biomass</i> <i>• Level 1: Describe the direction of energy flow in a pyramid of energy. Accept oral /written explanations for the direction of energy flow in a pyramid of energy</i> <i>• Level 2: Discuss the potential reasons for an inverted pyramid of biomass in an aquatic ecosystem</i> <i>• Level 2: Explain why the pyramid of energy is always upright and what factors contribute to the efficiency of energy transfer between trophic levels</i> <i>• Level 3: How will human activities, such as deforestation or</i>	<i>numbers represent in an ecosystem? Accept the correct definition for the pyramid of numbers. Define biomass and explain its significance in ecological studies. Accept the definition of biomass and explanations of the importance of biomass, etc.</i>	

	<i>overfishing, affect the shape and stability of a named ecological pyramid in an ecosystem? etc.</i> d) Chemistry (Week 13) i. Learning Task: • <i>What is the ideal gas equation and how is it derived?</i> • <i>A 150 dm³ cylinder of oxygen gas at a hospital, exerts a pressure of 800 kPa at 25°C. Calculate the mass of oxygen contained in the cylinder. [R = 8.314 Jmol⁻¹K⁻¹, O = 16], etc.</i> ii. Pedagogical Exemplars: • <i>Using collaborative learning review the previous knowledge of learners on Boyle's Law, Charles' Law and Avogadro's Law</i> • <i>In mixed ability groupings assist learners derive the ideal gas law from the various gas laws</i> • <i>Discuss each of the variables in the ideal gas Law.</i> • <i>Practice using the ideal gas equation (PV = nRT) in solving theoretical tasks including the determination of</i>	d) Chemistry (Week 13) i. Learning Task: <i>What is the ideal gas equation and how is it derived? etc.</i> ii. Pedagogical Exemplars: <i>Using collaborative learning review the previous knowledge of learners on Boyle's Law, Charles' Law and Avogadro's Law, etc.</i>	

	<i>molar mass.</i> <i>In small mixed-ability groups, use the ideal gas equation to determine the molar mass of different gases., etc.</i> iii. Key Assessment (DoK): <i>Level 1: Write the ideal gas equation and define the terms</i> <i>Level 2: A 0.143 g sample of ammonia at 100 kPa occupies $2.86 \times 10^{-4} \text{ m}^3$ at a temperature T. Determine the value of the temperature T. [$R = 8.314 \text{ J/K/mol}$, $N = 14$, $H = 1$]</i> <i>Level 3: Derive the ideal gas equation from the basic principles of kinetic theory and gas laws.</i> <i>level 3: When a sample of liquid Q, of mass 0.406 g vaporised, the vapour was found to occupy $2.34 \times 10^{-4} \text{ m}^3$ at 110 kPa and 473K</i> <i>a) Use the equation $PV = nRT$ to calculate the number of moles of Q in the sample</i> <i>b) Deduce the relative molecular</i>	iii. Key Assessment (DoK): <i>Level 1: Write the ideal gas equation and define the terms, etc.</i>	

	<i>mass of Q</i> <i>[R = 8.314 JK⁻¹mol⁻¹], etc.</i> <i>e) Physics (Week 13)</i> <i>i. Learning Task:</i> <i>Define the term refractive index of a medium and demonstrate understanding of its significance in optics</i> <i>Perform experiments to measure the refractive index of a transparent medium such as glass or water</i> <i>Solve problems involving light passing from one medium to another with different refractive indices, such as air to glass or water to air, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Analyse a data set with measurements of the angle of incidence and angle of refraction for different materials. Ask learners to identify the pattern and develop a formula to</i>	<i>e) Physics (Week 13)</i> <i>i. Learning Task:</i> <i>Define the term refractive index of a medium and demonstrate understanding of its significance in optics, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Analyse a data set with measurements of the angle of incidence and angle of refraction for different materials. Ask learners to identify the pattern and develop a formula to</i>	

	<i>calculate the refractive index of any transparent medium</i> • <i>Use a simple optical setup, such as a glass block and a protractor, to measure the angles of incidence and refraction. Guide learners in calculating the refractive index and comparing it with known values for different materials, etc.</i> <i>iii. Key Assessment (DoK):</i> • <i>Level 1: What is the refractive index of a medium?</i> • <i>Level 2: Explain how you can determine the refractive index of a transparent solid using a glass block and a ray of light</i> • <i>Level 3: Refractive indices have a variety of applications in Physics-related careers. In optometry, the cornea has a refractive index of 1.38 in the human eye. It</i>	<i>calculate the refractive index of any transparent medium, etc.</i> <i>iii. Key Assessment (DoK):</i> <i>Level 1: What is the refractive index of a medium?</i>	

	<i>forms a single thin lens together with the lens to project light onto the retina. The indices of refraction in the eye are crucial to its ability to form images. Calculate the angle of refraction when the angle of incident light travelling from air into the cornea is at 30°, etc.</i> <i>f) Computing (Week 13)</i> <i>i. Learning Task:</i> <i>• Define what Data Structures are and provide examples</i> <i>• Explain the different types of Data Structures and their characteristics</i> <i>• Analyse the advantages and disadvantages of different Data Structures for specific applications</i> <i>• Design and implement a data structure for a specific problem-solving task, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Present a brief lecture or use</i>	<i>f) Computing (Week 13)</i> <i>i. Learning Task:</i> <i>Define what Data Structures are and provide examples, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Present a brief lecture or use</i>	

	<i>visual aids to explain the basic definition of Data Structures, such as arrays, linked lists, stacks, queues, trees, and graphs</i> • <i>Engage students in a hands-on activity where they categorize various data structures based on their properties (e.g., linear vs. nonlinear, static vs. dynamic)</i> • <i>Assign a group project where students research and present case studies on how different data structures are used in real-world scenarios like databases, algorithms, or system design</i> • <i>Challenge students to develop a custom data structure for a given problem statement and explain their design choices through a presentation or coding project, etc.</i> iii. <i>Key Assessment (DoK):</i> • <i>Level 1: Write basic information about Data Structures</i> • <i>Level 2: Explain 5 characteristics and functions of different types of</i>	<i>visual aids to explain the basic definition of Data Structures, such as arrays, linked lists, stacks, queues, trees, and graphs, etc.</i> iii. <i>Key Assessment (DoK):</i> <i>Level 1: Write basic information about Data Structures, etc.</i>	

	<i>Data Structures</i> • <i>Level 3: Evaluate the effectiveness of various Data Structures in different contexts, etc.</i> <i>g) General science (Week 14)</i> <i>i. Learning Task:</i> • <i>Identify factors to be considered in setting up solar panels in Ghana The setup process of solar panels, including placement, orientation, and connection to the electrical system.</i> • <i>What is the Impact of environmental factors of solar panel installation?</i> • <i>Why is regular cleaning of the solar panels important?</i> <i>ii. Pedagogical Exemplars:</i> • <i>Use think-pair share to explain solar panel</i> • <i>Learners watch videos/simulations and explain function of locally available materials used to build solar panel in mixed ability groups.</i> • <i>Learners watch videos/simulations or look at diagrams/drawings and design solar</i>	<i>g) General science (Week 14)</i> <i>i. Learning Task:</i> <i>Identify factors to be considered in setting up solar panels in Ghana The setup process of solar panels, including placement, orientation, and connection to the electrical system, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Use think-pair share to explain solar panel, etc.</i>	

	<i>panels using locally available materials in mixed ability groups encouraging teamwork and information sharing, etc.</i> iii. Key Assessment (DoK): • <i>Level 2: Identify and describe routine maintenance tasks required to keep solar panels clean and functioning effectively, such as regular inspection, cleaning, and monitoring of system performance</i> • <i>Level 3: Create a visual diagram or flowchart illustrating the installation process of solar panels, highlighting key components and safety protocols</i> • <i>Evaluate the critical factors to consider when determining the optimal placement and orientation of solar panels for maximum sunlight exposure and energy efficiency, etc.</i> h) ICT (Week 14) i. Learning Task: • <i>Teacher begins the lesson with a</i>	iii. Key Assessment (DoK): <i>Level 2: Identify and describe routine maintenance tasks required to keep solar panels clean and functioning effectively, such as regular inspection, cleaning, and monitoring of system performance etc.</i> h) ICT (Week 14) i. Learning Task: <i>Teacher begins the lesson with a brief</i>	

	<i>brief discussion on what a computer network is and why it's important. Teachers ask learners to individually share their prior knowledge on network devices and the functions</i> • <i>The teacher presents a video on the main types of computer networks: Personal Area Network (PAN), Local Area Network (LAN), Wide Area Network (WAN), and others. Learners watch the video and write down key points in the video.</i> • <i>In small groups, the teacher assigns each group a type of network to discuss and give a diagram on the given type of network for discussion in the group and make a presentation to the whole class., etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Using Visuals and Simulations: Utilise</i>	<i>discussion on what a computer network is and why it's important. Teachers ask learners to individually share their prior knowledge on network devices and the functions, etc.</i> <i>ii. Pedagogical Exemplars: Using Visuals and Simulations:</i>	

	<i>network simulators, multimedia applications, packet-tracing tools, and visual analogies to help learners visualise network operations and understand complex concepts</i> • <i>Group Projects: Encourage collaborative learning by having learners work in groups to draw and discuss types of computer network with their advantages and disadvantages. This can foster discussion and deepen understanding through peer-to-peer education., etc.</i> <i>iii. Key Assessment (DoK):</i> • <i>Level 1: What is a local area network? List two differences between a Wide Area Network (WAN) and a Metropolitan Area Network (MAN)</i> • <i>Level 2: Explain how a router functions in a computer network</i> • <i>Level 3: How would you troubleshoot connectivity issues in a wireless network? Design a network layout for</i>	<i>Utilise network simulators, multimedia applications, packet-tracing tools, and visual analogies to help learners visualise network operations and understand complex concepts, etc.</i> <i>iii. Key Assessment (DoK):</i> <i>Listed response of at least 3 network types, etc.</i>	

	<i>a small business that includes various devices and ensures security</i> • <i>Level 4: As a network administrator of your company, develop a proposal for a city-wide Wi-Fi network that addresses potential challenges and benefits. If a company want to facilitating internal communication and file sharing within the company, which computer network will you recommend and why?</i> <i>i) Biology (Week 14)</i> <i>i. Learning Task:</i> • <i>Name the causative agent for the following diseases.</i> ○ <i>Cholera</i> ○ <i>Typhoid fever</i> ○ <i>Hepatitis A</i> • <i>Identify two water-borne diseases and provide two symptoms and one control/preventive measure.</i> • <i>Describe the following diseases based on the sub-headings provided below. Cholera,</i>	<i>i) Biology (Week 14)</i> <i>i. Learning Task:</i> <i>Name the causative agent for the following diseases.</i> ○ <i>Cholera</i> ○ <i>Typhoid fever</i> ○ <i>Hepatitis A, etc.</i>	

	<i>Typhoid fever, Hepatitis A, Influenza, Tuberculosis and COVID-19.</i> ○ <i>Causative agent</i> ○ <i>Mode of transmission</i> ○ <i>Symptoms (at least three)</i> ○ <i>Control/Preventive measures (at least three), etc.</i> <i>ii. Pedagogical Exemplars:</i> ● <i>Using project-based learning, learners gather data on common diseases among humans within the environment (e.g., Cholera by Vibrio cholerae)</i> ● <i>Using story telling strategy, guide learners to identify three water-borne diseases and provide symptoms and control/preventive measures</i> ● <i>Using talk for learning, learners create mind maps on the diseases identified including the vectors, causative organisms and control or preventive measures to curb them., etc.</i>		

	iii. Key Assessment (DoK): • Level 1: Name the causative agent of at least one of the following diseases; Cholera, Typhoid fever, Hepatitis A • Level 2: Identify at least two water-borne diseases and provide three symptoms and two control/preventive measures • Level 3: Describe the following diseases based on the sub-headings provided below. Cholera, Typhoid fever, Hepatitis A, Influenza, Tuberculosis and COVID-19. ○ Causative agent ○ Mode of transmission ○ Symptoms (at least three) ○ Control/Preventive measures (at least three), etc. j) Chemistry (Week 14) i. Learning Task: • Give three materials needed for the laboratory preparation of hydrogen gas • Use a balanced chemical equation to explain the 'pop' sound heard when hydrogen gas is tested with a	iii. Key Assessment (DoK): Level 1: Name the causative agent of at least one of the following diseases; Cholera, Typhoid fever, Hepatitis A, etc. j) Chemistry (Week 14) i. Learning Task: Give three materials needed for the laboratory preparation of hydrogen gas, etc.	

	<i>lighted splint</i> • Which property of hydrogen gas influence its collection during preparation, etc. ii. Pedagogical Exemplars: • Collaborative learning: Put learners in small mixed-ability groups to discuss the properties of each of the following gases: hydrogen, carbon dioxide, and ammonia. State their uses in everyday life • Experiential learning: Perform experiments to prepare hydrogen, ammonia, and carbon dioxide gas. Create charts to illustrate the experimental set-up for the preparation of each of the gases, etc. iii. Key Assessment (DoK): • Level 1: Explain why hydrogen gas is collected by upward delivery • Level 2: What property of hydrogen enables it to be used to fill balloons? • State the properties of CO₂ that allow it to be used in the	ii. Pedagogical Exemplars: Collaborative learning: Put learners in small mixed-ability groups to discuss the properties of each of the following gases: hydrogen, carbon dioxide, and ammonia. State their uses in everyday life, etc. iii. Key Assessment (DoK): Level 1: Explain why hydrogen gas is collected by upward delivery. etc.	

	<i>manufacture of fizzy drinks and as a refrigerant. Explain why a CO₂ filled fire extinguisher is not suitable for putting out a fire caused by burning Mg</i> • <i>Level 4: You are provided with the thistle funnel, delivery tube, split cork, conical flask, gas jar, beehive stand, water trough, Magnesium ribbon, and dilute HCl. Design an experiment to prepare and test for hydrogen. State three practical uses of hydrogen in everyday life, etc.</i>		
	<i>k) Physics (Week 14)</i> <i>i. Learning Task:</i> • <i>Draw a labelled diagram of the Gold leaf electroscope</i> • <i>Demonstrate the principles of electrostatics using a Gold leaf electroscope, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Show the learners a physical gold leaf electroscope and explain its basic components, such as the metal rod, the metal leaves, and the housing</i>	<i>k) Physics (Week 14)</i> <i>i. Learning Task:</i> <i>Draw a labelled diagram of the Gold leaf electroscope, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Show the learners a physical gold leaf electroscope and explain its basic components, such as the metal rod, the metal leaves,</i>	

	<i>Demonstrate how the electroscope responds when charged. A video or picture can be used where the equipment is not available</i> • <i>Provide a charged object (e.g., a plastic rod rubbed with a cloth). Using the process of charge separation, instruct learners to touch the metal rod of the electroscope with the charged object and observe the response of the gold leaves</i> • <i>Ask the learners to bring different objects (e.g., plastic, glass, metal) and experiment with charging the electroscope by induction. Have them predict and observe the behaviour of the gold leaves in each case. Safety precautions should be adhered to</i> • <i>Provide learners with a positively charged object and a negatively charged object. Ask them to charge the electroscope using</i>	<i>and the housing. Demonstrate how the electroscope responds when charged. A video or picture can be used where the equipment is not available, etc.</i>	

	<i>each object separately and compare the behaviour of the gold leaves in each case</i> <i>• Demonstrate charging the electroscope by friction with different materials (e.g., rubbing a glass rod with silk, rubbing a plastic rod with fur). Have learners predict the behaviour of the electroscope before each demonstration, etc.</i> <i>iii. Key Assessment (DoK):</i> <i>• Level 2: How does a gold leaf electroscope detect a charge?</i> <i>• Level 2: Historically, Gold leaf electroscopes were used to study atmospheric electricity. This was done by observing changes in the electroscope's behaviour during weather events like thunderstorms. How would you use the gold leaf electroscope to detect the charge carried by a body?</i> <i>• Level 3: Design an</i>	<i>iii. Key Assessment (DoK):</i> <i>Level 2: How does a gold leaf electroscope detect a charge?</i>	

	<i>experiment for the detection of charge using the gold leaf electroscope, etc.</i> <i>I) Computing (Week 14)</i> <i>i. Learning Task:</i> <i>• Define Data Structures and provide examples.</i> <i>• Explain the purpose and importance of Data Structures in organising and manipulating data.</i> <i>• Evaluate the efficiency and performance of different Data Structures in specific scenarios.</i> <i>• Design and implement a custom data structure for a complex problem-solving task.es, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Present a brief lecture or use visual aids to explain the basic definition of Data Structures, such as arrays, linked lists, stacks, queues, trees, and graphs</i>	<i>I) Computing (Week 14)</i> <i>i. Learning Task:</i> <i>Define Data Structures and provide examples, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Present a brief lecture or use visual aids to explain the basic definition of Data Structures, such as arrays, linked lists, stacks, queues, trees, and graphs., etc.</i>	

	• Engage students in a discussion or activity where they analyse how different Data Structures can efficiently store and retrieve data in various applications • Assign a project where students compare the time and space complexity of using different Data Structures for tasks like searching, sorting, or storing large datasets • Challenge students to create a new Data Structure that addresses a unique data manipulation requirement and present their design rationale through a written report or coding project, etc. iii. Key Assessment (DoK): • Level 1: Write half paragraph on basic information about Data Structures • Level 2: Discuss the significance		
		iii. Key Assessment (DoK): Level 1: Write half paragraph on basic information about Data Structures, etc.	

	<i>of Data Structures in data organization and manipulation</i> • <i>Level 3: Evaluate the advantages and disadvantages of using specific Data Structures based on performance metrics, etc.</i>		
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for weeks 13 and 14. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for weeks 13 and 14. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	

3. Peer-review of learning planners. Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan.</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning planner</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10min s

4. Reflection on the session: • Reflecting on what has been learned in the session. Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of weeks 15 and 16 of the teacher manual ahead of time and the DPLC Handbook Session 9 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 15 and 16 of the teacher manual ahead of time and the DPLC Handbook Session 9 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10min s

DPLC SESSION 9: Developing learning plans for weeks 15 & 16

<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Handbook Session 8, <i>developing learning plans for weeks 13 and 14</i>, which they think impacted learning positively. 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learned in DPLC Session 8, <i>developing learning plans for weeks 13 and 14</i>, supported learning.	1.1 Share two things you implemented based on DPLC Handbook Session 8, <i>developing learning plans for weeks 13 and 14</i>, which you think impacted learning positively. 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learned in DPLC Session 8, <i>developing learning plans for weeks 13 and 14</i>, supported learning.	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher manual to complete the learning planner, integrating	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session. Purpose: The purpose of this session is to assist science teachers in utilizing the teacher manual to create learning plans for lessons during weeks 15 and 16. Science teachers will focus on	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session. Purpose: The purpose of this session is to assist science teachers in utilizing the teacher manual to create learning plans for lessons during weeks 15 and 16. Science teachers will focus	60 mins

	developing learning plans for following lessons: A. <i>General science:</i> <i>Explain disadvantages of solar energy, forms of energy, form of force, sources, their generation and effects on the environment and motion.</i> B. <i>ICT:</i> <i>Classify network types and topologies.</i> C. <i>Biology:</i> <i>Morphological adaptations of mammals, and the Comparative study of the digestive system of different groups of mammals.</i> D. <i>Chemistry:</i> <i>The structure of the atom as well as Bohr's theory and the filling of electrons in orbitals.</i> E. <i>Physics:</i> <i>Matter and Classification of quantities into fundamental, derived, scalars and vectors.</i> F. <i>Computing:</i> <i>Apply knowledge of data structures to</i>	on developing learning plans for following lessons: A. <i>General science:</i> <i>Explain disadvantages of solar energy, forms of energy, form of force, sources, their generation and effects on the environment and motion.</i> B. <i>ICT:</i> <i>Classify network types and topologies.</i> C. <i>Biology:</i> <i>Morphological adaptations of mammals, and the Comparative study of the digestive system of different groups of mammals.</i> D. <i>Chemistry:</i> <i>The structure of the atom as well as Bohr's theory and the filling of electrons in orbitals.</i> E. <i>Physics:</i> <i>Matter and Classification of quantities into fundamental, derived, scalars and vectors.</i> F. <i>Computing:</i> <i>Apply knowledge of data structures to</i>	

	<i>explain their real-life applications effectively.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 15 and 16 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 15 and 16 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, key notes on differentiation, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 15 and 16 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 15 and 16 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e,	<i>explain their real-life applications effectively.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 15 and 16 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 15 and 16 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, key notes on differentiation, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 15 and 16 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 15 and 16 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f,	

	2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 15 and 16 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 15 and 16 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 15 and 16 (NTS 1a, 2c, 2f and 3d-3g). 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 15 and 16 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (week 15)</i> i. <i>How do I help learners explain the relationship advantages of solar energy?</i>	3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 15 and 16 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 15 and 16 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 15 and 16 in your teacher manual (NTS 1a, 2c, 2f and 3d-3g). 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 15 and 16 (NTS 1a, 2c, 2e, 2f, 3d-3g). E.g. a) <i>General Science (week15)</i> <i>How do I help learners explain the relationship solar energy and the environment?, etc.</i>	

	<i>ii. How do I help learners to explain the disadvantages solar energy?, etc.</i> <i>b) ICT (week 15)</i> <i>i. How can Classify network types and topologies make using the computer less stressful?</i> <i>ii. What is the best approach to teach Classification of network types and topologies?, etc.</i> <i>c) Biology (week 15)</i> <i>i. How would you relate fur or hair, mammary glands, limbs and appendages to their functions?</i> <i>ii. Why does an athlete pant for breath when she/he completes a race?, etc.</i> <i>d) Chemistry (week 15)</i> <i>i. How will the understanding of the content, application of solubility and solubility rules help learners appreciate its importance in their daily lives?</i> <i>ii. How can the application of solubility and solubility rules be used to identify matter?, etc.</i>	<i>b) ICT (week 15)</i> <i>How can Classify network types and topologies make using the computer less stressful?, etc.</i> <i>c) Biology (week 15)</i> <i>How would you relate fur or hair, mammary glands, limbs and appendages to their functions?, etc.</i> <i>d) Chemistry (week 15)</i> <i>How will the understanding of the content, application of solubility and solubility rules help learners appreciate its importance in their daily lives?</i>	

	e) <i>Physics (week 15)</i> i. <i>What feedback mechanisms can I put in place to help learners reflect on their learning and adjust as needed?</i> ii. <i>In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching the charge in everyday life?, etc.</i> f) <i>Computing (week 15)</i> i. <i>How will the Difference between the types of Data Structures help the learner better manipulate data?</i> ii. <i>What is the best approach to teach the differentiation between the types of Data Structures?, etc.</i> g) <i>General Science (week 16)</i> i) <i>How do I explain concepts associated with force such as distance, velocity?</i> ii) <i>How do I use activities to explain the concepts of forces such as distance, velocity?,</i>	e) <i>Physics (week 15)</i> <i>What feedback mechanisms can I put in place to help learners reflect on their learning and adjust as needed?, etc.</i> f) <i>Computing (week 15)</i> <i>How will the Difference between the types of Data Structures help the learner better manipulate data?, etc.</i> g) <i>General Science (week 16)</i> <i>How do I explain concepts associated with force such as distance, velocity?, etc.</i>	

	<i>h) ICT (week 16)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how to classify network types and topologies?</i> <i>ii. How can the concepts of network types and topologies be applied to other subject areas such as maths, English, biology?, etc.</i> <i>i) Biology (week 16)</i> <i>i. Why do herbivores typically have longer digestive tracts?</i> <i>ii. Imagine an environment where plant material is scarce and difficult to digest. What kind of digestive system adaptations might be beneficial for mammals in such an environment?, etc.</i> <i>j) Chemistry (week 16)</i> <i>i. How will understanding the content of qualitative analysis help learners appreciate its importance in forensic investigations?</i> <i>ii. What is the best approach of</i>	<i>h) ICT (week 16)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how to classify network types and topologies?, etc.</i> <i>i) Biology (week 16)</i> <i>Why do herbivores typically have longer digestive tracts?, etc.</i> <i>j) Chemistry (week 16)</i> <i>How will understanding the content of qualitative analysis help learners appreciate its importance in forensic investigations?, etc.</i>	

	<i>teaching the content, qualitative analysis to meet the varied needs of all learners?, etc.</i> <i>k) Physics (week 16)</i> <i>i. How can I convey the real-world significance of understanding magnets and magnetism to motivate my learners?</i> <i>ii. What strategies can I employ to ensure that learners are actively participating and thinking during the lesson on magnets?, etc.</i> <i>l) Computing (week 16)</i> <i>i. In what ways can I integrate the cross-cutting themes-Differentiate between the types of Data Structures?</i> <i>ii. How can the different types of data structures be applied or used in other subject areas such as mathematics, English, biology?, etc.</i>	<i>k) Physics (week 16)</i> <i>How can I convey the real-world significance of understanding magnets and magnetism to motivate my learners?, etc.</i> <i>l) Computing (week 16)</i> <i>In what ways can I integrate the cross-cutting themes-Differentiate between the types of Data Structures?, etc.</i>	
	2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 15	2.4 Discuss at least two key notes on differentiation for Weeks 15 and 16. See	

	and 16. Inform teachers to see the Teacher Manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General Science (Week 15)</i> <i>i. Learning Tasks:</i> <i>• Compile a list of at least three economic benefits related with the adoption of solar energy in Ghana.</i> <i>• Analyse how the implementation of solar energy initiatives impacts the country's economic growth and sustainability.</i> <i>• Disadvantages of solar energy, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>• Put the learners into small groups and assign each group a specific advantage of solar energy to the economy of Ghana, such as increased energy access or reduced reliance on fossil fuel imports. Have each group research and discuss their</i>	Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General Science (Week 15)</i> <i>i. Learning Tasks:</i> <i>Compile a list of at least three economic benefits related with the adoption of solar energy in Ghana, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>Put the learners into small groups and assign each group a specific advantage of solar energy to the economy of Ghana, such as increased energy access or reduced reliance on fossil fuel imports. Have each group research and discuss their assigned</i>	

	<i>assigned advantage, then present their findings to the class. This activity encourages collaboration, critical thinking, and in-depth exploration of the economic benefits of solar energy</i> • <i>Engage learners in mixed ability groups to focus on different disadvantage like high initial costs or intermittent sunlight exposure. Have learners become experts on their assigned topic, then reshuffle the groups so that each new group has an expert from every initial expert group. This way, students can share their knowledge and insights on the disadvantages of solar energy before presenting a comprehensive overview to the class</i> • <i>Provide case</i>	<i>advantage, then present their findings to the class. This activity encourages collaboration, critical thinking, and in-depth exploration of the economic benefits of solar energy, etc.</i>	

	<i>studies showcasing successful implementation of solar energy projects in Ghana, highlighting the economic benefits experienced by communities and businesses. Assign different case studies to individual learners or small groups based on their interests or learning styles. Students can analyse the economic impact, challenges faced, and lessons learned from each case study. This differentiated approach allows students to engage with real-world examples at their own pace and depth, catering to their diverse learning preferences, etc.</i> <i>iii. Key Assessment:</i> <i>• Level 2: Research and compile a list of at least three economic benefits related</i>	<i>iii. Key Assessment:</i> <i>Level 2: Research and compile a list of at least three economic benefits related with the</i>	

	<i>to the adoption of solar energy in Ghana</i> • <i>Level 2: Analyse how the implementation of solar energy initiatives impacts the country's economic growth and sustainability</i> • <i>Level 3: Evaluate the potential challenges that may arise in integrating solar power into Ghana's existing economic infrastructure. Outline potential drawbacks and challenges associated with the widespread deployment of solar energy technology in Ghana, etc.</i>	<i>adoption of solar energy in Ghana</i>	
	<i>b) ICT (Week 15)</i> <i>i. Learning Tasks</i> • <i>Engage learners to briefly explain what network topologies are and why they are important. Show examples of star, bus, mesh, and ring topologies using diagrams either in a video or printed format</i> • <i>Divide the class</i>	<i>b) ICT (Week 15)</i> <i>i. Learning Tasks</i> <i>Engage learners to briefly explain what network topologies are and why they are important. Show examples of star, bus, mesh, and ring topologies using diagrams either in a video or printed format, etc.</i>	

	<i>into small groups and assign each group a specific topology to discuss. Ask each group to list out the advantages and disadvantages of their assigned topology</i> • <i>Provide worksheets with scenarios requiring network solutions and task learners draw the most appropriate topology for each scenario and justify their choice</i> • <i>Each group presents their topology, discussing its pros and cons in the context of the scenarios provided. Learners assess other groups as they present their work to the whole class. Teacher also makes input where necessary, etc.</i> <i>ii. Pedagogical Exemplars</i> • <i>Utilise network simulators, multimedia applications,</i>		
		<i>ii. Pedagogical Exemplars</i> <i>Utilise network simulators, multimedia applications, packet-</i>	

	<i>packet-tracing tools, and visual analogies to help learners visualise network operations and understand complex concepts</i> • <i>Encourage collaborative learning by having learners work in groups to draw and discuss types of network topologies with their advantages and disadvantages. This can foster discussion and deepen understanding through peer-to-peer education</i> • <i>Engage in individual and mixed-ability/gender-sensitive group work to brainstorm structure and layout of computer networks in the society. Engage learners in their mixed-ability groupings to analyse scenarios and draw appropriate network topologies for the scenarios. Learners can also</i>	<i>tracing tools, and visual analogies to help learners visualise network operations and understand complex concepts, etc.</i>	

	<i>be made to set up a layout of a type network topology for a hands-on practical provided networking materials are available, etc.</i> iii. Key Assessments (DoK): • <i>Level 1: What is a network topology?</i> • <i>Level 2: Compare and contrast star and ring topologies.</i> • <i>Level 3: Analyse the impact of adding additional nodes to a star topology.</i> • <i>Level 4: Create a proposal for a network design for a new building using a specific topology and justify your choice, etc.</i> c) <i>Biology (week15)</i> i. <i>Learning Tasks:</i> • <i>Provide a list of some external organs and structures that are associated with mammals. Limit content expectation to structures that are located at the external of mammals, and can be observed from the exterior</i> • <i>Describe the functions of some</i>	iii. Key Assessments (DoK): <i>Level 1: What is a network topology?, etc.</i> c) <i>Biology (week15)</i> i. <i>Learning Tasks:</i> <i>Provide a list of some external organs and structures that are associated with mammals. Limit content expectation to structures that are located at the external of mammals, and can be observed from the exterior, etc.</i>	

	<i>external organs and structures found in mammals. Limit response to description of functions of the various features found in the external part of the mammalian body</i> <i>• Explain how external morphological features of mammals coordinate in their functions to ensure survival of the mammals. Response content should focus on how the various external organs of mammals function together to ensure survival; for example, the limbs are used to move the body around to find food essential items such as food, which is broken down by the teeth, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Learners in mixed-ability, all-inclusive groups, are to critically observe, discuss and write down their findings on the external features of a sedated mammal (e.g., Albino rat, rabbit, guinea pig.) presented to</i>	<i>ii. Pedagogical Exemplars:</i> <i>Learners in mixed-ability, all-inclusive groups, are to critically observe, discuss and write down their findings on the external features of a sedated mammal (e.g., Albino rat, rabbit, guinea pig.) presented to them</i>	

	<i>them at the lab: Learner experiences lessons in real life scenarios and therefore obtain better understanding in lessons</i> • <i>Learners are assigned in groups to research on external mammalian features and provide their functions. All learners participate in one aspect of the project or another. Thus, there is better understanding of content among them.</i> • <i>Learners in groups discuss their findings from research and share information through various group presentations. Learners improve their public speaking as they interact among themselves and observe their strength and weaknesses in their delivery and improve over this.</i>	<i>at the lab: Learner experiences lessons in real life scenarios and therefore obtain better understanding in lessons etc.</i>	

	iii. <i>Key Assessment (DoK)</i> • <i>Level 1: Name and provide the common features/organs located at the external part of mammals. Accept at least three external organs/features /structures of mammals and their functions</i> • <i>Level 2: Compare the limb structure of a named terrestrial mammal and a named marine mammal, and explain how each is suited to their mode of movement. Accept comparison and explanation of limbs of land based mammals (e.g. sheep) with the flippers of aquatic mammals such as dolphins and whales</i> • <i>Level 3: Devise a plan for a conservation program aimed at protecting a specific endangered mammal species by considering its unique external and internal features, habitat, and diet</i>	iii. <i>Key Assessment (DoK)</i> <i>Level 1: Name and provide the common features/organs located at the external part of mammals. Accept at least three external organs/features /structures of mammals and their functions, etc.</i>	

	<i>requirements. Accept conservation method and practices such as avoiding hunting/poaching, criminalising the commercialisation and trading of endangered mammals and providing a healthy habitat for endangered mammals, etc.</i> <i>d) Chemistry (week 15)</i> <i>i. Learning Tasks:</i> <i>• Explain the term solubility</i> <i>• State the units of solubility and use one of them to explain unsaturated, saturated and supersaturated solutions, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Using sample solutions, brainstorm to explain the terms solute, solvent, and solution.</i> <i>• With the aid of sample solutions such as sugar solution, a mixture of kerosene and water or, a mixture of coke and carbon dioxide, describe the various types</i>	<i>d) Chemistry (week 15)</i> <i>i. Learning Tasks:</i> <i>Explain the term solubility, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Using sample solutions, brainstorm to explain the terms solute, solvent, and solution, etc.</i>	

	<i>of solutions based on the state of solute and solvent and give specific examples (solid-liquid, solid-gas, gas-liquid, solid-solid, liquid-liquid, gas-gas solutions).</i> • <i>Watch a video or prepare samples of the various types of solutions (unsaturated, saturated, and supersaturated)</i> • <i>Inquiry-based learning: In groups,</i> • <i>Experiment to investigate the factors that affect solubility: temperature, pressure, nature of solute and solvent (molecular size and polarity)</i> <i>Note: Stirring or shaking increases the rate of solubility. Relate the factors to everyday life such as the dissolution of salt in soup, sugar in hot and cold water, carbon dioxide in fizzy drinks.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Define solubility.</i> • <i>Level 2: Explain each of the following terms; saturated solution, unsaturated solution and</i>		
		<i>iii. Key Assessments (DoK):</i> <i>Level 1: Define solubility, etc.</i>	

	<i>supersaturated solution</i> • <i>Level 4: A mother visited the hospital and was given a drug that contains an inorganic salt as an active ingredient. She was advised by the pharmacist to dissolve it in water to form a solution before drinking each morning. You saw your mother arguing with your father that it is best to dissolve it in distilled water before drinking. Based on your knowledge on the factors that affect solubility, how would you advise your mother?, etc.</i>		
	<i>e) Physics (week 15)</i> <i>i. Learning Tasks:</i> • <i>Explain the concept of how charges distribute on different surfaces, particularly conductors and insulators</i> • <i>Explain the concept of surface charge density</i> • <i>of charge and its behaviour</i> <i>ii. Pedagogical Exemplars:</i> • <i>Learners should be randomly grouped to research to differentiate how</i>	<i>e) Physics (week 15)</i> <i>i. Learning Tasks:</i> <i>Explain the concept of how charges distribute on different surfaces, particularly conductors and insulators, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Learners should be randomly grouped to research to</i>	

	<i>charges are distributed on the surfaces of conductors</i> • <i>Show learners, diagrams or 3D models of spherical, pear-shaped, and sharp point surfaces. Ask them to observe and describe how they visualise charges distributed on each surface</i> • <i>Use an interactive simulation or mobile/web application to illustrate how charges are distributed on different surfaces. Guide learners to observe the differences in charge distribution based on the surface's shape</i> • <i>Set up a demonstration where a charged object is brought near a neutral conductor with different surface geometries. Use charged pith balls or an electroscope to visualise the charge distribution on the surface, etc.</i> iii. <i>Key Assessment (DoK)</i> • <i>Level 1: How do charges distribute themselves on the surface of a conductor?</i> • <i>Level 1: Describe</i>	<i>differentiate how charges are distributed on the surfaces of conductors, etc.</i> iii. <i>Key Assessment (DoK)</i> <i>Level 1: How do charges distribute themselves on the surface of a conductor?, etc.</i>	

	<i>the distribution of charges on a spherical conductor</i> • <i>Level 2: Compare the charge distribution on a pear-shaped conductor to that on a spherical conductor. How does the shape affect the charge density?, etc.</i>		
	<i>f) Computing (week 15)</i> <i>i. Learning Tasks:</i> • <i>Define and provide examples of basic Data Structures such as arrays, linked lists, stacks, queues, trees, and graph</i> • <i>Explain the purpose and applications of different Data Structures in real-world scenarios.</i> • <i>Evaluate the trade-offs and performance considerations of using specific Data Structures for different tasks</i> • <i>Design and implement a custom data structure for a complex problem-solving task that combines multiple types of Data Structures, etc.</i> <i>ii. Pedagogical Exemplar:</i> • <i>Present a lecture or use visual aids to</i>	<i>f) Computing (week 15)</i> <i>i. Learning Tasks:</i> <i>Define and provide examples of basic Data Structures such as arrays, linked lists, stacks, queues, trees, and graph, etc.</i> <i>ii. Pedagogical Exemplar:</i> <i>Present a lecture</i>	

	<i>explain the definition and basic characteristics of each Data Structure type</i> • <i>Engage learners in a discussion or activity where they analyse how each type of Data Structure is used in practical applications like databases, operating systems, or algorithms</i> • <i>Assign a project where learners compare the time and space complexity of using arrays, linked lists, stacks, queues, trees, and graphs for tasks like searching, sorting, or graph traversal</i> • <i>Challenge learners to create a hybrid data structure that leverages the strengths of arrays, linked lists, stacks, queues, trees, and graphs to solve a complex data manipulation problem, etc.</i> <i>iii. Key Assessments (DoK)</i> • <i>Level 1: Discuss the basic types of Data Structures and their key features</i> • <i>Level 2: Explain how different Data Structures are</i>	<i>or use visual aids to explain the definition and basic characteristics of each Data Structure type</i> <i>iii. Key Assessments (DoK)</i> <i>Level 1: Discuss the basic types of Data Structures and their key features, etc.</i>	

	<i>utilised to organise and manipulate data efficiently</i> • <i>Level 3: Evaluate the advantages and disadvantages of using specific Data Structures based on performance metrics and task requirements</i> • <i>Level 4: Discuss different Data Structures and design innovative solutions that integrate multiple types for optimal performance in challenging scenarios, etc.</i> <i>g) General science (Week 16)</i> <i>i. Learning task</i> • <i>Identify the concepts of forces.</i> • <i>Explain concepts associated with forces.</i> • <i>Use hands-on experiment to explain some concepts associated with forces such as frictional force, Newton first and second law of motion, etc.</i> <i>ii. Pedagogical Exemplars</i> • <i>Using the talk-for-learning approach, place learners in mixed-</i>	<i>g) General science (Week 16)</i> <i>i. Learning task</i> <i>Identify the concepts of forces, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>Using the talk-for-learning approach, place learners in</i>	

	<i>ability/mixed-sex groups to discuss the concepts of distance, displacement, speed, velocity and acceleration with contextual examples</i> • <i>Using the enquiry approach, guide learners to develop task sheets to explore real-life applications of the concepts: speed, displacement, velocity, and acceleration</i> • <i>Using the 3E approach, guide learners to engage, explore and explain concepts such as forces, momentum and pressure</i> • <i>Using differentiated learning and scaffolding, guide learners to explore the applications of the concepts of forces, Momentum and Pressure in real life, etc.</i> iii. <i>Key Assessment (DoK)</i> • <i>When a carpet is beaten with a stick, dust emerges. Explain</i> • <i>Why is it advised to tie any luggage kept on the roof of a bus with a rope?</i>	<i>mixed-ability/mixed-sex groups to discuss the concepts of distance, displacement, speed, velocity and acceleration with contextual examples, etc.</i> iii. <i>Key Assessment (DoK)</i> <i>When a carpet is beaten with a stick, dust emerges. Explain, etc.</i>	

	• <i>Why is the passenger(s) sitting in a moving bus pushed in the forward direction when the bus stops suddenly?, etc.</i> <i>h) ICT (Week 16)</i> <i>i. Learning task:</i> • <i>Teachers discuss transmission media with learners and introduce the three main types of guided media to learners. Learners in their groups, research on one type of guided media each using their digital devices (if available) or textbooks. They should focus on their structure, how they transmit data, and their advantages and disadvantages.</i> • <i>Task learners to create a comparison chart that lists the key features of each type of guided media they researched on. This could include bandwidth, susceptibility to interference, and typical use cases.</i> • <i>Practical Demonstration: If</i>	<i>h) ICT (Week 16)</i> <i>i. Learning task:</i> <i>Teachers discuss transmission media with learners and introduce the three main types of guided media to learners. Learners in their groups, research on one type of guided media each using their digital devices (if available) or textbooks. They should focus on their structure, how they transmit data, and their advantages and disadvantages, etc.</i>	

	<i>possible, arrange for physical samples of each type of cable. Demonstrate the flexibility, thickness, and other physical characteristics. Analyse a real-world scenario where a particular type of guided media is used. Discuss why that choice was made over the others.</i> • <i>Each group presents a type of guided media, discussing its pros and cons in the context of the scenarios provided. Learners assess other groups as they present their work to the whole class. Teacher also makes input where necessary.</i> • <i>Teacher through questions and answers discuss what was learned and how it applies to real-world networking situations with the learners to climax the lesson.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Critical Media Literacy: This approach prepares educators to teach learners to critically analyse media and</i>		
		<i>ii. Pedagogical Exemplars:</i> <i>Critical Media Literacy: This approach prepares educators to teach learners to</i>	

	<i>technology. It involves questioning systemic issues of power and engaging in social justice through media creation</i> • <i>Problem-Posing and Constructivist Teaching: This pedagogy nurtures learning to identify, evaluate, and analyse various media texts. It's about engaging learners in a dialogue that challenges their preconceptions and encourages critical thinking transmission media, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: What are the three main types of guided media?</i> • <i>Level 2: Describe how signal degradation affects data transmission in coaxial cables.</i> • <i>Level 3: Develop a plan to upgrade an office network's cabling with a focus on balancing cost and performance</i> • <i>Level 4: Propose a design for a city's broadband infrastructure</i>	<i>critically analyse media and technology. It involves questioning systemic issues of power and engaging in social justice through media creation, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: What are the three main types of guided media?, etc.</i>	

	<i>using guided media, considering factors like geography, user density, and future scalability, etc.</i> <i>i) Biology (Week 16)</i> <i>i. Learning Task:</i> <i>• List the three major groups of mammals based on their dietary preferences. Provide support to struggling learners.</i> <i>• What are the differences and similarities among the length of the digestive tracts in herbivores, carnivores, and omnivores. How does the length relate to their dietary preferences?</i> <i>• Propose potential challenges faced by an omnivorous species in a rapidly changing habitat. How might their digestive system adapt strategically to overcome these challenges?</i> <i>ii. Pedagogical Exemplars:</i> <i>Using task-based learning, randomly formed mixed-ability and gender-responsive groups, obtain three different species of</i>	<i>i) Biology (Week 16)</i> <i>i. Learning Task:</i> <i>• List the three major groups of mammals based on their dietary preferences. Provide support to struggling learners, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Using task-based learning, randomly formed mixed-ability and gender-responsive</i>	

	<i>small mammals and dissect them, discuss the arrangement and functions of the internal organs and tissues, and compare them with those of other mammals, etc.</i> iii. Key Assessments (DoK): • <i>Level 1: What are the three major groups of mammals based on their dietary preferences?.</i> • <i>Level 2: Compare the length of the digestive tracts in herbivores, carnivores, and omnivores. How does the length relate to their dietary preferences?</i> • <i>Level 3: Imagine an environment where plant material is scarce and difficult to digest. What kind of digestive system adaptations might be beneficial for mammals in such an environment?</i> • <i>Level 4: Discuss the potential impact of climate change and its effect on the</i>	<i>groups, obtain three different species of small mammals and dissect them, discuss the arrangement and functions of the internal organs and tissues, and compare them with those of other mammals, etc.</i> iii. Key Assessments (DoK): <i>Level 1: What are the three major groups of mammals based on their dietary preferences?, etc.</i>	

	<i>feeding habit and survival of any of the following group of mammals, etc.</i> j) Chemistry (Week 16) i. Learning Tasks: • <i>Explain the importance of qualitative analysis in chemistry</i> • <i>How will you differentiate a calcium salt from a zinc salt using ammonia?, etc.</i> ii. Pedagogical Exemplars: • <i>Brainstorm to explain the solubility rules and predict the effect of precipitating agents on some ions.</i> • <i>In mixed-gender grouping where applicable, Design an experiment to test for the presence of the following cations (Al^{3+}, Ca^{2+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Pb^{2+}, NH_4^+) using $NaOH_{(aq)}$ and $NH_{3(aq)}$ as precipitating reagents</i> • <i>Design and perform tests to identify and describe the behaviour of the following anions (CO_3^{2-}, Cl^-, Br^-, I^-,</i>	j) Chemistry (Week 16) i. Learning Tasks: <i>Explain the importance of qualitative analysis in chemistry, etc.</i> ii. Pedagogical Exemplars: <i>Talk-for-learning: Brainstorm to explain the solubility rules and predict the effect of precipitating agents on some ions, etc.</i>	

	NO_3^-, SO_3^{2-}, SO_4^{2-}, S^{2-}) • Design an experiment to determine the presence of salt using the grid method, etc. iii. Key Assessments (DoK): • Level 1: Give one example of a cation, whose salts are soluble • Level 2: Which of the following compounds will be insoluble when added to water: NaBr or FeCl_2 or PbCO_3?, etc. k) Physics (Week 16) i. Learning Task: • Define what it means for a material to be magnetic or non-magnetic. • State examples of magnetic and non-magnetic materials • Discuss practical applications of magnetic and non-magnetic materials in technology and industry, etc.	iii. Key Assessments (DoK): Level 1: Give one example of a cation, whose salts are soluble, etc. k) Physics (week 16) Learning Task: Define what it means for a material to be magnetic or non-magnetic, etc. i. Pedagogical Exemplars: Provide a variety of objects made of different materials (e.g., paperclip, coin, pencil, aluminium foil, iron nail). Ask learners to experiment with a magnet and observe which objects are attracted to it and those which are not, etc.	

	ii. <i>Pedagogical Exemplars:</i> • <i>Provide a variety of objects made of different materials (e.g., paperclip, coin, pencil, aluminium foil, iron nail). Ask learners to experiment with a magnet and observe which objects are attracted to it and those which are not</i> • <i>Ask learners to separate these items and brainstorm to differentiate between magnetic and non-magnetic materials, etc.</i> iii. <i>Key Assessment (DoK):</i> • <i>Level 1: What is a magnetic material? Provide an example</i> • <i>Level 1: Give an example of a non-magnetic material commonly found in households.</i> • <i>Level 1: Explain the key difference between magnetic and non-magnetic materials in terms of their response to an external magnetic field, etc.</i>	ii. <i>Key Assessments (DoK):</i> <i>Level 1: What is a magnetic material? Provide an example, etc.</i>	

	<i>I) Computing (Week 16)</i> <i>i. Learning Tasks:</i> <i>• Define and differentiate between the basic types of Data Structures such as arrays, linked lists, stacks, queues, trees, and graphs</i> <i>• Explain the advantages and disadvantages of using specific Data Structures for different data management tasks</i> <i>• Evaluate the efficiency and scalability of various Data Structures in handling large datasets or complex algorithms</i> <i>• Design and implement a custom data structure that optimizes data manipulation for a specific problem domain, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Present a comparison chart or visual aid that highlights the key characteristics and differences of each Data Structure type</i> <i>• Engage learners in a discussion or</i>	<i>I) Computing (Week 16)</i> <i>i. Learning Tasks:</i> <i>• Define and differentiate between the basic types of Data Structures such as arrays, linked lists, stacks, queues, trees, and graphs, etc.</i> <i>ii. Pedagogical Exemplars::</i> <i>• Present a comparison chart or visual aid that highlights the key characteristics and differences of each Data</i>	

	case study where they analyse how arrays, linked lists, stacks, queues, trees, and graphs are suited for specific operations like searching, sorting, or storing hierarchical data • Assign a project where learners benchmark the performance of arrays, linked lists, stacks, queues, trees, and graphs in scenarios involving big data processing or advanced algorithmic tasks • Challenge learners to create a novel data structure that combines elements of arrays, linked lists, stacks, queues, trees, and graphs to address a complex real-world problem effectively, etc. iii. Key Assessments (DoK): • Level 1: Identify the distinct features of different Data Structures • Level 2: Discuss the practical implications of choosing different Data Structures based on task requirements	Structure type, etc. iii. Key Assessments (DoK): • Level 1: Identify the distinct features of different Data Structures, etc.	

	• <i>Level 3: Compare the trade-offs in performance and resource utilization when selecting Data Structures for demanding computational tasks</i> • <i>Level 4: Differentiate Data Structures and develop innovative solutions that push the boundaries of data organization and manipulation, etc.</i>		
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 15 and 16. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 15 and 16. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	

3. Peer-review of learning planners. Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan.</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning planner</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10 mins

4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 17 and 18 of the teacher manual ahead of time and the DPLC Handbook Session 10 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 17 and 18 of the teacher manual ahead of time and the DPLC Handbook Session 10 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10 mins

DPLC Session 10: Developing learning plans for Weeks 17 and 18

<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 9, <i>developing learning plans for Weeks 15 and 16</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 9, <i>developing learning plans for Weeks 15 and 16</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 9, <i>developing learning plans for Weeks 15 and 16</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 9, <i>developing learning plans for Weeks 15 and 16</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 17 and 18. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Uses of electronic components in household electronic gadgets and how to manage hazard in everyday life.</i> B. <i>ICT: Classify transmission media used to send and receive data in a network environment.</i> C. <i>Biology: The Morphology of flowering plants, and Distinguishing features of angiosperms.</i> D. <i>Chemistry: Periodicity and ionic bonding.</i> E. <i>Physics: Semiconductors and transducers.</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 17 and 18. Science teachers will focus on developing learning plans for the following lessons: A. <i>General science: Uses of electronic components in household electronic gadgets and how to manage hazard in everyday life.</i> B. <i>ICT: Classify transmission media used to send and receive data in a network environment.</i> C. <i>Biology: The Morphology of flowering plants, and Distinguishing features of angiosperms.</i> D. <i>Chemistry: Periodicity and ionic bonding.</i> E. <i>Physics: Semiconductors and transducers.</i>	

	<i>F. Computing: Apply Algorithms in various real-life and programming situations problems.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 17 and 18 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 17 and 18 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 17 and 18 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 17 and 18 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o).	<i>F. Computing: Apply Algorithms in various real-life and programming situations problems.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 17 and 18 lessons using the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 17 and 18 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 17 and 18 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 17 and 18 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j).	

	LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 17 and 18 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 17 and 18 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 17 and 18 (NTS 1a, 2c, 2f and 3d-3g). 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 17 and 18 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 17)</i> i. <i>How do I apply the knowledge of uses of electronic components to prevent everyday hazard when using electronic household gadgets?</i>	and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 17 and 18 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 17 and 18 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 17 and 18 in your teacher manual (NTS 1a, 2c, 2f and 3d-3g). 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 17 and 18 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 17)</i> <i>How do I apply the knowledge of uses of electronic components to prevent everyday hazard when using electronic household gadgets?, etc.</i>	

	ii. <i>How can the knowledge of electronic components be applied to build a household electronic gadget?, etc.</i> b) <i>ICT (Week 17)</i> i. <i>How can transmission media be used effectively to send and receive data in a network environment?</i> ii. <i>What is the best approach to teach Classification of transmission media to be used effectively to send and receive data in a network environment?, etc.</i> c) <i>Biology (Week 17)</i> i. <i>How can I describe the morphological features of flowering plants to show them as the most successful group in the evolution of the plant kingdom?</i> ii. <i>How can I distinguish between the two classes of flowering plants?, etc.</i> d) <i>Chemistry (Week 17)</i> i. <i>How will I make connections between the content, periodicity</i>	b) <i>ICT (Week 17)</i> <i>How can transmission media be used effectively to send and receive data in a network environment?, etc.</i> c) <i>Biology (Week 17)</i> <i>How can I describe the morphological features of flowering plants to show them as the most successful group in the evolution of the plant kingdom?, etc.</i> d) <i>Chemistry (Week 17)</i> <i>How will I make connections between the content, periodicity</i>	

	<i>and real-life experiences?</i> <i>ii. How will the knowledge and understanding of the content, periodicity help learners to organize things in life?, etc.</i> <i>e) Physics (Week 17)</i> <i>i. What real-life examples or scenarios can I use to illustrate the relevance of transducers in everyday life in various fields, such as engineering, medicine, and environmental monitoring?</i> <i>ii. What opportunities will I give learners to apply their knowledge of transducers in real-world situations, such as designing sensor systems or exploring transducer technologies?, etc.</i> <i>f) Computing (Week 17)</i> <i>i. How can learners use the various stages of app development to design their own app?</i> <i>ii. How can the different programming languages be used for app development?, etc.</i>	<i>and real-life experiences?, etc.</i> <i>e) Physics (Week 17)</i> <i>What real-life examples or scenarios can I use to illustrate the relevance of transducers in everyday life in various fields, such as engineering, medicine, and environmental monitoring?, etc.</i> <i>f) Computing (Week 17)</i> <i>How can learners use the various stages of app development to design their own app?, etc.</i>	

	<i>g) General Science (Week 18)</i> <i>i. How can the knowledge of hazard management be applied in everyday life such as workplaces, home?</i> <i>ii. How does the knowledge of hazard symbols help prevent hazard in everyday life in the workplaces, homes?, etc.</i> <i>h) ICT (Week 18)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how to transmission media be used effectively to send and receive data in a network environment? etc.</i> <i>ii. How can the concepts of transmission media be applied to other subject areas such as math, English, biology?, etc.</i> <i>i) Biology (Week 18)</i> <i>i. How will I use the knowledge in monocot and dicot plants to help learners identify</i>	<i>g) General Science (Week 18)</i> <i>How can the knowledge of hazard management be applied in everyday life such as workplaces, home?, etc.</i> <i>h) ICT (Week 18)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching how to transmission media be used effectively to send and receive data in a network environment?, etc.</i> <i>i) Biology (Week 18)</i> <i>How will I use your knowledge of monocot and dicot plants to help learners</i>	

	<i>these two species of cocoa and maize?</i> <i>ii. How can learners apply their knowledge of monocots and dicots plants to the choices of diet for most animals?, etc.</i> <i>j) Chemistry (Week 18)</i> <i>i. How do I make connections between the content, Ionic bonding and household compounds with ionic bonds?</i> <i>ii. How will the knowledge and understanding of the content, ionic bonding help learners appreciate the existence of the solid state which is the bases for all our physical and chemical properties?, etc.</i> <i>k) Physics (Week 18)</i> <i>i. In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching semiconductors?</i> <i>ii. What creative teaching approaches, interactive activities, or projects can I use to make the lesson</i>	<i>identify these two species of cocoa and maize?, etc.</i> <i>j) Chemistry (Week 18)</i> <i>How do I make connections between the content, Ionic bonding and household compounds with ionic bonds?, etc.</i> <i>k) Physics (Week 18)</i> <i>In what ways can I integrate the cross-cutting themes- 21st century skills, GESI, SEL and national values in teaching semiconductors?, etc.</i>	

	<i>on semiconductors enjoyable and memorable for learners?, etc.</i> <i>I) Computing (Week 18)</i> <i>i. What are the different user experience and user interface design principles used in app development?</i> <i>ii. What are the different platforms that apps can be developed for? etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 17 and 18. Inform teachers to see the Teacher Manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General science (Week 17)</i> <i>i. Learning Tasks:</i> <i>• Identify electronic components in household devices</i> <i>• Explain the uses of electronic components in household devices</i> <i>• Design circuits involving transistors and switches</i> <i>• Build an amplifier using electronic components, etc.</i> <i>ii. Pedagogical Exemplars:</i>	<i>I) Computing (Week 18)</i> <i>What are the different user experience and user interface design principles used in app development? etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 17 and 18. See Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>General Science (Week 17)</i> <i>i. Learning Tasks:</i> <i>Identify electronic components in household devices, etc.</i> <i>ii. Pedagogical Exemplars:</i>	

	• <i>Guide learners in revising the basic electronics components from the JHS curriculum using talk-for-learning approaches and internet resources</i> • <i>Demonstrate to learners how basic electronic components are used in circuits and electronic devices using simulations, pictures, charts, videos and realia</i> • <i>Conduct hands-on demonstrations using common household electronic devices, such as a simple circuit board with components like resistors, capacitors, LEDs, and switches. Explain the function of each component and how they work together to perform specific tasks in devices like radios, TVs, or microwaves</i> • <i>Present case studies of real-world household electronic devices, analysing their circuit diagrams and component usage. Discuss how different</i>	<i>Guide learners in revising the basic electronics components from the JHS curriculum using talk-for-learning approaches and internet resources, etc.</i>	

	<i>components are integrated into these devices to achieve specific functionalities. Encourage students to identify and explain the role of each component in the overall operation of the device</i> <i>• In groups, ask learners to design and build simple electronic devices or prototypes of household gadgets, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Level 1: Draw circuit symbols of four electronic components</i> <i>• Level 2: Explain why electronic symbols are important in circuits with examples</i> <i>• Level 3: Design circuits involving transistors and switches, etc.</i> <i>b) ICT (Week 17)</i> <i>i. Learning Tasks:</i> <i>• Divide learners into groups, and assign each group a specific transmission mode (simplex, half-duplex, or full-duplex) and have</i>	<i>iii. Key Assessments (DoK):</i> <i>Level 1: Draw circuit symbols of four electronic components, etc.</i> <i>d) ICT (Week 17)</i> <i>i. Learning Tasks:</i> <i>Divide learners into groups, and assign each group a specific transmission mode (simplex, half-duplex, or full-duplex) and have</i>	

	<i>group act out scenarios related to their assigned mode using role play</i> <i>• In groups, learners prepare Visual Representations based on their assigned transmission mode. The learners should consider the following in preparing their visual presentation</i> <i>• In groups, learners set up a mini-network using simple materials (e.g., strings, paper cups, or markers) and demonstrate how data flows in their assigned modes</i> <i>• Show a five minute video or simulations on the various transmission modes in computer networks for learners to watch. Divide the class into teams and organise a debate or discussion on the video or simulation watched. Assign teams to defend or critique a specific transmission</i>	<i>group act out scenarios related to their assigned mode using role play, etc.</i>	

	<i>mode. Encourage critical thinking and evidence-based arguments, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Provide a list of transmission modes such as simplex, half-duplex, and full-duplex, and ask learners to identify and explain each mode</i> <i>• Create a simulation or interactive activity where learners can experience sending and receiving data in simplex, half-duplex, and full-duplex modes to understand how each mode works</i> <i>• Assign a task where learners analyse case studies or scenarios to determine which transmission mode would be most suitable based on factors such as bandwidth requirements, latency, and network congestion</i> <i>• Challenge learners to create a network design proposal that incorporates</i>	<i>ii. Pedagogical Exemplars:</i> <i>Provide a list of transmission modes such as simplex, half-duplex, and full-duplex, and ask learners to identify and explain each mode, etc.</i>	

	<i>advanced transmission technologies like multiplexing, error correction, and flow control to enhance data transfer speeds and reliability, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Discuss the basic concepts of transmission modes in computer networks</i> • <i>Level 2: Apply knowledge of transmission modes to effectively transmit data in various network configurations</i> • <i>Level 3: Assess the implications of selecting specific transmission modes on network performance and efficiency, etc.</i> c) <i>Biology (Week 17)</i> i. <i>Learning Tasks:</i> • <i>In a tabular form, state three external differences between monocotyledonous and dicotyledonous plants</i> • <i>Describe the internal features of monocotyledonous and dicotyledonous</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: Discuss the basic concepts of transmission modes in computer networks, etc.</i> c) <i>Biology (Week 17)</i> i. <i>Learning Tasks:</i> <i>In a tabular form, state three external differences between monocotyledonous and dicotyledonous plants, etc.</i>	

	<i>plants in terms of their function</i> • <i>Discuss the external features of monocotyledonous and dicotyledonous plants, and describe how they are adapted to a named habitat for successful living, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>In mixed-ability gender-responsive and all -inclusive tasked-based groups, learners' sample different flowering plants from their immediate environment, and carefully observe and write down features that are common to monocotyledonous and dicotyledonous groups. Learners appreciate real-life situations by undertaking project assignment in their immediate environment, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List any six features that distinguish monocotyledonous from dicotyledonous, hence, state the</i>	ii. <i>Pedagogical Exemplars:</i> <i>In mixed-ability gender-responsive and all -inclusive tasked-based groups, learners' sample different flowering plants from their immediate environment, and carefully observe and write down features that are common to monocotyledonous and dicotyledonous groups. Learners appreciate real-life situations by undertaking project assignment in their immediate environment, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: List any six features that distinguish monocotyledonous from dicotyledonous, hence, state the</i>	

	<i>extent to which these two groups of flowering plants differ in each factor</i> • <i>Level 3: Name two examples each of a monocot and dicot plants. Describe how one of them is adapted to a named habitat for successful living</i> • <i>Level 4: Analyse and compare the internal features of monocotyledonous and dicotyledonous plants in terms of their functions</i> • <i>Level 4: Discuss how sexual reproduction occurs in flowering plants, hence examine the role of this form of reproduction in this group of plants, etc.</i> d) <i>Chemistry (Week 17)</i> i. <i>Learning Tasks:</i> • <i>How does the electron configuration of an atom relate to the block in which the element is found on the periodic table?</i> • <i>How will the electron configuration be used to predict the group of an element on the periodic table?, etc.</i> ii. <i>Pedagogical Exemplars:</i>	<i>extent to which these two groups of flowering plants differ in each factor, etc.</i> d) <i>Chemistry (Week 17)</i> i. <i>Learning Tasks:</i> <i>How does the electron configuration of an atom relate to the block in which the element is found on the periodic table?, etc.</i> ii. <i>Pedagogical Exemplars:</i>	

	• <i>Using the Activity-based-learning approach, guide learners to write the electron configuration of the first thirty elements individually based on the orbital notation</i> • <i>Collaborative Learning: In pairs, classify the elements according to the following categories: The blocks (s, p, d), Groups (IUPAC system and the Roman numeral system), the period in which the element belongs. Metals, semi-metals, and non-metals</i> • <i>Describe the physical properties (hardness, density, melting point, boiling point, and physical state) and chemical properties of some representative elements (groups 1, 2, 7 and the noble gases)</i> • <i>Make a design of the periodic table in pairs, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: An element X, has electron configuration $1S^2 2S^2$, State the block</i>	<i>Using the Activity-based-learning approach, guide learners to write the electron configuration of the first thirty elements individually based on the orbital notation, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: An element X, has electron configuration $1S^2$</i>	

	that X belongs to. Which group does X belong to? • Level 2: Consider the following elements: X and Y with atomic numbers, 17 and 11 respectively. Write the electron configuration of each element and use it to determine the, block to which each belongs, group to which each belongs, period to which each belongs • Level 2: Construct a periodic table using the first 20 elements. what is meant by ionisation energy and state how it varies across a period in the periodic table, etc. e) Physics (Week 17) i. Learning Tasks: • Define n-type and p-type semiconductors? • Explain how n-type and p-type semiconductors are formed • Distinguish between donor impurity and acceptor impurity • Explain the process of doping and its effects on the properties of a semiconductor, etc.	$2S^2$, State the block that X belongs to. Which group does X belong to?, etc. e) Physics (Week 17) i. Learning Tasks: Define n-type and p-type semiconductors?, etc.	

	ii. <i>Pedagogical Exemplars:</i> • <i>Use an interactive simulation or app to demonstrate the doping process in a semiconductor. Allow learners to adjust the dopant concentration and observe how it affects the formation of n-type and p-type regions</i> • <i>Engage learners in a particle model activity where they represent atoms and subatomic particles using small objects (e.g., marbles, beans). Demonstrate how the introduction of specific dopant atoms results in excess electrons (n-type) or holes (p-type)</i> • <i>Assign learners to research common dopant elements used in semiconductor manufacturing, such as phosphorus for n-type and boron for p-type. Have them present the properties and behaviours of these dopants, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: What are n-type and p-type semiconductors?</i>	ii. <i>Pedagogical Exemplars:</i> <i>Use an interactive simulation or app to demonstrate the doping process in a semiconductor. Allow learners to adjust the dopant concentration and observe how it affects the formation of n-type and p-type regions, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: What are n-type and p-type</i>	

	• <i>Level 1: Briefly explain how n-type and p-type semiconductors differ from each other</i> • <i>Level 2: Describe the process of doping to create an n-type semiconductor</i> • <i>Level 3: Discuss the role of majority and minority charge carriers in n-type and p-type semiconductors, and how these carriers influence the electrical properties of the material, etc.</i> <i>f) Computing (Week 17)</i> <i>i. Learning Tasks:</i> • <i>In groups guide learners to explain Algorithms with examples</i> • <i>Explain the advantages and disadvantages of using algorithms in solving real-life problems</i> • <i>Evaluate the efficiency and scalability of various algorithms, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Group discussion on the understanding of algorithms and</i>	<i>semiconductors?, etc.</i> <i>f) Computing (Week 17)</i> <i>i. Learning Tasks:</i> <i>In groups guide learners to explain Algorithms with examples, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Group discussion on the understanding of algorithms and</i>	

	<i>relate it to real time problems</i> • <i>Project- Based learning within a practical session (Individual and mixed ability/gender sensitive group work with no stereotyping) to use algorithms to solve real time problems using the program development cycle, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Explain Algorithms</i> • <i>Level 2: Explain and use Algorithms to solve a real-life problem</i> • <i>Level 3: Demonstrate Algorithms in solving real-life problems, etc.</i> g) <i>General science (Week 18)</i> i. <i>Learning Tasks:</i> • <i>Explain and identify hazards in the environment</i> • <i>Describe the causes of Hazards in the environment</i> • <i>Describe three (3) ways each how to manage hazards in school laboratory and construction sites, etc.</i> ii. <i>Pedagogical Exemplars:</i>	<i>relate it to real time problems, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Explain Algorithms, etc.</i> g) <i>General science (Week 18)</i> i. <i>Learning Tasks:</i> <i>Explain and identify hazards in the environment, etc.</i>	

	• Visit an accessible local industry, such as sawmills, palm kernel oil production, gari processing, etc., and assess their activities' possible risks and hazards • Resources persons share their personal experiences with learners regarding hazards and risks at the workplace. Afterwards, facilitate group discussions to reflect on key themes, raise questions, and encourage critical thinking about the issues presented • Using Talk-for-Learning approaches lets learners in mixed abilities show the difference in the hazards and risks in the home and workplace, etc.	ii. Pedagogical Exemplars: Visit an accessible local industry, such as sawmills, palm kernel oil production, gari processing, etc., and assess their activities' possible risks and hazards, etc.	
	iii. Key Assessments (DoK): • Explain four ways in which industrial activities and transportation contribute to each hazard • Explain how industrial activities and transportation contribute to each hazard • Explain three ways disaster preparedness and	iii. Key Assessments (DoK): Explain four ways in which industrial activities and transportation contribute to each hazard, etc.	

	<i>community engagement mitigate the impact of these hazards on human lives, etc.</i> <i>h) ICT (Week 18)</i> <i>i. Learning Tasks:</i> <i>• Divide learners into groups, and assign each group a specific computer safety measures and have group act out scenarios related to their assigned task using role play</i> <i>• In groups, learners prepare slides based on their assigned task on computer safety measures</i> <i>• Debate or Discussion: Show a five minute video or simulations on the various computer safety measures for learners to watch. Divide the class into teams and organise a debate or discussion on the video or simulation watched. Assign teams to defend or critique specific computer safety measures. Encourage critical thinking and evidence-based debates, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Provide a list of computer safety such as simplex, half-duplex, and full-</i>	<i>h) ICT (Week 18)</i> <i>i. Learning Tasks:</i> <i>Divide learners into groups, and assign each group a specific computer safety measures and have group act out scenarios related to their assigned task using role play, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Provide a list of computer safety such as simplex, half-duplex, and</i>	

	<i>duplex, and ask learners to identify and explain each mode</i> • <i>Assign a task where learners analyse case studies or scenarios to determine which computer safety measures would be most suitable based on certain scenarios</i> • <i>Challenge learners to create computer safety measures with some scenarios, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Discuss the basic computer safety measures in the society</i> • <i>Level 2: Apply knowledge of computer safety measures to effectively prevent some computer security risks?</i> • <i>Level 3: Assess the implications of selecting specific computer safety measures with given scenarios, etc.</i> i) <i>Biology (Week 18)</i> i. <i>Learning Tasks:</i> • <i>Mention at least two monocotyledonous and dicotyledonous plants</i> • <i>Explain the term Angiosperm</i>	<i>full-duplex, and ask learners to identify and explain each mode, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Discuss the basic computer safety measures in the society, etc.</i> i) <i>Biology (Week 18)</i> i. <i>Learning Tasks:</i> <i>Mention at least two monocotyledonous and dicotyledonous plants, etc.</i>	

	• Describe at least three features of monocotyledonous and dicotyledonous plant • Draw one each of a named monocot and dicot plants, etc. ii. Pedagogical Exemplars: • In employing individual-based learning, Sample flowering plants from the immediate environment, and create a poster on monocotyledonous and dicotyledonous plants, focusing on the features that are common to both groups of plants. Learners listen to their peers' opinions and accept constructive criticism, etc. iii. Key Assessments (DoK): • Level 1: List at least five monocotyledonous plants • Level 2: Summaries your understanding of the term Angiosperm • Level 3: Compare at least three features of monocotyledonous plants and	ii. Pedagogical Exemplars: • In employing individual-based learning, Sample flowering plants from the immediate environment, and create a poster on monocotyledonous and dicotyledonous plants, focusing on the features that are common to both groups of plants. Learners listen to their peers' opinions and accept constructive criticism, etc. iii. Key Assessments (DoK): Level 1: List at least five monocotyledonous plants, etc.	

	<i>dicotyledonous plants, etc.</i> <i>j) Chemistry (Week 18)</i> <i>i. Learning Tasks:</i> <i>• Explain chemical bonding</i> <i>• How are ionic compounds formed?</i> <i>• Use the Lewis dot structures to describe how MgCl_2 is formed, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Review the meaning of chemical bonding and the types of interatomic bonding (ionic, covalent and metallic) from the JHS curriculum</i> <i>• Discuss the factors that affect ionic bond formation (ionisation energy, electron affinity, electronegativity difference and lattice energy)</i> <i>• Using illustrations explain the formation of cations and anions and relate the charge on simple ions to the group number of the element on the periodic table</i> <i>• Activity-based learning: In mixed ability groups, use atomic models or simulations or electron dots to describe and explain the formation of</i>	<i>j) Chemistry (Week 18)</i> <i>i. Learning Tasks:</i> <i>Explain chemical bonding, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Review the meaning of chemical bonding and the types of interatomic bonding (ionic, covalent and metallic) from the JHS curriculum, etc.</i>	

	<i>ionic bonds between metals and non-metals</i> • <i>Use models to illustrate and describe the formation of sodium chloride crystals</i> • <i>Discuss the properties of ionic compounds, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 2: Describe how calcium ions are formed. Using the Lewis dot structures, describe the formation of calcium oxide</i> • <i>Level 2: Which compound in each of the following pairs of compounds is more ionic?, BeCl₂ and AlCl₃ Li₂O and CaO, etc.</i> k) <i>Physics (Week 18)</i> i. <i>Learning Tasks:</i> • <i>Define a transducer and explain its function in converting energy between different forms</i> • <i>Explain the concepts of "input" and "output" in relation to transducers, providing examples, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Provide a clear and concise definition of a transducer,</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 2: Describe how calcium ions are formed. Using the Lewis dot structures, describe the formation of calcium oxide, etc.</i> k) <i>Physics (Week 18)</i> i. <i>Learning Tasks:</i> <i>Define a transducer and explain its function in converting energy between different forms, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Provide a clear and concise definition of a</i>	

	<i>emphasising its role in converting one form of energy into another. Ask learners to rephrase the definition in their own words to ensure comprehension</i> ● <i>Provide a list of common transducers, such as microphones, thermocouples, light sensors, and pressure sensors. Ask learners to identify the inputs and outputs of each transducer</i> ● <i>Provide diagrams representing various transducers and ask learners to label the input and output components. Discuss how the input signal is transformed into the output signal</i> ● <i>Set up a demonstration with a practical transducer (e.g., a microphone or a temperature sensor). Show how the input signal (sound or temperature) is converted into an output signal (an electrical signal). Discuss the concept of transduction, etc.</i> <i>iii. Key Assessments (DoK):</i> ● <i>Level 1: Provide a simple example of a</i>	<i>transducer, emphasising its role in converting one form of energy into another. Ask learners to rephrase the definition in their own words to ensure comprehension, etc.</i> <i>iii. Key Assessments (DoK):</i> ● <i>Level 1: Provide a simple example of</i>	

	<i>transducer and its input</i> ● <i>Level 2: Explain the concept of "input" and "output" in the context of a transducer and how it converts energy from one form to another? Use a specific example to clarify your answer and discuss any limitations or challenges associated with this process</i> ● <i>Level 3: How would you select appropriate transducers to measure water levels in a reservoir and wells?, etc.</i> <i>I) Computing (Week 18)</i> <i>i. Learning Tasks:</i> ● <i>In groups guide learners to discuss Algorithms with examples</i> ● <i>Discuss further advantages and disadvantages of using algorithms in solving real-life problems</i> ● <i>Evaluate the efficiency and scalability of various algorithms, etc.</i> <i>ii. Pedagogical Exemplars:</i> ● <i>Group discussion on the understanding</i>	<i>a transducer and its input, etc.</i> <i>I) Computing (Week 18)</i> <i>i. Learning Tasks:</i> <i>In groups guide learners to discuss Algorithms with examples, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Group discussion on the</i>	

	<i>of algorithms and relate it to real time problems</i> • <i>Project- Based learning within a practical session (Individual and mixed ability/gender sensitive group work with no stereotyping) to use algorithms to solve real time problems using the program development cycle, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Oral discussion of at least 2 ways Algorithms can be applied in real life</i> • <i>Level 2: Written description of at least 3 ways in which Algorithms can be applied in real life</i> • <i>Level 3: Develop a simple Algorithm for queuing system for a shopping mall, etc.</i> 2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 17 and 18. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each	<i>understanding of algorithms and relate it to real time problems, etc</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Oral discussion of at least 2 ways Algorithms can be applied in real life, etc.</i> 2.5 In your subject groups or individually, complete learning planners for Weeks 17 and 18. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL	

	learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	
3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment between teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i>	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment between teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i>	10mins

	3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	
4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 19 and 20 of the teacher manual ahead of time and the DPLC Handbook Session 11 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 19 and 20 of the teacher manual ahead of time and the DPLC Handbook Session 11 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10mins

DPLC Session 11: Developing learning plans for Weeks 19 and 20			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Session 10, <i>developing learning plans for Weeks 17 and 18</i>, which they think impacted learning positively (NTS 1a, 1b). 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 10, <i>developing learning plans for Weeks 17 and 18</i>, supported learning (NTS 1a-1c).	1.1 Share two things you implemented based on DPLC Session 10, <i>developing learning plans for Weeks 17 and 18</i>, which you think impacted learning positively (NTS 1a, 1b). 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 10, <i>developing learning plans for Weeks 17 and 18</i>, supported learning (NTS 1a- 1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation , 21st century skills and national	2.1 Ask a teacher to read aloud the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b). Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 19 and 20. Science teachers will focus on developing learning plans for the following lessons:	2.1 Read the Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b). Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 19 and 20. Science teachers will focus on developing learning plans for the following lessons:	60 mins

values (2 learning planners to be completed per session)	A. <i>General science: Concepts of Lifestyle diseases and effects of drugs on humans.</i> B. <i>ICT: Discuss Physical Safety Risk (Electrocution, Fire hazard, Tripping hazard, Personal injury) in the use of computers.</i> C. <i>Biology: Distinctive features of monocotyledonous and dicotyledonous plants and how they relate to their functions, and relating the tissues of the roots of monocotyledonous and dicotyledonous plants to their functions.</i> D. <i>Chemistry: Covalent bonding and metallic bonding as well as hydrogen bonding and Van der Waals forces.</i> E. <i>Physics: Biasing of transistors and processes of transducers.</i>	A. <i>General science: Concepts of Lifestyle diseases and effects of drugs on humans.</i> B. <i>ICT: Discuss Physical Safety Risk (Electrocution, Fire hazard, Tripping hazard, Personal injury) in the use of computers.</i> C. <i>Biology: Distinctive features of monocotyledonous and dicotyledonous plants and how they relate to their functions, and relating the tissues of the roots of monocotyledonous and dicotyledonous plants to their functions.</i> D. <i>Chemistry: Covalent bonding and metallic bonding as well as hydrogen bonding and Van der Waals forces.</i> E. <i>Physics: Biasing of transistors and processes of transducers.</i>

	<i>F. Computing: Apply Algorithms in various real-life and programming situations problems.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 19 and 20 lessons using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 19 and 20 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, key notes on differentiation, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates Weeks 19 and 20 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual.	<i>F. Computing: Apply Algorithms in various real-life and programming situations problems.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 19 and 20 lessons using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 3a, 3e-3g and 3k). LI 1.1 Discuss the important aspects in Weeks 19 and 20 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, key notes on differentiation, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 19 and 20 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars and assessment strategies proposed in the teacher manual.	

	LO 2: Review the learning plans for Weeks 19 and 20 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan for Weeks 19 and 20 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 19 and 20 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 19 and 20 (NTS 1a, 2c, 2f and 3d-3g). 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities for Weeks 19 and 20 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 19)</i> i. <i>How do I explain the concepts lifestyle</i>	LO 2: Review the learning plans for Weeks 19 and 20 of the subject-based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of learning plan for Weeks 19 and 20 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 19 and 20 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 19 and 20 in your teacher manual (NTS 1a, 2c, 2f and 3d-3g). 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 19 and 20 (NTS 1a, 2c, 2e, 2f, 3d-3g). <i>E.g.</i> a) <i>General Science (Week 19)</i> <i>How do I explain the concepts lifestyle</i>	

	<i>diseases in real-life scenarios?</i> ii. <i>How is the knowledge of causes of lifestyle diseases important in everyday life?, etc.</i> b) <i>ICT (Week 19)</i> i. <i>How can Physical Safety Risk affect the use of computers?</i> ii. <i>What is the best approach to teach Physical Safety Risk in the use of computers?, etc.</i> c) <i>Biology (Week 19)</i> i. <i>How are dicots more robust than monocots?</i> ii. <i>How will I identify the distinctive internal features of monocot and dicot roots?, etc.</i> d) <i>Chemistry (Week 19)</i> i. <i>How will the knowledge and understanding of the content, covalent bonding help learners appreciate the existence of the liquid and gaseous phase?</i> ii. <i>How will the knowledge and understanding of the content, metallic bonding help learners</i>	<i>diseases in real-life scenarios?, etc.</i> b) <i>ICT (Week 19)</i> <i>How can Physical Safety Risk affect the use of computers?, etc.</i> c) <i>Biology (Week 19)</i> <i>How are dicots more robust than monocots?, etc.</i> d) <i>Chemistry (Week 19)</i> <i>How will the knowledge and understanding of the content, covalent bonding help learners appreciate the existence of the liquid and gaseous phase?, etc.</i>	

	<i>appreciate the crucial role metals play in the construction of bridges and other structures that require high strength and durability?, etc.</i> <i>e) Physics (Week 19)</i> <i>i. Which activities can I design to allow all learners to apply what they have learnt in the lesson on the process of transducers in a meaningful way?</i> <i>ii. What real-world scenarios can I create that will help all learners see the relevance of what they have learnt?, etc.</i> <i>f) Computing (Week 19)</i> <i>i. How does App development have a positive impact on daily life?</i> <i>ii. What is the most effective method for teaching App development?, etc.</i> <i>g) General Science (Week 20)</i> <i>i. In real-life scenarios, how do I explain concept of drugs and their effects on humans?</i> <i>ii. How does the knowledge of effects of drugs on</i>	<i>e) Physics (Week 19)</i> <i>Which activities can I design to allow all learners to apply what they have learnt in the lesson on the process of transducers in a meaningful way?, etc.</i> <i>f) Computing (Week 19)</i> <i>How does App development have a positive impact on daily life?, etc.</i> <i>g) General Science (Week 20)</i> <i>In real-life scenarios, how do I explain concept of drugs and their effects on humans?, etc.</i>	

	<i>humans influence our lifestyles?, etc.</i> <i>h) ICT (Week 20)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st Century, GESI, SEL, and National values in teaching Physical Safety Risk?</i> <i>ii. How can Physical Safety Risk be applied to other subject areas such as maths, English, biology?, etc.</i> <i>i) Biology (Week 20)</i> <i>i. How will I identify a monocot root and a dicot root based on the internal structures?</i> <i>ii. How do flowering plant survive in the dry season?, etc.</i> <i>j) Chemistry (Week 20)</i> <i>i. How do I make connections between hydrogen bonding and solubility, boiling point, adhesion and cohesion?</i> <i>ii. How will the knowledge and understanding of Van der Waals forces help learners relate it with real life phenomena such as surface tension in liquids and crystals in solids?, etc.</i>	<i>h) ICT (Week 20)</i> <i>In what ways can I integrate the cross-cutting themes - 21st Century, GESI, SEL, and National values in teaching Physical Safety Risk?, etc.</i> <i>i) Biology (Week 20)</i> <i>How will I identify a monocot root and a dicot root based on the internal structures?, etc.</i> <i>j) Chemistry (Week 20)</i> <i>How do I make connections between hydrogen bonding and solubility, boiling point, adhesion and cohesion?, etc.</i>	

	k) <i>Physics (Week 20)</i> i. <i>How can I convey the real-world significance of understanding semiconductors and their applications to motivate my learners?</i> ii. <i>How can I inspire learners to explore the ongoing research and future possibilities in semiconductor technology, such as quantum computing, nanoelectronics, and semiconductor materials?, etc.</i> l) <i>Computing (Week 20)</i> i. <i>In what ways can the principles of App development be integrated in my lesson?</i> ii. <i>How can the principles of App development be integrated or utilized across different?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 19 and 20. Inform teachers to see the Teacher manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). E.g. a) <i>General Science (Week 19)</i>	k) <i>Physics (Week 20)</i> <i>How can I convey the real-world significance of understanding semiconductors and their applications to motivate my learners?, etc.</i> l) <i>Computing (Week 20)</i> <i>In what ways can the principles of App development be integrated in my lesson?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 19 and 20. See Teacher Manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). E.g. a) <i>General Science (Week 19)</i>	

	i. <i>Learning Tasks:</i> • <i>Identify at least four lifestyle diseases</i> • <i>Explain at least four causes of lifestyle diseases</i> • <i>Describe at least four preventive measures of lifestyle diseases, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Invite a resource person (Healthcare giver/Medical practitioner/public health Nurse) to discuss lifestyle diseases</i> • <i>Allow learners to assess these lifestyle diseases within their environment, noting diseases that easily lead to stigmatisation, using guided inquiry and cross-share with their peers in class.</i> • <i>Using Talk-for-Learning approaches, let learners show the difference in the various lifestyle diseases according to their causes, effects,</i>	i. <i>Learning Tasks:</i> <i>Identify at least four lifestyle diseases, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Invite a resource person (Healthcare giver/Medical practitioner/public health Nurse) to discuss lifestyle diseases, etc.</i>	

	<i>preventions, and how to manage stigma in recovered patients, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Investigate the influence of cultural norms and traditions on the causes and effects of lifestyle diseases</i> • <i>Examine the role of technology and its impact on lifestyle diseases</i> • <i>Discuss strategic approaches to improving preventive measures, etc.</i> b) <i>ICT (Week 19)</i> i. <i>Learning Tasks:</i> • <i>Guide learners to discuss Internet safety</i> • <i>Learners in groups discuss how to minimize the risk of a computer related accident</i> • <i>Challenge learners to create health risk from using the computer, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Assign tasks where learners analyse case studies or</i>	iii. <i>Key Assessments (DoK):</i> <i>Investigate the influence of cultural norms and traditions on the causes and effects of lifestyle diseases, etc.</i> b) <i>ICT (Week 19)</i> i. <i>Learning Tasks:</i> <i>Guide learners to discuss Internet safety, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Assign tasks where learners analyse case studies or</i>	

	<i>scenarios to determine internet safety/child protection</i> • <i>Using cooperative learning activities, learners explain ways of minimizing the risk of a computer related accident with the aid of diagrams</i> • <i>In groups, Learners analyse health risk from using the computer using PowerPoint presentation, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List of at least 4 internet safety/child protection</i> • <i>Level 2: Explain of at least 4 various ways of minimising the risk of a computer related accident</i> • <i>Level 3: Analyse of at least 4 health risk from using the computer</i> c) <i>Biology (Week 19)</i> i. <i>Learning Tasks:</i> • <i>List at least five external features of monocotyledonous plants</i> • <i>Summaries your understanding of the two broad</i>	<i>scenarios to determine internet safety/child protection, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: List of at least 4 internet safety/child protection, etc.</i> c) <i>Biology (Week 19)</i> i. <i>Learning Tasks:</i> <i>List at least five external features of monocotyledonous plants, etc.</i>	

	<i>classes of angiosperms.</i> • <i>Predict how gymnosperms are different from angiosperms, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Using collaborative learning strategy, place learners into groups and assist them to design and present PowerPoint presentations on the morphological adaptations, similarities and differences between monocotyledonous and dicotyledonous plants to the entire class. By carrying out this task, learners work together, build self-confidence and believe that their thoughts and opinions are valued, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 2: List at least five external features of monocotyledonous plants</i> • <i>Level 2: Summaries your understanding of</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using collaborative learning strategy, place learners into groups and assist them to design and present PowerPoint presentations on the morphological adaptations, similarities and differences between monocotyledonous and dicotyledonous plants to the entire class. By carrying out this task, learners work together, build self-confidence and believe that their thoughts and opinions are valued, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 2: List at least five external features of monocotyledonous plants, etc.</i>	

	<i>the term dicotyledonous plants</i> • <i>Level 3: Considering the items given, explain 5 ways in which monocotyledonous plants and dicotyledonous plants, etc.</i> d) <i>Chemistry (Week 19)</i> i. <i>Learning Tasks:</i> • <i>Identify the nature of elements that combine to form a covalent compound</i> • <i>How are covalent compounds formed?</i> • <i>How are valence electrons represented in Lewis dot structures?</i> • <i>Use Lewis dot structures to explain the nature of chemical bonding found in oxygen gas (O₂) and identify the number of bonds formed in the molecule</i> • <i>What differentiates a polar covalent bond from a nonpolar covalent bond? etc.</i>	d) <i>Chemistry (Week 19)</i> i. <i>Learning Tasks:</i> <i>Identify the nature of elements that combine to form a covalent compound, etc.</i>	

	ii. <i>Pedagogical Exemplars:</i> • <i>Using talk-for-learning strategy ask probing questions to review the previous knowledge of learners on covalent bonding from the JHS curriculum</i> • <i>Based on the response of learners explain how covalent bonds are formed and allow learners to interact with each other in a whole class discussion using specific molecules</i> • <i>Identify and distinguish between the types of covalent bonds (simple covalent, dative or co-ordinate and polar covalent bonds)</i> • <i>Exploratory Learning: Using atomic models, explain the formation of covalent bonds between different non-metals, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Define a covalent bond</i> • <i>Level 2: State the type(s) of bonds in NH₄Cl. Describe</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using talk-for-learning strategy ask probing questions to review the previous knowledge of learners on covalent bonding from the JHS curriculum, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Define a covalent bond, etc.</i>	

	<i>how each type of bond(s) is formed</i> • <i>Level 2: Arrange the following molecules in order of decreasing polarisability: (Ne, H₂, N₂, Cl₂, and O₂). Explain the order.</i> e) <i>Physics (Week 19)</i> i. <i>Learning Tasks:</i> • <i>Identify some transducers and their processes in turning physical changes into electrical signals</i> • <i>Set up simple experiments using transducers. Record observations and analyse the data, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Ask learners to research and create a presentation explaining their assigned transducer's working principle and processes</i> • <i>Set up hands-on demonstrations for each transducer with real devices or simulation software. Have learners interact with the devices and observe how they work. Ask them to explain the</i>	e) <i>Physics (Week 19)</i> i. <i>Learning Tasks:</i> <i>Identify some transducers and their processes in turning physical changes into electrical signals, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Ask learners to research and create a presentation explaining their assigned transducer's working principle and processes, etc.</i>	

	<i>processes involved based on their observations</i> • <i>Ask learners to create process flow diagrams or flowcharts illustrating each transducer's step-by-step processes, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 2: Explain the operation of a loudspeaker, including how it converts electrical signals into sound</i> • <i>Level 2: How does a buzzer function as a transducer? What type of output does it generate?</i> • <i>Level 3: Discuss how a low-voltage DC motor converts electrical energy into mechanical motion, etc.</i> f) <i>Computing (Week 19)</i> i. <i>Learning Tasks:</i> • <i>Discuss Algorithm</i> • <i>Discuss algorithm implementation into programs with the use of flow chart</i> • <i>Discuss pseudocode algorithm and programming language such as python, etc.</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 2: Explain the operation of a loudspeaker, including how it converts electrical signals into sound, etc.</i> f) <i>Computing (Week 19)</i> i. <i>Learning Tasks:</i> <i>Discuss Algorithm, etc.</i>	

	ii. <i>Pedagogical Exemplars:</i> • <i>Using short responses, learners implement algorithm into programs with the use of flow chart</i> • <i>In mixed ability groups, learners implement algorithm into programs with the use of flow chart and pseudocode</i> • <i>In groups, learners implement algorithm into programs with the use of flow chart, pseudocode and programming language such as python, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Discuss algorithm implementation into programs with the use of flow charts</i> • <i>Level 2: Differentiate between algorithm implementation into programs with the use of flow chart and pseudocode</i> • <i>Level 3: Use python to demonstrate algorithm implementation into programs, etc.</i>	ii. <i>Pedagogical Exemplars:</i> <i>Using short responses, learners implement algorithm into programs with the use of flow chart, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Discuss algorithm implementation into programs with the use of flow charts, etc.</i>	

	<i>g) General science (Week 20)</i> <i>i. Learning Tasks:</i> <i>• Explain the term drugs</i> <i>• Describe at least three negative effects of drugs</i> <i>• Analyse the attributes of drugs, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Invite guest speakers, such as healthcare professionals, substance abuse counsellors, or recovered addicts, to share their expertise and personal experiences with drug use and addiction</i> <i>• Students engage in discussions, role-playing scenarios, and hands-on activities related to the effects of different drugs on the body and mind, refusal skills, and strategies for making healthy choices</i> <i>• Screen documentaries or educational videos that explore various aspects of drug use, addiction,</i>	<i>g) General science (Week 20)</i> <i>i. Learning Tasks:</i> <i>Explain the term drugs, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Invite guest speakers, such as healthcare professionals, substance abuse counsellors, or recovered addicts, to share their expertise and personal experiences with drug use and addiction, etc.</i>	

	and recovery. Afterward, facilitate group discussions to reflect on key themes, raise questions, and encourage critical thinking about the issues presented • Create role-playing scenarios that simulate common situations involving drugs, such as peer pressure to experiment with substances or encountering someone under the influence. Students can take on different roles and practice communication skills, assertiveness, and decision-making strategies in response to these scenarios, etc iii. Key Assessments (DoK): • Level 3: Describe any four classes of drugs and their effects, • Describe any three classes of drugs and their effects • Describe any two classes of drugs and their effects, etc.		
		iii. Key Assessments (DoK): Level 3: Describe any four classes of drugs and their effects, etc.	

	<i>h) ICT (Week 20)</i> <i>i. Learning Tasks:</i> • <i>Guide learners to discuss, causes of physical safety</i> • <i>Lead learners to identify and discuss how to prevent computer security risk</i> • <i>Discuss computer security risk, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>In mixed ability groups, learners list causes of physical safety in the computer laboratory</i> • <i>Using think-pair-share, guide learners to explain the various ways of preventing physical safety at the computer with the aid of a diagram</i> • <i>In groups, learners analyse computer security risks using PowerPoint presentation, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: State 5 physical safety measures to observe in the computer laboratory</i> • <i>Level 2: Explain various ways of preventing computer security risks at the</i>	<i>h) ICT (Week 20)</i> <i>i. Learning Tasks:</i> <i>Guide learners to discuss, causes of physical safety, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>In mixed ability groups, learners list causes of physical safety in the computer laboratory, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: State 5 physical safety measures to observe in the computer laboratory, etc.</i>	

	computer laboratory • Level 3: With the aid of PowerPoint presentation, analyse at least 4 computer security risks i) Biology (Week 20) i. Learning Tasks: • List five internal structures each for monocotyledonous and dicotyledonous plants • Identify and state one function each of five internal structures of monocotyledonous and dicotyledonous plants • Describe six internal structures each of monocotyledonous and dicotyledonous plants, etc. ii. Pedagogical Exemplars • Use group-based and experiential learning to facilitate this lesson. In mixed-ability and tasked-based groups, ask learners to watch videos/pictures/charts or listen to presentations on the internal tissues of flowering plants. Learners discuss what they learn from the video or presentation to	i) Biology (Week 20) i. Learning Tasks: List five internal structures each for monocotyledonous and dicotyledonous plants, etc. ii. Pedagogical Exemplars Use group-based and experiential learning to facilitate this lesson. In mixed-ability and tasked-based groups, ask learners to watch videos/pictures/charts or listen to presentations on the internal tissues of flowering plants. Learners discuss what they learn	

	<i>build self-confidence and they learn to critic their peers' opinions and express disagreement in constructive ways</i> • <i>Obtain monocotyledonous and dicotyledonous plants, make thin sections of parts such as the roots, stems, and leaves, and critically use a microscope to observe and compare the internal structures. In pairs create a poster on an A4 sheet, showing the various structures of the plants and their functions</i> • <i>Ask learners to submit their final posters for a gallery walk or whole class exhibition, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 2: Describe the essential components of the root and shoot systems of flowering plants</i> • <i>Level 3: Describe the functions of the internal structures of monocotyledonous and dicotyledonous</i>	<i>from the video or presentation to build self-confidence and they learn to critic their peers' opinions and express disagreement in constructive ways, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 2: Describe the essential components of the root and shoot systems of flowering plants, etc.</i>	

	roots, stems and leaves • Level 4: Describe the anatomical differences between monocotyledonous and dicotyledonous plants, etc. j) Chemistry (Week 20) i. Learning Tasks: • Describe how hydrogen bonds formed? • Explain the formation of hydrogen bonds, using the structural formula of two identical molecules • The molecular compound of propanol is $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, explain the nature of intermolecular forces that will exist in a 5L sample of propanol, etc. ii. Pedagogical Exemplars: • Using talk-for-learning approach, show charts, models or other resources and guide learners to identify and discuss different types of intermolecular forces found in compounds (ionic and covalent compounds). Note: Ionic compounds are linked by inter-	j) Chemistry (Week 20) i. Learning Tasks: Describe how hydrogen bonds formed?, etc. ii. Pedagogical Exemplars: Using talk-for-learning approach, show charts, models or other resources and guide learners to identify and discuss different types of intermolecular forces found in compounds (ionic and covalent	

	<i>ionic or electrostatic forces</i> • <i>Watch a video or use a chart to reinforce the types of intermolecular forces in molecules</i> • <i>Using think-pair-share, deduce and describe:</i> ○ <i>dipole-dipole type of Van der Waal's forces</i> ○ <i>induced-dipole-induced-dipole type of Van der Waal's forces</i> • <i>Using charts of molecular mass (molecular size, number of electrons per molecule) of the halogens and their boiling points, deduce and explain the factors that affect the strength of induced-dipole-induced-dipole forces of attraction</i> • <i>In pairs, and with the aid of charts or any other data, visualise and deduce the factors that affect the strength of hydrogen bond.</i> ○ <i>Electronegativity and size of elements directly bonded to the hydrogen</i> ○ <i>Number of hydrogen bonds per molecule</i>	<i>compounds).</i> <i>Note: Ionic compounds are linked by inter-ionic or electrostatic forces, etc.</i>	

	○ <i>Orientation of the hydrogen bond, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 2: In terms of intermolecular forces, explain why the solubility of ethanol in water is greater than the solubility of ether in water</i> • <i>Level 1: Deduce the type of intermolecular force present in each of the following compounds:</i> ○ <i>H₂S</i> ○ <i>NH₃</i> ○ <i>CH₄</i> ○ <i>SF₆</i> ○ <i>HF</i> • <i>Level 3: Consider the following compounds: CH₄, CO₂, NH₄Cl. Select the compound capable of undergoing dipole-dipole interactions and explain your answer.</i> k) <i>Physics (Week 20)</i> i. <i>Learning Tasks:</i> • <i>Explore the BJT diagram and label the emitter, base, and collector regions</i> • <i>Identify the emitter, base, and collector terminals</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 2: In terms of intermolecular forces, explain why the solubility of ethanol in water is greater than the solubility of ether in water, etc.</i> k) <i>Physics (Week 20)</i> i. <i>Learning Tasks:</i> <i>Explore the BJT diagram and label the emitter, base, and collector regions, etc.</i>	

	<i>using a physical BJT</i> • <i>Discuss the significance of the arrow symbol and how it represents the direction of conventional current flow, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Provide learners with interactive diagrams of a BJT, showing its layers and terminal connections. Explore the diagram and a physical BJT, label and describe the functions of the emitter, base, and collector regions and discuss the significance of the arrow symbol and how it represents the direction of conventional current flow</i> • <i>Use an interactive simulation or animation to show the flow of electrons and holes within a BJT. Ask learners to observe the movement of charge carriers and how the transistor operates as a current amplifier</i> • <i>Learners should work in pairs to explore the practical</i>	ii. <i>Pedagogical Exemplars:</i> <i>Provide learners with interactive diagrams of a BJT, showing its layers and terminal connections. Explore the diagram and a physical BJT, label and describe the functions of the emitter, base, and collector regions and discuss the significance of the arrow symbol and how it represents the direction of conventional current flow, etc.</i>	

	<i>applications of BJTs in household settings. They should conduct research to identify and describe domestic challenges that BJTs can help solve and the advantages and limitations of using BJTs in domestic applications</i> <i>• Learners should build simple circuits using BJTs to showcase how the application works in real-life scenarios, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>• Correctly label the emitter, base, and collector regions of a blank BJT diagram and briefly explain each region's function</i> <i>• Design a simple audio amplifier circuit using BJTs</i> <i>• You are given a malfunctioning light switch that is part of a lighting control system in your house. The BJT in the light switch is malfunctioning. Thus, the lights are not turning on/off properly as intended. Based on the observed</i>	<i>iii. Key Assessments (DoK):</i> <i>Correctly label the emitter, base, and collector regions of a blank BJT diagram and briefly explain each region's function, etc.</i>	

	<i>symptoms (lights not turning on/off properly), explain the potential reasons for the circuit malfunction.</i> <i>I) Computing (Week 20)</i> <i>i. Learning Tasks:</i> <i>• Algorithm implementation definition</i> <i>• Algorithm implementation definition into programs with the use of flow chart</i> <i>• Pseudocode algorithm and programming language such as python, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Using written text, learners develop an algorithm into programs with the use of flow chart</i> <i>• In groups, learners develop algorithm into programs with the use of flow chart and pseudocode</i> <i>• In groups, learners develop an algorithm into programs with the use of flow chart, pseudocode and programming language such as python, etc.</i>	<i>I) Computing (Week 20)</i> <i>i. Learning Tasks:</i> <i>Algorithm implementation definition, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Using written text, learners develop an algorithm into programs with the use of flow chart, etc.</i>	

	iii. <i>Key Assessments (DoK):</i> • <i>Level 1: What are algorithm implementation into programs with the use of flow chart</i> • <i>Level 2: Discuss the similarities and differences between algorithm implementation into programs with the use of flow chart and pseudocode</i> • <i>Level 3: Use python to further demonstrate algorithm implementation into programs, etc.</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1: What are algorithm implementation into programs with the use of flow chart, etc.</i>	
	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 19 and 20. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 19 and 20. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c. 3a, 3g and 3h).	

3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning plan</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 1b).	3.1 Exchange one of your learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, key notes on differentiation, teaching and learning activities, assessment, and closure) of a learning plan (NTS 1a, 1b, and 1e-1g). <i>Note:</i> <i>Areas for vital review:</i> <i>a) Alignment among teacher manual and learning planner</i> <i>b) Innovativeness of pedagogical choices</i> <i>c) Incorporation of GESI, SEL, national values and 21st century skills</i> <i>d) Differentiated instruction and assessment</i> <i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 1b).	10mins
4. Reflection on the session: • Reflecting on what has been learned in the session.	4.1 Ask teachers to share their views and experiences about the session (NTS 1a). 4.2 Encourage teachers who did not complete their	4.1 Share your views and experiences about the session (NTS 1a). 4.2 Complete your learning plans which were not	10mins

• Advance preparation towards next DPLC session	learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to read the contents of Weeks 21 and 22 of the teacher manual ahead of time and the DPLC Handbook Session 12 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	completed during the session (NTS 3I). 4.3 Remember to read the contents of Weeks 21 and 22 of the teacher manual ahead of time and the DPLC Handbook Session 12 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	

DPLC SESSION 12: Developing learning plans for Weeks 21 & 22			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Handbook Session 11, <i>developing learning plans for Weeks 19 and 20</i>, which they think impacted learning positively. 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learned in DPLC Session 11, <i>developing learning plans for Weeks 19 and 20</i>, supported learning (NTS 1a- 1c)	1.1 Share two things you implemented based on DPLC Handbook Session 11, <i>developing learning plans for Weeks 19 and 20</i>, which you think impacted learning positively. 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learned in DPLC Session 11, <i>developing learning plans for Weeks 19 and 20</i>, supported learning (NTS 1a- 1c)	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher manual to complete the	2.1 Ask a teacher to read aloud the session's Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	2. 1 Read the session's Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b).	60 mins

learning planner, integrating GESI, SEL, ICT, differentiation, 21st century skills and national values (2 learning planners to be completed per session)	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 21 & 22. science teachers will focus on developing learning plans for following lessons: A. <i>General science: Describe the production and design method of local soap making for different purposes.</i> B. <i>ICT: Discuss Causes of Physical Safety Risk of computer equipment.</i> C. <i>Biology: Relating the tissues of the stem of monocotyledonous and dicotyledonous plants to their functions and relating the tissues of the leaf of monocotyledonous and dicotyledonous plants to their functions.</i> D. <i>Chemistry: Intermolecular forces and properties of covalent compounds and methods of separation and purification of organic compounds.</i>	Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 21 & 22. science teachers will focus on developing learning plans for following lessons: A. <i>General science: Describe the production and design method of local soap making for different purposes.</i> B. <i>ICT: Discuss Causes of Physical Safety Risk of computer equipment.</i> C. <i>Biology: Relating the tissues of the stem of monocotyledonous and dicotyledonous plants to their functions and relating the tissues of the leaf of monocotyledonous and dicotyledonous plants to their functions.</i> D. <i>Chemistry: Intermolecular forces and properties of covalent compounds and methods of separation and purification of organic compounds.</i>	

	<i>E. Physics: Configuration of transistor and Description of the evolution of the various atomic models. i.e., J. J. Thompson's, Rutherford's, and Bohr's.</i> <i>F. Computing: Explain the basic principles of web design and identify the modern technologies used in web design.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 21 and 22 in the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3k and 3o). LI 1.1 Discuss the important aspects in Weeks 21 and 22 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 21 and 22 science lessons in the teacher manual taking into consideration cross-	<i>E. Physics: Configuration of transistor and Description of the evolution of the various atomic models. i.e., J. J. Thompson's, Rutherford's, and Bohr's.</i> <i>F. Computing: Explain the basic principles of web design and identify the modern technologies used in web design.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 21 and 22 in the teacher manual, taking into account GESI, ICT, SEL, national values and other cross-cutting issues (NTS 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3k and 3o). L1.1 Discuss the important aspects in Weeks 21 and 22 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 21 and 22 science lessons in the teacher manual taking into consideration cross-	

	cutting issues, GESI responsive resources, pedagogical exemplars, and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 21 and 22 of the subject based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, teaching and learning activities, assessment, and closure) of learning plans for Weeks 21 and 22 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 21 and 22 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 21 and 22 (NTS 1a, 1b, 2a and 2c). 2.3 Ask teachers to discuss at least two essential questions that will guide the lesson activities in Weeks 21 and 22 (NTS 1a, 2b, 2e, 2f, 3a and 3c-3j).	cutting issues, GESI responsive resources, pedagogical exemplars, and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 21 and 22 of the subject based science lessons (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, teaching and learning activities, assessment, and closure) of learning plans for Weeks 21 and 22 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 21 and 22 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 21 and 22 in your teacher manual (NTS 1a, 1b, 2a and 2c). 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 21 and 22 (NTS 1a, 2b, 2e, 2f, 3a and 3c-3j).	

	<i>E.g.</i> a) <i>General Science (Week 21)</i> i. <i>How do I use experiments to explain the role of four materials needed in saponification?</i> ii. <i>How can I use locally available technology and materials to produce local soaps?, etc.</i> b) <i>ICT (Week 21)</i> i. <i>How can one identify Physical Safety Risk?</i> ii. <i>What is the best approach to teach Causes of Physical Safety Risk in the use of computers?, etc.</i> c) <i>Biology (Week 21)</i> i. <i>What makes woody stems different from other plants parts?</i> ii. <i>What makes some plants survive in harsh conditions like dry weather?, etc.</i> d) <i>Chemistry (Week 21)</i> i. <i>How will the understanding of the content, intermolecular forces and properties of covalent compounds help</i>	<i>E.g.</i> a) <i>General Science (Week 21)</i> <i>How do I use experiments to explain the role of four materials needed in saponification?, etc.</i> b) <i>ICT (Week 21)</i> <i>How can one identify Physical Safety Risk?, etc.</i> c) <i>Biology (Week 21)</i> <i>What makes woody stems different from other plants parts?, etc.</i> d) <i>Chemistry (Week 21)</i> <i>How will the understanding of the content, intermolecular forces and properties of covalent compounds help learners relate it with the physical</i>	

	<i>learners relate it with the physical properties of substance?</i> <i>ii. How will the understanding of the content, methods of separation and purification of organic compounds help learners relate?, etc.</i> <i>e) Physics (Week 21)</i> <i>i. How can I convey the significance of understanding the historical development of atomic models and its impact on the field of science?</i> <i>ii. What creative teaching approaches, historical anecdotes, or interactive activities can I use to make the lesson on atomic models both enjoyable and memorable for learners?, etc.</i> <i>f) Computing (Week 21)</i> <i>i. How can web design affect everyday life positively?</i> <i>ii. What is the best approach to teach the principles of web design?, etc.</i>	<i>properties of substance?, etc.</i> <i>e) Physics (Week 21)</i> <i>How can I convey the significance of understanding the historical development of atomic models and its impact on the field of science?, etc.</i> <i>f) Computing (Week 21)</i> <i>How can web design affect everyday life positively?, etc.</i>	

	<i>g) General science (Week 22)</i> <i>i. How can knowledge of local soaps help in the production of different local soaps for different purpose in a community?</i> <i>ii. How do I explain to learners the importance of scientific processes involved in the production of local soap such as Alata Samina, Azuma blows?, etc.</i> <i>h) ICT (Week 22)</i> <i>i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching Causes of Physical Safety Risk?</i> <i>ii. How can Causes of Physical Safety Risk be identified?, etc.</i> <i>i) Biology (Week 22)</i> <i>i. What do learners already know about tissues found in plants?</i> <i>ii. How do I get learners to relate the tissues to the uses of plants in everyday life?, etc.</i>	<i>g) General science (Week 22)</i> <i>How can the knowledge of local soaps help in the production of different local soaps for different purpose in a community?, etc.</i> <i>h) ICT (Week 22)</i> <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and National values in teaching Causes of Physical Safety Risk?, etc.</i> <i>i) Biology (Week 22)</i> <i>What do learners already know about tissues found in plants?, etc.</i>	

	j) Chemistry (Week 22) i. How will I relate the content, methods of separation of mixtures with what learners already know, e.g., winnowing, used to remove stones from rice, etc.? ii. How will I relate the content, purification of organic compounds to the industry (petroleum refining)?, etc. k) Physics (Week 22) i. In what ways can I integrate the cross-cutting themes- 21st Century, GESI, SEL and National values in teaching transistor configuration? ii. What is the best approach to teach transistor configuration in everyday life for all learners to benefit from the lesson?, etc. l) Computing (Week 22) i. In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching the principles of web design?	j) Chemistry (Week 22) How will I relate the content, methods of separation of mixtures with what learners already know, e.g., winnowing, used to remove stones from rice?, etc. k) Physics (Week 22) In what ways can I integrate the cross-cutting themes- 21st Century, GESI, SEL and National values in teaching transistor configuration?, etc. l) Computing (Week 22) In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching the principles of web design?, etc.	

	<i>ii. How can principles of web design be applied or used in other subject areas such as math, English, biology?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 21 and 22. Inform teachers to see the Teacher manual for more examples on differentiation on the focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General Science (Week 21)</i> <i>i. Learning task</i> • <i>Explain term saponification.</i> • <i>Explain how technology can help in the production of local soap</i> • <i>Describe the process of making local soap, etc.</i> <i>ii. Pedagogical Exemplars</i> • <i>Organise a visit or field trips to local soap making facilities where learners can observe the production process firsthand</i> • <i>Putting learners in mixed ability groups, let them search the internet, brainstorm/think-pair-share on the</i>	2.4 Discuss at least two key notes on differentiation for Weeks 21 and 22. See Teacher manual for more examples on differentiation on focal areas not covered in this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> <i>a) General Science (Week 21)</i> <i>i. Learning task</i> <i>Explain term saponification, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>Organise a visit or field trips to local soap making facilities where learners can observe the production process firsthand, etc.</i>	

	<i>science in the process (Saponification) of local soap making</i> • <i>Showcase real-life examples of local soap producers who have successfully established their businesses</i> • <i>Research the different approaches to making soap in Ghana and other places, etc.</i> iii. <i>Key Assessment</i> • <i>Explain any 3 processes in the production of local soap</i> • <i>Explain saponification in your own words</i> • <i>Write a report on the processes involved in soap making from your field trip, etc.</i> b) <i>ICT (Week 21)</i> i. <i>Learning Tasks:</i> • <i>Guide learners to discuss computer related health problems</i> • <i>Learners lead discussions on the prevention of computer related health problems</i> • <i>Computer and your health, etc.</i>	iii. <i>Key Assessment</i> <i>Explain any 3 processes in the production of local soap, etc.</i> b) <i>ICT (Week 21)</i> i. <i>Learning Tasks:</i> <i>Guide learners to discuss computer related health problems, etc.</i>	

	ii. <i>Pedagogical Exemplars:</i> • <i>Create a simulation or interactive activity where learners can list computer related health problems</i> • <i>Assign tasks where learners analyse case studies or scenarios to determine and describe various ways of preventing computer related health problems with the aid of a diagram</i> • <i>Through debate, learners analyse the statement "Computer and your health" using PowerPoint presentation, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List 5 computer related health problems</i> • <i>Level 2: describe the various ways of preventing computer related health problems</i> • <i>Level 3: PowerPoint presentation on the debate of the statement "Computer and your health", etc.</i>	ii. <i>Pedagogical Exemplars:</i> <i>Create a simulation or interactive activity where learners can list computer related health problems, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: List 5 computer related health problems, etc.</i>	

	c) <i>Biology (Week 21)</i> i. <i>Learning Tasks:</i> • <i>Explain the term epidermis as used in plant leaves</i> • <i>In four sentences, describe the features of the epidermis of a monocotyledonous leaf</i> • <i>Describe the adaptations and functions of monocotyledonous leaf and draw a fully labelled diagram of its transverse section, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>Using diamond - nine strategy, guide learners to describe the structure of the monocotyledonous stem</i> • <i>Put learners in mixed-ability, gender-balanced groups, and ask them to brainstorm the functions of the various structures of the monocotyledonous stem</i> • <i>Ask learners to individually list and state the functions of the structures of monocotyledonous stem which aid in</i>	c) <i>Biology (Week 21)</i> i. <i>Learning Tasks:</i> <i>Explain the term epidermis as used in plant leaves, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Using diamond - nine strategy, guide learners to describe the structure of the monocotyledonous stem, etc.</i>	

	<i>the survival of the plant, etc.</i> iii. Key Assessments (DoK) • <i>Level 1: List the structures of the monocotyledonous stem</i> • <i>Level 2: Explain five structures of the monocotyledonous stem as an important organ to plants survival, etc.</i> d) Chemistry (Week 21) i. Learning Tasks: • <i>Which intermolecular forces occur in highly polar covalent compounds?</i> • <i>What intermolecular force occur in diatomic covalent compounds?</i> • <i>Explain the nature of intermolecular forces that accounts for the difference in boiling point of methanol and methane, etc.</i> ii. Pedagogical Exemplars: • <i>Discuss and explain how intermolecular forces affect physical properties such as solubility, density, viscosity,</i>	iii. Key Assessments (DoK) <i>Level 1: List the structures of the monocotyledonous stem, etc.</i> d) Chemistry (Week 21) i. Learning Tasks: <i>Which intermolecular forces occur in highly polar covalent compounds?, etc.</i> ii. Pedagogical Exemplars: <i>Discuss and explain how intermolecular forces affect physical properties such as solubility, density, viscosity,</i>	

	<i>enthalpy of vaporisation, volatility, surface tension, melting point and boiling points of compounds</i> <i>Perform activities to demonstrate some physical properties of covalent and ionic compounds such as their solubility in different solvents, density, melting point, etc. to their everyday life application, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 2: Arrange the following compounds in order of increasing boiling point and give reasons for the order: H₂O, CH₄, CH₃OH.</i> <i>Level 3: The boiling points of the hydrogen halides are: HF (19°C); HCl (–85°C); HBr (–67°C); and HI (–34°C). Explain any trend in the data, as well as any deviations from the trend, etc.</i> <i>e) Physics (Week 21)</i> <i>i. Learning Tasks</i> <i>Identify and briefly describe the main</i>	<i>enthalpy of vaporisation, volatility, surface tension, melting point and boiling points of compounds, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 2: Arrange the following compounds in order of increasing boiling point and give reasons for the order: H₂O, CH₄, CH₃OH, etc.</i> <i>e) Physics (Week 21)</i> <i>i. Learning Tasks</i> <i>Identify and briefly describe the main</i>	

	<i>transistor configurations: Common Emitter, Common Base, and Common Collector</i> • <i>Using diagrams, explain each transistor configuration, detailing how the terminals (emitter, base, and collector) are connected and the impact on their performance</i> • <i>Explain amplifying small AC signals using an NPN transistor, etc.</i> <i>ii. Pedagogical Exemplars</i> • <i>Provide diagrams of the common emitter, common collector, and common base configurations, explaining terminal connections and their effects on input and output</i> • <i>Conduct a practical activity or use interactive tools to help learners identify different transistor configurations, discuss the roles of the terminals in these configurations, and explore the impact of input</i>	<i>transistor configurations: Common Emitter, Common Base, and Common Collector, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>Provide diagrams of the common emitter, common collector, and common base configurations, explaining terminal connections and their effects on input and output, etc.</i>	

	<i>variations on the output</i> • <i>Explore and present the applications of transistor amplifiers in everyday devices, focusing on real-world examples to illustrate their use in technology, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: List the three common transistor configurations and briefly mention one key characteristic of each</i> • <i>Level 1: Explain the significance of different transistor configurations in electronic circuits, mainly focusing on how they affect the amplification and signal processing</i> • <i>Level 2: Describe the common emitter transistor configuration, including details on how it is connected within a circuit, and discuss its primary function and typical application in electronic devices, etc.</i>	iii. <i>Key Assessments (DoK)</i> <i>Level 1: List the three common transistor configurations and briefly mention one key characteristic of each, etc.</i>	

	<i>f) Computing (Week 21)</i> <i>i. Learning Tasks:</i> • <i>Define web design</i> • <i>Describe the web design</i> • <i>Explain the impact of web design on everyday life, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Group discussion on the understanding of what a web design is in learners own words</i> • <i>Project- Based learning within a practical session (Individual and mixed ability/gender sensitive group work with no stereotyping) Let learners describe the web design</i> • <i>Let learners in groups explain the impact of web design on everyday life, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Define web design</i> • <i>Level 2: Differentiate between web design and web development</i> • <i>Level 3: Discuss the impact of web design on everyday life, etc.</i>	<i>f) Computing (Week 21)</i> <i>i. Learning Tasks:</i> • <i>Define web design, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Group discussion on the understanding of what a web design is in learners own words, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Define web design, etc.</i>	

	<i>g) General science (Week 22)</i> <i>i. Learning task</i> • <i>Name four materials needed in saponification</i> • <i>Explain the role of at least four materials needed in saponification</i> • <i>Describe the process of making local soap using hands-on activity, etc</i> <i>ii. Pedagogical Exemplars</i> • <i>Organize a workshop where participants can learn about the soap making process step-by-step</i> • <i>Put learners into mixed ability and mixed-sex groups (where applicable), Let the learners conduct an experiment to prepare a local soap. They should vary the materials (reactants) to see the outcomes</i> • <i>Learners should create educational videos demonstrating the soap making process from start to finish, etc.</i> <i>iii. Key Assessment</i> • <i>Level 1: Name four materials needed in saponification.</i>	<i>g) General science (Week 22)</i> <i>i. Learning task</i> • <i>Name four materials needed in saponification, etc.</i> <i>ii. Pedagogical Exemplars</i> • <i>Organize a workshop where participants can learn about the soap making process step-by-step, etc.</i> <i>iii. Key Assessment</i> • <i>Level 1: Name four materials needed in</i>	

	• <i>Level 2: List and explain the role of four materials needed in saponification.</i> • <i>Level 3: Describe the process of making local soap.</i> • <i>Level 3: Explain why some local soaps different from each other?, etc.</i> <i>h) ICT (Week 22)</i> <i>i. Learning Tasks:</i> • <i>Learners lead discussions on the causes of physical safety risk of computer equipment</i> • <i>Identify the various prevention strategies/ measures of physical safety risk of computer equipment</i> • <i>Consider effects of physical safety risk of computer equipment, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Create a simulation or interactive activity where learners can identify the various causes of physical safety risk of computer equipment</i> • <i>Assign tasks where learners analyse case studies or</i>	<i>saponification, etc.</i> <i>h) ICT (Week 22)</i> <i>i. Learning Tasks:</i> • <i>Learners lead discussions on the causes of physical safety risk of computer equipment, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Create a simulation or interactive activity where learners can identify the various causes of physical safety risk of computer equipment, etc.</i>	

	<i>scenarios to determine and describe various ways of preventing physical safety risk of computer equipment with the aid of a diagram</i> • <i>Use group work to guide learners through PowerPoint presentation, analyse the causes and prevention of physical safety risk of computer equipment, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List 5 causes of physical safety risk of computer equipment</i> • <i>Level 2: Explain 8 various ways of preventing physical safety risk of computer equipment</i> • <i>Level 3: PowerPoint presentation analysis of the causes and prevention of physical safety risk of computer equipment, etc</i> i) <i>Biology (Week 22)</i> i. <i>Learning Tasks</i> • <i>List the six distinct regions of the transverse section</i>	iii. <i>Key Assessments (DoK):</i> • <i>Level 1: List 5 causes of physical safety risk of computer equipment, etc</i> i) <i>Biology (Week 22)</i> i. <i>Learning Tasks</i> • <i>List the six distinct regions of the</i>	

	<i>of dicotyledonous root</i> • <i>Draw and label fully the transverse section of a dicotyledonous root</i> • <i>List and state one function each of the parts of dicotyledonous root, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>In mixed-ability gender-responsive and all -inclusive tasked-based groups, learners' sample different flowering plants from their immediate environment, and carefully observe and write down features that are common to monocotyledonous and dicotyledonous groups, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: List any six features that distinguish monocotyledonous from dicotyledonous, hence state the extent to which these two groups of flowering plants differ in each factor</i>	<i>transverse section of dicotyledonous root, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>In mixed-ability gender-responsive and all -inclusive tasked-based groups, learners' sample different flowering plants from their immediate environment, and carefully observe and write down features that are common to monocotyledonous and dicotyledonous groups, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: List any six features that distinguish monocotyledonous from dicotyledonous, hence state the extent to which these two groups of flowering plants differ in each factor, etc.</i>	

	• <i>Level 3: Discuss the external features of monocotyledonous and dicotyledonous plants and describe how they are adapted to a named habitat for successful living</i> • <i>Level 4: Analyse and compare the internal features of monocotyledonous and dicotyledonous plants in terms of their functions, etc.</i> <i>j) Chemistry (Week 22)</i> <i>i. Learning Tasks:</i> • <i>What is the principle behind the use of distillation as a separation method?</i> • <i>Give two examples of mixtures that can be separated using the distillation method.</i> • <i>How will you recover and recycle a solvent containing dissolved solid impurities for an industrial process?, etc.</i>	<i>j) Chemistry (Week 22)</i> <i>i. Learning Tasks:</i> • <i>What is the principle behind the use of distillation as a separation method?, etc.</i>	

	ii. <i>Pedagogical Exemplars:</i> • <i>Watch video clips or observe teacher demonstration of: Distillation, Fractional distillation, Crystallisation, Discuss the key steps in the use of crystallisation, drying and distillation to purify a given impure organic compound.</i> • <i>Explore the use of melting and boiling points to determine the purity of a given organic compound.</i> • <i>Demonstrate the determination of melting points of some organic solids (benzoic acid, oxalic acid, ethanamide)</i> • <i>Describe paper chromatography as an analytical technique that separates components in a mixture of organic compounds and state its uses in everyday life, such as in forensics, natural product, etc.</i>	ii. <i>Pedagogical Exemplars:</i> • <i>Watch video clips or observe teacher demonstration of: Distillation, Fractional distillation, Crystallisation, Discuss the key steps in the use of crystallisation, drying and distillation to purify a given impure organic compound, etc.</i>	

	iii. Key Assessments (DoK): • Level 1: What is meant by the term crystallisation? • Level 3: State the procedures used in obtaining the green pigment chlorophyll, in leaves of plants • Level 3: Discuss why the leaves are ground with alcohol instead of water, etc. k) Physics (Week 22) i. Learning Tasks • Define the concept of an atomic model • Describe the evolution of atomic models from Dalton to Bohr • Explain the specific limitations of each atomic model and discuss how each has contributed to our current understanding of atomic structure, etc. ii. Pedagogical Exemplars • Outline the historical progression of atomic theory from ancient philosophies and discuss how ancient philosophers such	iii. Key Assessments (DoK): • Level 1: What is meant by the term crystallisation?, etc. k) Physics (Week 22) i. Learning Tasks • Define the concept of an atomic model, etc. ii. Pedagogical Exemplars • Outline the historical progression of atomic theory from ancient philosophies and discuss how ancient philosophers such	

	<i>as Democritus proposed the existence of indivisible particles to modern models</i> • <i>Introduce key atomic models like Thomson's "Plum Pudding" model, Rutherford's nuclear model, and Bohr's planetary model. Explain the key features of each model and how they contributed to our understanding of atomic structure</i> • <i>Assign learners to research key experiments that led to the development of different atomic models, such as the cathode ray tube experiment, the gold foil experiment, and the emission spectrum of hydrogen. Have them explain how the results of these experiments supported or challenged prevailing atomic theories at the time, etc.</i> <i>iii. Key Assessments</i> • <i>Level 1: Define an atomic model and explain its purpose in studying atoms</i>	<i>as Democritus proposed the existence of indivisible particles to modern models, etc.</i> <i>iii. Key Assessments</i> • <i>Level 1: Define an atomic model and explain its purpose in</i>	

	• <i>Level 1: Describe the Bohr atomic model, focusing on the arrangement of electrons and the model's fundamental principle about electron orbits</i> • <i>Level 2: Compare and contrast Thomson's Plum Pudding and Rutherford's Nuclear models. Discuss how each model contributed to the evolution of our understanding of the atomic structure, mainly focusing on the concept of electron distribution and the discovery of the nucleus, etc.</i> <i>I) Computing (Week 22)</i> <i>i. Learning Tasks:</i> • <i>Explain web design</i> • <i>Discuss the web design and web page</i> • <i>Explain the impact of web design on everyday life, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Utilise think-pair-share or similar collaborative approaches to facilitate discussions among learners and identify the</i>	<i>studying atoms, etc.</i> <i>I) Computing (Week 22)</i> <i>i. Learning Tasks:</i> • <i>Explain web design, etc.</i> <i>ii. Pedagogical Exemplars:</i> • <i>Utilise think-pair-share or similar collaborative approaches to facilitate discussions among learners and identify the</i>	

	<i>various components found in a web page. Encourage learners to list and describe the components they identify.</i> • <i>Group discussion on the understanding of what a web design is in learners own words</i> • <i>Project- Based learning within a practical session (Individual and mixed ability/gender sensitive group work with no stereotyping) Let learners describe the web design</i> • <i>Let learners in groups explain the impact of web design on everyday life, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: What are the main languages or platform used for web design?</i> • <i>Level 2: Discuss why a website is of essence in modern communication?</i> • <i>Level 3: Discuss the impact of web design on everyday life, etc.</i>	<i>various components found in a web page. Encourage learners to list and describe the components they identify, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: What are the main languages or platform used for web design?, etc.</i>	

	2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 21 and 22. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 21 and 22. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	
3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their completed learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). Areas for vital review: a) <i>Alignment among curriculum, teacher manual and learning plan</i> b) <i>Innovativeness of pedagogical choices</i> c) <i>Incorporation of GESI, SEL, national values and 21st century skills</i> d) <i>Differentiated instruction and assessment</i>	3.1 Exchange one of your completed learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, teaching and learning activities, assessment, and closure) of the learning plan (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). Areas for vital review: a) <i>Alignment among curriculum, teacher manual and learning plan</i> b) <i>Innovativeness of pedagogical choices</i> c) <i>Incorporation of GESI, SEL, national values and 21st century skills</i> d) <i>Differentiated instruction and assessment</i>	10mins

	<i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plans as appropriate (NTS 2b).	<i>e) Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plans as appropriate (NTS 2b).	
4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a, 1b and 3b). 4. 2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3l). 4.3 Remind teachers to read the contents of Weeks 23 and 24 in the teacher manual ahead of time and the DPLC Handbook Session 13 in preparation for the next session and bring along their DPLC Handbook and teacher manual (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a, 1b and 3b). 4. 2 Complete your learning plans which were not completed during the session (NTS 3l). 4.3 Remember to read the contents of Weeks 23 and 24 in the teacher manual ahead of time and the DPLC Handbook Session 13 in preparation for the next session and bring along your DPLC Handbook and teacher manual (NTS 1a, 1b).	10mins

DPLC SESSION 13: Developing learning plans for Weeks 23 & 24			
<i>The sections below provide the frame for what is to be done in the session</i>	Guidance notes on Leading the DPLC Session. <i>What the DPLC Coordinator will have to say during each stage of the session</i>	Guidance Notes on Teacher Activity during the DPLC Session. <i>What teachers will do during each stage of the session</i>	Time in session
1. Introduction: Review of previous learning using ideas from the last DPLC session	1.1 Start the session by asking teachers to share two things they implemented based on the DPLC Handbook Session 12, <i>developing learning plans for Weeks 21 and 22</i>, which they think impacted learning positively. 1.2 Ask teachers, as critical friends, to discuss why they think what a colleague did through the application of lessons learnt in DPLC Session 12, <i>developing learning plans for Weeks 21 and 22</i>, supported learning (NTS 1a- 1c).	1.1 Share two things you implemented based on DPLC Handbook Session 12, <i>developing learning plans for Weeks 21 and 22</i>, which you think impacted learning positively. 1.2 As a critical friend, discuss why you think what a colleague did through the application of lessons learnt in DPLC Session 12, <i>developing learning plans for Weeks 21 and 22</i>, supported learning (NTS 1a-1c).	10 mins
2. Planning for teaching, learning and assessment activities, using the teacher manual to complete the learning planner, integrating GESI, SEL, ICT, differentiation, 21st century	2.1 Ask a teacher to read aloud the session's Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b). Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 23 & 24. Science teachers will focus on developing learning plans for following lessons:	2.1 Read the session's Purpose, Learning Outcomes (LOs), and Learning Indicators (LIs) for the session (NTS 1b). Purpose: The purpose of this session is to assist science teachers in utilising the teacher manual to create learning plans for lessons during Weeks 23 & 24. Science teachers will focus on	60 mins

skills and national values (2 learning planners to be completed per session)	A. <i>General science: Indigenous foods and written reports, projects on their production.</i> B. <i>ICT: Discuss Causes of Physical Safety Risk of computer equipment.</i> C. <i>Biology: Explanation of factors that affect the growth and development of flowering plants, and good practices for the growth and development in flowering plants.</i> D. <i>Chemistry: Qualitative and quantitative elemental analysis of organic and classification of organic compounds.</i> E. <i>Physics: Explanation of Radioactivity and balancing of nuclear reactions.</i> F. <i>Computing: Apply computer Explain the basic principles of</i>	developing learning plans for following lessons: A. <i>General science: Indigenous foods and written reports, projects on their production.</i> B. <i>ICT: Discuss Causes of Physical Safety Risk of computer equipment.</i> C. <i>Biology: Explanation of factors that affect the growth and development of flowering plants, and good practices for the growth and development in flowering plants.</i> D. <i>Chemistry: Qualitative and quantitative elemental analysis of organic and classification of organic compounds.</i> E. <i>Physics: Explanation of Radioactivity and balancing of nuclear reactions.</i> F. <i>Computing: Apply computer Explain the basic</i>	

	<i>web design and identify the modern technologies used in web design.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 23 and 24 using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3k and 3o). LI 1.1 Discuss the important aspects in Weeks 23 and 24 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 23 and 24 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars, and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 23 and 24 of the subject based science lessons (NTS 1a,	<i>principles of web design and identify the modern technologies used in web design.</i> LO 1: Develop subject-specific learning plans for teaching Weeks 23 and 24 using the teacher manual, taking into account GESI, ICT, SEL, National values and other cross-cutting issues (NTS 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3k and 3o). LI 1.1 Discuss the important aspects in Weeks 23 and 24 science lessons in the teacher manual including content standards, LOs, LIs, key concepts, essential questions, GESI, pedagogical exemplars and assessment strategies of the learning planner template. LI 1.2 Complete the learning planner templates for Weeks 23 and 24 science lessons taking into consideration cross-cutting issues, GESI responsive resources, pedagogical exemplars, and assessment strategies proposed in the teacher manual. LO 2: Review the learning plans for Weeks 23 and 24 of the subject based science lessons	

	1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, teaching and learning activities, assessment and closure) of learning plans for Weeks 23 and 24 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 23 and 24 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Ask teachers to refer to their teacher manual and read silently the content standards, LOs, LIs and pedagogical exemplars for their subjects in Weeks 23 and 24. (NTS 1a, 1b, 2a and 2c). 2.3 Ask teachers to Discuss at least two essential questions that will guide the lesson activities in Weeks 23 and 24 (NTS 1a, 2b, 2e, 2f, 3a and 3c-3j). E.g. a) <i>General Science (Week 23)</i> i. <i>How do I Write a report on the science processes involved in gari production?</i> ii. <i>How do I explain the importance of</i>	(NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). LI 2.1 Critique the content (such as essential questions, teaching and learning activities, assessment and closure) of learning plans for Weeks 23 and 24 in line with the LOs, LIs and key concepts in the teacher manual. LI 2.2 Implement the recommendations made by a peer reviewer to the learning plans for Weeks 23 and 24 in line with the LOs, LIs and key concepts in the teacher manual where appropriate. 2.2 Read silently the content standards, LOs, LIs and pedagogical exemplars for your subject in Weeks 23 and 24 in your teacher manual (NTS 1a, 1b, 2a and 2c). 2.3 Discuss at least two essential questions that will guide the lesson activities in Weeks 23 and 24 (NTS 1a, 2b, 2e, 2f, 3a and 3c-3j). E.g. a) <i>General Science (Week 23)</i> <i>How do I write a report on the science processes involved in gari production?, etc.</i>	

	washing the corn before grinding it for gari production?, etc. b) ICT (Week 23) - How can one protect himself from Physical Risk? - What is the best approach to teach evaluation of Physical Safety Risk in the use of computers?, etc. c) Biology (Week 23) - Why would you consider factors such light, water, temperature, and nutrients in order to become a good farmer or gardener? - Predict the monocots and dicots that are likely to have a larger body size, and assign reasons for your choice?, etc. d) Chemistry (Week 23) - How will I relate the applications of qualitative and quantitative elemental analysis of organic compounds to other fields such as biochemistry, pharmaceuticals, environmental science, and more? - How will the knowledge and	b) ICT (Week 23) How can evaluation of Physical Safety Risk be identified?, etc. c) Biology (Week 23) Why would you consider factors such light, water, temperature, and nutrients in order to become a good farmer or gardener?, etc. d) Chemistry (Week 23) How will I relate the applications of qualitative and quantitative elemental analysis of organic compounds to other fields such as biochemistry, pharmaceuticals, environmental science, and more?, etc.	

	<i>understanding of the content, qualitative and quantitative elemental analysis of organic compounds help learners to solve problems in real life?, etc.</i> <i>e) Physics (Week 23)</i> <i>i. How can I adapt my teaching methods to meet the diverse needs and abilities of my learners when teaching about radioactivity?</i> <i>ii. What strategies can I employ to ensure that learners are actively participating and thinking during the lesson on radioactivity?, etc.</i> <i>f) Computing (Week 23)</i> <i>i. How does web design have a positive impact on daily life?</i> <i>ii. What is the most effective method for teaching web design?, etc.</i> <i>g) General science (Week 24)</i> <i>i. How can I demonstrate how long the fermentation process typically takes and what factors can affect it?</i>	<i>e) Physics (Week 23)</i> <i>What strategies can I employ to ensure that learners are actively participating and thinking during the lesson on radioactivity?, etc.</i> <i>f) Computing (Week 23)</i> <i>How does web design have a positive impact on daily life?, etc.</i> <i>g) General science (Week 24)</i> <i>How can I demonstrate how long the fermentation process typically takes and what</i>	

	ii. <i>How do I explain the production indigenous food in a community and its ingredients?, etc.</i> h) <i>ICT (Week 24)</i> i. <i>In what ways can I integrate the cross-cutting themes - 21st century skills, GESI, SEL, and national values in teaching evaluation of Physical Safety Risk?</i> ii. <i>How can evaluation of Physical Safety Risk be identified?, etc.</i> i) <i>Biology (Week 24)</i> i. <i>How would you ensure healthy plant growth and development in your backyard garden?</i> ii. <i>How would you prevent soil depletion and reduce the risk of pest and disease build-up on your farm?, etc.</i> j) <i>Chemistry (Week 24)</i> i. <i>What is the best approach to teaching classification of organic compounds to meet the varied needs of learning?</i> ii. <i>How will the knowledge and understanding of the content, classification of</i>	<i>factors can affect it?, etc.</i> h) <i>ICT (Week 24)</i> <i>In what ways can I integrate the cross-cutting themes - 21st Century, GESI, SEL, and National values in teaching evaluation of Physical Safety Risk?, etc.</i> i) <i>Biology (Week 24)</i> <i>How would you ensure healthy plant growth and development in your backyard garden?, etc.</i> j) <i>Chemistry (Week 24)</i> <i>What is the best approach to teaching classification of organic compounds to meet the varied needs of learning?, etc.</i>	

	<i>organic compounds help learners identify, group, and properly name organic compounds?, etc.</i> <i>k) Physics (Week 24)</i> <i>i. What is the best approach to teach the principles of reproduction apply in balancing of nuclear equations for all learners to benefit from the lesson?</i> <i>ii. Are there typical errors that learners tend to make when balancing nuclear equations, and how can I help them avoid these?, etc.</i> <i>l) Computing (Week 24)</i> <i>i. In what ways can I integrate principles of web design in my lesson?</i> <i>ii. How can the principles of web design be integrated or utilized across different academic subjects like mathematics, English, biology?, etc.</i> 2.4 Ask teachers to discuss at least two key notes on differentiation for Weeks 23 and 24. Inform teachers to see the Teacher manual for more examples on differentiation on the focal areas not covered in	<i>k) Physics (Week 24)</i> <i>What is the best approach to teach the principles of reproduction apply in balancing of nuclear equations for all learners to benefit from the lesson?, etc.</i> <i>l) Computing (Week 24)</i> <i>In what ways can I integrate principles of web design in my lesson?, etc.</i> 2.4 Discuss at least two key notes on differentiation for Weeks 23 and 24. See teacher manual for more examples on differentiation on focal areas not covered in this	

	this handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week 23)</i> i. <i>Content</i> • <i>Identify indigenous food in your community and its ingredients.</i> • <i>explanation of processes involved in gari production</i> • <i>Application of scientific processes involved in gari production, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>Place learners into mixed-ability and mixed-sex groups learning styles (where applicable.) Let the learners design an activity to prepare a named local food</i> • <i>Engage learners in groups to create more activities to prepare local food within their communities.</i> • <i>Encourage learners to do group or individual presentations about ideas generated.</i>	handbook (NTS 1a, 2b,2e, 2f, 3a and 3c-3j). <i>E.g.</i> a) <i>General Science (Week23)</i> i. <i>Content</i> <i>Identify indigenous food in your community and its ingredients, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Place learners into mixed-ability and mixed-sex groups learning styles (where applicable.) Let the learners design an activity to prepare a named local food, etc.</i>	

	• <i>Allow learners, working in convenient groups, to use the internet, books, and journals to brainstorm and write a report on the science underlying (fermentation, sun drying, etc.) the local food production stages., etc.</i> iii. <i>Key Assessment (DoK):</i> • <i>Identify one indigenous food in your community and its ingredients</i> • <i>Write down the activities involved in preparing your named local food\ dish</i> • <i>What activities will you consider when preparing local food?, etc.</i> b) <i>ICT (Week 23)</i> i. <i>Learning Tasks</i> • <i>Using think-pair-share identify various preventive measures on physical safety risk</i> • <i>Relate the various identified ways to prevent computer security threats</i> • <i>Application of preventive</i>	iii. <i>Key Assessment (DoK): Identify one indigenous food in your community and its ingredients, etc.</i> b) <i>ICT (Week 23)</i> i. <i>Learning Tasks</i> <i>Using think-pair-share identify various preventive measures on physical safety risk, etc.</i>	

	<i>measures on physical safety risk and computer security threats, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Create a simulation or interactive activity where learners can identify the various preventive measures on physical safety risk</i> • <i>Using cooperative learning groups, learners describe the various ways of preventing computer security threats with the aid of a diagram</i> • <i>Learners demonstrate using PowerPoint presentation on the application of preventive measures on physical safety risk and computer security threats, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1:List 4 preventive measures on physical safety risk</i> • <i>Level 2; Describe the various ways of preventing</i>	ii. <i>Pedagogical Exemplars:</i> <i>Create a simulation or interactive activity where learners can identify the various preventive measures on physical safety risk, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1:List 4 preventive measures on physical safety risk, etc.</i>	

	<i>computer security threats</i> • <i>Level 4: PowerPoint presentation on the application of preventive measures on physical safety risk and computer security threats, etc.</i> c) <i>Biology (Week 23)</i> i. <i>Learning Tasks</i> • <i>Predict the four primary factors that affect plant growth</i> • <i>What is meant by photoperiod?</i> • <i>Describe how each factor affects plant growth, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using inquiry-based learning, guide learners to Research on the factors that affect the growth and development of flowering plants. Learners learn to work independently, develop self-confidence and believe that their thoughts and opinions are valued, etc.</i>	c) <i>Biology (Week 23)</i> i. <i>Learning Tasks</i> <i>Predict the four primary factors that affect plant growth, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Using inquiry-based learning, guide learners to Research on the factors that affect the growth and development of flowering plants. Learners learn to work independently, develop self-confidence and believe that their thoughts and opinions are valued, etc.</i>	

	iii. <i>Key Assessments (DoK)</i> • <i>Level 1: List the factors that affect the growth and development of flowering plants in their natural environment</i> • <i>Level 3: Predict the environmental factors which may affect the growth of flowering plants, and the effects they have on this process</i> • <i>Level 4: Predict which of monocotyledonous and dicotyledonous are likely to have a larger body size and assign reasons for your choice, etc.</i> d) <i>Chemistry (Week 23)</i> i. <i>Learning Tasks:</i> • <i>Describe how to test for Carbon and hydrogen in a hydrocarbon compound</i> • <i>Outline the procedure to test for Nitrogen, Sulphur and Halogens in an organic compound</i> • <i>Explain the process that is used for the estimation of</i>	iii. <i>Key Assessments (DoK)</i> <i>Level 1: List the factors that affect the growth and development of flowering plants in their natural environment, etc.</i> d) <i>Chemistry (Week 23)</i> i. <i>Content</i> <i>Describe how to test for Carbon and hydrogen in a hydrocarbon compound, etc.</i>	

	<i>carbon, hydrogen and halogen in organic compound, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>In small mixed-ability groups, design and conduct experiments to test for the presence of carbon, hydrogen, sulphur, nitrogen and halogens in organic compounds</i> <i>Describe how the mass of elements (C, H, X) are obtained</i> <i>Perform calculations involving percentage composition using secondary data and review the calculation of empirical and molecular formulae, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1: Name the reagents used to test for the presence of carbon in an organic compound</i> • <i>Level 1: Define the empirical formula of a compound</i> • <i>Level 2: If the molar mass of a compound X is given, explain how to determine the molecular formula from the empirical formula</i> • <i>Level 3: An organic compound Q contains C, H, O and N. A mass of 0.132 g of Q was</i>	ii. <i>Pedagogical Exemplars:</i> <i>In small mixed-ability groups, design and conduct experiments to test for the presence of carbon, hydrogen, sulphur, nitrogen and halogens in organic compounds, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Name the reagents used to test for the presence of carbon in an organic compound, etc.</i>	

	<i>burnt completely in oxygen to produce 0.072 g of water, 0.176 g of carbon (IV) oxide and 24.0 cm³ of nitrogen. Calculate the empirical formula of Q and deduce the molecular formula if the molar mass of Q is 132 g mol⁻¹. [O = 16, N = 14, C 12, H = 1, V_m = 22400 cm³ mol⁻¹]</i> • <i>Level 4: Sample Q is a crystal obtained from the bark of a tree. Plan an investigation to show that carbon, hydrogen and nitrogen are contained in the sample, etc.</i> e) <i>Physics (Week 23)</i> i. <i>Learning Tasks</i> • <i>Define the nucleus of an atom and explain its role in the overall structure and stability of the atom</i> • <i>Describe the composition and structure of an atomic nucleus, detailing the types of particles it contains and their properties, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Begin with a multimedia presentation that includes animations to clearly illustrate the structure of an atom, focusing on the</i>		
		e) <i>Physics (Week 23)</i> i. <i>Learning Tasks</i> <i>Define the nucleus of an atom and explain its role in the overall structure and stability of the atom, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Begin with a multimedia presentation that includes animations to clearly illustrate</i>	

	<i>roles and characteristics of protons, neutrons, and electrons. Enhance understanding through a mix of diagrams, historical context, and quizzes</i> • <i>Engage students with hands-on activities using modelling materials to construct physical models of the nucleus, emphasising different isotopes' stability</i> • <i>Complement this with online simulations like PhET's "Build an Atom", allowing students to experiment with nuclear composition and explore its effects on atomic identity and stability, etc.</i> <i>iii. Key Assessments (DoK):</i> • <i>Level 1: Define the nucleus of an atom and explain its primary function within the atom</i> • <i>Level 1: Identify the subatomic particles that make up the nucleus of an atom and briefly describe the charge of each</i> • <i>Level 3: Discuss the concept of nuclides and analyse how differences in the number of protons</i>	<i>the structure of an atom, focusing on the roles and characteristics of protons, neutrons, and electrons. Enhance understanding through a mix of diagrams, historical context, and quizzes, etc.</i> <i>iii. Key Assessments (DoK):</i> <i>Level 1: Define the nucleus of an atom and explain its primary function within the atom, etc.</i>	

	<i>and neutrons can impact the stability of these nuclides</i> • <i>Level 3: Evaluate the importance of the neutron-to-proton ratio (N/Z ratio) in predicting the stability of nuclides. Include in your analysis how deviations from the ideal ratio can lead to different nuclear phenomena, such as radioactivity., etc.</i> f) <i>Computing (Week 23)</i> i. <i>Learning Tasks:</i> • <i>Identify the principles of web design</i> • <i>Describe the principles of web design</i> • <i>Explain the importance of principles of web design in everyday life, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using Think –pair-share, let learners Identify the principles of web design</i> • <i>Guide learners to describe the principles of web design</i> • <i>Project- Based learning within a practical session (Individual and mixed ability/gender sensitive group work with no stereotyping) Let learners in groups explain the</i>	f) <i>Computing (Week 23)</i> i. <i>Learning Tasks:</i> <i>Identify the principles of web design, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Using Think – pair-share, let learners Identify the principles of web design, etc.</i>	

	<i>importance of principles of web design in everyday life, etc.</i> iii. <i>Key Assessments (DoK):</i> • <i>Level 1; Identify the principles of web design</i> • <i>Level 2: describe the principles of web design</i> • <i>Level 3; provide explanation of the importance of the principles of web design in everyday life, etc..</i> g) <i>General science (Week 24)</i> i. <i>Learning Task:</i> • <i>Importance of washing the corn before grinding it for Kenkey</i> • <i>scientific processes involved in Kenkey production</i> • <i>importance of the scientific process involved in Kenkey production, etc.</i> ii. <i>Pedagogical Exemplars</i> • <i>Organise a visit or field trip to local kenkey-making facilities where learners can observe the production process first-hand. Learners will then reflect and make presentations</i> • <i>Allow learners, working in convenient groups, to search the internet,</i>	iii. <i>Key Assessments (DoK):</i> <i>Level 1; Identify the principles of web design, etc.</i> g) <i>General science (Week 24)</i> i. <i>Learning Task:</i> <i>Importance of washing the corn before grinding it for Kenkey, etc.</i> ii. <i>Pedagogical Exemplars</i> <i>Organise a visit or field trip to local kenkey-making facilities where learners can observe the production process first-hand. Learners will then reflect and make presentations, etc.</i>	

	<i>books, journals, think-pair-share, and write a report on the science processes (fermentation, sun drying, etc.) in the stages of production of the local food such as Kenkey</i> • <i>Research the different approaches to making kenkey in Ghana and other places.</i> <i>iii. Key Assessment</i> • <i>Level 2: Write down the science processes involved in kenkey production</i> • <i>Level 1: What is the importance of washing the corn before grinding it for Kenkey?</i> • <i>Level 3: How long does the fermentation process typically take, and what factors can affect it?, etc.</i> <i>h) ICT (Week 24)</i> <i>i. Learning Task:</i> • <i>Further discuss preventive measures on physical safety risk</i> • <i>Consider further ways to prevent computer security threats</i> • <i>With real-Life examples bring to bear the application of preventive</i>	<i>iii. Key Assessment</i> <i>Level 2: Write down the science processes involved in kenkey production, etc.</i> <i>h) ICT (Week 24)</i> <i>i. Learning Task:</i> <i>Further discuss preventive measures on physical safety risk, etc.</i>	

	<i>measures on physical safety risk and computer security threats, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>• In pairs, learners briefly explain further preventive measures on physical safety risk with the aid of a diagram</i> <i>• In mixed ability groups, learners explain further ways of preventing computer security threats with the aid of a diagram</i> <i>Learners demonstrate the application of preventive measures on physical safety risk and computer security threats in their everyday lives with a role play in groups, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>• Level 1: Write briefly on 5 preventive measures on physical safety risk</i> <i>• Level 2: Discuss 5 causes of computer security risks and suggest the various ways of preventing such computer security threats</i> <i>• Level 3: With the aid of a diagram demonstrate the application of</i>	ii. <i>Pedagogical Exemplars:</i> <i>In pairs, learners briefly explain further preventive measures on physical safety risk with the aid of a diagram, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Write briefly on 5 preventive measures on physical safety risk, etc.</i>	

	<i>preventive measures on physical safety risk and computer security threats, etc.</i> <i>i) Biology (Week 24)</i> <i>i. Learning Tasks</i> <i>• What is the importance of adding natural compost or manure to the soil?</i> <i>• Using fertiliser is not the same as providing the plant with all the necessary nutrients. Explain this statement.</i> <i>• Predict one reason why a plant may be diseased. Give one solution to your prediction</i> <i>ii. Pedagogical Exemplars</i> <i>• Using diamond - nine strategies, ask learners to identify the Soil texture and quality as presented before them and tell how it may possibly affect the growth and development of flowering plants</i> <i>• Put learners into mixed-ability, gender-balanced groups, and ask them to discuss soil texture and quality and how they are applied in the agricultural process and how it affects</i>	<i>i) Biology (Week 24)</i> <i>i. Learning Tasks</i> <i>What is the importance of adding natural compost or manure to the soil, etc.</i> <i>ii. Pedagogical Exemplars</i> <i>Using diamond - nine strategies, ask learners to identify the Soil texture and quality as presented before them and tell how it may possibly affect the growth and development of flowering plants, etc.</i>	

	<i>the growth and development of flowering plants</i> • Ask learners to individually to explain the concept Soil texture and quality and how it affects the growth and development of flowering plants, etc. iii. Key Assessments (DoK) • Level 2: Explain Soil texture and quality • Level 2: Summarise your understanding on Soil texture and quality and how it affects the growth and development of flowering plants. • Level 3: Considering the knowledge and application of Soil texture and quality explain how it affects the growth and development of flowering plants, etc. j) Chemistry (Week 24) i. Learning Tasks: • Identify unique properties of carbon that helps in the formation of organic compounds • Differentiate between organic compounds and inorganic compounds • Classify organic compounds into	iii. Key Assessments (DoK) Level 2: Explain Soil texture and quality, etc. j) Chemistry (Week 24) i. Learning Tasks: Identify unique properties of carbon that helps in the formation of organic compounds, etc.	

	<i>aliphatic hydrocarbons, alicyclic hydrocarbons, aromatic hydrocarbons and heterocyclics, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Prior to the lesson, investigate to find out answers to the following task: The meaning of organic chemistry and why carbon forms many</i> <i>• Through a whole class activity, differentiate between organic compounds and inorganic compounds, giving examples</i> <i>• With the aid of cut-outs on types and examples of organic compounds, classify different organic compounds into aliphatic hydrocarbons, alicyclic hydrocarbons, aromatic hydrocarbons and heterocyclics.</i> <i>• In small mixed-ability groups, model the various classes of organic compounds and draw their structures., etc.</i>	<i>ii. Pedagogical Exemplars:</i> <i>Prior to the lesson, investigate to find out answers to the following task: The meaning of organic chemistry and why carbon forms many, etc.</i>	

	iii. Key Assessments (DoK): • Level 1: What is meant by the term aromatic hydrocarbon? • Level 1: Describe the general differences in chemical bonding between organic and inorganic compounds • Level 2: In a tabulate form state the differences between organic compounds and inorganic compounds. • Level 3: Compare and contrast the physical and chemical properties of organic and inorganic compounds, etc. k) Physics (Week 24) i. Learning Tasks: • Define a nuclear reaction and distinguish it from a chemical reaction, focusing on the changes in the nucleus and the release of energy • Balance nuclear reactions, emphasizing the principles of mass, energy, and charge conservation. • Solving problems that involve identifying missing	iii. Key Assessments (DoK): Level 1: What is meant by the term aromatic hydrocarbon?, etc. k) Physics (Week24) i. Learning Tasks: Define a nuclear reaction and distinguish it from a chemical reaction, focusing on the changes in the nucleus and the release of energy, etc.	

	<i>particles in nuclear equations, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>• Guide students through balancing nuclear equations from simple to complex using interactive class discussions</i> <i>• Provide learners with cards that display balanced and unbalanced nuclear reactions and have them sort these into appropriate categories. Briefly explain why a reaction is balanced or not on each card</i> <i>• Utilise interactive online simulations to allow learners to experiment with balancing nuclear reactions by adjusting the number of protons and neutrons to explore how changes affect the stability and identity of nuclides, providing a visual and practical learning experience</i> <i>• Discuss the practical applications of nuclear reactions in fields such as medicine, power generation, and</i>	<i>ii. Pedagogical Exemplars:</i> <i>Guide students through balancing nuclear equations from simple to complex using interactive class discussions, etc.</i>	

	<i>scientific research. Use examples to show how nuclear reactions impact real-world technologies and industries, linking theoretical knowledge with practical utility., etc.</i> iii. Key Assessment • Level 1: Define nuclear reactions and explain what occurs at the atomic level during such reactions • Level 1: Describe the steps in balancing a nuclear reaction, emphasising the importance of conserving mass and charge. • Level 2: Given the nuclear equation ${}^{14}_x\text{N} + {}^4_2\text{He} \rightarrow {}^y_8\text{O} + {}^1_1\text{H},$ identify the missing numbers represented by x and y and balance the equation, ensuring the conservation of both mass and atomic numbers, etc. I) Computing (Week 24) i. Learning Tasks: • Identify the modern technologies used in web design • Describe the characteristics of	iii. Key Assessment Level 1: Define nuclear reactions and explain what occurs at the atomic level during such reactions, etc. I) Computing (Week 24) i. Content Identify the modern technologies	

	<i>modern technologies used in web design</i> • <i>Demonstrate the use of modern technologies used in web design in everyday life, etc.</i> ii. <i>Pedagogical Exemplars:</i> • <i>Using think –pair-share, let learners Identify the modern technologies used in web design</i> • <i>Let learners describe the characteristics of modern technologies used in web design</i> • <i>Project- Based learning within a practical session (Individual and mixed ability/gender sensitive group work with no stereotyping), let learners in groups Demonstrate the use of modern technologies used in web design in everyday life, etc.</i> iii. <i>Key Assessments (DoK)</i> • <i>Level 1: Identify modern technologies used in web design</i> • <i>Level 2: Describe the characteristics of modern technologies used in web design</i>	<i>used in web design, etc.</i> ii. <i>Pedagogical Exemplars:</i> <i>Using think – pair-share, let learners Identify the modern technologies used in web design, let learners Identify the modern technologies used in web design, etc.</i> iii. <i>Key Assessments (DoK):</i> <i>Level 1: Identify modern technologies used in web design, etc.</i>	

	• <i>Level 3: Demonstrate the use of modern technologies used in web design in everyday life, etc.</i> 2.5 Ask teachers in their subject groups or as individuals to complete learning planners for Weeks 23 and 24. Teachers should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	2.5 In your subject groups or individually, complete learning planners for Weeks 23 and 24. It should include and ensure alignment of teaching, learning and assessment activities, taking into consideration differentiation (such as providing activities with at least three different levels of difficulty), GESI and SEL in each learning planner to cater for all learners (NTS 1a, 1b, 2a, 2c, 3a, 3g and 3h).	
3. Peer-review of learning planners. • Reviewing planner to ensure alignment between course manual and learning planner based on the templates provided.	3.1 Ask teachers to exchange one of their completed learning plans with colleagues in the same department (where applicable) and peer review the content (such as essential questions, teaching and learning activities, assessment and closure) of the learning plan (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). Areas for vital review: a) <i>Alignment between teacher manual and learning plan</i> b) <i>Innovativeness of pedagogical choices</i>	3.1 Exchange one of your completed learning plans with a colleague in the same department (where applicable) and peer review the content (such as essential questions, teaching and learning activities, assessment and closure) of a learning plan (NTS 1a, 1b, 2b, 2c, 2e, 2f, 3a, 3d, 3e, 3g-3j and 3o). Areas for vital review: a) <i>Alignment between teacher manual and learning plan</i> b) <i>Innovativeness of pedagogical choices</i>	10mins

	c) <i>Incorporation of GESI, SEL, national values and 21st century skills</i> d) <i>Differentiated instruction and assessment</i> e) <i>Appropriateness of crafted essential questions, etc.</i> 3.2 Ask teachers to implement the recommendations made by a peer reviewer to their learning plan as appropriate (NTS 2b).	c) <i>Incorporation of GESI, SEL, national values and 21st century skills</i> d) <i>Differentiated instruction and assessment</i> e) <i>Appropriateness of crafted essential questions, etc.</i> 3.2 Implement the recommendations made by a peer reviewer to your learning plan as appropriate (NTS 2b).	
4. Reflection on the session: • Reflecting on what has been learned in the session. • Advance preparation towards next DPLC session	4.1 Ask teachers to share their views and experiences about the session (NTS 1a, 1b and 3b). 4.2 Encourage teachers who did not complete their learning plans during the session to complete them (NTS 3I). 4.3 Remind teachers to prepare for a review of all Year 1 DPLC sessions by <i>writing down notes on areas that went well, areas that can be improved upon and two suggestions for innovative actions and share with the whole group in the next DPLC session.</i> (NTS 1a, 1b).	4.1 Share your views and experiences about the session (NTS 1a, 1b and 3b). 4. 2 Complete your learning plans which were not completed during the session (NTS 3I). 4.3 Prepare for a review of all Year 1 DPLC sessions by <i>writing down notes on areas that went well, areas that can be improved upon and two suggestions for innovative actions and share with the whole group in the next DPLC session.</i> (NTS 1a, 1b).	10mins

Appendix 1

General Science

Learning Planner							
Subject	General Science	Week	1	Duration	180 minutes	Form	1
Strand	Exploring Materials	Sub-Strand	Science and materials in nature				
Content Standard	Demonstrate knowledge and understanding of the characteristics of science and show how they are applied in everyday life.						
Learning Outcome(s)	Evaluate the characteristics of science.						
Learning Indicator(s)	Explain the various characteristics of science in nature.						
Essential Question(s)	a) Carefully observe daily scientific principles and explain the characteristics of science applied within. b) How do you create a chart using the characteristics of science? c) How do you apply the characteristics of science, Measure the volume of water using a measuring cylinder?						
Pedagogical Strategies	a) Talk for learning approach, Inquiry-based method b) Think pair share c) Demonstration/ practical activity d) Collaborative learning, discussion method.						
Teaching & Learning Resources	Measuring cylinder, Beaker, Funnel, Litmus paper, Water, vinegar, Metre rule, Projector, Video and Internet						
Key Notes on Differentiation							
i. Learning Task - Write at least three situations in life where characteristics of science are evident - Identify at least four characteristics of science in nature - Explain at least four characteristics of science in nature, etc. ii. Pedagogical Exemplars: - Learners think about the importance of science and discuss their ideas with a peer. The teacher asks learners to present their ideas to the whole class. The teacher presents videos, charts, pictures, and demonstrations on the characteristics of science to learners, and learners in mixed-ability groups discuss the characteristics of science, considering its meaning and importance in real life. - Learners in mixed ability groups experiment as shown in Fig. 1, 2, 3 (refer to manual) to demonstrate the characteristics of science such as replicability, predictability (the ability of scientific investigations to make							

accurate and reliable predictions about future events), empirical (relies on observations and data gathered) - Learners reflect and share their views of different situations in life where the characteristics of science are evident with peers for critique - Group learners create a poster showing the key characteristics of science/definitions, significance, and application in daily life for a whole class gallery walk and presentation, etc. iii. Key Assessment - Level 1: Identify at least four (4) characteristics of science - Level 2: Explain four (4) characteristics of science - Level 2: Explain at least any four (4) characteristics of science in everyday life - Level 2: Explain the need to study the characteristics of science - Level 2: Describe how the scientific processes can be used to make predictions etc.	
Keywords	Empirical, replication. systematic, consistency, predictability, validity, Precision and accuracy.
Lesson 1	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
<u>Starter Activity (5 minutes)</u> Start with a riddle. Learners listen to the riddle and give a response Riddle! Riddle! I am something. The longer I grow, the shorter I become. What am I? Expected Response candle Note: Demonstrate with a burning candle.	
<u>Introductory Activity (10 minutes)</u> I. Put learners into mixed-ability groups and discuss the science overview and its importance using talk-for-learning. II. Encourage learners to accommodate individuals' diverse views as they interact	<u>Introductory Activity (10 minutes)</u> In mixed-ability groups discuss the science overview and its importance in using talk-for-learning.

and collaborate in their groups. <u>Activity 1 (15 minutes)</u> i. Presents videos or charts or pictures or photos, and demonstrations on the characteristics of science to learners. ii. Ask learners in mixed-ability groups to discuss and present the characteristics of science to the class, considering its meaning. E.g., Empirical replication. Systematic, consistency, predictability, validity, experimentation, observation, recording, etc. iii. Note: Allow adequate time for the presentation. <u>Activity 2 (15 minutes)</u> Together with learners, Summarise the characteristics of science from the learners' presentation.	<u>Activity 1 (15 minutes)</u> i. Watch and take down notes on the presented videos or charts or pictures or photos, and demonstrations on the characteristics of science. ii. in mixed-ability groups discuss and present the characteristics of science to the class, considering its meaning. E.g., Empirical replication. Systematic, consistency, predictability, validity, experimentation, observation, recording, etc. iii. Group in turns do their presentation. <u>Activity 2 (15 minutes)</u> Listen and put down notes.
Assessment DoK aligned to the Curriculum and Subject Teacher Manual 1. Level 1: Identify at least four (4) characteristics of science. 2. Level 2: Explain four (4) characteristics of science. 3. Level 2: Explain at least any four (4) characteristics of science in everyday life	
Lesson Closure In completing this part, refer to the Essential Questions to check that learning has taken place.	
<u>Activity (15 minutes)</u> a) Ask learners to share what they learned from the lesson with the whole class. (Offer learners the opportunity to ask questions for further clarification and address misconceptions). b) Ask learners how the replication process contributes to the reliability of scientific findings. c) Assign an activity for the next lesson.	

Reflection & Remarks	
Reflection a) What went well during the lesson delivery? b) Were the learners able to understand the characteristics of science in nature? c) The learners could explain the characteristics of science in everyday life.	
Lesson 2	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
<u>Starter Activity (5 minutes)</u> Imagine you're an explorer setting out on a quest to uncover hidden treasures in an uncharted land. What qualities do you think you'd need to succeed in such an adventure? Take a moment to jot down your thoughts. Expected responses: Good observation, curiosity, record keeping, mapping of trail etc. Now, let's shift our focus from exploration to scientific inquiry. How do the qualities you listed align with the characteristics of science? In today's lesson, we'll delve into the scientific mindset and explore the key traits that distinguish scientific inquiry from other ways of understanding the world.	
<u>Introductory activity (10 minutes)</u> Learners discuss the characteristics of science. Expected response. Empirical replication. Systematic, consistency, predictability, validity, experimentation, observation, recording. Encourage Learners to respect one another's views as they interact and collaborate in their groups.	<u>Introductory activity (10 minutes)</u> Discuss the characteristics of science.
<u>Activity 1 (40 minutes)</u> Put Learners in mixed ability groups to experiment with Measuring cylinder, Beaker, Funnel, Litmus paper, Water, vinegar, metre rule, etc the characteristics of science such as replicability, predictability (the ability of scientific investigations to make accurate and reliable predictions about future events), and empirical (relying on observations and data gathered) in different situations in life.	<u>Activity 1(40 minutes)</u> in mixed ability groups experiment with Measuring cylinder, Beaker, Funnel, Litmus paper, Water, vinegar, metre rule, etc the characteristics of science such as replicability, predictability (the ability of scientific investigations to make accurate and reliable predictions about future events), and empirical (relies on observations and data gathered) in different situations in life.

<u>Activity 2 (30 minutes)</u> Learners reflect and share their views of different situations in life where the characteristics of science are evident with peers for critique. <u>Activity 3 (25 minutes)</u> In Groups, learners create a poster that shows the characteristics of science definitions for a whole class gallery walk and presentation.	<u>Activity 2 (30 minutes)</u> Reflect and share their views of different situations in life where the characteristics of science are evident with peers for critique. <u>Activity 3 (25 minutes)</u> Create a poster that shows the characteristics of science definitions for a whole class gallery walk and presentation.
Assessment DoK aligned to the Curriculum and Subject Teacher Manual.	
1. Level 2: Explain the need to study the characteristics of science. 2. Level 2: Describe how the scientific processes can be used to make predictions etc.	
Lesson Closure In completing this part, refer to the Essential Questions to check that learning has taken place.	
<u>Activity (10 minutes)</u> a) Ask learners to share what they learned from the lesson with the whole class. (Offer learners the opportunity to ask questions for further clarification and address misconceptions). b) Assign an activity for the next lesson.	
Reflection & Remarks	
Reflection a) What went well during the lesson delivery? b) Were the learners able to understand the characteristics of science in nature? c) The learners could explain the characteristics of science in everyday life. Remarks:	

Biology

Learning Plan							
Subject	Biology	Week	1	Duration	60 minutes	Form	1
Strand	Exploring Biology in the Society1	Sub-Strand	Biology as the Science of life				
Content Standard	Demonstrate knowledge and understanding of Biology, the various branches and fields of study, and their benefits in everyday life						
Learning Outcome(s)	Explain the importance of Biology and its branches and relate this to everyday life.						
Learning Indicator(s)	a) Observe and discuss the importance of Biology, its various branches and their applications in everyday life. b) Explain the importance of Biology, its various branches and their applications in everyday life c) Explain the importance of Biology, its various branches and their applications in everyday life						
Essential Question(s)	Lesson 1 a) How would you apply the relevance of Biology in your everyday life and why? b) What would you do to improve upon food production as one of the importance of biology? c) What pedagogical strategies can I employ to help learners to understand the importance of biology in everyday life? Lesson 2 a) How would you use the knowledge of different fields of biology to select different professions in biology? b) How can you relate the knowledge of the branches of biology to the production of some common items and products we use in our everyday life? (e.g., honey, dried fish/ “Koobi”, bottled fruit juice, any antibiotic drug, lab coat, body cream, soap, bread, kenkey, palm wine, leather shoes and bags, etc.,) c) Which teaching and learning resources can I use to help learners to identify the various branches of biology?						
Pedagogical Strategies	Collaborative learning, Talk for Learning (TFL), Think-pair-share, Inquiry-Based Learning						
Teaching & Learning Resources	Honey, dried fish/ “Koobi”, bottled fruit juice, any antibiotic drug, lab coat, body cream, soap, bread, kenkey, palm wine, leather shoes and bags, etc., or their pictures if these materials are not readily available						

	<i>laptop, smartphone, USB drive, CD of video of biologists at work, Textbooks, Scientific journals, Professionals in the various fields of biology.</i>
Key Notes on Differentiation	
<i>Learning Tasks:</i> <i>Explain the term Biology. Limit content expectation to the definition of Biology.</i> <i>Describe at least four ways in which the knowledge of Biology is useful in everyday life. Extend content expectation to the discussion /explanation of how useful the knowledge of Biology is in the following areas of food production, gardening, home hygiene, human, animal, and plant health as well as conservation of natural resources.</i> <i>Discuss the importance of Biology in the production of Honey, Dried fish/ “Koobi”, and bottled fruit juice. Extend content response to the importance of Biology in the following areas Honey production, Dried fish/”Koobi ‘and bottled juice.</i> <i>Pedagogical Exemplars:</i> <i>Collaborative Learning: learners in mixed ability, gender-balanced groups, observe pictures and videos of specimens relating to Biology (e.g., honey and dry Tilapia, etc.) and share ideas with peers and accept feedback.</i> <i>Learners in mixed-ability groups learn from each other and provide emotional support to one another to achieve targets.</i> <i>Talk-For Learning: Learners in pairs discuss, analyse and share the contribution of biologists in the development of society; learners learn from each other and improve upon their communication skills. Communication and Collaboration: Learners speak politely and clearly as they share ideas on the video and pictures they watched with their peers and accept constructive feedback from their peers</i> <i>Key Assessments (DoK):</i> <i>Level 1: What is Biology? Accept oral/written responses for different definitions of biology.</i> <i>Level 2: How is the knowledge of Biology applied in everyday life? Accept oral/written explanations for four ways the knowledge of Biology is applied in everyday life.</i> <i>Level 3: Discuss the importance of Biology in the production of Honey, Dry fish/ “Kobi” and bottled fruit juice. Accept oral/written discussion on the importance of Biology in Honey, Dried fish/koobi and fruit juice production.</i> <i>Level 4: Describe briefly how you will use the knowledge gained in Biology to reclaim degraded land. Accept oral /written responses for four ways a degraded land can be reclaimed using knowledge gained in Biology</i>	
Keywords	<i>Botany, Zoology, Microbiology, Mycology, Parasitology, Cytology, Histology, Entomology, Ecology, etc.</i>
Lesson 1	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity

<u>Starter Activity (5 minutes)</u> <i>Introduce lesson by showing learners some items related to Biology such as, plants, fish, lab coat, honey, dried fish/ “Koobi”, bottled fruit juice, any antibiotic drug, lab coat, body cream, soap, bread, kenkey, palm wine, leather shoes and bags, etc., and ask learners to individually identify each and write what they know about these items.</i>	
<u>Introductory Activity (10minutes)</u> <i>Put learners in mixed-ability, gender-balanced groups, and ask learners to share ideas on what they recollect and know about the items shown in the starter activity. Encourage learners to show respect for individuals diverse views as they interact and collaborate in their groups</i> <u>Activity 1 (20 minutes)</u> <i>Ask learners to pair within their groups to brainstorm and respond to what they recollect and know about the items shown in starter activity.</i> <u>Activity 2 (20 minutes)</u> <i>Ask learners to use available resources (e.g. Textbooks, the internet, library, etc.) to research branches of Biology and their importance. The teacher provides the rubrics for the presentation to guide learners prepare their written group reports for the presentation</i>	<u>Introductory Activity (10minutes)</u> <i>Learners share ideas about items presented to them and discuss these materials in their groups. Learners show respect for one another’s views they interact and collaborate in their groups</i> <u>Activity 1 (20 minutes)</u> <i>In pairs learners recollect and discuss what they know about the items shown in the starter activity</i> <u>Activity 2 (20 minutes)</u> <i>Learners make use of available resources (e.g. Textbooks, the internet, library, etc.) to research further, branches of Biology and their importance. Learners prepare written group reports for presentation within the given time.</i>
Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
<i>Level 1: Recall: List at least five branches of biology Level 2: Skills of conceptual understanding; Summarise your understanding of the term Biology. Level 3: Strategic Thinking Considering the items given, explain 5 to 8 ways the knowledge of Biology is applied in everyday life. Level 3: Strategic Thinking Cite evidence on how can Biology is linked to other fields of study.</i>	

Lesson Closure <i>In completing this part, refer to the Essential Questions to check that learning has taken place.</i>	
<u>Activity (5 minutes)</u> a) Ask each group to present a concept map of the focal point of each activity as a summary of the lesson b) Assign an activity for the fields of work related to biology	
Reflection & Remarks (After the lesson) a) What was my best moment in the lesson? b) Did I managed and control my class well? c) What will I do differently? d) What did the learners find difficult to understand? e) What activities did the learners complete with ease and on time? f) Did I pay particular attention to learners with special educational needs (SEN)?	
Lesson 2	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
<u>Starter Activity (5 minutes)</u> <i>Learners watch a short video/ pictures of scientists at work in different branches relating to biology and randomly call learners to predict the main theme/focal point of the lesson.</i>	
<u>Introductory activity (10 minutes)</u> <i>Put learners in mixed-ability, gender-balanced groups, and ask them to link the various branches of biology they can identify in the picture of the various units in a hospital. Encourage learners to support one another as they collaborate in their groups.</i>	<u>Introductory activity (10 minutes)</u> <i>Learners discuss in their groups and link the various branches of biology they identify in the various units of the hospital in the picture provided. Learners support one another as they collaborate in their groups</i>
<u>Activity 1 (20 minutes)</u> <i>Put learners in mixed-ability, gender-balanced groups, and ask them to discuss and link the various branches of biology they can identify in the various units in a named community.</i>	<u>Activity 1(20 minutes)</u> <i>Discuss in their groups and link the various branches of biology they identify in the various units in their community</i>
<u>Activity 2 (20 minutes)</u> <i>Ask learners to individually write down at least 10 fields of science where the knowledge of biology is applied and explain how the knowledge of biology is applied in any 5 of the fields listed.</i>	<u>Activity 2 (20 minutes)</u> <i>Learners individually write down at least 10 fields of science where the knowledge of biology is applied and explain how the knowledge of biology is applied in any 5 of the fields listed.</i>

Assessment DoK aligned to the Curriculum and Subject Teacher Manual
<i>Level 2: Skills of conceptual understanding;</i> <i>What are the various branches in Biology and their everyday application?</i> <i>Level 3: Strategic thinking</i> <i>Describe the importance of 5 to 8 branches mentioned</i> <i>Level 3: Strategic thinking</i> <i>Which branch of Biology is linked to the mode of transmission and treatment of diseases?</i>
Lesson Closure
<i>In completing this part, refer to the Essential Questions to check that learning has taken place.</i>
<u>Activity (5 minutes)</u> <i>a) Draw learner's attention to the end of the lesson.</i> <i>b) Ask each group to present a concept map approach as a summary of the focal point of each lesson.</i> <i>c) Provide feedback to learners.</i> <i>d) Assign an activity for the next lesson.</i>
Reflection & Remarks (After the lesson)
<i>a) What was my best moment in the lesson?</i> <i>b) Did I manage and control my class well?</i> <i>c) What will I do differently?</i> <i>d) What did the learners find difficult to understand?</i> <i>e) What activities did the learners complete with ease and on time?</i> <i>f) Did I pay particular attention to learners with special educational needs (SEN)?</i>

Chemistry

Learning Planner							
Subject	Chemistry	Week	1	Duration	240 min	Form	1
Strand	Physical chemistry	Sub-Strand	Matter and its properties				
Content Standard	Demonstrate understanding of the scientific practices in chemistry using relevant acquired skills to solve problems as well as explaining the structure of the atom and its stability.						
Learning Outcome(s)	Use the knowledge and understanding of the scientific practices in chemistry to explain the structure of the atom as well as the stability of its nucleus.						
Learning Indicator(s)	Describe chemical processes around us and their applications in everyday life Discuss and explain safety rules and hazard symbols in the laboratory.						
Essential Question(s)	1. What prior knowledge do learners have about chemical processes that will help them understand Chemistry in everyday life. 2. What are the main branches of Chemistry? 3. Identify at least three importance of Chemistry to the society 4. How will I teach and assess learners on chemical processes around us and their application in everyday life.						
Pedagogical Strategies	Digital learning, Talk-for-Life Learning, Collaboration and Communication						
Teaching & Learning Resources	Videos, slides, pictures, charts, projector, labelled cards, computer or laptop. Household items with labels, Chemical containers with labels, Personal protective equipment (eye goggle, laboratory coat/apron, hand gloves), Flammable materials, Oxidizing materials, Hazard symbols, Prohibition signs.						
Key Notes on Differentiation							
Learning Tasks:							
1. Discuss and distinguish between the traditional branches of chemistry.							
2. Discuss the centrality of chemistry as a science discipline which is related to other science subjects.							
3. Draw flowcharts and pictures to summarize ways in which chemistry affects daily lives under the following headings: (Food and nutrition, Agriculture, Medicine, Transportation, Energy, etc.)							
Pedagogical Exemplars:							
Digital learning:							
a. Divide learners into mixed ability groups and show them video or slide/pictures on variety of natural and artificial phenomena that can be explained by chemistry. Visually impaired learners should be considered and alternative plans made for them.							

b. Guide learners to discuss and distinguish among the traditional branches of chemistry. Ask questions and encourage all learners to talk in the group. c. Using mixed ability groups, guide learners to draw flowcharts and pictures to summarize ways in which chemistry affects daily lives under the following headings: (Food and nutrition, Agriculture, Medicine, Transportation, Energy, etc.) Visually impaired learners should be considered and alternative plans made for them.	
Keywords	Chemistry, Pure and Applied Chemistry, Physical Chemistry, Organic chemistry, Inorganic chemistry, etc.
Lesson 1	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
Starter Activity (10 minutes): Introduce the lesson by asking the following questions to review relevant previous knowledge and deal with misconceptions. - What is matter? - Can matter be changed from one form to another? If yes, give examples Use their responses to introduce the meaning of chemistry.	
<u>Introductory Activity (15minutes)</u> III. Teacher projects a video, pictures/ charts showing a variety of natural and artificial phenomena that can be explained by chemistry and ask learners to watch. NB: Teacher should consider the SEN learners and make provisions for them. <u>Activity 1 (40 minutes)</u> I. Use concept map to explain the branches of chemistry. <u>Activity 2 (40 minutes)</u> I. Establish that chemistry is related to the other science discipline	<u>Introductory Activity (15minutes)</u> I. In an all-inclusive class, learners watch a video, pictures/ charts showing a variety of natural and artificial phenomena that can be explained by chemistry. Learners then observe, deduce and discuss the meaning of chemistry <u>Activity 1 (40 minutes)</u> I. Sort a given number of topics and subjects into the branches of chemistry. <u>Activity 2 (40 minutes)</u> I. Construct a table to show the relationship between chemistry and other subjects (physics, biology, geography etc).

Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
Level 1: 1. With clicker questions, define Chemistry. Level 2: 1. Distinguish between pure and applied chemistry.	
Lesson Closure <i>In completing this part, refer to the Essential Questions to check that learning has taken place.</i>	
<u>Activity (15 minutes)</u> d) State two ways by which chemistry is applied in everyday life. e) In your own words, distinguish between Pure and Applied chemistry	
Reflection & Remarks	
Reflection: 1. What went well during the lesson delivery? 2. Which teaching approach helped learners to understand what chemistry is? 3. Were the learners able to show the relationship between chemistry and other sciences? 4. Was the concept map useful for the lesson and must it be sustained?	
Lesson 2	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
<u>Starter Activity (10 minutes)</u> Review learners' previous knowledge of safety in the laboratory by showing a short video (audiovisual) of wrong practices in the kitchen and guide learners to discuss the content after which the lesson is introduced.	
<u>Introductory activity (25 minutes)</u> I. Help learners to organize themselves in pairs or groups and show a video of wrong practices in the chemistry laboratory and provide suitable alternative for SEN learners.	<u>Introductory activity (25 minutes)</u> I. In your pairs or groups, learners watch the video and discuss the dos and don'ts in the chemistry laboratory and hence the rules and regulations that should be followed in the laboratory. Encourage learners to, show respect to others' views as they carry out discussions by interacting and collaborating with group members.
<u>Activity 1 (25 minutes)</u> I. Show a chart of the various hazard symbols to learners in their small groups and randomly distribute chemical reagents, electrical gadgets	<u>Activity 1(25 minutes)</u> I. Using think-pair-share approach examine and discuss the assay of the chemical reagents, electrical gadgets and other materials under the headings provided.

<i>and other materials for learners to identify the hazard symbols on them based on the following headings: Corrosive, toxic, oxidizing, flammable, explosive, radioactive, irritant/harmful, biohazards. Encourage learners to be tolerant and circumspect with their criticisms and commentary on others' presentations.</i> <u>Activity 2 (25 minutes)</u> <i>I. Provide a worksheet of the prohibition signs for learners to identify, sketch and describe them under the following headings: (First aid, danger, No smoking, High voltage, etc).</i> <u>Activity 3 (25 minutes)</u> <i>I. Provide learners with pictures of the personal protective equipment and help them design a poster to be pasted at vantage places in the laboratory</i>	<u>Activity 2 (25 minutes)</u> <i>I. Sketch and describe the prohibition signs under the headings provided.</i> <u>Activity 3 (25 minutes)</u> <i>I. In mixed ability groups design posters on the need to use personal protective equipment and make a presentation.</i>
Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
Level 1: <i>1. With clicker questions, give two (2) examples of personal protective equipment used in the chemistry laboratory.</i> Level 2: <i>1. With safety procedure processes explain why it is not advisable to start a car in a closed garage?</i> Level 3: <i>1. Mercury is a heavy metal used in illegal mining (galamsey) of gold in water bodies. It was accidentally released into a river body. In presentations, what are the possible implications on the health of the people in the community.</i>	

Lesson Closure

In completing this part, refer to the Essential Questions to check that learning has taken place.

Activity (10 minutes)

- a) *Ask learners to summarize the key words (i.e. safety, hazards and personal protective equipment) in their own words.*

Reflection & Remarks

Reflection:

- 1. Which of the safety rules were well understood by the learners?*
- 2. Which personal protective equipment can help mitigate the potential risks of a chosen hazard symbol in the laboratory?*
- 3. Which interactive approach during the lesson delivery helped to demystify hazard symbols and empower learners to recognize and interpret them accurately?*

Remarks:

Computing

Learning Planner							
Subject	Computing	Week	1	Duration	240 minutes	Form	1
Strand	Computer Architecture and Organisation	Sub-Strand	Data Storage and Manipulation				
Content Standard	Demonstrate knowledge and understanding of data representation and Data Manipulation.						
Learning Outcome(s)	Apply computer Architecture concepts related to the design of modern processors, memories, Input and Output to manipulate data.						
Learning Indicator(s)	1. Describe data as Bit Patterns.						
Essential Question(s)	- How would you express decimal numbers into binary digit and vice versa? - What are bit patterns and how are they represented in computing? - How can bit patterns be used to represent different types of data, such as numbers, characters, and images? - What is the best approach to teach data representation as bit patterns for all learners to benefit from the lesson? - In what ways can I integrate the cross-cutting themes- 21st Century, GESI, SEL and National values in teaching data representation as bit patterns?						
Pedagogical Strategies	Problem-Based Learning; Project-Based Learning; Talk for Learning; Experiential learning; Group work/collaborative learning. Small group and large group discussions, Think-pair-share, Questioning Demonstration Brainstorming Brain writing						
Teaching & Learning Resources	Notepad or exercise book Pen Smartphones Laptop computers Desktop computers Tablets TV						

	Radio Productivity tools Open Educational Resources (Including: YouTube, MOOCS-Udemy/ Coursera, khan academy, TESSA) The iBox (CENDLOS) Subject based application software Instructional Laboratories (with multimedia equipment and smartboards) Maintenance and repair workshops
Key Notes on Differentiation	
<i>i. Learning Task:</i> - Play an activity ball game with the learners for the binary numbers' conversion. Write down a list of decimal numbers for the conversion (e.g.: 1-9 these varied numbers will cater for differentiation) and passing the activity ball to any learner randomly, the learner with the ball converts one of the decimal numbers of their choice in their books). Another activity may be to have a hat containing numbers on paper, learners pick random numbers to convert to binary - Use the answers of the learners to categorise the learners into proficiency levels and proceed to the differentiated tasks, etc. <i>ii. Pedagogical Exemplars:</i> - The teacher should build on the learners understanding by playing flash cards games (or related) with the learners in their mix-ability groupings before proceeding to the binary number conversions to decimal numbers and decimal numbers to binary numbers - Team teaching is recommended for the conversion activities. The teacher(s) should emphasis on how computers understand only binary numbers ("0s" and "1s"). The teacher can invite a mathematics teacher to support him/her on the delivery of this content before doing some of the suggested activities above), etc. <i>iii. Key Assessments (DoK):</i> - Level 1: Convert decimal numbers into their binary representations - Level 2: Given the binary number 101101, divide it into groups of three bits starting from the right. Add leading zeros if necessary. Convert each group into its decimal representation, etc.	
Keywords	Decimal numbers, bit patterns, data representation, nibbles, Octal, hexadecimal
Lesson 1	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
<u>Starter Activity (10 minutes)</u>	
<i>I. Establish rapport with learners by engaging them in brief discussion about the myths and misconceptions people have about Computing. For instance;</i>	

<i>Computing is only for men and hackers. You need to be good at Mathematics, etc.</i> II. <i>Explain to learners that, everyone can excel in the Subject regardless of their gender, background, socio – economic, etc. You can also give success stories of great achievers in Computing and how they started.</i>	
<u>Introductory Activity (25minutes)</u> I. <i>Use index or flash cards to introduce key words related with the concept to learners.</i> II. <i>Task them to brainstorm and explain how computers store text and other data. Engage all learners in the discussion.</i> III. <i>Using questioning, assist learners to express decimal numbers into binary and verse versa. Let them use either desktop computers or calculators if available to express decimal numbers to other number base systems in this exercise.</i> IV. <i>Invite learner to explain how the conversion is done and their observation about different number conversions.</i> V. <i>Provide clear explanations of the binary number system and how it relates to representing data in computers.</i> VI. <i>Encourage learners to think critically, ask questions, and discuss their thoughts processes during these activities to enhance their understanding.</i> <u>Activity 1 (25 minutes)</u> I. <i>With demonstration, introduce the concept of mapping decimal numbers to their corresponding nibble bit patterns.</i>	<u>Introductory Activity (25minutes)</u> I. <i>Identify key words shown.</i> II. <i>Think – pair – share their thought with class.</i> III. <i>Forms groups with instructions from teacher.</i> IV. <i>Collaborate with one another to accomplish the given task.</i> V. <i>Express decimal numbers into binary and other number base systems with their computers or calculators.</i> VI. <i>Think – pair – share their observations with one another.</i> <u>Activity 1 (25 minutes)</u> I. <i>Observe how bit patterns can be group into nibble and practice grouping bits as instructed. Ask questions where there for clarification when necessary.</i>

II. <i>Show learners the nibble patterns for decimal numbers 0 to 15, emphasizing that each pattern represents a unique value. Octal (Base-8 System):</i> <i>Explain that octal is a base-8 numbering system, where each digit represents three bits. Discuss how octal digits range from 0 to 7, emphasizing that each digit represents a unique combination of three bits.</i> III. <i>Guide learners to convert decimal numbers to octal by grouping the bits into sets of three and assigning an octal digit to each group. Reinforce that each octal digit represents a unique combination of three bits. Hexadecimal (Base-16 System):</i> <i>Introduce hexadecimal as a base-16 numbering system, where each digit represents four bits. Explain that hexadecimal digits range from 0 to 9 and A to F, where A represents 10, B represents 11, and so on up to F representing 15.</i> IV. <i>Show learners examples of converting decimal numbers to hexadecimal by grouping the bits into sets of four and assigning a hexadecimal digit to each group. Reinforce that each hexadecimal digit represents a unique combination of four bits.</i> <i>Provide learners with exercises and problems that involve converting between decimal, binary, nibbles, octal, and hexadecimal. Include practice problems that require converting between different representations, such as</i>	II. <i>Observe and practice as instructed. Ask questions where there for clarification when necessary.</i> III. <i>convert decimal numbers to octal by grouping the bits into sets of three and assigning an octal digit to each group</i> IV. <i>Practice as instructed. Ask questions where there for clarification when necessary.</i> V. <i>Practice as instructed. Ask questions where there for clarification when necessary.</i>

converting a decimal number to its binary, nibble, octal, and hexadecimal equivalents. Use visual aids, such as tables or charts, to show the relationships between data and information. <u>Activity 2 (35 minutes)</u> I. Group work/collaborative learning: In mixed ability/gender groups, assign binary patterns to represent each of the object. For example, a pencil could be represented in 4-bit pattern as 0110 and a book as 1101.	<u>Activity 2 (35 minutes)</u> I. Forms mixed ability or gender groups base on given instructions to carry out the task. Collaborate with one another to play the game.
Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
Level 1: 1. Convert decimal numbers into their binary representations	
Lesson Closure <i>In completing this part, refer to the Essential Questions to check that learning has taken place.</i>	
<u>Activity (25 minutes)</u> Guide learners to present their responses on the following ; a) The process of converting a decimal number to its binary representation is called _____? b) The binary representation of the decimal number 9 is _____?	
Reflection & Remarks	
Reflection What were my best moments in today's lesson and how can I create more situations? What went well in the lesson? Were the different subgroups in the class catered for? What did not go well in today's lesson? What must I do to improve on the challenges in the next lesson?	
Lesson 2	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
<u>Starter Activity (10 minutes)</u> I. Have you ever wondered why your smartphone or computer takes a little longer to launch or open an application for the first time but become faster on	

subsequent launches? Let's uncover the secret behind this speed boost by exploring the role of cache memory. II. Encourage all learners to think-pair- share their thought with class. Encourage all learners to participate in this activity.	
<u>Introductory activity (25 minutes)</u> I. Guide learners to describe the process of converting a binary number to its decimal equivalent. <u>Activity 1 (25 minutes)</u> II. Let learners take turns in guessing each other's objects based on their binary representation (bit patterns) <u>Activity 2 (40 minutes)</u> I. Using Game like Bit Flipping Challenge, let each learner get a sheet of paper or a digital worksheet with a grid of 8 bits (e.g., 0 0 0 0 0 0 0 0). Instruct them to start flipping the bits one by one, from right to left, and observe the changes in the resulting number. For each bit flipped, have them write down the decimal value of the new binary number.	<u>Introductory activity (25 minutes)</u> I. Describe the process of converting a binary number to its decimal equivalent. <u>Activity 1(25 minutes)</u> I. Take turns in guessing each other's objects based on their binary representation (bit patterns) <u>Activity 2 (40 minutes)</u> I. Get a sheet of paper or a digital worksheet with a grid of 8 bits (e.g., 0 0 0 0 0 0 0 0). Instruct them to start flipping the bits one by one, from right to left, and observe the changes in the resulting number. For each bit flipped, have them write down the decimal value of the new binary number.
Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
Level 2: 1. Given the binary number 101101, divide it into groups of three bits starting from the right. Add leading zeros if necessary. Convert each group into its decimal representation, etc.	
Lesson Closure <i>In completing this part, refer to the Essential Questions to check that learning has taken place.</i>	
<u>Activity (10 minutes)</u> Guide learners to do a presentation on how bit patterns can be used to represent different types of data, such as numbers, characters, and images.	

Reflection & Remarks
Reflection <i>What were my best moments in today's lesson and how can I create more situations?</i> <i>What went well in the lesson?</i> <i>Were the different subgroups in the class catered for?</i> <i>What did not go well in today's lesson?</i> <i>What must I do to improve on the challenges in the next lesson?</i>

Learning Planner							
Subject	Information & Communications Technology	Week	1	Duration	120 minutes	Form	1
Strand	ICTs in the Society	Sub-Strand	Organizing, Managing and Presenting Information Using Essential Productivity Tools				
Content Standard	Demonstrate knowledge and understanding of the use of various computing tools to create multimedia documents.						
Learning Outcome(s)	Create multimedia documents using appropriate computing tools						
Learning Indicator(s)	2. Describe software, hardware, and other computing features needed to create a document. 3. Create, Edit and Format text and paragraphs using desktop/online computing tools						
Essential Question(s)	▪ How will you explain computer hardware? Understanding ▪ How are the categories of hardware related? (Understanding, analyze,) ▪ How do you use these hardware types in creating a document? (Understanding, analyze, evaluate) ▪ How are the types of software related? (evaluate) ▪ What are the best approaches to teach computer hardware and computer software? ▪ In what ways can I integrate cross cutting theme GESI SEL national values in teaching components of the computer: Hardware and Software?						
Pedagogical Strategies	Problem-Based Learning; Project-Based Learning; Talk for Learning; Experiential learning; Group work/collaborative learning. Small group and large group discussions, Think-pair-share, Questioning Demonstration Brainstorming Brain writing						

Teaching & Learning Resources	Notepad or exercise book Pen Smartphones Laptop computers Desktop computers Tablets TV Radio Productivity tools Open Educational Resources (Including: YouTube, MOOCS-Udemy/ Coursera, khan academy, TESSA) The iBox (CENDLOS) Subject based application software Instructional Laboratories (with multimedia equipment and smartboards) Maintenance and repair workshops
Key Notes on Differentiation	
<i>i. Learning Task:</i> <i>The teacher should start the lesson by grouping the learners taking into consideration GESI, SEL and other cross cutting issues and have an open class discussion where learners brainstorm about the computer and what it requires to work efficiently</i> <i>Teachers can ask learners in their groups to individually think-write-share with their group members the definition of a computer and agree on one definition. Teachers can then ask each group to present their definition</i> <i>Teachers should task learners in their groups to brainstorm the purpose of computers in everyday life and ask each group to share their write up with the class using tell-it-all</i> <i>Teachers can ask learners in their groups to individually think-write-share with their group members the definition of computer hardware and software based on the outcome of the purposes of a computer. Teachers can then ask each group to present their definition</i> <i>Using a projector, teachers project a designed puzzle of names of hardware and software components and ask learners to write out words from the puzzle. Teachers ask members in each group to read out their words and ask other groups to write computer related words down. Teachers ask each group to regroup their written words under hardware and software components of a computer and present their responses to the class</i> <i>Teachers tasked each group to discuss the categories of hardware and software components with examples and present their results with the class. Teachers guide the whole class to draw the relations between hardware and software components, etc.</i> <i>ii. Pedagogical Exemplars:</i> <i>Think Pair Share: Using mixed-ability/mixed gender groups, learners think, write and discuss the definition of a computer and its purposes, software and hardware components addressing inclusivity and equity. For example, input devices should be</i>	

discussed to address accessibility issues for learners with disabilities such as visual impairment, dyslexia, and dysgraphia

- **Tell-it-all:** In small groupings, (ability, language, background, gender, etc.), learners list some hardware and software related words from a puzzle and group the words into hardware and software components. One group gives examples of hardware from their write up. Other groups repeat examples given by others and add their examples. This activity is repeated for examples of software as well
- **Ink-Pair-Share:** In pairs, learners write the relationship between hardware and software components using pen and paper and exchange their write ups with their colleagues. The teachers randomly select a few learners to read what colleagues wrote. Teacher then guides learners to draw a clear relationship between software and hardware components of a computer system, etc.

iii. Key Assessments (DoK):

- **Level 1:** What is a computer?
- **Level 2:** The external and internal devices and equipment that enable you to perform major functions such as input, output, storage, communication, processing, and more is known as.....
- **Level 3:** Distinguish between application software and systems software
- **Level 4:** It is the hardware part of the computer that makes the computer intelligent and not the software. True or False. (Explain your answer), etc.
- Enter twenty (20) words into a text editing software, using keyboard or any other input device.

Keywords	Software, Hardware, word processing application software input, processing, output, storage, communication, Liveware		
Lesson 1			
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual			
Teacher Activity		Learner Activity	
Starter <u>Activity (10 minutes)</u>			
Brainstorming:			
• An electric train is moving from Tamale (in the north) to Accra (in the south). What will be the direction of the smoke? (understanding)			
Teacher brainstorms with learners to define and identify			
• the key points in defining computer software and hardware. Use a concept map to link the key points • What learners use to place calls home. • The type of applications on mobile phones used to perform a task.			
<u>Introductory Activity (15minutes)</u>		<u>Introductory Activity (15minutes)</u>	
II. In small groupings (ability, language, background, gender, etc.) let learners List		II. In small groupings, (ability, language, background, gender, etc.), state and classify 10	

<i>at least 10 hardware components and categorize them into input, processing, output and storage for large group discussion.</i> <u>Activity 1 (15 minutes)</u> I. <i>engage learners in an interactive discussion and use questioning to explain that without system software a hardware will have no function and that system software is required as a platform for other software.</i> <u>Activity 2 (15 minutes)</u> I. <i>In a large group discussion, let learners discuss the various types of software and show how the types of software are related?</i>	<i>hardware components into input, processing, output and storage for large group discussion.</i> <u>Activity 1 (15 minutes)</u> I. <i>engage in class discussion and answer questions to gain understanding of how system software is used to manage hardware and how they function as a platform for other software.</i> <u>Activity 2 (15 minutes)</u> I. <i>Discuss the various types of software in your groups and show how the types are related in your notebooks</i>
Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
Level 1: 1. What is a computer? Level 2: 1. The external and internal devices and equipment that enable you to perform major functions such as input, output, storage, communication, processing, and more is known as.....	
Lesson Closure <i>In completing this part, refer to the Essential Questions to check that learning has taken place.</i>	
<u>Activity (15 minutes)</u> <i>Guide learners to recap their discussion and the points identified in the lesson. With the following as guiding questions;</i> f) <i>Describe software, hardware, and other computing features needed to create a document.</i> g) <i>Create, Edit and Format text and paragraphs using desktop/online computing tools</i>	
Reflection & Remarks	
Reflection <i>What was my best moments in today's lesson and how can I create more situations?</i> <i>What went well in the lesson?</i> <i>Were the different subgroups in the class catered for?</i> <i>What did not go well in today's lesson?</i> <i>What must I do to improve on the challenges in the next lesson?</i>	

Lesson 2	
Main Lesson drawing on Concepts, Skills and Competencies to reinforce as in the Subject Teacher Manual	
Teacher Activity	Learner Activity
Starter <u>Activity (10 minutes)</u>	
Brainstorming: It is the hardware part of the computer that makes the computer intelligent and not the software. True or False (understanding)	
<u>Introductory activity (25 minutes)</u> II. In small groupings (ability, language, background, gender, etc.) let learners List at least 10 hardware components and categorize them into input, processing, output and storage for large group discussion.	<u>Introductory activity (25 minutes)</u> II. In small groupings, (ability, language, background, gender, etc.), state and classify 10 hardware components into input, processing, output and storage for large group discussion.
<u>Activity 1 (25 minutes)</u> III. Show a relatively short video tutorial on how to create word document	<u>Activity 1(25 minutes)</u> I. follow/watch a video to create word document
<u>Activity 2 (25 minutes)</u> II. Guide learners to use these hardware components to create newsletters and birthday card.	<u>Activity 2 (25 minutes)</u> I. In groups, use the hardware components of the computer to create newsletter and birthday card
Assessment DoK aligned to the Curriculum and Subject Teacher Manual	
Level 4	
- Enter twenty (20) words into a text editing software, using keyboard or any other input device. (Learners should enter text (20 words) unaided – this should be their own original work or copied from given text).	
Lesson Closure	
In completing this part, refer to the Essential Questions to check that learning has taken place.	
<u>Activity (15 minutes)</u> Guide learners to recap their discussion and the points identified in the lesson. With the following as guiding questions; Enter twenty (20) words into a text editing software, using keyboard or any	

other input device.

b) *(Learners should enter text (20 words) unaided – this should be their own original work or copied from given text).*

Reflection & Remarks

Reflection

What was my best moments in today's lesson and how can I create more situations?

What went well in the lesson?

Were the different subgroups in the class catered for?

What did not go well in today's lesson?

What must I do to improve on the challenges in the next lesson?

Teacher Lesson Observation Form

Name of School

Subject being observed

Class

☐ Year 1

☐ Year 2

☐ Year 3

Sex of the teacher

☐ Male

☐ Female

1. Is the purpose of the lesson clearly stated in the lesson plan and focused on learners achieving the lesson learning outcomes?

- ☐ Yes
☐ In Part
☐ No
☐ NA

b1. Please provide an explanation to your answer in Q1 above

2. Are the unique needs of female learners, male learners, and learners with special education needs adequately catered for in the lesson plan? For example, the choice of teaching methods and learning activities reflects/does not reflect the learning needs of all learners.

For example, the choice of teaching methods, and learning activities.

- ☐ Yes
☐ In Part
☐ No
☐ NA

2b. Please provide an explanation to your answer in Q2 above

3. Does the teacher manage behavior well, maintaining a positive and non-threatening learning environment throughout the lesson?

- ☐ Yes
☐ In Part
☐ No
☐ NA

3b. Please provide an explanation to your answer in Q3 above

4. Are appropriate teaching and learning materials and other resources (including ICT, books, desks) available, accessible and being used to support learning of all females, males and learners with special education needs?

- ☐ Yes
☐ In Part
☐ No
☐ NA

4b. Please provide an explanation to your answer in Q4 above

5. Are learners engaged on tasks that challenge them in line with the content standards?

Does the teacher take into consideration the uniqueness of learners?

- ☐ Yes
☐ In Part
☐ No
☐ NA

5b. Please provide an explanation to your answer in Q5 above

6. Is there evidence that students are learning?

- ☐ Yes
☐ In Part
☐ No
☐ NA

6b. Please provide an explanation to your answer in Q6 above

7. Is teaching differentiated to cater for the varied needs of all learners (i.e., male learners, female learners, learners with special education needs) and those with poor literacy and/ or numeracy proficiency?

- ☐ Yes
☐ In Part
☐ No
☐ NA

7b. Please provide an explanation to your answer in Q7 above

8. Does the teacher use real life examples which are familiar to learners to explain concepts?

- ☐ Yes
☐ In Part
☐ No
☐ NA

8b. Please provide an explanation to your answer in Q8 above

9. Does the teacher point out or question traditional gender roles when they come up during the lessons as appropriate?

- ☐ Yes
☐ In Part
☐ No
☐ NA

9b. Please provide an explanation to your answer in Q9 above

10. Does the lesson include appropriate interactive and creative approaches e.g., group work, role play, storytelling to support learners achieving the learning outcomes?

If yes, give examples of the issues and skills that have been so integrated.

- ☐ Yes
☐ In Part
☐ No
☐ NA

10b. Please provide an explanation to your answer in Q10 above

11. Have cross-cutting issues and /or 21st century skills been integrated into the lesson to support learners in achieving the learning outcomes e.g., problem-solving, critical thinking, communication? If yes, give examples of the issues and skills that have been so integrated.

- ☐ Yes
☐ In Part
☐ No
☐ NA

11b. If yes, give examples of the issues and skills that have been so integrated.

12. Does the teacher incorporate ICT into their practice to support learning?

- ☐ Yes
☐ In Part
☐ No
☐ NA

12b. Please provide an explanation to your answer in Q12 above

13. Does the teacher encourage all female male and male learners (including those who may be shy or afraid to speak) to ask questions, answer questions, participate in group work, etc. during the lesson?

- ☐ Yes
☐ In Part
☐ No
☐ NA

13b. Please provide an explanation to your answer in Q13 above

14. Is assessment evident in the lesson? If yes, does it include assessment as, for or of learning and go beyond recall?

If yes, did it include assessment of, for or as learning and go beyond recall?

- ☐ Yes
☐ In Part
☐ No
☐ NA

14b. Please provide an explanation to your answer in Q14 above

15. Do learners make use of feedback from teacher and peers?

- ☐ Yes
☐ In Part
☐ No
☐ NA

15b. Please provide an explanation to your answer in Q15 above

16. Does the teacher sum up the lesson and evaluate the lesson against the learning outcomes with the learners?

- ☐ Yes
☐ In Part
☐ No
☐ NA

16b. Please provide an explanation to your answer in Q16 above

17. Does the teachers' planning of lessons taught before the one observed show how they plan for learning over time, considering individual and group needs?

- ☐ Yes
☐ In Part
☐ No
☐ NA

17b. Please provide an explanation to your answer in Q17 above

18. Does the teacher pay attention to the composition of females and males during group work and assigns females leadership roles.

- ☐ Yes
☐ In Part
☐ No
☐ NA

18b. Please provide an explanation to your answer in Q18 above

19. Does the teacher provide constructive verbal feedback to both females and males and learners with special education needs?

- ☐ Yes
☐ In Part
☐ No
☐ NA

19b. Please provide an explanation to your answer in Q19 above

20. Does the teacher provide constructive written feedback to both females and males and learners with special education needs in their exercise book?

- ☐ Yes
☐ In Part
☐ No
☐ NA

20b. Please provide an explanation to your answer in Q20 above

21. Key strengths in the lesson

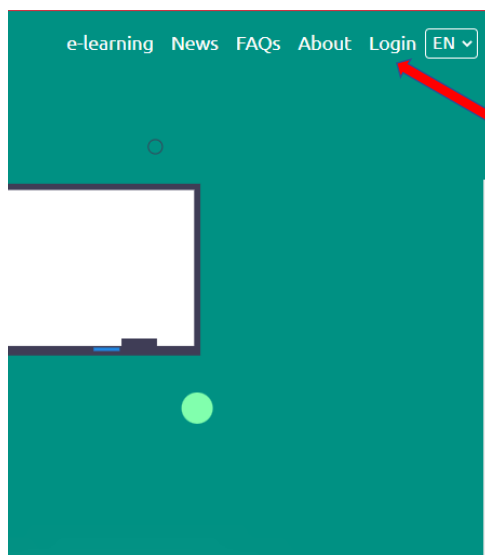
22. Areas for development

23. Next steps for teacher

24. Additional Notes (on teacher's actions, the flow of activities, etc.)

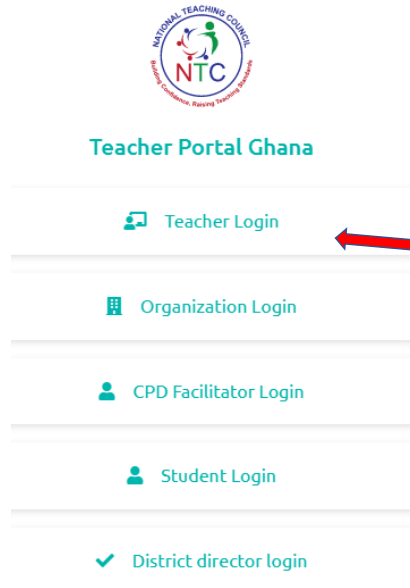
HOW TO AWARD CPD POINTS TO DESERVING TEACHERS

1. Visit tpg.ntc.gov.gh and click Login



Click Login on the
TPG homepage

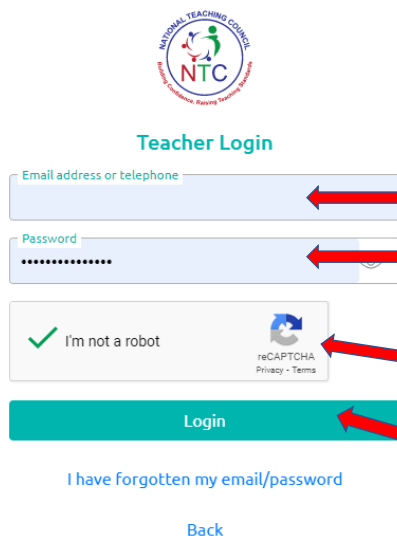
2. On the Login page, click Teacher Login



The image shows the 'Teacher Portal Ghana' login page. At the top is the NTC logo with the text 'NATIONAL TEACHING COUNCIL' and 'NTC'. Below the logo is the title 'Teacher Portal Ghana'. There are five login options listed in a vertical stack: 'Teacher Login' (with a laptop icon), 'Organization Login' (with a building icon), 'CPD Facilitator Login' (with a person icon), 'Student Login' (with a person icon), and 'District director login' (with a checkmark icon). A red arrow points from a text box to the 'Teacher Login' button.

Click Teacher Login

3. On the Teacher Login page enter your email address and password and then click Login



The image shows the 'Teacher Login' page. At the top is the NTC logo. Below the logo is the title 'Teacher Login'. There are four input fields: 'Email address or telephone', 'Password', 'I'm not a robot' (with a checkmark icon), and a 'Login' button. A red arrow points from a text box to the 'Email address or telephone' field. Another red arrow points from a text box to the 'Password' field. A third red arrow points from a text box to the 'I'm not a robot' checkbox. A fourth red arrow points from a text box to the 'Login' button. Below the 'Login' button is a link 'I have forgotten my email/password' and a 'Back' link.

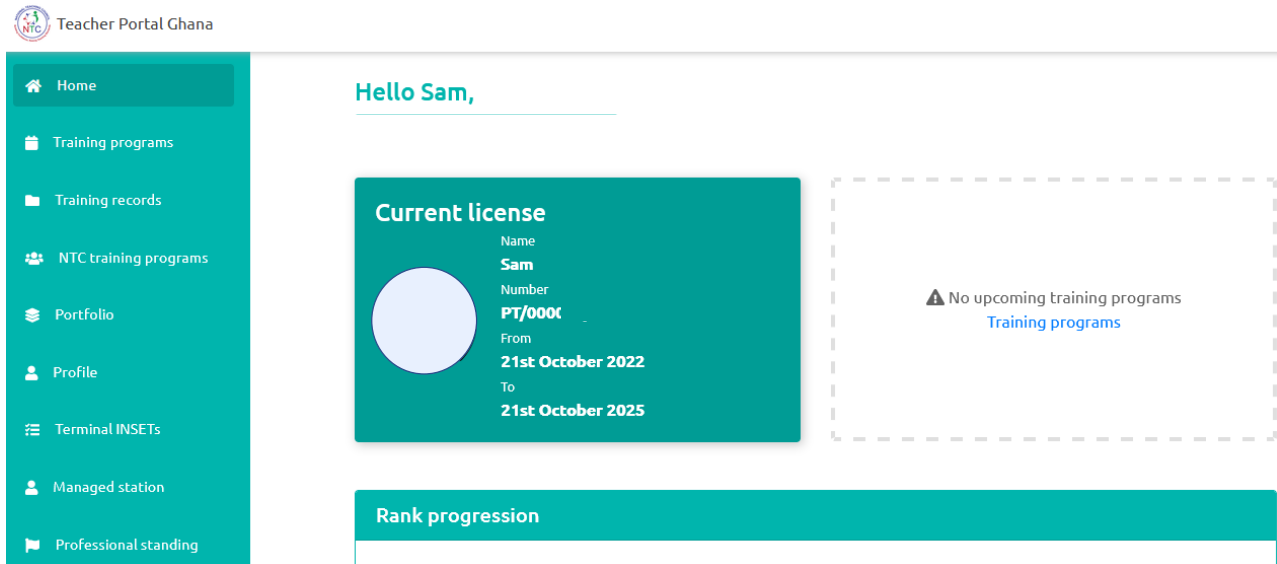
Enter your email address

Enter your password

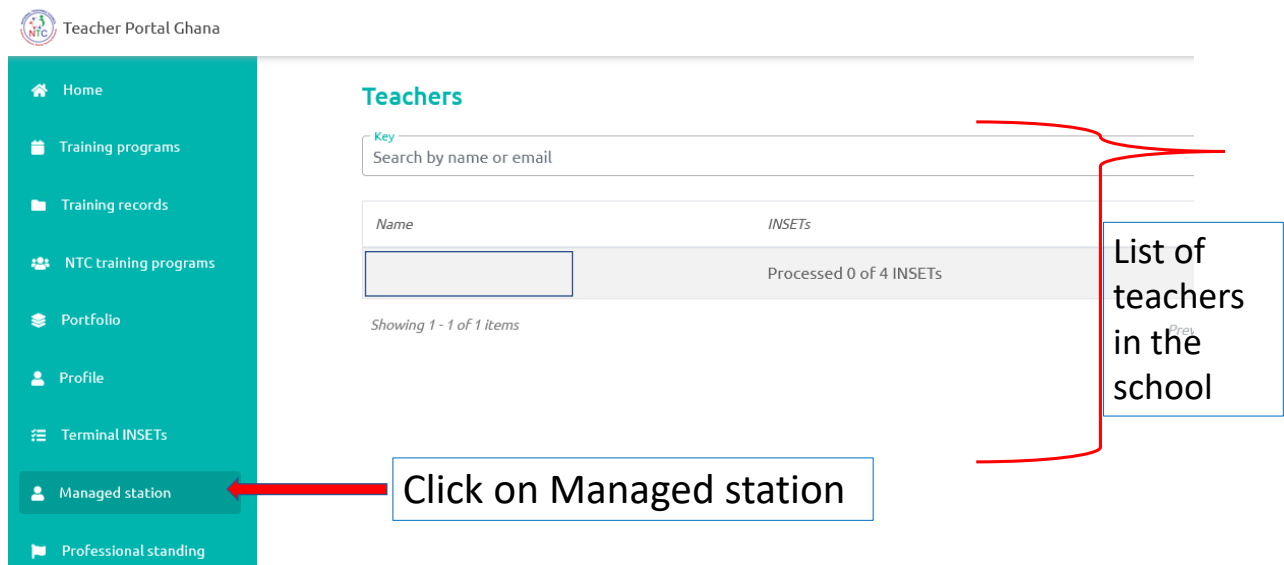
Check I'm not a robot

Click Login

4. After a successful login you will get access to your TPG account (Check image below)



5. To award CPD points, from the side menu tap on **Managed station** to display list of teachers



6. Click on the name of the teacher to display the page for awarding CPD points (Check image below)

Teachers /

Type	Year	Term	Processed	Processed by	Processed on	Credits
School Based Inset (SBI)	2022/2023	1	No	---	---	---
Cluster Based Inset (CBI)	2022/2023	1	No	---	---	---
School Based Inset (SBI)	2022/2023	1	No	---	---	---
Department Based Inset (DBI)	2022/2023	1	No	---	---	---

7. Click on the 3 dots after the Credits column at the extreme right side to process (Check image below)

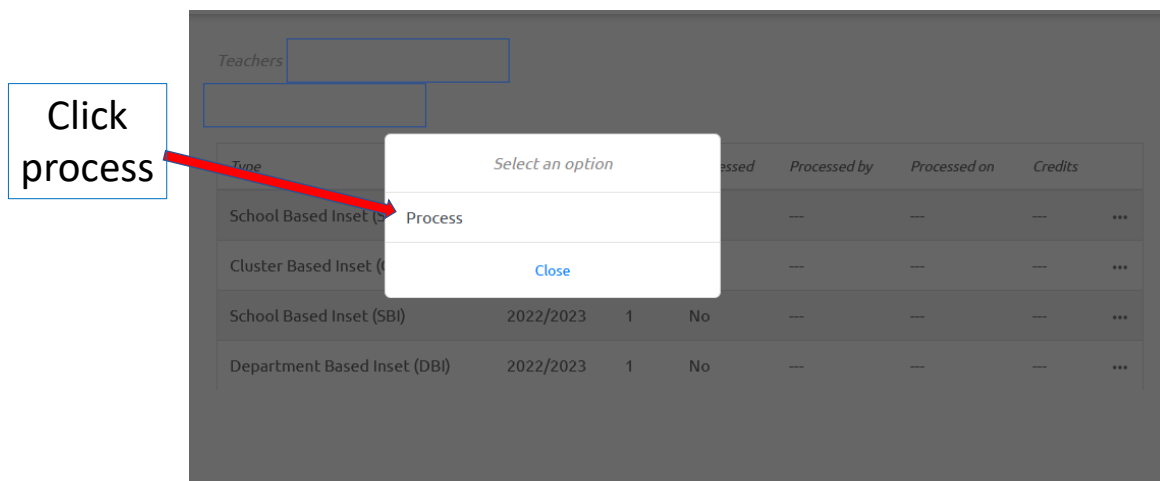
Teachers /

Click here to process

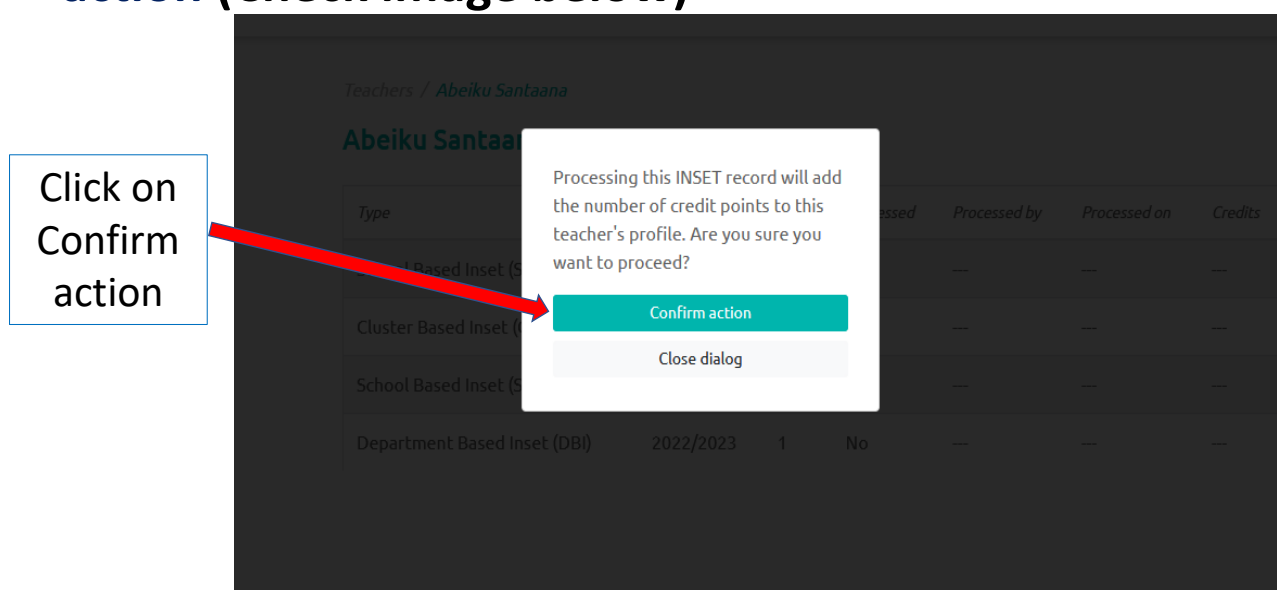
Type	Year	Term	Processed	Processed by	Processed on	Credits
School Based Inset (SBI)	2022/2023	1	No	---	---	---
Cluster Based Inset (CBI)	2022/2023	1	No	---	---	---
School Based Inset (SBI)	2022/2023	1	No	---	---	---
Department Based Inset (DBI)	2022/2023	1	No	---	---	---

Note: You will repeat same actions for all the INSET/PLC types

8. On the new page that appears click on **Process** (Check image below)



8. On the new page that appears click on **Confirm action** (Check image below)



9. The points for the teacher will then be processed (Check image below)

Teachers /

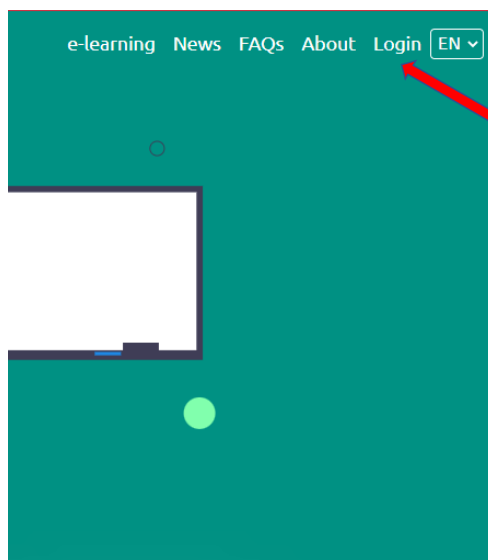
Points processed

Type	Year	Term	Processed	Processed by	Processed on	Credits	
School Based Inset (SBI)	2022/2023	1	Yes	(Teacher)	Saturday, 15th April, 2023	1	...
Cluster Based Inset (CBI)	2022/2023	1	Yes	(Teacher)	Saturday, 15th April, 2023	1	...
School Based Inset (SBI)	2022/2023	1	No	---	---	---	...
Department Based Inset (DBI)	2022/2023	1	No	---	---	---	...

THANK YOU

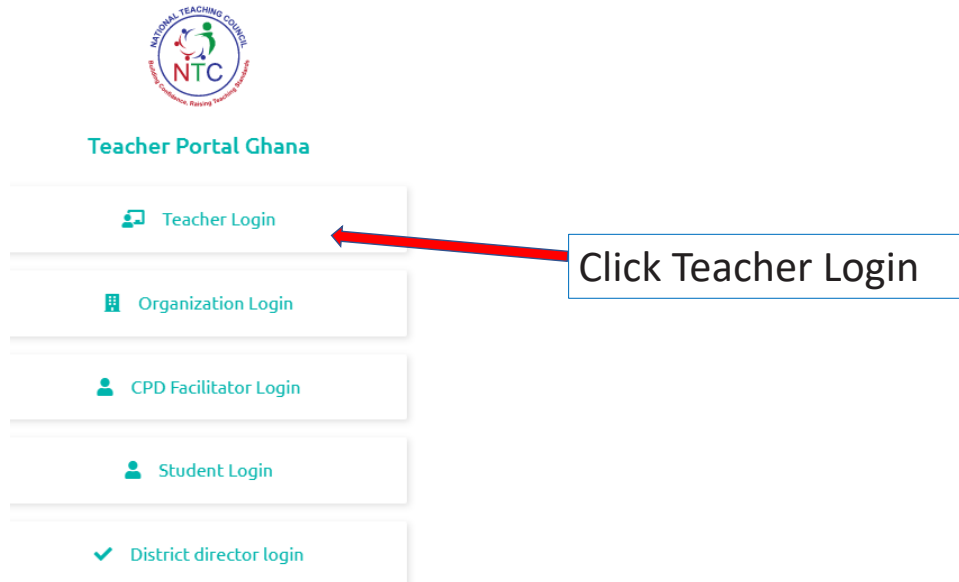
HOW TO CHECK CPD POINTS AND TRAINING RECORDS ON TEACHER PORTAL GHANA

1. Visit tpg.ntc.gov.gh and click Login



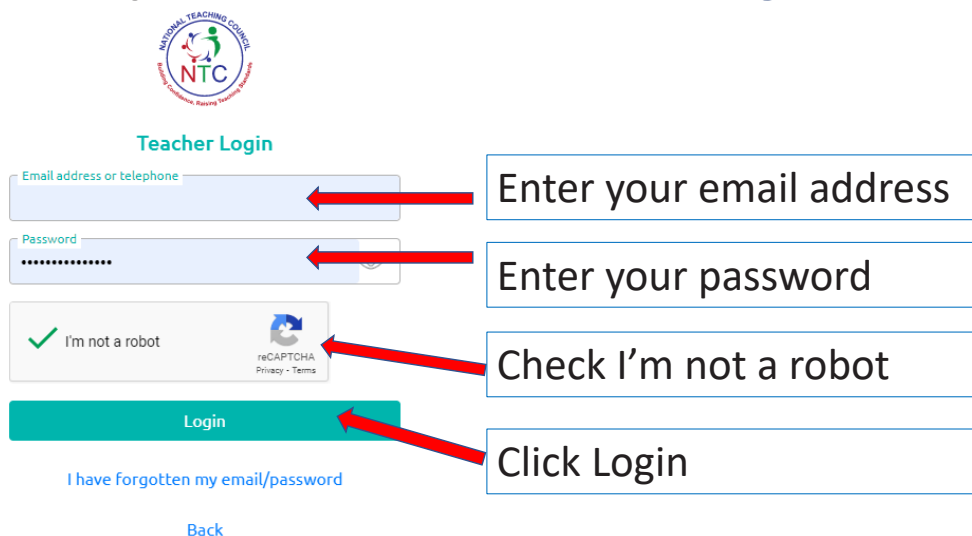
Click Login on the
TPG homepage

2. On the Login page, click Teacher Login



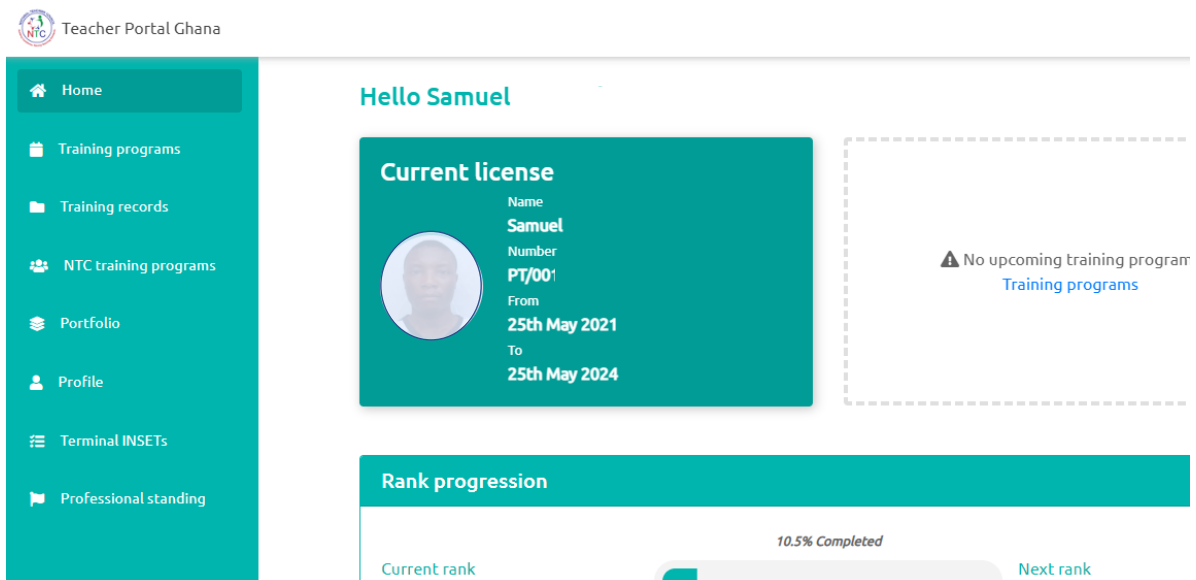
The image shows the 'Teacher Portal Ghana' login page. At the top is the NTC logo with the text 'NATIONAL TEACHING COUNCIL' and 'NTC' in the center. Below the logo is the title 'Teacher Portal Ghana'. There are five login options listed in a vertical stack: 'Teacher Login' (with a person icon), 'Organization Login' (with a building icon), 'CPD Facilitator Login' (with a person icon), 'Student Login' (with a person icon), and 'District director login' (with a checkmark icon). A red arrow points from a text box 'Click Teacher Login' to the 'Teacher Login' button.

3. On the Teacher Login page enter your email address and password and then click Login



The image shows the 'Teacher Login' page. At the top is the NTC logo. Below the logo is the title 'Teacher Login'. There are three input fields: 'Email address or telephone' (with a red arrow pointing to it from a text box 'Enter your email address'), 'Password' (with a red arrow pointing to it from a text box 'Enter your password'), and a reCAPTCHA box (with a red arrow pointing to it from a text box 'Check I'm not a robot'). Below the input fields is a green 'Login' button (with a red arrow pointing to it from a text box 'Click Login'). Below the 'Login' button is a link 'I have forgotten my email/password' and a link 'Back'.

4. After a successful login you will get access to your **TPG account** (Check image below)



5. To check CPD points, scroll down to **Rank progression**. You will see the CPD points progress bar and actual points accrued (Check image below)



6. To view training records, from the side menu tap on **Training records** (Check image below)

The screenshot shows the Teacher Portal Ghana interface. On the left is a teal side menu with options: Home, Training programs, Training records, NTC training programs, Portfolio, Profile, Terminal INSETs, and Professional standing. A red arrow points to 'Training records'. The main content area is titled 'Training records' with the subtitle 'Records for training programs registered and/or attended'. It shows 'Total points: 1.8988' and a list of three training programs:

Training Program	Status
Sensitization on Education Policies	⚠ Marked as absent
Differentiated Learning	✓ Processed Credits: 1.32
Advanced Mobile Learning with Multimedia (AMLM)	✓ Processed Credits: 0.5788

A red bracket on the right groups these programs under the label 'List of training programs'. A callout box at the bottom left says 'Click to view training records' with an arrow pointing to the 'Training records' menu item.

THANK YOU