TEACHING GUIDE

FOR SECONDARY CLASSES

SCIENCE FACT FILE

GRADE 8

THIRD EDITION

David Coppock

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Introduction

As science teachers in the 21st century, we stand on the shoulders of many hundreds, if not thousands, of scientific giants who have gone before us. Never in human history has so much been understood about the scientific world. Yet, there still remains a lot that is unknown.

We should open up to students the many wonderful discoveries that have already been made, and stir in them a desire to continue to investigate and explore those areas of science that are still not fully understood.

When Newton, Faraday, or Pasteur, were looking at the world and seeking explanations, they did not have a book that contained all the answers; they used the knowledge they had to ask questions, to investigate, to try to discover what they did not know. They were active and life-long learners.

Far too often we permit our students to be passive learners by providing them with information and asking them to learn it. Education must be active! We must encourage our students to be inquisitive and searching, particularly in the field of science education, and empower them to be our partners in the process of acquiring knowledge.

Our hope is that this series of books and teaching guides will help in that endeavour.

Organization of the book

The *Science Fact file* series provides a well-balanced and organized course in science, emphasizing the acquisition of knowledge to be used as a guide for intelligent behaviour in daily life. It is not only a collection of facts about the world around us; the content is focused on the acquisition and understanding of general concepts which are developed using problem-solving methods.

About the Teaching Guide

Science Fact file Teaching Guides 1, 2, and 3 have been written to promote and support effective science teaching. Suggestions for teaching procedures are provided for each unit, and answers for questions and solutions for exercises and problems are supplied.

Background information

This section will prove very helpful as it explains the scientific knowledge necessary to teach a particular unit.

Unit introduction

Below are some of the ways in which a unit can be introduced. Most of them can also be used to tackle new problems within the unit.

1. **Ask questions about the students' experiences in relation to the unit.**

   At the start of a new unit, it is vital to find out what knowledge (and misconceptions!) students may already have. This can give rise to questions which will be answered during the unit. Ask questions such as: *Have you ever seen…..? What did it look like? Have you ever made a …? Have you heard about…? Have you ever watched someone …?* The purpose of these questions is to obtain some facts from the students' past experiences.

   While questioning, the teacher should bear in mind that the purpose is not to obtain correct answers; it is to find out what the students know and how they think. Another purpose is to get the students to ask their own questions. As the discussion progresses, the main points of the answers can be recorded on the board. Any questions that cannot be answered should be written on the board under the heading 'Questions we cannot answer'. The students can then read the text to check their responses and also find answers to their questions.

2. **Using pictures**

   Pictures make it possible for the students to learn indirectly from other people's experiences. Students should be encouraged to study the pictures on the opening pages of a unit. To provide help to develop the concept, several thought-provoking questions should be asked about the pictures.

3. **Reading and discussion**

   Reading is a necessary and desirable activity for learning science, but too often it is the only activity. This is probably because reading is the method most familiar to teachers, who feel more at ease when using it.

   Groups can be formed in different ways, but this will affect how an activity is planned. If each group has a strong scientist, this person can take the lead and support the other group members. Alternatively, differentiated assignments and scaffolding can help strong and weaker groups to get the most out of the activity. Both approaches can and should be used, but both require the teacher to assign the groups. If students choose their groups, the teacher will not know in advance what the groups will be like, so he/she will not be able to design the activity accordingly.

4. **Experiments and observations**

   Though science concepts are best developed through first-hand experiences, sometimes, it is impossible to provide experiments that are simple enough for secondary level students, or they require laboratory facilities far beyond the resources of the average school. It is equally impossible to organize actual observations of all living things in their natural habitats. However with careful preparation, it should be possible to provide students with some opportunities to carry out relevant and meaningful practical work.

   These can be the experiments given in the book and/or those provided by the teacher. The purpose is to explore phenomena that require explanation. There are various ways in which the teacher can use the experiments and observations, depending on the time and materials available, and the size of the class. Ideally each student should do his/her own work; but this is not possible in all schools. Satisfactory results may be obtained by having different groups perform the experiments and make observations. However, the teacher should make sure that each student has an opportunity to work within a group. If an activity takes several days to prepare or carry out, the group should be selected in advance by the teacher.

   Before any experiment or observation is performed, ask questions such as: *What is the purpose of this experiment? What are we trying to find out? Why?* This is effective as the teacher can discover from the answers whether the students understand what is going to be done.

   When the results have been observed and recorded, ask what was done in the experiment and what happened. Do the results answer the questions posed at the start of the experiment? How do they explain what happened?

5. Field trips

Another means to provide opportunities for first-hand observation is through field studies. To decide what to observe and what questions to ask, the teacher should first study the unit thoroughly, then find out what first-hand information is available to help solve problems raised in the unit. Make a list of the things that can be seen and the questions that can be asked. Then take the students on the trip and have them make their observations. When they return to class, ask questions that bring out the observation, and call for explanation of those observations.

How to use this Teaching guide

Please do not see this guide as the definitive or only way in which to present the material in the book. You, as a teacher, know your students best, so use this guide to help you plan lessons that they will find interesting and exciting.

Also remember that the text book contains only some of the information on a given topic. Do not be afraid to extend your students' learning experience by supplementing the work with other resources that you might have access to.

Each chapter of the guide corresponds to a chapter in the textbook.

Lesson Plans – For each unit there is a series of suggested lesson plans based on a 45 minute lesson. These can be used as a basis for planning your lessons based on the resources and time allocation in your school; the timings mentioned are purely as a suggestion. Do take the time to make the plans according to your requirements.

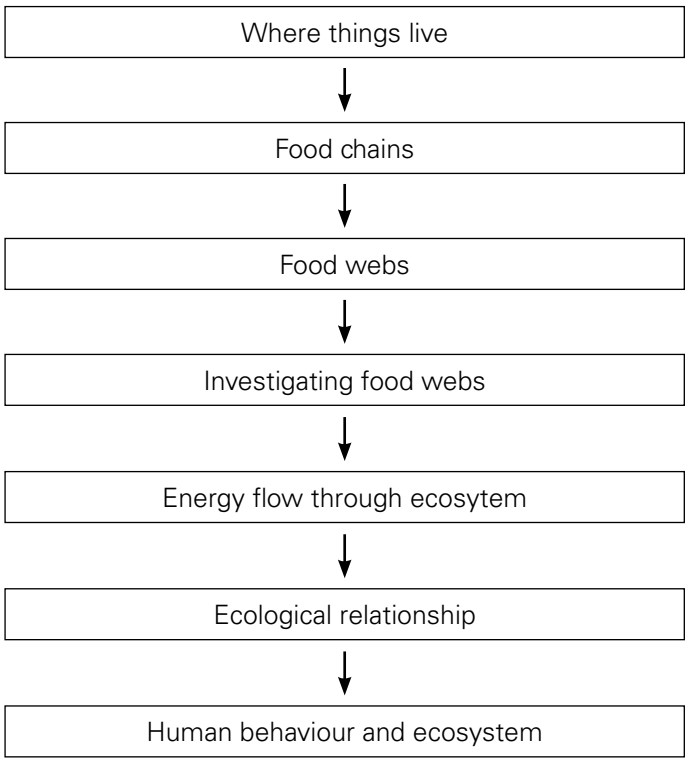
Worksheets – Photocopiable masters are referred to in the lesson plans; use these to supplement and extend the work presented in the textbook. Conduct experiments that can be carried out throughout the unit, there are also suggestions for investigations that can be conducted. The idea of the investigations is not to 'give' the students the experimental procedure but to encourage them to use their existing knowledge and understanding to draw up a plan and then carry out and evaluate their own experimental procedure.

Answers – These provide, where possible, the expected results of any activity and answers to any questions in the units, including the Test yourself section. They also contain answers to questions in the workbook.

Finally, a word about what we would like to achieve through this course. Our aim is to give students information about themselves and the world they live in, upon which they can base opinions, derive judgments, and determine courses of action in later life. We certainly do not see our suggestions as mandatory. We hope they will supplement and support the teacher's own professional practice. After all, no book can replace a good teacher!

Chapter 1 Ecology

UNIT FLOW CHART



INTRODUCTION

What is an environment? An environment can be defined as the conditions that act upon an animal or a plant. It includes all the physical conditions, such as the amount of water, sunlight, temperature, and type of soil. These are called the abiotic factors. An environment also includes all the populations and communities of living things within the area. These contribute to the biotic factors.

There are various kinds of environment. Not all environments have the same temperature, rainfall, or sunlight. Biologists have divided environments into at least six types. These are large areas or regions of the Earth called 'biomes'. A biome contains many communities with many populations. The physical conditions, such as the amount of rain, sunlight, temperature, and soil are similar throughout most of the biome's territory, making it possible for certain animals and plants to live there.

The major biomes on land are: Arctic-tundra area, coniferous-evergreen area, deciduous forest, grassland or savannah, desert, and tropical rain forest. These environments do not go from one extreme to another. Some environments present on the edges of two distinct areas blend together. The animals and plants that live in boundary areas are adapted to both environments. For example, ponds and woods often appear together, as do grasses and trees.

Lesson 1

Pages 7

OBJECTIVE

- To develop knowledge of the environment and to show how animals and plants are adapted to a range of very different environments.

LEARNING OUTCOMES

Students should be able to:

- describe the role of living things in cycling oxygen and carbon through an ecosystem, citing the processes of respiration, photosynthesis and combustion.

START (10 min)

Ask your students to imagine a wild animal (or plant). Once they have something in mind (e.g. whale, camel, palm tree) they can imagine what this organism needs to live. Students could create a mind map of the factors, and by looking at what other students include, they might realize they overlooked some aspects. For example, an animal needs food but also water, shelter, a mate, a suitable temperature, etc.

- When you have named a number of these factors, you can ask students to read page 7 and divide the factors into biotic and abiotic.
- Take students in the ground and ask them to write biotic and abiotic factors.

MAIN (15 min)

Read page 7

- Ask students to consider the reason(s) for which an organism does not live in a certain environment, they will usually focus on the abiotic elements of this environment.
- Ask students for the reasons why an organism can survive in a certain environment, they usually consider the animal's adaptations.
- Explain that the environment is made up of living and non-living components.
- Draw and discuss about carbon cycle.
- Describe how animals and plants are adapted to live in different habitats.

PLENARY (5 min)

Discuss that both plants and animals adapt to the environment, but that they also make changes to the environment. Some examples: The very small roots of moss growing on rocks will create and/or enlarge any tiny crack in the rock, creating a little bit of soil. Sheep will graze and eat many very small bushes and seedlings of trees. Without sheep, a grassy area would become a forest. Beavers build dams, flooding areas to create a better place for themselves.

Worksheet 1-1

HOMEWORK

- Sketch an environment in your notebook and make a list of 5 biotic and abiotic factors.

Lesson 2

Pages 8-10

OBJECTIVE

- To develop understanding about carbon and oxygen cycle.

LEARNING OUTCOMES

Students should be able to:

- Relate how oxygen and carbon cycles are complementary processes that bring balance and symmetry to life on earth.
- Describe global warming and explain how threats to the carbon-oxygen balance such as overpopulation, reliance on fossil fuels, and deforestation are contributing to global warming and climate change.

START (15 min)

- Show a chart of carbon and oxygen cycle. Explain the main features of carbon and oxygen cycle.

MAIN (10 min)

- Explain and relate how oxygen and carbon cycles are complementary processes that bring balance and symmetry to life on the earth.
- Write words photosynthesis, respiration and combustion on the board and ask students to define these words.
- Describe the role of living things in cycling oxygen and carbon through an ecosystem, citing the process of photosynthesis, respiration and combustion.
- Ask pupils to write word equations of photosynthesis, respiration and combustion.
- Discuss about upsetting the balance of atmosphere by increase or decrease in the percentages of different gases in the atmosphere.

- explain the process of upsetting the balance of atmosphere.
- Relate how oxygen and carbon cycles are complementary processes that bring balance and symmetry to life on the earth.
- discuss the terms global warming, greenhouse gases and green house effects.

PLENARY (5 min)

Discuss the greenhouse effects and write main points on the board.

Ask following questions:

Q. What are the biotic factors of forest?

Q. What are the abiotic factors of a river?

Test yourself page 9 of the student book.

REFLECTION (5 min)

Ask students to draw posters about greenhouse effects and discuss each poster with the entire class. Encourage students to ask questions and the group who made the poster to explain their reasons for their ideas.

HOMEWORK

- Exercise question 4 page 23 of the student book
- Test yourself page 10 of the student book

Lesson 3

Pages 11-13

OBJECTIVE

- To explain the feeding relationships between groups of organisms.
- To introduce the concept of energy flow through ecosystems.

LEARNING OUTCOMES

Students should be able to:

- describe how energy flows from producers to consumers, and how only part of the energy flows from one level of the pyramid to the next.
- draw a food web diagram to illustrate the food relationships between organisms.
- describe and illustrate through examples, key ecological relationships between organisms, including competition, predation and symbiosis.

START (5 min)

- Review the biotic and abiotic factors envisioned in the last lesson. Discuss the role of prey and predator. Explain how biotic and abiotic factors depend on each other.

MAIN (15 min)

- Read pages 11-13 and explain different terms.
- Write definition on the board.
- Ecology has a number of terms which students need to understand well. It may be useful to memorize the definitions, especially for second language learners. Please continue to check throughout this unit that students really grasp the meanings of these words.
- Help students to identify some features of predator and prey animals.
- Explain what a food chain is and name the links in a food chain.
- Explain the difference between a food chain and a food web.
- Describe the flow of energy from the producer to the final organisms in a food chain.
- Ask student why consumers need to eat (to obtain energy). Introduce the concept that plants use energy from the Sun to make their own food, and that eating plants means you are eating large molecules which were put together from smaller ones using the Sun's energy. By breaking down the larger molecules, we release this energy, e.g., to move our muscles.
- When an animal eats another animal, the Sun's energy is passed on again until it reaches the top predator. When this animal dies, the large molecules in its body are broken down to smaller ones by decomposers.
- Draw a food web on the board and ask students to explain the process of flow of energy.

PLENARY (10 min)

Worksheet 3-1

According to the UN, approximately 11% of the world's population is undernourished. This means that for every 8 people who have enough of the right food to eat, one person is hungry. Add to this the large impact that farms have on global warming: you might want to ask your students if they would be interested in organizing a vegetable day (or week) at school.

Examples of predator prey relationships can be found on:

https://animalsake.com/examples-of-predator-prey

HOMEWORK

- Test yourself page 12 questions of Student Book.

Lesson 4

Pages 14-16

OBJECTIVE

- To develop knowledge of the ecological relationship of very different environments.

LEARNING OUTCOMES

Students should be able to:

- predict how changes in an ecosystem (e.g. changes in the water supply, the introduction of a new population, hunting, migration) can affect available resources, and thus the balance among populations.

START (10 min)

In this lesson your students are given a description of an island which they have to draw. They then have to speculate how rabbits would have to adapt in order to survive there. As long as their ideas make sense in the scenario described, their answers are 'correct'.

MAIN (15 min)

Read pages 14-16

- Give them about 30 min to complete the activity, making sure each group has at least one student who is confident about drawing.
- Describe and illustrate through examples key ecological relationships between organisms, including competition, predation and symbiosis.

PLENARY (15 min)

Ask students to make a food web

HOMEWORK

- Exercise question 5 page 23

Lesson 5

Pages 19

OBJECTIVE

- To explore how changing one part of a food web can have an effect on other parts.

LEARNING OUTCOMES

Students should be able to:

- Hypothesise what would happen in the ecosystem if the population of one of the participants in different ecological relationships is affected.

START (10 min)

You may want to start the lesson by talking about human impact on ecosystems. This may take many directions. You could ask students how an area looks with elephants and how it would change if they were not there. For example, elephants dig water holes which also provide water for other animals, and eat young trees which would otherwise turn grasslands into forests.

If students bring up overfishing, you could ask what would happen to the species normally eaten by the fish which are removed, and also what happens to the species which eat the species which humans take out.

The purpose is to make students see that every species has its own role, and by drastically changing the number of one species, you impact the balance.

A new balance needs to be found, which could work, but as we are used to the existing balance, it may not be good.

MAIN (20 min)

- Go through the section on eutrophication with your students. This aims to show students that anything to do with ecology is rarely simple and that something small, like adding some nutrients to the water, may destroy an entire food web.
- The questions afterwards, relating to hypothetical changes to a food web, again show students the far-reaching impact of what may seem like a simple change.
- Describe some ways in which food chains have been affected by human activity.

PLENARY (5 min)

What students should take from this lesson is the concept that systems are in balance. A small change could upset the balance. In a very diverse system it is likely to find a new balance relatively quickly, but a bigger change, especially in a system with less diversity, could cause quite an upheaval and a new balance will take longer to reach, and may be very different from the previous one.

Work sheet 4-1

REFLECTION (10 min)

Discuss each poster with the entire class. Encourage students to ask questions and the group who made the poster to explain their reasons for their ideas.

HOMEWORK

- Investigation page 25

Lesson 6

Pages 20-21

OBJECTIVE

- To understand human behaviour and ecosystem.

LEARNING OUTCOMES

Students should be able to:

- Explain the ways in which human behaviour(e.g. replanting forests,reducing air and water pollution,protecting endangered species) can have positive effects on the local environment.

START (5 min)

Show different materials that are biodegradable and non-biodegradable discuss the importance of biodegradable materials to save the environment.

MAIN (15 min)

- Read page 20-21 and discuss the terms biodegradable and non-biodegradable.
- Discuss the positive and negative behaviour of human on the environment.
- write different terms on the board like reuse, reduce, recycle and restore and invite students to elaborate.
- Give examples about the terms reuse, reduce, recycle and restore.
- discuss in detail about the conservation of endangered species of plants and animals.
- show pictures of extinct animals and plants and discuss about the extinction of species.

PLENARY (5 min)

- Ask about reasons and importance of conservation of endangered species of plants and animals.
- Ask reasons of extinction of different animals and plants.
- Ask about global warming and some reasons of global warming.
- Test yourself page 21 of student book.

HOMEWORK

- Ask students to collect different pictures of endangered species of plants and animals and paste in notebook.
- Exercise question 6 and 7 of student book.

1. All organisms need the right environment to live. The environment includes biotic and abiotic factors.

Write definitions of the following terms:

a. Abiotic factors are

_____

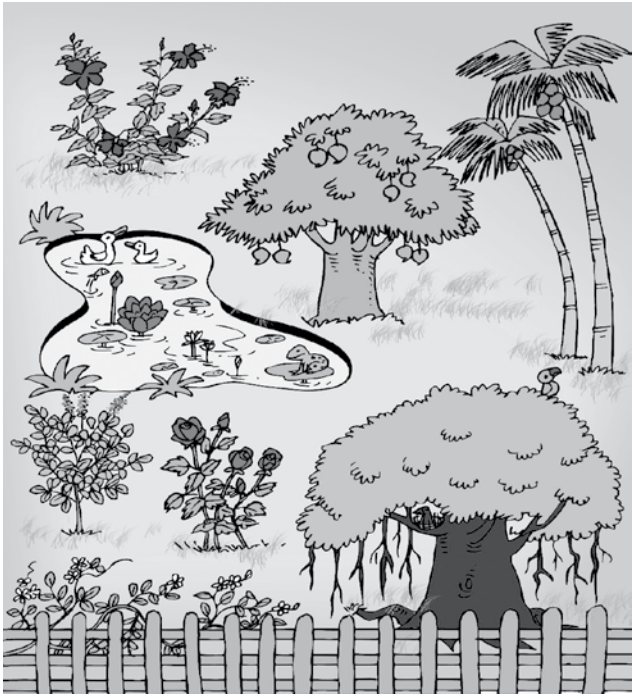
b. Biotic factors are

_____

c. An ecosystem is formed by

_____

2. List the biotic and abiotic factors shown in the picture below



biotic factors	abiotic factors

Four large groups of rabbits are placed in different environments (which are given below) and will have to adapt in order to survive. Fortunately, they are able to do so but after several generations they will look different. Draw the environment of rabbits with their adaptations. Annotate your drawing with explanations.

Island ONE

This is an old volcano, filled with fresh water. The temperature is moderate, with sufficient rainfall to keep the crater lake filled. Surrounding the crater lake there are many tall trees with leaves high in the canopy which block out the light on the ground. The island hosts different species of plant-eating animals and one species of fox, which lives on the ground.

Island TWO

This island has a fresh water spring in its centre but almost no soil or vegetation other than the plentiful seaweed washed up on the shores. There is minimal shelter between and under rocks. Snails and shellfish are found in rock pools, which remain filled with sea water during low tide. No predators live on the island but small sharks are found in the sea.

Island THREE

This island is covered in grass and herbs all year round which grow on a thick layer of sandy soil. It has a small fresh water lake. It is very windy and shrubs or trees do not survive. Many large fish-eating birds have their nests on the ground and they attack and kill any small creature approaching. In addition, a few foxes roam around who occasionally manage to steal an egg or a young bird.

Island FOUR

This island is covered with a layer of snow for most of the year. In spring and summer, a lush carpet of grass and herbs grows and these plants remain edible even when covered with snow. Trees or shrubs are absent. Birds of prey from neighbouring islands can be seen regularly. The sea around the island is frozen for part of the year but full of predators at any time.

1. Earlier in this section, you already came across animals that eat plants and animals.

a. Write the definitions of the terms below.

producer	
consumer	
herbivore	
carnivore	
omnivore	
decomposer	

b. A predator is an animal which hunts, kills, and eats other animals.

It is therefore a producer/herbivore/carnivore

c. The prey/predator is the animal which is hunted. It can be a herbivore or a carnivore.

2. Consider the list of features of animals below. Some are typical features of predators, others of prey. Copy the features into the correct columns.
   - Camouflage to avoid being seen by predators
   - Camouflage to avoid being seen by prey
   - Defense such as poison or stings
   - Eyes to the front of the head to judge size and distance well
   - Eyes to the side of the head to get a wide field of vision
   - live in groups
   - Sharp teeth and claws

predators	**prey**

3. We said the prey can be a herbivore or a carnivore. If it is a carnivore, it will be the prey for some animals and the predator for others. An example would be the seal which is prey for the polar bear but a predator of fish and squid.

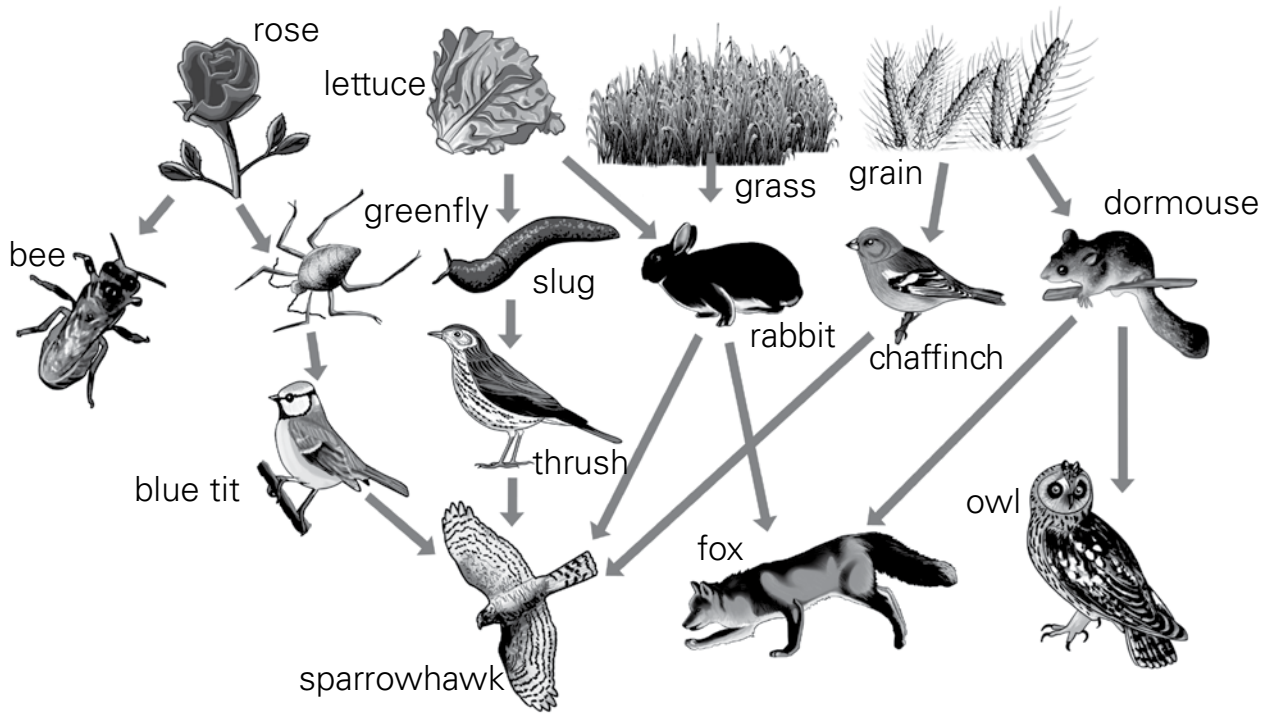
We can represent this situation in the following way

fish → seal → polar bear

This is an example of a food chain.

The arrows show in which direction the food or energy in the food travels, so the arrows represent 'is eaten by'.

As we said, the seal does not only eat fish, it also eats squid. The polar bear does not only eat seals. So this food chain is incomplete and this information should be added. The Consider the food web below.



Use this food web to identify different food chains. How many can you find? Write down at least 3 of them.

_____

_____

_____

Plants produce oxygen, so the more plants the better. Right? Wrong!

Yes, plants produce oxygen, but the situation is more complicated than just that.

If we follow the flow of energy, we start with sunlight. The plants in the pond use the sunlight to make their food and grow.

The herbivores will eat (most of) the plants and the carnivores will eat the herbivores and each other. Plants and animals which are not eaten will eventually die, and decomposers will break them down, returning the nutrients to the pond so that the growing plants can take them up again.

The nutrients will be the 'limiting factor', i.e., the fact that nutrients not readily available in this system stop plants from growing more. Now humans will change this situation. A farmer with a field next to the pond may put manure or fertilizer on his land. When it rains, some of the plants' nutrients in the manure or fertilizer will end up in the pond. Another possibility is that humans decide to dispose of their sewage in the pond. This will also add nutrients for plants to the pond water. Again, this all seems great. Plant power!

Indeed, plants will grow and animals will happily eat them and grow more numerous too. But the plants near the surface will block the sunlight of those below, and they will die. Of course, this is not good. But the problem is just starting.

The dead plants are broken down by decomposing bacteria. Since there are so many plants, there will be more and more bacteria and they use oxygen for the process of decomposition. The herbivores, whose numbers had grown because there was so much plant food to eat, now have a problem. Most of the plants they eat are dead and the amount of oxygen in the water is dropping because the bacteria use so much of it. So the herbivores die and are decomposed, and even less oxygen is available. Now the carnivores die and are decomposed. So, from a healthy pond with not too many nutrients in the water, living plants, herbivores, and carnivores all in balance, we have gone to a slimy, green, smelly pond where the bacteria are flourishing. To top it all off, some of these bacteria will give off toxic substances.

This process is called eutrophication and the only way to make this pond healthy again is to remove the surplus nutrients.

This can be done by scooping out the algae and the sediment on the bottom—a tedious and labour-intensive job, and really only possible in relatively small ponds.

This is an example of human impact on a food web and we can use these ideas to consider what happens in other food webs.

Answer the questions below.

a. If humans decided to grow roses where grass grows in the existing situation, what would happen to the population of rabbits?

_____

b. Would there still be the same amount of lettuce? Explain your answer.

_____

c. How would this affect the population of slugs? Explain your answer.

_____

d. How would this affect the population of thrushes? Explain your answer.

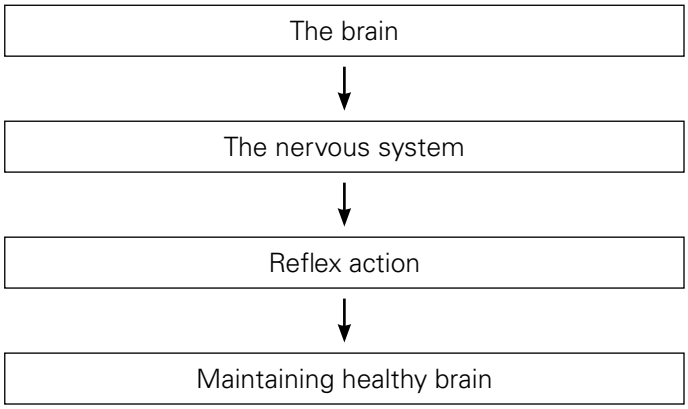
_____

e. If, in the existing situation, the sparrow hawks eat equal numbers of blue tits, thrushes, rabbits, and chaffinches, would that still be the case if the grass was replaced with roses? Which species might become much more important as food for the sparrow hawks? Explain your answer.

_____

Chapter 2 Human Nervous system

UNIT FLOW CHART



INTRODUCTION

Fortunately, we can get up in the morning without having to think about keeping our body temperature constant, keeping our heart beating, or coordinating our muscles so we do not fall over on our way to the shower. Although we can decide to breathe more slowly or faster, most of the time this also seems to run on 'autopilot'.

All of this is only possible by having organ systems which operate effectively, and a communication system which keeps it all working together.

Lesson 1

Pages 27-28

OBJECTIVE

- Identify the organs, functions and processes of the Human Nervous System.

LEARNING OUTCOMES

The students should be able to:

- explain how the brain works as the control station of a human body.
- identify the three major parts of the brain – forebrain, mid-brain, and hind brain and describe their various functions.

START (10 minutes)

- Show a chart or model of a human brain and discuss the parts and functions.

MAIN (20 minutes)

Read pages 27-28

- Discuss that the brain can be divided into three basic units: the forebrain, the midbrain, and the hindbrain.
- Ask from the students why human brain is like a very powerful computer?
- Explain that human brain stores memories, makes judgements and controls how we think and respond to things happening around us.

PLENARY (10 minutes)

Ask students to role play the parts of brain.

HOMEWORK

- Draw and colour a labeled diagram of the parts of brain.

Lesson 2

Pages 29-30

OBJECTIVE

- To explore the working of the brain.

LEARNING OUTCOMES

The students should be able to:

- describe the structure of the cerebrum, its division into two hemispheres (left and right) and the role of each hemisphere in the control of the body.

START (10 minutes)

Ask about the lefty and righty students in the class and discuss about the working of left and right hemisphere.

MAIN (15 minutes)

Read pages 29-30

- Explain that the cerebrum is made up of two halves called cerebral hemispheres.
- Explain the functions of right and left cerebral hemispheres.
- Explain that the right cerebral hemisphere processes information from the left side of the body, while the left cerebral hemisphere processes information from the right side of the body.

PLENARY (10 minutes)

Divide students in a group of two students and ask them to discuss about the working of left and right hemisphere.

Help students to solve worksheet 1-2

HOMEWORK

- Exercise question 4 page 37

Lesson 3

Page 31-33

OBJECTIVE

- To increase knowledge of nervous systems.

LEARNING OUTCOMES

The students should be able to:

- Identify the organs, functions and processes of the human nervous system.
- Sketch and label a diagram of the human nervous system.
- Explain and represent how messages flow through the body from and to the brain, and how the brain collaborates with the sensory organs to regulate this process.
- Map the various steps in the transmission of messages through the body and to the brain via a reflex arc.
- Describe the type and function of neurons in transmitting messages through the body.

START (5 minutes)

Discuss the following with your students. You may have seen a doctor tap a patient's knee gently. The patient's lower leg will then kick out slightly. If necessary, explain that this is a reflex action.

MAIN (20 minutes)

- Read pages 31-33 of the Student Book.
- For a reflex action to happen, several different parts of the body need to communicate.
- Display a chart of the nervous system showing the sensory and motor nerves and neurons.

PLENARY (10 minutes)

- Investigation page 38 of the student book.
- Ask questions about different parts of the nervous system and their function for instance:
  - i What happens when you touch a hot object?
  - ii Why do you remove your hand at once? What is this type of action called?
  - iii Consider coughing and talking; which action is voluntary? Explain your answer.
- Test yourself page 32

HOMEWORK

- Exercise question 5 page 37

Lesson 4

Pages 31-33

OBJECTIVE

- To increase knowledge of nervous systems.

LEARNING OUTCOMES

The students should be able to:

- predict what would happen if a nerve connection broke.
- create a plan of activities and exercises students can do to maintain a healthy brain.
- match various body functions with the relevant part of the brain that controls or regulates them (for instance, associating breathing with the brain stem).

START (5 minutes)

Activity page 35: Put 10 household (or laboratory) items in a tray. Place the tray in front of another student and ask them to have a close look at the items for one minute. Cover the tray with a cloth and ask the student to write down the name and position of as many items that they can remember.

How good is their memory? Try repeating the test with more items and/or a shorter observation time.

MAIN (15 minutes)

Read pages 34-35

- Ask students to discuss the activities to keep the brain active.
- Ask students why they use helmet when riding on a motor cycles?

PLENARY (15 minutes)

- Help students to solve Work sheet 2-2.
- Discuss the 'Test yourself' questions on page 35 of the Student Book.

HOMEWORK

- Exercise Question 7 page 38 of Student book.

1. Fill in the blanks with appropriate words.

   a. This outer surface of the cerebrum is called the _____.

   b. It deals with _____ body parts.

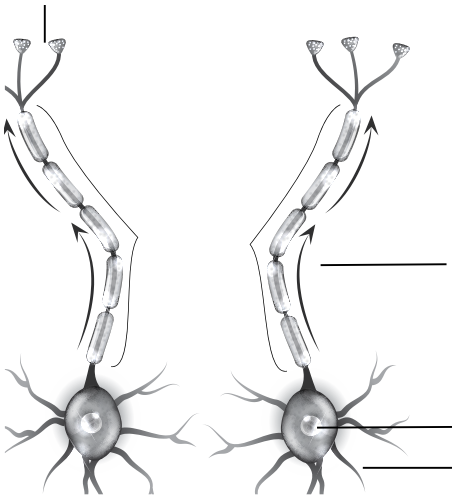
   c. The cerebrum is made up of two halves called _____.

   d. The _____ processes information from the left side of the body.

   e. The _____ processes information from the right side of the body.

Q1

Name the parts in the following diagram indicated with the letters.



Q2

Write short description of the following:

Effectors

_____

Receptors

_____

Motor nerve cells

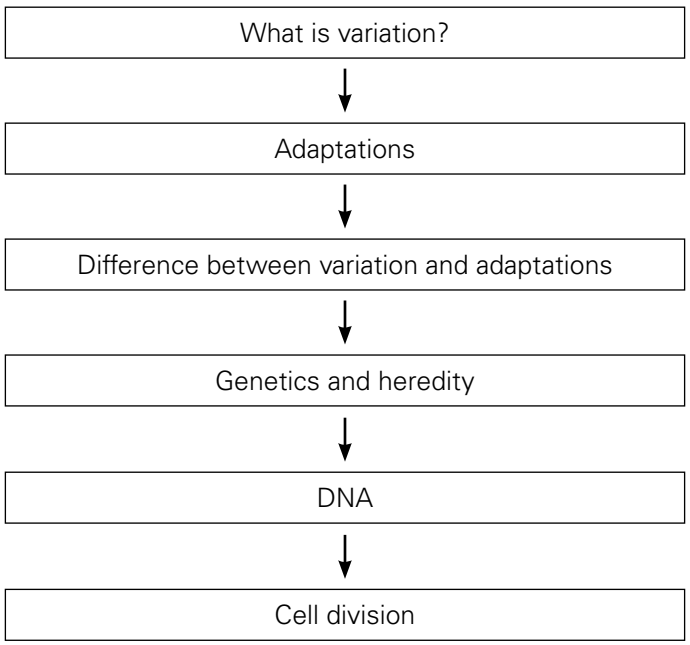
_____

Sensory nerve cells

_____

Chapter 3 Variations, Heredity and Cell Division

UNIT FLOW CHART



INTRODUCTION

When we have a large pile of items, we have no idea what it contains nor how many of each thing. So we start sorting the items. In a toolbox, the different sizes of screwdrivers will be placed together but separated from the hammer, the saw, and the wrench. Once they are all sorted, it will be easier to remember roughly which tools we have. Some very young children will already sort their building blocks so they know what they can build.

A small history lesson illustrates the importance of variation. In the middle of the 19th century, a fungus-like micro-organism infected potato crops in Northern Europe. In most countries this led to some problems, but with a variety of potatoes in most countries, it did not lead to disaster. However, due to a unique economic system and an overwhelming dependence on only one type of potato—which was very susceptible to this particular micro-organism—the potato blight destroyed most of the crop in Northern Ireland and lead to a million people dying of starvation and another 2 million emigrating (mainly to the UK and USA). The population of Ireland took 100 years to grow back to its former size.

Lesson 1

Pages 39-42

OBJECTIVES

- To develop an appreciation of variation in humans and other organisms.
- To introduce the scientific classification of living things and to consider the importance of classification.

LEARNING OUTCOMES

The students should be able to:

- describe variation and adaptation in living organisms.
- identify sources of variation from environmental and genetic factors.

START (15 min)

- Collect a range of pens and pencils. Put them together and ask students how they would divide them into two or three groups and then subdivide each group into two or three subgroups. Students can do this individually or in small groups.
- Ask a few students to explain how they made their groups and why. Then discuss the fact that different ways of sorting may all be valid. (Bigger concept: if one thing is right, all others are not necessarily wrong.)
- Suggest ways in which individuals of the same species differ from each other.
- Identify characteristics that are inherited.
- Suggest ways in which variation can be acquired within a species.

MAIN (20 min)

Read pages 39-42

- Variation is more likely to be continuous if it is affected by more than one gene and/or is heavily influenced by the environment; e.g. skin colour is regulated by at least 6 genes; height is affected by nutrition; blood groups are regulated by one gene and do not seem to be affected by the environment.
- Your passport may state height, hair and/or eye colour, and contain your signature, photograph, or fingerprint. Other options are facial recognition, DNA, and voice recognition. These all focus on traits which are unique to each of us, so they show variation between humans.
- Can two people have identical fingerprints? How do you prove your identity?

PLENARY (10 min)

Activity page 40: Make a list of the following characteristics for members of your class:

Eye colour, finger length (3rd finger left hand), presence or absence of ear lobes, shoe size. How do these characteristics vary between the members of your class? Present your data for finger length in the form of a bar chart.

Test yourself page 44

HOMEWORK

- Exercise question 5 page 57 of the student book.

Lesson 2

Page 43-44

OBJECTIVE

- To develop knowledge of the environment and to show how animals and plants are adapted to a range of very different environments.

LEARNING OUTCOMES

Students should be able to:

- Explain how different adaptations affect the chances of survival of different species of organisms.

START (5 min)

Ask students if you are placed in a desert what you will do to survive there for the longest period of time.

MAIN (30 min)

Read Pages 43-44

- Give them about 30 min to complete the activity, making sure each group has at least one student who is confident about drawing.
- Describe how animals and plants are adapted to live in different habitats.

REFLECTION (10 min)

- Discuss each poster with the entire class. Encourage students to ask questions and the

group who made the poster to explain their reasons for their ideas.

- Worksheet 1-3

HOMEWORK

- Exercise question 3 and 4 page 56 of the student book.

Lesson 3

Pages 45-46

OBJECTIVE

- To differentiate the variations and adaptation.

LEARNING OUTCOMES

The students should be able to:

- explain and illustrate the differences between variation and adaptation.
- recognize genetics as the study of heredity and understand and define heredity as the transfer of genetic information that specifies structure, characteristics and function, from parents to offspring.

START (15 min)

- Show the picture of and discuss Gregor Mendel founded the science of genetics.

Ask from students:

Q. How do they resemble their parents?

Q. How are they different from their parents?

MAIN (15 min)

Read pages 45-46

- Explain the term genetics
- Explain that heredity is the transfer of information that controls structure, characteristics and behaviour of offspring from their parents into the offspring.
- Discuss that the basic units of heredity are genes.
- Discuss that the Genes carry information that determines characteristics such as the colour of your hair, skin and eye.

PLENARY (15 min)

Discuss questions in test yourself page 46 of the student book.

HOMEWORK

- Search and write some achievements of Gregor Mendel.
- Exercise question 4 page 56 of the student book.

Lesson 4

Pages 47-49

OBJECTIVE

- To develop the concept of genetics and heredity.

LEARNING OUTCOMES

The students should be able to:

- differentiate between the concept of genes and chromosomes and relate them to how genetic characteristics are inherited.
- describe the composition and structure of DNA.
- design a model of DNA to demonstrate its structure, functions and various components.

START (15 min)

- Activity page 47: Ask your teacher if they can tell you which of their characteristics they inherited from each of their parents.

MAIN (15 min)

Ask students to read Pages 47-49

- Discuss about the terms dominant and recessive genes.
- Explain that a person who has two identical gene alleles for a characteristic is homozygous.
- Show a poster of and explain DNA stands for deoxyribonucleic acid.
- Explain that every chromosome contains one long DNA molecule.

PLENARY (15 min)

- Give play dough and ask students to make a 3D model of DNA.
- Worksheet 2-3
- Discuss questions in test yourself page 48 and 50 of the student book.

HOMEWORK

- Exercise question 6 page 57 of the student book.

Lesson 5

Pages 50

OBJECTIVE

- To describe cell division and its types.

LEARNING OUTCOMES

- Describe cell division and its types – mitosis and meiosis and relate them to the passage of genetic information through reproduction.

START (15 min)

- Ask students to find out the definition of cell division from the book.

MAIN (15 min)

- Explain the cell division and its types.
- Demonstrate it with the help of play dough.

PLENARY (15 min)

- Students will write the important points of the lesson in their notebooks.

HOMEWORK

- Ask students to search interesting facts about cell division.

Lesson 6

Pages 51-52

OBJECTIVE

- To understand stages of mitosis.

LEARNING OUTCOMES

- Explain the process of mitosis and meiosis and identify their key phases.

START (15 min)

Show the following video

https://www.youtube.com/watch?v=zrKdz93WlVk

MAIN (15 min)

- Ask students to think and draw possible stages of mitosis from their understanding from the video.

Read pages 51 -52

PLENARY (15 min)

- Give paper plates thread and glue to students to make a model of stages of mitosis.

HOMEWORK

- Do Q7 on page 57 of student book.

Lesson 7

Pages 53-54

OBJECTIVE

- To understand the process of meiosis and its key stages.

LEARNING OUTCOMES

- Explain the process of mitosis and meiosis and identify their key phases.

START (15 min)

Show the following video.

https://www.youtube.com/watch?v=zrKdz93WlVk

MAIN (15 min)

- Ask students to point out the differences between mitosis and meiosis.
- Read pages 51 -52

PLENARY (15 min)

- Give paper plates thread and glue to students to make a model of stages of meiosis.
- Worksheet 3-3

HOMEWORK

- Test Yourself on page 54 of student book.

Q1

ADAPTATION is a way an animal's body helps it survive or live in its environment. Fill in the table below to show how different animals have adapted to their habitat.

Animal feature	Name an animal which that this feature	What type of habitat does this animal live in?	How does this feature help the animal that cope with the environment?
Long Eyelashes			
Big ears			
Thick Feathers			

Q2

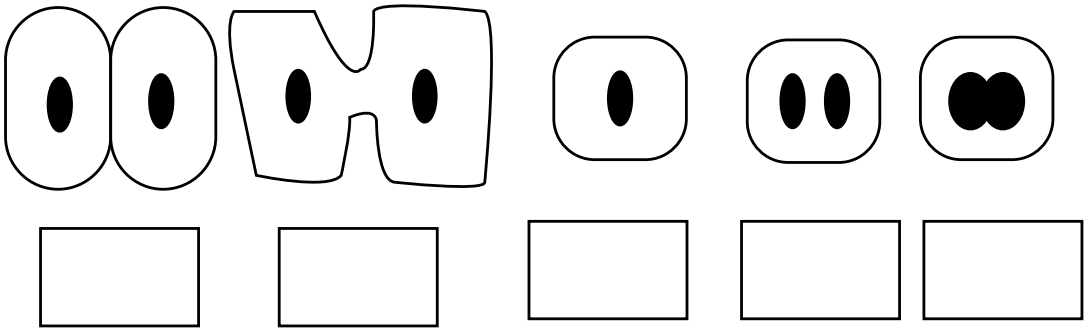
Why can't we see polar bears living in the desert?

1. In normal circumstances would the following traits be purely genetic or would the environment and/or a person's behaviour affect them? Are they examples of continuous or discontinuous variation?

Trait	Only genetic or also environmental	Continuous or discontinuous
gender		
height		
blood type		
left handedness		
eye colour		
fingerprint		
heart rate		
ability to roll tongue		

2. What is biometric verification and why is it necessary?

a. Two new cells are made when cell a divides. Arrange the following pictures by giving correct number.



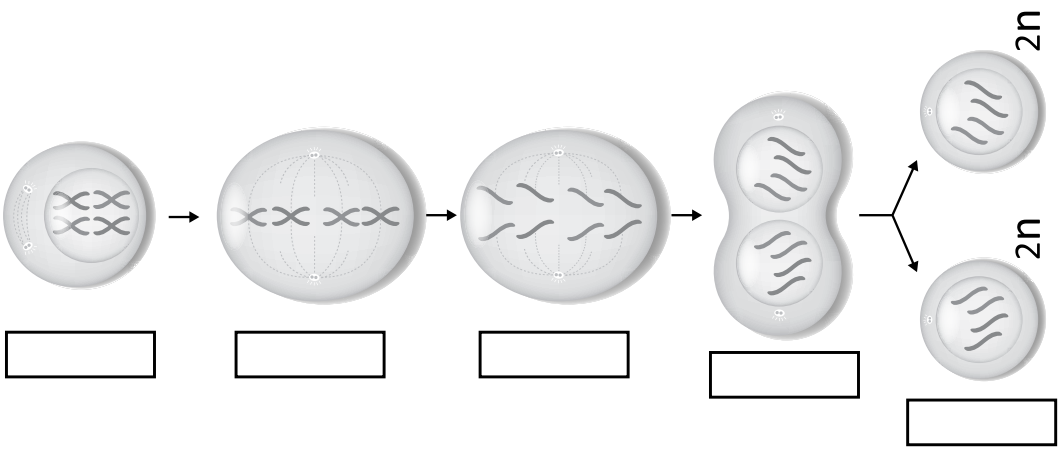
b. What is the significance of cell division?

_____

c. State what kind of cell division is it. Also write names of its phases.

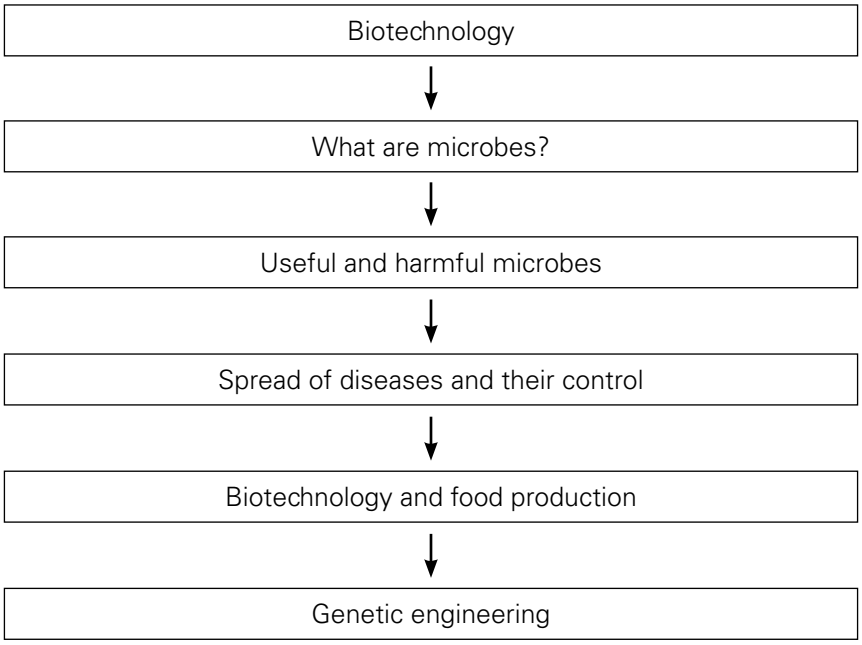
_____

d. Lable the following diagram:



Chapter 4 Biotechnology

UNIT FLOW CHART



INTRODUCTION

Although there is insufficient conclusive evidence, many people who study the history of disease and medicine believe that pre-historic civilisations most likely related (some) diseases to the actions or influence of spirits. It is also likely that they had some knowledge of herbal medicine.

The Egyptian civilization developed writing so they could pass on knowledge beyond what was remembered. Doctors carefully observed the results of treatments and (religious) value was placed on cleanliness.

Chinese medicine initially thought disease was caused by evil spirits, but around 1000 BCE there is evidence that they used specific drugs to treat diseases. The earliest evidence for the use of acupuncture is from 100-200 BCE.

The Greeks continued the process started by the Egyptians. They still believed in many gods, but the influence they were believed to exert on people's lives diminished as the Greeks gained more scientific knowledge.

Roman medicine was influenced by the needs of the army and this resulted in a focus on prevention rather than cure. of course, we now believe we know a lot more and are beyond superstitions – but most of us will warn others to dress warmly in winter 'or you will catch a cold'. A 'cold', like a number of other diseases, is caused by infection by a virus, not by a drop in temperature. As it gets colder outside, we spend more time indoors, rebreathing the same air and in closer contact with others. If one of these has a 'cold', the opportunities for transmission are greater than they are when it is warmer.

In this chapter, we will learn about microbes – organisms we did not even know existed until the middle of the 17th century. Some microbes are certainly capable of causing a lot of harm (such as the bacteria which caused the plague and killed as many as 25 million people in the Middle Ages) but others are beneficial, and quite a few are essential to our lives.

Lesson 1

Pages 60-62

OBJECTIVES

Introduce biotechnology with examples of fermentation in yeast

LEARNING OUTCOMES

Students should be able to:

- define biotechnology as the use of living cells and organisms in products and processes that can improve the quality of life.
- illustrate how biotechnology is a discipline/ field that has the potential to transform how we live.

START (10 min)

Ask if any of your students has been sick recently. Ask them if they would like to say what was wrong with them and what caused it. Answers may include injury, genetic diseases, and things like colds and measles. Discuss the difference between injury and disease, and between infectious and non-infectious diseases (those which have, e.g. genetic causes, allergies, etc.). It is worth spending some time on this since not all students may be clear on the causes of infectious diseases.

MAIN (25 min)

Read Pages 60-62

- Explain Biotechnology began thousands of years ago with fermentation.
- Discuss that yeast uses enzymes to break down the glucose into alcohol, carbon dioxide, and water. In doing so, energy is released.
- Worksheet 1-4
- Draw students' attention to the fact that one bacterium, one virus, or one fungus is unlikely to have any effect, good or bad. So the reproduction of these organisms is what we want, or want to avoid. Ask students to complete Task 1 of Worksheet 1-4.
- In Task 2, students are asked to calculate bacterial growth. Either have them do this with a calculator or co-teach with your IT colleague (and do it in Excel). The aim is to develop the understanding that bacterial growth initially is small, but once a sizable population exists, numbers increase very rapidly. You will refer to this when talking about disease.
- Tell them that microbes are useful too. It is important that students realize this because it is a common perception that an absence of microbes would be ideal; but this is not the case.

PLENARY (10 min)

Not only is cheese made with bacteria, some cheeses, get their structure and taste from the (edible) fungus that grows on their crust. Other foods which require the action of microbes are coffee, chocolate, olives, vinegar, etc. Ask students to investigate one of these or another type of food which involves microbes.

Discuss questions of test yourself page 61 of the student book.

Recommended extension

You could consider doing a whole lesson on non-biodegradable materials. Do some research on where it goes. A video search on the internet, using, e.g., 'How Much Plastic is in the Ocean?' as your search term should provide you with a number of videos about this topic. It is recommended to download these videos and then show them to your students to avoid disappointment if there is a problem with the internet. Have your students collect some waste, create posters, write articles for the school newspaper, or produce information brochures to send to parents. Showing parents that their children are learning about science in a practical way will impress most of them!

HOMEWORK

- Exercise question 3 page 73 of the student book.

Lesson 2

Pages 62-65

OBJECTIVES

Introduce genetic engineering and how it can help in making vaccines

LEARNING OUTCOMES

Students should be able to:

- discuss the applications of biotechnology in the Pakistani context and their effects on the people and the environment of Pakistan over time. Illustrative examples include: bread-making, making of yoghurt and cheese, vaccines for immunisation, insulin production, dyes etc.

START (10 min)

Discuss the following with students:

- Would they be willing to shake hands with a classmate?
- What if they saw this person sneeze while covering his/her nose and mouth with his/her hand. Would they still shake hands?
- What if this person used this hand to open the door? Would the student be willing to touch the door handle? What would be their reasons for being reluctant in any of the above scenarios? In Germany, it is fairly common for all students to shake hands with the teacher at the beginning and end of the lesson. While this may be considered polite, is it a good idea from the perspective of health? Suppose the first student carries some disease-causing microbes on his/her hands. Who would these microbes have spread to by the end of the lesson?

MAIN (15 min)

Read pages 62-65

- Discuss the diseases mentioned. Do any of your students know the symptoms?
- Discuss about diabetes is a disease where the body cannot control the level of sugar in the blood.
- This will be in continuation with the line above blood because not enough insulin is being produced.
- Explain that the creamy texture of yoghurt is produced by bacteria.
- Discuss that using genetic engineering, scientists use bacteria to produce human insulin.

PLENARY (15 min)

Activity page 62: Look on the side of a yoghurt pot for the list of ingredients. Write down the names of the bacteria that are used to make the yoghurt. Compare this list with other brands and types of yoghurt. Are the bacteria used the same or are they different?

Discuss questions of test yourself page 62 of the student book.

HOMEWORK

- Exercise question 4 and 5 page 73 of the student book.

Lesson 3

Pages 66-71

OBJECTIVE

- To know about the uses of biotechnology in the field of food sciences.

LEARNING OUTCOME

The students should be able to:

- relate the use of biotechnology in food sciences in producing foods with higher nutritional value and improved taste and quality (improvement of fermentation through genetically modified organisms or the introduction of certain genes to raise iron content in rice can be taken as examples).

START (15 min)

Read pages 66-71 and ask students to share what they have understood.

MAIN (15 min)

- Explain that genetic engineering is used to make vaccines.
- Explain that the process of Genetic modification involves removing the gene or genes that code for a desirable characteristic and inserting them into the DNA of other species.
- Discuss that the organism that has been modified is called transgenic.
- Explain the artificial selection that human artificially select only the most productive animals and plants to breed from.
- Discuss about golden rice
- Explain that a transgenic organism is iron-enriched rice.

PLENARY (15 min)

Activity page 70: Having read this chapter, have a debate with some of your classmates about the advantages and disadvantages of genetically modified foods.

HOMEWORK

- Exercise question 6 page 74 of the student book.

Biotechnology has been practiced for centuries. It has come a long way and has become much more advanced. Biotechnology has immensely impacted many fields. You have come to know about the achievements of biotechnology in your class and through your book.

1. Search for some more achievements that you find interesting using the internet or books.

_____

_____

_____

_____

_____

_____

2. Search and state how you think the present field of biotechnology is different from the past.

_____

_____

_____

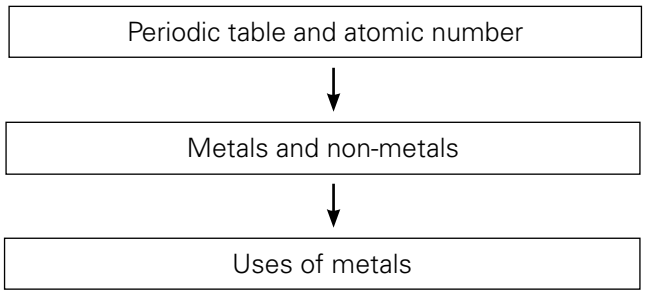
_____

_____

_____

Chapter 5 Periodic Table

UNIT FLOW CHART



INTRODUCTION

The purpose of this chapter is to give the students a basic knowledge of an atomic structure, the periodic table, and how atoms combine together in different ways to form compounds. Students should have a basic knowledge of atoms, molecules, and formulae which are the fundamentals of chemistry.

An atom is far too small to be seen by the naked eye. Only by using powerful microscopes it is possible to obtain a picture of an atom. It is difficult to imagine anything so small. Despite these difficulties scientists have been able to find out a great deal about atoms.

The periodic table is one way of arranging elements into groups that share similar properties. It was developed gradually over many years. In the early nineteenth century, a scientist called Döbereiner noticed that elements could be grouped into threes; each member of the group had similar properties to the other two. This idea was developed further by a British scientist, John Newlands. He arranged all the known elements in order of increasing atomic mass.

In 1869, the Russian chemist Mendeleev arranged the elements in order of relative atomic mass. However, he left gaps for elements that had not yet been discovered, and predicted the properties of those elements. These predictions proved correct when the elements were eventually discovered.

Each of the elements in the periodic table is shown by a symbol, a number above it and a number below it. The lower one is the atomic number. The upper one is the relative atomic mass.

Lesson 1

Pages 77-78

OBJECTIVE

- To know about the periodic table.

LEARNING OUTCOMES

Recognise Periodic Table as a way of classifying the elements in groups and periods.

START (15 min)

- Ask students to make a model of atomic structure with chocolate beans or any round shaped candy.
- Ask students to label electrons, protons, and neutrons.

MAIN (25 min)

Explain the concept of atomic number.

- Tell them that there are over 100 elements in the world. If they are asked to arrange them so that it will be easier to study them, then how will they do it.
- Introduce periodic table and explain them about periods.

PLENARY (15 min)

Do Test Yourself page 78 of student book.

Lesson 2

Pages 79-81

OBJECTIVE

- To know about periods in a periodic table.

LEARNING OUTCOMES

Recognise Periodic Table as a way of classifying the elements in groups and periods.

START (15 min)

- Ask students to open the following link and let them explore the periodic table.

https://www.youtube.com/watch?v=t_f8bB1kf6M

MAIN (25 min)

Read pages 79-81 to explain periods.

- Now ask them to observe groups and periods in the simulation of periodic table.

PLENARY (15 min)

Do Test yourself page 82 of the student book. Complete worksheet 1-5.

HOMEWORK

- Do Exercise questions 3 and 4, page 87 of the student book.

Lesson 3

Pages 82-85

OBJECTIVE

- To introduce the periodic table as a way of classifying elements.

LEARNING OUTCOMES

The student should be able to:

- Identify the properties of metals and non-metals.
- Relate the properties of metals to their uses.

START (10 min)

- Make a list of as many metallic objects as you can find in your house or school laboratory. For each item:

  1. Write down what the metal is.

  2. State the property of that metal that makes it good for its job.

- Carry out Investigation page 88 in the lab.

MAIN (25 min)

- Show the students a chart of the periodic table. Ask the students to classify the elements into metals and non-metals.
- Discuss that most elements in the periodic table are metals. Only about 20% are non-metals.
- Discuss the properties of metals and non-metals.
- Differentiate between the properties of metals and non-metals.
- Discuss questions of test yourself

PLENARY (15 min)

Ask students to write differences between metals and non-metals in their notebooks.

Discuss Worksheet 2-5

HOMEWORK

- Exercise questions 5 and 6

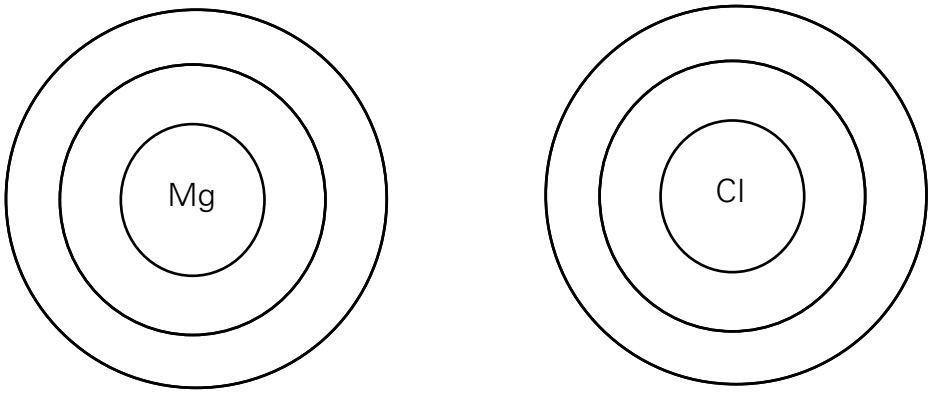
Q1

Complete the following table.

Elements	Atomic number	Mass number	Group	Period
i. oxygen				
ii. magnesium				
iii. calcium				
iv. carbon				

Q2

Complete the distribution of electrons in the following atoms:



Q3

a. Which element belongs to Group 2 and Period 3? _____

b. Which element belongs to Group 7 and Period 5? _____

Q1

In the following periodic table label the metals and non-metals:

	Group I	Group II										Group III	Group IV	Group V	Group VI	Group VII	Group VIII
I							1 H hydrogen 1										2 He helium 4
II	3 Li lithium 7	4 Be beryllium 9										5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
III	11 Na sodium 23	12 Mg magnesium 24										13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
IV	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 55	25 Mn manganese 56	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
V	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium 96	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
VI	55 Cs caesium 113	56 Ba barium 137	lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium 210	85 At astatine 210	86 Rn radon 222
VII	87 Fr francium 223	88 Ra radium 226	actinoids	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium	113 Nh nihonium	114 Fl flerovium	115 Mc moscovium	116 Lv livermorium	117 Ts tennessine	118 Og oganesson

Key: atomic number **Symbol** name mass number

This line divides the metals from the non-metals

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium 147	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	69 Tb terbium 159	66 Dy dysprosium 162	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium 227	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium 237	94 Pu plutonium 242	95 Am americium 243	96 Cm curium 247	97 Bk berkelium 247	98 Cf californium 251	99 Es einsteinium 254	100 Fm fermium 253	101 Md mendelevium 256	102 No nobelium 254	103 Lr lawrencium 257

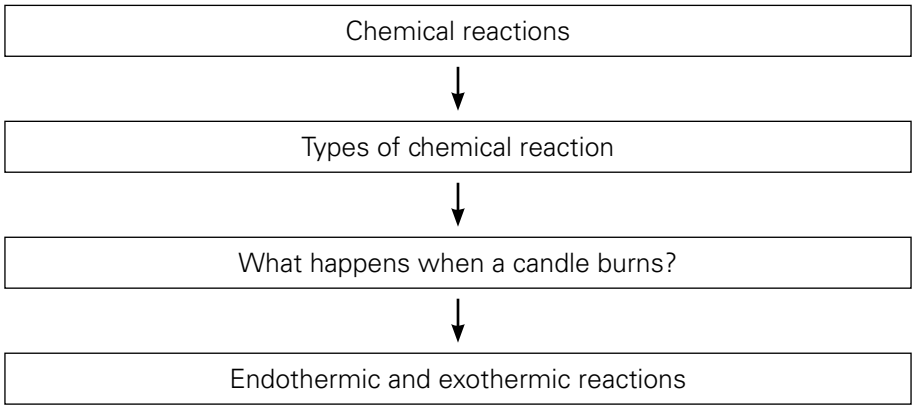
Q2

Complete the following table

Elements	Metals	Non-metals
I. Chlorine		
II. Silver		
III. Oxygen		
IV. calcium		
V. Argon		

Chapter 6 Chemical Reactions

UNIT FLOW CHART



INTRODUCTION

Changes in materials are taking place around us all the time. Most of the changes in materials are of two main kinds. In one kind, the volume or the state of the material is changed. We call this a physical change. In the other kind, one material is changed into another material. We call this a chemical change.

When a physical change takes place, a material is changed in size or form without actually becoming another material. If we stretch or squeeze a piece of soft rubber, we change its size, but it is still rubber. It springs back when we let it go. When sugar dissolves in water it changes form, from a solid to a liquid, but it is still sugar. Other physical changes occur when ice melts, when water freezes, when wet things become dry.

Explain that when a chemical change takes place, a material is changed into one or more different materials. For example, if we hold a piece of paper next to a lighted match, the paper catches fire and burns. A flame is seen, and some smoke, and then nothing but ashes. The paper has disappeared. Such a reaction cannot be reversed. We cannot get back the paper we have burnt. Similarly, when we heat mercuric oxide, mercury and oxygen are produced. A red powder is changed into a silver-coloured liquid and a colourless, odourless gas is given off. Both of these are examples of chemical changes. Other chemical changes occur when wood rots, iron rusts, milk sours, and cloth fades.

Ensure that the students understand the difference between a physical and a chemical change.

Lesson 1

pages 89-90

OBJECTIVE

- To understand law of conservation of mass.

LEARNING OUTCOMES

Define the Law of Conservation of Mass and demonstrate the law with an experiment.

START (10 min)

Experiment to prove Law of conservation of mass.

Requirements

Beaker, water, salt, weigh balance

Procedure

Add water in beaker and weigh on electronic balance. Note that weight. Now, weigh 5 gm of salt and add in beaker. Dissolve it and then weigh.

Have a discussion that why the weight did not change.

MAIN (25 min)

- Read pages 89-90 to understand law of conservation.
- Ask students to think of more examples.

PLENARY (10 min)

Solve the following problem.

6g of sulphur and 7g of oxygen were used to prepare sulphur dioxide gas. What will be the mass of sulphur dioxide gas?

Lesson 2

pages 91-92

OBJECTIVE

- To learn to balance the chemical equation.

LEARNING OUTCOMES

Write and balance chemical equations.

START (10 min)

Ask students about the law of conservation of mass.

MAIN (25 min)

- A physical balance can be used to demonstrate balancing equations.

PLENARY (10 min)

Do Test Yourself on page 92 of student book.

Homework

- Worksheet 6-6

Lesson 3

page 92-96

OBJECTIVE

- To explain what is meant by synthesis, decomposition, displacement, and combustion.

LEARNING OUTCOMES

The students should be able to:

- distinguish between different types of reactions (combination, displacement, double displacement and combustion).

START (10 min)

Ask the students to study displacement reaction on page 76 of the student's book. Explain that here iron and copper are competing to be the compound in the solution. Here iron wins. It drives out or displaces copper from the copper sulphate solution. Green iron sulphate is formed. In the same way, other metals displace less reactive metals. This means that a metal will always displace a less reactive metal from solutions of its compounds.

MAIN (20 min)

Read pages 92-96

- Explain the term synthesis.
- Experiment: Put iron nails into copper sulphate solution. Ask the students if they can see any reaction taking place? Explain that iron can

displace copper because it is more reactive than copper. Now put copper nails into iron sulphate solution. Is there any reaction taking place? Why not?

- Explain that only a more reactive metal can displace a less reactive metal.
- Explain the displacement and combustion reactions.
- Demonstrate displacement and combustion reactions.
- Write balanced chemical equations on the board and explain the terms reactants and products.
- Activity page 96: Make a list of as many chemical reactions as you can observe taking place in your home for one day.
- Worksheets 2-6, 3-6, 4-6

PLENARY (15 min)

Discuss the 'Test yourself' questions on page 96.

Home work

- Write an example of each of the following reactions with a word equation: synthesis, decomposition, displacement, and combustion.

Lesson 4

page 97-98

OBJECTIVE

- To understand endothermic and exothermic reactions.

LEARNING OUTCOMES

The students should be able to:

- distinguish between endothermic and exothermic reactions.
- recognize the importance of exothermic and endothermic reactions in daily life.

START (15 min)

Read page 97-98

MAIN (15 min)

Investigating endothermic and exothermic reactions

Material

beakers

Thermometer

Stirrer

Ice

Water

Vinegar or lemon juice

Baking soda

Procedure

Take water in beaker and note down its temperature.

Then add ice and note down the temperature of water after stirring for few seconds.

Repeat the same process with vinegar and baking soda.

Based on observation, decide which is the endothermic and which one is the exothermic reaction.

PLENARY (15 min)

- Do Test Yourself page 99 of student book.

Lesson 5

page 99-103

OBJECTIVE

- To explain how compounds are formed.

LEARNING OUTCOMES

The students should be able to:

- discuss the formation of ionic bonds as a result of electrostatic forces between atoms (e.g. NaCl).
- discuss types and formation of covalent bonds as a result of mutual sharing of electrons between atoms (e.g. H_2, O_2, N_2)
- name certain ionic and covalent compounds.

- draw cross and dot structures showing formation of ionic compounds and covalent compounds.

START (10 min)

Please ensure that students have read pages 99-103.

- Elicit students' prior knowledge about mixtures and compounds, and physical and chemical changes. Make sure that they understand that a new substance is made (with different properties) when a chemical change takes place. It is likely that some students remember that water is H_2O.
- They may remember that H is hydrogen – a flammable gas, and that O is oxygen – a gas that is needed for combustion. Together they form water, a liquid which, ironically, can be used to put out fires.
- Draw a dot and cross structures of H_2, O_2, N_2
- Draw a dot and cross structure of NaCl

MAIN (20 min)

- Explain by using coloured chalks/markers in dot and cross diagrams how magnesium and oxygen atoms share electrons to complete their octet and form covalent bonds.
- Explain that when two or more elements join, they form a compound.
- Identify the types and number of elements present in simple molecules and compounds.
- Explain the formation of covalent and ionic bonds.
- Mention the three types of covalent bonds with examples. Also explain how a formula is constructed.
- Task 1 of Worksheet 3-6 is just a quick reminder of the two types of compound.
- In task 2, students learn to write word equations. Point out that some elements have the same name as their ion, while others do not.
- The series of questions in task 3 refers to the steps to write an equation.
- In task 4, we look at the molecular formula of some compounds to see the number of atoms in each element. Students may need reminding that the number of atoms is indicated behind the chemical symbol of the element.
- Draw dot and cross models of ionic and covalent compounds.

PLENARY (15 min)

Draw models to show what type of bonds there are within:

a. an oxygen molecule.

b. a nitrogen molecule.

HOMEWORK

- Test yourself questions given on pages 41 and 43 of Student Book.

LEARNING OUTCOME

The students should be able to:

- design a car that is powered solely by a chemical reaction and can travel (STEAM).

START (10 min)

Materials required: square section plastic bottle with plastic screw cap, 2 drinking straws, 2 wooden (bamboo) skewers, 4 large plastic bottle caps, scissors, ruler, pencil sharpener, glue gun, sticky tape (duct tape), baking soda (sodium bicarbonate – a base), vinegar (acetic acid), tissue paper, measuring cylinder or jug, measuring tape.

MAIN (15 min)

Read page 106-108

- Discuss that gas will be formed in a chemical reaction that will push the car.
- Divide the students into groups(4 students).
- Follow the steps given in the investigation page 106-108 and design a car.
- Take care of precautions.

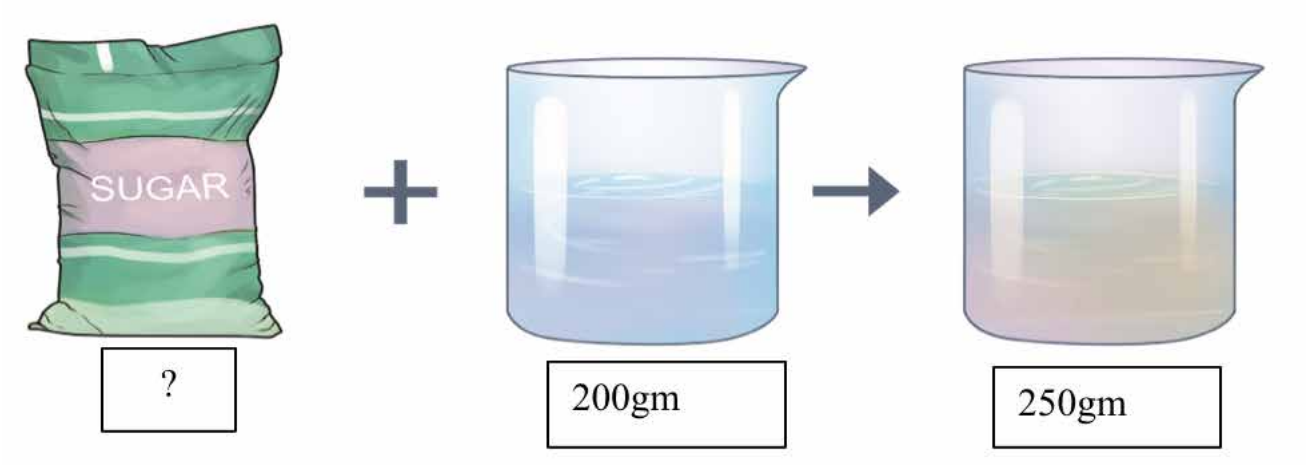
PLENARY (15 min)

Ask students to show their cars and compare with the designed by the other groups. Is the reaction endothermic or exothermic or neither?

Home work

- Suggest what changes you might make, to enable the car to travel further.

Some water was weighed in the beaker and its mass was 200gm. Some sugar was dissolved in it and the beaker was weighed again. This time the mass was 250 gm.



Answer the following questions.

a. Where did the sugar go?

_____

_____

b. Why did the mass increase?

_____

_____

c. Predict the mass of sugar dissolved.

_____

_____

d. Is there any way to destroy sugar completely?

_____

_____

1. Iron filings and sulphur are mixed in a watch glass.
   i. How would you separate the iron from the sulphur?

   _____

   _____

   ii. What type of change is this?

   _____

   _____

2. Iron filings and sulphur are put in a test tube and heated.
   i. What new substance is formed?

   _____

   _____

   ii. What type of reaction is this?

   _____

   _____

   iii. Can you now separate the iron from the sulphur? Give a reason for your answer.

   _____

   _____

   iv. What do you call the reaction in which heat is taken in, and the reaction in which heat is given out?

   _____

   _____

3. Iron reacts with oxygen to form iron oxide.
   i. Represent this chemical reaction with a word equation.

   _____

   _____

   ii. Name the reactant and the product in this chemical reaction.

   _____

   _____

Task 1

Burn a piece of magnesium ribbon in a jar of oxygen covered with a lid.

i. What new substance is formed?

_____

ii. Is this a chemical reaction?

_____

iii. Represent this reaction in the form of a word equation

_____

iv. Name the reactant and the product of the above reaction.

_____

v. When any element combines with oxygen, what is the process called?

_____

Task 2

Heat a small amount of sugar in a test tube.

i. What two new substances are formed in this reaction?

_____

ii. Represent the above reaction in the form of a word equation.

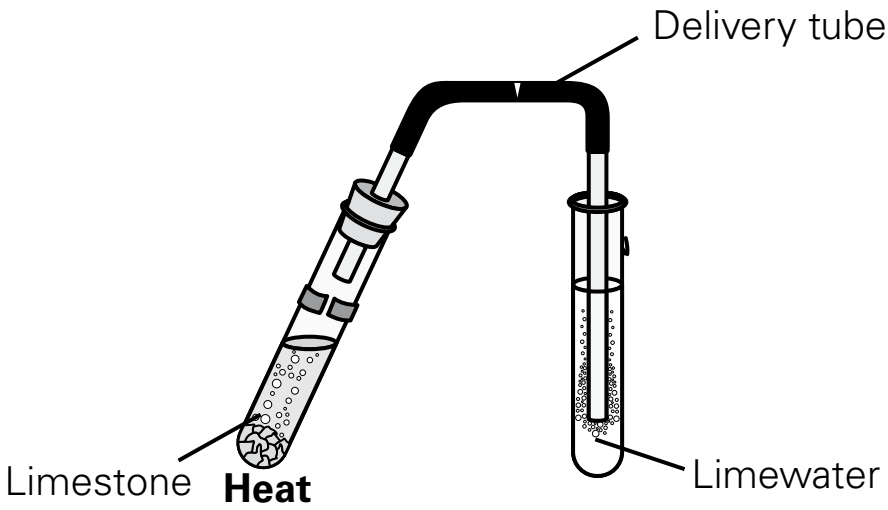
_____

iii. What type of reaction is this?

_____

Task 3

Heat a small amount of calcium carbonate (limestone) in a test tube. Pass the gas produced through some lime water.



i. Write a word equation for the above reaction.

_____

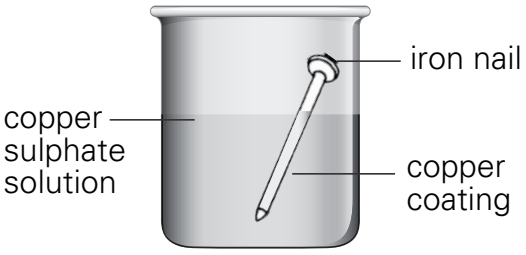
ii. What is the test for carbon dioxide?

_____

iii. What do you call to the process of breaking a compound into two or more substances?

_____

Put an iron nail into copper sulphate solution in a beaker.



i. Is this a chemical reaction? Give reasons to support your answer.

_____

ii. What type of chemical reaction is it?

_____

iii. Write chemical equation of the reaction.

_____

Light a candle and ask the students to observe the flame.

i. What type of reaction is this?

_____

_____

ii. What new substances are formed when a candle burns?

_____

_____

iii. Is this an exothermic or an endothermic reaction?

_____

_____

iv. Is respiration an example of combustion? Give reasons for your answer.

_____

_____

Balance the following chemical equations

1. $CO_2 + H_2O \longrightarrow C_6H_{12}O_6 + O_2$

2. $SiCl_4 + H_2O \longrightarrow H_4SiO_4 + HCl$

3. $Al + HCl \longrightarrow AlCl_3 + H_2$

4. $Na_2CO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$

5. $Ca_3(PO_4)_2 + SiO_2 \longrightarrow P_4O_{10} + CaSiO_3$

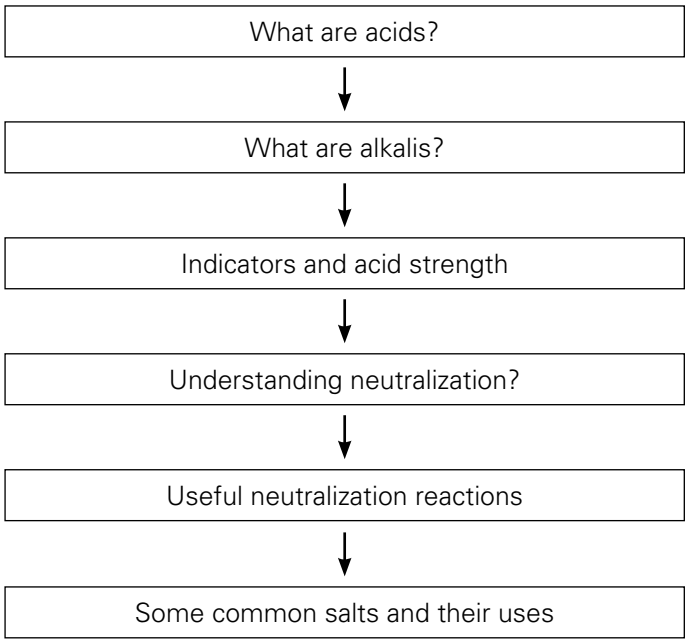
6. $KClO_3 \longrightarrow KClO_4 + KCl$

7. $Al_2(SO_4)_3 + Ca(OH)_2 \longrightarrow Al(OH)_3 + CaSO_4$

8. $H_2SO_4 + HI \longrightarrow H_2S + I_2 + H_2O$

Chapter 7 Acids, Bases, and Salts

UNIT FLOW CHART



INTRODUCTION

Students are likely to be familiar with acids but a lot less (if at all) with alkalis or bases. It is important to consider the safety aspect of these chemicals and to be aware that alkalis are just as harmful as acids. Please ensure that students working with alkalis are aware of the dangers, just as they would be with acids, and please ensure safety glasses are worn. In general, students this age should not be working with concentrated acids or alkalis.

Another misconception relates to the opposite of acid. If our juice is too sour, we add sugar to make it taste better. Our palate seems to suggest that sweet is the opposite of sour. Please help students understand that in chemistry, we work with acids and alkalis and not with sweet and sour. If students struggle with separating these concepts, you could have two batches of the same juice. Leave one outside the lab and measure the pH of the other in the lab. Take the students out to taste the juice (no eating/drinking in the lab), add a known amount of sugar and have them taste it again. It will taste less sour. Go back into the lab, add the same amount of sugar to the same amount of juice and test the pH. It should not change as the sugar does not impact pH.

Some hazardous chemicals can also be found outside the lab. For example, many chemical drain cleaners are strong alkalis and could cause harm when they come into contact with skin, eyes or when inhaled. Without wanting to scare students, it would be useful if they realized that many of the products we find useful and potentially harmful.

Making soap could be a fun experiment to do in the lab but requires sufficient supervision to ensure the students safety. Also, the product (soap) should be left for a few weeks to ensure all hydroxide has reacted.

Note: If you are doing a neutralization reaction between acid and alkali, it is recommended to put the acid in the burette (rather than the alkali). Acid is easier to clean and alkali may damage the glass of the burette. It may also damage the beaker but burettes are much more expensive.

Lesson 1

Pages 109–112

OBJECTIVE

- To explain how acids and alkalis can be identified and distinguished from each other.

LEARNING OUTCOMES

The students should be able to:

- classify acids, alkalis and salts and give examples of each.
- identify the physical and chemical properties of acids, alkalis and salts.
- observe and write the uses of acid, alkalis and salts in daily life.

START (10 min)

- Ask students which food/drink they know of tastes sour? Answers may include vinegar, lemon, fruits. Have a discussion about what sour tastes they enjoy.
- Read pages 109-110 and discuss the fact that a sour taste is caused by the presence of acid.
- What do they consider to be the opposite of sour? (Most likely, the answer will be "sweet") So what do they do if their orange juice is too sour? (It is likely that answers will include "add sugar".)
- Explain that while sweet may be the opposite of sour in taste, sugar does not affect the acidity of a solution – it only adds a sweet flavour so we notice the sour less.
- Ask the students if they have ever felt a heartburn, if they have what did they take to cure it? Bring in some antacid tablets and let students check what they contain.

MAIN (35 min)

Read Pages 109-112

- Students should be able to differentiate between a strong acid and a weak acid. Students must be familiar about the pH level of these different acids. Strong acid contain more hydrogen ions in solution than weak acids. Dilute acid contains more water than concentrated acid.
- identify some acids and their everyday uses.
- explain the difference between the strength and concentration of an acid.
- explain the difference between a base and an alkali.
- Test different acids with litmus paper and find out the pH of different alkalis.
- Show them the test for acids. Let them do the test themselves.
- Write down different alkalis on the board with their formulae. What do all alkalis have in common? How will you define alkalis?
- Test different alkalis with litmus paper and find out the pH of different alkalis.
- Discuss the properties of acids and alkalis and their uses in group activity.

PLENARY (15 min)

Take different substances like lemon juice, pure water, vinegar, sulphuric acid.

Find out pH from pH paper. Find out whether they are strong weak or neutral.

HOMEWORK

- Write five properties of acids and alkalis in notebooks.
- Find out as much as you can about acid rain. Write or email environmental pressure groups and power stations. Present your findings in a report.
- Exercise questions 4 page 122 of the student book.

Lesson 2

Page 113 and 114

OBJECTIVE

- To explain how acids and alkalis can be identified and distinguished from each other.

LEARNING OUTCOMES

The students should be able to:

- define pH and its ranges with reference to indicators.
- interpret the pH scale and identify acids, alkalis and salts.

START (10 min)

- At the start of this topic, we spoke about acids in food, giving it a sour taste. If we want to know if something in the lab is an acid, tasting it may not be very safe. The same goes for alkalis. So we need another method to decide if a solution is an acid or alkali and how acidic or alkaline it is.
- Explain what are indicators and how are they made.
- State some of uses of indicators.
- Discuss with students the meaning of the word 'indicator'. An indicator shows something. In chemistry, an indicator is a solution which has a different colour in an acidic solution compared to an alkaline solution.
- Why do we use indicators for acid and alkalis?

MAIN (20 min)

Read Pages 113-114

- Different indicators will be shown with their uses and explain how they are formed from different plants. If possible, have students make their own indicator (see "extension" at the end of this lesson).
- Ask students to test different indicators themselves with acids and alkalis.
- Investigation page 124 of the student book.
- Worksheet 1-7

PLENARY (15 min)

Name different indicators, their colors in acid and alkalis.

What is a universal indicator?

Discuss the questions test yourself page 114.

HOMEWORK

- Exercise questions 5 and 6 page 122 and 123 of the student book.

Lesson 3

page 115-116

OBJECTIVE

- To describe neutralization.

LEARNING OUTCOME

Describe neutralization reaction with real life examples.

START (5 min)

- Perform neutralization reaction using hydrochloric acid and sodium hydroxide.
- Take pH of sodium hydroxide and hydrochloric acid using universal indicator paper.
- Clamp burette in an iron stand and fill it with 50ml sodium hydroxide.
- Take 10ml hydrochloric acid in a conical flask.
- Add one to two drops of phenolphthalein in conical flask.
- Now, slowly add sodium hydroxide from burette into the flask till the solution in conical flask becomes light pink in colour.
- Take pH of the solution in conical flask.

MAIN (15 min)

- Explain the neutralization using the experiment.
- Read pages 115-116.

PLENARY (15 min)

Do Test Yourself page 115 of student book.

HOMEWORK

- Do Test Yourself page 116 of student book.

Lesson 4

page 117-119

OBJECTIVE

- To understand the application of neutralization in our daily life.

LEARNING OUTCOME

Describe neutralization reaction with real life examples.

START (5 min)

- Bring toothpaste and antacid solution. Take pH of these.

MAIN (15 min)

- Explain the uses of neutralization reaction with the help of examples.
- Read pages 117-119.

PLENARY (15 min)

Do Test Yourself on page 118 and 119 of student book.

HOMEWORK

- Worksheet 3-7

Q1

Acids are solutions which contain H^+ ions. The more H^+ ions, the more acidic the solution is. Acids are found in many foods and can taste great but other acids are dangerous and can burn your skin or eyes. When working with acids, always wear safety glasses to protect your eyes.

Answer the following questions.

i. What is the chemical formula of hydrochloric acid?

ii. As hydrochloric acid is an acid, it must release its H^+ ions. Can you think of what this equation would look like?

$$HCl \longrightarrow H^+ + \_\_\_\_\_$$

iii. Cross out the incorrect word:

a. If we put a lot of HCl in a little water, we have made a concentrated / dilute solution of HCl.

b. If we put a little HCl in a lot of water, we have made a concentrated / dilute solution of HCl.

iv. Describe the difference between a concentrated and a dilute solution.

Q2

The reaction you completed above is called the dissociation of hydrochloric acid: the hydrochloric acid separates into hydrogen ions and chloride ions. When you put hydrochloric acid in water, (almost) all hydrochloric acid molecules will dissociate into hydrogen ions and chloride ions. Acids which (almost) completely dissociate are called strong acids. Examples of strong acids are hydrochloric acid (HCl) and nitric acid (HNO_3).

Some other acids are weak acids. They do not dissociate completely in water. Examples are carbonic acid (H_2CO_3) and acetic acid (CH_3COOH).

For example, when acetic acid is placed in water, a few of the molecules will dissociate:

$$CH_3COOH \longrightarrow H^+ + CH_3COO^-$$

but many CH_3COOH molecules will not dissociate and just remain as they are. The strength of an acid (strong or weak) is a property of the acid and we cannot change this.

We can decide the concentration of any acid. So we can have a concentrated solution of a strong acid or a concentrated solution of a weak acid. The same for a dilute solution of a strong acid or a dilute solution of a weak acid.

i. Describe the difference between a strong and a weak acid. Give an example of each.

_____

ii. You have concentrated solution in the laboratory. You want to make it dilute. How will you dilute this concentrated solution?

_____

iii. You have two beakers of acids with different strengths. How will you find out the strength of these acids?

_____

Q3

Test the pH values of the following substances and classify them as strong acid, weak acid or neutral.

Substances	pH values	Strong/Weak/Neutral
1. Lemon juice		
2. Pure water		
3. Vinegar		
4. Sulphuric acid (concentrated)		
5. Acid rain		

Q1

Write down the formulae of following acids.

i. Hydrochloric acid _____

ii. Nitric acid _____

iii. Sulphuric acid _____

Q2

EXPERIMENT: Put some limestone in a test tube and add some dilute hydrochloric acid. Pass the gas through lime water as shown in the diagram.

i. What is the chemical name of limestone?

_____

ii. What happens when acid reacts with carbonate?

_____

iii. Which gas is produced?

_____

iv. What is test for this gas?

_____

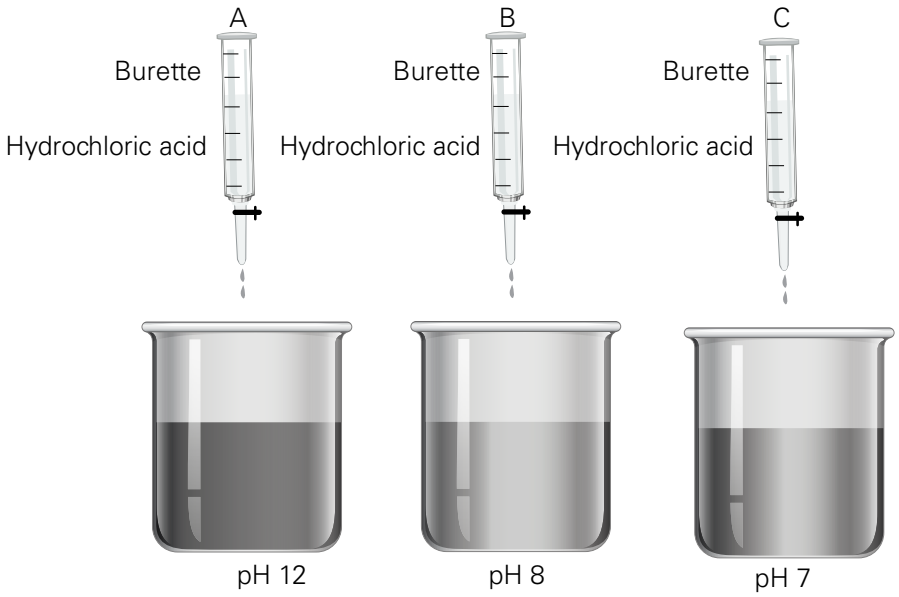
v. What is the equation for the above reaction?

_____

vi. What is the chemical property of acids?

_____

Setup the experiment as shown in the diagrams below.



i. What is the effect on pH when acid is added from the burette into the beaker with sodium hydroxide and universal indicator in diagram A?

_____

ii. What does pH 7 indicate in diagram C?

_____

iii. What does pH 8 indicate in diagram B?

_____

iv. What is neutralization?

_____

v. Write three uses of neutralization.

_____

vi. What types of salts are produced when sodium hydroxide reacts with:

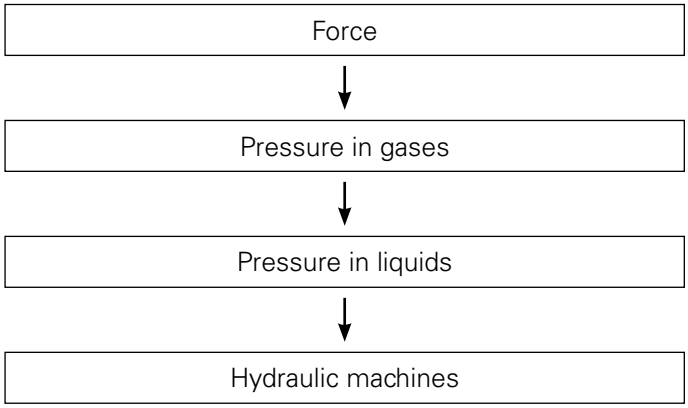
a. Hydrochloric acid _____

b. Nitric acid _____

c. Sulphuric acid _____

Chapter 8 Force and Pressure

UNIT FLOW CHART



INTRODUCTION

Suppose you were to bring into your class a hammer, a nail, and a piece of wood. You then asked the students to watch while you try to hammer the nail into the wood. However, you put the head of the nail on the wood and hammer the sharp point. Then, mystified, you ask your students what is wrong. At this point, they are probably laughing loudly and tell you that you have the nail the wrong way round. Without realizing, they already know about the relationship between pressure, force, and area.

This chapter can be explained very well with the help of simple demonstrations in class or examples from daily life. Use suitable videos from internet to explain the concepts given in the chapter.

Lesson 1

page 125-127

OBJECTIVE

- To understand balanced and unbalanced forces.

LEARNING OUTCOME

- Recognize that several forces may act on an object and that they may or may not balance each other.

START (15 min)

Read pages 125-127

Define force with examples of push and pull.

MAIN (15 min)

- Take students for Tug of war.
- Give example of unbalanced forces by putting unequal number of students on both sides.
- Similarly, give example of balanced forces by putting same number of students such that the rope remains in middle.
- Describe the effects of balanced and unbalanced forces.

PLENARY (15 min)

Do Test Yourself on page 128 of student book.

HOMEWORK

- Do Q3 on page 137 of student book.

Lesson 2

page 128-129

OBJECTIVE

- To differentiate between floating and sinking objects in terms of density.

LEARNING OUTCOMES

- Examine the effect of an unbalanced force on an object.
- Differentiate between floating and sinking objects in terms of density.

START (15 min)

Recreate the experiment given on page 128 using anything which is easily available.

MAIN (15 min)

- Explain upthrust with the help of the experiment.
- Read pages 128-129.

PLENARY (15 min)

Do Test Yourself on page 129 of student book.

HOMEWORK

Do Q4 and 5 on page 137 and 138 of student book.

Lesson 3

Pages 129-131

OBJECTIVE

- To explain the relationship between force, area, and pressure.

LEARNING OUTCOME

The students should be able to:

- relate pressure with force and area.

START (15 min)

Ask your students to hold the pencil as shown. Discuss what they feel and why. Can they give other examples about the size of the area in relation to pressure? You could think of camels' large feet not sinking into the sand, a sharp knife vs a blunt knife, poking a balloon with your finger vs a needle, tracks of a tank vs wheels of a car, etc. Attach a sheet of chart paper onto the soft board with thumb pins and common pins. Which pins are easier to push into the soft board? Why? Why do you feel more pain when pushing common pins?

MAIN (20 min)

Read pages 129-131

- The end of a common pin has a small area so it exerts more pressure on the thumb, whereas the head of a thumb pin has a larger area, so it

exerts less pressure on the thumb. The pointed pin exerts more pressure on the soft board.

- Explain and use the relationship between force, area, and pressure.
- Pressure depends on area and force.
- Write on the board P = Force / Area
- Discuss that Greater force greater pressure. Smaller area, greater pressure.
- Worksheet 1-8

HOMEWORK

Draw and mark different forces observed by a vehicle.

Lesson 4

pages 132-135

OBJECTIVE

- To compare pressure in gases with pressure in liquids, and give examples of their uses.

LEARNING OUTCOMES

The students should be able to:

- define 'pressure' with examples and its unit.
- examine the effect of force in the presence of air pressure.
- investigate effects related to pressure (e.g. water pressure increasing with depth, a balloon expanding when inflated etc.).

START (15 min)

- This is a great experiment for students to do. All you need is syringes without needles and some water. However, it is almost inevitable that they will end up squirting water at each other, so if you are confident that you will be able to restore order, please do this, but do it outside. Take two syringes. The first is filled with air and the second is filled with water.
- Ask from the students which one is easier to compress? Why?

MAIN (20 min)

Read Pages 132-135

- Use particle theory to show what causes pressure in a sealed container or tyres.
- Blow a balloon and explain that as air is blown into the balloon, the increased pressure causes the balloon to inflate. When fully inflated, the pressure inside the balloon is higher than that outside it because the tension forces of the rubber pull against the inflation.
- Describe some effects and uses of gases under pressure.
- Pressure in liquids can be shown by drilling small holes in the container and filling it with water.
- Use the particle model to explain the behaviour of gases under pressure.
- What happens if you put in more gas or if you take out some gas?
- If possible show students videos about gases under pressure.
- Explain atmospheric pressure and demonstrate movement of liquids in straw.
- Explain that hydraulic machines are machines which use liquids to transmit forces. This is called hydraulic pressure.
- Worksheet 2-8

PLENARY (10 min)

- Discuss following questions in class:

  i. What causes pressure in tyres?

  ii. How can you increase the pressure?

  iii. Why do we use air in tyres and not water?

  iv. What is atmospheric pressure?

  v. Where is air pressure higher, at sea level or at the top of a hill?

  vi. When a gas is heated, what happens to the pressure? Explain in terms of particle theory.

HOMEWORK

- Exercise questions 6 and 7 page 138 of the student book.

Lesson 5

Page 139

OBJECTIVE

- To examine the working of an elevator.

LEARNING OUTCOME

The students should be able to:

- make a hydraulic elevator (STEAM).

START (15 min)

12 x iced lolly sticks, wooden (bamboo) skewers, plastic tubing, 2 small syringes, coloured water, piece of flat board or card, thin wire, fine nosed pliers, nail hammer, sticky tape, glue gun, pencil sharpener.

MAIN (15 min)

Read page 139

- Divide students into groups.
- Ask students to follow the steps and design an elevator.
- Monitor the performance of the students.

PLENARY (5 min)

i. What happens when you push the plunger of the syringe?
ii. What happens when you pull the plunger of the syringe?
iii. Try putting some 10 g masses on the card at the top of your hydraulic elevator.
iv. How much can your elevator lift?

HOMEWORK

- Suggest how you might increase the performance of your elevator.

Lesson 6

Pages 140

OBJECTIVE

- To explore that gas is produced in a chemical reaction that apply force to launch a rocket.

LEARNING OUTCOME

The students should be able to:

- build a two stage rocket model (STEAM).

START (10 min)

2 Alka-Seltzer tablets, 2 plastic containers with a tight 'push fit' lid, glue gun, measuring cylinder, marker pen or labels.

MAIN (15 min)

- Ask students to read page 140
- Divide students into groups
- Ask students to follow the steps and design a rocket.
- Monitor the performance of the students.

PLENARY (15 min)

i. Look at the ingredients of Alka-Seltzer tablets. What gas is produced when water is added to an Alka- Seltzer tablet?
ii. Explain how the production of this gas causes the model rocket to launch.
iii. In what way does this experiment demonstrate how a 'real' rocket is launched?
iv. What are the variables in this experiment?

HOMEWORK

- Suggest how you might control these variables in order to increase the chances of a successful two- stage launch?

Q1

Your parents have just put a beautiful, new floor in your house. It is made of a rare and very expensive soft wood. They are inviting a lot of people to a party to show off their new floor. As you receive the guests at the door you come across the following situations: One of the guests brings her cousin who is visiting from abroad. She is tall, and wearing stiletto heels. You estimate her weight to be 980 N and the surface area of each heel to be 0.0001 m^2. Another friend wants to bring in his new pet: an elephant! You estimate the elephant's weight to be 54000 N and each of its feet to have a surface area of 0.18 m^2.

i. What pressure would each of these exert on your parents' new, soft wood floor?

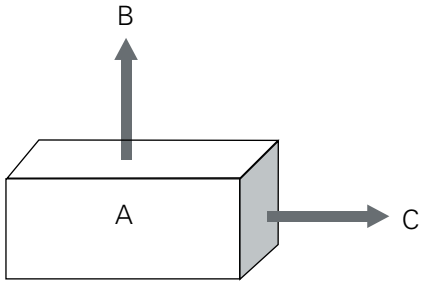
_____

ii. Which guest would cause less damage to the floor?

_____

Q2

A box is to be kept on a weak base. Considering the different sides of the box, answer the following questions.



i. Which side would create the smallest pressure? Why?

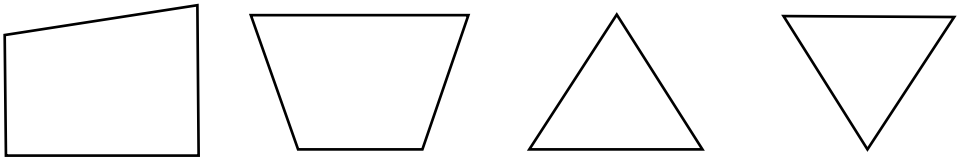
_____

ii. Which side would create the largest pressure? Why?

_____

Q3

Suppose below are the shapes of objects standing on the solid surface. Considering the shapes answer the questions given below.



A B C D

i. Which of the shapes would exert most pressure? Why?

_____

_____

ii. Which of the shapes would exert least pressure? Why?

_____

_____

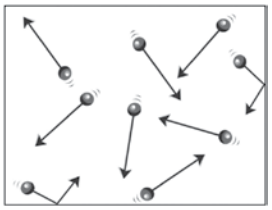
4. Why should the axe of a woodcutter be as sharp as possible?

_____

Q1

In the empty box, draw a particle model of a liquid. Think about the density of the particles in a liquid compared to in a gas, and about their size and speed.

a.



b. Use the above diagrams to explain what happens if you put pressure on a gas and on a liquid.

_____

Q2

i. What would happen if the hydraulic brakes of a car were filled with a gas rather than a liquid?

_____

ii. Explain why tyres are filled with air and not with water.

_____

iii. What happens to the pressure in a tyre during summer when temperature rises? Explain in terms of particle theory.

_____

iv. A diver dives into the sea to a depth of 20m.

a. Why is the pressure at this depth greater than atmospheric pressure?

_____

b. Other than depth and atmospheric pressure, state one more factor which affects pressure in liquids.

_____

1. Experiment

   i. Take two pieces of aluminium foil of exactly the same size and shape.

   ii. Crumple one piece into as tight a ball as you can.

   iii. Fold the other piece into the shape of a boat.

   iv. Put both of them in a bowl of water

   What happened to each piece of foil?

   a. ball _____

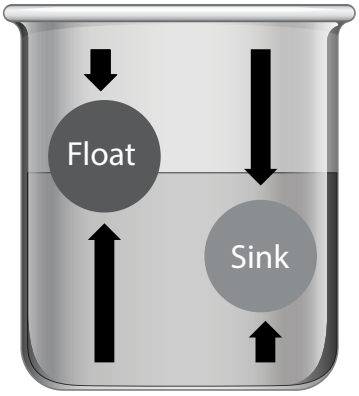
   b. boat _____

2. Up thrust

   When you are in the swimming pool, with the water up to your middle, you seem to weigh less than on land. Whereas gravity pulls you down, the water seems to push you up. This force is called upthrust.

   How much this upthrust, depends on the volume of the object (or person), although the pull of gravity on Earth is relative to the mass of the object (or person).

   If the upthrust is larger than the pull of gravity, the object will float. If the force of gravity is more than the up thrust, the object will sink.



   a. What is the force of gravity on a small but heavy object? big/small

   b. What is the upthrust on a small but heavy object? big/small

   c. Will a small but heavy object sink or float? sink/float

   d. What is the force of gravity on a large but light object? big/small

e. What is the upthrust on a large but light object? big/small

f. Will a large but light object sink or float? sink/float

3. You found a beautiful blue stone on the beach. Is it a sapphire?

The density of a sapphire is 3.98 g/ml.

The mass of the stone is 3.1 g.

The volume of the irregularly shaped stone can be found by putting it in water. The stone will take up space (where water particles used to be), displacing the water. Therefore the level of the water will go up.

The easiest way is to use a measuring cylinder. There was a certain amount of water in the measuring cylinder (volume 1). After adding the stone, the water level went up and is now at level 2. This 'extra' volume is caused by the stone.

Level 2 – level 1 = amount of water displaced = _____

Volume of the stone= _____

If the object does not fit in the measuring cylinder, you can use another container. Put it on a plate or tray which will catch the spilled water and fill the container to the rim. Gently lower the object into the water. Some water will spill out. The volume of the spilled water is the same as the volume of the object. So pouring the spilled water into a measuring cylinder will tell you how much water was displaced, which is the volume of the object.

Suppose there was 20.50 ml of water in your measuring cylinder. After adding the stone, the water level went up to 21.75 ml.

What was the volume of the stone? _____

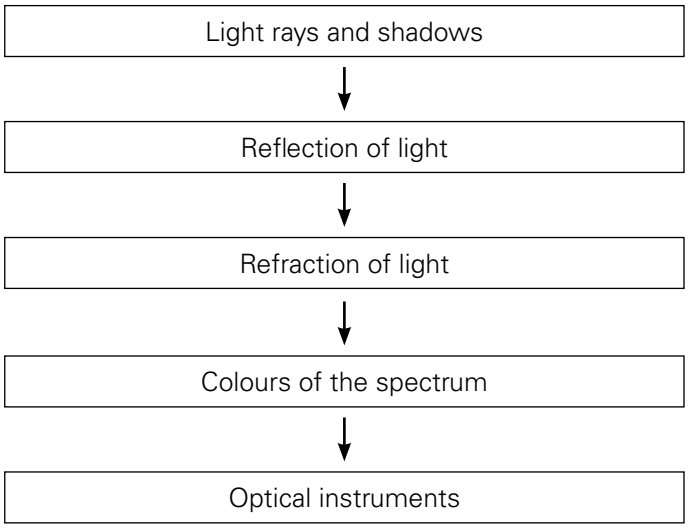
Density of the stone = mass/ volume = _____ g /ml

Is your blue stone a sapphire? Explain your answer.

_____

Chapter 9 Reflection and Refraction of Light

UNIT FLOW CHART



INTRODUCTION

Light is a form of energy and it is a part of electromagnetic spectrum. An object can only be seen when light from it enter the eyes. Light travels in straight lines. The rays of sunlight form shadow of trees on the ground. Opaque materials like wood and metal absorb light and do not let it through. When an opaque object is placed in a beam of light, a shadow is formed.

The speed of light is faster than sound. White light is made up of seven colours. When a ray of 'white' light is passed through a triangular prism it is split into different colours. The continuous spread of colour is called a spectrum. Reflection and refraction are important properties of light. A rainbow is an example of a spectrum that occurs naturally.

Lesson 1

page 141 and 142

OBJECTIVE

- To explain basic properties of light.

LEARNING OUTCOMES

The students should be able to:

- identify basic properties of light (i.e. speed, transmission through different media, absorption, reflection and dispersion).
- describe and show how an image is formed by the plane mirror.
- state the Laws of Reflection.

START (15 min)

Ask students to find the luminous and non-luminous objects around them.

Make shadows using a torch and hands.

MAIN (15 min)

Read pages 141-142

- Differentiate the luminous and non-luminous objects and explain that the Luminous objects give out their own light. Non-luminous objects do not emit light.
- Use a torch and book and demonstrate rays of light pass (are transmitted) through transparent materials such as glass but at a slower speed.
- Ask students to explain opaque, transparent and translucent materials
- Explain that the light travelling in air is reflected when it meets a different material.
- Discuss the laws of reflection and draw diagrams on the board.

PLENARY (15 min)

Test yourself page 142 of the student book.

HOMEWORK

- Exercise question 3 page 155 of the student book.

Lesson 2

Pages 143 and 144

OBJECTIVE

- To relate the different optical instruments which use curved mirrors.

LEARNING OUTCOME

The students should be able to:

- describe different optical instruments which use curved mirrors.

START (15 min)

Activity page 143: The diagram shows a candle in front of a plane mirror.

i. Draw two lines to represent rays of light leaving the top of the candle flame, reflecting off the mirror, and entering the top and bottom of the eye.

ii. Draw the image of the candle on the diagram.

iii. An image in a mirror is laterally inverted. What does this mean?

iv. Explain why the image in a plane mirror is called a virtual image.

MAIN (20 min)

Read pages 143-144

- Explain the term virtual and real image.
- Discuss that there are two types of spherical mirrors. Write names on board convex mirror and concave mirror
- Give examples and show pictures of uses of convex mirror and concave mirror

PLENARY (15 min)

Divide students into groups of students ask them to design a pinhole camera for investigation 1 page 156 of the student book.

Test yourself page 144 of the student book.

HOMEWORK

- Worksheet 1-9

Lesson 3

Pages 145 and 146

OBJECTIVE

- To interpret that light is refracted at the boundary between air and any transparent material.

LEARNING OUTCOMES

The students should be able to:

- explain that light is refracted at the boundary between air and any transparent material.
- distinguish between reflection and refraction of light with daily life examples.

START (15 min)

- Put a coin in the bucket filled with water and ask students one by one to try to pick up that coin.
- Put a pencil in a glass filled with water and ask the students to observe.

Ask from the students:

i. Why can't they pick up the coin?

ii. Why pencil appeared bent in this experiment.

MAIN (15 min)

Read pages 145- 146

- Explain that when light enters a material at an angle, it changes direction because its speed changes.
- Explain the difference between the apparent depth and the real depth.
- Show a convex lens and explain that a convex lens focuses the light rays to a point that is called the focal point. The distance between the focal point and the middle point (P) of the lens is the focal length.
- Show a convex lens and explain that a concave lens spreads the light rays. The focal point is found by tracing the refracted rays back through the lens.

PLENARY (10 min)

Divide students into groups of students and ask them to investigate 2 page 156 of the student book.

Test yourself page 146 of the student book.

HOMEWORK

- Exercise question 5 page 155 of the student book

Lesson 4

Pages 147 and 151

OBJECTIVE

- To investigate that white light is composed of different colours

LEARNING OUTCOMES

The students should be able to:

- relate the apparent colour of objects to reflected or absorbed light.
- investigate that light is made up of many colours. Relate the apparent color of objects to reflected or absorbed light.

START (15 min)

Read pages 147-151

MAIN (15 min)

- Explain that when a ray of 'white' light is passed through a triangular prism it is split into different colours.
- Discuss that the continuous spread of colour is called a spectrum.

- Use torches covered with different colour papers and show how different combination of colours give different lights.
- Explain that if you shine a ray of light through a coloured filter, some colours are blocked, or absorbed. Other colours are allowed through or transmitted through the filter.
- Mix different colours and show how a new colour is made.

PLENARY (10 min)

Ask students to draw and paint and write colour combinations.

Test yourself page 149,150 of the student book.

HOMEWORK

- Exercise question 6 page 156 of the student book.

Lesson 5

Page 152 and 153

OBJECTIVE

- To relate the use of different optical instruments with planes in which spherical mirrors are used.

LEARNING OUTCOMES

The students should be able to:

- describe use of different optical instruments with planes in which spherical mirrors are used.

START (15 min)

Show a microscope and discuss the different parts of the microscope specially lens and mirrors. Discuss the use of lens in the microscope.

MAIN (15 min)

Read pages 152-153

- Show a picture of a reflecting telescope uses concave mirrors instead of lenses to focus light rays together.
- Discuss that a refracting telescope works by having two lenses to focus light rays.
- Show a digital camera and explain that it uses a convex lens to form a small, inverted real image on a sensor at the back.
- Show a chart of the internal structure of a human eye and explain that it is a complex optical instrument that enables us to view everything around us.
- Worksheet 2-9

PLENARY (15 min)

Activity page 152: List as many uses of mirrors you can find in your home. State whether the mirror is plane, convex, or concave.

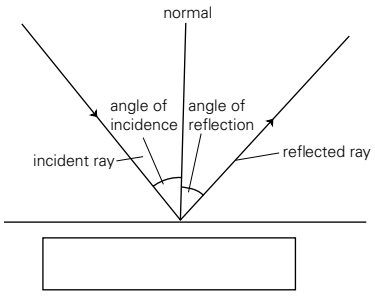
Test yourself page 153

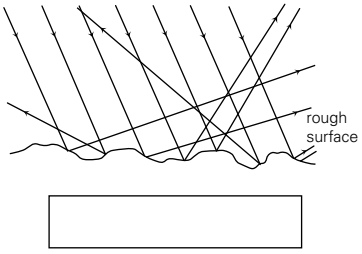
HOMEWORK

- Activity page 153: Design a model to demonstrate how light can be diffusely scattered but still obey the law of reflection. Use marbles and footballs instead of light in your model. Explain how it works.

Q1

Which one of the following is regular and irregular reflection?





Q2

Differentiate the following terms:

Regular reflection	Irregular reflection

Virtual image	real images

Concave mirror	Convex mirror

Q3

i. Why are shadows formed?

_____

ii. Give two examples of transparent and translucent objects:

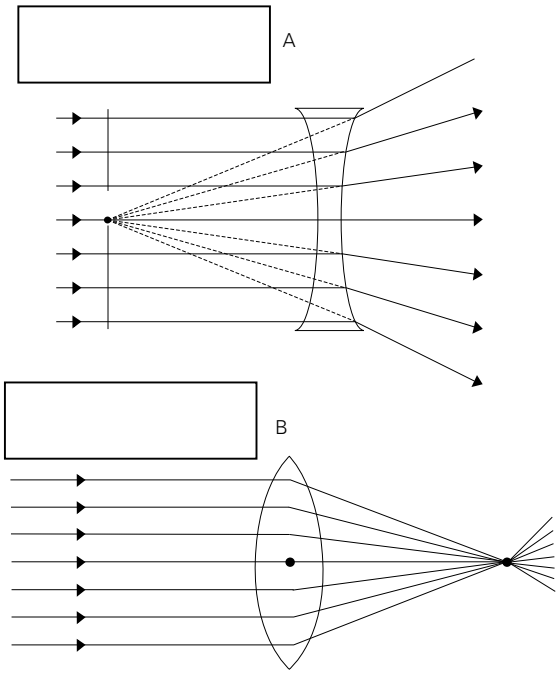
_____

iii. What are laws of reflection?

_____

Q1

Which one of the following is a concave mirror and convex mirror?



Q2

i. What are the laws of reflection?

_____

ii. Why do objects under water not appear where they seem to be?

_____

iii. Why do we see rainbows?

_____

_____

_____

Q3

Identify the colour made by mixing two colours:

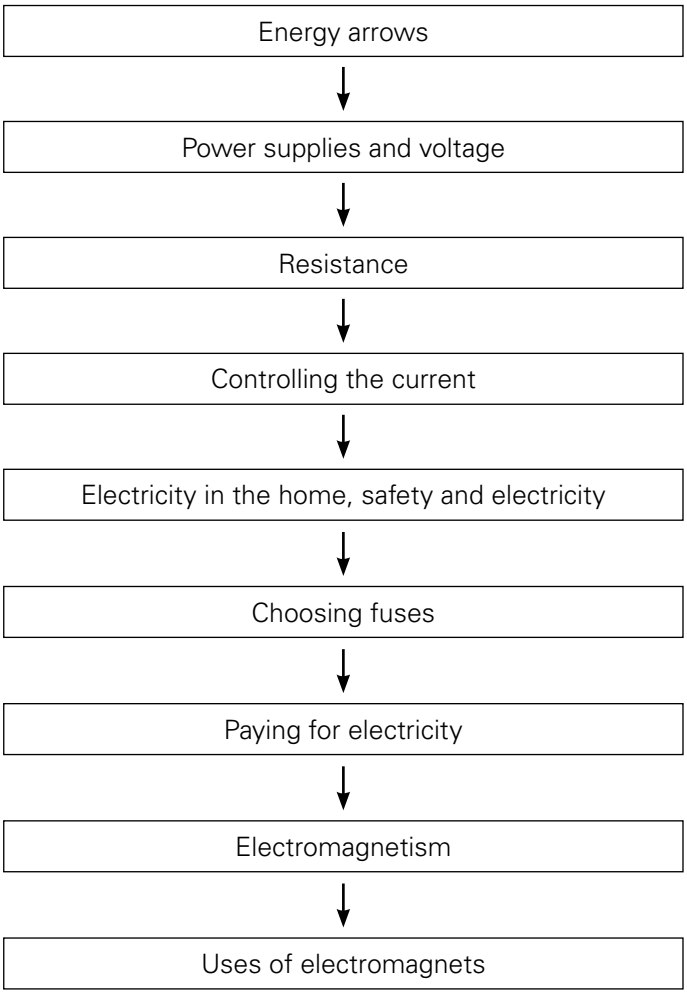
i. blue + yellow = _____

ii. red + yellow = _____

iii. red + blue = _____

Chapter 10 Electricity and Magnetism

UNIT FLOW CHART



INTRODUCTION

In our modern society we depend on electrical devices to do work for us. On page 88 we can see some of the electrical appliances which we use in our daily life. Each one converts electrical energy into another form.

Energy is always lost in some form or another, usually in the form of heat. All materials contain atoms. Atoms in turn contain small, electrically charged particles called electrons and ions.

Magnets were so weak that they could move only small pieces of iron. Finally scientists discovered how to make much stronger magnets by using electric current. They also learned how to use electric current to make electromagnets, where the magnetic force could be turned on or off. From then on, many new uses for magnets were found.

Telephone receivers, loudspeakers and speedometers, all have magnets in them. So do electric bells and buzzers. Magnets are found in every electric motor or generator. Doctors often use magnets to get tiny bits of iron out of a person's eyes or throat. In these and many other ways, magnets are used every day.

The objective of this chapter is to explain the properties and function of magnets and electromagnets. They will be able to identify the different ways they are used.

Lesson 1

pages 157-159

OBJECTIVE

- To define voltage, current, and resistance.

LEARNING OUTCOMES

The students should be able to:

- define voltage and current, state their SI unit.
- define resistance and its SI unit.
- formulate that resistance is the ratio of voltage to current.

START (10 min)

- If you look at the charger of a mobile telephone or laptop, it will usually tell you what the input should be in volts and amps. What are these volts and amps?

MAIN (20 min)

- Read page 157-159 of the Student Book.
- A circuit diagram should be drawn with the help of students' input and ask 'What does each component represent?'
- Show them models of a series and a parallel circuit with ammeter and voltmeter.
- Explain that what is the opposition to the flow of current called?
- Why is it necessary to use a resistor?
- Introduce the concepts of voltage and resistance.
- Recognize that any working electrical circuit needs a power supply to provide a voltage and that high voltages are dangerous.
- Explain that all materials show resistance against the flow of electricity through them and that a resistor can be used to control the current in a circuit.
- Worksheet 1-10

PLENARY (15 min)

Discuss 'Test yourself' questions given on page 159.

HOMEWORK

- Exercise Questions 3 and 4 pages 171 of the student book.

Lesson 2

Pages 160-162

OBJECTIVE

- To explain power.

LEARNING OUTCOMES

The students should be able to:

- define electric power and state its unit.
- recognize the electric power of various electrical appliances.
- estimate the cost of using electrical appliances (electricity bill) in daily life.

START (10 min)

Activity page 161: Try to find the power of some common electrical appliances (Hint: Use a catalogue or manufacturer's website). Good examples are an electric cooker, an electric kettle, an electric iron, a tumble drier, a toaster, an electric drill, a radio, a TV, and a table lamp.

What do you notice about the power of appliances that have a heating element and those that don't?

MAIN (15 min)

- Explain the formula for power by solving problem.
- Recognize that electricity must be paid for.
- Explain that some electrical appliances transfer more energy than others and this must be paid for.
- Write formula of electric power on the board and solve few examples.

PLENARY (20 min)

Discuss the 'Test yourself' question on page 161 of the Student Book.

HOMEWORK

- Paste a copy of an electric bill in your notebook.
- Make a list of the appliances used in your homes and write their power rating in your notebooks.

Lesson 3

Pages 162–165

OBJECTIVE

- To follow safety rules.

LEARNING OUTCOMES

The students should be able to:

- Recognize the terms: earth wire, fuse, circuit breaker etc.
- Analyze the danger of overloading and short circuit and identify the importance of earth wires, fuses and circuit breakers.
- List precautionary measures to ensure the safe use of electricity.

START (15 min)

Ask your students to imagine the following situation: A person is cold and wants to take a warm bath. However, the bathroom is very cold too, so he puts a small electric heater on the edge of the bath tub. He fills the bath and steps in. Unfortunately, he knocks over the heater which drops into the water. What will happen? (There will be a short circuit and a lot of current will run through the water.) Will the current stop or continue to run? (The current will stop because the fuse will blow or the circuit breaker will cut out.) In this example, the person is probably seriously injured but the current may have been enough to stop his/her heart. In smaller accidents at home, by having circuit breakers or fuses, the amount of may be limited so people do not get (seriously) hurt.

MAIN (15 min)

Read Pages 162-165

- Explain how fuses help to protect house circuits from damage due to too much current. If the current gets too great, the fuse wire melts and breaks the circuit. A circuit breaker is an automatic switch which also turns off current when it gets too high, but it can be reset.
- Explain safety devices used in homes.
- Explain the importance of fuses and circuit breakers in mains electricity circuits.

PLENARY (15 min)

Worksheet 2-10

HOMEWORK

- Exercise Questions 5 pages 171 of the student book

Lesson 4

Page 166-167

OBJECTIVES

- To identify magnetic materials.
- To show how magnets and electromagnets can be used in a number of devices

LEARNING OUTCOMES

The students should be able to:

- identify the shape and direction, of the magnetic field around a bar magnet.
- investigate the factors that affect the strength of an electromagnet.
- describe the properties that are unique to electromagnets (i.e. the strength varies with current, number of coils and type of metal in the core; the magnetic attraction can be turned on and off; and the poles can switch).

START (15 min)

Review 'Test yourself' questions from previous lessons.

Show a small piece of a broken magnet to the class and ask if it is a complete magnet? Test the properties of this magnetic piece.

Ask from the students:

i. Have you seen an electromagnetic crane?
ii. Where is it used?

- Where else do we use electromagnets?
- Investigation 2 page 174 of the student book.

MAIN (15 min)

Read pages 166-167

- Understand how magnetism can be induced in a piece of iron or steel.
- Explain the domain theory with arrows drawn in the same direction on the board.
- Discuss if a piece of iron is kept near a magnet, what will happen to the domain?
- Ask students to magnetize a piece of iron by stroking it repeatedly with a magnet. Bring an iron nail near to the induced magnet. What happens? Then bring a steel nail near to it.
- The teacher should show an electromagnet and explain how to make it.
- Demonstrate how an electromagnet is made.
- Describe some uses of magnets and electromagnets.
- Explain how can you make a temporary magnet.
- Discuss what happens to the domains before and after making a temporary magnet.
- Explain about the induced magnetism.
- Explain the process of how can you make a permanent magnet.

PLENARY (10 min)

- Students should be divided into four groups. Each group should be given an iron nail, copper wire, and batteries. They will be asked to make the electromagnet themselves.
- Discuss the following in class:
  i. How can you make a temporary magnet?
  ii. What are some uses of magnets and electromagnets?
- Worksheet 3-10

HOMEWORK

- 'Test yourself' questions, page 169 of Student Book.
- Project to construct a working model of an electromagnet can be assigned to the students.

EXTENSION

- http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel_pre_2011/electricityworld/mainselectricityrev3.shtml
- This site allows students to set the allowed maximum for a circuit breaker and then to set the current flowing through it. If the actual current exceeds the maximum set, the circuit breaker will cut the circuit. This circuit breaker is a slightly different design from the one in the Student Book.

Lesson 5

Page 168 and 169

OBJECTIVE

- To show how magnets and electromagnets can be used in a number of devices.

LEARNING OUTCOME

The students should be able to:

- describe briefly the working principles of electromagnetic devices such as a speaker and doorbell.
- To explain the concepts of a magnetic field of a permanent magnet and an electromagnet.

START (10 min)

- Ask students if they can identify the uses of electromagnets.

MAIN (25 min)

Read pages 167-169.

- A relay is an electronically controlled switch. It uses a small current to turn on a separate circuit, which may carry a large current.

- In electronic circuits, small reed relays are used. These have a very thin, flexible piece of metal inside a glass tube. The metal acts like a switch. When a magnet is nearby, the switch becomes magnetized and the contacts touch. The relay can be activated by a small bar magnet or a small coil. Some reed relays have their contacts together under normal conditions. The switch then opens in a magnetic field.
- Describe some uses of magnets and electromagnets.

PLENARY (10 min)

Ask and discuss responses of 'Test yourself' questions given on page 169 of Student Book.

HOMEWORK

- Exercise question 6 and 7 page 172 of the student book.PLENARY (10 min)

Ask and discuss responses of 'Test yourself' questions given on page 169 of Student Book.

HOMEWORK

- Exercise question 6 and 7 page 172 of the student book.

When you run a current through a circuit, you can measure two things:

- how many electrons are moving through the circuit—this is the current and is measured with an ammeter.
- how 'strong' these electrons are, i.e. how much energy or power or push each electron has – this is the potential difference or voltage and is measured with a voltmeter.

Task 1

How should voltmeters and ammeters be connected? In series or in parallel?

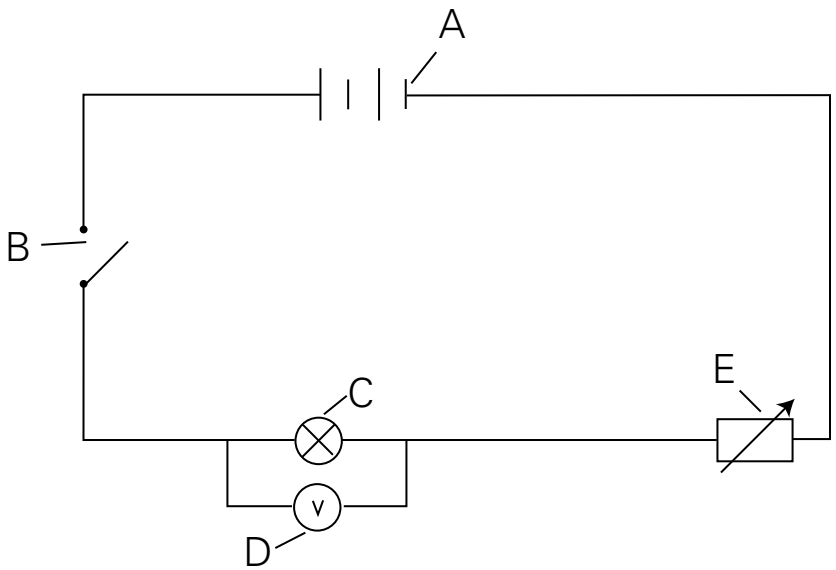
_____

Task 2

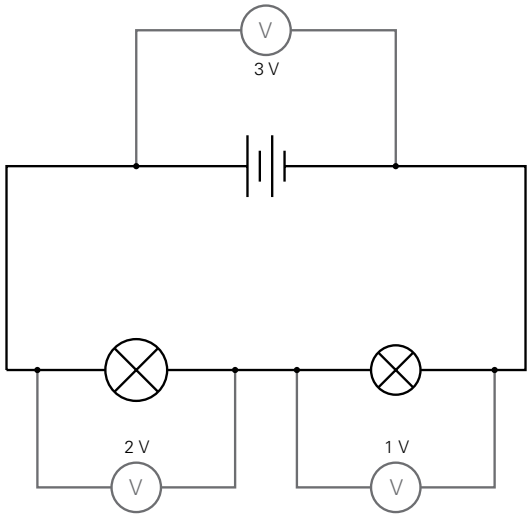
1. Complete the table.

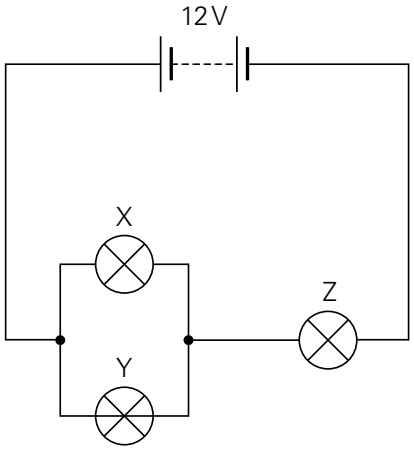
Components	Symbols	Definitions	Formulas
1. voltage			
2. current			
3. resistance			
4. variable resistors			
5. power			
6. energy			

2. Below is a diagram of an electric circuit. Name the components marked A to E.



3. All the bulbs in these circuits are the same. Voltage produced by the battery is shared equally between the bulbs in the circuit, answer the following:





Write down the reading on each voltmeter in diagrams 1 and 2.

A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

4. Write down two differences between series and parallel circuits.

Series circuit	parallel circuits

5. Draw a circuit diagram of the following set up:

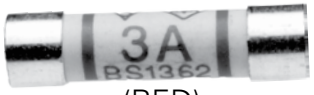
   A 6 V power source is connected in series with an ammeter and a 6 ohm resistor.

   a. What is the reading on the ammeter?

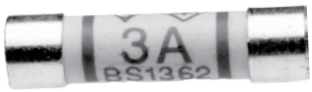
   _____

Task 1

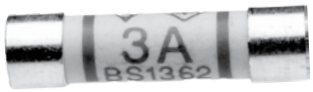
Look at the pictures of a circuit breaker and a fuse below.



(RED)



(BLACK)



(BROWN)

i. How can you tell if the circuit breaker was overloaded and cut out?

_____

ii. How can you see that the fuse has 'blown'?

_____

iii. Describe what might cause a circuit breaker to cut out or a fuse to blow.

_____

1. Make an electromagnet. Take an iron nail. Wind 20 turns of copper wire around the iron nail.

   a. Is it behaving like a magnet?

   _____

   b. How many pins are attracted by this electromagnet?

   _____

   c. Now connect the ends of the wire to two batteries. What do you observe?

   _____

   d. How many pins can be attracted now? Record your observations.

   _____

2. Now take the same size of iron nail, but this time wind 40 turns of copper wire with one battery, and then with two batteries. Record your observations.

No. of turns of wire	No. of batteries	No. of pins attracted by electromagnet
20	1	
20	2	
40	1	
40	2	

   a. Which variables have you changed in this experiment?

   _____

   b. Which variable has been constant?

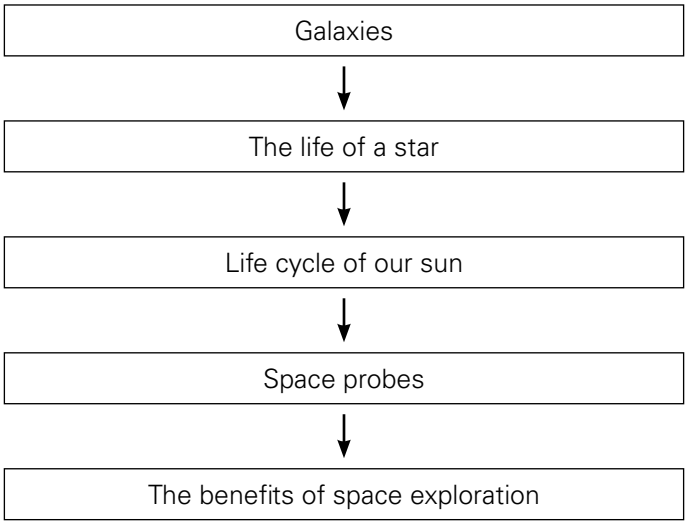
   _____

   c. How can you make an electromagnet stronger? List two ways.

   _____

Chapter 11 The Universe

UNIT FLOW CHART



INTRODUCTION

The universe contains everything that exists. We do not know how big the universe is. A galaxy is a star system. Our Earth is part of a galaxy called the Milky Way. There are thousands and thousands of stars in the Milky Way. These stars give a milky appearance to the sky, hence the name.

Galaxies are very far apart. The nearest galaxy to the Milky Way is called Andromeda. Andromeda is two million light years away. This means that the light we see from Andromeda has taken two million years to reach us. We are seeing it as it was two million years ago. Astronomers believe that there are many more galaxies further out in space that cannot be seen.

There are several theories regarding the origin and formation of the universe.

The big bang theory:

This theory suggests that the universe began 10,000 million years ago with an enormous explosion.

The pulsating universe theory:

Scientists assume the universe to be continually contracting and expanding. When the universe has expanded to a certain size it will begin to shrink. The galaxies will be pushed closer and closer together. Eventually they will explode causing the universe to expand again.

The expanding universe theory:

Scientists suggest that the universe will never collapse but keep on expanding. This theory implies that there has only ever been one big bang.

Lesson 1

pages 175-177

OBJECTIVE

- To explore the heavenly bodies present in the universe.

LEARNING OUTCOMES

The students should be able to:

- Explore and understand the term star, galaxy, Milky Way and black hole
- Compare the type of galaxies

START (10 min)

Show a video about the galaxies https://www.youtube.com/watch?v=RubnGwhcT6E and explain the different types of galaxies.

MAIN (10 min)

Ask students to read pages 175-177

- Explain that astronomers have estimated that the universe contains trillions of galaxies.
- Write on the board that Galaxies are classified according to their shape. These are:
  i. Spiral galaxies
  ii. Elliptical galaxies
  iii. Irregular galaxies
- Explain that Spiral galaxies have a distinctive 'whirl' shape with a flat bulge at the centre with spiral arms around it.
- Discuss that Elliptical galaxies have large amounts of dark matter but less gas and dust than spiral galaxies so fewer new, bright stars are made.
- Discuss that Irregular galaxies have no specific shape or structure.

PLENARY (10 min)

Activity: Present a solar system on a chart paper/ model.

Discuss questions of test yourself page 177 of the student book.

HOMEWORK

- Exercise question 2 and 5 page 187, 188 of the student book.

Lesson 2

Pages 178-179

OBJECTIVE

- To relate the different stages of a star.

LEARNING OUTCOMES

The students should be able to:

- Relate the life of a star with the formation of a black hole, neutron star, pulsar white dwarf, red giant.
- Discuss the life and death of our sun.

START (10 min)

Ask students to present their drawings/models to the other groups

MAIN (25 min)

Read Pages 178-179

- Explain that The horsehead nebula is dark cloud of gas and dust silhouetted against its bright background.
- Tell the students different stories about the black hole and discuss that the gravitational pull of a black hole is so strong that not even light can escape it.
- Discuss the different stages of a star.
- Explain that in about another 6 billion years, the Sun will run out of hydrogen and become a red giant, big enough to engulf Mercury and Venus, and burn up Earth.
- Explain that a few billion years after that, the Sun will begin to die.

PLENARY (15 min)

- Discuss questions of test yourself page 179 of the student book.

HOMEWORK

- Exercise question 3 page 188 of the student book

Lesson 3

Pages 180-181

OBJECTIVE

- To describe the importance of telescope.

LEARNING OUTCOME

- Show how information is collected from space by using telescopes (e.g., Hubble Space Telescope) and space probes (e.g., Galileo).

START (15 min)

Ideas for investigation page 189: Making a simple refracting telescope (students will be divided in the groups and will make a model following the steps given).

MAIN (15 min)

Read Pages 180-181

- Let students explore types of telescopes.

PLENARY (15 min)

Do Test Yourself page 181 of student book.

Lesson 4

Pages 182-184

OBJECTIVE

- To know about the history of space exploration.

LEARNING OUTCOMES

- Describe advancements in space technology and analyze the benefits generated by the technology of space exploration.

START (15 min)

Show students the following video. https://www.youtube.com/watch?v=Dp5xnT55_XA&pp=ygUcaGlzdG9yeSBvZiBzcGFjZSBleHBsb3JhdGlvbg%3D%3D

MAIN (15 min)

- Ask students to note down the important years and achievements from the video and create a historical timeline of space exploration.
- Read Pages 182-184

PLENARY (15 min)

Do Test Yourself page 184 of student book.

Lesson 5

Pages 184-186

OBJECTIVE

- To understand the importance of space technology.

LEARNING OUTCOME

- Describe advancements in space technology and analyze the benefits generated by the technology of space exploration.

START (15 min)

Ask students about their opinion regarding the benefits of space exploration.

MAIN (15 min)

Read Pages 184-186

- Show the following video and take their feedback.

https://www.youtube.com/watch?v=1Upxg0D-Eiw

PLENARY (15 min

Do Test Yourself page 186 of student book.

HOMEWORK

- Do Q6 on page 189 of student book.

Q1

Complete the following table:

Technologies	Uses
Solar panels	
GPS	
Zero gravity	

Q2

Unscramble the following words to fill in the blanks:

i. _____are large collections of clusters and are some of the largest known structures in the universe. (rspercluusste)

ii. As gravity gets stronger, temperatures rise and the nebula becomes a _____.(ostotaprr)

iii. A star begins its life as a massive cloud of dust and gases called a _____.(ulneba)

iv. _____spin very rapidly and give off light in pulses.(sarulsp)

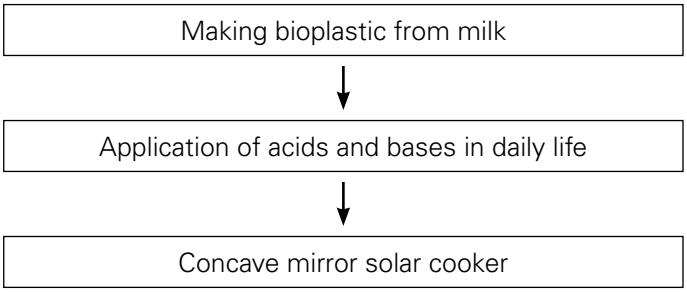
v. Stars that are much more massive than our Sun collapse in explosions called _____, to become black holes. (nopervsua)

Q3

Draw a flow chart to show the different stages of a star.

Chapter 12 Technology in Everyday Life

UNIT FLOW CHART



Lesson 1

Page 191-192

OBJECTIVE

- To encourage students to make plastic.

LEARNING OUTCOME

The students should be able to:

- Make bioplastic from milk and vinegar as an application of biotechnology.

START (10 min)

Materials required: Milk, white vinegar (acetic acid), bowl, sieve, spoon, absorbent paper, measuring cylinder, water bath, thermometer.

MAIN (25 min)

Read Page 191-192

- Explain that bioplastic is very durable and was widely used in the early part of the twentieth century until its oil- based plastics became more common.
- Design some objects with the plastic.
- Explain that drip irrigation system save water since they irrigate plants with a small amount of water.
- Follow the steps and make bioplastic in the lab.

PLENARY (10 min)

Ask the importance of bioplastic.

HOMEWORK

- Design some objects with the bioplastic and bring for presentation in class.

Lesson 2

Pages 193-197

OBJECTIVE

- To explore the process of making of toothpaste, soap and detergent as an application of acids and bases in daily life.

LEARNING OUTCOME

The students should be able to:

- Make toothpaste, soap and detergent as an application of acids and bases in daily life.

START (15 min)

Materials required: Baking soda (sodium bicarbonate), coconut oil, xylitol, peppermint extract, mixing bowl, large spoon, sterile glass jar, a lid and a label.

MAIN (15 min)

Read pages 193-194

- Discuss about Dental plaque that it is layer of bacteria which builds up on the surface of teeth.
- Explain that toothpastes contain mild abrasives which remove the food debris and plaque without damaging the tooth enamel.
- Follow the steps given on page 194 and make toothpaste.

PLENARY (15 min)

Ask students to give a name to their product and make an advertisement.

HOMEWORK

- Make detergent/ soap at home and give a name to your product.

Lesson 3

Pages 199-200

OBJECTIVE

- To practice the assembling of a concave mirror type solar cooker to convert solar energy into heat energy.

LEARNING OUTCOME

The students should be able to:

- Assemble a concave mirror type solar cooker to convert solar energy into heat energy.

START (15 min)

Materials required: Sheet of thick cardboard 40 cm x 40cm, aluminium cooking foil, glue, ruler, scissors, sticky tape, plain white card, 2 x clamp stands and clamps, metal rod, copper calorimeter, wire, thermometer.

MAIN (15 min)

Read pages 199-200

- Discuss about the use of solar oven.
- Explain that a solar cooker is a device which uses the energy of sunlight to cook food and heat liquids.
- Discuss about the load shedding.
- Explain that Solar cookers are good for the environment.
- Discuss about the importance of solar energy.

PLENARY (15 min)

Divide students in groups and ask them to follow the steps and make a solar oven.

HOMEWORK

- Ask students to make a solar oven for their households work.

Lesson 4

Pages 201-202

OBJECTIVE

- To describe the process of making of a simple wind turbine to produce electricity.

LEARNING OUTCOME

The students should be able to:

- Assemble and operate a simple wind turbine to produce electricity.

START (15 min)

Materials required: Thick cardboard, scissors, Blu Tack (or similar reusable plastic adhesive), low voltage (12V d.c.) electric motor, connecting wires, solder, soldering iron, clamp stand and clamp, ammeter, electric fan.

MAIN (15 min)

Read pages 201-202

- Explain that Wind turbines have been used for hundreds of years to harness the energy of the wind.
- Discuss that the Wind turbines are a renewable energy resource.

PLENARY (15 min)

Make a model of Wind turbine in groups (4 students in one group).

HOMEWORK

- Write Suggestions in your notebooks how you might modify the model in order to generate more electricity.

Lesson 5

Pages 203-205

OBJECTIVE

- To encourage students to use UPS.

LEARNING OUTCOME

The students should be able to:

- Demonstrate the working of UPS and use it to operate a fan or energy saver bulb.

START (15 min)

Materials required: This switches the UPS off if it develops a fault and stops working. The switch enables mains electricity to bypass the faulty UPS.

MAIN (15 min)

Read page 203-205

- Write the word UPS on the board and discuss that UPS stands for Uninterruptible Power Supply.
- Explain that UPS is a system that provides electricity when there is a failure in the mains supply.
- Discuss that the UPS can either be connected to the mains through the distribution board or via a wall socket.

- Take students to the section where UPS is placed and explain working.

PLENARY (15 min)

Ask students to solve examples given on page 206.

HOMEWORK

Check the working of UPS at home.

STUDENT BOOK ANSWERS

Chapter 1 Ecology

1) MULTIPLE CHOICE QUESTIONS

i. d. vegetation

ii. c. photosynthesis

iii. d. producers

iv. a. carnivores

v. b. lots of individuals of different species

2) TRUE OR FALSE

i. True

ii. True

iii. True

iv. False

v. False

3)

Examples of competition	Examples of predation	Examples of symbiosis
Two stags fighting for control over a herd of deer.	Lions hunting a zebra for food	Farm cats killing mice stopping them eating cereal crops.
Trees in a forest growing upwards to get light.	A spider catching a fly in its web.	Two chimpanzees picking fleas off each other's back
A seagull chasing off other birds from food in a garden		An oxpecker bird eating ticks off the back of a rhinoceros
		A honeybee visiting a flower to collect nectar and pollen

4) a. carbon dioxide

b. carbon dioxide

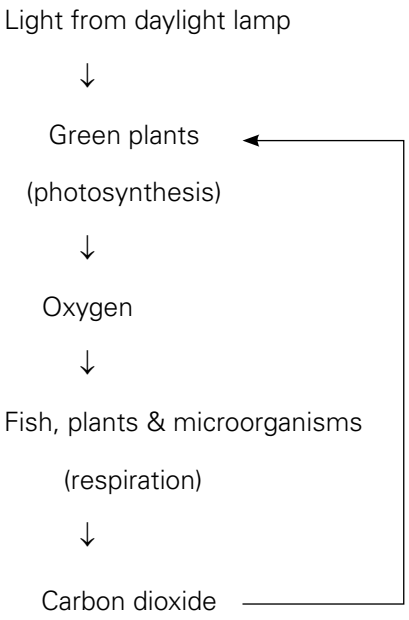
c. oxygen

d. i. levels of oxygen will drop and carbon dioxide will rise.

ii. Due to no light available, plant is not able to photosynthesize whereas respiration continues due to which levels of oxygen will drop and carbon dioxide will rise.

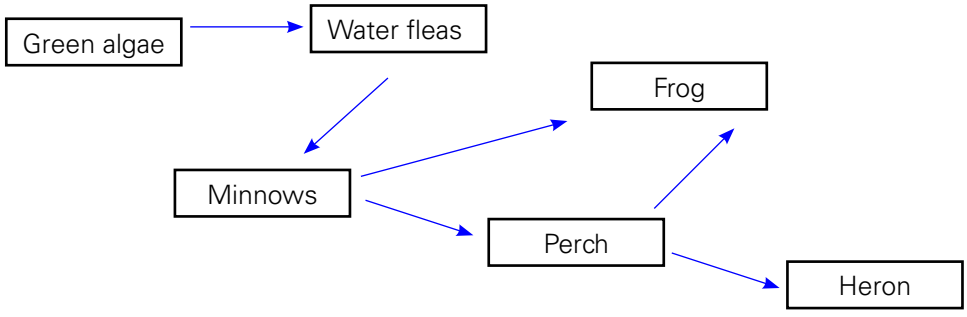
iii. Photosynthesis would have continued

e.



5)

a.



b.

i. green algae

ii. water fleas

iii. Frog

iv. Water fleas

v. frog

c. Addition of another carnivore in the ecosystem would increase predation and competition. The number of frogs, perch, and minnows can decrease.

6)

i. a. oak tree

b. fleas

ii.

a. Because when organisms from one trophic level are eaten by organisms from the next one, energy is lost as metabolic heat.

b. It is used up by the environment and organisms.

c. Because it measures the amount of real living material that is present in an ecosystem at every trophic level. It calculates the total mass of living things while accounting for their size and energy makeup.

d.1670KJ

e. The weight can be estimated by using height and volume of the oak tree.

7)

i. a. dumping industrial waste into water

b. deforestation and burning fossil fuel

ii.

a. Reduce the use of disposable and single-use plastic items. The rate of global warming should be slowed down by a decrease in greenhouse gas emissions.

b. Disposable and single-use plastic items can be reused instead of throwing off.

iii. Plastics

Chapter 2 Human Nervous System

1) MULTIPLE CHOICE QUESTIONS

i. b. kidneys

ii. b. neuron

iii. a. back of the brain

iv. c. sneezing

v. Vitamins and minerals

2) TRUE OR FALSE

i. True

ii. True

iii. False

iv. False

v. True

3)

i.

a. B

b. A

c. F

d. D

e. E

ii. Spinal cord

iii.
Stroke in right hemisphere will effect the functions of left sided muscles of body , visual problem, creativity, imagination, recongnizing colour and shape etc.

4)

Body function	**Part of body which controls or regulates it**
Beating of the heart	Medulla (brain stem)
Balance and coordination	Cerebellum
Constant body temperature	Hypothalamus
Movement of arms and legs	Cerebrum
Water content of the body	Hypothalamus

5)

i. Synapse is the connection that transmits impulses from one nerve to another.

ii. The branching ends of one nerve cell lie very close to the cell body of another nerve cell; however, they do not touch. When an impulse moves along one nerve cell, it releases a chemical that diffuses across the synapse and stimulates the other nerve cell.

iii. One nerve cell can have multiple synapses with other nerve cells hence a lot of connections can be made, so one stimulus can be responded in multiple ways.

iv. Anaesthesia momentarily block nerves at the procedure site from sending sensory information to brain's regions.

6)

i. This is the path that nerve impulses in a reflex action take hence called reflex arc.

ii.

a. smelling food

b. salivation

iii.

a. Impulses are travelling along the nerve cell to a muscle.

b. A relay nerve cell in the spinal cord passes the message on.

c. Impulses are sent to the spinal cord along the fibre of a sensory nerve cell.

iv. Because it transmits the signals to spinal cord in return spinal cord sends the command back.

v. Because information from a reflex does not need to get to the brain and they involve less paths of travel. As an alternative, a reflex arc happens at the spinal cord level, resulting in a faster travel time than when the brain is involved in decision-making.

7)

i. Oxygen and glucose are supplied by the blood to the brain and carry on respiration hence balanced diet is necessary for brain function to continue normally

ii. To carry on chemical reactions of brain.

iii. To avoid nerve injury in case of accidents.

iv. Yes, I agree. Because it contains omega-3 fatty acids that are excellent for brain functions.

Chapter 3 Variations, Heredity and Cell Division

1) MULTIPLE CHOICE QUESTIONS

a. detached ear lobes

d. thick layer of blubber beneath the skin

c. one gene comes from the male parent and one from female parent

b. helix

d. the same number of chromosomes which are genetically the same.

2) TRUE OR FALSE

i. True

ii. True

iii. False

iv. False

v. True

3)

i. mother

ii. Mother

iii. Two

iv. Lubna, Waseem, Ayman

v. Because this is an acquired characteristic. It is not inherited.

4)

i. Presence of wings, body, and antenna

ii. Different colours of wings, different patterns of wings, and different sizes

iii. Continuous variation

iv. Discontinuous variation

v. It helps in their survival because it prevents the butterfly to hide from prey.

5)

i. Gills: allow absorption of oxygen from water.

Scales: protect the body from attack.

Large mouth: helps to feed

Eyes: vision to find food and run away from predators

Streamlined body: Helps them to move in fast speed and decrease resistance

Tail: helps to swim and balances the body.

ii.

a. Continuous variation

b. Because tail helps to swim more efficiently hence long-tailed salmon will be able to survive efficiently in water

iii. The gills of salmon are equipped with tiny molecular pumps that can move sodium into and out of their bodies. They inject sodium into freshwater and expel it into saltwater. They can move carefully in their two distinct aquatic environments.

6)

i. nucleotide

ii. Because it has 5 carbons hence called pentose

ii. Adenine, thymine, cytosine, guanine

iv.

a. Guanine

b. Thymine

c. Cytosine

d. Guanine

e. Adenine

b. Guanine and cytosine pair up with each other and adenine and thymine make a pair.

7)

i. Chromosomes become shorter and fatter. DNA replicates.

Chromosomes line up across the centre of the cell.

One set of chromosomes is pulled to each end of the cell.

Cytoplasm and cell membrane divide to form two identical cells

ii.

a. It means DNA divides and forms exact copies of each other.

b. So that genetic characteristics remain the same after cell division.

iii. In almost every cell of the body.

iv. To increase the height of the plant.

Chapter 4 Biotechnology

1) MULTIPLE CHOICE QUESTIONS

i. a. alcohol, carbon dioxide, water and energy

ii. a. genes from another organism

iii. d. small rings of DNA

iv. d. Saccharomyces, a. E.coli

v. c. iron rice

2) TRUE OR FALSE

i. False

ii. True

iii. True

iv. False

v. True

3) bacteria: cheese

Yeast: baked bread

Spores of penicillin: Blue cheese

ii. If it is not sterile, microorganisms will cause contamination or failure to generate the intended product.

iii.

Yeast: It is required to carry out the reaction of fermentation.

Temperature: The optimum temperature for yeast to ferment is 25^0C - 35^0C. Higher temperatures can kill yeast and at lower temperatures fermentation does not take place.

Moisture: Moisture is necessary for fermentation.

4)

i. C, B, F, E, A, D

ii. a. a complex of enzymes, primarily chymosin

b. Rennet

contains the enzyme chymosin which causes the milk protein to coagulate to form semi-solid **curds**.

i. Enzymes that act on protein in milk.

ii. Causes coagulation of milk protein to form semi-solid curds.

iii.

a. Different bacteria have different enzymes that produce various types of cheeses and flavours

b. To develop unique flavours.

iv.

a. Pasteurization and fermentation

b. Rennet is added, to create different kinds of cheese, different varieties of bacteria can be added.

v. To retain milk's nutritional benefits in food that wasn't meant to be consumed right immediately.

5)

i. The fundamental genetic unit that parents pass on to their children.

ii. The process of genetic engineering includes altering the DNA to give it more useful characteristics.

iii. Bacterial and fungal cells.

iv. They are used to make those animal and plant products that are expensive or have less availability.

v. Cell has thousands of genes in chromosomes. These genes are removed from chromosomes by using enzymes hence these enzymes are called "chemical scissors".

vi. Products produced by bacteria are made far more quickly than by the original animal or plant cell because they reproduce and expand fast.

6)

i. Cart horse has strong build especially the legs, which enables it to pull heavy loads.

ii. 1. Choose a horse and mare with a strong physique.

2. Breed them with each other.

3. Choose the best offspring and breed them with each other.

4. Do this over and over again to improve the characteristics.

iii. To look out for any genetic diseases and overall health of the other horses.

iv. They have the same number of chromosomes. They also look alike.

Chapter 5 Periodic Table

1) MULTIPLE CHOICE QUESTIONS

i. b. 2,8,6

ii. a. left to right in order of ascending atomic number.

iii. c. the same number of electrons in their outer shell

iv. b. can be pulled into wires.

v. c. It conducts heat well.

2) TRUE OR FALSE

i. True

ii. False

iii. True

iv. False

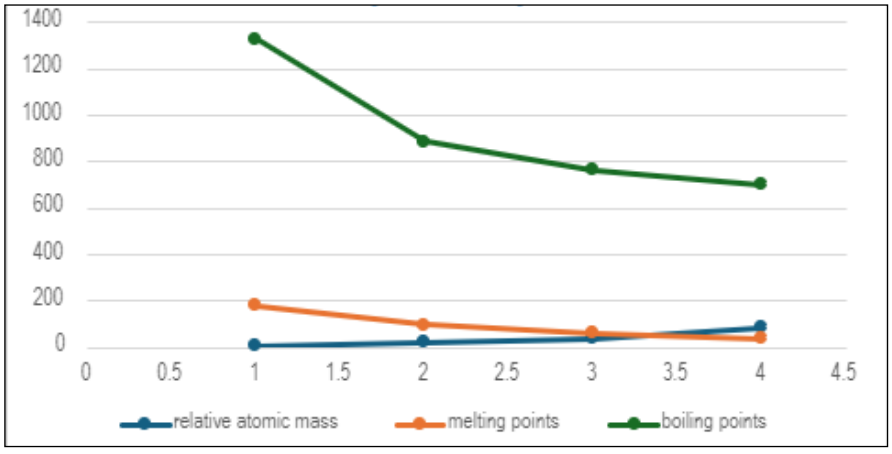
v. True

3)

i. lithium (Li) , sodium (Na), potassium (K), rubidium (Rb)

ii. 1 A

iii. And **iv.**



v. It indicates that as the relative mass is increasing, the melting and boiling points are decreasing.

4)

i. bohrium, curium, einsteinium

ii. Polonium, francium, germanium

iii. Uranium, neptunium

iv. Europium

5)

i. A

ii. B,F

iii.

a. I

b. IV

c. VIII

IV.

a. 1

b. 1

c. 6

V.

a. C, G

b. B, F, E

VI.

Group I metals react with water to form hydrogen and metal hydroxide.

A fire or explosion could occur from the heat this reaction produces igniting the metal or the hydrogen.

6)

i. So that it does not rust, iron is reactive it rusts when comes in contact with moisture.

ii. it is a good conductor hence conducts current with least losses, also it is light weight, so it does not require large support system

iii. Because it lasts long and is chemically inactive

iv. Because it makes gold stronger.

Chapter 6 Chemical Reactions

1) MULTIPLE CHOICE QUESTIONS

i. c. reactants

ii. d. all of the above

iii. a. combustion

iv. b. double displacement

v. d. an atom that has lost an electron

2) TRUE OR FALSE

i. False

ii. True

iii. True

iv. False

v. False

3)

Exothermic: Burning toast, Fireworks, rusting metal railings, using antacid tablets to neutralize stomach acid, Respiration in body cells

Endothermic: Baking bread, melting chocolate, Photosynthesis, Dissolving sugar in tea, Water evaporating from a puddle

4)

I. ii.

$2C(s)+2O_2(g) \longrightarrow 2CO_2.(g)$

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$

$C(s) + 2H_2(g) \longrightarrow CH_4(g)$

$CH_4(g)+2O_2(g) \longrightarrow CO_2(g)+2H_2O(g)$

$C_6H_{12}O_6(s)+6O_2(g) \longrightarrow 6CO_2+6H_2O$

iii.

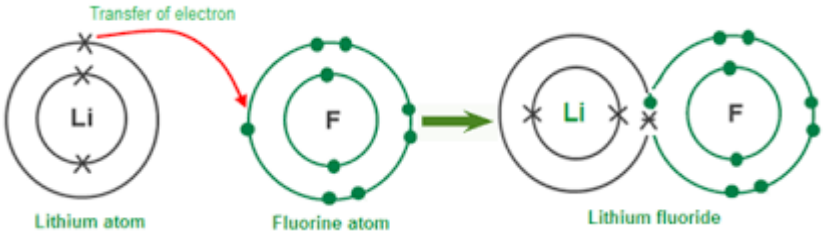
a. Oxygen is needed for both combustion and breathing. Energy is produced by both burning and breathing. The final byproduct of both respiration and combustion is carbon dioxide. The general chemical processes involved in burning and respiration are identical

b.

Combustion of glucose	Combustion of methane
It occurs in living cells.	It does not require living cells.
Energy is in the form of ATP which is used by the cell.	Energy is in the form of heat.

5)

I.



ii.

a. Ionic bonds are very strong. They require a lot of energy to break.

b. Due to the complete transfer of electrons, opposite charges are generated which creates an electrostatic attraction which is not easy to break.

iii. Because molten condition or solution have electrically charged ions that are free to move so they become conductors.

6)

i. Bond that is formed by sharing of electrons is covalent. In this diagram oxygen is sharing its electrons with two hydrogen atoms.

ii. Covalent bond is formed by sharing of electrons and ionic bond is formed by complete transfer of electron.

iii. Low melting points are a result of the weak attraction between molecules in solid covalent compounds. Hence most covalent bonds are either gases or liquids at room temperature

iv.

a. A water molecule has two poles: a negative charge on the oxygen pole (side) and a positive charge on the hydrogen pole (side) due to the unequal distribution of electrons among the atoms. The water molecule is referred to as electrically polar.

b. Water is termed as the universal solvent as it can dissolve more substances as compared to other solvents. This is due to its polar nature.

Chapter 7 Acids, Bases and Salts

1) MULTIPLE CHOICE QUESTIONS

i. c. vinegar

ii. a. 1

iii. d. 14

iv. c. 7

b. a salt and water

2) TRUE OR FALSE

i. True

ii. False

iii. True

iv. True

v. True

3)

i. It is added to give them a tangy flavor.

ii. It gives them sour or sharp taste and act as preservative.

4)

i. **a.** Lemonade (fizzy)

b. Sparkling mineral water (fizzy)

ii. Less acidic because it has 4.0 ph. whereas soft drink has 0.4 pH. This means it has way more H+ ions than orange juice.

iii. Sparkling water has carbon dioxide due to which it has slightly acidic pH.

Iv.

a. Because fizzy drinks are more acidic and have a lot of sugar

b. Because sugar gives energy.

5)

i.

a. red grape juice

b. beetroot juice

c. beetroot juice

d. red cabbage

ii.

a. red

b. It indicates that sodium hydroxide is an alkali

Iii. shows the extent of acidity or alkalinity in a solution

iv. By using a suitable indicator.

6)

Name of substance	pH	Colour of universal colour
hydrochloric acid	1	red
lemonade	3	orange
Pure water	7	green
sodium hydroxide	14	purple

7)

Strong acids are those which have more acidic strength that is it can produce more H+ ions meaning that they will have lower pH while concentrated acid means that it has less amount of water in it.

Experiment

Take equal volumes of both acids and measure the pH with the help of a pH meter or Universal indicator paper. Whichever will have the lowest pH value will be the stronger acid.

8)

i. Hydrogen is common in all acids

ii. Hydroxide is common in all alkalis

iii. It has ammonium group (NH4) attached with hydroxide group (OH-) while the other two have group

1A metals, sodium and potassium with hydroxide group.

iv. Salt and water

9)

i. Sodium chloride

ii. Calcium hydroxide

iii. Ammonium chloride

iv. Potassium sulphate

10)

Take the two types of eggshells and allow them to react with HCl.

The one in which more HCl will be consumed will have more calcium carbonate.

Chapter 8 Force and Pressure

1) MULTIPLE CHOICE QUESTIONS

i. d. staying still on one place

ii. b. Objects with a density lower than 1g/cm3 will float

iii. c. it increases

iv. b. 30 Pa

v. d. Its pressure increases, and it heats up

2)

i. Because the weight of the water that the object had displaced was equal to the amount of upward force, or upthrust. A boat's upthrust keeps it afloat. A floating boat moves a lot of water around. This water gives the bottom enough upthrust to counteract the boat's weight pushing downhill.

ii. Because the mass of clay is greater than the exact amount or volume of water as it is concentrated in one place. Hence clay is denser than water. So, the ball of clay sinks.

iii. It floats on water.

3)

i.

a. None

b. A, B

ii.

a. gains more speed

b. because it is exerting more force

iii.

a. loose speed

b. because of unequal forces

iv. Will start moving forward

v. they will stay stationary because both forces are balanced

4)

i. Density is the mass per unit volume.

ii. 1g/cm3

iii.

a. petrol

b. gold and lead

c. air

d. wood

iv. Wood is less dense than water hence it floats in it.

5)

i. a. to be made by illustrator

b. it is upthrust, provided by the water keeps a boat afloat by balancing the weight of the boat pushing downwards.

ii. The weight of the boat, the force of contact with the water pushing it upward, the wind pushing it forward, and the water's drag pulling it backward are the four forces operating on it.

iii. Because now there is more weight on the boat which is pointed downwards.

6)

i. by illustrator

ii. When pressure is high

P = F/A

A = 3x2 = 6cm = 0.06m2

P= 600/0.06 = 10,000 Pa

When pressure is low

P = F/A

A = 4x2 = 8cm = 0.08m2

P= 600/0.08 = 7500 Pa

iii

a. The most stable position is when the block is resting on its largest face (the face with the largest area in contact with the ground).

b. This position is most stable because it has the lowest centre of mass and a wider base, making it less likely to topple over.

7)

i. 200N

ii. 100N

iii. a. the output force will be weaker

b. the output force will be stronger

iv. Air is easily compressed and hence cannot transmit force as efficiently as oil.

Chapter 9 Reflection and Refraction of Light

1) MULTIPLE CHOICE QUESTION.

i. a. in straight lines at high speed

ii. c. transparent

iii. b. greaseproof paper

iv. c. plane

v. b. in all directions

2) **i.** A virtual image of yourself.

ii. The image is the same distance, size and inverted from the mirror.

iii. When you close your left eye the image appears to close their right eye.

iv. The image is formed because light reflects off the mirror so that the angle of incidence is equal to the angle of reflection

3)

i. glass

ii. coal

iii. Glass, water

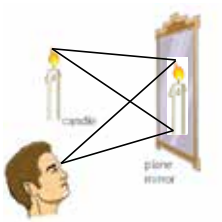
iv. Coal

v. tracing paper, snow

4)

i.

ii.



iii. It means that image appears changed from right to left

iv. Because no rays of light actually pass through mirror

Chapter 10 Electricity and Magnetism

1) MULTIPLE CHOICE QUESTIONS

i. a. 8V

ii. d. a thin nichrome wire

iii. d. 2V

iv. b. increasing the current flowing through it

a. change the direction of current

2) TRUE OR FALSE

i. True

ii. True

iii. True

iv. False

v. True

3)

i. battery

ii. bulb

iii. 1.5V

iv. A. 3V b. both circuits are connected in series having equal distribution of charges

v. 4V

4)

i. because electricity cannot pass easily through nichrome wire. Nichrome wire has higher resistance than copper wire

ii. When slider is moved to right, it provides a path to current with higher obstruction means higher resistance, when slider is moved to left, the current flows through an unobstructed path.

iii. **a.** when the slide control is moved to the right, brightness of the bulb decreases

b. when the slide control is moved to the left, brightness of the bulb increases

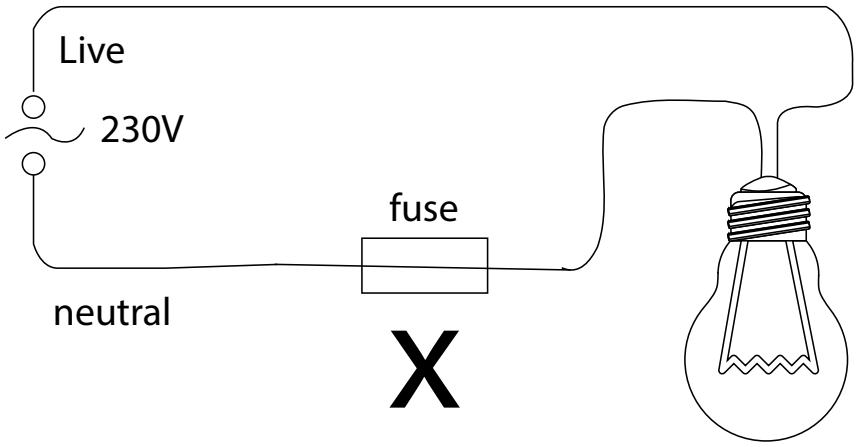
iv. 1 A

v. In speakers, to control volume.

5)

I. Because it's wired incorrectly so that the live conductor reaches the lampholder without being switched/fused first. If the bulb is removed, the lampholder terminals remain live, risking electric shock on contact. Also, placing the fuse/switch in the neutral means a fault may not disconnect the live.

II.



6)

I. The end where the current enters the coil becomes the south pole, and the end where it leaves becomes the north pole.

II. Two ways to make the electromagnet stronger

Increase the number of turns in the coil

Increase the current flowing through the coil

III. Reverse the direction of the current in the coil. This will swap the north and south poles of the electromagnet.

IV. a. Soft iron is commonly used because it is easily magnetized and demagnetized.

b. Steel retains magnetism (it is hard to demagnetize), so it would act like a permanent magnet rather than an electromagnet.

Soft iron is preferred because it loses magnetism quickly when the current is switched off.

7)

I. a. On:

The coil becomes an electromagnet, attracting the iron arm. The signal moves to the "on" position.

b. Off:

coil loses magnetism, the iron arm is released, and the signal returns to its original position.

II. a. Increasing the current makes the electromagnet stronger, so the arm moves more firmly.

Decreasing the current makes it weaker, so the arm may not move properly.

b. A stronger current produces a stronger magnetic field, which pulls the iron arm more effectively.

III. a. It would reverse the poles of the electromagnet.
b. Reversing the current changes the magnetic field direction, so the north and south poles swap.

IV. Attach a scale and a spring to the moving arm. The arm will move more as the current increases. The scale shows the amount of movement, which indicates the current.

Chapter 11 The Universe

1) MULTIPLE CHOICE QUESTIONS

i. b. the milky way

ii. b. A large group of stars in orbit around a high gravity area

iii. a. billions

iv. c. gas only

v. c. spiral galaxy

2) TRUE OR FALSE

i. True

ii. False

iii. False

iv. True

v. False

3)

The universe contains everything that exists. Astronomers have estimated that it contains trillions of galaxies. Planet Earth is just a tiny part, located in a galaxy called the milky way. Galaxies contain billions of stars. Astronomers once thought that our galaxy was the only one. Today, however, we know that our galaxy is only one of many. The nearest galaxy to ours is called andromeda which about 2.5 millions light years away. This measurement is the distance that light travels in one year moving at 300 000 kilometres per second.

4)

i.

a. Temperatures rise and the nebula transforms into a protostar as gravity increases. Nuclear fusion is the process by which hydrogen atoms combine to form helium atoms when the temperature rises.

b. The star will collapse due to a sudden drop in pressure, raising the temperature at its core to almost 100,000,000°C. Helium atoms will combine to form heavier atoms at such high temperatures. When this occurs, the star will continue to grow, eventually producing a red giant

c. Stars that are comparable in size to our Sun will eventually collapse to end their lives as visible white dwarf stars and ultimately invisible black dwarf stars.

d. massive stars that eclipse our Sun's mass disintegrate into black holes known as supernovae. Not even light can escape a black hole due to its extremely powerful gravitational attraction.

ii. Stage 2

iii. Stage 4

iv. Depends on the size of star as compared to sun. If it is similar or smaller to the size of sun, then it becomes dwarf star. If massive than sun, it becomes black hole.

v. 4-5 billion years

5)

i. Huge clouds of gas, dust, dark matter, and millions of stars bound together by gravity make up a galaxy.

ii. Spiral galaxy

iii.

a. Elliptical galaxy

b. Elliptical galaxies are round or oval whereas spiral is in whorl shape. Spiral and elliptical galaxies both have a bulge, but spiral galaxies do not have a flat disk of stars.

iv. Astronomers have observed with the help of telescopes that nearby galaxies are moving far away thus universe is expanding.

6)

i. Advanced robots developed for space exploration have found their use in industries such as robotic arms are useful in transporting materials.

Solar panels were developed to harvest energy for space missions. Now, solar panels are commonly used in houses.

Scratch resistant plastic was invented to endure the harshness of space. This has been used in sunglasses and spectacles.

Experiments performed in the zero gravity conditions in space help scientists to understand health problems on Earth and develop new medicines.

ii. The world would not have any modern means of communications such as phone. We would have almost no information about the universe. We wouldn't have any information about natural disasters priorly.

iii. These discoveries can lead us to find that life on other planets is possible that might us to find a way to inhabit other planets.

iv.

a. They can be right in the sense that the money should be spent on solving problems on earth such as poverty.

b. They can be wrong as space research has lead to many useful inventions such as solar panels.

WORKBOOK ANSWERS

Chapter 1 Ecology

1)

i. True

ii. False

iii. False

iv. False

v. False

2)

i. b. 1st consumer

ii. D. 2nd consumer

iii. C. there would be more lettuce

iv. D. producer ⟶ 1st consumer ⟶ 2nd consumer

v. c. arrows can point in any direction in food web

3)

i. surroundings in which living and non-living things live and survive

ii. Living parts of ecosystem

iii. Non-living parts of ecosystem are known as abiotic factors

iv. **a.** deer

b. grass

c. Birds

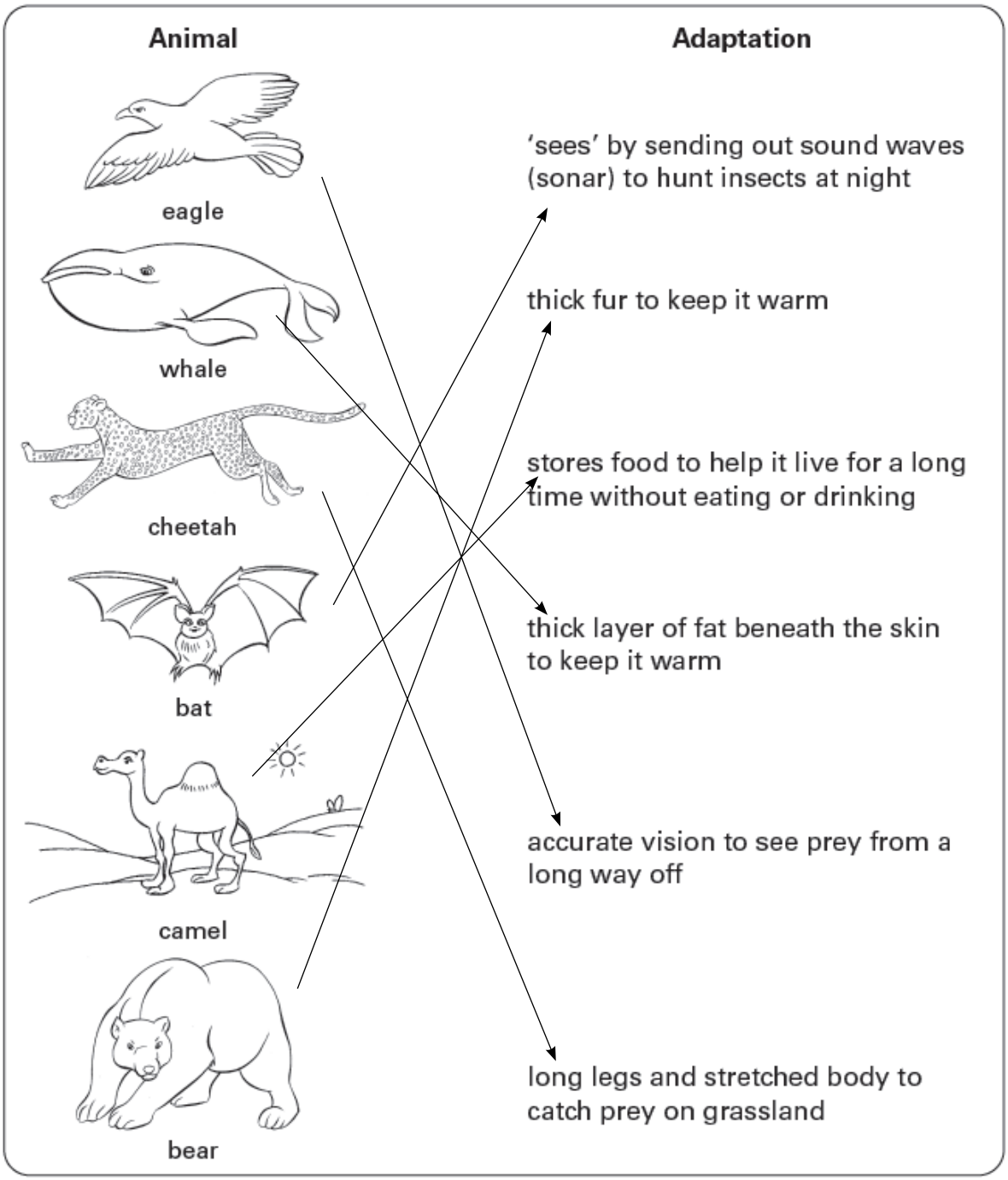
d. trees

v. **a.** sunlight

b. air

c. water

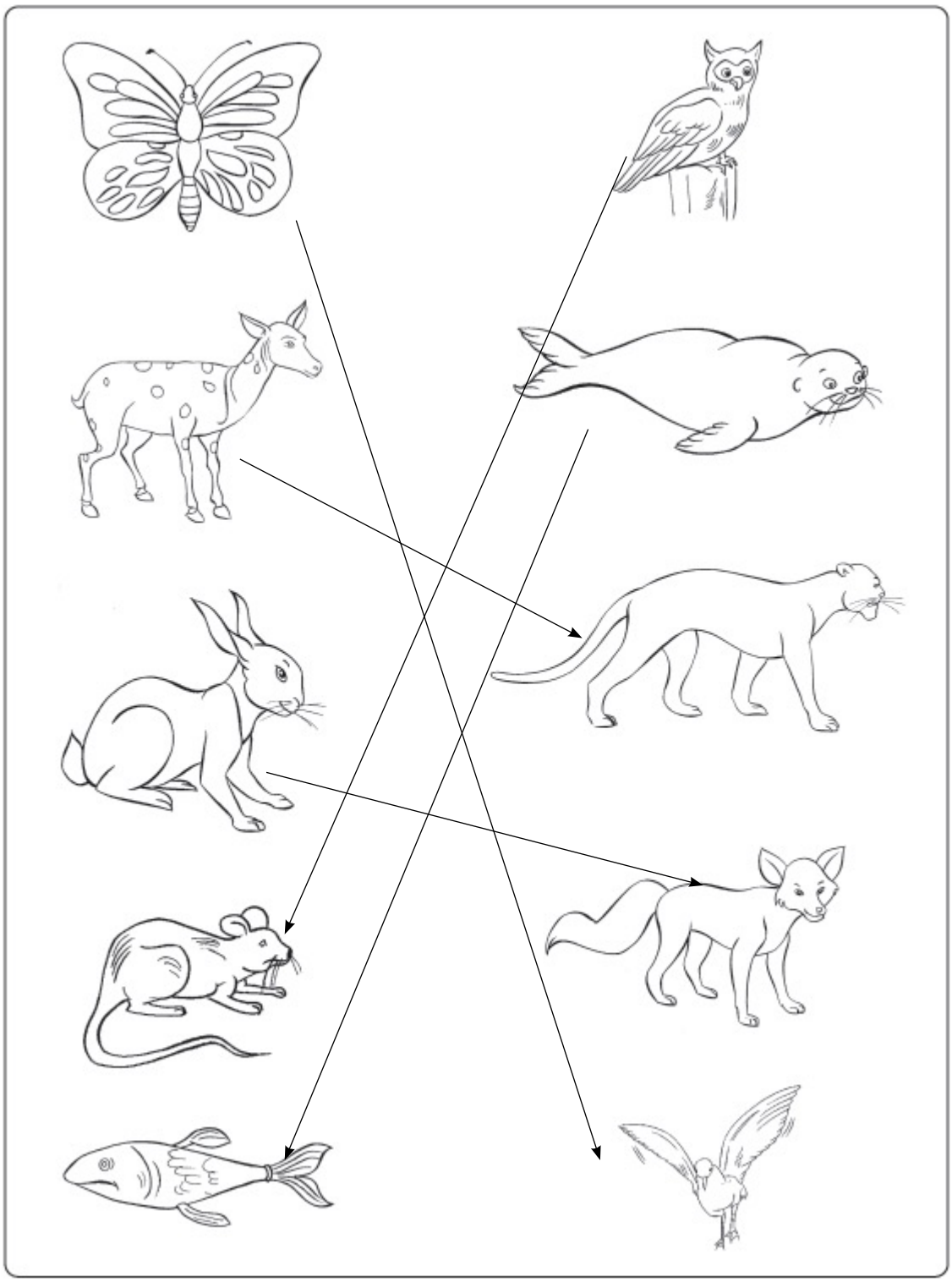
4)



5) **i.** students will write answer according to their own creative imagination

ii. students will write answer according to their own creative imagination

iii.



6)

i. herbivore: slug

Carnivore: cats

Consumer: thrush

ii. lettuce

iii. Lettuce is a plant which produces its own food through photosynthesis

iv. Arrows show which way the energy of food is transferring

7) **i.** by illustrator.

ii. **a.** as grasshoppers are eaten by lizards so their death will decrease the number of lizards

b. number of grass and lettuce plants will increase because grasshoppers won't eat them

c. there will be more lizards for foxes to eat because of absence of grasshoppers

8)

i. over the 60 years, the number of red squirrels has declined and they are now very rare

ii. Because they have been seen living together happily in many areas of woodland

iii. The grey squirrel is heavier than the red squirrel and spends more time on the ground eating from oak trees. Red squirrels spend more time in trees. They prefer coniferous woodland where they feed on the seeds from pine cones. The red squirrels are unable to digest acorns.

iv. For food

v. more pine trees should be planted so more food would be available for red squirrels

Chapter 2 Human Nervous System

1) TRUE OR FALSE

i. False

ii. False

iii. False

iv. True

v. True

2)

i. b. sensory nerve cell

ii. b. gland

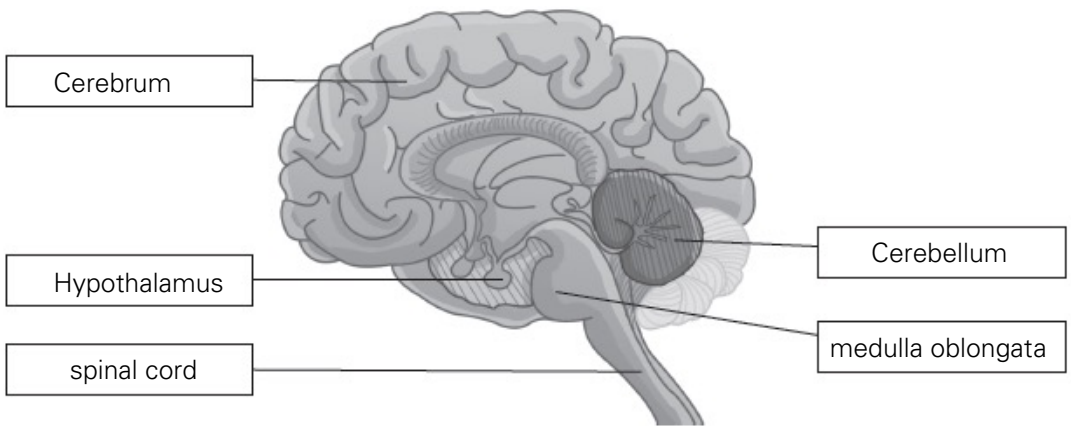
iii. d. synapse

iv. b. cerebrum

v. a. the left side of the body

3)

i.



ii. Spinal cord

iii. It is the thermostat of body, regulates temperature

iv. **a.** cerebral hemisphere

b. Information from the left side of the body is processed by the right cerebral hemisphere, while information from the right side of the body is processed by the left cerebral hemisphere.

4)

Challenge 1:

What is the sum of all the digits in the number 2025?

Challenge 2:

If you start counting from 1, what number will you say on the 15th count?

Challenge 3:

Without writing it down, name the days of the week in reverse order.

Challenge 4:

Think of a three-digit number. Reverse its digits and subtract the smaller number from the larger one. What is the result?

Chapter 3 Variations, Heredity and Cell Division

1) TRUE OR FALSE

i. True

ii. True

iii. False

iv. True

v. True

2)

i. c. height

ii. a. greasy fur

iii. c. 46

iv. a. blonde hair

v. c. 4

3)

i. 1

ii. 13cm

iii. 20

iv. Continuous variation

4) mistake in graph

5)

i. prophase ⟶ metaphase ⟶ metaphase ⟶ anaphase ⟶ telophase

ii. a. 24

b. 24

iii. Prophase

iv. It means DNA replicates to form 2 copies of each chromosome membrane

v. **a.** 2

b. 78

vi. In plants mitosis occurs at tip of stems and roots because apical meristem is present there that help in increase of length

Chapter 4 Biotechnology

1) TRUE OR FALSE

i. True

ii. False

iii. True

iv. False

v. True

2)

i. c. vinegar

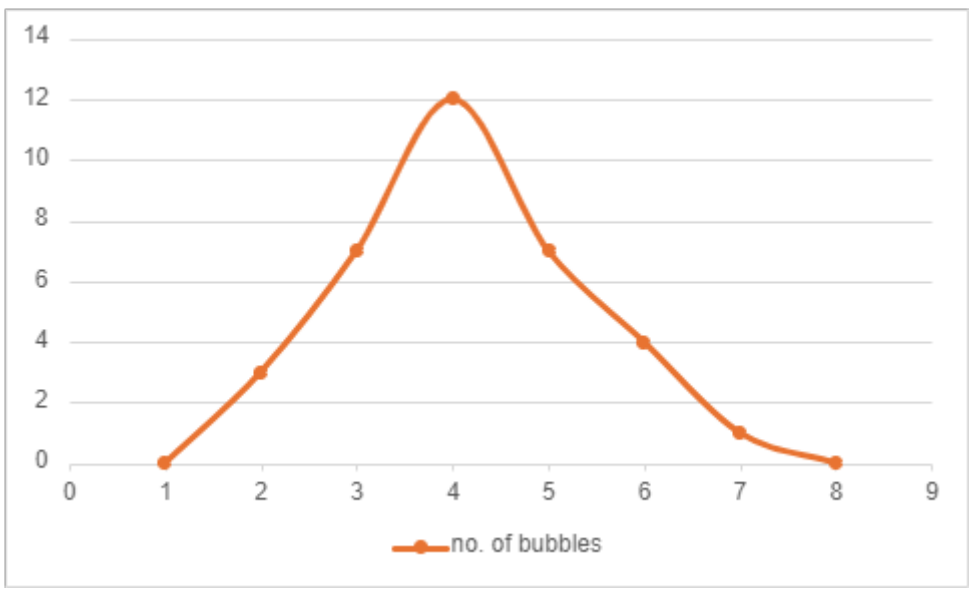
ii. c. 71.7°C

iii. b. controls levels of sugar in the blood

iv. d. transgenic

v. Golden rice (mistake in question)

3) i. a.



b .the rate of fermentation increases with temperature but at higher temperature yeast is killed

ii. **a.** 30°C)

b. this the ideal temperature for quickest fermentation, temperature greater than this would kill the yeast

iii. **a**. alcohol and water

b. alcohol evaporates, producing the smell associated with baked bread

iv. Above 70°C the enzymes are denatured

4)

i. C,B,A,F,D,E

ii. **a.** it is a protein present in milk

b. lactic acid coagulates casein to produce thick, cream yoghurt

iii. To destroy any naturally occurring bacteria in it

iv. **a.** pasteurization and fermentation

b. rennet is added in cheese making, different types of bacteria can be used to produce different type of cheese

v. to retain milk's nutritional benefits in food that wasn't meant to be consumed right immediately

5)

i. **a.** in form of plasmids which are small rings of DNA

b. bacterial DNA is circular and human DNA is linear

ii. Plasmids

iii. Since bacteria reproduce and grow at rapid rate, they make the products much more quickly than the original animal or plant cell

iv. Insulin gene from human cell can be inserted into bacterial DNA molecule

v. Advantages:

- Easier weed control
- Higher crop yield
- Saves time and cost

Disadvantages:

- More herbicide use harms environment
- Weeds may develop resistance
- Possible health risks and loss of biodiversity

6)

Fungi such as mushrooms have been eaten for centuries. In recent years the attention of food scientists has been drawn to a mould fungus called fusarium. Fusarium contains about 45% protein and 13% fat. This is about the same as the protein: fat ratio of meat. The big advantage that fusarium has is that it contains a lot of dietary fibre and is cholesterol free. Fusarium can be grown on any material containing carbohydrate such as potatoes, rice or wheat. It is grown in large industrial fermenters

Chapter 5 Periodic Table

1) TRUE OR FALSE

i. True

ii. False

iii. True

iv. False

v. true

2)

i. b. 1

ii. B. the total number of protons

iii. B. 3

iv. A. alkaline earth metals

v. c. 8

3)

Argon	Ar
beryllium	Be
boron	B
chlorine	Cl
fluorine	F
lithium	Li
nitrogen	N
oxygen	O
Phosphorus	P
Sulphur	S

4)

i. **a.** periods are horizontal rows in which elements are arranged from left to right according to their atomic number. Groups are columns of periodic table in which all the elements in group have same number of electrons on their outer shell

ii. **a.**

Group																	
I	II										III	IV	V	VI	VII	VIII
						1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9										5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24										13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 55	25 Mn manganese 56	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium 96	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 113	56 Ba barium 137	lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium 210	85 At astatine 210	86 Rn radon 222
87 Fr francium 223	88 Ra radium 226	actinoids	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium	113 Nh nihonium	114 Fl flerovium	115 Mc moscovium	116 Lv livermorium	117 Ts tennessine	118 Og oganesson

Key: atomic number **Symbol** name mass number

This line divides the metals from the non-metals

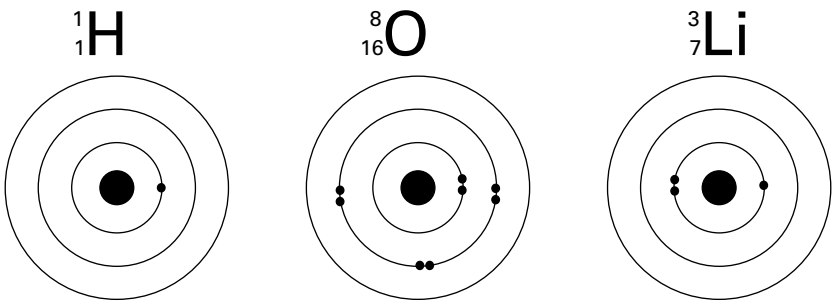
57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium 147	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	69 Tb terbium 159	66 Dy dysprosium 162	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium 227	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium 237	94 Pu plutonium 242	95 Am americium 243	96 Cm curium 247	97 Bk berkelium 247	98 Cf californium 251	99 Es einsteinium 254	100 Fm fermium 253	101 Md mendelevium 256	102 No nobelium 254	103 Lr lawrencium 257

b. they have same number of electrons in their outer shell

iii. Hydrogen has conspicuous properties which makes it different from other elements. It resembles alkali metals as well as halogens hence placed separately

iv. Refer to the diagram in the textbook on page 81

5)



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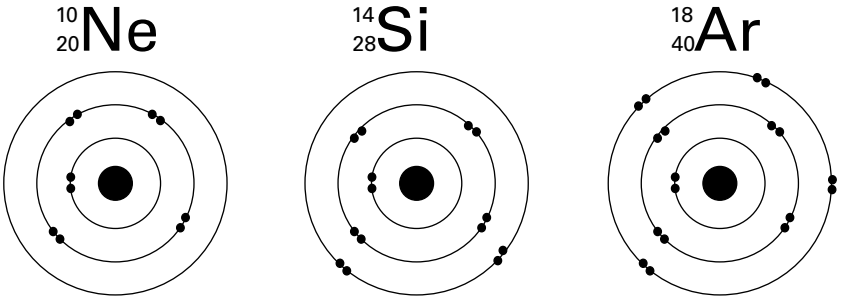
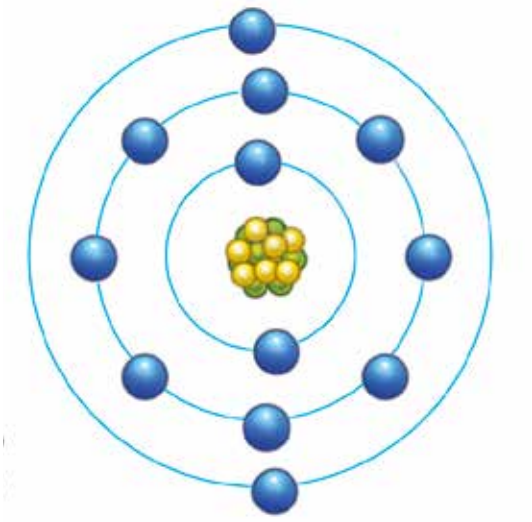


8) the group I (alkali metals) metals are lithium, potassium, sodium they all have one electron in their outer shell and increase in size down the group. And usually for metals, they have low melting points and low densities. They react vigorously with water giving off hydrogen gas and forming an alkali. Group I metal are reactive because their atoms can easily loose one electron to become negative ions



Chapter 6 Chemical Reactions

1) TRUE OR FALSE

I. True

II. False

III. False

IV. True

V. false

2)

I. c. iron sulphide

II. C. respiration

III. C. combustion

IV. D. reactants

V. a. heat

3)

I. H_2O

II. HCl

III. $MgCl_2$

iv. NH_3

V. CH_4

Vi. CO_2

4)

I,II

a. $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$

b. $2\ Mg\ (s) + O_2(g) \longrightarrow 2\ MgO\ (s)$

c. $2\ Na\ (s) + 2\ H_2O\ (l) \longrightarrow 2\ NaOH\ (aq) + H_2\ (g)$

d. $N_2\ (g) + 3H_2\ (g)\ 2NH_3\ (g)$

e. $CO_2\ (g) + H_2O\ (l) \longleftrightarrow H_2CO_3\ (aq)$

III. State symbols show the physical state of substances in a chemical equation, which helps us understand how a reaction occurs.

Example with water:

Consider the equation for water formation:

$2H_2\ (g) + O_2\ (g) \longrightarrow 2H_2O\ (l)$

- (g) means hydrogen and oxygen are gases.
- (l) means water is a liquid.

If we wrote just H_2O without (l), it could be confusing because water can also exist as ice (solid) or steam (gas). State symbols clarify the conditions.

5)

I. **a.** magnesium

b. silver

II.

a. magnesium, lead

b. by reading the metal X with lead nitrate, if reaction occurs means it is magnesium and if no reaction happen means its lead

III. In displacement reaction, one substance pushes out another substance to take its place

6)

U displaces Q from QO, so U is more reactive than Q.

U does not displace P from PO, so P is more reactive than U.

Therefore, the reactivity series from most reactive to least reactive is:

P > U > Q

7)

Exothermic: respiration in animal and plant cells, a burning match,a firework exploding

Endothermic: frying an egg, plants using sunlight energy to make food, sucking a mint to cool your mouth

8)

Exothermic Reactions (release heat/energy)

- A burning match
- A firework exploding
- Respiration in animal and plant cells

Endothermic Reactions (absorb heat/energy)

- Frying an egg
- Plants using sunlight energy to make food (photosynthesis)
- Sucking a mint to cool your mouth

9)

I. This reaction is an example of a combination reaction (also called a synthesis reaction).

II.

a. carbon atom and oxygen molecule

b. carbon dioxide

III. In covalent bond atom completes its outer shell by sharing electron with another atom. There are two covalent bonds in this example because two oxygen atoms are sharing electrons with carbon

IV. In ionic bond there is complete transfer of electron from one atom to another whereas covalent bond involves sharing of electrons between two atoms

V. because there are weak attractive forces between molecules having low melting points, hence most covalent compounds are liquid or gases at room temperature

Chapter 7 Acids, Bases and Salts

1) TRUE OR FALSE

I. True

II. False

III. True

IV. False

V. true

2)

I. a. green

II. C. violet/indigo

III. C. hydrochloric acid

IV. c

V. a. calcium carbonate

3)

I. litmus

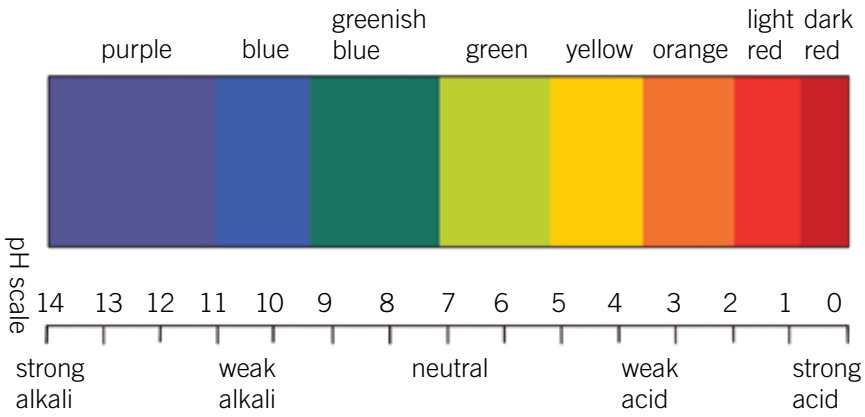
II.

a. red

b. blue

III. This is useful because the universal indicator provides a quick and clear way to determine the acidity or alkalinity of a solution. Each pH value corresponds to a distinct color, so instead of doing complex chemical tests, you can simply compare the color to a pH scale and know whether the solution is strongly acidic, neutral, or strongly alkaline.

IV.



4)

Household item	pH	Colour of universal indicator paper	Acid, alkali, or neutral
Oven cleaner	13	Blue	Strong alkali
Tap water	7	Green	Neutral
Vinegar	3	Orange	Weak acid
Lemon juice	1	Red	Strong acid
Baking powder	9	Violet/Indigo	Weak alkali

5)

Hydrochloric acid ⟶ Chloride

Nitric acid ⟶ Nitrate

Sulphuric acid ⟶Sulphate

Phosphoric acid ⟶ Phosphate

Ethanoic (acetic) acid ⟶ Ethanoate (acetate)

6)

I. it is alkaline

II. When an acid and an alkali are mixed together, they cancel out or neutralize each other forming salt and water

III. Salt and water

IV. When dilute hydrochloric acid is mixed with dilute sodium hydroxide, the hydrogen in the acid is replaced by the metal sodium. The salt sodium chloride is made. The hydrogen ions combine with hydrogen ions to make water

7)

i. To help the tablets dissolve faster and completely in water.

ii. To make the test fair and ensure results can be compared accurately.

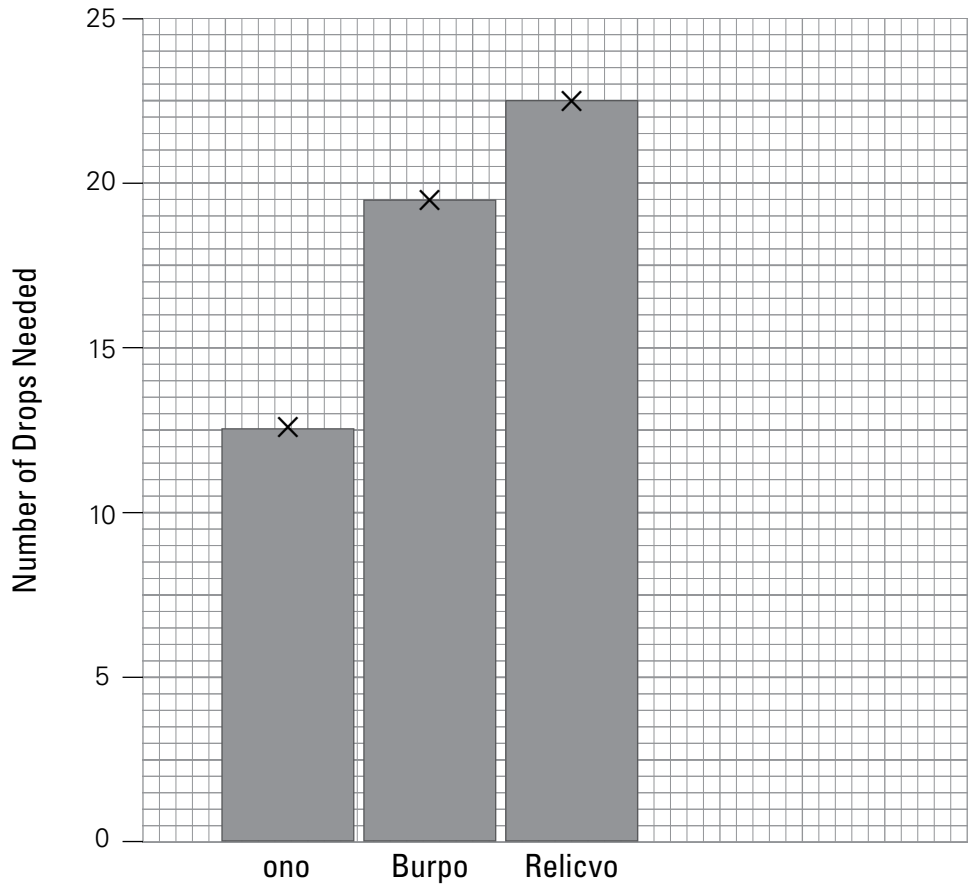
iii. By using a universal indicator or pH paper and checking when the color shows pH 7 (green).

iv. To improve reliability and reduce errors by averaging the results.

v.
- Ono: (12 + 12 + 14) ÷ 3 = 12.7
- Burpo: (18 + 19 + 22) ÷ 3 = 19.7
- Relievo: (22 + 21 + 24) ÷ 3 = 22.3

Indigestion tablet	1st Exp	2nd Exp	3rd Exp	Average
Ono	12	12	14	12.7
Burpo	18	19	22	19.7
Relievo	22	21	24	22.3

VI.



Graph to be drawn

vii. Ono requires the least acid to neutralize, so it is the most effective indigestion tablet. The effectiveness of an indigestion tablet is measured by how much acid it can neutralize. Since Ono needed the fewest drops of acid, it has the highest neutralizing capacity and is therefore the best choice.

8)

A salt is made whenever an acid reacts with an alkali. It is possible to find out just how much acid is needed to neutralize an alkali by carrying out filtration. This is an experiment that uses equipment that can measure the volume of a solution accurately. Acid is added to alkali until a neutral point is reached. The solution now contains salt and water. Thes salt can be obtained by evaporating the water away.

9)

i.

Plants need mineral elements for healthy growth,.

ii.

a. Cabbages (need nitrogen & phosphorus):

Super phosphate (high phosphorus) or Sulphate of ammonia (high nitrogen).

b. Parsnips (need nitrogen & potassium):

Nitrate of potash (high potassium and some nitrogen).

iii. Which fertilizer must be used by a gardener who wants to grow beans?

Beans need phosphorus and potassium, so use Nitrate of potash (potassium) or Super phosphate (phosphorus).

v. a.

- Root vegetables (like carrots, parsnips) need phosphorus for strong roots.
- Leafy vegetables (like cabbage, lettuce) need nitrogen for healthy leaves.

b.

Phosphorus helps in root development, while nitrogen helps in leaf growth and green color.

Chapter 8 Force and Pressure

1) TRUE OR FALSE

I. true

ii. True

iii. False

iv. True

v. false

2)

i. d. N

ii. D. keep moving at a steady speed in straight line

iii. D. 60,000 Pa

iv. A. the pressure is higher at the bottom than at the top

v. c. it has a small area, so pressure is large

3)

i. Which block has the largest mass?

China (mass = 70 g).

ii. Write the materials in order (smallest to largest mass):

Cork (2.4 g) - Wood (6 g) - Magnesium (14 g) - Aluminium (19 g) - Copper (22 g) - China (70 g).

iii. Volume of each block = $2 \times 2 \times 2 = 8\,cm3$

- wood: 6/8 = 0.75 g/cm3
- cork: 2.4/8= 0.30 g/cm3
- Magnesium: 14/8 = 1.75 g/cm3
- aluminium: 22/8=2.75 g/cm3
- china: 19/8 = 2.38 g/cm3

iv. a.

Blocks with density less than 1 g/cm³ will float:

Cork (0.3) and Wood (0.75).

b.

Objects float if their density is lower than water's density (1 g/cm³).

4)

i. A life jacket helps you float because it is made of materials that are less dense than water (like foam or air-filled pockets). This lowers your overall density, making it less than 1 g/cm³, so you become buoyant and float on water.

ii. Steel is denser than water, hence a piece of steel sinks in water whereas a steel ship is an air filled hallow steel object. The average density of ship falls below water because of abundance of air within it. A ship can therefore float on water

iii. A ship will sink farther into the ocean because the weight of ship as a whole increase, causing more water to be displaced in order to create the buoyant force required to sustain the extra weight

iv.

Whales are adapted to live in water, where buoyant force supports their massive weight. On land, there is no upthrust, so their full body weight presses down, making it extremely hard for them to move and causing stress on their organs.

v.

In water, your body experiences upthrust, reducing your effective weight. This means less pressure on your feet, so the pebbles don't press as hard and it feels less painful.

5. needs to be typed. Do Not use the image below.

i. Mass of the metal block

$$\text{Mass} = \frac{\text{Weight in air}}{g} = \frac{40\ \text{N}}{10\ \text{N/kg}} = 4\ \text{kg}$$

ii. Upthrust on the block

Upthrust = Weight in air – Wright in water = 40 N –30 N = 10 N

iii. Weight of water displaced

By Archimedes' principle, **upthrust = wieght of water displaced,** so:

Weight of water displaced = 10 N

iv. Mass of water displaced

$$\text{Mass} = \frac{\text{Weight in air}}{g} = \frac{40\ \text{N}}{10\ \text{N/kg}} = 1\ \text{kg}$$

6.

i

Stiletto heels have a very small area, so the pressure = force ÷ area is much higher, causing more damage to floors.

ii

Snow shoes have a large surface area, which spreads the weight over a bigger area, reducing pressure so they don't sink into the snow.

iii.

Studs increase grip by concentrating force on small points, creating high pressure that digs into the ground for better traction.

iv.

The nails are numerous and close together, so the fakir's weight is spread over many points, reducing pressure at each point and preventing injury.

v.

The thin handles have a small area, so the pressure on your hands is high, causing discomfort.

vi.

Wide feet spread the camel's weight over a large area, reducing pressure so they don't sink into soft sand.

7.

iii

- The flat end has a large area, so pressure on the surface is low, making it stable.
- The pointed end has a small area, so pressure is very high, causing it to sink or tip over easily.

8

i. Pressure at A

$$\text{Pressure at A} = \frac{\text{Force at A}}{\text{Area of A}} = \frac{50\ \text{N}}{A_A}$$

ii. Mass of water displaced

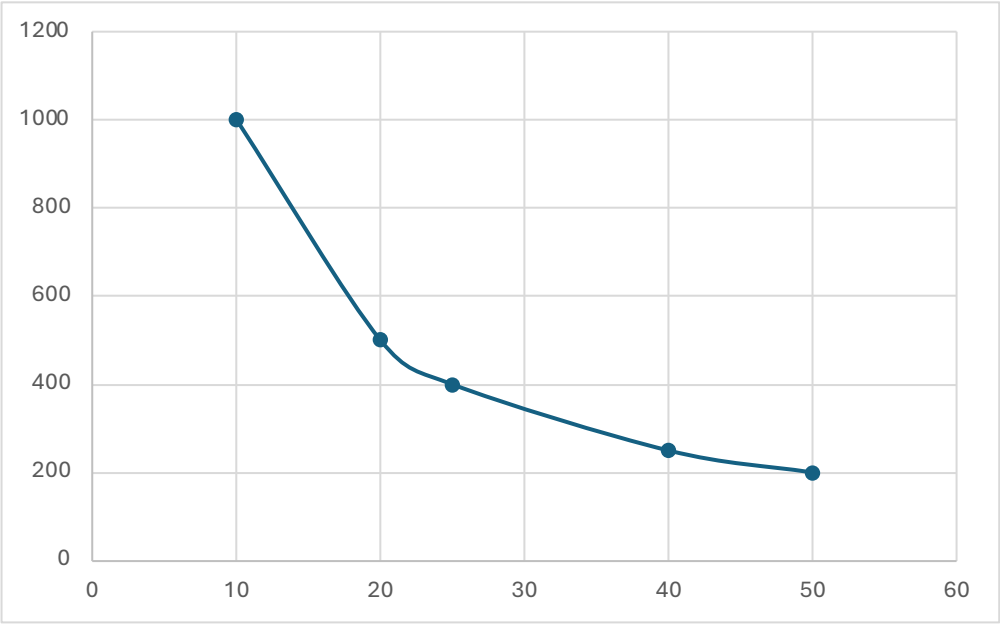
Pressure is the same throughout the fluid:

$$\text{Pressure at B} = \text{Pressure at A} = \frac{50}{A_A} = 1\ \text{kg}$$

iv.

The small piston moves the most because it has a smaller area, so it travels a greater distance to displace the same volume of fluid.

9.



i. pressure and volume of a gas are inversely proportional

ii.

As the volume decreases, the pressure increases. This is an inverse relationship (Boyle's Law):

$P \propto 1/V$

Example from the table:

- Volume = 50 cm^3 ⟶ Pressure = 200 kPa
- Volume = 10 cm^3 ⟶ Pressure = 1000 kPa

iii.

When a gas is compressed, its particles are forced closer together. Work is done on the gas, increasing the kinetic energy of particles, which raises the temperature.

iv.

1. LPG cylinders (cooking gas)
2. Compressed air in car tires

Chapter 9 Reflection and Refraction of Light

1. **i.** True

ii. True

iii. True

iv. True

v. True

2. **i.** c

ii. b

iii. c

iv. c

v. a

3. Rays of light are transmitted through materials such as glass.

Opaque materials, such as wood, absorb light. When a piece of wood is placed in a beam of light, a shadow is formed. This is because the light is absorbed by the wood. There are other materials such as greaseproof paper which let some light through. These are called translucent.

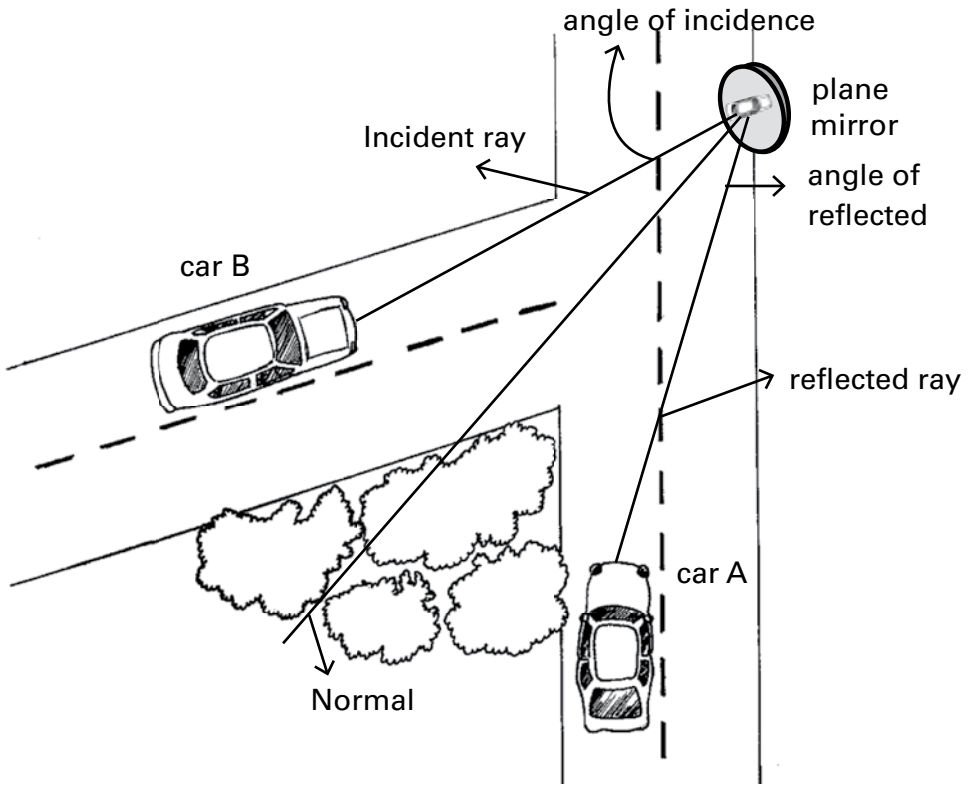
4.

i. The boy is able to see the book because light from the window falls on the book and is reflected into his eyes.

ii. The boy cannot see his reflection because the pages of the book have a rough, non-reflective surface that scatters light instead of reflecting it clearly.

iii. Underline the word non-reflective

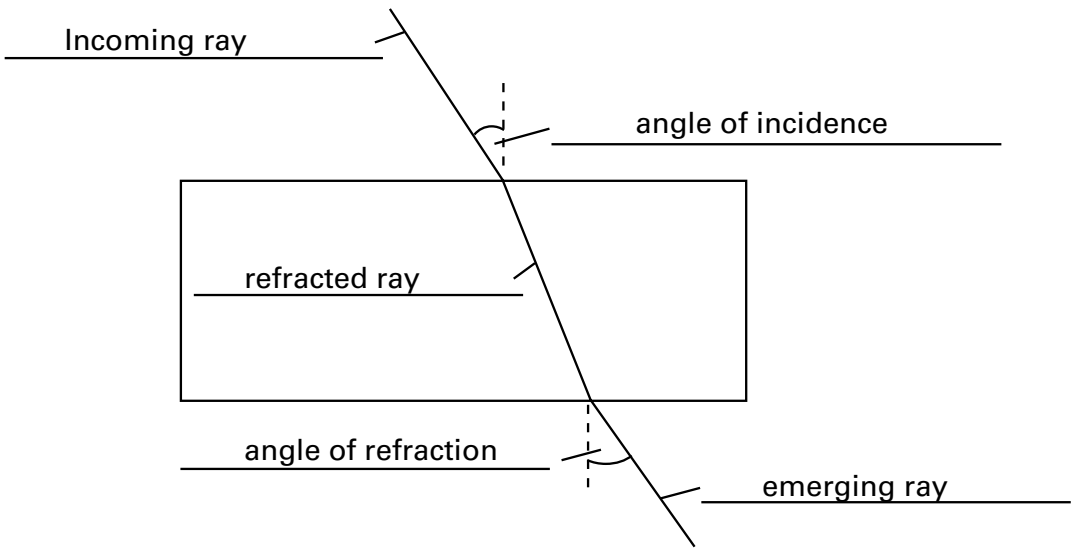
5. Imagine you are driving from a side road joining the main road at a blind junction. There is a big plane mirror on the opposite side of the junction to help you drive onto the main road safely.



6 The diagram shows a single ray of light passing through a glass block.

i. Put these labels on the diagram.

angle of incidence	**angle of refraction**	**emerging ray**
incoming ray	**refracted ray**	

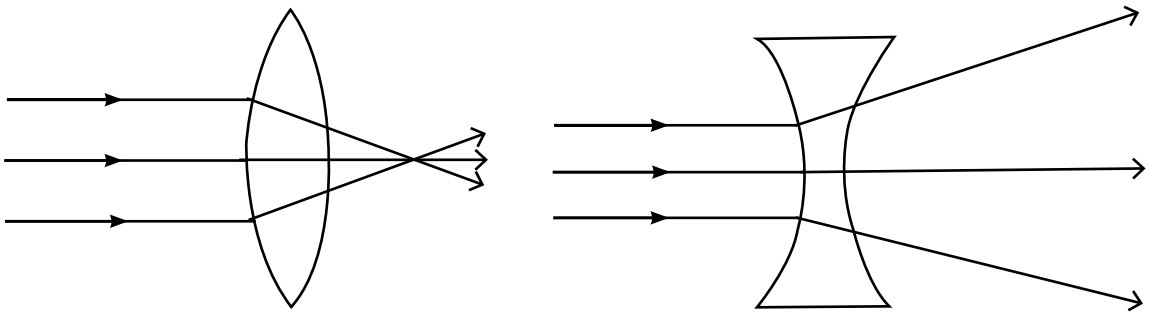


ii. What do the incoming ray and emerging ray have in common?

They are pauallel fo each other.

7 The diagram shows two lenses.

i.



A
Convex

B
Concave

a. lens A? Clip will look large and upright

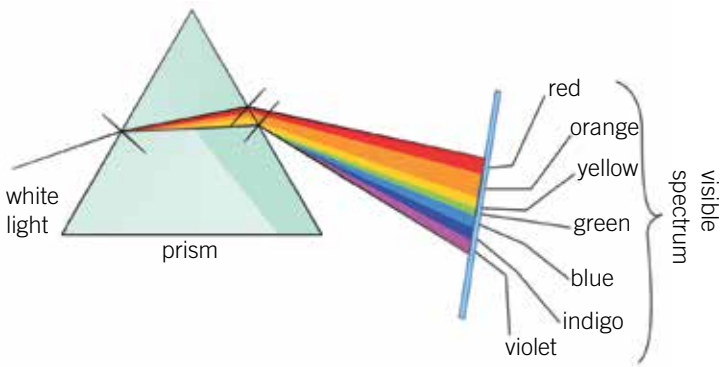
b. lens B? smaller and upright

Telescope

a. The image on screen is inverted, wheras object is upright.

b. Image can be magnified while object remains its originals size.

8 The diagram shows what happens to a ray of white light when it passes through a triangular prism and onto a screen.



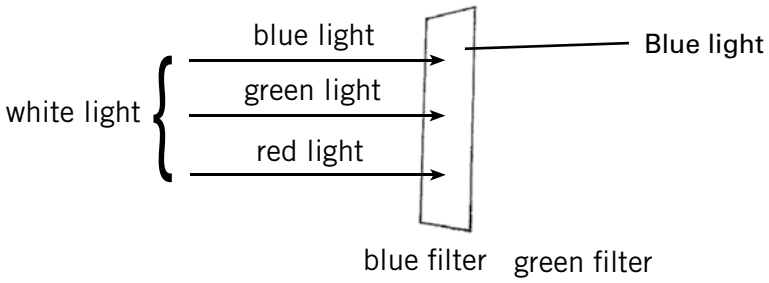
red, orange, yellow, green, blue, indigo, violet.

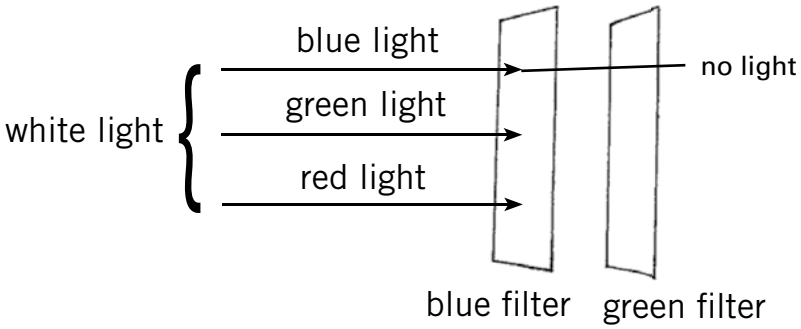
a. A? red

b. B? violet

9 **A coloured plastic sweet wrapper can be used as a colour filter.**

i. A colour filter allows only one colour of light to pass through and absorbs the other colours.





ii. a. Lens A (Convex lens)?

The paper clip would look magnified because a convex lens converges light rays and acts as a magnifying lens when the object is close.

- b. Lens B (Concave lens)?

The paper clip would look smaller because a concave lens diverges light rays and makes objects appear reduced in size.

iii. Lens B (concave lens) might be used in spectacles for correcting short-sightedness (myopia).

iv. a. The image is inverted compared to the object.

b. The image is smaller or larger in size (depending on the object's distance from the lens).

8. i. violet, indigo, blue, yellow, orange, red

ii. A. violet

B. red

9. **i.** A colour filter only allows light of its own colour to pass through and absorbs other colours.

ii. • White light contains all colours (ROYGBIV).

- When white light passes through a blue filter, only blue light is transmitted, and all other colours are absorbed.

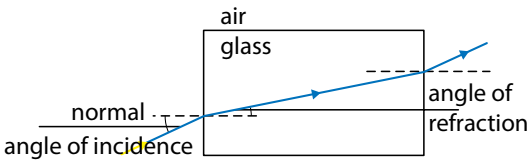
iii. • White light hits the blue filter ⟶ only blue light passes through.

- Then blue light hits the green filter ⟶ green filter blocks blue light (because it only transmits green).
- Result: No light comes out (it appears black).

10. Yellow light on a red car

i. • A red car under yellow light appears black because yellow light has no red component for reflection.

ii. The diagram shows yellow light from a street lamp shining on a red car.

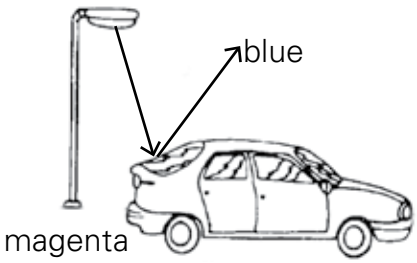


i. What colour does the car appear to be?

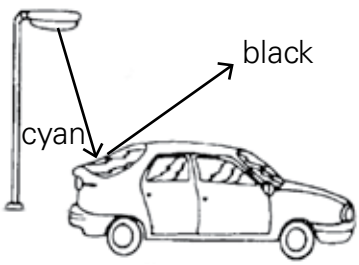
_____

ii. Draw simple diagrams to show what happens when

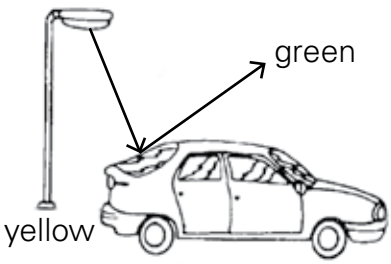
a. magenta light shines on a blue car.



b. cyan light shines on a red car.



c. yellow light shines on a green car.



Chapter 10 Electricity and Magnetism

1.

i. True

ii. True

iii. True

iv. True

v. False

2.

i. d

ii. a

iii. a

iv. b

v. c

3.

i.

Resistance is the property of a material that opposes the flow of electric current in a circuit.

ii.

The unit of resistance is the ohm (Ω).

iii. Calculate the resistance using the formula

$$R = \frac{\text{Voltage}}{\text{Current}}$$

Given:

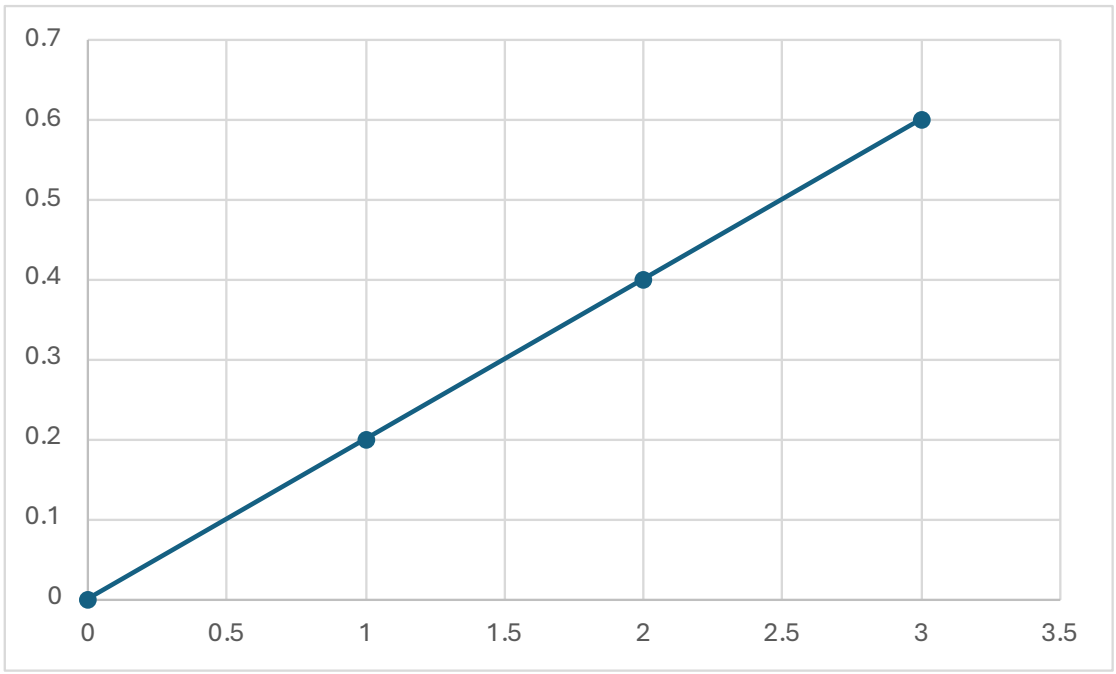
Voltage (V) = 6 V

Current (I) = 4 A

$$R = \frac{6}{4} = 1.5\ \Omega$$

4

i.



ii

a. Current at 3.5 V:

From the pattern, every 1V adds 0.2 A.

So at 3.5 V:

$$I = 0.2 \times 3.5 = 0.7 \text{ A}$$

b. Voltage for 0.1 A:

Every 0.2 A corresponds to 1 V.

So for 0.1 A:

V = 0.5 V

iii

If voltage doubles, current also doubles (Ohm's law: IV)

iv. Calculate resistance

Using Ohm's law:

$$R = \frac{V}{I}$$

Take any point, e.g., V = 4 V, I = 0.8 A:

$$R = \frac{4}{0.8} = 5\ \Omega$$

5.

i.

a. Electric kettle using 10 A

b. Table lamp using 0.25 A

ii.

Because the fuse will not blow if the current rises slightly above 2 A, the appliance could overheat and cause a fire before the fuse melts.

iii. Formula for current

$$\text{Current (A)} = \frac{\textit{Power (W)}}{\textit{Voltage (V)}}$$

a. Fan heater (2 kW)

$$\text{Current} = \frac{2000}{230} = 8.7\ \text{A}$$

Fuse: **13 A fuse** (next hight rating).

b. Fan heater (2 kW)

$$\text{Current} = \frac{1100}{230} = 4.8\ \text{A}$$

Fuse: **5 A fuse.**

6. **(i)** 20 W and 100 W

(ii) 1 kWh = energy used by 1 kW in 1 hour

(iii) 20 kWh

(iv) 100 kWh

(v) Rs 800 saved

7.

i.

Place a compass or sprinkle iron filings on the card around the wire.

The compass needle will deflect, or the filings will form circular patterns, showing the magnetic field.

ii.

Draw concentric circles around the wire on the card.

These circles represent the magnetic field lines.

Use arrows to show direction (clockwise or anticlockwise depending on current direction, using the right-hand rule).

iii.

The magnetic field is strongest closest to the wire because field strength decreases as distance increases.

iv.

a. Direction of magnetic field reverses

b. Strength of magnetic field stays the same

8.

i. In B, the coil is wrapped around an iron rod, which acts as a soft iron core.

The iron core concentrates and strengthens the magnetic field produced by the coil, making it much stronger than the coil alone in A.

ii.

a. Increase the current flowing through the coil.

b. Add more turns of wire to the coil.

iii.

The north and south poles swap places because the direction of the magnetic field depends on the direction of current.

iv.

Steel is magnetically hard, meaning it stays magnetized permanently.

For an electromagnet, we need a soft iron core so it can magnetize and demagnetize easily when the current is switched on and off.

v. It is called a solenoid.

9.

i.

An electromagnet can be switched on and off by controlling the electric current, making it ideal for scrapyards.

A permanent magnet is always magnetic and cannot be controlled.

ii. Use an electromagnet to pick up steel cans (because steel is magnetic).

Aluminium cans remain behind because aluminium is non-magnetic.

iii. Loudspeakers

a. In radios, TVs, mobile phones, computers, and public address systems.

b.

1. A magnet produces strong magnetic field.

2. A coil (electromagnet) is attached to a paper cone.

3. An amplifier sends a variable electric current to the coil (electromagnet).

4. The magnets repel and attract and the coil moves.

5. The coil makes the paper vibrate.

6. Vibrations travel through the air to the ear.

Chapter 11 The Universe

The Universe

1. True or False

i. True

ii. False

iii. True

iv. True

v. True

2. Choose the correct option

i. a. nuclear power

ii. d. white dwarf star

iii. c. spiral galaxy

iv. a. black hole

v. c. Galileo

3. Fill in the blanks

A star is born when massive clouds of dust and gases are compressed together under the force of gravity. Temperatures rise, and hydrogen atoms fuse to become helium atoms. This chemical reaction is called nuclear fusion.

During this chemical reaction, energy in the form of heat and light is released. Temperatures at the centre of a star, such as our Sun, are estimated to be at over 15,000,000°C.

4

i. A light year is the distance light travels in one year, about 9 trillion km (9,000,000,000,000 km).

ii. Distance to Proxima Centauri

Distance = 4 × 9,000,000,00

iii. Time for spacecraft at 200,000 km/h

5.

i.

1. Hydrogen

2. Helium

ii.

•Gravity pulls the particles together, causing them to clump and form a protostar.

iii.

•A Red giant forms from a star similar in size to our Sun.

•A Super red giant forms from a star much more massive than the Sun and is far larger and hotter.

v. A supernova is a massive explosion that occurs when a very large star collapses at the end of its life cycle, releasing enormous energy.

vi. Light, heat, and other electromagnetic radiation (including X-rays and radio waves).

vii.

•Black holes have extremely strong gravity that pulls in everything, including light, so no light escapes which makes them appear black.

viii.

Small stars (like our Sun): about 10 billion years.

•Massive stars: only a few million years because they burn fuel faster.

6.

i.

a. Spiral galaxy

b. Elliptical galaxy

c. Irregular galaxy

ii.

Galaxies are huge systems of stars, gas, dust, and dark matter held together by gravity.

iii.

Gravity

iv.

a. The Milky Way is a spiral galaxy.

b. It was named Milky Way because it appears as a milky band of light across the night sky, caused by billions of distant stars.

v.

Millions

7.

i. It was the first spacecraft to orbit an outer planet (Jupiter) and the first probe to enter the atmosphere of an outer planet.

ii.

- 18th October 1989

iii. From 1989 to 21st September 2003 , about 14 years.

iii. To study Jupiter's moons, upper atmosphere, and magnetic environment.

iv. 7th December 1995.

v. Jupiter's massive atmospheric pressure and extreme temperatures crushed and vaporized the probe.

vi.

a. Jupiter's moons:

- Evidence of water on one moon.
- Evidence of volcanic activity.

b. Jupiter's atmosphere:

- Found helium levels similar to the Sun.
- Discovered a strong magnetic field.

vii.

• Rings are made of tiny dust grains blasted off moons by meteoroids.

viii.

a. 21st September 2003.

b. Spacecraft was sent into Jupiter's atmosphere and burned up at 48 km/s.

c. To avoid contaminating Jupiter's moons with Earth microbes.

8.

1.

a.

• To protect astronauts' helmet visors and equipment from scratches in harsh space conditions.

b.

• Used in spectacles and sunglasses, making them more durable and long-lasting.

2.

a. Spacecraft and satellites needed a reliable power source far from Earth, so solar panels were created to convert sunlight into electricity.

b. Provides clean, renewable energy for homes, businesses, and remote areas.

3.

a. Astronauts needed nutritious, lightweight, and long-lasting food for long missions.

b. Improved food preservation techniques for packaged meals, emergency rations, and convenience foods.

4.

a.

• Robots were needed for handling equipment and repairs in space where humans could not easily work.

b. Robotics now widely used in automobile manufacturing, medical surgeries, and industrial automation.

Chapter 12 Technology in Everyday Life

1.

Crossword Answers

Across

2. Acetic

3. Xylitol

5. Solar

6. Casein

Down

1. Saponification

2. Polymers

2. True or False

i. True

ii. True

iii. False

iv. True

v. False

vi. True

vii. False

viii. False

ix. True

x. True

xi. False

WORKSHEET ANSWERS

Chapter 1 Ecology

Worksheet 1-1

1.

a. The non-living parts of an ecosystem are called abiotic factors.

b. The living parts of an ecosystem are called abiotic factors.

c. biotic and abiotic factors.

2.

Biotic factors	Abiotic factors
Trees	Water
Plants	
Duck	
Fish	

Worksheet 2-1

Students will draw and explain drawings according to their own understanding and creativity.

Worksheet 3-1

1

a.

producer	Any living thing that makes its own food is called a producer.
consumer	Animals are called consumers because they eat, or consume, other living things.
herbivore	Animals that eat plants are called herbivores.
carnivore	Animals that feed on other animals are called carnivores.
omnivore	Some animals feed on a diet that includes both plants and other animals. These are called omnivores.
decomposer	They are organisms that break down (decompose) dead plants and animals.

b. Carnivore

c. Prey

2.

Predators	Prey
Camouflage to avoid being seen by prey	Camouflage to avoid being seen by predators Defenses such as poison, stings
Eyes to the side of the head to get a wide field of vision	Eyes to the front of the head to judge size and distance well
Sharp teeth and claws	live in groups

a. Rose → greenfly → blue tit → sparrowhawk

b. Lettuce → slug → thrush → sparrowhawk

c. Grass → rabbit → fox

Worksheet 4-1

a. The population of rabbits might drop as roses will attract greenfly then the population of blue tits will increase. This will attract more sparrowhawks which feed on rabbits as well.

b. There will be more lettuce because the population of rabbits has decreased.

c. Population of slugs will increase because there is more lettuce.

d. As there are more slugs, there will be more thrushes to eat them.

e. If the grass was replaced with roses, rabbits would decline because they depend on grass for food. As a result, sparrow hawks would rely more on **blue tits, thrushes, and chaffinches** as their main food sources.

Explanation:

Removing grass reduces rabbit numbers, so birds become much more important in the sparrow hawks' diet.

Worksheet 1-2

a. cerebral cortex

b. voluntary

c. hemispheres

d. right hemisphere

e. left hemisphere

Worksheet 2-2

1

A. Synapse

B. Axon terminals

C. Axon

D. Nucleus

E. Dendrite

2

Effectors: Effectors respond to stimuli.

Receptors: Receptors detect stimuli.

Motor Nerve Cells: Motor nerve cells (or motor neurons) carry impulses from the central nervous system to muscles and glands.

Sensory nerve cells: Sensory nerve cells (or sensory neurons) carry impulses from sense receptors around the body to the central nervous system.

Chapter 3 Variations, Heredity and Cell division

Worksheet 1-3

Animal feature	Name the animal/ plant that has this feature	What type of habitat does this animal/ plant live in?	How does this feature help the animal/plant cope with the environment?
Long Eyelashes	Camel	Desert	Long eyelashes stop sand blowing into its eyes.
Small ears and white fur	Polar bear	Arctic	Reduce heat loss
Spines instead of leaves	Cactus	Desert	Reduce the loss of water by transpiration

Q2

Polar bears cannot survive in the hot climate of the desert because their body is adapted to the cold climate.

Worksheet 2-3

1

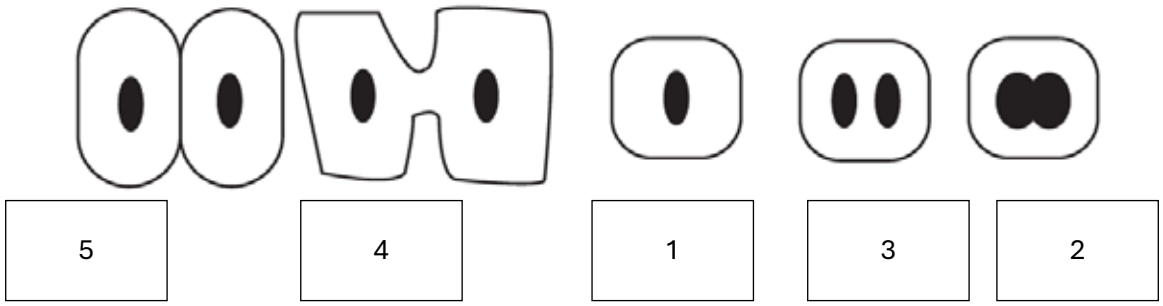
Trait	Only genetic or also environmental	Continuous or discontinuous
gender	Genetic	Discontinuous
height	Genetic	Continuous
blood type	Genetic	Discontinuous
left handedness	Genetic	Discontinuous
eye colour	Genetic	Continuous
fingerprint	Genetic	Discontinuous
heart rate	Both genetic and environmental factors	Continuous
ability to roll tongue	Genetic	Discontinuous

2

Biometric verification is a way of identifying an individual based on a unique characteristic like fingerprint or retina patterns.

Worksheet 3-3

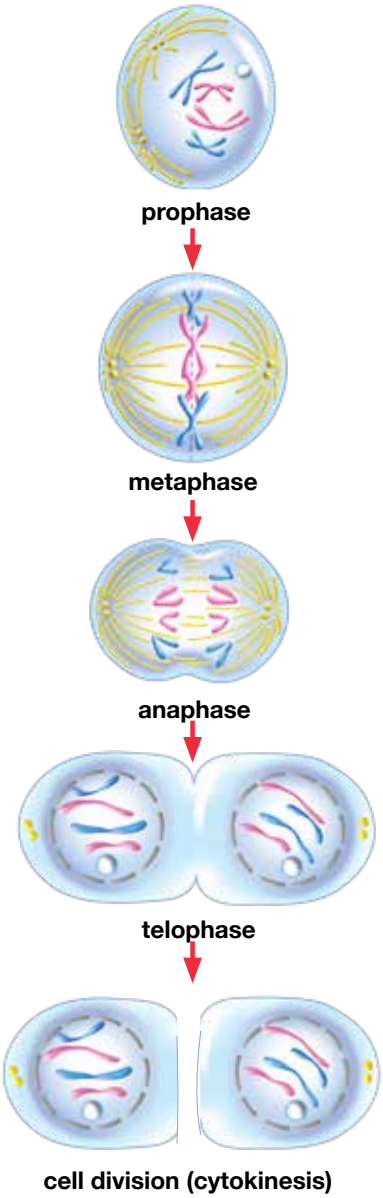
a



b. Cell division is responsible for many important functions such as healing and repairing, growth, and reproduction.

c. Mitosis. The phases of mitosis are prophase, metaphase, anaphase, telophase, and cytokinesis (cell division)

d.



Worksheet 1-4

Students will write answers according to their research.

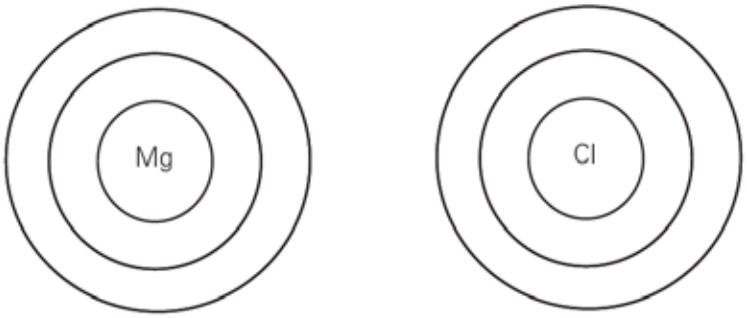
Chapter 5 Periodic Table

Worksheet 1-5

1

Elements	Atomic number	Mass number	Group	Period
Oxygen	8	16	VI	2nd
Magnesium	12	24	II	2nd
Calcium	20	40	II	3rd
Carbon	6	12	IV	2nd

2



3

a. Calcium

b. Iodine

Worksheet 2-5

Q1. Take a periodic table picture from the book.

Q2.

Elements	Metals	Non-metals
Chlorine		✓
Silver	✓	
Oxygen		✓
Calcium	✓	
Argon		✓

Chapter 6 Chemical reactions

Worksheet 1-6

a. It dissolved in the water.

b. Because sugar was added to the water.

c. 50 g.

d. Yes, by a chemical process such as burning or complete oxidation.

Worksheet 2-6

1

i. Magnet can be used to separate iron from sulphur.

ii. It is a physical change.

2

i. Iron sulphide

ii. Synthesis

iii. We cannot separate iron from sulphur after reaction as it has formed a new product.

iv. The reaction in which heat is taken in is called endothermic reaction and the reaction in which heat is given out is called exothermic reaction.

Worksheet 3-6

Task 1

i. Magnesium oxide

ii. Yes

iii. Magnesium + Oxygen → Magnesium oxide

iv. Reactants: Magnesium and oxygen

Product: Magnesium oxide

v. Combustion

Task 2

i. Carbon dioxide and water

ii. Sugar + oxygen → carbon dioxide + water

iii. Combustion

Task 3

i. Calcium carbonate → calcium hydroxide + carbon dioxide

ii. If carbon dioxide is bubbled through lime water, the lime water turns from a colourless to a cloudy white solution.

iii. Decomposition

Worksheet 4-6

Task 1

i. This is a chemical reaction because copper sulphate is reacting with iron nail because of which copper is displacing iron on iron nail.

ii. During a displacement reaction, one substance pushes out another substance to take its place.

Worksheet 5-6

i. Combustion

ii. Carbon dioxide and water

iii. Exothermic reaction

iv. Yes, because food is burned in the presence of oxygen and, carbon dioxide and water are produced.

Worksheet 6-6

1. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

2. $SiCl_4 + 4H_2O \rightarrow H_4SiO_4 + 4HCl$

3. $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

4. $Na_2CO3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

5. $2Ca3(PO_4)_2 + 6SiO_2 \rightarrow P_4O_{10} + 6CaSiO_3$

6. $4KClO_3 \rightarrow 3KClO_4 + KCl$

7. $Al_2(SO_4)_3 + 3Ca(OH)_2 \rightarrow 2Al(OH)_3 + 3CaSO_4$

8. $H_2SO_4 + 8HI \rightarrow H_2S + 4I_2 + 4H_2O$

Chapter 7 Acids, bases, and salts

Worksheet 1-7

Q1

i. HCl

i. $HCl \rightarrow H^+ + Cl^-$

a. If we put a lot of HCl in a little water, we have made a ~~concentrated~~ / dilute solution of HCl.

iii. If we put a little HCl in a lot of water, we have made a concentrated / ~~dilute~~ solution of HCl.

iv. Concentrated solution contains more amount of solute as compared to a dilute solution.

Q2

i. Strong acids have more H+ ions than the weak acids.

Example of strong acid: HNO_3

Example of weak acid: CH_3COOH

ii. Adding acid to water will dilute the acid.

iii. pH can be checked to estimate the strength of acids. Stronger acids have lower pH than weaker acids.

Q3

Students will write answers according to their observations.

Worksheet 2–7

Q1

i. HCl

ii. HNO_3

iii. H_2SO_4

Q2

i. CaCO3

ii. It decomposes and carbon dioxide is produced.

iii. Carbon dioxide

iv. Allow the gas to react with limewater. If it gets cloudy then it is carbon dioxide.

v. $CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

ivi. Acids react with metals to produce hydrogen gas.

Worksheet 3-7

i. If enough acid is added, the pH will lower and the color of solution in beaker will change.

ii. It means the solution is neutral.

iii. It indicates that there is a very weak alkali in the beaker.

iv. When acid and alkali are mixed, they cancel each other out or neutralize each other, forming salt and water.

v. Most toothpastes are slightly alkaline; not only do they remove the bacteria, but they also neutralize the acid produced by the bacteria.

a. sodium chloride

b. sodium nitrate

c. sodium sulphate

Chapter 8 Force and Pressure

Worksheet 1-8

Q1

i. Pressure = Force ÷ Area

For heels:

Pressure = 980 ÷ 0.0001

Pressure = 9,800,000 Pa

For elephant:

Pressure = 54000 ÷ 0.18

Pressure = 9720 Pa

ii. Elephant

Q2

i. Side A will create less pressure as there is more surface area.

ii. Side B will create more pressure as there is less surface area.

Q3

i. Shape D will exert the most pressure because it has the least surface area.

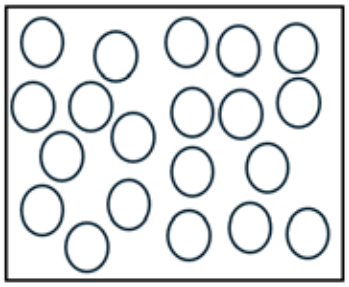
Q4

A Sharper axe will create maximum pressure for easy cutting.

Worksheet 2-8

Q1

a.



b

The distance between liquid particles is reduced slightly while the gas particles get compressed.

Q2

i. Liquids are suitable for hydraulic brakes because they are incompressible and can transfer force while gases are compressible and cannot transfer force efficiently.

ii. Air can be compressed while water cannot.

iii. Tires travel more quickly and collide with walls in the summer when the air molecules inside them heat up. Tire pressure rises because of the air particles' greater velocity exerting more pressure on tire.

iv.

a. Pressure increases with depth due to the weight the liquid above.

b. The density of the liquid also affects the pressure.

Worksheet 3-8

1. **a.** It sank.

b. It floated.

2. **a.** big

b. small

c. sink

d. small

e. big

f. float

Level 2 – Level 1 = amount of water displaced:

21.75 mL – 20.50 mL **= 1.25 mL**

Volume of the stone:

1.25 mL

Density of the stone = mass ÷ volume:

3.1 g ÷ 1.25 mL **= 2.48 g/mL**

Is your blue stone a sapphire? Explain:

No, because its density (2.48 g/mL) is much less than a sapphire's density (3.98 g/mL).

Worksheet 1-9

Q1. The second image

Q2. 1. Regular Reflection vs. Irregular Reflection

Regular Reflection: Occurs on a smooth surface; reflected rays are parallel; forms a clear image.

Irregular Reflection: Occurs on a rough surface; reflected rays scatter in different directions; no clear image is formed.

2. Virtual Image vs. Real Image

Virtual Image: Cannot be projected on a screen; formed by diverging rays; always upright.

Real Image: Can be projected on a screen; formed by converging rays; usually inverted.

3. Concave Mirror vs. Convex Mirror

Concave Mirror: Curves inward; converges light; can form real or virtual images; used in telescopes and shaving mirrors.

Convex Mirror: Curves outward; diverges light; forms only virtual, diminished images; used in vehicle rear-view mirrors.

Q3. **1.** Shadows are formed when an opaque object blocks light, preventing it from passing through.

2. Transparent: Glass, clear water

Translucent: Frosted glass, wax paper

3. The angle of incidence equals the angle of reflection.

The incident ray, reflected ray, and the normal all lie in the same plane.

Worksheet 2-9

Q1. A is a **convex mirror** (rays diverge after reflection).

B is a **concave mirror** (rays converge to a focal point after reflection).

Q2 **i.** – the angle of incidence is equal to the angle of reflection

- The incident ray, the reflected ray and the normal all lie in the same place

ii. When light passes from water (denser medium) to air (less dense medium), it bends away from the normal. This bending makes the object appear closer to the surface and at a different position than its real location.

iii. Rainbows form when sunlight is refracted, dispersed, and reflected inside raindrops.

Q3 **i.** green

ii. Orange

iii. Purple

Chapter 10 Electricty and Magnetism

worksheet 1-10:

1. Task 1

Ammeter → **Series**

Voltmeter → **Parallel**

Task 2

1.

Components	Symbols	Definitions	Formulas
1. Voltage	V	Potential difference between two points in a circuit	$V = \frac{V}{G}$ or $V = \frac{T}{R}$
2. Current	I	Flow of electric charge through a conductor	$I = \frac{Q}{t}$ or $I = \frac{V}{R}$
3. Resistance	R	Opposite to the flow of current in a circuit	$R = \frac{V}{I}$
4. Variable Resistor	—	A resistor whose resistance can be adjusted	No Fixed formula
5. Power	P	Rate of energy transfer in a circuit	$P = V \times I$
6. Energy	E	Total work done or energy used in a circuit	$E = P \times t$ or $E = V \times I \times t$

2. A: Battery

B: Switch

C: Bulb (Lamp)

D: Voltmeter

E: Variable Resistor (Rheostat)

3. Diagram 1:

A. 3 V

B. 2 V

C. 1 V

Diagram 2:

D. 12 V

E. 6 V

F. 6 V

4. In a series circuit, the same current flows through all parts.

In a parallel circuit, each part gets the same voltage.

5. Diagram to be drawn by illustrator

1 ampere (A).

Worksheet 2-10

TASK 1

i. The switch on the circuit breaker will be in the **OFF or tripped position** instead of ON.

ii. The fuse wire inside will be **broken or melted,** and sometimes the glass may look blackened.

iii. Too much current due to **overload or short circuit** can cause this.

worksheet 3-10

Q1, Q2 . Students will answer according to their observations

Chapter 11 The Universe

Q1.

Solar panels – help us face dangers of climate change by generating energy using sunlight

GPS – helps us navigate

Zero Gravity - for space research, medical studies, and manufacturing pure materials.

Advanced robotics

Enriching and storing foods

Q2.

i. superclusters

ii. protostar

iii. nebula

iv. pulsars

v. supernova

Q3.