



TEACHING GUIDE

5

The SCIENCE Factor

FOR PRIMARY CLASSES

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CONTENTS



INTRODUCTION

UNIT 1 The human body

iv

UNIT 2 The animal world

2

UNIT 3 The plant world

16

UNIT 4 Other living things

31

UNIT 5 Soil

41

UNIT 6 Food and diet

46

UNIT 7 Environment

52

UNIT 8 Matter and materials

57

UNIT 9 Heat, light, and sound

67

UNIT 10 Forces and machines

74

UNIT 11 Electricity and magnetism

85

UNIT 12 The solar system

91

WORKSHEETS

99

104

INTRODUCTION



About this series

This science series has been painstakingly written, edited, and published with one aim in mind: to provide primary school students in Pakistan with a comprehensive, engaging, informative, and entertaining experience while learning about science.

The contents follow the guidelines provided by the Cambridge International Primary Programme and the UK National Curriculum for General Science.

Some students can find the idea of studying science an ordeal. They may have been exposed to learning materials that are too dry and dense: providing basic information without considering the learning needs of today's students. We have spent as much effort in making sure our series engages the student as we have on ensuring the accuracy and relevance of the content, making this an outstanding work in all respects.

Salient features of the series

- **consistent with the nature of learning**

This series stimulates students' curiosity and develops their interest in learning. It also provides them with activities that facilitate their capacity for problem solving and enable them to learn more about themselves and the world around them.

- **coherent**

The ideas within this series have a logical and natural connection with each other. There is a progressive articulation of concepts, skills, and content that prepares students to understand and use more complex concepts as they advance through the learning process.

- **developmentally appropriate**

In accordance with providing for all areas of a child's development (i.e. physical, social, emotional, linguistic, aesthetic, and cognitive), this series provides for:

- active exploration of the environment
- self-directed and hands-on learning activities
- balance between individual and group activities
- regular and supportive interaction with teachers and peers
- balance between active movement and quiet activities.

- **comprehensive**

A great deal of work has gone into ensuring that students who work their way through this series end up with a sound knowledge of basic scientific principles that will put them in good stead for later learning, and indeed for when they have completed their formal education.

- **feasible**

The combination of a student text, workbook, interactive CD, and teacher's guide make learning and teaching feasible and accessible, without the need to purchase other materials.

- **useful and relevant**

The content in this series relates directly to students' needs and interests. It enables them to understand more about themselves and the world they live in.

General suggestions and advice on teaching science

Students should be encouraged to share what they know, so invite discussion and foster an environment where they feel comfortable. Starting from what a child knows helps them to feel confident learning new things.

The main focus of science at this level is to encourage the students to participate and investigate and this is done through asking and answering questions. Actively encourage students to participate in the different experiments and share their experiences.

We have created a character, Super Scientist.

Super Scientist has been used as a tool to make the book appealing to students. After all, we all know how much students enjoy animated characters. Teachers should use Super Scientist to generate interest, engagement, and humor. Super Scientist is here to make science fun.

A good way to approach the learning and teaching of science in every lesson is outlined below—all you have to remember is S.C.I.E.N.C.E.

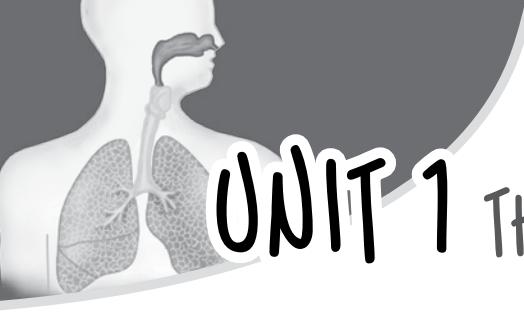
- S** — Start by saying what the students are going to learn about
- C** — Constantly encourage student participation and involvement
- I** — Investigate the topic and follow students' interests
- E** — Encourage all students to explore and contribute by rewarding participation and praising their involvement
- N** — Notice the interests and questions of the students and explore them further
- C** — Consolidate what has been learnt in the lesson and link it to other topics that have been taught and the world around them
- E** — End on a positive note and explain what has been learnt and what is coming next

About this teacher's guide

This teacher's guide contains lesson plans, worksheets, and information that will enable teachers to actively support their students' development and provide opportunities for the students to acquire important knowledge and skills. Worksheets at the end of this guide and the workbook along with extension activities will help to reinforce and boost learning.

Teachers are encouraged to actively involve students in reinforcing concepts by interacting with the software CD. If the required facilities are not available assign tasks from the CD for practice at home.

The cartoon character, Super Scientist, is the narrator and has been used for generating interest in the text. He is smart since he is a scientist, but he is prone to acting silly at times. He should be referred to and made use of for eliciting laughter wherever possible.



UNIT 1 THE HUMAN BODY

Background

This unit will help to explore the nervous, circulatory, respiratory, muscular, skeletal, digestive, and the urinary system in greater depth. The diagrams and the activities accompanying the text in the Student's Book will help to create an interesting lesson. Notebook and review questions will further help to strengthen these topics. Emphasis should be placed on the parts of each system by conducting activities which help students to understand their special functions.

Expected learning outcomes for the unit

Students should be able to:

- explain the function of the nervous system
- explain the function of the circulatory system
- identify the features of the respiratory system
- explain how muscles work
- identify the main muscles
- explain the function of the urinary system

1.1 The nervous system

Learning outcomes

Students should be able to:

Student's Book

- describe the two different parts of the nervous system

Workbook

- label the diagram of the nervous system

Resources

You will need:

- Student's Book pages 6-8
- Workbook page 2

Student's Book steps

1. Since students are already familiar with the brain and its functions, begin the class with brainstorming. Write the word 'Brain' on the board. Draw lines coming out of this word to form a word web. Ask students how much they know about the brain. They should know that

- it is a part of the nervous system
 - its main parts are cerebrum, cerebellum, and brain stem
 - and that the cerebrum is divided into parietal lobe, occipital lobe, temporal lobe, and frontal lobe.
2. Add everything relevant to the brain and the nervous system to the word web. This will help refresh their memory. Carry the lesson forward from here.
 3. Introduce them to Galen first as a scientist who belonged to Ancient Rome. Make use of this feature of the book by which a renowned scientist in the field is introduced. Your students should remember the name and contribution of each scientist.
 4. Tell them that there are two parts to their nervous system—the central nervous system which is the brain and the spinal cord and the peripheral nervous system which is nerves.
 5. Write these words and their definitions on the board.
 6. Read aloud from the Student's Book as the students follow in their own books. Look at the images together and practise saying the vocabulary aloud.

Activities

- Arrange the students in groups and read aloud the instructions for the 'Quick Messages' game. Challenge them to see how fast they can react. Remind them that this is their nervous system at work.
- Help the students to name the two different parts of the nervous system and to explain their differences.

Workbook steps

1. Help the students to identify the various parts of the nervous system. Ask them to look at the diagram in the Student's Book to help them identify the correct parts.
2. Help the students to describe what happens when they are playing their favourite sport. Ask the students to describe their favourite sport and what they do to a partner—they may wish to act out the different parts. Ask the students to think about their automatic responses—when a ball comes straight for their face and the decisions that they make—where they might choose to run to be in a better position to kick a goal.

Answers to Student's Book 1.1

The nervous system has two main parts: the central nervous system and the peripheral nervous system. The central nervous system consists of the brain and the spinal cord. When a message from the nerves reaches the brain, the brain works out what to do, and then sends a message telling your body how to react. The peripheral nervous system includes all the nerves throughout the body. The nerves react to something and send a message to the brain.

1.2 Circulatory system

Learning outcomes

Students should be able to:

Student's Book

- explain the importance of the heart, blood, and blood vessels in our bodies

Workbook

- label the diagram of the circulatory system
- explain how the heart works
- make a simple stethoscope

Resources

You will need:

- Student's Book pages 9 and 10
- Workbook pages 3 and 4
- A large wallchart of the structure of the heart
- A chart of the circulatory system

Student's Book steps

1. Do the same exercise on the board as done for Unit 1.1. Ask the students to recall everything that they know about the heart and add it to the word web on the board.
2. Make use of the chart of the circulatory system. Show them how the arteries and veins are like a web of vessels that are spread over our entire body. Emphasize that these vessels are connected to all the organs. Each organ needs a constant fresh supply of blood. This makes the heart very vital or important as an organ as it is its job to ensure that fresh blood is supplied to these organs.
3. Explain that the thumping sound in our chest is made by the heart pushing blood around the body. We can feel the 'pulse' in certain parts of the body which is produced after each pumping action of the heart. Teach them how to feel the pulse in their wrists.
4. Explain that the tubes that carry fresh blood away from the heart to other organs are called arteries and the tubes that carry the blood with carbon dioxide to the heart are called veins.
5. Ask the students to roll up their sleeves and see if they can see any veins on their arms.
6. Tell the students that if all the tiny and big blood vessels contained in the body were put in a straight line they would circle the globe more than 2.5 times!

Activities

Help the students to practise finding their pulse. Make a chart on the board with all of the students'

names and columns for their pulse before and after exercise. Allow the students to either run outside or on the spot inside to see if they can increase their pulse rate.

Workbook steps

1. Help the students label the different parts of the circulatory system and explain how the heart works. Remind the students that the complete diagrams are in the Student's Book.
2. Arrange the students in pairs or threes and read out the instructions on how to make a basic stethoscope. Give each group a cardboard tube to see if they can hear each other's heartbeats. Explain that before modern day stethoscopes, this is how doctors listened to their patient's hearts.

Answers to Student's Book 1.2

1. The circulatory system is made up of the heart, blood, and the blood vessels.
2. The circulatory system sends oxygen and nutrients around the body and takes away waste material.
3. The heart beats faster during exercise because it pumps harder to push oxygen around the body.
4. arteries, veins, and capillaries

1.3 Respiratory system

Learning outcomes

Students should be able to:

Student's Book

- identify the basic features of the respiratory system

Workbook

- label the diagram of the respiratory system
- explain what happens when we breathe in and out
- gain confidence with experimenting and measurement

Resources

You will need:

- Student's Book pages 11 and 12
- Workbook pages 5 and 6
- a piece of string (about 60 cm long)
- some round balloons
- a ruler or tape measure
- wallchart of the respiratory system

Student's Book steps

1. Ask the students to take a few deep breaths.
2. Explain that this is their respiratory system at work bringing in fresh oxygen and removing waste.
3. It'll help if students can feel their diaphragm to understand where it is located. If possible, make them lie on their backs and to talk to each other. They should be able to feel the muscle that moves just under the ribcage as they breathe and talk. This is their diaphragm. It moves to make space for the lungs to expand.
4. Write the word diaphragm on the board. Ask the students to sit up and see if they can find their diaphragms again. They should take deep breaths in and deep breaths out to feel their diaphragms moving.
5. Explain that their diaphragm is a big muscle and singers and musicians who play wind instruments use this muscle all the time to control and increase their lung capacity. If possible, show a short clip of an opera singer performing [e.g. <http://www.youtube.com/watch?v=VATmgtmR5o4>] so the students can hear what happens when someone really uses their diaphragm to sing.
6. Use a big wallchart or poster showing a labelled diagram of the respiratory system. Explain to students how air enters through the nostrils, passes through the pharynx, goes past the larynx, and passes through the trachea to enter the lungs. Explain how the exchange of gases takes place.
7. Read aloud from the Student's Book as the students follow in their own books. You can ask the students to do the reading as well.

Activities

Ask the students to put their hand in front of their mouths and feel the air coming out. Ask the students to describe its temperature—yes, it's warm. The air that is coming out has picked up heat as it has travelled around our bodies.

Workbook steps

1. Help the students to label the different features of the respiratory system and to describe what happens when they breathe in and breathe out.
2. Arrange the students into small groups. Explain that they now have an opportunity to measure their lung capacity. Read aloud from the Student's Book as the students follow in their own books. Give the materials required to each group and help them to measure their lung capacity.

Answers to Student's Book 1.3

1. The lungs, nose, mouth, larynx, pharynx, and the trachea make up the respiratory system.
2. We breathe in oxygen and breathe out carbon dioxide. Out of both, oxygen is more important for our survival.

1.4 Muscular system

Learning outcomes

Students should be able to:

Student's Book

- explain that there are different types of muscles at work in their body

Workbook

- attempt multiple choice questions related to the muscular system
- explain the functions of the skeletal system

Resources

You will need:

- Student's Book pages 12 and 13
- Workbook page 7
- wallchart of the muscular system

Student's Book steps

1. Ask students what comes to their minds when they hear the word 'muscles'. They will probably speak of a man bending his arms to show his biceps (though they may not call them biceps). Lead the explanation from there and say yes, that's what the man is showing off. He's developed them so much that they've become strong. Just like the biceps there are over 600 muscles in our body. Any work that the body does is because of these muscles. Some are attached to our bones and they make the bones move by contracting and expanding. The heart too is a muscle. Also say that there are no muscles in the brain, in fact, there shouldn't be! If somebody calls someone a musclehead it means they are calling that person stupid! Meaning there is muscle in their body where there should be brain!
2. Ask the students if they can name any of the muscles in the human body. Reward individual students with positive feedback for trying to name some of them.
3. Tell them about the different types of muscles in their bodies, giving examples of each. Explain the difference between voluntary and involuntary. Muscles that they can control e.g. if they want to wave to someone or pick something up are involuntary muscles, and muscles that they can't control that just work all the time, such as the heart are involuntary muscles.
4. Read aloud from the Student's Book as the students follow in their own books. Pause after each statement and look carefully at the diagrams. Practise saying the new vocabulary aloud.

Activities

- Ask the students to look at the diagram of human muscles in their Student's Book. Put them in pairs or threes and ask them to try and identify the different muscles in their own bodies as they stand up and move around. Encourage them to guess, refer to the diagram and have fun!

- Encourage the students to feel their quadriceps or quads burning by squatting down with their backs against a wall. They will need to be able to lean against a wall. You could time their efforts to see who is able to stay squatting the longest.

Workbook steps

1. Ask the students to identify the correct answers by circling the right response. Remind them that all of the information they need is in the Student's Book.
2. Help the students to identify the four different functions of the skeletal system. Remind them that all the answers are in the Student's Book.

Answers to Student's Book 1.4

1. The muscular system enables the body to move.
2. 600
3.
 - a. Voluntary muscles make the body move. They are attached to the skeleton and can be controlled. For example, we use our skeletal muscles to pick up something or wave at someone.
 - b. Involuntary muscles control the parts of the body which keep functioning without our control. Examples of these are smooth muscles in the digestive system and in our eyes.
4. The heart is a cardiac muscle. It is an involuntary muscle that pumps the blood around the body.

1.5 Skeletal system

Learning outcomes

Students should be able to:

Student's Book

- explain that the skeletal system serves four different purposes in the body

Resources

You will need:

- Student's Book page 14
- wallchart of a skeleton

Student's Book steps

1. Begin the class by asking students what they think bones do for our body. Write all answers on the board. Later tell them the four functions listed in the book.
2. Find out if any student has had a fracture. Ask if they know the name of the bone that broke. Build on this, asking the time it took to heal, whether they were put in a cast. Also suggest ways we can be careful with our bones to avoid fractures. Drinking milk makes the bones strong!

3. Use a big wallchart or a poster of the human skeleton and point out to different bones, naming the main ones. Explain that our bones serve four main functions in our bodies.
4. Explain that our bones form part of the skeletal system that keeps all of our organs in place. Our skeletal system also protects all of our soft organs, like our hearts and lungs. It works with our muscles and tendons to help us move.
5. Write these four main functions of bones on the board and ask the students to copy them down.
6. Read aloud from the Student's Book as the students follow in their own books or let the students read.

Activities

Help the students identify what different bones do by answering the questions to 'Which bone ...'

Answers to Student's Book 1.5

- a. 206
- b. more than 300

This difference is because when the babies grow up, the bones become harder and fuse together to form one bone.

1.6 Digestive system

Learning outcomes

Students should be able to:

Student's Book

- explain the basic function of the digestive system

Workbook

- label the diagram of the digestive system
- explain how the parts of the digestive system work

Resources

You will need:

- Student's Book pages 15 and 16
- Workbook page 8
- some food to share with the students
- wallchart or poster showing the digestive system

Student's Book steps

1. It would be a good idea to begin this lesson in break time. Ask your students to have their snacks in the classroom. Write 'The digestive system' on the board. Have a big wallchart showing the diagram of the system hanging in the classroom.

2. Ask students if they ever wondered where the food that they ate went. The system that they are going to study will explain exactly that. Ask them to begin eating their snack, feeling aware of it as they chew and swallow. They should look at the diagram of the digestive system as they do so, so that they know where the food is going after being swallowed.
3. Ask the students to describe what was happening when they were eating. Encourage individual students to describe chewing, their tongue moving the food about, and the saliva in their mouths.
4. Explain that chewing and breaking down the food with their tongues and the saliva in their mouths is the beginning of the journey of the food through their bodies.
5. Explain that muscles in their throat then push the food down into their stomachs where the food is broken down further.
6. Explain that the body uses what it needs from the food as it slowly pushes the food through long tubes called the intestines and then finally the waste is pushed out.
7. Read aloud from the Student's Book reinforcing the different steps that the food goes through before being pushed out as waste.

Activities

Help the students add up all of the different times to work out how long food takes on its journey through the digestive systems.

Workbook steps

Ask the students to label the diagram of the digestive system correctly and explain the function of the different parts.

Answers to Student's Book 1.6

1. The function of the digestive system is to take in food, extract the nutrients from it, and get rid of the waste.
2. The digestive system is like a long tube known as the digestive tract. It is about 8 metres long in an adult.
3. 3 hours
4. Gastric juices are found in the stomach. These are very acidic and break down the food into a paste.

1.7 Urinary system

Learning outcomes

Students should be able to:

Student's Book

- identify the four key parts of the urinary system
- explain the function of the four key parts of the urinary system

Workbook

- solve a crossword puzzle
- match the systems of the human body to their definitions

Resources

You will need:

- Student's Book page 16
- Workbook pages 9 and 10
- poster paper and markers
- copies of Worksheet 1 for all the children

Student's Book steps

1. Explain to the students that the digestive system produces waste and the solid waste goes out of the bowels.
2. Explain that there is another system that gets rid of the liquid toxins—the urinary system.
3. Write the words urinary system on the board and explain that the urinary system is made up of four main parts—the kidneys, the ureter, the bladder, and the urethra.
4. Write these words on the board.
5. Explain that the kidneys filter waste. The tubes or the ureter take the urine to the bladder. The bladder stores the waste and the urethra passes the waste out of their bodies.
6. Read aloud from the Student's Book as the students follow in their own books.
7. Look carefully at the diagrams and images in the Student's Book and practise saying the words aloud with the students.
8. Ask the students to complete Worksheet 1 at home. Discuss the answers in the next lesson.

Activities

Ask the students to draw a picture of themselves with the major organs and systems labelled as per the instructions in the Student's Book.

Workbook steps

1. Ask the students to complete the crossword puzzle on page 9 at home.
2. Help the students complete the 'Which system is which?' activity by drawing a line between the body systems and the correct definitions.

Review

1. vein—carries blood to the heart
capillary—small blood vessels that link the veins and the arteries
artery—carries blood away from the heart to other parts of the body
alveoli—tiny air sacs in the lungs that take in oxygen from the air and carry it to the blood where it is then pumped throughout the body
saliva—breaks down food and makes it easier to bite and swallow
ureter—tubes that transport the urine from the kidneys to the bladder
2. The nerves react to a stimulus. When the message reaches your brain, your brain sends a message telling your body how to react.
3. The right atrium fills with blood from the body which is low in oxygen. It is pushed into the right ventricle and then to the lungs where it picks up oxygen and gets rid of carbon dioxide. Students will draw a diagram similar to the one on page 9 of the Student's Book.
4. The respiratory system helps us to breathe. Air is inhaled through the nose and mouth and travels through the pharynx, larynx, and trachea into the lungs. The alveoli in the lungs take oxygen from the air and put it into the blood from where it is pumped throughout the body. The opposite happens when we breathe out. The alveoli absorb the carbon dioxide which travels through the trachea, larynx, and pharynx to your mouth and nose and exits the body.
5. Muscles are very flexible and can contract and expand. They help the body to move.
6. The skeleton comprises of all the bones in the body. It supports the body and protects the internal organs keeping them in place. It also works with the muscles and tendons to enable movement.
7. The two types of joints are the ball-and-socket joints and hinge joints. The knee and elbow are examples of hinge joints. The hip and shoulder joints are examples of ball-and-socket joints.
8. When we eat food, the saliva in the mouth starts to break down the food which makes it easier to bite and swallow. The teeth and tongue break it down further. Next the food is swallowed and travels down the oesophagus to the stomach. In the stomach, the food mixes with gastric juices to form a paste. It then passes the small intestine, where food is broken down further. The nutrients enter the bloodstream and are transported around the body while the undigested food is passed into the large intestine. Here water is also removed and the remaining waste travels through the rectum to come out of your body.
9. The urinary system is made up of the kidney, ureter, bladder, and urethra. The two kidneys act as filters. As blood travels around the body, it picks up toxins that are harmful for the body. These and other waste products are turned into urine and sent to the ureters. The ureters transport the urine from the kidneys to the bladder. The bladder then stores the urine until we need to go to the toilet. The urinary system makes sure that the body has the right amount of water and removes waste materials in liquid form.

Answers to Workbook

Page 2

Students will label the diagram as on page 7 of the Student's Book.

The eyes see the ball approaching, the message is then conveyed to the brain through the nervous system. The brain then works out what to do and sends a message to the body telling it how to react.

Page 3

Students will label the diagram as on page 9 of the Student's Book.

The right atrium fills with blood from the body which is low in oxygen. It is pushed into the right ventricle and then to the lungs where it picks up oxygen and gets rid of carbon dioxide.

Page 4

Students will follow the instructions to make a stethoscope.

Page 5

Students will label the diagram as on page 11 of the Student's Book.

Air is inhaled through the nose and mouth and travels through the pharynx, larynx, and trachea into the lungs. The alveoli in the lungs take oxygen from the air and put it into the blood from where it is pumped throughout the body. The opposite happens when we breathe out. The alveoli absorb the carbon dioxide which travels through the trachea, larynx, and pharynx to your mouth and nose and exits the body.

Page 6

Students should follow the instructions given to find out about their lung capacity.

Page 7

1. a, c, d 2. c 3. a 4. b, c 5. d

The skeletal muscles are attached to the bones by fibres called tendons. These are voluntary muscles and are used when we want to wave at someone, kick a ball, or pick up something.

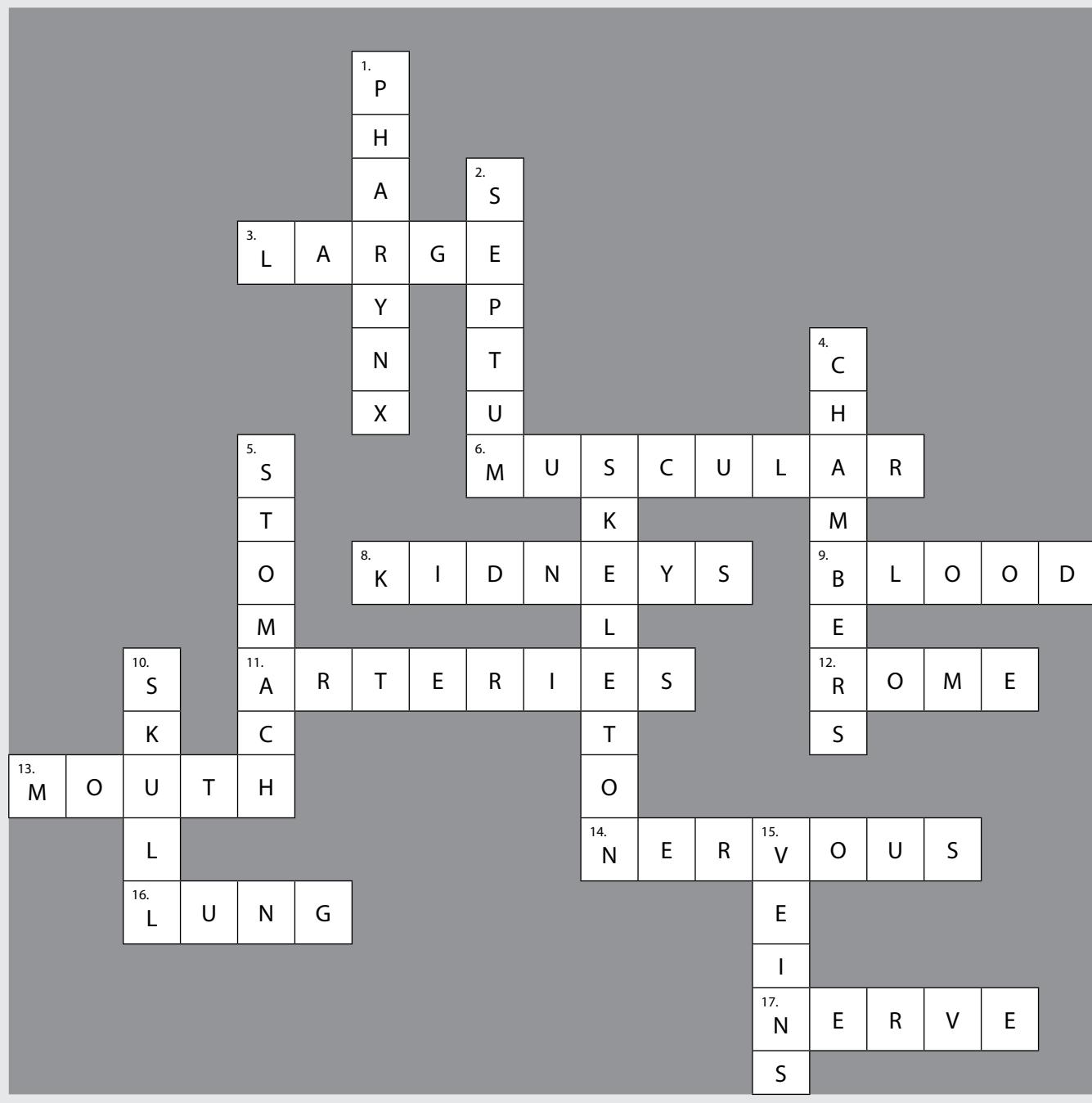
Page 8

Students will label the diagram of the digestive system as on page 15 of the Student's Book.

1. The saliva breaks down the food making it easier to bite and swallow the food.
2. The food is mixed with gastric juices that are very acidic. These break down the food further into a paste.
3. Inside the small intestine the food is broken down further. The nourishing part of the food is removed which enters the bloodstream and carried around the body.

- When the food is swallowed it travels down the oesophagus to the stomach.
- The undigested food passes into the large intestine where any last bits of goodness are removed. The rest is excreted out of the body through the rectum.

Page 9



Page 10

Nervous system: responds to information from the outside world and from the organs inside your body and tells the various parts of your body how to react

Circulatory system: sends oxygen and nutrients around the body to all the cells, and takes away waste materials

Respiratory system: takes in oxygen that we need to survive and expels carbon dioxide that we don't need

Muscular system: enables the body to move

Skeletal system: supports your body and protects your internal organs from damage

Digestive system: extracts the goodness from food and gets rid of waste

Urinary system: makes sure that you have the right amount of water in your body, and removes waste materials as a liquid

Reproductive system: create new humans

Answers to Worksheet 1

1. nerve
2. arteries
3. central, peripheral
4. Capillaries
5. Septum
6. alveoli
7. Involuntary
8. tendons
9. hinge
10. oesophagus
11. filters
12. bladder



UNIT 2 THE ANIMAL WORLD

Background

The purpose of this unit is to build on students' learning from previous years about classification. A hierarchy chart will be very useful to explain how animals are divided into vertebrates and invertebrates. These two classes are then sub-divided further. Students' prior knowledge will base on being able to classify animals through features such as being warm-blooded or cold-blooded, their life cycle, habitat, and their appearance. Introduce the concept of cells and move on to the structure of an animal cell through use of appealing visual material.

Expected learning outcomes for the unit

Students should be able to:

- explain the importance of classification
- describe the composition of an animal cell
- identify the main features of mammals, reptiles, birds, and fish
- identify amphibians and arthropods
- differentiate between vertebrates and invertebrates

2.1 Why classification

Learning outcomes

Students should be able to:

Student's Book

- identify the broad categories that animals can be divided into

Resources

You will need:

- Student's Book pages 18 and 19
- an assortment of clothes to classify, including: shirts, pants, socks, (socks of different colours and sizes) and clothes for different seasons
- animal figurines or pictures of different animals—land, sea, and air animals

Student's Book steps

1. Write the word 'Classification' on the board and gather students' responses about the word in the form of a word web.

2. Arrange them into groups and give them an assortment of clothes and ask them to organize them. Tell them to think about how they arrange their clothes at home—why they put clothes in certain places, and so on. Encourage the students to discuss their choices with each other and come up with an agreed way to organize the clothes in their small groups.

3. Ask them to explain their choices to the rest of the class, asking questions such as:

Why have you arranged the clothes into these groups?

Are there different ways to arrange the clothes?

Can you divide the groups into smaller groups, such as putting the socks into small groups based on size or colour?

How do you organize your clothes at home?

Why don't you keep them all in a big jumble together?

4. Explain to the students that in order to understand and organize things we sort them into different groups and this is called classification.

5. Explain that in order to understand and study living things scientists have divided them into different groups and like the grouping of the clothes, there are smaller and smaller groups that can be made until we reach one single group.

6. Explain that they are going to be learning about animal classification.

7. Ask the students to write a list of different animals. Ask them to group the different animals based on any similarities that they may have, such as where they live, or whether they fly, swim, or walk on land.

8. Explain that in order to understand animals, scientists have put them in two large groups which are vertebrates and invertebrates.

9. Read aloud from the Student's Book and ask the students to follow in their own books.

Activities

- Arrange the students in pairs or threes and give them access to resources in order to research different animals. Ask each group to share what they have learnt with the rest of the class.
- Arrange the students in groups and give them animal figurines or animal pictures and ask them to organize them in different groups depending on their different features. Encourage the students to discuss their decisions among each other. Explain there is no right answer, the activity just gives them a chance to look carefully at different animals and think about the different ways that scientists have classified them.

Answers to Student's Book 2.1

Answers will vary.

2.2 The animal kingdom

Learning outcomes

Students should be able to:

Student's Book

- explain that animals are made up of tiny cells
- name the main parts of an animal cell

Workbook

- draw and label an animal cell

Resources

You will need:

- Student's Book pages 20 and 21
- Workbook page 11

Student's Book steps

1. Start the lesson by introducing the animal kingdom through the chart on page 20 of the Student's Book. Help them to become familiar with the different classes in the animal kingdom.
2. Explain that all living things are made up of tiny cells.
3. Explain that all the cells in the human body have a different function. Some cells carry messages from the brain. Some cells carry blood to the heart. Some cells carry blood away from the heart. All of the different systems in the body are made up of tiny cells with different jobs.
4. Draw an animal cell on the board using the diagram from the Student's Book to guide you. Label the four key parts of the cell (nucleus, cytoplasm, cell membrane, and vacuole) practise saying these new words aloud.
5. Read aloud from the Student's Book as the students follow in their own books. Read the section a number of times paying particular attention to the different parts of an animal cell and the functions of the different parts.

Activities

Arrange the students in groups and ask them to act out the different parts of an animal cell—some students could be the cell membrane and have to let nutrients in and keep out diseases, one child could be the nucleus giving the orders to the parts of the cell, some students could be the cytoplasm and organize the parts of the cell by getting rid of waste inside the cell and moving things around and some other students could be the vacuole which processes the nutrients and waste and helps store nutrients and get rid of waste.

Workbook steps

The students can draw and label the main parts of an animal cell at home. Remind them that all of the information that they need is in the Student's Book.

Answers to Student's Book 2.2

Answers will vary depending on students' research about the classification of animals.

The animal kingdom is divided into vertebrates and invertebrates. Vertebrates include birds, fish, amphibians, reptiles, and mammals. Invertebrates include arthropods, echinoderms, cnidarians, sponges, molluscs, and worms.

2.3 Mammals

Learning outcomes

Students should be able to:

Student's Book

- identify the three groups that mammals are classified in

Resources

You will need:

- Student's Book pages 22-24
- pictures of different animals or animal figurines

Student's Book steps

1. Begin the lesson by recapping the classes in the animal kingdom. Begin the lesson by introducing mammals.
2. Explain that there are three main ways to decide if an animal is a mammal:
Is the animal warm-blooded?
Does the animal nurse its young?
Does the animal have fur or hair?
3. Write these questions on the board and explain them. Ask the students to identify mammals from the pictures or figurines they have by asking these questions. Reward the students with positive feedback.
4. After some time, talk about different mammals using examples. Additional pictures of mammals and those in the Student's Book will be helpful.
5. Read aloud from the Student's Book as the students follow in their own books. Look at the images carefully with the students.

Activities

Arrange the students in pairs or threes and ask them to brainstorm all of the different mammals that they think live in Pakistan. They can draw a picture of their favourite animal at home.

Answers to Student's Book 2.3

1. Mammals are warm-blooded; reptiles are cold-blooded.
2. Mammals give birth to fully-formed young; reptiles lay eggs.
3. Mammals have hair or fur; reptiles have scales.

2.4 Reptiles

Learning outcomes

Students should be able to:

Student's Book

- identify some features of reptiles
- differentiate between mammals and reptiles

Resources

You will need:

- Student's Book page 25

Student's Book steps

1. Explain that another class of animals which are vertebrates are called reptiles.
2. Ask the students if they know of any reptiles—appreciate students for answering even if they name animals that aren't reptiles.
3. Explain that reptiles have the following characteristics: They are cold-blooded. They lay leathery, waterproof eggs. They have four legs (except for snakes). They have scales instead of hair or fur. They have lungs to help them breathe. They have external ear opening (except for snakes).
4. Ask the students to create a checklist of questions that a scientist might ask to see if an animal is a reptile, for example: Is the animal cold-blooded?
5. Explain how mammals are further subdivided into three more groups.
6. Read aloud from the Student's Book as the students follow in their own books. Pause to look carefully at the pictures and read out any labels.

Activities

- Show the students a flow chart [refer to http://www.brianpcleary.com/animals/pdf/Classifying_Animal_Groups.pdf]. Help the students to draw up a classification chart to distinguish between a mammal and

a reptile. Remind the students of the different questions that scientists ask in order to classify mammals and reptiles.

- Ask the students to record the main differences between mammals and reptiles.
- Ask the students to research the differences between the animals listed in the Student's Book under 'Find Out'. They will need access to the library or computers.

2.4 (contd.) Birds

Learning outcomes

Students should be able to:

Student's Book

- name some flightless birds
- describe the common characteristics of birds

Resources

You will need:

- Student's Book page 26

Student's Book steps

1. Start your lesson with a discussion about birds. Elicit the students' prior knowledge about birds.
2. Explain that birds have certain characteristics and scientists have worked out a list to check and see if an animal is a bird: They are warm-blooded. They lay hard-shelled eggs. They have feathers and wings. They have scales but only on their legs and feet. They have lungs to help them breathe. They have a beak, but no teeth. They have a furcula, which is also known as a wishbone.
3. Read aloud from the Student's Book as the students follow in their own books. Pause to look at the pictures and read out the labels. Remind the students that scientists have worked out many ways to accurately classify animals.

Activities

As a class, make a list of birds that live in Pakistan, that the students know about. Ask the students to draw their favourite bird at home and bring it into class to display around the room.

2.4 (contd.) Fish

Learning outcomes

Students should be able to:

Student's Book

- discuss some common characteristics of fish
- explain how fish breathe

Resources

You will need:

- Student's Book pages 27 and 28
- paper, scissors, and markers

Student's Book steps

1. Ask the students to recall the different classification of animals that they have learnt about so far, including: reptiles, mammals, and birds.
2. Explain that another vertebrate among animals are fish. Elicit common examples of fish.
3. Explain the features of fish that scientists use in order to classify them using the Student's Book. Ask them to use these features to create questions and make a classification flow chart like they did for reptiles and mammals.
4. Read aloud from the Student's Book. Ask the students to follow in their own books.

Activities

- Ask the students to organize the letters to form the names of two birds and a fish for homework.
- As a class, brainstorm all of the different fish that live in Pakistan. Ask the students to choose their favourite fish, draw its picture, and cut it out. Display their pictures around the room.

Answers to Student's Book 2.4

1.

Mammals	Reptiles
warm-blooded	cold-blooded
have hair or fur	have scales
give birth to young	lay eggs with leathery, waterproof shells

2. Birds are warm-blooded, lay eggs with hard shells, have feathers and wings, and scales on their legs and feet. They breathe through their lungs, have a beak but no teeth, and have a furcula.
3. Fish take in oxygen from water through their mouth and pass it over the gills where the oxygen is extracted.

2.5 Amphibians

Learning outcomes

Students should be able to:

Student's Book

- identify some features of amphibians
- name some amphibians

Resources

You will need:

- Student's Book page 28
- the book *Animalia* by Graeme Base

Student's Book steps

1. At the start of the lesson, put the students in groups and give each group different animal pictures or figurines to look at.
2. Ask each group to discuss the different features of each animal and see if they can classify it. They may wish to use their Student's Book to help them. Encourage the groups to closely examine the animal pictures and discuss the different features.
3. After some time, ask the students to return to their seats and tell them that amphibians are another class among invertebrates. Write 'Amphibians' on the board and their features.
4. Explain that amphibians include frogs, toads, salamanders, and newts.
5. Read aloud from the Student's Book as the students follow in their own books. Reinforce the different features of amphibians.

Activities

- Provide the students with access to resources to work out the differences between a frog and a toad and the differences between a newt and a salamander. Ask the students to individually draw a picture of a frog, a toad, a newt, and a salamander and label its differences. They will need resources that have relevant images or access to the Internet.
- Read the book *Animalia* by Graeme Base and spot all the different animals. Ask the students to recall what they have learnt so far about the classification of animals. Ask them to choose a letter of the alphabet and draw all the animals that they know whose names start with that letter. Ask the students to illustrate the drawing and use *Animalia* as inspiration.

2.5 (contd.) Arthropods

Learning outcomes

Students should be able to:

Student's Book

- explain that arthropods make up most of the animals on Earth
- identify some of the features and sub-groups of arthropods

Workbook

- list features of mammals, reptiles, birds, fish, and insects
- identify an insect with the help of its physical features
- label the different parts of the body of an ant
- solve an animal wordsearch
- complete a chart of the animal kingdom
- fill in the blanks with appropriate words

Resources

You will need:

- Student's Book page 29
- Workbook pages 12-15

Student's Book steps

1. Revise the different features of animal cells and the classification of animals with the students.
2. Introduce another class of invertebrates: arthropods.
3. Explain that this is the largest group of animals, so to help study arthropods, scientists have classified arthropods into five main groups: insects (beetles, ants), arachnids (spider, scorpion), crustaceans (crabs, lobsters), centipedes, and millipedes.
4. Write the different sub-categories of arthropods on the board.
5. Read aloud from the Student's Book focusing on the different features of each sub-category. Look carefully at the pictures with the students and read out any labels. You may need to re-read the Student's Book and ask the students to revise this section at home.

Activities

- Take the students outside to a garden area and see if they can find any arthropods. Remind the students not to touch the arthropods just to see if they can find and categorize any. After some time return to the class and ask the students to draw a picture of their favourite arthropod.
- Help the students to draw a type of mollusc, sponge, and worm.

Workbook steps

1. Ask the students to complete the table 'Which animals have which features?' at home.
2. Help the students describe the physical characteristics of an insect.
3. Help the students label the different parts of the ant.
4. Ask the students to complete the 'Animal Word Find' at home.
5. Ask the students to fill in the gaps to complete the sentences at home. Remind them that all of the information they need is in the Student's Book.
6. Help the students to fill in the Animal Kingdom chart.

2.6 Other vertebrates

Learning outcomes

Students should be able to:

Student's Book

- identify some more groups of invertebrates
- identify and give examples of molluscs, sponges, worms, echinoderms, and cnidarians

Resources

You will need:

- Student's Book pages 31–33
- copies of Worksheet 2 for all the children

Student's Book steps

1. Revise the different classifications of animals with the students—ask the students to look back at the Student's Book. Draw a classification chart on the board as the students provide their feedback.
2. Explain that there are some more classes of invertebrates. Write the names of these classes on the board.
3. Talk about molluscs, sponges, worms, echinoderms, and cnidarians using pictures and examples.
4. Ask the students to complete Worksheet 2 at home. Discuss the answers in the next lesson.

Activities

Help the students to draw a type of mollusc, sponge, and worm.

Review

1. Scientists put organisms into different classes so that it is simpler to study them.
2. a. vertebrates
b. invertebrates
3. An animal cell is a cell that holds all the information necessary to keep an animal alive. Nerve cells in the brain send and receive messages. Blood cells carry oxygen around the body and other cells protect animals against disease. The main parts of an animal cell are the nucleus, cytoplasm, cell membrane, and the vacuole.
4. Placental mammals give birth to well-developed young. Examples include humans, whales, dogs, and rats. Marsupial mammals give birth to young who are partly developed. They crawl into the mother's pouch where they are fed until they are fully developed to emerge into the world. Examples include kangaroos, koalas, and opossums.
5. a. Characteristics of birds:
 - They are warm-blooded.
 - They have feathers and wings.
 - They have scales but only on their legs and feet.
 - They have lungs to help them breathe.
 - They have a beak, but no teeth.
 - They have a furcula, which is also known as a wishbone.b. Characteristics of fish:
 - They live in water.
 - They have gills to help them breathe.
 - Most have scales.
 - Most lay eggs.
 - Most have fins to help them move through water.
 - They are cold-blooded.c. Characteristics of amphibians:
 - They have thin skins.
 - They begin life in the water and then live on land.
 - Adult females return to the water to lay their eggs.
 - They do not have scales or claws.
 - They are cold-blooded.

- d Characteristics of arthropods:
- They are cold-blooded.
 - They are found on land, in trees, in water, and underground.
 - They are the major source of food for many other animals.
- e. Characteristics of reptiles:
- They are cold-blooded.
 - They lay leathery, waterproof eggs.
 - They have four legs (except for snakes).
 - They have scales instead of hair or fur. They have lungs to help them breathe. They have external ear opening (except for snakes).
6. Reptiles
7. Students will draw diagrams of a type of mollusc, sponge, and a worm similar to that on pages 31 and 32 of the Student's Book.

Answers to Workbook

Page 11

Students will draw a diagram similar to that on page 21 of the Student's Book.

Page 12

Mammal features include:

- They are warm-blooded
- Females are able to feed their young with milk from their mammary glands
- They have hair or fur.

Reptile features include:

- They are cold-blooded.
- They lay leathery, waterproof eggs.
- They have four legs (except for snakes).
- They have scales instead of hair or fur. They have lungs to help them breathe. They have external ear opening (except for snakes).

Bird features include:

- They are warm-blooded.
- They have feathers and wings.
- They have scales but only on their legs and feet.
- They have lungs to help them breathe.
- They have a beak, but no teeth.
- They have a furcula, which is also known as a wishbone.

Fish features include:

- They live in water.
- They have gills to help them breathe.
- Most have scales.
- Most lay eggs.
- Most have fins to help them move through water.
- They are cold-blooded.

Amphibian features include:

- They have thin skins.
- They begin life in the water and then live on land.
- Adult females return to the water to lay their eggs.
- They do not have scales or claws.
- They are cold-blooded.

Insect features include:

- a body divided into three sections (head, thorax, abdomen)
- one pair of antennae
- three pairs of legs on their thorax.

Page 13

- I. The insect's body is divided into three sections (head, thorax, and abdomen) it has a pair of antennae, and three pairs of legs on the thorax.
- II. Students will label the diagram as on page 29 of the Student's Book.

Page 14

A	R	T	S	P	I	D	B	R	A	T	I
S	K	D	S	A	F	C	R	A	B	Y	B
D	E	A	C	P	U	A	W	A	L	O	A
F	A	W	N	O	I	R	Y	O	I	P	T
G	R	H	O	G	L	D	T	I	T	S	P
T	T	A	B	E	A	O	E	A	M	N	E
U	H	L	K	K	X	R	N	R	G	A	X
R	W	H	A	L	E	S	O	E	P	K	R
T	O	T	K	X	L	P	F	O	L	E	T
L	R	R	J	A	D	M	W	A	M	I	S
E	M	S	A	L	A	M	A	N	D	E	R
H	U	M	M	I	N	G	B	I	R	D	I

a marsupial that hops—kangaroo
a mammal that flies—bat
a reptile that does not have legs—snake
a very large mammal that lives in the sea—whale
a reptile which hides in its shell for protection—turtle
a bird that can fly backwards—humming bird
an arachnid that spins a web—spider
a crustacean with a single pair of claws—crab
an amphibian that can regrow its tail and limbs—salamander
a worm that lives in soil—earthworm

Page 15

- I. Students will label and complete the hierarchy chart as on page 20 of the Student's Book.
- II.
 1. Nucleus
 2. Nerve
 3. elephant
 4. Marsupials
 5. warm
 6. reptiles
 7. famous
 8. invertebrates
 9. Arthropods
 10. beetle, ant, fly, ladybird (any two of these)

Answers to Worksheet 2

^{1.}	I	N	V	^{8.}	E	R	T	E	B	R	^{9.}	M	A	T	E	^{11.}	S					
					C							M					N					
					H							M					A					
			^{2.}	G	I	L	L	S				A					I					
					N							L					L					
^{3.}	A	R	T	H	R	O	P	O	D	S		S					S					
								D														
			^{4.}	R	E	P	T	I	L	E	S											
					R																	
			^{5.}	A	M	P	H	I	B	I	A	^{10.}	N	S								
						S							U									
													^{6.}	C	Y	T	O	P	L	A	S	M
														L								
														E								
													^{7.}	F	U	R	C	U	L	A		
														S								



UNIT 3 THE PLANT WORLD

Background

This unit helps the students to group plants into categories. They will be introduced to how the plant kingdom is classified into spore and seed bearing plants. These groups will be explored in further detail using a hierarchy chart. Explain the structure of the plant cell and conduct basic activities which help students to differentiate between a plant and an animal cell. Bean and maize seeds can be used to explain not only the structure of a seed but also monocots and dicots. The process of germination will be revisited along with how plants reproduce through seeds and spores.

Expected learning outcomes for the unit

Students should be able to:

- name the main groups of the plant kingdom
- describe the composition of a plant cell
- explain the difference between seeds and spores
- explain the conditions required and the process of germination
- describe the different ways that seeds are scattered

3.1 Classification of plants

Learning outcomes

Students should be able to:

Student's Book

- explain that plants are classified into different species
- describe some of the similarities and differences in plants
- explain the structure of a plant cell

Resources

You will need:

- Student's Book pages 34-37
- organize a visit outside into the school yard
- different leaves, seeds, or flowers for the students to closely observe and draw
- an empty fish tank or glass container

- soil
- different seeds
- rulers

Student's Book steps

1. Remind the students about the activity on sorting out clothes in particular groups and that classification is a way of understanding life on Earth.
2. Another way to explain classification is to ask the students to think about how books are organized in a library. Ask the students to explain the different categories of books in a library and try to organize the books into different levels, such as children's books and adult books, to very specific categories such as books on how to build rabbit hutches out of recycled cardboard.
3. Write the student responses on the board and order them from the large, inclusive categories to the very specific levels.
4. Explain that the way we classify living things is similar: we start at the big category, Kingdom, which is like the children and adult section and then narrow it down further to finally get to Species which is like getting to the specific book.
5. Explain that Kingdom is divided into five sections: Plants, Animals, Bacteria, Algi and Fungi, which is like dividing the children and adult section in the library into non-fiction, fiction, mystery, and so on.
6. Explain that there are four main ways of dividing up the plant kingdom: angiosperms, gymnosperms, ferns, and conifers.
7. Read the descriptions of the different types of plants from the Student's Book. Pause to look at the pictures with the students—stop before the description of plant cells.
8. Emphasize the different features of angiosperms, gymnosperms, ferns, and conifers.
9. Take the class outside and ask them to look carefully at the different plants. They should look carefully at the leaves of the plants and if there are any flowers or seeds.
10. Explain that plants, like animals and all living things, are made up of cells.
11. Read aloud the section on plant cells from the Student's Book. Make sure you read out the labels on the diagram.
12. Emphasize the differences and similarities between plant and animal cells.

Activities

- Give the students some leaves, flowers, or seeds to observe. Ask the students to carefully look at them and draw a picture of them.
- Help the students to plant the different seeds in the clear container. Make sure the seeds have sunlight and that the students regularly water and measure them. The students will delight in watching the seeds grow. The growing and measuring of the seeds will take some time and it may be best to start the experiment at the start of term so the students can observe the growth of the seeds. They will need

to make a rough sketch of the germination and growth of the seeds a few times and also take careful measurements. Give the students a template to help organize their observations of the seeds.

- Ask the students to draw a Venn diagram [see <http://sites.berwickfieldsps.vic.edu.au/procedures/venn-diagram/> for one example]. Ask the students to compare the features of angiosperms and gymnosperms in their Venn diagram. Ask them to look at the things they have in common—they both have seeds and they both have the same transportation system. Things that are particular to angiosperms—they have flowers, their seeds are within their flowers, and they attract birds and bees to scatter their seeds with their flowers. Things that are particular to gymnosperms—they do not have flowers, and they use different ways to scatter their seeds. Ask the students to illustrate their Venn diagrams with appropriate pictures. Remind them that all the information they need is in the Student's Book.

Answers to Student's Book 3.1

- Gymnosperms do not have flowers but angiosperms do.
- Conifers and ferns come under the class of gymnosperms. Conifers have cones and needles on their branches all year round. They are very common in the cooler northern hemisphere. Examples include pine, fur, and spruce trees.

Ferns have roots, leaves, stems, and trunks. They have a well-developed vascular system to transport water, minerals, and glucose. They reproduce through spores.

3.2 Seeds and spores

Learning outcomes

Students should be able to:

Student's Book

- explain the difference between seeds and spores
- describe the structure of a seed
- explain the difference between monocots and dicots

Workbook

- draw and label a plant cell
- match the parts of the seed with the given definitions
- draw and explain the difference between monocotyledons and dicotyledons

Resources

You will need:

- Student's Book pages 38-40
- Workbook pages 16 and 17
- dictionaries

Student's Book steps

1. Remind the students about the classification of plants and how plants can be divided in many different ways.
2. Remind the students about flowering plants: the dicots and the monocots and explain that in order to reproduce they release seeds or spores which will germinate and become new plants.
3. Explain the structure of a seed and the function of each part. Help them to differentiate between monocots and dicots using diagrams.
4. Read aloud from the Student's Book as the students follow in their own books. Make sure you read out the labels on the diagrams and encourage the students to practise saying the new words.

Activities

Remind the students to carefully observe the germination and growth of the seeds that they have planted. They will need to make a rough sketch of the changes every few days and to take careful measurements.

Workbook steps

1. Ask the students to draw a plant cell and label its main parts.
2. Ask the students to match the seed with the correct definition.
3. Help the students to draw a diagram of a monocot and a dicot and label their diagrams correctly. Remind them that all the information they need is in the Student's Book.

Answers to Student's Book 3.2

1. Students will draw a plant cell similar to that on page 37 of the Student's Book.
cell wall—provides protection in addition to the cell membrane
chloroplasts—contain chlorophyll required for photosynthesis
vacuole—stores water, food, and waste
2. Students will draw a diagram of the monocot and dicot seed similar to that on page 39 of the Student's Book.
Seeds of flowering plants contain either one or two cotyledons. Those with one cotyledon are called monocots and those with two are called dicots.

3.3 Germination of seeds

Learning outcomes

Students should be able to:

Student's Book

- identify the conditions necessary for germination
- explain the stages of germination

Workbook

- illustrate the stages of germination and explain them

Resources

You will need:

- Student's Book pages 40-42
- Workbook page 18
- paper and markers

Student's Book steps

1. Ask the students to predict the conditions a seed needs to grow.
2. Arrange the students into groups and ask them to discuss the perfect conditions for a seed to germinate.
3. Explain that like all living things seeds need food, water, and sunlight.
4. After the seeds have germinated and grown, discuss the growth of the seed, asking questions such as:

What was the first part of the seed to grow?

Why do you think this was so?

What were some of the differences and similarities in how different seeds grew?

How many leaves did it have at the start?

What did you notice about these leaves over time?

5. Explain that the first leaves of a seed are called cotyledons and these cotyledons provide food for the seed.
6. Explain that monocots have one cotyledon and dicots have two.
7. Ask the students to draw a diagram of the growth of a seed over time using the measurements and diagrams they took as the seeds grew.
8. Ask the students to compare their growth charts with different groups and discuss their observations.
9. Ask the students to label their diagrams and include the root system and the cotyledon(s).

10. Read aloud from the Student's Book as the students follow in their own books. Look carefully at the diagrams with the students and repeat the new vocabulary.

Activities

Help the students draw and label the parts of a seed.

Workbook steps

Ask the students to draw a series of diagrams that show the germination of seeds. Help them to label their diagrams correctly.

Answers to Student's Book 3.3

1. c
2. b
3. a

3.4 Scattering of seeds

Learning outcomes

Students should be able to:

Student's Book

- explain how the scattering of seeds takes place
- identify suitable methods of scattering for different seeds

Workbook

- explain how seeds are scattered
- identify the different types of seeds
- draw diagrams to show the different methods of seed dispersal
- solve a plant crossword

Resources

You will need:

- Student's Book pages 42–44
- Workbook pages 19 and 20
- different seeds to observe—ask the students if they have any at home that they can bring in as well as what you can find
- magnifying glasses

Student's Book steps

1. Remind the students that all living things need to reproduce. Plants reproduce by scattering their seeds or spores.
2. Explain that seeds can be scattered in many different ways and they are designed to make sure that they have the best chance of becoming a new plant.
3. Read aloud from the Student's Book asking the students to follow in their own books.
4. Discuss and explain the different ways in which they are scattered.

Workbook steps

1. Arrange the students in groups and give them magnifying glasses and some different seeds to closely observe. Ask the groups to discuss the different features of the seeds and how they think they have been designed to have the best chance of becoming a new plant. After some time, ask each group to share their observations and discussions with the rest of the class.
2. Ask the students to write down the different ways in which seeds are dispersed.
3. Ask the students to complete the plant crossword at home.

3.4 (contd.) Spores

Learning outcomes

Students should be able to:

Student's Book

- explain the difference between seeds and spores
- describe how spores are scattered
- explain the conditions required for the spores to germinate

Resources

You will need:

- Student's Book pages 44-45
- copies of Worksheet 3 for all the students

Student's Book steps

1. Explain that there is another way that some plants try to reproduce and this is through spores.
2. Explain that spores are very light as they are designed to be carried by the wind.
3. Explain that spores are very small and the plants that produce these, produce a lot of them.
4. Explain that unlike a seed, a spore needs to land in damp soil in order to germinate as it holds very little nutrients.

5. Read aloud from the Student's Book as the students follow in their own books. Look carefully at the images with the students and discuss what you can observe.
6. Ask the students to complete Worksheet 3 at home. Discuss the answers in the next lesson.

Activities

Ask the students to write down four different ways that seeds are scattered.

Review

1. Students will draw and label a plant cell similar to that on page 37 of the Student's Book.
2. Seeds need water, oxygen, light, and heat to germinate.
3. seeds—maple trees, papaya, dandelions
spores—ferns, orchids, mosses
Answers will vary.
4. Students will draw and label the diagram of a monocot seed similar to that on page 38 of the Student's Book.
seed coat—protects everything inside the seed
embryo—where life starts inside the seed
cotyledon—the seed leaf that emerges from the seed when it germinates
endosperm—tissue surrounding the embryo which also provides it with nutrition
5. The structure of the seed determines how they are scattered. They can be sticky, have hooks or spikes, be light, or shaped like wings. Some plants produce heavy seeds which fall directly to the ground. Seeds inside a fruit are excreted by animals and then start growing in the ground. Seeds in seed pods are thrown over a large area when the pods burst.
6. damp ground, right nutrients, and an area with sufficient light
7. Answers will vary.

Answers to Workbook

Page 16

Students will draw and label the diagram of the plant cell as on page 37 of the Student's Book.

The cotyledon is a seed leaf that emerges from the seed when germinated.

The embryo is where life starts within the seed.

The endosperm is a tissue that surrounds the embryo and provides it with nutrition.

The seed coat protects everything inside the seed so that it has a good chance of germinating.

Page 17

Students will draw a diagram of the monocot and dicot seed similar to that on page 39 of the Student's Book.

Seeds of flowering plants contain either one or two cotyledons. Those with one cotyledon are called monocots and those with two are called dicots.

Page 18

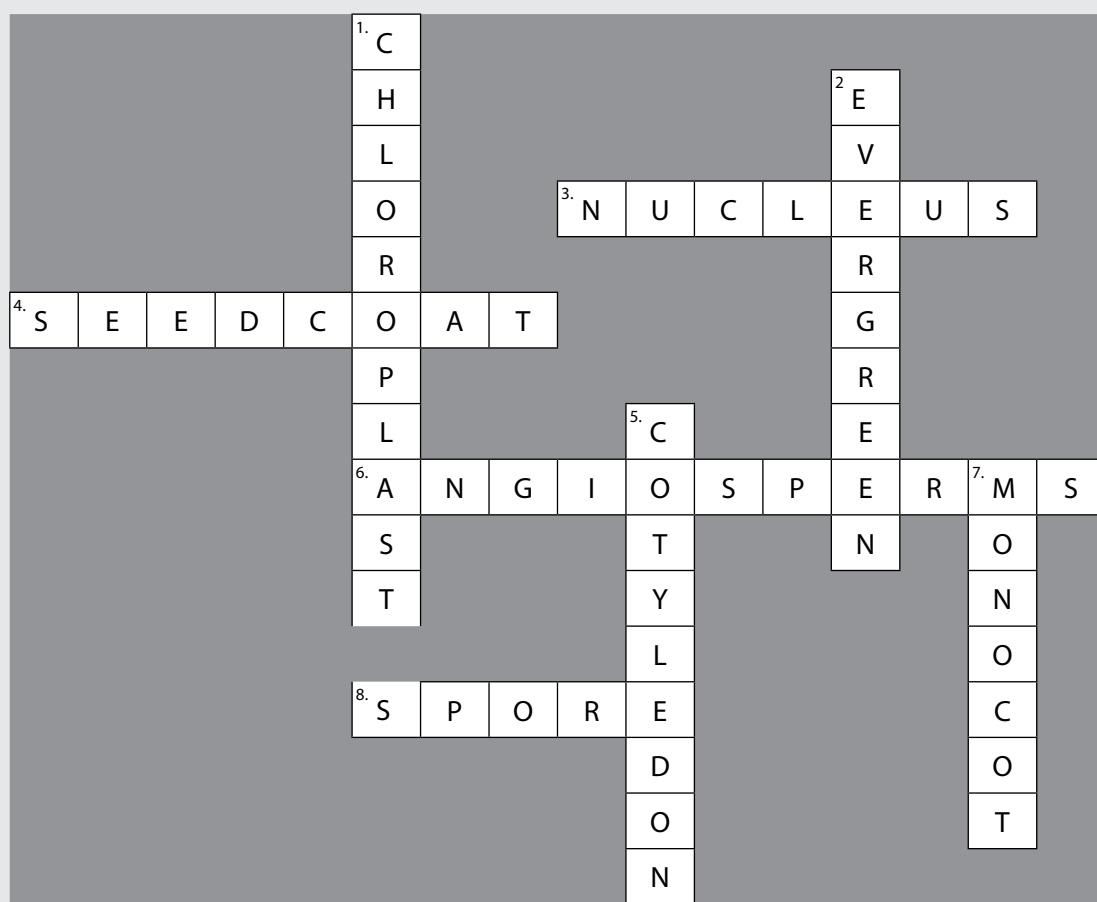
Students will draw the stages of germination as on page 41 of the Student's Book. They will write the description in their own words as on page 41 of the Student's Book.

Page 19

- I. Students will follow instructions given in the Workbook to show how seeds are scattered.
- II. The structure of the seed determines how they are scattered. They can be sticky, have hooks or spikes, be light, or shaped like wings. Some plants produce heavy seeds which fall directly to the ground. Seeds inside a fruit are excreted by animals and then start growing in the ground. Seeds in seed pods are thrown over a large area when the pods burst.

Students should be encouraged to draw diagrams using their imagination.

Page 20



Page 21

Students will complete the table related to plants and fungi as on page 46 of the Student's Book.

Students will follow instructions given in the Workbook to record the decomposition of a plant.

Answers to Worksheet 3

- | | |
|-----------------|------------------|
| 1. angiosperms | 6. roots |
| 2. pine tree | 7. flower |
| 3. vacuole | 8. spores |
| 4. dicotyledons | 9. cell wall |
| 5. endosperm | 10. chloroplasts |

The Science Factor 5 cover

You can plan out a complete lesson based on the cover of the Student's Book. Students can be asked to point to germination of a seed taking place and different methods of scattering of seeds.



UNIT 4 OTHER LIVING THINGS

Background

In this unit, students will be introduced to microorganisms. They will be familiar with a microscope so the lesson can be introduced by telling them that these are living things that can only be seen through a microscope. Use the text and diagrams in the Student's Book to explain what fungi, bacteria, and protists are. A table can be drawn on the board to list their properties as you explain them. Also discuss, using real-life examples, how certain microorganisms can be useful while others can be harmful.

Expected learning outcomes for the unit

Students should be able to:

- differentiate between plants and fungi
- explain the key characteristics of fungi, bacteria, and protists
- identify some uses of microorganisms
- identify the ways in which microorganisms can cause harm to humans

4.1 Fungi, bacteria, and other protists

Learning outcomes

Students should be able to:

Student's Book

- differentiate between plants and fungi

Workbook

- differentiate between plants and fungi
- conduct an activity to record the decomposition of a plant

Resources

You will need:

- Student's Book pages 46–48
- Workbook page 21
- dictionaries—enough for every pair or group of three

Student's Book steps

1. Welcome the students into the classroom and tell them that the lesson is going to be about other living things that are not plants or animals.
2. Explain that one of these things is fungi and scientists thought for a long time that it was a plant. Fungi has spores like some plants but it is quite different.
3. Draw a Venn diagram on the board and label one circle 'Fungi' and the other 'Plants'. In the intersecting section write 'produces spores'. In the section under 'Fungi' write, 'do not have stems, leaves and roots', 'do not have flowers', 'cannot make their own food'. In the section under 'Plants' write, 'have stems, leaves and roots', 'some plants have flowers', 'are able to produce their own food'.
4. Ask the students to copy down and illustrate the Venn diagram—you can display the completed diagrams around the room.
5. Explain that there are other living things that aren't plants, animals, or fungi and these include bacteria and protists.
6. Read aloud from the Student's Book as the students follow in their own books. Look carefully at the images with the students and read out the labels.
7. Emphasize that bacteria, protists, and fungi are all living things but they are not animals or plants.

Activities

Ask the students to complete the section to 'In your notebook' at home.

Workbook steps

1. Ask the students to complete the table on 'Fungi vs Plants'—they may do this at home.
2. Bring in a plant or go outside into the school yard and pull out a plant (preferably a weed!). Ask the students to closely observe the dying plant over the course of a week. They may take photos to show how the plant is decomposing or make careful drawings and notes. They will see how the microorganisms are going to work on the plant. Remind the students that the decomposing process helps break down the plant and return the nutrients to the soil.

Answers to Student's Book 4.1

1.

Plants	Fungi
have stems, leaves and roots	do not have stems, leaves, and roots
some plants have flowers	do not have flowers
are able to produce their own food	are not able to make their own food

2. protozoa and algae
3. one
4. to act as decomposers
5. animals and plants

4.2 Microorganisms—all good or all bad?

Learning outcomes

Students should be able to:

Student's Book

- explain how microorganisms help in food preparation and preventing diseases
- discuss how microorganisms can harm humans

Workbook

- list the benefits and harm caused by microorganisms

Resources

You will need:

- Student's Book page 48
- Workbook page 22
- copies of Worksheet 4 for all the students

Student's Book steps

1. Explain that microorganisms are essential to life—they help us by changing dead things into nutrients so new things can grow.
2. Explain that microorganisms can also harm us and that's why we need to cook certain food well and practise good hygiene.
3. Read aloud from the Student's Book as the students follow in their own books.
4. Ask the students to complete Worksheet 4 at home. Discuss the answers in the next lesson.

Workbook steps

Help the students to write down good and bad things that microorganisms do. Remind the students that all the information they need is in the Student's Book.

Review

1. a. vaccines
b. bacteria
c. penicillin
d. malaria
e. fungi
2. cooking, food preparation, preventing disease, provide nutrients, break down waste at sewerage plants, break down food for digestion, break down dead or dying organisms returning nutrients to soil
3. Mushrooms are fungi that attach themselves to plants and get their nourishment from them.
4. Antibiotics help to fight diseases. They work by getting the 'good' microorganisms to destroy the harmful microorganisms before they can do more damage.
5. Protists are a type of microorganism. There are two main types of protists—protozoa and algae. Protozoa are microscopic single cell organisms which do not depend on other microorganisms and live freely. They have an animal-like cell and move easily from one organism to the other. Amoeba is an example of protozoa.

Algae have a plant-like cell. They live in water and are able to make their own food from sunlight. Seaweed is an example of algae.
6. Amoeba is a type of protozoa. They live in water, among rotting food, and in humans. They have arm-like structures that help them move and grasp food particles. Students will draw a diagram similar to that on page 47 of the Student's Book.
7. Answers will vary.

Answers to Workbook

Page 22

Benefits

Some bacteria are used to make vinegar and milk products. Vaccines are made from microorganisms. They help to stop diseases from becoming infectious. Microorganisms in our body provide us with nutrients and help us break down and digest our food. Some microorganisms return nutrients to the soil. They also break down waste at the sewerage plants, which makes disposal easier and safer.

Harm

Microorganisms cause diseases such as malaria, tuberculosis, diphtheria, typhoid, fever, cholera, dysentery, and pneumonia. They can also cause damage to clothes, shoes, carpets, and other textiles as well as contaminate food.

Answers to Worksheet 4

C	O	(F)	U	N	G	I	R	(P)	D	K	C	P	(A)
(A)	L	G	A	E	J	O	P	E	G	R	E	D	N
G	P	A	D	F	(M)	S	I	N	E	G	(P)	T	T
S	R	(B)	V	X	U	H	C	I	R	J	R	Y	I
F	G	A	Y	Q	S	Y	N	C	Q	I	O	E	B
H	U	C	P	C	H	M	Q	I	A	G	T	A	I
U	B	T	A	F	R	A	H	L	K	B	O	R	O
R	T	E	J	H	O	S	E	L	P	I	Z	S	T
(Y)	D	R	S	R	O	H	N	I	L	O	O	M	I
E	A	I	Y	E	M	E	U	(N)	N	T	(A)	T	C
A	I	(A)	V	T	(S)	D	P	E	O	I	R	E	(S)
S	K	L	Q	W	C	F	H	Y	R	G	U	A	B
(T)	D	(P)	N	E	U	M	O	N	I	(A)	O	S	T
L	G	J	S	Y	W	C	V	Z	F	S	G	K	U
(M)	I	C	R	O	S	C	O	P	I	(C)	R	W	Q



UNIT 5

SOIL

Background

Students will be familiar with soil from previous years. It may have been referred to as the ground or earth. The lesson can be started by discussing that plants grow better in different types of soil. Explain that soil is made up of different things. Elaborate that there are different types of soil. It will be easier for students to understand about life in the soil as they will be familiar with microorganisms at this stage. Use experiments, notebook, and review questions to help strengthen the concepts taught in this unit.

Expected learning outcomes for the unit

Students should be able to:

- explain the composition of soil
- list the different types of soils and identify the characteristics of each type
- explain organic matter and describe its effects on soil
- describe the types of animals and microorganisms that live in soil
- explain the effect of these organisms on the soil

5.1 What is soil?

Learning outcomes

Students should be able to:

Student's Book

- define soil
- explain the composition of organic matter and describe its uses

Resources

You will need:

- Student's Book pages 52 and 53
- ask the students to bring in a shoe from home—it doesn't have to be their own, in fact a parent's or sibling's shoe is better. Reassure them that they will be able to take it home!

Student's Book steps

1. Ask the students to explain the different features of the shoe that they have brought, including: size; laces; slip on; for boys, girls, men or women; markings, and so on.
2. Ask the students to find a feature about their shoe that is completely different from all the other shoes that have been brought.
3. Remind them about the work that they did on classifying animals and plants. Ask the students if they can remember some of the ways that scientists classify animals and plants.
4. Encourage them to think how to classify the shoes. Ask them to name some broad categories that would include all the shoes and different levels that will eventually lead to each individual shoe.
5. Ask the students to do this in a series of questions such as:

Is the shoe for a female or a male?

Does the shoe have laces?

6. Give the students time to come up with a classification system. Encourage them to share their thoughts and discuss their choices with others. After some time, ask the students to share the way that they classified the shoes with the whole class. As a class, discuss the different ways that the shoes could be classified and come up with a classification chart for the shoes and draw it on the board.
7. Reiterate that classification systems help us to organize things and study them.
8. Explain that like the way that scientists have organized the animal and plant kingdom they have also organized non-living things like soil.
9. Read aloud from the Student's Book asking the students to follow in their own books.
10. Discuss the different things that make up soil.

Answers to Student's Book 5.1

minerals, water, air, and organic matter

Organic matter is the remains of dead plants and animals. It provides nutrients to the soil.

5.1 (contd.) Types of soil

Learning outcomes

Students should be able to:

Student's Book

- identify different types of soil
- explain that different soils react differently to water

Resources

You will need:

- Student's Book pages 53 and 54
- a tub of loam
- a tub of clay
- a tub of sand
- a tub of silt
- water

Student's Book steps

1. Ask the students to recall that in order to classify the different shoes, they first needed to know about the different features; such as shoes with laces, shoes for running, sandals, and so on.
2. Explain that this is similar to what scientists need to do when they classify different things.
3. Ask the students to read over the section on soils in their Student's Book and note down the different features of loam, clay, sand, and silt.
4. Divide the students into four groups and give each group time to explore the different tubs of soil encouraging them to touch and move the soil around and express what they can see and feel.
5. Ask the students to imagine a stream running through the different types of soil and predict what might happen to the soil. Help them to record their predictions and observations.
6. Create a trench in the different tubs and pour water into the trench continuously.
7. Ask the students to observe what happens to the different soils when in contact with running water.
8. Once all the students have had a chance to explore the different types of soil, discuss what they experienced as a class.
9. Read aloud from the Student's Book as the students follow in their own books. Look carefully at the images with the students and read out the labels.

5.2 Life in the soil

Learning outcomes

Students should be able to:

Student's Book

- describe the usefulness of bacteria and fungi in breaking down dead organisms and providing nutrients to the plants
- explain the benefits of worms, centipedes, millipedes, etc. for the soil

Workbook

- label the composition of soil on a pie chart
- name some creatures that live in the soil and how they affect the soil
- list the properties of different types of soil

Resources

You will need:

- Student's Book page 55
- Workbook pages 23 and 24
- access to a garden
- gloves, spades
- copies of Worksheet 5 for all the students

Student's Book steps

1. If possible, start the lesson in a garden or somewhere where there is soil.
2. Tell the students that they can be scientists and explore the garden for different types of soil.
3. Explain that they can look for soil and for things that might live in the soil.
4. Remind the students that there will be different colours of soil depending on the amount of water, plants, and shade. Try to take the students to an area that is quite varied or move around the school yard to different places.
5. Encourage the students to dig in the soil and closely observe what they dig up.
6. Remind them to look for living things as well as different types of soil.
7. Remind them to look at any plants that might be growing in the soil and the different features of the plants.
8. After some time return to the classroom and ask the students to share what they observed.
9. Read aloud from the Student's Book as the students follow in their own books.
10. Ask the students to complete Worksheet 5 at home. Discuss the answers in the next lesson.

Activities

Help the students to sort the list of the different soils from the best soil for growing plants to the worst.

Workbook steps

1. Ask the students to label the pie chart with the different things that soil is made up from. Remind them that all of the information they need is in the Student's Book.
2. Help the students name some creatures and organisms that live in the soil.
3. Help the students to describe the features of the different types of soil.

Review

1. Clay has fine grains with little air between the grains. It can retain water and as a result plant nutrients are not washed away.

Sand is made up of weathered limestone, granite, quartz, and shale rocks. Its large grains have lots of air between them and as a result water and nutrients are washed away easily.

Silt is made up of minerals, organic particles, and many nutrients. Nutrients are washed away easily too because the particles are larger than clay but smaller than sand particles.

Loam is a combination of clay, sand, and silt. It contains organic matter, retains enough water for plants to get nutrients, and allows air to pass through.

2. Loam retains enough water for plants to get the nutrients they need but allows air to pass through
3. Activities that take place in the soil:
 - Bacteria breaking down dead organisms so nutrients from them can be used by new plants
 - Conversion of harmful chemicals into nutrients by bacteria
 - Fungi breaking down dead organisms and releasing the nutrients for new plants
 - Fungi passing on nutrients directly to plants especially those that do not get enough sunlight
 - Worms, centipedes, millipedes, mites, beetles, slugs, and snails are some of the animals that live under the soil. Their movement creates space in the soil for air and water. They also eat dead plant and animal matter and return the nutrients back to the soil.
4. Soil erosion is when heavy rain or floods pick up and carry soil from one place to another leaving behind land unsuitable for plants.
5. loam, silt, clay, sand

Answers to Workbook

Page 23

Students will label the graph as on page 53 of the Student's Book.

Worms, centipedes, millipedes, mites, beetles, slugs, and snails are some of the animals that live under the soil. Their movement creates space in the soil for air and water. They also eat dead plant and animal matter and return the nutrients back to the soil.

Some microorganisms such as bacteria and fungi break down dead organisms so that the nutrients can be used by new plants. They convert harmful chemicals into nutrients that are good for plants.

Page 24

Clay has fine grains with little air between the grains. It can retain water and as a result plant nutrients are not washed away.

Sand is made up of weathered limestone, granite, quartz, and shale rocks. Its large grains have lots of air between them and as a result water and nutrients are washed away easily.

Silt is made up of minerals, organic particles, and many nutrients. Nutrients are washed away easily too because the particles are larger than clay but smaller than sand particles.

Loam is a combination of clay, sand, and silt. It contains organic matter, retains enough water for plants to get nutrients, and allows air to pass through.

Answers to Worksheet 5

- I. 1. True
 - 2. False
 - 3. True
 - 4. True
 - 5. True
 - 6. False
 - 7. True
 - 8. True
- II. a. humus
 - b. clay
 - c. sand
 - d. gravel
- III. a. weathered limestone
 - b. granite
 - c. quartz
 - d. shale rocks



UNIT 6 FOOD AND DIET

Background

Students will be familiar with food hygiene and nutrition. Talk to them about the two major types of bacteria (E.coli and salmonella) that cause food poisoning. To encourage participation, elicit tips from the students on how food poisoning can be prevented. These can be added to the ones in the Student's Book. Introduce genes to them by explaining that they are located in cells and carry instructions about growth. Proceed to talk about genetically modified foods and the arguments for and against them.

Expected learning outcomes for the unit

Students should be able to:

- identify the two main forms of bacteria that can cause food poisoning
- define genetically modified foods
- list some arguments for and against genetically modified foods
- list some ways of preventing food poisoning

6.1 Bacteria and food

Learning outcomes

Students should be able to:

Student's Book

- identify the bacteria that cause food poisoning
- explain how the E.coli and salmonella can cause food poisoning
- list steps that can be taken to prevent food poisoning

Workbook

- name the bacteria that cause food poisoning
- explain how these bacteria act upon the food
- list ways to prevent food poisoning

Resources

You will need:

- Student's Book pages 56 and 57
- Workbook page 25
- healthy fruit and vegetables
- chopping boards and safe knives

Student's Book steps

1. Welcome the students into the classroom and explain that they will be learning about bacteria and food.
2. Ask them if they have ever been sick from food poisoning. Explain that food poisoning is common in Pakistan because of bacteria on food.
3. Discuss E.coli and salmonella as two common types of bacteria that cause food poisoning. Explain that there are simple things that they can do to avoid getting sick from bacteria on food and these include washing their hands thoroughly, storing food properly, and cooking and preparing food hygienically.
4. Read aloud from the Student's Book as the students follow in their own books. Discuss the different things that the students need to do in order to stay healthy.
5. Ask all the students to wash their hands with soap and dry them properly.
6. After they come back, arrange them in groups and give them some healthy fruit and vegetables to prepare and eat.
7. Remind them to wash the fruit and vegetables first and then peel the vegetables (carrots, and so on).
8. Show the students how to handle a knife safely while chopping up the fruit and vegetables.
9. Sit down as a class and share the healthy food and a glass of fresh water with the students.
10. Remind the students that eating healthy foods and drinking water will help them to stay healthy.

Activities

Give poster papers and markers to the students. Review the relevant section in the Student's Book on the safe way to prepare and handle food so they don't get sick. Encourage them to make a poster with colourful pictures reminding people of the safe ways to prepare food.

Workbook steps

Help the students identify the two common forms of bacteria that cause food poisoning. Help the students to explain where the bacteria comes from and how it makes them sick. Remind them that all of the information they need is in the Student's Book.

Answers to Student's Book 6.1

1. It can cause food poisoning.
2. Refer to the tips to help prevent food poisoning on page 57 of the Student's Book.

6.2 Genetically modified food

Learning outcomes

Students should be able to:

Student's Book

- define genetically modified food
- state arguments for and against genetically modified food

Resources

You will need:

- Student's Book pages 58 and 59
- copies of Worksheet 6 for all the students

Student's Book steps

1. Write 'Genetically modified food' on the board and see if students have any prior knowledge about it.
2. Explain that some food has been changed by scientists and this food is called genetically modified food.
3. Explain that genetically modified food may be changed for different reasons. The food may have been changed so it is resistant to pests, or it may be better at growing in areas where there is little rain, or it might grow faster, or bigger.
4. Explain that some people think that this change by scientists is beneficial because it is easier to grow the food and other people think genetically modified food is harmful because it is changing nature.
5. Read aloud from the Student's Book pausing after each statement to emphasize the main points and to look at the pictures.
6. Discuss the arguments for and against genetically modified food.
7. Ask the students to complete Worksheet 6 at home. Discuss the answers in the next lesson.

Activities

Give students access to the Internet or appropriate resources in order to research genetically modified students. After some time, ask the students to share what they have learnt. Draw a table on the board with one column 'For', one column 'Against' and one column for 'Interesting' information or facts on the topic. Ask the students to come up to the board and write some points in the different columns. As a class, talk about the pros and cons of genetically modified food. Arrange the students in groups of six and

ask three students to come up with some arguments for genetically modified foods and three students to come up with some arguments against genetically modified foods. Give the students time to prepare their arguments. Ask them to have a debate, with each child given one minute to present their argument. Ask the rest of the class to score the 'For' and 'Against' teams out of ten. Praise all of the students with positive feedback for participation.

Review

1. James Lind was a Scottish doctor who discovered that lemon juice was a cure for scurvy.
2. Food poisoning occurs when you eat food with harmful bacteria. E.coli and Salmonella are two types of bacteria that cause food poisoning.
3. Tips to help prevent food poisoning
 - Cook food until it is really hot. If it's too hot, people can wait until it is cool enough to eat.
 - Wash your hands before handling food, as well as during the handling process.
 - Do not chop food on a chopping board that has been used but not washed.
 - Do not let heated food sit for too long before being eaten. This will give bacteria a chance to contaminate the food again.
 - Check that food is hot all the way through by poking a skewer through it or cutting a piece with a knife. Sometimes when you heat a thick piece of food, the middle does not cook enough.
 - Stir food when heating so that the heat is evenly distributed.
 - Do not reheat food more than once.
 - Make sure that frozen foods are properly thawed before heating them up.
4. GM foods are genetically modified foods. They have had their genes altered or had new genes added to them. Favourable genes with a particular trait are transferred from one plant to another. For example, a gene from a type of plant that survives well in a drought might be put into a plant that is unable to survive in a drought.

Answers to Workbook

Page 25

E.Coli—It causes food poisoning when food items such as meat or eggs are not cooked enough to kill the bacteria or when vegetables are not properly washed before being eaten.

Salmonella—It lives in the intestines of animals, including humans, and causes food poisoning when meat is not cooked properly.

Tips to help prevent food poisoning

- Cook food until it is really hot. If it's too hot, people can wait until it is just cool to eat.
- Wash your hands before handling food, as well as during the handling process.
- Do not chop food on a chopping board that has been used but not washed.
- Do not let heated food sit for too long before being eaten. This will give bacteria a chance to contaminate the food again.
- Check that food is hot all the way through by poking a skewer through it or cutting a piece with a knife. Sometimes when you heat a thick piece of food, the middle does not cook through enough.
- Stir food when heating so that the heat is evenly distributed.
- Do not reheat food more than once.
- Make sure that frozen foods are properly thawed before heating them up.

Answers to Worksheet 6

- I.
 1. heating
 2. E.coli, salmonella
 3. contaminate
 4. stirred
 5. thawed
 6. cells, instructions
 7. plants
 8. attractive
- II. Students can state any two arguments for and against GM foods mentioned in the Student's Book on page 59.



UNIT 7 ENVIRONMENT

Background

Through this unit, students will be introduced to different types of pollution. These will include land, noise, air, water, and visual pollution. Talk about their causes and harmful effects. Discuss ways of reducing pollution using text from the Student's Book and other resources. Explain the word 'biodegradable' and then use examples to differentiate between biodegradable and non-biodegradable waste. Conclude your lesson with a discussion about the effects of non-biodegradable materials on the environment.

Expected learning outcomes for the unit

Students should be able to:

- list the main types of environmental pollution
- identify the causes of pollution
- suggest ways to reduce these types of pollution
- explain the benefits of using biodegradable material
- identify biodegradable and non-biodegradable materials in their environment

7.1 Types of pollution

Learning outcomes

Student's Book

- identify the main types of environmental pollution
- become aware of the causes and effects of land and noise pollution

Resources

You will need:

- Student's Book pages 60 and 61

Student's Book steps

1. Welcome the students into the class and explain that they are going to be studying about pollution. Elicit what they know about it.
2. Explain that pollution is harmful for the environment—animals, plants, and humans. It can make them sick and can also be fatal.

3. Discuss the various measures that can be taken to protect ourselves and the environment from pollution.
4. Read aloud from the Student's Book, emphasizing the different types of pollution and how they are caused.

Activities

As a class, make a list of the types of land or noise pollution that the students have noticed around them. Ask the students to choose two different examples and explain them in more depth—they may do this at home.

7.1 (contd.) Land, air, water, noise, and visual pollution

Learning outcomes

- differentiate between indoor and outdoor air pollution
- list the harmful effects of air pollution
- identify examples of land, water, noise, and visual pollution
- explain what is meant by reduce, reuse, and recycle
- consider solutions to reduce pollution

Resources

You will need:

- Student's Book page 61–64
- markers and poster paper

Student's Book steps

1. Remind the students that all living things need clean air in order to live.
2. Explain that when the air is contaminated with different things the air becomes dirty or polluted and can make living things—including humans very sick.
3. Ask the students to recall the different types of pollution that have been discussed.
4. Explain that there is another form of pollution that can make people very sick and that is water pollution.
5. Explain that water pollution is a very serious concern as over 70% of the Earth is made up of water. Explain that water pollution affects drinking water, rivers, lakes, and oceans all over the world.
6. Read aloud from the Student's Book as the students follow in their own books. Explain that if everyone makes small changes together we can make a big difference.
7. Allow the students to walk around the school and make a list of all the different types of environmental pollution, reminding them that when they go home, some lights are still on at the school and other forms of pollution are still being generated.
8. Ask the students to share their lists and make a large list of all that they observed on the board.

9. Explain that if they follow the three 'R's they can help combat pollution—Reduce (buy and use less), Reuse (keep using things that don't need to be thrown away), and Recycle (lots of things can be turned into other things, don't just throw them away).
10. Ask the students to consider the following and share them with the rest of the class.
 - reduce approach to combat pollution (turning off lights, fixing leaky taps, not wasting water)
 - ways they could reduce waste and pollution at the school
 - reuse approach to combat pollution (bringing food in reusable containers)
 - recycle approach to combat pollution (using food scraps as compost in the garden)
11. Help each student to choose their best idea for reducing, reusing, or recycling environmental pollution at school and design a campaign to implement it.
12. Ask them to create a poster which identifies the problem and ways of tackling it.
13. Read aloud from the Student's Book as the students follow in their own books. Emphasize on the factors that contribute to land, air, noise, water, and visual pollution and some of the measures that can be taken to minimize them.

Activities

- As a class, make a list of the examples of air pollution that the students have noticed around them. Ask the students to choose two different examples and explain them in more depth—they may do this at home.
- As a class, make a list of all of the water and visual pollution that the students have noticed around them. Ask the students to choose two different examples and explain them in more depth—they may do this at home.

Answers to Student's Book 7.1

- 1 Pollution occurs when a part of the environment becomes unhealthy for organisms to live in it. It must be avoided because it can lead to health problems.
2. Answers will vary.

7.2 Reducing pollution

Learning outcomes

Student's Book

- describe ways to reduce pollution

Workbook

- give examples of different types of pollution
- list ways to prevent and reduce pollution
- discuss their suggestions in class

Resources

You will need:

- Student's Book page 64-66
- Workbook page 26

Student's Book steps

1. Go over the section on pollution in the Student's Book once again and discuss some of the different forms of environmental pollution, including land pollution, air pollution, water pollution, noise pollution, and visual pollution.
2. Explain that environmental pollution affects all living and non-living things. It reaches the soil which then reaches the plant, which is then eaten by an animal or a human, thereby affecting us.
3. Ask the students to consider the different ways that pollution affects living and non-living things and how this can directly or indirectly lead back to humans.
4. Make a list on the board of some of the effects of pollution.
5. Divide the class into seven groups and give each some markers and poster paper. Assign each group a different type of environmental pollution.
6. Ask them to put the type of pollution in a circle in the middle of the poster. State the problems caused by the type of pollution in one colour and then further branching out from the problems, suggest some strategies to overcome the problem in a different colour.
7. After some time, ask the groups to report back to the rest of the class about their type of pollution, how it affects our lives and possible solutions to overcome the problem.

Activities

Arrange the students in groups and ask them to brainstorm different ways that they can reduce pollution. After some time, ask them to share their discussion with the rest of the class. The students can make a list of ten different ways to reduce pollution at home.

Workbook steps

Ask the students to write down examples of the different types of pollution in their Workbook and list some of the ways that it can be reduced.

Answers to Student's Book 7.2

Noise pollution

Reduction: The use of quieter machinery will reduce noise pollution. Pressure horns should not be used. Car engines should be maintained. Avoid loud music in cars and homes. Musical functions in residential areas disturb residents and should be avoided. Planting trees help muffle the sound and prevent noise pollution.

Visual pollution

Reduction: Government should make rules about how things like billboards, power lines, and buildings need to fit into the environment.

Air pollution

Reduction: Use renewable sources, walking, cycling, and public transport. Cars should be well-maintained so that exhaust fumes are reduced to the minimum.

Water pollution

Reduction: Water pollution can be reduced by finding better ways to dispose of waste than dumping it in the waterways by factories. People should rely less on oil as an energy source. This would reduce oil tankers sailing around the world and therefore reduce the risk of oil spills.

7.3 Biodegradable and non-biodegradable

Learning outcomes

Student's Book

- identify materials that are biodegradable and non-biodegradable
- explain the importance of using biodegradable material

Workbook

- complete sentences related to pollution
- identify biodegradable and non-biodegradable items from the environment around them
- solve the environment wordsearch

Resources

You will need:

- Student's Book pages 67-69
- Workbook pages 27 and 28

- biodegradable materials (fruit or vegetable peels, paper, leaves, plants)
- non-biodegradable materials (plastic bottles, oil, plastic bags, mobile phones)
- copies of Worksheet 7 for all the students

Student's Book steps

1. Welcome the students into the classroom and tell them that they will be studying about two types of material.
2. Write the words on the board and their definitions—non-biodegradable: material that cannot be broken down, but can be recycled and biodegradable: material that can be returned to organic matter.
3. Read aloud from the Student's Book, pausing to emphasize the difference between biodegradable and non-biodegradable material.
4. Arrange the students in groups and give them some biodegradable and non-biodegradable material.
5. Ask the students to examine the material and classify the material as either biodegradable or non-biodegradable. Encourage the students to discuss their choices with each other.
6. After some time, ask the groups to show the material they were given and explain how they classified it.
7. Ask the students to complete Worksheet 7 at home. Discuss the answers in the next lesson.

Activities

Arrange the students in groups and ask them to walk around the classroom and make a list of all of the biodegradable and non-biodegradable things in the classroom. After some time, ask the groups to share their list with the rest of the class. Make a master list on the board and ask the students to copy it down.

Workbook steps

1. Help the students to complete the sentences by filling in the blanks. Remind them that all the information they need is in the Student's Book.
2. Allow the students to walk around the school and make a list of the biodegradable and non-biodegradable things. When they return, ask the students to share their list with the rest of the class.
3. Ask the students to complete the Environment wordsearch (page 28) at home.

Review

1. Rachel Carson was an American environmentalist. Students will write more about her based on their research.
2. Answers will vary.
3. Pollution is affecting the Earth in various ways. Various steps can be taken to reduce different types of pollution.

Land pollution

Reduction: reduce, reuse, recycle

Noise pollution

Reduction: The use of quieter machinery will reduce noise pollution. Pressure horns should not be used. Car engines should be maintained. Avoid loud music in cars and homes. Musical functions in residential areas disturb residents and should be avoided. Planting trees help muffle the sound and prevent noise pollution.

Air pollution

Reduction: use of renewable sources, walking, cycling, and use of public transport. Cars should be well-maintained so that exhaust fumes are reduced to the minimum.

Water pollution

Reduction: Water pollution can be reduced by finding better ways to dispose of waste than dumping it in the waterways by factories. People should rely less on oil as an energy source. This would reduce oil tankers sailing around the world and therefore reduce the risk of oil spills.

Visual pollution

Reduction: Government should make rules about how things like billboards, power lines, and buildings need to fit into the environment.

Oil spills could be avoided if people relied less on oil as a source of energy. Waste should not be dumped in waterways. People should avoid the use of plastic and adopt ways to reuse and recycle it.

4. biodegradable—decomposes naturally
non-biodegradable—does not decompose naturally
5. Land pollution is caused by use of chemical pesticides, dumping of rubbish, chemicals and other dangerous and poisonous substances used by factories. It can be decreased by reducing the amount of waste which is created, reusing, and recycling materials.
6. Marine life is affected by oil pollution from shipping accidents and dumping waste. Other animals, depending on this sea life as part of the food chain are also affected. Plastic and other waste can be fatal for them too.

Answers to Workbook

Page 26

Land pollution

Examples: use of chemical pesticides, dumping of rubbish, chemicals and other dangerous and poisonous substances used by factories

Prevention: reduce, reuse, recycle

Noise pollution

Examples: heavy road traffic, air traffic, and industrial machinery

Prevention: The use of quieter machinery will reduce noise pollution. Pressure horns should not be used. Car engines should be maintained. Avoid loud music in cars and homes. Musical functions in residential areas disturb residents and should be avoided. Planting trees help muffle the sound and prevent noise pollution.

Air pollution

Examples: It occurs when the air we breathe in contains harmful gases, poisons, dust, and smoke. Outdoor pollution is caused by industry and motor vehicles and indoor air pollution is caused by smoking appliances.

Prevention: Use of renewable sources, walking, cycling, and use of public transport. Cars should be well-maintained so that exhaust fumes are reduced to the minimum.

Water pollution

Examples: sewage and waste dumped in streams, rivers, oceans, chemical waste from factories, shipping accidents

Prevention: Water pollution can be reduced by finding better ways to dispose of waste than dumping it in the waterways by factories. People should rely less on oil as an energy source. This would reduce oil tankers sailing around the world and therefore reduce the risk of oil spills.

Visual pollution

Examples: Presence of large objects on the landscape such as power lines, advertising billboards, abandoned buildings and construction sites

Prevention: Government should make rules about how things like billboards, power lines, and buildings need to fit into the environment.

Page 27

I.

1. environment/landscape
2. when too many chemicals are used, they kill microorganisms essential for healthy soil.
3. can cause hearing loss, stress, lack of sleep, and high blood pressure

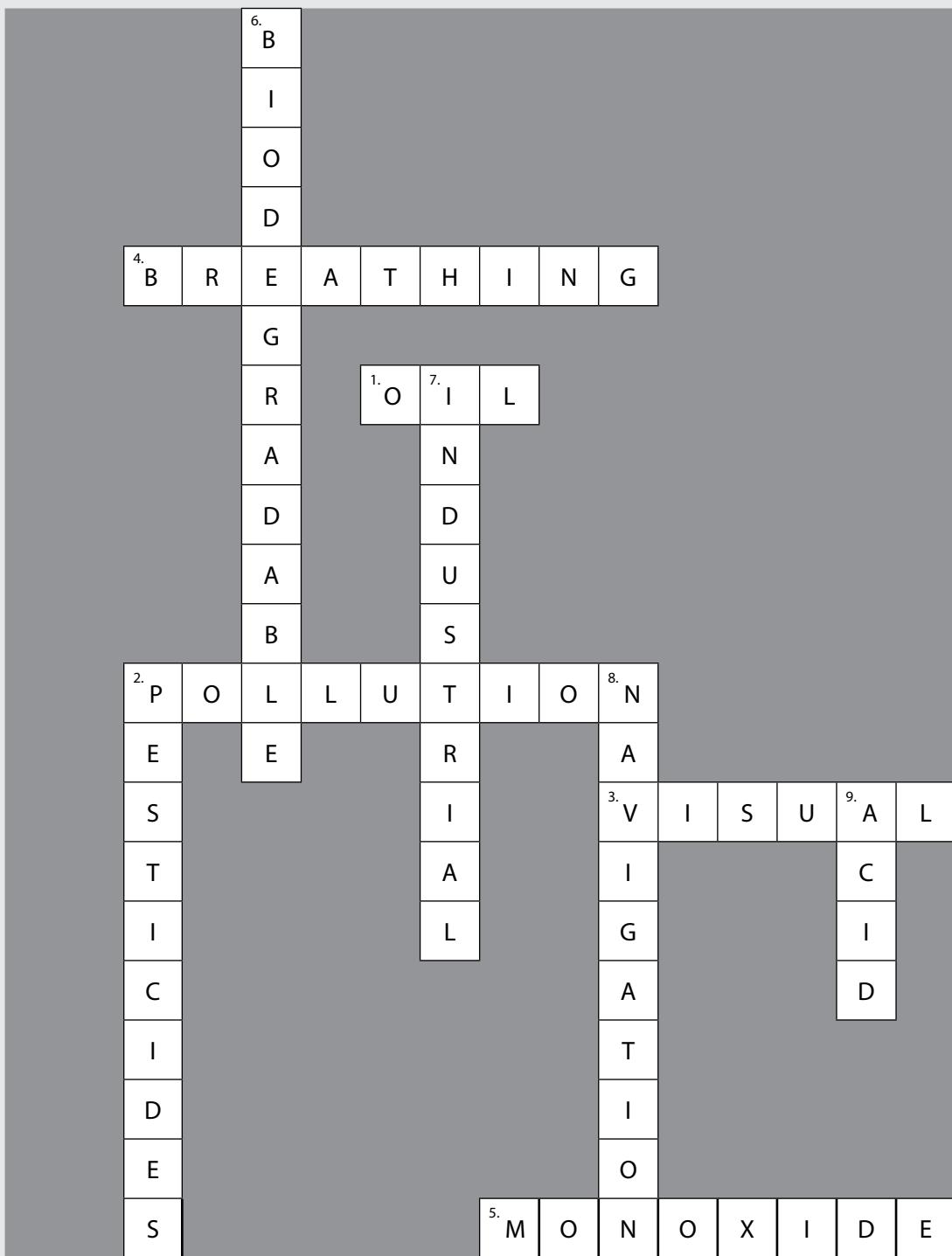
4. chemicals, dangerous and poisonous substances, coal fuelled electricity plants, etc.
5. by following the three 'Rs': Reduce, Reuse, Recycle
6. decomposed naturally
7. it takes it hundreds of years or even longer to break down
8. sewage and chemical waste dumped in the streams, rivers and oceans
9. a great environmentalist
10. the air we breathe contains harmful materials

II. Answers will vary.

Page 28 Environment wordsearch

W	A	T	E	R	W	A	Y	S	A	M	G	O	N	A
R	Z	V	S	E	C	P	N	U	Q	S	N	L	J	O
C	D	Y	E	C	X	U	V	M	J	A	O	H	P	E
O	T	P	U	Y	Z	A	N	I	X	F	P	L	L	U
N	C	L	W	C	O	G	E	O	P	A	G	Y	A	O
T	Y	U	A	L	T	I	H	D	I	M	F	M	S	R
A	Q	T	K	E	H	R	A	W	E	S	D	G	T	E
M	C	R	P	E	S	T	I	C	I	D	E	Q	I	O
I	N	E	E	C	M	O	X	S	A	Y	J	O	C	G
N	Q	X	R	F	O	E	F	W	D	R	L	B	I	K
A	I	Y	U	I	K	G	S	I	M	K	Z	W	V	X
T	I	S	I	R	E	N	E	W	A	B	L	E	W	D
E	O	U	X	T	V	U	F	P	S	Y	P	Q	P	S
B	P	R	O	E	W	J	D	S	E	W	A	G	E	A
P	L	Z	Y	J	Z	B	W	D	N	V	M	A	U	C

Answers to Worksheet 7



UNIT 8 MATTER AND MATERIALS

Background

This unit helps to reinforce the three states of matter and the structure of an atom and a molecule. Use the activities in the Student's Book and other experiments to demonstrate how matter can change from one state to another. Students should observe water as a solid, liquid, and gas and should also note changes to water when it is heated or cooled. Elaborate the fact that heating and cooling can cause matter to melt, freeze, condense, and evaporate. Explain each of these processes using hands-on activities and real-life examples. This will help in building a systematic understanding of materials and their properties.

Expected learning outcomes for the unit

Students should be able to:

- describe the three main states of matter and their properties
- explain that heat can change the state of matter
- list the different ways that heat can change matter

8.1 Matter and particles

Learning outcomes

Student's Book

- explain the three main states of matter and their properties
- explain that particles includes electrons, neutrons, protons, atoms, and molecules

Resources

You will need:

- Student's Book pages 70 and 71
- examples of solids (wood, metal, balls), balloons, water, and different shaped receptacles

Student's Book steps

1. Begin the lesson by asking the students if they can remember what matter is. They should remember that matter is everything around them and the three main forms of matter are solid, liquid, and gas.
2. Read aloud from the Student's Book as the students follow in their own books. Pause after each statement and check the students' understanding by asking questions such as:

Can you describe how the particles are packed together in solids?

How do the particles move in liquids?

3. Arrange the students in groups and give them some balloons, some water, different shaped containers, and some solids. Ask the students to play around with the different material and see if its shape changes, how it feels, how heavy it is, and how it can be manipulated.
4. After some time, ask the groups to share what they have observed with the rest of the class.
5. Record their observations on the board.

Activities

Help the students to draw pictures of how particles are packed within the different types of matter—solids, liquids, and gases. Remind the students that all of the information they need is in the Student's Book.

Answers to Student's Book 8.1

1. Albert Einstein was an expert in Physics who lived the last century. He is famous for his theory of relativity and was given the Nobel Prize for Physics in 1921.
2. The movement and arrangement of particles determine whether matter is in solid, liquid, or gas form.

8.2 Changing matter: melting

Learning outcomes

Student's Book

- describe that melting changes the state of matter
- explain that water can exist in all three states of matter

Resources

You will need:

- Student's Book pages 72 and 73
- ice cubes, water, a safe receptacle, and place to boil water
- paper plates, white chocolate, plain chocolate, dark chocolate

Student's Book steps

1. Begin your lesson by discussing the different ways that matter can change and how melting is one of the main ways that matter changes state.
2. Remind the students that water can exist in all three states: solid, liquid, and gas and that these states can change.
3. Ask the students to predict what would happen if you put water in a freezer. Students should know that it will turn to ice which is water in a solid matter.
4. Ask the students to predict what will happen if they hold an ice cube.

5. Give the students an ice cube each to hold and some napkins to clean up the liquid as it starts to melt. Explain that solid ice can change into liquid with heat from their hands.
6. Ask the students to predict what would happen if you boiled water—would the water change state, and if so, in what way?
7. In a safe environment, measure out some water and record the volume on the board.
8. Bring the temperature to the boiling point (remember, safety first) and ask the students to describe what they observe.
9. As the water begins to evaporate, ask the students to observe the steam and note that the water is now a gas.
10. Before the water completely evaporates, turn the heat off and allow the water to cool.
11. Measure again the amount of liquid left, ask the students what would happen if the water continued to boil.
12. As a class, discuss the different states of water and what caused these changes.

Activities

- Ask the students to create a poster showing the different states that water can exist in and how it changes when melted. Display the posters around the room.
- The students will certainly enjoy doing this experiment and perhaps eating it! Arrange the students in groups and give them a stopwatch, a paper plate, and some different types of chocolate. Ask them to time how long it takes the different types of chocolate to melt by putting it in different locations—outside in the Sun, in front of a heat source, in the classroom.

8.2 (contd.) Changing matter: freezing

Learning outcomes

Student's Book

- describe how freezing changes matter from a liquid to a solid

Resources

You will need:

- Student's Book page 73
- water, ice cube containers, freezer, stopwatch

The water will need to be frozen before the class begins, perhaps in the previous lesson.

Student's Book steps

1. Ask the students to recall the three main states of matter and some of their properties.
2. Explain that freezing is another way of changing matter by showing them the ice cubes that they prepared earlier.

3. Ask the students to recall what state the matter was in first—liquid and what it is now—solid.
4. Arrange the students in pairs or threes and give them some ice cubes and a stopwatch.
5. Ask them to put the ice cubes in different spots around the room—one in direct sunlight or near a heat source, one in the shade, and so on.
6. Ask them to predict which one will thaw quickest.
7. Ask them to share their observations with the class after they have completed the experiment.
8. Read aloud from the Student's Book asking the students to follow in their own books.

Activities

Help the students to put the list of things in order of what would freeze first. Help the students to put the list of things in order of what would melt first.

8.2 (contd.) Changing matter: condensation and evaporation

Learning outcomes

Student's Book

- explain the properties of matter
- describe condensation
- explain how heat changes matter through evaporation

Workbook

- decode words related to matter and materials
- identify the process of melting, freezing, evaporation, and condensation
- describe how heat can change the state of matter
- design and methodically record their experiment
- conduct an experiment to show evaporation and condensation

Resources

You will need:

- Student's Book pages 74 and 75
- Workbook pages 29-32
- an empty Pyrex jar, a metal lid for the jar, an empty tin can, some ice cubes, very hot water
- copies of Worksheet 8 for all the students

Student's Book steps

1. Welcome the students into the classroom and ask them to recall the different types of matter and their properties.

Solid	Has a definite shape Has a definite mass Has a definite volume Particles are tightly packed and usually don't move.
Liquid	Does not have a definite shape Has a definite mass Has a definite volume Takes the shape of its receptacle Particles are close together with no regular arrangement and can slide past each other.
Gas	Does not have a definite shape Does not have a definite mass Does not have a definite volume Takes the shape of its receptacle Will fill the space it is in Particles are separated with no regular arrangement.

2. Ask the students to recall the different ways that heat can change matter: melting and freezing
3. Explain the process of condensation using everyday examples.
4. Explain that heat can also change matter through evaporation.
5. Read aloud from the Student's Book as the students follow in their own books.
6. Ask the students to complete Worksheet 8 at home. Discuss the answers in the next lesson.

Activities

Ask the students to answer questions in 'Review'. Remind them that all the information they need is in the Student's Book.

Workbook steps

1. Help the students to decipher the 'Matter code'.
2. Ask the students to identify the correct process in 'Which process?'. Remind them that all of the information they need is in the Student's Book. They may complete this activity at home.
3. Explain that they get to be a scientist and design an experiment to test their hypothesis. Put them in groups and ask them to brainstorm some experiments that they might do to show how melting, freezing, evaporation, or condensation works.

4. After some time, ask them to work by themselves to choose an experiment and complete the planning stages.
5. You will then need to check their experiments and if possible, provide the materials, time, and support for them to complete their experiments in class.
6. Help the students set up for the experiment 'Making it rain inside a jar'. Remind the students that this is part of the water cycle and encourage them to observe how it works.

Review

1. a. Changing a solid into a liquid involves melting.
b. Changing a gas into a liquid involves condensing.
c. Changing a liquid into a gas involves evaporating.
d. Changing a liquid into a solid involves freezing.
2. Particles are very small things that help to make something larger. Electrons, neutrons, protons, atoms, and molecules are all examples of particles.
3. Heating can affect matter by changing it from one state to another. It can do this by melting, freezing, condensation, and evaporation. Refer to pages 72–75 of the Student's Book for examples.
4. Solids melt when they are given more heat energy. Heating solid matter gives the particles energy. Once the temperature reaches the melting point of that material, the particles have enough energy to move away from each other and change the solid into a liquid.
5. Freezing involves taking away energy from a liquid to turn it into a solid. When liquid is frozen, the particles stop moving and become closer till the liquid becomes a solid.
6. When a gas is cooled to become a liquid, condensation takes place. Gas particles lose energy and start moving together. Examples of condensation from daily life include dew forming on grass in the early morning, eye glasses fogging up when you enter a warm building on a cold winter day, or water drops forming on a glass holding a cold drink on a hot summer day.
7. Evaporation is different from boiling because liquids evaporate at temperatures below their boiling points. Boiling speeds up evaporation. At boiling point, the liquid being boiled will begin to evaporate. Water evaporates from the Earth during the water cycle. Although, the temperature on Earth never reaches the boiling point of water, but, the higher the temperature, the faster water evaporates.

Answers to Workbook

Page 29

External

- | | | |
|--------------|--------------|----------------|
| 1. Talc | 2. Blood | 3. Molecules |
| 4. Container | 5. Gases | 6. Temperature |
| 7. Heating | 8. Dissolved | 9. Freezing |

Page 30

block of butter into liquid butter—melting

liquid water into ice—freezing

liquid water into steam—evaporation

orange juice into ice blocks—freezing

sauce into steam—condensation

solid ice cream into liquid ice cream—melting

water vapour into dew—condensation

wet paint into dry paint—evaporation

Page 31

Answers will vary.

Page 32

Students will follow the instructions given in the Workbook to cause rain in the jar.

Answers to Worksheet 8

- | | |
|-----------------------|--------------------------|
| 1. Matter | 7. temperature is higher |
| 2. inside | 8. condensation |
| 3. three | 9. speeds up |
| 4. loosely | 10. 0°C |
| 5. Melting | 11. 60°C |
| 6. taking away energy | 12. Heat |



UNIT 9 HEAT, LIGHT, AND SOUND

Background

This unit introduces the movement of heat through conduction, convection, and radiation. Use examples and experiments which will help students to observe and understand these processes. Explain the properties of light including reflection, refraction, and diffraction. Introduce concave and convex mirrors and lenses through everyday examples. Explain how echo and reverberation occur using concert halls as an example. Conclude your lesson by talking about how music is produced. Vibration in a range of musical instruments can be used to create sounds which vary in pitch and volume. Use the resource material from this series to help reinforce the concepts in this unit.

Expected learning outcomes for the unit

Students should be able to:

- explain how electricity works
- explain electromagnetism
- define conduction, convection, and radiation
- identify these processes, giving everyday examples
- define reflection, refraction, and diffraction
- differentiate between concave and convex lens
- describe how an echo is heard

9.1 Conduction

Learning outcomes

Student's Book

- identify that there are three different ways to heat things
- describe conduction
- explain that different materials conduct heat differently

Workbook

- conduct an experiment to show that some materials conduct heat better than others

Resources

You will need:

- Student's Book pages 76 and 77
- Workbook page 34
- cup
- very hot water (not boiling)
- plastic spoon
- metal spoon
- wooden spoon or thin piece of wood (like an ice-lolly stick)
- ceramic spoon or thin piece of brick or porcelain

Student's Book Steps

1. Welcome the students to the class and explain that they are going to be studying about heat.
2. Explain that heat can move in three ways: conduction, convection, and radiation.
3. Explain that heat always moves from warmer matter to cooler matter.
4. Explain that conduction occurs when one part of an object is heated and the molecules vibrate. These vibrations move through the object until the whole object is heated. You may write this definition on the board.
5. Explain that if they were sitting around a camp fire toasting marshmallows on the end of a metal rod, the metal would conduct the heat from the fire up the rod and burn their fingers. This is because metal is a good conductor of heat.
6. Explain that wood is not a good conductor of heat, so if they were to toast marshmallows on the end of a stick, then their fingers wouldn't get burnt. Discuss that this is because wood is not a good conductor of heat.
7. Read aloud from the Student's Book as the students follow in their own books. Emphasize that conduction is when the molecules vibrate and the vibrations move through an object and heat it up.

Activities

Arrange the students in groups and ask them to discuss any materials that are used at home that might be good conductors of heat and some that might be bad conductors of heat. Ask them to think about how their food is cooked, how it is taken out of the oven—do their parents use oven gloves to pick up hot trays. After some time ask the groups to share their responses with the rest of the class. Make a list on the board of good conductors of heat and bad conductors of heat.

Workbook steps

1. Arrange the students in groups and tell them that they are going to do an experiment.
2. Ensure the students handle the hot water carefully—you may need to do this.

3. Read out the instructions in the Workbook and give the students the materials to experiment with.
4. At the end of the lesson, ask each group to report back on which material conducted heat the best and which material was not a good conductor of heat.

9.1 (contd.) Convection and radiation

Learning outcomes

Student's Book

- explain how heat spreads through convection
- describe radiation

Resources

You will need:

- Student's Book pages 77 and 78
- somewhere to continuously boil water
- a pot and some rice or pasta
- metal rods (e.g. iron, copper, brass)
- bunsen burner
- tripod
- wax

Student's Book steps

1. Explain that another way of spreading heat is through convection.
2. Remind the students that heat moves from warmer to cooler matter.
3. Explain that convection spreads heat by making the molecules move and as they move they take the heat with them.
4. Boil some water and put some pasta or a grain of rice in the water.
5. Help the students observe how rice or pasta rises to the top of the pot, gets pushed aside, sinks to the bottom, and rises again.
6. Explain that this is because the cooler water at the top of the pot sinks and the warmer water which is less dense with particles rises to the top and then sinks to the bottom as it cools. This creates an endless circular pattern of heat.
7. Write the definition for convection heat on the board—convection spreads heat by making the molecules move and as they move they take the heat with them.
8. Explain that convection happens in the oceans and in the atmosphere.
9. Explain that radiation is the heat that every object gives off. Radiation comes off an object in waves.

- Explain that the Sun radiates heat and the closer we are to it the hotter it is. Explain they might have felt this when the oven door is open, the closer they are the hotter it is. The oven is giving off waves of heat.
- Read aloud from the Student's Book as the students follow in their own books.

Activities

Carefully prepare the room for the experiment in the Student's Book. Remember safety comes first. Read out the instructions from the Student's Book. Demonstrate the experiment to the students before they attempt it themselves. When the students seem confident with what they have to do, put them in pairs or threes and ask them to follow the instructions in the Student's Book to see how conduction works with different metals.

Answers to Student's Book 9.1

Heat can be transferred from one object to another through conduction, convection, and radiation. During conduction, molecules vibrate in the part of the object that is heated. These vibrations pass on from one molecule to the other until the whole object is heated. Cooking pots with metal handles have to be handled carefully, as the handles are hot due to conduction.

Convection occurs when the heated molecules take the heat with them when they move and transfer it to other molecules. Once these molecules spread out, they are lighter and they rise. Hot air balloons are able to fly due to convection.

Radiation occurs when objects give off heat in the form of waves. The closer you are to the source of heat, the hotter it will feel. Sitting close to a fire place is an example.

9.2 Light

Learning outcomes

Student's Book

- define reflection, refraction, and diffraction
- identify the processes and give examples from their surroundings

Resources

You will need:

- torches
- different materials—foil, linen, tracing paper to see how light is affected
- small bowl
- coin
- a jug half full of water

Student's Book steps

- Begin your lesson by asking individual students if they can list some of the ways we use light in our lives. Praise them with positive feedback.

2. Read aloud from the Student's Book as the students follow in their own books. Discuss the different ways that light can behave when it hits different things.
3. Set up stations around the classroom with different materials and objects for the students to experiment with. Put the materials for reflection in one station, the materials for refraction on another station, and the materials for diffraction in another spot.
4. Encourage the students to experiment with the different materials and observe how light is affected.
5. After all of the students have had an opportunity to experiment, ask the students to return to their seats and share some of their observations and experiences about light.

Activities

Help the students conduct the activity under 'Activity Time' on page 80 of the Student's Book

9.2 (contd.) Convex and concave

Learning outcomes

Student's Book

- differentiate between concave and convex lens
- list the uses of convex and concave mirrors

Workbook

- solve a crossword puzzle
- conduct an experiment to see how light is reflected from different surfaces
- conduct an experiment to show refraction of light through water

Resources

You will need:

- Student's Book page 80 and 81
- Workbook pages 35-37
- clean jars, water, and newspapers

Student's Book steps

1. Help the students recall that humans use light to help them do things and ask them if they can think of some of the ways in which light helps us.
2. Explain that we use the way light travels to help us see better with spectacles.
3. Explain that the lenses in spectacles are cut in such a way that they help to see objects clearer.
4. Ask the students if they can remember the definition of refraction—the bending of light as it moves from one thing to another.
5. Explain that the two main different forms of lenses are convex (thicker in the middle than on the ends) and concave (thinner in the middle than on the ends).

6. Write these definitions on the board and ask the students to copy them down.
7. Explain that one way to remember the difference is think of the ‘cave’ in concave—a concave lens looks like the opening of a cave. It curves inwards.
8. Read aloud from the Student’s Book as the students follow in their own books.

Workbook steps

1. Ask the students to complete the light crossword at home.
2. Help the students to observe how light is reflected.
3. Read out the instructions for the experiment on refraction. Set up the materials at one of the stations and encourage the students to experience how refraction works.

Answers to Student’s Book 9.2

1. A convex lens is one that bulges out towards the light source and a concave lens appears sunken in the middle. Help the students draw diagrams which show light hitting a convex or a concave lens, the reflected waves spreading out, and the image appearing smaller or larger depending on the lens.
2. Convex and concave lenses are used in spectacles which help people who are long-sighted or short-sighted.

9.3 Sound

Learning outcomes

Student’s Book

- describe how an echo is heard
- define reverberation
- explain how objects absorb sound, so that there are no echoes or reverberations

Resources

You will need:

- Student’s Book pages 82 and 83
- cymbals or a loud instrument
- bowls, plastic wrap, elastic bands, tiny pieces of pepper or salt
- cardboard
- plastic funnels
- rubber tubing or garden hosepipe and something to cut it with

Student's Book steps

1. Welcome the students into the class by using hand gestures ONLY. Make no sound at all!
2. Write on the board that this lesson is about sound and the importance of sound and hearing in our lives.
3. Draw a picture of an ear and a sound wave going to the ear. See if the students can guess what you have drawn and can tell you without speaking. The students will enjoy doing this activity and find it funny that you are not speaking.
4. After some time, start talking and ask the students to share how hard it was to understand what was going on without any sound.
5. Explain that sound travels in waves of vibrations.
6. Put plastic wrap tightly over the top of a bowl and sprinkle some pepper or salt on top. Make a loud noise near it and show the students how it moves as it is a reaction to the vibrations of the sound wave. The plastic vibrates and makes the pepper or salt dance.
7. Explain how echo and reverberation occur.
8. Read aloud from the Student's Book as the students follow in their own books.

Activities

Ask the students to put their fingers on the throat where there is a bulge and say 'Aaaaaah'. They will be able to feel their vocal chords vibrating. Explain that what they can feel is the vibrations of the sound that they are making. Ask the students to experiment by making different sounds and sensing what they can feel. Encourage them to make lower pitched sounds and higher pitched sounds and feel the difference in their throats.

9.3 Making music

Learning outcomes

Student's Book

- describe how musical notes are created
- explain that all instruments work in the same way
- explain that musical notes are created by changing the force and length of vibrations

Workbook

- choose the correct answer to complete the sentences
- complete the diagrams showing waves reflecting off a mirror
- construct a simple megaphone
- observe how the sound waves sound louder when heard through a simple stethoscope
- conduct an experiment by using a tube to directly channel the sound into the listener's ear
- explain how an echo is heard

Resources

You will need:

- Student's Book pages 83 and 84
- Workbook pages 33, 38, and 39
- a guitar
- copies of Worksheet 9 for all the students

Student's Book steps

1. Begin your lesson by asking students to name different musical instruments. You may list these on the board.
2. Ask them to share if they can play any of these instruments.
3. Explain that music is a collection of different sounds. It is something that is heard when a vibration causes something else to vibrate. This can be demonstrated by using a guitar in the classroom.
4. The guitar can also be used to explain how different musical notes are created. Use the Student's Book to reinforce this concept.
5. Ask the students to complete Worksheet 9. Discuss the answers at the end of the lesson.

Activities

Give the students different instruments to play with. Encourage them to experiment by making different sounds and see if they can make some notes that people recognize.

Workbook steps

1. Help the students choose the correct words to complete the sentences about light.
2. Ask the students to complete page 33 in the Workbook.
3. Help the students to make the different sound instruments using the materials that you have brought in. Encourage the students to experiment with making different shapes and testing them out to see how well they work.
4. Help the students to explain the process of echoes in their workbook. Remind the students that all the information they need is in their Student's Book.

Review

1. copper, iron, gold
2. Answers will vary depending on students' research.
3. a. radiation b. conduction c. convection
4. It appears to be broken because of refraction. Light travels at different speeds through different states of matter. This causes light to bend resulting in refraction.
5. a. Regular reflection occurs when light hits a smooth surface forming a clear image.
b. Diffused reflection occurs when light hits rough surfaces producing a blurred image.
6. Echolocation is when sound waves are sent out to locate objects. Answers will vary about how humans use this phenomenon to their advantage depending on students' research.
7. Reverberation occurs when the echo is too short to be heard and the original sound continues to be heard for a longer time.
8. An echo is produced when the same sound is heard more than once. Sound waves are bounced off a surface. The harder, smoother, and flatter the surface is, the clearer the echo.

Answers to Workbook

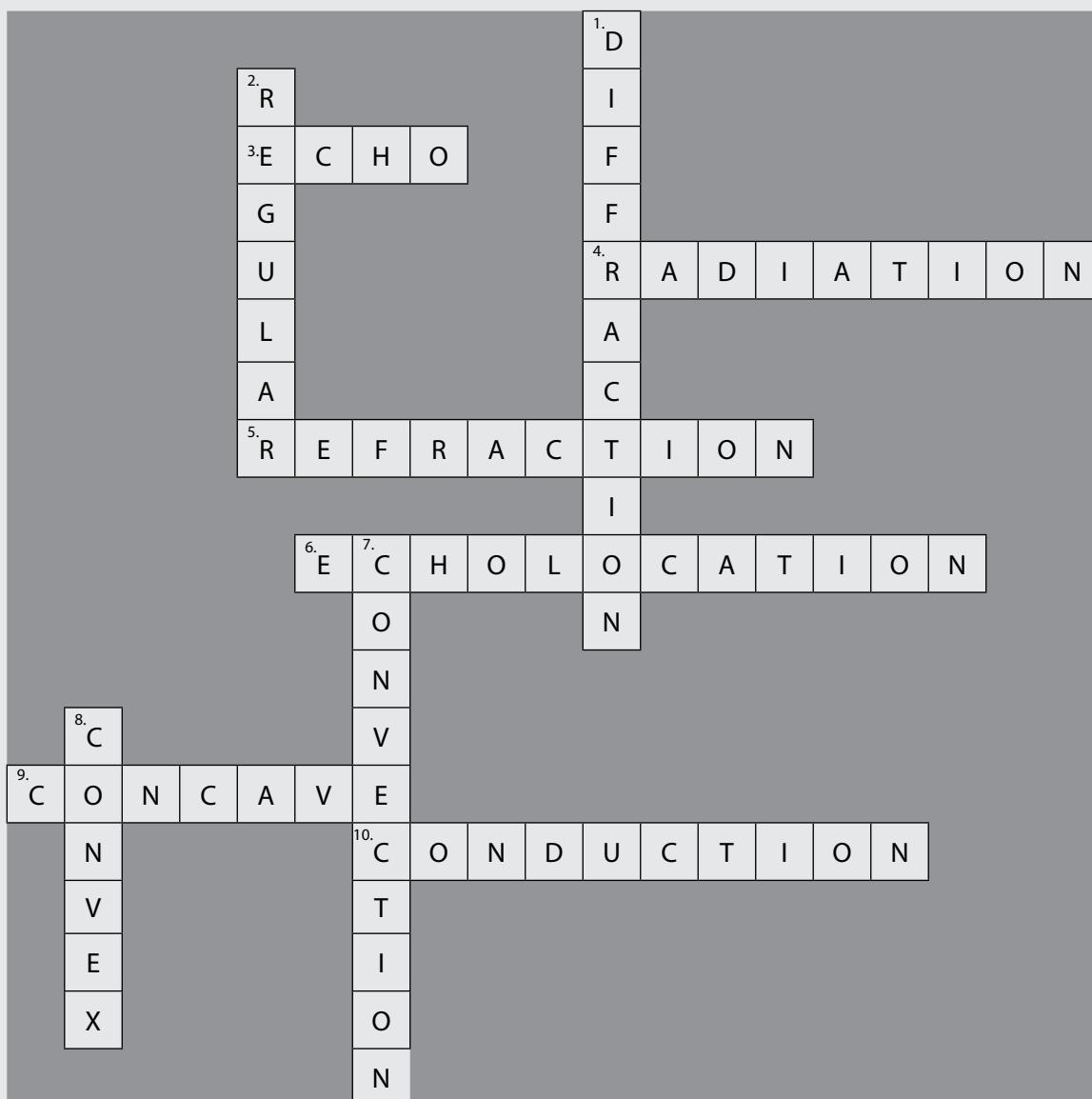
Page 33

- | | | |
|---------------|-----------|-----------------|
| 1. hotter | 2. sun | 3. vibrations |
| 4. reflection | 5. moving | 6. bends |
| 7. smaller | 8. slower | 9. echolocation |

Page 34

Students will follow the instructions given in the Workbook to observe conduction.

Page 35



Page 36

Students will follow the instructions given in the Workbook to observe reflection.

Page 37

Students will follow the instructions given in the Workbook to observe refraction.

Page 38

Students will follow the instructions given in the Workbook to observe the effects of the direction of sound.

Page 39

1. After a short while the man will hear an echo of his shout.
2. The man will not hear an echo because the cushions absorb the sound.
3. The man will not hear an echo because he is too close to the bottom. But he may hear a reverberation.

Answers to Worksheet 9

- | | | |
|---------------------|---------------------|---------------------|
| 1. vibrate | 2. Convection | 3. Hot air balloons |
| 4. Sun | 5. regular, diffuse | 6. refraction |
| 7. convex mirrors | 8. diffraction | 9. concave |
| 10. Concave mirrors | 11. echo | 12. echolocation |
| 13. amplify | 14. convex | 15. musical notes |



UNIT 10 FORCES AND MACHINES

Background

Students' existing knowledge will base on background of forces and machines from previous years. Explain to the students that people often mistake that mass and weight are the same. Explain the difference between these two and the units they are measured in. Students' knowledge of gravity will enable them to understand what happens to the mass and weight of an object if it goes into space. Similarly their familiarity with buoyancy, friction, and air resistance will help them to understand that movement occurs when a force becomes unbalanced.

Expected learning outcomes for the unit

Students should be able to:

- differentiate between mass and weight
- define balanced and unbalanced forces
- identify and give examples of buoyancy, gravity, friction, and air resistance
- identify the above forces from given examples

10.1 Mass and weight

Learning outcomes

Student's Book

- differentiate between mass and weight
- use examples to explain the difference between mass and weight

Resources

You will need:

- Student's Book pages 86 and 87

Student's Book steps

1. Welcome the students into the classroom and tell them that they are going to study the difference between mass and weight.
2. Write the words on the board with their definitions (mass is the amount of matter contained by an object; weight is the force with which an object is pulled to the centre of the Earth, i.e. gravity.).
3. Explain that weight and mass are thought to be the same because on Earth the mass and weight of an object is the same. But in space the mass and weight are different because there is no gravity.

4. Write the word 'Gravity' on the board.
5. Ask all the students to stand up and jump. Explain that to stay 'up' is impossible because of gravity. The students will enjoy this part of the lesson.
6. Explain that in space there is no gravity.
7. Read aloud from the Student's Book pausing after each statement to allow the students to ask any questions. You may need to read this section a number of times and concentrate on the examples that help explain forces.

Answers to Student's Book 10.1

1. Answers will vary depending on students' research about Isaac Newton.
2. Mass is the amount of matter contained in an object and is measured in kilograms. Weight is the amount of gravitational force acting on an object and is measured in newtons.

10.2 Balanced and unbalanced forces

Learning outcomes

Student's Book

- define balanced and unbalanced forces
- identify the forces of gravity, buoyancy, air resistance, and friction

Workbook

- relate the forces of friction, air resistance, gravity, and normal force to situations around them
- solve a picture quiz to identify the type of force being used
- solve a crossword puzzle

Resources

You will need:

- Student's Book pages 88 and 89
- Workbook pages 40-42
- copies of Worksheet 10 for all the students

Student's Book steps

1. Welcome the students into the classroom and tell them that they are going to study balanced and unbalanced forces.
2. Revise the forces of buoyancy, gravity, friction, and air resistance.
3. Explain balanced and unbalanced forces using examples and text from the Student's Book.
4. Ask the students to complete Worksheet 10 at home. Discuss the answers in the next lesson.

Activities

Help the students to work out which way the ball will go with the different forces at work.

Workbook steps

1. Help the students to work out which forces are at work in the nursery rhymes in the Student's Book. It may help to act out the actions being described. The students may wish to do this in groups and then share their responses with each other.
2. Help the students complete the picture quiz in class.
3. Ask the students to complete the crossword puzzle at home.

Review

1. A force becomes unbalanced when it moves or changes speed and direction. Tug-of-war is an example.
2. Selection of objects will vary. The force of gravity is pushing the object on the table downwards while a normal force is pushing it upwards in the opposite direction. Since the two forces are balanced, the object will keep still.
3. Buoyancy—a force that has an upward pressure and works in water. This is why boats float in water.
Gravity—a force that makes sure what goes up comes down and pulls everything towards the centre of the Earth.
Friction—the force that slows or stops objects that are sliding past each other.
Air resistance—a type of frictional force where air helps to slow down objects. Parachutes are an example.
4. When astronauts are travelling in space, their mass remains the same as on Earth. Since there is no force of gravity in space, astronauts float due to weightlessness.

Answers to Workbook

Page 40

Jack and Jill

1. When Jack and Jill are walking up the hill, gravity is trying to pull them downward. This is why walking up a hill is such a struggle.
2. As they climb, friction between their feet and the ground is slowing them down.
3. When Jack falls down and Jill starts tumbling, gravity pulls them to the bottom of the hill.

- As they tumble down the hill, friction between their bodies and the ground is slowing them. Without this friction they will travel very fast and will not be able to stop.

Humpty Dumpty

- When Humpty Dumpty is sitting on the wall, gravity is trying to pull him to the ground.
- It is normal force from the wall acting in opposition to gravity that keeps Humpty Dumpty on the wall.
- When Humpty Dumpty overbalanced, the normal force is no longer in opposition to gravity and Humpty Dumpty falls to the ground.
- The King's horses and King's men may have got to Humpty Dumpty sooner except that friction between the horses' hooves and the grounds slowed them down.

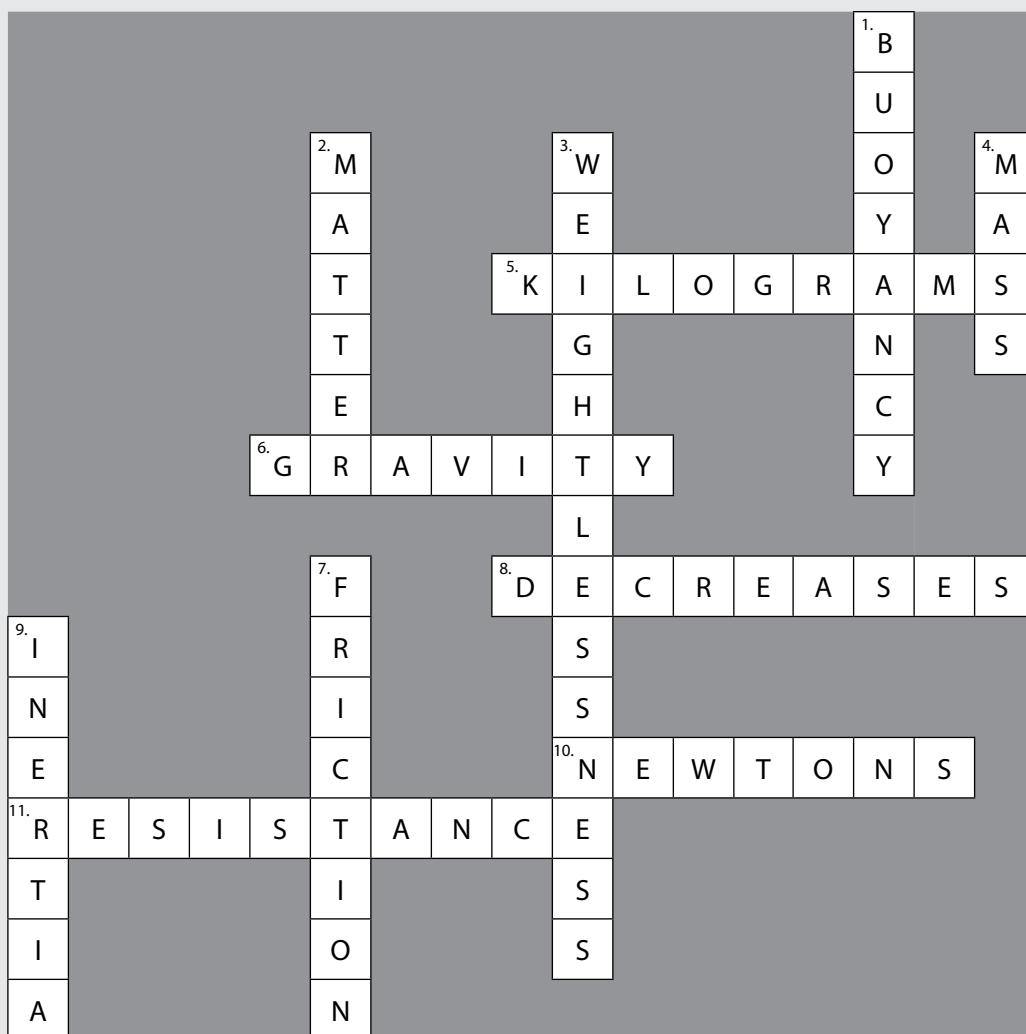
Hush-a-bye, baby

- Normal force from the tree branch is acting in opposition to gravity and keeping the cradle from falling to the ground.
- When the wind blows, the cradle overbalances. For a short while, friction between the cradle and the branch keeps the cradle from toppling all the way off the branch.
- When the wind gets too strong, the friction is no longer strong enough to stop the cradle from the branch. There is no longer a normal force to act in opposition to the gravity.

Gravity causes the cradle to fall to the ground. Air resistance slows it down but cannot stop it from falling.

Page 41

- His weight has decreased. His mass is the same.
- Inertia
- Friction between the ball and the grass.
- The smaller person will reach the end first because he doesn't cause as much friction as the larger person.
- The Sun because it is larger than the Earth.
- Neither will win because the forces are balanced.
- There is normal force acting on it. This force operates when two still objects are in contact with each other.
- The ice cube is floating because of a force known as buoyancy. This is a force that works in water.
- Air resistance is a type of friction in which the air slows the parachute from falling quickly.



Answers to Worksheet 10

K	R	B	H	I	N	E	R	T	I	A	P	Y
D	I	C	U	Y	C	E	L	O	N	S	I	G
F	C	L	F	O	G	H	W	P	I	T	M	J
Y	N	O	O	A	Y	B	C	T	T	R	E	B
H	O	C	R	G	J	A	K	M	O	O	N	R
G	H	A	D	R	R	L	N	E	P	N	T	E
Y	F	T	Y	A	N	A	D	C	Q	A	G	S
J	A	I	U	V	E	C	M	H	Y	U	A	I
M	R	N	W	I	G	B	I	S	H	T	T	S
A	T	O	C	T	V	G	T	E	F	S	I	T
F	A	N	B	Y	Y	Y	D	E	D	I	O	A
E	L	C	H	O	D	T	W	N	T	O	N	N
T	I	O	V	E	F	W	E	I	G	H	T	C
P	O	S	A	I	H	E	A	S	I	O	N	E
F	R	I	C	T	I	O	N	T	I	V	E	O

UNIT 11 ELECTRICITY AND MAGNETISM

Background

This unit will extend students' understanding of electricity and electromagnetism. Conduct the activity to make an electromagnet in the Student's Book using safety precautions. Use everyday examples to explain static electricity. Help the students observe an experiment given in the Student's Book to understand the difference between conductors and insulators. Discuss how electricity reaches our homes through the stages of generation, transmission, and distribution.

Expected learning outcomes for the unit

Students should be able to:

- define an electromagnet
- describe how an electromagnet can be made
- define static electricity and give examples
- explain the difference between conductors and insulators
- explain the three stages involved in getting electricity to our homes

11.1 Making an electromagnet

Learning outcomes

Student's Book

- conduct an experiment to create an electromagnet
- explain electromagnetism

Resources

You will need:

- Student's Book pages 90 and 91
- large iron nail
- thin coated copper wire (30 cm)
- D-cell battery
- paperclips and pins
- wire strippers

- masking tape
- a piece of paper
- a paper clip
- some thread
- scotch tape
- scissors
- a strong magnet

Student's Book steps

1. Begin your lesson by discussing the concept of electromagnetism.
2. Students should be able to remember what magnets, poles, and magnetic fields are. Help them to recall these and how electromagnets are used in various appliances in our everyday life.
3. Read the instructions to make an electromagnet from the Student's Book as the students follow in their own books.

Activities

Help the students to make an electromagnet. They will need help stripping the wire and making sure there are no twists in the wire. Allow them to experiment with turning the current on and off and seeing what materials they can pick up around the classroom.

Answers to Student's Book 11.1

1. An electromagnet works when an electric current passes through something with magnetic qualities. When the current is turned on, the magnet works, when the current is turned off, the magnet stops working.
2. Answers will vary.

11.2 Static electricity

Learning outcomes

Student's Book

- explain how static electricity is caused by friction

Resources

You will need:

- Student's Book pages 92 and 93
- woollen material
- balloons

Student's Book steps

1. Begin your lesson by explaining that electricity is one way that we can make artificial light and power to help us do things.
2. Students would remember that electricity is a type of energy.
3. Ask the students to recall the two different types of electricity: static electricity which doesn't move and current electricity which moves from one place to another.
4. Explain that the most impressive form of static electricity is lightning.
5. Explain that the energy in a lightning bolt is enough to power over 100 powerful light bulbs for a day.
6. Arrange the students in groups or pairs and give them a piece of woollen material.
7. Ask the students to rub the cloth on their hair and see what happens.
8. Explain that the wool rubbing on hair built up static electricity and creates a slight positive electrical charge.
9. Ask the students to recall a time when they may have felt a shock from static electricity, such as walking across on a woollen carpet and then grabbing a metal door handle.
10. Read aloud from the Student's Book as the students follow in their own books.

Answers to Student's Book 11.2

Static electricity is produced when two objects are rubbed together. When friction changes the balance of positive and negative charge between objects, an electric charge is produced.

11.3 Conductors and insulators

Learning outcomes

Student's Book

- differentiate between conductors and insulators
- identify the properties of conductors and insulators

Resources

You will need:

- Student's Book pages 93 and 94
- three connecting wires with clips on the end
- volt cell (battery)
- volt mounted light globe
- different materials (e.g. plastic, wood, cloth, glass, rubber, different metals)

Student's Book steps

1. Ask the students to recall the difference between static and current electricity.
2. Discuss how current electricity moves electricity from one place to another and can be controlled. Make a list of all of the important things that we use powered by current electricity (washing machines, toasters, lights). Also, make a list of what humans used to do before we had current electricity (washing by hand, cooking over a fire, using candles, and going to bed when it was dark). Ask the students to consider how current electricity has changed the way we work and live.
3. Ask the students to look carefully at electrical connections in their homes and at other places. The electrical wires above trains are connected via porcelain objects—these are called insulators. They stop the electricity.
4. Explain that some material allows electricity to travel through it (conductors) and some material stops it (insulators).
5. Write these definitions on the board.
6. Make a list of some common conductors on the board (copper, gold, concrete, everyday water) and some insulators (plastic, wood, rubber, glass).
7. Explain that insulators stop electricity from travelling and giving us a shock.
8. Ask the students if they know what their electrical points at home are covered with.
9. Read aloud from the Student's Book as the students follow in their own books.

Activities

Explain that they can do an experiment to test which materials make good conductors and which materials make good insulators. Look carefully at the instructions in the Student's Book with the entire class. Arrange the students in groups and give them the materials to make the experiments. Encourage them to test different objects and record what they have observed. After all of the students have had a chance to experiment with the different objects, ask each group to share their observations with the class.

11.4 How electricity gets to your home

Learning outcomes

Student's Book

- explain how electricity reaches from power plants to our homes

Workbook

- conduct an experiment to show that metals are attracted to magnets
- observe the magnetic field of a magnet through an experiment
- solve the wordsearch

Resources

You will need:

- Student's Book pages 94 and 95
- Workbook pages 43 and 44
- copies of Worksheet 11 for all the students

Student's Book steps

1. Explain that the electricity in their home and at school is probably current electricity.
2. Ask the students if they have ever wondered how the electricity got there.
3. Write the three stages of electricity getting to the home or school on the board: generation, transmission, and distribution.
4. Explain that generation is when electricity is made and there are several different ways to do this.
5. Explain that the second stage is transmission where a high level of electricity is sent along what is called the electricity grid. Because the electricity is very strong to use in the home it is stored in sub-stations from where the right level can be then sent out.
6. The final stage is distribution where the electricity is sent from the sub-stations out along power lines either above the ground or under the ground.
7. Ask the students if they have seen power lines above the ground.
8. Read aloud from the Student's Book as the students follow in their own books.
9. Ask the students to complete Worksheet 11 at home. Discuss the answers in the next lesson.

Activities

Help the students to answer the questions in 'Review'.

Workbook steps

1. Arrange the students in groups and ask them to read the instructions on how to 'Make a kite fly' (page 43). Provide them with the different materials and encourage them to experiment and see if they can make the kite fly.
2. Ask the students to complete the wordsearch (page 44) at home.

Review

1. Students will describe the steps with the help of diagrams similar to those on pages 90 and 91 of the Student's Book.
2. Friction is created when you run a comb through your hair. The comb is charged with static electricity because electrons have moved from your hair to the comb. The comb has a negative charge and when you hold it near paper its negative charge pushes away the negative charge in paper leaving it with a positive charge. Positive and negative charges attract, so the paper sticks to the comb.
3. Conductors are materials that allow an electric current to flow through them easily while insulators do not allow electric current to flow through them. Students will refer to the activity on pages 93 and 94 of the Student's Book to determine whether an object is a conductor or an insulator.
4. Current electricity is electricity that is created in one place and runs along a conductor to be used elsewhere. The stages of generation, transmission, and distribution are involved in helping electricity reach you.
 - Electricity is produced in a power plant using renewable and non-renewable resources.
 - A transformer receives this electricity and increases its power so that it can travel long distances.
 - It is then sent along the electricity grid and sub-stations.
 - From here, it travels to its destination through overground lines attached to pylons or underground cables.
5.
 - a. an electromagnet—generates electricity when needed
 - b. an insulator—disables flow of electric current
 - c. a conductor—allows flow of an electric current
 - d. a transformer—increases the power of electricity so it can travel long distances
 - e. a pylon—supports overground lines
 - f. a substation—sends electricity to its final destination

Answers to Workbook

Page 43

Students will follow instructions given in the Workbook to observe how metal objects will be attracted to a magnet if they are within magnetic fields.

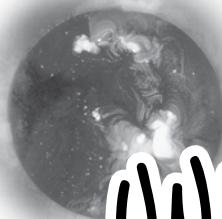
Page 44

E	L	E	C	T	R	O	M	A	G	N	E	T
T	S	I	A	P	L	H	C	E	P	P	C	A
Y	T	A	B	F	O	G	U	Y	O	O	U	R
A	A	T	L	D	H	N	P	O	W	A	R	A
Z	T	O	E	B	F	S	T	A	E	L	R	N
O	I	N	S	U	L	A	T	O	R	S	E	T
Q	C	O	N	D	U	C	T	O	R	S	N	U
(P)	O	L	E	S	J	O	L	C	U	R	T	L

1. static
2. conductors
3. insulators
4. current
5. power
6. electromagnet
7. poles, cables

Answers to Worksheet 11

1.	I	N	S	U	L	A	6.	T	O	R	S					
								R								
								A								
								N								
								5. C								
								U								
								S								
2.	E	L	E	C	T	R	O	M	A	G	N	E	T	I	S	M
								R		I				I		
								E		S				C		
								N		S				7. C		
								T		I				H		
								O						A		
3.	T	R	A	N	S	F	O	R	M	E	R					
										G						
										E						
4.	S	U	B	S	T	A	T	I	O	N						



UNIT 12 THE SOLAR SYSTEM

Background

Students' background knowledge will base on an understanding of the bodies in the solar system and how day, night, and the seasons occur. They will be introduced to facts about the Sun, planets, and the Moon in further detail. Also familiarize them with solar flares, solar winds, and Sun spots. Use the notebook and review questions in the Student's Book as well as material in the Workbook and the Teaching Guide to help in reinforcing the factual information in this unit.

Expected learning outcomes for the unit

Students should be able to:

- describe the composition of the Sun
- describe solar flares, solar winds, and Sun spots
- name the eight planets of the solar system
- list some characteristics of each of the planets

12.1 The Sun

Learning outcomes

Student's Book

- explain the composition of the Sun
- describe solar flares, solar winds, and Sun spots

Resources

You will need:

- Student's Book pages 97 and 98
- poster paper, coloured markers, scissors, string, or fishing line

Student's Book steps

1. Begin your lesson by asking the students to recall what they know about the movement of the Earth, the Sun and the other planets, asking questions such as:

Who can describe the difference in size between the Earth and the Sun?

Does the Earth travel around the Sun or does the Sun travel around the Earth?

What causes the seasons on Earth?

Can anyone describe the difference between the Earth's rotation and the Earth's revolution?

- Revise Earth's revolution around the Sun and this takes a year and that the Earth is tilted and it also rotates and this gives us day and night.
- Ask the students to name the heavenly bodies that make up the solar system: planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune), Sun, and moons.
- Discuss facts about the Sun, what solar flares, solar winds and Sun spots are, using the Student's Book.

Activities

Ask the students to put some facts on their posters about our solar system and the Sun. They can use the information in the Student's Book to help them.

Answers to Student's Book 12.1

- The solar system is all the planets, moons, and other bodies that depend on the Sun for their movement, light, and heat.
- The Sun is five billion years old.
- The Sun is composed of burning gases—70% hydrogen, 30% helium, and minor amounts of carbon, iron, magnesium, neon, nitrogen, oxygen, and silicon.

12.2 The planets

Learning outcomes

Student's Book

- identify the eight planets and explain their features
- identify the order of the eight planets from the Sun

Workbook

- identify the planets with the help of the clues given

Resources

You will need:

- Student's Book pages 99-102
- Workbook pages 45 and 46
- lots of different sized balls, balloons, and other round objects to represent the planets and some of their moons
- chalk

Student's Book steps

- Ask the students to name the eight planets in the solar system.
- Explain that because Mercury is the closest planet to the Sun it is very hot and we could never live on it.

3. Put a chair at one end of the classroom and explain that it is Mercury—ask them to circle around it expressing how hot it is.
4. Explain that we are in the inner solar system—Mercury, Venus, Earth, and Mars as these planets are closest to the Sun.
5. Read aloud the description for the planets in the inner solar system from the Student's Book.
6. Ask the students to pretend that they are visiting each planet on a rocket. Give the students time to work out what they will see and do when they go to visit these planets.
7. Ask the groups of astronauts to act out their voyage for the rest of the class. Encourage the students to have fun with this activity and to use the descriptions in the Student's Book to guide them.
8. Explain that it is going to be a bumpy ride as they go through an asteroid belt in order to get to the outer solar system and visit the other planets—Jupiter, Saturn, Uranus, and Neptune.
9. Read the description for the rest of the planets from the Student's Book.
10. Give the students time to prepare the rest of their rocket trip and perform it before the class. Encourage them to use furniture and any props in the class to improve their play. Remind the students that all the information they need is in the Student's Book. Encourage the students to have fun with this activity and to pretend that they are astronauts hurtling through space. They are exploring the planets as scientists and reporting back to the rest of the world.

Activities

- Ask the students to orbit the planets from closest to the Sun to the farthest. Remind them that all the information they need is in the Student's Book.
- As a class, create a model of the different planets, moons and the Sun. Use the balls, balloons and other round objects to represent the different things in our solar system. You may ask the students to hold these and slowly orbit around the Sun. You may wish to do this outside and use the chalk to mark out the Sun and the orbits of the different planets. The students will enjoy this activity and the learning will take place in the discussions about the balls and objects to use to represent the different celestial bodies not so much in the final model. Encourage the students to debate the appropriateness of colours, balls and positions and to use the information in the Student's Book as a guide.

Workbook steps

Ask the students to solve the worksheet on planets in the Workbook using the clues given.

Answers to Student's Book 12.2

1. Planets are large spherical bodies that orbit a sun.
2. Pluto is a dwarf planet as it is small and scientists have discovered similar-sized bodies within its orbit.
3. The asteroid belt is a series of asteroids which orbit the Sun between Mars and Jupiter.

12.3 Moons

Learning outcomes

Student's Book

- explain that moons are natural satellites
- explain how we measure our months according to the moon
- explain how lunar months are caused
- identify the number of moons of each planet of the solar system

Resources

You will need:

- Student's Book pages 103-105
- copies of Worksheet 12 for all the students

Student's Book steps

1. Ask the students if they saw any moons on their rocket trips.
2. Explain that while there is only one moon orbiting around Earth there are lots of other moons around the other planets. In fact, scientists think that there are still other moons that have yet to be discovered.
3. Introduce and explain the phases of the Moon.
4. Read aloud from the Student's Book as the students follow in their own books.
5. Ask the students to complete Worksheet 12 at home. Discuss the answers in the next lesson.

Activities

Ask the students to name the moons of the planets. Remind them that all the information they need is in the Student's Book. They may do this at home.

Review

1. Nicholas Copernicus was an astronomer who lived in Poland about 500 years ago. He was the first person to discover that the planets orbit the Sun.
2. The Sun is in the centre of our solar system and contributes to life on Earth by providing heat and light.
3. Venus is the closest planet to Earth. There are minimal chances of finding life on Venus as it is the hottest planet.
4. The order of the planets from the nearest to the farthest from the Sun are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.
5. Astronomers use telescopes to study the universe. The Hubble is a telescope that orbits the Earth so it can take images of space without interference of light, gases, and pollution.
6. Natural satellites are moons. They are large bodies that orbit the planets and help to determine the number of days in a month. Artificial satellites are man-made objects sent into space to collect information related to weather, car navigation systems, and live television transmission.
7. It passes through seven phases. Students will draw a diagram similar to that on page 103 of the Student's Book to describe the phases of the moon.
8. a. Callisto — Jupiter
b. Deimos — Mars
c. Europa — Jupiter
d. Ganymede — Jupiter
e. Io — Jupiter
f. Phobos — Mars
g. Titan — Saturn
h. Triton — Neptune

Answers to Workbook

Page 45

- | | | | |
|------------|------------|----------|-----------|
| 1. Mars | 2. Mercury | 3. Venus | 4. Uranus |
| 5. Neptune | 6. Jupiter | 7. Earth | 8. Saturn |

Answers to Worksheet 12

- | | | | | | |
|------|------|------|-------|-------|-------|
| 1. c | 2. b | 3. a | 4. b | 5. c | 6. b |
| 7. a | 8. a | 9. b | 10. b | 11. a | 12. a |

Name: _____

Date: _____

All about the human body

Fill in the blanks.

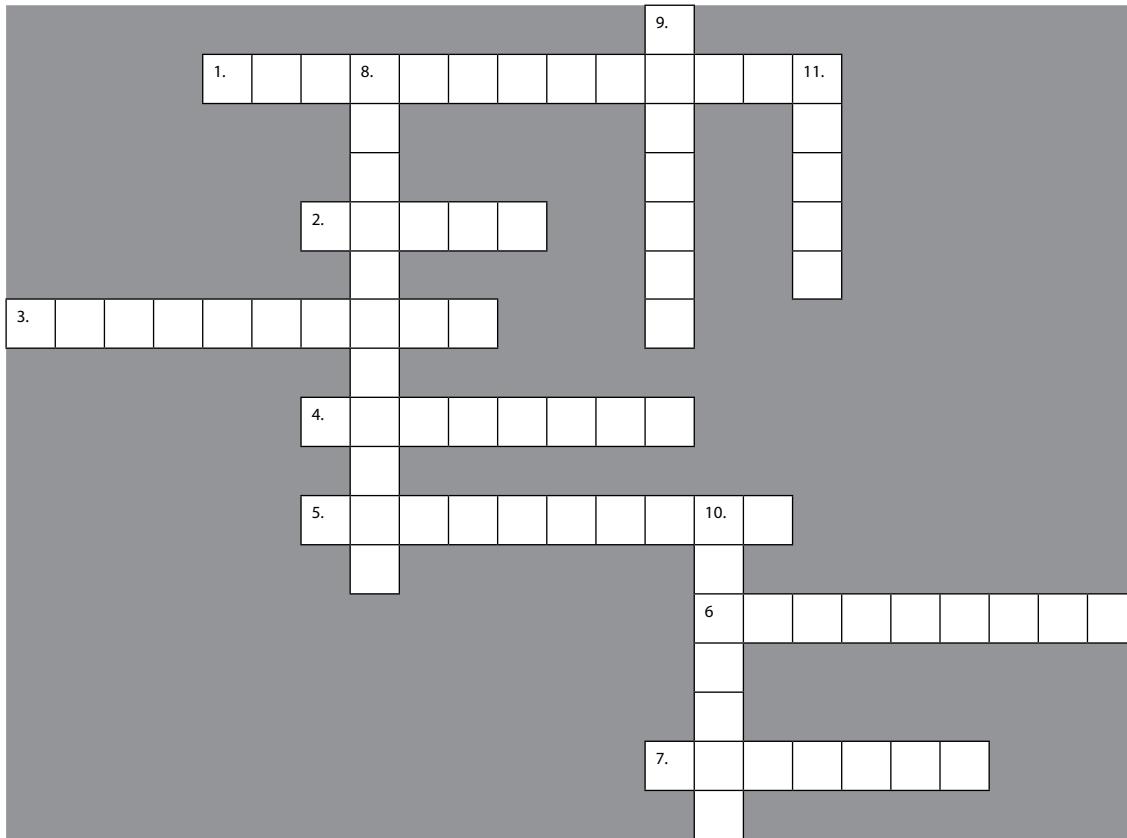
- I. A _____ is a fibre that carries impulses through the body.
2. Blood is carried away from the heart to the other organs and tissues in the body by _____.
3. The nervous system is divided into the _____ and _____ nervous systems.
4. _____ are small blood vessels that link the veins and arteries.
5. The _____ is a wall which separates the right and left sides of the heart.
6. The tiny air sacs in the lungs are called _____.
7. _____ muscles are those whose movement can't be controlled.
8. Skeletal muscles are attached to your bones by fibres called _____.
9. The knee and elbow joints are examples of _____ joints.
10. The food travels down the _____ when swallowed.
- II. The kidneys act as _____ in the urinary system.
12. Ureters are tubes that transport urine from the kidneys to the _____.

Name: _____

Date: _____

Animal classification

Solve the crossword puzzle using the clues below.



Across

- I. _____ are animals that do not have a spinal column.
2. Fish breathe through their _____.
3. The main source of food for a majority of animals are _____.
4. _____ are cold-blooded and lay eggs.
5. _____ belong to the class of vertebrates.
6. _____ helps to move materials around the cell.
7. _____ is also known as wishbone.

Down

8. Starfish and sea urchins are examples of _____.
9. _____ are warm-blooded.
10. The control centre of the cell is the _____.
- II. A _____ is an example of a mollusc.

Name: _____

Date: _____

Plants

Match the statement in the left column with the correct answer in the right column.

Column I

- I. Flowering plants are also known as _____.

2. _____ is an example of a conifer.

3. _____ stores food, water, and waste in the plant cell.

4. Seeds with two cotyledons are called _____.

5. _____ provides nutrition to the embryo.

6. _____ grow downwards and anchor the plant.

7. Seeds are formed in the _____ of the plant.

8. They are very small and light.

9. Plant cells have a _____ in addition to the cell membrane.

10. _____ contain chlorophyll.

Column 2

vacuole

roots

spores

angiosperms

cell wall

dicotyledons

chloroplasts

pine tree

flower

endosperm

Name: _____

Date: _____

Microorganisms

Circle the words from the box in the wordsearch.

mushrooms

bacteria

penicillin

antibiotics

protozoa

yeast

fungi

microscopic

algae

pneumonia

C	O	F	U	N	G	I	R	P	D	K	C	P	A
A	L	G	A	E	J	O	P	E	G	R	E	D	N
G	P	A	D	F	M	S	I	N	E	G	P	T	T
S	R	B	V	X	U	H	C	I	R	J	R	Y	I
F	G	A	Y	Q	S	Y	N	C	Q	I	O	E	B
H	U	C	P	C	H	M	Q	I	A	G	T	A	I
U	B	T	A	F	R	A	H	L	K	B	O	R	O
R	T	E	J	H	O	S	E	L	P	I	Z	S	T
Y	D	R	S	R	O	H	N	I	L	O	O	M	I
E	A	I	Y	E	M	E	U	N	N	T	A	T	C
A	I	A	V	T	S	D	P	E	O	I	R	E	S
S	K	L	Q	W	C	F	H	Y	R	G	U	A	B
T	D	P	N	E	U	M	O	N	I	A	O	S	T
L	G	J	S	Y	W	C	V	Z	F	S	G	K	U
M	I	C	R	O	S	C	O	P	I	C	R	W	Q

Name: _____

Date: _____

Soil

I. State whether the following statements are True or False.

1. People who study the Earth are called geologists. _____
2. Soil covers the bottom layer of the Earth. _____
3. Organic matter is the remains of dead plants and animals and provides nutrients to the soil. _____
4. Clay is able to retain water. _____
5. Nutrients in silt are washed away easily. _____
6. The best soil for plants is sand. _____
7. Bacteria, fungi, and decomposers are found in soil. _____
8. Decomposers create space in the soil. _____

II. Soil is made up of:

- a. _____
- b. _____
- c. _____
- d. _____

III. Sand is mainly made up of:

- a. _____
- b. _____
- c. _____
- d. _____

Name: _____

Date: _____

Food and diet

I. Fill in the blanks.

1. We can get rid of harmful bacteria by _____ food.
2. Two types of bacteria that cause food poisoning are _____ and _____.
3. If hot food sits for too long, it gives bacteria a chance to _____ the food again.
4. When food is heated, it should be _____ so that heat is evenly distributed.
5. Frozen food should be properly _____ before it is heated.
6. Genes are found in the _____ of organisms. They contain _____ about how something should grow.
7. Most genetically modified foods are _____.
8. Genes may be transferred from one type of tomatoes to another so they look more _____.

II. State two arguments each in support of and against GM foods.

Advantages

- a. _____.
- b. _____.

Disadvantages

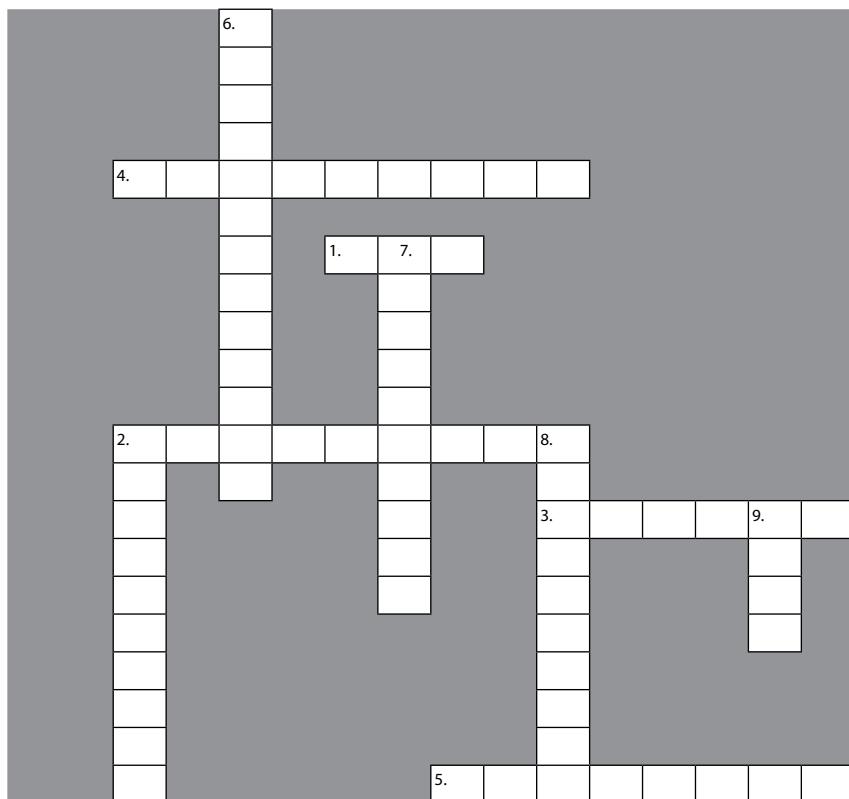
- a. _____.
- b. _____.

Name: _____

Date: _____

Pollution

Solve the crossword puzzle below using the clues.



Across

1. Shipping accidents can be a cause of _____ pollution.
2. _____ occurs when part of the environment becomes unhealthy.
3. Advertising billboards can be a cause of _____ pollution.
4. Indoor air pollution can cause _____ problems.
5. Carbon _____ is a harmful and deadly gas.

Down

2. _____ are a cause of land pollution linked to farming.
6. Paper is an example of _____ waste.
7. _____ pollution is an example of outdoor air pollution.
8. Noise pollution can interfere with the _____ system of animals.
9. _____ rain is harmful to crops and buildings.

Name: _____

Date: _____

Matter and materials

Underline the correct word in the following sentences.

- I. (Particle, Matter, Atom) is everything that exists.
2. The electrons are located (inside, outside, above) the atom.
3. A water molecule is made up of (two, three, four) atoms.
4. Particles in a liquid are (tightly, loosely, freely) packed together.
5. (Evaporation, Condensation, Melting) occurs when matter changes from a solid to a liquid.
6. Freezing occurs by (decreasing temperature, taking away energy, moving particles).
7. Water evaporates when the (temperature is constant, temperature is lower, temperature is higher).
8. When a gas changes to a liquid (evaporation, melting, condensation) takes place.
9. Boiling (reduces, speeds up, stops) evaporation.
10. Water freezes at (15°C, 0°C, 20°C).
- II. Candle wax melts at a temperature of (100°C, 80°C, 60°C).
12. (Sound, Force, Heat) is responsible for changing the state of matter.

Name: _____

Date: _____

Heat, light, and sound

Fill in the blanks.

- I. Molecules _____ during conduction.
2. _____ is the most common method of heating liquids and gases.
3. _____ are able to fly because of convection.
4. The biggest source of radiation is the _____.
5. The two types of reflection are _____ and _____.
6. A straw appearing to be bent or broken in a glass of water is an example of _____.
7. Rear view mirrors are an example of _____.
8. When light bends as it passes around the edge of an object _____ occurs.
9. A mirror or lens that appears sunken in the middle is called _____.
10. _____ provide a large close-up image.
- II. An _____ is when the same sound is heard more than once.
12. Dolphins and bats send out sound waves that hit objects and travel back to the animal. This is known as _____.
13. The wood of the guitar helps to _____ the sound.
14. People who are long sighted use _____ lenses.
15. It is possible to create different _____ by changing the force and length of vibrations.

Name: _____

Date: _____

Force

Circle the words from the box in the wordsearch.

kilogram	gravity	float	buoyancy	astronauts
weight	resistance	inertia	newton	friction

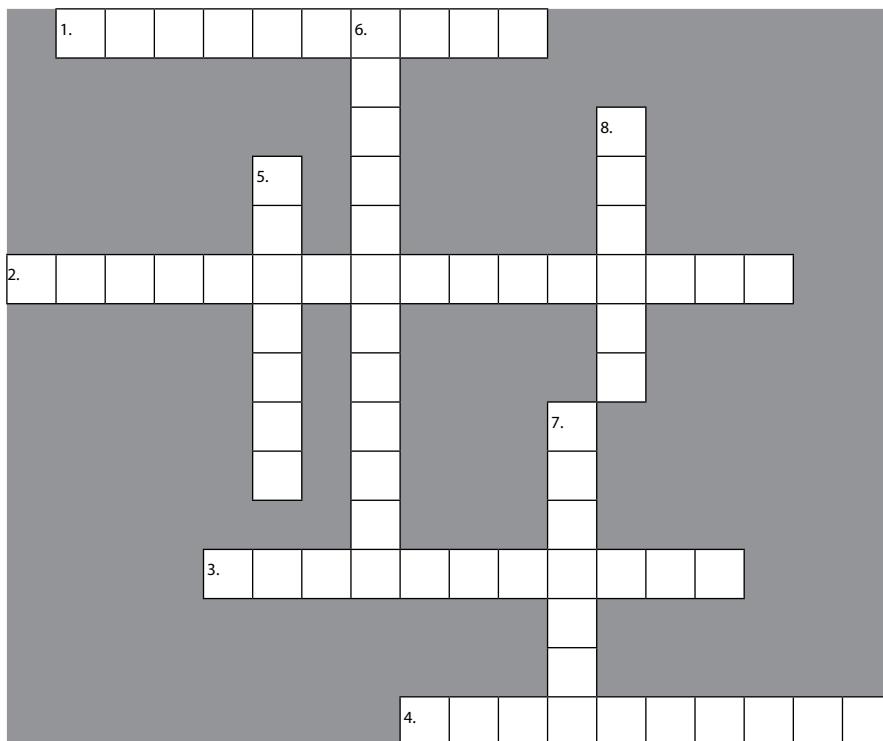
K	R	B	H	I	N	E	R	T	I	A	P	Y
D	I	C	U	Y	C	E	L	O	N	S	I	G
F	C	L	F	O	G	H	W	P	I	T	M	J
Y	N	O	O	A	Y	B	C	T	T	R	E	B
H	O	C	R	G	J	A	K	M	O	O	N	R
G	H	A	D	R	R	L	N	E	P	N	T	E
Y	F	T	Y	A	N	A	D	C	Q	A	G	S
J	A	I	U	V	E	C	M	H	Y	U	A	I
M	R	N	W	I	G	B	I	S	H	T	T	S
A	T	O	C	T	V	G	T	E	F	S	I	T
F	A	N	B	Y	Y	Y	D	E	D	I	O	A
E	L	C	H	O	D	T	W	N	T	O	N	N
T	I	O	V	E	F	W	E	I	G	H	T	C
P	O	S	A	I	H	E	A	S	I	O	N	E
F	R	I	C	T	I	O	N	T	I	V	E	O

Name: _____

Date: _____

Crossword time

Use the clues to complete the crossword.



Across

1. _____ do not allow an electric current to flow through them easily.
2. When an electric current passes through a magnet, _____ occurs.
3. _____ increases the power of the electricity so it can travel long distances.
4. During distribution, electricity travels from the _____ to the final destination.

Down

5. _____ flows easily through conductors.
6. _____ involves electricity being sent along an electricity grid.
7. Friction changes the balance of the positive and negative _____ between objects.
8. When two objects are rubbed together, _____ electricity is produced.

Name: _____

Date: _____

The solar system

Circle the correct answer.

- I. Which one of the following was an astronomer?
- a. Pasteur
 - b. Einstein
 - c. Copernicus
2. More than half of the Sun is made of:
- a. iron
 - b. hydrogen
 - c. oxygen
3. Gas particles released from the Sun and entering the Earth's atmosphere cause:
- a. solar flares
 - b. solar energy
 - c. solar winds
4. Which planet has a huge red spot?
- a. Mars
 - b. Jupiter
 - c. Uranus
5. The closest planet to the Earth is:
- a. Mercury
 - b. Neptune
 - c. Venus
6. _____ orbit the planets.
- a. asteroids
 - b. moons
 - c. stars
7. Man-made objects sent into space to orbit the Earth are called:
- a. artificial satellites
 - b. dwarf planets
 - c. ice rings
8. This involves measuring the time it takes for the moon to pass through a complete cycle of its phases:
- a. a lunar month
 - b. a calendar month
 - c. a sidereal month
9. The sidereal month is equal to _____ days.
- a. 29.531
 - b. 27.322
 - c. 28.262
10. Moons are made of:
- a. ice
 - b. rock
 - c. sand
- II. The four large moons on Jupiter are known as:
- a. Galilean
 - b. Phobos
 - c. Titan
12. _____ is the largest moon in the solar system.
- a. Ganymede
 - b. Phobos
 - c. Galilean

Teaching Notes