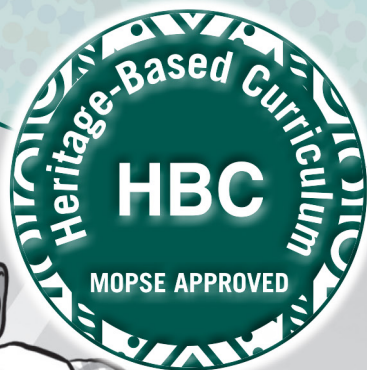


PlusOne

Science and Technology



Grade
6

James Chitamba

Teacher's Guide

PlusOne

Science and Technology

Teacher's Guide



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Introduction

This **PlusOne Science and Technology Grade 6 Teacher's Guide** provides basic and practical ways to teach key components required by the Science and Technology competency-based curriculum for primary schools. It closely follows the curriculum requirements and outcomes, tying to the topics and units.

This book offers valuable guidelines on how to use the PlusOne Science and Technology Grade 6 learner's book which has the following topics:

- 1** Health and hygiene practises
- 2** Food and nutrition
- 3** Crops, plants and animals
- 4** Environmental awareness and conservation
- 5** Tools, equipment and implements
- 6** Energy and fuels
- 7** Disaster risk management and resilience
- 8** Educational technology and innovations

In this Teacher's Guide for Grade 6, you can expect to find teaching skills that focus on high levels of engagement for learners through active learning styles. Many of these pedagogical approaches require the teacher to act as a facilitator who skillfully guides the learning process by employing targeted questions at appropriate times to encourage learners to think deeply on the more difficult or complex concepts and content.

Methodology and time allocation

Some of the inclusive learner-centred and multisensory methods and approaches that can be used to learn Science and Technology at junior level are suggested below. The principles of individualisation, concreteness, unification and stimulation should enhance implementation of these methods.

- a** Demonstrations
- b** Experimentation
- c** Science and technical exhibitions
- d** Simulations
- e** Resource persons
- f** Case-study
- g** Project work/research
- h** Games (quiz, research, debate, nature-based learning, field trip excursion)
- i** Gallery walk
- j** Debates

Five 30 minute periods per week, of 2 double lessons and 1 single lesson, should be allocated for adequate coverage of concepts. If possible, there should be internal arrangements for more time

for activities outside the classroom such as excursions and other educational visits. This will make learners have enough time for practical lessons.

Subject-specific aims

The Heritage-Based Junior Science and Technology Syllabus aims to:

- develop an understanding of basic scientific and indigenous knowledge concepts
- instil the use of traditional technologies to solve day-to-day problems
- develop problem-solving skills through hands-on experiences
- analyse scientific information
- cultivate curiosity and exploration
- appreciate innovative solutions
- develop environmental awareness and protection responsibility

Pedagogical approaches

These include the approaches, methods, strategies, appropriate relevant teaching, and learning resources for ensuring that every learner benefits from the teaching and learning process. The teacher should:

- create learning-centred classrooms using creative approaches.
- position inclusion and equity at the centre of quality teaching and learning.
- use differentiation and scaffolding as teaching and learning strategies.
- use Information Communications Technology (ICT) as a pedagogical tool.
- identify subject specific instructional expectations to make the subject relevant.
- integrate all assessment strategies.
- use questioning techniques that promote deep learning.

This Teacher's Guide provides teaching methodology for each lesson and concept to ensure that the correct pedagogical approach is used. However, this may need to change based on the skills levels of your class in any year, so use your own experience and discretion to adapt these methodologies accordingly.

Teaching tips

a Scheme of work

Never go into a class unprepared even if you have taught a lesson many times before. Have your ideas, plans and materials ready. You should make sure you are confident with your material. Classes are easier to manage, and behaviour is better when a lesson is tightly organised.

You might want to develop a regular pattern such as:

- A brief period of revision. What did we do last time?
- The introduction of new material given in the form of a class lesson.
- Activities, undertaken in pairs, groups or singly.
- Whole class discussion of what everyone has done.

When learners are used to being occupied for the whole time, they tend to be more co-operative and to value the lesson more.

Here are some points to remember when developing a scheme of work:

- Know your syllabus.
- Make a preliminary plan based on the time you think you will need to cover each unit.
- Be prepared to change that plan as you learn how much time each theme really takes. Consider school events which take up time such as sport, important national events, examinations and any other special occasions.
- Leave some spare time in your planning. Very few timetables work out perfectly.

Remember all the time that facts are only part of education. Keep in your mind the skills you wish to develop, particularly those of easy communication, co-operation and the development of mutual tolerance and respect. Make sure you have all the materials ready at hand for each lesson. If classes are sharing resources, make sure the ones you want are available when you want them. Before you start on any topic, check on your aims and work out how you can find out if you have achieved them. This is called evaluation.

When preparing materials and activities, consider the different abilities of your learners. Try to organise additional activities for the quicker learners to give you time to help those who are finding the lesson difficult.

b Learning-centred pedagogy

A learning-centred classroom creates the opportunity for learners to engage in meaningful hands-on activities that relate what they are learning to the real world. It is a place for learners to discuss ideas, become actively engaged in looking for answers, working in groups to solve problems. They also research analyse and evaluate information. The aim of the learning-centred classroom is to enable learners to take ownership of their learning.

Inclusion

Inclusion is ensuring access and learning for all learners especially those disadvantaged. Each lesson in this PlusOne Science and Technology Grade 7 Teacher's Guide contains advice on how to teach that concept to large classes, and to learners with special needs.

Differentiation and scaffolding

Differentiation is a process by which differences (learning styles, interest and readiness to learn) between learners are accommodated so that all learners in a group have the best possible chance of learning. Differentiation could be by content, tasks, questions, outcome, groupings and support.

c Marking work

When you have a large class the marking of learners' work can become a burden. If it is postponed the burden can become unbearable. Learners need to have their work marked and returned promptly with constructive criticism and as much encouragement as you can give them.

- Some marking of work can be done by learners themselves, swapping papers so that there is a check.
- You can mark work in class while you are going round supervising and encouraging the learners as they work. This has the advantage of offering instant praise and correction.
- Do not let your marking pile up from one day or one week to another.
- It is important to create an atmosphere of trust in which learners feel confident enough to ask you questions without feeling embarrassed.
- Learners should never be allowed to make fun of a learner who asks a question to which other learners already know the answer. Make it clear that such a response is not acceptable.

Use of Information and Communication Technologies (ICTs)

Teachers are encouraged to use ICT as a teaching and learning tool to enhance deep and independent learning. If your school has internet access, these functions can be done online. Alternatively, download the clips or games to use offline in the classroom. The internet can provide as much additional material as you will ever need.

Once your learners have the chance to use a computer, they too will have access to a world of information. This can be done through effective use of the following ICT tools:

- Laptop or desktop computers
- Smartphones
- Tablets
- CD players
- Projectors
- Calculators
- Radios
- Cameras
- Television sets
- Computer and related software, such as Microsoft Office packages (Word, PowerPoint, and Excel).

ICTs are a useful communication technology that can, by and large, be used to enhance the quality of teaching and learning in schools.

Diagnostic assessment

a Assessment as learning

Assessment as learning relates to engaging learners to reflect on the expectations of their learning. Information that learners provide the teacher forms the basis for refining teaching-learning strategies.

Learners are assisted to play their roles and to take responsibility of their own learning to improve performance. Learners are assisted to set their own goals and monitor their progress.

b Assessment for learning

It is an approach used to monitor learner's progress and achievement. This occurs throughout the learning process. The teacher employs assessment for learning to seek and interpret evidence which serves as timely feedback to refine their teaching strategies and improve learners' performance.

Learners become actively involved in the learning process and gain confidence in what they are expected to learn.

c Assessment of learning

This is summative assessment. It describes the level learners have attained in the learning, what they know and can do over a period of time. The emphasis is to evaluate the learner's cumulative progress and achievement.

Reinforcement and revision

Sometimes you will need to revise parts of the topic with the whole class. You will certainly need to start the next lesson by asking learners what they remember of the last one. Children need reinforcement. A few revision notes on the board to cover earlier work will be a very valuable start to every lesson.

The learner's book

Within each topic and unit of the learner's book, there are different types of text, illustrations and activities. These are designed to be used in a variety of ways to make lessons interesting, to increase learners' knowledge and motivation and to encourage them to be inquisitive, skilled, confident and mutually supportive.

Using resources effectively

In order to help learners gain the most draw on as many resources as possible. This section contains some suggestions on how best to use the resources in the learner's book and how to make use of other resources that may be available. The factual material in the Learner's Book is useful but it should be used alongside other information that the learners find out for themselves. It is important that learners learn techniques for finding out additional information.

Low-resource schools

Some schools do not have electronic devices. Teachers in such situations should prepare in an entirely different way from the better-equipped schools especially in urban areas. However, there are numerous parts that do not require learners to be working on a computer. Teachers might be able to use the following ideas:

- Prepare flashcards with key words by placing a picture on one card and its definition on another card. Hand one card to each learner randomly and ask learners to find their match.
- Ask learners to explain or describe in their own words their understanding of their key word.
- Create or provide classroom posters for your display boards. Use these for reference during explanations.
- Create ‘find the matching words’ activities by using the key words lists.
- Create ‘fill in the missing words’ worksheets.
- Draw information-rich sketches on a writing board, developing a discussion or explanation as the drawing is being developed and using the learner’s book as a point of reference.
- Ask learners to do the activities in the learner’s book or the teacher’s guide that do not require the use of a computer.
- Arrange learners in groups to work through questions in the learner’s book or teacher’s guide.

Using the local environment

The study of Science and Technology is about the whole of your learners’ social and cultural surroundings. The resources lie around the learner’s life. For example, some learners have easy access to cellphones, tablets, computers at both home and school. Let them utilise these resources as they learn in class. Take the learners out into their environment so that they can appreciate how digital the world has gone. That way, learners will enjoy the subject more.

Bring software technicians and network technicians into the school to talk about their roles in the community; make the most of local examples. These resource people and other valuable material to be used as teaching aids are called *realia*.

Topic 1

Health and hygiene

Unit 1: Human reproductive system

Unit objectives

By the end of this unit, learners should be able to:

- identify human reproductive parts.
- draw reproductive parts.
- explain the gestation period in humans.
- describe the process of puberty and physical changes.
- identify hygiene practices at puberty stage.
- discuss the importance of personal hygiene.

Teaching notes

- **Acne:** A condition in which red pimples appear on the skin, especially on the face.
- **Body odour:** A strong body smell.
- **Gestation period:** Time taken to develop a baby in the womb until birth.
- **Personal hygiene:** The practices that help us keep our bodies clean and healthy.
- **Puberty:** The time in which a child develops into an adult.
- The human reproductive system is a body system whose function is to produce human offspring.
- **Female reproductive system parts:** Ovaries, fallopian tube, cervix, vagina.
- **Male reproductive system parts:** Testis, scrotum, epididymis, penis, prostate glands.
- **Gestation in humans (pregnancy):** The period of time a human physically develops inside the mother's body until birth. It normally lasts 9 months (around 37-40 weeks).
- **Puberty:** The time when children develop into adults, enabling them to reproduce.

Physical changes at puberty

- **Boys:** Voice deepens, shoulders widen, muscles strengthen, chest grows larger, height increases, skin becomes oily (face), develop pimples, hair growth (pubic area, chest, face, armpits), experience wet dreams, sweat and body odour increase, develop interest in girls, penis and testicles become larger.

- **Girls:** Development of breasts, body shape changes, hips widen, height increases, skin becomes oily, develop pimples, hair growth (pubic area, armpits), menstruation begins, sweat production increases, develop interest in boys, extreme changes in moods.
- **Key hygiene practices at puberty stage:**
 - * Showering or bathing daily (use soap, shampoo, body wash).
 - * Hand hygiene (wash regularly, especially after toilet, before eating).
 - * Genital hygiene (clean daily).
 - * Menstrual hygiene (for girls: use/change sanitary pads/tampons regularly, wash hands).
 - * Foot hygiene (wash daily, trim toenails).
 - * Hair hygiene (wash regularly, clean/replace hair ties).
 - * Oral hygiene (brush teeth twice a day, floss once a day).
 - * Clothing hygiene (wear clean clothes, change daily, wash regularly).
 - * Practice good hygiene during sports (shower after).
 - * Avoid sharing personal items (towels, hair accessories).
 - * Use deodorant or antiperspirant to manage body odour.
- **Importance of personal hygiene:**
 - * **Prevents illnesses:** Removes germs and bacteria.
 - * **Boosts confidence:** Helps feel clean, fresh and confident.
 - * **Respects others:** Avoids spreading unpleasant odours or germs.

Activities guidelines

- **Activity 1.1:** Making reusable pads: With teacher assistance, guide groups of 5 learners to gather materials and make reusable sanitary pads. Encourage them to research online for videos and material suggestions before starting. Discuss the importance of this initiative.
- **Activity 1.2:** Draw and label reproductive parts: Provide learners with blank diagrams or guide them to draw their own simple diagrams of the male and female reproductive systems. Have them label the key parts identified in the unit. Facilitate a discussion to check understanding.

Suggested answers

Exercise 1.1

- 1 These include:
 - (i) Development of breasts.
 - (ii) The body shape changes, hips widen and height increases
 - (iii) The skin becomes oily
 - (iv) Pimples develop
- 2 Boys grow a hoarse voice at puberty.
- 3 The human gestation period is normally 9 months (or around 40 weeks).

Unit revision

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | C | 4 | D |
| 2 | A | 5 | A |
| 3 | D | 6 | B |

Structured questions

- 1 Body odour is a strong, unpleasant smell that can come from the body, especially when sweat mixes with bacteria on the skin.
- 2 An example of a birth complication caused by giving birth early (early pregnancy) is **premature birth**, where the baby is born before it is fully developed.
- 3 Pregnancy should be avoided in young people because it can lead to various disadvantages such as:
 - * **Health risks:** Young mothers and their babies are at higher risk of health complications like premature birth, low birth weight and nutritional deficiencies.
 - * **Educational disruption:** Early pregnancy often disrupts the young parent's education, leading to school dropouts and limiting future opportunities.
 - * **Emotional and social challenges:** Young parents may face significant emotional stress, social stigma and financial difficulties, as they may not be emotionally or financially ready for parenthood.
- 4 During puberty in boys, the **shoulders** widen.
- 5 Brushing teeth.

Unit 2: Foodborne diseases

Unit objectives

By the end of this unit, learners should be able to:

- define foodborne diseases.
- state the signs and symptoms of foodborne diseases.
- discuss prevention and control of foodborne diseases.

Teaching notes

- **Bacteria:** Microorganisms that can cause foodborne diseases.
- **Contamination:** The presence of harmful substances in food or drinks.
- **Control:** Measures taken to control the spread of foodborne diseases.
- **Fever:** A high body temperature.
- **Foodborne diseases:** Illnesses caused by eating contaminated food or drinks.

- **Parasites:** Microorganisms that can cause foodborne diseases.
- **Prevention:** Measures taken to prevent foodborne diseases.
- **Stomach cramps:** Pain or discomfort in your stomach area.
- **Viruses:** Microorganisms that can cause foodborne diseases.
- Foodborne diseases are illnesses caused by consuming food contaminated with harmful microorganisms (bacteria, viruses, parasites) or toxic substances.
- **Examples of foodborne diseases:** Salmonella, Botulism, E. coli infection.
- **Salmonella infection:** Caused by bacteria, from raw/undercooked meat, eggs, dairy.
 - * **Symptoms:** Diarrhoea, fever, stomach cramps, vomiting.
 - * **Prevention:** Wash hands, cook food thoroughly, avoid cross-contamination.
- Botulism: Caused by toxins from bacteria in improperly canned/preserved foods.
 - * **Symptoms:** Weak muscles, blurred vision, difficulty breathing, dry mouth.
 - * **Prevention:** Follow safe canning procedures, check canned goods, refrigerate/freeze perishable foods promptly.
- E. coli Infection: Caused by bacteria, often from raw/undercooked ground beef, unpasteurised milk, contaminated vegetables.
 - * **Symptoms:** Severe stomach cramps, bloody diarrhoea, vomiting, fever.
 - * **Prevention:** Handle raw ground beef safely, cook thoroughly, avoid unpasteurised products, wash food thoroughly.
- General ways to prevent and control foodborne diseases:
 - * Wash your hands with soap and clean water before handling food.
 - * Keep food clean and covered.
 - * Cook food properly to kill harmful substances.
 - * Store food safely in clean, covered containers.
 - * Avoid raw or undercooked food (especially meat, poultry, eggs).
 - * Drink safe water (boil if unsure).

Activities guidelines

- **Activity 2.1:** Write a short story: Guide learners to write a short story about a person who got sick from eating contaminated food. Encourage them to include symptoms and how the contamination might have happened.
- **Activity 2.2:** Create a poster: In groups, have learners create a poster about the prevention and control of foodborne diseases. Encourage clear visuals and concise messages. Display the posters in the classroom.
- **Handwashing demonstration:** Conduct a practical demonstration of proper handwashing techniques using soap and water.
- **Food safety scenarios:** Present various food handling scenarios (e.g., leaving food out, cross-contamination) and ask learners to identify the risks and suggest safe practices.
- **Discussion on food labels:** Discuss the importance of checking food labels for expiration dates and storage instructions.

Suggested answers

Exercise 2.1

- 1 Foodborne diseases are illnesses caused by consuming food or drinks that are contaminated with harmful microorganisms (like bacteria, viruses, or parasites) or toxic substances.
- 2 The signs and symptoms of foodborne diseases can vary, but common symptoms include diarrhoea, vomiting, stomach cramps and fever.
- 3 You can prevent and control foodborne diseases by:
 - (i) Washing your hands with soap and clean water before handling food.
 - (ii) Keeping food clean and covered.
 - (iii) Cooking food properly to kill harmful bacteria.
 - (iv) Storing food safely in clean, covered containers.
 - (v) Avoiding raw or undercooked food.
 - (vi) Drinking safe water. (Any three)
- 4 The importance of washing your hands before handling food is to remove germs and bacteria that could be on your hands, preventing them from contaminating the food and causing illness.
- 5 If you suspect that you have eaten contaminated food, you should:
 - (i) Seek medical attention immediately.
 - (ii) Drink plenty of safe water to stay hydrated.
 - (iii) Avoid eating more of the suspected food.
 - (iv) Inform an adult or guardian about your symptoms and what you ate.

Unit revision test

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | B | 4 | B |
| 2 | B | 5 | B |
| 3 | B | | |

Structured questions

- 1 Foodborne diseases are illnesses that occur when a person consumes food or drinks that have been contaminated with harmful microorganisms (like bacteria, viruses, or parasites) or toxic substances.
- 2 Two symptoms of E. coli infection are:
 - (i) Severe stomach cramps.
 - (ii) Bloody diarrhoea. (Other valid answers: Vomiting, Fever)
- 3 Botulism affects the body by producing toxins that attack the nervous system, leading to symptoms like weak muscles, blurred vision and difficulty breathing. It can be a very serious and life-threatening illness.

- 4 The importance of cooking food properly is that it helps to kill harmful bacteria, viruses and parasites that might be present in raw food. Cooking food to the correct temperature ensures that it is safe to eat and reduces the risk of foodborne illnesses.
- 5 Three ways to prevent foodborne diseases are:
 - (i) Wash your hands thoroughly with soap and clean water before and after handling food.
 - (ii) Cook food properly to the recommended temperatures, especially meat, poultry and eggs.
 - (iii) Store food safely by refrigerating perishable items promptly and keeping raw and cooked foods separate to avoid cross-contamination.
- 6 Salmonella, Botulism, E-coli infection
- 7 Consuming food contaminated with harmful micro-organisms or toxic substances.

Unit 3: Environmental hygiene

Unit objectives

By the end of this unit, learners should be able to:

- define land pollution.
- identify types of land pollution.
- explain effects of land pollution.
- discuss ways to reduce land pollution.

Teaching notes

- **Agricultural waste:** Pesticides, fertilisers and other chemicals used in farming that can contaminate soil and water.
- **Construction waste:** Debris and waste generated during building construction.
- **E-Waste:** Discarded electronic devices like phones, computers and televisions.
- **Industrial waste:** Chemicals and other harmful substances released by factories and industries.
- **Land pollution:** The contamination of the earth's surface, including soil, rocks and water, by human activities.
- **Littering:** Throwing trash on the ground instead of disposing of it properly.
- **Recycling:** The process of turning used materials into new products.
- **Land pollution:** Contamination or degradation of the land surface by human activities, affecting environment, wildlife and human health.
- **Types of land pollution:**
 - * **Littering:** Throwing trash on the ground.
 - * **Industrial waste:** Harmful chemicals from factories.
 - * **Agricultural waste:** Pesticides, fertilisers and their containers.
 - * **Electronic Waste (E-waste):** Old electronic items containing toxic metals.
 - * **Construction waste:** Debris from building demolition or construction.

- **Effects of land pollution:**

- * **Soil contamination:** Harmful substances seep into soil, affecting plant growth and making soil infertile.
- * **Water pollution:** Chemicals and waste contaminate water sources, making them unsafe.
- * **Loss of biodiversity:** Destruction of habitats, extinction of plants and animals.
- * **Human health problems:** Respiratory problems, skin diseases, other health issues.

- **Ways to reduce land pollution:**

- * **Proper waste disposal:** Throw trash in designated bins, recycle.
- * **Reducing plastic use:** Avoid single-use plastics, use reusable alternatives.
- * **Conserving water:** Use water efficiently to prevent water pollution.
- * **Supporting sustainable agriculture:** Minimise harmful chemicals/pesticides.
- * **Educate others:** Teach family/friends about keeping land clean.

Activities guidelines

- **Activity 3.1:** Create a poster: In groups, have learners create a poster illustrating different types of land pollution and their effects on the environment. Encourage them to use visuals and clear descriptions.
- **Activity 3.2:** Draw a scene: Guide learners to draw a scene depicting ways to reduce land pollution and promote environmental hygiene, such as a clean-up campaign or recycling bins.
- **Classroom waste audit:** Conduct a simple audit of classroom waste for a day or week to identify what types of waste are generated and discuss how they can be reduced, reused, or recycled.
- **Discussion on the 3 Rs (Reduce, Reuse, Recycle):** Explain and discuss the concepts of reduce, reuse and recycle as key strategies for minimising waste and pollution.
- **Community clean-up plan:** As a class, brainstorm ideas for a small-scale community clean-up or awareness campaign related to land pollution.

Suggested answers

Exercise 3.1

- 1 Land pollution is the contamination or degradation of the earth's surface (including soil, rocks and water) caused by human activities. It affects the environment by harming plants, animals and ecosystems and can also lead to human health problems.
- 2 Three types of land pollution and examples of each:
 - (i) Littering: Throwing plastic bags, bottles, or paper on the ground.
 - (ii) Industrial waste: Chemicals and harmful substances released by factories.
 - (iii) Agricultural waste: Pesticides, fertilisers and their containers used in farming.
 - (iv) Electronic waste (E-waste): Discarded phones, computers, or televisions.

- (v) Construction waste: Debris like cement, bricks and wood from building sites. (Any three with examples)

- 3 Littering contributes to land pollution by directly depositing trash, such as plastic, paper and bottles, onto the ground instead of in proper disposal bins. This waste accumulates, degrades the aesthetic appeal of the land and can release harmful substances into the soil and water.
- 4 Some ways to reduce industrial waste include:
- (i) Implementing cleaner production technologies that generate less waste.
 - (ii) Recycling and reusing industrial by-products.
 - (iii) Treating hazardous waste before disposal to neutralise harmful chemicals.
 - (iv) Optimising manufacturing processes to minimise material usage. (Any two)
- 5 The importance of proper waste disposal in preventing land pollution is that it ensures harmful substances and trash are contained and managed in a way that prevents them from contaminating the soil, water and air. This protects ecosystems, wildlife and human health from the negative effects of pollution.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 C |
| 2 B | 5 C |
| 3 C | |

Structured questions

- 1 Land pollution is the contamination or degradation of the Earth's surface (soil, rocks, water) due to human activities. Its effects on the environment include soil contamination (making it infertile), water pollution (making water unsafe) and loss of biodiversity (destroying habitats and leading to species extinction).
- 2 Three types of land pollution and examples of each:
- (i) Littering: Examples include plastic bottles, food wrappers and discarded paper thrown on streets or in parks.
 - (ii) Industrial waste: Examples include chemical by-products, heavy metals and toxic sludge released from factories.
 - (iii) Electronic waste (E-waste): Examples include old mobile phones, broken computers and discarded televisions.
- 3 It is important to reduce industrial waste because it often contains harmful chemicals and toxic substances that can severely contaminate soil and water, posing risks to plant growth, animal life and human health. Two ways to achieve this are:
- (i) Implementing waste reduction strategies at the source, such as optimising production processes to use fewer raw materials and generate less waste.

- (ii) Recycling and reusing industrial by-products whenever possible, turning waste into valuable resources instead of disposing of it.
- 4 Littering contributes to land pollution by directly depositing non-biodegradable and harmful materials (like plastics, glass and metals) onto the ground, where they accumulate and degrade the environment. These items can release toxins into the soil and water, harm wildlife and spoil natural beauty. Two ways to reduce littering are:
- (i) Always throwing trash in designated bins and ensuring it is properly sorted for recycling.
 - (ii) Educating others about the negative impacts of littering and encouraging responsible waste disposal habits.
- 5 Individuals play a crucial role in promoting environmental hygiene and reducing land pollution by adopting responsible daily habits. This includes practising proper waste disposal (using bins, recycling), reducing consumption of single-use plastics, conserving water and educating their families and friends about environmental responsibility. Collective individual actions contribute significantly to a cleaner and healthier environment.

Unit 4: Emotional intelligence

Unit objectives

By the end of this unit, learners should be able to:

- define emotional intelligence.
- explain various emotions.
- define self-awareness.
- explain the importance of self-awareness.
- discuss how to react to various situations.
- define self-regulation.
- explain the importance of self-regulation.
- demonstrate self-regulation techniques.

Teaching notes

- **Emotional Intelligence (EI):** The ability to recognise, understand and manage your emotions and the emotions of others.
- **Empathy:** The ability to understand and share the feelings of others.
- **Mindfulness:** The practice of focusing your attention on the present moment, without judgment.
- **Self-awareness:** The ability to understand your own emotions and recognise how they affect your thoughts and behaviour.
- **Self-regulation:** The ability to control or redirect disruptive emotions and impulses and adapt to changing circumstances.

- Emotional intelligence helps build better relationships, make smarter decisions and cope with challenges.
- **Key skills of emotional intelligence:** Self-awareness, Self-regulation, Motivation, Empathy, Social skills.
- **Emotions:** Feelings experienced in different situations (positive or negative), affecting thoughts and actions.
 - * **Happiness:** Excited, joyful.
 - * **Sadness:** Upset, down.
 - * **Anger:** Mad, frustrated.
 - * **Fear:** Scared, worried.
 - * **Surprise:** Shocked, amazed.
 - * **Disgust:** Sick, repelled.
- **Self-awareness:** The ability to recognise and understand your own emotions and thoughts.
 - * **Importance:** Helps understand emotions/thoughts, make better decisions, develop healthier relationships, improve communication skills.
- **How to react to different situations:**
 - * **Angry:** Deep breaths, think calmly.
 - * **Sad:** Talk to someone, do something happy (music, drawing).
 - * **Scared:** Focus on control, take small steps.
 - * **Happy:** Share happiness, celebrate.
- **Self-regulation:** The ability to control and manage your own emotions and behaviours, especially in difficult situations; managing reactions to avoid regret.
 - * **Importance:** Helps manage stress/anxiety, develop self-discipline, improve relationships, stay calm, make good choices, behave respectfully, achieve goals.
- **Self-regulation techniques:**
 - * **Take deep breaths:** Calm body and mind.
 - * **Count to ten:** Pause and think before reacting.
 - * **Use positive self-talk:** Tell yourself you can handle it calmly.
 - * **Take a break:** Go for a walk, listen to music, calming activity.
 - * **Practise mindfulness:** Pay attention to the present moment without judgment.

Activities guidelines

- **Activity 4.1:** Acting out emotions: Have learners take turns acting out different emotions (happy, sad, angry, surprised) while others guess the emotion. This helps them recognise and express feelings.
- **Activity 4.2:** Role-play different scenarios: In pairs, have learners role-play various scenarios (disagreement with a friend, feeling frustrated with homework). Guide them to practice self-awareness and thoughtful reactions using the techniques discussed.

- **Activity 4.3:** My Emotional Journal: Encourage learners to keep a journal for one week, writing down the emotions they experience daily, what triggered them and how they reacted. Discuss their observations (anonymously if preferred) to foster self-awareness.
- **Emotion charades:** Write different emotions on cards and have learners pick one to act out silently for others to guess.
- **Mindfulness minute:** Lead a short mindfulness exercise (focusing on breath, listening to sounds) to demonstrate a self-regulation technique.

Suggested answers

Exercise 4.1

- 1 Emotional intelligence is the ability to recognise, understand and manage your own emotions, as well as the emotions of others.
- 2 (Learners' answers will vary based on recent experiences. Example: "Recently, I felt happy when I scored well on a test; it's a feeling of joy and satisfaction. I also felt a bit frustrated when my drawing didn't turn out as I wanted; it is a feeling of annoyance when things do not go as planned").
- 3 Self-awareness is important in managing your emotions because it helps you to understand what you are feeling and why you are feeling it. By recognising your emotions, you can then choose how to react in a positive way instead of letting emotions control your actions.
- 4 Self-regulation helps you in stressful situations by enabling you to control your reactions and stay calm. Techniques like deep breathing or counting to ten give you time to think clearly before responding impulsively, leading to better choices.
- 5 A situation where using self-regulation would help you make a better choice is when you feel angry because a friend accidentally broke your toy. Instead of shouting or getting upset immediately, using self-regulation (like taking deep breaths or counting to ten) would help you calm down and discuss the situation calmly with your friend, leading to a more constructive solution.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 A | 4 C |
| 2 A | 5 D |
| 3 B | |

Structured questions

- 1 Emotional intelligence is the ability to understand and manage your own feelings, as well as the feelings of others. One example of how it can help you is by enabling you to resolve conflicts with friends more peacefully because you can understand their feelings and manage your own reactions.

- 2 (Learner's answers will vary. Example: "I felt angry when my brother took my book without asking. To handle that, I could use self-regulation techniques like taking a few deep breaths to calm down before speaking, or counting to ten to give myself time to think before reacting impulsively. This would help me talk to him calmly instead of shouting").
- 3 Being self-aware can help you in school or with friends by:
- (i) **In school:** Helping you understand what makes you feel stressed about homework or tests, so you can ask for help or manage your time better. It also helps you recognise when you're feeling frustrated, so you can take a break instead of giving up.
 - (ii) **With friends:** Helping you understand your own emotions during disagreements, so you can express yourself clearly and listen to your friends' feelings, leading to healthier relationships.
- 4 Taking a break can help you manage your emotions by giving you time and space to calm down when you feel overwhelmed or upset. Stepping away from a difficult situation allows your mind to clear, reduces intense feelings and helps you think more rationally before reacting.
- 5 Self-regulation is important in maintaining healthy relationships with others because it enables you to control your impulses and reactions, especially during disagreements or stressful moments. By managing your emotions, you can respond respectfully, avoid saying hurtful things and engage in constructive conversations, which strengthens trust and understanding in relationships.

Unit 5: HIV and AIDS

Unit objectives

By the end of this unit, learners should be able to:

- define HIV/AIDS.
- discuss how HIV/AIDS can be transmitted.
- describe how HIV/AIDS can be prevented.
- discuss how HIV/AIDS infected persons can be managed.

Teaching notes

- **HIV (Human Immunodeficiency Virus):** A virus that attacks the immune system and can lead to AIDS.
- **AIDS (Acquired Immunodeficiency Syndrome):** The final stage of HIV infection when the immune system is severely weakened.
- **Transmission:** The way HIV is spread from one person to another.
- **Antiretroviral Therapy (ART):** Medicine that helps manage HIV and prevent it from progressing to AIDS.

- **Condoms:** A protective barrier used during sex to prevent the transmission of HIV and other sexually transmitted infections.
- HIV attacks the body's immune system, weakening its ability to fight off infections.
- AIDS is the final stage of HIV infection, where the immune system is severely damaged.
- Transmission of HIV/AIDS (through blood, semen, vaginal fluids, breast milk):
 - * Unprotected sexual contact.
 - * Sharing needles (syringes or other sharp objects).
 - * From Mother to Child (during pregnancy, childbirth, or breastfeeding).
 - * Blood Transfusions or Organ Transplants (if not tested).

Prevention of HIV/AIDS:

- Use condoms (very effective).
- Get Tested and Know Your Status.
- Avoid sharing needles.
- Preventing mother-to-child transmission (special medications for pregnant women).
- Pre-exposure Prophylaxis (PrEP): Medication for HIV-negative people at high risk.

Management of HIV/AIDS (no cure, but manageable):

- **Antiretroviral Therapy (ART):** Combination of medicines taken daily to reduce virus in body, strengthen immune system.
- **Regular medical check-ups:** Monitor health, immune system, ART effectiveness.
- **Healthy lifestyle:** Eating healthy, regular exercise, avoiding stress, smoking, excessive alcohol, drugs.
- **Mental health support:** Counselling, support groups.
- **Stigma and support:** Communities should offer support and understanding to reduce shame and fear.

Activities guidelines

- **Activity 5.1:** HIV fact sheet: Guide learners to create a fact sheet about HIV/AIDS, explaining what it is and how it is transmitted. Encourage them to share it with classmates or family members.
- **Activity 5.2:** Create an HIV awareness poster and role-play: Have learners design a poster promoting HIV prevention (condoms, testing, avoiding sharing needles). Also, guide them to role-play a scenario where someone is getting tested for HIV, emphasising empathy and support.
- **Activity 5.3:** Write a short story: Guide learners to write a short story about someone living with HIV/AIDS, focusing on their daily life, management and the importance of support.
- **Discussion on misconceptions:** Address common misconceptions about HIV/AIDS transmission (for example, it cannot be spread by touching, hugging, sharing food, or mosquito bites).

- **Importance of confidentiality:** Discuss the importance of confidentiality and respect for individuals' health status.

Suggested answers

Exercises 5.1

- | | | | |
|---|---|---|---|
| 1 | A | 4 | A |
| 2 | C | 5 | C |
| 3 | C | | |

Exercise 5.2

- 1 HIV stands for **Human Immunodeficiency Virus**.
- 2 Two ways HIV can be transmitted are:
 - (i) Through unprotected sexual contact with an infected person.
 - (ii) By sharing needles or syringes with someone who is infected.
 - (iii) From mother to child during pregnancy, childbirth, or breastfeeding.
 - (iv) Through blood transfusions or organ transplants from an infected person (though this is rare in places where blood is screened). (Any two)
- 3 Antiretroviral Therapy (ART) is a combination of medicines that people with HIV take daily. It is important for people with HIV because it helps to reduce the amount of virus in the body, allowing the immune system to stay stronger and fight off infections, thus preventing the progression to AIDS.
- 4 You can prevent HIV from being passed from mother to child by ensuring that pregnant women who are HIV-positive take special medications (ART) during pregnancy and childbirth and by advising on safe feeding practices (for example, avoiding breastfeeding if safe alternatives are available).
- 5 It is important to reduce stigma for people living with HIV because stigma and discrimination can lead to shame, fear and isolation, making it harder for individuals to seek testing, treatment and support. Reducing stigma promotes acceptance, encourages open discussion and helps people with HIV live healthier, more integrated lives.

Unit revision

Multiple choice questions

- 1 B
- 2 B
- 3 B
- 4 B
- 5 B

Structured questions

- 1** HIV (Human Immunodeficiency Virus) is a virus that attacks and weakens the body's immune system. The immune system is like the body's defense army and when HIV attacks it, the body becomes less able to fight off infections and diseases, eventually leading to AIDS.
- 2** The main ways HIV is transmitted are:
 - (i)** Unprotected sexual contact (through bodily fluids like semen and vaginal fluids).
 - (ii)** Sharing needles or syringes contaminated with infected blood.
 - (iii)** From mother to child during pregnancy, childbirth, or breastfeeding.
 - (iv)** Through blood transfusions or organ transplants from an infected person (though blood is screened in many places).
- 3** HIV can be prevented by:
 - (i)** Using condoms consistently and correctly during sexual intercourse.
 - (ii)** Getting tested for HIV regularly to know one's status and take appropriate measures.
 - (iii)** Avoiding sharing needles, syringes, or other sharp objects that may have come into contact with blood.
 - (iv)** For pregnant women living with HIV, taking special medications (ART) to prevent transmission to their babies. (Any three)
- 4** Antiretroviral Therapy (ART) helps manage HIV by being a combination of medicines that reduces the amount of the HIV virus in the body. This allows the immune system to remain stronger, fight off other infections more effectively and prevents the HIV infection from progressing to its final stage, AIDS. It helps people with HIV live long and healthy lives.
- 5** It is important to reduce stigma and offer support to people living with HIV because stigma can lead to discrimination, isolation and psychological distress for individuals. By reducing stigma, communities create an environment where people with HIV feel safe to seek testing, access treatment, adhere to medication and live full, integrated lives, which ultimately helps in controlling the spread of the virus and improving public health.

Topic 2

Food and nutrition

Unit 6: Balanced diet

Unit objectives

By the end of this unit, learners should be able to:

- define a balanced diet.
- identify components of a balanced diet in an indigenous meal.
- discuss the health benefits of indigenous foods.

Teaching notes

- **Balanced diet:** A diet that provides the body with all the necessary nutrients, vitamins and minerals in their right proportions to maintain good health.
- **Fiber:** A type of carbohydrate that helps with digestion and bowel movement.
- **Minerals:** Substances that help regulate body functions.
- **Nutrients:** Substances that provide energy and support growth and development.
- **Vitamins:** Substances that help regulate body functions.
- A balanced diet includes a variety of foods from different food groups.
- The main components of a balanced diet are:
 - * **Carbohydrates:** Provide energy (for example, *sadza*, rice, bread).
 - * **Proteins:** Build and repair body tissues (for example, meat, fish, beans, eggs).
 - * **Fats:** Provide energy and help absorb vitamins (for example, oil, butter, margarine).
 - * **Vitamins:** Help regulate body functions (for example, vitamin A, C, D).
 - * **Minerals:** Help regulate body functions (for example, iron, calcium, potassium).
 - * **Fibre:** Helps with digestion and bowel movement (for example, fruits, vegetables, whole grains).
- Traditional Zimbabwean meals are rich in diverse nutrients, providing a balanced diet.
- Examples of components in indigenous meals:
 - * **Carbohydrates:** *Sadza/isitshwala*, nhopi, sweet potatoes, yams.
 - * **Proteins:** Legumes (beans, lentils, cowpeas), meat.

- * **Vitamins and minerals:** Leafy green vegetables (*nyevhe/ulude*, muboora, mutsine, spinach, kale, amaranth), fruits (baobab/*mauyu*, wild berries, *matamba*).
 - * **Fats:** Nuts and seeds (groundnuts, sunflower seeds, sesame).
- Health benefits of indigenous foods include: reducing the risk of chronic diseases, supporting healthy digestion, providing essential vitamins and minerals, boosting the immune system, being low in unhealthy fats and being nutrient-rich.

Activities guidelines

- **Activity 6.1:** Draw your favourite indigenous meal: Have learners draw and label their favourite indigenous meal, identifying the components of a balanced diet within it. Encourage them to share and explain their drawings to the class.
- **Activity 6.2:** Research indigenous foods: Guide learners to research and list five indigenous foods rich in vitamins and minerals. This can be done individually or in pairs using available resources (books, internet if accessible, or interviews with family/community members).
- **Activity 6.3:** Meal Planning: Facilitate a group activity where learners plan a balanced meal for a day (breakfast, lunch and dinner) using indigenous foods available in their area. Emphasise including carbohydrates, proteins, vegetables and fruits in each meal. Have groups present their menus and justify their choices.
- **Food group sorting:** Provide pictures or actual examples of various foods (both indigenous and non-indigenous) and have learners sort them into their respective food groups (carbohydrates, proteins, fats, vitamins, minerals, fibre).
- **Discussion on balanced diet importance:** Lead a class discussion on why eating a balanced diet is essential for growth, energy and overall health, especially for young learners. Connect this to their daily lives and energy levels for school activities.

Suggested answers

Exercise 6.1

- | | | | |
|---|---|---|---|
| 1 | C | 4 | C |
| 2 | B | 5 | D |
| 3 | B | | |

Exercise 6.2

Short answer questions

- 1 The components of a balanced diet are carbohydrates, proteins, fats, vitamins, minerals and fibre.
- 2 An example of an indigenous meal that provides a good balance of carbohydrates, proteins and vitamins is *sadza* with stewed beef and leafy green vegetables (like *muboora* or *nyevhe*).

- 3 Two health benefits of consuming leafy green vegetables are:
 - (i) They provide essential vitamins (like Vitamin A and C) and minerals (like iron and calcium) for healthy growth and development.
 - (ii) They support healthy digestion due to their high fibre content.
- 4 The importance of fibre in the diet is that it helps with digestion and promotes healthy bowel movement, preventing constipation.
- 5 An example of a vitamin is Vitamin C. Its function in the body is to boost the immune system, help with wound healing and protect cells from damage.

Unit revision exercises

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 C |
| 2 B | 5 B |
| 3 B | |

Structured questions

- 1 A balanced diet is a way of eating that includes all the different types of nutrients your body needs, in the right amounts, to stay healthy, grow and have energy.
- 2 Three indigenous foods rich in carbohydrates are:
 - (i) *Sadza/isitshwala* (from maize, millet, or sorghum)
 - (ii) Sweet potatoes
 - (iii) Yams
- 3 Two health benefits of consuming leafy green vegetables are:
 - (i) They are rich in vitamins and minerals (like Vitamin A, Vitamin C, iron and calcium) which are essential for healthy growth and development.
 - (ii) Their fibre content aids in healthy digestion and bowel movement.
- 4 Traditional meals can help prevent heart diseases because many indigenous foods are naturally low in unhealthy saturated fats. For example, meals often feature lean proteins from legumes and vegetables, which contribute to a heart-healthy diet.
- 5 Simple dinner menu using indigenous foods that includes all components of a balanced diet:
 - * *Sadza/Isitshwala* (Carbohydrates)
 - * *Beans/Nyemba stew* (Protein, Fibre)
 - * *Muboora/Ibhobola (Pumpkin leaves)* (Vitamins, Minerals, Fibre)
 - * *Wild berries/Mauyu (Baobab fruit)* for dessert (Vitamins, Minerals, Fibre)

Unit 7: Food packaging and storage

Unit objectives

By the end of this unit, learners should be able to:

- identify storage methods.
- discuss the importance of food packaging and storage.
- practice food packaging.
- list modern and indigenous storage methods.
- identify reasons for packaging.

Teaching notes

- **Contamination:** The presence of harmful substances or micro-organisms in food.
- **Indigenous:** Originating or occurring naturally in a particular place; native.
- **Modern:** Relating to the present or recent times.
- **Packaging:** Materials used to wrap or protect goods.
- **Preservation:** Keeping food in good condition for future use.
- **Reasons for packaging food include:** Protection (from damage, dust, spoilage, moisture), Hygiene (keeps food clean), Convenience (easy to transport, handle, store, consume), Preservation (extends shelf life), Information (details about the product) and Marketing (attractive packaging).

Common packaging materials

- * **Glass:** Jars and bottles; non-reactive, preserves flavour, but heavy and breakable (for example, jam, honey).
- * **Plastic:** Lightweight, versatile (bags, bottles, containers); not all suitable for food (for example, fruits, vegetables, bread).
- * **Metal:** Tins and aluminium cans; durable, protects from light/air (for example, beans, fish).
- * **Paper and cardboard:** For dry foods like cereals; lightweight but may not protect against moisture.
- **Importance of food storage:** Food safety (prevents contamination), Food preservation (extends shelf life), Convenience (easy transport/storage), Economic benefits (reduces waste), Emergency preparedness (backup supply), Environmental benefits (reduces waste), Health benefits (maintains nutritional value).
- **Modern storage methods:**
 - * **Refrigeration:** Low temperatures for perishable foods (dairy, meat, vegetables).
 - * **Freezing:** Below freezing point for extended preservation.
 - * **Canning:** Sealing in airtight containers and heating.
 - * **Vacuum sealing:** Removing air to prevent spoilage.

- Indigenous storage methods:
 - * **Granaries:** Structures for grains (maize, wheat, rice).
 - * **Underground storage pits:** For grains or root crops (potatoes, sweet potatoes) in cool, dry pits.
 - * **Clay pots:** For grains, beans, flour.

Activities guidelines

- **Project 7.1: Packaging food:** Have learners bring a small snack (sandwich, fruit) and different packaging materials (plastic bag, paper bag, cardboard box). They should package the snack in each material and observe how it affects the food over a short period (a few hours or overnight). Discuss their observations.
- **Practising food packaging:** Conduct a hands-on session where learners follow the steps in the learner's book to package fresh fruits or vegetables using provided materials. Emphasise hygiene, proper sealing and labelling.
- **Field trip/guest speaker:** If possible, arrange a visit to a local supermarket to observe different food packaging types or invite a local expert (from a food processing company or a community elder knowledgeable in traditional storage) to speak about packaging and storage.
- **Debate/Discussion:** Organise a debate on “Modern vs. Indigenous Food Storage: Which is Better?” Encourage learners to research and present arguments for both sides, considering factors like cost, accessibility, environmental impact and effectiveness.
- **Design a package:** Challenge learners to design a new food package for a specific indigenous food, considering the reasons for packaging (protection, information, marketing) and suitable materials.

Suggested answers

Exercise 7.1

- 1 A situation where food packaging and storage are crucial is when transporting perishable foods like fresh milk or meat over long distances, as proper packaging and refrigeration prevent spoilage and contamination.
- 2 Modern storage methods (refrigeration, freezing, canning, vacuum sealing) typically involve technology and controlled environments (like low temperatures or airtight seals) to preserve food for extended periods. They are often more efficient and can store a wider variety of foods. Indigenous storage methods (granaries, underground pits, clay pots) rely on natural conditions and traditional knowledge to preserve food, often for staple crops. They are usually simpler, do not require electricity, but may be less effective for highly perishable items. Both aim to extend food shelf life and prevent spoilage.
- 3 Some common materials used for packaging food are:
 - (i) Glass
 - (ii) Plastic

(iii) Metal

(iv) Paper and cardboard (Any three)

- 4 Food packaging and storage are important for food preservation because they control factors like temperature, moisture and exposure to microorganisms and light. This protection helps to slow down spoilage, prevent contamination and extend the shelf life of food, making it safe to eat for longer.
- 5 The purpose of a clay pot in indigenous storage methods is to store dry foods like grains, beans and flour. Clay pots help keep the contents cool and dry, protecting them from pests and moisture due to their porous nature, which allows for some air circulation while keeping pests out.

Unit revision exercises

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 D |
| 2 C | 5 B |
| 3 D | |

Structured questions

- 1 Three reasons why food packaging is important are:
- (i) **Protection:** It protects food from physical damage, dust, moisture and spoilage.
 - (ii) **Hygiene:** It keeps food clean and prevents contamination from external sources.
 - (iii) **Convenience:** It makes food easy to transport, handle, store and consume.
- 2 Two materials commonly used for food packaging are:
- (i) Plastic
 - (ii) Glass (Other valid answers: Metal, Paper/Cardboard)
- 3 One indigenous method of food storage is using **granaries**. These are structures built to store grains like maize, wheat and rice, keeping them dry and protected from pests.
- 4 The primary purpose of vacuum sealing food is to remove air from the packaging. This prevents the growth of spoilage organisms (like bacteria and mold) that need oxygen to thrive, thereby extending the food's shelf life.
- 5 Proper food storage is important for several reasons:
- It ensures food safety by preventing contamination and spoilage, reducing the risk of foodborne illnesses.
 - It helps in food preservation, allowing food to remain fresh and edible for longer periods.
 - It offers economic benefits by reducing food waste, saving money for individuals and families.

Unit 8: Food preparation

Unit objectives

By the end of this unit, learners should be able to:

- list ingredients to be used.
- state utensils used to prepare indigenous meal.
- discuss cooking methods to be used.
- prepare an indigenous meal.

Teaching notes

- **Cuisine:** A type of food cooked in a certain way based on a culture's ingredients, region and traditions.
- **Ingredients:** The food items used to prepare a meal.
- **Kapenta:** A type of small, dried fish commonly used in Zimbabwean cuisine.
- **Sadza:** A traditional Zimbabwean dish made from maize meal, similar to thick porridge.
- **Utensils:** Tools used for cooking and preparing food.
- Zimbabwean cuisine has a rich tradition of meals passed down through generations.
- **Sadza** is a thick maize porridge, rich in carbohydrates.
- **Dried kapenta** is a small dried fish, rich in protein, locally harvested from Lake Kariba.
- **Ingredients for Sadza and Kapenta:** Maize meal, water, dried kapenta, onions, tomatoes, salt, black pepper, vegetable oil.
- **Utensils for Sadza and Kapenta:** Large pot, wooden spoon (*mugoti*), cutting board, knife, frying pan, plates, spoons, bowl.

Cooking methods

- * **Boiling:** Used for *sadza*.
- * **Frying:** Used for dried kapenta.
- **Steps for preparing sadza:** Boil water, mix mealie-meal paste with cold water, add paste to boiling water stirring continuously, simmer, gradually add dry mealie-meal stirring constantly until thick, simmer on low heat.
- **Steps for preparing dried kapenta:** Soak in warm water, rinse and drain, fry in oil until golden brown and crispy, add chopped onions and tomatoes, season with salt.
- **Serving:** Serve fried kapenta over cooked *sadza*.

Activities guidelines

- **Activity 8.1:** Draw ingredients and utensils: Have learners draw and label the ingredients and utensils needed for preparing *sadza* and kapenta. Encourage them to compare their drawings with others.

- **Activity 8.2:** Role-play meal preparation: Organise a role-play activity where groups of learners simulate preparing sadza and kapenta, assigning roles for each step (“the one who boils water,” “the one who stirs *sadza*”). This can be done without actual cooking, focusing on the sequence of steps and use of utensils.
- **Practical meal preparation (with supervision):** If resources and safety permits, guide learners (with parent/guardian assistance as suggested in the learner’s book) to prepare a traditional dish of their choice at home. Encourage them to share pictures or a sample with the class. This reinforces practical skills and cultural appreciation.
- **Utensil identification game:** Show pictures of various cooking utensils (some used for sadza/kapenta, some not) and have learners identify them and state their function, specifically focusing on those used in the traditional meal.
- **Discussion on food safety in preparation:** Lead a discussion on hygiene practices during food preparation (washing hands, cleaning vegetables, proper cooking temperatures) to ensure food safety.

Suggested answers

Exercise 8.1

- 1 Three ingredients needed to prepare *sadza* and kapenta are:
 - (i) Maize meal
 - (ii) Dried kapenta
 - (iii) Onions (Other valid answers: tomatoes, salt, vegetable oil, black pepper)
- 2 The cooking method used to cook *sadza/isitshwala* is boiling. Water is boiled, a mealie-meal paste is added and then drier mealie-meal is gradually stirred in while boiling until it thickens.
- 3 The importance of stirring the *sadza/isitshwala* while it’s cooking is to prevent lumps from forming and to ensure that the mealie-meal cooks evenly and thickens to the desired smooth consistency.
- 4 (Learners will draw pictures of a large pot, wooden spoon, cutting board, knife, frying pan, plates, spoons and a bowl).
- 5 *Sadza/isitshwala* and kapenta is a traditional Zimbabwean meal that is both nutritious and widely enjoyed. *Sadza/isitshwala*, a thick porridge made from maize meal, serves as the carbohydrate staple, providing energy. It is typically prepared by boiling water and gradually stirring in mealie-meal until it reaches a thick consistency. Kapenta, small dried fish, is rich in protein and is usually fried with chopped onions and tomatoes, creating a savory relish. The combination of *sadza/isitshwala* and kapenta offers a balanced intake of carbohydrates and proteins, making it a wholesome and culturally significant dish.

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | A | 4 | A |
| 2 | B | 5 | A |
| 3 | A | | |

Structured questions

- 1 The primary ingredients required to prepare *sadza/isitshwala* are maize meal and water.
- 2 The process of preparing dried kapenta involves:
 - (i) **Soaking:** Place dried kapenta in a bowl, cover with warm water and let it soak for about 10 minutes to rehydrate and remove excess salt.
 - (ii) **Rinsing and draining:** Rinse the kapenta under cold water and drain thoroughly.
 - (iii) **Frying:** Heat cooking oil in a frying pan, add the kapenta and fry until golden brown and crispy.
 - (iv) **Adding vegetables:** Incorporate chopped onions and tomatoes, cooking until tender.
 - (v) **Seasoning:** Add salt to taste and stir well.
- 3 Two traditional utensils used in cooking *sadza/isitshwala* and their functions are:
 - (i) **Large pot:** Used for boiling water and cooking the sadza.
 - (ii) **Wooden spoon (*mugoti*):** Used for stirring the sadza continuously to prevent lumps and achieve the correct consistency.
- 4 It is important to soak dried kapenta before cooking to rehydrate the fish and to remove any excess salt, which can make the final dish too salty.
- 5 The steps involved in cooking *sadza/isitshwala* are:
 - (i) **Boil water:** Pour water into a pot and bring it to a boil.
 - (ii) **Mix mealie-meal paste:** In a separate bowl, mix a small amount of mealie-meal with cold water to create a smooth paste.
 - (iii) **Combine:** Add the paste to the boiling water, stirring continuously with a wooden spoon to prevent lumps.
 - (iv) **Cook:** Let it simmer until it thickens.
 - (v) **Add mealie-meal:** Gradually add dry mealie-meal, stirring constantly, until the *sadza/isitshwala* reaches the desired thick consistency.
 - (vi) **Simmer:** Cover the pot and let it cook on low heat for a few more minutes.

Topic 3

Crops, plants and animals

Unit 9: Germination

Unit objectives

By the end of this unit, learners should be able to:

- define germination.
- discuss conditions necessary for germination.
- describe germination stages.
- carry out an experiment on seed germination.

Teaching notes

- **Cotyledon:** The food store in a bean seed.
- **Embryo:** The part which will develop into roots and shoots of a new plant.
- **Endosperm:** The food store in a maize seed.
- **Germination:** The process of seeds developing into new plants (seedlings).
- **Imbibition:** The absorption of water by the seed before it germinates.
- **Plumule:** The part of a seed that develops into the shoot bearing the first true leaves.
- **Radicle:** The first root that emerges from a seed.
- **Testa:** The seed coat which protects the seed.
- The main parts of a seed are the seed coat (testa), embryo and food store (cotyledon in beans, endosperm in maize).
- **Conditions necessary for germination:** Water (moisture), suitable temperature (warmth, typically 25°C to 30°C) and oxygen (air).
- Seeds will not germinate if any of the necessary conditions are missing.

Stages of germination

1. **Imbibition:** Seed absorbs water, softens and swells.
2. **Seed coat cracking:** Seed coat opens, allowing embryo to emerge.
3. **Root emergence:** Radicle breaks through, anchoring plant and absorbing water/nutrients.
4. **Shoot emergence:** Plumule grows upward towards light.
5. **Cotyledon emergence:** Cotyledon emerges and plant begins photosynthesis.

Activities guidelines

- **Activity 9.1:** Observing the structure of a seed: Provide learners with bean and maize seeds. In pairs, guide them to carefully observe the seeds and identify the seed coat, embryo and food store. Encourage discussion on the differences between the two types of seeds.
- **Activity 9.2:** Experiment to demonstrate conditions necessary for germination: Facilitate this group experiment as described in the learner's book. Ensure learners understand the purpose of each test tube (control, lacking water, lacking oxygen, lacking suitable temperature). Guide them to record observations over 5-7 days and discuss the expected results, linking them to the necessary conditions for germination.
- **Activity 9.3:** Experiment to observe seed germination: Guide learners through this experiment using clear cups/jars and paper towels. Emphasise daily observation and recording of the changes, connecting each change to the stages of germination. This provides a visual, hands-on experience of the process.
- **Diagram labelling:** Provide blank diagrams of bean and maize seeds and have learners label the parts. Similarly, provide a diagram showing the stages of germination for them to label and describe.
- **Discussion on importance of germination:** Discuss the importance of germination in agriculture and for the continuation of plant life.

Suggested answers

Exercise 9.1

- 1 Germination is the process whereby seeds develop into new plants (or seedlings).
- 2 The other name for the seed coat is testa.
- 3 The embryo is the part which will develop into roots and shoots of a new plant.
- 4 In bean seeds, the food store is called the cotyledon.
- 5 In maize seeds, the food store is called the endosperm.

Exercise 9.2

- 1 The three conditions necessary for germination are: water (moisture), suitable temperature (warmth) and oxygen (air).
- 2 (Learners will draw a bean seed and label the testa, embryo and food store.)

Exercise 9.3

- 1 Imbibition is the absorption of water by the seed before it germinates, causing it to swell.
- 2 The root (radicle) emerges first during germination.
- 3 The first stage of germination is imbibition, where the seed absorbs water, causing it to soften and swell.
- 4 The radicle is the part of the seed that grows into the root.
- 5 The last stage of germination described is cotyledon emergence, where the cotyledon (seed leaf) emerges from the seed coat and the plant begins photosynthesis, producing its own food.

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | B | 6 | B |
| 2 | A | 7 | A |
| 3 | B | 8 | A |
| 4 | C | 9 | D |
| 5 | B | | |

Structured questions

- 1 The three conditions necessary for germination are water, oxygen and suitable temperature. (Note: The question asks for photosynthesis, but the context is germination. The answer is provided for germination as per the unit content).
- 2
 - (i) Food store is where the seed embryo gets its food.
 - (ii) Seed coat protects the seed from bad weather.
 - (iii) Embryo develops into plant shoots and roots.
- 3 A - Seed coat (Testa) B - Embryo C - Food store (Cotyledon)
- 4 The purpose of oil put in cooled boiled water is to prevent oxygen from dissolving back into the water and to prevent atmospheric oxygen from reaching the seeds, thus demonstrating the necessity of oxygen for germination. The boiled water itself has dissolved oxygen removed.
- 5 The seeds germinated in the first test tube because all three necessary conditions for germination were present: water (moist cotton wool), oxygen (air) and suitable temperature (room temperature).

Unit 10: Nutrient deficiency

Unit objectives

By the end of this unit, learners should be able to:

- identify plants nutrients.
- define plant nutrient deficiency.
- identify signs of plant nutrient deficiency.
- discuss ways to curb plant nutrient deficiency.
- carry out an experiment on plant nutrient deficiency.

Teaching notes

- **Chlorosis:** A condition in plants where the leaves turn yellow or pale.
- **Fertilisers:** Substances added to soil to promote plant growth.
- **Nitrogen:** A plant nutrient that helps plants grow leaves and stems.

- **Nutrient deficiency:** A condition where a plant lacks one or more essential nutrients.
- **Phosphorus:** A plant nutrient that helps plants grow roots and flowers.
- **Potassium:** A plant nutrient that helps plants grow strong and healthy.
- Plants require macro-nutrients (Nitrogen, Phosphorus, Potassium) and micro-nutrients for growth.
- **Functions of primary macro-nutrients**
 - * **Nitrogen (N):** Essential for chlorophyll production (green colour), vital for photosynthesis, promotes overall plant growth.
 - * **Phosphorus (P):** Important for root development, crucial for energy transfer, promotes flower and fruit formation.
 - * **Potassium (K):** Promotes flower and fruit formation, enhances disease resistance, helps plants grow strong and healthy.
- **Signs of nutrient deficiencies:**
 - * **Nitrogen deficiency:** Older leaves turn pale green or yellow (chlorosis), stunted growth, premature leaf drop.
 - * **Phosphorus deficiency:** Stunted growth, purplish leaves (especially undersides), poor root development.
 - * **Potassium deficiency:** Yellowing or browning of leaf margins (edges/tips), weak stems, increased disease susceptibility, delayed flowering/fruiting.
- **Preventing and correcting nutrient deficiencies:** Soil testing, balanced fertilisation, organic matter addition, proper watering practices and pH management (liming).

Activities guidelines

- **Project 10.1:** An Experiment on plant nutrient deficiencies: Guide learners through this experiment. Ensure they understand the setup for each pot (complete nutrients, N-deficient, P-deficient, K-deficient). Emphasise consistent watering and sunlight. Guide them to observe and record changes over 2-3 weeks, linking observed symptoms to specific nutrient deficiencies.
- **Observation of real plants:** If possible, bring in plants showing signs of nutrient deficiencies (or pictures/videos) and have learners identify the likely deficiency based on the symptoms discussed.
- **Discussion on soil testing:** Explain the importance of soil testing for farmers and gardeners to determine nutrient levels and pH and how this information helps in applying the correct fertilisers.
- **Role-play:** Farmer and agricultural extension officer: Have learners role-play a farmer describing plant problems to an agricultural extension officer, who then diagnoses the nutrient deficiency and suggests solutions.
- **Research on organic fertilisers:** Have learners research different types of organic matter (compost, manure) and how they improve soil health and nutrient availability.

Suggested answers

Exercise 10.1

- 1 True
- 2 True
- 3 False
- 4 True
- 5 False

Exercise 10.2

- 1 Plant nutrient deficiency is a condition where a plant lacks one or more essential nutrients that are required for its normal growth and development.
- 2 Three common symptoms of nitrogen deficiency in plants are:
 - (i) Older leaves turn pale green or yellow (chlorosis).
 - (ii) Overall plant growth is stunted.
 - (iii) Leaves may drop prematurely.
- 3 Crop rotation can help prevent nutrient deficiencies by rotating different types of crops in a field over time. Different crops absorb different nutrients from the soil. By rotating them, the soil's nutrient levels are not depleted of a single nutrient, allowing for natural replenishment or reducing the need for excessive fertilisation.
- 4 The role of potassium in plant health is crucial for promoting flower and fruit formation, enhancing the plant's resistance to diseases and helping plants grow strong and healthy overall.
- 5 Two methods to correct phosphorus deficiency in soil are:
 - (i) Applying phosphorus-rich fertilisers (superphosphate) to the soil.
 - (ii) Incorporating organic matter like compost or well-decomposed manure, which slowly releases phosphorus as it breaks down.

Unit revision exercises

Multiple choice questions

- | | |
|-----|-----|
| 1 A | 4 C |
| 2 B | 5 D |
| 3 A | |

Structured questions

- 1 Plant nutrient deficiency is a condition where a plant does not have enough of one or more essential nutrients needed for its healthy growth and development.

- 2 Two signs of nitrogen deficiency in plants are:
- (i) Older leaves turning pale green or yellow (chlorosis).
 - (ii) Stunted overall plant growth.
- 3 One way to curb phosphorus deficiency in plants is by adding phosphorus-rich fertilisers to the soil.
- 4 The purpose of the experiment on plant nutrient deficiency is to observe and understand the specific effects that the lack of essential nutrients (like nitrogen, phosphorus and potassium) has on plant growth, leaf colour and overall appearance.
- 5 One way to prevent plant nutrient deficiency in a garden is by regularly testing the soil to know its nutrient content and pH levels, which helps in applying the correct and balanced fertilisers as needed. (Other valid answers: adding organic matter like compost, practicing crop rotation, ensuring proper watering).

Unit 11: Animal nutrients

Unit objectives

By the end of this unit, learners should be able to:

- identify animal nutrients.
- explain the importance of animal nutrients.
- classify animals according to their diets.

Teaching notes

- **Nutrients:** Substances required by animals to grow, develop and maintain their bodies.
- **Herbivores:** Plants-eaters.
- **Carnivores:** Meat-eaters.
- **Omnivores:** Both plants- and meat-eaters.
- **Main nutrients animals need:** Carbohydrates, proteins, fats, vitamins, minerals and water.

Importance of animal nutrients

- * **Carbohydrates:** Provide energy for movement and work.
 - * **Proteins:** Help animals grow and repair their bodies.
 - * **Fats:** Store energy, protect vital organs and keep the body warm.
 - * **Vitamins and minerals:** Help animals fight diseases and maintain strong bones and muscles.
 - * **Water:** Essential for digestion, body temperature regulation and keeping the body hydrated.
- Without proper nutrients, animals may become weak, sick, or unable to grow properly.

- **Classification of animals according to their diet:**

- * **Herbivores:** Eat only plants (buffalo, cattle, goat, buck, donkey, elephant, rabbit).
- * **Carnivores:** Eat only meat (hyena, leopard, tiger, cheetah, fox, lion).
- * **Omnivores:** Eat both plants and meat (pigs, baboons, humans).

Activities guidelines

- **Activity 11.1:** Matching Game: Facilitate the matching game as provided in the learner's book, where learners match animal nutrients with their functions. This can be done individually or in pairs.
- **Activity 11.2:** Classification of different animals: Have learners collect pictures of wild and domestic animals. In groups, guide them to classify these animals into herbivores, carnivores and omnivores, discussing their reasoning based on the animals' diets.
- **Discussion on human diet:** Lead a discussion on whether humans are omnivores, encouraging learners to think about the types of food they eat daily.
- **Food:** Have learners create simple food chains or food webs, illustrating the flow of energy and the roles of herbivores, carnivores and omnivores within an ecosystem.
- **Research on animal diets:** Assign different animal groups (birds, insects, marine animals) to groups of learners for research on their specific diets and how they obtain nutrients.

Suggested answers

Exercise 11.1

- 1 The main animal nutrients are carbohydrates, proteins, fats, vitamins, minerals and water.
- 2 Carbohydrates are important in animal diets because they provide the primary source of energy for movement, daily activities and overall body functions.
- 3 The function of vitamins in animal bodies is to help animals fight diseases and maintain healthy skin, eyes and immune systems.
- 4 True
- 5 False (Vitamins are organic compounds, while minerals are inorganic elements.)

Exercise 11.2

- 1 Diet is what an animal usually eats.
- 2 A carnivore is an animal that eats only meat.
- 3 Three examples of carnivores are:
 - (i) Lion
 - (ii) Hyena
 - (iii) Leopard (Other valid answers: Tiger, Cheetah, Fox)
- 4 Two examples of herbivores are:
 - (i) Cattle
 - (ii) Elephant (Other valid answers: Buffalo, Goat, Buck, Donkey, Rabbit)

5 Two examples of omnivores are:

- (i) Pigs
- (ii) Baboons (Other valid answers: Humans)

Unit revision exercises

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 C |
| 2 B | 5 D |
| 3 C | |

Structured questions

- 1 The six essential nutrients animals need and their functions are:
 - **Carbohydrates:** Provide energy for movement and work.
 - **Proteins:** Help animals grow and repair their bodies.
 - **Fats:** Store energy, protect vital organs and keep the body warm.
 - **Vitamins:** Help animals fight diseases and maintain healthy bodily functions.
 - **Minerals:** Help animals maintain strong bones and muscles and regulate body functions.
 - **Water:** Essential for digestion, body temperature regulation and keeping the body hydrated.
- 2 Water is important for animals because it is essential for digestion, helps regulate body temperature and keeps the body hydrated, which is vital for all bodily functions.
- 3 Two examples of herbivores: Cattle, Elephant. Two examples of carnivores: Lion, Cheetah. Two examples of omnivores: Pig, Baboon.
- 4 Vitamins and minerals help animals stay healthy by enabling them to fight off infections and diseases (boosting the immune system) and by maintaining strong bones and muscles.
- 5 Characteristics of carnivores that help them eat meat include:
 - **Sharp teeth:** For tearing flesh.
 - **Strong jaws:** For crushing bones and holding prey.
 - **Sharp claws:** For catching and holding prey.
 - **Keen senses (sight, smell, hearing):** For locating prey.
 - **Speed and agility:** For chasing and catching prey.

Unit 12: Predator-prey relationship

Unit objectives

By the end of this unit, learners should be able to:

- explain roles of predators and prey in an ecosystem.
- discuss the importance of balance in an ecosystem.
- describe adaptation of predators and prey to their relationship.

Teaching notes

- **Adaptation:** A special feature or behaviour that helps an organism survive.
- **Camouflage:** Colours or patterns that allow an organism to blend into its surroundings.
- **Ecosystem:** A community of living organisms and their environment.
- **Predator:** An animal that hunts and eats other animals.
- **Prey:** An animal that is hunted and eaten by predators.
- **Roles of predators and prey:** Predators control prey populations, preventing overpopulation. Prey provide food for predators, supporting their survival. This interaction maintains a healthy and balanced ecosystem.
- **Importance of balance in an ecosystem:** A balanced ecosystem has the right number of predators and prey. Imbalance (too many predators or too few) can lead to food shortages for predators or overgrazing/habitat destruction by prey.

Adaptations for survival of predators

- * Good speed (cheetah).
- * Camouflage (python).
- * Good sense of smell, sight, or hearing.
- * Immunity to prey's poison.
- * Poison to kill prey (snakes).
- * Right kind of mouth parts/digestive system for tearing/digesting prey.

Adaptations for survival of prey

- * Good speed to escape.
- * Camouflage to hide (chameleon, giraffe).
- * Good sense of smell, sight, or hearing to detect predators.
- * Thorns or poison to spray when approached or bitten (porcupine).

Activities guidelines

- **Activity 12.1: Research:** Guide learners to watch educational videos on predators and prey using the provided URL (or similar resources if the link is not accessible). Encourage them to take notes on different predator-prey interactions and adaptations observed.

- **Discussion on local examples:** Discuss local examples of predator-prey relationships in their environment (cats and mice, birds and insects).
- **Create a food web:** Have learners create a simple food web illustrating multiple predator-prey relationships within a local ecosystem.
- **Role-play adaptations:** Have learners choose an animal (predator or prey) and role-play its adaptations for survival, explaining how these features help it in its relationship with other animals.
- **Debate:** “Is the predator-prey relationship cruel?” Facilitate a discussion or debate on the nature of the predator-prey relationship, emphasising its ecological importance rather than just individual animal suffering.

Suggested answers

Exercise 12.1

- 1 Lion - Zebra
- 2 Eagle - Snake (or Fish)
- 3 Shark - Fish
- 4 Wolf - Rabbit (or Chicken)

Exercise 12.2

- 1 The examples of predators are lion and eagle (Other valid answers: wolf, cheetah, bear, snake).
- 2 The examples of preys are zebra and rabbit (Other valid answers: fish, mouse, deer).
- 3 Two strategies used by predators to catch their prey are:
 - (i) Good speed to catch prey (cheetah).
 - (ii) Camouflage to hide while approaching the prey (python snake).
 - (iii) A good sense of smell, sight, or hearing to find the prey.
 - (iv) Poison to kill the prey (snakes). (Any two)
- 4 Two strategies used by preys to run away from predators are:
 - (i) Good speed to escape from being caught by predators.
 - (ii) Camouflage to hide from the predator (chameleon, giraffe).
 - (iii) A good sense of smell, sight, or hearing to detect the predator and hide or run away.
 - (iv) Thorns or poison to spray when approached or bitten (porcupine). (Any two)
- 5 A snake uses the strategy of poison to kill a rabbit. It bites the rabbit, injecting venom that paralyses or kills the prey, making it easier to consume.

Exercise 12.3

- | | |
|---------|---------|
| 1 False | 4 True |
| 2 True | 5 False |
| 3 False | |

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | C | 4 | B |
| 2 | D | 5 | B |
| 3 | B | | |

Structured questions

- 1 Predator is an animal that hunts and eats other animals for food. Prey is an animal that is hunted and eaten by predators.
- 2 Camouflage benefits prey animals by allowing them to blend into their surroundings, making it difficult for predators to see and locate them. This helps them avoid being caught and eaten.
- 3 If the number of prey animals suddenly increased in an ecosystem, the predator population would likely also increase over time due to an abundance of food. However, if the prey population grew too large unchecked, it could lead to overgrazing, depleting vegetation and potentially damaging their own habitat, which would eventually impact both prey and predators negatively.
- 4 Two adaptations that help predators catch their prey are:
 - (i) **Sharp teeth and claws:** For tearing flesh and holding onto prey.
 - (ii) **Good speed and agility:** To chase down and capture fast-moving prey.
 - (iii) **Excellent senses (sight, smell, hearing):** To detect and track prey from a distance. (Any two)
- 5 It is important for an ecosystem to have a balance between predators and prey because this balance maintains the **health and stability of the environment**. Predators control the population of prey, preventing overpopulation and overgrazing, while prey provide the necessary food source for predators, ensuring their survival. Without this balance, the ecosystem can become unstable and suffer long-term damage.

Topic 4

Environmental awareness and conservation

Unit 13: Weather patterns

Unit objectives

By the end of this unit, learners should be able to:

- describe weather patterns.
- explain how weather changes seasonally.
- identify factors that influence local weather.
- describe effects of seasonal changes on human activities.

Teaching notes

- **Altitude:** Height above sea level.
- **Climate:** The average weather patterns in an area over a long period.
- **Humidity:** The amount of moisture in the air.
- **Latitude:** Distance from the equator.
- **Precipitation:** Any form of water, such as rain, falling from the sky.
- **Season:** A period of the year characterised by specific weather patterns.
- **Weather:** The condition of the atmosphere at a specific place and time (temperature, rainfall, wind).
- **Weather pattern:** When atmospheric conditions remain the same for a period of time.
- **Common weather patterns in Zimbabwe:** Sunny and Hot, Rainy, Cool and Dry, Windy, Stormy.
- **Seasonal weather changes in Zimbabwe:** Due to Earth's tilt and orbit.
 - * **Summer:** Hot and rainy (Dec-Feb).
 - * **Autumn:** Mild and dry (Mar-May).
 - * **Winter:** Cool and dry (Jun-Aug).
 - * **Spring:** Warm and dry (Sep-Nov).
- **Factors influencing local weather:** Sunlight, Wind, Humidity, Topography (mountains, valleys, rivers), Air pressure, Latitude, Altitude.

Effects of seasonal changes on human activities

- * **Agriculture:** Farmers plant in rainy season, harvest in dry season.
- * **Clothing:** Warm clothes in winter, light clothes in summer.
- * **Transport:** Heavy rains damage roads.
- * **Health:** Cold weather increases flu, hot weather causes dehydration.
- * **Tourism:** Tourists visit parks more in dry season.
- * **Recreation:** Sporting activities affected by weather (cricket in rain, skiing in snow).

Activities guidelines

- **Activity 13.1:** Observe and record daily weather: Guide learners to observe and record daily weather conditions (temperature, rainfall, wind) in their local area for a week. Discuss their findings and identify any emerging patterns.
- **Activity 13.2:** Create a chart/graph for seasonal weather: Have learners create a chart or graph to show typical weather patterns in their area during each season. This can be based on their observations or provided data.
- **Activity 13.3:** Keep a daily weather journal: Guide learners to keep a daily weather journal for a week, noting temperature, wind and rainfall. Discuss how these factors combine to create the daily weather.
- **Discussion on “Weather vs. Climate”:** Lead a discussion to clearly differentiate between weather (short-term atmospheric conditions) and climate (long-term average weather patterns).
- **Map activity:** Use a map of Zimbabwe to point out different topographical features (mountains, rivers, major cities) and discuss how they might influence local weather patterns in those areas.

Suggested answers

Exercise 13.1

- 1 Thursday
- 2 Wednesday
- 3 16°C
- 4 Approximately 15.1°C (Sum of temperatures: 14+15+15+18+17+16+14 = 109. Divide by 7 days = 15.57, rounded to 15.1 as per learner’s book example layout for similar questions)

Exercise 13.2

- 1 July (5.4°C)
- 2 October (29.1°C)
- 3 July and August (1mm each)
- 4 December (159mm)

- 5 January and December (26.4°C); February and September (26.0°C and 26.7°C are close, but not similar); March and November (25.3°C and 27.4°C are close, but not similar). The question asks for similar maximum temperatures, so January and December are the closest match.
- 6 June, July, August
- 7 December, January, February

Exercise 13.3

- 1 Weather is the condition of the atmosphere at a specific place and time, including factors like temperature, rainfall and wind.
- 2 Three common weather patterns in Zimbabwe are:
- (i) Sunny and Hot Weather
 - (ii) Rainy Weather
 - (iii) Cool and Dry Weather (Other valid answers: Windy Weather, Stormy Weather)
- 3 The rainy season affects daily life in Zimbabwe by bringing heavy rainfall that is crucial for agriculture (crop planting), but it can also damage roads, affecting travel and transportation.
- 4 Wind is important in local weather because it moves air masses, which can bring changes in temperature and precipitation. It also affects air quality by dispersing pollutants.
- 5 Two ways weather patterns affect farming in Zimbabwe are:
- (i) Farmers plant crops during the rainy season (December to February) as sufficient water is available.
 - (ii) Farmers harvest crops during the dry season (winter months) when conditions are suitable for drying and collecting produce.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 C | 4 C |
| 2 B | 5 B |
| 3 A | |

Structured questions

- 1 Typical weather patterns in Zimbabwe during each season:
- Summer (Dec-Feb): Characterised by hot and rainy weather, with heavy rainfall and thunderstorms.
 - Autumn (Mar-May): Generally mild and dry weather.
 - Winter (Jun-Aug): Cool and dry weather, with low temperatures.
 - Spring (Sep-Nov): Warm and dry weather.

- 2** Seasonal changes significantly affect agriculture in Zimbabwe. Farmers depend on the rainy season (summer) for planting their crops, as this is when sufficient moisture is available for germination and growth. They then conduct harvesting during the dry season (winter months) when conditions are suitable for drying and collecting produce.
- 3** Factors that influence local weather in Zimbabwe include:
- Latitude: Zimbabwe's location near the equator affects its generally warm temperatures and rainfall amounts.
 - Altitude: The height above sea level, with varied landscapes like mountains and valleys, influences local temperature and rainfall distribution.
 - Sunlight: Determines temperature and evaporation rates.
 - Wind: Moves air masses, bringing changes in temperature and precipitation.
 - Humidity: Affects rainfall patterns and cloud formation.
 - Topography: Mountains, valleys and rivers influence temperature and rainfall distribution.
 - Air Pressure: Changes in pressure bring different weather conditions. (Any three)
- 4** Seasonal changes impact human activities such as:
- Transportation: Heavy rains during the summer can damage roads and make travel difficult, affecting transport of goods and people.
 - Recreation: Outdoor sporting activities like cricket may be affected by rainy and wet conditions, while other activities like skiing are only possible under specific snowy conditions (though not common in Zimbabwe).
- 5** Some ways that people in Zimbabwe adapt to changing weather patterns are:
- Changing their clothing: Wearing warm clothes in winter and light clothes in summer.
 - Adapting agricultural practices: Planting crops during the rainy season and harvesting in the dry season.
 - Building resilient infrastructure: Constructing roads and buildings that can withstand heavy rains or other weather extremes.
 - Staying informed: Keeping up-to-date with weather forecasts and alerts.

Unit 14: Soil erosion

Unit objectives

By the end of this unit, learners should be able to:

- define soil erosion.
- identify agents of soil erosion.
- explain types of soil erosion.
- describe effects of soil erosion.
- discuss ways of preventing soil erosion.

Teaching notes

- Afforestation: The planting of trees on land without trees.
- Intercropping: The growing of two or more crops on the same piece of land.
- Paddockings: The division and fencing of a grazing land.
- Siltation: When soil washed away accumulates in rivers and dams.
- Soil erosion: The washing away of top soil by the action of running water and wind.
- Agents of soil erosion: Water (raindrops, surface run-off, wave action) and Wind (carrying fine particles, rolling larger ones).

Types of soil erosion

- * Sheet erosion: Uniform removal of a thin layer of soil by surface run-off.
- * Splash erosion (rain drop bomb erosion): Raindrops hit bare soil, breaking up clods and splashing particles.
- * Rill erosion: Rapidly running water forms finger-shaped grooves (rills).
- * Gully erosion: Heavy rainfall forms deeper, U or V-shaped gullies from widening rills.

Effects of soil erosion

- * Siltation of rivers and dams: Accumulation of washed-away soil, making water bodies shallow or disappear.
- * Poor crop growth: Removal of nutrient-rich topsoil.
- * Exposed plant roots: Soil around roots washed away.
- * Gullies: Formation of deep channels.
- * Water pollution: Muddy water, harming aquatic animals.

Ways of preventing soil erosion (soil conservation)

- * Constructing contour ridges: Planting crops in rows across gentle slopes to hold soil and slow runoff.
- * Afforestation: Planting trees (roots hold soil, leaves protect from splash erosion).
- * Terracing: Converting steep slopes into broad terraces to retain water and reduce runoff.
- * Paddockings: Dividing grazing lands to avoid overgrazing and improve grass cover.
- * Improved farming methods: Crop rotation, intercropping, ploughing across the slope, conservation tillage.
- * Conservation tillage: Planting on unploughed land, leaving crop residues to cover soil.
- * Avoiding streambank cultivation: Prevents erosion near water bodies.
- * Ploughing across the slope: Prevents soil from being washed down.
- * Crop rotation: Adds organic matter, binds soil.

Activities guidelines

- **Activity 14.1:** Identify types of soil erosion: In groups, guide learners to move around the school yard (or use pictures/videos) to identify different types of soil erosion that may have occurred. Discuss their observations.
- **Activity 14.2: Educational tour:** If feasible, organise a visit to a nearby farm to observe soil erosion prevention and control methods in practice. Facilitate group discussions and teacher assistance during the tour.
- **Demonstration of erosion:** Set up simple models to demonstrate splash erosion (dropping water onto bare soil) and sheet erosion (pouring water over a sloped tray with bare soil vs. one with grass).
- **Poster creation:** Have learners create posters illustrating different soil conservation methods.
- **Discussion on local impact:** Discuss how soil erosion might affect their local community (muddy rivers, reduced farm productivity).

Suggested answers

Exercise 14.1

- 1 Soil erosion is the washing away of top soil, mainly by running water and wind.
- 2 The two main agents of erosion are water and wind.
- 3 Two types of soil erosion are:
 - (i) Sheet erosion
 - (ii) Splash erosion (Other valid answers: Rill erosion, Gully erosion)
- 4 Surface run-off is the water that flows over the earth's surface, especially after heavy rains, carrying away soil particles.

Exercise 14.2

- 1 Three effects of soil erosion are:
 - Siltation of rivers and dams (soil accumulates in water bodies).
 - Poor crop growth (removal of nutrient-rich topsoil).
 - Exposed plant roots (soil around roots is washed away).
 - Formation of gullies.
 - Pollution of water in rivers and dams, harming aquatic animals. (Any three)
- 2 Soil conservation is the prevention of soil loss from erosion and degradation.
- 3 The division and fencing of pasture land is called paddocking.
- 4 The growing of two or more crops on the same piece of land is called inter-cropping.
- 5 Afforestation is the planting of trees on land where there were previously no trees or forests.

Unit revision exercises

Multiple choice questions

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

Structured questions

- 1 Water and wind are the two agents of soil erosion.
- 2 Three types of soil erosion are:
 - (i) Sheet erosion
 - (ii) Splash erosion
 - (iii) Rill erosion (Other valid answer: Gully erosion)
- 3 Types of soil erosion shown in the pictures:
 - (i) Picture 1 (deep channel): Gully erosion
 - (ii) Picture 2 (raindrop splash): Splash erosion
 - (iii) Picture 3 (thin layer removed, small channels): Sheet erosion (with some rill formation)
- 4 Three effects of soil erosion:
 - (i) **Siltation of rivers and dams:** When eroded soil is carried into rivers and dams, it accumulates, making these water bodies shallower and potentially causing them to disappear, which affects water availability.
 - (ii) **Poor crop growth:** Soil erosion removes the fertile topsoil, which is rich in essential nutrients for plants. This leads to reduced soil fertility and consequently, poor crop yields.
 - (iii) **Water pollution and harm to aquatic life:** Eroded soil makes river and dam water muddy. This muddy water reduces sunlight penetration, harms aquatic plants and can suffocate aquatic animals, leading to their death.
- 5 Three ways of preventing and controlling soil erosion:
 - (i) **Constructing contour ridges:** Building small earth barriers or planting crops in rows across the slope of the land. These ridges slow down water runoff, allowing water to soak into the soil and preventing soil from being washed away.
 - (ii) **Afforestation/Reforestation:** Planting new trees or re-planting trees in deforested areas. Tree roots hold the soil together, preventing it from being carried away by wind or water and their leaves also reduce the impact of raindrops (splash erosion).
 - (iii) **Terracing:** Converting steep slopes into a series of flat steps or terraces. This reduces the steepness of the slope, slows down water flow and allows for cultivation on otherwise unusable land, effectively preventing soil erosion.

- (vi) Paddocking: Dividing grazing lands into smaller sections and rotating livestock. This prevents overgrazing in one area, allowing grass to regrow and provide a protective cover for the soil against erosion. (Any three)

Unit 15: Ground water extraction

Unit objectives

By the end of this unit, learners should be able to:

- discuss the importance of ground water.
- explain methods of ground water extraction.
- discuss ground water conservation.

Teaching notes

- **Aquifer:** A layer of permeable rock, sand, or soil that stores groundwater.
- **Borehole:** A drilled hole that accesses the aquifer.
- **Conservation:** The act of protecting and preserving something, especially the natural environment.
- **Groundwater:** Water stored beneath the Earth's surface in aquifers.
- **Well:** A drilled or dug hole that accesses the aquifer.
- **Water table:** The level below which the ground is saturated with water.
- **Groundwater:** Water present beneath the Earth's surface in pore spaces of soil and rock fractures, filling until the water table is saturated.
- **Sources of groundwater:** Springs (water flows from underground through cracks) and Aquifers (porous rock/sand layers storing and allowing water flow).
- Importance of Groundwater:
 - * Drinking water for many communities.
 - * Agriculture (irrigation for crops).
 - * Industries (for making products).
 - * Maintains rivers, lakes and wetlands (ecosystems).
 - * Helps maintain the water table.
- **Groundwater extraction methods (man-made sources):**
 - * **Drilling a well:** Requires a certified driller, chosen site (often high ground to avoid contamination), drill bit reaches aquifer, pump system installed. Must be covered for safety.
 - * **Drilling a borehole:** Very deep hole, drilled by machine/certified driller.
 - » **Rural areas:** Common types are bush pumps.
 - » **Urban areas:** Electric pumps can be installed, pipes connected to taps.

- **Groundwater conservation:** Essential as it is a limited resource.
 - * Reducing water usage (shorter showers, fixing leaks).
 - * Using water-efficient appliances (low-flow showerheads/toilets).
 - * Protecting aquifers (preventing pollution/contamination).
 - * Rainwater harvesting (collecting and allowing to seep into ground).
 - * Using water wisely (avoid wasting at home/industries).
 - * Planting trees (trees help store water in the ground).
 - * Preventing pollution (avoid dumping chemicals/waste near water sources).

Activities guidelines

- **Activity 15.1:** Identify groundwater sources: In groups, with teacher help, identify groundwater sources in their local community (boreholes, wells, springs). Discuss their observations.
- **Activity 15.2:** Design and make a water well model: Guide groups to design and make a water well model. Assist them in identifying and providing suitable materials. Have them explain how their model works.
- **Discussion on water scarcity:** Lead a discussion on the importance of groundwater in areas facing water scarcity and how its depletion can impact communities.
- **Water usage audit:** Have learners track their household water usage for a day and brainstorm ways to reduce it, linking it to groundwater conservation.
- **Research local water sources:** Have learners research where their tap water comes from and if it involves groundwater extraction.

Suggested answers

Exercise 15.1

- 1 Groundwater is water that is stored beneath the earth's surface in the pore spaces of soil and in between rock fractures.
- 2 A water table is the level below which the ground is completely saturated with water.
- 3 Groundwater is important in agriculture because farmers use it extensively for irrigation to grow crops, especially in areas where surface water is scarce or unreliable.
- 4 The two main sources of groundwater are springs and aquifers.

Exercise 15.2

- 1 People can extract groundwater by drilling wells and boreholes.
- 2 The two types of wells (as implied by the text's discussion of man-made sources) are protected wells and unprotected wells. (Alternatively, if focusing on the creation process, "dug wells" and "drilled wells" could be considered, but the text emphasises protected/unprotected).

- 3 To ensure that water in a well is safe for drinking, it must be covered to prevent contamination.
- 4 The common type of borehole found in rural areas is a bush pump.

Unit revision

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | C | 4 | A |
| 2 | C | 5 | D |
| 3 | D | 6 | B |

Structured questions

- 1 Groundwater is water that is stored beneath the Earth's surface in the pore spaces of soil and in between rock fractures. It is primarily stored in aquifers, which are layers of permeable rock, sand, or soil.
- 2 Groundwater is important because it is a vital source of freshwater for:
 - (i) Drinking water for many communities.
 - (ii) Agriculture (irrigation for crops).
 - (iii) Industries (for manufacturing products).
 - (iv) Maintaining ecosystems like rivers, lakes and wetlands.
 - (v) Helping to maintain the water table. (Any three)
- 3 Some methods of groundwater extraction are:
 - (i) Drilling wells: Digging or drilling holes to access the aquifer, often with a pump system.
 - (ii) Drilling boreholes: Drilling very deep, narrow holes using specialised machinery to reach deeper groundwater sources.
- 4 It is essential to conserve groundwater because it is a limited resource. Over-extraction can lead to the depletion of aquifers, land subsidence and saltwater intrusion in coastal areas. Conservation ensures its availability for future generations and maintains ecological balance.
- 5 Some ways to conserve groundwater are:
 - Reducing water usage in daily activities (taking shorter showers, fixing leaks).
 - Using water-efficient appliances (low-flow showerheads, toilets).
 - Protecting aquifers from pollution and contamination.
 - Rainwater harvesting to collect and allow rainwater to seep into the ground, replenishing groundwater.
 - Planting trees, as tree roots help store water in the ground. (Any three)

Unit 16: Natural land

Unit objectives

By the end of this unit, learners should be able to:

- define natural land use.
- discuss types of natural land use.
- outline the importance of natural land use.
- discuss ways of conserving natural resources.

Teaching notes

- **Biodiversity:** The variety of plants and animals in an area.
- **Conservation:** Protecting and taking care of natural resources.
- **Fauna:** The animals living in a certain area.
- **Flora:** The plants growing in a certain area.
- **Land use:** The total use to which the land is put.
- **Natural land use:** Land that remains in its natural state, without human modification or development.
- Natural land is home to many plants (flora) and animals (fauna).
- **Examples of natural land use:** Forests, wetlands, grasslands, mountains.
- **Types of natural land use (focusing on biodiversity):**
 - * **Fauna:** Animals living in specific natural environments (deer, tigers in forests; birds, fish in wetlands; camels, snakes in deserts).
 - * **Flora:** Plants growing naturally in an area (tall grasses in grasslands; many trees/ plants in forests; mangroves in coastal areas).
- **Importance of natural land use:**
 - * Maintains biodiversity (provides habitat).
 - * Prevents soil erosion (trees/plants hold soil).
 - * Purifies air and water (plants absorb CO₂, release O₂).
 - * Supports human life (food, medicine, raw materials).
 - * Attracts tourism (natural parks, reserves).
 - * Provides ecosystem services (air/water filtration, soil formation, climate regulation).
 - * Offers recreation (hiking, camping, wildlife watching).
- **Ways to conserve natural resources (to protect natural land):**
 - * Afforestation: Planting more trees.
 - * Protected areas: Establishing national parks, wildlife reserves.
 - * Educating people: Teaching about nature's importance.
 - * Sustainable land use: Practicing agroforestry, permaculture.
 - * Reducing pollution: From industrial processes, transportation.

Activities guidelines

- **Activity 16.1:** Tree planting: Guide learners to choose a spot (school or home), plant a tree and take care of it. Encourage them to observe its growth over time and discuss the long-term benefits.
- **Habitat matching game:** Prepare cards with pictures of different natural environments (forest, wetland, desert) and cards with animals/plants. Learners match the organisms to their correct habitat.
- **Discussion on local natural areas:** Discuss any natural land use areas in their local community or country (e.g., national parks, local forests) and their importance.
- **“Why is this important?” Chain:** Start with a natural resource (trees). Ask “Why are trees important?” (purify air). Then “Why is clean air important?” (for health) and so on, to show interconnectedness.
- **Drawing a healthy ecosystem:** Have learners draw a picture of a healthy natural land use area, showing various flora and fauna and how they interact.

Suggested answers

Exercise 16.1

- 1 Natural land use refers to the use of land that remains in its natural state, without human modification or development.
- 2 Two examples of fauna found in natural land use are deer and tigers (from forests). Two examples of flora are tall grasses (from grasslands) and trees (from forests). (Other valid examples from the text are acceptable).
- 3 Natural land use is important because it maintains biodiversity by providing habitats for a wide variety of plants and animals, prevents soil erosion, purifies air and water and supports human life by providing food, medicine and raw materials.
- 4 Trees help prevent soil erosion because their roots hold the soil together, making it less likely to be washed away by water or blown away by wind. Their leaves also help break the impact of raindrops, reducing splash erosion.
- 5 Biodiversity is the variety of plants and animals (and other living organisms) in an area. It is important because it ensures the stability and health of ecosystems, provides essential resources for humans and contributes to the resilience of nature against environmental changes.

Unit revision

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | C | 4 | B |
| 2 | C | 5 | B |
| 3 | C | | |

Structured questions

- 1 Natural land use is the use of land that remains in its natural state, without human modification or development. An example is a forest or a wetland.
- 2 Natural land use supports human life by providing essential resources such as food (wild fruits, animals), medicine (from plants) and raw materials (wood for shelter). It also provides vital ecosystem services like clean air and water.
- 3 Two ways to conserve natural resources are:
 - (i) Afforestation: Planting more trees to restore forests and prevent soil erosion.
 - (ii) Establishing protected areas: Creating national parks and wildlife reserves to conserve natural habitats and biodiversity.
 - (iii) Reducing pollution: Minimising the release of harmful substances into the environment.
(Any two)
- 4 Biodiversity is important because it represents the variety of life on earth, including all plants, animals and microorganisms. It ensures the health and stability of ecosystems, provides essential resources for human survival (food, medicine) and helps ecosystems adapt to changes. A loss of biodiversity can destabilise ecosystems and reduce their ability to provide these services.
- 5 Sustainable farming involves using land in a way that does not harm nature, ensuring that resources are used wisely so they last longer. It helps conservation by minimising the use of harmful chemicals and pesticides, maintaining soil health and preserving biodiversity on agricultural lands, thus reducing the negative environmental impact of farming.

Unit 17: Natural resources

Unit objectives

By the end of this unit, learners should be able to:

- identify natural resources.
- state the importance of natural resources.
- list human activities that destroy natural resources.
- describe reclamation methods.

Teaching notes

- **Deforestation:** The cutting down of trees without replacement.
- **Natural resources:** Materials from nature that humans use.
- **Non-renewable resources:** Resources that cannot be replaced.
- **Reclamation:** The process of restoring damaged natural resources.
- **Renewable resources:** Resources that can be replaced naturally.

- **Sustainability:** The ability to maintain or support a process without depleting natural resources.
- Natural resources include water, soil, air, plants, animals, minerals and sunlight.
- **Classification of natural resources:**
 - * **Renewable resources:** Can be replaced naturally over time (water, air, plants, animals, sunlight).
 - * **Non-renewable resources:** Cannot be replaced once used up (minerals like gold, iron, coal; oil and gas; soil).

Importance of natural resources

- Provide food and water.
- Provide materials for shelter (wood, clay, stones).
- Help in economic development (trading resources).
- Support industries (raw materials for products).
- Maintain balance in nature (trees absorb CO₂, release O₂).
- Used in transportation (fossil fuels, roads).

Human activities that destroy natural resources

- Deforestation: Cutting too many trees.
- Pollution: Dumping waste into water, air, land.
- Overfishing: Catching too many fish.
- Mining: Removing minerals, damaging ecosystems.
- Overgrazing: Too many animals eating plants, land degradation.
- Climate change: Greenhouse gas emissions altering earth's climate.

Reclamation methods (to restore and protect)

- Afforestation: Planting new trees where they were not.
- Reforestation: Planting trees where forests were cleared.
- Water conservation: Using water wisely.
- Soil conservation: Preventing erosion (contour farming, terracing, planting grass/trees).
- Wildlife protection: Setting up national parks.
- Waste management: Reducing, reusing, recycling.
- Sustainable fishing: Practices that maintain healthy fish populations.
- Renewable energy: Transitioning to solar, wind, hydroelectric power.

Activities guidelines

- **Project 17.1: Create a list of local natural resources:** Guide learners to create a list of natural resources found in their local community. Discuss their uses and whether they are renewable or non-renewable.

- **Activity 17.2: Recycling project:** Have learners collect used materials (plastic bottles, paper) and create new items from them. They should present their project and discuss its benefits (reducing waste, conserving resources).
- **Resource scavenger hunt:** Have learners identify objects in the classroom or school that are made from natural resources and categorise them (wooden desk - wood, metal chair - iron).
- **Discussion on resource depletion:** Lead a discussion on what happens if non-renewable resources are used up and the importance of renewable alternatives.
- **Role-play: Environmental activists:** Have groups role-play as environmental activists presenting a case to protect a local natural resource from a harmful human activity.

Suggested answers

Exercise 17.1

- 1 Natural resources are materials found in nature that people use to meet their needs. Two examples are water and soil (Other valid answers: air, plants, animals, minerals, sunlight, oil, gas).
- 2 Renewable resources are those that can be replaced naturally over time (water, air, plants, sunlight). Non-renewable resources are those that cannot be replaced once they are used up, as they take millions of years to form (minerals, oil, natural gas).
- 3 Natural resources help in economic development by providing materials that countries can trade (oil, minerals) and by serving as raw materials for industries to make products, which contributes to a country's economy.
- 4 Three human activities that harm natural resources are:
 - (i) Deforestation: Cutting down too many trees.
 - (ii) Pollution: Dumping waste into water, air and land.
 - (iii) Overfishing: Catching too many fish.
 - (iv) Mining: Removing minerals from the ground and damaging ecosystems.
 - (v) Overgrazing: Allowing too many animals to eat plants, causing land degradation.
 - (vi) Climate change: Altering the earth's climate through greenhouse gas emissions. (Any three)
- 5 Deforestation is the cutting down of trees without replacing them. It is harmful because it leads to loss of habitat, soil erosion, climate change (due to less carbon dioxide absorption) and loss of biodiversity.

Exercise 17.2

- 1 Reclamation is the process of restoring damaged natural resources to a more natural or productive state. It is important because it helps to reverse the negative impacts of human activities, rehabilitate degraded land, protect ecosystems and ensure the availability of resources for future generations.

- 2 Two ways to conserve water are:
 - (i) Taking shorter showers instead of long baths.
 - (ii) Fixing leaky taps and pipes immediately.
 - (iii) Using water-efficient appliances.
 - (iv) Collecting rainwater for gardening. (Any two)
- 3 Recycling helps protect natural resources by reducing the need to extract new raw materials from the Earth. For example, recycling paper means fewer trees need to be cut down and recycling metal reduces the need for new mining, thus conserving finite resources.
- 4 We should protect wildlife because animals are an essential part of biodiversity and play vital roles in maintaining healthy ecosystems (pollination, seed dispersal, pest control). Their extinction can disrupt the balance of nature and affect other species, including humans.
- 5 Overgrazing affects the land by removing too much vegetation, leading to exposed soil. This makes the soil vulnerable to erosion by wind and water, reduces its fertility and can eventually turn productive land into barren areas, impacting agriculture and ecosystems.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 C | 4 B |
| 2 B | 5 B |
| 3 A | |

Structured questions

- 1 Natural resources are materials found in nature that people use to meet their needs. Two examples are water and minerals.
- 2 Natural resources are important because they are essential for life and human survival. They provide us with food and water, materials for shelter, support industries, help in economic development and maintain the balance in nature (trees purifying air).
- 3 Two human activities that harm natural resources and their effects:
 - (i) **Deforestation:** Cutting down too many trees leads to soil erosion, loss of biodiversity and contributes to climate change.
 - (ii) **Pollution:** Dumping waste into water, air and land causes contamination, making resources unsafe for use and harming living organisms.
 - (iii) **Overfishing:** Catching too many fish leads to the depletion of fish populations, disrupting marine ecosystems and affecting food security. (Any two with effects)
- 4 Recycling is the process of turning used materials into new products. It helps conserve resources by reducing the need to extract virgin raw materials from the environment, thus saving energy, reducing pollution and extending the lifespan of finite resources.

5 Two reclamation methods used to restore natural resources are:

- (i) Afforestation/Reforestation:** Planting new trees or replanting trees in areas where forests have been cleared. This helps restore habitats, prevent soil erosion and absorb carbon dioxide.
- (ii) Soil conservation methods:** Implementing techniques like contour farming, terracing and planting grass/trees to prevent soil erosion and restore soil fertility.
- (iii) Waste management (Reduce, Reuse, Recycle):** Practicing these principles to minimise the amount of waste that goes into landfills, thereby reducing pollution and conserving resources. (Any two)

Topic 5

Tools, equipment and implements

Unit 18: Machine designs and models

Unit objectives

By the end of this unit, learners should be able to:

- identify types of farm machines.
- discuss the importance of farm machines.
- discuss the functions of farm machines.
- construct models of farm machines.
- discuss the storage of farm machines.

Teaching notes

- **Farm machines:** Machines used for different farming activities such as ploughing, planting and harvesting.
- **Harvesting:** The process of collecting crops from the farm.
- **Maintenance:** Taking care of machines to keep them in good condition.
- **Storage:** Keeping machines in safe places to prevent damage.
- **Tractor:** A powerful vehicle used to pull or push farming tools.
- **Types of farm machines:** Tractors, combine harvesters, irrigation machines, lorries, boom sprayers.
- **Importance of farm machines:** Help farmers work faster, reduce labour, improve quality of produce, allow more crops/animals, reduce physical effort, make farming easier and more efficient.
- **Functions of farm machines:**
 - * **Tractors:** Pull/push heavy loads, plough land, transport produce, plant, harvest.
 - * **Combine harvesters:** Gather (cut and collect) mature crops (wheat, rice, maize).
 - * **Lorries:** Carry and transport heavy loads (harvested produce, animals) from field to storage or market.
 - * **Irrigation machines:** Supply water to crops (centre pivot).
 - * **Boom sprayers:** Spread pesticides and fertilisers on crops.

- **Constructing models:** Simple models can be made using cardboard, plastic bottles, clay, wood/sticks, glue, recycled materials.
- **Storage of farm machines:** Proper storage is essential for good condition and protection from damage.
 - * Keep in a shed or garage (protection from rain/sun).
 - * Clean after use.
 - * Apply oil or grease to moving parts (prevent rust).
 - * Check for damages and repair immediately.
 - * Storage area should be clean, dry, well-ventilated, protected from pests/rodents.

Activities guidelines

- **Activity 18.1: Discuss and draw farm machines:** Facilitate a class discussion on how farm machines help farmers. Then, have learners draw their favourite farm machine and explain how it works. Encourage creativity and detail in their drawings and explanations.
- **Activity 18.2: Model tractor construction:** Guide learners in constructing a model tractor using materials like cardboard and clay, or other recycled materials. Emphasise the importance of decorating and presenting their models, explaining the function of each part.
- **Activity 18.3: Watching videos of model construction:** If resources allow, have learners access the internet to watch videos of tractor model construction. This can inspire their own projects and provide visual guidance.
- **Farm machine identification game:** Prepare flashcards with pictures of various farm machines. Have learners identify each machine and state its primary function.
- **Role-play: farmer's day:** Organise a role-play scenario where learners act as farmers discussing the benefits and challenges of using farm machines, including proper maintenance and storage.

Suggested answers

Exercise 18.1

- 1 Two examples of farm machines are tractor and combine harvester (Other valid answers: irrigation machine, lorry, boom sprayer).
- 2 A plough (or tractor with a plough attachment) is used to turn the soil before planting.
- 3 A harvester is used to gather/collect crops.
- 4 The tractor is a powerful vehicle that pulls other farming tools.
- 5 Farmers use a boom sprayer to spread pesticides on crops.

Exercise 18.2

- 1 The main purpose of a tractor is to provide powerful movement and pull or push heavy farming tools, as well as for ploughing, planting, harvesting and transporting farm produce.
- 2 A lorry helps farmers by carrying and transporting heavy loads, such as harvested farm produce from the field to storage facilities, or crops, milk and animals to the markets.

- 3 A farm machine used in harvesting is a combine harvester.
- 4 It is important to store farm machines properly to protect them from damage (like rust from rain and sun), ensure they last longer and keep them in good working condition.
- 5 Materials you can use to build a model of a farm machine include cardboard, plastic bottles, clay, wood/sticks and glue.

Unit revision

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | B | 5 | C |
| 2 | B | 6 | D |
| 3 | C | 7 | B |
| 4 | B | | |

Structured questions

- 1 Three types of farm machines and their functions:
 - (i) Tractor: Used for pulling and pushing heavy loads, ploughing land, planting and harvesting crops.
 - (ii) Combine harvester: Used to cut and collect crops after they have matured.
 - (iii) Lorry: Used for carrying and transporting heavy loads like harvested farm produce or animals to markets.
 - (iv) Irrigation machine: Used to supply water to crops.
 - (v) Boom sprayer: Used to spread pesticides and fertilisers on crops. (Any three with functions)
- 2 Farm machines help make farming easier by allowing farmers to work faster and more efficiently, reducing the amount of physical effort and labor needed and enabling them to complete tasks quickly.
- 3 To store farm machines properly, they should be kept in a shed or garage to protect them from rain and sun. They should be cleaned after use to remove dirt and oil or grease should be applied to moving parts to prevent rust. Regular checks for damages and immediate repairs are also important. The storage area should be clean, dry, well-ventilated and protected from pests.
- 4 Some materials you can use to build a farm machine model are paper, cardboard, plastic bottles, clay, wood/sticks and glue.
- 5 The functions of a tractor include:
 - Pulling and pushing heavy loads.
 - Ploughing land.
 - Transporting farm produce.
 - Attaching and powering other farming tools for planting and harvesting.

Unit 19: Farm implements

Unit objectives

By the end of this unit, learners should be able to:

- identify farm implements.
- explain the functions of farm implements.
- discuss the storage of implements.

Teaching notes

- **Cultivator:** A farm implement used to loosen the soil around plants and remove weeds.
- **Farm implements:** Tools or machines used in farming to make work easier and more efficient.
- **Harrow:** A farm implement used to break up clods and level the soil.
- **Planter:** A farm implement used to plant seeds evenly in rows.
- **Plough:** A farm implement used to break and turn over the soil.
- **Rust:** The damage that happens when metal is exposed to moisture.
- Farm implements can be simple tools or large machines and can be ox-drawn or tractor-drawn.
- **Common farm implements:** Ploughs (disc, chisel, mouldboard), cultivators (rotary, spring tooth, tine), harrows (disc, spike tooth, chain), planters.
- **Functions of farm implements:**
 - * **Ploughs:** Break and turn over the soil to prepare it for planting.
 - * **Cultivators:** Loosen soil around plants, remove weeds, aerate soil.
 - * **Harrows:** Break up clods and level the soil after ploughing.
 - * **Planters:** Place seeds in soil at correct depth and spacing.
- **Importance of proper storage of farm implements:**
 - * **Prevent damage:** Protect from rust, corrosion, wear and tear.
 - * **Reduce loss:** Prevent theft or misplacement.
 - * **Ensure safety:** Prevent accidents from improper storage.
- **Ways to properly store farm implements:** Clean after use, keep in a dry place, oil metal parts, store in a secure storeroom.

Activities guidelines

- **Activity 19.1: Visit a farm and draw implements:** If feasible, organise a visit to a nearby farm for learners to identify different farm implements in person. Alternatively, use pictures or videos of various implements. Have learners draw a chosen implement and label its parts.

- **Activity 19.2: Role-play the use of different farm implements:** In groups, have learners role-play the use of different farm implements. They can demonstrate the actions of ploughing, cultivating, harrowing and planting, explaining the purpose of each.
- **“What am I?” Game:** Describe the function of a farm implement and learners guess which implement it is.
- **Discussion on safety:** Lead a discussion on safety measures when using and storing farm implements, emphasising the dangers of rust and improper storage.
- **Research on traditional implements:** Have learners research traditional or indigenous farm implements used in their community or country, comparing them to modern implements.

Suggested answers

Exercise 19.1

- 1 Two types of ploughs are disc plough and mouldboard plough (Other valid answers: chisel plough).
- 2 The function of a harrow is to break up clods and level the soil after ploughing.
- 3 Two types of cultivators and their uses are:
 - (i) **Rotary cultivator:** Used to loosen the soil and remove weeds.
 - (ii) **Spring tooth cultivator:** Used to loosen the soil around plants and remove weeds. (Other valid answers: Tine cultivator)
- 4 The farm implement used for planting seeds in a straight row is a **planter**.
- 5 It is important to store farm implements properly to prevent damage (like rust), reduce loss (theft or misplacement) and ensure safety (prevent accidents).

Exercise 19.2

- 1 The function of a planter is to place seeds in the soil at the correct depth and spacing, ensuring even distribution for optimal growth.
- 2 It is important to store farm implements in a dry place to prevent rust and corrosion, which can damage the metal parts and reduce the lifespan and efficiency of the tools.
- 3 A plough is used to break and turn over the soil, preparing the land for planting by creating furrows. A cultivator is used to loosen the soil around existing plants and remove weeds, aerating the soil after planting.
- 4 Farm implements can be stored safely by:
 - (i) Cleaning them after use to remove dirt and plant materials.
 - (ii) Keeping them in a dry place to prevent rust.
 - (iii) Applying oil to metal parts to prevent rust.
 - (iv) Storing them in a secure, locked storeroom to prevent theft or damage.
- 5 The importance of farm implements in farming is that they make farming work easier, faster and more efficient. They help farmers prepare land, plant seeds, cultivate crops and manage fields more effectively, leading to better yields and reduced manual labour.

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | C | 4 | C |
| 2 | B | 5 | B |
| 3 | B | | |

Structured questions

- 1 Farm implements are tools and machines used in farming to make work easier and more efficient. Two examples are a plough and a harrow.
- 2 Farmers should oil their farm tools to prevent rust and corrosion on the metal parts. This helps to keep the tools in good working condition, extends their lifespan and ensures they operate smoothly.
- 3 A planter helps farmers by automatically placing seeds in the soil at the correct depth and with consistent spacing. This ensures that seeds are planted efficiently and uniformly, which is crucial for optimal crop growth and yield.
- 4 Cleaning farm tools is important because it removes dirt, mud and plant materials that can cause rust, corrosion, or damage over time. It also helps in identifying any wear or tear that needs repair, ensuring the tools remain in good condition for future use.
- 5 Two types of cultivators are:
 - (i) Rotary cultivator
 - (ii) Spring tooth cultivator (Other valid answer: Tine cultivator)

Unit 20: Measuring tools

Unit objectives

By the end of this unit, learners should be able to:

- identify the tools used for measuring temperature, mass and volume.
- measure temperature, mass and volume.
- record findings.

Teaching notes

- **Balance scale:** A tool used to measure mass.
- **Digital scale:** A device that electronically measures mass.
- **Measuring cylinder:** A tool used to measure volume.
- **Thermometer:** A tool used to measure temperature.
- **Unit of measurement:** A standard unit used to express a quantity.

- Measuring tools help find size, mass and amount accurately.
- **Measuring temperature:**
 - * Temperature is how hot or cold something is, measured in degrees Celsius (°C).
 - * Tool: Thermometer (clinical for body, laboratory for experiments).
- **Measuring mass:**
 - * Mass is the amount of matter in an object, measured in grams (g) or kilograms (kg).
 - * Tools: Balance (spring balance, electronic/digital balance). Digital scales are very accurate.
- **Measuring volume:**
 - * Volume is the amount of space inside a container, measured in millilitres (ml), litres (L), or cubic centimetres (cm³).
 - * **Tools:** Measuring cylinder (for liquids), Displacement can (for irregular solids, used with measuring cylinder).
 - * **Measuring irregular solid volume using measuring cylinder:** Note initial water level, submerge object, note new water level, volume is the difference.
 - * **Measuring irregular solid volume using displacement can:** Fill can to spout, immerse object, collect displaced water in measuring cylinder, volume of displaced water is volume of object.
- Recording measurements helps keep track of accurate data.

Activities guidelines

- **Activity 20.1: Measuring temperature:** Provide learners with thermometers (clinical and/or laboratory) and various objects (hot water, cold drink, classroom air). Guide them to measure and record temperatures in a table, ensuring they understand the units (°C).
- **Activity 20.2: Measuring mass:** Provide learners with different types of balances (spring, digital if available) and various small objects (pencil, book, toy). Guide them to measure and record the mass of each object in a table, emphasising units (*g* or *kg*).
- **Activity 20.3: Measuring volume:** Provide measuring cylinders, water and various liquids/solids (juice, stone, chalk). Guide learners through measuring the volume of liquids directly and using the displacement method for irregular solids. Have them record their findings.
- **“Which tool?” game:** Show pictures of different items to be measured (a person’s temperature, a bag of sugar, a bottle of juice, a rock) and have learners identify the correct measuring tool for each.
- **Discussion on accuracy:** Discuss the importance of accurate measurements in real-life situations (cooking, medicine, science experiments).

Suggested answers

Exercise 20.1

- 1 A clinical thermometer is used to measure body temperature.
- 2 A beam balance is used to measure mass.
- 3 A measuring cylinder is used to measure volume.
- 4 The unit of measurement for temperature is degrees Celsius ($^{\circ}\text{C}$).
- 5 A digital scale is used to measure mass accurately.

Exercise 20.2

- 1 Three tools used to measure mass are:
 - (i) Balance scale (or beam balance).
 - (ii) Spring balance.
 - (iii) Digital scale (or electronic balance).
- 2 The function of a thermometer is to measure how hot or cold something is, which is its temperature.
- 3 A measuring cylinder helps in measuring liquids by having clear markings (graduations) along its side that indicate specific volumes (in millilitres or litres), allowing for precise reading of the liquid's volume.
- 4 It is important to record measurements because it helps to keep accurate data, allows for comparison over time and is essential for scientific experiments, cooking and many other daily tasks where precision is needed.
- 5 A digital scale differs from a beam balance in that a digital scale measures mass electronically and displays the reading numerically on a screen, often with high accuracy. A beam balance, on the other hand, measures mass by comparing an unknown mass to known standard masses, balancing them on a lever system.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 C |
| 2 B | 5 B |
| 3 C | |

Structured questions

- 1 Three tools used to measure volume and their uses are:
 - (i) **Measuring cylinder:** Used to accurately measure the volume of liquids.
 - (ii) **Displacement can (or Eureka can):** Used in conjunction with a measuring cylinder to find the volume of irregular solid objects by measuring the volume of water they displace.

(iii) **Beaker/flask (less accurate for precise measurement):** Can be used for approximate volume measurements or holding liquids.

2 The advantages of using a digital scale instead of a spring balance are:

- **Higher accuracy:** Digital scales typically provide more precise and accurate measurements.
- **Ease of reading:** The mass is displayed directly as a number, making it easier and quicker to read compared to interpreting a needle on a spring balance.
- **Versatility:** Many digital scales can measure very small masses accurately, which spring balances might struggle with.

3 A clinical thermometer is specifically designed to measure human body temperature and typically has a narrower range (35°C to 42°C) and a constriction to prevent the mercury/alcohol from falling immediately after removal, allowing for a stable reading. A laboratory thermometer has a wider temperature range (-10°C to 110°C) and is used for general scientific experiments; it does not have a constriction, so the reading changes quickly.

4 Measuring tools are important in everyday life because they allow us to get accurate information about quantities like temperature, mass and volume. This precision is crucial for tasks like cooking (following recipes), taking medicine (correct dosage), buying groceries (accurate weight) and in various scientific and industrial applications, ensuring safety, efficiency and desired outcomes.

5 To measure the volume of fresh milk, you would:

- (i) Pour the fresh milk directly into a measuring cylinder.
- (ii) Place the measuring cylinder on a flat surface.
- (iii) Read the volume at eye level from the bottom of the meniscus (the curved surface of the liquid). The reading on the measuring cylinder directly indicates the volume of the milk in millilitres (ml) or litres (L).

Unit 21: Digital devices

Unit objectives

By the end of this unit, learners should be able to:

- identify a digital camera.
- capture photos.
- record videos.
- edit photos and videos.

Teaching notes

- **Cropping:** Removing unwanted parts of an image.
- **Digital camera:** A device used to capture photos and videos in digital form.

- **Filters:** Effects added to change the look of a photo or video.
- **Lens:** The part of the camera that captures light.
- **Shutter button:** The button used to take a photo.
- Digital cameras store images on a memory card, unlike old film cameras.
- **Features of a digital camera:** Lens, Shutter button, Flash, LCD screen, Memory card slot, Zoom button, Power button.
- **Steps for capturing photos:** Turn on camera, hold steady, frame shot, adjust focus (half-press shutter), capture image (full-press shutter).
- **Steps for recording videos:** Switch to video mode, press record button, hold camera still, press stop button.
- **Editing photos and videos:** Done using a computer or smartphone to improve their look.
- **Basic editing tasks:**
 - * **Cropping:** Remove unwanted parts.
 - * **Adjusting brightness:** Make lighter or darker.
 - * **Adding filters:** Change colours and styles.
 - * **Trimming videos:** Cut out unnecessary parts.
 - * **Adding text or music:** Enhance videos with text and sound.

Activities guidelines

- **Activity 21.1: Taking a photo:** Have learners use a digital camera or smartphone to capture photos of different objects or scenes. Encourage them to experiment with framing and focus.
- **Activity 21.2: Video storytelling:** Guide learners to record a short video telling a story or showcasing a talent. Encourage them to edit the video using available software or apps and share it.
- **Activity 21.3: Editing a photo:** Provide a simple editing app (e.g., on a smartphone or computer) and a sample picture. Guide learners through cropping the picture and adjusting its brightness.
- **Camera parts identification:** Show a diagram of a digital camera and have learners identify and label its parts, explaining the function of each.
- **Discussion on digital etiquette:** Discuss responsible use of digital cameras and sharing photos/videos, including privacy and consent.

Suggested answers

Exercise 21.1

- 1 Three main parts of a digital camera are:
 - (i) Lens
 - (ii) Shutter button
 - (iii) LCD screen (Other valid answers: Flash, Memory card slot, Zoom button, Power button)
- 2 You focus a camera before taking a picture by half-pressing the shutter button.

- 3 The purpose of the memory card in a digital camera is to store the captured photos and videos digitally.
- 4 It is important to hold the camera steady when taking photos to avoid blurry images and ensure the picture is clear and sharp.
- 5 The function of the zoom button is to adjust how close or far the subject appears in the photo or video without physically moving closer or further away.

Exercise 21.2

- 1 The steps for recording a video using a digital camera are:
 - (i) Switch to video mode.
 - (ii) Press the record button to start recording.
 - (iii) Hold the camera still to avoid shaking.
 - (iv) Press the stop button when done.
- 2 Cropping a photo removes unwanted parts from the edges of the image, allowing you to focus on the main subject or improve the composition.
- 3 Brightness adjustment can improve a photo by making a dark picture lighter and more visible, or by making an overly bright picture darker to reveal more detail and improve contrast.
- 4 Two features of a video editing app are:
 - (i) Trimming videos (cutting out unnecessary parts).
 - (ii) Adding text or music. (Other valid answers: Adjusting brightness, adding filters).
- 5 Editing photos and videos is important because it allows you to improve their quality, remove imperfections, enhance their visual appeal and add creative elements like text or music, making them look better and more engaging.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 B |
| 2 C | 5 A |
| 3 C | |

Structured questions

- 1 Two parts of a digital camera and their explanations:
 - (i) **Lens:** This is the part that gathers light from the scene and focuses it to create the image on the camera's sensor.
 - (ii) **Shutter button:** This is the button you press to take a photo. Half-pressing it often focuses the camera and fully pressing it captures the image.
 - (iii) **LCD screen:** This screen on the back of the camera displays the image or video being captured, allows you to review photos and navigate menus. (Any two)

- 2 The steps to taking a clear photo are:
 - (i) Turn on the camera.
 - (ii) Hold the camera steady using both hands to avoid blur.
 - (iii) Frame the shot by looking through the screen or viewfinder.
 - (iv) Adjust the focus by half-pressing the shutter button.
 - (v) Capture the image by fully pressing the shutter button.
- 3 You can improve a dark image using editing tools by adjusting its brightness. Increasing the brightness setting will make the picture lighter and more visible, bringing out details that were hidden in the shadows.
- 4 The purpose of a memory card in a digital camera is to store the photos and videos that are captured. It acts like the camera's digital "film," saving the images so they can be viewed, transferred, or printed later.
- 5 Video editing is important because it allows you to refine raw video footage by cutting out unnecessary parts (trimming), improving visual quality (adjusting brightness, adding filters) and enhancing the overall message or story by adding elements like text, music, or narration. This makes the video more engaging, professional and effective.

Unit 22: Digital tools - Spreadsheets

Unit objectives

By the end of this unit, learners should be able to:

- create a spreadsheet.
- use formulae to perform calculations.
- produce graphs from data.
- search data to solve a problem.
- sort data to solve a problem.
- filter data to solve a problem.

Teaching notes

- **Spreadsheet:** An electronic document arranged in rows and columns to store, manipulate and analyse data.
- **Workbook:** A file that contains one or more worksheets.
- **Worksheet:** A single page within a workbook containing cells arranged in rows and columns.
- **Cell:** The intersection point between a row and a column.
- **Row:** A horizontal arrangement of cells identified by numbers.
- **Column:** A vertical arrangement of cells identified by letters.
- **Formula:** A mathematical statement used to perform calculations in a spreadsheet (for example = SUM (A1:A5)).

- Spreadsheet programs include Microsoft Excel, Google Sheets, LibreOffice Calc and Numbers.
- **Charts:** Graphical representation of data such as bar, pie, column and line charts.
- **Sorting:** Arranging data in alphabetical or numerical order.
- **Filtering:** Displaying data that meets certain conditions while hiding the rest.

Activities guidelines

- **Activity 22.1:** Organising information into rows and columns. Learners draw a table with two headings: “Name” and “Mark.” Guide them to fill in 10 sample learners’ names such as Rodney, Nyarai, Pete, Limba, Delvine, Zodwa, Loice, Pearl, Tawanda and Promise, and assign each one a mark out of 100. Ask them to count how many rows and columns their table contains and discuss how such organisation helps in storing and viewing data.
- **Activity 22.2:** Using formulas in Excel. In groups of 3–5, learners open Microsoft Excel and enter the names and marks of the 10 learners used in Activity 22.1 into two columns. The facilitator demonstrates how to use Excel formulas: =MAX(B2:B11), =MIN(B2:B11), =AVERAGE(B2:B11), =COUNT(B2:B11), and =SUM(B2:B11). Then, learners use the same formulas in their groups. The teacher signals “start” and groups compete to complete all five calculations correctly. The first group to finish with accurate results is announced the winner.
- **Activity 22.3:** Creating and presenting charts. Guide each group to use the 10 learners’ marks to create three different types of charts in Excel: a bar chart, a pie chart and a line chart. Learners click “Insert” and select appropriate chart types. They label their charts clearly (For example, “ICT Marks for Term 1”). Groups then present their charts to the class, explaining which chart they found easiest to understand and why.
- **Activity 22.4:** Sorting speed comparison. Ask learners to write down all 10 learners’ names on a piece of paper and manually sort them alphabetically (A–Z). Time how long this takes. Then, instruct learners to open the same names list in Excel and use the “Sort A–Z” button to sort the data. Compare and record the time taken for both methods. Guide learners in discussing why computers sort faster and how sorting is helpful in real-life data analysis (For example, sorting exam results or attendance lists).

Suggested answers

Exercise 22.1

- 1 A row goes across (left to right); a column goes down (top to bottom).
- 2 Microsoft Excel, Google Sheets, LibreOffice Calc. (Any three spreadsheet programs.)
- 3 Column headers are named using letters of the alphabet.

Exercise 22.2

- 1 = SUM(C3:C12).
- 2 Formulas always start with an equal sign (=).
- 3 = MIN(B3:B6).

Exercise 22.3

- 1 To insert charts, we select **Insert** from the menu.
- 2 We can change chart design by selecting **Design** and choosing a different **style**.
- 3 Three chart types that can be created in Excel: Bar chart, Pie chart, Column chart.

Exercise 22.4

- 1 Sort and Filter commands are found under the **Home** and **Data** tabs.
- 2 Sorting is arranging data in a specific order.
- 3 Criteria for filtering numerical data include: greater than 50, equal to 75. (Any two.)

Unit revision

Multiple choice questions

- 1 C
 - 2 C
 - 3 A
- 4 A
 - 5 C

Structured questions

- 1 A spreadsheet program is software used to organise and calculate data using rows and columns.
- 2 A row is a horizontal arrangement of cells, while a cell is an individual box formed at the intersection of a row and column.
- 3 =SUM(B1:B10)
- 4 Cells are named using the column letter and row number, for example A1.
- 5 Ways to filter data: by number, by text, by specific condition (for example greater than or less than). (Any three.)

Practical work

- 6 In a village of 100 people, 40 owned cattle, 35 owned goats and 25 owned sheep. Enter this data in a spreadsheet and use it to create a 3D pie chart. Save the file using your name and class.
- 7 Enter student marks in Excel:

Name	Mark
Rodney	30
Pete	92
Nyarai	63
Senzeni	47
Mudiwa	77

Use Excel to calculate:

- (a) Highest mark
- (b) Lowest mark
- (c) Average mark
- (d) Number of students
- (e) Total marks

8 Enter the following in Excel and:

- (a) Sort numeric data from smallest to largest.
- (b) Sort text data alphabetically.
- (c) Filter marks greater than or equal to 50 and save your work.

Unit 23: Career opportunities

Unit objectives

By the end of this unit, learners should be able to:

- identify different career opportunities in ICT.
- discuss the roles of various ICT professionals.
- understand the importance of data in ICT careers.

Teaching notes

- Analysis: Studying data to find useful patterns.
- Data: Information collected and used for analysis.
- Finance: The management of money.
- ICT: Information and Communication Technology.
- Prediction: Using data to guess future trends.
- Statistics: A type of math used to study data.
- ICT careers are diverse and in high demand due to the pervasive nature of technology.
- Careers in ICT involving data: Data Analyst, Data Scientist, Statistical Analyst, Accountant.
- Roles of ICT Professionals:
 - * **Data analyst:** Collects, organises and studies data to find patterns and help businesses make decisions. Roles include collecting, cleaning, organising data; creating charts/reports; helping decision-making.
 - * **Data scientist:** Uses advanced computer programs and mathematics to study large data, predict trends and solve complex problems. Roles include using programming for analysis, finding hidden patterns, planning for future with predictions, using AI/Machine Learning.

- * **Statistical analyst:** Studies numbers and data using mathematics to understand trends and help businesses, governments and researchers. Roles include using math to analyse data, finding relationships, creating reports/presentations, understanding progress.
- * **Accountant:** Manages financial records, ensures money is used correctly, tracks income/expenses, prepares financial reports, advises on saving/investing, ensures compliance with financial laws, helps informed financial decisions.

Activities guidelines

- **Activity 22.1: A career poster:** Guide learners to research different careers in ICT (beyond those listed, if they wish) and create a poster about one that interests them. They should include roles, skills needed and why it interests them.
- **Activity 22.2: Data analysis:** If computers/spreadsheets are available, guide learners to use a spreadsheet to analyse a simple set of data (e.g., class test scores, favourite colours) and create charts/graphs to visualise the results. This provides a practical taste of data analysis.
- **Activity 22.3: Role play:** Have learners take turns acting as different ICT professionals (Data Analyst, Data Scientist, Statistical Analyst, Accountant) and explain their roles to the class. Encourage them to use key terms learned in the unit.
- **Guest speaker:** Invite a local ICT professional (if possible) to speak to the class about their career, daily tasks and the importance of their work.
- **Discussion on digital skills:** Discuss the importance of digital literacy and data analysis skills for future careers, even outside of direct ICT roles.

Suggested answers

Exercise 23.1

- 1 The main role of a data analyst is to collect, organise and study information (data) to help businesses make better decisions by finding useful patterns.
- 2 A data scientist helps a company plan for the future by using advanced computer programs and Mathematics to analyse large amounts of data, find hidden patterns and trends and make predictions about future outcomes or behaviours.
- 3 Businesses need a statistical analyst to study numbers and data using mathematical methods to understand trends, find relationships between different data sets and create reports that help the business understand its progress and make informed decisions.
- 4 Two responsibilities of an Accountant are:
 - (i) Keeping track of money coming in and going out (managing financial records).
 - (ii) Preparing financial reports and tax documents. (Other valid answers: analysing financial data, advising on saving/investing, ensuring financial law compliance, helping make informed financial decisions).
- 5 ICT is used in accounting to manage financial records, prepare financial reports and analyse financial data using specialised software and computer systems.

Exercise 23.2

- 1 Two careers in ICT that involve analysing data are data analyst and data scientist (or statistical analyst).
- 2 A data scientist needs skills in computer programming, mathematics and the ability to analyse large datasets to find hidden patterns and predict future trends.
- 3 Mathematics is used in the role of a statistical analyst to analyse data, find relationships between different sets of data and create statistical reports and presentations based on their findings.
- 4 An Accountant is important to a company because they manage financial records, ensure money is used correctly, help track income and expenses, prepare financial reports and provide advice on financial decisions, all of which are crucial for the company's financial health and legal compliance.
- 5 Data analysts help businesses make decisions by collecting, cleaning and organising data, then creating charts and reports that highlight useful patterns and insights, allowing companies to make informed choices based on evidence.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 B | 4 A |
| 2 B | 5 B |
| 3 B | |

Structured questions

- 1 Two roles of a Data Analyst are:
 - (i) Collecting and organising data from various sources to make it useful.
 - (ii) Creating charts and reports to explain findings and help companies make better decisions.
- 2 Data scientists help businesses predict the future by using advanced computer programs and Mathematics to analyse large sets of data, identify hidden patterns and trends and then use these insights to forecast future outcomes or behaviours, often employing Artificial Intelligence (AI) and Machine Learning techniques.
- 3 A statistical analyst might use tools such as statistical software packages (R, Python with libraries like Pandas/NumPy), spreadsheet programs Microsoft Excel, Google Sheets) and data visualisation tools to study data.
- 4 An Accountant is important for a business because they are responsible for managing all financial records, ensuring that money is tracked correctly, preparing essential financial reports and providing advice on financial matters. This ensures the business's financial stability, compliance with laws and informed decision-making.
- 5 One way ICT is used in accounting is through the use of **accounting software** (QuickBooks, SAP). This software automates tasks like recording transactions, generating financial statements and managing payroll, making accounting processes more efficient and accurate.

Topic 6

Energy and fuels

Unit 24: Heat, light and electrical energy

Unit objectives

By the end of this unit, learners should be able to:

- discuss sources of electrical, light and heat energy.
- describe the transfer of heat, light and electrical energy.
- demonstrate heat, electricity and light transfer.

Teaching notes

- **Conduction:** Transfer of heat through solids.
- **Conductor:** A material that allows electricity to pass through.
- **Convection:** Transfer of heat in liquids and gases.
- **Energy:** The ability to do work.
- **Insulator:** A material that blocks the flow of electricity.
- **Radiation:** Transfer of heat through space.
- **Reflection:** Light bouncing off surfaces.
- **Refraction:** Light bending when moving through different materials.
- **Sources of energy:**
 - * **Heat energy:** Sun (natural), fire, electrical appliances, friction.
 - * **Light energy:** Sun (natural), fire (candles, lamps), electrical sources (bulbs, LED lights), glow-in-the-dark materials.
 - * **Electrical energy:** Power stations, batteries, solar panels, generators.

Heat energy transfer

- * Conduction: Through solids (metal spoon in hot tea).
- * Convection: Through liquids and gases (warm air rising).
- * Radiation: In waves without a medium (warmth from the Sun).

- **Light energy transfer:**
 - * Travels in straight lines.
 - * **Reflection:** Bounces off surfaces (mirrors).
 - * **Refraction:** Bends through different materials (straw in water).
 - * **Absorption:** Materials soak up light and convert it to heat (black shirt in sunlight).
- **Electrical energy transfer:**
 - * Moves through **conductors** (metals).
 - * Blocked by **insulators** (rubber, plastic).
 - * Can be converted to heat, light, kinetic energy.

Activities guidelines

- **Activity 24.1: Identifying sources of energy:** Have learners identify and list at least three sources of heat, light and electrical energy in their homes. Facilitate a discussion on how each source is used.
- **Activity 24.2: Testing heat transfer:** Conduct the experiment with metal and plastic spoons in hot water. Guide learners to observe which spoon feels hotter and discuss why, linking it to the concept of conduction.
- **Demonstration of reflection:** Use a mirror and a flashlight to demonstrate how light reflects off a surface. Discuss how this applies to everyday objects.
- **Demonstration of refraction:** Place a pencil or straw in a glass of water and have learners observe how it appears bent. Explain this phenomenon as refraction.
- **Conductor/insulator test:** Provide a simple circuit (battery, bulb, wires) and various materials (metal paperclip, plastic ruler, wood, copper wire). Have learners test which materials are conductors (light the bulb) and which are insulators.

Suggested answers

Exercise 24.1

- 1 The main source of heat and light for the earth is the **Sun**.
- 2 Light travels in straight lines.
- 3 A metal pan getting hot on a stove is an example of conduction.
- 4 Electrical energy can come from power stations, batteries and solar panels (or generators).
- 5 A black car feels hotter than a white car in sunlight because of **absorption**.

Exercise 24.2

- 1 Three sources of heat energy are:

(i) The Sun	(iii) Electrical appliances (heaters, ovens)
(ii) Fire (burning wood, coal, gas)	(iv) Friction (Any three)

- 2 Light bends when it moves from air into water because it **changes speed** as it passes from one medium (air) to another (water) with a different density. This change in speed causes the light rays to change direction, resulting in the bending effect known as refraction.
- 3 Materials that are good conductors of electricity are typically metals (e.g., copper, aluminum, iron).
- 4 Heat moves through liquids primarily by convection. When a liquid is heated, the warmer, less dense parts rise and the cooler, denser parts sink, creating a continuous circulation current that transfers heat throughout the liquid.
- 5 Electrical wires have plastic covering because plastic is an insulator. This covering prevents electricity from escaping the wire, protects people from electric shocks and prevents short circuits.

Unit revision

Multiple choice questions

- | | |
|-----|-----|
| 1 C | 4 B |
| 2 B | 5 B |
| 3 C | |

Structured questions

- 1 Two natural sources of heat energy are the Sun and fire (e.g., from lightning-induced fires). Two artificial sources of heat energy are electrical heaters and burning **fossil fuels** (e.g., coal in a stove).
- 2 A mirror reflects light by having a smooth, polished surface that causes light rays to bounce off it in a predictable and organised manner. When light hits the mirror, it changes direction and the angle at which it reflects is equal to the angle at which it hits the surface.
- 3 A solar panel produces electricity by converting sunlight directly into electrical energy. It contains photovoltaic cells that absorb photons from sunlight. When photons hit these cells, they knock electrons loose from their atoms, creating an electric current. This direct current (DC) can then be converted to alternating current (AC) for use in homes and businesses.
- 4 A metal spoon heats up faster than a plastic one in hot water because metal is a much better conductor of heat than plastic. Heat energy is transferred more efficiently through the particles of the metal spoon via conduction, causing it to warm up quickly, whereas plastic is an insulator and transfers heat poorly.
- 5 Examples of how we use conduction, convection and radiation in daily life:
 - **Conduction:** When you touch a hot stove, heat transfers to your hand by conduction. Cooking food in a metal pan on a burner uses conduction to transfer heat from the stove to the food.
 - **Convection:** Boiling water in a pot involves convection, as the heated water rises and cooler water sinks, creating currents. A hot air balloon rises due to convection of heated air.
 - * **Radiation:** Feeling the warmth from a campfire or a fireplace without touching it is due to heat radiation. The Sun's warmth reaching the Earth is also an example of radiation.

Unit 25: Electrical circuits

Unit objectives

By the end of this unit, learners should be able to:

- identify components of an electrical circuit.
- discuss types of electrical circuits.
- create an electrical circuit.

Teaching notes

- **Circuit:** A complete path through which electricity flows.
- **Conductor:** A material that allows electricity to pass through.
- **Load:** A device that uses electricity.
- **Series circuit:** A circuit with one single path for electricity.
- **Parallel circuit:** A circuit with multiple paths for electricity.
- **Switch:** A device that controls the flow of electricity.
- Components of an electrical circuit:
 - * **Basic components:**
 - » **Power source:** Provides energy (battery, power supply).
 - » **Conductors:** Wires that connect components and allow electricity to flow.
 - » **Load:** Device that uses electricity (bulb, fan, motor).
 - » **Switch:** Controls flow (turns circuit on/off).
 - * **Additional components:**
 - » **Resistors:** Limit flow.
 - » **Capacitors:** Store and release electrical energy.
 - » **Fuses:** Protect circuits from too much current.

Types of electrical circuits

- * **Series circuit:** Components in a single path. If one breaks, entire circuit stops (old Christmas lights).
- * **Parallel circuit:** Components in multiple paths. If one breaks, others still work (home wiring).
- **Creating an electrical circuit:** Can be done with a battery, wires, small light bulb and optional switch. Connect positive terminal to one side of bulb, other side of bulb to negative terminal (with switch in between if used).

Activities guidelines

- **Activity 25.1: Identifying circuit components:** Provide learners with a flashlight. Guide them to identify its power source (battery), load (bulb) and switch. Have them draw a simple diagram showing how these components are connected.
- **Activity 25.2: Comparing circuits:** Provide batteries, wires and small bulbs. Guide learners to create both a series and a parallel circuit. Have them observe and discuss what happens when one bulb is removed from each circuit, highlighting the key difference.
- **Build a simple circuit:** Provide materials (battery, wires, small bulb, switch) and guide learners step-by-step to build a simple working circuit. Emphasise correct connections.
- **Circuit diagram drawing:** Provide various simple circuit diagrams (with symbols for components) and have learners identify the components and type of circuit.
- **Discussion on home wiring:** Discuss why homes are wired in parallel circuits, relating it to the convenience and safety of appliances working independently.

Suggested answers

Exercise 25.1

- 1 The device that provides energy in a circuit is called the **power source**.
- 2 A **conductor** allows electricity to flow from one component to another.
- 3 If one bulb breaks in a **series** circuit, all bulbs go out.
- 4 A house is wired using a **parallel** circuit.
- 5 A fuse helps to protect the circuit by **stopping the flow of electricity if there is too much current**.

Exercise 25.2

- 1 The four basic components of an electrical circuit are:
 - (a) Power source
 - (b) Conductor (wires)
 - (c) Load
 - (d) Switch
- 2 When a switch is turned off in a circuit, it breaks the complete path for electricity to flow. This stops the flow of current and the load (a bulb) will turn off.
- 3 A series circuit has all its components connected in a single, continuous path. If one component breaks or fails, the entire circuit is interrupted and all other components stop working. A parallel circuit has components connected in multiple, separate paths. If one component breaks or fails, the electricity can still flow through the other paths, so the other components continue to work.
- 4 Parallel circuits are used in homes because they allow each electrical appliance or light fixture to operate independently. If one appliance breaks or is turned off, the others in the house continue to function, unlike in a series circuit where a single failure would shut down everything.

- 5 To make a simple electrical circuit:
- (i) Connect one end of a wire to the **positive terminal** of a battery.
 - (ii) Connect the other end of that wire to one side of a small light bulb.
 - (iii) Use another wire to connect the other side of the light bulb to the negative terminal of the battery.
 - (iv) (Optional: If using a switch, place it along one of the wires).
 - (v) Once all connections are made, the circuit is complete and the bulb should light up (if the switch is closed).

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | B | 4 | C |
| 2 | B | 5 | C |
| 3 | C | | |

Structured questions

- 1 (Learners will draw a simple circuit diagram showing a power source (battery), conductors (wires), a load (light bulb) and a switch, all connected in a closed loop. Labels for each component should be included.)
- 2 The difference between a series circuit and a parallel circuit is that in a series circuit, all components are connected one after another in a single path, meaning the electricity flows through each component sequentially. If any component breaks, the entire circuit is broken. In contrast, a parallel circuit has components connected across multiple, separate paths, allowing electricity to flow through each component independently. If one component breaks, the others can still function.
- 3 Copper is used in electrical wires because it is an excellent electrical conductor. This means it allows electricity to flow through it very easily with minimal resistance, ensuring efficient transfer of electrical energy.
- 4 If a switch is not included in a circuit, the circuit will remain continuously on (if it's a closed circuit) or continuously off (if it is an open circuit). A switch provides a way to control the flow of electricity, allowing you to turn the device on or off as needed. Without it, you would have to disconnect a wire to break the circuit.
- 5 In a closed circuit, electricity flows from the positive terminal of the power source, through the conductors (wires), passing through the load (where the electrical energy is used, to light a bulb) and then returning to the negative terminal of the power source. This forms a continuous, unbroken loop, allowing the current to flow.

Unit 26: Sustainable use of fuels

Unit objectives

By the end of this unit, learners should be able to:

- identify fuel types.
- discuss the importance of sustainable use of fuels.
- discuss conservation measures when using fuels.

Teaching notes

- **Deforestation:** The cutting down of trees without replacing them.
- **Fossil fuels:** Fuels formed from ancient plants and animals (coal, oil, gas).
- **Fuels:** Substances that produce energy when burned.
- **Pollution:** The release of harmful substances into the environment.
- **Renewable fuels:** Fuels that can be replaced naturally (biogas, ethanol).
- **Sustainable:** Using resources wisely so they last longer.
- **Types of fuels:**
 - * **Renewable fuels:** Replaced naturally, cause less pollution. Examples: Biogas (from waste), Ethanol (from sugarcane/corn), Wood and charcoal (from trees, use responsibly).
 - * **Non-renewable fuels (fossil fuels):** Formed over millions of years from ancient organisms. Examples: Coal (electricity), Petroleum (gasoline, diesel, jet fuel), Natural gas (cooking, heating).
- **Importance of sustainable use of fuels:**
 - * Reduces pollution (harmful gases).
 - * Saves natural resources (fossil fuels take millions of years to form).
 - * Protects the environment (prevents deforestation from wood fuel).
 - * Ensures energy for the future (prevents running out of resources).
- **Conservation measures for using fuels:**
 - * **Saving electricity:** Switch off lights/appliances when not in use, use energy-efficient appliances (LED bulbs), use solar panels.
 - * **Reducing fuel usage in transportation:** Walk/cycle for short distances, use public transport/carpool, maintain vehicles for efficiency.
 - * **Using alternative fuels:** Use biogas and solar energy, plant trees to replace wood fuel, use improved cook stoves.

Activities guidelines

- **Activity 25.1: Identifying fuels around you:** Have learners list three types of fuels they use at home (for example electricity, cooking gas, firewood, petrol). Then, guide them to identify whether each is renewable or non-renewable and discuss its uses.
- **Activity 25.2: Discussion on fuel conservation:** Facilitate a discussion where learners talk to a friend or family member about how they save fuel at home. They should write down three methods and share them with the class.
- **Debate:** “Should we stop using fossil fuels completely?” Organise a debate on the topic, encouraging learners to research the pros and cons of fossil fuels and renewable energy sources.
- **Energy audit at home:** Challenge learners to conduct a simple “energy audit” at home, identifying ways their family could reduce energy consumption (for example unplugging chargers, turning off lights).
- **Poster campaign:** Have learners create posters promoting sustainable fuel use and conservation measures, to be displayed in the classroom or school.

Suggested answers

Exercise 26.1

- 1 Coal, petroleum and natural gas are examples of fossil fuels.
- 2 Using fuels sustainably helps reduce **pollution**, which harms the environment.
- 3 A fuel that can be replaced naturally is called a **renewable** fuel.
- 4 One way to conserve fuel is by using **LED** light bulbs instead of traditional ones.
- 5 Planting trees helps to replace those cut down for **wood fuel** (or **firewood**).

Exercise 26.2

- 1 Two fossil fuels are coal and petroleum (or natural gas). Two renewable fuels are biogas and ethanol (or wood/charcoal if used responsibly).
- 2 It is important to use fuels sustainably because it reduces pollution, saves natural resources (which take millions of years to form), protects the environment (preventing deforestation) and ensures energy availability for future generations.
- 3 Three ways we can conserve fuel at home are:
 - (i) Switching off lights and electrical appliances when not in use.
 - (ii) Using energy-efficient appliances (like LED bulbs).
 - (iii) Using solar panels to generate electricity for some needs.
 - (iv) Using improved cook stoves that use less fuel. (Any three)
- 4 Carpooling helps save fuel by reducing the number of vehicles on the road for the same number of people. Instead of multiple cars each using fuel for individual commutes, one car transports several people, thus consuming less fuel overall.

- 5 Some alternative fuels that reduce pollution are **biogas** and **solar energy** (as a source of electricity).

Unit revision

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | C | 4 | A |
| 2 | B | 5 | C |
| 3 | A | | |

Structured questions

- 1 Two reasons why it is important to use fuels sustainably are:
- (i) To reduce environmental pollution from burning fuels, which contributes to climate change and air quality issues.
 - (ii) To conserve natural resources like fossil fuels, which are finite and take millions of years to form, ensuring they are available for future generations.
- 2 The differences between fossil fuels and renewable fuels are:
- Fossil fuels are non-renewable; they are formed over millions of years from ancient organic matter and cannot be replaced within a human timescale (coal, petroleum, natural gas). They contribute significantly to pollution when burned.
 - Renewable fuels can be replaced naturally within a relatively short period (biogas, ethanol, wood if managed sustainably). They generally cause less pollution compared to fossil fuels.
- 3 Two ways to reduce fuel use in transportation are:
- (i) Walking or cycling for short distances instead of driving.
 - (ii) Using public transport or carpooling to share rides and reduce the number of individual vehicles on the road.
 - (iii) Maintaining vehicles properly to improve their fuel efficiency. (Any two)
- 4 Switching off electrical appliances helps conserve fuel because most electricity is generated by burning fuels (especially fossil fuels) at power stations. By reducing electricity consumption, we reduce the demand for fuel at power stations, thus conserving these resources.
- 5 Biogas is a better alternative to wood fuel because it is a renewable fuel produced from animal waste and plant material, making it sustainable. Unlike burning wood, which can lead to deforestation and produce harmful smoke, biogas combustion is cleaner, resulting in less air pollution and contributing to better environmental health.

Topic 7

Hazards preparedness

Unit 27: Hazards preparedness

Unit objectives

By the end of this unit, learners should be able to:

- identify emergency response plans.
- discuss preparedness activities.
- list emergency supplies.
- explain the importance of updating emergency plans.

Teaching notes

- Emergency is a dangerous event that requires immediate action.
- An emergency response plan is a set of steps to follow in an emergency.
- Preparedness refers to actions taken to be ready for emergencies.
- An emergency kit is a collection of supplies needed in a disaster.
- Evacuation is the act of leaving a place for safety during an emergency.
- Hazards preparedness involves having a plan, supplies and knowledge to stay safe from unexpected events like natural disasters, fires and accidents.
- Common emergency response plans include fire, earthquake, flood and storm emergency plans.
- Evacuation routes are safe ways to leave a building or area.
- Assembly points are safe places to gather after evacuating.
- Emergency contact numbers are crucial for reaching people in an emergency.
- Preparedness activities include drills and training, building safe shelters, having communication plans, learning first aid, creating an emergency kit and staying informed.
- Every home should have an emergency kit with essential supplies like food, water, flashlight and batteries, a first aid kit, a whistle and important documents.
- Emergency plans should be reviewed and updated regularly due to changes in family members, new hazards, updated contact numbers and ensuring supplies are not expired.

Activities guidelines

- **Home emergency plan creation:** Facilitate Activity 26.1 where students draw a simple map of their home and mark escape routes for fire and earthquake safety. Encourage them to discuss this with their families.
- **Family discussion on preparedness:** Guide students through Activity 26.2, prompting them to talk to their families about emergency plans and write down three things their families do to stay prepared.
- **Role-playing drills:** Organise mock fire and earthquake drills within the classroom or school premises. Emphasise the “Drop, Cover and Hold” technique for earthquakes and the importance of staying low to avoid smoke during a fire.
- **Emergency kit assembly:** In groups, have students brainstorm and list items for an emergency kit. If possible, bring in examples of items (e.g., an empty water bottle, a flashlight, a band-aid) for a hands-on demonstration. Discuss the purpose of each item.
- **Community resource integration:** Invite a local emergency services representative (e.g., fire department, civil protection unit) to speak to the class about local hazards, emergency procedures and the importance of preparedness.

Suggested answers

Exercise 27.1

- | | |
|-----------------|-----------|
| 1 hazard | 4 drills |
| 2 higher ground | 5 updated |
| 3 light | |

Exercise 27.2

- 1 Fire emergency plan, Earthquake emergency plan, Flood emergency plan, Storm emergency plan (Any three).
- 2 It is important to have an emergency communication plan to know how to reach family members and emergency contacts in case of an emergency, ensuring everyone’s safety and reducing panic.
- 3 Food and water, Flashlight and batteries, First aid kit, Whistle, Important documents (Any five).
- 4 During an earthquake, you should drop, cover and hold. This means dropping to the ground, taking cover under a sturdy piece of furniture and holding on until the shaking stops.
- 5 Emergency plans should be updated regularly because risks and contacts may change, new family members might join, or old supplies might expire. This ensures the plan remains effective and relevant.

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | B | 4 | C |
| 2 | B | 5 | A |
| 3 | B | | |

Structured questions

- 1 Hazards that require emergency preparedness include: earthquakes, floods, fires, storms, accidents (Any three).
- 2 Practising emergency drills is important because it helps people react quickly and correctly during a real emergency, which can save lives and reduce injuries. It ensures everyone knows what to do and where to go.
- 3 During a fire emergency, you should:
 - Know your escape routes.
 - Stay low to avoid smoke.
 - Call for help (emergency services) once you are in a safe place.
 - Evacuate safely to an assembly point.
- 4 Four important items in an emergency kit and their use:
 - **Food and water:** To provide sustenance for at least three days in case regular supplies are cut off.
 - **Flashlight and batteries:** To provide light during power outages or in dark conditions.
 - **First aid kit:** To treat minor injuries and provide immediate medical attention before professional help arrives.
 - **Whistle:** To signal for help if trapped or in need of assistance.
 - **Important documents (ID cards, medical records, emergency contacts):** To provide essential personal and medical information and contact details for family and emergency services. (Any four with explanation)
- 5 Families can improve their emergency response plans by:
 - Regularly reviewing and updating the plan.
 - Practicing drills together.
 - Discussing potential hazards and what to do in each scenario.
 - Ensuring the emergency kit is well-stocked and non-expired.
 - Updating emergency contact numbers.
 - Assigning roles and responsibilities to each family member.

Topic

8

Robotics and coding

Unit 28: Educational technology and innovation

Unit objectives

By the end of this unit, learners should be able to:

- identify text-based programming tools.
- make simple scripts to control movement.
- create interactive stories and games using text-based programming tools.

Teaching notes

- **Code:** Instructions written in a programming language.
- **Coding:** Writing instructions for a computer or robot.
- **Function:** A block of code that performs a specific action.
- **Interactive story:** A program where users can make choices and see different results.
- **JavaScript:** A language used mainly for web pages and games.
- **Python:** A programming language used for many applications.
- **Robot:** A machine that can follow instructions and move.
- **Script:** A set of code that performs a specific task.
- **Syntax:** The rules of a programming language, like grammar in English.
- **Variable:** A container that stores information, like a number or a word.
- **Text-based programming:** Uses written instructions (code) to tell a computer what to do, unlike block-based programming.
- **Robots:** Machines that can move, think and follow instructions. Coding is the language used to control them.
- Popular text-based programming tools:
 - * **Python:** Simple, powerful, used in robotics, games, websites. `print("Hello, Robot!")`
 - * **JavaScript:** Used for web pages and games, makes interactive programs. `console.log("Hello, Robot!")`.
- **Controlling robot movement with scripts:** Use functions (`forward()`, `turn_right()`) with arguments (numbers) to specify actions.

- **Creating interactive stories and games:** Use variables to store information and conditional statements (if statements) to make decisions based on user input (input() function in Python, prompt in JavaScript).

Activities guidelines

- **Activity 28.1: Robot dance:** If possible, use a simple online Python interpreter (like Replit, Trinket, or a browser-based Python sandbox) or a robot simulation software. Guide learners to write scripts using forward() and turn_right() (or similar functions) to make a virtual robot perform a simple dance. Encourage experimentation with different values.
- **Activity 28.2: Choose your own adventure:** Using an online Python interpreter, guide learners to create a simple “choose your own adventure” story. Emphasise the use of input() to get player choices and if/else statements to create different story paths.
- **Introduce variables:** Explain variables using simple analogies (a box that holds information). Have learners create variables to store names, numbers, or simple facts in a Python or JavaScript script.
- **Conditional statements practise:** Give learners simple scenarios (“If a number is greater than 10, print ‘Too high!’”) and have them write if statements to implement the logic.
- **Compare block-based vs. text-based:** Discuss the differences and similarities between block-based programming (like Scratch, which they learned in Grade 5) and text-based programming. Highlight the benefits of text-based for more complex tasks and understanding syntax.

Suggested answers

Exercise 28.1: Robot movements

1 Script to make a virtual robot move in a square (Python example):

```
forward(10)
turn_right(90)
forward(10)
turn_right(90)
forward(10)
turn_right(90)
forward(10)
turn_right(90)
```

2 Script to make a virtual robot draw a triangle (Python example):

```
forward(10)
turn_right(120) # For an equilateral triangle
forward(10)
turn_right(120)
forward(10)
turn_right(120)
```

3 Script to make a virtual robot move in a circle (use small turn increments) (Python example):

```
# To make a rough circle, repeat many small forward and turn steps
for _ in range(36): # Repeat 36 times for a 10-degree turn each time (36 * 10 = 360)
    forward(1)
    turn_right(10)
```

4 Script to make a virtual robot move forward 20 steps, turn left 45 degrees and then move forward 10 steps (Python example):

```
forward(20)
turn_left(45) # Assuming a turn_left function exists or use turn_right(-45)
forward(10)
```

5 Script to make a robot move forward 10 steps, then backward 10 steps (Python example):

```
forward(10)
backward(10) # Assuming a backward function exists or use forward(-10)
```

Exercise 28.2: Interactive story elements

1 Create a variable to store the player's score in a game (Python example):

```
player_score = 0
```

2 Create a variable to store the player's health in a game (Python example):

```
player_health = 100
```

3 Use an if statement to check if the player's score is greater than 100 (Python example):

```
if player_score > 100:
    print("Congratulations! You reached over 100 points!")
```

4 Use an if statement to check if the player's health is less than 10 (Python example):

```
if player_health < 10:
    print("Warning! Your health is critically low!")
```

5 Write a script that asks the player for two numbers and prints their sum (Python example):

```
num1_str = input("Enter the first number: ")
num2_str = input("Enter the second number: ")
```

```
# Convert input strings to numbers for calculation
```

```
num1 = int(num1_str)
num2 = int(num2_str)
sum_numbers = num1 + num2
print("The sum is:", sum_numbers)
```

Unit revision

Multiple choice questions:

- | | | | |
|---|---|---|---|
| 1 | A | 4 | A |
| 2 | B | 5 | B |
| 3 | C | | |

Structured questions

- 1 The difference between **block-based programming** and **text-based programming** is in how instructions are given. Block-based programming uses visual, draggable blocks that snap together to form code, making it easier for beginners to understand logic without worrying about syntax (Scratch). Text-based programming uses written instructions, or code, typed out using a specific programming language's syntax, which offers more flexibility and power for complex tasks (Python, JavaScript).
- 2 To control a robot using `forward()` and `turn_right()` functions:
 - The `forward(steps)` function tells the robot to move straight ahead for a specified number of steps.
 - The `turn right (degrees)` function tells the robot to rotate to its right by a specified number of degrees.
 - By combining these functions with different argument values, you can program the robot to move in various paths, like a square or a triangle.
- 3 To use the `input()` function (in Python) to get user input, you write `variable name = input("Prompt message here")`. The "Prompt message here" is the text displayed to the user, asking them for information. Whatever the user types and presses Enter will be stored as a string in the variable name.
- 4 To use an if statement to make a decision in a program, you write `if condition:`. If the condition (a comparison or logical test) is true, the code indented below the if statement will be executed. You can also add an `else:` block, which contains code that will be executed if the condition is false. This allows the program to choose different actions based on different situations or user input.
- 5 **Example of a simple script that creates an interactive story element (Python):**

```
print("You are standing at a crossroads").
direction = input("Do you go left or straight? (type 'left' or 'straight'): ")

if direction == "left":
    print("«You find a hidden path leading to a magical forest!»)
elif direction == "straight":
    print("«You walk down a busy road and reach a bustling town»").
else:
    print("«You hesitate and decide to stay put. Nothing happens»").
```

Unit 29: Technology design and safety

Unit objectives

By the end of this unit, learners should be able to:

- state safety rules when using tools.
- design an artefact.
- make an artefact.

Teaching notes

- **Artefact:** A useful object made by people.
- **Materials:** Items used to make an artefact (e.g., paper, wood, plastic).
- **Protective gear:** Items like gloves and goggles that keep us safe.
- **Safety:** Being careful to avoid danger or injury.
- **Tools:** Instruments used to build or create things.

Safety rules when using tools:

- Wear protective gear (safety goggles, gloves, aprons).
- Use tools correctly (follow instructions).
- Work in a clean space (neat work area).
- Handle sharp tools with care (never point at others).
- Do not rush (work slowly and carefully).
- Keep tools in the right place (store properly after use).
- Ask for help if unsure.

Steps to designing an artefact:

1. **Identify the need:** What do you want to create and why?
2. **Plan your design:** Draw a picture with labels.
3. **Choose materials:** Decide what materials to use.
4. **List the tools:** Make a list of needed tools.
5. **Follow safety rules:** Prepare workspace and tools safely.

Steps to making an artefact:

1. Gather materials and tools.
2. Cut and shape materials carefully.
3. Assemble the parts (stick, tie, connect).
4. Decorate and finish (add colours, patterns, labels).
5. Test your artefact to ensure it works as expected.

Activities guidelines

- **Activity 29.1: Discussion on safety rules:** In pairs, have learners discuss why safety rules are important when using tools. Encourage them to share examples of accidents that can happen if rules are not followed.
- **Activity 29.2: Design an artefact:** Guide learners to draw a simple artefact (e.g., a small box, a bookmark, a paper airplane). They should label the materials and tools needed for its creation.
- **Activity 29.3: Making an artefact:** In groups, guide learners to make a small artefact using safe practices. They should present their artefact to the class and explain its use, highlighting the design and making process.
- **Tool identification and safety:** Bring in various safe tools (e.g., child-safe scissors, glue sticks, rulers) and discuss how to use each one correctly and safely.
- “What’s wrong with this picture?” Show pictures of unsafe workshop practices and have learners identify the safety violations and suggest corrections.

Suggested answers

Exercise 29.1

- 1 We should wear protective gear when using tools to keep ourselves safe and prevent injuries to specific body parts like our eyes (goggles) or hands (gloves).
- 2 Three safety rules when working with tools are:
 - Wear protective gear (safety goggles, gloves).
 - Use tools correctly and follow instructions.
 - Work in a clean and organised space.
 - Handle sharp tools with care.
 - Do not rush; work slowly and carefully.
 - Keep tools in the right place after use.
 - Ask for help if unsure. (Any three)
- 3 An artefact is a **useful object made by people** for a specific purpose.
- 4 The steps to design an artefact are:
 - Identify the need (what to create and why).
 - Plan your design (draw a picture with labels).
 - Choose materials.
 - List the tools needed.
 - Follow safety rules (prepare workspace and tools safely).
- 5 An example of a tool used to cut materials is **scissors** (or a knife, saw).

Exercise 29.2

- 1 It is important to store tools properly after use to prevent damage to the tools themselves, to reduce the risk of accidents (tripping over misplaced tools) and to ensure they are organised and easy to find for future use.
- 2 Two materials that can be used to make artefacts are **cardboard** and **paper** (Other valid answers: wood, plastic, clay, fabric).
- 3 Planning is important before making an artefact because it helps to clarify the purpose of the artefact, allows you to choose the right materials and tools, helps in visualising the final product and ensures you follow safety rules from the beginning, leading to a more successful and safe creation.
- 4 We can test if an artefact works correctly by using it for its intended purpose and observing if it performs as expected. For example, if it is a pencil holder, put pencils in it to see if they stand upright and are held securely.
- 5 A situation where asking for help with tools is necessary is when you are unsure how to use a particular tool safely, or if a task requires handling a sharp or heavy **tool** that could cause injury if not managed properly by an adult or teacher.

Unit revision exercises

Multiple choice questions

- | | | | |
|---|---|---|---|
| 1 | B | 4 | B |
| 2 | B | 5 | B |
| 3 | C | | |

Structured questions

- 1 Two safety rules when using tools are:
 - Wear protective gear such as safety goggles and gloves when needed.
 - Use tools correctly by following their instructions and not rushing.
- 2 We should plan before making an artefact to clearly define its purpose, select appropriate materials and tools and visualise the design to ensure the final product meets the intended need and is created safely and efficiently.
- 3 The purpose of protective gear (like safety goggles, gloves, aprons) is to protect the user from potential injuries while working with tools and materials. For example, goggles protect eyes from flying debris and gloves protect hands from cuts or chemicals.
- 4 The process of making a pencil holder involves:
 - Gathering materials and tools (cardboard, glue, scissors).
 - Cutting and shaping the cardboard pieces according to the design.
 - Assembling the parts by sticking them together with glue to form the holder.
 - Decorating and finishing the holder with coloured paper or other embellishments.
 - Testing the pencil holder to ensure it can hold pencils securely.

- 5 It is important to keep tools in the right place after using them to prevent accidents (e.g., tripping), to protect the tools from damage (rust, being misplaced) and to ensure they are easily accessible and organised for future use.

Unit 30: Cyber security

Unit objectives

By the end of this unit, learners should be able to:

- define hacking.
- find out on types of hackers.
- identify the effects of hacking.
- outline methods of minimising effects of hacking.

Teaching notes

- **Antivirus software:** A program that protects computers from viruses.
- **Black hat hacker:** A hacker who steals or damages information.
- **Hacking:** Gaining access to a computer system or network without permission.
- **Identity theft:** When someone pretends to be another person by using their information.
- **White hat hacker:** A hacker who helps find security problems.
- **Hacking:** Breaking into a computer system or network without permission to steal, change, or damage information.

Types of hackers

- **White hat hackers (ethical hackers):** Help companies find weaknesses in systems; do not steal or destroy info.
- **Black hat hackers:** Bad hackers; break into systems to steal money/info or cause damage.
- **Gray hat hackers:** In between; may hack without permission but not to harm, sometimes to expose weaknesses.
- **Effects of hacking:** Loss of personal information, financial loss, damaged computer systems (viruses), identity theft, loss of trust.

How to minimise effects of hacking (safety tips)

- Use strong passwords (letters, numbers, symbols).
- Do not share personal information (passwords, private details).
- Install antivirus software.
- Install firewall (prevents unauthorised access).
- Use encryption (converts readable message to unreadable form).
- Be careful with emails (do not open from unknown people).
- Keep software updated (fixes security weaknesses).

Activities guidelines

- **Activity 30.1: Discussion on hacking:** In pairs, have learners discuss their understanding of hacking and share one example of how hacking has affected people (e.g., a news story, a personal anecdote if appropriate and safe).
- **Activity 30.2: Group work - cyber safety poster:** In small groups, have learners create a poster on how to stay safe online, incorporating tips discussed in the unit.
- **Activity 30.3: Role play - hacker scenario:** Guide learners to act out a situation where a hacker tries to trick someone online (a phishing email, a suspicious link). They should then demonstrate how the person can stay safe by applying the learned tips.
- **Strong password creation:** Have learners practise creating strong passwords (without actually using them for real accounts), emphasising the criteria for a strong password.
- **Discussion on online privacy:** Discuss the importance of not sharing personal information online and the potential dangers of doing so.

Suggested answers

Exercise 30.1

- 1 Hacking is when someone breaks into a computer system or network **without permission** to access, steal, change, or damage information.
- 2 Two types of hackers and their roles are:
 - **White hat hackers:** Also called ethical hackers, they help companies and governments find weaknesses in computer systems to improve security, without causing harm.
 - **Black hat hackers:** These are malicious hackers who break into systems to steal money, personal information, or cause damage. (Other valid answer: Gray hat hackers)
- 3 Three effects of hacking are:
 - * **Loss of personal information:** Hackers can steal private details like passwords and bank details.
 - * **Financial loss:** Individuals and companies can lose money due to hacked accounts or systems.
 - * **Damaged computer systems:** Hackers can insert viruses that destroy files or make systems unusable.
 - **Identity theft:** Hackers can use stolen personal details to pretend to be another person.
 - **Loss of trust:** When companies are hacked, customers may stop trusting them. (Any three)
- 4 Antivirus software helps protect computers by detecting and removing viruses and other malicious software that hackers might use to damage systems or steal information.
- 5 It is important to use a strong password because it makes it much harder for hackers to guess or crack your password, thereby protecting your online accounts and personal information from unauthorised access.

Exercise 30.2

- ➊ Black hat hackers break into computer systems to steal money, personal information, or cause damage to the systems and data.
- ➋ Hacking can cause financial loss when hackers gain unauthorised access to bank accounts, credit card information, or company financial systems, leading to unauthorised transactions, theft of funds, or disruption of business operations that result in monetary losses.
- ➌ Updating software helps in cybersecurity by fixing security weaknesses or vulnerabilities that hackers could exploit. Software updates often include patches that close these loopholes, making the system more secure against new threats.
- ➍ We should avoid clicking unknown links in emails because these links often lead to phishing websites (designed to steal personal information) or download malicious software (viruses, malware) onto your computer, compromising your security.
- ➎ An example of how identity theft can happen is when a hacker steals your personal details, such as your name, date of birth and national ID number and then uses this information to open new bank accounts, apply for loans, or make purchases in your name without your permission.

Unit revision

Multiple choice questions

- | | | | |
|---|---|---|---|
| ➊ | B | ➌ | B |
| ➋ | A | ➍ | A |
| ➌ | B | | |

Structured questions

- ➊ Hacking, in my own words, is like someone secretly breaking into your digital space, like your computer or phone, without your permission. They might do this to steal your private information, mess things up, or even pretend to be you online.
- ➋ Three effects of hacking and how they affect people:
 - (i) **Financial loss:** People can lose their savings or money from their bank accounts if hackers steal their banking details and make unauthorised transactions.
 - (ii) **Identity theft:** Hackers can steal personal details (like name, address, ID number) and use them to open new accounts or commit crimes in the victim's name, causing significant problems for the person whose identity was stolen.
 - (iii) **Damaged computer systems:** Hackers can introduce viruses or malicious software that can delete important files, make a computer run very slowly, or even stop it from working entirely, causing frustration and potential loss of valuable data.

- 3 The difference between a **White hat hacker** and a **Black hat hacker** is their intention. A White Hat Hacker (or ethical hacker) uses their skills for good, helping organisations find and fix security weaknesses to protect systems from attacks. A Black Hat Hacker, on the other hand, uses their skills for malicious purposes, breaking into systems to steal data, cause damage, or gain financial benefit illegally.
- 4 You should not share personal information online (like passwords, home address, phone number, or bank details) because this information can be **stolen by hackers** and used for harmful activities such as **identity theft, financial fraud**, or even to target you or your family in the real world. Keeping personal information private helps protect your safety and security.
- 5 Two ways to stay safe from hackers are:
 - (i) Using strong and unique passwords for all your online accounts, combining letters, numbers and symbols and changing them regularly.
 - (ii) Installing and regularly updating antivirus software on your computer and devices to detect and remove malicious programs that hackers might try to use. (Other valid answers: being careful with suspicious emails/links, keeping software updated, using a firewall, enabling encryption).