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Basic 7

Facilitator's Guide



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Basic 7

Facilitator's Guide

Gershon Ellis Komla Dorvlo • McClean Nana Frimpong • Tania Kliphuis



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Contents

Welcome and orientation	vii
Introduction to the syllabus and assessment	viii
Rationale	viii
Learning domains/profile of expected learning behaviours.....	ix
Attitudes and values	x
Creative pedagogical approaches.....	xi
Instructional expectations in the CCP Science curriculum	xiii
Organisation and structure of the Science curriculum/scope.....	xiii
Assessment.....	xiv
Section 1: Diversity of matter	1
Topic 1: Materials	1
Module 1: Classifying and ordering materials.....	3
Unit 1.1: Solids, liquids and gases.....	3
Unit 1.2: The periodic table.....	8
Assessment activity	11
Topic 2: Living cells	12
Module 2: Animal and plant cells.....	12
Unit 2.1: Animal cells.....	12
Unit 2.2: Plant cells	14
Assessment activity	16
Section 1 Assessment	17
Section 2: Cycles	19
Topic 1: Earth science	19
Module 3: The water cycle	22
Unit 3.1: Stages of the water cycle	22
Unit 3.2: The importance of the water cycle.....	24
Assessment activity	26
Topic 2: Life cycle of organisms	27
Module 4: The housefly	27
Unit 4.1: The life cycle of the housefly	27
Unit 4.2: The effect of the housefly on humans.....	29
Assessment activity	32

Topic 3: Crop production.....	33
Module 5: Plant nutrients	33
Unit 5.1: Organic and inorganic nutrient sources	33
Unit 5.2: The application of plant nutrients.....	35
Assessment activity	36
Topic 4: Animal production.....	37
Module 6: Domestic animals.....	37
Unit 6.1: Classification of domestic animals.....	37
Unit 6.2: Comparing domestic animals.....	39
Unit 6.3: The usefulness of animals	41
Assessment activity	42
Section 2 Assessment	43
Section 3: Systems	44
Topic 1: The human body system.....	44
Module 7: The human digestive system.....	46
Unit 7.1: Food nutrients	46
Unit 7.2: Parts and processes of the digestive system.....	48
Unit 7.3: Chemical digestion.....	50
Assessment activity	54
Topic 2: The solar system.....	55
Module 8: The inner planets of the solar system.....	55
Unit 8.1: Our solar system	55
Unit 8.2: Mercury and Venus	57
Assessment activity	59
Topic 3: The ecosystem	60
Module 9: Interdependence and interaction in the environment.....	60
Unit 9.1: Ecosystems.....	60
Unit 9.2: Types of ecosystems	62
Unit 9.3: Interactions in the environment.....	64
Assessment activity	66
Topic 4: Farming systems.....	67
Module 10: Types of farming systems in Ghana and around the world	67
Unit 10.1: Types of farming systems	67
Unit 10.2: Why we use different farming systems.....	69
Assessment activity	71
Section 3 Assessment	72

Section 4: Forces and Energy	74
Topic 1: Energy	74
Module 11: Forms and applications of energy.....	78
Unit 11.1: Forms of energy.....	78
Unit 11.2: Daily applications of forms of energy	81
Unit 11.3: Heat transfer	82
Unit 11.4: Light energy	84
Topic 2: Electricity and electronics	86
Unit 11.5: Electricity generation	86
Unit 11.6: Electronics	88
Topic 3: Conversion and conservation of energy	91
Unit 11.7: The law of conservation of energy	91
Assessment activity	93
Topic 4: Force and motion	94
Module 12: Force, motion and efficiency	94
Unit 12.1: Newton's First Law of Motion	94
Unit 12.2: Magnets.....	97
Unit 12.3: Simple machines.....	99
Unit 12.4: Efficiency	100
Assessment activity	102
Topic 5: Agricultural tools.....	103
Module 13: Handling agricultural tools.....	103
Unit 13.1: Handling and maintaining agricultural tools.....	103
Assessment activity	107
Section 4 Assessment	108
Section 5: Humans and the environment.....	110
Topic 1: Waste management	110
Module 14: Keeping the environment clean	112
Unit 14.1: Types of waste	112
Unit 14.2: Waste management practices	114
Assessment activity	115
Topic 2: Human health	116
Module 15: Common diseases.....	116
Unit 15.1: Food nutrients and health.....	116
Unit 15.2: Deficiency diseases	118
Unit 15.3: Viral diseases	120
Assessment activity	122
Topic 3: Science and industry	123
Module 16: The future of science in Ghana	123
Unit 16.1: Careers in science	123

Topic 4: Climate change and green economy.....	125
Unit 16.2: Sustainability in Ghana	125
Assessment activity	127
Topic 5: Understanding the environment.....	128
Module 17: Associations in the environment	128
Unit 17.1: Plants and animals that live in different landforms.....	128
Unit 17.2: Associations in the environment	130
Assessment activity	131
Section 5 Assessment	132
General/generic assessment tools	133

Welcome and orientation

A warm welcome to you, Teacher. We hope that you will find this Teacher's Guide for Basic 7 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 133 and 134, 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 learnt 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, re-writing, 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, state principles, facts and concepts. Knowledge is the ability to remember or recall concepts already learnt 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 concept/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, 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 and laws, and the 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 is to

- 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		B7		B8		B9		B10
STRAND (SECTION)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)
DIVERSITY OF MATTER	1	Materials	1	Materials	1	Materials	1	Materials
	2	Living cells	2	Living cells	2	Living cells	2	Living cells
CYCLES	1	Earth Science	1	Earth Science	1	Earth Science	1	Earth Science
	2	Life cycle of organisms	2	Life cycle of organisms	2	Life cycle of organisms	2	Life cycle of organisms
	3	Crop production	3	Crop production	3	Crop production	3	Crop production
	4	Animal production	4	Animal production	4	Animal 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	2	The solar system	2	The solar system	2	The solar system
	3	The ecosystem	3	The ecosystem	3	The ecosystem	3	The ecosystem
	4	Farming systems	4	Farming systems	4	Farming systems	4	Farming systems

LEVEL		B7		B8		B9		B10
STRAND (SECTION)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)		SUB-STRANDS (TOPICS)
FORCES AND ENERGY	1	Energy	1	Energy	1	Energy	1	Energy
	2	Electricity and electronics	2	Electricity and electronics	2	Electricity and electronics	2	Electricity and electronics
	3	Conversion and conservation of energy	3	Conversion and conservation of energy	3	Conversion and conservation of energy	3	Conversion and conservation of energy
	4	Force and motion	4	Force and motion	4	Force and motion	4	Force and motion
	5	Agricultural tools	5	Agricultural tools	5	Agricultural tools	5	Agricultural tools
HUMANS AND THE ENVIRONMENT	1	Waste management	1	Waste management	1	Waste management	1	Waste management
	2	Human health	2	Human health	2	Human health	2	Human health
	3	Science and industry	3	Science and industry	3	Science and industry	3	Science and industry
	4	Climate change and green economy	4	Climate change and green economy	4	Climate change and green economy	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

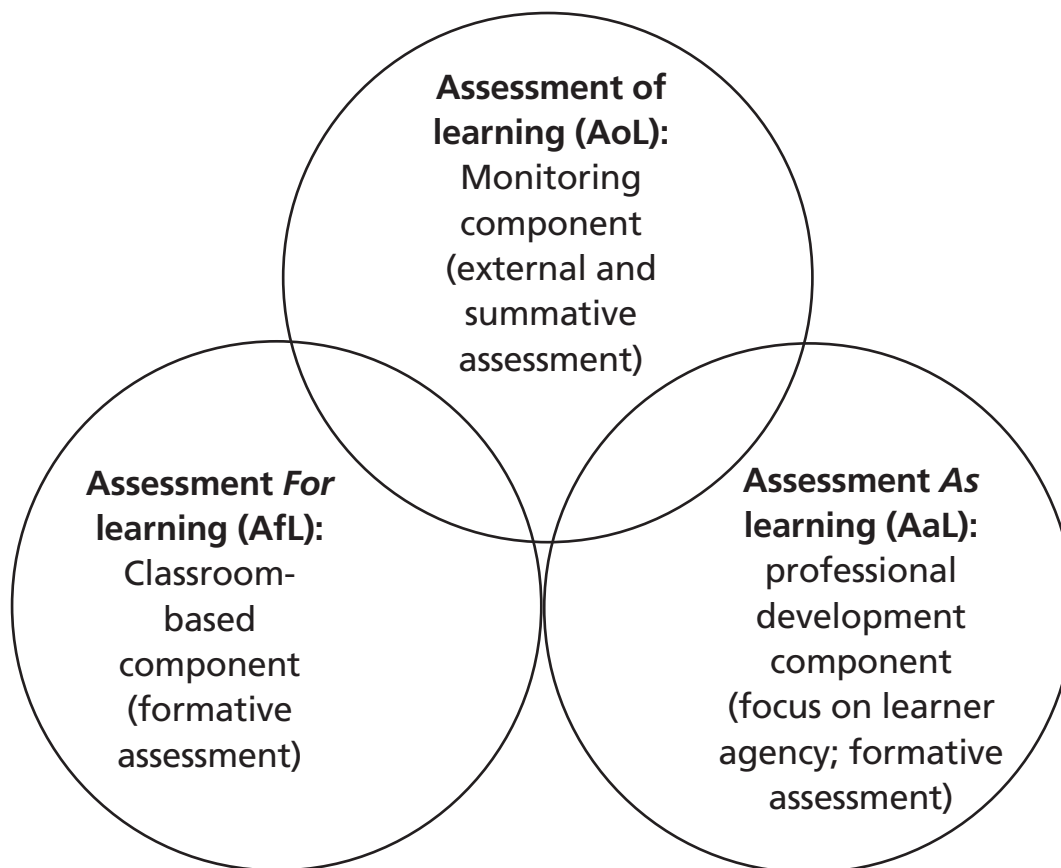
- knowledge, skills, attitudes and values.
- the core competencies of critical thinking and problem solving (CP), creativity and innovation (CI), communication and collaboration (CC), cultural identity and global citizenship (CG), personal development and leadership (PL), and digital literacy (DL).

In addition:

- 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 year 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.

Level of proficiency	Benchmark	Grade level descriptor
1. Highly proficient (HP)	80% +	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 students 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 133 and 134 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 covered in the Basic 7 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.
- Use the **Check...** feature at the end of each unit to ensure that your learners are grasping the content at the right pace. If you realise that a learner or group of learners have not achieved a specific outcome, you can offer remedial work or encourage them to return to that section of the Learner's Book to try again. Using these checklists will act as a diagnostic tool and checkpoint for you throughout the year to ensure that you and your learners are keeping up with the demands of the curriculum.

Topic 1: Materials

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: Materials		
B7.1.1.1 Recognise materials as important resources that provide for human needs	B7.1.1.1.1 Classify materials into liquids, solids and gases <ol style="list-style-type: none"> 1. Create and complete a table to record the texture, appearance, colour and shape of a group of materials assembled from the environment. 2. Group materials into liquids, solids and gases. 3. Discuss the differences among liquids, solids and gases. 4. Give examples of solids, liquids and gases that can be identified from the environment. 	CI5.2, CP5.1; CC8.2, CP5.6
	B7.1.1.1.2 Discuss the importance of liquids in the life of humans <ol style="list-style-type: none"> 1. Present a report on the importance of liquids to human life. 2. Describe the need to preserve liquids for human use. 3. Record liquids they see being used in the community. 	CC8.1, CC8.5, CP5.2, CP5.1
	B7.1.1.1.3 Discuss the importance of specific solids to life <ol style="list-style-type: none"> 1. Identify solids in the environment that support the survival of humans and other life forms. 2. Explain the need to preserve useful solid materials in the environment for life. 3. Model objects from solid materials that can be useful to humans and other life forms. 	CP5.1, CP5.2, CP5.7, CI5.2, CI6.10
B7.1.1.2 Understand the periodic table as different elements made up of metals and non-metals and noble gases arranged in an order	B7.1.1.2.1 Demonstrate the knowledge of the orderly arrangement of metals, non-metals and noble gases in the periodic table <ol style="list-style-type: none"> 1. Name and write the chemical symbol of the first 20 elements in the periodic table. 2. Identify metals, non-metals and noble gases in the periodic table. 3. Deduce from the periodic table that the elements are arranged in order of their atomic number and those in the same group have common properties. 	DL5.1, CP5.1, CP5.6
Topic 2: Living cells		
B7.1.2.1 Demonstrate understanding of the structure of organisms and functions of cells in living systems	B7.1.2.1.1 Describe the structure and function of living cells of an animal <ol style="list-style-type: none"> 1. Identify and describe the structure of an animal cell seen in a video, on a chart and under a microscope. 2. State the function of each organelle in the animal cell. 3. Look at a sample of animal cells from different parts of an animal with a microscope, watch a video, or look at pictures of cells and draw the conclusion that animals are made up of cells. 4. Draw and label an animal cell. 5. Develop a model to represent an animal cell. 	DL5.5, CC8.2, CP5.7, DL6.6, CI6.5, CI5.3

Content standard	Indicators and exemplars	Core competencies
Topic 2: Living cells		
	<p>B7.1.2.1.2 State the functions of each organelle in a plant cell</p> <ol style="list-style-type: none"> 1. Identify and describe the structure of a plant cell as seen in a video, on a chart, in pictures or under a microscope. 2. State the function of each organelle in the plant cell. 3. Look at a sample of a plant cell from different parts of a plant with a microscope, watch a video, or look at pictures and confirm that plants are made up of cells. 4. Draw and label a plant cell. 5. Develop a model to represent a plant cell. 	CC8.1, DL5.3, CC8.1, CP5.1, DL6.4, CI6.5, CI5.3

Unit 1.1 Solids, liquids and gases

Content standard

- Recognise materials as important resources for providing for human needs.

Indicators

- Classify materials into solids, liquids and gases.
- Discuss the importance of liquids to humans.
- Discuss the importance of specific solids to life.

Core competencies

- Merge simple/complex ideas to create novel situations or things.
- 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.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Speak clearly and explain ideas.
- 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.
- Provide new insight into controversial situations or tasks.
- Reflect on work and explore the thinking behind thoughts and processes.

Unit in a nutshell

- There are three states of matter: solid, liquid and gas.
- Solids hold their shape, liquids take on the shape of their container, and gases, which have no fixed volume, expand to fill their container.
- When a particular kind of matter is used to make an object, such as a chair, it is referred to as a 'material'.
- Examples of solid materials are metals, minerals, ceramics, plastics and wood.
- Examples of liquids are water, vegetable oil, vinegar and petrol.
- Water, essential for life, is the most important liquid in the world.

ACTIVITY 1.1.1**Grouping and comparing solids, liquids and gases and give examples**

LB page 4

(Pairs)

CI5.2, CP5.1, CC8.2, CP5.6

- It is important that learners understand the terminology used in this activity.
 - Texture: How something feels to the touch.
 - Appearance: What something looks like.
- The descriptors they use are part of the properties of the material. The properties of a material can determine how and when it is used. For example, a window is made of glass because it is see-through and can withstand wind, but a bridge cannot be glass, as it is too brittle.

Answers

1. a)

	Texture	Appearance	Colour	Shape
Helium	Gas	Gas (invisible)	Clear/colourless	No shape/takes shape of container
Brick	Rough, hard	Solid	Red/grey	Rectangular
Candle	Smooth, hard but can be scratched	Solid, able to melt	Depends on candle	Cylindrical
Air in a balloon	Gas	Gas (invisible)	Clear/colourless	No shape/takes shape of balloon
Cooking oil	Oily, liquid	Thick liquid	Yellow	No shape/takes shape of container
Oxygen	Gas	Gas (invisible)	Clear/colourless	No shape/takes shape of container
Ice	Brittle, hard	Opaque	Clear	Depends on shape in which it was frozen (likely to be a cube)
Juice	Liquid	Thin liquid	Depends on juice	No shape/takes shape of container
Petrol	Oily, liquid	Thick liquid	Orange/amber	No shape/takes shape of liquid

b)

Solids	Liquids	Gases
brick, candle, ice	petrol, cooking oil, juice	air in balloon, helium, oxygen

2. a) A solid holds its shape, but a liquid takes on the shape of its container. A solid is rigid and does not flow/cannot be poured unless in powdered form, but a liquid flows/can be poured.
- b) Yes, a solid can become a liquid when it is heated enough to melt it. Yes, a liquid can become a solid when it is cooled enough to freeze it.
- c) Liquids are like gases because they flow. Although gases are often invisible, we know that gases can flow because we can see and feel air move as a strong wind or a little breeze. In physics, both liquids and gases are classified as fluids because they flow.
- d) Yes, a liquid can become a gas if it is heated enough to evaporate. The individual particles of liquid gain energy and movement as they are heated. Eventually, they escape the body of liquid and become particles of gas in the air. Yes, a gas can become a liquid if it is cooled enough to condensate. Or, if it is squashed into a small space at very high pressure. Cylinders of LP gas such as propane or butane, which is used for cooking or heating, contain gas in liquid form.
- e) Liquids are visible, but gases are often invisible. Liquids have a fixed volume (take up a fixed amount of space), but gases have no fixed volume. This is why gases can be easily compressed/squashed.
3. Examples of solids include coins (metal), wood, soap, aluminum tins, margarine/butter, biscuits, sweets, maize meal, ceramic tiles.
Examples of liquids include milk, vinegar, bleach, kerosene.
Examples of gases include air (a mixture of gases), carbon dioxide in fizzy drinks or fire extinguishers. Note that clouds and steam are a collection of water droplets formed when water vapour in the air condenses into liquid.

(Groups)

CC8.1, CC8.5, CP5.2, CP5.1

Guidelines

- Learners will work in groups to discuss the need to conserve water. Groups should be mixed gender (unless your school is a single-gender school).
- Where necessary, help learners to access information.
- Write down the assessment rubric on the board so that learners know how their reports will be assessed.

Answers

Here is some general information:

- Water makes up 60% of the human body. Cells are full of water. And blood is 80% water. All the chemical changes and activities that take place inside the cells can only happen in water. And blood is the carrier of food and wastes to different parts of the body.
- Water is used for
 - cleaning (bathing, laundry and washing of dishes)
 - making foods, beverages and cleaning agents
 - cooking
 - water sports (swimming, surfing)
 - transport
 - carrying away sewage
 - generating electricity – the turbines are turned by steam or falling water
 - gardening and farming/irrigation
 - industrial processes such as mixing, washing or cooling – for example in smelting factories, petrol refineries and paper mills.
- One can conserve water by collecting/harvesting rainwater, fixing leaking water pipes and dripping taps, as well as using water sparingly and not wasting it.
- Water supplies can be contaminated by
 - sewage
 - agricultural pollution and fertilisers
 - river dumping and industrial waste.

Assessment

See the rubrics for posters, reports and oral presentations on page 134 at the back of this guide.

ACTIVITY 1.1.3

Identifying and classifying different types of solids and explain their usefulness

LB page 7

(Groups)

CP5.1, CP5.2, CP5.7, CI5.2, CI6.10

Guidelines

- For this activity, learners may need to do some research on the internet.
- Make learners aware that for purposes of variety, quality and price, one kind of object or item can be made from a variety of materials. For example:
 - bathroom basins can be plastic or ceramic
 - taps can be plastic or metal (brass or chrome)
 - glasses can be plastic or made of glass.

For a good visual summary of different kinds of plastic, learners can look at this web page:

<https://thisisplastics.com/plastics-101/different-types-plastic/> Search for **different types of plastics**.

Answers

- a)** Examples of metal materials are iron, copper and aluminium (these are the most commonly used metals in manufacturing).

 - Iron is used to make heavy cooking pots. When refined as steel, it has many uses, including used as girders, reinforcing rods, scaffolding, the bodies of cars, trucks, planes and kitchen appliances (stoves and washing machines), cookware (pots and kitchen utensils) and cutlery.
 - Copper is used to make electrical wiring, plumbing pipes, brass (when mixed with zinc) for items such as door handles, locks and bolts.
 - Aluminium is used to make aluminium foil, non-rust window frames, and light-weight bicycle frames.
- b)** Examples of ceramic materials are earthenware, stoneware, porcelain and glass (these are materials baked from clay and sand).

 - Earthenware include bricks, terracotta tiles and pottery objects.
 - Stoneware includes ceramic tiles and pottery objects.
 - Porcelaine includes toilets, basins, porcelaine tiles and false teeth.
 - Glass is used for windows, mirrors, bottles, drinking glasses and spectacle lenses.
- c)** Examples of plastic materials are nylon, polypropylene, polyvinyl chloride, and polyethylene terephthalate.

 - Nylon is used for rope, fishing line and toothbrush bristles.
 - Polyethylene is the most common plastic and comes in three forms, namely high-density, low-density and linear low-density.
 - High-density polyethylene (HDPE) is the strongest of the three and is, for example, used to make white (opaque) 2-litre milk bottles.

- Low-density polyethylene (LDPE) is soft and transparent/clear, and is, for example, used to make clingwrap.
- Linear low-density polyethylene (LLDPE) is tough and does not tear or puncture easily. It is, for example, used to make plastic pouches.
- Polyvinylchloride (PVC) is tough and weather resistant and is used to make gutters and pipes.
- Polyethylene terephthalate (PET) is strong and flexible and transparent. It is used as the packaging for bottled water and to make polyester fabric.
- d)** Examples of materials made from plants or plant fibres include wood/timber, cardboard and paper and textiles/fabrics.
 - Wood/timber is used for building and construction (struts or poles) as well as to make furniture
 - Cardboard and paper are used to make boxes, bags and books.
 - Textiles/fabrics, such as cotton, linen, hemp and bamboo, are used for clothing, sheets and towels.
- 2. a)** The advantages of mining are that it supplies useful or valuable resources, provides employment, and is an important source of income for a country. The disadvantages of mining are that mineral resources are non-renewable and that it damages and pollutes the environment.
- b)** Most plastics are made from petroleum and natural gas.
- c)** Plastics are useful materials because they are versatile and relatively cheap/inexpensive. The problem with plastics is that they are made from non-renewable fossil fuels, they are non-biodegradable (they take 20–500 years to degrade) and litter the oceans. When plastics degrade or are burned as rubbish, they release toxic gases into the air.
- 3.** Solid materials are useful for many daily activities. Learners may mention natural solids, such as soil and foods, which are essential for growing plants and feeding animals and people. However, humans also use solids for other purposes, such as constructing shelters, carrying and storing goods, etc.

Check...

Learners can:	Yes	No
1. Create a table to record the texture, appearance, colour and shape of a group of materials assembled from the environment.		
2. Classify materials as solids, liquids, or gases.		
3. Discuss the differences among liquids, solids, and gases.		
4. Give examples of solids, liquids, and gases that can be identified from the environment.		
5. Understand the importance of liquids to human life.		
6. Describe the need to preserve clean water for human use.		
7. Record how and why their community uses water.		
8. Identify solids in the environment that support human life.		
9. Identify the importance of soil for supporting life.		
10. Understand the importance of preserving useful solid materials in the environment.		
11. Consider how to use recyclable materials to create new useful objects or materials.		

Unit 1.2 The periodic table

Content standard

- Understand the periodic table as different elements made up of metals and non-metals and noble gases arranged in order.

Indicator

- Demonstrate the knowledge of the orderly arrangement of metals, non-metals and noble gases in the periodic table.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Combine information and ideas from several sources to reach a conclusion.
- Demonstrate a thorough understanding of a generalised concept and facts specific to the task or situation.

Unit in a nutshell

- Elements are substances in their simplest form. There are about 117 different elements which can be combined in different ways to make up all the substances in our world. For example, water is a compound of two different elements, **hydrogen** and **oxygen**. And air is a mixture of gases such as nitrogen and oxygen.
- The elements are broadly divided into two kinds, namely
 - metals, such as aluminium (Al), copper (Cu) and lead (Pb).
 - non-metals, such as hydrogen (H), carbon (C), oxygen (O), nitrogen (N) and sulfur (S).
- The periodic table is a system for grouping elements with similar properties together. The rows are called 'periods' and the columns are called 'groups'. The metals are in the first two groups of the periodic table and on the left-hand side of the right block. The **noble gases** are on the far-right column of the periodic table.



INTERNET

There are **interactive periodic tables** online that the learners can use to learn and revise what they know. Try the following: <https://ptable.com/#Properties>

ACTIVITY 1.2.1

Working out the order of arrangement of elements in the periodic table, and identifying metals, non-metals and noble gases

LB page 9

(Pairs)

DL5.1, CP5.1, CP5.6

Guidelines

- Elements up to number 93 are natural elements; the others have been made by chemists.
- What is in each block?
 - A name and a symbol, for example Hydrogen, H
 - The atomic number at the top (which indicates the number of protons found in the element's atoms).
- The names of the elements can be represented as symbols. Some symbols are the first letter of the name, such as C for carbon. Others are the first and second letter, such as Al for aluminium, and some are taken from the Latin name, such as Pb for lead, which, in Latin, is *plumbum*.

Answers

1. They are arranged in order of increasing atomic number, in rows, from left to right. These are the periods.
2. Elements in the same group have similar chemical properties. That is why they behave in the same way.

ACTIVITY 1.2.2

Naming the first 20 elements in the periodic table, giving their symbols and identifying metals, non-metals and noble gases

LB page 10

(Individual)

DL5.1, CP5.1, CP5.6

Guidelines

After hydrogen (H), helium (He) is the second-most abundant element in the universe.

Answers

1. 1 – Hydrogen (H)
2 – Helium (He)
3 – Lithium (Li)
4 – Beryllium (Be)
5 – Boron (B)
6 – Carbon (C)
7 – Nitrogen (N)
8 – Oxygen (O)
9 – Fluorine (F)
10 – Neon (Ne)
11 – Sodium (Na)
12 – Magnesium (Mg)
13 – Aluminum (Al)
14 – Silicon (Si)
15 – Phosphorus (P)
16 – Sulfur (S)
17 – Chlorine (Cl)
18 – Argon (Ar)
19 – Potassium (K)
20 – Calcium (Ca)

2.
 - a) hydrogen (H), helium (He)
 - b) carbon (C), hydrogen (H)
 - c) carbon (C)
 - d) nitrogen (N)
 - e) oxygen (O)
 - f) nitrogen (N), phosphorous (P), potassium (K)
 - g) lithium (Li), beryllium (Be), sodium (Na), magnesium (Mg), aluminium (Al)
 - h) hydrogen (H), boron (B), carbon (C), nitrogen (N), oxygen (O), fluorine (F), silicon (Si), phosphorous (P), sulfur (S), chlorine (Cl), potassium (K), calcium (Ca)
 - i) helium (He), neon (Ne), argon (Ar)
3. See the answers to question 1 of this activity.

EXTENSION ACTIVITY

Let learners do the same as they did for the first 20 elements in Activity 1.2.2 for the rest of the elements in the periodic table.

Check...

Learners can:	Yes	No
1. Name and write the chemical symbol of the first 20 elements in the periodic table.		
2. Identify metals in the periodic table.		
3. Identify non-metals in the periodic table.		
4. Identify noble gases in the periodic table.		
5. Recognise that elements are arranged in order of their atomic properties.		
6. Identify common properties among elements in the same group on the periodic table.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1. Matter is anything that has mass and takes up space in the environment. It includes all living and non-living things. (2)
2.
 - a) Learners can name any solid. For example, pen, desk, soil, brick, plastic. (1)
 - b) Learners can name any liquid. For example, water, juice, oil, paraffin. (1)
 - c) Learners can name any gas. For example, air, oxygen, carbon dioxide, methane, helium. (1)
3.
 - a) Learners can name any three materials that they use daily. For example, wood, water, toothpaste, pen, paper, glass, etc. (3)
 - b) Learners' answers will depend on the materials they named in question 3(a). (6)
4. Learners can list any three properties of each:
 - solid:
 - rigid
 - has a regular shape and volume
 - particles are packed closely together
 - force of attraction between the particles is strong.
 - liquid:
 - does not have a regular shape
 - particles are less closely packed together compared to solids
 - force of attraction between particles is weaker compared to that of solids, but stronger compared to that gases
 - liquids can flow from one point to another.
 - gas:
 - has no regular shape or volume
 - little or no force of attraction between particles
 - particles are even less closely packed together compared to those of liquids. (9)
5. Learners can suggest any three reasons, including that it can be used
 - for cleaning purposes
 - to drink
 - in industry for cooling and heating
 - for the transportation of goods. (3)
6. Li, P, N (2)
7.
 - a) H
 - b) He
 - c) Mg
 - d) P
 - e) K (5)
8. On the far right-hand side of the periodic table. (2)
9. K, Al (1)
10. Elements are arranged in order of their increasing atomic numbers. All elements with similar properties fall into groups (columns) and periods (rows). The metals are in the first two groups of the periodic table and on the left-hand side of the right block. The noble gases are on the far-right column of the periodic table. (4)

Total: 40 marks

Topic 2: Living cells

Module 2

Animal and plant cells

Unit 2.1 Animal cells

Content standard

- Demonstrate understanding of the structure of organisms and functions of cells in living systems.

Indicators

- Describe the structure and function of an animal's living cells.
- State the functions of each organelle in a plant cell.

Core competencies

- Evaluate the quality and validity of information.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Provide new insight into controversial situations or tasks.
- Show evidence of knowledge and recognition of ethical use of information.
- Anticipate and overcome difficulties relating to taking initiatives.
- Identify requirements of a given situation and justify more than one creative tool that will be suitable.

Unit in a nutshell

- Cells are the building blocks of all organisms.
- Cells are very small. You need a microscope to see them.
- A cell is a bag of fluid. The fluid is called 'cytoplasm' which is surrounded by what is called a 'cell membrane'.
- Not all cells are alike – they come in different shapes and sizes.
- Unlike animal cells, plant cells have a rigid cell wall and organelles called 'chloroplasts' (for photosynthesis).

ACTIVITY 2.1.1

Looking at samples of animal and plant tissue, and describing a cell

LB page 16

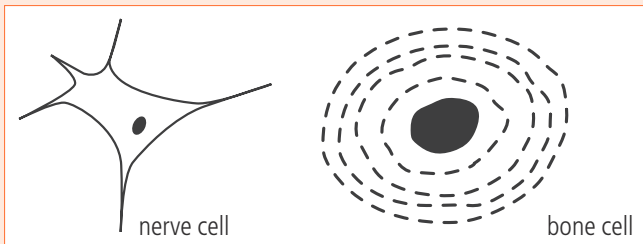
(Individual)

DL5.5, CC8.2, CP5.7, DL6.6, CI6.5, CI5.3

Answers

- three
 - three
 - cells, tissues

2. a)



- nerve, bone
- 40 cells
 - It is very small – too small to be seen with the naked eye. Only visible under a microscope.

PRACTICAL ACTIVITY 1

Developing a model of an animal cell

LB page 17

(Groups)

DL5.5, CC8.2, CP5.7, DL6.6, CI6.5, CI5.3

Guidelines

- This should be a fun activity for the learners and will help them to repeat and consolidate their understanding of animal cells and the parts thereof.
- Allow the learners to work in groups of your choice. Choose the groups carefully based on the learners' ability and try to ensure that each group has an even blend of boys and girls (unless you teach at a same gender school).

Assessment

See the rubrics for posters and models on page 134 at the back of this guide.

Check...

Learners can:	Yes	No
1. Identify and describe the structure of an animal cell.		
2. State the function of each organelle in an animal cell.		
3. Understand that animals are made up of cells.		
4. Draw and label an animal cell.		
5. Develop a model to represent an animal cell.		

Unit 2.2 Plant cells

Content standard

- Demonstrate understanding of the structure of organisms and functions of cells in living systems.

Indicator

- State the functions of each organelle in a plant cell.

Core competencies

- Speak clearly and explain ideas.
- Find and utilise digital content.
- Combine information and ideas from several sources to reach a conclusion.
- Adhere to behavioural protocols that prevail in cyberspace.
- Anticipate and overcome difficulties relating to taking initiatives.
- Identify requirements of a given situation and justify more than one creative tool that will be suitable.

Unit in a nutshell

- Cells are the building blocks of all organisms.
- Cells are very small. You need a microscope to see them.
- A cell is a bag of fluid. The fluid is called cytoplasm and the 'bag' is called the cell membrane.
- Not all cells are alike – they come in different shapes and sizes.
- Unlike animal cells, plant cells have a rigid cell wall and organelles called chloroplasts (for photosynthesis).

ACTIVITY 2.2.1

Drawing and labelling an animal cell and a plant cell LB page 19

(Individual)

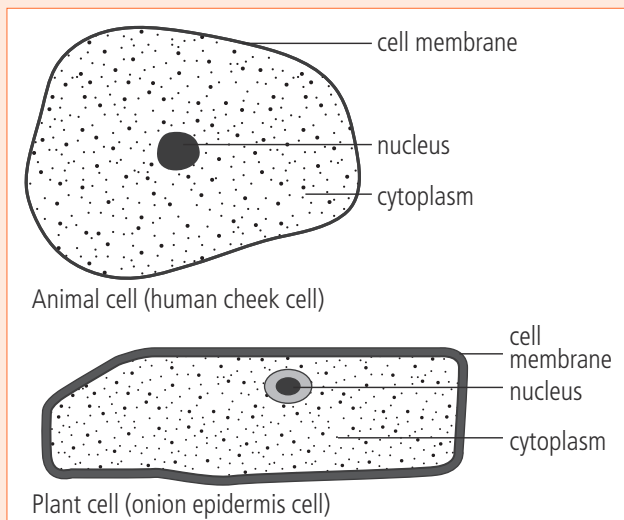
DL5.5, CC8.2, CP5.7, DL6.6, CI6.5, CI5.3

Guidelines

- Note that it is only with a very powerful microscope, under high magnification, that it is possible to see the cell organelles.
- If you do not have a microscope, search for micrographs on the internet to show learners. Alternatively, visit your local library where you may be able to find resources to help you.
- Contact a local university or research laboratory and ask for assistance, as they may be able to accommodate a school tour or send a representative to give a talk to your learners about microscopes and how they are used.

Answers

2 – 3.



PRACTICAL ACTIVITY 2 Developing a model of a plant cell

LB page 20

(Pairs)

DL5.5, CC8.2, CP5.7, DL6.6, CI6.5, CI5.3

Guidelines

- This should be a fun activity for the learners and will help them to repeat and consolidate their understanding of plant cells and the parts thereof.
- Allow the learners to work in groups. Choose the groups carefully based on the learners' ability and try to ensure that each group has an even blend of boys and girls (unless you teach at a same gender school).

Assessment

See the rubrics for posters and models on page 134 at the back of this guide.

ACTIVITY 2.2.2

Stating the function of the parts of a cell

LB page 21

(Pairs)

DL5.5, CC8.2, CP5.7, DL6.6, CI6.5, CI5.3

Answers

- a) cell membrane – like a skin, it protects the cell and keeps the contents inside; it also controls the movement of substances in and out of the cell
 - b) cell wall – it gives the cell structure, support and protection
 - c) cytoplasm – it provides a watery environment where chemical changes and activities can take place
 - d) nucleus – it carries the genetic information (DNA) and controls the cell's activities (what happens inside the cell)
 - e) mitochondria – they produce energy for the cell

- f) vacuole – stores food for later use or waste for disposal; in plants, the vacuoles also store water
- g) chloroplast – makes food (glucose) for the plant using light energy from the Sun
- 2. nucleus, mitochondria, vacuole, chloroplasts
- 3. cell wall, chloroplasts



INTERNET

Find **examples of micrographs** online using the following link:

<https://ib.bioninja.com.au/standard-level/topic-1-cell-biology/12-ultrastructure-of-cells/cell-micrographs.html>

You can also check out Science photo library for examples.

Check...

Learners can:	Yes	No
1. Identify and describe the structure of a plant cell.		
2. State the function of each organelle in a plant cell.		
3. Understand that plants are made up of cells.		
4. Draw and label a plant cell.		
5. Develop a model to represent a plant cell.		

ASSESSMENT ACTIVITY

LB page 22

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1. A microscope is a piece of specialised equipment that magnifies an object to enlarge it and make it bigger for observational purposes. (2)
2. An animal cell has more organelles than a plant cell. (1)
3. Enclosed in a membrane; scattered in the cytoplasm. (2)
4. mitochondrion (1)
5. See the table on page 20 and 21 of the Learner's Book for the answers. (18)
6. See Figure 2.6 on page 19 of the Learner's Book for a labelled diagram of the plant cell. (10)
7. It provides rigid support for the plant. It provides food for the plant (cellulose). (2)
8. B (1)
9. a) Animal cells only: K
Plant cells only: A, F
Both animal and plant cells: B, C, D, E, G, H, I, J (11)
- b) Plant cells are different to animal cells. Plant cells have chloroplasts that contain chlorophyll. This allows the cell to create its own food through the process of photosynthesis. Plant cells also have a large central vacuole for storing cell sap. The plant cell wall is made of a carbohydrate called 'cellulose'. This is a permeable membrane through which water can pass in and out of the cell. In an animal cell, the cell membrane is the outermost layer of the cell. (6)

Total: 55 marks

Activity 1: Multiple choice

1. B
2. A
3. A
4. C
5. B
6. C
7. B
8. C
9. A
10. B

(10)

Activity 2: Longer questions

1. a) A: solid + example (accept any correct example)
B: liquid + example (accept any correct example)
C: gas + example (accept any correct example)

(6)

- b) Accept any two of each:

- A (solid):
 - rigid
 - has a regular shape and volume
 - particles are packed closely together
 - force of attraction between the particles is strong.
- B (liquid):
 - does not have a regular shape
 - particles are less closely packed together compared to those of solids
 - force of attraction between particles is weaker compared to that of solids, but stronger compared to that of gases
 - liquids can flow from one point to another.
- C (gas):
 - has no regular shape or volume
 - little or no force of attraction between particles
 - particles are even less closely packed together compared to those of liquids.

(6)

- c) Learners can write down any two ways of water conservation.

(4)

2. a) A: animal cell; found in the cheek/heart/skin, etc.
B: plant cell; found in the stem

(4)

- b) I: cell membrane
II: nucleus
III: cytoplasm
IV: vacuole
V: mitochondria
VI: cell wall
VII: chloroplast

(7)

- c) I: Keeps the cell contained.
 II: Controls activities of the cell.
 III: Solution that fills each cell; contains organelles.
 IV: Stores materials, such as food and water.
 V: Produces energy for the cell to function.
 VI: Provides support.
 VII: It contains a green pigment (colour) called 'chlorophyll' that traps sunlight; it converts light energy into chemical energy through the process of photosynthesis. (7)
- d) Cells perform all or some of the characteristics of life. In other words, a cell is the basic unit of all life. (3)
- e) An electron microscope (1)
3. a) (i) Aluminium
 (ii) Beryllium
 (iii) Sodium
 (iv) Chlorine
 (v) Helium
 (vi) Argon
 (vii) Oxygen (7)
- b) (i) 13
 (ii) 4
 (iii) 11
 (iv) 17
 (v) 2
 (vi) 18
 (vii) 8 (7)
- c) (i) metal
 (ii) metal
 (iii) metal
 (iv) non-metal
 (v) non-metal
 (vi) non-metal
 (vii) non-metal (7)
- d) Any two properties of metals:
- shiny
 - ductile
 - malleable
 - good conductors
- Any two properties of non-metals:
- poor conductors
 - dull
 - brittle (4)

Total: 73 marks

Topic 1: Earth science

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: Earth Science		
B7.2.1.1 Recognise that the water cycle is an example of repeated patterns of change in nature and understand how it occurs	B7.2.1.1.1 Explain how the water cycle occurs as a repeated pattern in nature <ol style="list-style-type: none"> 1. Identify the natural sources of water and list the stages of the water cycle (evaporation, condensation, precipitation and transpiration) while looking at pictures and watching videos. 2. Draw a flowchart or diagram to show the order of the stages in the water cycle and how they are linked to each other. 3. Explain why the water cycle is a repeated pattern in nature by searching the internet, books, journals, TV news, radio news and any other sources. 	DL5.1, CI5.2, CI6.3, CP5.1
	B7.2.1.1.2 Describe the importance of the water cycle in nature <ol style="list-style-type: none"> 1. Describe the stages of the water cycle by watching a video or looking at a picture of it. 2. Describe the importance of the water cycle in terms of <ol style="list-style-type: none"> a) energy source (release of energy to warm the environment) b) carrier of nutrients c) improving the water table d) regulating weather patterns e) providing clean water. 3. With a diagram, illustrate the importance of the water cycle in a community. 	CC8.1, DL5.6, CP5.1, CC8.2, CI5.2
Topic 2: Life cycle of organisms		
B7.2.2.1 Demonstrate the skills of carrying out activities to show the stages of the life cycle of a housefly, the effects of its activities on humans, and how to reduce such effects	B7.2.2.1.1 Describe the life cycle of the housefly <ol style="list-style-type: none"> 1. Identify and describe the stages of the life cycle of the housefly. 2. Show the order of the stages of the life cycle of the housefly, e.g. eggs → larva → pupa → adult. Arrange flashcards or cut-outs to illustrate the stages. 3. Draw each stage of the life cycle of the housefly and use arrows to link the stages to make the cycle complete. 4. Write notes on each of the stages of the housefly. 	DL5.3, CC8.1, DL5.6, CC9.6, CI5.5, CI6.2, CC8.2

Content standard	Indicators and exemplars	Core competencies
Topic 2: Life cycle of organisms		
	<p>B7.2.2.1.2 Discuss the activities of the housefly as a menace to humans and show how to reduce the effects of those activities</p> <ol style="list-style-type: none"> 1. Use drawings, pictures and cartoons to demonstrate their knowledge of the housefly's feeding habits, e.g. feeding on dead animals, rotten food, manure, solid and liquid waste. 2. Discuss how the activities of the housefly affect humans in terms of <ol style="list-style-type: none"> a) transferring types of diseases (such as dysentery). b) food poisoning. c) being a nuisance in the environment. 3. Design an invention that can reduce the effects of the activities of the housefly on humans, and educate people of your community about the invention. 	CI5.1, CI6.6, CC8.1, DL5.1, CI5.3, CI6.3, DL5.6
Topic 3: Crop production		
B7.2.3.1 Demonstrate understanding of the different plant nutrients (organic and inorganic fertilisers) and their application in school farming (school gardening)	<p>B7.2.3.1.1 Observe and list all plant nutrient sources available in a community and categorise them into organic and inorganic nutrient sources</p> <ol style="list-style-type: none"> 1. Create a table to explain the differences between organic and inorganic plant nutrients. 2. Compare the volumes of organic and inorganic nutrient sources required by different plants. 	CI5.2, CP5.6, CP5.7
	<p>B7.2.3.1.2 Describe the physical characteristics of different plant nutrients (organic and inorganic) and how each is applied to plants in the field</p> <ol style="list-style-type: none"> 1. Identify each plant nutrient source and explain how its physical structure and appearance affect its application. 2. Describe in groups how each type of nutrient source may be applied to plants in the field (e.g. the school garden). 3. Demonstrate practical application of each type of nutrient source to plants in the field (e.g. school garden). 	DL5.5, CC8.2, CC9.1, CC9.5, CI5.5
Topic 4: Animal production		
B7.2.4.1 Demonstrate an understanding of the differences among domestic animals, such as ruminants, monogastrics and poultry (monogastric herbivores)	<p>B7.2.4.1.1 Examine and list domestic animals in the community</p> <ol style="list-style-type: none"> 1. Identify different types of domestic animals in the community. 2. Match different domestic animals with their breeds. 3. List and discuss the characteristics, such as shape, colour, size, food/feeding and others, that can be used to classify domestic animals. 	DL5.1, CP5.6, DL5.6, CC9.1, CC8.2
	<p>B7.2.4.1.2 Show the differences and similarities among domestic animals</p> <ol style="list-style-type: none"> 1. Classify domestic animals into ruminants, monogastrics and poultry. 2. Give examples of animals classified as ruminants, monogastrics and poultry. 3. Discuss and write down the differences between ruminants, monogastrics and poultry. 4. Write down similarities in the nature and characteristics of ruminants, monogastrics and poultry in Ghana and other countries. 	CP5.6, CC8.1, DL5.3, DL5.1, CC8.2, CP5.1, CP5.2

Content standard	Indicators and exemplars	Core competencies
Topic 4: Animal production		
B7.2.4.2 Show an understanding of the usefulness of the different types of animals for domestic and commercial purposes	B7.2.4.2.1 Discuss and write down the domestic and commercial uses of different types of animals <ol style="list-style-type: none"> 1. Explain the concepts of domestic use and commercial use of animals. 2. Describe the domestic uses of ruminants, monogastrics and poultry. 	DL6.6, CC8.2, CC8.1, DL5.5
	B7.2.4.2.2 Observe and compare the uses of the different types of animals <ol style="list-style-type: none"> 1. Observe and discuss different uses of different animals found in the community. 2. List and match the different domestic animals to their commercial uses, including their by-products (such as animal waste). 	CC7.1, CC8.1, DL5.5, CP5.6, DL5.1, CP5.2

Unit 3.1 Stages of the water cycle

Content standard

- Recognise that the water cycle is an example of repeated patterns of change in nature and understand how it occurs.

Indicator

- Explain how the water cycle occurs as a repeated pattern in nature.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Merge simple/complex ideas to create novel situations or things.
- Select the most effective creative tools for work, and give reasons for the choice.
- Combine information and ideas from several sources to reach a conclusion.

Unit in a nutshell

Although there are sometimes droughts and floods, the Earth's total amount of water is fixed. Water is continuously cycled between the Earth's surface (land and oceans) and the atmosphere. The water cycle is driven by energy from the Sun.

Water is a special substance because it occurs naturally in solid, liquid and gas states. The water cycle involves changes of state:

- Heat from the Sun changes liquid water into water vapour – the process of evaporation.
- Water vapour rises, cools and changes into liquid droplets in the form of clouds – the process of condensation.
- Water returns to the Earth in the form of rain, hail or snow – the process of precipitation.
- Surface water collects as lakes and rivers from water run-off. Water that soaks into the ground (by infiltration or percolation) collects as groundwater.

ACTIVITY 3.1.1**Identifying the natural sources of water in the water cycle, listing and describing the stages**

LB page 31

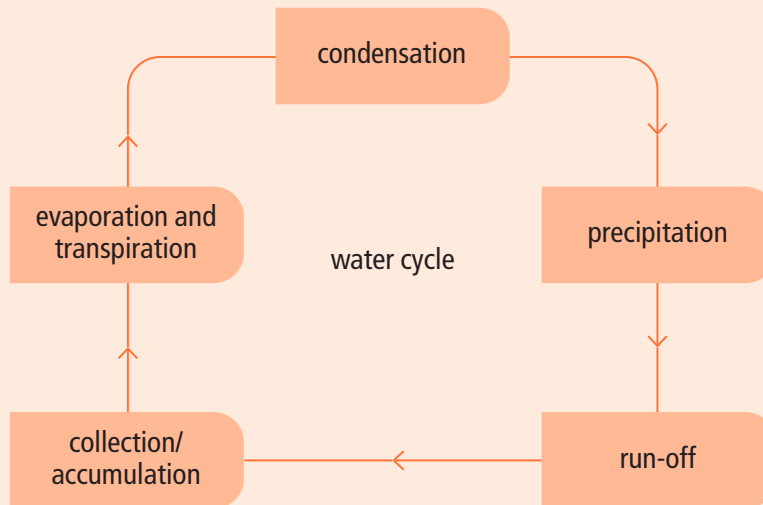
(Pairs)

DL5.1, CI5.2, CI6.3, CP5.1

Answers

1. snow caps and/or glaciers (frozen rivers), rivers, lakes, groundwater, which is accessed by springs or wells
2. The four stages of the water cycle include the following:
 - evaporation – water changes from a liquid into water vapour (a gas) when heated by the Sun; in this way, water enters the air/atmosphere
 - transpiration – the evaporation of water from the leaves of plants
 - condensation – water vapour in the air/atmosphere cools and forms clouds; water changes from a gas into a liquid in the form of tiny water droplets
 - precipitation – water falls from clouds as liquid rain or frozen hail or snow.

3.



The water cycle

Check...

Learners can:	Yes	No
1. Identify natural sources of water.		
2. List the stages of the water cycle.		
3. Draw a flow chart or diagram to represent the order of the stages of the water cycle.		
4. Understand and explain how the stages of the water cycle are linked to each other.		
5. Understand that the water cycle is a repeated pattern in nature.		

Unit 3.2 The importance of the water cycle

Content standard

- Recognise that the water cycle is an example of repeated patterns of change in nature and understand how it occurs.

Indicator

- Describe the importance of the water cycle in nature.

Core competencies

- Speak clearly and explain ideas.
- Be prepared to make decisions using available information.
- 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.
- Merge simple/complex ideas to create novel situations or things.

Unit in a nutshell

The water cycle is important because it renews the supply of fresh water on which all land-based plants and animals depend. Not only do plants and animals need water for survival, but water in rivers, lakes, wetlands and estuaries is a habitat for many species.



INTERNET

Some good web pages on **the water cycle** to visit:

- <https://climatekids.nasa.gov/water-cycle/>
- <https://www.natgeokids.com/za/discover/science/nature/water-cycle/>
- <https://www.kidzone.ws/Water/>
- <https://www.theschoolrun.com/homework-help/water-and-the-water-cycle>

ACTIVITY 3.2.1

Explaining why the water cycle is a repeating pattern in nature and explaining the importance of the water cycle

LB page 34

(Groups)

DL5.1, CC8.1, DL5.6, CP5.1, CC8.2, CI5.2

Answers

1. The Sun
2.
 - It changes from liquid water on the Earth's surface to water vapour in the atmosphere through the process of evaporation.
 - It changes from water vapour into liquid water droplets in the atmosphere through the process of condensation. These water droplets can freeze to form hail or snow.

3. Into the air/the atmosphere. (Air is a mixture of gases that include nitrogen, oxygen, carbon dioxide and water vapour).
4. When water evaporates into water vapour, the water vapour carries with it a parcel of heat energy. This is called 'latent heat energy'. Latent means hidden. When the water vapour condenses, it releases this parcel of heat.
5.
 - All plants and animals need water.
 - Plants and animals need water to transport nutrients and wastes, and to make up the cytoplasm of their cells.
 - Plants need water for photosynthesis (the process of making their own food – glucose and starch – from water and carbon dioxide).
 - Water is the habitat for aquatic (freshwater) and marine (saltwater) plants and animals.
6. Saltwater is a mixture of salt dissolved in water. The process of evaporation separates the water from the salt, leaving the salt behind. The water vapour, when it condenses, is fresh/pure water.
7. When it rains, some water soaks into the ground. This process is called 'infiltration' or 'percolation'. The water seeps down until it reaches an impenetrable layer of rock, where it collects. The surface of this collection or accumulation of groundwater is called the 'water table'. The level of the water table rises during the rainy season.
8. Water is good at dissolving substances. Think of how salt or sugar 'disappears' when it is stirred into water. In other words, water is a good solvent.
9. The water cycle plays a big role in the weather in the following ways:
 - The amount of evaporation that takes place affects the air humidity, which is the water vapour content of the air.
 - The amount of condensation that takes place affects cloud formation – whether it is sunny or cloudy or foggy.
 - Precipitation – rain, snow and hail – is a significant aspect of the weather.

EXTENSION ACTIVITY

Learners can create a model of the water cycle using recycled materials as well as arts and crafts materials, such as cotton wool and paints.

Check...

Learners can:	Yes	No
1. Describe the stages of the water cycle.		
2. Describe the importance of the water cycle as an energy source.		
3. Explain how water and the water cycle carries nutrients to support life.		
4. Explain how the water cycle can affect the water table.		
5. Describe how the water cycle regulates weather patterns.		
6. Understand the role of the water cycle in the provision of clean water.		
7. Explain the importance of the water cycle in a community.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic.
Learners should aim for at least 60%.

1.
 - a) The water cycle (1)
 - b)
 - A: evaporation
 - B: condensation
 - C: precipitation
 - D: run-off (16)
2. Learners can list any three of the following:
 - Living things need clean water to survive.
 - The water table needs to be replenished.
 - Water carries nutrients.
 - The water cycle regulates weather patterns.
 - Water is an energy source. (3)

Total: 20 marks

Topic 2: Life cycle of organisms

Module 4

The housefly

Unit 4.1 The life cycle of the housefly

Content standard

- Demonstrate the skills of carrying out activities to show the stages of the life cycle of a housefly, the effects of its activities on humans, and how to reduce these effects.

Indicator

- Describe the life cycle of the housefly.

Core competencies

- Find and utilise digital content.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking as a group.
- Be prepared to make decisions using available information.
- Work with all group members to complete a task successfully.
- Try new alternatives and different approaches.
- Reflect on approaches to creative tasks and evaluate the effectiveness of tools used.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- A pest is any animal, plant or organism that causes irritation or harm to humans, animals or plants.
- Pests include household pests, such as cockroaches and houseflies.
- Although pests do not cause disease directly, they can transmit diseases by acting as carriers/vectors.
- Like most pests, houseflies are insects and begin life as a larva – a worm-like maggot that looks very different to the adult form. In other words, they undergo a metamorphosis.

HOMEWORK ACTIVITY

Ask learners to find and bring specimens of the housefly at the various stages of development.

ACTIVITY 4.1.1

Showing the stage orders of the housefly's life cycle

LB page 38

(Individual)

DL5.3, CC8.1, DL5.6, CC9.6

Resources

If you can, ask learners to find specimens of the housefly at various stages of its development. As an alternative to asking learners to find eggs, maggots, fly pupae and adult flies, you could display these in class in glass jars.

Guidelines

- If learners are collecting their own stages of the housefly, warn them to try not to touch the specimens. If they do, they should promptly wash their hands well.
- Point out that an insect such as a cockroach undergoes an incomplete metamorphosis (it has a nymph stage which looks like an insect) and that the housefly undergoes a complete metamorphosis (it becomes a pupa).

Answers

- Note that the drawings should show the relative sizes of the different stages of the housefly's life cycle (refer to the diagram on page 37 of the Learner's Book):
 - egg: is white, elongated and about 1 mm long
 - larva: is pale, worm-like, tapers at the head (a blackish tip) and 3–9 mm long
 - pupa: is brown, shiny, ribbed, tapers at the head end, about 9 mm long
 - adult: has two large eyes, antennae, six legs, two wings and is about 9 mm long. Eyes are brown, body is black, and wings are transparent.

EXTENSION ACTIVITY

Learners can take photos of the housefly at each of the stages and present a poster with the photos displayed on it. Alternatively, they can do a presentation using the photos and a presentation software program. If it is not possible to use photographs or the internet, encourage learners to visit a local library to find suitable pictures that they can either photocopy for their posters or redraw. It may be useful to have pictures available that you have sourced, which you can offer to learners as references.



INTERNET

Find videos and photos online of the **housefly** at each of the **various stages**. Here is a link to a video: <https://www.youtube.com/watch?v=F5dnUoJVBls>

Check...

Learners can:	Yes	No
1. Define 'life cycle'.		
2. Identify and describe the stages of the life cycle of the housefly.		
3. Show the order of the stages of the life cycle of a housefly by means of a diagram or flow chart.		
4. Write notes to explain each stage of the life cycle of the housefly.		

Unit 4.2 The effect of the housefly on humans

Content standard

- Demonstrate the skills of carrying out activities to show the stages of the life cycle of a housefly, the effects of its activities on humans, and how to reduce these effects.

Indicator

- Discuss the activities of the housefly as a menace to humans and show how to reduce the effects of those activities.

Core competencies

- Examine alternatives in creating new things.
- Be open-minded, adapting and modifying ideas to achieve creative results.
- Speak clearly and explain ideas.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Identify requirements of a given situation and justify more than one creative tool that will be suitable.
- Select the most effective creative tools for work and give reasons for the choice.
- Be prepared to make decisions using available information.

Unit in a nutshell

Houseflies carry bacteria and other disease-causing organisms that it picks up from feeding on dung or rotting meat. It carries these on its legs, mouthparts and hairs. It can easily transmit these bacteria and disease-causing organisms to any human food that it settles on via its saliva which it secretes, turning food into a semi-liquid that it can suck up.

ACTIVITY 4.2.1

Discussing how the activities of houseflies affect humans; describing the housefly's feeding habits

LB page 40

(Class)

CI5.1, CI6.6, CI8.8, DL5.1

Answers

1. A pest irritates or harms a different organism. The housefly is a pest to humans because it is a nuisance, it directly spreads diseases to humans, and it indirectly causes food poisoning by contaminating food and water.
2. The behaviour of houseflies makes them a nuisance: when they search for food, they crawl on any surface, including your skin, and they fly to and fro with an irritating buzzing sound.
3. Houseflies transmit diseases and cause food poisoning by picking up pathogens like bacteria, fungi and viruses, and toxins on their legs or in their mouths. They then deposit the pathogens onto surfaces and food.

ACTIVITY 4.2.2**Designing an invention to control houseflies and educating your community about how houseflies transmit diseases**

LB page 42

(Groups)

CI5.3, CI6.3, DL5.6

Answers

1.

Method	How it works	Challenges with the implementation of this method
a) Eliminate breeding sites	Interrupts the lifecycle of the housefly before the pupa undergoes metamorphosis into an adult	Direct exposure to pathogens and toxins during clean-up
b) Reduce or remove things that attract flies	Reduces the population of houseflies in that specific place, thereby reducing the effect of the houseflies in that area	Accessing necessary equipment and services to ensure suitable handling of domestic waste
c) Prevent contact with food, surfaces and utensils	Prevents houseflies from depositing pathogens on food, surfaces and utensils	Implementing this method introduces inconveniences, e.g. closing the doors and windows can make the kitchen hot and stuffy
d) Use biological and chemical pest control methods	Interrupts the lifecycle of the housefly at some stage	Acquiring and maintaining biological control agents without the control agents becoming pests; chemical control agents not being specific to houseflies so other creatures get poisoned, too

Note: Another challenge for methods (a) – (d) is being constantly vigilant, quick to apply the method, and getting everyone to implement the method.

2. Examples of ways in which houseflies are controlled include the following:

- composting animal waste
- covering domestic waste
- disposing of domestic waste
- using rubbish bins with lids
- emptying rubbish bins regularly
- covering food
- keeping utensils clean
- using self-closing doors for the kitchen
- using insect screens on the windows
- introducing wasps that parasitise houseflies
- keeping chickens to eat housefly larvae
- applying chemicals to window screens and surfaces
- using pesticides to kill and control flies.

Assessment

Rubric for assessing the learner's invention to control houseflies (note that the numbers are mark allocations):

Criteria	1	2	3	4
Design your own invention	No original design and no invention	Original design but is not an invention to control houseflies	Invention to control houseflies, but lacks originality	Invention to control houseflies is original
Is it a simple or complicated invention?	Invention is unnecessarily complicated	Invention is simple	Invention can easily be done	
Is it easily do-able?	Invention seems impossible to do	Invention could be done, but with difficulty		
Is it cheap or expensive to make/do?	There are unnecessary costs, making the invention expensive	There are necessary costs making the invention expensive	The invention is cheap	
Will it be effective for the control of houseflies?	Invention will not control houseflies and will not prevent transmission of disease by houseflies	Invention will not control houseflies, but will prevent the transmission of diseases by houseflies	Invention will control houseflies to a small extent	Invention will control houseflies effectively

Rubric for assessing the learner's poster or booklet that outlines the invention and educates the community about how houseflies transmit diseases:

Criteria	1	2	3	4
Poster or booklet	Format is a poster or a booklet			
Short and simple	Information is unnecessarily long and complicated	Most of the information is short and simple	Information is short and simple	
Lively and eye-catching	Appearance is lively and eye-catching			
Pictures rather than words	Pictures are used whenever possible			
Content	Does not show how houseflies transmit diseases	Partially shows how houseflies transmit disease	Shows how houseflies transmit diseases	Shows how houseflies transmit diseases and how the invention works to control houseflies

Check...

Learners can:	Yes	No
1. Demonstrate knowledge of a housefly's feeding habits, including sources of food.		
2. Discuss the housefly's activities that affect humans, including disease transfer and food poisoning.		
3. Explain how and why the housefly is a nuisance.		
4. Design an intervention that can reduce the effects of the activities of the housefly on humans.		
5. Design an education programme to explain to a community about their chosen intervention.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1. **a)** larvae (1)
b) imago (1)
c) pupae (1)
d) maggots (1)
2. **a)** The life cycle of a housefly (1)
b) A: Adult housefly; B: Eggs; C: Larva; D: Pupa (4)
3. Any one reason:
 - They transfer diseases.
 - They can cause food poisoning.
 - They are irritating and make life uncomfortable. (2)
4. It means that the housefly does not carry the disease itself, but rather carries the disease-causing pathogen or organism. (4)
5. C, A, B (3)
6. Learners can choose one method to name and describe. (5)

Method	How it works
a) Eliminate breeding sites	Interrupts the lifecycle of the housefly before the pupa undergoes metamorphosis into an adult
b) Reduce or remove things that attract flies	Reduces the population of houseflies in a specific place, thereby reducing the effect of the houseflies there
c) Prevent contact with food, surfaces and utensils	Prevents houseflies from depositing pathogens onto food, surfaces and utensils
d) Use biological and chemical pest control methods	Interrupts the lifecycle of the housefly at some stage

Total: 23 marks

Topic 3: Crop production

Module 5

Plant nutrients

Unit 5.1 Organic and inorganic nutrient sources

Content standard

- Demonstrate understanding of the different plant nutrients (organic and inorganic fertilisers) and their application in school farming (school gardening).

Indicator

- Observe and list all plant nutrient sources available in a community and categorise them into organic and inorganic nutrient sources.

Core competencies

- Merge simple/complex ideas to create novel situations or things.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Provide new insight into controversial situations or tasks.

Unit in a nutshell

- The nutrient content of the soil is improved by adding compost, manure or fertilisers (organic and inorganic).
- Fertilisers contain chemicals/elements such as nitrogen, phosphate and potassium (NPK). Nitrogen for leaf growth, and potassium for flower and fruit development.
- Compost is made from the decomposed/rotted remains of plant and animal matter. Biodegradable matter decomposes into a dark, crumbly soil-like mixture. Compost improves the structure of the soil and contains micro-organisms that are important for soil health.
- Manure is the dung or droppings of grazing animals or poultry.

ACTIVITY 5.1.1

Comparing organic and inorganic fertilisers LB page 47

(Pairs)

CI5.2, CP5.6, CP5.7

Answers

1. Learners to complete the table:

Organic fertilisers	Inorganic fertilisers
They are by-products of plants, animals and natural processes	They are manufactured from synthetic sources
They are cheap	They are expensive to produce and purchase
Nutrients can be diluted	Nutrients are concentrated
Nutrients cannot be controlled in terms of quantity and quality	It is easy to control the amount of specific nutrients added
They help improve soil structure	They help improve soil quality
They absorb and hold water	They do not absorb or hold water in any particular way
They help to limit soil erosion	They have no effect on soil erosion
They are a useful form of waste disposal	They are used carefully because they are additional/extra

2. Organic fertilisers
3. Accept reasonable responses from the learners. For example: If the yield is low and there is no alternative to improve the soil quality or if there is little time to allow for organic methods to take hold and be successful, I might use inorganic fertilisers.

ACTIVITY 5.1.2

Identifying different kinds of fertilisers and demonstrating their application

LB page 48

(Groups)

DL5.5, CC8.2, CC9.1, CC9.5, CI5.5

Resources

You or the learners will need to bring different types of fertilisers to class. These can merely be samples, in other words the quantities do not have to be large.

Guidelines

- Ensure that learners follow safety precautions when handling any of the samples of fertilisers. Remind them that fertilisers can be hazardous to handle.
- You can either practise the application of the fertilisers now or leave it for Activity 5.2.1.
- It is important that learners 'learn by doing'. Allow them to touch, feel and apply the fertilisers as much as possible.
- Learners' paragraphs will be based on the crops/plants that they work with for this activity. Use page 48 of the Learner's Book as a guideline and check the product information carefully. Learners' paragraphs should demonstrate an understanding of the volumes of nutrient sources that different plants require.

HOMEWORK ACTIVITY

Learners should have experience of applying organic and inorganic fertilisers. They should assist doing this at home, if possible, or they should visit a garden centre or farm in their community and observe and ask questions.

Check...

Learners can:	Yes	No
1. Explain the differences between organic and inorganic plant nutrients.		
2. Identify plant nutrient sources and explain how its physical structure and appearance affect its application.		
3. Compare volumes of organic and inorganic plant nutrient sources that different plants require.		

Unit 5.2 The application of plant nutrients

Content standard

- Demonstrate understanding of the different plant nutrients (organic and inorganic fertilisers) and their application in school farming (school gardening).

Indicator

- Describe the physical characteristics of different plant nutrients (organic and inorganic) and how each is applied to plants in the field.

Core competencies

- Evaluate the quality and validity of information.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Work towards group goals.
- Appreciate the importance of all team members in discussions and actively encourage contributions from them.
- Try new alternatives and different approaches.

Unit in a nutshell

- Manure can be added to the soil directly (although, this must be done with caution), or mixed with water and added in liquid form.
- By the end of this unit, the learners should be comfortable with identifying plant nutrient sources and explaining how its physical structure and appearance will affect its application. They will also work in groups to describe how to apply different nutrient sources and demonstrate this practically.

ACTIVITY 5.2.1

Demonstrating the practical application of a plant nutrient source

LB page 52

(Class)

DL5.5, CC8.2, CC9.1, CC9.5, CI5.5

Guidelines

This activity requires advance preparation. Identify a suitable part of the school garden and ensure that each section is big enough for learners to practise their application of the nutrients. They will use three different methods. If there is not enough space or resources are limited, you can demonstrate the application methods to the learners.

Check...

Learners can:	Yes	No
1. Explain how the physical properties of a plant nutrient source affect how it is applied.		
2. Explain the purpose of applying plant nutrient sources.		
3. Describe how to apply plant nutrient sources.		
4. Demonstrate the practical application of each type of plant nutrient source.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1. Farmyard manure is the general name for droppings of farm animals. (2)

2. A (1)

3. D (1)

4.

Macronutrient	Symbol	Purpose
Nitrogen	a) N	b) Helps with plant growth
Phosphorus	c) P	d) Ensures the plant's roots develop properly
Potassium	e) K	f) Necessary for the overall health of the plant or crop

(6)

5. It means that the farmer will need 17% nitrogen, 10% phosphorous, and 10% potassium for every kg per hectare. (4)

6. There are four steps, namely:

- Wear protective clothing and gear.
- Dissolve the fertiliser in water.
- Prepare the machine or spray bottle.
- Spraying the fertiliser over a large area, or apply it directly to the foliage.

(3)

7. While organic nutrient sources can be applied relatively easily by an amateur farmer or gardener, inorganic fertiliser must be carefully applied by someone with knowledge and experience of the chemical itself as well as the process of applying it. Organic nutrients can be broadcast over a large area, but it is not certain what nutrients will be involved or at what quantities. However, with inorganic nutrient sources, the amount of specific nutrients is carefully monitored and controlled. (4)

8. a) A: manure; B: inorganic fertiliser; C: mulch (3)

b) Organic nutrient source: A, C; inorganic nutrient source: B (3)

c) A: broadcast method; B: spray method; C: ring method (3)

d) C (2)

e) It is non-toxic, it is relatively inexpensive, and it is water-wise. (3)

Total: 35 marks

Topic 4: Animal production

Module 6

Domestic animals

Unit 6.1 Classification of domestic animals

Content standard

- Demonstrate an understanding of the differences among domestic animals such as ruminants, monogastrics and poultry (monogastric herbivore).

Indicator

- Examine and list domestic animals in the community.

Core competencies

- Ascertain when information is needed and be able to 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.
- Be prepared to make decisions using available information.
- Work towards group goals.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.

Unit in a nutshell

- Animals are a good source of produce, particularly protein.
- They are kept for their meat, milk and eggs. They are also kept for their wool, hides, feathers and manure.
- It is important to select the right breed of animal, depending on the purpose of the animal. For example, some chicken breeds provide eggs, whereas others are good for meat.

ACTIVITY 6.1.1

Identifying different types of farm animals and considering ways of classifying them and their uses

LB page 56

(Groups)

DL5.1, CP5.6, DL5.6, CC9.1, CC8.2

Resources

For each group, provide photos or pictures of farm animals.

Guidelines

- Learners should start to understand that farm animals have different diets and are farmed in different ways.
- Learners can use the pictures that you provide to sort through their knowledge of farm animals, and to make deductions (if they do not know) about what each animal eats.

ACTIVITY 6.1.2**Identifying domestic animals in the community** LB page 58

(Individual)
DL5.1, CP5.6

Guidelines

- This activity aims to encourage the learners to apply their knowledge to their own lives and their own communities.
- Allow for some discussion time for learners to consolidate their research and knowledge.

EXTENSION ACTIVITY

Learners can research information, including interesting and important facts, about one chosen domestic animal from their community.

Check...

Learners can:	Yes	No
1. Describe what a domestic animal is, and give reasons why humans domesticate animals.		
2. Identify common characteristics of domestic animals.		
3. Identify how the shape and size of domestic animals is an important characteristic.		
4. Identify the importance of colour as a characteristic in a domestic animal.		
5. Explain that domestic animals must be fed and/or provided with a food source.		

Unit 6.2 Comparing domestic animals

Content standard

- Demonstrate an understanding of the differences among domestic animals such as ruminants, monogastrics and poultry (monogastric herbivore).

Indicator

- Show the differences and similarities among domestic animals.

Core competencies

- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Speak clearly and explain ideas.
- Find and utilise digital content.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Explain ideas in a clear order with relevant details, using the correct construction and structure of speech.
- Combine information and ideas from several sources to reach a conclusion.
- Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- Ruminants include cattle, sheep and goats.
 - Ruminants have a digestive system that is specially adapted to breaking down plant material.
 - The most distinguishable part of the ruminant's digestive process is the fact that these animals ruminate – that is, they 'chew the cud'. This process is important for the learners to understand.
- Non-ruminants or monogastric animals have simple stomachs.
 - Monogastric animals can be herbivores, carnivores or omnivores.
 - Learners will learn about the pig, which is a monogastric omnivore, and poultry, which have a very specialised digestive system because they do not have teeth or a tongue to masticate (chew).

ACTIVITY 6.2.1

Classifying animals into ruminants, monogastrics and poultry and comparing and giving examples LB page 63

(Pairs)

CP5.6, CC8.1, DL5.3, DL5.1, CC8.2, CP5.1, CP5.2

Answers

1. a)
 - ostrich – poultry
 - water buffalo – ruminant
 - deer – ruminant
 - horse – monogastric
 - turkey – poultry

- b)
 - ostrich – southern Africa
 - water buffalo – Asia
 - deer – Europe
 - horse – most continents
 - turkey – North America
- 2. a) Learners can give any two examples, e.g. goats, camels and giraffes.
- b) Learners can give any two examples, e.g. pigs and rabbits.
- c) Learners can give any two examples, e.g. chickens, ducks and guinea fowls.
- 3. a) Ruminants are herbivores and mainly graze on grass or browse leaves of shrubs and other small plants.
- b) Monogastrics have simple stomachs and can be either herbivorous, omnivorous or carnivorous.
- c) Poultry do not have a mouth, which means they do not chew. Instead, they have beaks without teeth that can break down the food.
- 4. a) oesophagus
- b) rumen
- c) reticulum
- d) omasum
- e) abomasum
- f) intestines

Check...

Learners can:	Yes	No
1. Define ruminant, monogastric and poultry.		
2. Classify domestic animals as ruminant, monogastric and poultry.		
3. Give examples of animals classified as ruminant, monogastric and poultry.		
4. Describe the characteristics and feeding habits of ruminant domestic animals.		
5. Describe the characteristics and feeding habits of monogastric domestic animals.		
6. Describe the characteristics and feeding habits of poultry.		
7. Explain the similarities and differences in the nature and characteristics of ruminants, monogastrics and poultry.		

Unit 6.3 The usefulness of animals

Content standard

- Show an understanding of the usefulness of the different types of animals for domestic and commercial purposes.

Indicator

- Discuss and write down the domestic and commercial uses of different types of animals.
- Observe and compare the uses of the different types of animals.

Core competencies

- Demonstrate knowledge and recognition of ethical use of information.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Evaluate the quality and validity of information.
- Identify words or sentences in context appropriately.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- Domestic and commercial animals are farmed and used for a variety of purposes, including for meat, fur/pelt and other by-products.

ACTIVITY 6.3.1

Comparing the domestic and commercial use of animals

LB page 66

(Class)

DL6.6, CC8.2, CC8.1, DL5.5

Guidelines

- Facilitate a class discussion where the learners discuss the use of animals in domestic and commercial settings.
- They should consider the inputs as well as the processes that go into the farming of these animals.
- They are likely to deduce that domestic farming of animals is vastly different to commercial farming of animals in input and process.
- Learners should also discuss the products and by-products that result from animal production. In general, domestic use of the animals usually results in less waste, as people tend to use as much of the animal products as they can.
- However, in commercial situations, by-products can be more useful. A farmer may sell or exchange one by-product for another.

HOMEWORK ACTIVITY

Ask learners to bring samples of by-products (or at least the packaging for these) and present this to the class as a show-and-tell activity. They will need to explain what it is and what animal it is a product of.

Check...

Learners can:	Yes	No
1. Explain the commercial use of animals.		
2. Compare the commercial use of animals to their domestic use.		
3. Describe the usefulness of animals in terms of their products and by-products.		
4. List and match the different domestic animals to their commercial uses.		

ASSESSMENT ACTIVITY

LB page 67

Learners should answer the questions in their exercise books to assess their understanding of the Topic.
Learners should aim for at least 60%.

1.
 - a) B (1)
 - b) A (1)
 - c) A (1)
 - d) C (1)
2.
 - a) Ruminants have a complex stomach. They are herbivores that ruminate to break down and digest plant matter. (2)
 - b) Monogastrics are animals with simple stomachs. They can be herbivores, omnivores or carnivores. (2)
3. Learners can list any three of the following characteristics:
 - grow easily and mature quickly
 - reproduce easily in captivity
 - eat mostly plant-based diets, making it cheaper to feed them
 - strong and adapt easily to changing conditions
 - social animals, making it easier to control and tame them. (6)
4. Learners can list any five of the following important uses:
 - food production
 - companionship
 - cultural representations
 - animal coats and furs
 - used as working animals
 - used for scientific or biological research
 - used for recreation or sport. (5)
5. Learners can mention any three by-products of domestic animals, including eggs, fur, wool, meat and dairy. (3)
6. Their teeth and complex stomachs break down plant materials and extract nutrients from it. (3)
7.

a) monogastric	b) monogastric
c) monogastric	d) ruminant
e) poultry (monogastric)	f) ruminant
g) poultry (monogastric)	h) ruminant
i) monogastric	j) monogastric

 (10)

Total: 35 marks

Activity 1: Multiple choice

1. C
2. B
3. A
4. B
5. B
6. B
7. C
8. B
9. B
10. B

(10)

Activity 2: Longer questions

1. **A:** evaporation
B: transpiration
C: condensation
D: precipitation
E: run-off (5)
2. Houseflies lay their eggs in decaying organic matter. (2)
3. Learners can choose any method of control. See page 41 of the Learner's Book for information about these control methods. (3)
4. **a)** Legumes are planted at flowering stage and ploughed back into the soil. They will then decay in place and provide nutrients and improve the structure of the soil. (3)
b) Organic nutrient sources can be applied without much experience. These sources, such as manure or compost, are usually applied using the broadcast method. It is not really possible to control or plan for the distribution of nutrients when applying organic nutrient sources. However, with inorganic nutrient sources, the application is carefully controlled and planned and should be adhered to. The method of application is typically the spray method, because the fertiliser is diluted with water in a specific ratio. Precautions must be taken when handling inorganic nutrient sources as they can be hazardous to a person without the experience of using them. (5)
5. **a)** A ruminant has a complex stomach and can break down fibrous plant materials, while a monogastric has a simple stomach. (2)
b) Poultry do not have teeth and, therefore, cannot chew or break down green grass enough to be able to digest it properly. (2)

Total: 32 marks

Topic 1: The human body system

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: The human body system		
B7.3.1.1 Show an understanding of the concept of food and the process of digestion, and appreciate its importance in humans	B7.3.1.1.1 Explain the concept of food and the need for humans to eat <ol style="list-style-type: none"> 1. Explain what food is, the nutrients found in them and deduce its definition. 2. Compare and contrast the appearance of people who have been starved for some time with those who have been eating and look healthy and strong. 3. Deduce from the comparison in Exemplar 2 why it is so important for humans to eat food. 	DL5.1, CP5.1, DL6.6, CP5.8
	B7.3.1.1.2 Examine what happens to food at the various stages of digestion in humans <ol style="list-style-type: none"> 1. Identify the parts of the alimentary canal in a drawing of the digestive system. 2. Research and describe what happens to food, for example a piece of boiled yam/cassava/plantain/cocoyam/bread, egg, meat, orange, palm oil and many others, when it gets into the mouth, stomach, large and small intestines. 3. Draw and label the digestive system of humans. 	CC7.4, DL5.5, DL5.1, DL6.4, DL6.6, CP5.4, CP5.8, CI6.2
	B7.3.1.1.3 Identify the end product of digestion of starchy, protein and oily foods and explain how absorption of the digested food occurs in humans <ol style="list-style-type: none"> 1. Observe and describe, using animation, how digested food is absorbed into the body of humans. 2. Draw a flowchart to show that starch is digested into sugar, protein is digested into amino acids, and oils are digested into fatty acids. 3. Perform practical tests on food: starch, glucose, protein and fats and oils. 	DL5.1, CC8.1, CI5.3, CI5.2, CC9.3, PL6.3
Topic 2: The solar system		
B7.3.2.1 Demonstrate knowledge of the inner planets of the solar system and understand their movement in the system	B7.3.2.1.1 Identify the inner planets of the solar system and describe their properties <ol style="list-style-type: none"> 1. Identify and describe what constitutes the inner planets of the solar system using pictures, videos, etc. 2. Describe the galaxy, milky way, and elliptical shape of the paths of movement of the inner planets. 3. Design and construct a model of the solar system. 	DL5.1, CC8.1, CC8.2, DL5.3, CP5.8, CI5.1, CI5.3, CI6.6

Content standard	Indicators and exemplars	Core competencies
Topic 2: The solar system		
	B7.3.2.1.2 Discuss the properties and the relative motions of the planets Mercury and Venus <ol style="list-style-type: none"> Outline properties peculiar to each of the planets Mercury and Venus. Describe the movement of the planets Mercury and Venus around the Sun. 	DL5.1, CP5.6, DL5.5, CC8.2, CP5.1
Topic 3: The ecosystem		
B7.3.3.1 Recognise the components of and interdependences in an ecosystem, and appreciate their interactions	B7.3.3.1.1 Analyse the components of ecosystems and identify their interactions <ol style="list-style-type: none"> Describe an ecosystem as a self-sustaining unit in which components interact. For example, a pond, a forest and many others. Group ecosystems into terrestrial, aquatic and arboreal categories. Identify and list the components, such as biotic and abiotic, of each category of ecosystem. Differentiate between organisms in the different ecosystems mentioned in Exemplar 2. Explain how the components of the different ecosystems affect one another. 	CC9.6, CC8.1, CC8.4, DL5.5, DL5.6, CP5.1, CP6.7, DL5.1, CP5.6, CP5.2
Topic 4: Farming systems		
B7.3.4.1 Demonstrate an understanding of the differences among the various farming systems, including land rotation, crop rotation, mixed cropping, mixed farming and organic farming	B7.3.4.1.1 Examine and discuss the differences among the various farming systems <ol style="list-style-type: none"> Identify and define the different types of farming systems in Ghana and elsewhere. Discuss the characteristics of the different farming systems in Ghana. Compare and contrast the characteristics of the different farming systems. 	DL5.3, DL6.1, CG5.4, CC8.1, DL5.1, CP5.1, CG5.3, CP5.4, CP5.2, CP5.1
	B7.3.4.1.2 Categorise different farming systems <ol style="list-style-type: none"> Classify different descriptions of farming systems under land rotation, crop rotation, mixed cropping, mixed farming and organic farming. Group farming systems prevailing in their community under land rotation, crop rotation, mixed cropping, mixed farming and organic farming. 	CP5.1, CG5.2, DL5.3
	B7.3.4.1.3 Discuss the usefulness of different farming systems <ol style="list-style-type: none"> Discuss and tabulate the reasons behind the use of various farming systems. Debate the merits and demerits of the different farming systems. 	CC8.5, CI5.5, CP5.4, CP5.1, CP6.7, CC8.5, CG5.3

Unit 7.1 Food nutrients

Content standard

- Show an understanding of the concept of food and the process of digestion, and appreciate its importance to the human body.

Indicator

- Explain the concept of food and the need for humans to eat.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Combine information and ideas from several sources to reach a conclusion.
- Demonstrate knowledge and recognition of ethical uses of information.
- Identify and prove misconceptions about a generalised concept or fact specific to a task or situation.
- Combine information and ideas from several sources to reach a conclusion.

Unit in a nutshell

- Humans require three major classes of food for energy production. These are proteins, carbohydrates and fats. The human body also requires three different types of supplements that are vital for body functions. These are vitamins, minerals and water.
- Not getting enough of these nutrients in your diet often leads to malnutrition, nutrient-deficiencies or other health problems. For this reason, a balanced diet is important.

ACTIVITY 7.1.1**Explaining what food is and why we need it** LB page 74

(Class)

DL5.1, CP5.1

Guidelines

- Learners will have a discussion about the importance of food. Try to steer them away from appearance and, instead, towards overall health and vitality.
- Introduce the terms 'nourished' and 'malnourished'.
- Learners should conclude that food is important for good health, for energy to do life's activities, and for growth and development.

Answers

1.
 - a) Anything that provides nutrients. Food is something that humans and animals eat or drink for energy.
 - b) We need food to provide us with energy to grow, live and develop.
 - c) Not all food is nutritious. Junk food is food that provides more energy than we need and may not have all the necessary vitamins and minerals for the body to function optimally.
2.
 - a) Picture A shows a well-nourished teenager while Picture B shows an undernourished teenager. The teenager in Picture A looks healthy. He looks like he has energy. The teenager in Picture B does not look healthy. He is too thin, and he looks like he does not have energy – he looks cold because he does not have a healthy amount of fat on his body.
 - b) Children and teenagers are still developing and growing. They need energy for that, as well as to learn.
 - c) Accept any correct examples from the learners.

ACTIVITY 7.1.2 Identifying the nutrients found in different foods LB page 75

(Pairs)

DL5.1, DL6.6, CP5.8

Answers

1.

Food	Nutrients
yam fufu	carbohydrates (starch)
potatoes	carbohydrates (starch)
beans	carbohydrates (starch), protein
oranges	carbohydrates (sugar), vitamin C
milk	protein, calcium
fish	protein, iodine, lipids or fats
sunflower oil	lipids or fats
2. Margarine and water: margarine is a synthetic food item (which means it is not made from natural sources but rather from vegetable fat and oils), and water is not food.

Check...

Learners can:	Yes	No
1. Explain what food is and the nutrients found in them.		
2. Understand why humans need to eat.		
3. Compare and contrast the appearance of a person who is malnourished with a person who is adequately nourished.		
4. Identify the nutrients found in different foods.		
5. Explain what a nourishing diet looks like, and how humans can get the nutrients they need.		

Unit 7.2 Parts and processes of the digestive system

Content standard

- Show an understanding of the concept of food and the process of digestion, and appreciate its importance in humans.

Indicator

- Examine what happens to food at the various stages of digestion in humans.

Core competencies

- Identify underlying themes, implications and issues.
- Evaluate the quality and validity of information.
- Adhere to behavioural protocols that prevail in cyberspace.
- Display knowledge and recognition of ethical uses of information.
- Generate hypotheses to help answer complex problems.
- Identify and prove misconceptions about a generalised concept or fact specific to a task or situation.
- Reflect on approaches to creative tasks and evaluate the effectiveness of tools used.

Unit in a nutshell

- How do the nutrients from the food that we chew and swallow end up in our bloodstream? Food moves through the alimentary canal which consists of the pharynx (throat), oesophagus (gullet), stomach, small intestine and large intestine (colon).
- During the digestive process, the following happens:
 - The teeth and the stomach break down food mechanically.
 - When you swallow food, it undergoes a journey from your gullet to your stomach, and then moves through the small and large intestines. Nutrients and water are absorbed along the way.

ACTIVITY 7.2.1

Identifying parts of the alimentary canal

LB page 79

(Pairs)

CC7.4, DL5.5

Answers

2. Mouth, oesophagus, stomach, small intestine, large intestine, rectum, anus
3. The gut
4. It cannot be gravity because it is not a sheer dropdown from the mouth to the anus, but rather a complex path. Also, food can move through the alimentary canal even when a person is sitting, standing or is upside down, so gravity does not explain why the food moves through the way it does. (The process is called peristalsis.)



INTERNET

Try this interactive labelling exercise: <https://www.purposegames.com/game/digestive-system-labeling-interactive-game> on the **digestive system**.

PRACTICAL ACTIVITY 1 Creating a model of the digestive system LB page 79

(Groups)
C16.2

Materials and apparatus

See the list of materials needed on page 79 of the Learner's Book. Use recycled materials as far as possible. Ask learners to bring any materials that they can, to class.

Guidelines

- Hand out templates (see template on page 135 of this guide) which learners can either trace and copy, or which they can stick onto their large piece of cardboard. This will be used as their template for the project.
- Allow some class time to do the activity because the learners may have questions. Other than that, they can be allowed to work on it for homework.
- Ensure that all the parts are labelled.

Assessment

Use the rubric for models on page 134 of this Teacher's Guide to assess and award marks for the learners' models.

Check...

Learners can:	Yes	No
1. Identify the parts of the digestive system in the human body.		
2. Draw and label the digestive system in the human body.		
3. Describe the digestive process, from ingestion to excretion.		
4. Develop a model of the digestive system.		

Unit 7.3 Chemical digestion

Content standard

- Show an understanding of the concept of food and the process of digestion, and appreciate its importance in humans.

Indicator

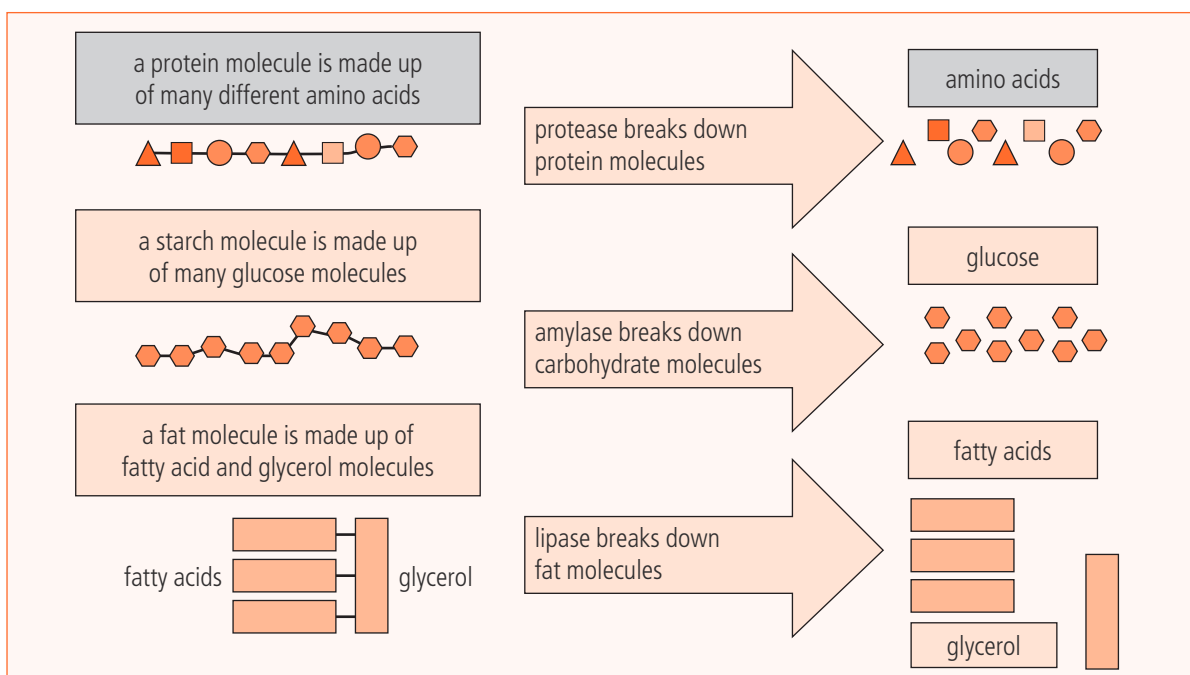
- Identify the end products of digestion of starch, protein and oily foods and explain how absorption of the digested food occurs in humans.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate, and effectively use it to solve a problem.
- Speak clearly and explain ideas.
- Identify requirements of a given situation and justify more than one creative tool that will be suitable.
- Merge simple/complex ideas to create novel situations or things.
- Understand roles during group activities.
- Manage time effectively.

Unit in a nutshell

- Enzymes (a special class of protein) break down food.
- Carbohydrates are broken down into sugars and starch.
- Proteins are broken down into amino acids.
- Fats are broken down into fatty acids and glycerides/cholesterol.
- Amylase breaks down starch.
- Pepsin breaks down proteins.
- Lipase breaks down fats.
- The villi (finger-like projections that make up the inner lining of the small intestine) are rich in blood vessels. Here, nutrients are absorbed into the bloodstream.
- See below for a diagrammatic representation of the above:



ACTIVITY 7.3.1**Describing chemical digestion and absorption**

LB page 80

(Pairs)

DL5.1, CC8.1, CI5.3, CI5.2

Answers

1. Enzymes help break down nutrients into the end products that can be absorbed into and used by the body.
2. Pancreas, liver, gall bladder

3. a)

Enzyme	Food group/Nutrients	End products
amylase	starch (carbohydrates)	glucose
protease, peptidase	protein	amino acids
lipase	oils/fats	fatty acids + glycerol

b) protein $\xrightarrow{\text{protease}}$ amino acidsOils and fats $\xrightarrow{\text{lipase}}$ fatty acids + glycerol

4. The nutrients are absorbed by the bloodstream inside the small intestine.

ACTIVITY 7.3.2**Describing what happens to a piece of bread that you eat**

LB page 81

(Pairs)

DL5.1, DL6.4, DL6.6, CP5.4, CP5.8

Resources

Give each learner a small piece of bread.

Guidelines

- This is an opportunity for learners to relate their knowledge to their practical, everyday experience.
- Allow for this to be a discussion activity where learners can apply their knowledge.

PRACTICAL ACTIVITY 2 Testing for starch

LB page 81

(Groups)
CC9.3, PL6.3

Materials and apparatus

Yam/potato, cooking oil, water, iodine solution, beakers, source of heat

Guidelines

- Ensure that the learners read through the instructions before attempting the activity.
- Note that there must always be a control, otherwise the activity will not make sense to the learners.
- If you do not have enough resources to do this practical test, show the learners how it looks by using the suggested video found in the link provided on page 81 of the Learner's Book.

PRACTICAL ACTIVITY 3 Testing for glucose

LB page 82

(Groups)
CC9.3, PL6.3

Materials and apparatus

Sugar water solution, Fehling's or Benedict's solution, test tubes, source of heat or boiling water in a beaker

Guidelines

- Ensure that the learners read through the instructions before attempting the activity.
- Note that there must always be a control, otherwise the activity will not make sense to the learners.
- If you do not have enough resources to do this practical test, show the learners how it looks by showing them a suitable video that you found online. Search for **test for glucose**.

PRACTICAL ACTIVITY 4 Testing for protein

LB page 83

(Groups)
CC9.3, PL6.3

Materials and apparatus

One egg, sodium hydroxide, 1% copper(II) sulphate solution, test tubes

Guidelines

- Ensure that the learners read through the instructions before attempting the activity.
- Note that there must always be a control, otherwise the activity will not make sense to the learners.
- If you do not have enough resources to do this practical test, show the learners how it looks by showing them a suitable video that you found online. Search for **test for protein**

PRACTICAL ACTIVITY 5 Part 1: Emulsion test

LB page 83

(Groups)
CC9.3, PL6.3

Materials and apparatus

Cooking oil, ethanol, water, test tubes

Guidelines

- Ensure that the learners read through the instructions before attempting the activity.
- Note that there must always be a control, otherwise the activity will not make sense to the learners.
- If you do not have enough resources to do this practical test, show the learners how it looks by showing them a suitable video that you found online. Search for **emulsion test**.

PRACTICAL ACTIVITY 5 Part 2: Smear test

LB page 84

(Groups)
CC9.3, PL6.3

Materials and apparatus

Small amount of butter or fat, white paper (filter paper)

Guidelines

- Ensure that the learners read through the instructions before attempting the activity.
- Note that there must always be a control, otherwise the activity will not make sense to the learners.
- If you do not have enough resources to do this practical test, show the learners how it looks by showing them a suitable video that you found online. Search for **smear test for fatty/oily foods**.

Check...

Learners can:	Yes	No
1. Describe how digested food is absorbed into the body.		
2. Perform a practical test to show the presence of starch in food.		
3. Draw a flow chart to show that starch is digested into sugar.		
4. Perform a practical test to show the presence of glucose in food.		
5. Perform a practical test to show the presence of protein in food.		
6. Draw a flow chart to show that protein is digested into amino acids.		
7. Perform a practical test to show the presence of fats and oils in food.		
8. Draw a flow chart to show that oils are digested into fatty acids.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic.
Learners should aim for at least 60%.

1.
 - a) Chewing/tearing and pounding of food into smaller pieces. (2)
 - b) It breaks down the food enough so that nutrients can be absorbed from it. (3)
2.
 - a) ingestion
 - b) assimilation
 - c) egestion (3)
3.
 - a) fat or oil
 - b) glucose
 - c) ethanol
 - d) brick-red colour
 - e) 1% copper(II) sulphate solution
 - f) violet
 - g) iodine (7)
4.
 - a) mouth
 - b) oesophagus
 - c) stomach
 - d) small intestine
 - e) large intestine (5)
5.
 - a) stomach
 - b) small intestine
 - c) mouth
 - d) large intestine/anus (4)
6.
 - a) glucose
 - b) amino acids
 - c) fatty acids, glycerol (3)

Total: 27 marks

Topic 2: The solar system

Module 8

The inner planets of the solar system

Unit 8.1 Our solar system

Content standard

- Demonstrate knowledge of the inner planets of the solar system and understand their movement in the system.

Indicator

- Identify the inner planets of the solar system and describe their properties.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Find and utilise digital content.
- Identify and prove misconceptions about a generalised concept or fact specific to a task or situation.
- Examine alternatives in creating new things.
- Identify requirements of a given situation and justify more than one creative tool that will be suitable.
- Be open-minded, adapting and modifying ideas to achieve creative results.

Unit in a nutshell

- In the vast universe, each star system (collection of stars) is called a 'galaxy'.
- The Sun is one star in a galaxy of more than 100 billion stars.
- The Sun is at the center of a system of planets, moons and asteroids which together make up our solar system. The planets move around the Sun in more or less circular paths (elliptical paths) called 'orbits'.
- The terrestrial planets are Mercury, Venus, Earth and Mars.
- The giant planets are Jupiter and Saturn. Jupiter is made up mainly of hydrogen gas. Saturn has rings made up of particles of rock and dust.



INTERNET

There are many online resources that you can use to investigate **the solar system** in some detail. Try NASA's website, as a starting point. Also try free stargazing apps using a smartphone or tablet.

ACTIVITY 8.1.1**Describing some of the features of the universe and quizzing your classmates**

LB page 90

(Class)

*DL5.1, CC8.1, CC8.2, DL5.3, CP5.8***Guidelines**

- By working in groups, you can allow the learners to swap their quizzes with another group. Limit the quizzes to five to 10 questions.

Answers

- A thousand billion OR a million multiplied by a million
 - A collection of stars
- Spiral galaxy
 - It looks like a smear of white stars, hence the name.
 - It contains approximately 100 to 400 billion stars.
 - The Sun is just one star in the Milky Way, so the Milky Way includes our solar system and many others, too.

PRACTICAL ACTIVITY 1**Describing and constructing a model of the solar system**

LB page 91

(Groups)

*CI5.1, CI5.3, CI6.6***Materials**

This activity requires the use of papier-mâché, which is a mixture of flour and water and torn up pieces of paper (you can use newspaper or any scrap paper that is not glossy or greasy) that hardens when left to dry. It also requires balloons, paint and skewer sticks (or you can use sharpened smooth sticks that learners can search for outside). Plan ahead so that there is enough time for the models to dry out.

Assessment

Use the rubric for building models on page 134 of this Teacher's Guide to assess the learners' models.

Check...

Learners can:	Yes	No
1. Define a solar system.		
2. Identify the inner planets of the solar system.		
3. Describe the characteristics of the inner planets of the solar system.		
4. Describe the galaxy and milky way.		
5. Describe the elliptical shape of the paths of movement of the inner planets found in the solar system.		
6. Design and construct a model of the solar system.		

Unit 8.2 Mercury and Venus

Content standard

- Demonstrate knowledge of the inner planets of the solar system and understand their movement in the system.

Indicator

- Discuss the properties and the relative motions of the planets Mercury and Venus.

Core competencies

- Ascertain when information is needed and be able to 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.
- 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 from several sources to reach a conclusion.

Unit in a nutshell

- Mercury is the planet closest to the Sun and has no moons. Because it is closest, its orbit path is the shortest, namely 88 days. It is the smallest of the terrestrial planets.
- Venus is the second closest to the Sun and also has no moons. It is called 'the morning and evening star' because it is the first and largest 'star' to appear in the night sky and the last seen at dawn. Venus spins/rotates in the opposite direction than the other planets in the solar system, and it takes the planet 225 days to complete its orbit around the Sun.

ACTIVITY 8.2.1

Identifying and describing the inner planets of the solar system

LB page 93

(Pairs)

DL5.1, CP5.6

Answers

1. Mercury, Venus, Earth, Mars
2. Learners can list any four of the following:
 - They are solid and rocky.
 - None of them have rings.
 - They are smaller than the outer planets.
 - They have short orbits compared to the outer planets.
 - They rotate slower compared to the outer planets.
3.
 - a) Mars, because the gases and the soil on that planet make it appear red.
 - b) Earth, because the abundance of water makes the planet appear blue from space.
 - c) Mercury
 - d) Mercury
 - e) Mars

(Individual)

DL5.5, CC8.2, CP5.1

Answers

	Mercury	Venus
Planet's position in solar system	Closest to the Sun	Second planet from the Sun
Moons	No moons	No moons
Temperature	Extreme temperatures	Hottest planet
Atmosphere	Thin atmosphere	Thick clouds of sulfuric acid
Rotation	Equal to 59 days on Earth	Equal to 88 days on Earth
Revolution	Equal to 243 days on Earth	Equal to 224 days on Earth
Does the planet support life?	No	No

Check...

Learners can:	Yes	No
1. Describe the characteristics of Mercury and Venus.		
2. Describe the movement of Mercury and Venus around the Sun.		
3. Understand why conditions on Mercury and Venus are not suitable for life.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1.
 - a) B
 - b) C
 - c) B
 - d) B (4)
2. A group of objects that revolves around a central star, such as the Sun. (3)
3.
 - a) Spiral galaxy
 - b) The Milky Way is vast, containing our solar system and many others, too.
 - c) It looks like a smear of white stars, hence the name.
 - d) It contains approximately 100 to 400 billion stars. (4)
4. Learners should come up with three reasons. For example:
 - Earth has fresh water.
 - Earth has reasonable temperatures.
 - Earth is a terrestrial planet, which means organisms can live on solid surfaces.
 - Earth has an atmosphere with the correct mix of gases. (6)
5. Any two unique features, including:
 - Venus is the hottest planet.
 - Venus is the brightest object in the sky.
 - Venus' rotation is opposite to those of the other planets. (2)

Total: 19 marks

Topic 3: The ecosystem

Module 9

Interdependence and interaction in the environment

Unit 9.1 Ecosystems

Content standard

- Recognise the components of and interdependences in an ecosystem, and appreciate their interactions.

Indicator

- Analyse the components of ecosystems and identify the interactions within.

Core competencies

- Work with all group members to complete a task successfully.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.

Unit in a nutshell

- Animals and plants thrive in different environments.
- An ecosystem is a community of interacting organisms and their physical environment. It is an area that can sustain itself.
- Ecosystems are made up of biotic and abiotic components.

ACTIVITY 9.1.1

Describing an ecosystem

LB page 99

(Pairs)

CC9.6, CC8.1, CC8.4, DL5.5, DL5.6

Answers

- a) An ecosystem is a self-sustaining unit in which living (biotic) and non-living (abiotic) components interact.
 - b) A biotic component is a living organism, such as a plant or an animal.
 - c) An abiotic component is something that is not living, such as rocks, soil or water.
- a) Learners can mention the following components visible in the photograph:
 - biotic – grasses, trees
 - abiotic – rocks, water, topographical features (mountains and waterfalls).
 - b) An example of an animal is a fish. A fish needs water as well as a food source to survive. It, therefore, needs plants or algae in the water which produce food by using the Sun for photosynthesis.

(Groups)

CP5.1, CP6.7

Guidelines

- The emphasis of this activity should be on identifying the biotic and abiotic components that make up an ecosystem. The added practical activity of creating the mini ecosystem is simply a way to engage learners and to help them 'learn by doing'.
- Allow learners to work in small groups for this practical activity. They can either choose their own group members, or you can assign groups based on ability level.
- The learners' ecosystems require advance planning. Learners must write a list of both the biotic and abiotic components that they will need. This step is important, especially if creating the ecosystem is not going to be possible or realistic for your learners or your class.
- The learners can design the mini ecosystem by drawing a labelled diagram. The labels should identify the abiotic and biotic components that they listed in their planning.
- Learners may not be able to include everything from their planning and/or design. This is fine. They should submit their planning and design to you so that you can check that they have identified the components in enough detail.
- Learners who can/want to can now build their mini ecosystem. Remind learners to be thoughtful and mindful of living creatures, and to not harm the environment from which they are drawing their components.
- Also emphasise safety when handling small animals and insects, as some of these may be dangerous when handled. Those should be left in the environment.
- Groups can present their ecosystems to the class. Once done, they must return any small animals or insects back to where they found them.

Check...

Learners can:	Yes	No
1. Define an ecosystem.		
2. Define biotic and abiotic factors.		

Unit 9.2 Types of ecosystems

Content standard

- Recognise the components of and interdependences in an ecosystem, and appreciate their interactions.

Indicator

- Analyse the components of ecosystems and identify the interactions within.

Core competencies

- Anticipate different responses from the audience and plan for them.
- Evaluate the quality and validity of information.
- Be prepared to make better decisions using available information.
- Combine information and ideas from several sources to reach a conclusion.
- Implement strategies with accuracy.

Unit in a nutshell

- There are three main types of ecosystems:
 - Terrestrial ecosystems are ecosystems that are found on land.
 - Aquatic ecosystems are ecosystems that are found in a body of water – this includes the oceans, lakes and rivers.
 - Arboreal ecosystems are ecosystems that are found in trees.
- Different animals and plants live in each of the different ecosystems. They have unique features and characteristics that enable them to thrive in these environments.

ACTIVITY 9.2.1

Differentiating between organisms in different ecosystems

LB page 103

(Individual)

DL5.1, CC8.1, CP5.6, CP5.2

Answers

- Learners can choose an animal from the Learner's Book examples, or they can use the internet or the library to find their own examples.
 - Example answer (using examples from the Learner's Book):

	Tortoise (terrestrial)	Lobster (aquatic)	Fruit bat (arboreal)
Habitat	Lives, eats and sleeps on dry land	Lives in water	Lives, eats and sleeps in trees
Means of respiration	Lungs	Uses gills at the base of the legs	Lungs
Nature of skin	Tough, scaly skin on head and legs/feet. Hard shell	Hard shell with thin legs. Soft body beneath the shell	Hairy body and head, with leathery wings
Adaptations	Can retract into its hard shell to avoid predators. Is similar in colour to the soil and surroundings	Can stay underwater without floating to the surface	Small and strong claws on feet, which it uses to grip onto the trees when landed

2. a) Learners can choose a plant from the Learner's Book examples, or they can use the internet or the library to find their own examples.
- b) Example answer (using examples from the Learner's Book):

	Mahogany trees (terrestrial)	Algae (aquatic)	Liana (arboreal)
Habitat	Grow on land	Grows in water, sometimes on water, or on objects that are in or around water	Grows (climbs) on and up trees
Source of nutrients	Absorb nutrients from the soil, up through the roots. Leaves undergo the process of photosynthesis, which also produces food for the tree	Absorbs dissolved nutrients from water. Undergoes photosynthesis	Absorbs nutrients from the soil. Undergoes photosynthesis
Root development	Extensive roots to support the weight of the tree on land	No extensive roots – rather clings to the surfaces, or floats	Winds its roots around other plants and trees to climb
Exchange of gases (oxygen and carbon dioxide)	Exchanges gases with the air	Exchanges gases with the air	Exchanges gases with the air
Nature of body	Thick, woody stem with woody branches	Small, flexible and cling to surfaces. Flat and carpet-like	Woody but flexible stems that allow it to climb up other plants

Check...

Learners can:	Yes	No
1. Provide examples of ecosystems.		
2. Define ecosystems as terrestrial, aquatic and arboreal.		
3. Classify ecosystems as terrestrial, aquatic and arboreal.		
4. Identify and list biotic and abiotic components in ecosystems.		
5. Give examples of organisms that live in terrestrial ecosystems.		
6. Give examples of organisms that live in aquatic ecosystems.		
7. Give examples of organisms that live in arboreal ecosystems.		

Unit 9.3 Interactions in the environment

Content standard

- Recognise the components of and interdependences in an ecosystem, and appreciate their interactions.

Indicator

- Analyse the components of ecosystems and identify the interactions within.

Core competencies

- Work with all group members to complete a task successfully.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Anticipate different responses from the audience and plan for them.
- Evaluate the quality and validity of information.
- Be prepared to make better decisions using available information.
- Combine information and ideas from several sources to reach a conclusion.
- Implement strategies with accuracy.

Unit in a nutshell

- Living organisms in the environment/ecosystem depend on each other and live as neighbours. Feeding relationships are at the heart of this interdependence, leading to food chains and food webs.
- Plants are producers. They make their own food.
- Animals are consumers. They eat plants or other animals.
 - Primary consumers eat plants and secondary consumers eat animals.
 - Animals that eat plants are called 'herbivores'.
 - Animals that eat meat/other animals are called 'carnivores'.
 - Animals that eat both plants and meat/other animals are called 'omnivores'.
- A food chain shows what animals eat. In a habitat, food chains link up to form a food web.
- An ecosystem is a natural self-contained area or unit/habitat in which living organisms interact with one another and the non-living components of the physical environment. The study of interactions is called 'ecology'.



INTERNET

Watch videos and animations online of **animals interacting in the wild**.

ACTIVITY 9.3.1

Explaining how organisms affect each other LB page 107

(Pairs)
CC8.1

Answers

- Learners' food chains should be in the correct order of energy transfer.
 - palm fruit → squirrel → snake → eagle
 - grass → zebra → lion
 - seaweed → sea slug → crab → seagull
 - grass → impala → baboon → vulture
 - acacia leaves → giraffe → lion
 - algae → shrimp → tuna → shark
- Herbivory (fish eats the seaweed)
 - Predation (seal is the shark's prey)
 - Seaweed produces its own food through the process of photosynthesis. It does not rely on another organism for its nutrition.
 - The shark is the tertiary consumer.
- In their paragraphs, pay attention to the learners' ability to understand that abiotic factors and biotic factors interact in ways that support the ecosystem. For example, without the soil, many decomposers would have no habitat. An earthworm must live in moist soil conditions, or its body will dry out. Likewise, without earthworms, the soil would not be aerated and there would be fewer nutrients released into the soil. The conclusion that the learners should reach is that decomposers play an important role in improving soil quality, which, in turn, leads to better nutrient availability for plants and, therefore, better food for animals and humans.

ACTIVITY 9.3.2

Answering questions about an ecosystem LB page 109

(Groups)

DL 5.3, CI 5.2, CI 5.4

Answers

- Learners can draw any food chain they like, provided it is one that is found in a terrestrial or arboreal ecosystem.
- No, succulent plants are found in desert environments that are dry and do not receive much rainfall. The Kakum National Park receives a good amount of rainfall, therefore, succulent plants are not typically found there.
- Commensalism – this is because the area is protected, which allows it to thrive. The animals and plants have a thriving habitat and the humans also benefit in a variety of ways.
- Learners should understand that human activity could have resulted in the degradation and exploitation of the natural area. By splitting it into two areas, the communities around the area are still able to use the forest reserve for their own needs, while the conservation area is off limits for these purposes. This is a win-win situation for the plants and animals of the Kakum Conservation Area and the villagers that surround it. It is a way to ensure that humans co-exist more peacefully with nature.

Check...

Learners can:	Yes	No
1. Explain how biotic and abiotic factors in these ecosystems affect one another.		
2. Explain the characteristics of the organisms that live in these ecosystems, and why they are suited to them.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic.
Learners should aim for at least 60%.

1.
 - a) B
 - b) D
 - c) B
 - d) D
 - e) A(5)

2.
 - a) green plant → insect → lizard → hawk (4)
 - b)
 - (i) green plant
 - (ii) insect
 - (iii) lizard(3)

Total: 12 marks

Topic 4: Farming systems

Module 10

Types of farming systems in Ghana and around the world

Unit 10.1 Types of farming systems

Content standard

- Demonstrate an understanding of the differences among the various farming systems, including land rotation, crop rotation, mixed cropping, mixed farming, and organic farming.

Indicators

- Examine and discuss the differences among the various farming systems.
- Categorise the different farming systems.

Core competencies

- Find and utilise digital content.
- Develop and exhibit a sense of cultural identity.
- Develop and exhibit the ability to defend one's cultural beliefs, practices and norms.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Combine information and ideas from several sources to reach a conclusion.
- Generate hypotheses to help answer complex problems.
- Analyse and make distinct judgements about viewpoints expressed in an argument.

Unit in a nutshell

- Crop production is an important source of food and income. It involves cycles of sowing, growing and harvesting, according to the season.
- Crop production is the growing and harvesting of plants for food and other uses. Commercial farmers grow crops to sell.
- Farming is a system with inputs, processes and outputs.
- Types of farming are arable farming (growing crops), pastoral farming (rearing animals), and mixed farming (growing crops and keeping animals).
- Farming systems can be commercial or subsistence, intensive or extensive.

EXTENSION ACTIVITY

If the learners have experience working in a garden or on a farm they can do a presentation that outlines a typical day. They should mention the tasks they perform as well as the tools they use, what type of farming system it is, etc.

(Pairs)

DL5.3, DL6.1, CG5.4, CC8.1

Answers

1.
 - a) A farming method in which the farmer cultivates different pieces of land at different times.
 - b) A farming method in which the farmer grows different types of crops on the same piece of land in a definite order or cycle.
 - c) A farming method in which multiple crops are grown on the same piece of land for a long time.
 - d) A farming method in which the farmer raises livestock and grows crops on the same piece of land.
 - e) A form of agriculture that avoids the use of synthetic fertilisers, pesticides and other agro-chemicals to protect the natural environment.

	Land rotation	Crop rotation	Mixed cropping	Mixed farming	Organic farming
Is it used on small/ large farms?	large	large	small	large	small/large
How many types of crops are planted in one year?	one	one	multiple	one/multiple	one/multiple
Does it require special tools or equipment?	yes	yes	no	yes	no

2.
 - a)

	Land rotation	Crop rotation	Mixed cropping	Mixed farming	Organic farming
Is it used on small/ large farms?	large	large	small	large	small/large
How many types of crops are planted in one year?	one	one	multiple	one/multiple	one/multiple
Does it require special tools or equipment?	yes	yes	no	yes	no
 - b) Land rotation requires leaving land to lie fallow while the crops are planted elsewhere. Crop rotation does not leave land to lie fallow, rather, different types of crops are planted one year after the next.
 - c) Mixed cropping is usually done on small farms and entails planting different types of crops on one piece of land. Mixed farming, on the other hand, means to simultaneously farm both crops and livestock.

Check...

Learners can:	Yes	No
1. Identify and define types of farming systems in Ghana and elsewhere.		
2. Discuss the characteristics of land rotation as a type of farming.		
3. Discuss the characteristics of crop rotation as a type of farming.		
4. Discuss the characteristics of mixed cropping as a type of farming.		
5. Discuss the characteristics of mixed farming.		
6. Discuss the characteristics of organic farming.		
7. Compare and contrast the different types of farming systems.		

Unit 10.2 Why we use different farming systems

Content standard

- Demonstrate an understanding of the differences among the various farming systems, including land rotation, crop rotation, mixed cropping, mixed farming, and organic farming.

Indicator

- Discuss the usefulness of the different farming systems.

Core competencies

- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Try new alternatives and different approaches.
- Generate hypotheses to help answer complex problems.
- Combine information and ideas from several sources to reach a conclusion.
- Implement strategies with accuracy.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Develop and exhibit a sense of cultural identity.

Unit in a nutshell

- Commercial farming is farming for profit, whereas subsistence farming entails producing one's own food to feed oneself and one's family.
- Intensive agriculture is a system of farming that uses large amounts of capital and/or labour relative to land area and produces a high output.
- Extensive agriculture is a system of farming that uses small amounts of capital and/or labour relative to the land area and produces a low output.
- Agricultural activity varies from place to place. It depends on
 - physical factors, such as relief, soil and climate
 - human factors, such as population density, market, labour, technology, capital, transport, and politics and culture.
- Change in agricultural land use has advantages and disadvantages:
 - Food production (output) has increased with the use of high-yielding varieties, fertilisers, irrigation and machinery.
 - But the intensification of farming has environmental consequences, such as run-off water pollution, soil salinisation, soil erosion and land degradation.
- Methods of increasing agricultural production/output in Low Income Countries (LICs) include planting pits, trickle drip irrigation, the use of organic fertilisers, and biocontrol.
- Sustainable development of agriculture depends on
 - agricultural conservation that promotes minimum soil disturbance, maintenance of a permanent soil cover, and diversification of plant and animal species
 - land management practices that include the use of legumes in crop rotations, water harvesting and growing trees on croplands (agroforestry).

ACTIVITY 10.2.1**Classifying different descriptions of farming systems**

LB page 119

(Pairs)

CP5.4, CP5.2, CP5.1

Answers

1. a) Number 3
- b) Number 4
- c) Number 1
- d) Number 5
- e) Number 2

ACTIVITY 10.2.2**Grouping farming systems in your community** LB page 119

(Pairs)

CP5.1

- 1–4. This activity requires some advance preparation on the part of your learners. They must understand the different types of farming systems, as well as the advantages and disadvantages of each system. Unless you teach in a farming community, the learners may also need to do some research to find out what farming system is most widely practised in the community.

Check...

Learners can:	Yes	No
1. Discuss the reasons why various farming systems are used.		
2. Debate the advantages and disadvantages of the different farming systems.		
3. Group farming systems in their community based on the types they have learned about.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1. A farming system is the type of farming method or process that a farmer uses to produce or raise crops and animals. (2)
2.
 - a) Learners can mention any five farming systems, for example land rotation, crop rotation, mixed cropping, mixed farming, organic farming. (5)
 - b)
 - Land rotation is a farming method in which the farmer cultivates different pieces of land at different times.
 - Crop rotation is a farming method in which the farmer grows different types of crops on the same piece of land in a definite order or cycle.
 - Mixed cropping is a farming method in which multiple crops are grown on the same piece of land for a long time.
 - Mixed farming is a farming method in which the farmer simultaneously raises livestock and grows crops on the same piece of land.
 - Organic farming is a form of agriculture that avoids the use of synthetic fertilisers, pesticides and other agro-chemicals to protect the natural environment. (10)
 - c) Refer to page 117 and 118 of the Learner's Book for advantages and disadvantages of each of the farming systems. Accept any two disadvantages and any two advantages. Ensure that the learner has clearly specified which farming system they have selected. (4)
3.
 - a) A – cowpeas; B – yam; C – maize (3)
 - b)

Year/plot	Plot 1	Plot 2	Plot 3
1	yams	cowpeas	maize
2	cowpeas	maize	yams
3	maize	yam	cowpeas

 (6)
 - c) Crop rotation (1)
 - d) Any two of the following reasons:
 - maintains soil fertility
 - weed control
 - pest and disease control. (4)

Total: 35 marks

Activity 1: Multiple choice

- | | | |
|------|-------|------|
| 1. C | 2. C | |
| 3. C | 4. B | |
| 5. A | 6. C | |
| 7. B | 8. D | |
| 9. D | 10. A | (10) |

Activity 2: Longer questions

1. Carbohydrates, protein, fat, vitamins and minerals (5)
2.
 - a) carbohydrates
 - b) builds, repairs and maintains body tissue
 - c) provides energy for the body's activities, protects various body parts, keeps brain and nervous system healthy
 - d) vitamins and minerals (4)
3.
 - a) oesophagus
 - b) stomach
 - c) small intestine
 - d) large intestine (4)
4.
 - a)
 - Spiral galaxy: twisted collection of stars in a spiral formation
 - Elliptical galaxy: round collection of stars
 - Lenticular galaxy: combination of a spiral and elliptical galaxy. (6)
 - b) It is a spiral galaxy. (2)
5. Rotation refers to the spinning of a planet on its own axis. Revolution refers to a planet's path or orbit around the Sun. (5)
6.
 - a) An ecosystem is a community of interacting organisms and their physical environment. (3)
 - b) Any two of the following: forest ecosystem, arboreal ecosystems, terrestrial ecosystems. Can also accept pond, grassland, mountain, valley, etc. (2)

7.		Terrestrial plants	Aquatic plants	Arboreal plants	
a)	Habitat	Grow on land	Grow in or on water	Grow on trees	(3)
b)	Exchange of gases	Exchanges gases with the air	Plants that float on the surface of the water exchange gases with the air. Those that live in the water exchange gases with the water	Exchange gases with the air	(3)
c)	Source of nutrients	Absorb nutrients from the soil	Absorb dissolved nutrients from water	Absorb nutrients from either the plant or from debris on the plant	(3)

8. a) A type of interaction where both organisms benefit from the association. (3)

b) When humans respire, they exhale carbon dioxide. Plants use carbon dioxide (as well as sunlight and water) for photosynthesis through which they make their own food. A by-product of photosynthesis is oxygen, which humans require for respiration. (4)

9.

Farming systems	Advantages	Disadvantages
Monoculture	Farmer becomes expert in the production of that crop	Poor weather conditions may lead to total crop failure
Bush fallow	Low cost	Deforestation
Land rotation	Improves or maintains soil fertility	Deforestation and expensive

(12)

10. This farming system can deliver year-round profits as farmers do not have to farm in season. (2)

11. The four principles of crop rotation are as follows:

- Deep-rooted crops should follow shallow-rooted crops.
- Crops of the same family should not follow each other.
- The programme must include legumes.
- Crops that use the same amount of plant nutrients should not follow one another. (4)

Total: 75 marks

Topic 1: Energy

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: Energy		
B7.4.1.1 Demonstrate an understanding of forms of energy and their daily applications	B7.4.1.1.1 Identify the various forms of energy and show how they are related <ol style="list-style-type: none"> 1. List forms of energy in terms of potential, kinetic, heat, sound, solar, electrical, nuclear, chemical and light. 2. Using diagrams, demonstrate and show how potential energy (P.E.) is related to kinetic energy (K.E.); (mechanical energy = P.E. + K.E.). 	DL5.3, DL5.1, CC8.2, CC8.5, CI5.2, CI6.2, CI5.4
	B7.4.1.1.2 Explain daily applications of forms of energy <ol style="list-style-type: none"> 1. Discuss how forms of energy are used in daily life. 2. Match forms of energy to appliances (gadgets) used daily at school, in the house and in the community. 3. Explain factors that affect potential and kinetic energy in their application in daily life. 4. Use mathematical expressions for both potential energy (P.E. = mgh) and kinetic energy (K.E. = $\frac{1}{2}mv^2$) and use the expressions to solve problems involving mechanical energy. 	CC8.1, DL5.5, DL6.6, CP5.6, CI5.2, DL5.1, CC8.2
B7.4.1.2 Demonstrate an understanding of the concept of heat transfer and its applications in life	B7.4.1.2.1 Explain and demonstrate how heat is transferred in various media <ol style="list-style-type: none"> 1. Explain how heat is transferred through different media (gas, plastic, metal and liquid). 2. Carry out an activity to show how heat is transferred through different media. 	DL5.1, CC8.2, CI5.4
B7.4.1.3 Demonstrate understanding of characteristics of light, such as travelling in a straight line, reflection, refraction and dispersion	B7.4.1.3.1 Demonstrate how light travels in a straight line <ol style="list-style-type: none"> 1. Perform experiments to show that light travels in a straight line and can be reflected and refracted, and produce reports, posters or diagrams. 2. Perform an experiment to show dispersion of light into colours. 	DL5.3, CI5.6, CI5.7, CI6.8, CP5.6, CP5.7, CP5.8, CC8.2, CC9.1
Topic 2: Electricity and electronics		
B7.4.2.1 Demonstrate understanding of forms of electricity, its generation and effects on the environment	B7.4.2.1.1 Describe the various forms of electricity generation <ol style="list-style-type: none"> 1. Search for and discuss information about the nature and generation of thermal and nuclear electricity, and produce reports, posters, diagrams and charts about your findings. 	DL5.1, DL5.6, CC8.2
	B7.4.2.1.2 Explain the impact of electricity generation on the environment. <ol style="list-style-type: none"> 1. Debate the negative effects of both thermal and nuclear electricity generation on the environment and how to reduce the effects. Create posters or leaflets of the outcome of the debate. 	CP5.4, CP5.1, CP6.7, CC8.5

Content standard	Indicators and exemplars	Core competencies
Topic 2: Electricity and electronics		
B7.4.2.2 Demonstrate knowledge of how to assemble and explain the functions of basic electronic components and their interdependence in an electronic circuit	B7.4.2.2.1 Demonstrate how to assemble basic electronic components in an electronic circuit 1. Examine electronic components such as types of LEDs, P-N junction diodes, colour code resistors and capacitors, and arrange them in an electronic circuit.	DL5.3, CI6.8
	B7.4.2.2.2 Discuss the function of each electronic component and their interdependence with each other 1. Dismantle and assemble spoilt electronic gadgets such as a radio, TV, mobile phone, electronic watch and others that can be found at home or school and name the parts. 2. Identify the positive (P) region and negative (N) region of the P-N junction diode and construct a simple electronic circuit comprising a 3V battery made of two dry cells in series with a switch and an LED. 3. Explain what happens when the switch in an electronic circuit is closed and when it is opened.	CI6.6, CI6.8, CI5.2, CC8.2
	B7.4.2.2.3 Discuss the function of each electronic component such as resistor, diode and inductor, and their interdependence for the functioning of an electronic gadget 1. Discuss the roles and the significance of the following electronic components in a circuit and how they affect each other: <i>i.</i> LED <i>ii.</i> resistor <i>iii.</i> diode <i>iv.</i> inductor. 2. Explain changes in brightness in an LED in relation to the addition of resistors, diodes and inductors in an electronic circuit.	CC8.2, CP5.6, CP5.7
Topic 3: Conversion and conservation of energy		
B7.4.3.1. Demonstrate an understanding of the principle of conservation and conversion of energy and their application in real life situations	B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy 1. Explain the law of conservation of energy by using a diagram to show that in a closed system the value of chemical energy, for example in a dry cell which changes into electrical energy, heat and light energy will remain the same. 2. Use exemplar 1 to explain energy conversion and its application to life.	DL5.1, CP5.1, CI5.2, CI6.8, CI6.6
	B7.4.3.1.2 Demonstrate the conversion of energy into useable forms 1. Illustrate everyday use of the conversion of energy and use a diagram to show the conversion of energy to other forms.	CI6.9, CI6.8, CI6.10
	B7.4.3.1.3 Know how energy could be conserved for future use in life 1. Describe how energy is conserved and explain how it can be done for the benefit of humans and other life forms.	DL5.1, CP5.1, CC8.2

Content standard	Indicators and exemplars	Core competencies
Topic 4: Force and motion		
B7.4.4.1 Examine the concept of motion, Newton's First Law of Motion, as well as magnetic force in relation to motion, and understand their applications to life	B7.4.4.1.1 Understand that unbalanced forces acting on an object, causing it to move <ol style="list-style-type: none"> 1. Explain inertia as a tendency of a body to resist motion. 2. Demonstrate how unbalanced forces cause motion. 	CC8.2, CP5.1, CI6.9, DL5.5
	B7.4.4.1.2 State and explain Newton's First Law of Motion. <ol style="list-style-type: none"> 1. Research to find what Newton's First Law of Motion is and discuss it. 	DL5.1, DL6.4, DL6.6, CC8.2, CI5.2, CI6.8, CI6.6
	B7.4.4.1.3 Examine the application of Newton's First Law of Motion in life <ol style="list-style-type: none"> 1. Discuss some applications of Newton's First Law of Motion. For example, when a metallic ball is placed on a smooth surface and given a push, it will be in motion until it gets to a blockade and it stops. Use of seatbelts in a vehicle, etc. 2. Explain the importance of Newton's First Law of Motion. 	CC8.2, CC9.5, DL5.5, CP5.1, CI5.2, CI6.8, CI6.6, CC8.2, CC9.5
	B7.4.4.1.4 Demonstrate the behaviour of magnets and their uses in life <ol style="list-style-type: none"> 1. Discuss what magnets are and describe the types of magnets that exist. 2. Demonstrate the characteristics (repulsive, attractive, and orientation N-S direction) of a magnet. 3. Discuss the uses of magnets in everyday life. 	CC8.2, CI5.2, CP5.1
B7.4.4.2 Recognise some simple machines and show understanding of their efficiency in doing work	B7.4.4.2.1 Identify simple machines <ol style="list-style-type: none"> 1. List examples of simple machines. 	DL5.1, CC8.1
	B7.4.4.2.2 Describe the types and functions of levers <ol style="list-style-type: none"> 1. Name the types of levers and explain their general functions. 2. Classify levers into first, second and third classes and demonstrate how the principals involved in each class make work easier in everyday life. 	DL5.1, CC8.1, CP5.6, CP6.7
	B7.4.4.2.3 Know work input and output as well as their efficiency as they are applied to machines <ol style="list-style-type: none"> 1. Explain the terms work input, work output and efficiency. 2. Explain efficiency of a machine as the ratio of work output to work input, expressed as a percentage. 3. Explain the concept of efficiency of a machine. 4. Describe how efficiency of simple machines can be improved (for example by oiling its parts to reduce friction). 	CC8.2, DL5.3, CC8.2, DL5.3, CP5.1, DL5.1, CI6.8, CI6.6, CI5.7
Topic 5: Agricultural tools		
B7.4.5.1 Demonstrate knowledge and skills in handling and maintaining basic and simple agricultural tools	B7.4.5.1.1 Explain the basic rules for handling and maintaining simple agricultural tools <ol style="list-style-type: none"> 1. List some simple or basic farm tools in agriculture (give examples found in animal and crop farming). 2. Discuss the meaning and importance of handling and maintaining agricultural tools. 3. List and match the basic rules for handling and maintaining specific simple tools used in agriculture. 4. Describe how to handle and maintain simple and basic agricultural tools 	DL5.1, CG5.2, CP5.6, CI5.2, CI6.8, CI6.6, CC8.1, CI5.5

Content standard	Indicators and exemplars	Core competencies
Topic 5: Agricultural tools		
	<p>B7.4.5.1.2 Apply the basic rules for handling and maintaining basic and simple agricultural tools in the community</p> <ol style="list-style-type: none"> 1. Observe and discuss the handling and maintenance of basic and simple agricultural tools used on farms visited in the community and write a report. 2. Assemble agricultural tools from the community and practise handling the tools to perform simple agricultural operations. Write down the operational rules of handling agricultural tools. 3. Assemble agricultural tools from the community and practise the basic rules in tools maintenance. List the rules that were used. 	CC7.2, CC7.4, CC8.3, CP5.2, DL5.1, CG5.2, CI5.3, CI6.2, CI6.3, CI5.7, CI6.8, CI6.10

Unit 11.1 Forms of energy

Content standard

- Demonstrate an understanding of forms of energy and their daily applications.

Indicator

- Identify the various forms of energy and show how they are related.

Core competencies

- Find and utilise digital content.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.
- Merge simple/complex ideas to create novel situations or things.
- Reflect on approaches to creative tasks and evaluate the effectiveness of tools used.
- Visualise alternatives, see possibilities, and identify problems and challenges.

Unit in a nutshell

- Energy is the ability of a system to do work. Energy cannot be created or destroyed.
- There are different forms of energy:
 - Heat energy is the result of the movement of molecules in an object or substance.
 - Light energy is energy that we can see.
 - Sound energy is energy that we can hear.
 - Chemical energy is released during chemical reactions.
 - Solar energy is energy received from the Sun.
 - Nuclear energy is the energy that is released when the bonds that hold the nucleus of an atom are broken.
- Potential energy is energy that is stored and can be used later.
- Kinetic energy is movement energy.
- Mechanical energy is potential energy (P.E.) + kinetic energy (K.E.).
- Potential energy, kinetic energy and mechanical energy are all expressed in Joules (J).

ACTIVITY 11.1.1**Listing forms of energy**

LB page 127

(Groups)

DL5.3, DL5.1, CC8.2

Guidelines

Accept learners' examples, provided they are correct and reasonable. Example answers include:

- Potential energy: using a cricket bat, pulling back an elastic band, getting ready to throw a ball.
- Kinetic energy: writing, running, driving (in a car), something rolling off a table, rain falling.
- Heat energy: heat from a fire, stove, paraffin lamp, heater, etc.
- Sound energy: person talking, dog barking, car hooting, radio and television playing, talking on phone, music playing.
- Solar energy: light from the Sun (can also accept mention of solar-powered devices).
- Electrical energy: washing machine, dishwasher, lamp, heater, stove, microwave
- Chemical energy: energy in a cell/battery, food, coal/charcoal, oil/petrol/diesel.
- Light energy: light bulb, sunlight, torch shining.

ACTIVITY 11.1.2

Showing how potential energy is related to kinetic energy

LB page 128

(Pairs)

CC8.5, CI5.2, CI6.2, CI5.4

Answers

1. The pendulum of the clock has potential energy before it moves (kinetic energy) and makes impact.

Weighted end of
pendulum is raised

+

Weighted end is released,
gravity pulls it down

=

Pendulum swings

2. The person holding the tennis racquet pulls it backwards, then the person swings it so that it has kinetic energy and hits the tennis ball.

Tennis racquet
is pulled back

+

Tennis racquet is swung
towards the tennis ball

=

Tennis racquet hits
the tennis ball

3. The bow is pulled back tightly, then the person lets go and releases the arrow, which flies through the air.

Bow is pulled
back tightly

+

Arrow is released

=

Arrow flies through
the air

ACTIVITY 11.1.3

Calculating mechanical energy

LB page 130

(Pairs)

CC8.5, CI5.2, CI6.2, CI5.4

Answers

1. a) $P.E. = 82 \times 9.8 \times 0.8$
 $= 642.88 \text{ J}$

c) $M.E. = 642.88 + 1\,025$
 $= 1\,667.88 \text{ J}$

2. a) $P.E. = 0.6 \times 9.8 \times 1.2$
 $= 7 \text{ J}$

c) $M.E. = 7 + 67.5$
 $= 74.5 \text{ J}$

3. a) $P.E. = 2.5 \times 9.8 \times 1.8$
 $= 44.1 \text{ J}$

c) $M.E. = 44.1 + 80$
 $= 124.1 \text{ J}$

b) $K.E. = \frac{1}{2} \times 82 \times (5)^2$
 $= 41 \times 25$
 $= 1\,025 \text{ J}$

b) $K.E. = \frac{1}{2} \times 0.6 \times (15)^2$
 $= 0.3 \times 225$
 $= 67.5 \text{ J}$

b) $K.E. = \frac{1}{2} \times 2.5 \times (8)^2$
 $= 1.25 \times 64$
 $= 80 \text{ J}$

Check...

Learners can:	Yes	No
1. List forms of energy (potential, kinetic, heat, sound, solar, electrical, nuclear, chemical, light).		
2. Show understanding of each form of energy.		
3. Demonstrate and show by diagrams how potential energy (P.E.) is related to kinetic energy (K.E.): Mechanical energy = P.E. + K.E.		
4. Explain factors that affect P.E. and K.E.		
5. Use mathematical expressions for potential energy ($P.E. = mgh$) and kinetic energy ($K.E. = \frac{1}{2}mv^2$).		
6. Use mathematical expressions for P.E. and K.E. to solve problems involving mechanical energy.		

Unit 11.2 Daily applications of forms of energy

Content standard

- Demonstrate an understanding of forms of energy and their daily applications.

Indicator

- Explain daily applications of forms of energy.

Core competencies

- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Evaluate the quality and validity of information.
- Demonstrate knowledge and recognition of ethical uses of information.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Merge simple/complex ideas to create novel situations or things.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Explain ideas in a clear order with relevant details, using construction and structure of speech.

Unit in a nutshell

- Energy is the ability to do work.
- In daily life, energy is used constantly.
- Appliances and gadgets at home, at school and in the community use and give off different types of energy.

ACTIVITY 11.2.1

Matching forms of energy to appliances

LB page 132

(Pairs)

CP5.6, CI5.2

Answers

1. a) D b) C c) A d) B
2. Accept any correct and reasonable answers, for example:
 - a) radio, musical instrument
 - b) charcoal, paraffin
 - c) fire, stove
 - d) lamp, candle.

Check...

Learners can:	Yes	No
1. Discuss how energy is used in daily life.		
2. Match forms of energy to appliances used daily.		

Unit 11.3 Heat transfer

Content standard

- Demonstrate an understanding of the concept of heat transfer and its applications in life.

Indicator

- Explain and demonstrate how heat is transferred in various media.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Visualise alternatives, see possibilities, and identify problems and challenges.

Unit in a nutshell

- Heat is transferred by convection, conduction and radiation.
- It is important to understand heat transfer because it impacts how people use heat in their daily lives.
- Convection is mostly seen in gas and liquid, because the particles move in particular ways when they are heated and cooled.
- Conduction depends on the material that the conductor is made of. A poor conductor is known as an insulator and can be used for particular purposes. For example, the plastic handles on a pot.
- All objects that are heated radiate heat.

ACTIVITY 11.3.1

Explaining how heat is transferred in different media

LB page 135

(Pairs)

DL5.1, CC8.2

Answers

1. Wood is a poor heat conductor, which means that it cannot transfer heat well. This makes wood ideal as a spoon to stir the food. The pot is hot, and the food is hot. If a person used a metal spoon, for example, the heat from the food may be transferred to the person's hand (the person holding the spoon). By using a wooden spoon, the heat is not transferred from the hot food to the person's hand, which means the person can stir the food without burning his or her hand.
2. The heater works to warm up a room by convection. As cooler air particles sink, they are heated by the heater. They then rise and move away from the heat source as other cooler air particles rush in to take their place. In this way, all the air inside the room circulates. This means that even the air furthest away from the heater will eventually become warm.

PRACTICAL ACTIVITY 1**Showing how heat is transferred through different media**

LB page 135

(Groups)

CI5.4

Guidance

- The shear butter is used because it will easily melt if the spoon becomes hot.
- Ensure that the learners work carefully with the hot water so as not to scald themselves.
- If possible, try to ensure that the spoons are of similar sizes. This will help to ensure that the result can be considered reliable.
- It is also important to pour the water as far away from the spoons as possible (this is why it is preferable to use a shallow bowl). Avoid allowing the steam to melt the shear butter as you want to prove that the metal spoon is a better conductor of heat than the plastic and/or wooden spoon.

ACTIVITY 11.3.2**Revising heat transfer**

LB page 136

(Pairs)

DL5.1, CC8.2, CI5.4

Answers

1. A. convection
B. radiation
C. conduction
2. The heat from the stove radiates out from the flame/stovetop towards the teapot. The teapot becomes hot because it is made of a material that is a good conductor of heat. This means that the material that the teapot is made of can transfer heat easily. Inside the teapot, the water is heated by convection. As cooler liquid particles sink to the bottom of the teapot closest to the heat source, they are heated. They then rise and circulate as cooler particles rush in to take their place. In this way, all the water in the teapot becomes heated.

Check...

Learners can:	Yes	No
1. Explain how heat is transferred through different media.		
2. Describe convection, conduction and radiation.		
3. Carry out a practical activity to show how heat is transferred through different media.		

Unit 11.4 Light energy

Content standard

- Demonstrate an understanding of the characteristics of light, such as travelling in a straight line, reflection, refraction and dispersion.

Indicator

- Demonstrate how light travels in a straight line.

Core competencies

- Find and utilise digital content.
- Understand and use analogies and metaphors.
- Put forward constructive comments, ideas, explanations and new ways of doing things.
- Recognise and generalise information and experience, search for trends and patterns.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Provide new insight into controversial situations or tasks.
- Identify and prove misconceptions about a generalised concept or fact specific to a task or situation.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Work towards group goals.

Unit in a nutshell

- Light travels in a straight line. The path of light is never curved.
- Light can be reflected when it hits a smooth and shiny surface.
- Light can be refracted. This means that it may appear to bend.
- Light can be dispersed.

ACTIVITY 11.4.1 Explaining how light travels and can be reflected LB page 138

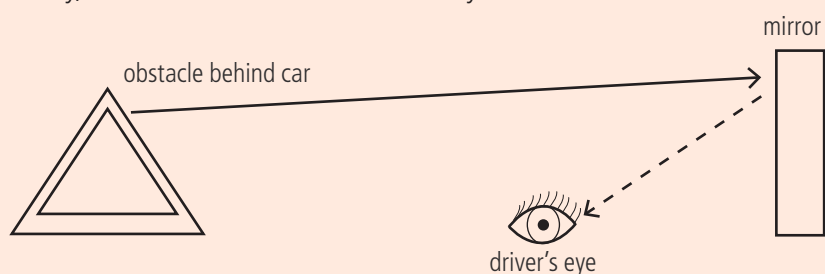
(Pairs)

DL5.3, CI5.6, CI5.7, CI6.8

Answers

1. A simple line drawing similar to Figure 11.21 will suffice.
2. a) It is important for a driver to be able to see what is happening around the car. The side mirrors allow the driver to see if there are any cars or objects close to the sides of the car. This allows the driver to safely overtake another car on the road, for example, or even to turn. The rearview mirror allows the driver to see what is behind the car. This helps the driver to stop or brake safely, as well as to see if there are any obstacles behind the car when reversing.

b)



- Mirrors are also used in cameras, in microscopes, for traffic safety (for example at concealed driveways), by dentists and surgeons, for grooming purposes, for security in shops, in solar cookers, as well as in other solar-powered devices.

Assessment

Use the rubric for reports on page 134 of this Teacher's Guide to help you assess the learners' reports.

PRACTICAL ACTIVITY 2 Showing dispersion of light into colours LB page 139

(Groups)

CP5.6, CP5.7, CP5.8, CC8.2, CC9.1

Materials and apparatus

The most essential apparatus for this activity is the mirror. It is also essential that you try to make the room as dark as possible.

Guidelines

- This is an enjoyable activity that requires very little effort.
- If you have access to a prism, you can also allow the learners to experiment with that.
- Ensure that the room is as dark as possible. You may need to use another classroom or storeroom in the school for it to have the maximum impact that you require.
- Ask the learners if they can name all of the colours that they see. Allow them some time to write these down. They should recognise at least six colours, namely red, orange, yellow, blue, green and purple (indigo/violet).



INTERNET

Watch this video with the learners to learn more about **the formation of rainbows**:

<https://www.khanacademy.org/science/in-in-class10th-physics/in-in-the-human-eye-and-the-colourful-world/in-in-dispersion-of-light-in-prism/v/formation-of-rainbows-how-far-are-they-physics-khan-academy>

Check...

Learners can:	Yes	No
1. Define light.		
2. Describe the characteristics of light.		
3. Understand and explain refraction.		
4. Understand and explain reflection.		
5. Understand and describe dispersion of light and how it results in different colours.		

Topic 2: Electricity and electronics

Unit 11.5 Electricity generation

Content standard

- Demonstrate understanding of forms of electricity, its generation and effects on the environment.

Indicators

- Describe the various forms of electricity generation.
- Explain the impact of electricity generation on the environment.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Be prepared to make decisions using available information.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Generate hypotheses to help answer complex problems.
- Combine information and ideas from several sources to reach a conclusion.
- Implement strategies with accuracy.
- Vary the level of detail and the language used when presenting to make it appropriate to the audience.

Unit in a nutshell

- Electricity is a form of energy that is generated using other sources.
- Thermal electricity generation is the most common form of energy generation in Africa.
- However, there are other common methods, such as hydropower.
- Nuclear energy generation is seen as the future of electricity generation in Ghana. A small amount of fuel is needed to create a large amount of energy.
- Nuclear energy generation is considered to be 'clean'. However, it is risky if the nuclear power plants are not properly planned and/or maintained.

ACTIVITY 11.5.1

Discussing and debating thermal and nuclear power generation

LB page 143

(Pairs)

CP5.4, CP5.1, CP6.7, CC8.5

Answers

1. a) The table should compare the negative effects of thermal electricity generation and nuclear electricity generation:

Thermal electricity generation	Nuclear electricity generation
Deforestation and land degradation	Potential for radioactive meltdown
Harmful emissions	Difficult to discard the waste products
Non-renewable sources	Non-renewable sources

- b) Learners' essays should be carefully thought out and substantiated with facts. Remind the learners to weigh up the risks – even if something has risks, it does not mean that it is not the correct option.
- c) Learners' posters should contain some information about why they prefer their chosen method. Display these in the classroom.
2. Set aside at least half a lesson to stage the debate. Divide the class into two groups. One group will be anti-nuclear power and the other group will be anti-thermal power generation. Allow them to respectfully put forward their opinions and reasons why.

Check...

Learners can:	Yes	No
1. Define and describe electricity generation.		
2. Explain thermal electricity generation, including its impact on the environment.		
3. Explain nuclear electricity generation, including its impact on the environment.		
4. Discuss and debate the advantages and disadvantages of thermal and nuclear electricity generation.		

Unit 11.6 Electronics

Content standard

- Demonstrate knowledge of how to assemble and explain the functions of basic electronic components and their interdependence in an electronic circuit.

Indicators

- Demonstrate how to assemble basic electronic components in an electronic circuit.
- Discuss the function of each electronic component and their interdependence.
- Discuss the function of each electronic component, such as a resistor, diode and inductor, and their interdependence for the functioning of an electronic gadget.

Core competencies

- Find and utilise digital content.
- Recognise and generalise information and experience; search for trends and patterns.
- Be open-minded, adapting and modifying ideas to achieve creative results.
- Merge simple/complex ideas to create novel situations or things.
- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Demonstrate a thorough understanding of a generalised concept and facts specific to a task or situation.
- Provide new insight into controversial tasks or situations.

Unit in a nutshell

- There are differences between electric and electronic circuits. The primary difference is that electronic circuits can perform more complex actions.
- Electronic circuits also include more components.
- The electronic components that the learners need to know include
 - resistors
 - capacitors
 - light emitting diodes (LEDs)
 - P-N junction diodes
 - inductors.

PRACTICAL ACTIVITY 3

Constructing a simple electronic circuit LB page 146

(Groups)

DL5.3, CI6.8

Materials and apparatus

It would be ideal to allow for learners to do this in pairs or small groups. However, if you do not have enough materials, do it as a demonstration.

Guidelines

- Depending on the access you have to resources, you can split the class into groups for this practical activity.
- Allow the learners to touch and feel the components. They must be given enough time to examine all the components and experiment with them.

Answers

1. Learners will first need to identify the positive and negative terminals of the P-N junction diode before they move on. This is critical for when they draw their circuit (question 5).
2. Then, learners should construct the circuit, taking care to connect everything properly. To do this, they should apply the principles that they have learned about electric circuits.
3. The LED will glow because there is an uninterrupted flow of current.
4. The flow of current will be interrupted and, therefore, the LED will not work/glow.
5. Ensure that the learners have drawn all the components in the correct order. They must draw the P-N junction diode correctly, showing the direction in which the current flows (positive to negative, depending on how they connected it).

ACTIVITY 11.6.1

Discussing the roles and significance of electronic components

LB page 147

(Pairs)

CC8.2, CP5.6, CP5.7

Answers

1.
 - a) Gives off light.
 - b) Controls the flow of current through the circuit.
 - c) Allows the current to flow in one direction.
 - d) Stores energy.
2.
 - a) It controls current flow to the LED, which prevents it from burning out.
 - b) It increases the current, causing the LED to glow brighter and brighter.
 - c) The inductor stores energy but the resistor ensures that the flow of current is even and not in short bursts.

PRACTICAL ACTIVITY 4

Explaining changes in brightness in an LED

LB page 147

(Groups)

CC8.2, CP5.6, CP5.7

Materials and apparatus

It would be ideal to allow for learners to do this in pairs or small groups. However, if you do not have enough materials, do it as a demonstration. If you do not have the material to do a demonstration, look for a video on this and show it to the learners.

Guidelines

- Depending on the access you have to resources, you can split the class into groups for this practical activity.
- Allow the learners to touch and feel the components. They must be given enough time to examine all the components and experiment with them.

Answers

1. The LED will dim.
2. The LED will glow consistently and for a longer period of time.
3. The LEDs will both glow but not as brightly as when there is one.

Check...

Learners can:	Yes	No
1. Define electronic circuits and understand how they differ from electrical circuits.		
2. List electronic circuit components.		
3. Understand how each electronic circuit component is used in an electronic circuit.		
4. Correctly arrange electronic circuit components in a circuit.		
5. Identify the positive and negative regions of a P-N junction diode.		
6. Construct a simple electronic circuit.		
7. Explain what happens when the switch in an electronic circuit is closed and when it is opened.		
8. Explain changes in brightness in an LED when different components are added to an electronic circuit.		

Topic 3: Conversion and conservation of energy

Unit 11.7 The law of conservation of energy

Content standard

- Demonstrate an understanding of the principle of conservation and conversion of energy and their application in real life situations.

Indicators

- Explain the principle underlying conservation and conversion of energy.
- Demonstrate the conversion of energy into useable forms.
- Know how energy could be conserved for future use in life.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Combine information and ideas from several sources to reach a conclusion.
- Merge simple/complex ideas to create novel situations or things.
- Recognise and generalise information and experience; search for trends and patterns.
- Be open-minded, adapting and modifying ideas to achieve creative results.
- Interpret and apply learning in new contexts.
- Reflect on work and explore the thinking behind thoughts and processes.
- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.

Unit in a nutshell

- In a closed system, the amount of energy that is transferred stays the same. This is called 'conservation of energy'.

ACTIVITY 11.7.1 Explaining the law of conservation of energy LB page 149

(Groups)
DL5.1, CP5.1

Answer

- The value of the energy stays the same when it converts from chemical energy to the other types of energy. The reason for this is because energy cannot be destroyed, it can only be transferred.

ACTIVITY 11.7.2**Describing everyday use of conservation of energy**

LB page 150

(Groups)

C15.2, C16.8, C16.6

Answers

1. **a)** chemical to mechanical (or kinetic) **b)** chemical to light **c)** electrical to light
d) chemical to mechanical **e)** light to chemical **f)** electrical to heat
2. **a)** It shows energy flowing through organisms in the form of food. The value of the energy stays the same throughout the food chain – it does not decrease or increase.
b) Humans can get energy from food because energy is conserved. We use that energy for our own activities, such as movement and doing work.

Check...

Learners can:	Yes	No
1. Explain the Law of Conservation of Energy in relation to chemical energy in a closed system.		
2. Explain how the Law of Conservation of Energy can be applied in everyday life.		
3. Show, using diagrams, how energy is converted to other forms.		
4. Describe how energy conversion can be used for the benefit of living things.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1.
 - a) Accept any correct answers, for example candle, torch, lamp.
 - b) Accept any correct answers, for example musical instrument, radio, loudspeaker.
 - c) Accept any correct answers, for example food, petrol, diesel, paraffin. (3)
2. Mechanical energy is the combination of potential energy and kinetic energy. When the bow is pulled back tightly, it has potential energy. When it is released, the arrow is released and has kinetic energy. (3)
3.
 - a) $P.E. = mgh$
 $= 2 \times 9.8 \times 2$
 $= 39.2 \text{ J}$ (3)
 - b) $K.E. = \frac{1}{2} \times 2 \times (2)^2$
 $= 1 \times 4$
 $= 4 \text{ J}$ (3)
 - c) $M.E. = 39.2 + 4$
 $= 43.2 \text{ J}$ (2)
4. Convection is a method of heat transfer in fluids. Conduction is a method of heat transfer in solid materials. (4)
5. Light travels in a straight line. The direction of light can only be changed by reflection or refraction. Light is dispersed. (4)
6.
 - a) Ensure the learners' circuit drawings have all the components, including two 1.5 V cells, an LED and a switch. They must draw the symbols correctly. (3)
 - b) The LED will glow. (1)
 - c) The LED will not glow. (1)
7. It shows the dispersal of visible light through a prism. The white light shines onto a prism and is dispersed into colours (rainbow). (4)
8. The flowchart should not be a food chain. See below:



(4)

Total: 35 marks

Topic 4: Force and motion

Module 12

Force, motion and efficiency

Unit 12.1 Newton's First Law of Motion

Content standard

- Examine the concept of motion, Newton's First Law of Motion, magnetic force in relation to motion and understand their applications to life.

Indicators

- Understand that unbalanced forces acting on an object cause it to move.
- State and explain Newton's First Law of Motion.
- Examine the applications of Newton's First Law of Motion in life.

Core competencies

- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Combine information and ideas from several sources to reach a conclusion.
- Interpret and apply learning in new contexts.
- Evaluate the quality and validity of information.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Adhere to behavioural protocols that prevail in cyberspace.
- Demonstrate knowledge and recognition of ethical uses of information.
- Merge simple/complex ideas to create novel situations or things.
- Recognise and generalise information and experience; search for trends and patterns.
- Be open-minded, adapting and modifying ideas to achieve creative results.
- Appreciate the importance of including all team members in discussions and actively encourage contributions from them.
- Evaluate the quality and validity of information.

Unit in a nutshell

- A force is an interaction that can change the motion of an object if it is not opposed and can change the speed of an object.
- Newton's First Law of Motion is important and has daily applications.
- Some examples of Newton's First Law of Motion: when given a push, a metallic ball on a smooth surface will keep on rolling until it encounters a blockade/obstacle; the use of seatbelts and airbags in a vehicle.

PRACTICAL ACTIVITY 1

Demonstrating how unbalanced forces cause motion

LB page 154

(Groups)

CC8.2, CP5.1, CI6.9, DL5.5

Guidelines

- This is a simple and practical demonstration of the concepts of inertia and motion.
- The learners must understand that inertia is the resistance of an object to movement.
- When the ludo dice are stacked on top of each other, they are in a state of inertia.
- When the ludo dice are tapped, the forces are unbalanced, which forces motion.

ACTIVITY 12.1.1

Researching to find out about Newton's First Law of Motion

LB page 155

(Pairs)

DL5.1, DL6.4, DL6.6, CC8.2, CI5.2, CI6.8, CI6.6

Guidelines

In their research, learners will discover that Newton's First Law of Motion states that an object will continue in a state of inertia (that is resistant to movement – so either in rest, or continuing in its movement in a straight line) until acted upon by an unbalanced force.

The metallic ball will continue in a straight line until it meets with an obstruction (the blockade). This will change its motion and force it to stop.

PRACTICAL ACTIVITY 2

Showing Newton's First Law of Motion

LB page 156

(Groups)

CC8.2, CC9.5, DL5.5, CP5.1, CI5.2, CI6.8, CI6.6

Materials and apparatus

Set up the demonstration as illustrated in the Learner's Book.

Guidelines

- This is another simple demonstration that illustrates difficult concepts.
- The object to watch here is the coin.
- The coin is in a state of inertia because it is resting on the index card.
- The learners may expect that the coin will move with the index card. However, the unbalanced force (in other words the flicking action) will only affect the index card. The coin will simply drop into the cup due to gravity. If you do not have the equipment for a demonstration, look for a video on the **demonstration of Newton's First Law of Motion** and show that to your learners.

ACTIVITY 12.1.2**Discussing the application and importance of Newton's First Law of Motion**

LB page 157

(Groups)

CC8.2, CC9.5, CP5.1

Answers

1. An object at rest will stay at rest, and an object in motion will stay in motion until acted upon by an outside, unbalanced external force.
2. When you are travelling in a car, your body is travelling at the same speed as the car. If the car suddenly brakes or crashes into something, it will stop but your body will continue at the same speed as before. This is very dangerous because it means that you could be flung around or out of the car if you do not have a seat belt on. The seat belt will provide an unbalanced force on your body, stopping the motion and slowing your speed to a stop when the car stops.

Check...

Learners can:	Yes	No
1. Define the concept of motion.		
2. Define inertia.		
3. Explain that unbalanced forces cause motion.		
4. State Newton's First Law of Motion.		
5. Explain Newton's First Law of Motion.		
6. Discuss how Newton's First Law of Motion is applied in reality.		

Unit 12.2 Magnets

Content standard

- Examine the concept of motion, Newton's First Law of Motion, and magnetic force in relation to motion, and understand their applications to life.

Indicator

- Demonstrate the behaviour of magnets and their use in life.

Core competencies

- Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.
- Merge simple/complex ideas to create novel situations or things.
- Combine information and ideas from several sources to reach a conclusion.

Unit in a nutshell

- In magnetic force, opposites attract and like poles repel.
- Every magnet has a south and a north pole, which face south and north respectively. This is because Earth has its own magnetic field.

PRACTICAL ACTIVITY 3

Testing for magnetism

LB page 158

(Groups)
CC8.2

Materials and apparatus

Provide learners with a variety of metal and non-metal objects to test.

Guidelines

Allow learners enough time to experiment and complete their tables.

Answers

Object	Is it magnetic or non-magnetic?
paper clip	magnetic
coin	magnetic
pen	non-magnetic
eraser	non-magnetic

PRACTICAL ACTIVITY 4**Demonstrating characteristics of magnets** LB page 159

(Groups)

CI5.2

Materials and apparatus

It would be ideal for learners to work in pairs or small groups. However, do this as a demonstration if you do not have enough magnets.

Guidelines

- Allow the learners to examine and work with the magnets.
- They will see that negative and negative and positive and positive will be repulsive, while negative and positive will be attractive.

ACTIVITY 12.2.1**Discussing the uses of magnets in everyday life**

LB page 160

(Pairs)

CP5.1

Answers

1. Learners can choose any example, either from the Learner's Book or by doing their own research. For example, the magnet found in a fridge door.
2. One magnet is placed in the fridge door, while the other one is placed on the door frame of the fridge. When the fridge is closed, the magnets are attracted to one another, which causes the door to close tightly enough to form a seal. This keeps the food and beverages in the fridge fresh.

Check...

Learners can:	Yes	No
1. Define magnets and explain how they work.		
2. List types of magnets and their uses.		
3. Explain how magnets behave in relation to each other.		
4. Discuss how magnets are used in daily life.		

Unit 12.3 Simple machines

Content standard

- Recognise some simple machines and show understanding of their efficiency in doing work.

Indicators

- Identify simple machines.
- Describe the types and functions of levers.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Speak clearly and explain ideas.
- Demonstrate a thorough understanding of a generalised concept and facts specific to tasks or situations.

Unit in a nutshell

- Simple machines make work easier.
- Simple machines include a
 - wedge – inclined plane – wheel and axle – screw – pulley – lever.
- A lever makes it possible to lift or move heavy objects that are hard to move.
 - In a first-class lever, the fulcrum is between the effort and the load.
 - In a second-class lever, the load is between the fulcrum and effort.
 - In a third-class lever, the effort is between the fulcrum and the load.

ACTIVITY 12.3.1

Classifying levers

LB page 163

(Pairs)

DL5.1, CC8.1, CP5.6, CP6.7

Answers

1. a) second class, b) third class, c) first class, d) second class, e) first class
2. a) Allows heavy loads to be moved from place to place.
b) Pierces through paper.
c) Cuts through paper/card.
d) Cuts through metal to open tin cans.
e) Pries apart two things that are nailed or stuck together.

Check...

Learners can:	Yes	No
1. Define work.		
2. Define efficiency.		
3. Look at simple machines and describe how they improve efficiency.		
4. Label the effort, fulcrum and load in diagrams that show levers.		
5. Understand the similarities and differences between the three classes of levers.		
6. Mention examples of each of the three classes of levers.		

Unit 12.4 Efficiency

Content standard

- Recognise some simple machines, and show understanding of their efficiency in doing work.

Indicator

- Know work input, and output and efficiency, as they apply to machines.

Core competencies

- Explain ideas in a clear order with relevant details, using correct construction and structure of speech.
- Find and utilise digital content.
- Combine information and ideas from several sources to reach a conclusion.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Recognise and generalise information and experience; search for trends and patterns.
- Be open-minded, adapting and modifying ideas to achieve creative results.
- Put forward constructive comments, ideas, explanations and new ways of doing things.

Unit in a nutshell

- Efficiency is the ratio of output to input. It is expressed as a percentage.
- The lower the number, the less efficient the machine.
- Friction can affect efficiency.

ACTIVITY 12.4.1

Explaining terms

LB page 164

(Pairs)

CC8.2, DL5.3

Answers

1. Work input is the energy that goes in to do the work, or the force that is applied to do the work.
2. Work output is the result of the input, or the work that was done.
3. Efficiency is the ratio of work done to the machine or on the machine as compared to the useful work actually done by the machine.

ACTIVITY 12.4.2

Calculating and discussing efficiency

LB page 165

(Pairs)

CC8.2, DL5.3, CP5.1

Answers

1. 82%
2. 82,2% (accept 82%)
3. **a)** 44,2% (accept 44%)
b) 89,6% (accept 90%)
c) In the first example, the thick carpet makes it more difficult for the box to move along the ramp. In the second example, the carpet has been removed and the ramp is now smooth, which makes it easier to move the box along.

ACTIVITY 12.4.3

Describing how to improve efficiency

LB page 165

(Groups)

DL5.1, CI6.8, CI6.6, CI5.7

Answers

1. Either apply oil to the inner bit of the doorknob so that it turns more easily, or use something that will give you more grip on the doorknob (such as a piece of leather) so that it is easier to turn the knob.
2. Either use something that will give you more grip, or heat the lid so that it expands and it is easier to turn.
3. Apply a lot of weight and force, or use a longer crowbar.
4. Ensure that the blade is sharp to reduce friction and cut more cleanly.

Check...

Learners can:	Yes	No
1. Define efficiency.		
2. Explain the concept of efficiency of a machine.		
3. Express efficiency as a percentage (the ratio of work output to work input).		
4. Describe how the efficiency of simple machines can be improved.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1.
 - a) inertia
 - b) motion
 - c) metals
 - d) attract
 - e) first class (5)
2.
 - a) An object will stay in a state of inertia until acted upon by an outside, unbalanced external force. (3)
 - b) A ball resting on grass will not move until a person kicks the ball, forcing it to move or roll. (4)
3. Accept any two correct answers: fridge magnets, magnets in doors, doorbells, magnetised tools. (2)
4. First-class lever: places the fulcrum directly in between the effort and the load.
Second class lever: places the fulcrum close to the load, away from the effort.
Third class lever: places the fulcrum close to the effort, away from the load. (6)
5.
 - a) A: Load
B: Effort
C: Fulcrum (3)
 - b) Second class lever (1)
6. Efficiency refers to the ratio of work done to the machine or on the machine, as compared to the useful work actually done by the machine. The lower the efficiency, the more effort it requires to do work and the less useful a machine will be. (4)
7. Oil was applied and so there is less friction. This improved the efficiency of the screw. (2)

Total: 30 marks

Topic 5: Agricultural tools

Module 13

Handling agricultural tools

Unit 13.1 Handling and maintaining agricultural tools

Content standard

- Demonstrate knowledge and skills in the handling and maintenance of basic and simple agricultural tools.

Indicators

- Explain the basic rules in handling and maintaining simple agricultural tools.
- Apply the basic rules for handling and maintaining basic and simple agricultural tools in the community.

Core competencies

- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Develop and exhibit the ability to defend one's cultural beliefs, practices and norms.
- Demonstrate a thorough understanding of a generalised concepts and facts specific to a task or situation.
- Merge simple/complex ideas to create novel situations or things.
- Recognise and generalise information and experiences; search for trends and patterns.
- Be open-minded, adapting and modifying ideas to achieve creative results.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Try new alternatives and different approaches.
- Interpret correctly and respond to non-verbal communication, such as facial expressions, cues and gestures.
- Identify underlying themes, implications and issues when listening.
- Develop and exhibit ability to defend one's cultural beliefs, practices and norms.
- Reflect on approaches to creative tasks and evaluate the effectiveness of the tools used.
- Select the most effective creative tools for work and give reasons for the choice.

Unit in a nutshell

- Basic agricultural tools follow the principles of simple machines. That is, they make work easier.
- Tools can be used for maintenance, for planting and harvesting, and to care for growing plants as well as livestock.
- Proper maintenance of the tools is essential for safety reasons as well as to ensure that they are kept in good condition.

ACTIVITY 13.1.1

Listing basic farm tools and their functions LB page 170

(Groups)

DL5.1, CG5.2, CP5.6

Answers

1 – 2. Basic functions for each tool:

Farm tool	Function
Rake	Used to sweep up and gather leaves and other debris or mulch; can also be used to spread or level soil
Shovel	Used to dig holes or to move soil or manure from place to place
Hoe	Used to break up tough soil or soft rocks
Hammers	Multipurpose – used around the farm for maintenance and repairs
Wheelbarrow	Used to carry heavy items or soil or manure from place to place
Hand fork and trowel	Used for small areas of soil to dig small holes and to rake the soil
Axe	Used to chop wood or thick stems
Shears	Used to cut or prune bushes, hedges and trees
Sickle	Used to cut long grasses or long grass-like crops (such as rice)
Watering can	Used to water small areas
Sheep shears	Shear or cut off the sheep's wool
Feeding trough	Provide feed and water to animals
Bucket	Carry feed or liquids around the farm
Hose pipe	Provides water for irrigation, used to give water to animals, or used for cleaning
Rope	Multipurpose – can be used to hold up trees or branches, or to lead animals to where they are needed
Secateurs	Used to cut small twigs or branches, rope, etc.

3. Learners will probably come up with answers such as the following:

- It is important for safety reasons. Someone could get hurt if they do not know how to handle the tools.
- It is important as it ensures that the tools do not get broken or damaged.
- It is important as it ensures that the tools do not damage any of the crops or hurt any of the animals on the farm.

4. The word 'maintenance' refers to the upkeep of the tools or looking after the tools so that they stay in a good condition. It is important because it refers to how tools are stored, whether they are oiled or sharpened, etc.

ACTIVITY 13.1.2

Describing maintenance and handling of tools LB page 173

(Groups)

CP5.6, CI5.2, CI6.8, CI6.6, CC8.1, CI5.5

Answers

1. Maintenance and safety:

Farm tool	Maintenance	Safety
Rake	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting 	<ul style="list-style-type: none"> Carry it upright with the sharp end pointing down Do not leave lying down – it should always be propped up against a steady surface
Shovel	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting 	<ul style="list-style-type: none"> Carry it upright with the sharp end pointing down Do not leave lying down – it should always be propped up against a steady surface
Hoe	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting 	<ul style="list-style-type: none"> Carry it upright with the sharp end pointing down Do not leave lying down – it should always be propped up against a steady surface
Hammers	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting 	<ul style="list-style-type: none"> Watch out for hands and fingers Wear thick gloves when using Always check surroundings before using
Wheelbarrow	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting Wheels can be oiled from time to time 	<ul style="list-style-type: none"> Only use on flat surfaces Never use downhill
Hand fork and trowel	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting 	<ul style="list-style-type: none"> Carry it upright with the sharp end pointing down Do not leave lying down – it should always be propped up against a steady surface
Axe	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting Blade must be kept sharp 	<ul style="list-style-type: none"> Watch out for hands and fingers Wear thick gloves when using Always check surroundings before using Only use if blade is sharp Never leave lying around
Shears	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting Blade must be kept sharp 	<ul style="list-style-type: none"> Watch out for hands and fingers Wear thick gloves when using Always check surroundings before using Only use if blade is sharp Never leave lying around
Sickle	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting Blade must be kept sharp 	<ul style="list-style-type: none"> Watch out for hands and fingers Wear thick gloves when using Always check surroundings before using Only use if blade is sharp Never leave lying around
Watering can	<ul style="list-style-type: none"> Should be emptied and dried after use 	<ul style="list-style-type: none"> Never use water that has collected in the watering can for animals, as it might contain micro-organisms

Farm tool	Maintenance	Safety
Sheep shears	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting Blades must be kept sharp 	<ul style="list-style-type: none"> Watch out for hands and fingers Wear thick gloves when using Always check surroundings before using Only use if blades are sharp Never leave lying around Should only be used by experienced sheep shearers
Feeding trough	<ul style="list-style-type: none"> Should be kept clean and free of any debris 	<ul style="list-style-type: none"> Clean often to avoid illness in animals
Bucket	<ul style="list-style-type: none"> Should be emptied and dried after use 	<ul style="list-style-type: none"> Never use water that has collected in the watering can for animals, as it might contain micro-organisms
Hose pipe	<ul style="list-style-type: none"> Keep out of the sun to avoid degrading 	<ul style="list-style-type: none"> Always put away after use to avoid people tripping over it and animals becoming entangled
Rope	<ul style="list-style-type: none"> Keep out of the sun to avoid degrading 	<ul style="list-style-type: none"> Always put away after use to avoid people tripping over it and animals becoming entangled
Secateurs	<ul style="list-style-type: none"> Should be kept clean and free of any debris Should be kept dry to avoid rusting Blades must be kept sharp 	<ul style="list-style-type: none"> Watch out for hands and fingers Wear thick gloves when using Always check surroundings before using Only use if blades are sharp Never leave lying around Should only be used by experienced sheep shearers

- Learners can choose any tool from the ones listed in the unit. Allow them to work with a partner that has chosen a different tool to them, so that learning and sharing can take place.

PRACTICAL ACTIVITY 1

Observing the use of tools in your community

LB page 173

(Individual)

CC7.2, CC7.4, CC8.3, CP5.2, DL5.1, CG5.2, CI5.3, CI6.2, CI6.3

Guidance

Farm visits:

- Assist learners with setting up visits to farms or garden centres in the community. The farms can be of any size and can be either crop or animal farms, or both.
- Prepare the learners beforehand by explaining the information that they will need to include in their report. This will help them to focus their observations while they are on the farm.
- Remind learners to be observant, polite, respectful and to stay out of the way as much as possible while still learning. They should ask questions and be interested.

The learners' reports must include the following information:

- the tools they observed during the visit
- the functions of these tools
- how the tools are assembled
- the rules that the farmer has regarding the use of tools.

Assessment

Use the rubric for reports on page 134 of this Teacher's Guide to assess the learners' reports.

Check...

Learners can:	Yes	No
1. List basic farm tools in agriculture.		
2. Discuss the uses of basic farm tools.		
3. Explain the importance of the correct handling and proper maintenance of farm tools.		
4. List basic rules for the correct handling and care of farm tools.		
5. Demonstrate and describe how to correctly handle and maintain farm tools.		

ASSESSMENT ACTIVITY

LB page 174

Learners should answer the questions in their exercise books to assess their understanding of the Topic.
Learners should aim for at least 60%.

1.
 - a) B
 - b) D
 - c) A
 - d) J
 - e) H
 - f) C
 - g) E
 - h) F
 - i) I
 - j) G(10)
2.
 - a) The caring for tools to keep them in a good condition. It applies to tools because it ensures that the tools stay in good shape and that they are efficient. (4)
 - b) Learners can write down any three safety rules, for example:
 - Ensure that blades are sharp.
 - Store tools neatly to avoid injury.
 - Wear protective gear such as gloves when using sharp tools like secateurs and an axe.
 - Never drink water that has been left in a bucket or watering can. (6)

Total: 20 marks

Activity 1: Multiple choice

1. B
2. C
3. B
4. A
5. A
6. C
7. C
8. D
9. A
10. D (10)

Activity 2: Longer questions

1. P.E. = mgh
 $= 0.5 \times 9.8 \times 15$
 $= 73.5 \text{ J}$ (3)
2. K.E. = $\frac{1}{2}mv^2$
 $= \frac{1}{2} \times 1000 \times (33)^2$
 $= 500 \times 1089$
 $= 544500 \text{ J}$ (3)
3. The diagram shows convection. It shows how heated air rises and moves away as cooler air takes its place. In this way, an entire room can be heated/warmed. (4)
4. See Figure 11.18 on page 137 of the Learner's Book. (4)
5. The law of conservation of energy states that energy cannot be created or destroyed, it can only be transferred. An example is a food chain where energy flows through different organisms, from green plants to the ultimate consumer. (5)
6. The boy is travelling at the same speed of the bicycle. When the bicycle hits the rock, the bicycle stops but the boy does not. This is known as Newton's First Law of Motion. (4)
7. a) Efficiency is the ratio between the work input and the work output. In other words, it is the difference between how much work is done to or on a machine, and how much useful work the machine actually does. (2)
 b) Friction (or any other force) can affect efficiency. (1)
8. a) Efficiency = $\frac{\text{output}}{\text{input}} \times 100$
 $= \frac{14}{46} \times 100$
 $= 30.43\%$ (accept 30%) (3)
 b) No (1)

9. a) Learners can name any four basic agricultural tools. (4)
b) Learners must state a use for each of the four tools they listed in (a). (4)
10. It is important to store tools properly to prevent their degradation, or to prevent them from breaking. It is also important for safety reasons, because some tools are very sharp and need to be stored away so they do not cause injury. (2)

Total: 50 marks

Topic 1: Waste management

Learning outcomes

Content standard	Indicators and exemplars	Core competencies
Topic 1: Waste management		
B7.5.1.1 Exhibit knowledge and skill of scientific basis for management practices of types of waste in the environment	B7.5.1.1.1 Apply information from research on good management practices of waste to make the environment clean <ol style="list-style-type: none"> 1. Research for information on good waste management practices and use it to carry out a project to make the environment clean. 2. Write a report for presentation on the outcome of the project carried out in Exemplar 1. 3. Discuss how to manage types of waste and explain the science underlying it. 	CP5.1, DL5.1, CP5.2, CC8.1
Topic 2: Human health		
B7.5.2.1 Demonstrate knowledge of common deficiency diseases of humans, their causes, symptoms, effects and prevention	B7.5.2.1.1 Explain the relationship between food nutrients and common deficiency diseases and how they affect humans <ol style="list-style-type: none"> 1. Name and analyse food nutrients such as carbohydrates, proteins, fatty acids, as well as their uses in the human body. 2. Discuss and make presentations on deficiency diseases associated with a lack of food nutrients such as carbohydrates, proteins, fatty acids, vitamins and others in the human body. 3. Name the nutrients they gain or lack in the foods they normally eat. 4. Describe symptoms, effects and prevention of common deficiency diseases such as night blindness, rickets, scurvy, kwashiorkor and others. 	CP5.5, CI5.2, CP5.6CC8.2, CP5.1
B7.5.2.2 Demonstrate knowledge of the nature of selected viral diseases of humans, their causes, symptoms, effects and management	B7.5.2.2.1 Explain the nature of viral diseases with special emphasis on the coronavirus (COVID-19), Ebola and H1N1 – their causes, symptoms, effects on humans and its prevention <ol style="list-style-type: none"> 1. Discuss the nature of viral diseases. 2. Search for information and make presentations on the coronavirus (COVID-19), Ebola and H1N1; their mode of transmission from person to person, community to community and from country to country. 3. Describe the symptoms, effects and prevention of COVID-19, Ebola and H1N1, and explain why they are declared pandemics. 4. Describe the role of individuals, community members and government in managing COVID-19 Ebola and H1N1. 5. Design and produce a poster to educate community members on the incidence and control of viral diseases such as COVID-19, Ebola and H1N1. 	CP5.1, DL5.1, CC8.1, CC8.1, CI5.2

Content standard	Indicators and exemplars	Core competencies
Topic 3: Science and industry		
B7.5.3.1 Realise how careers in science can improve human life, and do research on Ghanaian and internationally recognised scientists and science educators and model after them	<p>B7.5.3.1.1 Discover and explain how careers in science can improve human conditions and relate these careers to the work of great national and international scientists and science educators</p> <ol style="list-style-type: none"> 1. Describe various careers in science and relate them to the work of national scientists. E.g. Prof. Ibok Oduro, Prof. Francis Allotey, Prof. Ewurama Addy, and Science Educationists: Prof. Anamuah-Mensah, Prof. Theophilus Ossei-Anto, Prof. Christian Anthony-Krueger and others. 2. Describe various careers in science and relate them to the work of international scientists like Albert Einstein, Alexander Fleming, Charles Darwin, Paul Ratnei, Stephen Hawking, etc. through presentations. 3. Research and build a portfolio on the impact of science and technology and innovation in homes, schools, communities and the universe, and make a presentation. 4. Identify the science and technology careers that Ghana must focus on and give reasons. 	CP5.1, CC8.1, DL5.1
Topic 4: Climate change and green economy		
B7.5.4.1 Demonstrate understanding of sustainable energy choices and their impact on the environment	<p>B7.5.4.1.1 Search for information on ways sustainable energy choices and scientific ideas are used to protect the environment</p> <ol style="list-style-type: none"> 1. Describe how people use sustainable energy choices and scientific ideas to protect the environment. 2. Analyse greenhouse effects on the environment and show how they can be minimised. 3. Design a project to show how energy can be locally sustained through the use of scientific processes to protect the environment. 	CP5.1, CP5.4
Topic 5: Understanding the environment		
B7.5.5.1 Demonstrate understanding of different plants and animals found in different landforms and how they survive (with an emphasis on landforms found in Ghana)	<p>B7.5.5.1.1 List and describe the different types of plants and animals that live in different landforms, such as plateau plains, mountain valleys and others (with an emphasis on landforms found in Ghana)</p> <ol style="list-style-type: none"> 1. Identify different types of plants and animals found in different landforms (plateau plains, mountain valleys and others). 2. Describe the characteristics that enable different types of animals to live in different landforms (plateau plains, mountain valleys and others). 3. Describe the characteristics that enable different types of plants to survive in different landforms (plateau plains, mountain valleys and others). 4. Make an album of the different types of plants and animals that live in different landforms (plateau plains, mountain valleys and others). 	CP5.5, CP5.1, CP5.4
	<p>B7.5.5.1.2 Explain the nature of associations that exist among plants and animals in different landforms and their mechanisms for survival</p> <ol style="list-style-type: none"> 1. Describe the nature of associations such as mutualism, parasitism and commensalism among plants and animals, and explain the effects on their habitats. 2. Carry out research about the different ways that different plants and animals survive in the landforms in which they are found. 	CP5.6, CC8.5, DL5.1

Topic 1: Waste management

Unit 14.1 Types of waste

Content standard

- Exhibit knowledge and skill of scientific basis for management practices of types of waste in the environment.

Indicator

- Apply information from research on good management practices of waste to make the environment clean.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.

Unit in a nutshell

- Before learners can investigate good waste management practices, they need to understand the different types of waste that exist, particularly in an urban setting.
- Waste in urban areas can be a problem.
- Waste includes household waste and commercial waste.
- Waste such as textiles, household batteries and e-waste must be disposed of responsibly.

ACTIVITY 14.1.1**Discussing how to manage types of waste** LB page 180

(Groups)
CP5.1, DL5.1

Guidelines

- Learners need access to the library or the internet for this activity.
- They will learn about waste management practices in Unit 14.2.

Answers

1.
 - a) Solid waste should go to landfill (a designated dumping site for general waste).
 - b) Liquid waste should be discarded down the drain or sewer pipe, provided the waste is not toxic or dangerous for other people or animals.
 - c) Recyclable waste should be sorted and collected/delivered to special processing centres that are able to recycle the materials.
 - d) Green waste should be discarded at special dumpsites for this type of waste. Green waste can also be used as mulch/ground cover by local farms, or as firewood (if it is the appropriate type of vegetation).
2. Some materials can be processed for reuse. Examples include plastic, glass and polystyrene. The materials can be heated and/or melted down, and then reshaped into a different form. Other containers, such as glass bottles, can simply be cleaned and sterilised and used again for the same purpose.
3.
 - a) Learners are likely to say 'recycling'. This is because it prevents landfills from becoming too full, which uses up valuable land and can be toxic to the surrounding environment.
 - b) Learners can discuss using less non-recyclable materials and using more recyclable materials (for example, avoiding the use of plastic bags for shopping) and ensuring that they separate their waste so that recyclable materials do not end up in a landfill.

Check...

Learners can:	Yes	No
1. Discuss different types of waste.		
2. Explain how different types of waste are created and disposed of.		

Unit 14.2 Waste management practices

Content standard

- Exhibit knowledge and skill of scientific basis for management practices of types of waste in the environment.

Indicator

- Apply information from research on good management practices of waste to make the environment clean.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Analyse and make distinct judgements about viewpoints expressed in an argument.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.

Unit in a nutshell

- Different types of waste need to be disposed of and discarded in different ways.
- Household waste usually ends up at landfill sites. The rubbish is either collected by the municipality, or it is taken to the landfill site by citizens (this is known as 'tipping').
- Even landfill sites need to be properly managed. They cannot simply be allowed to pile up with rubbish. As the rubbish is tipped into the landfill, specialised machines press the rubbish down so that it forms tight layers.
- Because waste management can be an issue for congested urban areas, people must often resort to burning, tipping or dumping their rubbish. This is bad for the environment and can cause harm and pollution.

ACTIVITY 14.2.1

Discussing information about good waste management practices

LB page 181

(Class)

CP5.1, DL5.1

Guidelines

- Allow learners to discuss each of the points in their groups or as a class.
- The class/groups may come up with more points in the course of their discussion.
- Keep the class on track. For example, if the conversation steers away from good or bad waste management practices, remind learners to come back to that topic.
- Give learners some time to complete and add to their mind maps after the discussion.

ACTIVITY 14.2.2

Carrying out a project to make the environment clean

LB page 182

(Groups)

CP5.1, DL5.1, CP5.2, CC8.1

Guidelines

- Learners must be encouraged to do research for this project/activity. They can use the internet to do this. Point them to the internet box on page 182 of the Learner's Book.
- Learners must be practical in their approach and must show evidence that they have considered the needs and circumstances of their school and the school community.

Assessment

Use the rubric for reports/investigations on page 134 of this Teacher's Guide to help you assess the learners' projects.

Check...

Learners can:	Yes	No
1. Discuss different waste management techniques.		
2. Understand that different types of waste need different management techniques.		
3. Plan and conduct an activity to clean up an area of the community.		

ASSESSMENT ACTIVITY

LB page 183

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

- Learners can name any three of the following types of waste:
 - general rubbish: leftover food and scraps, general household waste
 - sewage: human and animal waste
 - recyclable waste: plastic, glass, polystyrene and paper
 - green waste: general garden waste
 - medical waste: things used in a medical setting
 - hazardous waste: toxic and hazardous substances that need to be discarded
 - construction waste: rubble and debris from construction sites
 - scrap metal: metal items that are too big to be discarded
 - textile waste: old clothes
 - e-waste: old computers and other technology devices.(6)
- It is important to recycle to avoid the overuse of landfill sites as well as to avoid the problems that landfill brings in terms of damaging the environment. (2)
- Learners can list the following:
 - Open dumping: littering and dumping waste in any open area.
 - Open burning: burning waste without filtering the emissions.(4)
 - Learners can list the following:
 - Recycling: collecting recyclable materials (separate from household waste) and recycling it.
 - Timeous rubbish collection: ensuring that waste is collected properly from areas where people live and taken to designated landfill sites.(4)
- Some urban challenges include crowding and overpopulation so that there is too much rubbish to collect. Another challenge is the cause of unsanitary conditions because people are discarding and dumping their waste in any open areas. (2)
- Poor waste management practices can result in unsanitary and potentially hazardous living conditions for people and animals. Uncollected waste can also cause pollution. (2)

Total: 20 marks

Topic 2: Human health

Module 15 Common diseases

Unit 15.1 Food nutrients and health

Content standard

- Demonstrate knowledge of common deficiency diseases in humans, their causes, symptoms, effects and prevention.

Indicator

- Explain the relationship between food nutrients and common deficiency diseases and how they affect humans.

Core competencies

- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.
- Merge simple/complex ideas to create novel situations or things.
- Demonstrate a thorough understanding of generalised concepts 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

- This unit revises the different food nutrients and what they are important for.
- Carbohydrates provide energy.
- Protein builds, repairs and maintains body tissue.
- Fat provides energy, protects organs and keeps the brain and nervous system healthy and functioning optimally.
- Vitamins help to maintain a strong immune system.
- Mineral salts help to balance water levels in the body.
- Water is essential for life and the body cannot function without it.

ACTIVITY 15.1.1

Naming and analysing food nutrients

LB page 186

(Pairs)
CP5.5

Answers

Nutrient	Function in the body
Carbohydrates	Provide energy for the body's activities
Proteins	Build, repair and maintain body tissue
Fats	Provide energy for the body's activities and protects organs and body parts; keep brain and nervous system functioning
Vitamins	Help maintain a strong immune system
Mineral salts	Help to balance water levels in the body; used as part of body structures, for example calcium in bones
Water	Helps to control body temperature; makes up most of the body

HOMEWORK ACTIVITY

Ask learners to keep a food diary for one week and to analyse it according to what they learn in this module.

Check...

Learners can:	Yes	No
1. Name and analyse food nutrients and their uses in the body.		
2. Explain the use of each food nutrient to the body.		

Unit 15.2 Deficiency diseases

Content standard

- Demonstrate knowledge of common deficiency diseases on humans, their causes, symptoms, effects and prevention.

Indicator

- Explain the relationship between food nutrients and common deficiency diseases and how they affect humans.

Core competencies

- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.
- Merge simple/complex ideas to create novel situations or things.
- Demonstrate a thorough understanding of generalised concepts 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

- A deficiency is a lack of something. A deficiency disease, therefore, is directly linked to a lack of a specific nutrient in the body.
- Night blindness is a sign that a person is deficient in Vitamin A.
- Rickets is caused by a deficiency in Vitamin D.
- Scurvy is a condition that is directly related to a deficiency in Vitamin C.
- Anaemia is a chronic condition that results from low iron levels in the blood, which is a result of a Vitamin B deficiency.
- Kwashiorkor and marasmus are 'starvation' conditions. They are caused by a lack of adequate nutrition. In the case of kwashiorkor, it is a direct result of a lack of protein in the diet. Marasmus is an overall starvation of the body due to a lack of food and nutrients.

ACTIVITY 15.2.1

Relating nutrients to deficiency diseases

LB page 191

(Individual)

CI5.2, CP5.6, CC8.2, CP5.1

Answers

1. a) C b) E c) A d) B e) D
2. The learners' reports should show that kwashiorkor and marasmus are similar in that they are both linked to poor nutrition and underfeeding/starvation. However, kwashiorkor is specifically a deficiency in protein, and can be caused by an over-reliance on carbohydrates/grains. Marasmus is a disease caused by starvation. They can also list the similar symptoms as well as the symptoms that differ. For example, kwashiorkor shows a distended belly, whereas a person suffering from marasmus will be thin and shrunken all over their body.

Assessment

Use the rubric for reports on page 134 of this Teacher's Guide to help you assess the learners' investigation into the differences and similarities between kwashiorkor and marasmus.

Check...

Learners can:	Yes	No
1. Discuss deficiency diseases associated with the lack of food nutrients.		
2. Relate the nutrients they gain or lack to the foods they normally eat.		
3. Describe the symptoms, effects and prevention of different deficiency diseases.		

Unit 15.3 Viral diseases

Content standard

- Demonstrate knowledge of the nature of selected viral diseases in humans, their causes, symptoms, effects and management.

Indicator

- Explain the nature of viral diseases with special emphasis on the coronavirus (COVID-19), Ebola and H1N1 – 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 be able to identify, locate, evaluate and effectively use it to solve a problem.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Merge simple/complex ideas to create novel situations or things.

Unit in a nutshell

- A viral disease is a highly contagious illness that is caused by a viral pathogen (virus). Because viruses replicate quickly, they tend to spread through populations at a rapid pace.
- COVID-19 is the most recent novel virus that has had a profound effect on human populations.
- Ebola is another viral disease that flares up in Africa from time to time. This deadly disease can spread quickly through communities but has never become a global pandemic like COVID-19.
- H1N1 is also known as 'bird flu' or 'avian flu'. This is a strain of influenza that had a more profound impact on people than the seasonal flu virus.

ACTIVITY 15.3.1

Discussing the nature of viral disease

LB page 193

(Groups)

CP5.1, DL5.1, CC8.1

Answers

- a) One person who is sick may cough, sneeze or talk to people that they know and speak to on a daily basis. These people may get sick.
 - b) The people that have become infected go to other places and know other people. They then infect more people. The infection is now in the community.
2. When many people are infected, they may still travel. People travel for work or leisure. They will then transmit the infection to people in other countries, who will then spread it person-to-person until it is found in communities across the world.

ACTIVITY 15.3.2**Describing the role of individuals, community members and government in managing viral diseases**

LB page 195

(Class)

CC8.1, C15.2

Answers

1.
 - a) A pandemic is an epidemic that occurs in many countries or across the entire world.
 - b) Because it affected most countries in the world.
 - c) Countries may enforce quarantine or 'lockdown' to limit the movement of people in their communities. They may also enforce travel bans to prevent people from travelling to and from the country. Other laws may be put in place, such as limiting the size of gatherings and enforcing mask wearing.
2. The learners must debate whether the responsibility lies with people (personal responsibility), communities or government. Divide the class into three groups. Allow each group to discuss their ideas before starting the debate.

Assessment

You can use the rubric for oral presentations on page 134 of this Teacher's Guide to assess the learners if you wish to. At the least, you should give them the criteria listed so that they are aware of what is expected of them when they do oral presentations and speaking, as in a debate.

Check...

Learners can:	Yes	No
1. Discuss the nature of viral diseases.		
2. Describe the mode of transmission from person to person, community to community, and country to country of various viral diseases.		
3. Describe the symptoms, effects and prevention of various viral diseases.		
4. Discuss the role of individuals, community members and government in managing viral disease outbreaks.		
5. Design and produce an educational poster to educate community members about viral disease outbreaks.		

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1.
 - a) Protects body parts and organs in the body. Keeps the immune system and nervous system functioning optimally. Provides sufficient warmth for the body.
 - b) Provides energy for the body's activities.
 - c) Helps to protect and repair body tissue. (6)
2.
 - a) kwashiorkor
 - b) scurvy
 - c) rickets (3)
3. Learners can list any three of the following:
 - dry eyes and skin
 - difficulty seeing in low light or in the dark
 - squinting and blurry vision
 - blindness
 - delayed growth
 - increase in infections. (3)
4. Slow re-feeding programme. Milk powder mixed with some water is given at first in small amounts, until food can be slowly introduced into the child's diet. Should also include improving the circumstances of the sufferer so that there is access to enough food. (2)
5. The learners' emails should mention the following:
 - Vitamin C is important for keeping the body healthy and for fighting infections.
 - Scurvy is caused by a deficiency in Vitamin C.
 - Vitamin C is found in fruits and vegetables.
 - The symptoms of scurvy include:
 - bruising on the body
 - bleeding gums
 - fatigue and general weakness
 - rash between the fingers. (7)
6. Because it has affected almost every country across the world. (2)
7. Two common symptoms include fatigue and a general increase in infections. (2)

Total: 25 marks

Topic 3: Science and industry

Module 16 The future of science in Ghana

Unit 16.1 Careers in science

Content standard

- Realise how careers in science can improve human life, do research about Ghanaian and internationally recognised scientists and science educators, and model after them.

Indicator

- Discover and explain how careers in science can improve human conditions and relate these careers to the work of great national and international scientists and science educators.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
- Ascertain why information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
- Combine information and ideas from several sources to reach a conclusion.

Unit in a nutshell

- Science has a greater impact on our lives than many people realise. Everything, from the clothes we wear to the food we eat, is impacted by scientific and technological advances.
- Ghana is home to many prominent scientists and technologists as well as science educators.
- There are many careers in science. Learners can research the various fields to find out what careers they could pursue and what they would need to embark on that career. Not every scientific career demands a multi-year degree – a career in science is attainable for almost every learner.

ACTIVITY 16.1.1

Researching the impact of science, technology and innovation

LB page 200

(Groups)

DL5.1

Answers

- Learners can list anything from their daily lives that they feel they cannot live without. Examples include soap, shampoo, food, coffee/tea, mobile phone, television, clothes, etc.
- Learners can list anything that they feel is important for their community.
- Learners must now think more broadly and consider global problems that need to be solved, such as deforestation, climate change, space travel, satellite or GPS, etc.
- Learners should choose one example from their personal life, their home or family life, their school, their community, their country and the world. They must put together a portfolio of these innovations or solutions.

5. You can either allow learners to present their portfolio to the class as a whole, or, alternatively, split the class into smaller groups and allow the presentations to take place that way. This is a good solution if you have a large class.

ACTIVITY 16.1.2

Describing various careers in science and relating them to the work of scientists

LB page 203

(Groups)
CP5.1, CC8.1

Answers

1. Learners should research the contributions of the local scientists and find out more about the problems that they helped to solve.
 - a) Professor Ibok Oduro is a professor of Postharvest Technology.
 - b) Professor Francis Allotey was a mathematical physicist.
 - c) Professor Ewurama Addy was a biochemist.
 - d) Professor Theophilus Ossei-Anto is a science educator.
 - e) Professor Christian Anthony-Krueger is a biology professor.
 - f) Professor Kwabena Frimpong-Boateng is a physician and cardiothoracic surgeon.
 - g) Professor Elsie Effah Kaufmann is a biomedical engineer.
 - h) Appostle Dr. Kwadwo Safo Kantanka is a physicist, chemist, biologist and agriculturalist.
2. Learners can find out about any other Ghanaian scientists – either still alive or deceased.
3. Learners should research the scientific career that interests them most.

Assessment

Use the rubric for reports on page 134 of this Teacher's Guide to help you assess the learners' research.

ACTIVITY 16.1.3

Identifying the importance of science and technology careers for Ghana's future

LB page 204

(Class)
CP5.1

Guidelines

- Explain the concept of 'future-proofing', which means to act now to have a positive result in the future. It means that results may not be immediately clear, but they will become clear in the future.
- Allow the learners to discuss the points outlined in the Learner's Book.
- Ensure that learners are respectful of each other's opinions and that they substantiate their claims and opinions with facts or, at least, well-thought through arguments.

Check...

Learners can:	Yes	No
1. Describe various careers in science.		
2. Understand and appreciate the impact of science and technology, and innovation on daily life.		
3. Identify careers in science and technology that Ghana should focus on, with reasons.		

Topic 4: Climate change and green economy

Unit 16.2 Sustainability in Ghana

Content standard

- Demonstrate understanding of sustainable energy choices and their impact on the environment.

Indicator

- Search for information on ways in which sustainable energy choices and scientific ideas are used to protect the environment.

Core competencies

- Combine information and ideas from several sources to reach a conclusion.
- Generate hypotheses to help answer complex problems.

Unit in a nutshell

- This unit wraps up a lot of the content that has already been covered earlier in the year, such as energy production and waste management.
- The content here consolidates this prior knowledge. Remind learners of what they know so that they feel empowered.
- Sustainability is an important concept when it comes to science and technology, because scientists are constantly attempting to find sustainable ways of producing energy and living our daily lives.
- While individuals can do plenty to live sustainably, these are things that need to be done on a governmental and policy level to see real changes.
- The Earth is currently in the midst of what is now known as a 'climate emergency'. This is partly due to the unsustainable use of resources and the use of greenhouse gases, which contribute to the enhanced greenhouse effect.
- It is important to acknowledge that the Earth maintains a constant and life-sustaining temperature through a natural greenhouse effect process. However, greenhouse gases and human activities have led to an enhanced greenhouse effect, which is having a profound impact on our world.

ACTIVITY 16.2.1

Describing how people use sustainable energy to protect the environment

LB page 206

(Pairs)
CP5.1

Answers

Sustainable energy source	Description	How it is used in Ghana	Why it is good for the environment
Biomass	Plant or animal material that is used as fuel to produce electricity	Biomass is considered the most important renewable energy source in Ghana	It is sustainable and renewable
Solar energy	Sunlight that is harnessed with special equipment to generate electricity	Solar energy is often used instead of relying on the main electricity grid	It is sustainable and renewable. It does not damage the environment
Wind energy	Wind power that is harnessed using special turbines, in order to generate electricity	Several wind farms are being built around Ghana to produce and supply energy	It is sustainable and renewable. It does not damage the environment
Hydropower	Wave or falling water, which is directed onto huge turbines that turn and are used to generate electricity	Ghana has the potential for wind power because of its long coastline and suitable dams	It is sustainable, especially because Ghana has access to plenty of water
Municipal waste	The burning of general household waste, in order to create enough heat to turn turbines that generate electricity	Considered an option to deal with Ghana's waste problem, as well as Ghana's reliance on fossil fuels	It solves the problem of what to do with municipal waste and uses it rather than leaves it in landfill sites

ACTIVITY 16.2.2

Analysing how the greenhouse effect impacts the environment

LB page 208

(Groups)
CP5.1, CP5.4

Answers

- 1 – 2. Learners may need to do some research and read about the greenhouse effect and how it is impacting on climate change around the world. The greenhouse effect raises the global temperatures, even by a small amount. This has an impact on ocean temperatures which can impact on delicate ecosystems, as well as lead to the melting of permafrost and the ice caps in the arctic and Antarctic regions. If the ice caps melt, sea levels could rise, which will change coastlines around the world. Climate change also leads to other extreme weather events, such as natural bushfires, tornadoes, hurricanes, drought and flooding. All of these impact on animal and plant life.
3. Learners can suggest various options for humans to slow down their negative impact on the environment. For example:
 - using renewable energy sources
 - reducing waste.

Check...

Learners can:	Yes	No
1. Define sustainability and explain its importance.		
2. Describe how people use sustainable energy to protect the environment.		
3. Explain the greenhouse effect and the enhanced greenhouse effect.		
4. Understand that the enhanced greenhouse effect has impacts on the environment.		

ASSESSMENT ACTIVITY

LB page 209

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

- Learners could suggest
 - improving education in general and, specifically, science education.
 - improving teacher training.
 - increasing government funding in science education and scientific education programmes.
 - promoting science education at university level.
 - increasing funding into scientific research and development programmes. (4)
- Allow learners to give their own opinion. Encourage them to provide a well-thought through reason for their answer. (3)
- B (1)
- D (1)
- The Sun's rays enter the Earth's atmosphere and warm the Earth. Some of these rays are reflected off the atmosphere back to space. The rays that do enter the atmosphere are immediately reflected off the Earth's surface. Some of these rays become trapped inside the atmosphere by the gases present there, and this keeps the Earth at a warm enough temperature to sustain life. (Note: You can also accept a diagram if you think that your learners will benefit more from presenting the information in diagrammatic form.) (4)
- Sustainable energy sources will provide a more consistent energy supply to the country, as well as ensure that we have energy for many years to come. (2)
- Chlorofluorocarbons
 - Food and Drugs Authority
 - Cocoa Research Institute of Ghana
 - Ghana Standard Authority
 - Carbon dioxide (5)

Total: 20 marks

Topic 5: Understanding the environment

Module 17

Associations in the environment

Unit 17.1 Plants and animals that live in different landforms

Content standard

- Demonstrate understanding of different plants and animals found in different landforms and how they survive (with an emphasis on landforms found in Ghana).

Indicator

- List and describe the different types of plants and animals that live in different landforms, such as plateau plains, mountain valleys and others (with an emphasis on landforms found in Ghana).

Core competencies

- Effectively evaluate the success of solutions used in an attempt to solve a complex problem.
- Combine information and ideas from several sources to reach a conclusion.
- Generate hypotheses to help answer complex problems.

Unit in a nutshell

- Different animals and plants survive in different landforms.
- Animals that live in and on plateau plains will differ from animals that live in arboreal environments. The same goes for plants.
- The landform is the abiotic factor in an ecosystem. It affects the climate, topography and rock features, for example. Thus, it is an important factor for the living organisms that make it their home.

ACTIVITY 17.1.1

Identifying different types of plants and animals in different landforms

LB page 212

(Pairs)

CP5.5, CP5.1, CP5.6

Guidelines

- Learners have a strong foundation for this module from what they learned in Module 9. Encourage them to refer to that module to support their own learning.
- Learners can use the internet or the library to do research for this project.
- Learners must choose one type of landform from the list. They should then collect photos or pictures of plants and animals that live in and around that landform.
- They should present an album of these plants and animals, with notes that describe why they are suited to that environment.
- For example, a monkey is suited to a mountain valley because there are plenty of trees. Monkeys prefer to sleep and rest in trees, and their bodies are adapted to this.

Assessment

Use the rubric for reports on page 134 of this Teacher's Guide to help you assess the research and reports for this activity.

Check...

Learners can:	Yes	No
1. Identify different landforms in Ghana and elsewhere.		
2. Identify different types of plants and animals found in different landforms.		
3. Describe the characteristics that enable different types of animals to live in different landforms.		
4. Describe the characteristics that enable different types of plants to survive in different landforms.		
5. Make an album of different types of plants and animals that live in different landforms.		

Unit 17.2 Associations in the environment

Content standard

- Demonstrate understanding of different plants and animals found in different landforms and how they survive (with an emphasis on landforms found in Ghana).

Indicator

- Explain the nature of associations that exist among plants and animals in different landforms and their mechanisms for survival.

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.
- Ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.

Unit in a nutshell

- Learners learned about associations in the environment earlier in the year.
- Mutualism, parasitism and commensalism are three types of interactions and associations that animals can have in an environment.
- Mutualism benefits both organisms.
- Parasitism negatively affects one organism but benefits the other.
- Commensalism benefits one organism but does no harm, or does not impact, the other.

ACTIVITY 17.2.1

Describing associations among plants and animals

LB page 214

(Pairs)

CP5.1, CP5.4. CP5.6

Guidelines

- Learners should update their albums with descriptions of the various associations between plants and animals in their chosen landforms.
- Learners should do interactions between
 - plants and plants.
 - plants and animals.
 - animals and animals.
- If appropriate, learners can also do the interactions between humans and plants and/or humans and animals.

Assessment

Use the rubric for reports on page 134 of this Teacher's Guide to help you assess the research and reports for this activity.

Check...

Learners can:	Yes	No
1. Understand and describe mutualism among plants and animals.		
2. Understand and describe parasitism among plants and animals.		
3. Understand and describe commensalism among plants and animals.		
4. Discuss examples of associations that exist among plants and animals in particular habitats.		
5. Explain the effects of associations on habitats.		
6. Describe the different ways that different plants and animals survive in the landforms in which they are found.		

ASSESSMENT ACTIVITY

LB page 215

Learners should answer the questions in their exercise books to assess their understanding of the Topic. Learners should aim for at least 60%.

1. They are grazers and browsers, so their food source is abundant on a grassland or plain. Their bodies are suited for walking long distances on level ground. (4)
2. This is because trees will be more abundant in a mountain valley than on a plateau. Monkeys enjoy a high vantage point when they sleep or rest. (3)
3. Mountain valleys are generally quite wet and humid. This means that the vegetation is likely to be lush and include more trees and tall shrubs and bushes. (3)
4.
 - a) Commensalism is when one organism benefits from the interaction but the other one is not negatively affected.
 - b) Mutualism is when neither organism benefits nor suffers negatively from the interaction.
 - c) Parasitism is when one organism benefits from the interaction at the expense of the other, which is negatively affected. (6)
5. The remora fish and the shark. The remora fish benefits by being taken along with the shark. This does not benefit or negatively affect the shark in any way. Another example is the cattle egret and buffalo. The cattle egret benefits by eating the insects that the buffalo stirs up as it walks. This does not affect the buffalo in any way. (4)

Total: 20 marks

Activity 1: Multiple choice

1. D
 2. A
 3. C
 4. B
 5. A
 6. D
 7. D
 8. C
 9. A
 10. C
- (10)

Activity 2: Longer questions

1.
 - a) General household rubbish, industrial waste and construction waste. (3)
 - b) Waste can pollute the environment as well as create unsanitary living conditions for people. (3)
2.
 - a) Water helps to control body temperature and makes up the greater part of body fluids, such as blood.
 - b) Vitamins help to maintain a strong immune system and keep the body's organs working optimally.
 - c) Fat provides energy, acts as protection for body parts and organs, and keeps the nervous system healthy and functioning. (6)
3. Scurvy is caused by a deficiency in vitamin C. Symptoms include bruising, bleeding gums, fatigue and a rash in between the fingers. It can be easily treated by improving the person's diet. Anaemia is caused by a deficiency in iron (vitamin B), which is often a chronic condition. Symptoms include fatigue, dizziness, shortness of breath, brittle nails and frequent headaches. Treatment includes taking supplements as well as improving the person's diet. (5)
4. A virus is transmitted to another person when one person sneezes, coughs or talks and droplets travel towards the other person. That person then infects other people who, in turn, infect others, and so on. Eventually, due to globalisation and the ease of international travel, people take the virus with them to other countries, thus sparking a pandemic. (2)
5. Learners can list and describe any three of the following:
 - vaccines and other medicines/drugs
 - cars and other vehicles
 - telephonic and audiovisual technology
 - environmentally friendly farming methods
 - hygienic practices (particularly in medical contexts)
 - banned usage of CFCs.

(6)

Total: 35 marks

General/generic assessment tools

- These rubrics can be used for formal or informal assessment. They serve only as a guideline; feel free to adapt them for your purpose.
- For formal assessment, write the relevant rubric up on the board beforehand so that learners know how they will be assessed.
- For informal assessment, you may prefer to remove mark allocations and use them as checklists. Learners can use the rubrics themselves for self-assessment or peer assessment.

Rubric for drawings

The drawing	Marks
1. is accurate	4
2. has correct labels for features or parts	4
3. is drawn with single, unbroken lines	4
3. is large and clear	3
4. includes a scale bar or scale factor	2
6. has straight label lines	1
7. has a heading/title	1
8. is not shaded or coloured in	1
Total	20

Rubric for graphs

Criteria for graph	
1. Data points are correctly plotted, in other words <ul style="list-style-type: none"> • graph covers the full range of data from minimum value to maximum value • scale is correct • values are correct. 	10
2. Graph is easy to 'read', in other words it includes, where necessary, <ul style="list-style-type: none"> • a title • a key to decode lines or bars of a different colour or pattern • a labelled horizontal x-axis • a labelled vertical y-axis • tick intervals/sub-divisions along the axes. 	10
Total	20

Note: If choice of graph (e.g. line graph versus bar graph) is inappropriate, subtract 7 marks.

Rubric for posters

Criteria for poster	Marks
1. Concise with relevant and interesting information/fact-packed/conveys message well	5
2. Well-structured with effective use of headings	5
3. Written in learner's own words	5
4. Presented in an eye-catching/attractive/creative/lively/ way	5
Total	20

Rubric for reports (for a practical activity or investigation)

The report	Marks
1. clearly states aim or purpose	3
2. briefly describes method (and materials, where necessary)	3
3. details results (or observations)	6
4. follows a logical order or sequence, e.g. aim, method, observation/results, conclusion	3
5. Learner has engaged fully with the task and demonstrates a clear understanding, in other words they know what is important and relevant, they have applied their mind, and they have arrived at the correct conclusion(s)	5
Total	20

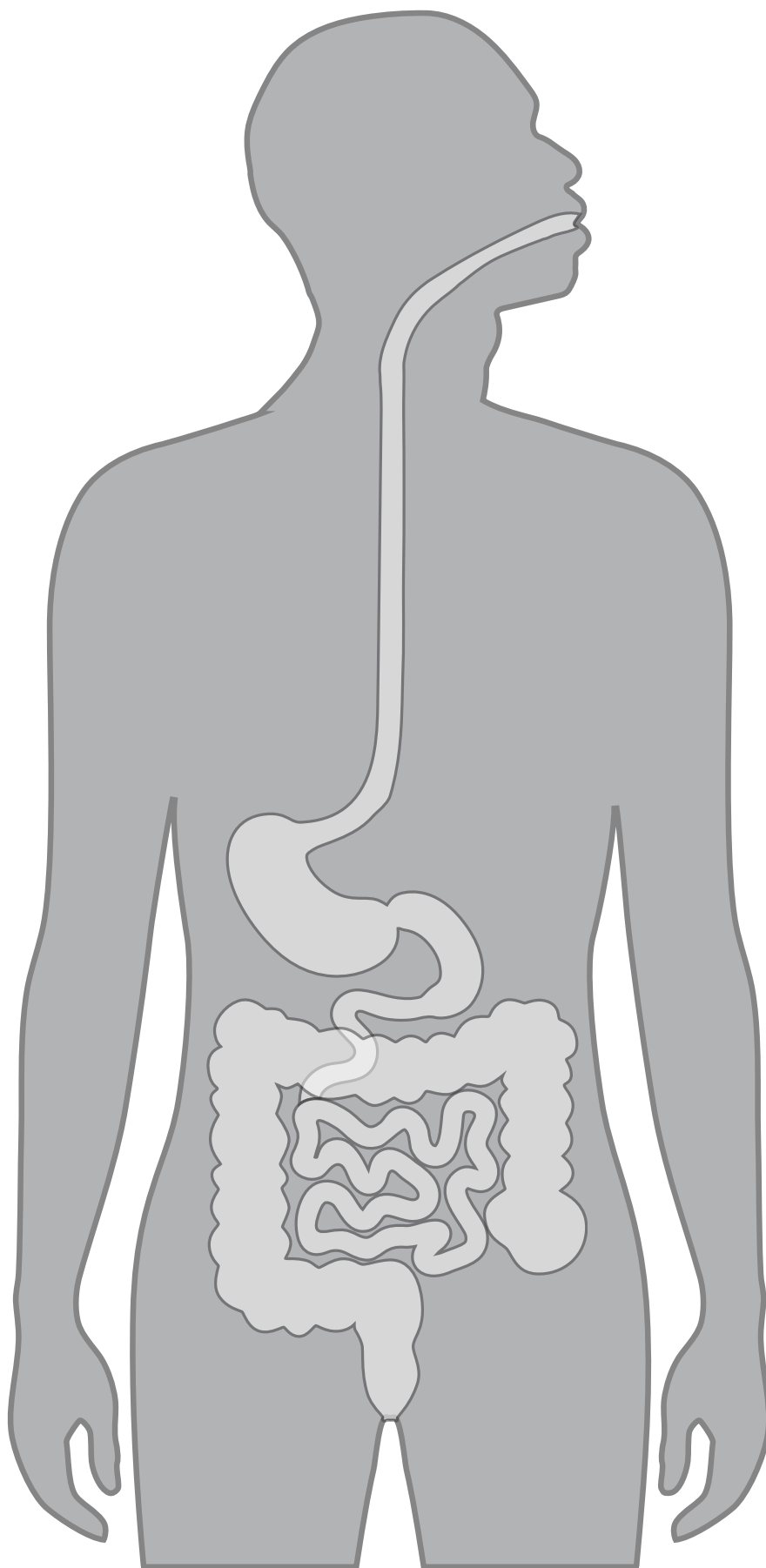
Rubric for models

The model	Marks
1. is a reasonable or accurate representation	4
2. includes all the key parts or key mechanisms	4
3. has labelled parts/legends or keys/explanations	4
4. is well-constructed/put together	4
5. is inventive/original	4
Total	20

Rubric for oral presentation

Criteria for oral presentation	Marks
1. The presentation is built upon appropriate/relevant content.	5
2. The presentation is well structured. In other words, it has an introduction and a conclusion and is easy to follow.	5
3. The presentation follows an interesting/creative/thoughtful/engaging approach.	5
4. The presentation is fluent/confident delivery.	5
Total	20

Template for human digestive system activity



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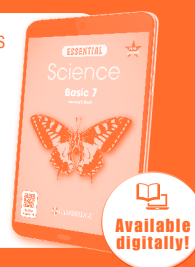
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