PlusOne

Science and Technology

Heritage-Based Curriculum
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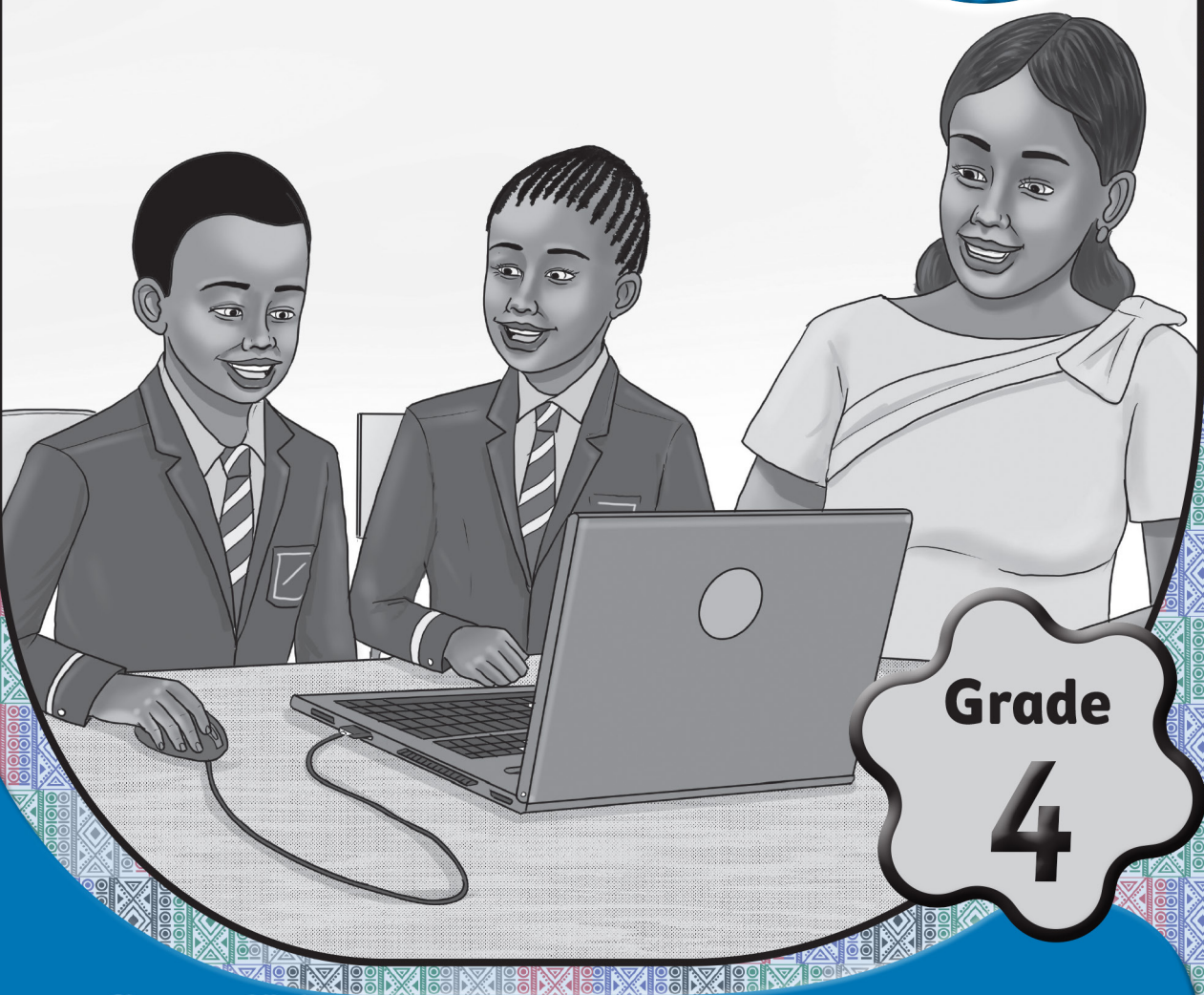

Grade
4

Cleopatra Nkala

Teacher's Guide

PlusOne

Science and Technology

Teacher's Guide

SECONDARY BOOK PRESS
Anchors of the schools curricula

Published by:
Secondary Book Press Private Limited
4th Floor, CABS Centre Building,
Cnr Jason Moyo & 2nd Street,
Harare, Zimbabwe
Tel: +263 242 771 406 | +263 242 753 201
Mobile: +263 712 560 870 | +263 788 954 870
Email: sales@secondarybookpress.co.zw
Website: www.secondarybookpress.co.zw

PlusOne Science and Technology| Grade 4 - Teacher's Guide

ISBN: 978-1-77928-496-9

First Published in 2025

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Introduction

This **PlusOne Science and Technology Grade 4 Teacher's Guide** provides basic and practical ways to teach key components required by the Science and Technology Heritage-Based Curriculum for primary schools. It closely follows the curriculum requirements and outcomes, tying to the topics and units.

This Teacher's Guide offers valuable guidelines on how to use the PlusOne Science and Technology Grade 4 Learner's Book which has the following topics:

1. Health and hygiene practices
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 4, 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, drama, storytelling)
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 syllabus aims to enable learners to:

- apply to self, work and society.
- select and use a wide range of materials and components in the environment.
- develop the creative, technical and practical expertise to participate in a scientific and
- technological world.
- demonstrate innate talent that lead to originality and innovativeness.
- enhance scientific and technological designs, through the use of Information and Communication Technology.
- manipulate materials and equipment to enhance creativity.
- develop critical evaluation skills in technical, aesthetic, economic, environmental, social and cultural contexts.
- explore opportunities that promote a sense of self-reliance, enterprising and community development.

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 and 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 4 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

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: Dental

Unit objectives

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

a. name the different types of teeth.
b. identify different types of teeth.
c. state the functions of the different teeth.
d. describe the causes of tooth decay.
e. outline methods of preventing tooth decay.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 1-6.
- Science and Technology Grade 3-7 syllabus.
- Charts
- Toothbrush/toothpaste/charcoal

Teaching notes

- There are four types of teeth: incisors, canines, premolars and molars. Incisors are for biting and chopping food. Canines are for tearing food. Premolars and molars are for tearing, crushing and grinding food.
- Tooth decay is the destruction of the outer surface of the tooth, caused by acid produced by germs that act on food remains. Sugary foods can speed up this process.
- Preventing tooth decay involves:
  - Brushing regularly with fluoride toothpaste.
  - Using mouthwash.
  - Eating healthy meals.
  - Visiting a dentist regularly.

Activities guidelines

Activity 1.1

Teeth identification: Guide learners to work in pairs and identify the different types of teeth in their mouths. Using a mirror, each learner observes their partner's teeth. They should name the four types, count how many of each they see and describe their appearance and function.

Activity 1.2

Dentist visit findings: Arrange a visit to a local dentist. Before the visit, help learners prepare questions about tooth decay prevention. During the visit, they should ask their questions and take notes. Afterward, they write a report summarising the visit and discuss their findings as a class to create a poster on preventing tooth decay.

Suggested answers

Exercise 1.1

1. The four types of teeth are: incisors, canines, premolars and molars.
2. Functions:
   - Incisors: biting and chopping food.
   - Canines: tearing food.
   - Premolars: tearing and crushing food.
   - Molars: grinding, tearing and crushing food.
3. Canines
4. A - Incisor, B - Canine, C - Premolar, D - Molar, E - Molar, F - Premolar, G - Canine and H - Incisor.

Exercise 1.2

1. Tooth decay happens when food remains are left on teeth, attracting germs. These germs produce acid which damages the tooth.
2. **(a)** Germs acting on food remains.

   (b) Sweets, chocolates, cakes, biscuits. Accept any sugary foods.
3. Nutritious, healthy meals.
4. Brush teeth with fluoride toothpaste twice a day. Rinse with mouthwash to kill germs. Eat healthy meals and limit sugary foods. Visit your dentist for regular checkups and cleanings. Use wood ash or a salt solution. Drink chlorinated water. (Any two)
5. Cavities or holes in the teeth and breakdown of the tooth's outer layer.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. **(a)** Incisor, canine, premolar, molar.
   (b) Incisor: biting food. Canine: tearing food. Premolar: crushing food. Molar: grinding food.
2. Tooth decay is the destruction of the tooth's outer surface. Tooth decay is the rotting of teeth. Allow any relevant definition.
3. Sweets, chocolates or cakes. (Any one)
4. Brush your teeth twice a day. Avoid sugary foods. Drink chlorinated water. Use wood ash to clean teeth. Use a salt solution to clean teeth. (Accept any other relevant answer)
5. Oral hygiene is important for keeping your mouth clean and free of disease and for preventing problems like bad breath.

Unit 2: Proper food handling practices

Unit objectives

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

a. state proper food handling practices.
b. demonstrate proper food handling practices.
c. explain the impact of improper food handling practices.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 7-11.
- Science and Technology Grade 3-7 syllabus.
- Charts
- Indigenous recipes
- Ash/ kitchen utensils.

Teaching notes

- Proper food handling means preparing food in a safe and hygienic way.
- It involves:
  - maintaining personal hygiene (washing hands, wearing clean clothes).
  - cooking and storing food at safe temperatures.
  - separating raw and cooked foods.
  - cleaning surfaces and utensils regularly.
- Improper food handling can lead to:
  Foodborne illnesses such as dysentery, tapeworm and roundworm infections.
  - chemical contamination.
  - food poisoning.

Activities guidelines

Activity 2.1

School kitchen observation: Take learners on a supervised visit to the school kitchen with a checklist. They observe whether staff wear protective gear, whether raw and cooked foods are separated, whether cleaning is done properly and if food is cooked to the right temperature. They summarise findings in a report.

Activity 2.2

Role-play food handling: Show a video on food safety. Then divide learners into pairs to role-play scenarios like preparing a salad or handling raw meat, demonstrating safe practices. Each pair gives feedback to each other.

Suggested answers

Exercise 2.1

1. True
2. False
3. True
4. True
5. False
6. False
7. True
8. True
9. False
10. True

Exercise 2.2

1. Use a food thermometer to check cooking temperature.
2. Hand washing removes germs before food preparation.
3. A food thermometer checks the temperature of food to find out if it is enough to destroy germs.

Exercise 2.3

Danger	Description
Foodborne illnesses	Illnesses happen when bad germs get into food.
Chemical contamination	Pesticides accidentally mix with food.
Food poisoning	Harmful germs are present in food.

Unit revision exercises

Multiple choice answers

1. A, B, D (Any of these is correct)
2. B
3. B
4. A
5. A
6. A
7. A
8. B
9. B
10. B

Structured questions answers

1. Aprons
2. Wash hands. Wear gloves. Separate raw and cooked foods.
3. In the fridge.
4. Unwashed hands can transfer germs to food. Dirty clothing can introduce germs and dirt to food. Cross-contamination occurs when raw food touches cooked food or when dirty utensils are used for both. Uncleaned surfaces and utensils can transfer bacteria to food. Accidental mixing of chemicals like pesticides or cleaning agents can contaminate food. (Any two)
5. Foodborne illnesses, chemical contamination or food poisoning. (Any one)
6. It is important to keep raw and cooked foods separate to avoid contamination of cooked food. It is important to keep raw and cooked foods separate to avoid spoiling the cooked food.
7. Using airtight containers.

Unit 3: Environmental hygiene – Air pollution

Unit objectives

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

a. define air pollution.
b. identify the causes of air pollution.

c list air pollutants.
d explain the effects of air pollution.
e outline measures to reduce air pollution.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 12-18.
- Science and Technology Grade 3-7 syllabus.
- Charts
- Digital tools/ rubbish bin/ environment

Teaching notes

- Air pollution is the release of harmful substances into the air.
- Causes of air pollution include smoke from burning plastics and cigarettes, exhaust fumes from vehicles and industrial gases.
- Air pollutants include smoke, dust and farm chemicals.
- Effects of air pollution include respiratory diseases like asthma, damage to plants, allergic reactions and acid rain.
- Measures to reduce air pollution include avoiding burning plastics, maintaining vehicles, planting more trees and using clean energy sources like solar power.

Activities guidelines

Activity 3.1

Community air pollutants: learners work in pairs to list three air pollutants they observe in their community (for example, smoke, dust, fumes). They share findings and discuss why these pollutants are harmful.

Activity 3.2

Pollution effects: Each learner lists one effect of air pollution on humans, one on animals and one on plants. They discuss in pairs how these effects impact their community.

Activity 3.3

Poster creation: learners create posters showing three specific ways to reduce air pollution (for example, planting trees, using solar power). Each group presents their poster and explains the solutions.

Suggested answers

Exercise 3.1

1. Air pollution is the release of harmful substances into the air.
2. Smoke from burning plastic, exhaust fumes from vehicles, industrial gases, dust particles. Accept any other relevant answer.
3. Exhaust fumes.

Exercise 3.2

1. asthma
2. make food
3. sneezing
4. acid
5. see
6. they can develop chronic health conditions such as cardiovascular diseases.

Exercise 3.3

1. Well-maintained
2. Water
3. Toxic
4. Trees
5. Solar
6. chemicals
7. disposal
8. compost
9. filters
10. trees

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Air pollution is the release of harmful substances into the air.
2. Smoke from burning plastic, exhaust fumes from vehicles, industrial gases, dust particles. Accept any other relevant answer.
3. Air pollution can be reduced by avoiding smoking, not burning tyres and plastic, controlling farm chemicals, driving well-maintained vehicles, sprinkling water before sweeping, planting more trees, using clean energy and reducing waste/recycling. Accept any one of these answers.

4. On plants, it chokes leaves, reduces photosynthesis, causes plant death. On animals, it causes respiratory diseases. (Any two)
5. Air pollution affects human health by causing respiratory diseases, allergic reactions, increased risk of heart disease.
6. pollutants

Unit 4: Mental health

Unit objectives

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

a. define mental wellness.
b. identify activities that promote mental wellness.
c. explain the importance of mental wellness.
d. demonstrate activities that promote mental wellness.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 19-22.
- Science and Technology Grade 3-7 syllabus.
- Charts,rubbish bin, digital tools, environment.

Teaching notes

- Mental health is a person's emotional, psychological and social well-being. It affects how we think, feel and act.
- Activities that promote mental wellness include breathing exercises, sports, creative arts like drawing and singing, seeking guidance or counselling.
- Maintaining good mental health is crucial because it enhances concentration, helps manage stress, reduces conflicts and boosts confidence.

Activities guidelines

Activity 4.1

Mental wellness demonstration: Use simple, in-class activities to demonstrate and practise mental wellness. For example, lead the class in a simple breathing exercise: "Breathe in deeply through your nose for a count of three, hold for a count of three and breathe out slowly through your mouth for a count of six." Encourage learners to demonstrate other activities like stretching or a short guided meditation.

Activity 4.2

Importance of mental health discussion: Prompt learners to think about the personal and social benefits of good mental health. Divide learners into pairs. Instruct them to discuss the importance of mental health activities. Provide discussion prompts such as: "How does feeling calm help you concentrate in class?" or "Why is it easier to work in a group when everyone feels happy and confident?"

Suggested answers

Exercise 4.1

1. Mental health is a person's emotional, psychological and social well-being.
2. breathing
3. drawing
4. counselling
5. Swimming, football or taekwondo. (Any two)

Exercise 4.2

1. True
2. False
3. False
4. True

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Mental health is a person's emotional, psychological and social well-being.
2. Activities that promote mental wellness include simple breathing exercises, participating in sports like swimming, football or taekwondo, enjoying leisure activities such as drawing, painting, singing or playing a musical instrument, attending guidance and counselling sessions and taking short mental breaks. (Any three)
3. Maintaining mental wellness is important because it helps in concentration, teamwork, managing stress and preventing burnout, reducing conflicts and boosting. (Any two)

Unit 5: Immunisation

Unit objectives

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

- identify child killer diseases.
- explain immunisation.
- outline the importance of immunisation.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 23-28.
- Science and Technology Grade 3-7 syllabus.
- Posters, newsletter, ICT tools, resource person.

Teaching notes

- Child killer diseases are serious diseases that affect young children due to their weak immune systems. Examples include polio, measles, tetanus, tuberculosis, whooping cough and diphtheria.
- Immunisation is a safe and effective way to protect against these diseases by strengthening the body's immune system with vaccines.
- Immunisation is important because it helps prevent deadly diseases, boosts the immune system and reduces healthcare costs.

Activities guidelines

Activity 5.1

Defining immunisation: Use a collaborative approach to help learners define and understand the concept of immunisation. Divide learners into groups. Instruct each group to come up with their own simple definition of "immunisation" and discuss how vaccines work to protect the body. Have each group share their ideas and as a class, combine their definitions to form a comprehensive class definition.

Activity 5.2

Importance of immunisation discussion: Guide learners to think critically about why immunisation is a vital public health measure. Instruct learners to work in their groups. Have them discuss why immunisation is important, using the following prompts: "How does immunisation help prevent deadly diseases in our community?" or "How does immunisation help families save money on medical expenses?" Encourage them to think beyond individual health and consider the broader community benefits.

Suggested answers

Exercise 5.1

1. protecting
2. defences
3. killed
4. MMR
5. 9 to 12 months
6. BCG
7. DPT
8. 6, 10 and 14
9. Pertussis
10. 10-15 years

Exercise 5.2

1. infectious
2. deadly
3. immune system
4. healthcare
5. polio
6. Preventing deadly diseases, boosting the immune system, reducing healthcare costs, preventing disabilities caused by diseases such as polio. (Any one)
7. False
8. True

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Immunisation
2. Polio, measles, tetanus, tuberculosis, diphtheria and whooping cough. (Any three)
3. Multiple doses are important to build resistance to specific infections and make the immune system stronger.
4. MMR or MR vaccine prevents measles, the BCG vaccine prevents tuberculosis and the DPT vaccine helps protect against tetanus, whooping cough and diphtheria. (Any one combination)
5. Immunisation helps to reduces healthcare costs by preventing deadly diseases.
6. BCG vaccine.

Topic 2 Food and nutrition

Unit 6: Food nutrients

Unit objectives

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

a. name food nutrients.
b. discuss the functions of food nutrients.
c. explain what a balanced diet is.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 29-34.
- Science and Technology Grade 3-7 syllabus.
- Food items, learners, resource person.

Teaching notes

- Food nutrients are substances in food that keep us healthy. The main nutrients are carbohydrates, proteins, fats, vitamins and mineral salts.
- Carbohydrates provide energy, proteins are for growth and tissue repair, fats provide energy and maintain body temperature, mineral salts build strong bones and teeth and vitamins are for growth and proper body functioning.
- A balanced diet contains all these nutrients in the right proportions.

Activities guidelines

Activity 6.1

Food grouping: Use a hands-on activity to help learners classify different foods into their nutrient groups. Divide learners into groups. Provide a variety of pictures or actual food samples (for example, a potato, a piece of meat, an avocado, an apple, a tomato). Instruct them to group the food items according to their main nutrient class (carbohydrates, proteins, fats, vitamins and mineral salts). Have each group explain their choices and discuss the functions of each nutrient.

Activity 6.2

Meal plan design: Help learners apply their knowledge of nutrients to create a healthy meal plan. Divide learners into groups. Instruct them to design a simple weekly meal plan for a family. Have them explain how their meal plan meets the requirements of a balanced diet by including a variety of foods from all the food groups. Instruct them to present their meal plan to the class, justifying their choices.

Suggested answers

Exercise 6.1

Nutrient	Function in the human body	Example of food
Carbohydrates	Primary source of energy.	Grains, rice, potatoes
Proteins	Building and repairing tissues, growth.	Fish, eggs, meat
Fats	Provide energy, maintain body temperature.	Nuts, avocados, oil
Vitamins	Growth and proper body functioning.	Fruits and vegetables
Fibre	Aids digestion.	Leafy vegetables, fruits
Water	Hydration and body processes.	Water, fruits, vegetables
Mineral salts	Building strong bones, muscles and teeth.	Spinach, cabbage, tomatoes

Exercise 6.2

1. nutrients
2. A balanced diet supports growth, provides energy, aids tissue repair and helps protect the body against diseases. (Any one)
3. starchy foods
4. fruits and vegetables
5. to provide calcium
6. by supplying proteins and nutrients

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. energy
2. growth
3. body temperature
4. bones
5. skin
6. potatoes
7. fats
8. calcium
9. fish, eggs, meat, legumes. (Any one)
10. oranges, carrots, spinach. (Any one)

Unit 7: Food Science and Technology

Unit objectives

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

a. list food processing methods.
b. explain the food processing methods.
c. identify career paths related to food science and technology.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 35-40.
- Science and Technology Grade 3-7 syllabus.
- Processed food, videos, food processing tools, flow charts.

Teaching notes

- Food processing methods are techniques used to convert raw food into safe, edible products.
- These methods include:
  - Winnowing (separating chaff from grains).
  - Sorting (separating food by characteristics like size or quality).
  - Grading (categorising food by standards).
  - Grinding (reducing food to smaller particles).
- Career paths in this field include roles in hotel management, foods and beverage service, event management, food production supervisors, food safety experts, food technologists, food microbiologists, nutritionists and public health food scientists.

Activities guidelines

Activity 7.1

Food processing research: Use digital tools to help learners explore the process of food processing in detail.
Provide learners with digital devices to search for simulation videos on food processing methods. Instruct them to write down the methods they observe and create a diagram or flowchart showing how each one works. Have them share their findings with the class and discuss why these processes are necessary.

Activity 7.2

Career path research: Guide learners in researching the career opportunities available in food science and technology. Divide learners into groups. Instruct them to research various career paths related to food science and technology using digital devices. Provide prompts such as: "What does a food technologist do?", "What kind of education is needed for a hotel manager?" or "How do food safety experts ensure our food is safe?" Have them write down their findings and prepare a brief presentation to share with the class.

Suggested answers

Exercise 7.1

1. safe
2. chaff
3. grinding
4. grading
5. texture
6. market
7. uniform
8. ready

Exercise 7.2

1. hotel management
2. food processing
3. public health
4. Foods and beverage service.
5. nutritional quality
6. safe

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Winnowing, sorting, grading and grinding.
2. Sorting is the process of separating food items based on specific characteristics such as size, shape or quality. It is important for ensuring uniformity and removing defective products before packaging.
3. It ensures that only quality items reach the market and increases the market value of the products.
4. Winnowing is used to separate lighter chaff from heavier grains.
5. Grinding
6. Grains, coffee beans, spices. (Any three)

Unit 8: Meal planning and budgeting

Unit objectives

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

a. explain budgeting.
b. prepare a meal.
c. illustrate a budget for their family.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 41-47.
- Science and Technology Grade 3-7 syllabus.
- Charts, meal calendar, ingredients, cooking utensils.

Teaching notes

- Meal planning is deciding in advance what meals to eat, which saves time, reduces food waste and ensures balanced nutrition.
- Meal budgeting is planning how much money to spend on food, which helps control costs and avoid overspending.
- Meal preparation involves getting food ready for cooking, including washing, cutting and seasoning ingredients. Proper preparation ensures meals are safe, nutritious and flavourful.

Activities guidelines

Activity 8.1

Weekly meal plan: Guide learners to work in groups to create a practical and balanced weekly meal plan for a family. This activity helps them apply their knowledge of food groups and nutrients. Divide learners into groups of 3-4. Instruct them to design a simple weekly meal plan for a family, ensuring it includes balanced meals for breakfast, lunch and supper. Encourage them to consider factors like the family's likes and dislikes and to include foods from all the main food groups (for example, carbohydrates, proteins, fruits and vegetables). Have each group present their meal plan to the class, explaining why they chose the meals and how their plan promotes a balanced diet.

Activity 8.2

Grocery budgeting: Lead a hands-on activity where learners practise creating a budget for their meal plan. This helps them understand the financial aspect of meal planning. Divide learners into pairs. Instruct them to create a grocery budget for one week based on a simple meal plan they've developed. Have them discuss ways to reduce food expenses while still eating healthily, such as buying foods that are in season or cooking from scratch instead of buying pre-packaged meals. Instruct them to present their findings to the class, explaining their budget and cost-saving strategies.

Activity 8.3

Meal preparation demonstration: Use role-play and a practical cooking session to help learners understand the steps of meal preparation. Divide learners into pairs. Instruct them to describe, step-by-step, how to prepare a simple meal such as a vegetable soup. With the help of an adult, provide a recipe and have them prepare a meal at home. Remind them to follow all safety and hygiene practices, such as washing hands and using clean utensils. The next day, facilitate a discussion about their experiences, challenges and successes in preparing the meal.

Suggested answers

Exercise 8.1

1. in advance
2. food wastage
3. time
4. special dietary needs
5. balanced meals

Exercise 8.2

1. spend
2. overspending
3. wisely

4. other needs
5. control spending

Exercise 8.3

1. buying
2. safe
3. washed
4. cutting and peeling
5. flavour
6. contamination
7. healthy eating
8. meal preparation
9. healthy
10. taste

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Meal planning is deciding in advance what meals you will eat each day, week or month.
2. It saves time by avoiding last-minute decisions, it reduces food waste by efficiently using ingredients, it ensures balanced and nutritious meals, it helps manage special dietary needs such as diabetes or allergies and it prevents repetition by encouraging variety. (Any two)
3. Meal budgeting is planning how much money you will spend on food within a certain period.
4. It controls spending on food, it minimises food waste, it ensures affordability of nutritious meals, it allocates money wisely, it manages dietary needs within financial limits, it reduces financial stress related to food expenses, it develops healthy eating habits. (Any two)
5. Proper meal preparation ensures meals are tasty, nutritious and safe to eat.
6. Washing, cutting, peeling and seasoning. (Any two)
7. A balanced diet is important in meal planning because it ensures that the body receives all the necessary nutrients for growth and overall well-being.

Topic 3 Crops, plants and animals

Unit 9: Crops

Unit objectives

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

a. define crop rotation.
b. name pests that affect crops.
c. explain ways of controlling pests.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 48-53.
- Science and Technology Grade 3-7 syllabus.
- Local environment, crops, ICT tools.

Teaching notes

- Crop pests are organisms that damage crops, such as aphids, caterpillars, birds, rabbits and moles. They reduce crop yield and quality.
- To control pests, farmers can use crop rotation, chemical control (pesticides), weeding, biological control (natural predators) and hand-picking.
- Crop rotation is an effective method that involves growing different crops in the same area in different seasons to reduce pests and improve soil fertility.

Activities guidelines

Activity 9.1

Crop pests discussion: Engage learners in a discussion about pests in their local environment. This helps them connect the topic to their everyday lives. Divide learners into groups. Instruct them to discuss crop pests they see in gardens or farms in their local area and suggest simple methods to control each one (for example, hand-picking caterpillars, chasing birds away).

Have them present their findings to the class, drawing pictures of the pests and their proposed control methods on a poster.

Activity 9.2

Pest control methods discussion: Facilitate a discussion to help learners understand the pros and cons of different pest control methods. Divide learners into groups. Instruct them to discuss which pest control method is most effective in their area and why. Have them explain the advantages (for example, quick, effective) and disadvantages (for example, harmful to environment, expensive) of using pesticides. Instruct them to share their findings with the class, encouraging a debate about the best methods for sustainable farming.

Suggested answers

Exercise 9.1

1. sucking sap
2. Butterflies and moths.

Exercise 9.2

1. False
2. True
3. True
4. False
5. True
6. False
7. True
8. True
9. True

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Crop rotation is the practice of growing different crops on the same land in different seasons to reduce pests and improve soil fertility.
2. It helps to control pests, weeds and diseases, it allows crops to use different soil nutrients, it improves soil fertility. (Any two)
3. Aphids, caterpillars, moles, birds. (Any three)

4. Crop rotation: Planting different crops on the same land in different seasons. Chemical control (pesticides): Using sprays to kill pests. Weeding: Pulling out unwanted plants that pests might hide in. Biological control: Using good bugs or other natural enemies to fight bad bugs. Hand-picking: Removing pests from plants by hand. (Any three)
5. Chemical control or using pesticides.

Unit 10: Plants

Unit objectives

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

a. describe the life cycle of a bean plant.
b. name plant nutrients.
c. identify natural sources of plant nutrients.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 54-60.
- Science and Technology Grade 3-7 syllabus.
- Charts, organic matter, bean seeds.

Teaching notes

- The life cycle of a bean plant includes seed, germination, seedling, growth and harvesting stages.
- Plants require nutrients to grow, such as nitrogen for leafy growth, phosphorus for root development and potassium for water uptake and overall growth.
- These nutrients are absorbed from the soil and air and their natural sources include soil, organic matter like compost and water.

Activities guidelines

Activity 10.1

Bean plant life cycle: In small groups, learners discuss the bean plant life cycle, plant a bean seed, monitor and record observations in a journal, noting sprouting and leaf appearance.

Activity 10.2

Plant nutrients discussion: In groups, learners discuss plant nutrients and their functions. They observe plants in the school garden and suggest what nutrients they may have or be lacking based on appearance.

Activity 10.3

Natural sources of nutrients discussion: In pairs, learners discuss natural sources of plant nutrients (for example, compost, animal manure, rainwater). They share findings and explain why these sources are beneficial for plants.

Suggested answers

Exercise 10.1

1. C
2. C
3. C
4. A
5. growth
6. pods
7. Air, warmth and moisture.
8. Photosynthesis
9. They absorb water and nutrients from the soil to support plant growth.

Exercise 10.2

1. C
2. C
3. B
4. B
5. Nitrogen is essential for leafy growth and chlorophyll production, which makes leaves green and healthy.
6. Photosynthesis.
7. Potassium helps regulate water uptake, enhances stress tolerance and improves crop yield and quality.
8. Plants obtain nutrients from the soil through their roots and from the atmosphere through tiny openings on their leaves called stomata.

Exercise 10.3

1. B
2. B
3. A

4. C
5. B
6. Soil, organic matter (compost) and air.
7. Stomata.
8. Compost is good for plant growth because it adds nutrients to the soil, improves its structure and helps it retain moisture.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Seed, germination, growth and harvesting.
2. Plant nutrients are substances from the soil or atmosphere that plants need to grow.
3. Through their roots from the soil.
4. Soil, organic matter and air.
5. Phosphorus is essential for strong root development, energy transfer and photosynthesis.
6. Plants need potassium to regulate water uptake and enhance overall plant growth and stress tolerance.
7. Germination stage.
8. Nitrogen, phosphorus and potassium.

Unit 11: Animals

Unit objectives

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

a. identify characteristics of vertebrates and invertebrates.
b. classify vertebrates into five groups.
c. describe characteristics of vertebrates and invertebrates.
d. state examples of vertebrates in each group.
e. identify vertebrates and invertebrates according to their habitat.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 61-68.
- Science and Technology Grade 3-7 syllabus.
- Fish pond, charts, local environment.

Teaching notes

- Animals are classified as vertebrates or invertebrates.
- Vertebrates are animals with a backbone and invertebrates are animals without a backbone.
- Vertebrates are further divided into fish, amphibians, reptiles, birds and mammals.
- Each group has unique characteristics, such as scales on fish and reptiles, feathers on birds and fur on mammals.
- Invertebrates often have soft or segmented bodies or hard exoskeletons.
- Animals live in different habitats, including water, land and air, which provide them with food, shelter and a place to reproduce.

Activities guidelines

Activity 11.1

Vertebrate classification table: Use a collaborative activity to help learners classify vertebrates. Divide learners into small groups. Provide each group with a large, empty table similar to the one in the learner's book. Instruct them to fill in the table by classifying vertebrates into the five groups which are fish, amphibians, reptiles, birds and mammals whose examples and characteristics are provided in their textbook.

Activity 11.2

Invertebrate characteristics: Guide learners in a discussion to help them describe the characteristics of invertebrates. Divide learners into groups. Instruct them to discuss and describe the characteristics of different invertebrates, such as soft bodies (snails), segmented bodies (millipedes) or hard exoskeletons (insects). Have them provide examples for each characteristic.

Activity 11.3

Habitats and animals: Use a discussion-based activity to help learners identify animals in different habitats and classify them. Divide learners into groups. Instruct them to discuss different habitats (for example, water, land, underground, in trees) and the animals that live there. Have them identify whether each animal is a vertebrate or an invertebrate and explain their reasoning. Have each group present their findings to the class.

Suggested answers

Exercise 11.1

1. backbone
2. water and land
3. feathers
4. milk
5. lungs
6. fins
7. dog
8. water
9. wings
10. scales

Exercise 11.2

1. backbone
2. soft
3. segmented
4. muscular foot
5. worm
6. six
7. exoskeleton
8. swimming
9. Burrowing and mixing soil.
10. arachnids

Exercise 11.3

1. **(a)** Water, land, underground, in trees and in the air.

   (b) Water: Fish, frogs, crocodiles. Land: Mammals like dogs, cows, elephants or cattle, snakes, lizards. Underground: Moles, some snakes. In trees: Birds, baboons. In the air: Most birds like eagles or storks.

2. **(a)** Land, freshwater, seas and deserts.

   (b) Land: Worms, insects like ants or beetles, centipedes, millipedes, snails, slugs. Freshwater: Snails, some insects. Seas: Jellyfish, octopuses, crabs, starfish, sponges. Deserts: Various insects, spiders, scorpions.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1.

Animal group	Birds	Reptiles	Amphibians	Fish	Mammals
Example	Dove	Crocodile	Frog	Kapenta	Lion
External feature	Feathers	Scales	Soft moist skin	Scales	Fur
Habitat	Nests, trees	Land, water	Land, water	Water	Land

2. A vertebrate is an animal with a backbone.
3. An invertebrate is an animal without a backbone.
4. Worms, insects, snails, centipedes, millipedes, slugs, spiders, jellyfish, octopuses, crabs, starfish and sponges. (Any two)
5. Water, land. (Any two)

Unit 12: Food web

Unit objectives

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

a. identify components of a food web.
b. draw a simple food web.
c. explain the importance of food webs.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 69-75.
- Science and Technology Grade 3-7 syllabus.
- Charts, ICT tools.

Teaching notes

A food web is a network of interconnected food chains.

Its components are:

- Producers (plants that make their own food).
- Consumers (animals that eat other organisms).
- Decomposers (organisms that break down dead matter).

Food webs are important for:

- Showing the flow of energy.
- Illustrating food chains.
- Maintaining the balance of an ecosystem.

Activities guidelines

Activity 12.1

Food web discussion and drawing: Learners discuss different food webs using diagrams from the learner's book. In pairs or individually, they draw a simple food web for a specific environment, labelling producers, consumers and decomposers and using arrows to show energy flow. They then share their diagrams and explain each stage.

Activity 12.2

Food web scenarios: In groups, learners discuss and predict what would happen in scenarios like a forest with too many zebras, a farmer removes all insects from his farm or a wildfire burning plants in a grassland. They then discuss the importance of food webs, highlighting how they show the interconnectedness of all living things.

Suggested answers

Exercise 12.1

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

Exercise 12.2

1. Ecosystem
2. Overpopulation
3. Energy
4. Food web
5. Understand
6. Animals and plants
7. Dead plants and animals would pile up and nutrients would not be recycled back into the soil, which would disrupt the entire food web.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. A food web is a complex network of interconnecting and overlapping food chains showing feeding relationships within an ecosystem.
2. **(a)** Producers: Make their own food using sunlight.
   (b) Consumers: Depend on plants and other animals for food.
   (c) Decomposers: Break down dead material and recycle nutrients.
3. Grass, trees, algae. (Any one)
4. Rabbit, lion, bird. (Any one)
5. Fungi, bacteria, earthworms. (Any one)
6. An omnivore is an organism that eats both plants and animals.
7. Cow, goat, rabbit. (Any one)
8. Carnivores eat other animals (meat).
9. Learners draw a simple food web showing three levels of consumers (producers, consumers and decomposers).

Topic 4 Environmental awareness and conservation

Unit 13: Climate and weather

Unit objectives

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

a. list weather elements.
b. identify weather instruments.
c. construct weather instruments.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 76-81.
- Science and Technology Grade 3-7 syllabus.
- Weather station, charts, weather instruments.

Teaching notes

- Weather elements are atmospheric conditions like rainfall, wind, cloud cover, temperature and humidity.
- Weather instruments are tools used to measure these elements.
- A rain gauge measures rainfall in mm, a wind vane measures wind direction, a cup anemometer measures wind speed in *km/h* or *m/s*, a thermometer measures temperature in °C or °F and a hygrometer measures humidity in %.

Activities guidelines

Activity 13.1

Weather observation: Lead learners in a hands-on, long-term observation activity to help them understand weather patterns. Instruct learners to observe the weather for one week and record the temperature, wind speed and direction, cloud cover and rainfall each day in a small notebook or chart. At the end of the week, have them compare their results with their classmates and discuss any patterns or causes for changes they observed.

Activity 13.2

Instrument and function matching: Use a matching activity to help learners connect weather instruments to their functions. Divide learners into groups. Provide each group with a large, blank table with two columns: "Weather Instrument" and "Function." Instruct them to match the weather instruments from the learner's book with their correct functions.

Weather Instrument	Function
Thermometer	Measures temperature.
Rain gauge	Measures the amount of rainfall.
Wind vane	Measures the direction of the wind.
Cup anemometer	Measures wind speed.
Hygrometer	Measures humidity.

Suggested answers

Exercise 13.1

1. True
2. False
3. True
4. True
5. False
6. False
7. False
8. True

Exercise 13.2

1. thermometer
2. rain gauge
3. wind vane
4. cup anemometer
5. hygrometer
6. open
7. millimetres
8. degrees Celsius (°C)

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. A weather element refers to the prevailing atmospheric condition at a particular time and place.
2. Temperature, rainfall, wind, cloud cover and humidity. (Any three)

3 (a) Thermometer: Measures temperature.

(b) Hygrometer: Measures humidity.

(c) Cup anemometer: Measures wind speed.

(d) Rain gauge: Measures rainfall.

(e) Wind vane: Measures wind direction.

4 It is important to measure weather elements to help people plan daily activities, prepare for different weather events and predict weather patterns.

Unit 14: Soil components

Unit objectives

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

- list four components of the soil.
- explain the importance of the soil components in the soil and plants.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 82-86.
- Science and Technology Grade 3-7 syllabus.
- Soil samples, sand, organic matter, garden tools.

Teaching notes

- Soil is made up of four main components: mineral matter, water, organic matter (humus) and air.
- Mineral matter provides nutrients, water transports nutrients to plant roots, organic matter enriches the soil and retains moisture and air provides oxygen for plant roots and soil organisms.
- Each component is vital for plant growth and overall soil health.

Activities guidelines

Activity 14.1

Soil sorting experiment: Conduct a hands-on experiment to help learners identify the different components of soil. Instruct learners to collect soil samples from different places (for example, a garden, a playground, a roadside). Have them observe and compare the textures and colours of the samples. Guide them to separate the soil components (organic matter, small rocks, sand) using a magnifying glass.

Activity 14.2

Soil component importance discussion: Lead a discussion to help learners understand the importance of each soil component. Divide learners into pairs. Instruct them to discuss the importance of soil components in the soil and plants. Have them work together to create a table matching each soil component to its importance.

Suggested answers

Exercise 14.1

1. Mineral matter, organic matter, water and air.
2. Organic matter or humus.
3. Air
4. Mineral matter.
5. Water.

Exercise 14.2

Match the soil component with its importance.

Soil component	Importance
Air	Essential for respiration of plants and soil organisms; aids decomposition processes.
Water	Dissolves minerals, facilitates nutrient uptake by plant roots and supports photosynthesis.
Organic matter	Enriches the soil, boosts fertility, enhances water retention and supports beneficial soil organisms.
Mineral matter	Supplies plants with vital nutrients needed for growth and development.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Mineral matter, organic matter, water and air.
2. Mineral matter supplies plants with vital nutrients for growth.
3. Organic matter is decomposed plant and animal materials that enrich the soil.

4. Compost, dead leaves, manure. (Any two)
5. Air is important because it provides oxygen for plant roots to breathe and for soil organisms to carry out decomposition.
6. Water dissolves nutrients in the soil, making them available for plants to absorb through their roots.

Unit 15: Soil as an ecosystem

Unit objectives

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

a. identify organisms living in the soil.
b. discuss how plants and animals benefit from the soil.
c. explain how soil is enriched by soil organisms.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 87-94.
- Science and Technology Grade 3-7 syllabus.
- School garden, garden tools, humus, compost.

Teaching notes

- Soil is an ecosystem that is home to many organisms like earthworms, ants, moles and centipedes.
- These organisms benefit from the soil by using it for shelter, food and protection.
- Soil also provides plants with essential nutrients like nitrogen, potassium and phosphorus.
- Soil organisms enrich the soil by breaking down dead plants and animals into humus, which adds nutrients and improves soil fertility.

Activities guidelines

Activity 15.1

Soil organisms exploration: Organise a supervised exploration of the school garden to discover and identify soil organisms. Take learners to the school garden with a hoe and spade, emphasising safety when using the tools. Instruct them to carefully dig up a small section of soil and observe the organisms they find, using a magnifying glass to look for small, microscopic organisms. Have them list the organisms they identified and then, in their groups, discuss how each organism is adapted to survive in the soil. Encourage learners to draw the organisms they found in their science notebooks.

Activity 15.2

Plant nutrient observation: Lead an observational activity to help learners understand the connection between plants and soil nutrients. Take learners to the school garden and have them observe different plants. Instruct them to carefully dig a small hole near a plant to look at its roots. Remind them to be gentle so as not to damage the plant. Have them discuss how plants get nutrients from the soil by observing the roots and noting that the soil around the roots is where nutrients is absorbed. Instruct them to record their observations in a chart, noting the plant's health and the condition of the soil.

Activity 15.3

Decomposition experiment: Conduct a simple, long-term experiment to demonstrate how organisms enrich the soil through decomposition. Instruct learners to collect fallen leaves and place them in a clear plastic container with soil. Have them observe the leaves every few days over a period of two weeks, noting any changes in their appearance. Guide them to identify small organisms like insects or fungi that may be helping to break down the leaves. Lead a discussion on how this process helps the soil by turning dead matter into rich, fertile humus.

Activity 15.4

Burrowing animals observation: Facilitate an outdoor activity to help learners find and understand burrowing animals. Take learners outside to an open area with soil and have them observe the ground for signs of animal life, such as small holes or tunnels. Instruct them to carefully dig a small section of soil to find burrowing animals or insects. Remind them to not disturb any living animal or insect. Have them list the animals they observe and discuss how these animals survive in the soil and how they contribute to soil health by mixing and aerating it.

Suggested answers

Exercise 15.1

1. Earthworms, spiders, moles, termites, ants, centipedes, millipedes, frogs. (Any three)
2. Spiders make their homes in holes they dig underground.
3. chambers
4. Earthworms help the soil by burrowing in it, breaking down dead plants and animals, mixing the material into tiny pieces and enriching the soil with their waste (worm castings). They also dig tunnels that allow air and water to reach plant roots.
5. The soil itself or the tunnels and burrows they create, protects small animals in the soil from harsh weather.
6. Some animals dig tunnels in the soil for shelter, food storage and protection from harsh weather and predators.

Exercise 15.2

1. Nitrogen, Potassium, Phosphorus.
2. Nitrogen helps produce proteins for growth, potassium strengthens roots and helps resist diseases, phosphorus supports root development and energy transfer.
3. The plants would not be able to grow or would not be healthy.

Exercise 15.3

1. Earthworms, insects, bacteria, fungi.
2. They form humus, which adds nutrients to the soil and helps plants grow better.
3. Mushroom.
4. They break down dead wood, leaves and other dead organic matter, recycling nutrients back into the soil for plants to use.
5. Ants, beetles.
6. Earthworms eat dead plants and animals, breaking them into tiny pieces and mixing them with the soil. Their waste makes the soil rich in nutrients. They also dig tunnels, which allows air and water to reach plant roots.

Exercise 15.4

1. Moles, rabbits, ants, termites. (Any two)
2. Moles dig tunnels underground, which helps loosen the soil, allowing air and water to reach plant roots.
3. mixing nutrients
4. termites
5. For protection from predators and to hide from extreme weather and for shelter.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Humus
2. Earthworms
3. Nutrients

4. Earthworms, ants, millipedes, termites, frogs. (Any two)
5. Plants absorb nutrients from the soil through their roots.
6. Fungi break down dead plants and animals into useful nutrients for the plants.
7. False
8. True
9. False

Unit 16: Soil erosion

Unit objectives

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

- define soil erosion.
- list agents of soil erosion.
- explain causes of soil erosion.
- state ways of controlling soil erosion.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 95-100.
- Science and Technology Grade 3-7 syllabus.
- Charts, local environment, ICT tools.

Teaching notes

- Soil erosion is the carrying away of the top fertile soil.
- Its agents are water, wind, gravity and human activities.
- Causes of soil erosion include deforestation, poor farming practices, overgrazing and natural factors like heavy rainfall.
- Soil erosion can be controlled by planting trees and grass, mulching the soil, building terraces on slopes, using cover crops, building windbreaks and adopting good farming practices.

Activities guidelines

Activity 16.1

Soil erosion demonstration: Conduct a simple science experiment to visually demonstrate how water and wind cause soil erosion. Provide a tray of dry soil and a tray with soil covered in grass or small plants. Instruct learners to take a handful of soil from the dry tray and blow on it to observe what happens.

Then, have them use a watering can to pour water on a small heap of soil in both trays and observe the movement of soil particles. Instruct them to record their observations in a table and discuss the differences between the two trays, focusing on which one experienced less erosion.

Activity 16.2

Soil erosion observation: Lead an outdoor activity to help learners identify real-world signs of soil erosion. Instruct learners to look around the schoolyard or community to find signs of soil erosion, such as exposed tree roots, small gullies or channels or muddy water after it rains. Have them identify what is causing the erosion (for example, lack of grass, foot traffic, a slope with no plants). Encourage them to take notes or draw what they see and to propose simple solutions to prevent it.

Activity 16.3

Soil erosion control discussion: Engage learners in a problem-solving activity to brainstorm and present solutions to soil erosion. Divide learners into groups. Instruct them to suggest ways to prevent and control soil erosion using methods from the learner's book. Have them choose one method and create a simple model or a poster to demonstrate how it works (for example, a model showing how a terraced hillside prevents water run-off). Have them present their suggestions and models to the class.

Suggested answers

Exercise 16.1

1. carrying away
2. agents of soil erosion
3. Water, wind, gravity, human activities, animals, glaciers. (Any three)
4. large rocks
5. Deforestation, overgrazing, deep ploughing, land clearing. (Any three)

Exercise 16.2

1. True
2. False
3. True
4. False
5. True
6. False
7. True
8. True
9. True
10. False

Exercise 16.3

1. trees
2. Mulch
3. terraces

4. overgrazing
5. Crop rotation
6. soil erosion
7. mulching
8. hedges

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Water, wind, gravity, animals, glaciers, human activities. (Any two)
2. Heavy rainfall, strong winds, deforestation and overgrazing. (Any two)
3. Deforestation: Cutting down trees removes roots that hold the soil, exposing it to wind and water erosion.
   - Overgrazing: Too many animals feeding on a piece of land strip it of vegetation, leaving the soil bare and vulnerable to erosion.
   - Poor farming practices: Such as monocropping and deep ploughing, weaken soil structure, making it more prone to erosion.
   - Land clearing and urbanisation: Expose the soil as vegetation is removed for construction and agriculture, increasing erosion risks.
   - Poor water management: Leads to excessive runoff due to inadequate drainage systems, while over-irrigation washes away topsoil. (Any two)
4. Deforestation is the cutting down of trees without replacing them.
5. Planting trees and grass, mulching, terracing, using cover crops, building windbreaks, using stones and boulders (riprap), good farming practices: (Any three)

Unit 17: Water cycle

Unit objectives

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

a. identify states of water.
b. demonstrate the changes in water states.
c. explain the water cycle.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 101-105.
- Science and Technology syllabus, 2024-2030, Grade 3-7.
- Charts, water, freezer, ice tray, heat source, beakers.

Teaching notes

- Water exists in three states: solid (ice), liquid (water) and gas (water vapour).
- Water changes state when heated or cooled.
- The water cycle is the continuous movement of water and includes evaporation, condensation, precipitation and collection.
- The water cycle includes evaporation, where liquid turns to gas; condensation, where gas turns to liquid; precipitation, where water falls back to earth; and collection, where water gathers in rivers and oceans.

Activities guidelines

Activity 17.1

Freezing water experiment: Conduct a hands-on experiment to demonstrate the change of water from a liquid to a solid state. Provide learners with water, a small plastic container with a lid and access to a freezer. Instruct them to fill the container with water, leaving a small space at the top to allow for expansion. Have them observe what happens to the water after it has been in the freezer overnight and record their findings. Lead a discussion on the process of freezing and why the water changed state.

Activity 17.2

Water cycle diagram: Use a drawing activity to help learners visualise and label the stages of the water cycle. Instruct learners to draw and label a simple diagram of the water cycle, including the sun, clouds, a body of water and land. Have them label each stage correctly: evaporation, condensation, precipitation and collection.

Encourage them to use arrows to show the direction of water movement in the cycle. Have them share their diagrams with the class and explain each stage of the cycle.

Suggested answers

Exercise 17.1

1. tasteless, odourless
2. solid water, liquid water, gaseous water
3. Liquid water
4. Gaseous water

Exercise 17.2

1. The water level decreased because it evaporated.
2. The size of the container increased because the water expanded when it froze into ice.
3. Evaporation
4. Freezing

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Solid, liquid and gas.
2. liquid
3. solid
4. gaseous
5. Evaporation, condensation, precipitation and run-off.
6. condensation.
7. The hydrologic cycle.
8. Precipitation is when water falls back to the earth as rain, snow or hail.

Unit 18: Water pollution

Unit objectives

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

a. define water pollution.
b. name causes of water pollution.
c. identify effects of water pollution.
d. state ways of water treatment.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 106-112.
- Science and Technology syllabus, 2024-2030, Grade 3-7.
- Water sources, charts, local environment, filtration aaparatus, boiling apparatus.

Teaching notes

- Water pollution is the introduction of harmful substances into water sources.
- Causes include human and animal waste, farm chemicals, industrial waste and oil spills.
- Effects of pollution are the death of marine animals, poor crop growth and the spread of waterborne diseases.
- Water can be treated by boiling, adding chemicals like chlorine and using sewage treatment processes.

Activities guidelines

Activity 18.1

Water pollution observation: Lead an outdoor observation activity to help learners identify real-world signs of water pollution. Instruct learners to go outside and observe nearby water sources, such as drains, small ponds or rivers. Provide them with a checklist to record their observations, including: Signs of pollution (for example, trash, foam, discoloured water, bad smell). Possible causes (for example, a nearby factory, a farm, a dumping site). Whether the water looks safe for drinking and why. Facilitate a class discussion where learners share their findings and discuss the potential health risks.

Activity 18.2

Effects of water pollution investigation: Use a group activity to help learners investigate the different effects of water pollution on living things. Divide learners into small groups.

Assign each group a specific effect to focus on (for example, Group 1: Effects on farmers; Group 2:

Effects on marine animals; Group 3: Effects on human health). Instruct them to discuss and write answers to the questions provided and to prepare a brief presentation for the class.

Activity 18.3

Water treatment demonstration: Conduct a simple, supervised demonstration to show how water can be treated at home. Provide a sample of dirty water (for example, tap water mixed with some soil). Guide learners in a demonstration of boiling one sample and adding a few drops of a chlorine solution to another. Have them observe the changes in the water and discuss which method is best for home use, taking into account which method is safer and easier to do. Remind them that for a real-life situation, it is best to boil water.

Suggested answers

Exercise 18.1

1. urine, faeces
2. farm chemicals
3. oil spills
4. industries
5. livestock

Exercise 18.2

1. cholera, dysentery
2. crops
3. marine animals
4. toxic waste
5. oil spills

Exercise 18.3

1. Sewage treatment
2. Chlorine
3. Boiling, bacteria
4. Purification

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Water pollution is the introduction of harmful substances into water.
2. Releasing human waste, industrial waste and oil spills. (Any two)

3. Death of marine animals, spread of waterborne diseases and poor crop growth.
4. Boiling water, adding chlorine and sewage treatment.
5. Polluted water may have a bad smell, a cloudy or dark colour and visible waste like plastic or oil spills.
6. Cholera, typhoid, dysentery. (Any two)
7. Oil spills cover the surface of the water, which blocks oxygen and sunlight, causing marine animals to suffocate.
8. The crops can absorb the harmful chemicals from the polluted water, which affects their growth and makes them unsafe to eat.
9. Boiling water makes it safe for drinking by heating it to a temperature that kills harmful bacteria and germs.

Unit 19: Waterborne diseases

Unit objectives

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

a. define waterborne diseases.
b. list water borne diseases.
c. explain how diseases are transmitted through water.
d. identify the symptoms of cholera, typhoid and bilharzia.
e. explain ways of preventing and treating waterborne diseases.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 113-119.
- Science and Technology Grade 3-7 syllabus.
- Print media, realia, ICT tools.

Teaching notes

- Waterborne diseases are illnesses spread through contaminated water.
- Examples are cholera, typhoid and bilharzia.
- Cholera and typhoid are bacterial infections transmitted by drinking contaminated water or food.
- Bilharzia is caused by parasitic worms that enter the body through the skin from infected water.
- Prevention of waterborne diseases include drinking safe water, practicing good hygiene, protecting water sources.

Activities guidelines

Activity 19.1

Disease transmission discussion: Facilitate a group discussion to help learners understand how waterborne diseases are transmitted. Divide learners into pairs. Instruct them to discuss how diseases are transmitted through water, using specific examples from the learner's book (for example, drinking contaminated water for cholera, contact with infected water for bilharzia). Encourage them to think of additional ways diseases can be transmitted and to share these with the class.

Activity 19.2

Waterborne disease symptoms discussion: Use a collaborative activity to help learners identify the signs and symptoms of waterborne diseases. Divide learners into groups. Instruct them to discuss the signs and symptoms of cholera, typhoid and bilharzia as outlined in the learner's book. Provide a table for them to fill in, listing each disease and its corresponding symptoms. Have them present their findings to the class, explaining the difference between a sign and a symptom.

Activity 19.3

Prevention role-play: Use role-play to help learners practise and reinforce methods of preventing waterborne diseases. Divide learners into groups. Instruct them to create and perform a short role-play illustrating one or two methods of preventing waterborne diseases. Examples could include: A learner demonstrating proper handwashing with soap and clean water. A learner explaining why a family should boil their drinking water. A learner warning a friend about swimming in dirty water.

Suggested answers

Exercise 19.1

1. bacteria
2. faeces
3. parasites
4. contaminated
5. seafood
6. hands
7. hygiene
8. water

Exercise 19.2

1. bilharzia
2. Cholera
3. High fever, headache or stomach pain. (Any one)
4. Bilharzia
5. Cholera, bilharzia
6. cholera, typhoid

Exercise 19.3

1. Boiling
2. contamination
3. cooking
4. stagnant
5. medical help

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Waterborne diseases are illnesses caused by infection and spread through drinking or using contaminated water.
2. Severe watery diarrhoea and dehydration.
3. Drinking contaminated water and eating food washed with dirty water.
4. Bilharzia is transmitted when a person swims, bathes or walks in contaminated water, allowing the parasitic worms to enter the body through the skin.
5. Drinking safe water and practising good hygiene.
6. True
7. False
8. False

Unit 20: Land use

Unit objectives

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

- explain land use.
- classify land according to use.
- list various land uses.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 120-125.
- Science and Technology Grade 3-7 syllabus.
- Local environment, charts, maps, digital tools.

Teaching notes

- Land use is how people use land, classified into rural and urban.
- Rural use includes farming and forestry, while urban use includes residential, industrial and commercial areas.
- Improper land use leads to environmental problems like deforestation, soil erosion and pollution.
- Siting settlements depends on factors like water availability, soil fertility and topography.

Activities guidelines

Activity 20.1

Local land use: Encourage learners to become local observers and analyse the land use in their immediate area. Instruct learners to observe their local surroundings, either by walking around the school or by looking at maps or satellite images, to identify how the land is used. Have them classify the areas they identified as either rural or urban land use and discuss how different land uses contribute to human development. Instruct them to present their findings in class using drawings or a poster.

Activity 20.2

Environmental effects discussion: Guide learners to identify and discuss the environmental consequences of land use. Instruct learners to observe their surroundings for signs of environmental degradation (for example, litter, exposed soil, smoke from a factory). Have them, in their pairs, discuss how land users contribute to environmental damage and suggest ways to reduce negative impacts.

Activity 20.3

Settlement siting discussion: Use maps and a discussion-based activity to help learners understand the factors that influence where people live. Instruct learners to use maps (either a physical map or an online one) to identify rural and urban settlements in their region. Have them discuss what made these settlements develop by considering factors such as proximity to water, soil type and the presence of roads or railways.

Suggested answers

Exercise 20.1

1. Land use is the way people use land for various purposes, such as farming, housing and industry.
2. Rural and urban land use.
3. Farming, forestry and conservation.
4. Residential areas, factories, roads.
5. It helps in proper land planning and balancing development with resource conservation.
6. Land use can affect human activities by providing places for housing, farming and work or by creating challenges like pollution and traffic congestion.

Exercise 20.2

1. Deforestation is the clearing of forests for farming and urban development. Deforestation is the cutting down of trees.
2. Soil erosion, pollution, loss of biodiversity. (Any two)
3. Urbanisation removes natural habitats and increases pollution from factories and vehicles.
4. The land becomes less productive and essential nutrients are washed away.
5. Planting trees and avoiding poor farming practices. (Any two)
6. True

Exercise 20.3

1. Water availability, soil fertility, topography, accessibility, climate, security and economic opportunities. (Any three)
2. Accessibility is important because it makes the movement of goods and people easier through roads, railways and transport networks.
3. Farming
4. Limited access to services and poor transportation. (Any two)
5. Climate, as people prefer regions with moderate weather conditions.
6. True

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Land use is the way people utilise land for various purposes, such as farming, housing and industry.
2. Rural and urban land use.
3. Deforestation and soil erosion.
4. Residential, industrial and commercial.
5. Water availability, climate, topography, soil fertility, accessibility, security and economic opportunities. (Any one)
6. Deforestation is the cutting down of trees without replacing them.
7. True
8. True
9. True
10. Poor land use leads to deforestation, soil erosion and pollution, which damages the environment and reduces land productivity.

Unit 21: Land conservation

Unit objectives

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

a. explain proper use of land.
b. identify ways of conserving land.
c. list effects of improper use of land.
d. practise land conservation measures.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 121-132.
- Science and Technology Grade 3-7 syllabus.
- Local environment, charts, maps, digital tools.

Teaching notes

- Proper land use involves considering factors like topography, soil composition and water availability.
- Land conservation is essential to keep land productive.
- Methods of land conservation include afforestation, land reclamation, preventing overgrazing and using organic farming.

- Improper land use leads to soil erosion, pollution, poor urban development and food shortages.

Activities guidelines

Activity 21.1

Local land use observation: Lead an observational activity to help learners identify proper and improper land use in their local area. Instruct learners to walk around their school or community and observe how the land is used. Have them note down any examples of improper land use they see (for example, garbage dumping, soil erosion on a slope). Have them discuss with their classmates how the land could be used properly and propose a plan for one of the areas they observed.

Activity 21.2

Afforestation and conservation discussion: Engage learners in a discussion about afforestation and its role in land conservation. Instruct learners to identify trees planted in their school or community and discuss the benefits of having them. Have them research how afforestation is promoted in their area and discuss how planting trees helps maintain productivity and prevents soil erosion.

Activity 21.3

Improper land use research: Use digital tools to help learners research the effects of improper land use and propose solutions. Instruct learners to use digital devices to research the effects of improper land use (for example, images of areas affected by deforestation, pollution or poor urban development). Have them discuss how these effects can be reduced and create a digital presentation or a short video with their findings and proposed solutions.

Activity 21.4

Soil conservation discussion: Organise a practical discussion to help learners connect soil conservation to improving agriculture. Instruct learners to identify soil conservation practices used in their community (for example, terracing on a nearby farm, mulching in a home garden). Have them discuss how soil conservation improves agriculture by preventing soil erosion and maintaining soil fertility.

Suggested answers

Exercise 21.1

1. Balancing economic, social and environmental needs.
2. Systematic assessment of land potential.
3. Loss of biodiversity.
4. proper land use

Exercise 21.2

1. Afforestation is the planting of trees in an area where there was no recent tree cover.
2. Reforestation or planting trees on previously deforested land, irrigation of dry land and drainage of waterlogged areas. (Any two)
3. Rotate grazing areas, control the number of livestock per grazing area and plant alternative fodder crops to supplement grass and trees. (Any two)
4. Organic farming helps in land conservation by avoiding harmful chemicals and using natural methods like compost and crop rotation to maintain soil health.
5. Terracing, contour ploughing, cover cropping and mulching. (Any two)

Exercise 21.3

1. When land is not used properly, it can lead to poor urban development, soil erosion, food shortages and soil pollution.
2. Soil erosion and loss of productivity.
3. Improper land use reduces the amount of fertile land available for agriculture, which can lead to food shortages.
4. Poor urban development can lead to overcrowding and inadequate infrastructure, which puts a strain on the land and can lead to pollution and environmental damage.
5. Soil pollution can contaminate water sources, harm plants and make the land unsuitable for agriculture.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Land conservation is the practice of protecting and managing land to ensure it remains productive and usable for future generations.
2. Planting more trees, land reclamation through land recovery processes, checking overgrazing, reducing or stopping the use of harmful chemicals and preventing or reducing soil erosion through terracing, contour ploughing, cover cropping, mulching, building windbreaks and using riprap. (Any two)
3. Farming and forestry.

4. Poor urban development leading to overcrowding and inadequate infrastructure, soil erosion which reduces land productivity, limited land available for agriculture causing food shortages and the risk of soil pollution from chemicals and waste dumping.
5. Afforestation helps in land conservation by preventing soil erosion with their roots, improving soil fertility and reducing the effects of climate change.
6. Land reclamation is important to restore damaged land to a productive state, making it usable for agriculture, settlement or other purposes.
7. by rotating grazing areas or controlling the number of livestock.
8. Reducing the use of farm chemicals prevents soil pollution and the degradation of soil quality, which helps in maintaining its health and fertility.

Unit 22: Man-made resources

Unit objectives

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

a. identify man-made resources.
b. state the importance of man-made resources.
c. construct models of man-made resources.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 133-139.
- Science and Technology Grade 3-7 syllabus.
- Charts, realia, construction materials.

Teaching notes

- Man-made resources are features created by humans, such as dams, roads, airports, seaports and monuments.
- They are important for transportation, water supply economic growth (trade and tourism) and preserving history and culture.
- Building models of these resources can help learners understand their function and structure.

Activities guidelines

Activity 22.1

Local man-made resources discussion: Lead a classroom discussion to help learners identify man-made resources in their immediate area and understand their purpose. Instruct learners to name man-made resources found in their local area (for example, a local bridge, a large building, a road). Have them identify a famous monument in their country (for example, a statue, a historical building) and explain its purpose and historical significance. Encourage learners to think about how these resources impact their daily lives.

Activity 22.2

Importance of resources discussion: Guide learners to discuss the importance of man-made resources, focusing on their economic and cultural impact. Instruct learners to discuss the importance of man-made resources, considering their role in transportation, water conservation, economic growth and cultural preservation. Have them work in pairs to write a short paragraph explaining how roads and airports help in economic growth by facilitating trade and tourism. Ask pairs to share their paragraphs with the class.

Activity 22.3

Model construction: Facilitate a hands-on activity where learners construct a model of a man-made resource of their choice. Divide learners into pairs. Instruct them to identify a man-made resource they would like to model (for example, a simple bridge, a house, a dam). Have them draw a simple plan or sketch of the model on paper first. Provide simple materials such as cardboard, paper, glue, tape and scissors for construction. Instruct them to construct the model using the materials of their choice, following their plan. Have them present their finished model to the class, explaining its function and the materials they used.

Suggested answers

Exercise 22.1

1. Dams, roads, airports, seaports and monuments. (Any three)
2. Dams: to store water; roads: for transportation; airports: for aeroplanes to take off and land; seaports: for transportation of goods and passengers by ship and monuments: for preserving history and culture. (Any three)
3. dam
4. monument
5. False
6. True
7. Roads are used to allow people and vehicles to travel safely from one place to another.
8. Seaports and airports.

Exercise 22.2

Man-made resources	Importance
Seaports	Provide transportation.
Dams	Help in water conservation and supply.
Airports/Seaports	Support economic growth.
Monuments	Preserve history and culture.
Roads	Improve communication and access.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. A man-made resource is a feature that is made or created by human beings.
2. **(a)** Dams, roads, airports and seaports.

   (b) Dams: store water; roads: for transportation; airports: for air travel and trade; seaports: for shipping goods and passengers.
3. An airport is for air transportation, where planes take off and land. A seaport is for water transportation, where ships dock to load and unload goods.

Topic 5 Tools, equipment and implements

Unit 23: Equipment and machinery

Unit objectives

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

a. identify farm machinery.
b. state uses of farm machinery.
c. list advantages of using farm equipment and machinery.
d. explain disadvantages of using farm equipment and machinery.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 140-145.
- Science and Technology Grade 3-7 syllabus.
- Farm equipment and machinery, ICT tools.

Teaching notes

- Farm machinery includes mechanical devices like tractors, harvesters, ploughs and sprayers.
- These machines make farm work more efficient.
- Advantages include increased productivity, reduced labour costs and higher income.
- Disadvantages are high maintenance costs, environmental pollution and damage to soil structure.

Activities guidelines

Activity 23.1

Farm machinery uses discussion: Engage learners in a discussion about the uses of different farm machines. This helps them understand how technology is applied in agriculture. Divide learners into groups.

Instruct them to discuss the uses of various farm machinery, such as a tractor for pulling implements and a combine harvester for reaping. Have them write down their findings in their notebooks, creating a table that lists each machine and its primary function. Facilitate a class discussion where groups share their findings.

Suggested answers

Exercise 23.1

Farm machinery	Use
Tractor	Used for pulling farm implements.
Combine harvester	Used to harvest grain crops.
Sprayer	Used to apply herbicides, pesticides and fertilisers.
Backhoe	Used to dig fence post holes or small ponds.
Harrow	Used to level soil and break up clumps.

Exercise 23.2

1. increase
2. labour
3. maintenance
4. pollution
5. structure
6. True
7. False
8. True
9. False
10. False

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Tools that make agricultural tasks simple.
2. A tractor is used for pulling farm implements, acting as a stationary power source and transporting crops.
3. A combine harvester.
4. preparing a proper seedbed, burying crop residue, controlling weeds, mixing and incorporating soil. (Any one)
5. A harrow
6. A backhoe is used for digging fence post holes or small excavation jobs like digging small ponds.

7 sprayer

8 Increases farm productivity, reduces labour costs, more space for crops, higher income from agriculture, improved quality of farm produce, saves time. (Any two)

9 High maintenance costs, environmental pollution, damage to soil structure, soil erosion, difficulty in practising mixed cropping, requires skilled labour. (Any one)

Unit 24: Maintenance of farm equipment

Unit objectives

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

- describe the maintenance of farm equipment.
- state the importance of maintenance of farm equipment.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 146-151.
- Science and Technology Grade 3-7 syllabus.
- Farm equipment and machinery, ICT tools, local environment.

Teaching notes

- Regular maintenance of farm equipment is essential for longevity and safety.
- Practices include checking oil and water levels, checking tyres and batteries, cleaning air filters, lubricating moving parts and fixing broken parts.
- Proper maintenance ensures efficient performance, reduces long-term costs and improves safety for the operator.

Activities guidelines

Activity 24.1

Maintenance practices research: Guide learners in researching farm equipment maintenance practices to understand the importance of regular care. Instruct learners to visit a nearby farm, if possible or use online resources to research maintenance practices for different types of farm equipment. Have them write a summary of three useful practices they found (for instance, checking oil levels, lubricating moving parts, cleaning air filters). Have them present their findings to the class, explaining why each practice is important.

Activity 24.2

Importance of maintenance discussion: Facilitate a discussion to help students understand the benefits of maintaining farm equipment. Divide students into pairs. Instruct them to discuss the advantages of maintaining farm equipment, considering factors such as safety, cost savings and longevity. Have them present their findings to the class, explaining how maintenance prevents accidents, reduces expensive repairs and keeps machines working efficiently for a longer time.

Suggested answers

Exercise 24.1

1. longer
2. better
3. efficiently
4. expensive
5. dangerous

Unit revision exercises

Multiple choice answers

1. B
2. A
3. D
4. A
5. B
6. B
7. B
8. B

Structured questions answers

1. last
2. water
3. smoothly
4. Checking oil levels, checking tyres, cleaning the radiator, checking lights and signals, cleaning air filters, checking trailer connections, looking for and fixing broken parts, lubricating moving parts, checking the battery, checking belts and pipes, checking hydraulic pipes, oiling the chains and clutch. (Any one)
5. It is important to check the oil level to ensure the engine runs smoothly and does not overheat.
6. False
7. True
8. False
9. When farm machines are not maintained, they can break down, perform poorly and become dangerous.
10. Maintenance helps keep farm workers safe by ensuring that all parts are working properly and are not loose or damaged.

Unit 25: Measuring devices

Unit objectives

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

a. identify devices used to measure length and mass.
b. use measuring devices to measure length and mass.
c. demonstrate the use of measuring devices.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 152-156.
- Science and Technology Grade 3-7 syllabus.
- Charts, measuring devices, ICT gadgets.

Teaching notes

- Different devices are used to measure length and mass.
- For length, we use:
  - A ruler for small, straight objects.
  - A tape measure for longer objects.
  - A measuring wheel for long distances.
  - A string for curved objects.
- For mass, we use a balance.
- It is important to use the correct tool for the specific task to ensure accuracy.

Activities guidelines

Activity 25.1

Measuring devices demonstration: Facilitate a hands-on demonstration to help learners practise using different measuring devices. Provide learners with various measuring devices (ruler, tape measure, string and balance). Guide them to measure the length and mass of different objects in the classroom (for example, a book, a desk, a curved bottle). Have them record their measurements in a table, noting which device they used for each object. Have them share their observations with the class, explaining why they chose a particular device for a specific measurement.

Suggested answers

Exercise 25.1

1. **(a)** Ruler or tape measure.
   (b) String
   (c) Measuring wheel.
2. mass
3. True
4. A tape measure is better for measuring large objects because it is flexible and longer than a ruler.
5. It is pushed along the ground and a counting mechanism records the number of rotations to determine the distance.
6. Weighing ingredients for cooking or weighing fruits and vegetables at the market. (Any one)
7. Tape measure: useful for measuring long or flexible objects like a table or a person. Ruler: useful for measuring small, straight objects like a book or a pencil.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. A tape measure is used to measure the length of objects.
2. Ruler
3. A measuring wheel works by rolling over the ground and a counter records the distance.
4. A ruler provides a more accurate measurement than a string.
5. A balance measures the amount of matter (mass) in an object, while a tape measure measures distance or length.
6. The circumference of a tree trunk, a cylindrical object or a curved object. (Any one)
7. A measuring wheel is better for long distances because it can measure large areas like a field more quickly and is more practical than stretching a long tape measure.
8. A book, pencil, crayon, smartphone. (Accept any two relevant answers)
9. Weighing ingredients for cooking or weighing fruits at the market. (Any one)

Unit 26: Digital devices

Unit objectives

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

a. state entertainment devices.
b. explain the uses of entertainment devices.
c. outline computer peripherals.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 157-162.
- Science and Technology Grade 3-7 syllabus.
- Realia such as desktop with keyboard, mouse, printer and usb drive.
- Projector
- Computer speakers

Teaching notes

- Entertainment devices provide leisure and amusement. Examples include televisions (for viewing content), gaming consoles (for playing games) and streaming devices (for accessing online media).
- Computer peripherals are external devices that connect to a computer to expand its functionality.
- They are classified as:
  - Input (keyboard, mouse)
  - Output (monitor, printer)
  - Storage devices (USB drive, hard drive)

Activities guidelines

Activity 26.1

Entertainment devices discussion: Facilitate a classroom discussion to help learners identify and understand the uses of various entertainment devices. Instruct students to discuss the use of entertainment devices in their daily lives, such as televisions for watching shows or gaming consoles for playing video games. Encourage them to share their personal experiences with these devices and discuss how they have changed the way people have fun and get information.

Activity 26.2

Peripheral classification: Lead a hands-on activity to help learners classify different computer peripherals into their correct categories. Provide learners with a list of computer peripherals and a table with three columns: "Input devices," "Output devices," and "Storage devices." Instruct them to discuss each device and classify it into the correct category based on its function. Have them share their completed tables with the class and explain why they placed each device in a specific category.

Input devices	Output devices	Storage devices
Keyboard	Monitor	Hard disk drive (HDD)
Microphone	Printer	Memory card
Mouse	Projector	Solid-state drive (SSD)
Scanner	Speakers	USB flash drive

Suggested answers

Exercise 26.1

1.

Entertainment device	Function
Television	Displays digital images and videos.
Gaming console	Used for playing video games.
Streaming device	Allows access to online media content.

2. Smart TVs, LED TVs, OLED TVs. (Any two)
3. Amazon Fire Stick, Apple TV, Roku, Google Chromecast. (Any two)
4. Gaming console

Exercise 26.2

1. Peripheral
2. Keyboard, mouse, scanner, microphone. (Any two)
3. USB flash drive, hard disk drive, solid-state drive (SSD), memory card. (Any two)
4. Printer
5. Microphone
6. The main function of a monitor is to display text, images and videos.

Unit revision exercises

Multiple choice answers

1. B
2. B
3. C

4. C
5. C
6. C
7. C
8. B
9. A
10. B

Structured questions answers

1. A computer peripheral is an external device that connects to a computer to extend its capabilities.
2. Input, output and storage devices.
3. storage
4. input
5. output
6. A streaming device is used to access online content, including movies, television shows and music.
7. PlayStation, Xbox or Nintendo Switch. (Any one)
8. A smart television is different from other televisions because it has internet connectivity, allowing it to access online content and streaming services.
9. True
10. Speaker

Unit 27: Digital tools

Unit objectives

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

a. create a presentation.
b. import images into a presentation.
c. change slide layout.
d. add text description to slides.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 163-169.
- Science and Technology Grade 3-7 syllabus.
- Powerpoint packages, MS powerpoint sheets.

Teaching notes

A presentation is a collection of slides used to display information visually. PowerPoint is a popular software for creating presentations.

Key skills include:

- Creating a new presentation.
- Saving it.
- Changing the slide layout.
- Adding text using a text box.
- Importing images.
- Properly formatted slides with a good balance of text and images help communicate ideas clearly.

Activities guidelines

Activity 27.1

Creating a presentation: Guide learners through the steps to open Microsoft PowerPoint, create a new presentation and save it with a relevant title.

Guide learners through the steps to open Microsoft PowerPoint, create a new blank presentation and save it with a relevant title like 'Planting Trees'. Remind them to save their work frequently to avoid losing their progress.

Activity 27.2

Changing slide layout: Instruct learners to open their presentation and use the 'Layout' option to change the slide format.
Instruct learners to open their presentation and use the 'Layout' option to change the slide format. Discuss with them which layout might be best for different types of content (for example, a 'Title and Content' layout for a main idea, a 'Two Content' layout for comparing two things).

Activity 27.3

Adding text: Instruct learners to open a slide, click the 'Insert' tab, select 'Text Box,' and type a description. Instruct students to open a slide, click the 'Insert' tab, select 'Text Box,' and type a description related to their presentation topic. Guide them on how to format the text by changing the font size, colour and alignment to make it easy to read.

Activity 27.4

Importing images: Instruct learners to open a slide, click the 'Insert' tab, select 'Pictures,' and import an image from their computer. Instruct learners to open a slide, click the 'Insert' tab, select 'Pictures,' and import an image from their computer. Guide them on how to resize and move the image to fit the slide's layout without distorting it.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. New
2. Home
3. Insert
4. Using a text box.
5. When you click ‘Text Box’, a box appears on the slide where you can enter text.
6. True
7. False
8. False
9. You click on ‘Pictures’ to insert an image file from your computer into the slide.
10. You click on the ‘Home’ tab and select the ‘Layout’ option to choose a new layout for the slide.

Unit 28: Career opportunities

Unit objectives

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

a. name career opportunities in ICT.
b. discuss the roles of personnel in different careers in ICT.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner’s Book page 170-174.
- Science and Technology Grade 3-7 syllabus.
- Computers, realia.

Teaching notes

- ICT offers various career opportunities, such as graphic designer, digital media specialist and computer science teacher.
- A graphic designer creates visual content like logos and posters.
- A digital media specialist manages online content and social media.
- A computer science teacher educates learners on technology and programming.

Activities guidelines

Activity 28.1

ICT careers research: Lead a collaborative research project to help learners explore career paths in ICT. Divide learners into groups. Instruct them to research the qualifications needed, the typical daily tasks and the tools used for each of the careers mentioned in the unit (for example, graphic designer, digital media specialist, computer science teacher). Have them present their findings to the class using a poster or a short presentation.

Suggested answers

Exercise 28.1

1. logos
2. engagement
3. programming
4. clients
5. coding
6. websites
7. photoshop
8. animations
9. lesson plans

Unit revision exercises

Multiple choice answers

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

9 B

10 A

Structured questions answers

1 Graphic designer, digital media specialist and Computer Science teacher. (Accept any other relevant answers)

2 A digital media specialist.

3 A graphic designer creates visual content, such as logos, posters and advertisements, for businesses and media.

4 A Computer Science teacher teaches coding and software development and prepares lesson plans for students. (Accept any other relevant answers)

5 Adobe Photoshop, Adobe Illustrator, CorelDRAW, Canva, Figma, Affinity Designer. (Any two)

6 A digital media specialist.

Topic 6 Energy and fuels

Unit 29: Forms of energy

Unit objectives

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

a. identify forms of energy.
b. describe forms of energy.
c. demonstrate kinetic energy.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 175-180.
- Science and Technology Grade 3-7 syllabus.
- Batteries, heaters, solar cooker and solar panel.

Teaching notes

- Energy is the ability to do work and exists in forms such as heat, light, sound, kinetic and potential energy.
- Heat energy is a change in temperature, light energy allows us to see and sound energy is produced by vibrations.
- Kinetic energy is the energy of movement and potential energy is stored energy.

Activities guidelines

Activity 29.1

Energy sources discussion: Guide learners in a discussion to help them identify and describe different forms of energy in their environment. Divide learners into pairs. Instruct them to identify sources of energy in their environment (for example, the sun, a light bulb, a car engine). Have them discuss how these sources provide different forms of energy (for example, the sun provides heat and light energy). Have them write down and share examples of objects that produce heat, light and sound energy.

Activity 29.2

Kinetic energy demonstration: Use a simple demonstration to help learners understand the concept of kinetic energy. Provide learners with a small ball. Instruct them to roll the ball on the ground and observe its movement, noting that it is moving because of kinetic energy. Have them push the ball harder to see the change in speed and discuss why the kinetic energy increased. Ask them to discuss why the ball eventually stops moving, explaining that it is because the kinetic energy is used up due to friction.

Suggested answers

Exercise 29.1

1. Energy is the ability to do work or cause change.
2. Heat, light, sound, kinetic, potential energy. (Any three)
3. Light energy
4. Potential energy
5. A moving car. (Accept any relevant answer)
6. The sun, a fire or a stove. (Any one)

Exercise 29.2

1. Kinetic energy is the energy of a moving object.
2. A running person, a flying bird, a moving car. (Any two)
3. By pushing or applying more force to the object.
4. It stops moving.
5. False
6. kinetic

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. work
2. motion
3. potential

4. A stretched rubber band, water behind a dam, a compressed spring. (Any one)
5. heat and light
6. True
7. Sound energy
8. It loses its kinetic energy and stops moving.
9. Light energy

Unit 30: Fuels

Unit objectives

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

- explain the conditions necessary for fuels to burn.
- identify fuel hazards.
- suggest safety precautions when using fuel.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 181-186.
- Science and Technology syllabus, 2024-2030, Grade 3-7.
- Wood, candle, paraffin, spirit and gas.

Teaching notes

- For fuel to burn, three conditions must be met: fuel, oxygen and heat. This is known as the fire triangle.
- Fuel hazards include fire outbreaks, explosions, toxic fumes and skin burns.
- Safety precautions involve:
  - Storing fuel in a well-ventilated area.
  - Using proper containers.
  - Handling fuel with care.
- Sand or a fire extinguisher should be used to put out fires and water should not be used on oil fires.

Activities guidelines

Activity 30.1

Fire triangle experiment: Conduct a safe experiment to demonstrate that oxygen is necessary for combustion. Provide students with two candles, a transparent beaker and matches.

Supervise closely as you light both candles. Cover one candle with the beaker and have learners observe what happens. Ask learners to discuss why the covered candle went out, introducing the concept of the fire triangle (fuel, oxygen and heat).

Activity 30.2

Fuel hazards discussion: Engage learners in a discussion to help them identify and understand different fuel hazards. Divide students into groups. Instruct them to discuss different fuel hazards (for example, a gas cylinder near a fire, a spilled flammable liquid). Have them brainstorm and identify ways to prevent these hazards in a home or school setting. Encourage them to create a short skit to illustrate a hazard and its prevention.

Activity 30.3

Fuel safety demonstration: Demonstrate how to handle fuel safely and extinguish a small fire. Use a fire extinguisher and sand to demonstrate how they can be used to put out fires. Emphasise that water should never be used on oil or petrol fires. Have learners, under strict supervision, practise how to extinguish a small, controlled fire (for example, in a metal container) using a damp cloth or sand.

Suggested answers

Exercise 30.1

1. gas
2. oxygen, heat
3. It has access to oxygen.
4. It has run out of oxygen.

Exercise 30.2

1. Fire outbreaks, explosions, toxic fumes or skin burns. (Any two)
2. It can cause an explosion.
3. Gas
4. False
5. C

Exercise 30.3

1. To prevent the buildup of toxic fumes and reduce the risk of fire or explosion.
2. Use a damp cloth or sand.
3. To prevent fire outbreaks or explosions.
4. Sand, a fire extinguisher or a damp cloth. (Any two)
5. False
6. B

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. fuel, oxygen, heat.
2. explosion
3. well-ventilated
4. Wood, petrol, gas, coal, diesel, paraffin. (Any two)
5. False
6. True
7. True
8. Sand or a fire extinguisher. (Any one)
9. To prevent accidents like fires, explosions and skin burns.

Topic 7

Disaster risk management and resilience

Unit 31: Hazards

Unit objectives

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

a. identify man-made hazards.
b. describe different man-made hazards.
c. discuss the impact of hazards.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 187-192.
- Science and Technology Grade 3-7 syllabus.
- Pictures, newspapers, local environment.

Teaching notes

- Man-made hazards are dangers created by human activities, such as fire outbreaks, pollution and road accidents.
- These hazards can occur at home, school or in the community.
- Their impact includes health problems, injuries, loss of life and destruction of property.
- Proper safety measures and preparedness are essential to mitigate these risks.

Activities guidelines

Activity 31.1

Man-made hazards discussion: Lead a collaborative discussion to help learners identify man-made hazards in different settings. Divide learners into groups. Instruct them to identify man-made hazards that can occur at home (for example, poisoning from chemicals), school (for example, vandalism) and in the community (for example, air pollution). Have them discuss how each can be prevented (for example, locking up chemicals, being careful with electricity, proper waste disposal). Have each group share their findings with the class.

Activity 31.2

Hazard impact discussion: Use a video and a discussion to help learners understand the real-world impact of man-made hazards. Show a short video on man-made hazards and their effects (for example, a video on air pollution, a news report on a road accident). Instruct learners to discuss how each hazard in the video affected people (for example, injuries, health problems) and the environment (for example, polluted rivers, damaged buildings).

Suggested answers

Exercise 31.1

1. Vandalism
2. cleaning agents
3. accidents
4. health
5. false
6. True
7. B
8. A
9. B
10. A

Exercise 31.2

1. Pollution
2. destruction of property
3. False
4. True
5. B
6. B
7. B

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Fire, pollution.
2. True
3. False
4. False
5. Air pollution can cause respiratory diseases like asthma.

6. Pollution can lead to environmental damage that affects their health and habitats. Pollution can harm animals by contaminating their water sources and food supply.
7. Injuries and loss of life.
8. Small objects can be a choking hazard for small children.

Unit 32: Safety and evacuations

Unit objectives

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

a. state different disaster mitigation measures for given hazards.
b. discuss possible interventions to mitigate against man-made hazards.
c. produce a hazards mitigation guideline.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 193-198.
- Science and Technology Grade 3-7 syllabus.
- Videos, newspaper cuttings, digital tools and disaster map.

Teaching notes

- Disaster mitigation interventions are actions to reduce the impact of disasters.
- Disaster mitigation interventions include preparedness, response and recovery, which are demonstrated by emergency drills, first aid and rebuilding.
- Measures for specific hazards include building flood barriers, conducting fire drills and constructing earthquake-resistant buildings.
- A hazards mitigation guideline outlines these steps to improve community safety.

Activities guidelines

Activity 32.1

Mitigation measures discussion: Use a video and group discussion to help learners understand various disaster mitigation measures. Show a video on disaster mitigation measures (for example, flood barriers, earthquake-resistant buildings, fire drills). Divide learners into groups and instruct them to discuss how each measure helps reduce risks. Have them list five measures for different hazards and present their findings to the class.

Activity 32.2

Disaster interventions discussion: Lead a discussion on the different phases of disaster management: preparedness, response and recovery. Instruct learners to examine newspaper cuttings or online news articles about disaster responses. Have them, in pairs, discuss why preparedness and response are essential for disaster management, citing examples from the news articles.

Activity 32.3

Guideline creation: Engage learners in a practical activity to create a hazards mitigation guideline. Divide learners into groups. Instruct them to create a simple hazards mitigation guideline for a disaster of their choice (for example, a fire, a flood). The guideline should include: a list of possible hazards, practical mitigation measures and a simple emergency response procedure. Have them present and explain their guideline to the class.

Suggested answers

Exercise 32.1

Hazard	Mitigation Measure
Fire	Conducting fire drills.
Flood	Installing flood barriers.
Earthquake	Constructing earthquake-resistant buildings.
Storm	Securing outdoor objects.
Industrial accident	Wearing protective gear.

Exercise 32.2

1. mitigation interventions.
2. Preparedness or emergency drills, response or first aid, recovery or rebuilding. (Any two, each coming from a different pair)
3. Preparedness helps by educating people on how to act, which can reduce panic and injuries during a disaster.
4. Rebuilding damaged structures.
5. Resilience

Unit revision exercises

Multiple choice answers

1. B
2. B
3. A

4 B
5 C
6 B
7 B
8 B
9 B
10 A

Structured questions answers

1 **(a)** Mitigation: Measures taken to reduce the impact of disasters.
(b) Preparedness: Being ready to deal with an emergency.
2 Fires, floods
3 safety
4 mitigation
5 danger
6 injury
7 moving people safely.
8 storms
9 safety
10 response planning

Unit 33: Emergency professionals

Unit objectives

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

a list emergency responders.
b discuss their roles in keeping the community safe.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 199-102.
- Science and Technology Grade 3-7 syllabus.
- Toy helmets, badges and digital tools.

Teaching notes

- Emergency responders include the Civil Protection Unit, police officers, firefighters, health personnel and traditional leaders.

- Their roles involve rescuing people, providing medical care, maintaining public order and guiding communities during disasters.
- Their teamwork is vital for saving lives and property.

Activities guidelines

Activity 33.1

Responders roles discussion: Engage learners in a group discussion to help them understand the roles of different emergency professionals. Divide learners into small groups. Instruct them to discuss the roles of different emergency responders, such as firefighters, police officers and health personnel. Encourage them to share real-life stories or examples from the news where these responders helped people. Have each group present their findings to the class.

Local responders visit: Organise a visit to a local fire or police station to provide a hands-on learning experience. Organise a tour to a local fire or police station. Instruct learners to ask questions about the jobs and observe equipment demonstrations. Have them write a report on what they learned, focusing on how these professionals work together to keep the community safe.

Suggested answers

Exercise 33.1

Emergency responder	Role
Police officer	Directs traffic and ensures public safety.
Firefighter	Puts out fires and rescues people.
Civil Protection Unit	Coordinates disaster response efforts.
Health personnel	Provide medical care and First Aid.
Traditional leader	Guides the community during emergencies.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Firefighters and police officers.
2. Civil Protection Unit
3. Putting out fires

4. First Aid
5. True
6. False
7. Doctors, nurses or paramedics.
8. A police officer's role is to maintain law and order, control crowds and direct traffic during emergencies.
9. They guide community members, coordinate local emergency plans and help organise evacuations.

Unit 34: Psycho-emotional support

Unit objectives

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

a. explain what psycho-social support entails.
b. outline the impact of hazards.
c. identify needs of victims.
d. classify the types of psycho-social support needed.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 203-209.
- Science and Technology Grade 3-7 syllabus.
- First Aid Kit, videos and drawing materials.

Teaching notes

- Psycho-social support is assistance for people affected by disasters, helping with emotional and mental well-being.
- Man-made hazards can cause trauma, fear and anxiety.
- Victims need emotional, social and medical support.
- Services include immediate first aid, counselling and community support.
- Types of support are emotional, social, counselling, educational and recreational.

Activities guidelines

Activity 34.1

Psycho-social support discussion: Lead a group discussion to help learners understand the concept and impact of psycho-social support. Divide learners into groups. Instruct them to discuss what psycho-social support is and why it matters after man-made hazards.

Have them list man-made hazards (such as fires and industrial accidents) and discuss how these events can affect people's emotions and social connections.

Activity 34.2

Poster creation: Use a creative activity to help learners visualise and present the needs of disaster victims. Provide learners with poster paper, markers and coloured pencils. Instruct them to create a poster showing the different needs of disaster victims (for example, emotional support, social support, medical attention). Have them present the poster, explaining why each need is important for a victim's recovery.

Activity 34.3

Support role-play: Use role-play to help learners practise providing psycho-social support in a simulated scenario. Instruct learners to read stories about people who have lived through disasters. Have them act out short scenes where they give different types of support (for example, a friend providing emotional help, a volunteer guiding a victim to a safe place). Encourage them to discuss what each type of support does and which kind would be most helpful in different situations.

Suggested answers

Exercise 34.1

1. emotional well-being.
2. Post-Traumatic Stress Disorder
3. PTSD
4. It helps victims recover from trauma, stress and anxiety.
5. fire
6. fear

Exercise 34.2

1. Emotional
2. Social
3. Counselling
4. Educational
5. Medical
6. sadness
7. victims
8. talking through trauma.

Exercise 34.3

1. Immediate psychological First Aid.
2. Safe spaces
3. Social support
4. Community support networks
5. Counselling and therapy
6. Educational support

7. Recreational activities
8. Emotional support

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Psycho-social support is the assistance provided to individuals affected by disasters to support their emotional, social and mental well-being.
2. An industrial accident, road accident, fire outbreaks. (Accept any relevant answer)
3. Fear, anxiety and depression.
4. Emotional support, social support, counselling services, educational support, medical attention. (Any two)
5. Counselling helps people by providing a safe space to talk about their experiences, managing their emotions and learning coping strategies.
6. Community-based support is help offered by local groups and neighbours.
7. Playing games or listening to music. (Any relevant answer)

Unit 35: Emotional resilience (psycho-emotional support after a disaster)

Unit objectives

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

a. identify sources of support when affected by a disaster.
b. explain the importance of emotional resilience.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 210-215.
- Science and Technology syllabus, 2024-2030, Grade 3-7.
- Puppets, dolls, posters nd music player.

Teaching notes

- Emotional resilience is the ability to recover from emotional distress.
- Sources of support include family, school, community and the government.
- Coping strategies include talking about feelings, engaging in relaxing activities and seeking professional help.
- Resilience helps people adapt to change, manage stress and build strong relationships.

Activities guidelines

Activity 35.1

Support sources discussion: Lead a guided discussion to help learners identify their support systems. Divide learners into groups. Instruct them to discuss different sources of emotional support in their community, such as family, school and friends. Have them brainstorm ways each of these sources can provide help (for example, a family member can offer a hug, a teacher can listen to a problem). Have each group share their findings with the class.

Activity 35.2

Coping with trauma discussion: Facilitate a discussion to help learners understand and practise healthy coping mechanisms. Instruct learners to discuss different emotions people might feel after a disaster, such as fear, sadness and anger. Have them suggest healthy ways to manage these emotions, such as deep breathing, talking to a trusted adult or playing a calming game. Encourage learners to share a time when they felt a strong emotion and what they did to feel better.

Activity 35.3

Emotional resilience role-play: Use role-playing to help learners practise showing emotional resilience and supporting others. Instruct learners to role-play scenarios where characters experience and manage fear, stress and anxiety. Encourage them to think about how they would react if a friend was feeling scared or upset and what they would say to provide comfort and support. Have them discuss the importance of seeking comfort and support and why it is a sign of strength, not weakness.

Suggested answers

Exercise 35.1

Source of support	Description
Family	Provides love and reassurance in tough times.
School	Teachers and counsellors offer guidance and a safe space.
Community	Friends, neighbours and religious groups provide support.
Government	Offers counselling programmes and mental health services.

Exercise 35.2

1. trusted individuals
2. deep breathing
3. counselling
4. community rebuilding
5. writing
6. routine

Exercise 35.3

1. recover quickly
2. positive outlook
3. seeking
4. stress and anxiety
5. adapt
6. Seeking support from others is important because it helps individuals share their feelings and get comfort and guidance, which is essential for emotional recovery.
7. Talking about feelings, engaging in relaxing activities, seeking professional help, drawing, writing, playing games. (Accept any two relevant answers)

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Family, school, community and government. (Any two)
2. reduce stress
3. recover from trauma.
4. neighbours
5. Talking about feelings. Engaging in relaxing activities. Seeking professional help through counselling. Expressing emotions through writing, drawing or music. Playing games. Spending time with loved ones. Taking deep breaths. (Accept any two relevant answers)
6. True
7. False
8. True

Topic 8 Educational technology and innovation

Unit 36: Everyday technology interaction

Unit objectives

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

a. name the messaging applications.
b. use messaging applications.
c. research using child-friendly search engines.
d. identify online safety rules.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 216-222.
- Science and Technology Grade 3-7 syllabus.
- Computers, smartphones, tablets and interactive boards.

Teaching notes

- Messaging applications like WhatsApp and Gmail allow instant communication.
- Digital citizenship is the responsible use of technology, which includes online safety rules like not sharing personal information, using strong passwords and avoiding unknown links.
- Cyberbullying is a serious online risk that involves harassing or intimidating others and it must be reported to a trusted adult.

Activities guidelines

Activity 36.1

Messaging apps discussion: Engage learners in a discussion to help them identify and understand the function of various messaging applications. Divide learners into pairs.

Instruct them to name messaging applications they know (for example, WhatsApp, Facebook Messenger, Gmail) and discuss how they help people communicate. Have them practise sending a simple message using a child-friendly application like Kiddle, emphasising that they should only communicate with people they know and trust.

Activity 36.2

Online safety poster: Facilitate a creative activity where learners design a poster to promote online safety. Instruct learners to discuss why online safety is important and to identify safe and unsafe online practices (for example, sharing a password is unsafe; telling an adult about a problem is safe). Have them create a poster listing at least five key online safety rules, using colourful images and simple text to make the rules easy to remember.

Activity 36.3

Cyberbullying role-play: Use role-playing to help learners understand and respond to cyberbullying. Divide learners into pairs. Instruct them to create a short role-play of a situation where someone is cyberbullied, focusing on how the victim and others can respond safely and effectively. Have them brainstorm ways to stop cyberbullying, such as blocking the bully or telling a trusted adult. Have them discuss how they can support victims of cyberbullying.

Suggested answers

Exercise 36.1

1. emails
2. Text messages, images, videos, voice notes. (Any three)
3. Chat, share media, make voice and video calls.
4. Facebook Messenger
5. Gmail

Exercise 36.2

1. password
2. personal
3. adult, teacher, parent, guardian. (Any one)
4. To avoid viruses, scams or inappropriate content.
5. Full name, address, school name, phone number or passwords. (Any one)
6. By using strong passwords and enabling privacy settings.
7. Inform a trusted adult immediately.
8. It helps you control who can see your posts and personal information, protecting your privacy.

Exercise 36.3

1. Harassment, impersonation, exclusion, outing, cyberstalking, flaming. (Any two)
2. A trusted adult.
3. False
4. True
5. Impersonation
6. Stress, anxiety or low self-esteem.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Cyber-bullying is when people use digital platforms to harass, threaten or embarrass others.
2. WhatsApp, Gmail, Facebook Messenger. (Any two)
3. Bing, Google.
4. passwords
5. teacher
6. messaging
7. text messages
8. emailing
9. virus infection
10. stress

Unit 37: Robotics and coding

Unit objectives

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

a. state basic components of robotics.
b. identify block-based coding platforms.
c. explain making robots using block-based coding platforms.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 223-230.
- Science and Technology Grade 3-7 syllabus.
- Visual aids, puzzles and digital tools.

Teaching notes

Robotics is the design and programming of robots.

Robots have:

- Sensors (for example, light, sound, touch) to detect the environment.
- Actuators (for example, motors, wheels) for movement.

Coding is the language used to give instructions to robots.

Block-based coding platforms like Scratch are beginner-friendly because they use a visual drag-and-drop interface instead of text.

Activities guidelines

Activity 37.1

Block-based coding exploration: Guide learners in a hands-on exploration of block-based coding platforms. Provide learners with digital devices and access to platforms like Scratch, Scratch Jr and Tinker. Instruct them to explore the interface, drag and drop different blocks and observe how they connect. Encourage them to discuss the benefits of using this visual method of programming compared to writing code.

Activity 37.2

Simple game creation: Lead a creative project where learners design a simple game using a block-based coding platform. Instruct learners to design a simple game or interactive animation using Scratch. The game should involve a character (sprite) that moves or reacts to a user's action (for example, a mouse click, a key press). Encourage them to use different blocks to create a simple storyline for their game. Have them share their work with classmates, explaining the code they used.

Suggested answers

Exercise 37.1

1. Robotics is the branch of technology that deals with the design, construction and operation of robots.
2. Light sensor, sound sensor, touch sensor. (Any two)

3. They enable movement in any direction and actions like driving wheels and moving arms. (Any two)
4. It uses visual blocks, which are easier to understand than text-based code.
5. sensor
6. Python
7. False
8. False
9. Motor

Exercise 37.2

1. Block-based coding
2. actuators
3. True
4. Block-based coding uses visual blocks that represent commands, making it easier for beginners to understand and use without having to write complex text-based code.
5. Scratch Jr is a simpler version of Scratch designed for younger learners with fewer features and a more basic interface.
6. False
7. The main function of sensors is to detect changes in the environment and send information to the robot.
8. Move forward, turn or respond to key presses. (Any two)
9. The main advantage is that it is beginner-friendly and visual, making programming concepts easier to grasp.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Scratch Jr
2. Sensors
3. function
4. Scratch, Scratch Jr, Tinker. (Any two)
5. To enable movement in robots.
6. False
7. False

8 Sensors help robots detect the environment, such as light, sound or touch, allowing them to react to their surroundings.

Unit 38: Technology design and safety

Unit objectives

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

a state safety rules when using tools.
b design an artefact.
c make an artefact.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 231-235.
- Science and Technology Grade 3-7 syllabus.
- Realia, tools and equipment.

Teaching notes

Digital safety is crucial when using technology.

Rules include:

- Using strong passwords.
- Protecting personal information.
- Being cautious about downloading files.

Designing a digital artefact involves planning, sketching a wireframe and choosing the right tools.

Creating the artefact involves using design software to add text, images and other elements, ensuring a user-friendly and visually appealing result.

Activities guidelines

Activity 38.1

Digital safety discussion: Lead a collaborative activity to help learners understand the importance of digital safety. Divide learners into pairs. Instruct them to discuss the importance of following safety rules when using digital tools and to create a list of at least five rules. Have them use a simple digital design tool to create a digital poster illustrating these rules.

Activity 38.2

Artefact design: Guide learners through the process of designing a digital artefact from scratch. Instruct learners to individually choose an artefact they want to create (for example, a digital poster for a school event, a logo for a class project). Have them sketch a rough layout or wireframe of their design on paper first, labelling where text and images will go. Have them label the elements and tools needed for their design.

Activity 38.3

Artefact creation: Facilitate a hands-on project where learners create their digital artefact. Provide learners with access to a simple digital tool (for example, Canva, Microsoft Paint or a simple online tool). Instruct them to create their digital artefact based on the wireframe they designed, following digital safety rules. Encourage them to use images, text and colours to make their design visually appealing. Have them save their finished product and present it to the class, explaining their design choices and the tools they used.

Suggested answers

Exercise 38.1

1. To prevent security risks, data loss and protect personal information.
2. Use strong passwords, be cautious when downloading software and protect personal information online.
3. By not sharing it on public platforms and using strong passwords.
4. You should be cautious and only download from trusted sources.
5. Security risks, data loss or eye strain. (Any one)
6. False

Exercise 38.2

1. A digital artefact is a digital creation such as an image, website or animation.
2. Identify the artefact you want to create, sketch a rough layout, choose the appropriate digital tools and software, plan how to arrange text, images and other elements, ensure accessibility and user-friendly navigation. (Any two)
3. It helps you plan the structure and layout of the artefact before you start creating it, ensuring it is well-organised and user-friendly.
4. You should consider the project's purpose, the complexity of the design and its user-friendliness.
5. Planning helps you to structure your project, choose the right tools and ensure that the final product is effective.
6. False

Exercise 38.3

1. Open the chosen design software.
2. It is important to choose the right software because it provides the necessary tools and features to create the desired artefact.
3. By adjusting colours and fonts and incorporating images or icons. (Any two)
4. Resize or crop it to fit well in the design.
5. Check for errors and adjust colours and fonts for readability. (Any two)
6. False

Unit revision exercises

Multiple choice answers

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

Unit 39: Cyber security

Unit objectives

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

a. identify malware and how it affects computers.
b. list types of malwares.
c. name antiviruses software.
d. explain how antiviruses work.

Suggested learning and teaching aids

- PlusOne Science and Technology Grade 4 Learner's Book page 236-241.
- Science and Technology syllabus, 2024-2030, Grade 3-7.
- ICT tools and ICT devices.

Teaching notes

Cyber security protects computers from digital threats.

Malware is software designed to harm computers and includes:

- Viruses (replicates and spreads).
- Worms (spreads through networks).
- Trojans (disguises itself).
- Ransomware (locks files for payment).
- Spyware (steals information secretly).

Antivirus software detects and removes these threats and it should be updated regularly to protect against new malware.

Activities guidelines

Activity 39.1

Malware research: Lead a collaborative research project to help learners understand malware. Divide learners into groups. Instruct them to research and explain how different types of malware work, such as a virus attaching to a file or ransomware locking a computer. Have each group prepare a short presentation to share their findings with the class.

Activity 39.2

Malware effects discussion: Facilitate a discussion to help learners understand the real-world effects of malware on a computer. Divide learners into pairs. Instruct them to discuss the effects of malware on computers, such as slowing down performance, deleting files or stealing personal information. Have them brainstorm and list signs that a computer might be infected with malware (for example, it runs slowly, strange pop-ups appear).

Activity 39.3

Antivirus software discussion: Guide a discussion to help learners identify and understand the function of antivirus software. Instruct learners to identify different antivirus software programs they know (for example, Windows Defender, Norton, Avast). Have them discuss how these programs work, such as scanning files for threats and removing detected malware. Emphasise the importance of updating the software regularly to protect against new threats.

Suggested answers

Exercise 39.1

1. Malware is malicious software designed to harm or exploit computers.
2. Viruses, worms, Trojans, ransomware and spyware. (Any three)
3. Viruses spread by attaching themselves to files or programs.
4. Ransomware is malware that locks a user's files and demands payment to unlock them.

5. Spyware can steal personal information, such as passwords and bank details and use it for fraud.
6. Trojan

Exercise 39.2

1. It may slow down, freeze or crash. Files may get corrupted or deleted.
2. Malware uses up the computer's power, which makes it slow and causes programs to take longer to open or run.
3. Spyware
4. Worm
5. Delete or corrupt files. Computer may freeze or crash. Computer performance may slow down. Programs take longer to open or run. (Any two)
6. Malware can interfere with internet connections, making websites load slowly or blocking access to certain sites.

Exercise 39.3

1. Windows Defender, Norton Antivirus, McAfee Antivirus, Avast Antivirus, Bitdefender. Accept any two relevant answers.
2. The main function of antivirus software is to detect, prevent and remove malicious programs from computers.
3. Antivirus software detects malware by scanning files and programs for malware signatures and blocking suspicious files before they can cause harm.
4. It is important to update antivirus software regularly to detect new malware and protect against evolving threats.
5. Norton
6. When an antivirus detects a threat, it blocks the suspicious file or program and removes the detected threat from the system.

Unit revision exercises

Multiple choice answers

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

Structured questions answers

1. Malware is malicious software designed to harm or exploit computer systems.
2. Viruses, Worms, Trojans, Ransomware, Spyware. (Any two)

3 detecting and removing malware.
4 worm
5 steal sensitive information.
6 money
7 Trojan
8 secretly
9 monitor and control network traffic.