ESSENTIAL



Science Basic 8

Facilitator's Guide









Science Basic 8

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Welcome and orientation

A warm welcome to you, Teacher. We hope that you will find this Teacher's Guide for Basic 8 Science useful and easy to use.

Teacher's Guide orientation

The introduction section covers the introductory pages to the Science curriculum for Basic 7–10 (the Common Core Programme or CCP), outlined as follows:

- Rationale why the study of science is important and what it involves.
- Aims how learners are expected to develop by studying science.
- *Profile of expected learning behaviours* the three learning domains which are the basis for instruction and assessment, namely:
 - knowledge, understanding and application
 - process skills
 - attitudes and values.
- Creative pedagogical approaches these include principles of learner-centred teaching, inclusion, differentiated teaching, instructional scaffolding, exposure to information and communications technology (ICT) tools, and emphasis on the development of core competencies.
- Instructional expectations a summary of your expected role as teacher.
- Organisation and structure of the curriculum the scope of content covered over four years for B7, B8, B9 and B10.
- Suggested time allocation how many periods a week.
- Assessment modes of assessment and the benchmarks for reporting school-based assessment (SBA).

On pages xiv–xvi, we offer you guidelines on assessment.

The remainder of this Teacher's Guide follows the structure of the Learner's Book. It is divided into the five sections (Note that Strands are referred to as *Sections* in the Learner's Book) that run throughout the four years of the Science CCP, namely:

- 1. Diversity of matter
- 2. Cycles
- 3. Systems
- **4.** Forces and energy
- 5. Humans and the environment.

The Sections, in turn, are divided into Topics (for each sub-strand) and these are divided into Modules and Units. For each unit, we give you a brief overview ('Unit in a nutshell'). We then focus on each activity covered in the unit, listing the resources you will need to do the activity as well as the answers to the activity. Where relevant, we give some tips for doing the activity.

The intention of the CCP is to provide learners with an education of heart, mind and hands. We wish you a rewarding year of teaching and hope that you and your learners will have fun.

Introduction to the syllabus and assessment

Rationale

Science is a collaborative and creative human endeavour arising from our desire to understand the world around us and the wider universe. The study of a Science CCP from Basic 7 through Basic 10 enables learners to build on what they have learned from Basic 1 to Basic 6, and to further develop their knowledge of and about science.

We are surrounded by technology and the products of science every day. Government policy decisions that affect every aspect of our lives are based on scientific evidence. As learners grow up in an increasingly technologically and scientifically advanced world, they need to be *scientifically literate* to understand relevant issues and be able to live successfully.

Economic, political, social and physical development of a country is hinged on science, technology and innovation. Science has changed our lives and it is vital to Ghana's future development.

To provide a real science education, teachers must facilitate learning in an enabling science classroom that allows learners to discover and understand the world around them and lays the ground for science and science-related studies at higher levels of education. Learners should be encouraged to:

- understand how science can be used to explain what is occurring
- predict how things will behave
- analyse the causes and effects of phenomena in our environment.

The study of science also involves the development of attitudes and concerns about sustainable development. Science should, therefore, be taught using practical and minds-on approaches so that learners find it fun and relevant and adopt science as a culture.

Aims

The CCP science curriculum is aimed at developing scientifically literate individuals who are good problem solvers, have the ability to think creatively and have both the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens. The specific aims are for learners to:

- 1. develop a spirit of curiosity, creativity, innovation and critical thinking for investigating and understanding their environment
- 2. develop skills, habits and attitudes necessary for scientific inquiry
- **3.** communicate scientific ideas effectively
- 4. use scientific concepts relevant to their lives to explain the world around them
- 5. design activities for exploring and applying scientific ideas and concepts
- 6. develop skills for using technology to enhance learning
- 7. develop a humane and responsible attitude toward the use of all resources in Ghana and elsewhere
- 8. show concern and understanding of the interdependence of all living things and the Earth on which they live
- 9. use materials in their environment in a sustainable manner
- 10. live a healthy, quality life.

Learning domains/profile of expected learning behaviours

There are three integral learning domains that form the basis for instruction and assessment, namely:

- knowledge, understanding and application
- process skills
- attitudes and values.

The learning indicators specified in the syllabus and covered in the activities in the Learner's Book relate to these three domains and make use of commanding or action verbs (such as 'identify', 'classify' and 'design') that describe or indicate the expected outcome. (In the Learner's Book, the learning indicators are also listed at the beginning of each module under Objectives.)

Knowledge, understanding and application

Under this domain, learners acquire knowledge through learning experiences. They may also show understanding of concepts by comparing, summarising, rewriting, etc. in their own words and constructing meaning from instruction. Learners may also apply the knowledge acquired in some new contexts. At a higher level of learning behaviour, learners may be required to analyse an issue or a problem. At a much higher level, learners may be required to synthesise knowledge by integrating several ideas to formulate a plan, solve a problem, or compose a story or a piece of music. Further, learners may be required to evaluate, estimate and interpret a concept. At the last level, which is the highest, learners may be required to create, invent, compose, design and construct. The relevant learning behaviours are unpacked as follows:

- **Knowing:** The ability to remember, recall, identify, define, describe, list, name, match and state principles, facts and concepts. Knowledge is the ability to remember or recall concepts already learned and this constitutes the lowest level of learning.
- **Understanding:** The ability to explain, summarise, translate, rewrite, paraphrase, give examples, generalise, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some concepts that may be verbal, pictorial or symbolic.
- **Applying:** This dimension is also referred to as 'use of knowledge'. It is the ability to use knowledge or apply knowledge, apply rules, methods, principles, theories, etc. to situations that are new and unfamiliar. It also involves the ability to produce, solve, plan, demonstrate, discover, etc.
- Analysing: The ability to break down concepts/information into its component parts, to differentiate, compare, distinguish, outline, separate, identify significant points, etc. It is the ability to recognise unstated assumptions and logical fallacies and the ability to recognise inferences from facts, etc.
- **Synthesising:** The ability to put parts or ideas together to form a new whole. It involves the ability to combine, compile, compose, devise, plan, revise, organise and create, and generate new ideas and solutions.
- **Evaluating:** The ability to appraise, compare features of different things and make comments or judgement, contrast, criticise, justify, support, discuss, conclude, make recommendations, etc. Evaluation refers to the ability to judge the worth or value of some concepts based on some criteria.
- **Creating:** The ability to use information or materials to plan, compose, produce, manufacture or construct other products. Creating is the highest form of thinking and learning, and is the area in which generally most learners perform poorly.

Process skills

These are specific activities or tasks that indicate performance or proficiency in the learning of science. They are the core of inquiry-based learning.

- **Equipment handling:** This is the skill of knowing the functions and limitations of various apparatus, and developing the ability to select and handle them appropriately for various tasks.
- **Observing:** Using the senses to gather information about objects or events. This also includes the use of instruments to extend the range of our senses.
- **Classifying:** Grouping objects or events based on common characteristics.
- **Comparing:** Identifying the similarities and differences between two or more objects, concepts or processes.
- **Communicating/reporting:** Transmitting, receiving and presenting information in concise, clear and accurate forms this can be verbal, written, pictorial, tabular or graphical.
- **Predicting:** Assessing the likelihood of an outcome based on prior knowledge of how things usually turn out.
- Analysing: Identifying the parts of objects, information or processes, and the patterns and relationships between these parts.
- Generating possibilities: Exploring all the options, possibilities and alternatives beyond the obvious or preferred one.
- **Evaluating:** Assessing the reasonableness, accuracy and quality of information, processes or ideas to inform decision-making. It also involves assessing feasibility.
- Designing: Visualising and creating a mental or physical model of a process or event, or objects or gadgets.
- Measuring: Using standard and non-standard instruments or devices to accurately determine size, amount, degree or quantity.
- Interpreting: Organising and evaluating data in terms of its worth good, bad, reliable, unreliable; making inferences and predictions from written or graphical data; extrapolating and deriving conclusions. Interpretation is also referred to as 'information handling'.
- **Recording:** Putting data or measurements in a table (tabulating) or in graph form; making well-labelled drawings.
- **Generalising:** Using the conclusions arrived at in an experiment or observation of events to say what could happen in similar situations.
- Designing of experiments: Developing hypotheses (assumptions/proposed explanations); planning
 and designing of experiments to test hypotheses or reach conclusions; persistence in the execution of
 experiments; modification of experiments, where necessary, to fine-tune.

Attitudes and values

To be resourceful, competent and reflective citizens, willing and capable of solving personal problems and society's problems, learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. Learners, therefore, need to acquire positive attitudes, values and psycho-social skills that will enable them to participate in debates and take a stand on issues affecting themselves and others.

Attitudes

- Curiosity: The inclination to wonder about and seek information about how things work.
- Perseverance: The ability to pursue a problem to a satisfying conclusion.
- Flexibility in ideas: Willingness to change an opinion in the face of more plausible evidence.
- Respect for evidence: Giving weight to the facts or the results of an investigation.
- **Reflection:** The habit of critically reviewing ways in which an investigation has been carried out to identify possible faults, mistakes or improvements.

Values

At the heart of this curriculum is the belief in nurturing honest, creative and responsible citizens. As such, every part of this curriculum, including the related pedagogy, should be consistent with the following set of values.

- **Respect:** This includes respect for the nation of Ghana, its institutions, laws and culture, and respect among its citizens and friends of Ghana.
- **Diversity:** Ghana is a multicultural society in which every citizen enjoys fundamental rights and responsibilities. Learners must be taught to respect the views of all persons and to see national diversity as a powerful force for national development. The curriculum promotes social cohesion.
- Equity: The levels of socio-economic development across the country are uneven and Ghana's learners
 are from diverse backgrounds. There should be equal opportunities for all. Learners should strive for
 fairness and to care for each other.
- Commitment to achieving excellence: Learners must be taught to appreciate the opportunities
 provided through the curriculum and persist in doing their best in whatever field of endeavour as
 global citizens. The curriculum encourages innovativeness through creative and critical thinking and the
 use of contemporary technology.
- Teamwork/collaboration: Learners are encouraged to be committed to team-oriented working and learning environments. This also means that learners should have an attitude of tolerance to be able to work and live peacefully with others.
- Truth and integrity: The curriculum aims to develop learners as individuals who will consistently tell the truth, irrespective of the consequences, and be morally upright, with an attitude of doing the right thing even when no one is watching. They are to be true to themselves and willing to live the values of honesty and compassion. Equally important is practising positive values as part of the ethos or culture of the workplace, which includes integrity and perseverance.

Creative pedagogical approaches

The creative pedagogical approach (CCP) emphasises the following approaches and principles:

- Learner-centred classrooms/teaching
- Inclusion
- Differentiation
- Scaffolding
- Information communications technology (ICT)
- Core competencies.

Learner-centred classrooms/teaching

Learners are active participants in their own learning. The curriculum encourages the creation of a learner-centred classroom in which learners take ownership of their learning. They should engage in meaningful 'hands-on' activities and should be actively engaged in looking for answers, working in groups to solve problems, researching information, and analysing and evaluating information. Learner-centred classrooms provide the opportunity for deep and profound learning.

The teacher as a facilitator needs to create a learning environment that:

- makes learners feel safe and accepted
- helps learners to interact with varied sources of information in a variety of ways
- helps learners to identify a problem suitable for investigation through project work

- connects the problem with the context of the learners' world so that it presents realistic opportunities for learning
- organises the subject matter around the problem, not the subject
- gives learners responsibility for defining their learning experience and planning to solve the problem
- encourages learners to collaborate in learning
- expects all learners to demonstrate the results of their learning through a product or performance.

Inclusion

Inclusion means ensuring access and learning for all learners, especially those disadvantaged. The curriculum promotes:

- learning that is linked to the learners' backgrounds and to their prior experiences, interests, potential and capacities
- learning that is meaningful because it aligns with learners' abilities (e.g. learning that is oriented towards developing general capabilities and solving the practical problems of everyday life)
- the active involvement of the learners in the selection and organisation of learning experiences, making them aware of their importance and enabling them to assess their own learning progress.

Differentiation

Differentiated teaching means tailoring instructions to meet learners' individual needs. Differences between learners (in learning styles, interest and readiness to learn) are accommodated so that all learners in a group have the best chance of learning. Also, no learner should be held back by any other.

- *Differentiation by outcome* works well for open-ended tasks or projects. Learners are all given the same stimulus, material or task and answer at their own level of ability.
- Differentiation by task involves setting different tasks for learners of different abilities or grading the level of the task.
- Differentiation by support involves offering extra support to weaker learners.

Scaffolding

Instructional scaffolding involves the use of a variety of instructional techniques that move learners progressively towards a stronger understanding, and ultimately, greater independence in the learning process. Common scaffolding strategies include:

- giving learners a simplified version of a lesson, assignment or reading, and then gradually increasing the complexity, difficulty or sophistication over time
- describing or illustrating a concept, problem or process in multiple ways to ensure understanding.

Information communication technology (ICT)

Learners need to be exposed to various ICT tools, including calculators, radios, cameras, phones, televisions, computers and related software, e.g. Microsoft Office packages such as Word, Excel and PowerPoint. Familiarity with ICT tools provides opportunities for learners to fit into the global world and the world of work.

Core competencies

The core competencies describe a body of skills necessary for learners to develop to become critical thinkers, problem solvers, creators, innovators, good communicators, collaborators, culturally identified individuals, digitally literate and global citizens who have a keen interest in their personal development. These competencies include:

- critical thinking and problem solving (CP)
- creativity and innovation (CI)

- communication and collaboration (CC)
- cultural identity and global citizenship (CG)
- personal development and leadership (PL)
- digital literacy (DL).

Instructional expectations in the CCP Science curriculum

This serves as a summary of your role as teacher as intended by the CCP for Science. Your role includes the following:

- Guide and facilitate learning by generating discourse among learners and challenging them to accept and share responsibility for their own learning based on their own individual differences.
- Select science content, adapt and plan lessons to meet the interests, knowledge, understanding, abilities and experiences of learners.
- Work together as colleagues within and across disciplines and grade levels to develop communities of Science learners who exhibit the skills of scientific inquiry and the attitudes and social values conducive to science learning.
- Systematically gather data about learners' progress and understanding, using various assessment methods.
- Use assessment to guide your Science teaching and to provide feedback to both learners and parents.
- Design and manage learning environments that provide learners with time, space and resources needed for learning Science.

Organisation and structure of the Science curriculum/scope

The content, covered over the four years, is summarised in the following table. Each strand is divided into two to five topics (sub-strands). With three exceptions, these are the same throughout the four-year programme.

LEVEL		В7		B8		В9		B10
STRAND (SECTION)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)
DIVERSITY OF	1	Materials	1	Materials	1	Materials	1	Materials
MATTER	2	Living cells						
CYCLES	1	Earth Science						
	2	Life cycle of organisms						
	3	Crop production						
	4	Animal production						
SYSTEMS	1	The human body systems	1	The human body systems	1	The human body systems	1	The human body systems
	2	The solar system						
	3	The ecosystem						
	4	Farming systems						

LEVEL		В7		B8		В9		B10
STRAND (SECTION)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)
FORCES AND	1	Energy	1	Energy	1	Energy	1	Energy
ENERGY	2	Electricity and electronics						
	3	Conversion and conservation of energy						
	4	Force and motion						
	5	Agricultural tools						
HUMANS AND THE	1	Waste management	1	Waste management	1	Waste management	1	Waste management
ENVIRONMENT	2	Human health						
	3	Science and industry						
	4	Climate change and green economy						
	5	Understanding the environment	5	Understanding the environment	5	Understanding the environment	5	Understanding the environment

Table 1: Science syllabus of the CCP, Basic 7–10

Suggested time allocation

A total of four periods a week, each period consisting of 50 minutes.

Assessment

Assessment is the process of collecting and evaluating information about learners and using the information to improve their learning. Assessment is at its most powerful when it is development-focused, rather than just mark-focused.

Learners are assessed on:

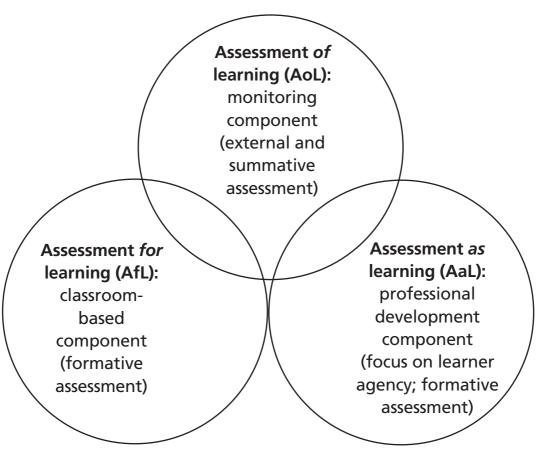
- knowledge, skills, attitudes and values
- the core competencies of critical thinking and problem solving (CP), creativity and innovation (CI), communication and collaboration (CC), cultural identity and global citizenship (CG), personal development and leadership (PL), and digital literacy (DL).

In addition, they are assessed on:

the 4Rs, including Reading, wRiting, aRithmetic and cReativity.

Modes of assessment

The CCP suggests that assessment involves three modes of assessment, namely assessment for learning, assessment as learning and assessment of learning. We illustrate these three modes of assessment in the diagram below.



Source: SA Journal of Education (http://www.sajournalofeducation.co.za/index.php/saje)

Figure 1: Three modes of assessment

The table below shows which assessment tasks are suitable for the different modes of assessment.

Assessment for learning	Assessment as learning	Assessment of learning
Class exercises	Portfolio	CAT
		CAT
Quizzes	Journal entries	End-of-term assessment
Class tests (written, oral, aural and/ or practical)	Project work	End-of-term assessment
Class assessment task (CAT)	Checklist	
	Questionnaire	

Table 2: Examples of assessment tasks for the different modes of assessment

Reporting school-based assessment (SBA)

A nationwide grading system for the CCP is given in the table below. It shows how the mark or score relates to the level of proficiency.

Le	vel of proficiency	Benchmark	Grade level descriptor
1.	Highly proficient (HP)	80% and above	Learner shows high level of proficiency in knowledge, skills and values and can transfer them automatically and flexibly through authentic performance tasks.
2.	Proficient (P)	68–79%	Learner demonstrates sufficient level of proficient knowledge, skills and core understanding; can transfer them independently through authentic performance tasks.
3.	Approaching proficiency (AP)	54–67%	Learner is approaching proficiency in terms of knowledge, skills and values with little guidance and can transfer understanding through authentic performance tasks.
4.	Developing (D)	40–53%	Learner demonstrates developing level of knowledge, skills and values but needs help throughout the performance of authentic tasks.
5.	Emerging (E)	39% and below	Learner is emerging with minimal understanding in terms of knowledge, skills and values but needs a lot of help.

Table 3: Levels of proficiency, benchmarks and the grade level descriptors

Assessment tools

Both you, as teacher, and the learners should assess learning. Learner assessment includes peer assessment and self-assessment.

- **Teacher assessment:** You observe learners at work and intervene or give guidance or feedback where necessary; you take note of learners' comments and questions in class; you mark work or tests.
- Peer assessment: Learners give comment or feedback; they swap books with a partner and mark each other's work.
- **Self-assessment:** Learners mark their own answers or compare their work with a partner, or other members of the group or class; they self-reflect.

We offer the following to help you with assessment:

- Some activities have an assessment suggestion which usually refers you to one of the generic rubrics on pages 136–137 at the end of this Teacher's Guide. You or the learners can use these for assessment of drawings, graphs, posters, reports, models and oral presentations.
- Each of the five sections (strands) covered in the Basic 8 Learner's Book ends with an assessment. You will find the marking memos for these at the end of each section in this Teacher's Guide.
- Learners can do some of the assessments for informal assessment. They then mark their own answers, or swap books with a partner for marking.
- Learners can do one or more of the assessments as an open book test for formal assessment.

Section 1

Diversity of matter

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: Materials		'
B8.1.1.1 Demonstrate knowledge of types of mixtures and understanding of the processes of scientific ways of separating the components of mixtures.	 B8.1.1.1.1 Identify types of mixtures by name and characteristics. Group materials such as powder, pebbles, bottle tops, salt, sugar, sand, gari, gravel, oil, water and others into two main categories: solids and liquids. Put any two of the materials (in 1) together and describe the resultant nature of the product formed. Draw observable conclusions on homogeneous and heterogeneous characteristics from mixtures of two or more materials such as sand and gravel; sand and water; oil and water. Compare and contrast solutes and solvents based on their physical characteristics. Identify and separate mixtures such as a sand and sugar mixture, sugar and salt mixture and solutions such as a salt solution, sugar solution, fruit juice and vinegar solution based on their physical properties. Identify a suspension as a type of mixture, e.g. a mixture of groundnut paste and water in a glass. Differentiate between a colloid and a suspension and show the colloidal effect. 	CP5.1, CP5.2, CP6.2, CC8.2, CP6.3, CP6.4, CC8.1
	 B8.1.1.1.2 Design and perform processes for separating kinds of mixtures. Perform activities such as distilling, filtering, sieving and others to separate different kinds of mixtures and present a report on your findings using drawings and written work. 	CI5.1, CC7.5
B8.1.1.2 Demonstrate understanding of atoms and the atomic structure of elements in the periodic table.	 B8.1.1.2.1 Describe atoms as composed of sub-atomic particles. Explain an atom of an element and its structure using/ linking it to the periodic table. List the sub-atomic particles found in the atom and indicate their location in the atom (e.g. proton, electron, neutron). State the electrical charges on the sub-atomic particles. Describe the differences between the atomic number and the mass number of elements. Determine the number of protons, neutrons and electrons in an atom. 	CP6.4, CP5.1, CP6.3, CP5.2
	 B8.1.1.2.2 Explain the arrangement of elements in terms of the number of protons in the nuclei of atoms of each element. 1. Explain how elements are arranged in order of the number of protons, using the periodic table. 2. Draw the distribution of electrons (electron configuration) in the atoms. 3. Explain the formation of ions. 4. Describe a molecule as a combination of atoms. 	CP6.3, CP5.1, DL5.1, CP5.6, CP5.3

Content standard	Indicators and exemplars	Core competencies						
Topic 2: Living cells								
B8.1.2.1 Demonstrate an understanding of the types of cells and their structure in relation to different organisms.	 B8.1.2.1.1 Examine and describe the structure of prokaryotic and eukaryotic cells. Compare and contrast prokaryotic and eukaryotic cells. Create a table to show a chart or a slideshow depicting images and labels of the types of cells. Identify their differences and similarities after observation. Draw and label a prokaryotic cell and a eukaryotic cell and make a presentation on what is observed. 	CP6.4, DL5.5, CP6.3, CC7.5						
	 B8.1.2.1.2 Classify organisms (plants or animals) as prokaryotic or eukaryotic based on the type of cells they are made of. 1. Observe and list examples of organisms (plants and animals) as prokaryotic or eukaryotic based on each cell type. 2. Explain the impact of prokaryotes and eukaryotes on humans' health and devise safety measures to protect them. 	CP6.3, DL5.5, CP6.2, CC8.2						

Topic 1: Materials

Module 1 Mixtures

Unit 1.1 Types of mixtures

Content standard

Demonstrate knowledge of types of mixtures and understanding of the processes of scientific ways of separating the components of mixtures.

Learning indicator

Identify types of mixtures by name and characteristics.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Explain plans for attaining goals.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Select alternatives that meet selected criteria.
- Identify important and appropriate criteria and use them to evaluate alternatives.
- Speak clearly and explain ideas.

Unit in a nutshell

CP5.1

- Pure substances rarely exist out of a laboratory environment.
- A mixture is a physical combination of two or more substances.
- A homogenous mixture is a type of mixture in which the composition is uniform.
- A colloid is a heterogenous mixture in which the particles are bigger than those in a solution, but smaller than those in a suspension.
- Combining different substances can result in five main types of colloid mixtures: aerosols, foams, emulsions, sols and gels. Some of these colloids exist naturally, while others are manufactured products. Depending on the types of particles and dispersion mediums you use, colloid mixtures can be healthy, neutral or dangerous.

LB page 5 **Group materials ACTIVITY 1.1** (Individual)

- 1. **Solids:** powder, pebbles, bottle tops, sand, gari, gravel, salt, sugar **Liquids:** oil, blood, kerosene, diesel, petrol, water, ink
- **2.** a) Accept any combination of the solids, for example, powder and pebbles.
 - **b)** Accept any combination of the liquids, for example, water and oil.
 - c) Accept any combination of a solid and a liquid, for example, salt and water.
- **3.** They do not mix uniformly.

PRACTICAL ACTIVITY 1

Draw conclusions about homogeneous and heterogeneous mixtures LB page 6

(Group/Class) CP5.2, CP6.2

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- Ensure that groups are of mixed ability. This will ensure that more-skilled learners have an opportunity to work with less-skilled learners; a form of peer-to-peer learning and teaching that can be very effective for retention and understanding.
- Ensure that the groups behave respectfully towards each other, especially encouraging girls to participate and take the lead.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.
- If laboratory-grade materials are not available, you can use table salt and crush up a piece of chalk.

Answers

- 1. When 5 g of salt is added to 250 ml of water and the mixture stirred, the salt dissolves completely, and a uniform mixture is formed.
 - The mixture of salt and water is homogeneous. This is because the salt dissolves completely in the water. The mixture forms a **solution**.
- 2. When 5 g of powdered chalk is added to 250 ml of water and the mixture stirred and allowed to stand, chalk particles are seen floating in the water. A non-uniform mixture is formed. The mixture of powdered chalk and water is heterogeneous. This is because the powdered chalk particles do not dissolve in the water. They are suspended in the water. The mixture forms a suspension.
- 3. When oil is added to water and the mixture is shaken vigorously and allowed to stand, two layers of mixture are formed. The oil is seen on top of the water.
 - The mixture of oil and water forms a heterogeneous mixture. The mixture is a type of **colloid** (i.e. **emulsion**).

EXPERIMENT 1

Create and describe a mixture

LB page 7

(Group/Class/Individual) *CP5.2, CC8.2*

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- Ensure that groups are of mixed ability. This will ensure that more-skilled learners have an opportunity to work with less-skilled learners.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.
- Thereafter, learners should write a paragraph independently.

Assessment

Use the rubric for report writing to assess the learners' paragraphs. See page 137.

EXPERIMENT 2

Differentiate between a colloid and a suspension

LB page 8

(Group/Class) *CP6.4, CP5.2, CC8.1*

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- Ensure that groups are of mixed ability. This will ensure that more-skilled learners have an opportunity to work with less-skilled learners.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.
- Ensure you work through the conclusion on page 9 of the Learner's Book carefully with them. They must understand the concept, as well as the terminology.

ACTIVITY 1.2

Compare and contrast solutions, suspensions and colloids

LB page 9

(Pair/Individual) *CP6.2*

4					
1.		Solutions	Suspensions	Colloids	
	Homogeneous or heterogeneous	Homogeneous	Heterogeneous	Homogeneous	
	Particle size	Tiny	Can be large	Bigger than solution, smaller than suspension	
	Sedimentation	Does not settle on standing	Settles	Does not settle	
	Can/Cannot be separated by filtration	Cannot	Can	Cannot	

2. Light can pass through a solution, whereas it cannot pass through a colloid.

REMEDIAL ACTIVITY

It is important to ensure learners understand the terminology. Learners can complete vocabulary-based exercises, such as match the term with its definition, or even crosswords or word searches (you can create these free-of-charge online; search 'free crossword builder').

Unit 1.2 Methods of separating mixtures

Content standard

• Demonstrate knowledge of types of mixtures and understanding of the processes of scientific ways of separating the components of mixtures.

Learning indicator

Design and perform processes for separating kinds of mixtures.

Core competencies

- Examine alternatives in creating new things.
- Identify and analyse different points of views of speakers.

Unit in a nutshell

- Physical methods of separation do not involve chemical reactions.
- Hand sorting refers to the act of physically separating large particles of a material from another material.
- Magnetisation can be used to separate magnetic materials from non-magnetic materials.
- Decantation can be used to separate a solid and a liquid, but only if they have different densities.
- Sieving is used to separate a material with a small particle size from another material with a larger particle size.
- Filtration is used to separate an insoluble solid from a liquid.
- Evaporation is used to separate a liquid from a solid. However, the liquid may not be recoverable.
- Distillation can be used to separate two liquids that have different boiling points.
- You can demonstrate all of these methods of separation using basic household and kitchen substances and objects.

EXPERIMENT 1

Separate iron filings and flour

LB page 10

(Group/Class) CI5.1, CC7.5

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- Ensure that groups are of mixed ability. This will ensure that more-skilled learners have an opportunity to work with less-skilled learners.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.

EXPERIMENT 2

Separate a mixture of sand and water

LB page 12

(Group/Class) *CI5.1, CC7.5*

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.

EXPERIMENT 3

Demonstrate how salt is separated from water LB page 14

(Group/Class) *CI5.1, CC7.5*

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.
- Ensure that groups are of mixed ability so that more-skilled learners have an opportunity to work with less-skilled learners.
- Ensure that girls are encouraged to take the lead and to participate fully. If necessary, you can create girls-only groups to build girls' confidence in speaking in groups.

EXPERIMENT 4

Separate a mixture of acetone and water

(Group/Class) CI5.1, CC7.5

Guidelines

- If possible, allow learners to perform the experiment in small groups.
- Ensure that groups are of mixed ability so that more-skilled learners have an opportunity to work with less-skilled learners.
- If there are not enough resources, or if there is not enough time, it is possible for you to do it as a class demonstration, and then to allow the learners to discuss their observations in small groups.

ACTIVITY 1.3

Identify the method used to separate salt and water

LB page 16

LB page 15

(Group/Class) *CI5.1, CC7.5*

Answers

- 1. A retort stand/clamp
 - B thermometer
 - C condenser
 - D water
- 2. Simple distillation

- **3.** Thermometer measures the temperature of the vapour above the mixture. Condenser cools the vapour passing through the delivery tube.
- **4.** Physical processes involved are boiling, vaporisation/evaporation and condensation.

ACTIVITY 1.4

Visit a distillery

LB page 17

(Class) CI5.1, CC7.5

Guidelines

- If possible, arrange to visit a local and informal distillery.
- If you cannot visit a local distillery, or before you visit the distillery, allow learners to watch the following videos:
- Regional Report: A day in the life of an akpeteshie distiller: https://www.youtube.com/watch?v=nCoSgPB0cOQ
- How local gin, akpeteshie, is brewed in Ghana A day at Hakeem's Camp: https://www.youtube.com/watch?v=ryGePGtlsyU
- If possible, organise a trip to an industrial distillery. Learners should compare the equipment and the processes involved.

ASSESSMENT ACTIVITY

LB page 18

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. A mixture is a physical combination of two materials/substances.
- 2. Because materials have different properties, it is possible for them to be physically separated.
- **3.** a) Homogeneous mixtures are uniform. These are called solutions. Heterogeneous mixtures are non-uniform. These are either suspensions or colloids.
 - b) Homogeneous: sugar water solution; heterogeneous: water and oil.
- **4.** A **solute** is any substance that dissolves in a **solvent**.
- **5.** Temperature, stirring/shaking, size of the particles
- **6.** Distillation works by heating the mixture, so that the liquid with the lower boiling point changes to a gas. The vapour is collected separately and cooled, so that it condenses. This condensation is channelled to a separate beaker, where the now pure liquid can collect.
- **7.** Filtration

Atoms

Unit 2.1 What are atoms?

Content standard

• Demonstrate understanding of atoms and the atomic structure of elements in the periodic table.

Learning indicator

Describe atoms as composed of sub-atomic particles.

Core competencies

- Identify important and appropriate criteria and use them to evaluate alternatives.
- Combine information and ideas from several sources to reach a conclusion.
- Identify important and appropriate alternatives.
- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Select alternatives that adequately meet selected criteria.

Unit in a nutshell

- All matter is made up of elements, and elements are made up of atoms, molecules and ions.
- The atom is the smallest particle.
- Atoms are electrically neutral. They have no charge.
- The four parts of an atom are: nucleus, electrons, protons, neutrons.

ACTIVITY 2.1

Work with atoms and the periodic table

LB page 23

(Individual)

CP5.1, CP5.2, CP6.3, CP6.4

1.

Element	Symbol	Atomic number (Z)	Mass number (A)	Neutrons (N)
Hydrogen	Н	1	1	0
Helium	Не	2	4	2
Lithium	Li	3	7	4
Beryllium	Ве	4	9	5
Boron	В	5	11	6
Carbon	С	6	12	6
Nitrogen	N	7	14	7
Oxygen	0	8	16	8
Fluorine	F	9	19	10
Neon	Ne	10	20	10
Sodium	Na	11	23	12
Magnesium	Mg	12	24	12
Aluminium	Al	13	27	14
Silicon	Si	14	28	14
Phosphorus	Р	15	31	16
Sulfur	S	16	32	16
Chlorine	Cl	17	35	18
Argon	Ar	18	40	22
Potassium	K	19	39	20
Calcium	Ca	20	40	20

- **2. a)** 35 (Z + N = A)
 - b) Chlorine

REMEDIAL ACTIVITY

Create a model of an atom using cheap resources, such as papier mâché or polystyrene balls. Refer to the model during lessons, so that learners can understand how an atom is composed.

Unit 2.2 The arrangement of elements

Content standard

• Demonstrate understanding of atoms and the atomic structure of elements in the periodic table.

Learning indicator

• Explain the arrangement of elements in terms of the number of protons in the nuclei of atoms of each element.

Core competencies

- Select alternatives that adequately meet selected criteria.
- Combine information and ideas from several sources to reach a conclusion.
- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Create simple logic trees to think through problems.

Unit in a nutshell

- Elements in the periodic table are arranged in order of increasing atomic number.
- Learners must be familiar with the periodic table: how it is arranged, and how to read it and use it.
- Electron configuration is the arrangement of electrons in the shell of an atom.
- lons are formed when atoms gain or lose one or more electrons.
- Cations are formed when atoms lose one or more electrons.
- Anions are formed when atoms gain one or more electrons.
- Molecules are formed when two or more atoms are chemically joined together.

ACTIVITY 2.2	Draw the distribution of electrons in atoms	LB page 27
(Individual) CP5.1, DL5.1		

Element Electron configuration of the atom Diagram Hydrogen 1H:1

Element	Electron configuration of the atom	Diagram
Lithium	₃ Li: 2, 1	Diagram
Carbon	₆ C: 2, 4	
Sodium	₁₁ Na : 2, 8, 1	
Magnesium	₁₂ Mg : 2, 8, 2	
Potassium	₁₅ P: 2, 8, 5	
Argon	₁₈ Ar : 2, 8, 8	
Chlorine	₁₇ CI : 2, 8, 7	

ACTIVITY 2.3	Explain the formation of ions	LB page 30
(Individual) <i>CP5</i> .6		

- 1. Zinc, potassium, chlorine, phosphorus, magnesium, sodium, oxygen, lithium, helium, hydrogen
- 2. Cation: zinc, potassium, magnesium, sodium, lithium, helium, hydrogen Anion: chlorine, phosphorus, oxygen

REMEDIAL ACTIVITY

Encourage learners to create mind maps or logic trees to solve the problems in this unit. It is in their interest to write down their thinking/working out as this allows them to systematically arrive at the answer.

ASSESSMENT ACTIVITY

LB page 31

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. A electron
 - B neutron
 - C proton
 - D nucleus
- 2. The elements with similar properties are found in a column, called the **group**, and a row, called the **period**.
- 3. They share similar properties.
- **4.** A combination of atoms
- **5.** 2, 8, 1
- **6.** Cations are positively changed atoms. Most metals form cations. Anions are negatively charged atoms. Most non-metals form anions.
- 7. a) hydrogen and oxygen
 - b) carbon dioxide
 - c) sodium chloride

Topic 2: Living cells

Module 3

Prokaryotic and eukaryotic cells

Unit 3.1 The structure of cells

Content standard

• Demonstrate an understanding of the types of cells and their structure in relation to different organisms.

Learning indicator

• Examine and describe the structure of prokaryotic and eukaryotic cells.

Core competencies

- Identify important and appropriate criteria and use them to evaluate alternatives.
- Evaluate the quality and validity of information.
- Select alternatives that adequately meet selected criteria.
- Identify and analyse different points of views of speakers.

Unit in a nutshell

- A cell is the smallest functional unit of a living thing.
- Every living organism on Earth is classified as a prokaryote or a eukaryote.
- Prokaryotic cells are small and simple cells. Prokaryotes are unicellular organisms.
- Eukaryotes are generally multicellular. Eukaryotic cells are more complex.
- The key difference between prokaryotic cells and eukaryotic cells is that prokaryotic cells lack membrane-bound organelles, including a nucleus.
- Prokaryotic cells and eukaryotic cells both contain DNA, plasma membrane, cytoplasm and ribosomes.

ACTIVITY 3.1

Draw and label a prokaryotic cell

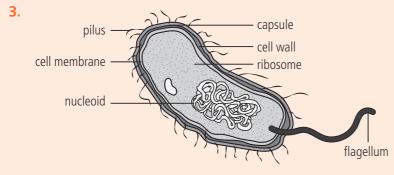
LB page 34

(Individual/Pair) *CP6.3, CC7.5*

Guidelines

- Learners should work individually for guestions 1 and 2.
- Then, allow them to work in pairs or small groups to discuss their observations.
- They are required to have prior knowledge of plant and animal cells for this activity. Do remedial work for learners who may not have this baseline knowledge.

- 1. Prokaryotic cells **lack** membrane-bound organelles, such as a **nucleus**. Instead, the cells consist of a single **open space** that has separate **regions**.
- 2. a) Capsule, cell membrane, pili, flagella
 - b) Learners should split up into pairs or small groups and present their observations to each other. They should note the lack of organelles. Allow them to discuss their observations freely using their own words. It is more important, for now, that they see the differences rather than get the terminology right. However, it is worth wrapping up with a class discussion, and for you to model the correct terminology when you do that.



ACTIVITY 3.2

Make a presentation on what you observe about a eukaryotic cell LB page 36

(Individual/Group/Class) *CP6.3, CC7.5*

Guidelines

- Provide learners with A3 sheets of paper. Encourage them to use the scientific rules for drawing and labelling, which includes a heading for the drawing.
- Write up the assessment rubric on the board so that learners know how their diagrams will be assessed.
- The presentations can also be assessed using a rubric. However, because only one learner from each group will present to the class, this assessment can be peer assessment and informal.
- Split the class into groups of six to eight learners. Ensure that groups are of mixed ability. One learner
 from each group will be elected to present to the class. Set aside enough time for these two-minute
 presentations.

Answers

- 1. A mitochondrion
 - B Golgi body
 - C endoplasmic reticulum
 - D nucleus
 - E cell wall
 - F large vacuole

- 2. A Golgi body
 - B lysosome
 - C nucleus
 - D endoplasmic reticulum
 - E mitochondrion
- 3. The learners must choose to draw either a plant cell or animal cell. They must include all the labels observed in question 1 or 2, as well as adding others, such as the cell membrane, etc.

Assessment

See the rubric for diagrams on page 136 and oral presentations on page 137.

ACTIVITY 3.3

Compare and contrast prokaryotic and eukaryotic cells

LB page 38

(Individual/Pair) *CP6.4*

Answers

- 1. a) Eukaryotic cell
 - b) Prokaryotic cell
- 2. C ribosomes; D plasma membrane
- 3. a) Learners can mention the nucleus, mitochondria, lysosome.
 - b) Learners can mention capsule, flagellum, pili.
 - c) DNA and cytoplasm



INTERNET

This video is an entertaining comparison between eukaryotic and prokaryotic cells. If you have the resources available, show it to the class. It also explains how antibiotics work, which will be useful information for Unit 3.3: https://www.youtube.com/watch?v=Pxujitlv8wc.

ACTIVITY 3.4

Create a table to identify the different cells LB page 38

(Individual/Pair)

Guidelines

- Allow learners to discuss the table in pairs. Working with a peer is an effective way to learn and retain new information.
- Each learner must then complete the table individually. You can assign this for homework if you run out of class time.

	Prokaryotic cell	Eukaryotic cell	
Cell structure	Unicellular	Multicellular	
Where is DNA found?	In the nucleoid	In the nucleus	
Key difference	No membrane-bound organelles; consist of single open space with separate regions	Contain a nucleus and membrane-bound organelles	
Key similarity	Contain ribosomes for protein synthesis		
Simple diagram showing basic structure of the cell	pilus capsule cell wall ribosome nucleoid flagellum	endoplasmic reticulum nuclear membrane ribosome Golgi body mitochondrion plasma membrane	

REMEDIAL ACTIVITY

Ask learners to draw large scientific drawings (with labels) of each cell. They should do this on A3 sheets of paper. Display these in the class.

Unit 3.2 Classifying organisms

Content standard

• Demonstrate an understanding of the types of cells and their structure in relation to different organisms.

Learning indicator

• Classify organisms (plants or animals) as prokaryotic or eukaryotic based on the type of cells they are made of.

Core competencies

- Select alternatives that adequately meet selected criteria.
- Evaluate the quality and validity of information.
- Explain plans for attaining goals.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

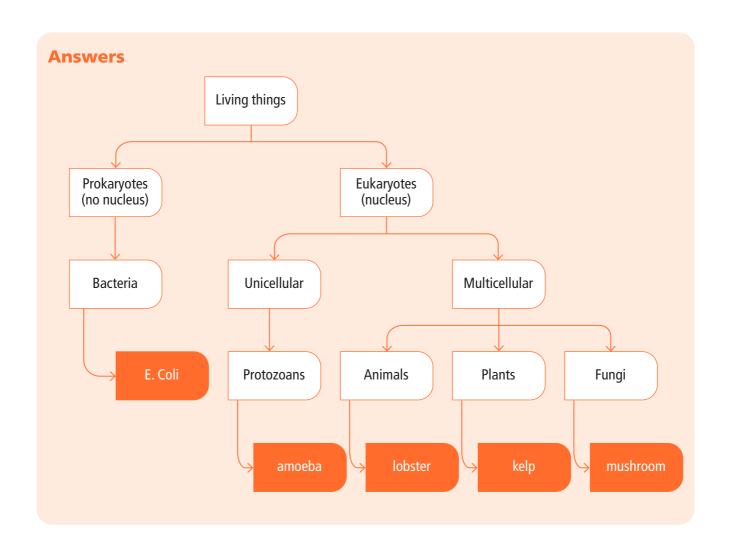
- Introduce the concept of classification by asking learners to classify common objects or concepts. For
 example, prepare a large selection of animals for them to classify as 'land animals' or 'water animals'.
 Then, extend to classifying the water animals as 'river animals' or 'sea animals'. Draw this logic tree on
 the board as an introduction to the first activity.
- Eukaryotes include multicellular organisms, such as plants, animals and algae and most types of fungi.
- Protozoans are unicellular, although they have a nucleus. Therefore, they are classified as eukaryotes.
- Bacteria are unicellular and classified as prokaryotes.

ACTIVITY 3.5

Observe and list examples of organisms

LB page 39

(Individual/Pair) *CP6.3, DL5.5*



Unit 3.3 Impact of prokaryotes and eukaryotes on human health

Content standard

• Demonstrate an understanding of the types of cells and their structure in relation to different organisms.

Learning indicator

• Classify organisms (plants or animals) as prokaryotic or eukaryotic based on the type of cells they are made of.

Core competencies

- Explain plans for attaining goals.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- This unit is a good opportunity to discuss diseases such as Ebola and COVID-19. Find up-to-date information and news sources about these, as the situation is constantly evolving.
- Bacteria have a bad reputation, but mutualistic bacteria are essential for good health. It is important for you and the learners to make this distinction.
- Harmful bacteria can cause bacterial infections. Bacterial infections will be covered in more detail in Module 15. Here, it is most important for learners to understand that bacteria are prokaryotes.
- Eukaryotes impact health indirectly (by carrying disease-causing pathogens) and directly (by causing disease).
- An example of a eukaryote that has an impact on human health is the *Plasmodium* parasite, carried by the *Anopheles* mosquito. This eukaryote causes malaria. Learners will cover malaria in more detail in Module 5.

ACTIVITY 3.6

Explain the impact of prokaryotes on human health

LB page 41

(Individual/Group) *CP6.2, CC8.2*

- The learners will need at least a week or two to conduct research and compile their report.
- Encourage the learners to paraphrase information (i.e. they should not plagiarise), and to include a bibliography.
- On the due date of the report, split the class into groups of four to six learners. Ensure that groups are of mixed ability. Each learner must present their report to their group. This is an excellent teaching and learning tool. Learners often learn most effectively from their peers.
- Take in the reports for marking. Use the rubric to mark the reports. This rubric should be given to the learners before they start the activity.

Assessment

See the rubric for reports on page 137.

ACTIVITY 3.7

Explain the impact of eukaryotes on human health

LB page 42

(Individual) *CP6.2, CP8.2*

Guidelines

- Give learners enough time to formulate their opinion/reasoning, and then to write their paragraph.
- Go through the writing process with them: plan, draft, edit, write, proofread, present.
- They will then research one of the diseases mentioned in Figure 3.8. Allow them to use the internet to conduct this research. Alternatively, try to have relevant news articles, journal articles or printed information sheets available for them.

Answers

- 1. Learners' answers will vary, but in this question, the learners must be able to link human activity with the outbreak of certain diseases.
- 2. The answers to this question will depend on which disease the learner picks. In their response to the second part (describe how the disease can be prevented), it should be clear that the learners are able to see the link between human activity and the outbreak of the diseases. They should mention at least two of the following prevention/control methods:
 - Tracking outbreaks so that they can be contained
 - Ensuring that health and safety guidelines are followed when farming or hunting, or when preparing meat
 - Educating people to understand how disease is spread.

ACTIVITY 3.8

Devise safety measures to protect human health

LB page 45

(Pair) *CP6.2, CC8.2*

- Allow time for pairs to read the article and discuss the questions. They will also need to read the case study beforehand.
- If there is not enough time for the pairs to present their role-plays to the class, then break the class up into groups of six to eight learners. Ensure that groups are of mixed ability. Each pair can then present their role-plays to the group.

Answers

- 1. There are only two beds, and over 30 people need treatment daily.
- 2. These are the rainy months in Ghana. Mosquitos breed during these months, and so there are more mosquitos around, causing the outbreak.
- 3. Learners must draw their information from the case study and the article.

ASSESSMENT ACTIVITY

LB page 46

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- **1.** a) A
 - **b)** C
- 2. a) A eukaryotic cell
 - B prokaryotic cell
 - C cytoplasm
 - D endoplasmic reticulum
 - E nucleus
 - F ribosomes
 - G plasma membrane
 - b) Prokaryotic cells do not have a nucleus.
 - c) Any two: plasma membrane, DNA, ribosomes, cytoplasm

Section 1 Assessment

LB page 47

Activity 1: Multiple choice

1. C

2. E

3. B

4. D

5. D

6. D

7. D

8. D

9. C

10. B

Activity 2: Short questions

a) Saturated solution is a solution that cannot dissolve any more solute at a given temperature.
 Examples are carbonated drinks, seawater.

Pure substance has a fixed (constant) composition and contains only one type of particle. Examples are gold (metal), diamond, hydrogen gas.

Colloid is a heterogeneous mixture in which the dispersed particles are intermediate in size between those of a solution and a suspension. Examples are blood, glue, toothpaste. (3)

d) Suspension is a heterogeneous (non-uniform) mixture of two substances, one of which is finely divided and dispersed in the other. Examples are sand and water, chalk and water, muddy water.

2. a) Evaporation

- b) Filtration/Sieving
- c) Filtration
- d) Hand sorting/Sieving
- e) Magnetisation

f) Filtration (6)

- 3. a) Turpentine
 - b) Water
 - c) Water

d) Alcohol (4)

4.

Shell number (energy level) (<i>n</i>)	Shell name	Maximum number of electrons (N)
1	К	2
2	L	8
3	М	18
4	N	32
5	0	50
6	Р	64

(6)

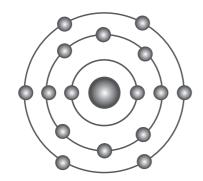
(10)

(3)

(3)

Section 1 Assessment (continued)

5. a)



b) Electron configuration of atom *X* is 2, 8, 6

6. a) (i) Proton number is 13 and electron number is 13 (2)

(ii) Proton number is 13 and electron number is 10 (2) **b)** Cation (2)

7.	Atom	lon
	Atoms are electrically neutral.	lons are electrically charged. They carry either positive or negative charge.
	The number of protons is equal to the number of electrons.	The number of protons differ from the number of electrons.

8. a)

Protons		Electrons	
1.	They are positively charged.	They are negatively charged.	
2.	They are found in the nucleus.	They are found in shells or orbit around the nucleus.	(4)

- b) Both are charged particles. In a neutral atom, the number of protons is equal to the number of electrons. (4)
- 9. A prokaryotes
 - B eukaryotes
 - C multicellular
 - D unicellular (4)

Total: 65

(3)

(2)

(4)

Cycles

Learning outcomes

Content standard	Indicators and exemplars	Core competencies	
Topic 1: Earth scien	ice		
B8.2.1.1 Demonstrate understanding of the process of the carbon cycle as an example of repeated patterns of change in nature and how it relates to the environment.	 B8.2.1.1.1 Explain the process of the carbon cycle. Identify the carbon cycle from the internet, charts or pictures and write short notes on what happens at each stage. Produce a flow chart to trace the process of the carbon cycle in nature. Explain the process of the carbon cycle depicting processes such as: a) Photosynthesis b) Respiration c) Burning d) Decay. Compile information on the carbon cycle and give reasons why it is a repeated pattern, e.g. it is because the carbon is circulated continuously in the environment. 	DL5.1, CP6.3, CC8.2, CP6.4	
	 B8.2.1.1.2 Describe the role of the carbon cycle to the environment. 1. Describe the role of the carbon cycle in maintaining balance in the composition of air in the environment. E.g. plants absorb carbon in the form of carbon (IV) oxide from the air for photosynthesis and oxygen is produced for respiration and in return, respiration gives out carbon in the form of carbon (IV) oxide. Note: Discuss photosynthesis and respiration in plants as part of the carbon cycle. 2. Explain the effect of the carbon cycle on food chains, using diagrams. 3. Describe the relationship between greenhouse gases and the carbon cycle. 	CP5.5, CC8.2, DL5.1, CP6.1	
Topic 2: Life cycle of organisms			
B8.2.2.1 Demonstrate an activity to show the life cycle of the <i>Anopheles</i> mosquito and show how the effects of the mosquito on humans can	 B8.2.2.1.1 Describe the life cycle and economic importance of the <i>Anopheles</i> mosquito. 1. Observe and draw the different stages of the life cycle of the <i>Anopheles</i> mosquito, e.g. by breeding the mosquito in a glass jar. 2. Describe the economic importance of the <i>Anopheles</i> mosquito. 	CP6.4, DL5.5, CP6.2, CC8.2	
be managed.	 B8.2.2.1.2 Discuss the impact of the <i>Anopheles</i> mosquito on humans and how it can be controlled. Discuss the impact of the female <i>Anopheles</i> mosquito as a vector of <i>Plasmodium</i> on humans. Generate solutions to control malaria in Ghana. 	CC8.2, CP6.1	

Content standard	Indicators and exemplars	Core competencies	
Topic 3: Crop production			
B8.2.3.1 Demonstrate knowledge and skills in planting crops in different seed beds.	 B8.2.3.1.1 Explore the different seed beds for planting crops in your community. 1. Observe and discuss different seed beds for planting different crops. 2. List and compare the differences and similarities among seed beds in the community. 3. Match the types of seed beds with the types and stages of crops planted in your community. 	CP6.2, CP5.3	
	 B8.2.3.1.2 Plant different types of crops in different seed beds. 1. Observe and discuss the practice of planting different crops in different seed beds. 2. Select different plant parts, (seeds, seedlings, cuttings, leaves, roots) and plant them in different seed beds. 	CP6.2, CC8.2, CP6.2	
B8.2.3.2 Demonstrate understanding of the differences in height, size, and flowering of crops grown in different seed beds.	 B8.2.3.2.1 Compare and contrast the differences in height, size, and flowering of crops grown in different seed beds. Measure the heights, sizes, number of flowers, and number of fruits of plants grown in different seed beds. Discuss the differences and similarities in the heights, sizes, number of flowers and fruits of plants grown in different seed beds using tables and graphs. Write and give presentations on the reasons for differences in the heights, sizes, number of flowers and fruits of plants grown in different seed beds. 	CP5.5, CP5.2, CC8.2	
Topic 4: Animal pro	oduction		
B8.2.4.1 Recognise the different types of feed for different types of animals.	 B8.2.4.1.1 Compare and contrast the different types of feed for different types of animals. Match the different types of feed with different types of animals. Discuss the types of nutrients and their sources in the different types of animal feed. Select and discuss appropriate feed for animals based on the proportions of nutrients indicated on the package or labels. 	CP6.1, CP5.5	
B8.2.4.2 Demonstrate understanding of the importance of water and animal feed to the growth of animals.	 B8.2.4.2.1 Explain the importance of water and animal feed to the growth of animals. List and discuss the usefulness of water and feed for the growth and reproduction of animals. Predict what will happen to animals who are not provided with adequate water. 	CP5.6, CC8.2, CP5.5	

Topic 1: Earth science

Module 4 The carbon cycle

Unit 4.1 The process of the carbon cycle

Content standard

Demonstrate understanding of the process of the carbon cycle as an example of a repeated pattern of change in nature and how it relates to the environment.

Learning indicator

Explain the process of the carbon cycle.

Core competencies

- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.
- Select alternatives that adequately meet selected criteria.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Identify important and appropriate criteria and use them to evaluate alternatives.

Unit in a nutshell

- Along with the water cycle, the nitrogen cycle and the rock cycle, among others, the carbon cycle is an essential process for life on Earth.
- Carbon is the building block of all life on Earth.
- Carbon can be ingested (for example, when an animal eats another animal), or it can be absorbed in gas form (especially as carbon dioxide).
- The carbon cycle maintains balance in the biosphere. However, humans are upsetting that balance by burning fossil fuels at a fast rate. This will be covered in more detail in Unit 4.2.
- Revise the biosphere with the learners if you need to. The biosphere (bio-meaning life) is where life is found on Earth, and includes the water, the soil, the rocks and the lower sections of the atmosphere.

ACTIVITY 4.1

Identify the carbon cycle from the internet LB page 51

(Individual/Group) DL5.1

Guidelines

Learners may not understand why they are expected to research the carbon cycle before doing any theory on it in the Learner's Book. Explain that knowing how to find information, process it, and communicate it is an important learning tool and skill.

- If possible, allow them to visit the website listed in the Learner's Book, which contains a short article on the carbon cycle. They should then relate it to the diagram provided.
- If there are no resources available to allow learners to use the internet, then you should give them time to visit the library to find information on the carbon cycle. Alternatively, have books and resources available in the classroom.
- Once they have done their reading and made notes, they should break into small groups and discuss with one another what they have found. Ensure that groups are of mixed ability.

ACTIVITY 4.2

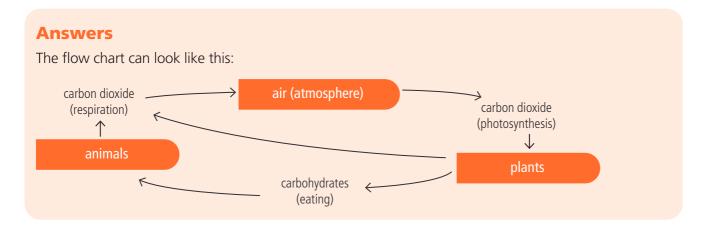
Produce a flow chart to trace the process of the carbon cycle in nature

LB page 53

(Individual/Group) *CP6.3, CP8.2*

Guidelines

- The most important aspect of the flow chart is that learners must understand that the carbon cycle is continuous. In other words, they should not draw a linear process.
- Allow them time to draw their own flow charts, and to write notes.
- Then, they should break into pairs or small groups. Each learner should present their flow charts to their partner/group, and then listen as the others do the same.
- It is important for the learners to try and draw the flow chart from memory, applying what they have learned, rather than simply copying the flow charts from the Learner's Book. You may consider doing this activity as a pop quiz.



(Individual)

CP6.4, CC8.2

Explain the process of the carbon cycle

LB page 54

Answers

- 1. a) Plants use carbon dioxide, which is a by-product of animal respiration; animals eat plants, which they can only do because plants have produced their own food.
 - b) sunlight + carbon dioxide = oxygen + glucose
 - c) Animals and humans breathe in oxygen and breathe out carbon dioxide. Plants use carbon dioxide for photosynthesis, and oxygen is a by-product. This exchange of gases maintains balance and is an example of mutualism.
- 2. a) Coal, oil and natural gas
 - b) Fossil fuels form when dead organisms decay and are buried deep underground for millions of years. These remains are reservoirs of carbon. When fossil fuels are burned, they release the carbon that is stored in them.

ACTIVITY 4.4

Compile information on the carbon cycle

LB page 54

(Individual) DL5.1, CC8.2

- **1.** a) The order of the events is not right; it shows a linear process, while the carbon cycle is continuous; photosynthesis occurs before respiration (it is necessary for animal respiration).
 - b) See Activity 4.2 on page 29 for a correct carbon cycle. Learners can simply switch the order listed in the flow chart and add arrows to show the interconnections and continuous flow.
 - c) Carbon is reused and recycled continuously throughout the carbon cycle. The carbon cycle does not have a beginning and an end.
- 2. Learners should be able to see that the forest has vegetation and other life forms that contain carbon. The beach sand will also store carbon. Likewise for the vegetation and life (marine animals, etc.) found in the ocean. The learners can describe how the vegetation (in the forest and the oceans) will undergo photosynthesis, using carbon dioxide and releasing oxygen into the atmosphere, which will be used by animals for respiration (the by-product of which is more carbon dioxide). Additionally, any decaying matter will have carbon stored, and will be absorbed into the earth.

Unit 4.2 The role of the carbon cycle in the environment

Content standard

• Demonstrate understanding of the process of the carbon cycle as an example of repeated patterns of change in nature and how it relates to the environment.

Learning indicator

Describe the role of the carbon cycle in the environment.

Core competencies

- Effectively evaluate the success of solution used in an attempt to solve a complex problem.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.
- Effectively define goals towards solving a problem.

Unit in a nutshell

- The carbon cycle maintains balance in the composition of the environment.
- Plants absorb carbon in the form of carbon dioxide from the air from photosynthesis, and oxygen is
 produced for respiration in return. When animals and humans respire, they take in oxygen and give out
 carbon dioxide.
- Carbon also moves through the food chain.
- Fossil fuels are reservoirs of carbon. When they are burned for energy, they give off carbon dioxide.
- Carbon dioxide is a greenhouse gas. Too much carbon dioxide in the atmosphere has led to the enhanced greenhouse effect.



INTERNET

This website is a good online teaching tool for this content: https://climatescienceteaching.org/lesson/carbon-cycle/intro

ACTIVITY 4.5

Describe the role of the carbon cycle in maintaining balance in the composition of air in the environment

LB page 56

(Individual/Pair) *CP5.5, CC8.2*

- Allow learners to discuss the questions in pairs. They should then answer the questions individually.
- Giving learners an opportunity to discuss the work with a partner helps them to formulate their ideas, and to express them in a clear and thoughtful way.

- Try to partner learners who have different abilities. If you teach in a mixed school, ensure that girls are encouraged to participate fully and to express themselves freely. If necessary, partner girls with girls to build their confidence when speaking in pairs and groups.
- This activity is a good baseline for you. If the learners struggle to answer the questions, you will need to go back and revise photosynthesis and mutualism.

Answers

- 1. A oxygen; B carbon dioxide
- 2. The diagram shows that humans/animals and plants live in balance in the environment. Humans need oxygen to carry out life processes. Humans exhale carbon dioxide, which plants use (along with sunlight) to create food. Plants give off oxygen during photosynthesis. In this way, oxygen and carbon dioxide are cycled and recycled between humans/animals and plants.

ACTIVITY 4.6

Explain the effect of the carbon cycle on food chains

LB page 57

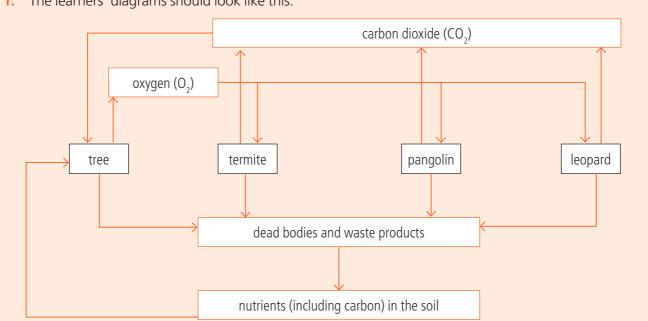
(Pair/Individual) CP5.5, DL5.1

Guidelines

- Allow learners to discuss the activity in pairs or small groups. Draw their attention to Figure 4.5 on page 57 of the Learner's Book. Ask them to discuss it in detail. It is important that they understand how carbon moves through the food chain, and the interconnections.
- Learners can then answer the questions individually. If you prefer, you can give them this activity to complete as homework.

Answers

1. The learners' diagrams should look like this:



2. When animals and plants die and decay, their bodies decompose, and the carbon is absorbed into the soil. Carbon is also contained in the waste products that are excreted by consumers in the food chain. This is then included as part of the nutrients that the plants growing in the soil absorb.

ACTIVITY 4.7

Describe the relationship between greenhouse gases and the carbon cycle

LB page 58

(Individual) *CP6.1*

Guidelines

• Learners will need to use a dictionary, or rely on context, to find the definition for 'afforestation'.

Answers

- 1. The greenhouse gases include carbon dioxide and other gases. These trap solar heat in the atmosphere. However, an increase in deforestation and the burning of fossil fuels has led to an excess of carbon dioxide and other greenhouse gases in the atmosphere.
- 2. a) Vegetation, including trees, absorb carbon dioxide (which they use for photosynthesis). However, if there are fewer trees, less carbon dioxide will be absorbed, leading to higher levels of carbon dioxide in the atmosphere.
 - **b)** Farming and agricultural activity
 - c) Afforestation is the planting of trees to replace trees that have been cut down.
 - d) Any two: reduce the effects of arable farming, limit the clearance of trees from farmlands, enhance the provision of ecosystem services, improve the soil's fertility and moisture content.

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) A photosynthesis; B plants (can also accept carbon dioxide); C respiration; D animals (can also accept oxygen)
 - b) Photosynthesis is the process during which plants convert sunlight and carbon dioxide into glucose and oxygen.
 - c) Animals and humans breathe in oxygen; when they breathe out, they release carbon dioxide into the atmosphere, which plants need for photosynthesis.
- 2. Carbon moves through the food chain. When an organism such as an animal or plant dies, it begins to decay. The carbon contained in the remains breaks down and is absorbed by the soil. Thus, the carbon begins its movement through the food chain once more. Similarly, waste products contain traces of carbon that are absorbed by the soil and water.
- 3. a) Fossil fuels are the ancient remains of animals and vegetation. Over millions of years, with pressure and heat, these remains have transformed into coal, oil and natural gas. Humans use these for energy.
 - b) Fossil fuels are reservoirs of carbon. When they are burned, the carbon is released.
 - c) Learners can draw a simplified diagram that explains the greenhouse effect. Their drawing should show how atmospheric gases trap heat and allow some heat to escape.
 - d) Because of the over-reliance on fossil fuels, there is an excess of carbon dioxide and other gases in the atmosphere. This has led to the enhanced greenhouse effect, which means that less solar energy is able to escape the Earth's atmosphere. This has led to global warming, and the current climate emergency.

Topic 2: Life cycle of organisms

Module 5

Life cycle of the mosquito

Unit 5.1 The Anopheles mosquito

Content standard

Demonstrate an activity to show the life cycle of the Anopheles mosquito and show how the effects of the mosquito on humans can be managed.

Learning indicator

Describe the life cycle and economic importance of the *Anopheles* mosquito.

Core competencies

- Identify important and appropriate criteria and use them to evaluate alternatives.
- Evaluate the quality and validity of information.
- Explain plans for attaining goals.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.

Unit in a nutshell

- Learners will remember that the mosquito, as well as the *Plasmodium* parasite, are eukaryotes. These have an impact on human health.
- The female mosquito bites to draw blood. Its saliva may be infected with the *Plasmodium* parasite.
- The life cycle of the mosquito is egg \rightarrow larva \rightarrow pupa \rightarrow adult.
- Mosquitoes are an important part of the ecosystem. They have both positive and negative effects on the economy.
- Be sensitive to learners who have been affected by malaria in some way, either by becoming ill themselves or possibly losing family members to the disease.

PRACTICAL ACTIVITY 1 Collect and observe mosquitoes

LB page 64

(Group/Class) CP6.4, DL5.5

- Ensure that groups are of mixed ability so that more-skilled learners have an opportunity to work with less-skilled learners.
- Help the learners to acquire a water source that is a known breeding area for mosquitoes.
- Prepare the glass jar or container beforehand. It is important that learners do not allow the mosquitoes to escape while they are observing them.
- Place the jar in a warm place. As a class, observe the contents of the jar over the course of a week.

• Safely discard the water and its contents away from the school premises once you have finished your observations.

ACTIVITY 5.1

Observe and draw the different stages of the life cycle of the *Anopheles* mosquito

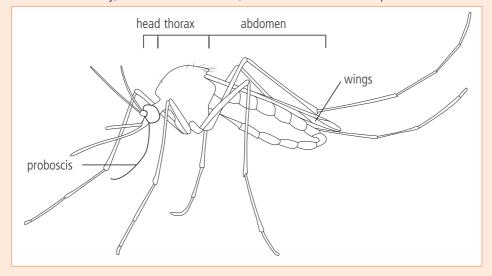
LB page 64

(Individual) *CP6.4, DL5.5*

Answers

- 1. a) C, D, A, B
 - **b)** C Egg
 - Adult female lays eggs on the surface of standing water.
 - Eggs hatch within 48 hours.
 - D Larva
 - Larvae live in the water.
 - Larvae moult four times as they grow.
 - A Pupa
 - Pupa lives near the surface of the water.
 - It takes about two days from pupa to adult mosquito.
 - B Adult
 - The wings are still wet, so the adult must rest on the surface of the water to dry out.
 - Once dry, it will look for food, and then a mate to reproduce.

2.



ACTIVITY 5.2

Describe the economic importance of the *Anopheles* mosquito

LB page 65

(Pair/Group) *CP6.2, CC8.2*

- Allow the learners enough time to discuss both questions in some detail.
- Learners should use their knowledge from Module 3, as well as what they have learned in Module 5.
- You may want to allow learners to do some research to enrich the activity. If so, then conduct the
 activity this way:
 - Day 1: Allow learners 5–10 minutes to read the questions and talk about what kind of research they need to do. They should divide up the research tasks among themselves. Then, give the learners one or two days to do their research independently, using the internet or the library.
 - Day 2: Learners should come together in pairs or in their small groups to discuss what they have found online or in the library to answer the questions.

Unit 5.2 The effect of the *Anopheles* mosquito on humans

Content standard

 Demonstrate an activity to show the life cycle of the Anopheles mosquito and show how the effects of the mosquito on humans can be managed.

Learning indicator

Discuss the impact of the Anopheles mosquito on humans and how it can be controlled.

Core competencies

- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Effectively define goals towards solving a problem.

Unit in a nutshell

- Mosquitoes are pests, but they are also vectors of disease. They carry the parasite that causes malaria.
- Malaria in Ghana accounts for 3% of global deaths due to the disease.
- There are four methods for controlling mosquitoes each of these has advantages and disadvantages.
- The costs and implications of a particular method should be weighed carefully by the community and the individual.
- Be sure to emphasise that communities affected by malaria are not to blame for this. While there are measures that can be taken to reduce the impact of malaria and spread of the disease, proper vaccination programmes and eradication measures need to be managed by local and national authorities.

ACTIVITY 5.3

Discuss the impact of malaria in Ghana

LB page 67

(Pair/Individual) *CC8.2*

Guidelines

- Allow learners to discuss the questions in pairs. They should then answer the questions individually.
- Giving learners an opportunity to discuss the work with a partner helps them to formulate their ideas, and to express them in a clear and thoughtful way.
- Help learners to find older population pyramids, which they can use to do the project on LB page 67. This is a good way for them to link what they know to pertinent issues facing Ghana and their community.

Answers

1. Ghana gets plenty of rain during warmer months. This rain leads to flooding and an abundance of standing water (puddles, ponds, drains, etc.). These provide fertile breeding grounds for the *Anopheles* mosquito.

2. Children and pregnant women have reduced natural immunity. While this group does not necessarily experience more infections, the death rates are higher because their immune systems cannot cope with the infection as well.

ACTIVITY 5.4

Generate solutions to control malaria in Ghana LB page 70

(Pair/Individual) *CP6.1*

Guidelines

- Allow learners to discuss the control methods in pairs. They should discuss which of the solutions best suit their communities, taking the advantages and disadvantages into consideration.
- Giving learners an opportunity to discuss the work with a partner helps them to formulate their ideas, and to express them in a clear and thoughtful way.
- Learners then create their posters individually. Display these in the classroom and give the learners an opportunity to look at their peers' work.

Assessment

Use the rubric for posters on page 137 at the back of the Teacher's Guide to assess the posters.

REMEDIAL ACTIVITY

Encourage learners to draw up mind maps with their ideas before committing to their poster content and design. Proper planning will ensure that they stay on brief and that they answer the question effectively.

ASSESSMENT ACTIVITY

LB page 71

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- **1.** C
- **2**. B
- **3.** B
- **4.** Accept any reasonable answers. For example: Environmental control method it is less expensive and easier for individuals and communities to do on their own.

Topic 3: Crop production

Module 6

Planting and growing crops

Unit 6.1 Different seed beds for planting crops

Content standard

Demonstrate knowledge and skills in planting crops in different seed beds.

Learning indicator

Explore the different seed beds for planting crops in your community.

Core competencies

- Explain plans for attaining goals.
- Create simple logic trees to think through problems.

Unit in a nutshell

- There are three main types of seed beds: flat seed beds, raised seed beds and sunken seed beds.
- The choice of seed bed is dictated by the climate and the type of crop. However, it is often also affected by the resources and tools available to the farmer. If a farmer only has hand tools, and little to no assistance, it would be difficult for them to manage a raised seed bed system.
- Proper preparation and cultivation of seed beds is essential for good yields.
- Attention to seed beds is best practice. Often, it may mean fewer plants but a better yield because the crops can grow optimally.

ACTIVITY 6.1

Observe and discuss different seed beds for planting different crops

LB page 76

(Pair) *CP6.2*

- Allow learners to work in pairs to complete this activity.
- The learners must read the scenarios carefully, and then match the scenario with the picture and letter.
- Set aside time for feedback. Ask why learners chose the matches that they did. The learners must have good reasons for their answers (and not simply that they matched the type of crop to the pictures!).

Answers

- 1. C (sunken seed bed)
- 2. A (flat seed bed)
- **3.** B (raised seed bed)

ACTIVITY 6.2

List and compare the differences and similarities among seed beds

LB page 76

(Individual) *CP5.3*

Answers

		Flat seed bed	Raised seed bed	Sunken seed bed
	Shape	Level ground, with pathways between	Built up ridges, with furrows between	Furrows, with built up ridges between
	Suitable for what type of climate?	Temperate, with adequate rainfall (not too much)	Rainy, temperate	Dry
9	Examples of crops	Cabbage, tomatoes, maize	Carrots, strawberries	Rice, maize
	Sketch of side profile	*****	* * * * * * * * *	

Unit 6.2 Planting different types of crops in different seed beds

Content standard

Demonstrate knowledge and skills in planting crops in different seed beds.

Learning indicator

Plant different types of crops in different seed beds.

Core competencies

- Explain plans for attaining goals.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- This unit is more practical and requires that learners put their knowledge of seed beds to use.
- The learners must understand the factors that affect the choice of seed bed.
- New plants can grow from seeds and seedlings. But they can also be propagated from various parts of the plant, including the stem, leaf and roots.
- It is important to do this properly. Plants will not grow from stems, leaves and roots that have not been adequately prepared for propagation.

ACTIVITY 6.3

Observe and discuss the practice of planting different crops in different seed beds

LB page 78

(Group/Class) *CP6.2, CC8.2*

Guidelines

- It is important for the learners to see seed beds in action, and to understand how farmers (small-, medium-, and large-scale) plant and propagate crops.
- Spend some time a week or two before the assignment preparing the learners. Assist learners who have not got easy access to a farm.
- If you think that it will be easier (in terms of access) and simpler, organise a field trip for the entire class to visit a farm. This would be ideal in conjunction with the learners conducting their own visits.

Assessment

Use the rubric for marking reports on page 137 of the Teacher's Guide.

ACTIVITY 6.4

Select different plant parts and plant them in different seed beds

LB page 80

(Group/Class) *CP6.2*

- If possible, ask the school to allocate an area of the grounds to your class so that you may conduct these practical sessions.
- Clearly demarcate the area in which your class may start their joint project.
- Encourage the class to work together. If you have a large class, you may want to split them into groups. (Ensure that groups are of mixed ability.) This will allow them time to discuss their ideas and prepare them for a class discussion.
- Then, the groups must come together as a class to discuss the best way forward. It will be useful if each group gets a different assignment, i.e., Group 1: stem cutting; Group 2: leaf cutting, etc.
- After the planting operation, have a class discussion about what the learners learned, what they think worked well, what didn't work well, etc.
- Be mindful of learners with physical challenges that may prevent them from fully participating. In these cases, these learners can take on a managerial role in the group, with the other group members performing the more physical aspects.

Unit 6.3 Compare and contrast crops grown in different seed beds

Content standard

• Demonstrate understanding of the differences in height, size, and flowering of crops grown in different seed beds.

Learning indicator

 Compare and contrast the differences in height, size, and flowering of crops grown in different seed beds.

Core competencies

- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.
- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- Now that the learners have investigated the different types of seed bed, and executed a planting plan, where they have planted seeds, seedlings and cuttings into different types of seed beds, they should be able to observe how these affect the crop.
- Discuss the root structures of different crops remember that, in some cases, we eat the bulb or the root of the plant. Also discuss the flowers and fruit of different crops.
- It is also worth revising photosynthesis, with the intention that learners remember the leaf is necessary for photosynthesis, and that the fruit is the food that is created during that process. Also briefly revise that the flower is for reproduction.

ACTIVITY 6.5

Measure plants grown in different seed beds LB page 81

(Group/Class) *CP5.5, CP5.2*

- The learners must observe their crops (see previous unit) weekly.
- They should measure and observe, without disturbing the crop in any way.
- Help the learners to come up with a consistent measuring method. Remind them that their measurement and observation criteria must be consistent, or the results will be meaningless.
- Revise the compilation of a bar graph. You can enlist the mathematics teacher to assist you with this.
- Once again, be mindful of learners who have physical challenges preventing them from completing the
 physical aspects of this activity. These learners should take on a more managerial role in the group, in
 order to fully participate.

ACTIVITY 6.6

Write and present reasons for differences in plants grown in different seed beds

LB page 82

(Individual) *CC8.2*

Guidelines

- The learners will compile the information that they have collected in Activity 6.5 to create a project/report.
- Their report must include the following:
 - The crops and seed beds that they used
 - The reasons why
 - Their table with measurements and data
 - Their bar graphs
 - How the choice of seed bed may have affected their data
- Allow time for learners to present their reports.

Assessment

Use the rubric for reports and oral presentations on page 137 of the Teacher's Guide.

ASSESSMENT ACTIVITY

LB page 83

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. The roots need space to grow. Aeration is important. If there is debris, such as weeds or insect eggs, this can lead to infestations or unhealthy crops.
- 2. a) Raised seed bed
 - b) Flat seed bed
 - c) Raised seed bed
 - d) Sunken seed bed
 - e) Flat seed bed
- 3. Step 1: Choose the plant that you want to propagate.
 - Step 2: Cut the stem at the node, ensuring that there is at least one other node on the stem.
 - Step 3: Place the stem in water, until it begins to form roots.
 - Step 4: Plant this in a tray until roots are more firmly established.
 - Step 5: Transplant the plant into the seed bed.
- **4.** a) Raised seed bed. Because the fruit develops on the ground, you want to be able to have good drainage and access to the fruit.
 - b) The yield of fruit will be greater if the plants are given enough space. If you plant too many plants, there will be fewer fruit.

Topic 4: Animal production

Module 7 Feeding animals

Unit 7.1 Types of feed

Content standard

Recognise the different types of feed for different types of animals.

Learning indicator

Compare and contrast the different types of feed for different types of animals.

Core competencies

- Effectively define goals towards solving a problem.
- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.

Unit in a nutshell

- Before starting with this unit, it would be a good idea to encourage learners to return to their notes for Basic 7, and revise the different digestive systems of domestic animals. This knowledge is important because it affects what the animals are fed.
- In this unit, they are introduced to the two broad categories of feed, namely fodder and forage.
- Essentially, fodder is food that is manufactured and/or prepared especially for animals, while forage is what grazing animals (mostly ruminants) eat.
- It must be noted that most livestock will need to have their diets supplemented with nutrients (usually in the form of concentrates) for them to get enough nutrition.
- Learners are also shown a typical animal feed label, which they must interpret and read.

ACTIVITY 7.1

Match the different types of feed with different types of animals LB page 87

(Pair) CP6.1

Answers

- 1. Fodder (monogastric poultry and usually farmed intensively)
- 2. Fodder (monogastric animal that requires special care)
- 3. Forage (grazing animal, ruminant)
- 4. Forage (grazing animal, ruminant)

ACTIVITY 7.2

Discuss the types of nutrients and their sources in different types of animal feed LB page 88

(Individual) *CP5.5*

Answers

- 1. They need roughage to encourage healthy digestion.
- 2. Introduce more protein and other vitamins to the chickens' diet, in the form of manufactured pellets with the correct proportions of nutrients.
- 3. No. Hay is not nutritionally dense. A horse requires other sources of nutrients for a more complete and balanced diet.
- 4. a) C
 - **b)** A
 - **c)** B

ACTIVITY 7.3

Select and discuss appropriate feed for animals LB page 89

(Pair/Group) *CP5.5*

Guidelines

- Allow learners to work in pairs or small groups to interpret the label. Assign learners to mixed-ability groups or pairs.
- First, work through the labels with them, so that they know where to find the important information.
- Then, allow for them to discuss and answer the questions.
- If there is time, allow for a class discussion of the pairs or groups' answers.

Answers

- 1. a) Ruminant
 - b) No, ruminants are usually also allowed to graze.
- 2. a) It means that the animal is producing milk for young (or for dairy production).
 - **b)** Lactating animals will require more protein and fat than animals that are not lactating.
- 3. It is important for the farmer to know how to use it so that they use it efficiently (no waste), and for optimum health for the animal (not too much, not too little).
- 4. a) About 140 to 141 cows $(150 + 700 = 850 \div 6 \text{ kg})$
 - **b)** $150 \div 25 = 6$ bags

Unit 7.2 The importance of water and feed

Content standard

• Demonstrate understanding of the importance of water and animal feed to the growth of animals.

Learning indicator

• Explain the importance of water and animal feed to the growth of animals.

Core competencies

- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.
- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.

Unit in a nutshell

- Revise the important nutrients with learners. They learned about these in the context of human health in Basic 7, but animals' needs are similar.
- It is important for learners to understand that it is a farmer's responsibility to ensure the health of their livestock.
- It may not be enough to simply allow animals to graze freely. In most cases, livestock must have their feed supplemented to ensure optimal health, as well as a productive and lucrative yield.
- At the end of the unit on page 92 of the Learner's Book, there is a case study about Vara Wudiu, which is the project of a Ghanaian biochemist. His intention is to alleviate the effects of drought on the health of livestock. This is a good example of how Ghanaians can act global but think local.

ACTIVITY 7.4

List and discuss the usefulness of water and feed for the growth and reproduction of animals LB page 91

(Pair/Individual) *CP5.6, CC8.2*

- It is important for learners to understand how to read, understand, synthesise and interpret information that is presented to them in a variety of ways. An infographic is a visual representation of facts. The information provided on an infographic should be succinct.
- Allow the learners to work in pairs or small groups to discuss the information that they know.
- Then, allow the learners some time (either during class or for homework) to do some research on the internet or in the library to find some of the functions and sources of the nutrients. They will specifically need to research the functions of vitamin E, calcium and manganese in chickens and chicken by-products.
- Learners can either redraw the infographic in their exercise books, or they can present their information in the form of a table, or a simple list.

Answers

Protein:

Function: Essential for growth

Source: Fish meal, steamed bone meal added to chickens' diet

Carbohydrates:

• Function: Provides energy for the chickens to carry out life processes

Source: Corn, cereal grains

Vitamin E:

Function: Improved growth, good immune health

Source: Added to feeds; or in natural forms, such as spinach, broccoli

Calcium:

Function: Builds and supports healthy bones, essential in the formation of eggshells

Source: Ground eggshells or oyster shells

Manganese:

Function: Essential for reproduction, egg formation, eggshell formation, wound healing

Source: Added to feeds in the form of sulphates

ACTIVITY 7.5

Predict what will happen to animals that do not have adequate water

LB page 91

(Group/Class) *CP5.5, CC8.2*

- For this activity, learners are expected to work as teams in their groups.
- Try to limit the group sizes to a maximum of eight learners. This is a good size for ensuring that all the learners can have their say, as well as to build a bridge between the learners who need more help and the learners who are better at articulating their thoughts.
- Ensure an even split between boys and girls, and encourage the girls to participate fully. Likewise, encourage the boys to be respectful of everyone's opinions, especially those of the girls.
- Teach the learners how to brainstorm.
 - First, they should appoint one or two team members as 'scribe'. This person should write down all the ideas that are mentioned in the brainstorming session. There are no 'good' or 'bad' ideas during this session. The brainstorming session should have a time limit (say, 10 or 15 minutes). During this time, the group should express their ideas and thoughts freely, allowing others to build on them.
 - Once the brainstorming session has come to an end, the group must take all the ideas and group them together. They will find that many of them follow specific themes. These should be organised accordingly.
 - The ideas that are unrealistic or irrelevant should then be discarded, leaving the group with the
 ideas that are easy to implement and inexpensive (they should bear these two criteria in mind
 when deciding on their final ideas to present to the class).
- Each group should then choose one or two group members to present their ideas on the group's behalf.
- Allow a few minutes for feedback and a class discussion once all groups have had their turn to present.

ASSESSMENT ACTIVITY

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) False
 - b) True
 - c) False
 - d) True
 - e) False

2. a) Any two:

- Farmer can control the amount of feed that the livestock are eating.
- The quality of the feed can be managed. Pellets, for example, can be manufactured to contain specific mixes of nutrients, essential for optimum growth.
- Feeding time can be scheduled, which makes farm management easier.
- Growing grass for cattle fodder on land in between crop cycles for human food (for example, maize) can improve the soil quality.
- Antibiotics can be included in the feed, making it easier for the farmer to control pests and diseases.
- **b)** Any two:
 - Animals that are fed fodder are generally not allowed to roam freely, resulting in
 potential animal abuses, as well as outbreaks of diseases due to the confined nature of
 battery farming.
 - It is expensive.
 - Growing crops for manufacturing fodder can use up agricultural land that could otherwise be used for growing human food crops.
 - Some end-users of the livestock products may object to the addition of certain products or antibiotics in the animals' feed.
 - If crops fail, then the supply of feed available will be affected.
- 3. An animal that is allowed to graze freely and wander around, rather than being kept indoors exclusively.
- **4.** a) To ensure that they are getting enough of the nutrients that they need to be healthy; also, to ensure a good product.
 - b) Any three: cereal grains and by-products, high protein meals, fish meal, bone meal and by-products of the dairy industry.
- **5.** Learners' responses should include the following:
 - The species of animal (including whether the animal is a ruminant or monogastric)
 - The current climate conditions
 - Availability of forage, if appropriate
 - How the farm is set up (i.e. is there room to allow animals to graze, or are the animals kept indoors?)
 - The livestock's nutritional needs.

Section 2 Assessment

LB page 95

Activity 1: Multiple choice

- **1.** E
- **2.** C
- **3.** A
- **4.** D
- **5**. C
- **6.** B
- **7.** B
- **8.** B
- **9**. C

10. D (10)

Activity 2: Short questions

- 1. A photosynthesis
 - B carbon dioxide
 - C respiration
 - D dead organisms and waste products
 - E decomposition
 - F fossil fuels
 - G burning

H-oxygen (8)

- 2. The formation of these fossil fuels is important because they all store large amounts of carbon. We say that they are reservoirs of carbon. Fossil fuels form over millions of years. As plants and animals die, their bodies are buried under the ground. With heat and pressure, these remains are turned into coal, oil or natural gas. When fossil fuels are burned, the carbon that is stored in them is released into the atmosphere. Humans use fossil fuels for energy. (4)
- 3. A by-product of human and animal respiration is carbon dioxide. This means that the body uses oxygen for various life processes and, once it is done, it produces carbon dioxide. This is exhaled back into the air. Carbon dioxide is, therefore, a waste product of human and animal respiration. On the other hand, carbon dioxide is necessary for plants to undergo photosynthesis. A by-product of photosynthesis is oxygen. The processes of photosynthesis and human and animal respiration both important stages in the carbon cycle maintain balance in the atmosphere. (8)
- 4. Any two:

Male mosquitoes	Female mosquitoes	
Male mosquitoes feed on nectar.	Female mosquitoes feed on nectar and the blood of human beings and other mammals.	
Live a very short time (about one week).	Live longer than males (about a month).	
Do not fly long distances because their food source is more readily available.	Fly longer distances than males in order to find food in the form of blood.	

(4)

Section 2 Assessment (continued)

- 5. egg, larva, pupa, adult. (4)
- 6. a) It is the *Plasmodium* parasite that causes malaria. Mosquitoes are, therefore, vectors for malaria. They do not necessarily cause it, but they can carry the parasite that causes it, which means that they can infect people with it. (2)
 - b) When a female mosquito bites a human or other mammal, it injects saliva into the bite. The saliva contains an enzyme that prevents blood clotting, allowing the mosquito to draw blood without the human's blood clotting around the bite. When a mosquito is infected by the *Plasmodium* parasite, the parasite can be transmitted to the person via the mosquito's saliva. If an infected mosquito bites a human, the parasite is released into the human's bloodstream via the bite. The parasite travels to the liver, where it matures. Once it is mature, it enters the bloodstream again and begins to infect the red blood cells.
- 7. a) Any one:
 - Helps to keep the environment clean and tidy.
 - It is not expensive and does not require any special skills or equipment.
 - It does not harm beneficial insects or destroy habitats.
 - It does not cause pollution.

(2)

- b) Any two:
 - It is not a large-scale solution.
 - It can disrupt an ecosystem if not done properly.
 - It can take some time before benefits are seen. (4)
- 8. a) raised seed bed
 - b) flat seed bed
 - c) sunken seed bed (3)
- 9. Diagram should look similar to this:



Carrots need to grow long roots that are straight. A raised seed bed gives the carrots space to do this. It also means that the farmer can easily reach the crop to harvest it when the time comes. (5)

- Soil generally contains all types of debris, such as rocks and old roots from previous plants or seedlings. These should be cleared. In addition, it is very important to ensure that the soil is free from insect eggs, fungus and weeds. If these are left in the soil, they may prevent the seeds or seedlings from growing.(3)
- **11.** a) 1. Cut stem (ensuring there is a node).
 - 2. Place in water, until roots begin to form.
 - 3. Once roots have formed, plant in the soil. (3)
 - b) So that the plant can grow leaves, which is what the plant uses in photosynthesis. (3)

Section 2 Assessment (continued)

12. Learners should include three advantages and three disadvantages.

Advantages	Disadvantages
 Animal waste can be a source of nutrients for the soil of the fields on which the livestock are allowed to graze. It is more likely that livestock will pick up parasites and pests when they are allowed to graze. Animals that can graze freely are considered 'free range', and this can be seen by some people as an advantage. It is less expensive. 	 It requires more time because livestock need to be taken out to graze, then rounded up and brought back. Drought can affect the grazing land that is available. More land is needed. Farmers cannot control how much or how little the livestock eat. Herders may have to walk far with the flock or herd in order to find suitable grazing lands. Once a field or pasture has been grazed, it may not be usable for some time until it recovers. It is difficult to introduce specific nutrients and antibiotics in the animals' diet.

- 13. It means that most livestock will be given additional feed that has added vitamins, minerals and other nutrients. This is to ensure that the animals are healthy, but also to ensure that the products and by-products are of good quality. Most farmers will supplement their feed with concentrates, available in the form of pellets and high-protein meals. (6)
- 14. a) Any one: plant stems, grasses, plant or vegetable matter
 - b) Any one: fish meal, bone meal, meat by-products, milk
 - c) Any one: fish meal, bone meal, meat by-products, milk
 - d) Salt licks

Total: 75

(4)

Section 3

Systems

Learning outcomes

Content standard	Indicators and exemplars	Core competencies	
Topic 1: The human body system			
B8.3.1.1 Demonstrate knowledge of parts of the mammalian tooth and the functions of the different types of	 B8.3.1.1.1 Identify parts of a mammalian tooth. Label parts, such as crown, neck and root of a mammalian tooth. Explain the functions of each part of the mammalian tooth of humans. 	CP6.4, DL5.5, CC8.1	
teeth in relation to feeding in man.	 B8.3.1.1.2 Discuss the functions of the different types of teeth such as incisors, canines, premolars and molars. Discuss the functions of the different types of human teeth. Draw the different types of teeth. 	CC8.5, CP6.7, DL5.5	
	 B8.3.1.1.3 Explain the causes and prevention of tooth and gum decay. Describe the causes of tooth decay, gum diseases and formation of plaque and the proper way of preventing tooth decay. Demonstrate proper ways of cleaning the teeth. 	CP6.4, CC8.5, CP5.6	
Topic 2: The solar s	system		
B8.3.2.1 Demonstrate knowledge of the outer planets of the solar system.	 B8.3.2.1.1 Identify the outer planets of the solar system and describe their properties. Describe the composition of the solar system using charts, pictures and digital content. Identify and draw the planets that form the outer solar system. Discuss the properties that are peculiar to each of the planet: Jupiter, Saturn, Uranus and Neptune. Search and explain why there is no life on Jupiter, Saturn, Uranus and Neptune. Construct a model of the outer solar system (Jupiter, Saturn, Uranus and Neptune) and display it for discussion. 	CC8.5, CP6.4, DL5.5, CP5.2	
Topic 3: Ecosystem			
B8.3.3.1 Demonstrate an understanding of the interdependence of organisms in an ecosystem and their interaction.	 B8.3.3.1.1 Explore the feeding relationships within an ecosystem. Discuss how life on Earth would be like without the Sun. Explain the terms: producer, primary consumer, secondary consumer, food chain and food web as applied in energy transfer in an ecosystem. Illustrate with diagrams how energy from the Sun flows through a food chain and food web in an ecosystem. 	CP6.4, CC8.5, CP5.3	

Content standard	Indicators and exemplars	Core competencies	
Topic 4: Farming sy	Topic 4: Farming systems		
B8.3.4.1 Demonstrate understanding of the different crops, animals and land combinations under various farming systems.	 B8.3.4.1.1 Identify and describe the types of crops, animals and land combinations for the different farming systems. Describe the types of crops, animals and land combinations in the different farming systems in your community. Discuss the advantages and disadvantages of each farming system identified. 	CC8.5, CP6.4	
	 B8.3.4.1.2 Discuss the usefulness of the different crops and animals involved in the different farming systems. 1. Explain how the different components of farming systems contribute to each other. 2. Discuss and write down the contributions of crops and animals towards the sustainability of each farming system. 	CP5.2, CC8.5, CP5.2	

Topic 1: The human body system

Module 8

Mammalian teeth

Unit 8.1 Parts of the tooth

Content standard

• Demonstrate knowledge of parts of the mammalian tooth and the functions of the different types of teeth in relation to feeding in man.

Learning indicator

• Identify parts of a mammalian tooth.

Core competencies

- Identify important and appropriate criteria and use them to evaluate alternatives.
- Evaluate the quality and validity of information.
- Speak clearly and explain ideas.

Unit in a nutshell

- Mammals, including humans, are warm-blooded animals that give birth to live young. Ensure that learners are comfortable with the classification of certain animals as mammals.
- Dentition of mammals depends on their diet. This can be seen in carnivores, which generally have large and sharp teeth, and herbivores, which tend to have flat teeth.
- The tooth is more complex than it seems. Each part of the tooth has a special function, and learners must be able to draw and label these.

ACTIVITY 8.1

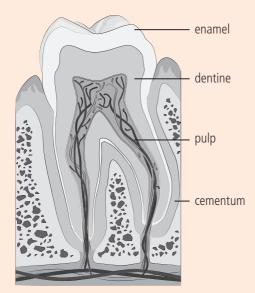
Label and explain the functions of each part of the mammalian tooth

LB page 100

(Individual) *CP6.4, DL5.5, CC8.1*

Answers

1.



- **2.** a) Protects the underlying tooth.
 - **b)** Forms a barrier between the cementum and enamel.
 - c) Keeps the tooth in position in the mouth.
- **3. a)** hard
 - b) bonelike
 - c) soft
 - d) bonelike

Unit 8.2 Functions of different types of teeth

Content standard

• Demonstrate knowledge of parts of the mammalian tooth and the functions of the different types of teeth in relation to feeding in man.

Learning indicator

Discuss the functions of the different types of human teeth.

Core competencies

- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Implement strategies with accuracy.
- Evaluate the quality and validity of information.

Unit in a nutshell

- Ask learners to look at their teeth in a mirror. They will notice that their teeth are all different.
- Each tooth serves a particular function, related to digestion and mastication (chewing).
- The teeth emerge during babyhood, and in early childhood they fall out and are replaced by the secondary teeth. These are the teeth that a person will have throughout their lives.

ACTIVITY 8.2

Discuss and draw the different teeth and their functions

LB page 102

(Pair/Individual) *CC8.5, CP6.7, DL5.5*

Answers

- 1. a) These are the teeth that emerge before a child is three years old. They are known as milk teeth.
 - b) Adults have more molars. Adults also have premolars, which children do not have. Children have only 20 teeth, while adults have around 32 teeth.
- 2. Incisor

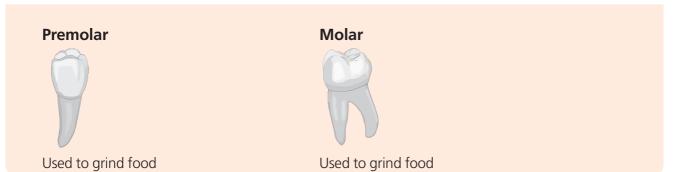


Used for grasping and cutting food into smaller pieces

Canine



Used to pierce and tear food



Unit 8.3 Tooth decay

Content standard

• Demonstrate knowledge of parts of the mammalian tooth and the functions of the different types of teeth in relation to feeding in man.

Learning indicator

Explain the causes and prevention of tooth and gum decay.

Core competencies

- Identify important and appropriate criteria and use them to evaluate alternatives.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.

Unit in a nutshell

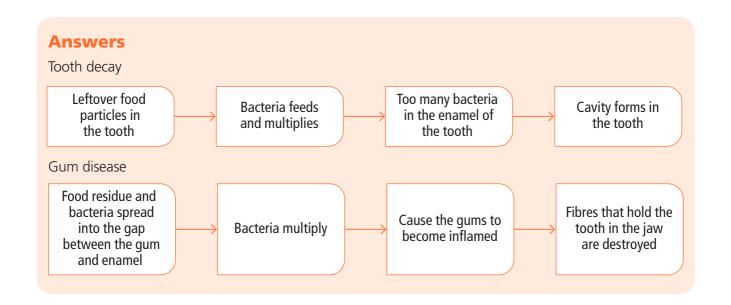
- Gum disease and tooth decay are problematic because they can lead to serious health problems.
- It is essential to keep the mouth and teeth healthy in order to prevent tooth decay and gum disease. Because the secondary teeth are the teeth that a person will have throughout their life, it is important to look after our oral health.
- Tooth decay is caused by bacteria, which is left to breed and cause damage to the enamel of the tooth. This can lead to painful cavities.
- Gum disease can be mild or severe. Gum disease can cause bad breath.
- This unit serves as a good opportunity to demonstrate the proper way to clean one's teeth. You can
 either ask a community dental health worker to come in and do a demonstration, or you can do it
 yourself. To properly clean your teeth, you should:
 - floss before brushing, at least twice a day
 - brush carefully with a soft-bristled brush for at least two minutes
 - use toothpaste, or bicarbonate of soda
 - brush behind the front teeth
 - ensure that you brush the teeth at the back of the mouth
 - softly brush the tongue, either with your toothbrush or a special tongue scraper, available at a chemist or pharmacy
 - rinse with clean water and do not swallow.

ACTIVITY 8.3

Draw flow diagrams to show tooth decay LB page 104

(Individual) *CP6.4, CC8.5, CP5.6*

- It is important for learners to be able to synthesise information and present it in a different format.
- You can allow the learners to discuss their ideas in pairs or small groups, but they must complete their flow diagrams independently.
- If you have run out of time in class, allow them to do this for homework.



ASSESSMENT ACTIVITY

LB page 105

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- **1.** D
- **2**. C
- **3.** A
- **4.** A
- **5**. B
- **6.** A crown
 - B neck
 - $\mathsf{C}-\mathsf{root}$
 - D enamel
 - E dentine
 - F pulp cavity
 - G-gum
 - H cementum

Topic 2: The solar system

Module 9

The outer planets of the solar system

Unit 9.1 The outer planets

Content standard

Demonstrate knowledge of the outer planets of the solar system.

Learning indicator

• Identify the outer planets of the solar system and describe their properties.

Core competencies

- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Identify important and appropriate criteria and use them to evaluate alternatives.
- Evaluate the quality and validity of information.
- Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- The outer planets are Jupiter, Saturn, Uranus and Neptune.
- These planets are massive (they are known as the gas giants).
- Humans have wondered about the universe since the beginning of consciousness. Start by discussing local stories and indigenous folktales about the stars and what lies beyond our planet.
- Scientists search the universe for answers to important physics questions about life and matter. By understanding the universe, we can also predict Earth's future (millions of years from now).

ACTIVITY 9.1

Describe the composition of the solar system LB page 109

(Individual) *CC8.5*

Answers Jupiter Saturn Uranus Neptune

Assessment

Use the rubric for drawings on page 136 at the back of the Teacher's Guide.

ACTIVITY 9.2

Discuss the properties of the outer planets

LB page 111

(Individual) *CP6.4*

Answers

Property	Jupiter	Saturn	Uranus	Neptune
Position from the Sun	fifth planet from the Sun	sixth planet from the Sun	seventh planet from the Sun	eighth planet from the Sun
Time to complete one full orbit	11.9 Earth years	30 Earth years	84 Earth years	164.8 Earth years
Composition of atmosphere	hydrogen, helium	hydrogen, helium	methane	methane
Number of moons	63	60	27	13

ACTIVITY 9.3

Research and explain why there is no life on the outer planets

LB page 111

(Pair/Group/Individual) *DL5.5*

Guidelines

- Allow the learners to work in pairs or small groups to discuss their ideas.
- If there is time, let each pair or group share their ideas with the class.
- They should then each write their own paragraphs.

Answer

To be able to support life, a planet needs an atmosphere that contains life-supporting gases that can allow sunlight to filter through, while also deflecting some sunlight so that the planet does not get too hot; and soil and water. The gas giants do not have these conditions, and so life is not possible on those planets.

PRACTICAL ACTIVITY 1

Construct a model of the outer solar system

LB page 111

(Group) *CP5.2*

Guidelines

- Ensure that groups are of mixed ability. This will ensure that more skilled learners have an opportunity
 to work with less skilled learners; a form of peer-to-peer learning and teaching that can be very
 effective for retention and understanding.
- Collect the materials needed ahead of time. Learners can also bring some of the materials from home.
- If you cannot get hold of foam balls, then use recycled materials. Encourage the learners to be creative.
- Check that the model is neatly constructed, but also accurate in terms of labels and scale.

Assessment

Use the rubric for building models on page 137 of the Teacher's Guide.

ASSESSMENT ACTIVITY

LB page 113

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- **1.** A
- **2.** C
- **3**. D
- 4. True
- 5. a) Any two:
 - Seventh planet from the Sun
 - Takes 84 Earth years to complete a full orbit
 - Turns on its axis every 17.2 Earth hours
 - Four times bigger than Earth
 - Uranus has 27 known moons
 - Blue-green colour due to methane gas in atmosphere
 - b) Any two:
 - Eighth planet from the Sun
 - Takes 164.8 Earth years to complete a full orbit
 - Very cold (far from Sun)
 - Has at least 13 moons
 - Blue colour due to methane gas in atmosphere
- 6. A Jupiter B Saturn C Uranus D Neptune

Topic 3: Ecosystem

Module 10

Interdependence and interaction of organisms

Unit 10.1 Feeding relationships in an ecosystem

Content standard

• Demonstrate an understanding of the interdependence of organisms in an ecosystem and their interaction.

Learning indicator

• Explore the feeding relationships within an ecosystem.

Core competencies

- Identify important and appropriate criteria and use them to evaluate alternatives.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Create simple logic trees to think through problems.

Unit in a nutshell

- The Sun makes all life possible.
- It is advisable to revise some terminology before starting the unit:
 - Competition: In an ecosystem, resources are scarce. This means that there is competition for resources, including food, water, light and nutrients.
 - Producer: This refers to plants, which make their own food.
 - Consumer: This refers to any organism that eats food in an ecosystem, whether that organism is a herbivore, carnivore, or omnivore.
 - Herbivore: An organism that only eats plant material.
 - Carnivore: An animal that only eats other animals.
 - **Omnivore:** An animal that eats both plant material and other animals.

ACTIVITY 10.1

Discuss how life on Earth would be like without the Sun

LB page 115

(Group/Class) *CP6.4*

- In this activity learners will work in a group, and then present to the class.
- Try to limit the group sizes to about six to eight learners in order to allow for sufficient engagement. Learners may sometimes become overwhelmed if there are too many learners in a group and if the group is too small, learners with stronger personalities can be too directive.

- Ensure that groups are of mixed ability so that more-skilled learners have an opportunity to work with less-skilled learners.
- Encourage respectful and engaging brainstorming. Revise with learners how to write every idea down, and then to group them according to theme.
- Once the groups have had an opportunity to discuss the questions, allow some time for class feedback.
- The main point of the exercise is to show learners that life on Earth is not possible without the Sun. The Sun is important for photosynthesis, but also for warmth and the water cycle.

ACTIVITY 10.2

Explain terms as they apply to energy transferin an ecosystem

LB page 117

(Individual/Pair) *CC8.5*

Guidelines

- Allow learners an opportunity to use the internet or the library to research a local food chain.
- They should use the labels provided.
- Then, once they have completed that part of the activity, they must work in pairs to discuss and present their food chains. This tests their ability to put into words concepts that they have learned.
- The last question (question 4 (d)) leads into the next section, which covers food webs.

ACTIVITY 10.3

Illustrate how energy from the Sun flows through an ecosystem

LB page 119

(Individual) *CP5.3*

Answers

1. a) Any one: locust, ant, impala, zebra

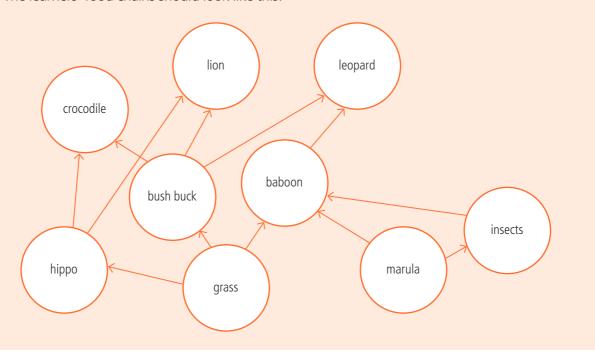
b) Any one: toad, snake, bird, lion

c) Hawk, eagle

d) Primary consumers: locust, ant, impala, zebra Secondary consumers: toad, snake, bird

Tertiary consumers: lion, hawk, eagle

2. The learners' food chains should look like this:



ASSESSMENT ACTIVITY

LB page 120

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. Because plants rely on sunlight for photosynthesis, which is the starting point for all food chains.
- 2. a) Producers
 - b) Consumers
 - c) Terrestrial food chain
 - d) Aquatic food chain
 - e) Food web
- **3.** The Sun's energy is transferred to the producer. A consumer then eats the producer, and a secondary consumer eats the primary consumer, and so on. Throughout, decomposers break down waste products and decaying organisms.
- 4. a) A producer
 - B primary consumer
 - C secondary consumer
 - D tertiary consumer
 - **b)** B
 - c) C and D

Topic 4: Farming systems

Module 11 Crop and animal farming

Unit 11.1 Farming systems

Content standard

Demonstrate an understanding of the different crop, animal and land combinations under various farming systems.

Learning indicator

Identify and describe the types of crops, animals and land combinations for the different farming systems.

Core competencies

- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Identify important and appropriate criteria and use them to evaluate alternatives.

Unit in a nutshell

- Learners already have some background knowledge about the various farming systems that can
- This unit focuses specifically on mixed farming, which is a combination of livestock and crop farming. Revise what they know about mixed farming before they begin.
- They will be introduced to different models of mixed farming, which can be used in commercial or subsistence settings.
- It is essential that they can relate this content to their community context. If possible, arrange for a field trip to a local farm or farm area, or ask a farmer to come in to talk to the learners.

ACTIVITY 11.1

Describe the types of crops, animals and land combinations in the different farming systems LB page 124

(Group/Class) CC8.5

- In this activity, learners will work in a group, and then present to the class.
- Try to limit the group sizes to about six to eight learners, to allow for sufficient engagement. Learners may sometimes become overwhelmed if there are too many learners in a group and, if the group is too small, learners with stronger personalities can be too directive.
- Ensure that groups are of mixed ability so that more-skilled learners have an opportunity to work with less-skilled learners.

- The learners are encouraged to relate their context and individual experiences and knowledge to the content that has been presented to them in the unit.
- Once the groups have written down their ideas and chosen a spokesperson, allow for the presentations. Limit their time to about three to five minutes. Allow for a few questions directed at the group as a whole.

ACTIVITY 11.2

Discuss the advantages and disadvantages of each farming system

LB page 124

(Individual/Group) *CC8.5, CP6.4*

Guidelines

- Learners should do the first question independently. If necessary from a time perspective, they can do this for homework.
- Answering the first question involves doing a close reading of the content that has been presented, and also making some judgements.
- Have a brief discussion of everyone's answers, and then the learners should get back into the same groups that they worked with for Activity 11.1.
- The groups should apply their knowledge about the advantages and disadvantages of the farming systems to the example that they came up with for the previous activity.

Answers

1. The completed table could look something like this:

Fa	rming system	Advantages	Disadvantages	
a)	On-farm mixed farming	 Economical, because available resources are used Farmer has control over what they need for their livestock or crops 	 Everything relies on the other, so if something fails, it could be disastrous for the whole farm Time-consuming 	
b)	Between-farm mixed farming	 Reduces waste Encourages sharing and co-operation between farmers in a community 	 Means that money is spent on things that could have been produced by the farm itself (for example, manure) Little or no control over quality 	
c)	Diverse mixed farming	 If one aspect of the business is not successful, it can be carried by the other aspect for a time No cross-pollination; can be run entirely separately 	 Expensive because the farmer would need to run two separate farms Needs space and is more time-consuming 	
d)	Integrated mixed farming	EconomicalSustainable	 Everything relies on the other, so if something fails, it could be disastrous for the whole farm Requires plenty of experience and careful management 	

2. Learners' responses will depend on their chosen example. Use the above as a guide.

Unit 11.2 The usefulness of crops and animals

Content standard

Demonstrate an understanding of the different crop, animal and land combinations under various farming systems.

Learning indicator

Discuss the usefulness of the different crops and animals involved in the different farming systems.

Core competencies

- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- While they can have a symbiotic relationship, livestock and crops contribute differently and are useful for a variety of different reasons.
- Learners are given an example (Gabriel) and then are visually shown how all components of the farm interact and contribute in some way. Work through this visual carefully with them as they will need to use it for Activity 11.3.
- Encourage learners to try to understand how the components of a mixed farm are all connected.
- This is important because it leads into sustainability, which is a huge issue globally, for the continent of Africa, and for Ghana as a nation. Sustainability affects food security and has implications for the socioeconomic well-being of Ghanaians.
- You will also need to revise crop rotation as a farming system. Ensure that learners understand what it is and what it entails (they learned about it in Basic 7).

ACTIVITY 11.3

Explain how the different components of a farming system contribute to each other

LB page 126

(Pair/Individual) CP5.2

- It is a good idea to first allow learners to work in pairs to talk through the diagram.
- Often, people need to order their thoughts before they can write them down. Talking it through with a partner will help the learners to do this.
- Then, they can answer the questions independently.

Answers

- 1. The farmer and his family provide labour for the farm, tending to the livestock and managing the crops. The animals provide an income through the sale of certain by-products (such as eggs or milk). They also provide manure for fertilising the crops. The crops provide an income, also, through the sale of surplus produce. The crop residues are used to feed the animals. Both the animals and the crops provide food for the family/household.
- 2. For this, the learners must understand crop rotation and how it works. Their explanations should touch upon the fact that large areas of land are needed to allow one area to lie fallow. It may be possible to allow grazing on the fallow field once some vegetation begins growing there. This would help with breaking down the soil, as well as the manure that will be left behind to act as a fertiliser.

ACTIVITY 11.4

Discuss the contributions of crops and animals towards sustainable farming

LB page 127

(Pair/Individual) *CC8.5, CP5.2*

Answers

- 1. Sustainable farming refers to the ability to farm livestock or crops without negatively affecting the natural environment, or the communities that surround the farm. It means that it can continue in the future.
- 2. The livestock are working animals, so they pull carts and carry things on their backs. They may provide other by-products for the farmer and his or her family.
- 3. Learners' answers will depend on their example.

ASSESSMENT ACTIVITY

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. Subsistence farming is farming that is not for commercial reasons, but personal reasons. Commercial farming is a business venture.
- 2. a) Any one of the following: animals can be reared to work on the farm, ensures a balanced diet, resources can be recycled (manure for fertiliser, crop residue for feed).
 - b) On-farm mixed farming
 - c) It is the most economical for the farmer, which benefits the farmer and the community. It is also less wasteful because everything is reused and recycled.
- 3. Learners will probably mention that if one aspect of the farm fails, the other aspect will be able to carry the farm for a time.
- 4. The farmer and his family provide labour for the farm, tending to the livestock and managing the crops. The animals provide an income through the sale of certain by-products (such as eggs or milk). They also provide manure for fertilising the crops. The crops provide an income, also, through the sale of surplus produce. The crop residues are used to feed the animals. Both the animals and the crops provide food for the family/household.
- **5.** A. Feed (failed crops, crop residue, oats, etc.)
 - B. Manure, provide work, pest control
 - C. Food, profit
 - D. Labour

Section 3 Assessment

LB page 129

Activity 1: Multiple choice

3. D

5. D

7. C **9.** C

2. A

4. B

6. D

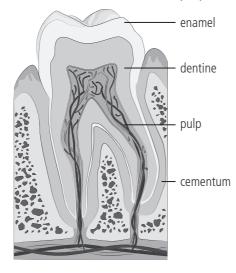
8. C

10. B

(10)

Activity 2: Short questions

1. a) A – enamel; B – dentine; C – pulp; D – cementum



(4)

b) At least one of each:

The enamel:

- is a very hard outer layer or surface of the tooth
- gives the tooth its whitish colour
- protects the dentine.

The dentine:

- forms the bulk of the tooth
- is a tissue found beneath the enamel
- is bonelike, which means that it is hard but brittle.

The pulp cavity:

- makes up the centre of the tooth
- contains nerves and blood vessels that carry oxygen and food to the living cells of the dentine
- is enclosed by a thick layer of dentine.

Cementum:

- replaces the enamel in the root region
- is bonelike
- is surrounded by a membrane that attaches the tooth to its socket in the jawbone. (4)

Section 3 Assessment (continued)

2. a) B

	b) C c) A	(3
3.	 Any two of the following: Brush your teeth regularly using a toothbrush and toothpaste. Avoid using sharp objects, such as toothpicks and pins to remove food particles that have become stuck between the teeth. Avoid eating hard foods, as you could crack the teeth. Reduce the consumption of sugary foods, such as sweets and fizzy drinks. Eating a healthy diet that includes plenty of fruit and vegetables can improve your health, as well as providing important vitamins and nutrients to keep the teeth and gums healthy. If possible, visit a dentist every six to twelve months. 	(4
4.	 Any two of the following: They are much larger and more massive than Earth. They do not have solid surfaces. They are composed mainly of hydrogen and helium. Because of their massive size, their gravitational force is much greater than Earth's. The atmospheric layers that surround the planets are very thick. The outer layers of the planets are cold because they are a great distance from the Sun, but temperatures increase inside the planets. The outer planets each have more than one moon. All have rings, which are made up of gases and other space materials. 	(2
5.	 At least four points: Jupiter is a gas giant, which means it probably does not have a solid surface. The gases that make up the atmosphere and planet would be toxic for life to survive. It is also very far from the sun (a ray of sunlight takes more than an hour to reach the surface of the planet), which means that is it very cold. Saturn does not have a solid surface and is composed mainly of gases, such as hydrogen and helium. There is only a small amount of ice in its lower clouds. Uranus has no solid surface. It is mostly composed of ice made up of methane, water and ammonia. It is also surrounded by an atmosphere of hydrogen and helium. Besides these icy and gaseous conditions, Uranus is very cold. Neptune is also a gas giant. This means that it does not have a solid surface for life to grow and live on. The surface temperature is too cold. Liquid water would immediately freeze. 	(8
6.	Plants rely on sunlight for photosynthesis.	(2
7.	A food chain shows a simple transfer of energy. A food web shows all the interconnected food chains in an ecosystem.	
8.	When a mixed farm is integrated, it means that the resources are shared between the components.	(4

Section 3 Assessment (continued)

9. Any two:

- Crop residue can be used to feed livestock.
- Livestock manure can be used as fertiliser.
- Livestock, such as cattle, can be used to pull ploughs and other heavy farm equipment.
- Animals can be used as a form of pest control. For example, ducks could be used to eat snails
 and other insects in the crop fields, and goats will only eat specific grasses and herbs, so they
 can also be used to deal with unwanted weeds.
- Livestock can be used to prepare a field for planting. In Nigeria, a herd of cattle or goats
 may be herded to a piece of land, and their hooves will kick up the soil and get it ready
 for planting.
- 10. Sustainable means employing specific practices now in order to have a positive, or at least neutral, impact in the future. In terms of farming, sustainability refers to the ability to farm livestock or crops without negatively affecting the natural environment, or the communities that surround the farm.(3)

Total: 50

Section 4

Forces and energy

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: Energy		
B8.4.1.1 Demonstrate the skill to evaluate the conversion of	B8.4.1.1.1 Describe energy conversion.Describe how energy is converted from one form to another.	CP5.2, CC8.5
energy from one form to another.	 B8.4.1.1.2 Discuss the importance of conversion of energy. 1. Explain the processes that a dammed river goes through to produce electricity. 2. Describe how to harness natural forms of energy into other forms. 	CP5.2, CC8.5
B8.4.1.2 Show an understanding of the sources of renewable energy and how to manage these sources in a sustainable manner.	 B8.4.1.2.1 Describe renewable and non-renewable forms of energy. 1. Explain renewable and non-renewable sources of energy. 2. Identify the various sources of renewable and non-renewable forms of energy and classify them e.g. wind, coal, hydro, crude oil, natural gas, solar and biogas. 3. Describe how to produce energy from a renewable source. 	CC8.2, CP5.2, CC8.5
	 B8.4.1.2.2 Demonstrate how to manage sources of renewable energy sustainably. Research about information on the stages involved in managing renewable energy sources. Create a table to describe challenges associated with the management of different sources of renewable energy. 	DL5.1, CP5.6
B8.4.1.3 Demonstrate an understanding of the relationship between heat and temperature.	 1.3 Demonstrate and the relationship between heat and temperature in the environment. 1. Create a table to show the distinguishing features of temperature and heat. 	
Topic 2: Electricity	and electronics	
 B8.4.2.1 Demonstrate knowledge of electricity transmission. Electricity transmission. Draw a flow chart to show the stages of electricity transmission transmission from the point of consumption. 		CP5.1, CP5.3
B8.4.2.2 Demonstrate understanding of the functions of capacitors in relation to LEDs, diodes, and resistors in electronic circuits.	 B8.4.2.2.1 Demonstrate the charging and discharging action of a capacitor in a DC electronic circuit. 1. Research information about capacitors in electronic circuits and explain their functions when connected with direct current (DC). 2. Describe the charging and discharging actions of a capacitor and explain the role of LEDs, diodes, and resistors in an electronic circuit. 	DL5.5, CC8.2, CP5.1

Content standard	Indicators and exemplars	Core competencies	
Topic 3: Conversion	n and conservation		
B8.4.3.1 Evaluate the impact of conversion of energy and energy conservation on the environment.	 B8.4.3.1.1 Explain the importance of conversion of energy and energy conservation in daily life. Classify the importance of energy conversion and energy conservation in daily life. Search from multimedia sources, books, internet for information on the impact of energy. Research conversion and conservation in their environment and make a poster presentation on their findings. 	CP5.1, DL5.5, CC8.2	
Topic 4: Force and	motion		
B8.4.4.1 Demonstrate the production of magnets, domestic and industrial application of magnetic force and its relationship to Newton's Second Law of Motion in everyday life.	 B8.4.4.1.1 Demonstrate simple ways of making magnets and show how magnetic force can be applied in domestic and industrial activities. 1. Produce magnets (using magnetic materials such as pieces of iron and a bar magnet and electricity). 2. Demonstrate some application of magnetic force in domestic and industrial activities (e.g. compass, alarms, loudspeakers, etc.). 3. Explore other industrial and domestic applications of magnetic force and present findings. 	CI5.1, CP5.6, CC8.1	
	 B8.4.4.1.2 Explain the relationship between magnetic force and Newton's Second Law of Motion, and show the law's application to life. 1. Explain Newton's Second Law of Motion with examples from daily life. 2. Perform an experiment to show the relationship between force and motion using magnetic force, and the principle of Newton's Second Law of Motion. 	CP5.2	
B8.4.4.2 Demonstrate understanding of complex machines and how they work.	e B8.4.4.2.1 Identify complex machines and describe their functions in life. CC8.2, CP5		
Topic 5: Agricultural tools			
B8.4.5.1 Demonstrate knowledge and skills in the use of basic and simple agricultural tools for basic on-farm activities.	 B8.4.5.1.1 Show and discuss the use of basic and simple agricultural tools for basic on-farm activities. 1. Collect and list different types of agricultural tools used for on-farm activities. 2. Match each tool with the familiar type of agricultural activity it is used for and create an album of the tools. 	CP5.6, CP5.2	
	 B8.4.5.1.2 Engage in the use of basic and simple agricultural tools for basic farm activities. 1. Explain how the different agricultural tools are used on a farm or in a school garden to perform specific agricultural activities. 2. Practise the use of different agricultural tools for specific activities on a farm or in a school garden. 3. Select appropriate tools for specific agriculture tasks. 	CP5.7, CI5.5, CP5.2	

Topic 1: Energy

Module 12 Energy conversion

Unit 12.1 Energy conversion

Content standard

Demonstrate the skill to evaluate the conversion of energy from one form to another.

Learning indicator

Describe energy conversion.

Core competencies

- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.

Unit in a nutshell

- Energy is the ability to do work.
- Learners should recall the types of energy they learned about in Basic 7: kinetic, potential, thermal, electrical, sound, solar, light and nuclear.
- Power measures how much energy is used or produced per second.
- In doing work, energy is changed or converted into a different type of energy.

PRACTICAL ACTIVITY 1 Describe energy conversion

LB page 134

(Group/Class) CP5.2. CC8.5

Guidelines

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to set up the circuit.
- If working in groups, each learner in the group can feel the light bulb.
- If you are presenting it as a class demonstration, choose a handful of volunteers.

PRACTICAL ACTIVITY 2 Produce chemical energy

LB page 134

(Group/Class)

CP5.2

Guidelines

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to set up the experiment.
- Be very clear at every step of setting up the experiment so that learners can see what you are doing. Encourage them to volunteer instructions or suggestions about what you should do next.
- Guide the learners to notice that the chemical energy in the battery is converted into electrical energy in the conducting wires and pencils.

PRACTICAL ACTIVITY 3

Describe how energy is converted from one form to another

LB page 135

(Group/Class) *CP5.2*

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to make the coffee can steam engine from a tin lid. Be very careful when doing this, as it is easy to cut yourself (therefore, it is safer for you to do it ahead of the class). If you are going to do it as a demonstration, then you only need to make one or two. Alternatively, make one per group.
- Be very clear at every step of setting up the experiment so that learners can see what you are doing.
 Encourage them to volunteer instructions or suggestions about what you should do next.
- Guide the learners in understanding the conclusion, as outlined in the Learner's Book.

Unit 12.2 The importance of energy conversion

Content standard

• Demonstrate the skill to evaluate the conversion of energy from one form to another.

Learning indicator

Discuss the importance of conversion of energy.

Core competencies

- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.

Unit in a nutshell

- Understanding energy and energy conversions helps people in their everyday lives, including generating power in the form of electricity (light and heat).
- The focus is on the conversion of potential and kinetic energy to electricity, including harnessing natural sources of energy.
- The unit focuses on hydroelectric power and solar energy.

ACTIVITY 12.1

Explain the processes that a dammed river goes through to produce electricityLB page 137

(Pair) *CP5.2*

Guidelines

- Allow learners time to research the history of the Akosombo hydroelectric power station.
- Ensure that each pair plan how they will approach the research project ahead of starting. This will ensure a fair and equal split of the work.
- Remind learners that they will not be assessed on their individual performance, but on the quality of their work with their partner.

Answers

- 2. Learners should display understanding of how hydroelectric power works.
- 3. Learners' answers can include the following points:

Advantages	Disadvantages		
 Provides electricity for the aluminium industry. An important investment for Ghana's economic development. Provides most of the electricity to Togo and Benin. 	 Many people were displaced. Poverty has increased due to failed resettlement of locals. Building of the dam has affected the climate in the area (less rain, higher temperatures). Eutrophication is a problem, which has resulted in an invasive weed. This causes water-borne illnesses. 		

PRACTICAL ACTIVITY 4 Use solar energy

LB page 138

(Group/Class) CP5.2

Guidelines

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to connect the cell to the LED.
- Be very clear at every step of setting up the experiment so that learners can see what you are doing. Encourage them to volunteer instructions or suggestions about what you should do next.
- Guide the learners in understanding the conclusion, as outlined in the Learner's Book.

ACTIVITY 12.2

Describe how to harness and convert natural forms of energy into other forms LB page 139

(Pair) CP5.2, CC8.5

Guidelines

- Learners may be able to answer some of these questions without having to do research. However, encourage them to use the internet as this is a good opportunity to develop these skills.
- Once the pairs have finished, form groups with two or three pairs.
- Each pair will take turns presenting their findings.
- Learners who are better with images than words can use detailed diagrams in their explanations.

Answers

Encourage learners to use their own words to answer the questions.

Unit 12.3 Renewable and non-renewable forms of energy

Content standard

 Show an understanding of the sources of renewable energy and how to manage these sources in a sustainable manner.

Learning indicators

- Describe renewable and non-renewable forms of energy.
- Demonstrate how to manage sources of renewable energy sustainably.

Core competencies

- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.

Unit in a nutshell

- Learners should have some prior knowledge of renewable and non-renewable energy sources.
- Learners should understand that the world is mostly reliant on non-renewable energy sources but that there is a focus on moving towards more sustainable, renewable energy sources.
- The most important benefit of renewable energy sources is that they are better for the environment.

ACTIVITY 12.3

Describe how to produce energy from a renewable source

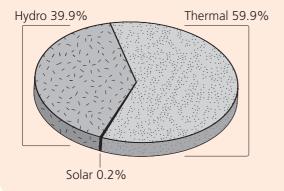
LB page 143

(Pair/Individual) *CP5.2, CC8.5*

- Learners should be developing their research skills.
- Learners can work in pairs, but it is preferable that they do this activity individually. However, some learners do need support, so use your discretion.
- It is essential that learners know how to translate information into visual representations (in this case, a pie chart).
- Learners can choose which source to research further.

Answers

The pie chart will look similar to this:



ACTIVITY 12.4

Explain renewable and non-renewable sources of energy LB page 147

(Pair/Individual) *CC8.2*

Guidelines

- Learners will read the case study and use it to answer the questions.
- These types of comprehension activities are important for developing learners' ability to read for meaning.

Answers

- 1. a) Renewable: Source of energy cannot run out; clean energy.

 Non-renewable: Sources of energy that can be depleted; mostly cause harm to the environment.
 - **b)** Non-renewable sources of energy: 'The compressed air is mixed with the fuel ... natural gas or light crude oil or diesel.'
- 2. Similarity: The fast-moving gas and steam move the turbine, giving the blades kinetic energy. Difference: Steam is water vapour, whereas the gas is a mixture of compressed air and fuel.
- **3.** Learners' answers will depend on their interpretation of the facts. They may note that it is a reliable form of electricity generation, but that it is not renewable/sustainable.
- **4.** To ensure uninterrupted power supply (different sources).

REMEDIAL ACTIVITY

Ask the Mathematics teacher for support if learners are struggling with data collection and presenting data in charts and tables. Often, learners just need practice, and the Mathematics teacher can provide this in the form of worksheets or additional activities.

Unit 12.4 Managing sources of renewable energy sustainably

Content standard

 Show an understanding of the sources of renewable energy and how to manage these sources in a sustainable manner.

Learning indicator

Demonstrate how to manage sources of renewable energy sustainably.

Core competencies

- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.

Unit in a nutshell

- For learners' understanding of this unit, they must understand the term 'sustainable'. Spend some time explaining what this term means.
- By now, learners should know that renewable energy is more sustainable than non-renewable energy sources.
- If you have time, spend a lesson on climate change and the climate emergency. If you do not, encourage learners to do their own research.

ACTIVITY 12.5

Research stages involved in managing renewable energy sources LB page 149

(Pair/Group) DL5.1

Guidelines

- Follow the link in the Learner's Book to the PDF of the Renewable Energy Act, 2011.
- If possible, print a copy for each pair or group.
- It is important for learners' civil society development to be able to read and interpret documents such as these.

Answers

The intention of the Act (in short) is to: 'provide for the development, management, utilisation, sustainability and adequate supply of renewable energy for generation of heat and power and for related matters'.

ACTIVITY 12.6

Describe challenges associated with the management of renewable energy LB page 149

(Pair/Group/Class/Individual) *CP5.6*

- Learners can do this activity in pairs or small groups. Encourage them to use a brainstorming approach, where they discuss ideas freely and then group their thoughts into clear patterns to answer the question.
- Alternatively, have the brainstorming discussion as a class, and then assign the development of the table for homework.
- For this activity, the learners will consolidate everything that they have learned about renewable energy so far.
- It is important that they understand the term 'sustainable'.

Unit 12.5 The relationship between heat and temperature in the environment

Content standard

• Demonstrate an understanding of the relationship between heat and temperature.

Learning indicator

• Discuss the differences and the relationship between heat and temperature in the environment.

Core competencies

- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.

Unit in a nutshell

- It is important that learners do not confuse the terms 'temperature' and 'heat'.
- Temperature is a property of an object that determines the direction in which heat will flow.
- Heat is a form of energy, which always transfers from a hotter region to a colder region.
- You will also need to describe the term 'kinetic molecular theory'. This describes the relationship between temperature and the arrangement and movement of particles of matter.

ACTIVITY 12.7

Discuss the relationship between temperature
and heat

LB page 152

(Pair/Individual) *CP5.6, CC8.5*

Guidelines

Learners will use the graph to answer the questions.

Answers

- **1.** a) 140 °C
 - **b)** 70 °C
 - c) 80 °C
 - d) 1 100 J
- 2. When the substance is heated to 70 °C, it will melt, becoming liquid. When it is heated to 140 °C, it will boil.

Topic 2: Electricity and electronics

Unit 12.6 Electricity transmission

Content standard

Demonstrate knowledge of electricity transmission.

Learning indicator

Explain how electricity transmission occurs.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Create simple logic trees to think through problems.

Unit in a nutshell

- Learners should have some previous knowledge of basic electricity terms and a basic electric circuit.
- Revise circuits, electric current, voltage, potential difference.
- To apply what the learners now know about electricity and energy conversion, they will learn how
 electricity is transmitted from the power station to homes and businesses.

ACTIVITY 12.8

Identify the different stages of electricity transmission and draw a flow chart

LB page 156

(Pair/Individual) *CP5.1, CP5.3*

Guidelines

- It is important for learners to understand how to interpret information that is presented differently to how they have seen it previously.
- Allow learners to work in pairs to interpret the flow diagram.

Answers

- 1. Step-up transformer
- 2. Transmission customers
- 3. Step-down transformer
- **4.** Primary customers
- 5. Sub-transmission customers
- **6.** Secondary customers

Unit 12.7 Capacitors in DC electronic circuits

Content standard

 Demonstrate understanding of the functions of capacitors in relation to LEDs, diodes and resistors in electronic circuits.

Learning indicator

• Demonstrate the charging and discharging action of a capacitor in a DC electronic circuit.

Core competencies

- Evaluate the quality and validity of information.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.
- Combine information and ideas to reach a conclusion.

Unit in a nutshell

- In Basic 7, learners were introduced to capacitors.
- This year, they will extend their understanding by learning more about atoms and charges.
- This content can be challenging for some learners, so take your time with the content and ensure
 that the learners really understand the purpose of a capacitor and what its function is in an
 electronic circuit.

PRACTICAL ACTIVITY 5

Describe the charging and discharging actions of a capacitor

LB page 160

(Group/Class) *DL5.5, CP5.1, CC8.2*

- Learners can do this practical activity in groups. Ensure that groups are of mixed ability. Alternatively, depending on time and resources, you can do it as a class demonstration.
- If you do not have the resources available, work through the diagram and the conclusion in detail.

Unit 12.8 Conversion of energy and energy conservation in daily life

Content standard

• Evaluate the impact of conversion of energy and energy conservation on the environment.

Learning indicator

• Explain the importance of conversion of energy and energy conservation in daily life.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Evaluate the quality and validity of information.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- Learners must understand how to apply their academic knowledge to everyday life.
- In this unit, learners will gain a deeper understanding of conversion of energy, as well as energy conservation. In particular, they will learn how energy conservation impacts the environment.
- The unit will focus on food, electricity and transportation.

ACTIVITY 12.9

Present information on conversion and conservation of energy in your environment LB page 165

(Pair/Individual) *CP5.1, DL5.5, CC8.2*

Guidelines

- Learners will do more research for the purposes of putting together a presentation.
- Read through the requirements carefully and encourage learners to check back often to ensure that they answer all points.
- Learners can choose the format of their presentations. For example, they may choose to do a PowerPoint presentation, or they may decide to use a speech with a poster.
- For learners who may be too nervous to present in front of the whole class, allocate some time outside of class hours for them to be able to present only to you.

Assessment

Use the rubric on page 137 of the Teacher's Guide for assessing presentations.

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) 1 Potential; 2 Potential; 3 Kinetic; 4 Electrical
 - b) Answers can include:
 - Communities may require resettlement.
 - Ecosystems may be affected.
 - Drought may impact on power generation capabilities.
- 2. a) Photovoltaic cells
 - b) To capture and store solar energy, converting it to electrical energy
 - c) Answers can include:
 - Clean source of energy (renewable)
 - Affordable (after initial set-up)
- 3. Renewable energy is sustainable, as it cannot be depleted. Non-renewable energy, on the other hand, is not sustainable and can be depleted.
- 4. Any three: solar, hydro-electric, wind, biomass
- **5.** Answers can include:
 - Can be more affordable
 - Reduces reliance on non-renewable energy sources
 - Better for the environment
- **6. a)** Heat is the transference of energy from an object or region at a lower temperature to an object or region at a higher temperature.
 - b) During phase changes
- **7.** a) Step-down transformer
 - b) Distribution end
- 8. a) To store charge and release it when needed
 - **b)** A. Current will flow through the LED.

Topic 3: Force and motion

Module 13 Magnetic force, motion and machines

Unit 13.1 Magnetic force

Content standard

Demonstrate the production of magnets, domestic and industrial application of magnetic force and its relationship to Newton's Second Law of Motion in everyday life.

Learning indicator

Demonstrate simple ways of making magnets and show how magnetic force can be applied in domestic and industrial activities.

Core competencies

- Examine alternatives in creating new things.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Speak clearly and explain ideas.

Unit in a nutshell

- Learners have prior knowledge of magnetism from Basic 7.
- Revise the basics of magnets with the learners.

ACTIVITY 13.1

Make a temporary magnet

LB page 171

(Group) CI5.1

Guidelines

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to create the magnet by stroking.
- Be very clear at every step of setting up the experiment so that learners can see what you are doing. Encourage them to volunteer instructions or suggestions about what you should do next.
- Guide the learners in understanding the conclusion, as outlined in the Learner's Book.

ACTIVITY 13.2

Make an electromagnet

LB page 172

(Pair/Group) CP5.6

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to make the electromagnet.
- Be very clear at every step of setting up the experiment so that learners can see what you are doing. Encourage them to volunteer instructions or suggestions about what you should do next.
- Guide the learners in understanding the conclusion, as outlined in the Learner's Book.

ACTIVITY 13.3 Investigate a doorbell

(Class)

CC8.1

Guidelines

- Do this activity as a class discussion/exercise.
- Work through the diagram, pointing out each of the labels and asking volunteers to provide their purpose or role.
- Then, as a class, come up with a succinct explanation of how the doorbell works.

ACTIVITY 13.4

Explore other domestic and industrial uses of magnets and present findings LB page 175

(Individual) *CC8.1*

Guidelines

- Learners will do more research for the purposes of putting together a report.
- It may be worthwhile assigning the fields to particular learners and then putting together the groups based on that. This will assist in ensuring a wide spread of topics, as well as creating groups that vary in ability and presentation styles.
- Allow learners to assess their peers using the rubric on page 137. You should then read through the reports and ensure fair assessment.

Assessment

Use the rubric on page 137 of the Teacher's Guide for assessing reports.

Unit 13.2 Newton's Second Law of Motion

Content standard

• Demonstrate the production of magnets, domestic and industrial application of magnetic force and its relationship to Newton's Second Law of Motion in everyday life.

Learning indicator

• Explain the relationship between magnetic force and Newton's Second Law of Motion; and show the law's application to life.

Core competencies

• Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- In Basic 7, learners learned about Newton's First Law of Motion: An object at rest stays at rest and an
 object in motion stays in motion with the same speed and in the same direction unless acted upon by
 an unbalanced force.
- When teaching the laws of motion, break down the laws into smaller, more digestible chunks.
 Learners are often intimidated by the language. Assist them to understand the words so that they can understand the content and the concept.

ACTIVITY 13.5

Problem solving with Newton's Second Law LB page 178

(Individual) *CP5.2*

Guidelines

- The problems in this activity are presented in visual form to assist learners with solving them.
- You can either allow learners to do this for homework, or you can do the problems in class as a class.
- The formula to be used is $a = \frac{F_{\text{net}}}{m}$ or $F_{\text{net}} = ma$

Answers

A.
$$F = 25$$
; $m = 15$ kg, so: $a = \frac{25}{15} = 1.7$

B.
$$F = 30$$
; $m = 15$ kg, so: $a = \frac{30}{15} = 2$

C.
$$F = 30$$
; $m = 40$ kg, so: $a = \frac{30}{40} = 0.75$

D.
$$F = 5$$
; $m = 15$ kg, so: $a = \frac{5}{15} = 0.3$

(Group) *CP5.2*

Guidelines

- It is important that learners are able to relate what they learn to their everyday life.
- Allow the groups time to discuss and come up with a good explanation of how Newton's Second Law
 of Motion can be described with an example from daily life.
- Examples include: pushing a shopping cart, hitting a ball, a car accident, throwing an object from a height, etc.

EXPERIMENT 1

Show the relationship between force and motion

LB page 180

(Pair/Group) *CP5.2*

- Learners can do this in groups if you have sufficient resources and time.
- Alternatively, do this as a class demonstration.
- Follow the instructions in the Learner's Book to set up the experiment.
- Be very clear at every step of setting up the experiment so that learners can see what you are doing.
- Ensure that learners with vision or hearing challenges are situated in positions where they can hear you and see what you are doing clearly.
- Encourage learners to volunteer instructions or suggestions about what you should do next.
- Guide the learners in understanding the conclusion, as outlined in the Learner's Book.

Unit 13.3 Complex machines

Content standard

• Demonstrate understanding of complex machines and how they work.

Learning indicator

• Identify complex machines and describe their functions in life.

Core competencies

- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.
- Identify and prove misconceptions about a generalised concept or fact specific to a task or situation.
- Identify and explain a confusion, uncertainty, or contradiction surrounding an event.

Unit in a nutshell

- A complex machine is a combination of two or more simple machines.
- Learners should have some background knowledge of simple machines. Spend some time revising these, as it is important foundational knowledge.
- There are many free resources that you can use in this unit to demonstrate simple machines. For example, an axe is a wedge, a see-saw is a lever, etc.

ACTIVITY 13.7	Recap simple machines	LB page 183
(Individual) CC8.2		

Guidelines

- This activity is ideal for homework.
- Encourage learners to spend time doing it properly, as they can use it for their revision for tests and exams.

Answers

The table can look like this:

Type of simple machine	How it works	Diagram	Example
Lever	Consists of a fulcrum, an effort arm and a load	load effort effort arm load arm fulcrum	Hammer pulling out nail

Type of simple machine	How it works	Diagram	Example
Inclined plane	Flat surface with one end raised higher than the other		Wheelchair ramp
Wedge	Two inclined planes back- to-back, which enables the wedge to separate things	wedge	Axe
Screw	Small, inclined planes mounted on a cylinder	inclined plane (ridges)	Screw-in lightbulb
Wheel and axle	A wheel with a cylinder through its centre, which rotate together	wheel	Doorknob
Pulley	Grooved wheel combined with a rope, which helps to raise, lower or move loads with minimum effort	load effort	Fixed pulley

ACTIVITY 13.8

Explain complex machines and how they differ fromsimple machines
LB page 185

(Group/Pair) *CP5.8*

Guidelines

Allow learners to do this quick activity in groups or pairs.

Answers

- 1. A wedge; B lever; C wheel and axle
- 2. A wheel and axle; B lever; C screw

ACTIVITY 13.9

Explain how the functions of a complex machine can improve the quality of life

LB page 185

(Pair/Individual) *CC8.2*

Guidelines

- Learners will write a paragraph in this activity.
- First, allow them some time to discuss the activity and their thoughts with a partner. This will give them a good starting point.
- Each learner should write his or her own paragraph.

Assessment

Use the rubric for writing on page 137 of the Teacher's Guide.

Topic 4: Forces and energy

Unit 13.4 Agricultural tools

Content standard

 Demonstrate knowledge and skills in the use of basic and simple agricultural tools for basic on-farm activities.

Learning indicator

Show and discuss the use of basic and simple agricultural tools for basic on-farm activities.

Core competencies

- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Analyse and make distinct judgement about viewpoints expressed in an argument.

Unit in a nutshell

- Learners will revisit the basic tools they studied in Basic 7.
- It is important that learners understand the connection between simple and complex machines and these tools.
- If you are running out of time in the classroom, assign pairs to read through and summarise the information in the table for homework.

ACTIVITY 13.10

Collect and list different types of agricultural tools used for on-farm activities

LB page 188

(Class) CP5.6

Guidelines

- You will need to set up a visit with a local farm. Alternatively, if there is a school garden, you can visit that
- Learners should make a list of all of the tools they see at the farm or school.
- Allow learners to use their smart phones to take photos. Alternatively, they can draw diagrams of the tools they see.
- Learners will need their list for the next activity.

ACTIVITY 13.11

Match tools with the agricultural activity it is used for LB page 188

(Individual) *CP5.2*

• Learners will create an album of the tools that they listed in Activity 13.10.

Assessment

Use the rubric for presentations on page 137 of the Teacher's Guide.

Unit 13.5 Using basic and simple agricultural tools for basic farm activities

Content standard

 Demonstrate knowledge and skills in the use of basic and simple agricultural tools for basic on-farm activities.

Learning indicator

Engage in the use of basic and simple agricultural tools for basic farm activities.

Core competencies

- Provide new insight into controversial situations or tasks.
- Try new alternatives and different approaches.
- Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- In the previous unit, learners learned about basic agricultural tools and their uses.
- In this unit, they will practise using them.
- Be mindful of learners with physical challenges that might prevent them from being able to use these tools. These learners should take on a managerial role in the activities – directing and instructing other learners what to do.
- There may also be a difference between the strength levels of the boys and the girls. This is fine. However, be sure to emphasise that many of these tools are not based on strength but on technique and so they should be able to manage.
- Many learners will have experience working with these tools from assisting at home or in the community.

ACTIVITY 13.12

Select appropriate tools and explain how these are used to perform specific agricultural activities LB page 189

(Individual) *CP5.2*

Guidelines

- Learners are going to take the information provided to come up with a plan for how they would cultivate a patch of land.
- They will write a report on how to use the land to produce crops.
- Ensure learners use the headings to outline how they would go about cultivating the land.

Assessment

Use the rubric for report writing on page 137 of the Teacher's Guide.

ACTIVITY 13.13

Practise the use of different tools for specific activities

LB page 190

(Group) *CP5.7, CI5.5*

Guidelines

- Learners should be given an opportunity to put their plan into action by working in the school garden.
- Ensure that groups are of mixed ability so that more-skilled learners have an opportunity to work with less-skilled learners.
- Give each group a tray of seedlings and allow them access to basic agricultural tools.
- Encourage the groups to come up with a plan of action, and to assign tasks to each group member for a period of four to six weeks.
- They should keep a weekly report of how they care for the seedlings.

Assessment

Use the rubric for report writing on page 137 of the Teacher's Guide.

ASSESSMENT ACTIVITY

LB page 192

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) Steel
 - b) North
- 2. Answers can include:
 - It can be turned on and off.
 - It is more powerful.
- **3.** a) 0.8
 - **b)** 0.7
 - **c)** 0.3
- 4. a) Inclined plane and wedge
 - **b)** Can be used to chop trees or wood to make fences
- 5. Wheel and axle, wedge, lever
- 6. a) Axe, sickle and/or cutlass
 - b) Spade, shovel and/or pickaxe
 - c) Sickle, hoe and wheelbarrow
 - d) Hand trowel and fork and/or spading fork

Activity 1: Multiple choice

C
 B
 D
 D
 C
 A
 C
 A
 C
 D
 A
 D
 D
 (10)

Activity 2: Short questions

- 1. The learners' steps should read like this:
 - i. The sluice gates in the dam wall open, allowing the water in the reservoir to flow into the pipe in the dam wall. The pipe carrying the water is called a penstock.
 - **ii.** The water in the dam has potential energy which is converted into kinetic energy as the water flows down the penstock.
 - iii. The kinetic energy of the water is converted into kinetic energy of the blades of the turbine when the fast-moving water strikes the turbine blades.
 - iv. The kinetic energy of the blades of the turbine is converted into electrical energy in the generator.
 - v. The electric power generated is then transmitted through the power cables. (10)
- **2.** a) The table can look like this:

Renewable energy	Non-renewable energy
Can be used over and over (replenished)	Can only be used once
In plentiful supply	Limited supply
Produce clean energy	Produce harmful gases that pollute and lead to climate change

b) Any two for renewable: geothermal, biomass, solar, wind, hydroelectric.

Any two for non-renewable: fossil fuels, natural gas, coal, nuclear. (4)

(6)

(5)

(2)

- **3.** The solar energy generated domestically is stored in batteries which are expensive and need to be recharged very often. Wind energy also uses storage batteries together with air compression chambers. The storage of the power compensates for the unreliable weather.
- 4. a) Resistor (1)
 - **b)** Resistors limit the amount of current flowing through a circuit. The larger the resistance of a circuit, the smaller the current in the circuit.
 - c) Since LEDs require small currents to operate, an LED is always connected with a resistor in a circuit. (2)
- 5. An electromagnet can be made by passing a current through an insulated wire wound around any length of steel or soft iron. The magnetism can be switched on and off by turning the current on and off. The strength of the magnetism can be increased by using more insulated windings and by increasing the current in the windings (using a larger battery). (5)

Section 4 Assessment (continued)

- 6. a) force
 - b) accelerate

c) direction

7. Any two: wheel and axle, pulley, lever, screws (2)

8. a) C

b) A

c) E

d) B

e) D (5)

Total: 55

(3)

Section 5

Humans and the environment

Learning outcomes

Content standard	Indicators and exemplars	Core competencies		
Topic 1: Waste mai	Topic 1: Waste management			
B8.5.1.1 Demonstrate knowledge of waste management systems and apply it in an environment.	 B8.5.1.1.1 Explain sustainable waste management practices. Outline approaches to waste management in promoting sustainable management. Conduct a survey of a community's waste management practices and present a report. 	CP5.1, DL6.6		
	 B8.5.1.1.2 Apply knowledge of waste management practices to manage waste in a community. 1. Carry out an activity to manage waste using knowledge acquired in indicator B8.5.1.1.1 in their communities. 2. Evaluate the waste management practices carried out in a community and present a report. 	CP6.1, CC8.2		
Topic 2: Human he	alth			
B8.5.2.1 Demonstrate knowledge of common communicable diseases in humans, such as hepatitis, and their causes, symptoms, effects and prevention.	 B8.5.2.1.1 Explain the symptoms, effects and prevention of common communicable diseases. Compile data on the number of males and females who suffer from common communicable diseases such as hepatitis, from a medical centre, and determine the possible causes of these diseases. Identify causes, symptoms, effects and prevention of hepatitis, HIV, measles and others, and make a presentation. Search for the causes, symptoms and prevention of hepatitis and develop a plan to minimise the disease. 	CP5.6, CC8.2, CP5.1		
	 B8.5.2.1.2 Analyse the risk factors of communicable diseases. Search for information that is associated with communicable diseases. Create awareness about risk factors of communicable diseases such as hepatitis, HIV, measles and others in order to prevent the diseases in their schools and communities. 	DL5.5, CC8.3		
B8.5.2.2 Demonstrate knowledge of the nature of selected bacterial diseases in humans, and their causes, symptoms, effects and prevention.	 B8.5.2.2.1 Explain the nature of bacterial diseases with special emphasis on food poisoning/gonorrhoea meningitis, their causes, symptoms, effects on humans and prevention. Discuss the nature of bacterial diseases. Search for information and make presentations on food poisoning, gonorrhoea and meningitis, and their mode of transmission from person to person, community to community, and from country to country. Describe the symptoms, effects and prevention of food poisoning, gonorrhoea and meningitis. Describe the role of individuals, community members and government in managing food poisoning, gonorrhoea and meningitis. Design and produce a poster to educate their community members on the incidence and control of named bacterial diseases: food poisoning, gonorrhoea and meningitis. 	CP5.1, DL5.1, CC8.1, CI5.1		

Content standard	Indicators and exemplars	Core competencies	
Topic 3: Science and industry			
B8.5.3.1 Demonstrate an understanding of connections among science, technology, innovation, society and the environment.	 B8.5.3.1.1 Examine the relationship among science, technology, innovation and society. 1. Explain the interrelationship of science and technology and innovation. 2. Discuss technological advancements in the world and its impact on the Ghanaian environment. 	CP6.1, CC8.2, DL5.5	
Topic 4: Climate ch	ange and green economy		
B8.5.4.1 Demonstrate an understanding of the effects of climate change in the world and the greening of tropical countries, including Ghana.	 B8.5.4.1.1 Explain the concept of climate change and its effect on the environment. Describe the signs of climate change. Search for causes and effects of climate change and present a report. Explain how countries on the continents are adapting to climate change, for example, tree planting and legislation on bush burning. 	CP5.1, CC8.2, DL5.1	
	 B8.5.4.1.2 Describe climate change and green economy actions. Describe climate change adaptation measures that can be applied in the community. Discuss mitigation strategies that your community can adapt to reduce the effects of climate change. 	CP5.1, CC8.1, DL5.1, CC8.2	
Topic 5: Understan	ding the environment		
B8.5.5.1 Demonstrate understanding of the differences among soils, plant roots, stems, leaves, flowers and fruits of plants in the different environments.	 B8.5.5.1.1 Discuss the physical properties of soils. Collect and describe different samples of soils (sandy soil, loamy soil, clay soil, etc.) from the school garden and the community. Discuss how each soil type retains water and supports the root system of plants. Conduct an experiment to demonstrate how different soil types retain water to support the root system of crops. 	CP5.1, CC8.2	
	 B8.5.5.1.2 Analyse the physical properties of soils and soil water content, and demonstrate their importance in crop production. 1. Examine and discuss the different physical properties of each soil type and how these properties help support crop production. 2. Observe and describe the growth of different plants in different soil types. 3. Demonstrate how plants absorb water and nutrients from the soil (osmosis). 	CP5.5, CP5.3, CC8.1, CI5.5, CP5.1	
B8.5.6.1 Recognise the different types of rock as the origin of different types of soil.	 B8.5.6.1.1 Observe and describe different types of rock as the origin of soils. Identify different labelled samples of rocks presented in the classroom/laboratory. Describe the visible characteristics of each rock. Collect samples of rocks from around the community and label them according to the rock identification guide, and compare them with the labelled laboratory samples in Exemplar 1. Research and report the stages of weathering of rocks to form soil. 	CP6.3, Cl6.8, CP6.4	

Topic 1: Waste management

Module 14 Keeping the environment clean

Unit 14.1 Sustainable waste management

Content standard

Demonstrate knowledge of waste management systems and apply it in an environment.

Learning indicators

- Explain sustainable waste management practices.
- Apply knowledge of waste management practices to manage waste in a community.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Have knowledge and recognition of ethical use of information.
- Effectively define goals towards solving a problem.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- Waste management is a challenge that is facing not only Ghana but the world at large.
- Proper waste management is about ensuring that the natural environment and the built environment are kept clean, as well as ensuring that the population is healthy.
- However, there is a proliferation of waste as the world becomes more and more industrialised and technology focused. This waste is piling up and causing many problems, not least pollution, including water and air pollution.
- Good waste management practices involve reducing the amount of waste in the world and recycling what waste can be recycled.

ACTIVITY 14.1

Outline approaches to waste management in promoting sustainable management

LB page 201

(Individual/Pair) CP5.1

- Learners can do this activity in pairs. Alternatively, they can do it independently.
- They will need to think critically about what they have learned in order to complete the table.

Answers

1. a) Example answer:

Type of waste management	Advantage	Disadvantage
Reduce and reuse	There is less rubbish or waste to deal with.	People may not want to use less, or to wait longer before they upgrade or update devices.
Recycle	Non-biodegradable materials can be reused in some form.	Recycling projects must be run separately from general rubbish, and this can be a logistical challenge. It is also more expensive.
Compost	The compost can be added to the soil, which is good for the nutrient level of the soil.	Space is needed to do this properly, which is difficult in an urban area.
Waste to energy	The waste is used to solve another problem: energy provision.	Even with filters, the burning of waste can cause air pollution. Also, it is expensive because power stations must be built or retrofitted to cope with it.
Landfill	The rubbish is out of sight, and in one place.	Eventually, landfill sites will be too full and they will need to be expanded.

- **b)** Learners' paragraphs should focus on the disadvantages of landfill, and the advantages of reducing and reusing.
- **2. a)** It composts waste to encourage the formation of maggots, which it then sells to the livestock farming industry as feed.
 - b) It solves the problem of what to do with certain types of waste. The benefit is that farmers have an option to buy an affordable type of feed for their animals.
 - c) If the maggots are not sold in time, there may be a risk of a housefly infestation.
 - d) Composting.

ACTIVITY 14.2

Conduct a survey to find out more about a community's waste management practices LB page 202

(Group/Pair) *DL6.6*

- The learners should be encouraged to work in pairs or small groups of no more than five learners. This is for their own safety, as well as having educational benefits.
- They must conduct a survey of at least 20 people in their community about waste management practices.
- The survey form on page 202 of the Learner's Book can be used. Revise how to use tally marks so that the learners can quickly count the respondents' answers.
- Encourage them to see that the survey form/questionnaire asks closed questions, but they can ask open-ended questions as well. One or two of the pair or group should take notes, or they can use the recording app on their mobiles.
- They will need to then interpret their data into a bar graph or pie chart. They should know how to
 do this from Mathematics, but you can assist if necessary. A bar graph may be more suitable for
 most learners.

- Individually, they should write paragraphs to show their conclusion. They can do this after consulting with their partner or group.
- They will use this part of the report for the next activity, so encourage them to keep it safe.

ACTIVITY 14.3

Apply knowledge of waste management practices to manage waste in a community LB page 202

(Group/Pair) CP6.1, CC8.2

Guidelines

- Learners will continue working with the report that they started in Activity 14.2.
- The learners should come up with a waste management plan for the community that is more sustainable.
- They should plan a campaign to present this plan to the community, and to put it into action. Their plan should include information about:
 - community meetings
 - who in the community must be consulted
 - how they will get the community's buy-in
 - details of any posters/text messages/emails they will send to the community
 - the benefits of the plan for the community
 - the constraints or challenges that the community will face in implementation.
- The learners must then compile the report and present it to you.

Assessment

Use the rubric for research and report writing on page 137 of this Teacher's Guide to assess the reports.

ASSESSMENT ACTIVITY

LB page 203

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. A reduce
 - B recycle
 - C compost
 - D controlled burning/waste to energy
 - F landfill
- 2. Learners' answers should focus on the two pillars: clean environment and healthy population. They can also touch on the impact that pollution has on ecosystems, and how this may be affecting climate change. From a local perspective, they can discuss the impact that pollution can have on urban areas, as well as fishing grounds and farming land.
- 3. Learners' answers will vary. However, they should be able to understand that policy change and a mental shift in the global population is necessary. Their answers may touch on the fact that it creates jobs, but at what expense?

Topic 2: Human health

Module 15 Communicable diseases

Unit 15.1 Examples of communicable diseases

Content standard

Demonstrate knowledge of common communicable diseases in humans, such as hepatitis, and their causes, symptoms, effects and prevention.

Learning indicator

Explain the symptoms, effects and prevention of common communicable diseases.

Core competencies

- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.
- Combine information and ideas from several sources to reach a conclusion.

Unit in a nutshell

- Communicable diseases, unlike illnesses such as cancer or heart disease, can spread through a population, often rapidly.
- A recent example is COVID-19, which caused a global pandemic from the end of 2019.
- Other communicable diseases have been problematic for years, especially in less economically developed countries.
- Education, awareness and vaccination are all tools that can help to manage and prevent the spread of such diseases.
- Be mindful of learners who have been personally impacted by any of the communicable diseases they will learn about in this unit. There should be no stigma around any of these diseases.

ACTIVITY 15.1

Identify causes, symptoms, effects and prevention of communicable diseases and make a presentation

LB page 207

(Individual/Group) CP5.6, CC8.2

- Learners can answer the first question independently.
- Then, arrange the learners into groups. Ensure that groups are of mixed ability. Your class should have four or eight groups, depending on size.
- Assign each group with one of the diseases listed.

- The groups will work to research their assigned diseases. They will need to collaborate to divide the work, discuss their desired outcomes, and then come together to synthesise their data and information.
- Each learner must then compile a report independently.
- These will be shared with their group. Each group must choose a representative to present their research to the class.

Answers

- 1. a) TB, COVID-19, measles
 - b) TB, COVID-19, measles
 - c) HIV
- 2. Learners' reports and presentations will depend on which disease they have been assigned.

Assessment

Use the rubrics for report writing and presentation on page 137 of the Teacher's Guide.

ACTIVITY 15.2

Compile data about people who suffer from hepatitis

LB page 209

(Pair/Group) CP5.6

Guidelines

- Learners may need your help arranging meetings with the local clinic. Remind learners that the healthcare workers are busy, and that they will need to make an appointment or wait for a gap in their schedule.
- It may be worth arranging for a nursing sister or doctor to visit your class and answer all the learners' questions in one go. Prepare this person in advance so that they know what information to bring.
- The pairs or groups (no larger than six to eight per group) should then spend time analysing the provided statistics and figures.
- You are checking the learners' ability to make sense of complex information, and to use their prior knowledge to extrapolate and see connections.

ACTIVITY 15.3

Search for the causes, symptoms and prevention of hepatitis

LB page 209

(Individual/Pair) CP5.1

- Learners should first do research using the internet or the library.
- They will then discuss their findings with their partner.
- The information that they find in this activity leads into the content for Unit 15.2. •
- Lastly, learners will discuss how stigma can have negative health effects in a community.
- To fully answer the second question, they must write down some of the common symptoms and causes of bacterial infections. For example, if a person has gonorrhoea, they may feel shame and prefer to simply ignore it and hope it will go away.

Unit 15.2 Risk factors associated with communicable diseases

Content standard

 Demonstrate knowledge of common communicable diseases in humans, such as hepatitis, and their causes, symptoms, effects and prevention.

Learning indicator

Analyse the risk factors of communicable diseases.

Core competencies

- Evaluate the quality and validity of information.
- Apply appropriate diction and structure sentences correctly for narrative, persuasive, imaginative and expository purposes.

Unit in a nutshell

- This unit focuses on the long-term effects that communicable diseases can have on a person's health and life.
- In general, people get sick and recover fully. However, some infections are difficult to shake and can cause damage to organs and the body's immune system.
- These are known as risk factors. It is especially applicable to diseases that are not initially fatal, or don't feel too bad. This can lull people into a false sense of security.
- The prevention of these diseases is critical for long-term public health.

ACTIVITY 15.4

Search for information that is associated with communicable diseases LB page 211

(Individual) *DL5.5*

Answers

A completed table may look like this:

Long-term effect	Personal impact	Social impact
Measles-caused blindness	Life-changing; will have to learn new skills and learn to live as a blind person.	Could affect the person's ability to work, especially if they are poor and live in a rural area.
Long COVID	Can feel debilitating. Flare ups can be unpredictable, which makes life difficult. Can feel isolated and lonely because there is still so much that scientists do not understand. Could have severe health effects, particularly on the lungs and the heart.	Can affect the workforce, especially if people are too ill to work. Children may need to miss school if they need to take care of ill caregivers.
Liver cancer	Loss of income, fear, grief and death.	Families and communities will be affected by the loss, children may need to miss school, or partners/family members may have to stop working to care for the patient.

ACTIVITY 15.5

Create awareness about the risk factors of communicable diseases

LB page 211

(Pair/Group) CC8.3

- Allow the learners to work in pairs or small groups for this activity.
- They will need to choose one of the communicable diseases that they have learned about and design an awareness campaign for it.
- Their campaign should focus on vaccination and preventative measures (mask-wearing, social distancing, etc.) as ways to slow spread or prevent spread completely.
- Allow the pairs or groups to display their posters in the school hall.

Unit 15.3 Bacterial diseases

Content standard

Demonstrate knowledge of the nature of selected bacterial diseases in humans, their causes, symptoms, effects and prevention.

Learning indicator

Explain the nature of bacterial diseases with special emphasis on food poisoning/gonorrhoea/ meningitis, their causes, symptoms, effects on humans and prevention.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.
- Speak clearly and explain ideas.
- Merge simple/complex ideas to create novel situations or things.

Unit in a nutshell

- Viral infections and diseases are very difficult to treat.
- Bacterial infections can usually be treated with antibiotics. However, it does depend on the severity of the infection and when in the infection cycle the patient has sought medical attention.
- There are a number of ways in which bacteria can be introduced into the body and the bloodstream. In this unit, learners focus on bacterial diseases that are spread by unsafe sex, contaminated food and water, and droplets from coughing or sneezing.
- The unit also focuses on the role of government, communities and individuals in slowing or preventing the spread of diseases.
- Be mindful of learners who have been personally affected by any of these bacterial diseases (whether directly or indirectly). There should be no shame or stigma; so be aware of your language and how you speak about sufferers of these diseases.

ACTIVITY 15.6

Discuss the nature of bacterial diseases and their mode of transmission

LB page 214

(Individual) CP5.1, DL5.1

Answers

- 1. The sandwiches were more than likely contaminated with bacteria that has caused food poisoning.
- 2. a) Gonorrhoea is the most likely option.
 - b) He needs to seek medical advice so that he can be properly treated, and then he needs to practise safe sex. He also needs to contact the people he has had sexual intercourse with and encourage them to get tested and treated, if necessary. He needs to do this to prevent spreading gonorrhoea to more people.

3. Bacterial meningitis is a medical emergency. It can cause rapid death or brain damage. Prevention is really the best way to deal with it. Bacterial meningitis mostly affects infants and small children. It is critical that the baby be vaccinated because they should not take a chance.

ACTIVITY 15.7

Search for information to describe bacterial diseases

LB page 214

(Individual) DL5.1, CC8.1

Guidelines

- This exercise tests the learners' ability to interpret information and put it into their own words.
- They will need to write three letters.
- The first letter is written from the point of view of someone who is suffering from food poisoning.
- The second letter is written from the point of view of someone who is suffering from gonorrhoea.
- The third letter is written from the point of view of someone who is suffering from bacterial meningitis.
- The letters should be creative, but they should also be factual. They should not introduce any stigma (other than to express that they are feeling stigmatised, perhaps) or perpetuate stereotypes.

ACTIVITY 15.8

Describe the role of the individuals, community members and government in managing bacterial infections

LB page 215

(Pair/Individual)

Guidelines

- Learners will write an essay in this activity.
- First, allow them some time to discuss the statement and their thoughts with a partner. This will give them a good starting point.
- Each learner should write their own essay.

Assessment

Use the rubric for essay writing on page 137 of the Teacher's Guide.

ACTIVITY 15.9

Design and produce a poster to educate your community about bacterial infections LB page 216

(Individual) *CI5.2*

- Learners will choose one of the bacterial infections that they have learned about and design an educational poster.
- Their posters should be attractive and colourful. They should not use too much text. The idea is to get the message across quickly and simply.
- Allow learners to display their posters and walk around to look at their classmates' posters also.

Assessment

Use the rubric for making posters on page 137 of the Teacher's Guide.

ASSESSMENT ACTIVITY

(LB page 217)

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. Because it can be passed on from person to person.
- 2. a) Any two:
 - Fever
 - Loss of taste
 - Loss of smell
 - Sore throat
 - Dry cough
 - Chills, body aches
 - Shortness of breath
 - b) Any two:
 - Cough
 - Runny nose
 - Inflamed eyes
 - Sore throat
 - Fever
 - Skin rash
 - c) Any two:
 - Fatigue
 - Yellow skin and eyes (jaundice)
 - Appetite loss or unexplained weight loss
 - Abdominal pain
 - Dark urine and pale stool
 - Liver cancer, or liver failure
- **3.** COVID-19 enters the body through the mouth via saliva or mucus droplets, and the nose or eyes. A mask prevents these droplets from reaching your nose and mouth, and it also prevents you from infecting others.

4. The table can look like this:

Hepatitis A	Hepatitis B	Hepatitis C	Hepatitis E
Vaccination (before exposure) Safe drinking water and properly cooked, safe food	Vaccination	Screening Preventative measures (such as wearing a condom, or medical intervention in childbirth)	Safe drinking water and properly cooked, safe food

- **5.** Personal impact: withdrawal, denial, loss of income, guilt and inaction, depression. Impact on community: stigma and discrimination, spread of disease, fear and grief.
- **6.** Answer can include the following information:

Government

- Effective and easily accessed vaccination drives
- Robust and effective healthcare services
- Education
- Collaboration with global health partners, such as WHO

Communities

- Swift response to any bacterial outbreaks in the community
- Service delivery to ensure a clean and safe environment
- Communication with community members in the event of an outbreak
- Collaboration with government

Individuals

- Participating in vaccination drives
- Practising regular hand washing
- Keeping areas surrounding home clean and tidy
- Taking responsibility for own health by making use of health facilities
- Practising safe sex
- **7.** a) Bacterial meningitis
 - b) Food poisoning
 - **c)** Gonorrhoea

Topic 3: Science and industry

Module 16 Innovation and society

Unit 16.1 The relationship among science, technology and innovation

Content standard

Demonstrate an understanding of connections among science, technology, innovation, society and the environment.

Learning indicator

Examine the relationship among science, technology, innovation and society.

Core competencies

- Effectively define goals towards solving a problem.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Evaluate the quality and validity of information.

Unit in a nutshell

- It is most important to work on the learners' understanding of the terminology for this unit.
- Science is the development of knowledge. Technology is the application of knowledge. Innovation is the application of technology.
- All three are interrelated and dependent on each other to solve problems in the world. Without innovation, scientific discoveries would not be used to solve problems. Without technology, we would not have the know-how when it comes to how to get products to the market.
- One of the best investments that a country's government can make is in education.
- One intersection that must be emphasised is local and indigenous knowledge, which must be linked to modern scientific discoveries and applied to modern problems.

ACTIVITY 16.1

Explain the interrelationship of science, technology and innovation LB page 219

(Individual/Class) CP6.1, CC8.2

- Learners must be given an opportunity to research a local product. This can either be a product they know of, or they must search the internet to find a suitable example.
- The learners should then use the product as an example to describe how science, technology and innovation drove the production of the product.

• Set aside a lesson or two for the learners' presentations, if possible. If your class is too big, break up the class into mixed-ability groups and allow each learner to present to their group.

Assessment

Use the rubric for oral presentation on page 137 of the Teacher's Guide.

ACTIVITY 16.2

Discuss technological advancements in the world and its impact on Ghana

LB page 221

(Pair/Individual) *DL5.5, CC8.2*

Guidelines

- It would be preferable to allow the learners to discuss their answers in pairs, and then to have a class discussion.
- Alternatively, if you have run out of time, you can allow learners to do this for homework.

Answers

- 1. a) That the Sun can be used as a power source
 - b) The technology to convert solar power into energy using photovoltaic cells
 - c) The solar-powered car
- 2. It is innovative because it takes science and technology and uses both to solve a real problem, which is that fuel is expensive, and people need an affordable and sustainable way to travel.
- **3.** If the global community pools its resources and knowledge, problems can be solved much more quickly.
- 4. It will mean that the economy will be less dependent on fuel, which is good for the environment. The car is also less expensive to run, so more people will have access to transport, which means that they can run businesses more easily.

ASSESSMENT ACTIVITY

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) Science: Plants can be bred to have specific genetic properties
 Technology: How to propagate seeds and crops with specific genetic properties
 Innovation: Crops that are drought-resistant
 - b) Science: Solar power can be harnessed for energy Technology: How to harness solar power for energy Innovation: A solar-powered car that is safe and rechargeable
- 2. Indigenous knowledge systems hold much knowledge and information that should not be forgotten or dismissed. Even in ancient history, before science became more modern, Africans were making technological and innovative discoveries and products. Besides that, Ghanaians have customs, vegetation and ways of life that must be preserved. Instead of wiping it away to take on Western scientific methods, Africans should find a way to combine Western science with local knowledge.
- 3. With global collaboration, problems can be identified and solved much more quickly. There are no benefits to different countries coming to the same scientific conclusions separately. It is better to collaborate and work together.

Topic 4: Climate change and green economy

Module 17

Climate change

Unit 17.1 The climate emergency

Content standard

• Demonstrate an understanding of the effects of climate change in the world and the greening of tropical countries, including Ghana.

Learning indicator

• Explain the concept of climate change and its effect on the environment.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.

Unit in a nutshell

- Climate change is a crisis that is facing the entire planet.
- Less economically developed countries, and people living in poverty, are most affected by climate change.
- Climate change refers to long-term changes in climate and weather patterns.
- These changes may result (and have already resulted) in more extreme weather patterns and events, such as droughts, flooding, tropical storms, hurricanes, heatwaves, and so on.
- Climate change is directly linked to carbon emissions and the resulting enhanced greenhouse effect. Revise the greenhouse effect from Basic 7.
- Countries are working to adapt to climate change, as it is a foregone conclusion at this point. However, more can be done to slow the effects. Unfortunately, there is not much one can do on an individual level, except to put pressure on governments to address the problems.

ACTIVITY 17.1

Describe the signs of climate change

LB page 226

(Group) *CP5.1, CC8.2*

- Ensure that groups are of mixed ability. This will ensure that more-skilled learners have an opportunity to work with less-skilled learners.
- Hopefully, learners would have been able to read the article at the link provided in the Learner's Book. That will give them a lot of information on which to base their assumptions.
- Encourage the learners to be creative, but also realistic. They need to discuss an actual future that is possible.
- Remind them that climate change is happening, and the signs are already there. They can draw on their own experiences of drought or flooding, etc., to build their proposed future world.
- Allow one group member from each group a couple of minutes to share the group's prediction with the class.

ACTIVITY 17.2

Search for causes and effects of climate change and present a report LB page 226

(Individual) *CP5.1, DL5.1*

Guidelines

- Learners should do some research for this activity, using the internet or the library.
- For the first part, they can copy the Venn diagram into their exercise books. They will need to add their own labels, as per the instructions.
- Remind learners that a Venn diagram shows us how multiple things connect and come together for one purpose.
- Their report will then touch on how climate change affects countries, communities and individuals.
- Lastly, their report should mention the effects on Ghana. Agriculture will be difficult because of droughts, forests are being continually destroyed, and fishing will become almost impossible as species die off, and coastal towns become flooded.

Assessment

Use the rubric for report writing on page 137 in the Teacher's Guide.

ACTIVITY 17.3

Explain how Ghana is adapting to climate change

LB page 229

(Pair/Group) *CP5.1, DL5.1*

- Learners can work in pairs or small groups to complete this activity.
- They will read the goal and objectives provided for Ghana's strategy to adapt to climate change. They should then compare it to the COP26 goals. They will notice that they are very much in line with those.
- The pairs or groups can then discuss some practical steps that local governments or even households can take. This can include education or switching to solar power.
- Then, learners can discuss which of the objectives resonates most with them. They must be able to substantiate their answer.

Unit 17.2 Green economy

Content standard

Demonstrate an understanding of the effects of climate change in the world and the greening of tropical countries, including Ghana.

Learning indicators

Describe climate change and green economy actions.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Speak clearly and explain ideas.
- Ascertain when information is needed and identify, locate, evaluate and effectively use it to solve a problem.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- A green economy is one in which emissions are low, resources are used efficiently, and the well-being of the population is prioritised.
- Governments need to put in place regulatory frameworks to move the country forward towards a green economy goal.
- Businesses and industry then need to do their part, by investing and actively changing the ways they work in order to achieve the goals set by government.
- Individuals and households have less power, but they still have an opportunity to apply pressure on governments and businesses to move towards a more green economy.

ACTIVITY 17.4

Describe climate change adaptation measures LB page 231 that can be applied in the community

(Individual/Class) CP5.1, CC8.1, DL5.1

Guidelines

- Allow learners to use the internet to do research to answer the guestions.
- This is a good activity to mark as a class, as it will give you the opportunity to lead a class discussion. This helps the learners who are lagging to hear model answers from the stronger learners.
- It is also a good way for learners to share their ideas with their peers, as well as to learn how to have a discussion respectfully and with the intention of learning something.

ACTIVITY 17.5

Discuss mitigation strategies that your community can adapt to reduce the effects of climate change LB page 231

(Group) CC8.2, DL5.1

- Ensure that groups are of mixed ability. This will ensure that more-skilled learners have an opportunity to work with less-skilled learners.
- Learners must apply their knowledge about climate change and the green economy for a discussion about mitigation strategies.
- Remind them about Ghana's adaptation strategies from the previous unit, as this might help them to come up with practical mitigation strategies for their community.
- After a time (15–20 minutes), two groups should join up. One group presents to the other group, and then they switch. They can discuss any similarities or differences.

ASSESSMENT ACTIVITY

LB page 232

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) A solar energy travels to Earth
 - B atmosphere containing greenhouse gases
 - C trapped solar energy
 - D outgoing energy
 - b) Not enough solar energy/heat is allowed to escape, which causes the Earth's surface to heat up.
- 2. Carbon emissions are a direct result of burning fossil fuels.
- 3. Any two:
 - Loss of species and a loss of biodiversity.
 - More periods of prolonged drought in regions that are already vulnerable.
 - An increase in the number of wildfires.
 - More violent tropical storms, which can displace people and cause flooding.
- **4.** Policies, greed and power make it difficult for individuals to contribute in any meaningful way. Until governments are forced to prevent businesses from operating in these conditions, people are bound by that. People can live more environmentally friendly lifestyles, but the overall system must become more sustainable for it to have a real effect.
- 5. It is a clean form of energy, which benefits the ecosystem, as well as being better for the health of the population. More people will have access to solar power. Ultimately, this will benefit the economy.

Topic 5: Understanding the environment

Module 18 Soil and crop production

Unit 18.1 Physical properties of soils

Content standard

Demonstrate understanding of the differences among soils, plant roots, stems, leaves, flowers and fruits of plants in the different environments.

Learning indicator

Discuss physical properties of soils.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- Although learners may not yet know the names or characteristics of different types of soils, they know that there are different types.
- Ask the learners to think about the types of soil on a beach, compared to a farm, garden or a riverbed. Explain that these are different types of soil, with different characteristics that affect how well plants can grow.
- It is necessary to have different samples of soils available for learners to observe and work with. They will also need to collect their own samples.
- Learners will be exposed to four basic soil types this year: sandy soil, loamy soil, clay and silt. Depending on your location, they may also see chalk and/or peat. You can simply mention these; they do not have to know the properties in any detail. Chalk is fine and dusty to the touch, and does not retain water. Peat retains moisture and is high in nutrients; it is usually found near wetlands and marshes. Peat is similar to loamy soil, but it holds more moisture.
- Encourage the learners to wear gloves and to wash their hands well after handling soil. Some soil can contain microbes that may cause them to become sick, so it is important to practise good laboratory safety standards.

ACTIVITY 18.1

Collect and describe different samples of soils LB page 235

(Pair)

CP5.1

- Learners can do this activity in pairs. One learner should handle the soil (wearing gloves), while the other takes notes.
- Encourage them to read the instructions carefully before beginning the activity.
- You will need to forewarn the learners about this activity, because they will need to bring three samples (per pair).
- If you do not have enough resources for each pair, split the class into small groups. If necessary, you could do this as a demonstration.
- Each pair will need: three clean and dry jars, labels, pens (or permanent markers), a small sieve, gloves, a clean piece of paper, a bowl.

ACTIVITY 18.2

Discuss how each soil type retains water and supports roots

LB page 238

(Pair) *CP5.1, CC8.2*

Guidelines

- Learners should work in the same pairs that they did for Activity 18.1.
- Remind learners of the safety protocols.
- Once again, encourage learners to read through the instructions carefully before starting the activity.
- Each pair will need: their soil samples, a bowl or container, water, gloves.
- Once they have completed their activity, they should discuss their answers to questions 2 to 4 and then write down their answers in their exercise books.

Answers

- **2.** a) C
 - **b)** A
 - **c)** B
- 3. Clay soil retains water and so it will bind the particles of the soil together, allowing you to compact the soil. Loamy soil retains water but is also well aerated, so it can be compressed to a point. However, it will break apart somewhat. Sandy soil does not retain moisture and is extremely aerated and therefore cannot be compressed at all. It will break apart completely.
- **4.** Learners should surmise that loamy soil is the best for growing crops, as it retains just enough moisture but also allows the roots to grow freely and well.

EXPERIMENT 1

Demonstrate how different soil types retain water to support the root system of crops

LB page 239

(Pair) *CP5.1, CC8.2*

- You can either allow learners to work with their partners from Activity 18.1 and Activity 18.2, or you can do this as a demonstration.
- Read through the instructions carefully before starting the experiment.
- You will need to wet the soil samples the day before to allow for some saturation ahead of the actual experiment.
- The next day, use the sieve to add more water and time how long it takes to drain.
- Note that you should add the same amount of water to each soil type, to ensure that the experiment is fair and consistent.

Unit 18.2 The importance of soil in crop production

Content standard

• Demonstrate understanding of the differences among soils, plant roots, stems, leaves, flowers and fruits of plants in the different environments.

Learning indicator

• Analyse the physical properties of soils and soil water content and demonstrate their importance in crop production.

Core competencies

- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.
- Create simple logic trees to think through problems.
- Speak clearly and explain ideas.
- Try new alternatives and different approaches.
- Combine information from several sources to reach a conclusion.

Unit in a nutshell

- One of the most important factors when it comes to successful crop production is the quality of the soil.
- Soil quality is impacted by many factors, but it starts with the type of soil that the farmer is attempting to grow crops in.
- In this short unit, learners will discuss what they know about soil types and make assumptions about what this means for crop production.
- Then, they will read a case study about soil types in northern Ghana, and how soil quality can be affected by human activities.
- Lastly, learners will observe and describe how plants grow in different soil types.

ACTIVITY 18.3

Examine and discuss the different physical properties of each soil type and how these properties support crop production

LB page 240

(Individual/Pair) *CP5.1*

Guidelines

- Learners can do this activity in pairs. Alternatively, they can do it independently.
- They will need to think critically about what they have learned to complete the table.
- The learners must then read the extract carefully to extract the relevant information they need to answer the questions.

Answers

1. Example answer:

Soil type	Properties	How this supports/does not support crop production	
a) Sandy soil	Texture: Fine Drainage: Extremely well drained Nutrients: Contains few nutrients	Does not support crop production because it does not retain water or nutrients. Texture is too fine for roots to take hold.	
b) Loamy soil	Texture: Coarse, mixed Drainage: Good Nutrients: Contains nutrients	Supports crop production because there is a good balance of moisture and nutrients. The soil is firm enough to support roots and plants, but soft enough for roots to grow well.	
c) Clay soil	Texture: Sticky, thick Drainage: Poor Nutrients: Nutrient rich	Does not support crop production because the soil is waterlogged and is not aerated. Crops are not able to grow well because the roots cannot penetrate the clay.	

- **2.** a) It is generally sandy with some clay.
 - b) Soils are prone to erosion. The topsoil is low in moisture and low in nutrients. There are plenty of rocks and boulders, which can restrict the growth of roots.
 - c) Mulching, cover cropping, improved fallow, composting, minimum tillage, non-burning of crop residues, application of organic matter, fodder banks. Erosion prevention.
 - d) Erosion removes the topsoil, which exposes the lower sandy soils. These do not retain moisture, which makes the soil more prone to drought.

EXPERIMENT 2

Observe and describe the growth of plants on different soil types

LB page 241

(Group/Class) *CP5.3, CC8.1*

Guidelines

- You can do this activity as a class demonstration/class activity.
- Collect three samples of soil: sandy (beach sand), loamy (from a farm or garden shop), clay (from a riverbed).
- You will also need to find three plants or seedlings that are of similar age and size.
- Try to keep the conditions the same for all three plants as you want to be able to compare them directly over the three weeks.
- Follow the instructions. Once a week, encourage the learners to observe what they see and to write down their observations.
- Have a class discussion at the end of the three weeks to talk about the results and conclusion of the experiment.

EXPERIMENT 3

Demonstrate how plants absorb water and nutrients from the soil LB page 243

(Class/Group) *CI5.5, CP5.1*

Guidelines

- Learners will enjoy this experiment because it is fun to see the flowers change colour.
- You can either do this as a group activity, or as a class demonstration.
- The flowers must be white. If you cannot find white flowers, you could use celery stalks.
- Ensure that enough food colouring has been added to the water. It should be a deep colour.

ACTIVITY 18.4

Discuss the relationship between soil and osmosis

LB page 244

(Individual) *CP5.1*

Guidelines

- Learners should do this activity independently. However, you can allow for some discussion before they attempt to write their responses.
- If necessary, learners can do this activity for homework.

Answers

Learners should be able to see that loamy soil holds enough moisture so that the water potential between the plant and the soil will be equal and, therefore, healthy. Sandy soil has a low water potential, and so the plant's cells will release water. This means that the plant will not have enough water and nutrients to survive. Clay soil has too much moisture, which means that the plant's cells will always have a lower water potential. This will result in too much water and nutrients entering the plant's cells, which is also not optimal.

Unit 18.3 The origin of soils

Content standard

Recognise the different types of rock as the origin of different types of soil.

Learning indicator

Observe and describe different types of rock as the origin of soils.

Core competencies

- Select alternatives that adequately meet selected criteria.
- Recognise and generalise information and experience.
- Search for trends and patterns.
- Identify important and appropriate criteria and use them to evaluate alternatives.
- Identify important and appropriate alternatives.

Unit in a nutshell

- Now that learners understand that there are different types of soil, they will be exposed to how soil forms.
- Explain that soil is a mixture of weathered rock, humus, water and air.
- There are three main types of rock: igneous, metamorphic and sedimentary. They each form in slightly different ways and have slightly different characteristics.
- Weathering is the process of breaking down rocks due to physical, chemical or biological processes. You do not have to go into too much detail about weathering, but the learners should understand how rocks are broken down to tiny particles, resulting in soil.

ACTIVITY 18.5

Identify samples of rocks and describe their characteristics LB page 246

(Individual/Pair) CP6.3, CI6.8

Guidelines

- In the first part of the activity, learners will look at photos of rocks and try to classify these.
- Then, give them some samples of rocks that you have collected. As a class, identify what types of rocks these are. Allow learners to discuss it until there is consensus.
- Label each rock and display the collection on a table in the classroom for the duration of the topic.

Answers

- 1. a) Metamorphic: hard and contains crystals
 - b) Sedimentary: layers of sediment are visible
 - c) Igneous: shiny/glossy and hard

(Group/Individual) *CP6.4*

Guidelines

- Now, learners will collect their own samples of rocks. Each learner should bring their own variety of rocks.
- Then, working in groups of 4 to 6 learners, they will need to clean, discuss, classify and label their samples.
- Allow them to walk around and observe other groups' collections.
- Working on their own (and perhaps for homework), they should draw up a table with their classifications and observations.

ACTIVITY 18.7

Research and report the stages of weathering of rocks to form soil

LB page 248

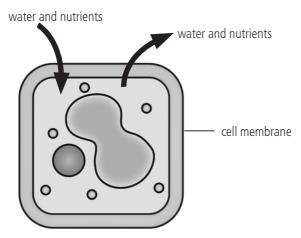
(Individual/Pair) *CP6.3*

Answers

- 1. A topsoil
 - B upper subsoil
 - C lower subsoil
 - D solid bedrock
- 2. Soil forms in layers. The layers take many years to form. First, the solid bedrock is exposed or chemical weathering results in the rock being broken into smaller rocks. Eventually these are exposed at the surface, due to erosion and other weathering. Weathering then results in these rocks being broken down into tiny particles. These settle on the Earth's surface and, over time, mix with humus and other organic matter to form a mixture that is soil.
- 3. Example answer: Yes, for example, chalk will form chalk soil. Sedimentary rock (such as sandstone) will result in sandy soils. The rocks have different characteristics and so will have different textures, etc., when they are broken down.

Learners should be able to answer most of the questions correctly and with confidence. Encourage learners to note the sections they struggle with so that you can guide them further on how to revise these for the examination.

- 1. a) False
 - b) True
 - c) False
 - d) False
 - e) True
- 2. Deep root systems grow down to collect water from the water table. Wide root systems grow horizontally to collect as much surface water as possible.
- **3.** a) Osmosis is a special type of diffusion that explains how solvent particles move through a semi-permeable membrane from an area of high water potential to an area of low water potential.
 - b) The cell membrane is semi-permeable. It separates the inside of the cell from the outer environment and allows some substances to move in and out of the cell. Because it is semi-permeable, by osmosis, it absorbs and releases nutrients depending on the water potential of the soil that it is planted in. If the water potential in the cell is low, it will absorb water and nutrients from the soil. If the water potential in the soil is lower, the cell will release water and nutrients.
 - c) Diagram can look like this:



Types of rock How they are formed		Characteristics of this type of rock	
(a) Igneous rock	(b) Igneous rock is formed when magma has cooled and become solid.	Shiny or glossy, hard, weather resistant	
Sedimentary rock	(c) Formed where oceans, lakes, or water once existed. Layers of sediment are compressed over millions of years.	(d) Layered, soft-looking, can contain fossils	
(e) Metamorphic rock	(f) Formed deep within the Earth, changing igneous and sedimentary rocks by using extreme heat and pressure.	Hard, can contain crystals, can be smoothed so that it is shiny and glossy	

Section 5 Assessment LB page 251

A	tiv	ity 1: Multiple choice	
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	tiv	ity 2: Short questions upple need to live in a clean environment. People also need to be healthy, which they cannot	(10)
		if waste is not properly managed.	(4)
2.	D, E	E, B, A, C	(5)
3.	a) b)	 Any four: Fever Loss of taste Loss of smell Sore throat Dry cough Chills, body aches Shortness of breath Any four: Cough Runny nose Inflamed eyes Sore throat Fever 	(4)
		• Skin rash	(4)
4.	a) b)	Detoxification, production of cholesterol, balances blood sugar, produces bile, immunity. It causes inflammation of the liver, which makes it difficult for the liver to function optimally.	(4) (2)
5.	a) b) c) d)	Exposure to contaminated waste, contaminated food or water Sexually transmitted disease; blood to blood Blood to blood (for example, mother to child); can be sexually transmitted Exposure to contaminated waste; contaminated food or water	(2)(2)(2)(2)
6.		ronic illness, which impacts on quality of life. Inability to work, or at least to work consistently. matisation, which can lead to isolation. Depression and loneliness.	(4)

Section 5 Assessment (continued)

7.	It can lead to death or permanent brain damage. It is endemic in Ghana, which means that it is a high-risk area for bacterial meningitis.				
8.	 Any two: Effective and easily accessed vaccination drives Robust and effective healthcare services Education Collaboration with global health partners, such as WHO 	(2)			
	 Any two: Swift response to any bacterial outbreaks in the community Service delivery to ensure a clean and safe environment Communication with community members in the event of an outbreak 	(2)			
	 Collaboration with government Any two: Participating in vaccination drives Practising regular hand washing Keeping areas surrounding home clean and tidy Taking responsibility for own health by making use of health facilities 	(2)			
	 Practising safe sex 	(2)			
9.	Solar energy travels to Earth. About half of the solar energy is reflected by the Earth's atmosphere. The rest of the solar energy reaches the Earth's surface. It is absorbed by the ground and the oceans. The atmosphere keeps too much heat from escaping, which keeps the Earth warm enough to support life. However, some heat is allowed to escape to prevent the Earth from becoming too warm. The heat that is released is trapped by pollution and greenhouse gases. Climate change is sometimes referred to as 'global warming'. The world is getting warmer because of the trapped heat due to pollution and the greenhouse effect.				
10.	 Any two: Loss of species and a loss of biodiversity More periods of prolonged drought in regions that are already vulnerable An increase in the number of wildfires More violent tropical storms, which can displace people and cause flooding 	(2)			
11.	 Examples: Businesses must partner with government to drive the country's move to greener forms of energy together. Technical innovation sits with businesses. Businesses who are incentivised will come up with affordable and exciting solutions. Businesses that are currently emitting large volumes of carbon must begin finding new ways of working to reduce their emissions and, in the meantime, to offset their emissions. 	s (5)			
12.	a) Does not retain water; dries very quickly; contains very few nutrientsb) Mulching, adding compost or peat	(3) (4)			

Section 5 Assessment (continued)

- 13. a) Osmosis is a special type of diffusion that explains how solvent particles move through a semi-permeable membrane from an area of high water potential to an area of low water potential. The cell membrane is semi-permeable, allowing some substances (such as water and nutrients) to move in and out of the cell.
 - (3)
 - b) Loamy soil, because it holds a good amount of moisture, while still allowing for run-off.

Total: 80

(3)

Science

Basic 8

Facilitator's Guide

ESSENTIAL Science offers you a premium course in Science. The material has been developed to meet the full requirements of the Common Core curriculum for JHS, as developed by the National Council for Curriculum and Assessment (NaCCA), carefully addressing all Strands, Sub-strands, Content Standards, Indicators and Core Competencies. Throughout the series, attitudes, values and skills as prescribed by the curriculum, are addressed.

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- clear explanations of basic concepts
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- answers to activities in the Learner's Book
- assessment rubrics and checklists that can be used to assess learners formally or informally
- memos that can be used to assess learners' understanding of the concepts learned
- activities that can be used for diagnostic assessment
- suggestions for how to include local materials and ICT in the learning process
- curriculum coverage tables at the start of each Strand indicating how Content Standards and Core Competencies are covered in the course
- remedial and extension activities to support multi-ability learning.

Learning is Essential!





