NEW OXFORD SECONDARY SCIENCE

TEACHING GUIDE

GRADE 7

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Introduction

I. Overview:

In today's rapidly changing world, students must have a solid foundation of general knowledge in order to become well-rounded individuals. History, geography, science, literature, current events, and other subjects are all included in general knowledge. This teacher's guide series is designed for 6th, 7th, and 8th-grade teachers to assist them in facilitating effective learning experiences by providing a comprehensive framework based on the 5 E's lesson plan.

II. The 5 E's Lesson Plan:

The 5 E's Lesson Plan is an inquiry-based instructional model widely used in teaching to promote active learning and engage students in the learning process. Engage, Explore, Explain, Elaborate, and Evaluate are the five E's. This method encourages students to investigate concepts, construct meaning, and apply their learning in real-world situations. Each phase of the 5 E's offers a unique opportunity to deepen students' comprehension and foster critical thinking skills.

1. **Engage:** The Engage phase serves as a hook to draw students in and activate their prior knowledge. It arouses curiosity and provides a framework for learning. Teachers can use thought-provoking questions, multimedia resources, real-life examples, or interactive activities to pique students' interest in the topic of study during this phase. Engaging students from the start prepares them for an exciting and focused learning experience.
2. **Explain:** Students are given opportunities to articulate their understanding and make sense of the concepts they have learned during the Engage phase. Teachers play an important role in facilitating discussions, explaining concepts, and clarifying misconceptions. This phase encourages effective communication skills and assists students in developing a solid foundation of knowledge by organizing their thoughts and clearly expressing their ideas.
3. **Explore:** The Explore phase encourages students to further investigate and investigate the topic. Hands-on activities, experiments, group projects, and research are used to deepen students' understanding through firsthand experiences. This stage encourages teamwork, critical thinking, and problem-solving abilities. Teachers can help students conduct experiments, analyze data, and explore primary and secondary resources in order to gather information and make meaningful connections.
4. **Elaborate:** The Elaborate phase encourages students to broaden their understanding and apply what they've learned in real-world situations. It consists of activities that require students to think critically, solve problems, and make connections outside of the classroom. Project-based learning, case studies, debates, and simulations require students to analyze, synthesize, and create. This stage promotes creativity, independent thinking, and the ability to apply knowledge in a variety of situations.

5. **Evaluate:** During the Evaluate phase, teachers can assess students' learning progress and measure how well they met the lesson objectives. Formative and summative assessments are used to provide feedback and guide future instruction. Quizzes, presentations, projects, and written assignments are all examples of assessments. Teachers can provide personalized and targeted instruction by assessing students' performance and identifying areas of strength and areas that require additional reinforcement.

III. Sixth, Seventh, and Eighth Grade General Knowledge:

General Knowledge is critical to the overall development of students in the sixth, seventh, and eighth grades. It broadens their worldview, fosters their curiosity, and provides them with the knowledge they need to become active and informed citizens. General Knowledge subjects provide a holistic approach to education by fostering interdisciplinary connections and promoting critical thinking skills.

This teacher's guide series will provide a variety of General Knowledge topics appropriate for students in grades 6th, 7th, and 8th, with each topic aligned to the 5 E's lesson plan. It will suggest engaging activities, exploration strategies, explanation techniques, opportunities for elaboration, and evaluation methods. The guide's goal is to inspire educators to create dynamic, interactive learning environments that inspire students to develop a lifelong love of learning and exploration.

IV. Alignment with the Oxford Textbook Series:

This Oxford Teacher Guide series has been thoughtfully designed to work in tandem with the Oxford textbook series, giving educators a comprehensive and cohesive approach to teaching. Teachers can enrich students' learning experiences and deepen their understanding of the subject matter by incorporating the General Knowledge topics from this guide into the existing curriculum based on the Oxford textbooks. This alignment ensures a logical progression of topics, allowing students to gain a broader perspective, make interdisciplinary connections, and build a well-rounded knowledge base that supplements the content covered in the Oxford textbooks. Together, the Oxford Teacher Guide series and the Oxford textbook series form a potent combination that improves students' educational experiences and fosters intellectual growth.

V. How to use this guide:

1. **Familiarize Yourself with the Guide:** Read through the entire guide thoroughly to understand its structure and content. Make yourself familiar with the 5 E's lesson plan and its various phases: Participate, investigate, explain, elaborate, and evaluate.
2. **Plan Your Lessons:** Create a lesson plan for each topic using the 5 E's. Begin with the Engage phase, which aims to pique students' interest and activate prior knowledge. Choose appropriate strategies to engage your students from the start, such as thought-provoking questions, multimedia resources, or interactive activities.
3. **Explore and Discover:** Students proceed to the Explore phase, where they further investigate and explore the topic. To encourage active learning and critical thinking, create hands-on activities, experiments, group projects, or research projects. Give students opportunities to gather information, analyze data, and make connections.
4. **Explain and Clarify:** Move on to the Explain phase, where students express their understanding and make sense of what they've learned. Facilitate discussions, explain things, and clear up any misconceptions that may arise. Encourage students to ask questions, express their opinions, and participate in meaningful discussions.

5. **Elaborate and Apply:** In the Elaborate phase, students extend their understanding and apply what they've learned in real-world situations. Make it possible for students to think critically, solve problems, and make connections outside of the classroom. Encourage them to participate in project-based learning, case studies, debates, or simulations that require them to analyze, synthesize, and create.
6. **Evaluate and Assess:** At the end of each lesson, evaluate students' learning progress and measure their achievement of the lesson objectives. To provide feedback and guide future instruction, use a variety of formative and summative assessments, such as quizzes, presentations, projects, or written assignments. Identify and address areas for improvement in subsequent lessons.
7. **Adapt and Personalize:** Feel free to adapt and personalize the lessons to meet your student's specific needs and learning styles. To cater to diverse learners and create an inclusive classroom environment, modify activities, assessments, and resources.
8. **Reflect and Iterate:** Reflect on your teaching practice and the effectiveness of your lessons on a regular basis. Seek feedback from students and colleagues to improve and refine your instruction over time. Iterate on the lessons in response to feedback to improve student engagement and learning outcomes.

Progression Grid:

A comprehensive progression grid outlines the sequential development of concepts across the grades in the Teacher Guide. This progression grid is a useful tool for educators, highlighting the logical flow of topics and the increasing complexity of ideas as students' progress from sixth to eighth grade. The grid enables teachers to visualize the interconnectedness of concepts and identify the foundational knowledge that students will need to build on in subsequent grades. Educators can ensure a scaffolder learning experience in which students gradually deepen their understanding and skills over time by following the progression grid. The grid also helps educators anticipate and address potential gaps or overlaps in the content covered, which aids in curriculum planning. Overall, the progression grid provided in this guide enables teachers to create cohesive and coherent lessons that maximize student learning and promote a smooth educational journey.

Breakdown of the Academic Year:

The breakdown of the academic year provided in the guide allows for a systematic progression of topics throughout the academic year. Each term focuses on a specific set of chapters that cover a wide range of general knowledge topics. It allows for in-depth exploration, discussion, activities, and assessments within each chapter. Teachers can modify the pace and chapter allocation based on the needs of their specific curriculum and students.

PROGRESSION GRID		
Biology		
Grade VI	**Grade VII**	**Grade VIII**
Unit 1: Cellular Organization.	Unit 1: Plant Systems	Unit 3: Variations, Heredity, and Cell Divisions.
Unit 2: Reproduction in Plants	Unit 2: Human Respiratory and Circulatory System.	Unit 1: Ecology
Unit 3: Balanced Diet	Unit 3: Immunity and Diseases	Unit 4: Biotechnology
Unit 4: Human Digestive System		Unit 2: Human Nervous System

Chemistry		
Grade VI	**Grade VII**	**Grade VIII**
Unit 5: Matters as Particles	Unit 4: Structure of an atom.	Unit 5: Periodic Table
Unit 6: Elements and Compounds	Unit 5: Physical and Chemical Changes. Unit 6: Chemical Bonds	Unit 6: Chemical Reactions
Unit 7:Mixtures	Unit 7: Solutions	Unit 7: Acids, Bases and Salts.

Physics		
Grade VI	**Grade VII**	**Grade VII**
Unit 8: Energy	Unit 8: Force and Motion. Unit 9: Waves and Energy	Unit 8: Force and Pressure.
Unit 9: Electricity	Unit 10: Heat and Temperature.	Unit 9: Reflection and Refraction of Light.
Unit 10: Magnetism	Unit 9: Waves and Energy	Unit 10: Electricity and Magnetism

Space Sciences		
Grade VI	**Grade VII**	**Grade VIII**
Unit 11: Solar System	Unit 11: Earth and Space	Unit11: Our Universe

ACADEMIC YEAR BREAKDOWN

Term 1:

Chapter 1: Plant System
Chapter 2: Human Respiratory and Circulatory System
Chapter 3: Immunity and Diseases
Chapter 4: Structure of an Atom

Term 2:

Chapter 5: Physical and Chemical Changes
Chapter 6: Chemical Bonds
Chapter 7: Solutions
Chapter 8: Force and Motion

Term 3:

Chapter 9: Waves and Energy
Chapter 10: Heat and Temperature
Chapter 11: Earth and Space
Chapter 12: Technology in Everyday Life

CHAPTER 01 Plant Systems

Student Book Pages 10–21

Learning outcomes

- Explain the root and shoot system in plants and label different parts of leaf, stem and root (external and internal structure).
- Predict the role of xylem and phloem in transport of water and food in plants by observing the cross section of the stem.
- Define the process of photosynthesis and derive word equations for it.
- Know that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein).
- Explain that the structure of leaves is adapted to the process of photosynthesis.
- Describe the process of respiration and write word equations for it. Compare and contrast the processes of photosynthesis and respiration.
- Investigate the phenomena of transpiration and its importance in a plant (Explain how wind, temperature, light, humidity affecting/affect the rate of transpiration in plants).
- Explore and apply natural raise of water based on the principal of transpiration..

Keywords

organs, cells, tissues, vascular tissue, ground tissue, epidermis, xylem, phloem, vascular bundle stem, roots, leaves, root hair, stomata, chlorophyll, oxygen, carbon dioxide, sugar molecule, photosynthesis, respiration, chemical energy, heat energy, light energy

Overview of the Unit

- The root system and shoot system differ in that the root system contains tubers, roots, and adventitious rhizoids of the plant, whereas the shoot system contains areal parts of the plant such as flower buds, flowers, leaves, and fruits.
- Water, nutrients, and minerals are transported by tissues in plants.
- Water and mineral salts are transported from the roots to other parts of the plant by xylem, while sucrose and amino acids are transported between the leaves and other parts of the plant by phloem.
- Photosynthesis is the process of converting light energy into chemical energy. Light energy is used by green plants and other organisms to convert carbon dioxide and water into glucose. As a byproduct of this process, oxygen is produced. Green plants and photosynthetic bacteria exhibit this process. They use electromagnetic radiation to create chemical energy. They absorb carbon dioxide from the atmosphere and convert it to oxygen and carbohydrates using water and sunlight.
- Plants, like humans, require specific mineral ions to thrive. Mineral ions are found in soil and are absorbed by plants via their roots. The plant will appear discoloured, wilted, and generally under the weather if any one of these ions is deficient, leading to a mineral iron deficiency.
- Leaves are designed for photosynthesis and gas exchange. They have a large surface area for photosynthesis and openings called stomata that allow carbon dioxide into the leaf and oxygen out.
- Respiration is a chemical oxidation process that occurs between cells and results in oxidation of food to liberate energy and carbon dioxide.
- The evaporation of water from plants is known as transpiration. The majority of the water absorbed by a plant's roots, up to 99.5 percent is not used for growth or metabolism; it is excess water that leaves the plant via transpiration.

Lesson Plan 1	Student Book pages	Time	Workbook pages
Root System and Shoot System	8	45 mins	-

Objective:

Explain the root and shoot system in plants and label different parts of leaf, stem, and root (external and internal structure).

Engage: (5 mins)

Begin the lesson by asking, "What are some of the different parts of a plant that you can think of?" Allow students to discuss their responses. Then, show students actual examples of different plants and ask them to identify and name the parts they see roots, stems, leaves, flowers, and so on. This activity will spark their interest and prepare them to learn about plant structure and systems.

Useful Link

https://www.youtube.com/watch?v=P1s7XHH_2-k

Explain: (10 min)

Explain the Root System:

- Explain that the root system is the underground part of the plant that oversees anchoring it to the soil as well as absorbing water and nutrients.
- Distinguish between the two types of roots: taproots (a single primary root with lateral branches) and fibrous roots (a network of thin roots).
- Describe the functions of roots in some plants, such as water and nutrient absorption and food storage.

Keywords

Root system
Shoot system
Dicot
Vascular bundle
Cells
Microscope
Observe

Explain Shoot System:

- Explain that the shoot system is the plant's above-ground structure, which includes the stem, leaves, and flowers (if applicable).
- Discuss the stem's role in supporting the plant, transporting water and nutrients, and acting as a site for leaf and flower attachment.
- Explain how leaves help with photosynthesis, gas exchange, and transpiration.

Explore: (15 min)

External Structure:

- Provide students with plant specimens or photographs of various plants and ask them to identify the roots, stems, and leaves in each.
- Instruct students to describe the differences they noticed in the root and shoot systems of various plants.
- Make small groups of students draw and label the external parts of a plant, such as the root, stem, and leaf.

Internal Structure:

- Show cross-sections of a root, stem, and leaf.
- Describe the internal structures of each component.
- Epidermis, cortex, endodermis, vascular tissue (xylem and phloem), and root hairs comprise the root.
- Epidermis, cortex, vascular bundles, pith, and nodes comprise the stem.
- Epidermis, mesophyll (palisade and spongy layers), veins (xylem and phloem), stomata, and guard cells comprise the leaf.

Elaborate: (10 min)

Role-Play - Transport of Water and Nutrients:

- Form groups of students and assign roles (roots, stem, leaves, xylem, and phloem).
- Create an environment in which water and nutrients must be transported from the roots to the leaves.
- Students should act out the process of water and nutrient transport through the various plant parts.

Evaluate: (5 min)

Ask students to complete Q14 on page 8 of Workbook.

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Transport System in Plants	13-15	45 mins	2-3

Objective:

Predict the role of the xylem and phloem in the transport of water and food in plants by observing the cross-section of the stem.

Keywords

Transport
Xylem
Phloem
Transpiration

Engage:

The teacher will relate the human transport system with the plant transport system. Discuss with the students that human bodies have a system that allows nutrients, oxygen, carbon dioxide, hormones, antibodies, urea, and heat to move throughout the body via blood plasma. Similarly, plants have a system for transporting food, water, and other nutrients.

Explain:

- Explain that plants rely heavily on transportation. Trees transport all the nutrients and water they require to survive from their roots to the tips of their leaves.
- Water is the most significant constraint in plant transportation because it is a limiting factor in growth. To address this issue, trees and other plants have developed an ideal system for water absorption and translocation.
- Plant transport systems are made up of bundles of tubes in the stem, branches, and roots. These tubes are referred to as xylem and phloem.
- Xylem's primary function is to transport water and dissolved minerals from the roots to the rest of the plant body.
- The phloem, on the other hand, transports the food produced in the leaves to all parts of the plant.

Explore:

This hands-on experiment will teach students about the functions of phloem and xylem.

Material:

- white flowers
- glasses of water
- food colorings

Useful Link

https://www.youtube.com/watch?v=DhyYtT1K844

Procedure:

- Teacher will give students white flowers, glasses of water, and their choice of food colorings to colour the water, and a flower.
- The teacher can limit the colours to those that will show up best in the interior of the stem,

usually red and blue, or create purple by combining the two.

- Each student would have their own cup and could choose their own colour (or they could share cups either as pairs or as table groups).

Discussion: (Predict, observe and explain)

The teacher will ask the following questions from the students to start the class discussion.

1. Why are the petals changing?
2. Will the entire flower or just parts of it change colour?
3. Will the colour of the stem change? What is your reasoning?
4. What about the stem's interior?
5. How does it work if the flower does change colour? Aren't things supposed to move down, not up?

Findings of the experiment.

- Within a day or two, the white flowers will have turned the colour of the water in which they are sitting. The colour changed along the stem, but only in certain areas.
- Students should be encouraged to share their discoveries, questions, and hypotheses about what happened to their flowers.

Elaborate:

Following the colour change experiment, the plant will be dissected and observed using a microscope to examine the interior of the stem.

Evaluate:

On-board Assessment

- Ask students to do Concept Check on page 14.
- Ask students to complete Q2 and 3 on page 2-3 of workbook.

Home Assignment:

- Paste the dissected part of the stem on your notebook and label it.
- Do Q3 on page 23 of student book

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Photosynthesis	15-17	45 mins	3

Learning Objective:

Define the process of photosynthesis and derive word equations for it.

Keywords

Carbon dioxide
Chlorophyll
Glucose

Engage:

Brainstorming:

Review with your students what all living things require to survive: food, water, light, and air.

Divide the class into small groups and ask them to discuss their sources of food, water, light, and air.

- Inquire about what dogs eat and drink.
- What do birds consume?
- What do plants consume?

Students will most likely struggle to identify plant food sources, prompting the lesson's guiding question, "What do plants eat?"

Explain:

Show a video to explain the topic.

Explore:

- When students comprehend the basic concepts of photosynthesis, you can guide them through a simple experiment in which they can witness photosynthesis.
- Students use small plants to place plant samples in water-filled test tubes that they cork.
- Students will observe that over the course of time, tiny air bubbles will form on the test tube's walls.
- Explain to the students that the bubbles formed at the end of the experiment are evidence of the chemical reaction that takes place when plants convert CO_2 and water (hydrogen) into carbohydrates (food).

Useful Link

https://youtu.be/CL9A8YhwUps

Elaborate:

Teacher will ask students to draw a flower on a piece of paper. Ask them to add the sun, water, soil, and rain to their drawing. Then, have them write carbon dioxide and draw an arrow to the flower. Write the word oxygen on the opposite side and draw another arrow, this time away from the flower. Draw a sugar cube at the bottom of the plant. Make sure to reinforce the process of photosynthesis to them as they draw.

Evaluate:

Ask students to complete Concept Check page 17 of student book.

Home Assignment:

Complete Q4 on page 3 of workbook.

Lesson Plan 4	Student Book pages	Time	Workbook pages
Plants Leaves Are Adapted for Photosynthesis	17	45 mins	-

Objective:

Explain that the structure of leaves is adapted to the process of photosynthesis.

Keywords

Adapt
Palisade cells
Stomata

Engage: (5 mins)

- Start the lesson by displaying a picture of a lush green leaf and a diagram of a leaf cross-section to the students.
- Instruct the students to talk about what they notice about the leaf and the diagram. Prompt them to describe the various parts and any patterns they notice.
- Record their findings on chart paper or a whiteboard.
- Facilitate a class discussion by asking students why they believe leaves have such a specific structure and what they believe the various parts are for.
- Direct the discussion towards the idea that leaves are designed to perform photosynthesis and that their structure facilitates this vital process.

Explain: (10 mins)

- Introduce photosynthesis to the students as the process by which plants convert sunlight, water, and carbon dioxide into glucose (sugar) and oxygen.
- Display the leaf cross-section diagrams and explain how leaves have specific structures that aid in photosynthesis.
- Point out and explain the various leaf parts, such as the cuticle, epidermis, mesophyll, veins (vascular tissue), and stomata.
- Discuss the functions of each component, emphasizing how they contribute to the photosynthesis process.

Explore: (15 mins)

- Form small groups with the students.
- Give each group a small potted plant with leaves and a pair of magnifying glasses.
- Instruct the students to use magnifying glasses to carefully examine the leaves.
- Encourage them to look at the different parts of the leaves and discuss their findings in groups.
- Instruct the students to identify and describe any leaf structures they notice that may be related to photosynthesis.
- As needed, circulate among the groups to answer questions and provide guidance.

Elaborate: (10 mins)

- Reassemble the students.
- Place one of the potted plants with leaves in a prominent place.
- Request that the students share their observations and descriptions of photosynthesis-related leaf structures.
- Use the plant on display to highlight and reinforce the various leaf structures while discussing their roles in photosynthesis.
- Facilitate a class discussion by asking questions like, "How does the cuticle aid in photosynthesis?"
- What is the purpose of stomata?
- How do veins (vascular tissue) help with photosynthesis?
- How does the structure of mesophyll cells help the photosynthesis process?
- Encourage students to ask questions and investigate the leaf further.

Evaluate: (5 mins)

Students can be paired up and take turns explaining the different parts of a leaf and their functions to one another.

Home Assignment

Complete Q5 on page 3 of workbook.

Lesson Plan 5	**Student Book pages**	**Time**	**Workbook pages**
Respiration	18	45 mins	-

Objective:

Describe the process of respiration and write word equations for it. Compare and contrast the processes of photosynthesis and respiration.

Keywords

Respiration
Surplus
Oxygen

Engage: (5 mins)

- Start the lesson by having the students recall what they already know about photosynthesis. Record their responses on chart paper or a whiteboard.
- Facilitate a class discussion about photosynthesis, emphasizing the importance of this process in converting sunlight, water, and carbon dioxide into glucose and oxygen.
- Ask the students if they are aware of another process that occurs in cells that involve the breakdown of glucose to release energy.
- Allow students to express their ideas and responses.
- Explain that this is the opposite of photosynthesis and is called respiration.

Explain: (10 mins)

- Provide handouts with diagrams illustrating the photosynthesis and respiration processes.
- Step through the respiration diagram, explaining each step in detail, including both aerobic and anaerobic respiration.
- It is important to emphasize that respiration occurs in cells and involves the breakdown of glucose and other organic molecules to release energy.
- Write down the word equation for aerobic respiration on the board:

  Glucose + Oxygen → Carbon Dioxide + Water + Energy

Explore: (15 mins)

- Form pairs or small groups of students.
- Distribute index cards and coloured pencils or markers to each group.
- On index cards, instruct the groups to create illustrated word equations for photosynthesis and respiration.
- Encourage them to represent the reactants and products, as well as any energy sources or sinks, with symbols and arrows.

Elaborate: (10 mins)

- Allow each group to present their illustrated word equations to the rest of the class.
- Conduct a class discussion comparing and contrasting photosynthesis and respiration.
- Make a comparison chart outlining the similarities and differences between the two processes.
- Encourage students to think about the reactants, products, locations, and overall goals of each process.
- Discuss how photosynthesis and respiration are interconnected in maintaining the balance of oxygen and carbon dioxide in the atmosphere.

Evaluate: (5 min)

Ask students to do Discuss and Answer page 18.

Home Assignment

Complete Q5(v) on page 24 of student book.

Lesson Plan 6	**Student Book pages**	**Time**	**Workbook pages**
Transpiration	19-21	45 mins	-

Objective:

- Investigate the phenomena of transpiration and its importance in a plant (Explain how wind, temperature, light, humidity affect the rate of transpiration in plants).
- Explore and apply natural raise of water based on the principle of transpiration

Keywords

Diffuse
Transpiration stream
Flaccid

Useful Link

https://www.youtube.com/watch?v=5jJLfwTkGe8
https://www.youtube.com/watch?v=bvPM6sfidY4&pp=ygUNdHJhbnNwaXJhdGlvbg%3D%3D

Engage: (5 mins)

- Begin the lesson by asking students if they've ever seen water droplets on leaves or plants wilt.
- Facilitate a class discussion about these observations and invite students to share their theories about why these phenomena occur.
- Record their answers on chart paper or a whiteboard.
- Introduce the term "transpiration" and explain that it is the process by which water is lost from a plant's leaves via tiny openings known as stomata.

Explain: (10 mins)

- Give a brief explanation of transpiration, emphasising its importance in plants.
- Discuss how transpiration aids plant water absorption, nutrient transport, cooling, and turgidity.
- Explain how the rate of transpiration can be affected by environmental factors such as wind, temperature, light, and humidity.

Explore: (15 mins)

- Form small groups with the students.
- Give a potted plant to each group.
- Instruct the groups to create a closed system by covering the plants' leaves with plastic bags and securing them with rubber bands.
- Encourage students to place a clear container (such as a graduated cylinder) on top of the plastic bag to collect any water droplets.
- Request that the groups place their plants in various areas of the classroom to expose them to varying environmental conditions (e.g., near a fan, under a light source, in a warmer or cooler spot).
- Instruct students to keep track of the rate of transpiration and any water collection in the containers for a set amount of time (e.g., 30 minutes).

Elaborate: (10 mins)

- Reassemble the students.
- Request that each group share their observations and discuss how environmental factors influenced the rate of transpiration.
- Explain how wind, temperature, light, and humidity affect transpiration using the observations.

- Wind promotes the movement of water vapour away from the leaves, which increases transpiration, while higher temperatures and light intensity also increase transpiration rates.
- Discuss how humidity affects transpiration, with higher humidity slowing it down due to a lower vapour pressure gradient between the plant and the atmosphere oxygen and carbon dioxide in the atmosphere.

Evaluate: (5 mins)

Ask students to do Concept Check page 19 and 21 of student book.

Home Assignment:

Do Q5 (iv, vi, and vii) on page 24 of student book.

Lesson Plan 7	Student Book pages	Time	Workbook pages
Nutrients for Plants	21-22	45 mins	4

Objective:

Know that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein).

Keywords

Nutrients
Active transport

Useful Link

https://www.youtube.com/watch?v=w_x-WDdQdxI

Engage: (5 min)

- Begin the lesson by displaying a picture of a healthy green plant and a yellowing plant to the students.
- Instruct the students to talk about what they notice about the two plants. Prompt them to describe the colour differences and overall appearance.
- Record their findings on chart paper or a whiteboard.
- In order to facilitate a class discussion, ask the students why they believe the two plants look different.
- Introduce the concept of the importance of minerals in plant growth and the fact that plants require specific minerals such as magnesium and nitrates to stay healthy.

Explain: (10 mins)

- Gather the students and explain that you will be carrying out a simple experiment to demonstrate the importance of magnesium and nitrates in plant growth.
- Show the magnesium sulphate to the students and explain that it is a magnesium source.
- Show the students the nitrate-containing fertilizer and explain that it is a source of nitrates.
- Display the potted plants in a visible location without the roots.
- Divide the students into two groups, one for the magnesium sulphate and the other for the nitrate fertilizer.
- Instruct each group to dissolve a small amount of their assigned mineral in a cup of water.
- Give each group a watering can or spray bottle containing their mineral solution.
- Every day for the next week, have the groups water their assigned plants with their mineral solution.
- Explain that during the week, students should observe and record any changes in the plant's appearance, growth, or overall health.

Explore: (15 mins)

- Make small groups of students.
- Each group should be given a small potted plant, soil, and a plastic bag.
- Instruct the students to gently remove the plant from the pot and shake off any excess soil.
- Ask the students to cut a small section of the root from each plant with the scissors.
- Place the root samples in plastic bags and label them with the students' group names.
- Gather the root samples from each group and set them aside for the next activity.

Elaborate: (10 mins)

- Reassemble the students after a week and ask them to share their observations and recordings.
- Record their findings on chart paper or a whiteboard.
- Facilitate a discussion about the differences observed in plants treated with magnesium and nitrates versus control plants.
- Encourage the discussion to focus on the fact that magnesium is required for chlorophyll production and nitrates are required for protein synthesis, both of which are required for healthy plant growth.

Evaluate: (5 mins)

Instruct the students to reflect on what they have learned about the importance of minerals in maintaining healthy plant growth and life processes.

Home Assignment:

Complete Q8 on page 4 of Workbook.

Worksheet 1:

1. Complete the following sentences:

i. Through photosynthesis, plants make their own _____.

ii. Plants use _____ to absorb energy in _____.

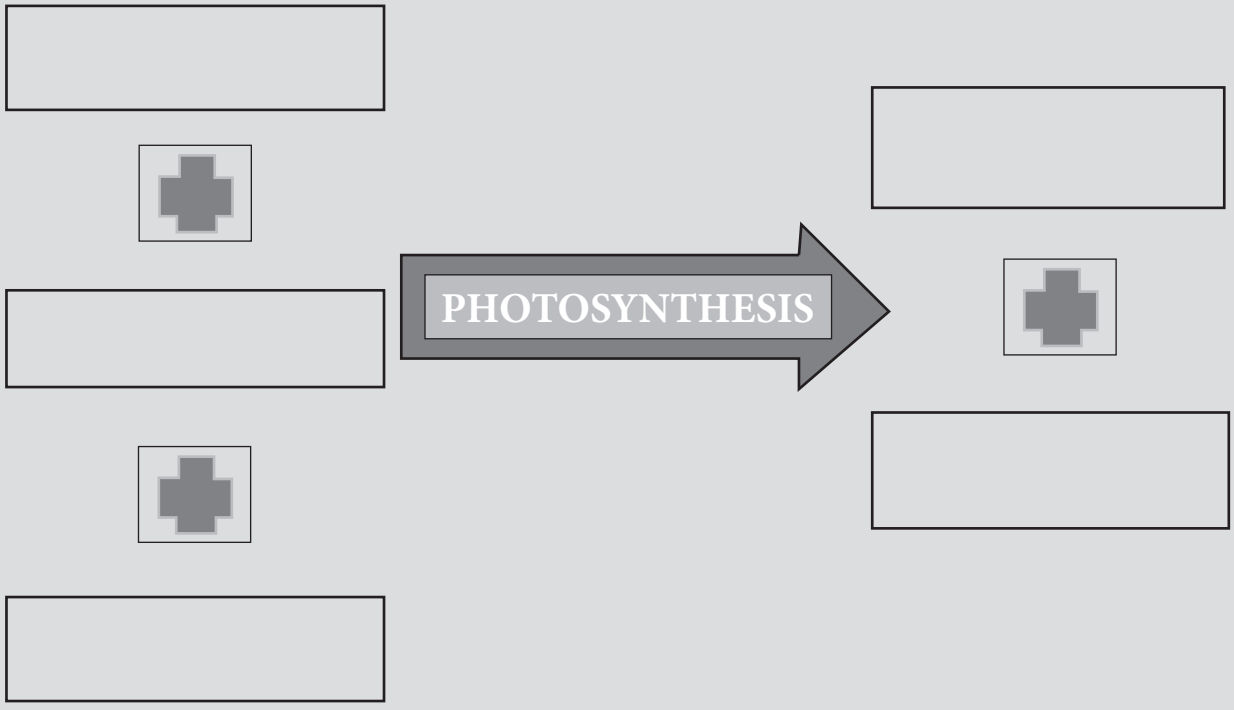
iii. The roots absorb _____ and _____ from the soil.

iv. The water and minerals pass up the stem to the _____.

v. Plants absorb carbon dioxide from the _____ through small holes in the leaves.

vi. Plants produce _____ gas during photosynthesis.

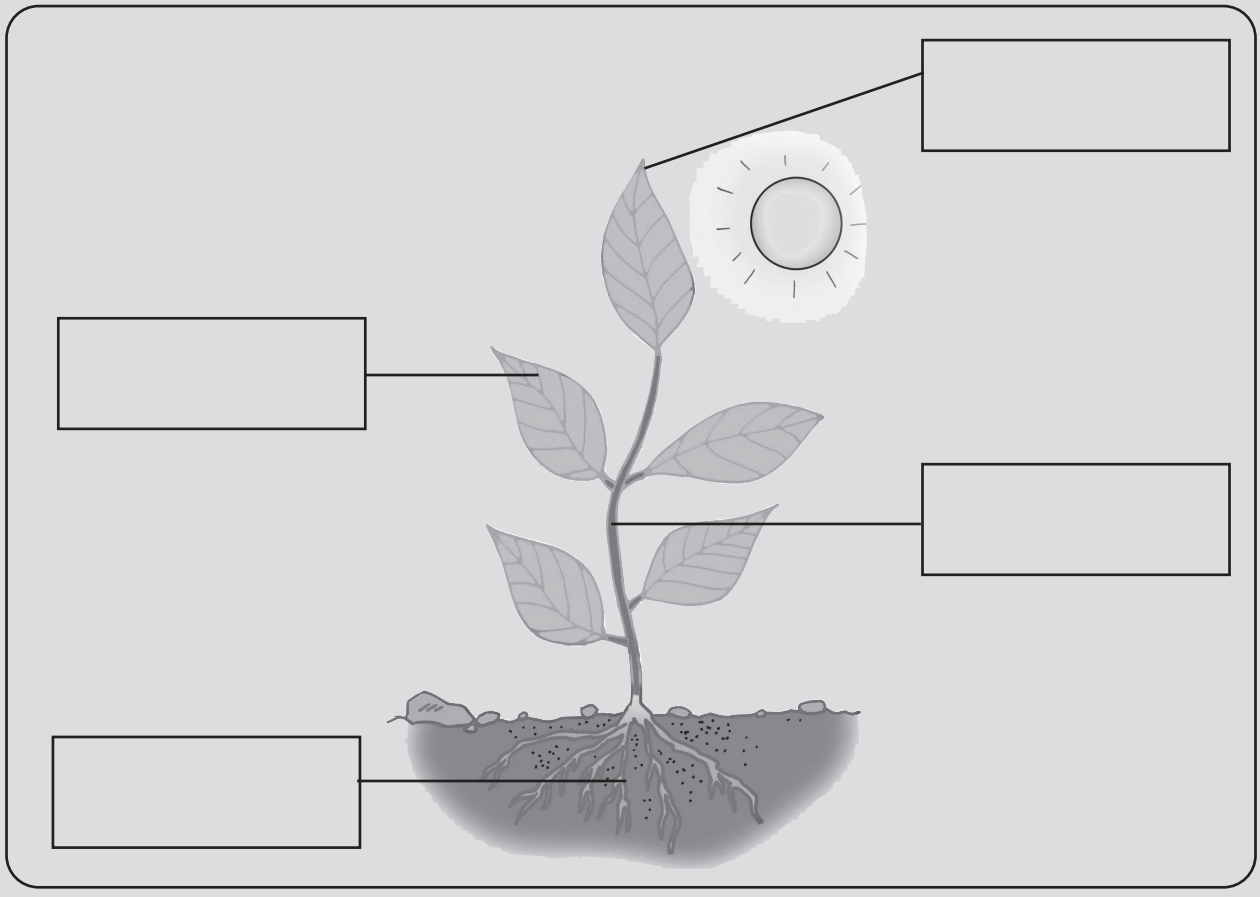
2. Complete the following word equation:



Worksheet 2:

Define Transpiration process:

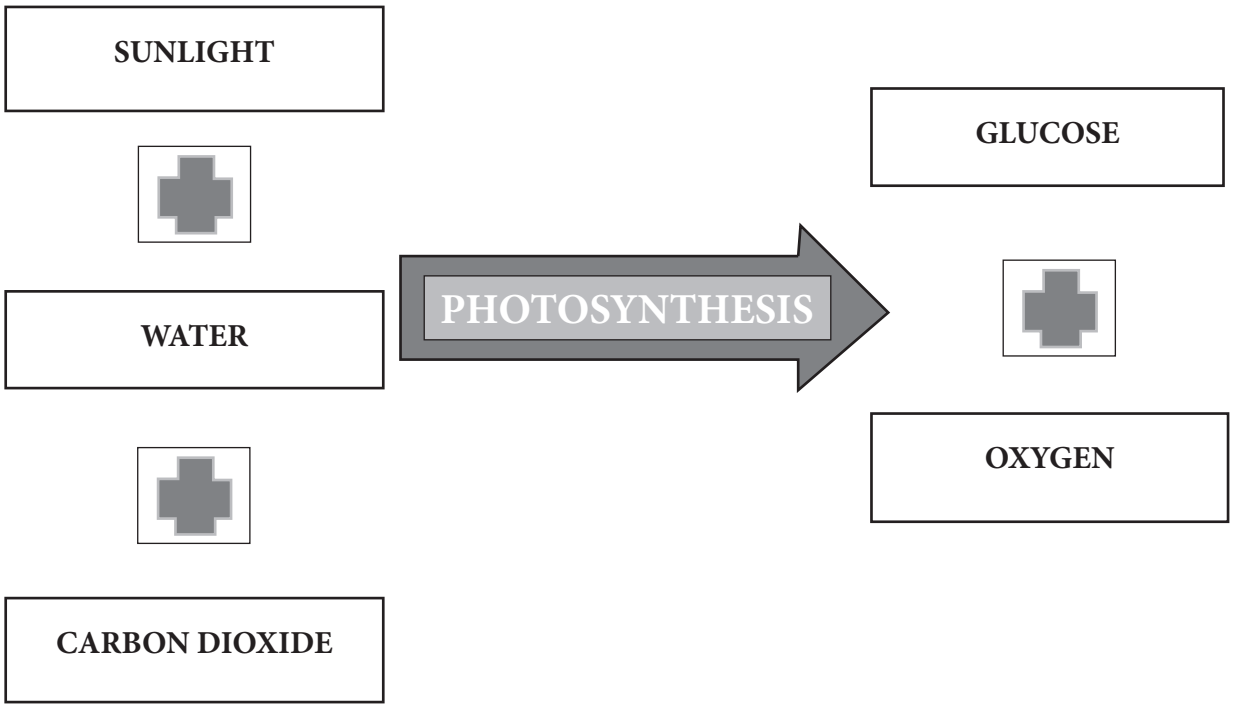
Label the diagram showing the TRANSPIRATION PROCESS in Plants



Answers for Worksheet 1:

i. Food
ii. sunlight, leaves
iii. water, minerals
iv. leaves
v. air
vi. oxygen

3. Complete the following word equation:

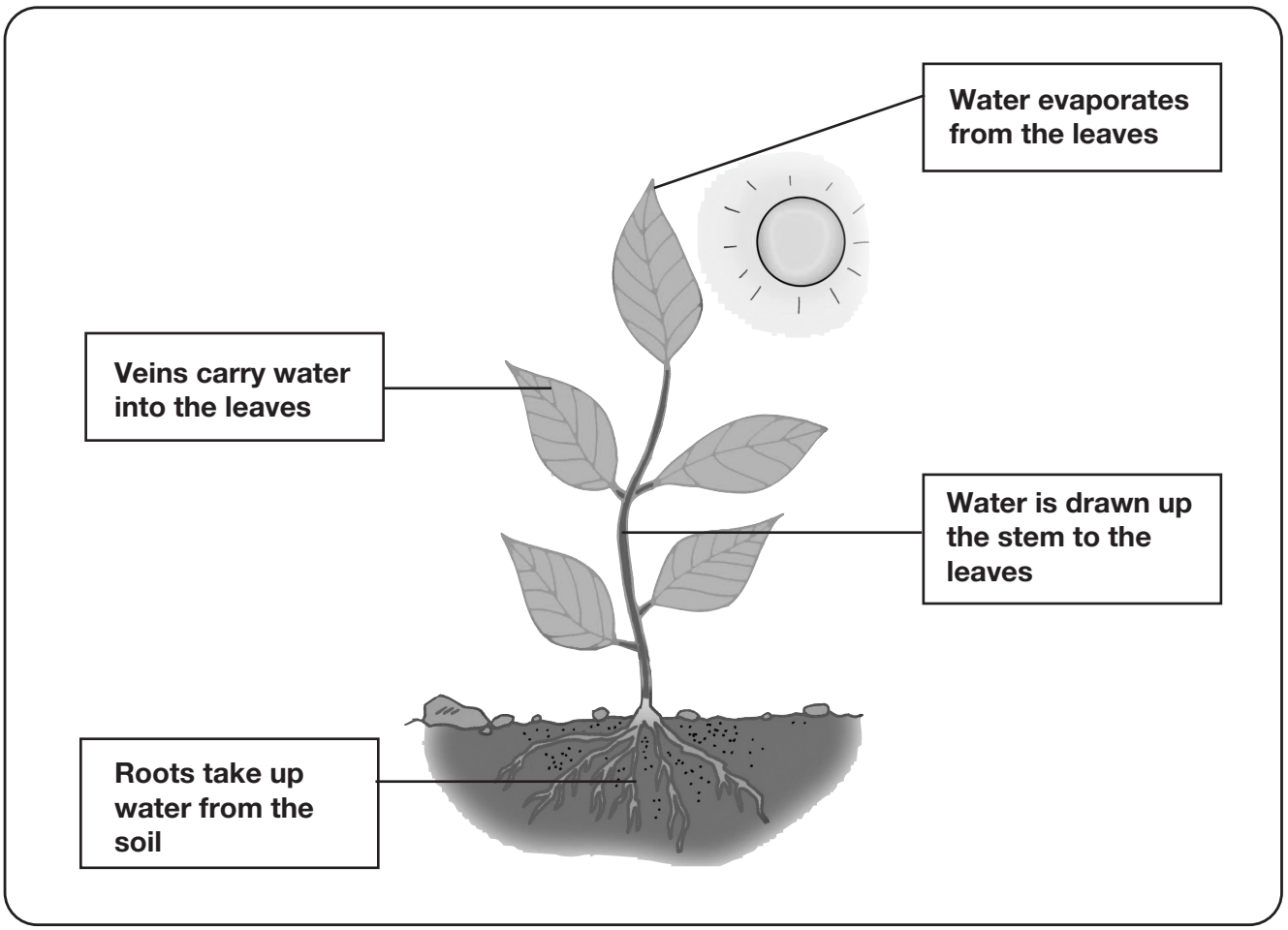


Answers for Worksheet 2:

Define Transpiration process:

The process of transpiration involves the movement of water through a plant and its evaporation from aerial parts like leaves, stems, and flowers.

Label the diagram showing the TRANSPIRATION PROCESS in Plants:



Exercise Answers

1. Choose the correct answer.

i. Sap rises in a plant because of:

b) transpiration pull

ii. Mineral salts are absorbed into cells by:

c) active transport

iii. Food is transported in the phloem as:

b) sucrose

iv. The movement of particles from a region of higher concentration to a region of lower concentration is called:

b) diffusion

2. Fill in the blanks.

i. Roots absorb water through root hairs.

ii. Transpiration from a plant takes place through the stomata.

iii. On the surface of leaves, more stomata are present.

iv. The plant tissue which moves foods from the leaves to the growing points and storage places is phloem.

4. Short answer questions.

i. The two sets of tubes which make up the transport system of a plant are xylem and phloem.

ii. The two sets of transport tubes in a leaf can be found in the vascular bundles.

iii. Phloem carries dissolved food to storage areas, growing points, and other places where it is needed.

iv. Photosynthesis is the process by which plants convert carbon dioxide and water into glucose and oxygen using sunlight.

v. The process by which water enters the root hairs is called osmosis.

vi. Factors that affect transpiration include temperature, humidity, wind, and light intensity.

vii. Humidity affects transpiration by reducing the rate of water loss, as high humidity creates a lesser concentration gradient for water vapor to diffuse out of the leaf.

5. Long answer questions

i. Larger, multi-cellular plants need a transport system to move water, nutrients, and food to all parts of the plant efficiently. This is essential for the survival and growth of the plant, as diffusion alone would not be sufficient to supply all the cells in a large plant.

ii. Xylem carries water and dissolved mineral salts from the roots to the rest of the plant. It does so through a process called transpiration pull, where water is drawn up due to evaporation from the leaves creating a negative pressure, which pulls the water up.

iii. Phloem carries food (mainly sucrose) from the leaves, where it is produced during photosynthesis, to other parts of the plant. This process is called translocation and is driven by pressure gradients within the phloem.

iv. Transpiration stream refers to the continuous movement of water and minerals through the xylem from the roots to the leaves, where it is eventually lost to the atmosphere through transpiration.

v. Differences between respiration and photosynthesis:
- Photosynthesis occurs in plants, while respiration occurs in both plants and animals.
- Photosynthesis converts carbon dioxide and water into glucose and oxygen, while respiration breaks down glucose to release energy and produce carbon dioxide and water as byproducts.
- Photosynthesis requires light (usually sunlight), while respiration can occur in the absence of light.

vi. Factors that produce a high rate of transpiration:
- High temperature
- Low humidity
- Windy conditions
- Intense light

vii. The rate of transpiration is greatly reduced at night because the stomata of the leaves usually close during the dark hours. This closure minimizes water loss and conserves water when photosynthesis is not taking place.

viii. Translocation is the process of transporting the produced food (mainly sucrose) from the leaves to other parts of the plant where it is needed for growth or storage. It involves the movement of dissolved food through the phloem, driven by pressure gradients.

ix. Factors increasing the rate of transpiration:
- High temperature
- Low humidity
- Windy conditions
- Intense light
- Large leaf surface area

6. Think about it

i. Leaf B with a bigger surface area will likely lose the most water because it has more stomata. Stomata are the primary sites of transpiration, and more stomata mean a higher potential for water loss.

ii. Leaf C with a smaller surface area will likely lose the least water because it has fewer stomata. With fewer stomata, there will be less surface area for water to evaporate from, leading to reduced transpiration.

Activities:

1. Table with features and functions of xylem and phloem:

Xylem	Phloem
Feature: Water transport	Feature: Water transport
Function: Transports water and minerals from roots to all parts of the plan.	Function: Transport food (mainly sucrose) from leaves o other parts of the plant.

2. Painting diagrams of xylem and phloem with transport process details: This activity would involve learners creating visual representations of xylem and phloem and labeling the transport processes within these tissues.
3. Preparing "plant food" using old banana peels: Burying the banana peels near plants that require high levels of potassium can provide essential nutrients to the plants. The discussion would revolve around the importance of nutrients, including potassium, for the growth and development of both plants and humans. It would also explore how plants transport food through the phloem to various parts of the plant.
4. Model of the inside of a plant: Learners can create a model using a paper cup, a toilet paper tube, thin white straws, and thick colored straws to represent the outer bark, xylem, and phloem, respectively. The activity would help visualize the arrangement of these tissues and their roles in plant transport.

Projects:

1. Experiment to compare the effects of different chemical fertilizers on a flowering plant:
   - **Equipment and materials:** Two different chemical fertilizers, identical pots, soil, seeds/ plants of the same species, measuring tools, water, sunlight.
   - **Measurements**: Growth rate, height, number of leaves, number of flowers, color, overall health of the plants.
   - **Ensuring a fair comparison:** Use the same species of plants, same soil type, same amount of water and sunlight, and ensure that each plant gets an equal amount of each fertilizer.
2. Experiment with celery leaves and colored water to understand the transport system in plants:
   - Soak celery leaves in colored water to observe the movement of water through the xylem, staining the veins.
   - Repeat the experiment with other leaves to compare the transport systems in different plants.
   - Dry the leaves and paste them in a lab book to document the observations.

CHAPTER 02

Human Respiratory and Circulatory System

Student Book Pages 18-23

Learning outcomes

- Differentiate between the processes of respiration and breathing.
- Differentiate between aerobic and anaerobic respiration.
- Trace the path of air in and out of the body and how it converts during the process of respiration.
- Sketch and label the Human Circulatory System.
- Hypothesize how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate. Test their hypothesis, calculate their pulse rate and record their findings.
- Describe the role and function of major organs in the Human Respiratory System including trachea, lungs and alveoli (air sacs).
- Explain that living organisms have a complex transport system for transfer of various solids, liquids, and gases across the body.
- Describe the structure and function of the human heart.
- Explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gases, nutrients, wastes and heat.
- Compare and contrast arteries, veins and capillaries.
- Describe the composition of blood and the functions of red cells, white cells, platelets and plasma

Keywords

respiration, breathing, lungs, carbon dioxide, oxygen, nasal cavity, pharynx, larynx, trachea, bronchi, lungs, alveoli, heart, pulmonary circulation ,deoxygenated blood, oxygenated blood, systemic circulation, coronary circulation, the epicardium, myocardium, the right atrium, the right ventricle, the left atrium, the left ventricle, chambers

Overview of the Unit

- Respiration is a metabolic process that all organisms go through. It is a biochemical process that occurs within organisms' cells. The breakdown of glucose produces energy in this process, which is then used by cells to perform various functions. Respiration is performed by all living species, from single-celled organisms to dominant multicellular organisms.
- The human respiratory system is made up of organs and tissues that assist us in breathing. Aside from the lungs, there are muscles and a vast network of blood vessels that help with respiration.
- Breathing is the process of moving air into and out of the lungs to allow for gas exchange with the internal environment, primarily to remove carbon dioxide and bring in oxygen.
- There are two types of cellular respiration: aerobic and anaerobic. Aerobic means "involving air." As a result, aerobic respiration is the cellular respiration process that uses oxygen to produce energy from food.
- The term anaerobic means "without air." Thus this type of cellular respiration does not generate energy through the use of oxygen.
- The presence or absence of oxygen during the processes is the main difference between aerobic and anaerobic respiration.
- The transport system comprises two systems that are closely linked: the blood vascular system or circulatory system and the lymphatic system.
- The heart, lungs, blood vessels, capillaries, and blood are all organs associated with the circulatory system in humans.
- The pumping organ that squirts out blood is the heart. The heart exerts such force that it is capable of squirting blood up to 9 metres in height. It never stops beating and keeps the blood flowing to all parts of the body.
- Blood vessels are a network of pathways that transport blood throughout the body. Arteries and veins are the two main types of blood vessels in the body's circulatory system.
- Blood is made up of:
  Plasma is the fluid portion of the blood that is 90% water.
  The solid component of blood is made up of red blood cells, white blood cells, and platelets.
- The lymphatic system is a subsystem of the circulatory system in humans. It also plays an important role in human transportation. Lymph is a type of fluid known as tissue fluid. It participates in the exchange of nutrients and gases that occurs through blood. Any remaining fluid in the cells and tissues is collected by the lymph and drained into the veins that carry blood.

Lesson Plan 1	Student Book pages	Time	Workbook pages
Root System and Shoot System	25-26	40 Minutes	11

Objective:

Differentiate between the processes of respiration and breathing

Resources:

pulmonary specialist or a doctor

a picture of a healthy lung versus an unhealthy lung.

Keywords

Windpipe or trachea
Vocal cords
Bronchi
Bronchioles

Engage: (5 min)

The teacher will start the lesson by blowing up a balloon. The teacher will ask the class if they can think of any organs that are similar to the balloon and how it was inflated.

The students should be able to come up with an answer: the lungs.

Useful Link

https://youtu.be/k9BWCnnXOG8

Explain: (10 min)

To explain the topic, use a large poster with a diagram of the human breathing system.

- During the process of respiration, oxygen is inhaled and transported to various parts, where it is used in a series of chemical reactions to break down glucose molecules at the cellular level.
- The glucose molecules produced are used to release energy.
- The following parts of the human body are involved in the process of respiration.
    - Nasal Cavity
    - Pharynx
    - Larynx
    - Trachea
    - Bronchi
    - Lungs
    - Alveoli
    - Heart
    - All of these components work together to form the respiratory tract, which extends from the external nostrils and nasal chamber to the lungs.
    - Warms and moisturizes the air, bringing it to the proper humidity level for your body.
    - The cells in your body receive oxygen.
    - Exhaling removes waste gases from your body, including carbon dioxide. Keeps harmful substances and irritants out of your airways.
- The main differentiation between breathing and respiration is that breathing is a physiological process that moves air into and out of the respiratory system, whereas respiration is a biochemical process that uses oxygen and generates energy through the breakdown of glucose.

Explore: (15 min)

Invite a pulmonary specialist or a doctor to speak to your students about the lungs and the human body. Some doctors or specialists may bring in human lung models so that your students can see all

of the different parts and details of the lungs. You might also ask the doctor or specialist to bring in chest x-rays to show the students.

To get your students ready, have them brainstorm possible questions to ask the doctor.

Elaborate: (5 min)

After explaining respiration, the teacher should show the students a picture of a healthy lung versus an unhealthy lung. The teacher should ask the students what they know about smoking and why it is harmful for their health. The teacher should explain how smoking affects the lungs.

After the discussion students will be asked to write three reasons why smoking is bad for our health.

Evaluate: (5 min)

Students will be given worksheet 1 to assess their understanding of the topic.

Home Assignment:

Complete Q1 on page 11 of workbook.

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
How We Breathe	26-27	45 Minutes	11

Objective:

- Trace the path of air in and out of the body and how it converts during the process of respiration.
- Describe the role and function of major organs in the Human Respiratory System including trachea, lungs and alveoli (air sacs).

Keywords

Diaphragm
Intercostal muscles
Inhale
Exhale

Resources:

- Labelled diagrams of the respiratory system
- Small balloons,
- Straws
- Tape
- White board and marker
- Pen and paper

Useful Link

https://youtu.be/uyqt7ekkP2E

Engage: (5 mins)

- Begin the lesson by asking students if they understand how and why we breathe.
- Allow students to share their thoughts and ideas during a class discussion about breathing.
- Record their responses on chart paper or a whiteboard.
- Begin the discussion by asking the students if they understand the distinction between breathing and respiration.
- Allow students to express their ideas and responses.

Explain: (10 mins)

- Introduce the concepts of respiration and breathing.
- Explain that breathing is the process of bringing air into and out of the body, whereas respiration is the process by which cells use oxygen to produce energy and remove carbon dioxide.
- Use respiratory system models or diagrams to explain the structures involved in breathing and respiration, such as the nose, trachea, bronchi, lungs, and alveoli.

- Give students handouts with labelled diagrams of the respiratory system to refer to during the explanation.
- Discuss how the respiratory system works to allow the body and the environment to exchange oxygen and carbon dioxide.

Explore: (15 mins)

- Form small groups with the students.
- Each group should be given a set of small balloons, straws, and tape.
- Instruct the groups to use the materials provided to construct a model of the respiratory system.
- Explain that the balloons will represent the lungs, the straws the trachea and bronchi, and the tape will connect the various components.
- Encourage the groups to be imaginative and accurate in their depictions of the respiratory system.
- When the models are finished, have each group present and explain their models to the class.

Elaborate: (10 mins)

- As each group presents, have them blow into the straw and observe the expansion and contraction of the balloons to demonstrate how air moves in and out of the "lungs" (balloons).
- Facilitate a class discussion in which the different models are compared and the accuracy of the representations is discussed.
- Discuss the functions of each respiratory system component as demonstrated by the models.
- Emphasize the significance of the respiratory system's proper functioning for the process of respiration.

Evaluate: (5 mins)

Ask students to complete Concept Check on page 27 of student book.

Home Assignment:

- Complete Q3 on page 39 of Student book.
- Complete Q2 on page 11 of workbook.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Aerobic and Anaerobic Respiration	28	45 Minutes	15

Objective:

Differentiate between aerobic and anaerobic respiration.

Keywords

Aerobic respiration
Anaerobic respiration

Resources:

- White board and marker
- Computer with internet
- Index cards

Useful Link

https://youtu.be/WsqP1O7388g

Engage: (5 mins)

- Start the lesson by asking students to define the terms "aerobic" and "anaerobic."
- Organise a class discussion to elicit their prior knowledge and understanding of these terms.
- Fill in the blanks on the whiteboard with their responses.

- Change the topic to respiration by asking students if they know how our bodies produce energy.
- Allow students to express their ideas and thoughts.

Explain: (10 mins)

- Introduce aerobic and anaerobic respiration concepts.
- Explain how aerobic respiration works in the presence of oxygen and involves the breakdown of glucose to produce energy, carbon dioxide, and water.
- Discuss the efficiency of aerobic respiration in terms of energy produced per glucose molecule.
- Explain that in the absence of oxygen, anaerobic respiration, also known as fermentation, occurs and involves the partial breakdown of glucose to produce energy and byproducts such as lactic acid or ethanol.
- It is important to emphasize that anaerobic respiration is less efficient than aerobic respiration.
- Real-world examples, such as human and other organisms' respiration, can help students understand the practical applications and contexts of aerobic and anaerobic respiration.

Explore: (15 mins)

- Form pairs or small groups of students.
- Instruct each group to conduct research and find examples of aerobic and anaerobic respiration in various organisms or real-life situations.
- Encourage them to gather information using computers or tablets with internet access.
    - Ask guiding questions to help them investigate the various examples, such as:
    - How do these organisms or situations use aerobic or anaerobic respiration?
    - What by products or end products result from these respiration processes?
    - What are the advantages and disadvantages of aerobic and anaerobic respiration in these situations?

Elaborate: (10 mins)

- Ask each group share their findings as well as examples of aerobic and anaerobic respiration.
- Facilitate a class discussion in which the examples are analyzed and compared, with a focus on the similarities and differences between aerobic and anaerobic respiration.
- Guide the discussion to highlight the benefits and drawbacks of each type of respiration in various scenarios.
- Use the students' examples to reinforce your understanding of aerobic and anaerobic respiration and its practical applications.

Evaluate: (5 mins)

- Give each student an index card or a small slip of paper.
- Students should write "A" on one side of the card and "B" on the other.
- Explain that you will read a series of statements, with students holding up either the "A" or "B" side of their card to indicate whether the statement describes aerobic or anaerobic respiration.
- Read out a series of statements, giving students a few seconds to decide and hold up their cards. Here are a few examples of statements:
    - "Occurs in the presence of oxygen"
    - "Produces carbon dioxide and water as byproducts"
    - "More energy-efficient in terms of production"
    - "Produces lactic acid as a byproduct" "Can occur in muscle cells during intense exercise"

- After each statement, have a brief class discussion about the correct answer.
- Keep track of the number of correct answers for each statement to determine overall comprehension.

Home Assignment:

Complete Q8 on page 15 of workbook.

Lesson Plan 4	Student Book pages	Time	Workbook pages
The Pulse	29	45 Minutes	-

Objective:

Hypothesize how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate. Test their hypothesis, calculate their pulse rate and record their findings.

Keywords

Pulse
Wave

Resources:

- a stopwatch or timer,
- Sheets to record pulse rate.
- Chart paper
- Pen and paper

Useful Link

https://youtu.be/DLmmN0jy-s0

Engage: (5 mins)

- Start the lesson by asking students if they've ever noticed their heart rate increases while participating in physical activity.
- Facilitate a class discussion in which they can share their observations and experiences about heart rate during exercise.
- Fill in the blanks on the chart paper with their responses.
- Move the conversation to the topic of pulse rate and how it relates to the level of exercise.
- Instruct students to make predictions or hypotheses about how different types of exercises (from rest to high-intensity interval training) will affect their pulse rate.
- Encourage them to provide evidence to support their hypotheses.

Explain: (10 mins)

- Introduce the concept of pulse rate as a heart rate measurement.
- Explain that pulse rate is the number of times the heart beats per minute and that it can be used to assess cardiovascular fitness and exercise intensity.
- Discuss how different intensities of exercise can affect pulse rate.
- Give examples of different intensity levels of exercises (e.g., resting, walking, jogging, sprinting) and their potential impact on pulse rate.
- Explain why high-intensity exercises raise the heart rate more than low-intensity exercises.
- In order to understand the relationship between exercise intensity and pulse rate, emphasize the importance of measuring and recording pulse rate before, during, and after exercise.

Explore: (15 mins)

- Form pairs or small groups of students.
- Give each group a stopwatch or timer, and pulse rate data recording sheets.

- Instruct the groups to design an experiment to test the impact of a specific exercise intensity level (e.g., resting, walking, jogging, sprinting) on pulse rate.
- Encourage them to record the duration of their exercise, as well as their pulse rate before, during, and after exercise, on their recording sheets.

Elaborate: (10 mins)

- Allow the groups to present to the rest of the class their experimental designs and data collection methods.
- Conduct a class discussion in which you compare and contrast the various exercises and their effects on pulse rate.
- Orient the discussion towards identifying patterns or trends in the data, such as higher pulse rates during high-intensity exercises.
- Discuss how individual fitness levels, age, and exercise duration can all influence pulse rate.
- Encourage students to analyze and interpret their results in order to reach conclusions about the relationship between exercise intensity and pulse rate.

Evaluate: (5 mins)

Ask each student to write a short Conclusion about their hypothesis, the data they gathered, and their conclusions about the impact of exercise intensity on pulse rate.

Home Assignment:

- Explore how different exercise levels, from resting to intense intervals, affect pulse rate.
- Complete Q5(iv) on page 39 of student book.

Lesson Plan 5	**Student Book pages**	**Time**	**Workbook pages**
The Human Transport System and Heart	30-31	45 Minutes	14

Learning Objective:

- Describe the structure and function of human heart.

Keywords

Circulatory system
Heart
Blood
Blood vessels

Resources:

- 3-D model of a heart
- a jar halfway with water.
- Balloon.
- Scissors
- Straw
- Paper and coloured pencils

Useful Link

https://youtu.be/tg_ObDJEaGo

Engage: (5 mins)

- Tell your students that they will be studying the heart today.
- Ask them to place their hand on their heart and feel the heartbeat.
- Students will feel their heartbeat.
- Ask them to tell the importance of heart.
- Students will respond to the teacher's question and share their knowledge of the importance of the heart with the class.

Explain: (10 mins)

Use can also use a 3D model of a human heart to explain:

- One of the most significant organs necessary for maintaining life is the human heart. It is a four-chambered muscular organ. The heart is roughly the size of a clenched fist.
- The human heart is one of the most reliable and hardest working muscles in the human body, functioning throughout a person's lifespan.
- The human heart's primary function is to circulate blood throughout the body.
- Blood transports oxygen, hormones, glucose, and other substances throughout the body, including the human heart.
- The heart also ensures that the body's blood pressure remains stable.
- The heart is located in the thoracic cavity, between the lungs.
- The heart's internal cavity is divided into four chambers:
    - The right atrium
    - The right ventricle
    - The left atrium
    - The left ventricle
- The two atria are hollow chambers with thin walls that receive blood from the veins. The ventricles are two thick-walled chambers that force blood out of the heart.
- The left atrium receives oxygenated blood from the pulmonary veins, while the right atrium receives deoxygenated blood from veins.

Explore: (15 mins)

Stem Activity:

Heart Pump Project

- Fill a jar halfway with water.
- Cut the balloon's neck at the point where it begins to widen. Set aside the neck section.
- Stretch the balloon over the jar's opening and pull it down as tightly as you can. The flatter the surface of the balloon can be, the better.
- Poke two small holes in the surface of the balloon with the tip of a skewer. Make them about an inch apart and near the opposite edges of the jar.
- Insert the straw's long end into each hole. The straws should fit snugly in the holes so that no air can get around them.
- Move the uncut end of the balloon neck onto one of the straws and wrap it with tape.
- To catch the pumped water, place your pump in a large pan or the sink. Straighten the straws downward. Gently press the stretched balloon in the center and observe what happens to the water in the jar.
- Teacher will demonstrate the experiment.

Explanation:

- The teacher will explain that the students constructed a simple pump that transferred water from the jar through the straws and into the pan. The balloon's cut end served as a valve, preventing water from flowing back down the straw. In a similar manner, your heart pumps blood into your body via your arteries.

- Inside the human heart are four distinct chambers. This heart model pump demonstrates how one chamber and its valve function.
- Remove the balloon valve from the straw and try pumping water again. Have you noticed any differences? You probably noticed that water continued to come out of the straw, but without the valve, there was nothing to prevent some of the water from flowing back down the straw.

Elaborate: (5 min)

- Teacher will ask the students to draw a heart on a paper and colour it to differentiate different parts of heart.
- Students will draw a picture of heart and colour it.

Evaluate: (5 min)

- Provide worksheet 2 to solve it by the students.
- Ask students to complete Q5 on page 14 of workbook.

Home Assignment:

- Draw a labeled diagram of human heart.
- Complete Q3 on page 38 of student book.

Lesson Plan 6	**Student Book pages**	**Time**	**Workbook pages**
Blood Circulation in the Human Body	32-34	45 Minutes	-

Learning Objective:

- Explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gases, nutrients, wastes and heat.
- Sketch and label the Human Circulatory System
- Compare and contrast arteries, veins and capillaries.

Keywords

Heartbeat
Oxygenated blood
Deoxygenated blood
Arteries
Veins
Capillaries

Resources:

- Handouts with labelled diagrams of arteries, veins, and capillaries
- White and marker
- Pen and paper

Useful Link

https://youtu.be/SwHjwO7BnsI

Engage: (5 mins)

- Start by asking students whether they are familiar with the term "circulatory system" and its functions.
- In order to gather prior knowledge and understanding of the circulatory system, lead a class discussion.
- Inquire if students have any observations or questions about these blood vessels.

Explain: (10 mins)

- Explain the circulatory system as the network of blood vessels that transports blood throughout the body.
- Discuss the circulatory system's major components: the heart, arteries, veins, and capillaries.
- Explain the heart's function as the pump that drives blood circulation.
- Give a brief explanation of the three types of blood vessels: arteries, veins, and capillaries.

- Explain how arteries transport oxygenated blood away from the heart, veins transport deoxygenated blood back to the heart, and capillaries facilitate gas, nutrient, and waste material exchange.
- Discuss the structural and functional differences between arteries, veins, and capillaries, such as thickness, elasticity, and the presence of valves.

Explain: (15 mins)

- Handouts with labelled diagrams of arteries, veins, and capillaries should be distributed.
- Instruct the students to compare and contrast the structural and functional characteristics of each type of blood vessel, either individually or in pairs.
- Encourage them to identify specific features such as vessel wall thickness, the presence or absence of valves, and lumen size.

Elaborate: (10 mins)

- Ask each pair or individual share their findings and discuss the similarities and differences discovered between arteries, veins, and capillaries.
- Create a comprehensive comparison chart on a whiteboard using the information shared by the students.
- Allow students to ask questions and clarify any concepts that are still unclear.

Evaluate: (5 mins)

Complete Concept Check on page 33 and 34 of student book.

Home Assignment:

- Provide copies of worksheet 3 to solve at home.
- Complete Q5(i) on page 39 of student book

Lesson Plan 7	**Student Book pages**	**Time**	**Workbook pages**
Composition of Blood and Its Main Components	35-36	45 Minutes	17

Objective:

Describe the composition of blood and the functions of red cells, white cells, platelets and plasma.

Engage: (5 mins)

Useful Link

https://youtu.be/UgvH3A-BDx8

- Ask students what they know about blood and its role in the body.
- In order to gather prior knowledge and understanding of blood, lead a class discussion.
- Display images of blood cells and plasma to visually engage students and pique their interest.

Explain: (10 mins)

- Introduce blood as a vital connective tissue that transports oxygen, nutrients, waste products, hormones, and immune cells throughout the body.
- Discuss the structure of blood, focusing on its four main components: red blood cells, white blood cells, platelets, and plasma.
- Explain that red blood cells, or erythrocytes, transport oxygen to body tissues.
- Describe the structure of red blood cells, including the absence of a nucleus and their distinctive shape.

- Discuss how white blood cells, or leukocytes, help the body fight infections and foreign substances.
- Describe the various types of white blood cells and their specific roles in the immune response.
- Explain the role of platelets, or thrombocytes, in blood clotting and scab formation to prevent excessive bleeding.
- Discuss the properties of plasma, the liquid component of blood that contains water, proteins, electrolytes, hormones, and other dissolved substances.
- Describe how plasma transports nutrients, hormones, waste, and heat throughout the body.

Explore: (15 mins)

STEM Activity: Blood Cell Models

Materials Needed:

- Playdough or modeling clay in various colors (red, white, yellow)
- Toothpicks
- Markers or stickers
- Reference materials on blood cell structures

Procedure:

1. Form small groups with the students.
2. Give each group a different colour of playdough or modelling clay, as well as toothpicks.
3. Instruct the groups to make playdough or modelling clay models of red blood cells, white blood cells, and platelets.
4. Encourage students to consult reference materials to ensure that their models are accurate.
5. When the models are finished, have the students examine and compare them in their groups.
6. Instruct them to use their models to discuss the structural differences and characteristics of each type of blood cell.

Elaborate: (10 mins)

- Bring the students back together as a class after the exploration phase.
- Request that each group present their models and explain the characteristics and functions of the various blood cells they created.
- Facilitate a class discussion in which the models are compared and contrasted, with an emphasis on the structural and functional characteristics of each blood cell type.
- Prompt students to elaborate on their understanding and connections to the real-world functions of blood cells by asking probing questions.
- Based on the information shared by the students, summarize the key characteristics of red blood cells, white blood cells, and platelets.

Evaluate: (5 mins)

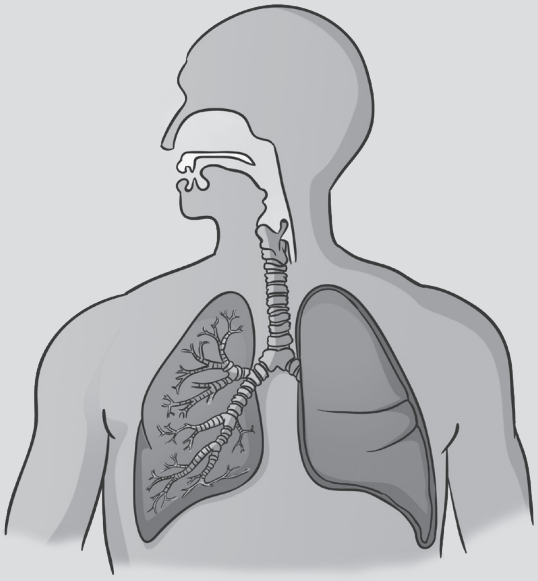
Ask students to complete Q6 on page 14 of workbook.

Home Assignment:

- Write down the functions of red cells, white cells, platelets and plasma in your notebooks.
- Complete Q11 on page 17 of workbook.

Worksheet 1:

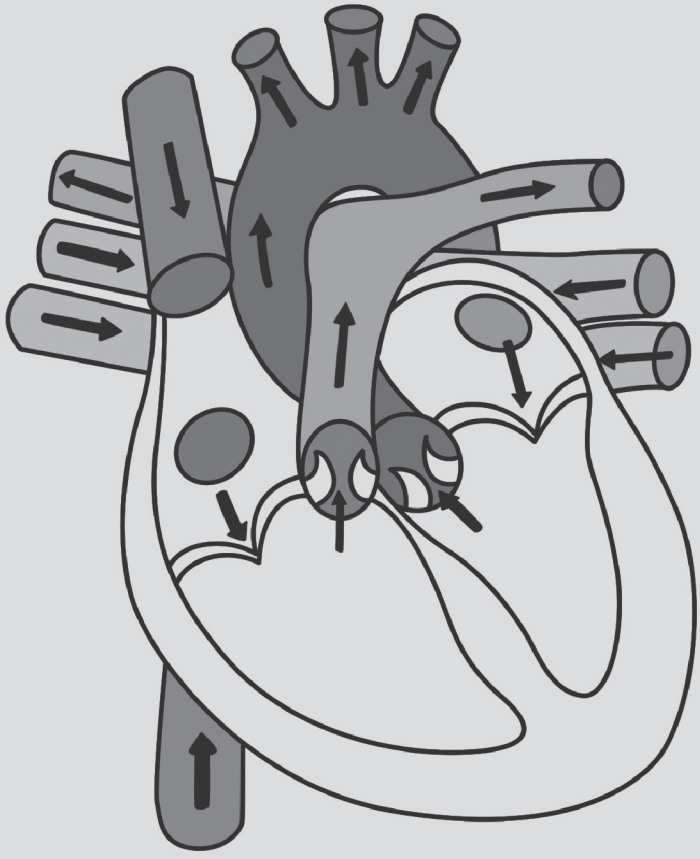
Label the diagram and write the organs in the correct order in which they participate in the human respiratory system:



No.	Name of organ	Function
1		
2		
3		
4		
5		
6		

Worksheet 2:

Label and write down the function of different parts of the heart in the table belo.



Parts	Function
Aorta	
Vena Cava	
Right Atrium	
Left Atrium	
Right Ventricle	
Left Ventricle	

Worksheet 3:

Blood Circulation:

How does blood circulate in the human body?

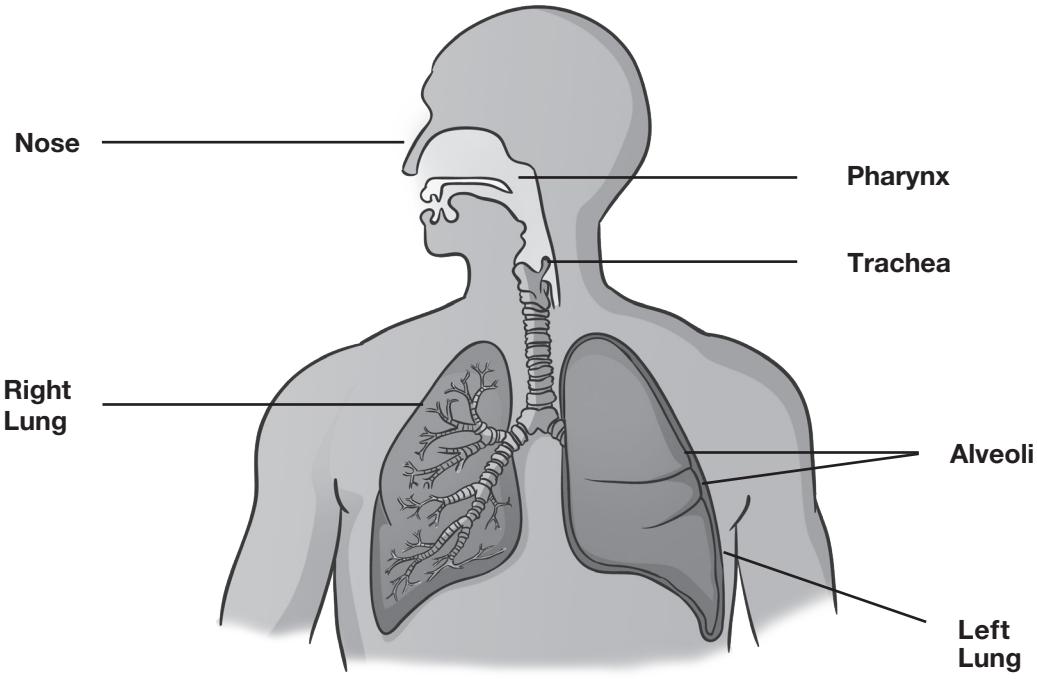
What is the function of human arteries?

What is the function of veins?

What is the function of capillaries?

Answers for Worksheet 1:

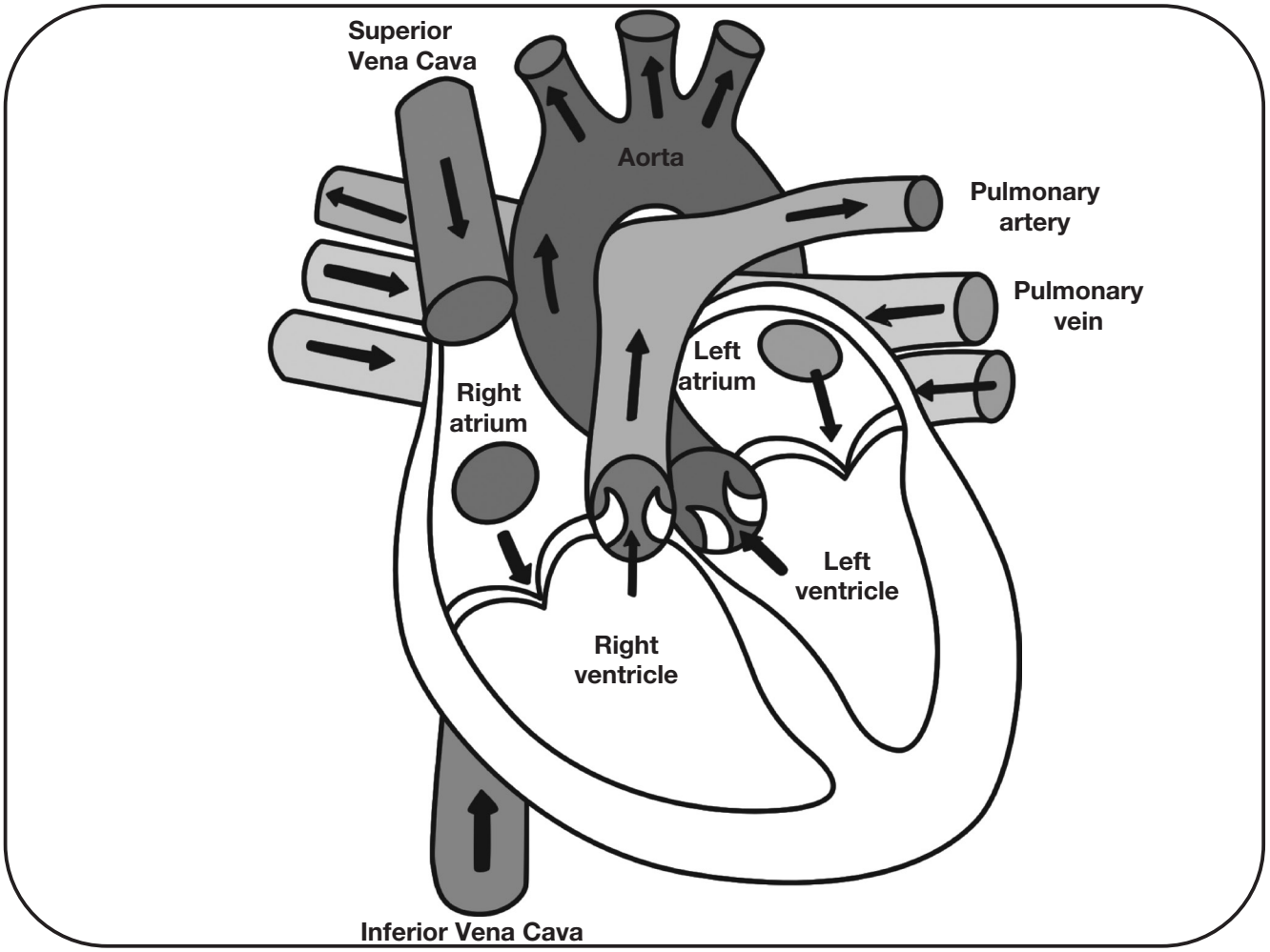
Label the diagram and write the organs in the correct order in which they participate in the human respiratory system:



No.	Name of organ	Function
1	Nasal Cavity	As air enters the body through the nasal cavity, it is warmed and filtered.
2	Pharynx	Allow inhaled air to enter the nasal cavity and travel to the respiratory tract.
3	Larynx	In the human respiratory system, the larynx is located between the pharynx and the trachea. It guards the lower respiratory tract. The epiglottis protects the upper part of the larynx from food entering the larynx and trachea.
4	Trachea	Allows air to enter the lungs. It is held together by cartilage rings that prevent it from collapsing.
5	Bronchi	The bronchi are windpipe extensions that transport air to and from the lungs.
6	Lungs	The organ where gas exchange takes place.

Answers for Worksheet 2:

Label and write down the function of different parts of the heart in the table below.



Parts	Function
Aorta	The aorta's main function is to supply blood to almost all of the body's major organs via the smaller arteries that branch off of it.
Superior Vena Cava	Carries deoxygenated blood from the upper body.
Right Atrium	Receives deoxygenated blood through the veins.
Left Atrium	Receives oxygen-rich blood from the lungs.
Right Ventricle	Pumps deoxygenated blood into the lungs.
Left Ventricle	Pumps oxygenated blood out to the rest of the body.

Answers for worksheet 3:

Blood Circulation:

How does blood circulate in the human body?

Circulatory system, a system of blood vessels, transports blood pumped by the heart to all parts of the body, carrying oxygen and other substances required by our cells.

What is the functions of human arteries?

An artery is a vessel that transports oxygen-rich blood from the heart to the farthest parts of the body. Because blood in arteries is usually oxygenated, haemoglobin in red blood cells is oxygenated. The resulting haemoglobin form (oxyhemoglobin) is what gives arterial blood its bright red colour.

What is the function of veins?

Veins are blood vessels that return low-oxygen-content blood from the body to the heart. The presence of deoxygenated haemoglobin in venous blood causes it to appear dark.

What is the function of capillaries?

Capillaries are blood vessels that connect the smallest arteries to the smallest veins in the body.

Exercise Answers

1. Choose the correct answer.
   - **i. b)** nitrogen
   - **ii d)** the diaphragm is lowered
   - **iii. b)** up and out
   - **iv. a)** exercise
   - **v. a)** to carry oxygen
   - **vi. b)** to clot the blood
   - **vii. d)** to protect against germs
   - **viii. c)** oxygen and dissolved food
   - **ix. d)** carry oxygen round the body

2. Fill in the blanks.

liver
energy
alveoli
4-5%
cells
red blood cells
blood cells
left ventricle
60-80
body

3. Here is a simplified diagram showing a section through the human heart:
   - **a.** Human Heart
   - **b.** Pumping blood to the rest of the body
   - **c.** Receiving oxygenated blood from the lungs

4. The diagram on the right shows the chest cavity. One of the lungs is cut away to show the air sacs or alveoli
   - **i.** Oxygen
   - **ii.** Carbon dioxide
   - **iii.** Thin walls for diffusion, large surface area, rich blood supply, moist lining
   - **iv.** Diaphragm moves down when inhaling and up when exhaling
   - **v.** Exhaled air has more carbon dioxide and less oxygen
   - **vi.** Cellular respiration
   - **vii.** Oxygen + Glucose Carbon Dioxide + Water + Energy
   - **viii.** Diaphragm contracts and flattens, intercostal muscles contract to lift ribs, increasing chest volume and decreasing pressure, allowing air to enter (inhale); relaxation of muscles reverses the process (exhale)

5. Short answer question.

i. Cells

ii. Nose, mouth, trachea, bronchi, bronchioles, alveoli

iii. Nose filters, warms, and humidifies air

iv. Tiny air sacs in the lungs where gas exchange occurs

v. Cilia help move mucus and trapped particles out of the respiratory tract

vi. Red blood cells, white blood cells, platelets, plasma

vii. Carries oxygen

viii. To transport nutrients, oxygen, and waste products

ix. Oxygen, nutrients, hormones, waste products

x. About 5-6 liters

xi. Prevents backflow of blood

6. Long answer question

i. Pulmonary vein → Left atrium → Left ventricle → Aorta → Body cells → Vena cava → Right atrium → Right ventricle → Pulmonary artery → Lungs

ii. Breathing is the mechanical process of inhaling and exhaling air, while respiration is the chemical process that occurs in cells to release energy from nutrients.

iii. Burning and Respiration:

Similarities:

- Both processes involve the utilization of oxygen.
- Both processes release energy.
- Carbon dioxide is produced as a waste product in both processes.

Differences:

- Respiration occurs within living cells and is a controlled process, while burning is a chemical reaction that occurs outside living organisms and is often uncontrolled.
- Respiration is a complex series of chemical reactions that release energy from nutrients, while burning involves the rapid oxidation of a substance.
- Respiration is essential for the survival of organisms, while burning is not a biological process.

iv. Why you breathe faster and your heart rate increases when you run:

When you run, your muscles require more oxygen to produce energy for increased activity. Breathing faster helps supply this additional oxygen, and an increased heart rate ensures that oxygen-rich blood is delivered to the muscles at a higher rate.

v. Veins vs. Arteries vs. Capillaries:

Structure:

- Arteries: Thick, muscular walls to withstand high pressure.
- Veins: Thinner walls and have valves to prevent backflow.
- Capillaries: Extremely thin walls for efficient gas exchange.

Function:

- Arteries: Carry oxygenated blood away from the heart to body tissues.
- Veins: Carry deoxygenated blood from body tissues back to the heart.
- Capillaries: Facilitate the exchange of gases, nutrients, and waste products between blood and surrounding tissues.

vi. Some arteries do carry deoxygenated blood (e.g., pulmonary artery), and some veins carry oxygenated blood (e.g., pulmonary veins). The distinction is generally based on the direction of flow rather than oxygen content.

vii. Importance of White Blood Cells:

White blood cells are vital components of the immune system. They defend the body against infections, foreign substances, and harmful microorganisms. White blood cells identify and destroy pathogens, helping to prevent and fight off illnesses.

6 Think about it

i. (Answers will vary)

ii. Blood carries oxygen, nutrients, hormones, and waste products, playing a vital role in transportation, regulation, and protection.

iii. **a.** Bell-jar: Chest,
tubing: trachea,
balloons: lungs,
rubber sheet: diaphragm

b. Balloons expand when the rubber sheet is pulled down and deflate when pushed up.

c. Air pressure decreases when the rubber sheet is pulled down and increases when pushed up.

d. Similar: Demonstrates expansion and contraction of lungs; Different: Lungs expand due to muscle contractions, not external pressure.

Activities:

1. The air pressure at high altitudes is lower, leading to a decrease in the availability of oxygen in the air. This makes it harder to obtain sufficient oxygen during breathing, making it more difficult for my friend to hold their breath on top of the mountains.

2. Negative Effects on Lungs: Group 1 could create a story illustrating the harmful effects of smoking on lung health, leading to respiratory diseases.

Positive Effects on Lungs: Group 2 might develop a story showcasing a character who engages in regular exercise and maintains a healthy lifestyle, leading to strong and efficient lung function.

3. The resting heart rate is around 60-100 beats per minute. During exercise, it can increase significantly, potentially reaching 120-200 beats per minute. Similar responses might occur for classmates, but individual fitness levels can vary.

4. Heart Model: The model demonstrates how squeezing the middle bottle (representing the heart) pushes water (representing blood) through the straw vessels (representing arteries and veins) to simulate blood circulation.

5. Yarn Model: Thick blue and red yarn represent veins and arteries, respectively, while thin white yarn symbolizes capillaries. The model illustrates the interconnectedness of blood vessels throughout the body.

Projects:

1. Create a model of the human circulatory system to demonstrate the flow of blood through arteries, veins, and capillaries.

2. Artificial respiration is a technique used to assist or replace breathing when someone cannot breathe on their own. Scientists may avoid the term "artificial respiration" due to its potential confusion with mechanical ventilation, which involves the use of machines to assist breathing.

3. Passive smoking refers to inhaling secondhand smoke from tobacco products used by others. It can lead to various health risks similar to those faced by active smokers.

5. Sheep's Heart: Plastic tubes can be used to trace the path of blood through the heart chambers and major vessels.
6. Learn to measure and record blood pressure under the guidance of a doctor. Research the prevalence, causes, and treatments of high blood pressure.

   Please note that these answers are based on the information you provided. If you need further clarification or additional details, feel free to ask.

CHAPTER 03

Immunity and Diseases

Student Book Pages 40-49

Learning Outcomes:

- Identify the various types of pathogens that cause infectious diseases.
- Explain the various defenses that the body has against pathogens, before the innate immune system is activated.
- Describe the parts of the immunity system and how they function to produce an immune response.
- Describe the three types of immunity in humans – innate, adaptive, and passive.
- Illustrate how adaptive immunity develops over time.
- Visualize the ways to add additional layers of defense (such as wearing masks, using sanitizers, etc.)
- Propose some common strategies for strengthening their immune system.
- Explain how infectious diseases such as Hepatitis, COVID-19, Typhoid, Whooping Cough, Measles and Dengue are caused/contracted, how they are tested and diagnosed, and how they can be prevented.
- Suggest ways in which communities of people can safeguard against the spread of infectious diseases.

Keywords

Pulmonary artery, pulmonary vein, capillaries, innate immunity, adaptive immunity, passive immunity, pathogens, immune system, virus, bacteria, antibodies, infectious diseases, non-infectious diseases, vaccine

OVERVIEW OF THE UNIT:

- Pathogens are microorganisms that cause a wide range of diseases in both plants and animals. Most pathogens are parasites, which means they cause harm to their hosts. Pathogens are classified into four types: viruses, bacteria, fungi, parasites.
- The Immune System is made up of various types of cells and molecules that protect our bodies from pathogens. Pathogens include parasites as well as fungi, bacteria, viruses, and haptens.Haptens are molecules that, when they come into contact with a protein, may trigger an immune response. All of these cells and molecules are distributed throughout the body's tissues and lymphoid organs, where they eliminate or prevent microbial infections, slow tumour growth, and begin the repairing process of damaged tissues.
- Some of the actions to safeguard against infectious diseases are:
  1. Improved access to vaccinations and contraception.
  2. Screening, counselling, and education for those at risk of infection.
  3. Access to treatment assistance.
  4. Observing good hygiene practices such as hand washing.
  5. Standard infection control precautions, including contact, droplet, and airborne precautions.

Lesson Plan 1	Student Book pages	Time	Workbook pages
Pathogens	40-41	45 Minutes	23

Learning Objective:

- Identify the various types of pathogens that cause infectious diseases.

Keywords

Pathogens
Diseases
Microorganisms

Resources:

- Poster showing the diagram of different types of pathogens.

- Chart Paper
- Colourful Markers
- White board and marker

Useful Link

https://youtu.be/WsZS4RCWpcE

Engage: (5 min)

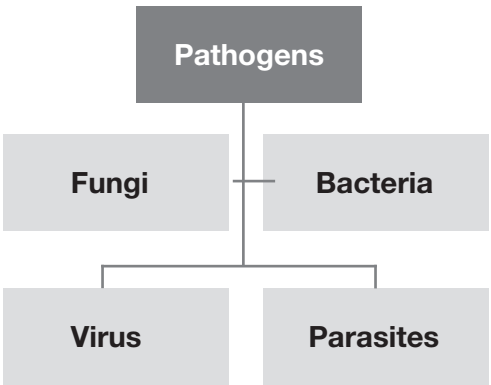
The teacher will ask questions like:

- What is sickness?
- How do we get sick?
- Remember the reason for your sickness when you were sick last time.
- How can we save ourselves from getting sick?

Students will recall and give answers to the questions. (Answers vary according to student's observations and experiences)

Explain: (10 min)

- Teacher can explain the topic with the help of a diagram.



- Bacteria are the most common microorganisms that can be found almost anywhere. The dimensions range from 0.15 to 700 m. While the majority of bacteria are beneficial to us, some are pathogenic and cause diseases in plants and animals.
- Viruses are not thought to be living organisms. They are only capable of replicating within the host. They have a genome made up of DNA or RNA that is encased in a protein coat. They are extremely small, with virus sizes ranging from 20 to 300 nm.
- An organism that lives on or inside a host organism and obtains its food from or at the expense of the host is considered a parasite. Protozoa, helminths, and ectoparasites are the three main types of parasites that can cause disease in humans.
- Fungi are mostly saprophytes that absorb organic matter from decomposing or dead substrates. Parasitic fungi get their food from living plants and animals.

Explore: (15 min)

- After explaining the topic, the teacher will divide the class into four or five groups.
- The teacher will ask the students to make a poster on 'Pathogens'.
- Students will make a poster on pathogens.
- They will show different types of pathogens with examples.

Elaborate: (5 min)

- The teacher will ask the groups to present their poster in front of their class.
- One of the students from each group will come and explain their poster to the class.

- Other students will be encouraged to ask questions at the end of each presentation.

Evaluate: (5 min)

- Teacher will name the diseases and ask students to tell the pathogens that cause them.
- Students will identify the pathogens based on what they have learned in the lesson.
- Students will do Q7 on page 23 of Workbook.

Home Assignment:

Worksheet 1 will be given.

Lesson Plan 2 Immunity	Student Book pages 42	Time 45 Minutes	Workbook pages 20

Learning Objective:

Explain the various lines of defenses that the body has against pathogens.

Keywords

Defense
Infectious disease
Mechanism
Immunity

Resources:

- Whiteboard or projector
- Markers or chalk
- Sticky notes
- Microscope (optional)
- Various pictures/diagrams of immune system components (pre-prepared or found online)

Useful Link

https://youtu.be/_AukawR1l4s

Engage:(5 min)

Begin by projecting image of a virus or bacteria onto the board. Inquire of students what they know about how the body defends itself against such pathogens. In order to spark curiosity, ask questions such as, "What do you think happens when a harmful invader enters our body?" or "Have you ever wondered why we don't get sick all the time?"

Explain: (10 min)

- Give a brief overview of the immune system, noting that it functions as the body's defence force against intruders.
- Explain that the immune system has three lines of defence: the first line, the second line, and the third line. Make a note of these on the board.
- Examine the First Line of Defence: The physical and chemical barriers that prevent pathogens from entering the body, such as skin, mucus, and stomach acid.
- Talk about the Second Line of Defence: The non-specific immune response, which includes fever, white blood cells, and inflammation, and is used to attack pathogens that have gotten past the first line of defence.
- Examine the Third Line of Defence: the specific immune response, in which antibodies and immune cells target specific pathogens to create immunity.

Explore: (15 min)

- Divide the class into small groups and give each group a different pathogen (for example, a virus, bacteria, fungus, or parasite).

- Ask each group to come up with ideas for the first, second, and third lines of defence against their assigned pathogen. They can write down their ideas on sticky notes and stick them to a poster board or whiteboard.
- After that, each group should present their findings to the class.

Elaborate: (10 min)

- Use microscopes (if available) or prepared slides with images of white blood cells attacking pathogens to introduce a hands-on activity.
- Allow students to look at the slides through a microscope or on a projector screen.
- Inquire about how the observed process is related to the second and third lines of defence.
- Encourage students to discuss how this knowledge might be applied in real-world situations, such as vaccine development or disease understanding.

Evaluate: (5 min)

- Do Q2 on page 20 of workbook.

Home Assignment:

- Have students create a superhero character to represent each line of defence:
- The Front Line of Defence: Physical and chemical barriers, such as skin and mucus, could be involved. Assign them the task of drawing or describing the superhero's appearance and powers as they relate to this line of defence.
- The Second Line of Defence: This superhero could represent a general immune response, such as white blood cells or inflammation. Assign them the task of illustrating or describing the superhero's special abilities related to the second line of defence.
- The Third Line of Defence: The superhero should represent the specific immune response, including antibodies and immune cells, for this line of defence. Encourage students to be imaginative when designing a superhero who embodies the characteristics of this line.
- Students can create their superhero using drawing, digital design, or descriptive writing. They can give a brief explanation of each superhero's powers and how they protect the body from intruders.
- Ask students to name their superheroes and submit their creations by the next class.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Types of Immunity System	43-46	45 Minutes	21-23

Learning Objective:

- Describe the three types of immunity in humans – innate, adaptive, and passive.
- Illustrate how adaptive immunity develops over time.

Keywords

Innate immunity
Acquired immunity
Passive immunity

Engage: (5 min)

- Begin the lesson by asking students if they have ever been sick or heard anything about the immune system.
- Facilitate a class discussion to gather their prior immunity knowledge and understanding.
- Fill in the blanks on the whiteboard with their responses.
- Display images of the immune system to visually engage students.

Useful Link

https://youtu.be/xRmwUjW7Nwo

- Inquire if students have any observations or questions about the immune system and its functions.

Explain: (10 min)

- Introduce the concept of immunity and its significance in the body's defence against pathogens.
- Explain the three types of immunity: innate, adaptive, and passive immunity.
- Explain that innate immunity is the body's first line of defence and is non-specific, whereas adaptive immunity is specific and grows over time.
- Discuss the innate immune system's components, such as physical barriers, phagocytes, and natural killer cells.
- Adaptive immunity can be defined as a more sophisticated and targeted defence mechanism.
- Explain B and T cell roles in adaptive immunity, as well as their ability to recognize and respond to specific pathogens.
- Discuss the concept of memory cells and how they help to develop long-term immunity.

Explore: (15 mins)

Materials Needed:

- Whiteboard or chart paper
- Markers or chalk
- Sticky notes or index cards (different colors)

Procedure:

Students will use a hands-on approach to simulate the immune response and investigate the development of adaptive immunity in this activity.

1. Form small groups with the students.
2. Students should be informed that they will be simulating the immune system's response to a pathogen.
3. Assign a pathogen to each group (for example, bacteria, virus, or fungus).
4. Instruct the groups to create a flowchart or diagram on the whiteboard or chart paper to represent their assigned pathogen's immune response.
5. Provide different coloured sticky notes or index cards to represent different immune cells and components.
6. Sticky notes or index cards should be used by each group to represent the various cells and components of the immune response, such as phagocytes, B cells, T cells, antibodies, and memory cells.
7. Encourage students to talk about and collaborate in their groups to figure out the sequence of events and interactions between immune cells and components.

Elaborate: (10 mins)

- Instruct each group to present their flowchart or diagram and explain the sequence of events in their assigned pathogen's immune response.
- Facilitate a class discussion in which students compare and contrast immune responses to different pathogens and identify similarities and differences in the immune components involved.
- Emphasize the importance of adaptive immunity and memory cell development in providing long-term protection against specific pathogens.

Evaluate: (5 mins)

- Students can use concept maps or diagrams to demonstrate their understanding of the three types of immunity and how adaptive immunity develops.
- Ask students to complete Q3 on page 48 of student book.

Homework:

- Write down the challenges the immune system faces and the strategies it uses to effectively combat pathogens in your notebooks.
- Do Q3 and 8 on page 21 and 23 of workbook.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Parts of Immune System	46	45 Minutes	21

Objective:

Describe the parts of the immunity system and how they function to produce an immune response.

Resources:

- images of the armor shield
- Tags with the words- ‘GERMS’ and ‘WHITE BLOOD CELLS’
- White board and marker

Engage: (5 min)

- Make use of the soldier’s armor shield analogy. How he defends
- himself from the enemy. Then ask your students if they are aware
- that our bodies have a shield that protects us from all of the
- pathogens discussed in the previous lesson. You can show the
- images of the armor shield in the beginning of the lesson to gain
- the interest of the students.

Explain: (10 min)

White Blood Cells

- White blood cell, also known as leukocytes or leukocytes, are immune system cells that protect the body from both infectious disease and foreign invaders. All white blood cells are produced and derived from hematopoietics stem cells, which are multipotent cells in the bone marrow. Leukocytes can be found in all part of the body, including the blood and lymphatics systems.

Antibodies

- Antibodies are proteins that protect your body when an unwelcome substance enters it. Antibodies, which are produced by your immune system, bind to these unwanted substances and eliminate them from your system.

Spleen

- As the immune system's largest internalorgan, the spleen containsa large number of immune system cells. Indeed, the spleen receives approximately 25% of the blood that flows from the heart with each beat. The spleen filters blood as it circulates to detect pathogens. When pathogens are detected, immune system cells become activated and multiply in number in order to neutralise the pathogen.

Lymphatic System

- The immune system includes the lymphatic system. The Lymphatic system is a vast network of vessels, nodes, and ducts that run through almost every tissue in the body. Throughout the body, there are 500-600 lymph nodes. In response to infection, these nodes swell due to a buildup of lymph fluid, bacteria, or other organisms, as well as immune system cells.

Explore: (15 min)

Role Play

(The activity will be done in a big room or playground)

- Begin by explaining that the body must protect itself from germs in various ways, one of which is through white blood cells.
- Begin by explaining that the body must protect itself from germs in various ways, one of which is through white blood cells.
- Teacher will divide the students as germs and white blood cells.
- Explain the students that the room or playground is the human being.
- Tag the students as ‘GERMS’ and ‘WHITE BLOOD CELLS’
- The students who are acting as a germ enters the body(room/playground), students who are white blood cells locate the germ and capture it.
- The white blood cells will tag the germs, and the germs will be eliminated from the game.
- The game is over once all of the germs have been captured.

Elaborate: (5 min)

- Discussion questions:
- How do germs enter the body?
- What if the white blood cells are unable to capture all of the germs?
- What types of things are referred to as "germs"?
- What happens if a person is deficient in white blood cells?

All the students will actively participate in the discussion.

Evaluate: (5 min)

- Worksheet will be given to the students.
- Students will complete the worksheet on their own.
- Ask students to complete Q4 on page 21 of workbook

Home Assignment:

Worksheet 3.2 will be given.

Lesson Plan 5	Student Book pages	Time	Workbook pages
Strengthening the Immune System Against the Spread of Infectious Diseases.	47	45 Minutes	-

Objective:

- Visualize the ways to add additional layers of defense (such as wearing masks, using sanitizers, etc.)

- Propose some common strategies for strengthening their immune system.

Engage: (5 mins)

- Display poster depicting preventive measures.
- Inquire if students have any observations or questions about these preventive measures.

Explain: (10 mins)

- Introduce the concept of adding extra layers of defence to prevent disease spread.
- Explain the importance of precautionary measures like wearing masks, using sanitizers, practicing good hygiene, and keeping a physical distance.
- Discuss the rationale for each preventive measure and how it helps to reduce disease transmission.
- Change the subject to immune system strengthening strategies.
- Explain how to eat a balanced diet, get enough sleep, engage in regular physical activity, manage stress, and avoid harmful substances.
- Stress the importance of a strong immune system in protecting the body from disease.

Explore: (15 mins)

STEM Activity: Design a Protective Barrier

Materials Needed:

- Various materials for building models (e.g., cardboard, plastic cups, straws, tape, string, paper, rubber bands, etc.)
- Craft supplies, scissors, rulers, markers, etc.
- Access to a computer for research

Description:

In this activity, students will work in small groups to design and construct a protective barrier capable of effectively preventing disease spread. They will investigate various materials and design strategies while keeping the principles of effectiveness, practicability, and cost-effectiveness in mind.

1. Divide the students into small groups to investigate.
2. Explain to the students that their task is to design and construct a protective barrier that an individual can use to prevent disease spread.
3. Discuss the key factors to consider when designing the barrier, such as pathogen blocking effectiveness, user comfort, ease of use, and material availability.
4. Provide students with a variety of materials and research resources (if available).
5. Instruct the groups to brainstorm and sketch their preliminary design ideas for the protective barrier, taking into account the materials and resources available.
6. Encourage students to discuss and experiment with various design concepts, such as face masks, shields, gloves, or any other creative ideas they may have.

Elaborate: (10 mins)

- Once the groups' design ideas have been finalized, instruct them to begin constructing their protective barriers with the materials provided.
- Encourage students to collaborate by assigning tasks based on their strengths and interests to each group member.

- Remind them to build their models with the principles of effectiveness, practicability, and cost-effectiveness in mind.
- Allow students to be creative with their designs, including features like adjustable straps, breathable materials, or innovative mechanisms.
- Circulate among the groups, asking questions about their design choices and providing guidance or suggestions as needed.

Evaluate: (5 mins)

Ask students to complete Q3(iii) on page 49 of student book.

Homework:

Think about the lesson and write down two additional strategies you can use to strengthen your immune system.

Lesson Plan 6	**Student Book pages**	**Time**	**Workbook pages**
Ways in Which Communities of People Can Safeguard Against the Spread of Infectious Diseases.		45 Minutes	-

Objective:

Suggest ways in which communities of people can safeguard against the spread of infectious diseases.

Engage: (5 mins)

- Display poster depicting preventive measures.
- Inquire if students have any observations or questions about these preventive measures.

Explain: (10 mins)

- Role-Play: Divide students into small groups and assign each group a specific scenario related to infectious diseases. A scenario might involve a community dealing with a measles outbreak, for example. Students should discuss and act out in groups how community members would respond to prevent the spread of the disease, taking into account factors such as communication, education, and cooperation.

Explain: (10 mins)

- Infectious diseases and their modes of transmission, such as person-to-person contact, respiratory droplets, contaminated surfaces, and vectors, are introduced.
- Discuss the impact of common infectious diseases such as the flu, COVID-19, measles, and tuberculosis, as well as the importance of prevention.
- Provide information on preventive measures such as hand hygiene, mask use, vaccination, social distancing, covering coughs and sneezes, and keeping the environment clean.
- Discuss the idea of community-based preventive measures, emphasizing the importance of collective responsibility in preventing the spread of infectious diseases.

Explore: (15 mins)

- Form small groups with the students.
- Instruct each group to brainstorm and discuss various ways communities can protect themselves from the spread of infectious diseases.

- Encourage them to think creatively and critically as they generate ideas.
- Provide students with resources (printed or digital) to research and investigate additional preventive measures and examples from real-world situations.
- Instruct the groups to create a collaborative visual representation of their proposed preventive measures, such as a poster, infographic, or model.

Elaborate: (10 mins)

- Divide the class into two groups and assign them different perspectives on preventive measures for infectious diseases.
- For example, one group may advocate for the mandatory use of masks in public, while another opposes it.
- Give each group time to prepare their arguments and evidence.
- Hold a class debate in which students present their arguments and counter arguments and engage in respectful debate.

Evaluate: (5 mins)

Ask students to complete Q3(iv) on page 49 of student book.

Home Work:

Explore how vaccination plays an important role in community protection.

Worksheet 1:

1. Write down the name of the pathogen that causes the following diseases

Malaria	
Ring Worm	
Covid 19	
Tuberculosis	
Whooping Cough	
Hepatitis	
Dengue Measles	

2. Write two features of each pathogen:

i. Virus: _____ _____

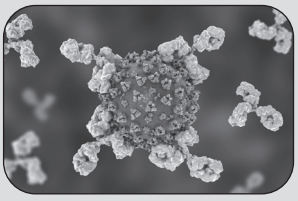
ii. Bacteria _____ _____

iii. Parasite _____ _____

iv. Fungi _____ _____

Worksheet 2:

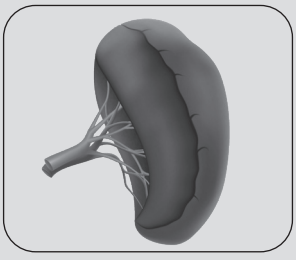
Recognize the parts of the immune system and write down its name and function:



Name: _____

Function: _____

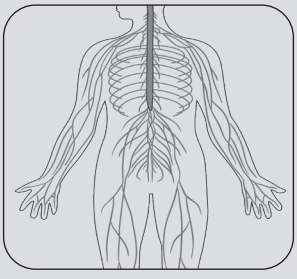
_____



Name: _____

Function: _____

_____



Name: _____

Function: _____

_____

Answers for Worksheet 1:

1. Write down the name of the pathogen that causes the following diseases.

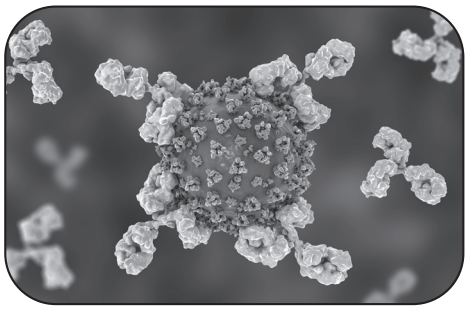
Malaria	Virus
Ring Worm	Fungi
Covid 19	Virus
Tuberculosis	Bacteria
Whooping Cough	Bacteria
Hepatitis	Virus
Measles	Virus

2. Write two features of each pathogen:

1. **Virus:**
   - **i.** Virus forces the cells of living plants and animals to make copies of the virus, once it enters the plant or animal body.
   - **ii.** They cannot reproduce on their own.
2. **Bacteria:**
   - **i.** A parasite gets its food from the living body of another organism.
   - **ii.** Some parasites are highly reproductive.
3. **Parasite:**
   - **i.** A parasite gets its food from the living body of another organism.
   - **ii.** Some parasites are highly reproductive.
4. **Fungi:**
   - **i.** Fungi do not have chlorophyll.
   - **ii.** They feed on the bodies of other living things or their dead remains.

Answers for Worksheet 2:

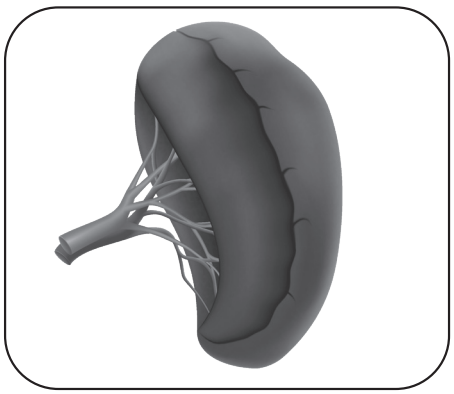
Recognize the parts of the immune system and write down its name and function:



Name: White Blood Cells

Function:

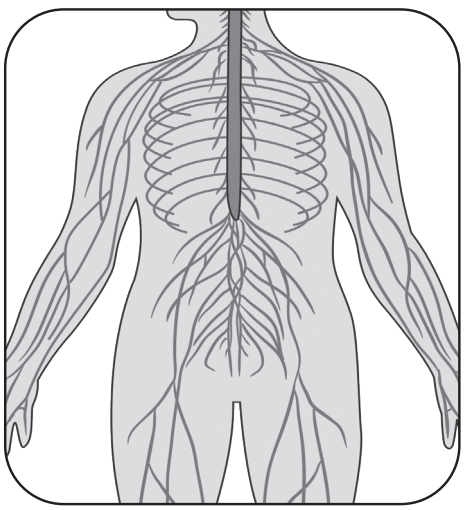
Protect the body from both infectious disease and foreign invaders.



Name: Spleen

Function:

The spleen receives approximately 25% of the blood that flows from the heart with each beat. The spleen filters blood as it circulates to detect pathogens.



Name: Lymphatic System

Function:

The lymphatic system is a vast network of vessels, nodes, and ducts that run through almost every tissue in the body. In response to infection, these nodes swell due to a buildup of lymph fluid, bacteria, or other organisms, as well as immune system cells.

CHAPTER 04

Structure of an Atom

Student Book Pages 53-64

Learning Outcomes:

- Describe and draw the structure of an atom in terms of electrons, protons and neutrons.
- Describe how an atom is electrically neutral.
- Differentiate between atomic number and mass number.
- Determine the atomic number and mass number of elements on the basis of the number of protons, electrons and neutrons.
- Show the arrangement of electrons in K, L and M shells of elements
- Draw the atomic structure of the first eighteen elements of the Periodic Table.
- Explain that the Periodic Table is a way to organize elements in a systematic order.
- Recognize periods and groups in the Periodic Table

Keywords

Atom (divisible entity), molecule, symbol, atomic number, mass number, electrons, protons, neutrons, nucleus, orbit/ shell, neutral, elements, periodic table, groups, periods, metals, non-metals, valence shell, valence number, ions, cations, anions, compound, formula

OVERVIEW OF THE UNIT:

- The structure of an atom is made up of a nucleus (centre), protons (positively charged), and neutrons (neutral). Electrons are negatively charged particles that revolve around the nucleus's centre.
- In the year 1808, John Dalton presented the first evidence-based theory on the structure of the atom, known as Dalton's Atomic theory. An atom, according to this theory, is the smallest and ultimate particle of matter.
- However, by the end of the nineteenth and beginning of the twentieth centuries, scientists such as J.J. Thomson, Goldstein, Rutherford, Chadwick, Bohr, and others had established that the atom is not as simple as Dalton had suggested.
- The atom is made up of 36 subatomic particles, the most important of which are electrons, protons, and neutrons. Because these three particles are essential constituents of atoms, they are referred to as elementary fundamental particles of an atom.
- An atom is made up of two parts. These are the nucleus and the extra nucleus components. The nucleus is located in the center of the atom and is surrounded by extra nucleus components.
- The nucleus is responsible for the majority of the atom's mass, so the atomic mass number equals the number of protons and neutrons present in the nucleus.
- Protons and neutrons together are named nucleons. Because protons are positively charged and neutrons are neutral, the nucleus is positively charged.

Lesson Plan 1	**Student Book pages**	**Time**	**Workbook pages**
Structure of an Atom and Periodic Table .	53-54	45 Minutes	28

Objective:

- Describe and draw the structure of an atom in terms of electrons, protons and neutrons.
- Describe how an atom is electrically neutral.

Keywords

Indivisible
Proton
Neutron
Electron

Resources:

- Paper and pen
- Colourful dough

- Images of important scientists and events

Useful Link

https://youtu.be/TYEYEluTmGQ

Engage: (5 min)

Warm-up Activity:

Play with Dough

- Demonstrate and ask the students to follow your steps.
- Draw the orbits on a piece of paper with a marker.
- Make small balls of dough and place them as protons, neutrons and electrons.
- Use different colours to differentiate them.
- Students will make the structure of an atom by following the steps of their teacher.

Explain: (10 mins)

- The centre of an atom is the microscopic atomic nucleus. It is made up of positively charged particles called "protons" and uncharged particles called "neutrons."
- The extra nuclear region, on the other hand, is a much larger region. It is made up of a web of negatively charged particles known as electrons. Electrons orbit the nucleus in a circle. The attraction between protons and electrons holds the atom's structure together.

- Except for hydrogen, all atoms are made up of these three subatomic particles. Hydrogen is an exception to all other atoms in that it has only one proton and one electron but no neutrons.
- The number of protons in an atom determines its element. The number of electrons, on the other hand, indicates the type of reactions that will occur in an atom.
- In the structure of an atom, the atomic nucleus is made up of a fixed number of protons. Furthermore, the proton attracts the same number of electrons as the electrons, resulting in an electrically neutral atom. Ions are formed when electrons are added to or removed from an atom.
- Different atoms are arranged in a table called periodic table so that they could be identified easily.

Explore: (15 mins)

Role-Play

- Group the students into smaller groups.
- Each group should produce a skit describing the components of an atom.
- Encourage students to think of ways to bring the atom parts to life. For example, Mr. Proton and Ms. Neutron could share a house, and Mr. Proton could only say 'positive' things, whereas Ms. Neutron is 'neutral' on every decision.
- When the groups have completed their skits, they will present them to the class

Elaborate: (5 min)

- Discuss the evolution of our knowledge of atomic structure. Show images of important scientists and events that played a role in our understanding of the atom, such as J.J. Thomson, Rutherford, and Bohr.
- Students will see the images carefully and listen carefully to the discussion.

- They will also participate in the discussion.

Evaluate: (5 min)

Complete Concept Check page 54

Home Assignment:

Complete Q9 on page 28 of workbook.

Lesson Plan 2	Student Book pages	Time	Workbook pages
Atomic number and Mass Number	55-56	45 Minutes	25-26

Objective:

- Differentiate between atomic number and mass number.
- Determine the atomic number and mass number of elements on the basis of the number of protons, electrons, and neutrons

Keywords

Atomic number
Atomic mass

Resources:

- Whiteboard and markers
- Visual aids (charts, diagrams, or a periodic table)
- Modeling kits (optional)

Useful Link

https://youtu.be/gUA8k4gOpbk

Engage: (5 min)

Warm-up Activity:

Play with Dough

- Begin by asking a series of questions to grab students' interest and engage their prior knowledge:
- How much do you know about atoms?
- Have you ever heard of the terms "atomic number" and "mass number"?
- Can you name a few elements and their symbols from the periodic table?

Explain: (10 mins)

- Give a detailed explanation of the key concepts:
- Atomic Number: The number of protons in an atom's nucleus that determines the element's periodic table identity.
- The sum of protons and neutrons in an atom's nucleus represents the atom's mass.
- Use visual aids and diagrams to illustrate these concepts and relate them to periodic table elements.
- Ask students to complete Q1 and 3 on page 25-26 of workbook.

Explore: (15 mins)

Role-Play

- Divide the class into small groups and instruct each group to do the following:
- Choose one of the elements from the periodic table.

- Determine the element's atomic number (protons) and mass number (protons + neutrons).
- Make a note of their findings on a worksheet or whiteboard.
- Circulate around the groups, providing directions and answering questions

Elaborate: (10 minutes)

- Discuss the role of electrons in atomic structure with the students. Explain how the number of electrons in a neutral atom equals the number of protons. Discuss briefly isotopes, in which the number of neutrons can vary.
- Challenge students to identify the number of electrons for their chosen element and calculate the number of neutrons for a specific isotope (e.g., carbon-12 and carbon-14) as a hands-on STEM activity.

Evaluate: (5 minutes)

Ask students to complete Discuss and Answer page 56 of student book.

Home Assignment:

Complete Q3 on page 62 of student book

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
The Arrangement of Electrons in Shells of Elements	56-58	45 Minutes	25

Objective:

- Show the arrangement of electrons in K, L, and M shells of elements
- Draw the atomic structure of the first eighteen elements of the Periodic Table.

Keywords

Energy levels
Shells

Engage: (5 min)

Brainstorming:

Reinforce the structure of an atom.

Useful Link

https://youtu.be/hSkJzE2Vz_w

Draw the structure of an atom on the board.

Revise the parts of an atom.

The teacher can ask questions about the structure of an atom like:

- Where are electrons present in the structure of an atom?
- Do all elements have same number of electrons?
- How do we know the number of electrons present in each orbit of the atom?
- Students will recall and try to answer the questions.

Explain: (10 min)

- An electron shell is an orbit that electrons follow around an atom's nucleus. The electrons, which are negatively charged fundamental particles, are thought to occupy diffuse shells in the space that surrounds the positively charged nucleus. The first shell is the one closest to the nucleus.
- The shells are labelled as follows:

K	The first shell
L	The second shell
M	The third shell so on.

- The electrons occupy the shell in the following order:
  2, 8, 18.
- The atomic shell model also aids in understanding atomic chemical properties.

Explain: (15 mins)

STEM Activity:

Model making

Teacher make four groups of students.
Teacher will provide the material for the activity.

- Paper plates
- Marker
- Colour paper
- Glue
- Each group will be assigned different element.
- Teacher will guide the students to make a 3D model of the structure of an atom.
- Students will make a model by using the given material.
- Students will arrange the electrons in their atom's orbits according to their assigned element.

Explore: (5 mins)

Class Discussion:

Explain the link of electronic configuration with the Periodic Table:

- Show the periodic table chart to the students.
- Explain the students that elements are arranged in the periodic table according to the electronic configuration.
- Students will carefully listen to the teacher.
- Students will ask questions that will arise in their minds.

Evaluate: (5 min)

On-Board Assessment

Complete Q5 on page 25 of workbook.

Home Assignment:

Complete Concept Check on page 59 of student book.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Recognize Periods and Groups in the Periodic Table	56-58	45 Minutes	-

Objective:

- Explain that the Periodic Table is a way to organize elements in a systematic order.
- Recognize periods and groups in the Periodic Table

Keywords

Groups
Periods
Outer shell electrons

Resources:

- Large Periodic Table poster or digital projection
- Colored markers
- Periodic Table worksheets or handouts
- Periodic Table building materials (e.g., index cards with element names and symbols)
- Interactive whiteboard or chalkboard

Useful Link

https://youtu.be/7mLPC74GHMo

Engage: (5min)

Begin by displaying a Periodic Table poster or projection to the students. To pique their interest, ask them open-ended questions such as:

- What do you notice about this table?
- Have you ever wondered why elements are arranged in this particular order?
- Are there any patterns or groups of elements that you can identify?

Explain: (10 min)

- Explain the Periodic Table's purpose:
- It is a method of organizing all known chemical elements according to their properties.
- To demonstrate similarities in properties and behaviours, elements are arranged in rows (periods) and columns (groups).
- Draw a simplified version of the Periodic Table on the interactive whiteboard or chalkboard, emphasizing the concepts of periods and groups.

Explore: (15 min)

- Distribute Periodic Table worksheets to small groups of students. Instruct each group to do the following:
- Identify and label the provided table's periods (rows) and groups (columns).
- Discuss any patterns or trends they notice within each element group.
- After that, each group will present their findings to the class, emphasizing the patterns they discovered.

Elaborate: (10 min)

- Involve students in a hands-on STEM activity in which they will create a simplified Periodic Table.
- Give each student/group index cards with element names and symbols. Instruct them to arrange the elements on a large display (e.g., a wall or bulletin board) into periods and groups based on their properties.
- Encourage students to discuss their placements and to look for patterns or trends as they create their own Periodic Table.

Evaluate: (5min)

Complete Discuss and Answer page 59 of student book.

Home Assignment:

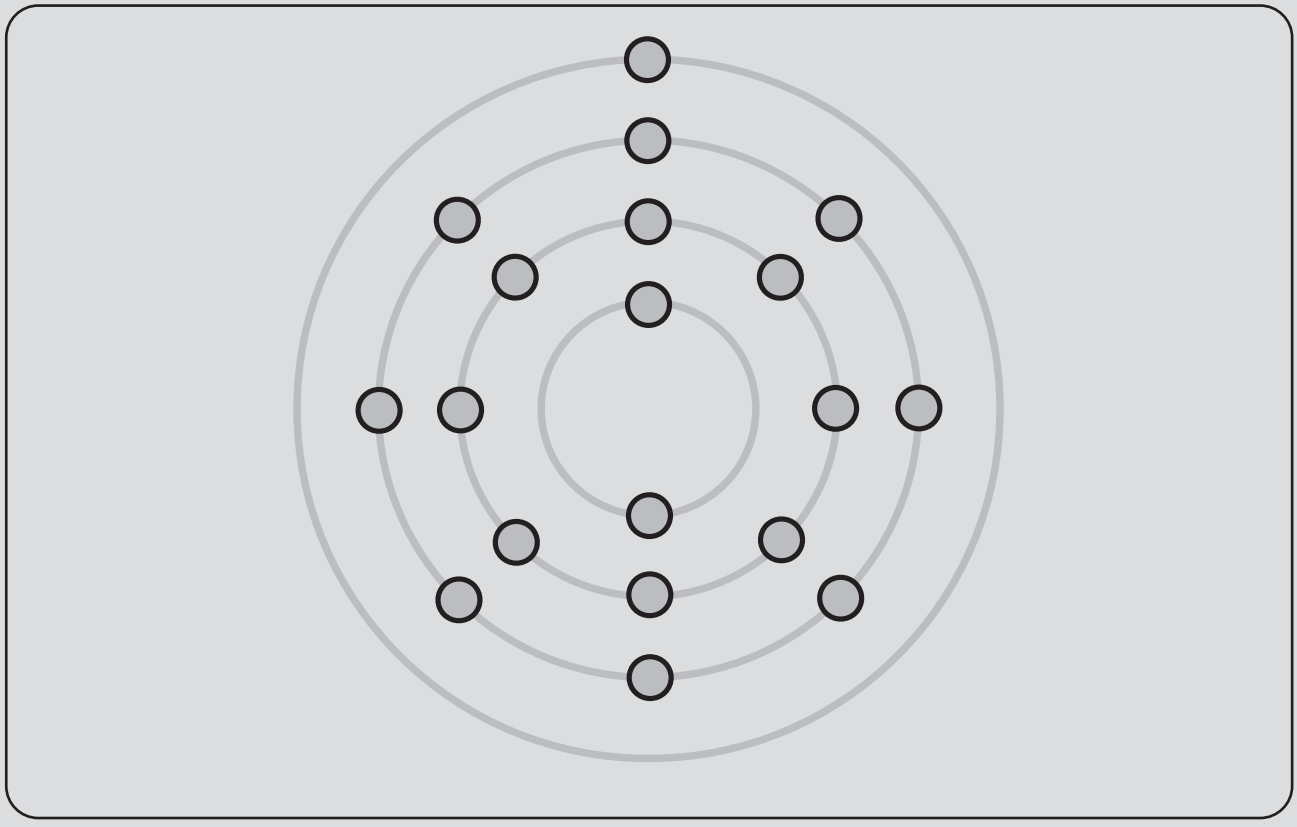
Complete Q7 page 63 of student book.

Worksheet 1:

Atoms are composed of the following subatomic particles:

Particle	Charge	Relative Mass
Neutron		
Proton		
Electron		

Draw the structure of Potassium atom:



Worksheet 2:

Draw and write down the electronic configuration of first ten elements of periodic table:

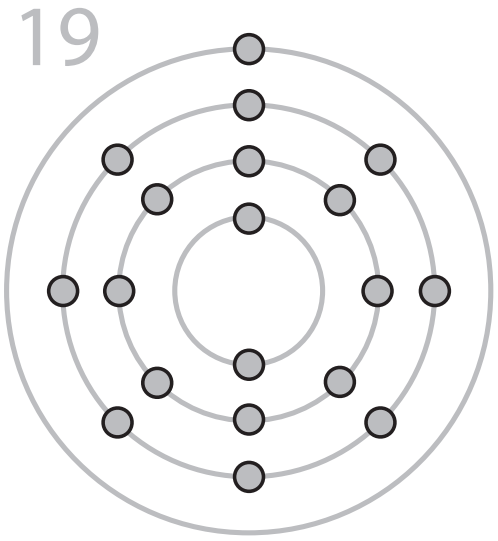
Name of element	Electronic Configuration	Name of element	Electronic Configuration
Hydrogen		Carbon	
Helium		Nitrogen	
Lithium		Oxygen	
Beryllium		Fluorine	
Boron		Neon	

Answers for Worksheet 1:

Atoms are composed of the following subatomic particles:

Particle	Charge	Relative Mass
Neutron	1	None
Proton	1	Positive
Electron	Almost Nothing	Negative

Draw the structure of Potassium atom:

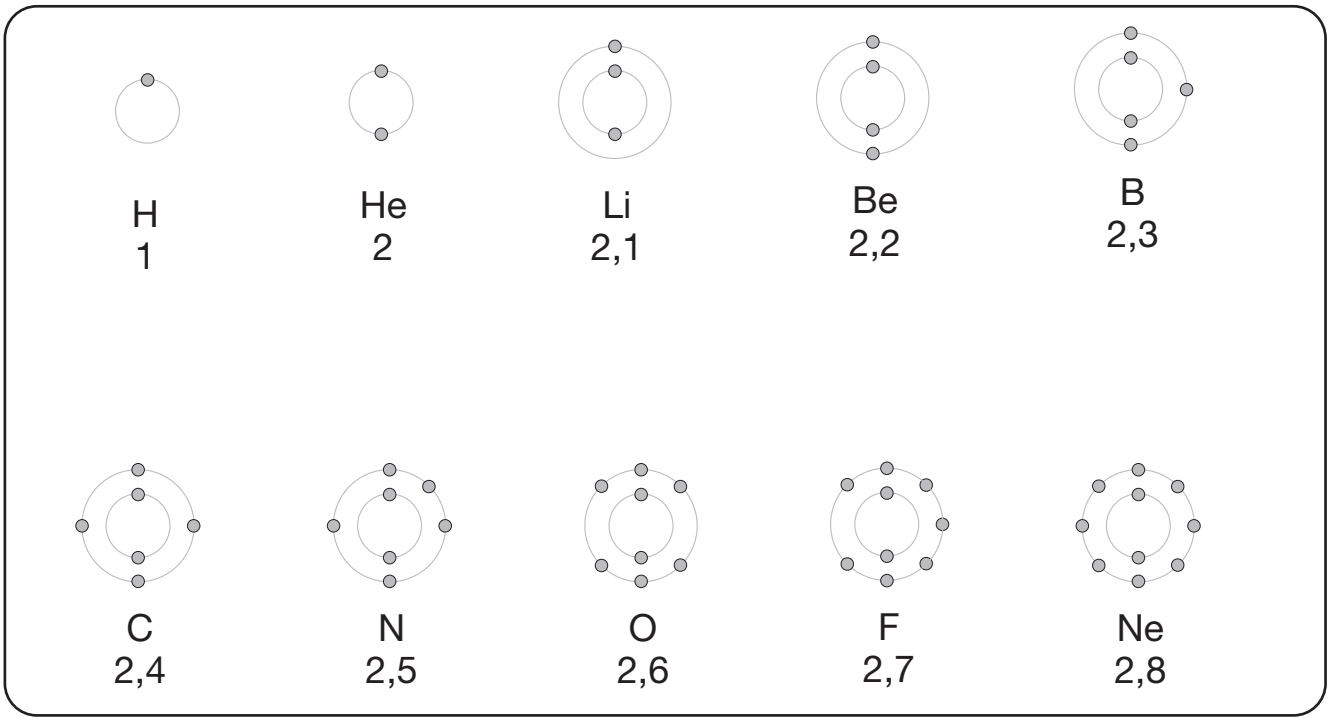


K

2,8,8,1

Answers for Worksheet 2:

Draw and write down the electronic configuration of first ten elements of periodic table:



Exercise Answers

1. Multiple Choice Questions:

i. **d)** classifying the elements

ii. **b)** electrons

iii. **a)** 2

iv. **c)** 6

v. **b)** period

2. Fill in the Blanks:

i. Calcium

ii. Protons and neutrons

iii. Atomic number

iv. Valency

v. Electrons

3. **i.** **a)** There are 11 electrons in this sodium atom.

b) The electrical charge on an electron is negative (-1).

c) The different levels of electrons around the nucleus are called "energy levels" or "electron shells."

ii. **a)** The nucleus of the atom contains two types of particles: protons and neutrons.

b) The electrical charge on the nucleus of the atom is positive.

4. **a)** The three particles that are neutral atoms are A, B, and E. This is because the number of electrons is equal to the number of protons in each of these particles, resulting in no net electrical charge.

b) The charge (atomic number) of each particle is as follows:

A: Atomic number = 12 (protons)

B: Atomic number = 12 (protons)

C: Atomic number = 12 (protons)

D: Atomic number = 8 (protons)

E: Atomic number = 9 (protons)

c) The mass number represents the sum of protons and neutrons in an atom.

A: 12+ 12= 24

B: 12 +14= 26

C: 12+12=24

D: 8+8=16

E: 9+9=185

i. An element is a substance composed of atoms with the same number of protons in their nuclei, making them chemically identical.

ii. Mass number is the sum of protons and neutrons in the nucleus of an atom.

iii. The electron distribution for the atom with atomic number 12 (magnesium) is 2 electrons in the first energy level and 8 electrons in the second energy level.

iv. The group II elements are alkaline earth metals, including beryllium (Be), magnesium (Mg), calcium (Ca), strontium (Sr), barium (Ba), and radium (Ra).

v. There are 18 groups and 7 periods in the periodic table.

6. i. Atomic number represents the number of protons in the nucleus of an atom, while mass number is the sum of protons and neutrons. Atomic number determines an element's identity, while mass number indicates its atomic mass.

ii. An atom is neutral when the number of protons equals the number of electrons. For example, a carbon atom with 6 protons and 6 electrons is neutral.

iii. Elements are arranged in the periodic table based on their atomic number. They are organized into periods (rows) and groups (columns) based on similar properties.

iv. Elements have different group and period numbers because of their distinct atomic properties. The group number indicates the number of valence electrons, while the period number indicates the number of electron shells.

v. Potassium (K) and sodium (Na) have different period numbers because they have different numbers of electron shells (energy levels), even though they share the same group number (Group 1) due to similar valence electron configurations

7. Think about it:

Symbol	Group	Period	Atomic Number	Mass Number
Aluminum (Al)	13	3	13	27
Boron (B)	13	2	5	11
Phosphorus (P)	15	3	15	31
Sulfur (S)	16	3	16	32

CHAPTER 05 Physical and Chemical Changes

Student Book Pages 65-74

Learning Outcomes:

- Differentiate between physical and chemical changes while considering daily life examples.
- Recognize that oxygen is needed in combustion, rusting and tarnishing.
- Explore methods of preventing rusting.
- Relate uses of materials to their chemical properties (e.g., tendency to rust, flammability).
- Evaluate Impact of combustion reaction on environment.
- Relate uses of materials to their physical properties (e.g., melting point, boiling point, solubility, thermal conductivity).
- Distinguish between physical and chemical properties of matter

Keywords

rust, reversible, non-reversible, chemical change, physical change, solubility, thermal conductivity, tendency to rust, flammability, reactant, products, combustion, burning, rusting, tarnishing, iron oxide

OVERVIEW OF THE UNIT:

- A chemical change occurs as a result of a chemical reaction, whereas a physical change occurs when matter changes forms but retains its chemical identity.
- Chemical changes include burning, cooking, rusting, and rotting.
- Physical changes include boiling, melting, freezing, and shredding.
- Many physical changes can be reversed if enough energy is supplied. A chemical change can only be reversed by another chemical reaction.
- A new compound (product) is formed as a result of a chemical change in which the atoms rearrange to form new chemical bonds. A chemical change is always accompanied by a chemical reaction. The starting materials and the finished product are chemically distinct. Here are some examples of chemical transformations:
  - Wood burning
  - Milk fermentation
  - Acid and base mixture
- A physical change does not result in the formation of any new chemical species. Changing the state of a pure substance from solid to liquid to gas is a physical change because the matter's identity does not change. A physical change is characterized by changes in physical properties but not by changes in chemical properties. Physical properties, for example, change during steel tempering, crystallization, and melting. Here are some physical examples:
  - Crumpling an aluminium foil sheet
  - An ice cube melting
  - Silver casting in a mould

Lesson Plan 1	Student Book pages	Time	Workbook pages
Physical Changes	65-66	45 Minutes	-

Objective:

- Identify the physical changes in matter.

Resources:

- egg
- bowl

- beater
- sponge
- ice on a plate
- can
- sugar
- glass of water
- pen and paper

Engage: (5 min)

- To begin, give each student a piece of paper and instruct them to change it as much as possible.
- Discuss the concept of physical change and identify the physical changes the students made to their paper after they have completely changed it.
- Students will tear, twist, fold, cut up, shred, and colour on it.

Explain: (10 mins)

- Typically, a physical change is seen when something melts, freezes, condenses, breaks, crushes, cuts, or bends.
- Powdering sugar, slicing, shredding, grating fruits and vegetables, and making gold ornaments are all examples of physical changes. All of these are physical changes because the original substance is unchanged but in a different form.
- Physical changes include all reversible and some irreversible changes. Melting butter, for example, is reversible and a physical change because there is only a state change from solid to liquid form. Glass breaking is an irreversible physical change because glass cannot be reconstituted to its original shape. Regardless, it is still glass in both forms.
- A physical change is one in which no new substances are formed and can be reversed by reversing the conditions.
- Physical Change Examples
    - Creating a salt and sugar solution
    - Salt and sugar crystal crushing
    - Crushing chalk stick
    - Iron magnetization
    - the process of boiling water to produce steam

Explore: (15 mins)

Hand-on Activity

Physical change Station

- The teacher will give the following things to the students:
  egg, bowl, beater, sponge, ice on a plate, can, sugar, glass of water, pen and paper.
- Students will work in groups.
- Each group will use given things to set up a physical change station.

- Students will tag the physical change as cutting, melting, crushing etc.

Elaborate: (10 minutes)

Useful Link

https://youtu.be/hv-hThK-vZI

Group Discussion

The teacher will explain to the students how can they identify the physical change.

Students will discuss the different physical changes that have been shown on their table.

Evaluate: (5 min)

The worksheet 1 will be given to the students by the teacher for them to complete on their own.

Home Assignment:

- List the physical properties of a matter on your notebooks.
- Complete Discuss and Answer page 66 of student book

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Chemical Changes	67-69	45 Minutes	33-34

Objective:

- Identify the Chemical changes in matter.
- Differentiate between physical and chemical changes while considering daily life examples.

Keywords

Chemical reactions
Chemical composition
Respiration
Combustion

Engage: (5 min)

Discussion/Present Interesting Facts

- Today, the Statue of Liberty is recognized for its distinctive blue-green hue. The surface of the Statue of Liberty is covered with thin copper sheets, so when it was first unveiled, it was of a shiny copper colour. It took about twenty years of exposure to weather to turn the Statue of Liberty from its shiny new penny colour to the green it is today. How this happened to the Statue of Liberty can be understood by a chemical reaction.

Useful Link

https://youtu.be/uIPULuRFrfs

- Show an image of the Statue of Liberty. Ask students what they think happened to the statue to cause its colour to change from bright copper to today's blue-green.
- Students can give different answers.
- Expected answers:
  - It has been painted.
  - It has become dirty.
  - It is because of the rust on it etc.
- Teacher then explains the students that it is because of the chemical reaction that has been taking place for many years.

Explain: (10 mins)

The following are some of the characteristics of a chemical change:

- One or more new substances are formed as a result of a chemical change. When we burn a piece of paper with a lit match stick, we produce entirely new substances such as carbon

dioxide, water vapour, smoke, and ash.

- A chemical change is usually irreversible: For example, burning paper is a permanent and irreversible change. This is due to the fact that we cannot recombine the byproducts of paper burning to produce the original paper.
- During a chemical change, a large amount of energy (in the form of heat, light, and sound) is either absorbed or released: A chemical change occurs when a cracker is burned. When a cracker explodes, it emits heat, light, and sound energy.
- A chemical change may result in a smell change or the release of a new smell: When food spoils, it emits an unpleasant odour. This indicates that new substances have formed in spoiled food, which has a foul odour.
- A chemical change could cause a permanent colour change: Fruit ripening is a chemical transformation. As raw fruit ripens, its colour changes.
- A chemical reaction can result in the formation of a gas. For example, when a metal, like zinc, reacts with diluted hydrochloric acid, zinc chloride salt and hydrogen gas are produced.
- Some of the examples of chemical changes are:
    - Plants combine carbon dioxide and water in the presence of chlorophyll and sunlight to form two new substances, glucose and oxygen gas, during photosynthesis. Thus, photosynthesis is a chemical change.
    - During digestion, various food materials break down to form new substances that can be absorbed by the body. Thus, digestion is a chemical change

Explore: (10 min)

Stem Activity:

Experiment:

Teacher will demonstrate the experiment.

Teacher will provide:

- Paper Towels
- Small (non-metal) Bowls
- A Few Old Pennies
- White Vinegar
- Iodized Salt

Students will perform the experiment.

Students will:

- Tear a paper towel and line the bottoms of the bowls with it.
- Put a penny in each small bowl.
- Pour the vinegar and salt into a small non-metal mixing bowl and stir to combine.
- Pour only vinegar into the second small bowl.

Explanation:

When dirty pennies are dipped in vinegar and salt, the copper oxide and some of the copper on the penny dissolve in the water and are washed away. When the penny is rinsed and wiped clean,

it appears to be brand new. When a penny is soaked in only vinegar, the oxidation process is accelerated, and the penny becomes greener after a few hours.

Elaborate: (10 min)

Make a Chart.

- Assign students the task of creating a chart with examples of chemical changes.
- Students will design charts to depict examples of chemical changes.
- Ask students to describe what happens during the change and why it is an example of a chemical change.
- Ask students to attempt Concept Check page 68.

Evaluate: (5 min)

- Give worksheet 2 to the students.
- Ask students to attempt Q2-3 on page 73 of student book.

Home Assignment:

- Make a poster showing the difference between physical and chemical changes in matter. Use daily life examples to explain the difference.
- Attempt Q5 and 8 on page 33-34 of workbook.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Impact of Burning on the Environment	69	45 Minutes	35

Objective:

- Evaluate Impact of combustion reaction on environments.

Keywords

Impact
Burning
Greenhouse gases

Resources:

- Candles (one per group).
- Glass jars (one per group).
- Aluminum foil .
- Lighters or matches.

Useful Link

https://youtu.be/gBLQUplzZZo

Engage: (5 min)

Begin with images depicting different types of burning, such as wildfires, industrial smokestacks, or controlled burns.

- Open-ended questions such as, "What do you see in the images?"
- Why do you believe people burn things in this manner?
- Have you ever considered the environmental impact of these activities?

Explain: (10 mins)

- Explain briefly the various types of burning (wildfires, combustion engines, waste incineration, etc.).
- Discuss the air's constituents (oxygen, nitrogen, and carbon dioxide) and how burning alters their composition.
- Explain what greenhouse gases are and how they contribute to climate change.

Explore: (15 min)

- Break the class up into small groups.
- Each group should be given a simple candle, a glass jar, and a piece of aluminium foil.
- Instruct students to complete the following tasks:
  - Place the candle inside the glass jar and light it.
  - Wrap aluminium foil around the jar's opening.
  - Keep an eye on what happens to the flame.
  - Discuss their findings and hypotheses about why this happened.

Elaborate: (10 min)

- Explain the greenhouse effect and its relationship to the use of fossil fuels.
- Provide the following materials for a simple classroom demonstration:
  - A transparent plastic container (to represent the atmosphere)
  - A heat lamp (which represents the sun)
  - A temperature gauge
  - A container of water
  - A black paper surface (to represent the surface of the Earth)
- Set up the demonstration, shine the heat lamp on the container with the black paper surface inside, and watch the temperature rise.
- Discuss how this model depicts the greenhouse effect and its relationship to the use of fossil fuels.

Evaluate: (5 min)

- Attempt Q11 on page 35 of workbook.

Home Assignment:

- Assign each student or group a specific aspect of the environmental impact of burning (e.g., wildfires, air pollution, deforestation).
- Instruct them to conduct research on the topic assigned to them and to prepare a brief report or presentation.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Rusting and Tarnishing of Metals	70	45 Minutes	-

Objective:

- Recognize that oxygen is needed in combustion, rusting and tarnishing.
- Explore methods of preventing rusting.

Keywords

Rust
Tarnish
Exposed

Resources:

- Images or video clips of rusty or tarnished metal objects.
- Iron nails.
- Small plastic cups.
- Water.
- Salt.

Useful Link

https://youtu.be/T4pSuflO9fk

- Magnets (optional).
- Copper coins.
- Vinegar.
- Toothbrushes.
- Metal samples.
- Paint or zinc coating materials.

Engage:(5 min)

- Begin by displaying a series of images of rusted or tarnished metal objects.
- Inquire open-ended questions such as,
    - What do you notice about these metal objects?
    - What causes metals to rust or tarnish, in your opinion?
    - What effect might rust or tarnish have on the performance of these objects?

Explain: (10 mins)

- Explain how rusting (iron) and tarnishing (other metals) work.
- Discuss the chemical reactions that occur during the rusting and tarnishing processes.
- Explain the concepts of "oxidation" and "corrosion."
- Mention environmental factors such as moisture and oxygen that speed up these processes.

Explore: (15 min)

- Provide the following materials to each group:
    - Iron nails (several per group)
    - Small plastic cups
    - Water
    - Salt
    - Magnets (optional)
- Instruct students to complete the following tasks:
    - Separate the iron nails into separate cups.
    - Fill one cup with water, another with saltwater, and leave one nail alone (control group).
    - Observe and document changes in the nails over several days.
    - Discuss their findings and compare the various conditions.

Elaborate: (10 min)

- Discuss metal rusting and tarnishing prevention methods (e.g., painting, galvanization).
- Students should create an experiment to test the effectiveness of one preventive measure.
- Materials based on their experiment design, such as metal samples, paint, or zinc coatings, should be provided.
- Students should carry out their experiments and report their findings to the class.

Evaluate: (5 min)

- Give students a collection of metal objects, some with rust or tarnish and some without.
- Students should be able to identify and sort the objects as "affected by rust/tarnish" or "not affected by rust/tarnish."
- Allow them to explain their reasoning behind each classification.

- As a class, discuss their classifications and explanations.

Home Assignment:

- Assign a specific real-world scenario or object where rusting or tarnishing is a concern (e.g., a historic bridge, a marine vessel, a piece of artwork) to each student or group.
- Students should conduct research on the following topics:
  - The object's or structure's history and significance.
  - The materials used in its creation or construction.
  - The difficulties presented by rusting or tarnishing in that context.
  - The techniques used to prevent or reduce rusting or tarnishing.
  - Students should prepare a detailed report.

Lesson Plan 5	**Student Book pages**	**Time**	**Workbook pages**
Difference Between Chemical and Physical Properties of Matter	89-90	45 Minutes	33

Objective:

- Distinguish between physical and chemical properties of matter.
- Relate uses of materials to their chemical properties (e.g., tendency to rust, flammability). .
- Relate uses of materials to their physical properties (e.g., melting point, boiling point, solubility, thermal conductivity).

Useful Link

https://youtu.be/8uAca9uKvPk

Resources:

- Various materials for physical properties observation (e.g., metals, plastics, liquids).
- Materials for simple chemical reactions (e.g., vinegar, baking soda).
- Cards with material names and cards with properties (for the evaluation activity).

Engage: (5 min)

- Begin by showing images:
- One demonstrating a physical change (e.g., ice melting into water).
- One showing a chemical change (e.g., a piece of paper burning).
- Ask students to describe what they observe in each image.
- Pose questions like:
  - What is happening in these images?
  - Are these changes reversible or irreversible?
  - How can we categorize these changes?

Explain: (10 mins)

- Define physical properties (such as colour, shape, and density) as well as chemical properties (such as flammability and reactivity).
- Discuss how physical properties can be observed without changing the chemical composition of

a substance, whereas chemical properties require changes in composition.

- Explain how the properties of materials determine their uses.

Explore: (15 min)

Activity 1: Identifying Physical Properties

- Provide a wide range of materials, such as various metals, plastics, and liquids.
- Students should be instructed to observe and record the physical properties of each material (for example, colour, texture, and flexibility).
- Allow them to debate and classify the materials based on their physical properties.

Activity 2: Identifying Chemical Properties

- Give materials for basic chemical reactions, such as vinegar and baking soda.
- Instruct students to mix the provided substances and observe any chemical changes (for example, gas production and fizzing).
- Discuss what they saw and classify the reactions as chemical changes.

Elaborate: (10 min)

- Present students with a variety of real-world scenarios (for example, designing a spacecraft, selecting building materials, or selecting a fuel source for a vehicle).
- Students should work in groups to discuss and justify their material selections based on the physical and chemical properties required for the scenario.
- Encourage critical thinking and discussion about material trade-offs.

Evaluate: (5 min)

- On separate cards, provide a list of materials and a set of properties (both physical and chemical).
- Students should be instructed to match each material with the properties that best describe it.
- As a class, go over the matches and clear up any misconceptions.

Home Assignment:

- Assign a specific material commonly used in daily life to each student or group (e.g., aluminium foil, plastic water bottles, wooden furniture).
- Instruct them to research and list the physical and chemical properties of the material.
- Complete Q4 on page 34 of workbook.


USE
ME

Worksheet 1:

Circle the phrases that explain the phenomenon of physical change:

Bicycle metal rusting	Ice melts whites	Whipped egg
Soured milk	Salt dissolved in water	Erosion
Sugar dissolved in water	cake baking	breaking glass

Describe how the objects has changed in any three of the above examples.

1.

2.

3.

Worksheet 2:

Identify and write the name and definition of the following examples of chemical changes:

Chemical Reaction:
Definition:

Glucose + Oxygen ⟶ Carbon Dioxide + Water + Energy

Chemical Reaction:
Definition:

Combustible Reaction(Wood) ⟶ + Oxygen Carbon Dioxide + Water

Chemical Reaction:
Definition:

Methane + Oxygen ⟶ Carbon Dioxide + Water

Answers for Worksheet 1:

Circle the phrases that explain the phenomenon of physical change:

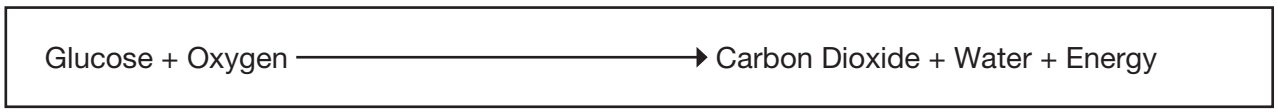
Bicycle metal rusting	Ice melts	Whipped egg whites
Soured milk	Salt dissolved in water	Erosion
Sugar dissolved in water	cake baking	breaking glass

Describe how the objects has changed in any three of the above examples.

1. Salt dissolved in water and become a solution.
2. Glass breaks into smaller pieces.
3. Ice melts and becomes liquid.

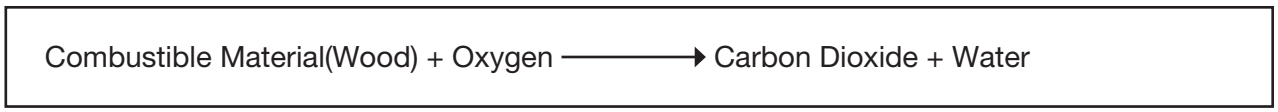
Answers for Worksheet 2:

Identify and write the name and definition of the following examples of chemical changes:



Chemical Reaction: Respiration

Definition: When we breathe the inhaled oxygen reacts with glucose to release energy.



Chemical Reaction: Combustion

Definition: When oxygen combines with a combustible material to form carbon dioxide and water and energy.

Chemical Reaction: Burning Fuels

Definition: Fuels burn to form carbon dioxide and water, and energy.

Exercise Answers

1. Choose the correct answer:

i. **d)** rusting

ii. a) changing size

iii. b) baking bread dough

iv. d) exploding a firework

v. d) wax

2. Fill in the Blanks:

i. When a fuel burns it releases heat energy.

ii. Rusting of steel is an example of chemical change.

iii. Fuel reacts with oxygen gas when it burns.

iv. In a chemical change, atoms are combined to form molecules.

v. When carbon burns, carbon dioxide gas is produced.

3. **i.** One change that happens during a chemical change in baking a cake is the transformation of raw ingredients into a completely different substance with different properties, such as the conversion of cake batter into a solid, fluffy cake with a different taste and texture.

ii. **a)** Word equation for the breakdown of sodium hydrogen carbonate:

Sodium hydrogen carbonate (baking powder) → Sodium carbonate + Carbon dioxide + Water

b) Baking powder is added to the cake mixture to help the cake rise and become fluffy. The carbon dioxide gas produced during the breakdown of sodium hydrogen carbonate creates bubbles in the cake mixture, making the cake light and airy.

c) To test for carbon dioxide gas, one can use the effervescence (bubbling) test. Collect the gas released during the reaction (e.g., by placing a container over the mixture), and then bubble the gas through limewater (calcium hydroxide solution). If the limewater turns cloudy or milky, it indicates the presence of carbon dioxide.

4. **i.** The only state of matter that can be easily compressed is gas.

ii. When particles are heated, they move faster.

iii. The two states of matter that flow easily are liquid and gas.

iv. Two examples of a chemical change are burning wood and digesting food.

v. A hydrocarbon is a compound made up of hydrogen and carbon atoms.

vi. The word "fuel" refers to a substance that can be burned or otherwise used to produce energy. Two examples of fuels are gasoline and natural gas.

5. Long Answer Questions:

i. Difference Between Physical and Chemical Change:

Physical Change: Physical changes are changes in which the substance's identity remains the same even though its physical appearance or state may change. No new substances are formed during a physical change. Examples include melting ice (from solid to liquid) and evaporating water (from liquid to gas).

Chemical Change: Chemical changes are changes in which the substances involved are transformed into new substances with different properties. Chemical bonds are broken

and new bonds are formed. Examples include burning wood (producing ash and smoke), digesting food (breaking down complex molecules into simpler ones), and rusting iron (forming iron oxide).

ii. Equations for Combustion, Rusting, and Ammonia Formation:

Combustion: Combustion is the reaction of a substance with oxygen to produce heat and light. The general equation for the combustion of a hydrocarbon (like methane, CH_4) is:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Rusting: Rusting is the corrosion of iron in the presence of oxygen and moisture. The equation for rusting can be simplified as:

$4Fe + 3O_2 + 6H_2O \rightarrow 4Fe(OH)_3$ (iron(III) hydroxide, rust)

Ammonia Formation: The formation of ammonia (NH_3) can be represented by the equation:

$N_2 + 3H_2 \rightarrow 2NH_3$

Reversible Reactions: Reversible reactions are chemical reactions that can proceed in both the forward and reverse directions. In other words, the products of a reversible reaction can react together to form the original reactants.

Examples include the dissociation of water into hydrogen and oxygen ($2H_2O \leftrightarrow 2H_2 + O_2$) and the equilibrium reaction between carbon dioxide and water to form carbonic acid ($CO_2 + H_2O \leftrightarrow H_2CO_3$).

iv. Changes Observed During a Chemical Reaction:

- Change in color
- Formation of a precipitate (solid)
- Evolution of gas (bubbles)
- Change in temperature (heat is absorbed or released)
- Change in odor
- Formation of a new substance with different properties

6. Think About It:

a) Compounds that contain carbon and hydrogen are called hydrocarbons.

b) The gas produced when carbon burns in a good supply of oxygen is carbon dioxide (CO2).

c) Word equation for the burning of hydrogen in oxygen:

$2H_2 + O_2 \rightarrow 2H_2O$

d) The reactants of the above reaction are hydrogen (H_2) and oxygen (O_2).

e) The products of the above reaction are water vapor (H_2O). a) Methane (CH_4) contains the elements carbon (C) and hydrogen (H). Octane (C_8H_{18}) also contains carbon and hydrogen.

a) Methane (CH_4) contains the elements carbon (C) and hydrogen (H). Octane (C_8H_{18}) also contains carbon and hydrogen.

b) When methane is burnt, the two compounds formed are carbon dioxide (CO_2) and water vapor (H_2O).

c) The formulae for the two products formed when methane is burnt are CO_2 and H_2O.

d) Word equation for the burning of methane:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

CHAPTER 06

Chemical Bonds

Student Book Pages 75-83

Learning Outcomes:

- Define valency and explain the formation of ions.
- Write chemical formulae on the basis of valency of the constituent elements. such as H_2O NaCl, NH_3, CO, CO_2, etc.
- Recognize that a chemical bond results from the attraction between atoms in a compound and that the atoms' electrons are involved in this bonding.

Keywords

chemical bonds, ionic bonds, covalent bonds, electrostatic forces, single covalent bond, double covalent bond, triple covalent bond, mutual sharing

OVERVIEW OF THE UNIT:

- The valency of an atom is its ability to combine. The valency of an element expresses the number of bonds that an atom can form as part of a compound.
- The number of protons in most atoms equals the number of electrons. This means that an atom normally has no charge.
- When an atom gains electrons (anions), it becomes negatively charged, and when it loses electrons(cations), it becomes positively charged.
- The term "ion" refers to a charged atom, regardless of the sign of the charge.
- A chemical formula is a scientific notation that uses atomic symbols and numerical subscripts to show the number and type of atoms present in a molecule.e.g. H_2O, CH_4 etc.
- Chemical bonding is the joining of atoms, molecules, or ions to form more complex and stable compounds with changed physical and chemical properties.
- Depending on the type of bonded atoms, there are various types of chemical bonding, each with its own unique bonding mechanism:
  - o Covalent Bond: It happens when nonmetallic atoms with similar (usually high) electronegativities combine to share electrons from their last orbit and form a stable chemical compound.
  - o Ionic bonding: It is formed by the union of metallic and non-metallic atoms via electron transfer from the metal to the non-metal. Thus, electrically charged ions, cations (+) and anions (-), are formed, which are electrostatically attracted to each other, forming the bond.

Lesson Plan 1	Student Book pages	Time	Workbook pages
Valency and Formation of Ions	75-77	45 Minutes	38

Objective:

- Define valency and explain the formation of ions.

Useful Link

https://youtu.be/2ugSvI-F__I

Resources:

- a blank diagram with only the nucleus and some empty shells
- colourful buttons.
- White board and board marker

Engage: (5 min)

Analogy/Discussion

- Think of a group of individuals with various hand patterns. Some people don't have any hands, whereas others have one, two, or three. Nobody has more than four, and no one has more than

four. A person with four hands can hold the hands of four others at the same time, whereas a person with no hands can never hold any hand. Similarly, some atoms can only hold one electron, while others can hold two, three, four, or none. This property is known as valency.

- Ask students to try to tell the valency of some elements.
- Students will tell the valency of the element asked by the teacher.

Explain: (10 mins)

- The number of atoms of one element combined with one atom of another element to form a molecule is referred to as its valency.
- Valency is a measure of an atom's combining power. The number of electrons in an element's outermost shell determines its valency.
- An ion is a charged atom (positive or negative). An element must gain or lose an electron to form an ion.
- An ion is formed when electrons are gained or lost. When an atom gains an electron, it has more electrons than protons, resulting in a negatively charged element atom.
- When an atom loses an electron, it becomes positively charged because it now has more electrons than protons.

Explore: (15 min)

Useful Link

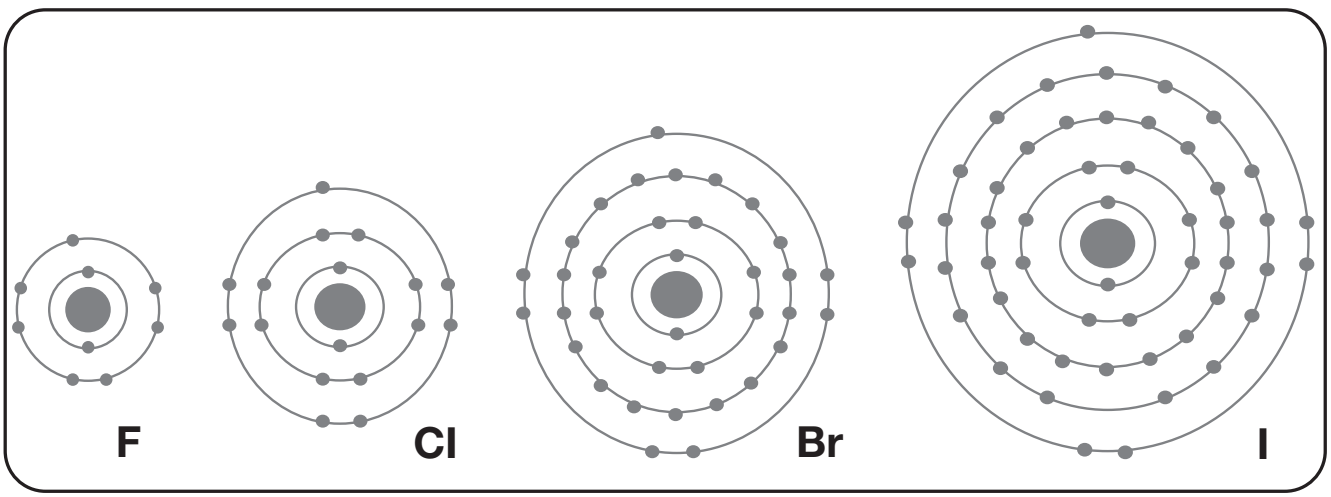
https://youtu.be/K9rZQJuOgDk

Stem Activity

- Give students a blank diagram with only the nucleus and some empty shells and colourful buttons.
- Tell them to arrange the buttons to show electrons in different shells of an atom
- Students can begin by simply placing the appropriate number of buttons in each shell to represent a specific element.
- They can use different coloured buttons to represent those in the K, L, M, N

Elaborate: (5 min)

Draw the following atomic structures on the board one at a time, then select a student at random to circle only the valence electrons for each element.



Evaluate: (5 min)

Ask students to complete Discuss and Answer on page 77 of student book.

Home Assignment:

Draw the atomic structure of the following elements and write the number of valence electrons for each element.

- Potassium
- Sulfur
- Silicon
- Boron

Complete Q2 on page 38 of workbook.

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Chemical Formulae	78-79	45 Minutes	-

Objective:

- Write chemical formulae on the basis of valency of the constituent elements. such as HO NaCl, NH_3, CO, CO, etc

Useful Link

https://youtu.be/GJ4Mds0CWLE

Resources:

- Whiteboard and markers or chalkboard and chalk
- Projector and screen
- Periodic table
- Modeling kits or balls and sticks for atoms and molecules (optional)
- Worksheets with blank chemical formulas
- Pencils and erasers

Engage: (5 min)

Begin by displaying models of common compounds such as H_2O (water), NaCl (table salt), NH_3 (ammonia), CO_2 (carbon dioxide), and CO (carbon monoxide). Inquire about the similarities and differences between these substances. Hold a brief discussion about the significance of chemical formulas and their necessity.

Explain: (10 min)

- Introduce the concept of valency, defining it as the number of electrons that an atom can lose, gain, or share to achieve a stable electron configuration.
- Discuss how atoms combine to form compounds by transferring or sharing electrons in order to achieve a stable state. The periodic table can be used to show the valency of common elements.
- Explain how chemical formulas represent the atom-to-atom ratio of a compound and how the valency of each element determines this ratio.

Explore: (15 min)

- Give students blank worksheets with the chemical symbols of elements (H, O, N, C, Na, Cl, and so on) and their valency.
- Use the valency information provided to have students work individually or in groups to write the chemical formulas for common compounds such as H_2O, NaCl, NH_3, CO_2, and CO.
- Walk around the classroom to assist students and clear up any confusion.

Elaborate: (10 min)

- Display the correct chemical formulas (H_2O, NaCl, NH_3, CO_2, CO) on the board and explain them step by step.
- Discuss how subscripts are used to represent the number of atoms in a compound.
- Ask students to complete Concept Check on page 82 of student book.

Evaluate: (5 min)

Ask students to complete Q3 on page 82 of student book.

Home assignment:

- Research and write down the chemical formulas for three common household compounds. Also list the valency of each compound's constituent elements.
- Example compounds are:
- Table sugar (sucrose)
- Baking soda (sodium bicarbonate)
- Vinegar (acetic acid)
- Complete Q1 on page 38 of workbook.

Lesson Plan 3	Student Book pages	Time	Workbook pages
Chemical Bond	80	45 Minutes	41

Objective:

- Recognize that a chemical bond results from the attraction between atoms in a compound and that the atoms' electrons are involved in this bonding.

Resources:

- pictures of covalent bond and ionic bond
- index cards with the name and chemical formula of compounds
- periodic table of elements
- gumdrops
- glue
- marker
- poster board

Keywords

Chemical bonds
Ionic bonds
Covalent bonds

Useful Link

https://youtu.be/OTgpN62ou24

Engage: (5 min)

Warm-up activity:

Think-Pair-Share

Paste the pictures of

1. Covalent Bond
2. Ionic Bond

- Ask students to discuss the pictures in pairs.
- Students will discuss and make notes of their discussion.
- Ask students what they have observed about these pictures and then relate their observation with your explanation of the topic.
- Students will share what they already know or what they guess from the pictures.

Explain: (10 min)

- Chemical bonding is the formation of a chemical bond between two or more atoms, molecules, or ions that results in the formation of a chemical compound. These chemical bonds are what hold the atoms in the resulting compound together.
- Chemical bonding is the attractive force that holds various components (atoms, ions, etc.) together and stabilizes them through the overall loss of energy. As a result, chemical compounds are dependent on the strength of the chemical bonds between their components; the stronger the bonding between the components, the more stable the resulting compound.
- Chemical bonds known as ionic bonds involve the exchange of electrons between two atoms or molecules. In this case, an atom loses an electron, which is then gained by another atom. When such an electron transfer occurs, one of the atoms acquires a negative charge and is termed the anion.
- A covalent bond signifies electron sharing between atoms. This type of chemical bonding is common in carbon compounds (also known as organic compounds). The electrons shared by the two atoms now extend around the nuclei of the atoms, resulting in the formation of a molecule.

Explore: (15 min)

Stem Activity:

Models using Gumdrops

- Create index cards with the name and chemical formula of compounds formed by covalent and ionic bonds prior to the activity.
- Display the periodic table of elements to students. Discuss how periodic table elements can be combined using covalent or ionic bonds.
- Distribute gumdrops, glue, markers, poster board, and the two index cards you made to each pair of students (one covalent, one ionic).
- Students will draw diagrams of covalent and ionic bonds that show how electrons in a covalent bond are shared versus transferred in an ionic bond.
- Students will write the chemical symbol for each element and position its outer shell electrons, represented by gumdrops, to show how it is bonded to the other elements in the compound for each compound.
- When students complete their models, they will share them with the class.

Elaborate: (5min

- Divide the class into two groups. One group will represent and explain ionic bonds and the other will represent covalent bonds.
- Ask students to complete Concept Check on page 80 of student book.

Evaluate: (5 min)

Complete Q5 on page 83 of student book.

Home Assignment:

Complete Q9-10 on page 41 of workbook.

Worksheet 1:

Complete the following sentences with the correct word

1. Elements of the same group have the same/different number of valence electrons.
2. Elements in group 0 have 0/2 in the valence shell.
3. Elements like Argon and Neon in group zero have 6/8 valence electrons.
4. Elements of group 1/2 have 2 elecrtons in their valence shells.
5. The group 0 is known as zero group as the elements of group zero have

stable/Unstable valence shells.

Draw the atomic structure of the following elements. Also write the number of valence electrons of each element.

1. **Sulphur**

Number of Electrons:

2. **Boro**

Number of Electrons:

3. Argon

Number of Electrons:

Worksheet 2:

Fill in the table below:

Compound	Element 1		Element 2		Bond Type
	Metal	Non-Metal	Metal	Non-Metal	
$CuCl_2$					
Cao					
NO_2					
Fe_2O_3					
H_2O					
NO_2					
$MgBr_2$					
SO_2					

Answers for Worksheet 1:

Complete the following sentences:

1. Elements of the same group have the same/different number of valence electrons.
2. Elements in group zero have 0/2 in the valence shell.
3. Elements like Argon and Neon in group zero have 6/8 valence electrons.
4. Elements of group 1/2 have 2 electrons in their valence shells.
5. Group 0 is known as the zero group as the elements of group zero have

stable/Unstable valence shells.

Draw the atomic structure of the following elements. Also write the number of valence electrons and valency of each element.

Sulphur insert image from folder

Number of Valence Electrons: 6
Valency: 2,4,6

Boron insert image from folder

Number of Valence Electrons: 3
Valency: 3

Argon insert image from folder

Number of Valence Electrons: 8
Valency: 0

Answers for Worksheet 2:

Fill in the table below:

Compound	Element 1		Element 2		Bond Type
	Metal	**Non-Metal**	**Metal**	**Non-Metal**	
$CuCl_2$	Copper Metal		Chlorine Non-metal		Ionic
CaO	Calcium Metal		Oxygen Non-metal		Ionic
NO_2	Nitrogen Non-metal		Oxygen Non-metal		Covalent
Fe_2O_3	Iron Metal		Oxygen Non-metal		Ionic
H_2O	Hydrogen Non-metal		Oxygen Non-metal		Covalent
NO_2	Nitrogen Non-metal		Oxygen Non-metal		Covalent
$MgBr_2$	Magnesium Metal		Boron Non-metal		Ionic
SO_2	Sulpher Non-metal		Oxygen Non-metal		Covalent

Exercise Answers

1. Choose the correct answer:

i. **b)** Compound

ii. **b)** it changes into negative ion

iii. **b)** a covalent bond is formed

iv. **b)** CO

v. **c)** 8

2. Fill in the Blanks:

i. The ionic bond has the attraction between cation and anion.

ii. A chlorine atom has 7 electrons in its outermost shell.

iii. The group number in the periodic table is the number of valence electrons of the elements.

iv. Hydrogen atom is reactive because it has an incomplete shell.

v. The formula of ammonia is NH_3.

3. Formulas of Compounds:

a) Carbon dioxide: CO_2

b) Ammonia: NH_3

c) Sodium chloride: NaCl

d) Water: H_2O

4. Short Answer Questions:

i. Valency is the measure of an element's ability to combine with other elements and form chemical compounds. It is determined by the number of valence electrons an element has.

ii. The valence shell is the outermost electron shell of an atom. It contains the valence electrons, which are involved in chemical bonding.

iii. An ion is an atom or molecule that has gained or lost one or more electrons, resulting in an electrically charged particle.

iv. A cation is a positively charged ion that forms when an atom loses one or more electrons.

v. An anion is a negatively charged ion that forms when an atom gains one or more electrons.

vi. Neutral atoms are atoms that have an equal number of protons and electrons, resulting in no net electrical charge.

5. Long Answer Questions:

i. Bonds are formed through the interaction of electrons in the outermost energy shells (valence shells) of atoms. Atoms can form bonds by sharing, gaining, or losing electrons. Bonds allow atoms to achieve stable electron configurations, such as the noble gas configuration.

ii. Ionic bonds are formed between atoms when one atom (usually a metal) transfers electrons to another atom (usually a non-metal). This transfer of electrons creates ions with opposite charges (cation and anion) that are attracted to each other due to electrostatic forces. For example, in the formation of sodium chloride (NaCl), sodium (Na) donates an electron to chlorine (Cl), resulting in the formation of Na+ and Cl- ions, which are held together by electrostatic attraction.

iii. Covalent bonds are formed when two atoms (usually non-metals) share electrons to achieve a stable electron configuration. In a covalent bond, electrons are shared between the atoms, creating a molecule. For example, in the formation of a water molecule (H2O), two hydrogen (H) atoms and one oxygen (O) atom share electrons to form covalent bonds. Each hydrogen atom shares one electron with the oxygen atom, resulting in a stable molecule.

CHAPTER 07 Solutions

Student Book Pages 84-92

Objectives:

- Demonstrate the process of solution formation (using water as universal solvent).
- Distinguish among solute, solvent and solution; saturated and unsaturated solution.
- Define solubility.
- Recognize that the amount of solute which dissolves in a given solvent has an upper limit.
- Identify the factors which affect the solubility of a solute in a solvent and recognize the importance of these factors in homes and industries.
- Explain what is meant by a concentrated and dilute solution.
- Identify ways of accelerating the process of dissolving materials in a given amount of water and provide reasoning (i.e., increasing the temperature, stirring, and breaking the solid into smaller pieces increases the process of dissolving).
- Explore the effectiveness of various cleaning solutions in cleaning tarnished and oxidized coins. (STEAM)
- Make a rock candy with sugar using crystal seeding technique. (STEAM)

OVERVIEW OF THE UNIT:

- A solution is a uniform mixture of one or more components.
- A solution is made up of two parts: a solvent and a solute.
- The solvent is the component that dissolves the other component. In general, the solvent is present in greater abundance than the solute.
- Solute refers to the components that are dissolved in the solvent.
- A liquid solution is made up of a solid, liquid, or gas that has been dissolved in a liquid solvent.
- The examples below show the solvent and solute in some solutions.
- Air is a gaseous mixture that is homogeneous. Both the solvent and the solute are gases in this case.
- Sugar syrup is a solution made by dissolving sugar in water.
- Water serves as the solvent, and sugar serves as the solute.
- Iodine tincture is an iodine-in-alcohol solution. The solute is iodine, and the solvent is alcohol

Keywords

solute, solvent, solution, solubility, concentrated, saturated, dilute, dissolving, soluble, insoluble, rate, surface area, stirring

Lesson Plan 1	Student Book pages	Time	Workbook pages
Solutions	84-86	45 Minutes	45

Objective:

- Demonstrate the process of solution formation (using water as universal solvent).
- Distinguish among solute, solvent and solution; saturated and unsaturated solution.
- Recognize that the amount of solute which dissolves in a given solvent has an upper limit.

Keywords

Solution
Homogenous
Solute
Solvent

Resources:

- Salt (solute)
- Water (solvent)

Useful Link

https://youtu.be/eTe0a61IohE

- Clear cups or beakers
- Stirring rods or spoons
- Food coloring (optional)
- Sugar (optional)
- Graduated cylinders
- Whiteboard and markers or chalkboard and chalk
- Interactive simulations or videos demonstrating solution formation (optional)

Engage: (5 min)

- Begin by displaying a clear glass of water and a glass with visible salt at the bottom.
- Inquire with students about what they notice about the two glasses and whether they can explain any differences.
- To generate interest in how substances dissolve in water, lead a class discussion.

Explain: (10 min)

- Introduce important terms such as solute, solvent, solution, saturated solution, and unsaturated solution.
- To demonstrate the concepts and their relationships, use diagrams or visuals.
- A solute is a substance that dissolves in a solvent to form a solution. Water is known as the universal solvent because it can dissolve a wide range of substances.
- Discuss the concept that the amount of solute that can dissolve in a solvent is not infinite and that solubility has a limit.

Explore: (15 min)

- Students should be divided into pairs or small groups.
- Give each group a clear cup or beaker, a stirring rod or spoon, and a pinch of salt.
- Students should be instructed to add salt to the water while stirring until no more salt can dissolve (saturated solution).
- Encourage them to keep a table of their findings, noting the amount of salt added and whether it dissolved or remained at the bottom.
- Another group can optionally create an unsaturated solution by adding less salt and stirring.

Elaborate: (10 min)

- Allow groups to present their findings to the class and discuss the differences between saturated and unsaturated solutions.
- Make a live demonstration by pouring a large amount of salt into a graduated cylinder filled with water. Demonstrate that the excess salt settles at the bottom, emphasising the fact that solubility has limits.
- You can also talk about how temperature affects solubility (hot water dissolves more solute than cold water).

Evaluate: (5 min)

Complete Discuss and Answer on page 86 of student book.

Home Assignment:

Perform a solubility experiment at home with various substances (e.g., salt, sugar, baking soda) and water. Keep track of your findings and decide which substances dissolve completely, partially, or not

at all. Additionally, investigate how temperature affects solubility by testing a substance's solubility in hot and cold water.

Complete Q6 on page 45 of workbook.

Lesson Plan 2	Student Book pages	Time	Workbook pages
Solubility	86	45 Minutes	-

Objective:

- Define solubility.
- Identify ways of accelerating the process of dissolving materials in a given amount of water and provide reasoning (i.e., increasing the temperature, stirring, and breaking the solid into smaller pieces increases the process of dissolving).

Useful Link

https://youtu.be/fc2zyrVR4kA

Engage: (5 min)

Hand-On Activity

- Make a glass of squash with squash and sugar.
- Students will get excited to see that why the teacher is making juice today in the lesson.
- This will help gain the interest of students in the lecture.
- Explain to the students that

  when you make a sugary drink from a squash, you dissolve two substances (the squash and sugar) into a uniform solution.
- Solubility refers to a chemical substance's (or solute's) ability to dissolve in a solvent (usually a liquid) and form a homogeneous solution.

Explain: (10 min)

- Solubility is the maximum amount of solute that can dissolve in a defined quantity of solvent at a given temperature.
- A solute is any substance that can be solid, liquid, or gas when dissolved in a solvent.
- A solution is a liquid that is a homogeneous mixture of one or more solutes in a solvent.
- A common example of a solution is adding sugar cubes to a cup of tea or coffee.
- Solubility is the property that allows sugar molecules to dissolve. As a result, solubility can be defined as a substance's (solute's) ability to dissolve in a given solvent.

Explore: (15 min)

Scientific Inquiry

- Students will predict and test the solubility of several similar-looking materials in this activity. This activity will help students think critically about common substances and how they will (or will not) dissolve.
- The teacher will provide the following materials.
- A variety of common white powders and crystals (e.g. sugar, flour, cornstarch, several varieties of salt, baking soda)
- Plates made of paper
- Stirring rods
- Water

- Students will do all their work on paper plates.
- First, students will draw a circle and label each substance. Then, based on their predictions, they will write 'soluble' or 'insoluble' in or near each circle with a pen or marker.
- They will then place a small amount of each substance in the circle, add a few drops of water, and stir to see if the mixture dissolves. They can add more water as needed if they are unsure. If their predictions were incorrect, instruct them to correct their errors on the paper plate with a different colour pen or marker.

Elaborate: (5 min)

Class Discussion:

Comparison of Predictions and Findings.

- Ask the students to make notes of the differences between their predictions and the results of the experiment.
- Students will make notes of their findings.
- The teacher will discuss the results of the experiment with the students.
- Students will share their results with the class.

Evaluate: (5 min)

Worksheet 7.1 will be given to the students.

Home Assignment:

List ten compounds that are soluble in water.

Lesson Plan 3 Concentrated and Dilute Solutions	**Student Book pages**	**Time** 45 Minutes	**Workbook pages** -

Objective:

- Explain what is meant by a concentrated and dilute solution.

Resources:

- two glasses of water
- blue ink
- Three test tubes
- a test tube holder
- a measuring flask
- a spoon
- copper sulphate

Useful Link

https://youtu.be/V6-mlh9xRjg

Engage:(5 min)

Warm-up Activity:

- Show students two glasses of water, one with a few drops of blue ink and the other with more.
- The students will observe the two glasses.
- Ask students: What is the difference between these two solutions?
- Expected Answer:
- One is light blue and another is dark blue

- Explain the reason for this colour difference by introducing the concept of Dilute and concentrated solutions.

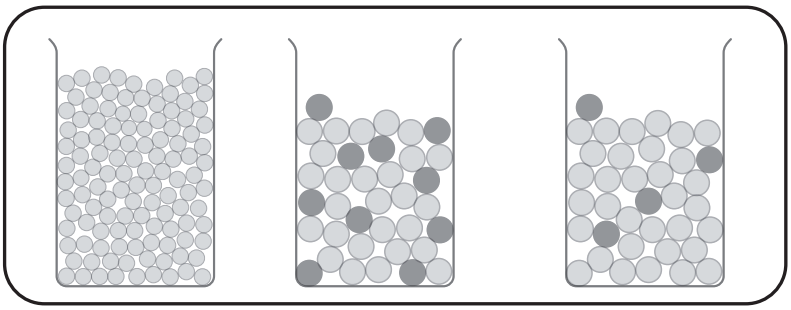
Explain: (10 min)

- A concentrated solution is a liquid with a high solute concentration. A dilute solution of dissolved salt from a well in drinking water. By looking at a colourless watery solution, it is impossible to tell whether it is dilute or concentrated. However, when looking at coloured solutions of different concentration levels, we can tell which one is dilute and which one is concentrated. We can differentiate between concentrated and diluted coloured solutions as:
- Diluted solution: A dilute solution is formed when a small amount of solute is dissolved in a relatively large amount of solvent.
- Concentrated solution: A concentrated solution is one in which the amount of solute dissolved is relatively large in comparison to the amount of solvent.

Explore: (10 min)

STEM Activity:

Experiment



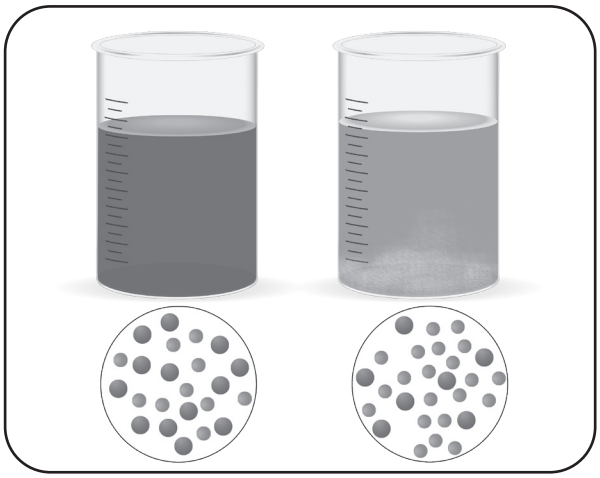
- The teacher will provide: Three test tubes, a test tube holder, a measuring flask, a spoon, copper sulphate, and water
- The teacher will demonstrate the experiment.
- Students will:
- Take three thoroughly cleaned test tubes. Now, one by one, place the test tubes in a test tube holder. Using a measuring flask, fill each tube with 5 millilitres of water. Now add 1 spoon of copper sulphate to the first test tube, 2 spoons to the second test tube, and the remaining 3 spoons to the third test tube. Then, thoroughly shake the test tubes until the copper sulphate grains are completely dissolved. Set the test tubes back in their original positions in the test tube holder.
- Ask students: Do all of the solutions have the same shade of blue?

Explanation:

With less copper sulphate, the solution appears less blue. This indicates that the solution is less dilute. As the amount of copper sulphate is increased, the colour of the solutions gradually deepens. With the addition of copper sulphate, the solution has become more concentrated rather than diluted.

Elaborate: (10 min)

Stem Activity



- Ask students:
- We know how to convert a diluted solution into a concentrated solution. Now, can you convert a concentrated solution to a dilute solution?
- Let the students think of the idea themselves to convert the concentrated solution into the dilute solution.
- Most of the students will be able to understand that by adding more solvent, we can convert the concentrated solution into a dilute solution.
- Observe the students to see if they are doing the task correctly.
- In the end, explain to the students that we can make a concentrated solution by adding more solute, and we can convert a concentrated solution into a dilute solution by adding more solvent into the solution.

Evaluate: (5 min)

Worksheet 2 will be given to the students.

Home Assignment:

Make concentrated and diluted solutions with anything that you will find in the kitchen, and share your experience with the class in the next lesson.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Factors Affecting Solubility	107	45 Minutes	-

Objective:

- Identify the factors which affect the solubility of a solute in a solvent and recognize the importance of these factors in homes and industries.
- Identify ways of accelerating the process of dissolving materials in a given amount of water and provide reasoning (i.e., increasing the temperature, stirring, and breaking the solid into smaller pieces increases the process of dissolving).

Resources:

- a clear container filled with water
- a coloured solid (such as sugar or salt).

Useful Link

https://youtu.be/qL5-lcc_TfY

Engage: (5 mins)

- Start the lesson with a visual demonstration of dissolving. Display a clear container filled with water and a coloured solid (such as sugar or salt).
- Instruct students to observe what happens and to discuss the dissolving process. Pose questions such as, "What changes do you notice when the solid is added to the water?"
- Why do you believe the solid vanishes in water?
- Can you think of anything that could influence how quickly the solid dissolves?

Explain: (10 mins)

- Explain dissolving as the process by which a solid solute dissolves and disperses uniformly in a solvent, resulting in a homogeneous mixture known as a solution.
- Discuss the following factors that can hasten the dissolution process:
- Temperature: Raising the temperature of the solvent increases the rate of dissolution because it provides more kinetic energy for particles to collide and break the bonds that hold the solute together.
- Stirring or agitation: Agitating the mixture through stirring or shaking increases the contact between the solute and solvent, allowing for faster dissolution.
- Surface area: By breaking the solid solute into smaller pieces, the surface area increases, providing more contact points with the solvent and speeding up the dissolving process.
- Give examples and real-life scenarios to demonstrate how these variables affect the rate of dissolution.

Explore: (15 mins)

- Conduct a series of experiments in which students investigate the factors that influence dissolving rate.
- Experiment 1: Have students dissolve equal amounts of a solute (such as sugar or salt) in various temperatures of water and time how long it takes for complete dissolution.
- Experiment 2: Students can compare the rate of solute dissolution in still water versus stirred or agitated water.
- Experiment 3: Students can compare the rate of a solute's dissolution in whole versus crushed or powdered form.
- Students can design their own experiments in small groups to investigate additional factors that may influence the rate of dissolving.
- Encourage students to take notes and measurements during the experiments, and to participate in discussions to explain their findings based on the factors discussed.

Elaborate: (10 mins)

- Assign students to conduct research and present on a specific application where accelerating the dissolving process is critical. Cooking, pharmaceuticals, and industrial processes are some examples.
- Students should explain the importance of fast dissolving in their presentations, describe the factors that can be manipulated to speed up the process, and provide real-life examples or case studies.

Home Assignment:

- Research real-world examples of substances with varying solubilities in different solvents.

- Provide specific examples and scenarios in which substances dissolve well or poorly in various solvents.
- Complete Q10 on page 46 of workbook.

Lesson Plan 5	**Student Book pages**	**Time**	**Workbook pages**
Make a Rock Candy	108	45 Minutes	-

Objective:

- Make a rock candy with sugar using crystal seeding technique. (STEAM)

Useful Link

https://youtu.be/VpOU0Fo7QfU

Engage: (5 mins)

- Begin the lesson by displaying a sample of rock candy or pictures of various crystals.
- Inquire if students have ever seen or tasted rock candy. Talk about their observations and experiences.
- In order to facilitate a discussion, ask questions such as:
  - What is rock candy made of, in your opinion?
  - How do you believe crystals form?
  - Are there any other examples of crystals in everyday life that you can think of?

Explain: (10 mins)

- Explain that rock candy is a type of crystallised sugar formed by a process known as crystal seeding.
- Discuss the concept of crystal seeding, which involves introducing a small seed crystal into a supersaturated sugar solution and allowing more sugar molecules to join the crystal lattice, resulting in larger sugar crystals.
- Explain how crystals form using the principles of solubility, saturation, and evaporation.
- Give an overview of the chemical and physical processes that contribute to the formation of rock candy.

Explore: (15 mins)

- Divide the class into small groups and give each group the following materials:
- Jars or containers made of glass
- Strings or wooden skewers
- Preparation of a supersaturated sugar solution
- Extra sugar to coat the seed crystals
- Instruct the groups to prepare their rock candy as follows:
- To serve as seed crystals, coat the wooden skewers or strings with sugar.
- In the supersaturated sugar solution, dip the coated skewers or strings.
- Allow the skewers or strings to hang freely in the glass jars or containers.
- Encourage students to record their daily observations, including changes in crystal size and shape.

Elaborate: (10 mins)

- Allow each group to present their rock candy creations to the class, explaining their process and observations.

- Facilitate a class discussion about the factors that can influence the growth of sugar crystals, such as temperature, time, and sugar solution concentration.
- Engage students in a brainstorming session to discuss other variables that could be manipulated to influence crystal growth, such as stirring the solution, using different types of sugar, or adding flavourings or colorings.

Evaluate: (5 mins)

Examine their understanding by assessing their explanations of the scientific principles underlying the formation of rock candy crystals.

Home Assignment:

- Design and conduct your own crystal growth investigation using your knowledge of crystal formation from the rock candy experiment.
- Steps:
- choose a solute (substance to crystallize) for your experiment.
- Identify a solvent (liquid in which the solute will dissolve) for your chosen solute.
- Formulate a hypothesis.
- Create a detailed experimental plan, including materials, procedure, and variables to be tested (e.g., changing the temperature or stirring frequency).

Lesson Plan 6	Student Book pages	Time	Workbook pages
Effectiveness of Various Cleaning Solutions in Cleaning Tarnished and Oxidized Coin	108	45 Minutes	-

Objective:

- Explore the effectiveness of various cleaning solutions in cleaning tarnished and oxidized coins. (STEAM)

Useful Link

https://youtu.be/ydZMjzU2eF0

Engage: (5 min)

- Begin the lesson by showing students a tarnished or oxidized coin and asking them to notice its appearance.
- Facilitate a class discussion by asking questions such as,
  - Have you ever seen a coin like this? What happened to it, in your opinion?
  - How do you think we can restore the coin's lustre and cleanliness?
  - Can you think of any cleaning solutions that could help remove tarnish and oxidation from coins?

Explain: (10 mins)

- Explain tarnish and oxidation, emphasizing that tarnish is a thin layer of corrosion that forms on the surface of certain metals (such as copper) as a result of chemical reactions with air and moisture.
- Discuss the various cleaning solutions for removing tarnish and oxidation from coins, including vinegar, lemon juice, baking soda paste, and commercial metal cleaners.
- Give an overview of how these cleaning solutions work, either through acid-base reactions or by chemically breaking down tarnish and oxidation.
- Discuss how important it is to use proper cleaning methods to avoid damaging the coins.

Explore: (15 mins)

- Divide the class into small groups and distribute tarnished or oxidized coins to each group.
- Assign a different cleaning solution to each group to investigate, such as vinegar, lemon juice, baking soda paste, or a commercial metal cleaner.
- Instruct the groups to devise a simple experiment to test the effectiveness of the cleaning solution assigned to them on the coins. They must consider variables such as concentration, application method, and cleaning duration.
- Provide containers, cleaning solutions, brushes, and clothes for the groups to use as they conduct their experiments.
- Encourage students to keep track of their observations, measurements, and results while cleaning.
- Facilitate a discussion after the cleaning experiments in which groups share their findings and discuss the effectiveness of various cleaning solutions.

Elaborate: (10 mins)

- Allow each group to present to the class their findings and observations, including the methods they used and the results they obtained.
- Facilitate a discussion about the effectiveness of various cleaning solutions.
- Encourage students to think creatively and come up with new ways to clean tarnished and oxidized coins.

Evaluate: (5 mins)

Students should be asked to explain the scientific concepts underlying the effectiveness of the cleaning agents they tested.

Home Assignment:

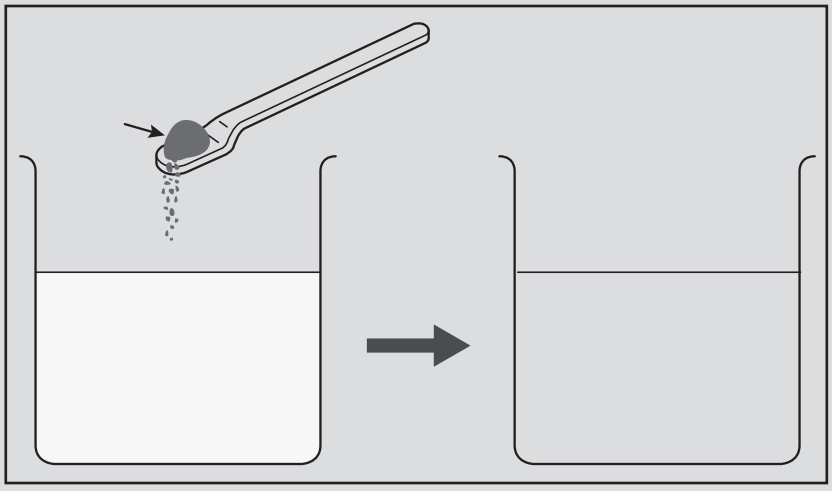
Write a brief description of each cleaning solution you used in the classroom experiment, including its chemical composition, intended use, and any safety precautions.

Worksheet 1:

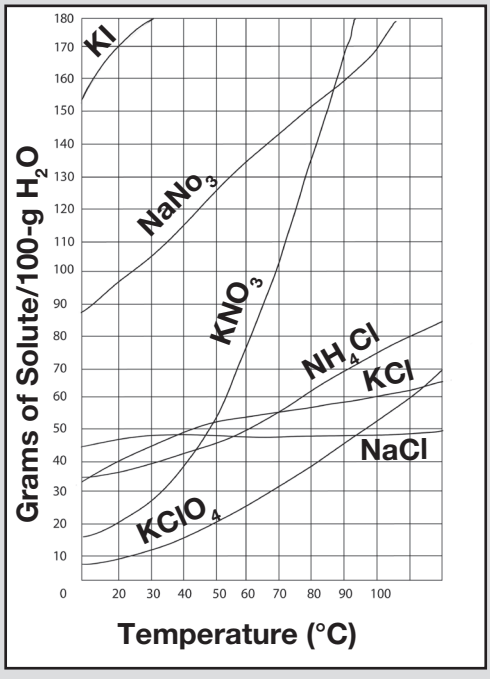
Worksheet 7.1:

1. Define Solubility:

2. Identify Solute, Solvent and Solution:



3. Answer the following questions by looking at the solubility curve:



i. At 20 °C, which salt is the least soluble in water?

ii. At 80 °C, how much potassium chloride can be dissolved in 200 gm of water?

iii. Which salt changes its solubility the least from 0 to 100 °C?

Worksheet 2:

Write down two properties of each of the following solutions:

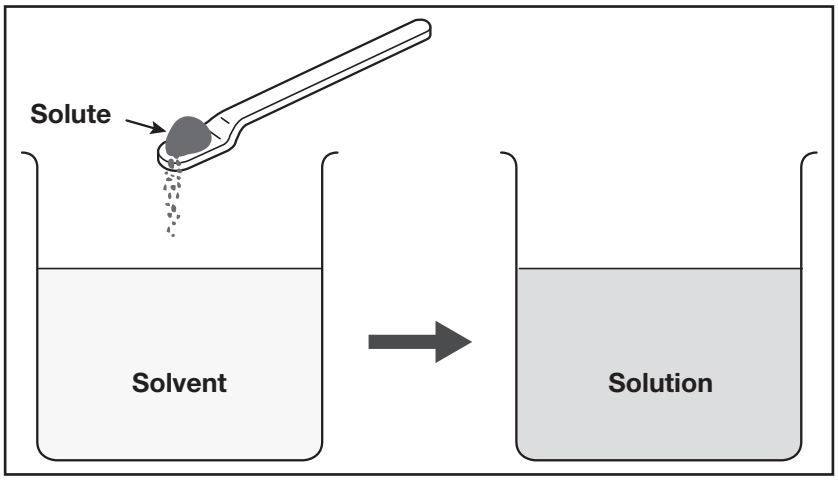
Diluted Solution	Concentrated Solution	Saturated Solution
		

Answers for Worksheet 1:

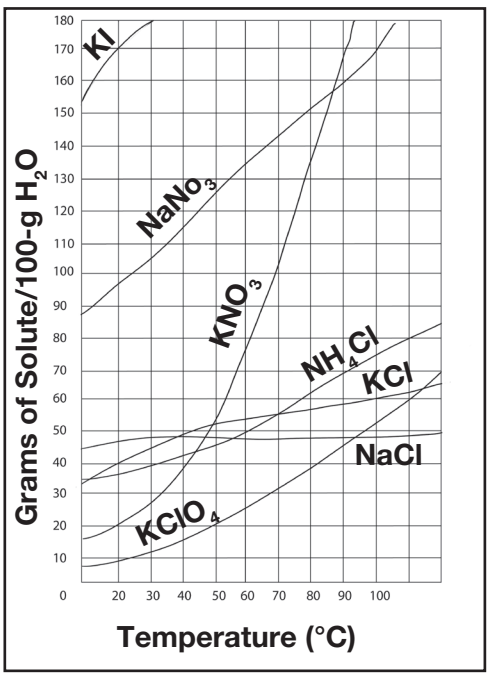
1. Define Solubility:

Solubility is the ability to dissolve, particularly in water:

2. Identify Solute, Solvent and Solution:



3. Answer the following questions by looking at the solubility curve:



i. At 20 °C, which salt is the least soluble in water?

$KClO_3$

ii. At 80 °C, how much potassium chloride can be dissolved in 200 grammes of water?

116g

iii. Which salt changes its solubility the least from 0 to 100 °C?

NaCl

Answers for Worksheet 2:

Write down two properties of each of the following solutions:

Diluted Solution	Concentrated Solution	Saturated Solution
		
It contains very little solute.	It contains a lot of solute.	Contains the maximum amount of solute.
Can dissolve significantly more solute.	Can dissolve a bit more solute.	No more solute can be dissolved.

Exercise Answers

1. Choose the correct answer:

i. **d)** adding a solute to a solvent

ii. **b)** dilute

iii. **b)** oil

iv. **a)** 100 g of liquid

2. Fill in the Blanks:

i. Aziz added sugar to his tea until no more would dissolve. He had made a saturated solution.

ii. Sugar will dissolve in water because it is soluble.

iii. Flour will not dissolve in water because it is insoluble.

iv. To produce sugar from a sugar solution, you need to allow the water to evaporate.

v. As temperature increases, the solubility is also increased.

1. **i.** Two factors or variables that should have been kept the same in order to make sure the experiment was a fair test are:

- The type and amount of fruit jelly used in each trial.
- The stirring method or technique used to dissolve the jelly in water.

ii. To plot a graph of the students' results, follow these instructions:

- Label the x-axis (horizontal) as "Temperature (0C)" and the y-axis (vertical) as "Time for jelly to dissolve (minutes)."
- Plot the data points on the graph for each temperature and the corresponding time it took for the jelly to dissolve.
- Draw a line of best fit that goes through the data points.

iii. Circle the point on the graph that appears to be an outlier or seems wrong.

iv. **a)** The conclusion, "The temperature of the water did affect how quickly the jelly dissolved," is not very scientific because it lacks specific details and quantitative information. It doesn't explain how the temperature affected the dissolution process.

b) A more scientific conclusion could be: "As the temperature of the water increased, the time taken for the jelly to dissolve decreased, indicating that higher temperatures lead to faster dissolution rates."

4. Short Answer Questions:

i. The mass of the solution when 20 g of salt is dissolved in 100 g of water is 120 g (20 g salt + 100 g water).

ii. A solution is a homogeneous mixture in which a solute is uniformly distributed in a solvent. Examples of solutions include saltwater (salt dissolved in water) and sugar dissolved in tea.

iii. When salt is dissolved in water, salt is the solute, and water is the solvent.

iv. Another name for a weak solution is a dilute solution.

v. A saturated solution is a solution in which the solvent has dissolved the maximum amount of solute that it can at a given temperature and pressure.

vi. The most plentiful liquid solution on Earth is seawater.

vii. One common solvent other than water is ethanol (alcohol

viii. Solubility of a substance refers to the maximum amount of solute that can dissolve in a given amount of solvent at a specific temperature and pressure.

5. Long Answer Questions:

i. A soft drink is considered a solution because it is a homogeneous mixture where various solutes (such as sugar, flavorings, and carbon dioxide) are uniformly dissolved in a liquid solvent (usually carbonated water or soda). In a soft drink, the solutes are evenly distributed throughout the liquid, creating a consistent taste and composition.

ii. To make a concentrated solution weaker, you can dilute it by adding more solvent to it. By increasing the amount of solvent while keeping the amount of solute constant, you reduce the concentration of the solute in the solution. This process decreases the strength or concentration of the solution.

iii. Warming a saturated solution typically increases its solubility. When you warm a saturated solution, it allows the solvent molecules to move more energetically, making it easier for additional solute to dissolve. As a result, more solute can be added to the solution without causing precipitation or crystallization.

iv. The effect of temperature on the amount of gas that will dissolve in a liquid is as follows: As temperature increases, the solubility of gases generally decreases. In simpler terms, gas is less soluble in a liquid at higher temperatures. This phenomenon is commonly observed when carbon dioxide (CO_2) gas bubbles out of a carbonated beverage as it warms up.

v. You can use one or two crystals of the solute to determine the state of the solution as follows:

- If the crystals dissolve completely in the solution, the solution is unsaturated because it can still dissolve more solute.
- If the crystals remain undissolved at the bottom of the test tube, the solution is saturated because it has reached its maximum solute concentration at that temperature.
- If the crystals initially dissolve but more solute precipitates out over time, the solution is supersaturated because it contains more solute than it should at that temperature. The excess solute crystallizes out.

vi. The effect of temperature on the solubility of a substance depends on the specific substance and its interactions with the solvent. In general, for many solid solutes, an increase in temperature leads to an increase in solubility, allowing more solute to dissolve. However, for gases, higher temperatures often lead to decreased solubility, causing gases to escape from the liquid.

vii. The key difference between a solution and a suspension is the uniformity of particle distribution:

Solution:

- Homogeneous mixture with uniformly dispersed particles.
- Particles are usually molecules or ions.
- Particles do not settle
- Examples: Saltwater, sugar dissolved in tea, air (mixture of gases).

Suspension:

- Heterogeneous mixture with unevenly dispersed particles.
- Particles can be larger and visible.
- Particles may settle over time.

Examples: Muddy water, orange juice with pulp, sand in water.

- Medicine (oral liquid medications)
- Food and beverage production (flavoring and preservative solutions)

- Chemical reactions (reactants and products dissolved in solvents)
- Cleaning agents (detergent solutions)
- Industrial processes (chemical solutions for various purposes)

6. Think about it:

i. Temperature has a significant effect on the solubility of these solids in water. As the temperature increases from 20 $_0$C to 80 $_0$C, the amount of each solid that can dissolve in water generally increases.

At 80 $_0$C, all three substances (A, B, and C) dissolve more compared to their respective amounts at 20 $_0$C. This suggests that higher temperatures lead to greater solubility for these solids in water.

ii. Which substance is the most soluble in water at 20 ^{0}C?

Substance C is the most soluble in water at 20 ^{0}C, as it dissolves the largest amount (35.8 grams) among the three substances at that temperature.

iii. Which substance is the least soluble in water at 80 ^{0}C?

Substance C is the least soluble in water at 80 ^{0}C, as it dissolves the smallest amount (38.6 grams) among the three substances at that temperature.

CHAPTER 08

Forces and Motion

Student Book Pages 99-111

Objectives:

- Describe the effect of force on changing the speed and direction of motion with time.
- Define and state the SI unit of force.
- Formulate the relationship between speed, distance, and time.
- State SI (System International) unit of speed.
- Calculate average speed.
- Interpret a distance-time graph.
- Give examples of contact forces and non-contact forces.
- Demonstrate that forces always work in action and reaction pairs (equal in magnitude, opposite in direction)

Keywords

force, push, pull, stretch, turn, force arrow, interact, balance, direction, magnitude, upward, downward, attract, repel, force metre, newton metre, Newton (N), weight, gravity, mass, matter, contact force, non-contact force, gravitational force, balanced forces, unbalanced forces

OVERVIEW OF THE UNIT:

- Force is defined as a push or pull acting on an object or energy as a result of physical action or movement. This happens when two entities come into contact. Every object in the universe exerts a force on others, according to the universal law of gravitation.
- We say a body is in motion when it is moving. For example, if a boy is walking, we will refer to him as being in motion. But suppose the boy takes a 5-minute break and sits down. If someone asks if the boy is moving at that time, the answer will be 'No.' We can derive from this that a body's motion is subject to time. Thus, Motion is defined in physics as a change in a body's position with respect to time.
- In nature, force and motion are strongly intertwined. Force can be defined as the cause of motion. If something is moving, we can say that some force is acting on it or that some force acted on it to cause it to move. If a person is walking and thus in motion, there must be some force acting on him to cause him to move.
- The first person to discover the relationship between motion and force was Sir Isaac Newton. We can draw three conclusions from his studies of force and laws of motion:
- The body can be accelerated by force.
- The body is slowed by force.
- The direction of a moving body can be changed by force.

Lesson Plan 1	Student Book pages	Time	Workbook pages
Force	99-100	45 Minutes	48

Learning Objective:

- Describe the effect of force on changing the speed and direction of motion with time.
- Define and state the SI unit of force.

Keywords

Force
Push
Pull
Forcemeter
Newton

Engage: (5 min)

Warm-up Activity

- Put a ball on the ground. Ask the students how they can move this ball.
- Ask one of the students to move the ball.

- Ask: What happens if you put more pressure on the ball?
- Then have another student push it even harder.
- Explanation: The greater the force, the greater the distance travelled by the object.)
- Now, give a rubber band to a student and ask him or her to gently stretch it. Then inquire, "Does the shape of the rubber band change when stretched?"

Useful Link

https://youtu.be/QuFh8GYDf7A

- The students who are involved in the activity will follow the teacher's instructions. Other students will observe the activity and participate by answering the teacher's questions.

Explain: (10 min)

- Force is defined as a push or pull that can alter an object's state of motion or shape. The SI (International System of Units) unit of force is the Newton, represented by the letter "N." One Newton is defined as the force required to accelerate a one-kilogram mass by one meter per second squared (1 N = 1 kg m/s^2).
- When a force is applied to a stationary object, the object tends to move in the direction of the force. When a force is applied to a stationary tennis ball, the ball will continue to move in the direction of the applied force.
- A force can either stop or slow down a moving object - A force must be applied to a moving object to either stop or slow it down. The motion of a moving ball, for example, can be stopped by applying external force.
- Any moving object's direction can be changed by applying an external force to that object. For example, applying force at an angle can change the direction of a moving football.
- Consider a circular rod; by hammering the rod and applying an external force, the shape of the rod can be changed to a flat sheet.
- As we continue to pedal the bicycle pedal, the speed of the bicycle increases. When we apply the brake, the bicycle's speed decreases.

Explore: (15 min)

Investigation:

- Investigate the fact that the greater the force, the greater the change in the distance covered by the object.
- Experiment to show that some objects can return to their original shape after being released from force.
- When you apply a push or pull to an object, it changes its position or shape.
- The greater the force, the greater the change in the object's distance covered.
- Some objects return to their original shape after force is released, while others do not.
- Help students design an experiment to demonstrate the effects of force.
- Teacher will provide:
    - Sponge
    - Rubber band
    - Ball
    - Toy car
    - Play dough
    - Teacher will guide the students in their findings.

  - Students will design an experiment to investigate the effects of force.
- Students will experiment with the given material and note down their findings.

Elaborate: (5 min)

Analysis

- The teacher will discuss the findings of the students in class discussion.
- Students will make a written presentation of their experiment and draw conclusions.
- Students will share their presentations with the class.

Evaluate: (5 min)

Pen and Pencil Test

- Give worksheet 1 to solve.
- Complete Q1 on page 48 of workbook.

Home Assignment:

- Investigate and provide real-world examples of various forces and their effects on objects. Describe how forces are important in everyday activities like driving a car, lifting objects, and even walking.
- Complete Concept Check on page 100 of student book.

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Balanced and Unbalanced Forces	100-101	45 Minutes	-

Learning Objective:

- Distinguish between balanced and unbalanced forces.
- Demonstrate that forces always work in action and reaction pairs (equal in magnitude, opposite in direction)

Keywords

Opposite
Equal
Balanced
Unbalanced

Resources:

- Book
- A wooden block
- Thread
- Pen and paper
- White board and marker

Useful Link

https://youtu.be/YyJSlclbd-s

Engage: (5 min)

Brainstorming

- Put a book on the table.
- Ask the students:

  What forces are acting on the book?
- The student's answers may vary.
- Draw the diagram on the board and use arrows to show and explain the forces acting on the book.
- You can also call two students and instruct them to pull each other. If the students are unable to move each other, explain that this is due to the forces being balanced. Then call another student

and instruct him to join the student on one side and instruct them to pull each other now. The side with two students will most likely be able to move a student towards them. Explain to the students that this is due to unbalanced forces on both sides.

Explain: (10 min)

When forces applied to a body are equal in magnitude but in opposite directions, the net force acting on the body is referred to as Balanced Force. A balanced force is defined as two equal forces acting on a body in exactly opposite directions.

Examples:

1. There will be no winner when two arm wrestlers exert a similar force on each other but push against each other in opposite directions. As a result, the net force (resultant force) is zero or balanced.
2. If the rope does not move in a tug of war, the two teams are exerting equal but opposing balanced forces on the rope. As a result, the net force or resultant force on the rope is zero.
    - The force is unbalanced when an unequal amount of force is applied to the body in the same or opposite direction. Thus, a force is said to be unbalanced if it consists of two opposing forces acting on a body that are not equal in magnitude and size. When an unbalanced force is applied to a body, it changes its state of motion as well as the direction in which the magnitude of the force is greater.

Examples:

1. When you kick a football, it moves from one location to another, indicating that the forces acting on the football are unbalanced.
2. In a tug of war, if one side pulls the rope with more force than the opposing side, the rope will move in the direction of the greater force.

Explore: (15 min)

STEM Activity

- Hang a wooden block with thread and ask the students:
- How many forces are acting on the block?
- What is the force acting downward on a block?
- What forces are acting upwards on the block?
- Draw a diagram of the block, thread, and hand on the board, with two arrows representing the two forces, and ask:
- Why is the block at rest?
- Ask a student to cut the thread and explain what happens to the block now.
- Draw a diagram of the block and the thread on the board after the thread has been cut, with an arrow representing one force, and ask: "How many forces are acting on the block after the thread has been cut?"
- Is the force in balance or out of balance?
- Explain to the students that unbalanced force causes the object to move.
- Write the following conclusions on the board:
- When two forces acting on a body produce no motion in it, the forces are said to be balanced. When two forces acting on a body produce motion in it, the forces are said to be unbalanced.

Elaborate: (5 min)

Flash Cards

- Make flash cards showing the pictures of different situations like:
  1. A tug of war when the rope is not moving.
  2. A glass on the table.
  3. A child riding a bicycle.
  4. A falling vase etc.
- Show the flashcards one at a time to the class and ask to tell the force shown in the image is balanced or unbalanced.
- Students will tell by looking at the picture that the force shown in the picture is balanced or unbalanced.

Evaluate: (5 min)

- Give worksheet 2 to solve.
- Complete Concept Check page 101 of student book.

Home Assignment:

- In your notebook, paste the images demonstrating balanced and unbalanced forces.
- Attempt Q3 on page 106 of student book.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Speed	102	45 Minutes	-

Objective:

- Formulate the relationship between speed, distance, and time.
- State SI (System International) unit of speed.

Keywords

Speed
Distance
Time

Engage: (5 mins)

- Begin the lesson by having students consider situations in which they must consider speed, distance, and time. Travelling, sports, or even everyday activities like walking to school are examples.
- To facilitate a class discussion, ask questions such as,
  - What is speed? What would you call it?
  - What do you think the relationships between speed, distance, and time are?
  - Can you think of any real-world examples where speed, distance, and time are critical?

Useful Link

https://youtu.be/EGqpLug-sDk

Explain: (10 mins)

- Explain that speed is the rate at which an object moves. It is defined as the distance traveled per unit of time.
- Introduce the speed calculation formula: Speed = Distance/Time.
- Talk about the SI (System International) unit of speed, which is meters per second (m/s).
- Give examples to demonstrate the concepts of speed, distance, and time, as well as how they are related.

Explore: (15 mins)

- Divide the class into small groups and distribute materials such as:
  - toy cars,
  - measuring tapes,
  - and stopwatches
- Instruct the groups to devise a test to determine the speed of the toy cars. They should think about things like distance, time, and the number of trials.
- Encourage students to record the time and distance travelled by the toy cars for each trial.
- Instruct the groups to use the formula of Speed = Distance/Time to calculate the speed of the toy cars.
- Facilitate a class discussion in which groups share their findings, discuss any difficulties they faced, and compare the speeds of their toy cars.

Elaborate: (10 mins)

- Allow each group to present their experiment and findings to the class, including the methods used, data collected, and calculations performed.
- Engage students in a discussion about how changing the distance or time affects an object's speed.
- Additional examples or scenarios where students can apply the concept of speed, distance, and time, such as track and field events, cycling races, or calculating travel time between two cities, should be provided.

Evaluate: (5 mins)

- Assign a set of problems to students that require them to calculate speed, distance, or time using the formula Speed = Distance/Time.
- Finish the lesson with a class discussion in which students discuss the significance of understanding the relationship between speed, distance, and time in various real-life scenarios.
- Complete Q6 (i and ii) on page 111 of student book.

Home Assignment:

Choose a mode of transportation, such as a bicycle, car, or walking. Calculate how long it takes to travel a certain distance using that mode of transportation. Divide the distance travelled by the time taken to calculate the speed for each mode. Compare the speeds of various modes of transportation and discuss the effects of speed on efficiency, convenience, and environmental impact in transportation.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Average Speed and Distance-Time Graph	102-104	45 Minutes	49

Objective:

- Calculate average speed.
- Interpret a distance-time graph.

Keywords

Average speed
Interpret
Graph

Resources:

- White board
- Projector/graphing software
- Pen and paper

- Set of distance-time graphs

Useful Link

https://youtu.be/K9rZQJuOgDk

Engage: (5 mins)

- Begin the lesson by projecting a distance-time graph on the board or by employing a digital tool such as graphing software or an online graphing tool.
- Ask students to look at the graph and describe what they notice about the distance-time relationship.
- In order to facilitate a class discussion, ask questions such as:
  - What does the graph's slope represent?
  - How does a distance-time graph help us calculate speed?
  - Can you think of any real-world applications for distance-time graphs?

Explain: (10 mins)

- Explain that average speed is a measure of how quickly an object travels a given distance in a given amount of time.
- Introduce the average speed calculation formula: Average Speed = Total Distance/Total Time.
- Discuss distance-time graph interpretation, emphasizing that the slope of the graph represents speed.
- Give examples of how to calculate average speed and interpret distance-time graphs.

Explore: (15 mins)

- Divide the class into small groups and distribute a set of distance-time graphs to each group.
- Assign the groups the task of analyzing the graphs and calculating the average speed for each scenario.
- Encourage students to compare their calculated average speeds and discuss their findings in groups.
- Facilitate a class discussion in which groups share their distance-time graph analyses, calculations, and interpretations.

Elaborate: (10 mins)

- Each group should present one of the distance-time graphs they examined, explaining their findings and interpretations.
- Engage students in a discussion about how the slope of the graph relates to an object's speed.

Evaluate: (5 mins)

- Assign a set of problems to students that require them to calculate average speed using the formula Average Speed = Total Distance/Total Time.
- For Example:
- Ali rides his bicycle to school every day. On Monday, he covers a distance of 6 kilometers in 30 minutes. On Tuesday, he covers a distance of 8 kilometers in 40 minutes. Calculate John's average speed for the two days.
- Solution:
- To calculate average speed, we need to divide the total distance traveled by the total time taken.
- For Monday:

  Distance = 6 kilometers

Time = 30 minutes = 0.5 hours

For Tuesday:

Distance = 8 kilometers

Time = 40 minutes = 0.67 hours

Total Distance = 6 + 8 = 14 kilometers

Total Time = 0.5 + 0.67 = 1.17 hours

Average Speed = Total Distance / Total Time

Average Speed = 14 kilometers / 1.17 hours

Calculating the average speed:

Average Speed ≈ 11.97 kilometers per hour

Therefore, Ali's average speed for the two days is approximately 11.97 kilometers per hour.

- You can give students similar problems with varying distances and times to practice calculating average speed using the given formula.

Home Assignment:

- Measure the time it takes for you to walk or run a certain distance in your neighborhood (e.g., from your house to a nearby park or store). Divide the distance by the time taken to get your average speed. Next, on a piece of paper, draw a simple distance-time graph with time on the x-axis and distance on the y-axis to represent your walk or run. Analyze the graph and explain how your speed changed throughout the activity.
- Give worksheet 8.3 to solve at home.
- Attempt Q2 on page 49 of workbook.

Lesson Plan 5	Student Book pages	Time	Workbook pages
Types of Forces	105-107	45 Minutes	50

Objective:

Give examples of contact forces and non-contact forces

Keywords

Contact forces
Non-contact forces
Friction
Gravity

Resources:

- Whiteboard and markers or chalkboard and chalk
- Projector and screen (optional)
- Various objects (e.g., books, magnets, rubber bands, balloons, paper clips, marbles)
- Spring scales or force sensors (optional)
- Pencils and erasers

Engage: (5 min)

- Start the lesson by having students consider the forces they encounter in their daily lives.
- Demonstrate common force scenarios, such as pushing a door, playing with magnets, or pulling a rubber band.
- Encourage students to share their observations and experiences with forces.

Explain: (10 min)

- Introduce the concept of forces and explain that there are two types of forces: contact forces and non-contact forces.

- Contact forces are defined as those that require physical contact between objects, whereas non-contact forces act without direct physical contact.
- Give examples of contact forces (such as friction, tension, and applied force) as well as non-contact forces (such as gravity, magnetism, and electrostatic force).

Explore: (15 min)

- Students should be divided into small groups.
- Books, magnets, rubber bands, balloons, paper clips, and marbles should be distributed to each group.
- Instruct each group to examine the objects and determine whether the forces they see are contact or non-contact.
- Ask students to record their findings on a worksheet.

Elaborate: (10 min)

- Allow each group to present their findings to the class and explain why they classified the forces as contact or non-contact.
- Conduct a hands-on demonstration using spring scales or force sensors to measure forces in various scenarios, such as stretching a rubber band (contact force) and the force of gravity acting on an object (non-contact force).
- As an example of contact force, discuss the concept of contact area and how it affects friction.

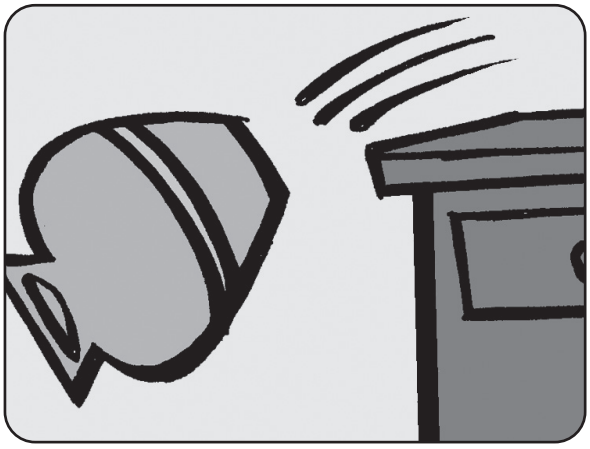
Evaluate: (5 min)

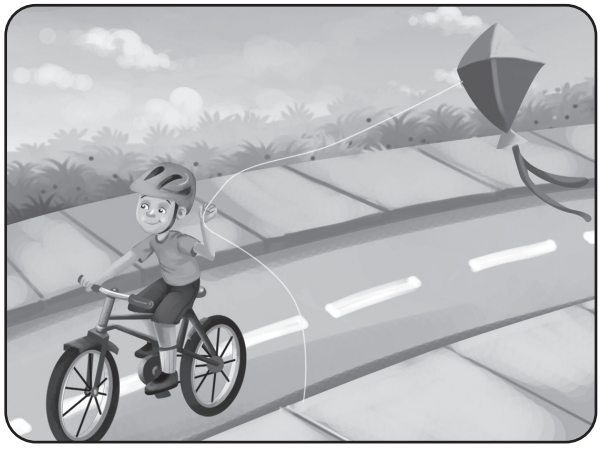
- Distribute a brief quiz or worksheet containing questions about contact and non-contact forces.
- Example:
- Question 1: Determine whether the following scenarios involve contact (C) or non-contact (NC) forces.
    - o A person pushing a car to get it moving.
    - o A magnet attracting a metal paperclip.
- Question 2: Explain whether the force described in each scenario is contact or non-contact. Give a brief explanation for your choice.
    - o Scenario 1: A soccer ball rolling on the grass comes to a stop.
    - o Scenario 2: A satellite orbiting Earth
- Complete Q5 (iii) on page 110 of student book

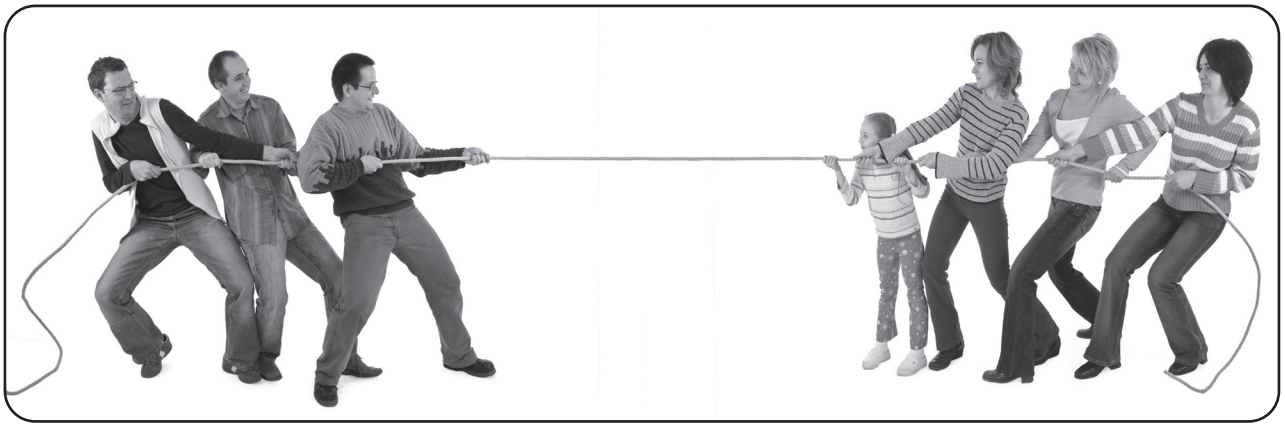
Home Assignment:

- Identify and document three real-life examples of contact forces encountered while performing daily activities.
- Identify and document three real-world examples of non-contact forces in your environment.
- Create a one-page presentation that explains how the forces act and why they are classified as contact or non-contact.
- Complete Q4-5 on page 50 of workbook.

Flashcards Lesson 2







Worksheet 1:

Identify the effect of force on objects in the given situations:

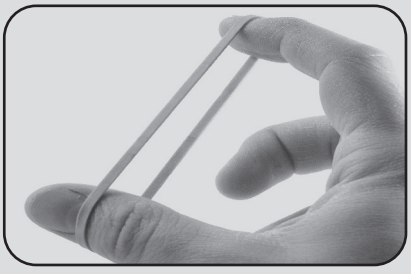
1. On a plate, a ball of dough is placed.

How force is applied?	
Is there a change in the state of motion?	
Is there a change in shape?	

2. A spring attached to a surface

How Force is applied?	
Is there a change in the state of motion?	
Is there a change in shape?	

3. A rubber band between two fingers.



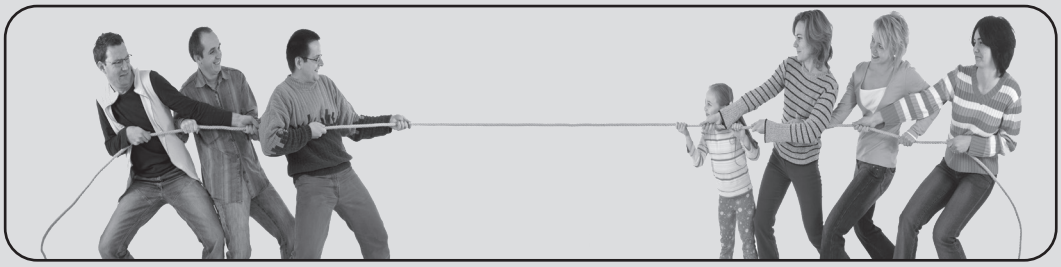
How Force is applied?	
Is there a change in the state of motion?	
Is there a change in shape?	

4. piece of sponge in your hand.

How Force is applied?	
Is there a change in the state of motion?	
Is there a change in shape?	

Worksheet 2:

1. A rope is being pulled in opposite directions by forces of 100 N and 80 N. What will the net force on the rope be?



100 N 80 N

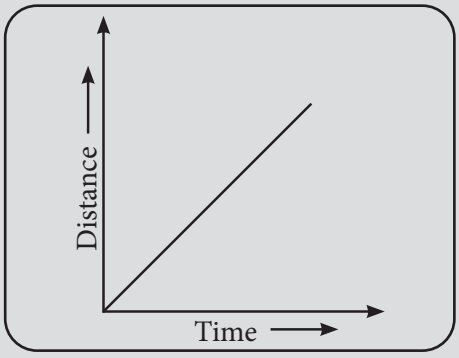
Write examples of Balanced and unbalanced forces from everyday life:

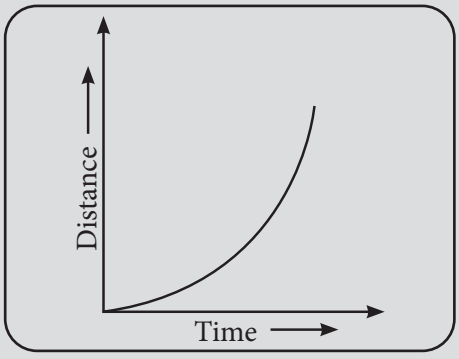
Examples of balanced force:

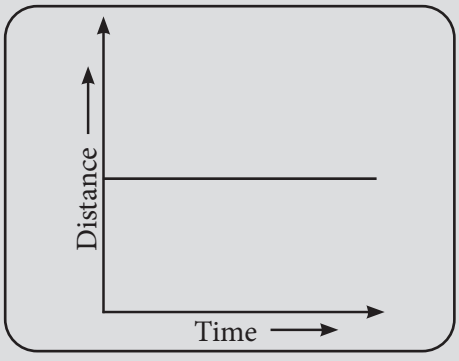
Examples of unbalanced force:

Worksheet 3:

Interpret the following graph and identify the speed of the object :







Answers for Worksheet 1:

Identify the effect of force on objects in the given situations:

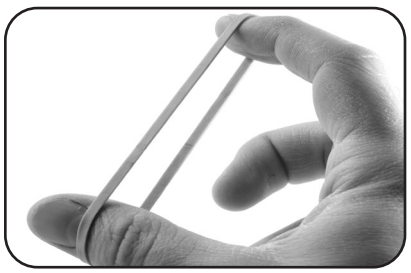
1. On a plate, a ball of dough is placed.

How force is applied?	By pressing with your hands
Is there a change in the state of motion?	No
Is there a change in shape?	Yes

2. A spring attached to the seat of a bicycle.

How Force is applied?	By sitting on the seat of bicycle.
Is there a change in the state of motion?	No
Is there a change in shape?	Yes

3. A rubber band hanging down from a nail in the wall.



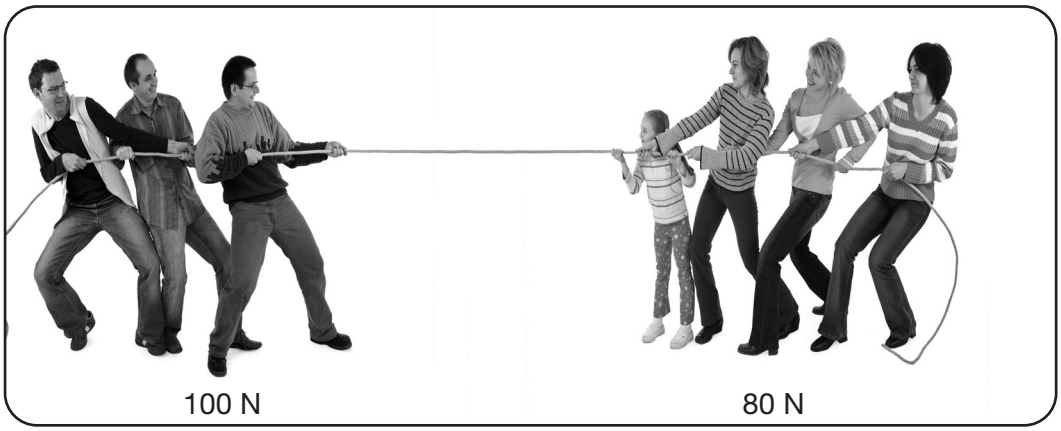
How Force is applied?	By pulling the free end of a rubber band.
Is there a change in the state of motion?	No
Is there a change in shape?	Yes

4. pi**e**ce of sponge in your hand.

How Force is applied?	By squeezing the sponge with your hands.
Is there a change in the state of motion?	No
Is there a change in shape?	Yes

Answers for Worksheet 2:

1. A rope is being pulled in opposite directions by forces of 100 N and 80 N. What will the net force on the rope be?



Because the forces are acting in opposite directions, the net force on the rope is equal to the difference of the two forces acting on the rope.

In this case, the net force is equal to 100N - 80 N = 20 N

The object moves in the direction of the 100 N force.

Write examples of Balanced and unbalanced forces from everyday life:

Examples of balanced force:

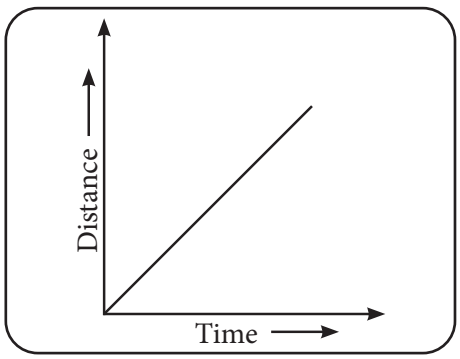
1. A man pushing against the wall.
2. A book is on the table.
3. Running a vehicle at a constant speed.
4. Sitting on a chair.

Examples of unbalanced force:

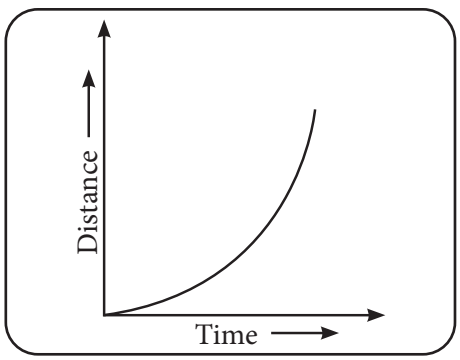
1. The force that causes a seesaw to move up and down.
2. The force that causes a book to slide across a slanted surface.
3. The force that causes a wooden block to move when pushed with the hand.
4. The force that causes a football to move when kicked with the leg.

Answers for Worksheet 3:

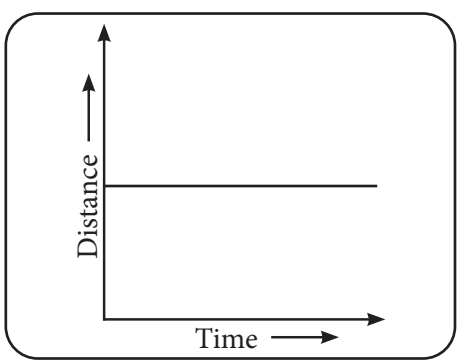
Interpret the following graph and identify the speed of the object :



The object is moving with uniform speed



The speed of the object is not constant.



The object is at stationery position.

Exercise Answers

1. Choose the Correct Answer:

- **i. b)** Toward the left
- **ii. b)** The magnitude of the force
- **iii. b)** A fan blowing a student's hair
- **iv. b)** Newton meter
- **v. c)** metres per second

2. Fill in the Blanks:

- **i.** In science, a push or a pull in a given direction is called a force.
- **ii.** The force that pulls a falling object toward the Earth is called gravity.
- **iii.** The head of the force arrow indicates the direction of the force.
- **iv.** The force that one surface exerts on another when they rub against each other is called friction.
- **v.** The distance-time graph which shows that the object is at rest will be a horizontal line.

3. Look at the Following Diagrams:

- **i.** What is the net force acting on the blocks?
  - **(a)** The net force is zero because the forces on each block are balanced.
  - **(b)** The net force is 5N.

4. Short Answer Questions:

- **i.** Forces acting on an object are balanced when the net force on the object is zero.
- **ii.** Which of the forces acting in the examples below are balanced?
  - **a)** A cell phone resting on the counter: Balanced
  - **b)** A picture hanging on the wall: Balanced
  - **c)** Any object with no motion: Balanced
  - **d)** Pushing a lawnmower across the yard: Unbalanced
  - **e)** A skydiver falling towards the ground: Unbalanced

5. Contact Forces: Contact forces are forces that act on an object when it is physically touching or in direct contact with another object. These forces result from the interaction between the surfaces of objects in contact. Examples of contact forces include:

Friction (e.g., the force that opposes the motion of a sliding book on a table)

Tension (e.g., the force exerted by a rope when pulling an object)

Normal Force (e.g., the force exerted by a surface to support the weight of an object)

Non-contact Forces: Non-contact forces are forces that act on an object without direct physical contact between the objects involved. These forces can act over a distance due to fields or interactions between objects. Examples of non-contact forces include:

Gravity (e.g., the force of Earth's gravity pulling objects towards it)

Electrostatic Force (e.g., the force between charged particles, like the attraction or repulsion between charged objects)

Magnetic Force (e.g., the force between magnets or the interaction between a magnet and a magnetic material)

6. **i.** When the net force on an object is zero, the object will either remain at rest or continue to move at a constant velocity. This is described by Newton's First Law of Motion, which states that an object at rest tends to stay at rest, and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force. In other words, if the net force is zero, there is no acceleration, and the object's motion does not change.

ii. When the net force on an object is not zero, the object will accelerate in the direction of the net force. The acceleration is directly proportional to the magnitude of the net force and inversely proportional to the object's mass (F = ma, where F is the net force, m is the mass, and a is the acceleration). This means that the object will either speed up, slow down, or change direction, depending on the direction and magnitude of the net force. The greater the net force, the greater the acceleration, and the more significant the change in motion.

7. Mass: Mass is a measure of the amount of matter in an object. It is a scalar quantity and is measured in units such as kilograms (kg) or grams (g). Mass remains the same regardless of the location of the object and is a fundamental property of matter.

Weight: Weight is the force exerted on an object due to gravity. It is a vector quantity and is measured in units of force, such as newtons (N) or pounds (lb). Weight depends on both the mass of the object and the gravitational field strength at its location.

8. The weight of a body will change if the gravitational force acting on it changes. Weight is directly proportional to the strength of the gravitational field. If the gravitational force increases, the weight of the body will increase, and if the gravitational force decreases, the weight of the body will decrease. Weight can be calculated using the formula: Weight = Mass × Gravitational Acceleration.

9. Gravitational Force and Electrostatic Force are both fundamental forces of nature that act at a distance:

Similarities:

- They are both long-range forces, meaning they can act over large distances without direct contact.
- They both follow the inverse square law, where the force decreases with the square of the distance between the objects.
- Both forces are attractive when objects have opposite properties (e.g., mass and charge) and repulsive when they have the same properties.

10. Electrostatic force, magnetic force, and gravitational force differ in several ways:

1. **Origin:**

Gravitational Force: It arises from mass and affects all objects with mass.

Electrostatic Force: It arises from electric charges and affects charged objects.

Magnetic Force: It results from magnetic fields and moving charges.

2. **Interaction:**

Gravitational Force: Always attractive, acts on all masses.

Electrostatic Force: Attractive or repulsive, acts on charged objects.

Magnetic Force: Attractive or repulsive, acts on magnetic or moving charges.

3. **Range:**

   Gravitational Force: Long-range, affects celestial bodies.

   Electrostatic Force: Long-range, depends on charge magnitudes.

   Magnetic Force: Shorter range, most influential at close distances.

4. **Force Carriers:**

   Gravitational Force: No force carriers.

   Electrostatic Force: Mediated by photons.

   Magnetic Force: Mediated by virtual particles, including photons.

   Long answer questions:

   i. The difference between speed and average speed is as follows:

1. **Speed:**

- Speed is a scalar quantity that measures the rate at which an object covers a certain distance.
- It represents the magnitude of the object's velocity and does not specify the direction of motion.
- Speed is calculated by dividing the distance traveled by the time taken, and its unit is typically meters per second (m/s) in the International System of Units (SI).

2. **Average Speed:**

- Average speed is also a scalar quantity that represents the overall rate of motion of an object over a certain time interval.
- It is calculated by dividing the total distance traveled by the total time taken during a specific journey.
- Average speed provides a single value that summarizes the entire journey's speed, regardless of any variations in speed that may have occurred.
- Like speed, the unit of average speed is typically meters per second (m/s).

  1. Accounts for Variability: Average speed takes into account any variations in an object's speed during its motion. In real-world scenarios, objects often do not move at a constant speed but may accelerate, decelerate, or change direction. Average speed considers all these changes.
  2. Overall Performance: Average speed provides a single value that summarizes the entire journey's speed, making it easier to compare the overall performance of different objects or analyze the efficiency of a journey.
  3. Simplicity: Average speed simplifies complex motion patterns. It is especially useful when analyzing motion over extended periods, where it's not practical to track an object's speed at every instant.
  4. Planning and Decision-Making: Average speed is crucial for practical purposes like navigation, transportation, and logistics. It helps in planning routes, estimating travel times, and making decisions about efficient resource utilization.
  5. Realistic Representation: Instantaneous speed may not represent the true speed of an object during a journey. By calculating average speed, we get a more realistic representation of how quickly the object covered the entire distance.
  6. Safety: In contexts like traffic safety or sports, average speed may be more relevant for assessing risks and determining safe speeds. It reflects the overall behavior of an object or vehicle.

Think about it:

i. To calculate the speed of the train, you would use the formula: Speed = Distance / Time. Given that it covers 120 m in 2 s, the speed would be 120 m / 2 s = 60 m/s.

To calculate the time taken to cover 240 m, you would rearrange the formula: Time = Distance / Speed, which gives Time = 240 m / 60 m/s = 4 s.

ii. To find the total distance of Ahmed's journey, we can use the formula:

Total Distance = (Speed1 × Time1) + (Speed2 × Time2)

In this case, for the first part of the journey:

$Speed_1$ = 65 km/h

$Time_1$ = 2 hours

And for the second part of the journey:

$Speed_2$ = 78 km/h

$Time_2$ = Total Time - Time1 = 5 hours - 2 hours = 3 hours

Now, we can calculate the distances for each part:

$Distance_1$ = (65 km/h) × (2 hours) = 130 km

$Distance_2$ = (78 km/h) × (3 hours) = 234 km

Finally, add the distances together to find the total distance of the journey:

Total Distance = Distance1 + Distance2 = 130 km + 234 km = 364 km

So, the total distance of Ahmed's journey was 364 kilometers.

iii. To predict how long the trip will take, you can use the formula:

Time = Distance / Speed

In this case, Daniyal's distance is 45 kilometers, and his average speed is 20 km/h.

Time = 45 km / 20 km/h

Time = 2.25 hours

Now, convert hours to minutes (since there are 60 minutes in an hour):

2.25 hours × 60 minutes/hour = 135 minutes

So, it will take Daniyal approximately 135 minutes to ride his bike to the nearby beach.

iv. On Earth, a mass of 60 kg would weigh 60 kg × 10 N/kg = 600 N.

On the other planet, with half the gravitational force of Earth, the weight would be 600 N / 2 = 300 N.

v. If there were no frictional force, objects would not experience resistance to motion. This would result in objects continuing to move with constant velocity once a force is applied, and it would be difficult to stop or control their motion. Everyday activities like walking, driving, and using brakes would be very challenging without friction.

CHAPTER 09

Waves and Energy

Student Book Pages 10–21

Learning outcomes

- Define a wave.
- Compare the types of waves (mechanical and electromagnetic) with daily life examples.
- Distinguish between Longitudinal and Transverse waves.
- Identify: (1) water wave and Sound wave as mechanical wave; (2) light wave as electromagnetic wave.
- Define the terms: Wavelength, frequency, and time period of wave.
- Define and relate:
  - Pitch and frequency.
  - Amplitude and frequency.
- Explain the factors affecting pitch and loudness of sound.
- Compare and interpret waveforms in terms of pitch and loudness.
- Construct the inverse relation between time period and frequency
- Relate common phenomenon (e.g., echo, hearing thunder after seeing lightning) to the properties of sound.

Overview of the Unit

- A wave transmits energy in the form of signals from one point to another, but no material object travels with it. The frequency of a wave is calculated by incorporating a time factor into the equation.
- We rely entirely on waves for all of our wireless communications.
- A wave is a transfer of energy in the form of vibration through a medium such as space or mass.
- Different waves include sea waves or tides, sounds, photons of light travelling, and even the movement of small plants blown by the wind.
- The characteristics of waves vary with its types. There are two types of waves based on orientation of particle motion and direction of energy:
- Mechanical waves
- Electromagnetic waves

Keywords

longitudinal, transverse, mechanical, electromagnetic, echo, wavelength, vibrate, vibration, amplitude, wave forms, vacuum, frequency, low frequency, high frequency, medium, crests and troughs, mean/rest position, displacement, high pitch, low pitch, loudness, loud sound, soft sound

Lesson Plan 1	**Student Book pages**	**Time**	**Workbook pages**
Types of Mechanical Waves	112-113	45 Minutes	59

Learning Objective:

- Define a wave.
- Differentiate longitudinal and transverse waves.
- Identify water wave and Sound wave as mechanical wave

Keywords

Waves transverse waves longitudinal waves

Resources:

- Set of images showing different types of waves
- Pen and paper

Useful Link

https://youtu.be/WZc0ws5bd80

Engage: (5 min)

Brainstorming:

- Ask students:

  Why would an engineer need to know about waves?
- Students will give different answers.
- **Explanation:** Because sound and light travel in waves, engineers can use what they know about them to create radios, televisions, light bulbs, and even reading glasses. Engineers apply what they've learned about waves to help people in a variety of ways.

Explain: (10 min)

- A mechanical wave is an oscillation of matter that is responsible for energy transfer through a medium.
- The transmission medium sets a limit on how far a wave can travel. In this, the oscillating material revolves around a fixed point with little displacement.
- One intriguing property of mechanical waves is how they are measured, which is given by displacement divided by wavelength. Harmonic effects are produced when this dimensionless factor is 1, and when it is greater than 1, turbulence is produced, such as when waves break on a beach.
- Mechanical waves are classified into two types:
- Longitudinal waves - The movement of the particles in this type of wave is parallel to the motion of the energy, i.e. the displacement of the medium is in the same direction as the wave. Sound Waves and Pressure Waves are two examples.
- Transverse waves occur when the movement of the particles is at right angles or perpendicular to the motion of the energy. For example: light.

Explore: (15 min)

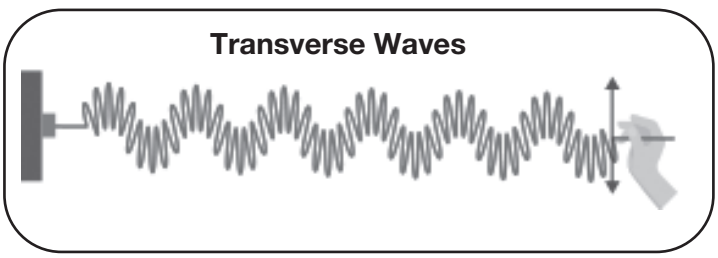
Stem Activity:

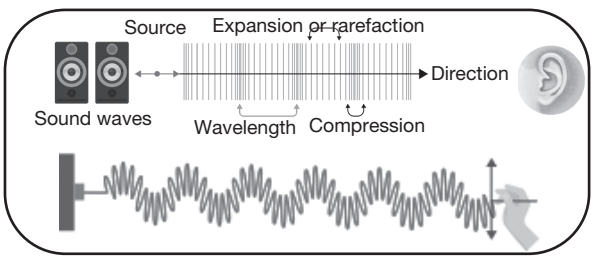
- Ask students to form a circle with the students' right shoulders pointing towards the center.
- Ask students to create a transverse wave using this ring of students. A student should raise her arms and then lower them, and then the student behind her raises and lowers her arms, and so on around the circle
- Once the students have a grip on it, ask them what caused the disturbance in the wave.
- Inquire whether the disturbance moves up and down the circle or horizontally.
- Inquire whether the wave moved horizontally around them.
- Thus the definition of transverse wave is complete.
- Still standing in the same position as in Demo #1, ask the students to describe which direction the disturbance would travel in the ring if they wanted to make a longitudinal wave.
- The students should state that the disturbance must follow the same path as the wave and go around the ring.
- Instruct students on how to create a longitudinal wave.

- To make a longitudinal wave one student gently pushes the back of the student in front of her, and then the pushed student gently pushes the student in front of her, and so on, creating a longitudinal wave that travels around the ring.
- Ask: What is the source of the disturbance, students?
- Is the disturbance moving up and down the ring or around it?
- In which direction does the wave move?
- This disturbance is a longitudinal wave because it travels in the same direction as the wave.

Elaborate: (5 min)

Display images of different types of waves to students and have them identify longitudinal and transverse waves





Evaluate: (5 min)

Complete Q9 on page 59 in workbook.

Home Assignment:

Give worksheet 1 to solve at home

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Electromagnetic Waves	114	45 Minutes	-

Objectives:

- Identify: light wave as electromagnetic wave.
- Compare the types of waves (mechanical and electromagnetic) with daily life examples.

Keywords

Electric field
Magnetic field
Source
Disturbance

Resources:

- Flashlight or laser pointer (for demonstrating light)
- Slinky or a coil spring (for demonstrating mechanical waves)
- Various objects that emit or reflect light (e.g., flashlight, mirror, prism)
- Whiteboard or chalkboard and markers/chalk
- Diagrams or illustrations of electromagnetic waves
- Pen/pencil and paper for writing and note-taking

Useful Link

https://youtu.be/btNvr8KAQyM

Engage: (5 min)

- Begin the lesson by displaying a variety of objects that emit or reflect light (for example, a torch, a mirror, or a prism).
- Ask them questions like:

  What do you notice about these objects?

  Have you ever thought about how light travels?

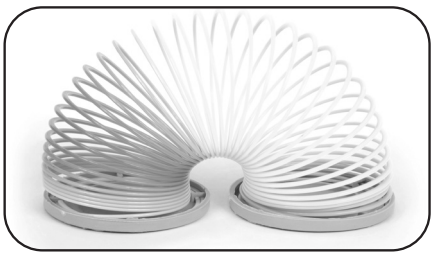
  Do you believe light resembles other types of waves?

Explain: (10 min)

- Explain electromagnetic waves and how light fits into this category in a few sentences. Discuss the properties of electromagnetic waves (for example, they don't need a medium to travel through and can travel through a vacuum).
- Describe the key distinctions between mechanical and electromagnetic waves.

Explore: (15 min)

Engage students in a hands-on STEM activity. Provide materials such as slinkies (for mechanical waves) and flashlights (for light waves). Students should demonstrate and compare the differences between these waves. Encourage them to connect the hands-on activity to the concepts being taught.



Slinkies

Elaborate: (10 min)

- Engage students in a discussion about the practical applications of light waves in their daily lives.
- Discuss examples such as fibre optic communication, microwave cooking, and the role of visible light in photography.
- Encourage students to consider how these applications rely on the distinct properties of light waves.

Evaluate: (5 min)

- Ask students how do light waves' properties make them suitable for various applications?
- Complete Q9 in workbook.

Home Assignment:

Find an object in your home that exhibits a mechanical wave (for example, a vibrating phone). "Explain how this wave differs from an electromagnetic wave, such as light."

Lesson Plan 3	Student Book pages	Time	Workbook pages
Sound waves and properties of waves	115-116	45 Minutes	-

Objective:

- Define the terms: Wavelength, frequency, and time period of wave.
- Define and relate:
  1. Pitch and frequency.
  2. Amplitude and frequency.

Keywords

Waves
Amplitude
Frequency

Resources:

- audio clips or musical tones
- sound-editing software or musical instruments
- white board and marker
- pen and paper

Useful Link

https://youtu.be/9VSHa1mKcTw

Engage: (5 mins)

- Start the lesson by playing various audio clips or musical tones with varying pitches and levels of loudness.
- Instruct the students to discuss and describe their observations of the sounds they hear.
- In order to facilitate a class discussion, ask questions such as:
  - How would you characterize the differences in the sounds?
  - What do you think determines a sound's pitch and loudness?
  - Can you think of any examples where pitch and volume are important?

Explain: (10 mins)

- Explain that pitch refers to a sound's perceived highness or lowness, whereas loudness refers to a sound's perceived volume or intensity.
- Discuss the relationship between pitch and loudness and wave properties such as frequency and amplitude.
- Introduce frequency and amplitude as physical properties that determine pitch and loudness, respectively.
- Give students examples and visual representations to help them understand the connection between waveforms, pitch, and loudness.

Explore: (15 mins)

- Divide the class into small groups and give each group a set of waveforms or sound clips with varying properties.
- Instruct the groups to listen to the sounds and analyze the waveforms to identify pitch and loudness patterns.
- Ask students to record their observations and then compare and interpret the waveforms in terms of pitch and loudness in small groups.
- Facilitate a class discussion in which groups share their findings and discuss how different waveforms correspond to different pitches and levels of loudness.

Elaborate: (10 mins)

Allow students to create their own sound compositions or waveforms. They accomplish this by varying the pitch (frequency) and loudness (volume) of the sounds they generate. They can convey specific emotions or messages in their compositions by making these changes. They can, for example, produce high-pitched and loud sounds to convey excitement or low-pitched and soft sounds to convey calmness. Students can accomplish this by utilizing various sound-editing software or musical instruments that allow them to manipulate these parameters in order to achieve the desired emotional or communicative effects.

Evaluate: (5 mins)

- Provide students with real-life examples, such as recordings of various musical instruments or environmental sounds and ask them to identify the differences in pitch and loudness.
- Complete Q3 page 122 of student book.

Home Assignment:

- Provide worksheet 2 to solve at home.
- Complete Q8 on page 58 of workbook.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Inverse Relation Between Time Period and Frequency	142	45 Minutes	-

Objective:

Construct the inverse relation between time period and frequency

Keywords

Time period | Frequency | Inverse

Engage: (5 mins)

- Begin by asking students if they understand the concepts of time period and frequency.
- Show them a simple pendulum or any other oscillating object and ask them to watch it move.
- Pose questions to the students, such as:
  - What do you notice about the pendulum's motion?
  - Do you believe there is a link between the time it takes the pendulum to complete one cycle and the number of cycles it completes in a given period of time?
  - How do you think the pendulum's time period and frequency are related?

Useful Link

https://youtu.be/zIEygRS0dAk

Explain: (10 mins)

- Explain that time period is the amount of time it takes an oscillating object to complete one full cycle of motion, whereas frequency is the number of cycles the object completes in a given time.
- Introduce the formula: frequency = one divided by the time period.
- Discuss how frequency and time period are inversely related, with one increasing while the other decreases.
- To help students understand the concept of the inverse relationship between time period and frequency, use examples and visual representations.

Explore: (15 mins)

- Distribute simple pendulums or other oscillating objects to the students in pairs or small groups.
- Instruct the students to use a stopwatch or other appropriate timing device to measure the time period of their pendulum's motion.
- Instruct students to calculate the frequency of their pendulum using the formula: frequency = 1 / time period

- Encourage the groups to discuss the relationship between time period and frequency by having them share their measurements and calculations.

Elaborate: (10 mins)

- Discuss the time period and frequency of various oscillating objects or systems, such as a tuning fork or a vibrating string.
- Involve students in a hands-on activity in which they can change the length of a pendulum or the tension in a vibrating string to see how it affects the time period and frequency.
- Encourage students to keep a journal of their observations and to talk about how the time period and frequency change as they change the parameters.

Evaluate: (5 mins)

Assign a set of problems to students in which they have to determine the frequency given the time period or vice versa.

For Example:

1. Calculate the frequency of a pendulum with a time period of 2 seconds.

Solution:

Using the formula frequency = 1 / time period,

we have frequency = 1 / 2 = 0.5 Hz.

2. Determine the time period of a tuning fork that vibrates at a frequency of 440 Hz.

Solution:

- Using the formula time period = 1 / frequency,
- we have time period = 1 / 440 = 0.0023 seconds.

Lesson Plan 5	**Student Book pages**	**Time**	**Workbook pages**
Sound waves and properties of waves	115-116	45 Minutes	-

Objective:

- Explain the factors affecting pitch and loudness of sound.
- Compare and interpret waveforms in terms of pitch and loudness.
- Relate common phenomenon (e.g., echo, hearing thunder after seeing lightning) to the properties of sound.

Keywords

Pitch Loudness

Resources

- yarn or string
- a ball
- a spoon
- two paper cups
- 1 long piece of string/yarn
- two paperclips

Useful Link

https://youtu.be/2mlBh5d1IUY

Engage: (5 min)

Warm-up Activity

- Call one student to come and throw a ball.
- The student who is called by the teacher will throw the ball.

Explanation:

- Sound waves are similar to balls in that they bounce back and forth. Sound waves are vibrations of energy that resemble waves. The waves are constructed from microscopic building blocks known as molecules.
- To get to another location, sound waves bounce back and forth through solids, liquids, and gases. That is how you can hear sounds close to you, outside, or underwater. You may have experienced the vibrating energy of sound waves while standing near a large marching band at a parade or a football game. The instruments produce sound vibrations that are so powerful that you can feel them in your chest.
- All students will participate in the activity by asking questions about sound waves.

Explain: (10 min)

- The amplitude of the sound wave affects the phenomenon of sound. The sound is said to be loud if the amplitude of the sound wave is large.
- It is proportional to the square of the vibration amplitude. If the amplitude of the sound wave doubles, the loudness of the sound quadruples.
- It is measured in decibels (dB).
- Human ears perceive sounds above 80 decibels as noise.
- Ask students to read pages 116-119.

Explore: (10 min)

Stem Activity

- Ask students where sound waves come from.
- Answer: Vibration

Explanation:

- The vibrations generate sound waves, which travel through mediums like air and water before reaching our ears.
- Not only can sound waves travel through air and water, but they can also travel through wood, earth, and many other substances, including the string we will be using in our experiment. sound cannot travel through a vacuum.

Experiment:

Students will:

- Make a loop in the yarn or string and insert the handle of the spoon.
- Pull tightly so that the spoon hangs in the center of the string and you have about two feet on each side of the spoon. Wrap each string once or twice around your pointer finger on each hand and push the string against the opening of each ear. Do not insert the string into the ear, just press to the opening as if you were plucking your ears.
- Allow the spoon to hang just below your waistline after placing both ends of the string near your ears for this first test.

- It is not necessary to use the ends of each piece of string. It's fine to hold it anywhere along the length of each side. You can also experiment with adjusting the height of the spoon to see if it changes the sound with the string pressed against your ear opening.
- Request that another student gently tap the ruler on the round part of the spoon.
- It is not necessary to strike it hard.
- Students can experiment with various spoon sizes and even forks.
- They can also experiment with different types of strings to get a different sound.

Explain:

When the ruler strikes the spoon, it causes vibrations that produce sound waves. Instead of just spreading out into the air around you, these sound waves travel up the yarn and into the ear.

Elaborate: (10 min)

Students will make a simple string phone.

What do we need.

- two paper cups
- 1 long piece of string/yarn
- two paperclips

What to do.

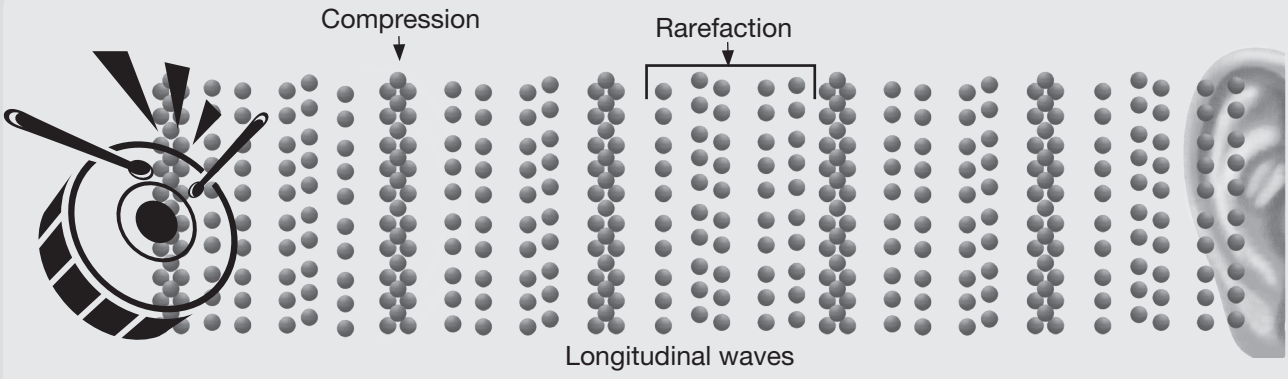
- On the bottom of each paper cup, make a small slit.
- Tie a knot in one end of the paper clip with the string.
- Rep #2 with the opposite end of the string.
- Insert the paper clips into the small holes in the paper cups' bottoms.
- Pull the paper clips and string through by grasping the other ends of the paper clips.
- Allow the students to take each paper cup and walk away from one another until the string is taut.
- Allow one student to hold the paper cup to his or her ear while the other speaks softly into his or her paper cup.

Evaluate: (5 min)

Ask students to complete Q4 and 5 on page 123 of student book.

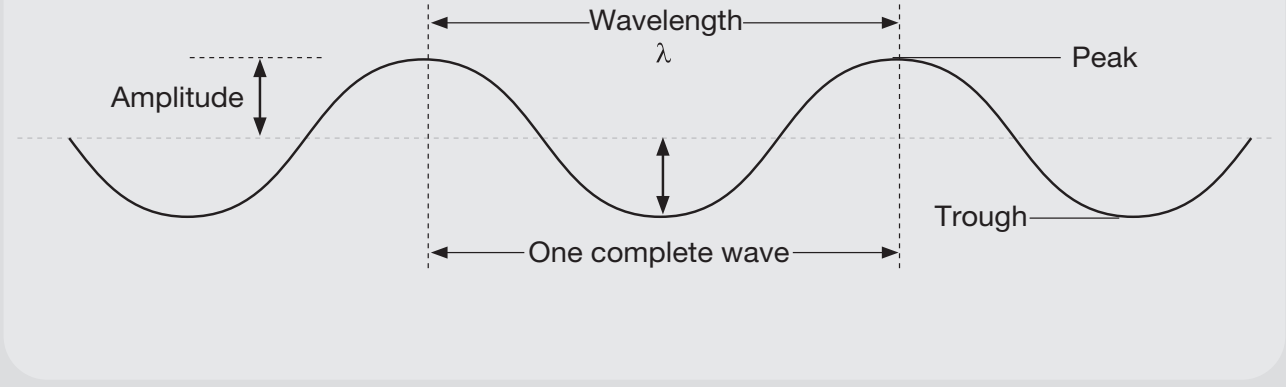
Worksheet 1:

1. Identify and define the waves.



Name:

Definition:



Name:

Definition:

2. Write two differences between Longitudinal and Transverse waves.

1.

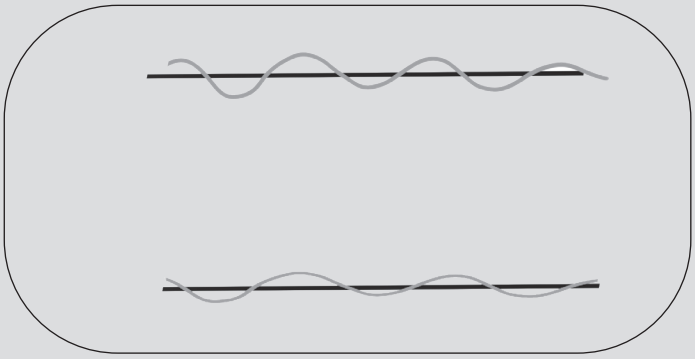
2.

Worksheet 2:

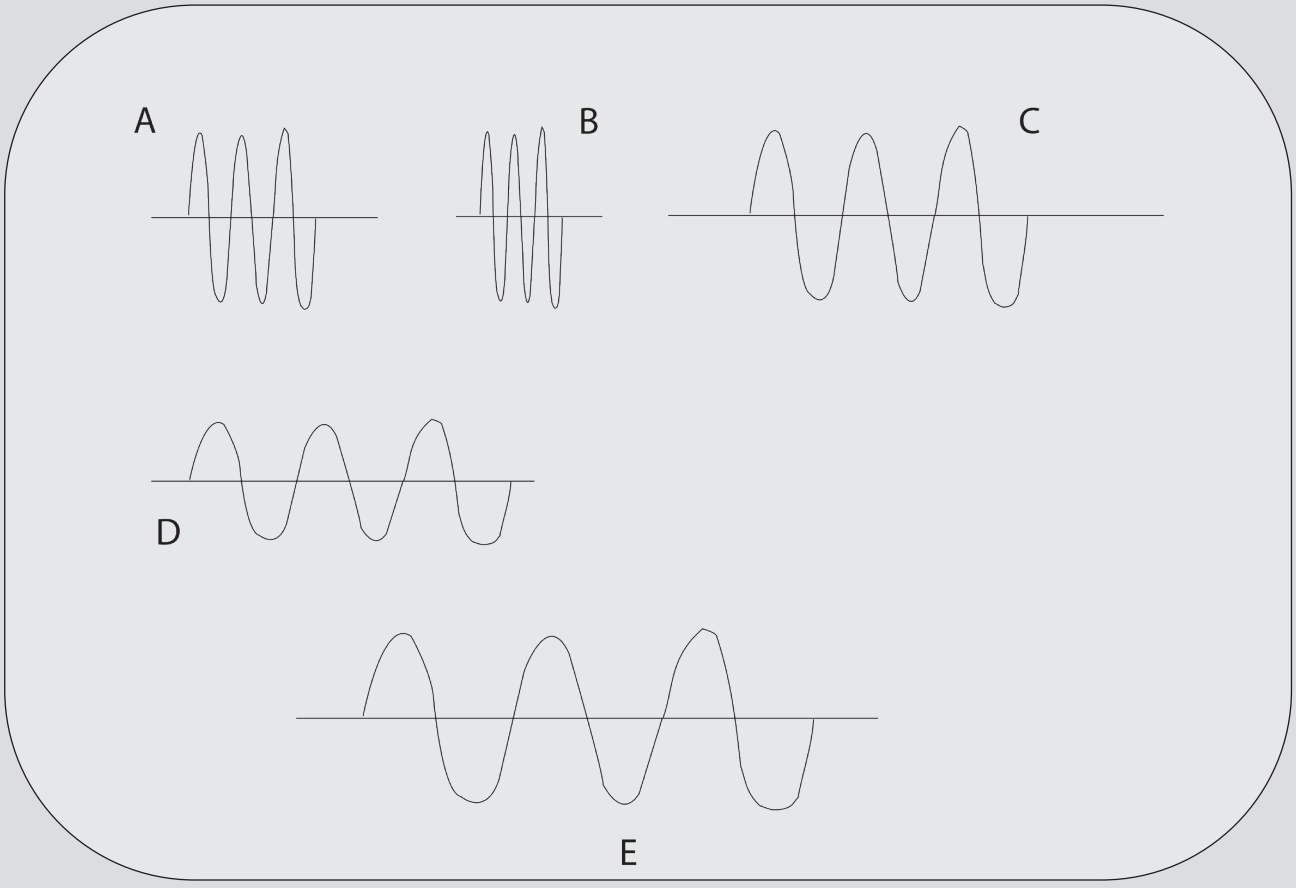
1. Identify the sound wave for a quiet and loud sound.

a. _____

b. _____



2. Answer the following questions by looking at the given sound waves.



a. Which of the waves has the highest frequency? _____

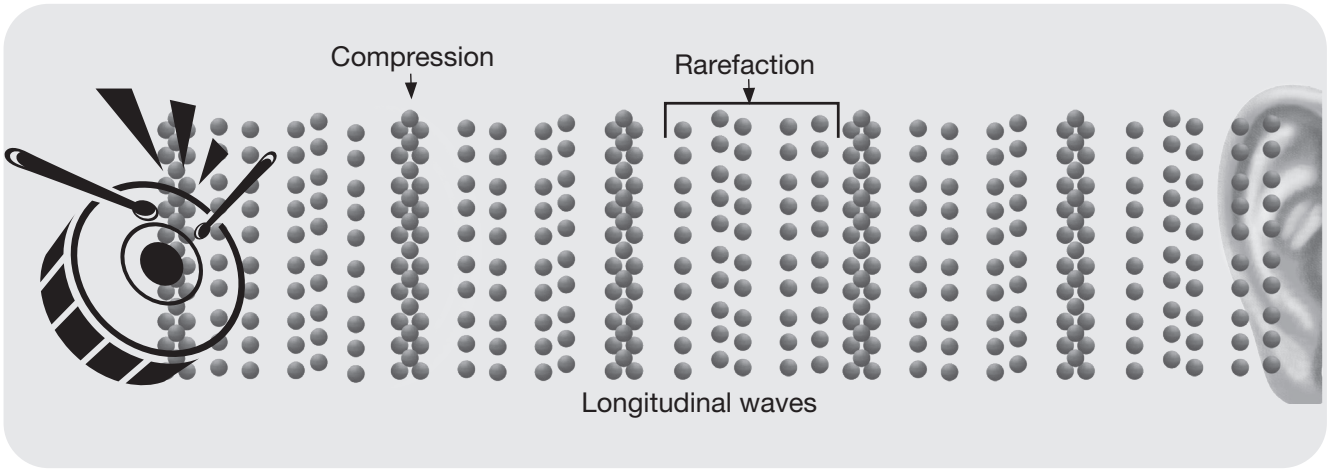
b. Which of the waves has the shortest wavelength? _____

c. Which wave has the largest amplitude? _____

d. Which wave has the lowest pitch? _____

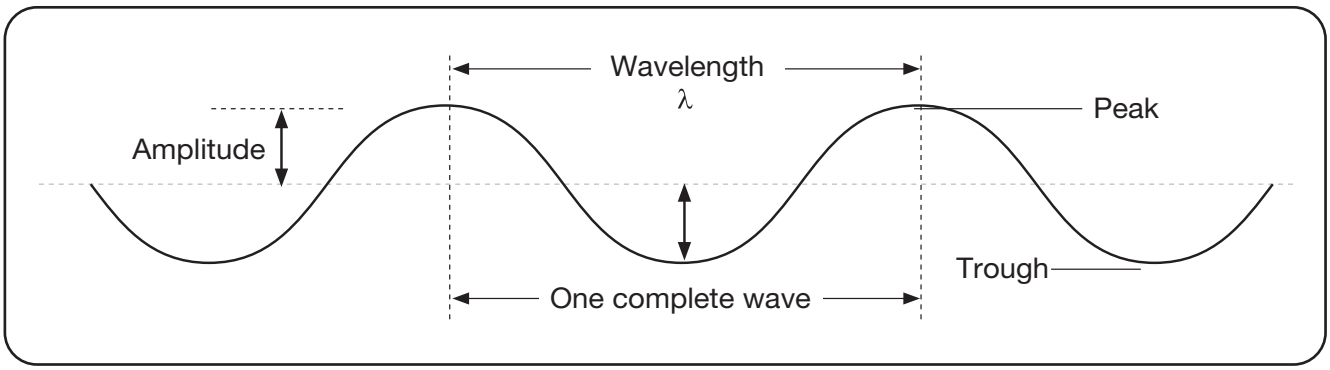
Answers for Worksheet 1:

1. Identify and define the waves.



Name: Longitudinal waves.

Definition: Longitudinal waves are those in which the displacement of the medium is in the same direction as the travelling wave.



Name: Transverse waves.

Definition: A transverse wave is one in which particles move perpendicular to the wave's propagation direction.

2. Write two differences between Longitudinal and Transverse waves.

1. Longitudinal waves cannot be polarized whereas transverse waves can be polarized.

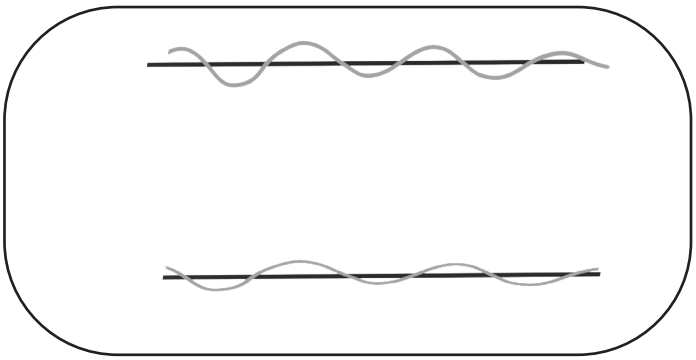
2. Longitudinal waves are possible in all mediums and transverse waves are possible only in solids.

Answers for Worksheet 2:

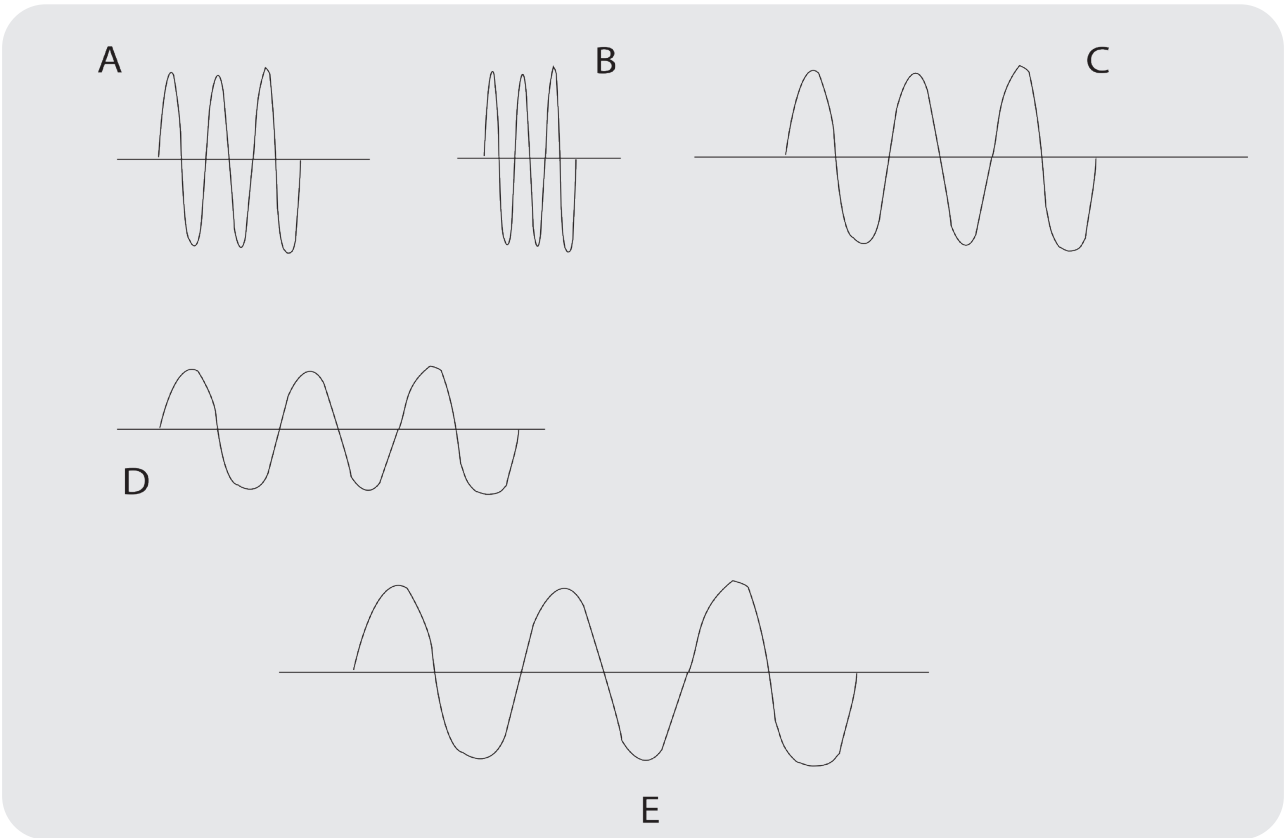
1. dentify the sound wave for a quiet and loud sound.

a. _____

b _____



2. Answer the following questions by looking at the given sound waves.



a. Which of the waves has the highest frequency?
b. Which of the waves has the shortest wavelength?
c. Which wave has the largest amplitude?
d. Which has the shortest amplitude?

Exercise Answers

1. **i.** **c)** perpendicular to the direction of the sound wave
ii. **a)** low pitched
iii. **d)** loud
iv. **c)** Hertz
v. **a)** has too high a frequency
vi. **b)** water

2. **i.** vibration
ii. closer together
iii. farther apart, in steel
iv. less
v. energy
vi. frequency
vii. loud

4. **i.** A wave is a disturbance that travels through a medium, carrying energy from one place to another.
ii. Both sound and light are forms of energy that travel in waves.
iii. Amplitude: The maximum displacement or distance moved by a point on a vibrating body or wave measured from its equilibrium or central position.
Frequency: The number of cycles of a periodic wave that occur in a unit of time, typically measured in Hertz (Hz).
Wavelength: The distance between successive crests, troughs, or identical parts of a wave.
Pitch: The perceived frequency of sound. High pitch corresponds to a high frequency, and low pitch corresponds to a low frequency.
Loudness: The subjective perception of the intensity or amplitude of sound.
iv. Longitudinal waves have vibrations parallel to the direction of the wave, while transverse waves have vibrations perpendicular to the direction of the wave.
v. Compressions are regions of high pressure and density in a longitudinal wave, while rarefactions are regions of low pressure and density.
vi. Sound travels fastest in solids because the particles in solids are closely packed, allowing sound waves to propagate quickly.
vii. Frequency and pitch are related; higher frequency corresponds to higher pitch.
Loudness and amplitude are related; greater amplitude corresponds to greater loudness.
viii. An echo is a sound wave reflection off a surface that produces a distinct repeated sound.
ix. Thick fabric on walls in a movie theatre absorbs sound, reducing echoes and improving sound quality.
x. Regions of high pressure are called compressions, and regions of low pressure are called rarefactions.
xi. Frequency of sound is the number of oscillations per unit of time and is typically measured in Hertz (Hz).
xii. Audible frequency refers to the range of frequencies that can be heard by the human ear.

xiii. The amplitude of a sound wave is the maximum displacement or distance moved by a point on a vibrating body or wave measured from its equilibrium or central position.

5. i. Sounds are made by the vibration of objects. When an object vibrates, it creates pressure waves in the surrounding medium (usually air). These pressure waves travel as sound waves, carrying the vibrations from the source to our ears.

ii. Ultrasound is sound with a frequency higher than the upper limit of human hearing. We cannot hear it because our ears are not sensitive to such high frequencies.

Ultrasound has several uses, including medical imaging (ultrasound scans), cleaning delicate items (ultrasonic cleaners), and measuring distances (ultrasonic sensors).

iii. Echolocation is a biological sonar system used by some animals, such as bats and dolphins, to navigate and locate objects. It involves emitting high-frequency sound waves and listening to the echoes produced when the sound waves bounce off objects. By measuring the time it takes for the echoes to return, these animals can determine the distance and location of objects in their environment.

iv. Types of musical instruments can be categorized as follows:

String Instruments: Produce sound through the vibration of strings, e.g., guitar, violin.

Wind Instruments: Produce sound by blowing air through a tube or over an edge, e.g., flute, trumpet.

Percussion Instruments: Produce sound by striking or shaking, e.g., drums, xylophone.

Keyboard Instruments: Produce sound by striking strings or other materials with keys, e.g., piano, organ.

v. Astronauts cannot talk to each other in space because there is no air to transmit sound waves. However, they can see each other because light does not require a medium (such as air) to propagate.

vi. Amplitude affects the volume or loudness of sounds. Greater amplitude corresponds to a louder sound.

vii. The speed of light is faster than sound because light travels at approximately 299,792,458 meters per second (m/s), while sound in air typically travels at around 343 meters per second (m/s).

6. i. a) A high-pitched sound with a low volume would have a waveform with closely spaced crests and troughs, indicating a high frequency but small amplitude.

b) A low-pitched sound with a loud volume would have a waveform with widely spaced crests and troughs, indicating a low frequency but large amplitude.

ii. Tightening the strings on a guitar increases their tension and raises the pitch of the sound produced.

iii. Theatres and cinemas have thick curtains along the walls to absorb sound and reduce echoes, improving the acoustics of the space and enhancing the quality of sound for the audience.

CHAPTER 10

Heat and Temperature

Student Book Pages 125-137

Learning outcomes

- Describe the expansion of the three states of matter on heating, and contraction on cooling, in terms of particles.
- Predict the effects of heat gain and heat loss.
- Compare all three scales of temperature (including interconversion of temperature scales).
- Define the terms heat and temperature on the basis of Kinetic Molecular Theory.
- Explain why metals are good thermal conductors and fluids are poor conductors of heat using the particle model.
- Construct the concept of heat conduction, convection and radiation by applying particle theory including daily life examples.
- Identify the effects of thermal expansion and contraction with their applications in daily life.
- State and explain the practical methods of thermal insulation used for constructing buildings.

OVERVIEW OF THE UNIT:

- Heat and temperature are related, but they do not mean the same thing. Knowing the difference between heat and temperature can help us gain a better understanding of our surroundings.
- Temperature refers to the measurement of the average energy of the motions of the molecules in a substance, whereas heat refers to the total energy of the motion of the molecules of a substance.
- Heat is affected by factors such as particle speed, particle size, and particle number, among others. The temperature, on the other hand, is unaffected by these variables.
- Temperature is a measurement that relates to the energy possessed by a substance's molecules, which is directly related to the kinetic energy held by the substance's particles.
- Kelvin is the SI unit of temperature. As previously stated, temperature is directly related to kinetic energy of molecules; thus, doubling the temperature (Kelvin) of a substance doubles the average kinetic energy held by those molecules.

Keywords

conduction, convection, radiation, kinetic energy, convection current, thermometer, expansion, contraction, thermal, insulator, conductor, temperature, heat gain, heat loss, poor absorber

Lesson Plan 1	Student Book pages	Time	Workbook pages
Heat and Temperature	125	45 Minutes	65

Objective:

- Predict the effects of heat gain and heat loss.

Keywords

Heat Temperature Average energy

Resources:

- two identical cups of water
- A heat lamp
- Cardboard• aluminium foil
- fabric and foam

Engage: (5 mins)

- Begin the lesson by having students consider everyday situations in which they experience heat gain or loss. Sitting in the sun, drinking a hot beverage, or wearing warm clothing are all examples.

Useful Link

https://youtu.be/Enf0-zWgmWo

- Initiate a discussion by asking questions such as,
  - What happens to your body when you sit in the sun for a long time?
  - Why do we dress warmly in the winter?
  - What happens when heat transfers from a hot beverage to your hands?

Explain: (10 mins)

- Explain that heat gain and heat loss are processes that involve the transfer of thermal energy between objects or systems.
- Heat gain is defined as the transfer of thermal energy from one object or system to another, resulting in an increase in temperature.
- Heat loss is defined as the transfer of thermal energy from an object or system to its surroundings, which results in a decrease in temperature.
- Discuss various heat transfer mechanisms such as conduction, convection, and radiation.

Explore: (15 mins)

- Experiment with heat gain and heat loss in a series of hands-on experiments.
- As an example:
  - Place two identical cups of water in separate locations, one warm and one cool. Observe and record temperature changes over time.
  - Discuss the ability of various materials to conduct heat, such as metal, fabric, and plastic.
  - To simulate heat gain on an object, use a heat lamp and measure the temperature increase.
- During these experiments, encourage students to make predictions, observe, and record their findings.

Elaborate: (10 mins)

- Introduce real-world scenarios in which understanding heat gain and heat loss is critical, such as home insulation, energy-saving appliances, or thermal regulation in living organisms.
- Engage students in a design challenge in which they have to create an insulating material to prevent heat gain in a cold beverage or minimise heat loss from a cup of hot water.
- Encourage students to design and test their insulating solutions using materials such as cardboard, aluminium foil, fabric, and foam.
- Discuss the effectiveness of various designs and have students explain how the principles of heat gain and heat loss influenced their decisions.

Evaluate: (5 mins)

Instruct students to create a visual representation, such as a diagram or infographic, illustrating examples of heat gain and heat loss in various settings.

Home Assignment:

- Choose three scenarios or objects (for example, a melting ice cube, a warm room, or a cooling beverage) in which heat gain or heat loss is a factor.
- Make predictions about how each scenario or object will be affected by heat gain or heat loss. Consider temperature, comfort, and any physical or chemical changes that may occur.
- Investigate and explain the scientific principles of heat transfer (conduction, convection, and radiation) as they apply to your scenario.
- To illustrate your predictions, create simple visual aids (diagrams, charts).

Lesson Plan 2	Student Book pages	Time	Workbook pages
Scales of Temperature	126-127	45 Minutes	70

Objective:

- Compare all three scales of temperature (including interconversion of temperature scales).

Keywords

Celsius Fahrenheit Kelvin

Resources:

- Three Thermometers for each group.
- water samples ranging in temperature from cold to hot

Useful Link

https://youtu.be/CHn_lLbnm8c

Engage: (5 mins)

- Begin by asking students to share their knowledge of temperature scales. Initiate a conversation about common temperature scales like Celsius, Fahrenheit, and Kelvin.
- Show a thermometer to students and ask them to identify the temperature scale. Discuss the function and significance of temperature measurement in everyday life and in scientific contexts.

Explain: (10 mins)

- Describe the three primary temperature scales: Celsius, Fahrenheit, and Kelvin.
- Give a brief overview of each scale, including its origins, key reference points, and common applications.
- Discuss the formulas for converting between the Celsius, Fahrenheit, and Kelvin scales.
- Explain the concept of absolute zero, which is the coldest temperature on the Kelvin scale.

Explore: (15 mins)

- Divide students into small groups and distribute three thermometers calibrated in Celsius, Fahrenheit, and Kelvin scales to each group.
- Prepare a series of water samples ranging in temperature from cold to hot. Ice-cold water, room temperature water, and warm water from a kettle or hot tap all are acceptable.
- Instruct each group to use all three thermometers to simultaneously measure the temperature of the water samples. Encourage them to keep a table or a chart with the readings from each thermometer.
- After gathering the data, divide it into groups and have them analyze the results. Ask them to look for patterns or differences in the temperature readings obtained from each scale.
- Organize a class discussion in which each group shares its findings and observations. Assist

students in identifying any similarities or differences in temperature readings on different scales.

- Encourage students to discuss the benefits and drawbacks of each temperature scale based on their experiment. Encourage them to consider the precision, ease of use, and applicability of each scale in various contexts.
- Finish the activity by summarizing the main points covered and emphasizing the significance of understanding temperature scales and measurements in various fields.

Elaborate: (10 mins)

Involve students in a group project in which they investigate and present real-world examples and applications of each temperature scale.

Evaluate: (5 mins)

Attempt Q2 on page 136 of student book.

Home Assignment:

Attempt Q7 on page 70 of workbook.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Heat on the Move	127	45 Minutes	-

Objective:

- Describe the expansion of the three states of matter on heating, and contraction on cooling, in terms of particles.
- Define the terms heat and temperature on the basis of Kinetic Molecular Theory.

Keywords

Thermal energy | Expansion | Particles

Resources:

- Containers with lids
- Balloons
- Ice cubes
- Heat source (e.g., lamp, hot water)
- Measuring instruments (e.g., thermometer)

Useful Link

https://youtu.be/IcCeb7Eimws

Engage: (5 min)

- Begin the lesson by demonstrating a series of simple demonstrations to the students.
- Show a closed container with a balloon inside, then heat the container (for example, with a lamp). Instruct students to predict what will happen to the balloon as it warms up.
- Display an ice cube and a glass of water. As the ice cube warms, ask students to predict what will happen to it.
- Share a video or run a virtual experiment demonstrating how gases expand when heated. Instruct students to observe and discuss their findings.

Explain: (10 min)

Explain the Kinetic Molecular Theory in detail, emphasizing how it describes the behaviour of particles in different states of matter. Define the terms "heat" and "temperature" in this theory's context. Distinguish between heat and temperature as the transfer of thermal energy between objects.

Explore: (15 min)

- Engage students in a hands-on STEM activity that investigates matter expansion and contraction.
- Provide materials such as a lidded container, a balloon, ice cubes, and a heat source.
- Students should conduct experiments to see how matter (air in the balloon, ice cubes, etc.) expands when heated and contracts when cooled. Encourage them to keep track of their observations and measurements.

Elaborate: (10 min)

Lead a discussion with students about the real-world applications of matter expansion and contraction. Discuss how these concepts apply to various engineering and construction projects, such as the construction of bridges, roads, and buildings. Investigate how temperature control is important in industries such as food preservation and automotive engineering.

Evaluate: (5 min)

Complete Discuss and Answer on page 127 of student book.

Home Assignment:

- Select a common household object (for example, a metal spoon, a plastic bottle, or a rubber band) and investigate how it reacts when heated and cooled. Describe your findings using Kinetic Molecular Theory and explain why these changes occur.
- Complete Concept Check page 128 of student book.

Lesson Plan 4	Student Book pages	Time	Workbook pages
Conductors	156-158	45 Minutes	-

Objective:

- Explain why metals are good thermal conductors and fluids are poor conductors of heat using the particle model.

Engage: (5 min)

Brainstorming

- Why did you feel hot in your hand when you touch the hot pan?
- Students will try to give the answer.
- Explain: Heat conduction is an important part of our lives, whether we realize it or not. You probably use it every day, whether you're cooking or using a radiator. Basic heat conduction is the transfer of heat from a heat source to an object.

Useful Link

https://youtu.be/Me60Ti0E_rY

Explain: (10 min)

- When heat conduction occurs, heat energy is typically transferred from one molecule to another that is in direct contact with each other. The position of the molecules, however, remains unchanged. They simply vibrate with one another.
- There is the movement of electrically charged particles in the medium during the conduction of electricity. As a result, electric current is typically carried and moved by ions or electrons.
- There aren't many conductive objects. When compared to a metal hanger, a stick has lower conductivity. It's because wood is a poor conductor of electricity. A metal object, on the other hand, is an excellent conductor.
- Conduction works primarily by rapidly shaking the molecule with heat. During this process, the entire molecule gradually passes the heat until it is all heated.
- Fluids and gases are less conductive. This is due to the large distance between the atoms in a gas. Conduction decreases as the number of collisions between atoms decreases. However, as the temperature rises, the conductivity may increase.

Explore: (15 min)

STEM Activity

Give each student a cooking pot, a stick of butter, and three different types of spoons.

Students will:

- Bring a pot of water to a boil.
- Immerse the spoons in water.
- Make three slices of butter and put one in each of the spoons.
- Check the butter after a few minutes.

Explanation:

The butter on the metal spoon has melted significantly, the butter on the wooden spoon has melted slightly, and the butter on the plastic spoon has melted barely at all. This is heat conduction in action.

Metal conducts heat more effectively than wood, which conducts heat more effectively than plastic.

Elaborate:(5 min)

Identification Exercise

Tell students different scenarios and ask them to identify whether it is conduction or not.

- People would use heaters to keep their homes warm during the winter.
- The boiling water inside the pot heats up a metal spoon.
- If you hold an ice cube in your hand for an extended period of time, it will quickly melt.
- Physical therapists primarily use heating pads to warm and relieve strained muscles.
- A lamp's light can be used to incubate chicken eggs.
- A microwave oven uses radiation to heat and cook food.
- The heater at its base allows hot air balloons to move up into the air.
- After several minutes, when a piece of hot lasagna is placed on a plate, the plate will feel warm.

Evaluate: (5 min)

Quiz

- Ask:
- What is conduction?
- What is meant by conductors?
- Give some examples of good conductors of heat.
- Students will take turns answering the questions.

Home Assignment:

Provide worksheet 1 to solve at home.

Lesson Plan 5	**Student Book pages**	**Time**	**Workbook pages**
Modes of Heat Transfer	128	45 Minutes	-

Objective:

Construct the concept of heat conduction, convection and radiation by applying particle theory including daily life examples.

Keywords

Conduction Convection Radiation

Resources:

- Metal rods
- Wax
- Heat source
- Containers
- Water
- Food coloring
- Heat lamps (optional)
- Visual aids and diagrams

Useful Link

https://youtu.be/Me60Ti0E_rY

Engage: (5 min)

Begin the lesson with a quick demonstration. In a cup of hot water, a glass of cold water, and a cup of room temperature water, place a metal spoon. In each case, have students predict what will happen to the spoon. Discuss their predictions and observations to introduce the concept of conduction heat transfer.

Explain: (10 min)

Based on particle theory, explain heat transfer methods (conduction, convection, and radiation). Define each method and explain its molecular operation. Use visual aids and diagrams to assist students in comprehending the concepts.

Explore: (15 min)

- Engage students in hands-on STEM activities:
- Conduction: Provide materials like metal rods and wax. Ask students to observe how heat moves through the rod, melting the wax at the other end, after heating one end of the rod.• Convection: Heat a container of water to demonstrate convection. Make convection currents visible by adding a few drops of food colouring. Explain how hot water rises and cold water sinks.
- Radiation: To demonstrate radiation, use heat lamps or the sun (if available). Explain how heat is transferred using electromagnetic waves.

Elaborate: (10 min)

- Divide students into small groups and assign each group a real-world scenario (for example, a pot on the stove or a car engine cooling system).
- Assign them the task of identifying and explaining the heat transfer methods at work in their scenarios. Groups can present their findings to the rest of the class.

Evaluate: (5 min)

Give worksheet 2 to solve. Complete Q9 on page 70 of workbook.

Home Assignment:

- In your daily life, observe and describe three different situations in which heat transfer methods (conduction, convection, or radiation) are at work. Create a brief report that explains how each method is used in these situations and how it affects the objects or processes involved."
- Complete Concept Check page 129 and 132.

Lesson Plan 6	**Student Book pages**	**Time**	**Workbook pages**
Thermal Expansion and Contraction	134	45 Minutes	67

Objective:

- Identify the effects of thermal expansion and contraction with their applications in daily life.

Keywords

thermal expansion contraction

Resources:

- Metal rod
- Candle
- Balloon
- Freezer
- Visual aids and diagrams

Useful Link

https://youtu.be/6pScZaNz7nY

Engage: (5 min)

Begin the lesson with a scenario that everyone can relate to. Show students a jar with a tight lid and ask if they've ever had trouble opening a previously easy-to-open jar. Discuss why this occurs, introducing the concept of temperature affecting the size and shape of objects.

Explain: (10 min)

Explain thermal expansion and contraction in detail. Explain how temperature changes cause materials to expand (grow larger) when heated and contract (grow smaller) when cooled. Consider railway tracks and bridges, which expand in hot weather and contract in cold weather.

Explore: (15 min)

- Engage students in STEM activities that are hands-on:
- Thermal Expansion: To demonstrate expansion, use a metal rod and a candle flame. Heat one end of the rod and watch the length change.
- Contraction: Cool a balloon in a freezer and then observe how it shrinks in size.
- Real-World Examples: Discuss everyday scenarios in which thermal expansion and contraction are relevant, such as the design of sidewalks with expansion joints or the operation of thermostats.

Elaborate: (10 min)

Assign each group a specific application of thermal expansion or contraction (e.g., bimetallic strips in thermostats, expansion joints in bridges). Request that they conduct research and present how these applications work and why they are important.

Evaluate: (5 min)

A group discussion is used to assess student understanding. Ask questions related to thermal expansion and contraction and request examples from daily life where these phenomena play a role.

Home Assignment:

Discover and describe two practical applications of thermal expansion and contraction in your home. Explain how these applications work and why they are important in everyday life. Complete Q4 on page 67 of workbook.

Lesson Plan 7	**Student Book pages**	**Time**	**Workbook pages**
Thermal Insulation	134-135	45 Minutes	-

Objective:

- State and explain the practical methods of thermal insulation used for constructing buildings.

Keywords

Insulation | Heat gain | Heat loss

Resources:

- images of buildings with various types of insulation.
- Cardboard
- insulation materials (e.g., cotton balls, foam, aluminum foil)
- thermometer

Useful Link

https://youtu.be/KpHOq9nIVBY

Engage: (5 mins)

- Display images of buildings with various types of insulation and ask students to identify the differences and potential benefits.

- Start a conversation about the value of thermal insulation in terms of energy efficiency and comfort.

Explain: (10 mins)

- Explain thermal insulation and its application in buildings. Discuss how thermal insulation reduces heat transfer between a building's interior and exterior, resulting in energy savings and improved comfort.
- Present a variety of practical thermal insulation methods commonly used in building construction, such as:
- Materials for insulation: Discuss insulation materials such as fibreglass, cellulose, foam boards, and reflective insulation. Describe their properties and efficacy in reducing heat transfer.
- Insulation placement: Discuss the importance of insulating walls, roofs, floors, and windows to reduce heat loss or gain.
- Sealing techniques: Explain the importance of air sealing in preventing draughts and preserving the effectiveness of insulation. Explain thermal insulation and its application in buildings. Discuss how thermal insulation reduces heat transfer between a building's interior and exterior, resulting in energy savings and improved comfort.
- Present a variety of practical thermal insulation methods commonly used in building construction, such as:
- Materials for insulation: Discuss insulation materials such as fibreglass, cellulose, foam boards, and reflective insulation. Describe their properties and efficacy in reducing heat transfer.
- Insulation placement: Discuss the importance of insulating walls, roofs, floors, and windows to reduce heat loss or gain.
- Sealing techniques: Explain the importance of air sealing in preventing draughts and preserving the effectiveness of insulation.

Explore: (15 mins)

STEM Activity:

- Provide students with a cardboard or material mock-up of a small building or structure.
- Divide the building into sections or rooms using cardboard dividers or partitions.
- Instruct students to choose different insulation materials (e.g., cotton balls, foam, aluminum foil) and apply them to specific areas of the building, such as walls, windows, or the roof.
- Place a thermometer in each section or room to monitor the temperature.
- Simulate temperature differences by using heat sources (e.g., lamps or heating pads) outside the building.
- Ask students to record and compare the temperature changes in the insulated and non-insulated areas over a set period of time.
- Encourage students to discuss their findings and draw conclusions about the effectiveness of different insulation methods in maintaining temperature inside the building.
- Have students reflect on the real-world applications of insulation in energy-efficient construction and its impact on reducing heating and cooling costs.

Elaborate: (10 mins)

- Assign a group project to students in which they will research and present real-life examples of buildings or structures that have used effective thermal insulation methods. They can present their findings in the form of presentations, posters, or digital media.
- When discussing suitable insulation methods for different regions, encourage students to consider the local climate and environmental factors.

Evaluate: (5 mins)

- Ask students to reflect on the significance of thermal insulation in building construction and how it helps with energy conservation and a sustainable environment.
- Ask students to complete Q3 on page 136 of student book.

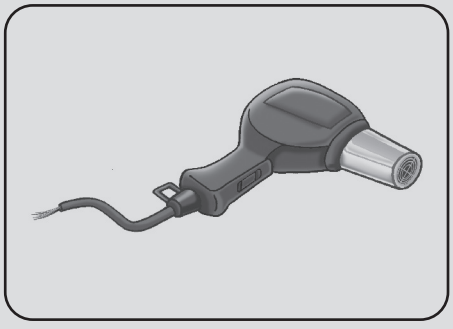
Home Assignment:

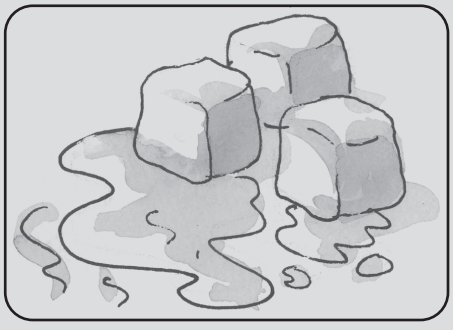
- Explore your home or a nearby building, identifying areas where insulation materials may be used and describing how they aid in maintaining a comfortable temperature inside.
- Additionally, research and list at least two common building insulation materials, explaining how they work to keep buildings warm in the winter and cool in the summer.

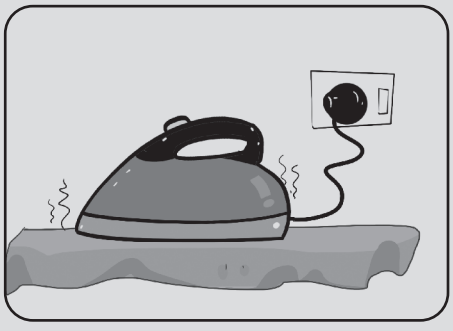
Worksheet 1:

What is conduction?

Explain the process of conduction in the following images.



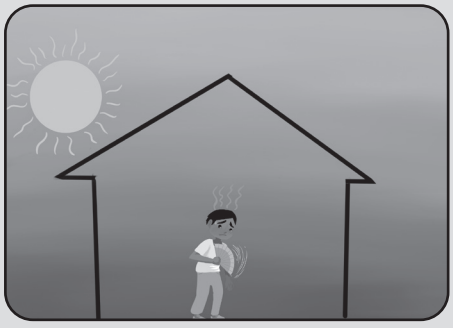


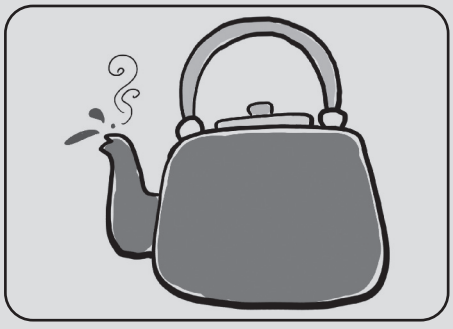


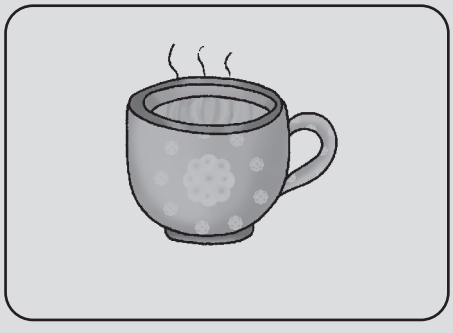
Worksheet 2:

What is convection?

Explain the process of convection in the following images.







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Answers for Worksheet 1:

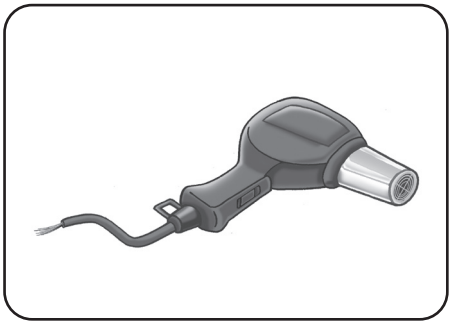
What is conduction?

The transmission of heat or electrical charge through the materials. Conduction is possible in solids, liquids, and gases.

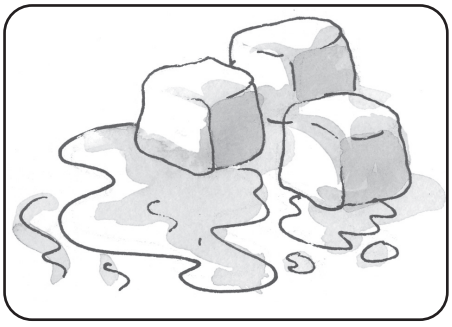
Explain the process of conduction in the following images.

It feels hot on your feet when you walk on the beach in summer.

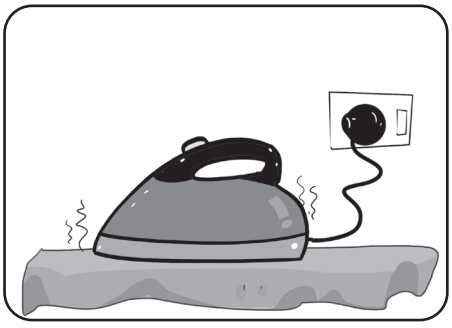
Our hair gets hot when we use it on our hair.



Ice melts in hand when we hold it in our hand.



When you iron your clothes, the heat transfers from the iron to clothes.



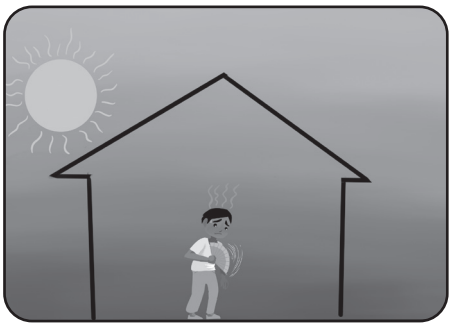
Answers for Worksheet 2:

What is convection?

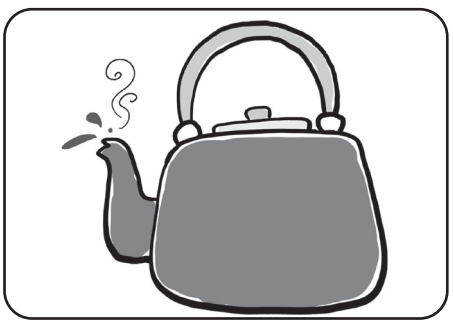
Convection is the process of transferring heat through the bulk movement of molecules in fluids like gases and liquids.

Explain the process of convection in the following images.

When there is movement of air in houses or buildings, the chimney effect occurs due to convection. It results from temperature differences.

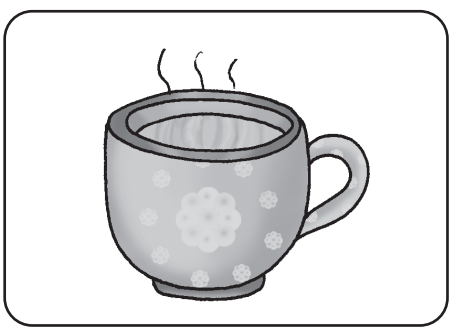


Thermal expansion occurs when water is heated in a kettle. The hotter lower layer of water becomes less dense and moves upward.



A source of heat at the balloon's bottom heats the air molecules around the flame, allowing them to move up.

The steam of a hot cup of tea shows the transfer of heat into air.



Exercise Answers

1. **i.** **b)** iron
ii. **b)** conductor
iii. **c)** making a vacuum between the walls
iv. **d)** convection and radiation
v. **a)** which is cold is less dense than hot air
vi. **d)** loose white shirt

2. **i.** 310 K
ii. -273 °C
iii. 323 K
iv. 100 °C
v. 263 K

3. **i.** Heat is the total energy of molecular motion in an object, while temperature is the measure of the average kinetic energy of the molecules in an object.
ii. The unit used to measure temperature is the Kelvin (K).
iii. The fixed points of a centigrade scale are the freezing point (0°C) and boiling point (100°C) of water at standard atmospheric pressure.
iv. Absolute zero is the temperature at which molecular motion ceases, equal to 0 Kelvin (0 K).
v. Conductors allow the easy flow of heat, while insulators resist the flow of heat.
vi. Birds fluff out their feathers in cold weather to create a layer of trapped air that provides insulation, reducing heat loss.
vii. Three methods of heat transfer:
Conduction: Transfer of heat through direct contact, e.g., a metal spoon heating in a hot beverage.
Convection: Transfer of heat through the movement of fluids (liquids or gases), e.g., boiling water in a kettle.
Radiation: Transfer of heat through electromagnetic waves, e.g., the Sun heating the Earth.
viii. "Hot air rises" means that in a gas, the particles with higher kinetic energy (hotter particles) are less dense and tend to move upward, displacing cooler, denser air.
ix. The greenhouse effect is the process by which certain gases in Earth's atmosphere trap heat from the Sun, preventing it from escaping into space and thereby warming the planet.
x. Yes, the atmosphere traps heat through the greenhouse effect, which is essential for maintaining Earth's temperature within a range suitable for life. Without this natural greenhouse effect, the Earth would be much colder.

4. **i.** **a)** Conduction is the transfer of heat through direct contact between particles in a solid or between adjacent particles in a stationary fluid. Convection, on the other hand, is the transfer of heat by the movement of fluids (liquids or gases) due to differences in density caused by temperature variations.
b) There are no convection currents in solids because the particles in a solid are closely packed and do not have the freedom to move past each other to create fluid-like circulation.

ii. Explanation with a labelled diagram showing convection currents in an electric kettle:

In an electric kettle, the heating element at the base of the kettle heats the water directly in contact with it.

As the water near the heating element heats up, it becomes less dense and rises.

The rising hot water displaces the cooler, denser water above it, creating a convection current.

The cooler water moves down to the heating element, where it is heated, and the cycle repeats.

This continuous circulation of water due to convection currents ensures that the entire volume of water in the kettle is gradually heated.

iii. Formation of land and sea breezes:

During the day, the land heats up more quickly than the sea due to its lower heat capacity.

The warm air over the land rises, creating a low-pressure area, and cooler air from the sea moves in to fill the gap, resulting in a sea breeze blowing from the sea towards the land.

At night, the land cools down faster than the sea, and the process reverses. The warmer air over the sea rises, creating a low-pressure area, and cooler air from the land moves towards the sea, resulting in a land breeze blowing from the land towards the sea.

iv. A vacuum flask prevents the transfer of heat through:

Conduction by having a double-wall construction with a vacuum between the walls, which eliminates direct contact between the inner and outer walls.

Convection by having the vacuum, as air (or any other gas) is absent inside the flask to prevent the circulation of air currents.

Radiation by having reflective surfaces and a silvered inner wall to minimize heat radiation.

v. Thermographs are instruments used to record temperature variations over time. They are used in various applications, such as meteorology to monitor weather conditions, in science experiments to measure temperature changes, and in medical settings for body temperature monitoring.

5. i. A cup of tea at 85°C has more heat because it has a higher temperature and a larger quantity of water compared to a full bath at 50°C.

ii. It takes longer to boil a kettle of water than to warm it to a lower temperature because boiling water requires the addition of heat energy to change its phase from a liquid to a gas (vaporization), while warming water to a lower temperature involves raising its temperature without changing its phase.

iii. If water is heated in a saucepan made of a material that is not a good conductor of thermal energy, it will take longer to heat the water, and the saucepan itself may become hotter due to poor heat conduction.

iv. Tiled floors feel colder because they are better conductors of heat, while carpets feel warmer because they are insulators and trap heat.

v. A blanket keeps a person warm by trapping the heat radiated by their body, reducing heat loss to the surroundings.

vi. A metal skewer inserted into a jacket potato conducts heat from the metal to the interior of the potato, helping to cook it more quickly by distributing heat more effectively within the potato.

CHAPTER 11

Earth and Space

Student Book Pages 10–21

Learning outcomes

- Recognize that the force of gravity keeps planets and moons in their orbits.
- Differentiate between mass and weight, using examples of weightlessness experienced by astronauts on the surface of the Moon.
- Recognize that tides are caused by the gravitational pull of the Moon
- Describe the effects of the Earth's annual revolution around the Sun, given the tilt of its axis (e.g., different seasons, different constellations visible at different times of the year).
- Describe how seasons in Earth's Northern and Southern Hemispheres are related to Earth's annual movement around the Sun

Keywords

force of gravity, orbit, tides, annual revolution, axis, weightlessness

OVERVIEW OF THE UNIT:

- Gravity is the force that pulls objects toward the center of a planet or other body. The gravitational force keeps all of the planets in orbit around the sun.
- Gravity keeps the moon in orbit around Earth. The moon's gravitational pull draws the seas towards it, causing ocean tides.
- Gravity makes planets and stars by pulling together the substances from which they are created.
- Gravity attracts not only mass but also light. This principle was discovered by Albert Einstein. When you shine a flashlight upwards, the light will become slightly redder as gravity pulls it up. The change is invisible to the naked eye, but scientists can measure it.
- Weightlessness is defined as having no gravitational force. We feel weight because the ground applies an equal and opposite force to our bodies after our bodies apply a force to the ground due to gravitational attraction.
- When we are falling freely under g, there is nothing solid that can exert a force on us, giving us the sensation of weightlessness. In general, the ground exerts equal and opposite force on you, so you feel weighted, and if you fall freely, we feel weightless.
- The tidal cycle is divided into two stages: high tide and low tide. The tidal cycle is the rise and fall of sea level caused by the gravitational pull of the sun and moon.
- Although all tides have high and low points, the number varies from place to place.
- We call it high tide when the water reaches its highest point during the tidal cycle (after the flood tide stage).
- The wave begins to fall as it approaches its peak, and its height gradually decreases. This falling motion is known as an ebb tide, and the height of the wave continues to fall until it reaches a minimum point. Low tide is the point at which the tide stops falling.
- Constellations are star clusters. The constellations visible at night are determined by your location on Earth and the time of year. Long ago, constellations were named after objects, animals, and people.
- Once every year, Earth completes one orbit around the Sun. As we orbit, our view of space through the night sky changes. Because Earth is in a different orbit, the night sky looks slightly different each night. Each night, the stars appear to move slightly west of where they were the night before.
- What stars and constellations you see and how high they appear to rise in the sky are also determined by your location on Earth. The Northern and Southern Hemispheres are always pointing in opposite directions.

Lesson Plan 1	**Student Book pages**	**Time**	**Workbook pages**
What is Gravity?	138-139	45 Minutes	-

Objective:

- Recognize that the force of gravity keeps planets and moons in their orbits.

Keywords

Gravity Mass Weight

Resources

- two apples
- cups
- scissors
- water
- chart paper
- colour makers
- white board and marker

Useful Link

https://youtu.be/H9YMgx5T9Sk

Engage: (5 min)

Warm-up Activity

- Discuss with your students what they already believe about gravity.
- Display the two apples to your students. Discuss whether they believe the whole apple or the half apple will hit the ground first if they are both dropped from the same height at the same time.
- Students will observe the activity.
- Many students can answer that the half-apple will reach the ground first because of its less weight.
- Then let them (apples) go! Because all objects descend at the same rate, they should both land at the same time.

Explain: (10 min)

- Gravity is an an invisible force that attracts objects to each other. The Earth's gravity is what keeps you on the ground and causes things to fall.
- Gravity exists in everything that has mass. Gravity is stronger for heavier objects. Gravity weakens with distance as well. As a result, the stronger the gravitational pull of two objects, the closer they are to each other.
- The gravity of the Earth is caused by all of its mass. All of its mass exerts a combined gravitational pull on all of your body's mass. This gives you weight. And if you were on a planet with a lower mass than Earth, you would weigh less.
- You have the same gravitational pull on Earth as it has on you. However, because Earth is so much larger than you, your force has no effect on our planet.
- Gravity keeps the planets in orbit around the sun and the moon in orbit around Earth.
- Gravity is crucially significant to us. We couldn't survive without it. The sun's gravity keeps Earth in orbit around it, allowing us to enjoy the sun's light and warmth from a safe distance. It keeps our atmosphere and the air we need to breathe stable. Our world is held together by gravity.

Explore: (15 min)

Stem Activity

- Take your students outside the classroom in an open area.
- Distribute cups and scissors to your students, and instruct them to cut holes near the bottom of their cups. Consider what will happen if they fill the cups with water.
- Students will follow the teacher’s instructions.
- Students should talk about what would happen if they dropped the cup full of water.

Fill the cups with water and let your students drop them. The water will end up splashing all over the place. This is because gravity will pull the water out of the holes. But it won't spill out of the holes if the cup is dropped! When gravity pulls on the cup, both the cup and the water fall at the same rate.

Elaborate: (5 min)

Make a Poster

Gravity in Space

- Ask students to make a poster that will show the solar system and the gravity between the planets and the Sun.
- Have the students do this activity in groups.
- Students will use colored markers and to make the poster.

Evaluate: (5 min)

- Distribute the worksheet 1.
- Ask students to complete Concept Check and Discuss and Answer on page 139 of student book.

Home Assignment:

- Make a list of the situations when you feel a gravitational pull around you.
- Complete Q3(i-iii) and Q4(i) on page 145-146.

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Weightlessness on the Moon	140	45 Minutes	73

Objective:

Differentiate between mass and weight, using examples of weightlessness experienced by astronauts on the surface of the Moon.

Keywords

Weightlessness | Gravitational force | Contact forces

Resources:

- Objects of different masses
- Spring scale
- Trampoline or bouncy ball
- Visual aids and diagrams

Useful Link

https://youtu.be/HG_Z1bKs6ow

Engage: (5 min)

- Begin the lesson with a thought-provoking question, such as "What is the difference between mass and weight?"
- Encourage students to share their initial ideas and thoughts. Show students a short video or images of astronauts bouncing around on the Moon's surface and ask them why they appear to be moving differently.

Explain: (10 min)

- Give a detailed explanation of mass and weight.
- Define mass as the amount of matter in an object (which is constant everywhere) and weight as the force of gravity acting on an object (which varies depending on the gravitational field).
- Use visuals and diagrams to assist students in comprehending the concepts.

Explore: (15 min)

Engage students in STEM activities that are hands-on:

- Weight Comparison: Give students objects of varying masses and ask them to compare their weights using a spring scale.
- Moon Bouncing Simulation to simulate how astronauts move on the Moon's surface due to its lower gravity, set up a small trampoline or use a bouncy ball. Discuss the weight difference between the Moon and Earth.

Elaborate: (10 min)

Divide the students into small groups and give each group a different scenario. Ask them to conduct research and explain how mass and weight are relevant in that scenario. They can look at how mass and weight relate to a sport like weightlifting or how they influence the design of space equipment, for instance.

Evaluate: (5 min)

- Divide the students into small groups and give each group a different scenario.
- Ask them to conduct research and explain how mass and weight are relevant in that scenario.
- They can look at how mass and weight relate to a sport like weightlifting or how they influence the design of space equipment.
- Ask students to complete Discuss and Answer on page 140 of student book.

Home Assignment:

- Research and provide examples of situations in which the differentiation between mass and weight is critical. Present your findings in a brief report or presentation.
- Complete Q3 on page 73 of workbook.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
Moon Causes Tides	140-141	45 Minutes	75

Objectives:

- Recognize that tides are caused by the gravitational pull of the Moon.

Keywords

Tidal constituent | High tides | Low tides

Resources

- White board and marker
- Pen and paper
- worksheets

Useful Link

https://youtu.be/CVNqxh_zmOM

Engage: (5 min)

Brainstorming:

- Start by writing the question 'What are tides?' on the board for the class.
- Students should respond to the question in writing.
- Students should exchange explanations with another student. Students will observe the extent of similarity between the two explanations.
- Now, as a class, go over the students' explanations, noting key points about tides on the board.

Explain: (10 min)

- The tidal cycle is the rise and fall of sea level caused by the gravitational pull of the sun and moon. The tidal cycle is divided into two stages: high tide and low tide.
- Although all tides have high and low points, the number varies from place to place.
- High tide is the highest point that a tide can reach during the tidal cycle. This happens when the moon is directly over a specific location.
- Because of the shorter distance, the gravitational force increases, causing the water to rise. As a result, the sea level rises until it reaches its peak.
- Water tends to come up to the shore during a high tide. As a result, beaches and shorelines become narrower or smaller. Flood tides precede high tides.
- When the moon is the farthest away from an area, the gravitational pull is weaker, causing the tide to fall. The stage is called low tide when the tide reaches its lowest point. During this time, the moon's gravitational pull is at its weakest.
- During low tides, the water retreats to the sea, exposing more land on shorelines or beaches.

Explore: (10 min)

Role-Play

You can either divide the students into groups for this activity or do it all together as a class:

1. Students stand in a tight circle, interlocking their elbows and facing inward.
2. One student will remain on the circle's rim, representing the moon by slowly walking around the perimeter. The students in the circle who are closest to the moon lean toward it as it passes by. Students on the opposite side of the circle bulge out as well, indicating differential gravitational forces. After the moon has passed, the students rise to their feet.
3. The moon stops at various points around the circle, allowing the students to see where high and low tides are in relation to the moon's orbit.
4. In addition to the moon, another student plays the sun. The previous activity can then be repeated with the combined gravitational pull of the moon and the sun.
5. Students show where the sun aligns with the moon (spring tide) and where the sun, Earth, and moon form a 90-degree angle (leap tide).

Explain:

- This circle is a very simplified representation of the Earth if it were covered in water at a constant depth.
- If necessary, the teacher can stand in the centre of the circle and direct students to lean outward.
- High tides are areas where students are leaning away from the circle's centre. Low tides are at the circle's edges, halfway between high tides.

- Remember that the sun's gravitational pull is weaker than that of the moon.
- The tides are more extreme when the sun, Earth, and moon are in alignment. When the sun, Earth, and moon form a 90-degree angle, the sun's and moon's gravitational pulls mostly cancel each other out.

Elaborate: (10 min)

Group Activity

- Ask the students to consider the effects of rising sea levels on coastal communities.
- You can accomplish this by starting a group discussion.
- Students will write a paragraph about how rising sea levels might affect the coast, specifically who and what would be affected.

Evaluate: (5 min)

Distribute worksheet 2 among the students.

Home Assignment:

Complete Q8 on page 75 of workbook.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
Movement of Earth and Seasons	141-143	45 Minutes	-

Objectives:

- Describe the effects of the Earth's annual revolution around the Sun, given the tilt of its axis (e.g., different seasons, different constellations visible at different times of the year).
- Describe how seasons in Earth's Northern and Southern Hemispheres are related to Earth's annual movement around the Sun

Keywords

Northern hemisphere Southern hemisphere

Resources:

- Globe or diagram of Earth's orbit
- Planetarium app or star chart
- Visual aids and diagrams

Useful Link

https://youtu.be/tX3Y5bzNDiU

Engage: (5 min)

Begin the lesson by having students describe the various seasons as well as any patterns they notice in the weather, daylight, and outdoor activities throughout the year.

Show students video of seasonal changes and ask them what they believe causes these variations.

Explain: (10 min)

- Explain the annual revolution of the Earth around the Sun.
- Discuss the concept of axial tilt and how it affects the seasons in various parts of the world.
- Explain how the Earth's orbital position affects the constellations visible in the night sky

Explore: (15 min)

- Model Earth's Orbit: Show the Earth's orbit around the Sun using a globe or a diagram. Show how the tilt of the Earth's axis affects the angle and intensity of sunlight throughout the year.
- Seasonal Constellations: Show how the constellations, visible in the night sky, change throughout the year using a planetarium app or a star chart. Instruct students to identify constellations that they can see at various times.

Elaborate: (10 min)

- Divide the class into small groups and assign each group a season.
- Ask them to investigate and present how the characteristics of that season (e.g., temperature, daylight hours, weather patterns) are related to Earth's orbital position.

Evaluate: (5 min)

- Complete Q1 on page 72 of workbook.

Home Assignment:

- Select a location near your home or school from which you can easily observe nature and the environment.
- Over the course of a year, visit this location at least once a month. Make observations and take notes on the following:
- Temperature and weather conditions change.
- The length of the day and the position of the Sun in the sky.
- Any changes in plant and animal behaviour (e.g., budding, flowering, migration).
- The appearance of the night sky, including any identifiable constellations.

Making a Seasonal Journal: Record your observations for each month in a notebook or digital document. You can illustrate your findings with sketches, photographs, or charts.

Review your seasonal journal at the end of the year for analysis and conclusion. Make a summary.

Worksheet 1:

1. Define Gravity

2. Why don't you feel the gravity of the bat and ball?

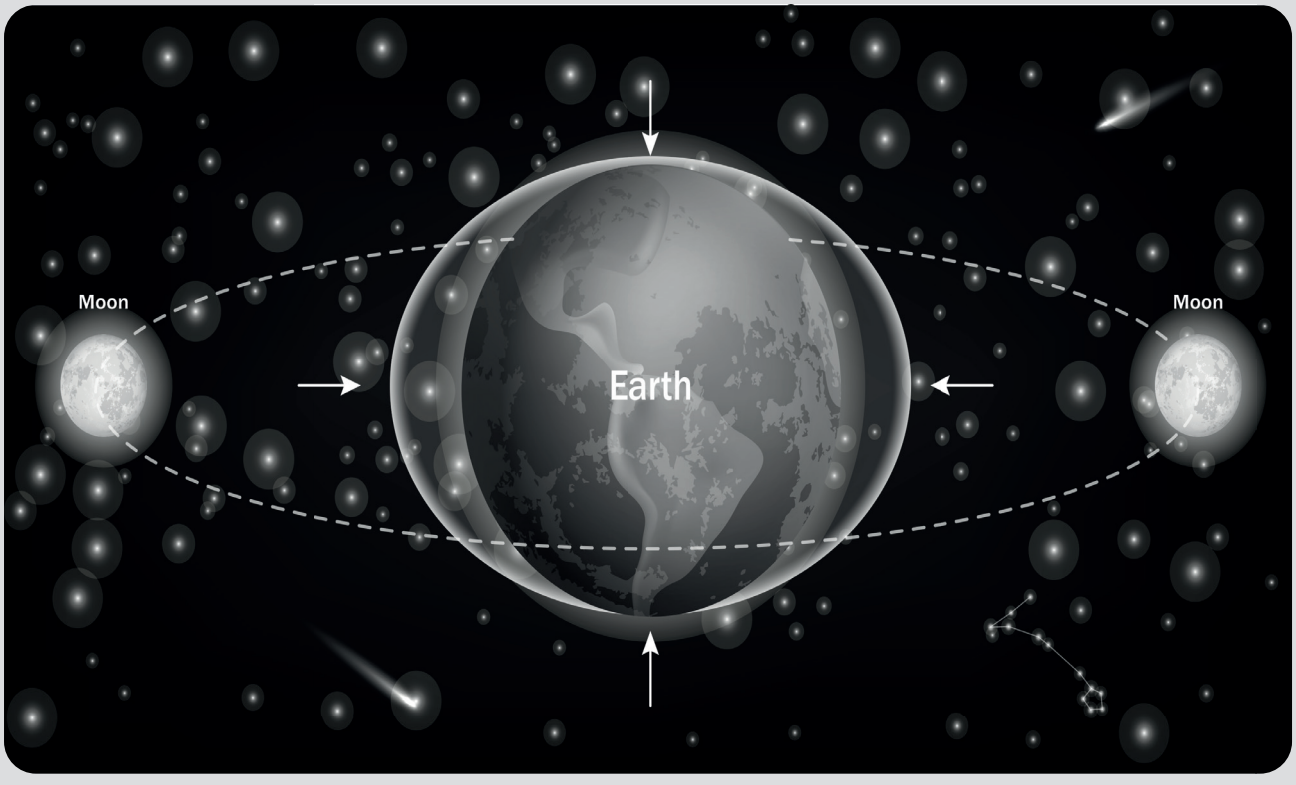
3. Why do you not feel the planet Mercury's gravity pulling on you?

4. Discuss how gravity is the force that governs the motion of our solar system.

Worksheet 2:

1. What is high tide?

2. What is low tide?



Answers for Worksheet 1:

Define Gravity

The force that pulls a body towards the center of the earth or any other mass-carrying physical body

1. Why do not you feel the gravity of the bat and ball?

We do not feel gravity between the bat and ball because there is no gravity between them.

2. Do all planets in solar system have same gravity like Earth?

All planets have gravitational force. But as all planets do not have same mass so every planet have different amount of gravitational force.

Discuss how gravity is the force that governs the motion of our solar system.

Sun's gravity pulls the planet and keeps them in an elliptical pathway. It keeps them in circular motion.

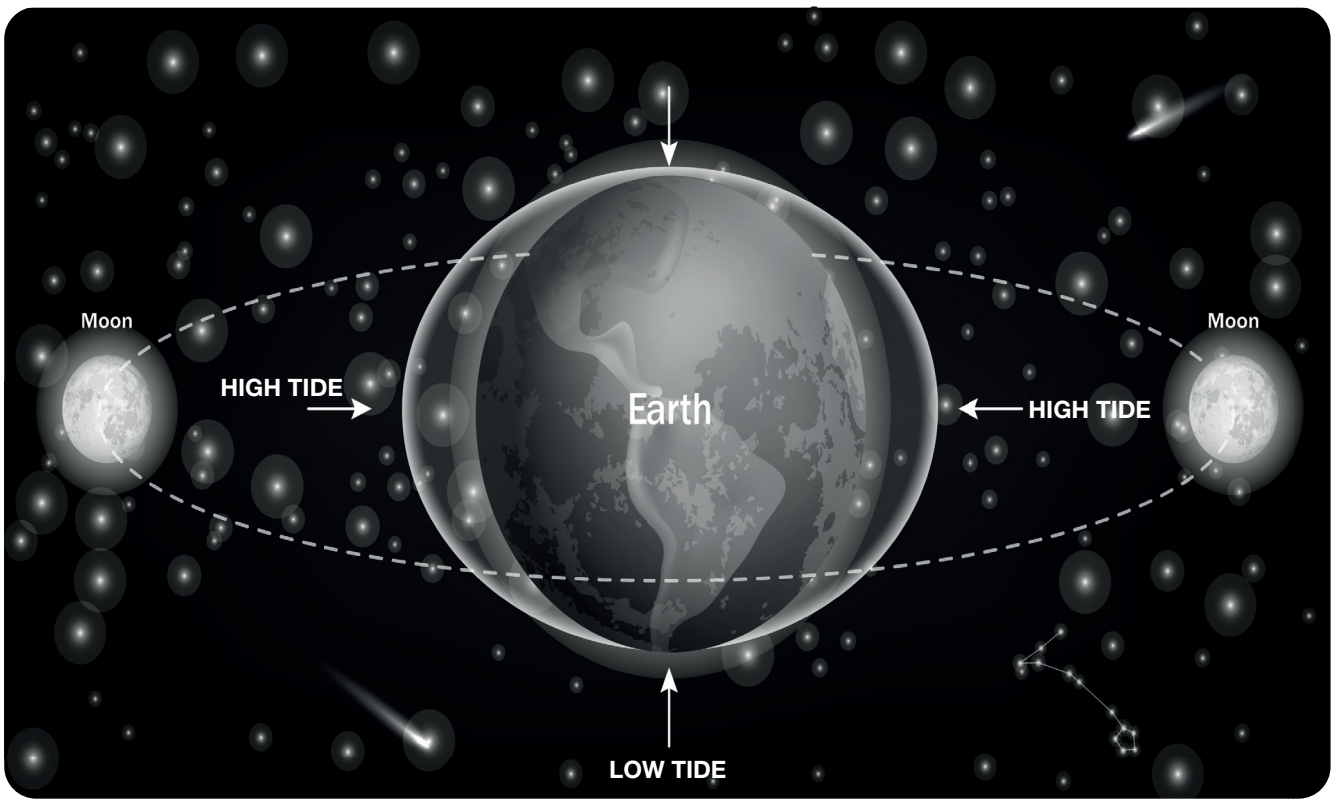
Answers for Worksheet : 2

What is high tide?

When the sea or a river reaches its highest level and comes the furthest up the beach or bank.

What is low tide?

When the sea has reached its lowest point



Exercise Answers

1. **i**. When the North Pole tilts towards the Sun, it is summer in the Northern Hemisphere.

ii. The correct statement about high tides is: d. Water covers much of the shore, after rising to its highest level, and this is called high tides.

iii. The weight of a 1 kg object on Earth is: c. 10 N.

iv. The condition for weightlessness is: b. Weightlessness exists when all contact forces are removed.

2. Short answer questions:

i. Weight is the force with which an object is pulled towards the center of the Earth (or any other celestial body) due to gravity. It is typically measured in newtons (N).

ii. Gravity is the natural force of attraction that exists between all objects with mass. It is responsible for the phenomenon of weight and is what keeps objects anchored to the Earth.

iii. Mass is a measure of the amount of matter in an object. It is typically measured in kilograms (kg).

iv. High tides are the periodic rise in sea level when the gravitational pull of the Moon and the Sun is at its maximum. Low tides are the periodic drop in sea level when the gravitational pull is at its minimum.

v. Constellations are groupings of stars that form patterns in the night sky as seen from Earth.

4. Long answer questions:

i. Gravity was discovered by Sir Isaac Newton when he observed an apple falling from a tree and realized that there must be a force that causes objects to fall towards the Earth.

ii. People in different regions see different constellations because the Earth's rotation causes the night sky to appear different from different locations. The stars visible at night vary with the observer's latitude and time of year.

iii. Weightlessness on the Moon is due to the weaker gravitational pull of the Moon compared to Earth. Astronauts experience reduced weight on the Moon because gravity on the Moon is only about 1/6th as strong as on Earth.

iv. Seasons are formed due to the tilt of the Earth's axis. As the Earth orbits the Sun, different parts of the Earth receive varying amounts of sunlight, leading to changes in temperature and weather patterns.

v. High tides and low tides are formed by the gravitational pull of the Moon and the Sun on the Earth's oceans. The side of the Earth facing the Moon experiences high tide, while the side opposite the Moon experiences a second high tide due to the Earth's rotation.

5. Think about it:

a. On the Moon, the mass of astronauts remains the same as it is on Earth because mass is a fundamental property of matter and does not change with location. In other words, an astronaut's mass on the Moon is the same as their mass on Earth.

b. However, the weight of astronauts on the Moon is significantly less than their weight on Earth. This is because weight is the result of the gravitational force acting on an object's mass, and the gravitational pull of the Moon is much weaker than that of Earth. Specifically, the Moon's gravity is approximately 1/6th (about 16.6%) as strong as Earth's gravity. As a result, astronauts on the Moon experience only about 1/6th of the weight they would experience on Earth. This is why astronauts can move more easily and feel lighter on the Moon's surface compared to Earth.

CHAPTER 12

Technology in Everyday Life

Student Book Pages 10–21

Objectives:

- Design a model to demonstrate drip & sprinkler irrigation system for conservation of water.
- Use different techniques of preserving foods like orange juice, apple jam and pickles.
- Make a simple Stethoscope.
- Make a sanitizer using suitable substances

Keywords

design, engineers, irrigation system, preservation, conservation, food sustainability

OVERVIEW OF THE UNIT:

- Irrigation is the method of artificially applying water to crops in order to meet their water requirements. Water for irrigation can be obtained from wells, ponds, lakes, canals, tube-wells, and even dams. Irrigation provides the necessary moisture for growth and development, germination, and other related functions.
- The modern technique compensates for the disadvantages of older methods, helping in the proper use of water.
- Keeping food from spoiling after harvest or slaughter can be done in a number of different ways. Such practices can be traced back to prehistoric times. Drying, refrigeration, and fermentation are among the oldest methods of preservation. Modern techniques include canning, pasteurization, freezing, irradiation, and chemical addition.
- A stethoscope is a medical tool that amplifies sounds so that a person can listen carefully to the sounds made by the heart, lungs, intestines, and abdomen. Listening to these sounds can assist nurses, EMTs, doctors, and cardiologists in detecting health problems such as blood flow issues, blood pressure issues, and respiratory issues. There are two types of stethoscopes: acoustic and electrical.
- Hand sanitizer, also known as hand antiseptic, hand rub, or hand rub, is an agent that is applied to the hands in order to remove common pathogens. Hand sanitizers are commonly available in foam, gel, or liquid form. When soap and water are unavailable for hand washing, they should be used. Although hand sanitizer's effectiveness varies, it is used as a simple means of infection control in a wide range of settings, from day care centers and schools to hospitals and health care clinics and supermarkets.

Lesson Plan 1	**Student Book pages**	**Time**	**Workbook pages**
Water Conservation while Irrigating Plants	181-183	45 Minutes	79

Objectives:

- Design a model to demonstrate drip & sprinkler irrigation system for conservation of water.

Engage:(5 min)

Useful Link

https://youtu.be/amrCMakolKA

Concept Building

- Begin the lesson by discussing the importance of water for plants and then the ways to provide water to the plants at different levels.
- Write on the board.
- ‘How to provide water to the plants’.
- Ask students to tell the ways they know.
- Talk about how plants at the home level are supplied with water before moving on to the fields.
- Students will participate and give answers to the teacher’s questions.

Explain: (10 min)

- Crops require water in order to grow and develop. The method of providing water to the crops is recognised as irrigation.
- The frequency, rate, amount, and time of irrigation differ for different crops, as well as depending on soil type and season. Summer crops, for example, require significantly more water than winter crops.
- There are various types of irrigation used to increase crop yield. These irrigation systems are used in accordance with the various types of soils, climates, crops, and resources. Farmers commonly use the following types of irrigation:
- Farmers can play an important role in water conservation by using various water conservation irrigation methods.
- Farmers commonly use the following types of irrigation methods for conservation of water:
- Sprinkler Irrigation

  In this method, overhead high-pressure sprinklers or sprinklers from the moving platform distribute water from a central location.
- Drip Irrigation

  In this method, plants are watered using narrow tubes, and the water is delivered directly to the plant's base.

Explore: (15 min)

STEM Activity

1. Provide material to the students:
   - Water basin and water for putting student irrigation systems to the test.
   - Straws
   - Cardboard
   - Paper Cups
   - Clay, foil, and rubber bands
   - Tape Glue Toothpicks or other reusable materials
2. Divide students into groups, each with its own set of materials.
3. Explain that students must work together to design an irrigation system that can move two cups of water at least three feet. The team's goal is to divide the water into two separate containers of one cup each.
4. Students get together to plan their irrigation system. They sketch their plan and then present it to the class.
5. The teams then carry out their plans. They may need to reconsider their design.
6. Next, teams will put their irrigation system to the test to see how well it works. Students will measure how much water is collected in each of the two destination containers and compare it to the goal of one cup in each container. Teams may test their systems three times and count the most successful test as the most successful.

Elaborate: (5 min)

Class Discussion and Presentation

- Ask students to present their irrigation plan to the class.
- Discuss each group’s plan with the class.

- Appreciate and discuss any improvements that could be made.

Evaluate: (5 min)

Distribute worksheet 1 among students.

Home Assignment:

Complete Q1 on page 79 of workbook.

Lesson Plan 2	**Student Book pages**	**Time**	**Workbook pages**
Food Preserving Techniques	184-187	45 Minutes	79

Objectives:

- Use different techniques of preserving foods like orange juice, apple jam and pickles.

Engage: (5 min)

Useful Link

https://youtu.be/QHna4jHcH68

Warm-up Activity

- Arrange some food items on your table like:
- Apple, a piece of meat, a cup of milk, cooked food, etc.
- Ask students to tell them what can we do to save these food items.
- Students can give different answers like:
- Refrigerate or save it in an airtight jar etc.
- Then pick each item and ask how to store that particular food item.
- On some of the food items, students might become confused.

Explanation:

Tell the students that there are different methods to preserve food that is being used according to the type of food.

Explain: (10 min)

- Food preservation is the process of treating and handling food in order to prevent or slow food spoilage, loss of quality, edibility, or nutritional value, and thus allow for longer food storage.
- Preservation generally implies preventing the growth of bacteria, fungi (such as yeasts), and other microorganisms, as well as delaying the oxidation of rancid-causing fats.
- There are many benefits of food preservation:
    - Food preservation adds variety to the food. If fresh peas are unavailable during the hot summer months, canned or dehydrated peas could be used instead.
    - Food preservation increases the shelf life of food. Pineapples, cherries, and other fruits and vegetables can be preserved in a variety of ways for extended periods of time.
    - Food preservation increases food supply.
    - Excess food that would otherwise be wasted are processed and preserved, adding to the existing supply and decreasing food waste.
    - Food preservation aids in the reduction of dietary deficiencies. Preserved food help to diversify the diet. For example, no vegetables are grown in several Middle Eastern countries due to arid soil conditions. This shortfall is made up for by the importation of fresh and preserved fruits and vegetables.

Explore: (15 min)

Experiment

- The experiment given in the textbook will be done.
- Students can be divided into two groups. One will make and preserve pickles and the other will make and preserve jam.
- Give instructions for the experiment.
- Guide the students to perform their experiment.
- Students will perform the experiment.

Elaborate: (5 min)

After the experiment, have students write down the steps for preserving pickles or jam in their own words on a chart.

Evaluate: (5 min)

Complete Q2 on page 79 of workbook.

Home Assignment:

Worksheet 2 will be given to solve at home.

Lesson Plan 3	**Student Book pages**	**Time**	**Workbook pages**
How to Make a Stethoscope	188-189	45 Minutes	81

Objectives:

- Make a simple Stethoscope.

Useful Link

https://youtu.be/L9AgAm7mUSc

Engage: (5 min)

- Begin the lesson by showing students pictures or diagrams of stethoscopes and asking them what they are used for. Share fascinating facts about the history of the stethoscope and its role in medical examinations. Ask students why they think doctors and nurses use stethoscopes.

Explain: (10 min)

Explain how a stethoscope works and its components, such as the chest piece, tubing, and earpieces, in detail.

Explain how a stethoscope amplifies sound from the body, allowing doctors to listen to internal organs and bodily functions.

Explore: (15 min)

Perform the activity given in book

Materials:

- Two small paper or plastic cups
- A long piece of thread (approximately 3-4 feet)
- A small piece of plastic or cardboard
- Tape or glue
- Scissors

Procedure:

- Turn the cups upside down so that the open ends face each other.
- Use scissors to carefully poke a small hole in the center of the base of each cup.
- Thread one end of the thread through the hole in the base of one cup.
- Tie a secure knot at the end of the thread inside the cup to keep it from slipping through.
- Cut a small circular piece of plastic or cardboard, approximately the size of a quarter.
- Use tape or glue to attach this circular piece to the open end of the cup with the thread.
- Place the cup with the diaphragm against your chest (over the area you want to listen to, like your heart).
- Hold the other cup with the thread near your ear.
- Press the diaphragm cup against your skin gently but firmly.
- While pressing, place the cup with the thread against your ear.
- Listen carefully, and you should be able to hear sounds from within your body, such as your heartbeat or your breath.
- Try listening to different parts of your body to hear various sounds.

Elaborate: (10 min)

Conduct listening exercises in which students use stethoscopes to listen to their own heartbeats, pulses at various locations, or even the sound of their stomachs digesting.

Evaluate: (5 min)

- Ask students to explain how their simple stethoscopes work and to discuss the importance of sound in medical diagnosis.
- Complete Q4 on page 81 of workbook.

Home Assignment:

- Research a particular medical condition or scenario in which the use of a stethoscope is critical for diagnosis (for example, listening for crackles in the lungs in pneumonia).
- Write a brief report describing the condition, how doctors use stethoscopes to diagnose patients, and the importance of early detection.

Lesson Plan 4	**Student Book pages**	**Time**	**Workbook pages**
How to Make a Hand Sanitizer	190-191	45 Minutes	81

Objectives:

- Make a sanitizer using suitable substances

Resources:

- Isopropyl alcohol (at least 70%)
- Aloe vera gel
- Essential oils (optional for fragrance)
- Small empty bottles with pumps or sprays
- Visual aids and diagrams

Useful Link

https://youtu.be/0C6dqKev_s4

Engage: (5 min)

- Begin the lesson by discussing the significance of hand sanitizers in preventing the spread of germs and diseases.
- Show students commercial hand sanitizers and ask them if they understand how these products kill germs.

Explain: (10 min)

- Explain the science behind hand sanitizers, including the active ingredients that kill germs and how they do so.
- Introduce the concept of alcohol-based sanitizers and their ability to kill a wide variety of pathogens.

Explore: (15 min)

- Perform the activity given in the book.
- Provide materials such as 70% isopropyl alcohol, aloe vera gel, essential oils (for fragrance), and small empty bottles with pumps or sprays.
- Sanitizer Mixing: Assist students in measuring and mixing the ingredients to make a hand sanitizer. Discuss the significance of alcohol concentration and aloe vera gel's soothing properties.

Elaborate: (10 min)

- Divide the students into small groups and give each group a different substance (for example, soap and water, hand sanitizer, or plain water).
- To determine which substance is most effective at cleaning hands, have them conduct a germ-spreading experiment with a harmless powder or visible ink.

Evaluate: (5 min)

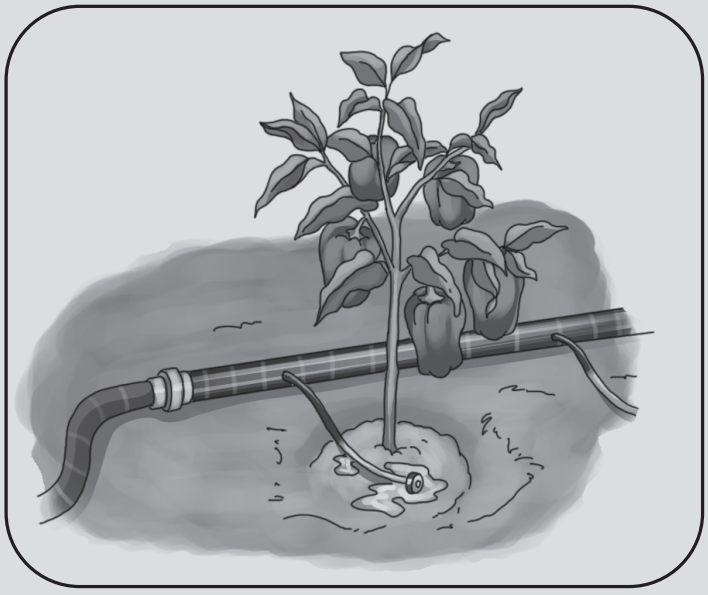
Ask students to explain the science behind hand sanitizers and the importance of proper hand hygiene in preventing the spread of illnesses.

Home Assignment:

- Prepare a brief report on the history and development of hand sanitizers, as well as their effectiveness in preventing disease transmission.
- Complete Q3 on page 81 of workbook.

Worksheet 1:

Identify and explain the type of irrigation:



Name: _____

Explain: _____

_____

_____

Name: _____

Explain: _____

_____

_____

Worksheet 2:

Identify the method of food preservation:

1. In the container, food is processed and sealed.

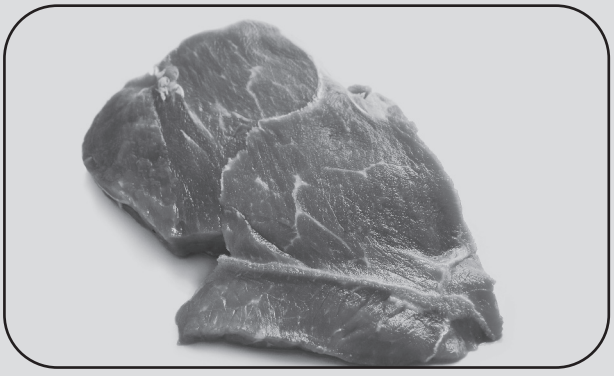
2. Food has been dried.

3. Food is quickly frozen.

4. Food should be soaked in salt water, vinegar, or oil.

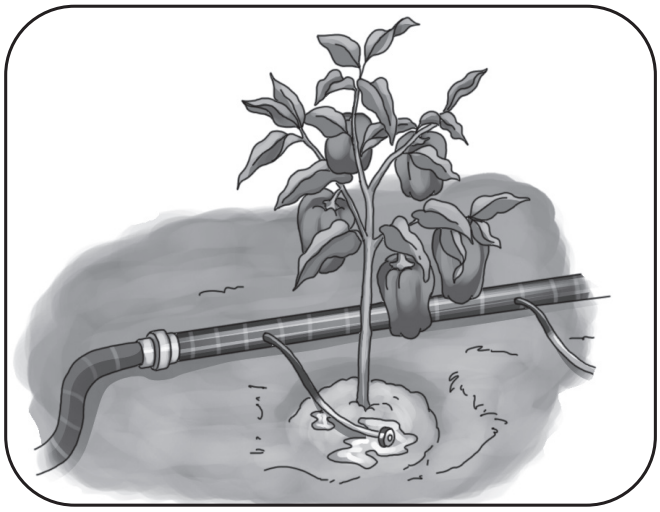
5. Food is vacuum-sealed in an airtight bag.

How do you store the following food items?



Answers for Worksheet 1:

Identify and explain the type of irrigation:



Name: Drip Irrigation System

Explain: Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to plant roots, either above or below the soil surface. The goal is to direct water into the root zone while minimizing evaporation

Name: Sprinkler Irrigation System

Explain: A sprinkler irrigation system is a modern irrigation method.

Perpendicular pipes with rotating nozzles on top are joined to the main pipeline at regular intervals in this type of irrigation system. When water is forced through the main pipe under pressure by a pump, it escapes through the rotating nozzles. It is sprayed on the crop as if it were raining.

Answers for Worksheet 2:

Identify the method of food preservation:

1. In the container, food is processed and sealed.

2. Food has been dried.

3. Food is quickly frozen.

4. Food should be soaked in salt water, vinegar, or oil.

5. Food is vacuum-sealed in an airtight bag.

Canning

Drying

Freezing

Pickling

Vacuum packing

How do you store the following food items?

Freezing and Cooling.

Canning.