PROFESSIONAL DEVELOPMENT FOR QUALITY EDUCATION

Science Teachers' Guide

Lesson Plans

Grade 5

Quaid-e-Azam Academy for Educational Development, Punjab
Wahdat Road, Lahore

PREFACE

There are many reasons why English Language learning has always been considered an essential skill. Approximately four hundred million people worldwide speak English as their first language, whereas English is listed as one of the official languages in more than a quarter of the world. It allows a person to communicate with new people and helps them to see things from a different perspective or get a deeper understanding of another culture. Moreover, it is the language of the media industry, internet, business, and higher education. The Single National Curriculum (SNC) 2020 also highlights its importance as "individual development, international communication and making better career choices". With its implementation, the Quaid-e-Azam Academy for Education Development (QAED), Government of Punjab, through its Material Development Wing, was entrusted with the task of developing teacher guides with the help of education experts and teachers from government and non-government institutions. This task was supervised by the English Language team of the Material Development Wing. The team not only critically reviewed the entire guide but also ensured the incorporation of its recommendations.

While developing this guide, the team recognized that instructional settings and availability of resources vary significantly in the province of Punjab. Therefore, keeping in mind, the important aspects of SNC and active learning, a contextually relevant teaching process has been devised to ensure student learning outcomes.

On behalf of Quaid-e-Azam Academy for Education Development, Government of Punjab, I am deeply grateful to all involved in creating this guide. I hope that this book will be helpful for teachers to teach English effectively and enable them to perform their duties properly.

Thank you,
The Director General
Quaid-i-Azam Academy for Educational Development,
Government of Punjab

Science – Teacher Guide

Introduction

The Government of Punjab School Education Department notified Single National Curriculum (SNC) in 2021. To ensure its effective execution, Quaid-e-Azam Academy for Educational Development has taken the following initiatives:

1. Organized a professional development program for teachers to enhance their understanding of SNC
2. Develop teacher guides to improve instructions at the school level.

Through these initiatives, the teachers will be able to:

- Observe the alignment between SNC, Academic Calendar & Textbooks.
- Ensure the achievement of student learning outcomes given in SNC
- Equip themselves with new teaching techniques.
- Create an interactive learning environment.

Active Learning promotes students to learn by doing through collaborative activities such as problem-solving, role-playing, watching others, arguing, and many more.

Students will not passively acquire material owing to engaging activities and several types of evaluation. The objective is to improve students' capacity to think critically and creatively via the application of innovative instructional strategies and flexible evaluation techniques.

Using this form of instruction, students' knowledge will develop, their social skills will blossom, and their feeling of community will grow.

Increasing the population's familiarity with and comfort with science is a primary goal of science education in Pakistan. Although the scientific method and the process of inquiry are fundamental to teaching and learning in the scientific disciplines, all decisions are ultimately grounded in the active learning process.

We hope to encourage people's innate inquisitiveness by emphasizing the significance of thinking critically about their surroundings and then formulating questions, hypotheses, and experiments to test them.

To encourage the independence and self-confidence of students as learners, a range of instructional strategies are deployed to create an environment conducive to attaining the desired results.

SNC recommends that teachers utilize a range of materials, not simply the prescribed textbooks and teacher's guides.

Brief Overview of SNC

SNC emphasizes developing analytical, critical, and creative thinking through a more activities-based approach rather than static teacher-centric learning. Furthermore, it focuses on equipping learners with principles and attributes such as truthfulness, honesty, tolerance, respect, peaceful coexistence, environmental awareness & care, democracy, human rights, sustainable development, global citizenship, personal care, and safety (SNC 2020).

- The SNC is standards, benchmarks, and outcomes-based across all subjects.
  - The components of the curriculum are given below:
    - Competency: A key learning area involving applied skills and knowledge enabling learners to perform successfully in educational, professional, and other life contexts.
    - Standard: It defines competency by broadly specifying the knowledge, skills, and attitudes to be acquired by students in a particular key learning area during the first five years of schooling.
    - Benchmarks: Further elaborate the expectations about what learners know under each standard, indicating what the students will accomplish at each developmental level to meet the standards.
    - Student Learning Outcomes (SLOs): These are built upon the descriptions of the benchmarks and describe (in key points) what students will accomplish at the end of each unit.

Along with standards and benchmarks, the curriculum also provides a progression matrix containing SLOs grade-wise. For further detail, please refer to the SNC 2020 for the specific subject. In addition, this guide includes lesson plans based on student learning outcomes and textbook content developed by Punjab Textbook Board.

Key Components of Lesson Plan:

TEMPLATE FOR LESSON PLAN

Topic

Lesson plan No.	
Grade:	**Time:**

SLO:

Material / Resources required:

Information for Teachers:

- New concepts
- New ideas
- Teaching tips

Introduction:

- Warm up
- Brainstorming
- Elicitation
- Mind map etc.

Development:

Activity1

Activity2 (Minimum two activities)

Conclusion / Sum up / Wrap up:

Assessment: Focus will be on formative assessment

Follow up:

- home work
- written work
- project

oral assignment etc.

List of Selected Students Learning Outcomes (SLOs)	
General Science-V	
Sr. No	**Students' Learning Outcomes**
Unit 1: Classification of Living	
1.	• Describe classification of organisms and its importance. • Classify the Plants into two groups (monocots and dicot) and five example of each group. • Differentiate between vertebrates and invertebrates based on their characteristics. • Classify vertebrates into fish, amphibians, reptiles, birds and mammals on the basis of their characteristics. • Classify invertebrates into five groups (sponge, worms, insects, molluscs, echinoderms on the basis of their characteristics. • Understand the concept of extinction and endanger species and the role of human action in the loss of biodiversity.
Unit 2: Microorganisms	
2.	• Identify the main groups of microorganisms and give examples for each. • Describe the role of microorganisms in decomposition and discus its harmful and beneficial effects. • Recognize the Microorganisms get transmitted into humans and cause infectious diseases • Suggest preventive measure to protect themselves from these infections
Unit 3: Flowers and Seeds	
3.	• Describe pollination and describe its types with examples. • Define reproduction and differentiate between sexual and asexual reproduction. • Describe the structure of seed and demonstrate its germination.
Unit 4: Environmental Pollution	
4.	• Define pollution and its types • Explain the effects of water air and land pollution (unclean or toxic water, smoke, smog, excess carbon dioxide or other gases, open garbage dumps industrial water, etc.) on the environmental and life. • Explain the effects of fossil fuels and releasing green gases in the air. • Differentiate b/w Biodegradable and non-biodegradable materials.
Unit 5: Physical and Chemical Changes of Matter	
5.	• Describe and demonstrates the process of melting freezing, boiling, evaporation, and condensation. • Identify ways of accelerating the process of dissolving materials in given amount of water and provide reasoning (i.e, increasing the temperature, stirring and breaking the solid into smaller pieces increasing the process of dissolving). • Differentiate between physical and chemical changes with examples.

Unit 6: Light and Sound	
6.	• Identify natural and artificial sources of light. • Investigate luminous and non-luminous objects in daily life. • Identify and differentiate between transparent, opaque and translucent objects. • Explain the formation of shadows. • Predict the location, size and shape of a shadow from a light source relative to the position of objects. • Demonstrate that shining surfaces reflect light better than dull surfaces • Describe and demonstrate how sound is produced by a vibrating body. • Identify that speed of sound differs in solids, liquids, and gaseous medium.
Unit 7: Electricity and Magnetism	
7.	• Describe charges and their properties • Describer and design an electric circuit and explain its components. • Describe and demonstrate that magnets have two poles and like poles repel and opposite poles attract. • Explain different types of magnets (permanent, temporary and electromagnet).
Unit 8: Structure of Earth	
8.	• Describe the Structure of the Earth (i.e., curst, mantle and core) and the physical characteristics of these distinct parts. • Describe the sources of Water on the Earth. • Investigate the composition and characteristics of different soil. • Identify similarities and differences among the different types of soil**.**
Unit 9: Space and Satellites	
9.	• Define the term ‘space’ and emphasize the need to explore it. • Describe the uses of various satellites in space i.e. geostationary, weather, communication and global positioning system (GPS). • Define artificial satellite and explain their importance in exploring the Earth and Space.
Unit 10: Technology in Everyday Life	
10	• Enlist and practice safety procedures while carrying out the activities. • Use a plumb line to install a flag pole vertically. • Make moveable wagon, bus, trolley, etc • Prepare LED light strings working with 12 volt battery

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Space Exploration

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Lesson Plan
1

CLASSIFICATION OF LIVING ORGANISMS
Classification of Organism and Its Types

Duration: 40 Minutes

Students Learning Outcome:

- Describe classification of organisms and its importance.

Materials:

Buttons (some of the same colour, shape and size and some of different colour, shape and size)

Information for Teachers:

- Humans constantly try to organize information about the world around them in meaningful ways. One way that we try to accomplish this is by classifying things into different groups based on how things are alike and different.
- Classification allows us to understand diversity better.
- It helps in the identification of living organisms as well as in understanding the diversity of living organisms.
- Classification helps us to learn about different kinds of plants and animals, their features, similarities and differences.
- It enables us to understand how complex organisms evolve from simpler organisms.
- It is essential to understand the inter-relationships among the different groups of organisms.
- Classification forms a base for the development of other biological sciences.

Introduction: 10 Minutes

- Divide the class into groups.
- Give each group a set of buttons (some of the same colour, shape and size and some of different colour, shape and size)

- Ask students to separate the given set of buttons on whatever basis they find suitable.
- Monitor students during the activity and restate the task if required.
- Once all the groups have completed the task, ask them to take a round to see each other's work.
- Ask each group to answer the following questions one by one:

- Why did you put all blue (or any other colour students have used) buttons together? Or
- Why did you put all round buttons together?
- Why did you place big and small buttons separately? Or
- Why did you place square and round buttons separately?

- Take students' responses and write the words 'same' and 'different' on the board.
- Tell students that in today's lesson, you will learn how to place living organisms into different groups.

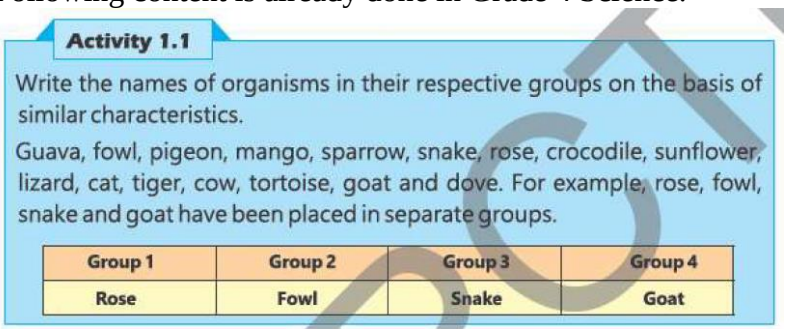
Sum up the Activity

By asking questions from them.

Development: 15 Minutes

Activity 1 – Classification of Organisms

- Ask students to go to page 2 of the Grade 5 Science textbook and attempt activity 1.1.
- Following content is already done in Grade 4 Science.



Activity 1.1

Write the names of organisms in their respective groups on the basis of similar characteristics.

Guava, fowl, pigeon, mango, sparrow, snake, rose, crocodile, sunflower, lizard, cat, tiger, cow, tortoise, goat and dove. For example, rose, fowl, snake and goat have been placed in separate groups.

Group 1	Group 2	Group 3	Group 4
Rose	Fowl	Snake	Goat

- Meanwhile, draw the following table on the board.

Group 1	Group 2	Group 3	Group 4
Rose	Fowl	Snake	Goat

- Select some volunteers randomly and call them one by one to the board.
- Ask each of them to write one answer in the table.
- Keep the rest of the students engaged by asking them, whether the answers on the board are correct.
- Now, ask the class the following questions:
  - Why did you put rose and mango in one group?
  - Why did you put cow and dove in different groups?
- Take students' responses and tell them that we place the organisms of similar characteristics in one group. For example, we made a group of flowering plants like mango, guava, rose and sunflower. We made another group of organisms of other similar characteristics. For example, we made a group of fowl, pigeon, dove and sparrow. All of them have the same characteristics. We have separated the organisms on the basis of similarities and differences. Thus, we have classified the organisms.

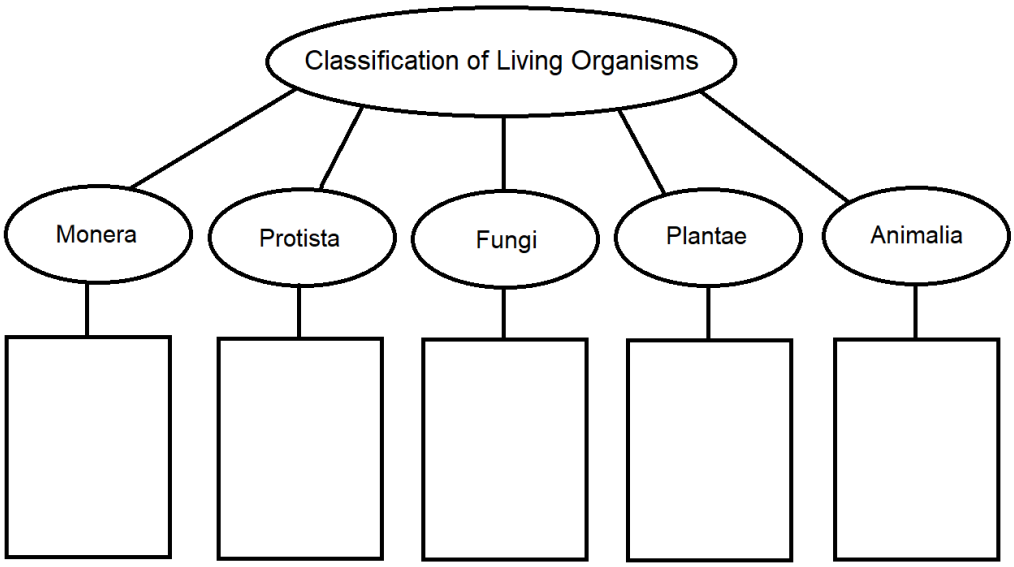
Sum up the Activity 5 Minutes

- Now, write down the definition of classification on the board. Read it and ask students to repeat it after you.

> To put organisms into separate groups on the basis of similarities and differences is c classification.

Activity 2 – Graphic Organization 20 Minutes

- Begin the activity by telling students the importance of classification. Due to classification, we can determine the similarities and differences among organisms. Due to the structure and other characteristics of organisms, we can identify and study them. We can also know the relationship among organisms.
- Now, draw the following graphic organizer on the board.



- Tell students that the organisms have been divided into five kingdoms on the basis of similarities and differences. The names of kingdoms are Monera, Protista, Fungi, Plantae and Animalia.
- Divide the class into five groups and name them kingdoms as follows:
  - Group 1: Monera
  - Group 2: Protista
  - Group 3: Fungi
  - Group 4: Plantae
  - Group 5: Animalia
- Ask each group to read and discuss their respective kingdoms on pages 3 and 4 of the Grade 5 Science textbook.
- Instruct each group to write collectively the following information about their respective kingdom.
  - How do the organisms look like?
  - Where are they found?
  - How do they get food?
  - Some examples
  - Any other point (if any).
- Monitor students during the activity and guide where required.

- Once all the groups have completed the task, ask them to share their responses by filling in the organization chart on the board.
- Appreciate students' efforts using positive remarks.
- Explain the five-kingdom system using examples to the students.
- Play the following video link about five-kingdom classification: https://www.youtube.com/watch?v=G3EShHv7W04

Sum Up the Activity

Ask the follow-up questions after the video.

- Name the five kingdoms.
- Organisms of which kingdom can make their own food?
- To which kingdom does mushroom belong?

Conclusion / Sum up / Wrap up: 9 Minutes

Sum up the lesson by focusing on the following points:

- To put organisms into separate groups on the basis of similarities and differences is called classification.
- The organisms have been divided into five kingdoms on the basis of similarities and differences. The names of kingdoms are Monera, Protista, Fungi, Plantae and Animalia.

Assessment: Teach a Friend 20 Minutes

- Divide the class into groups of five students.
- In every group, assign one of the five kingdoms to each student and ask him/her to explain it to the rest of the four group members. E.g., if student 1 explains Kingdom Monera to the group, student 2 will explain Kingdom Protista.
- Monitor students' during activity and guide them where required.
- Ask the following questions to the class to ensure that students' understanding of the concept has been established.
  - Organisms of which kingdom can make their own food?
  - In which Kingdom are Amoeba and Paramaecium found?
  - Why can fungi not make their own food?
  - How do you find animals different from plants?

Teach a Friend

A good strategy for determinir students understand a concept or pr is to have them teach it to a fr Students need to think about knowledge and skills needed understanding and include information in their teaching.

Follow up: 1 Minute

- Answer question 2 (part ii, iv & v) on page 18 of the textbook in the notebooks.

Glossary

Classification	To put organisms into separate groups on the basis of similari and differences is called classification.
Chlorophyll	A green substance found in plants that helps plants make thei food.
Microscopic	Something so small that can be seen through a microscope on

Teacher Guide
Grade-5

Lesson Plan
2

CLASSIFICATION OF LIVING ORGANISMS
Classification of Plants

Duration: 80 Minutes

Students Learning Outcome:

- Classify the Plants into two groups (monocots and dicot) and five examples of each group.

Materials:

- Seeds of wheat, rice, maize, pea, bean and gram
- Leaves of monocot plants (wheat/rice/maize/sugarcane) and dicot plants (rose/pea/gram/mango)
- Flowers of monocot plants (wheat/rice/maize/sugarcane) and dicot plants (rose/pea/gram/mango)
  2-3 adhesive tapes

Information for Teachers:

- Flowering plants are divided into two groups - monocots and dicots. A monocot, which is an abbreviation for monocotyledon, will have only one cotyledon and a dicot, or dicotyledon, will have two cotyledons.
- Leaves of dicots have veins that are branched. Sometimes the veins branch out on either side of the leaf from a middle vein, in an arrangement resembling a feather shown below.

- Monocots have veins that are parallel to one another as shown in the picture. However, this does not mean that all monocots have narrow grass-like leaves.

- If your plant is flowering, you can tell if it is a monocot or dicot by the number of petals and other flower parts. Monocots have flower parts in threes or multiples of threes as shown below.

- Dicots have flower parts in multiples of fours or fives like the five-petaled dicot flower as shown below.

Introduction 15 Minutes

- On a paper, place seeds of wheat, rice, maize, pea, bean and gram and fold it. Make at least four such sets.
- Divide the class into four groups and give a set of seeds to each of them.
- Ask each group to unfold the paper and observe each type of seed to tell whether it can be split into two halves or not.
- Instruct students to stick the seeds into their notebooks using adhesive tape and write which type of seed is this (can be split into two halves or cannot be split into two halves).
- Meanwhile, draw the following table on the board.

S. No.	Type of Seed	Can be split into two halves or cannot be split into two halves?
1	Wheat	No
2	Rice	
3	Maize	
4	Pea	
5	Bean	
6	Gram	

Sum Up the Activity

- Select a few students randomly and ask them to share their answers and write them in the table as yes/no.

- Tell students that today you will learn about two types of plants called monocot and dicot plants.

Development: 15 Minutes

Activity 1 – Explanation

- Ask students to go to page 5 of the Grade 5 Science textbook and find the term monocot.
- Write the word 'monocot' on the board and describe its meaning as follows:

Monocot = mono cot

means one means cotyledon

- Explain to students that the flowering plants whose seeds have one cotyledon are called monocot plants. Sugarcane, wheat, rice, bamboo and maize are examples of monocot plants.
- Tell students that the other type of plant is called dicot plants.
- Write the word 'dicot' on the board and describe its meaning as follows:

Dicot = di cot

means two means cotyledon

- Explain to students that the flowering plants whose seeds have two cotyledons are called dicot plants. Mango, guava, pea and rose are examples of dicot plants.

Sum up the Activity

- Ask a few volunteers to repeat the explanation of monocot and dicot plants to the class. Guide them where required.

Activity 2 – Observation 20 Minutes

- Provide leaves of monocot and dicot plants to the students and ask them to observe their arrangement of veins.
- Ask a volunteer to draw the leaves of monocot and dicot plants on the board to show the difference in their arrangement of veins.
- Explain to students that in the leaves of a monocot plant, the veins are parallel to each other whereas, in the leaves of a dicot plant the veins are in the form of a net.
- Now, provide flowers of monocot and dicot plants to the students.
- Point out floral leaves of the flowers and tell students that the small leaves of a flower are called floral leaves.
- Ask students to count the number of floral leaves of the flowers of monocot and dicot plants.
- Select a few students randomly and ask them to share their answers. Write their answers on the board.
- Explain to students that the number of floral leaves of a flower of a monocot plant is three or multiple of three whereas, the number of floral leaves of a dicot plant is four or five or their multiple.
- Ask students to go to page 6 of the Grade 5 Science textbook and see the table summarizing the differences between the monocot and dicot plants.

Part of Plant	Monocot Plant	Dicot Plant
Seed		
Leaf		
Flower		

- Play the following video links to show students the differences between monocot and dicot plants.
  https://www.youtube.com/watch?v=xe99TGccbxo
  https://www.youtube.com/watch?v=7DqsZbSdbrk

Sum Up the Activity

- Ask the follow-up questions after watching the videos.
  - What is the key difference between monocot and dicot plants?
  - How are the veins of the leaves of dicot plants?
  - How are floral leaves found in a monocot plant?

Conclusion / Sum up / Wrap up: 10 Minutes

Sum up the lesson by focusing on the following points:

- The flowering plants whose seeds have one cotyledon are called monocot plants. Sugarcane, wheat, rice, bamboo and maize are examples of monocot plants.
- The flowering plants whose seeds have two cotyledons are called monocot plants. Mango, guava, pea and rose are examples of dicot plants.
- In the leaves of a monocot plant, the veins are parallel to each other whereas, in the leaves of a dicot plant the veins are in the form of a net.
- The number of floral leaves of a flower of a monocot plant is three or multiple of three whereas, the number of floral leaves of a dicot plant is four or five or their multiple.

Assessment: Sentence Prompts 19 Minutes

- Write the following sentence prompts on the board:
  - I understand…
  - I do not understand…….
  - I need more information about……...
- Ask students to copy the sentence prompts in their notebooks and complete them. Guide them to keep in view what they have learned about monocot and dicot plants while completing sentence prompts.
- Collect notebooks at the end for checking students' responses.

Sentence Prompts

Sentence prompts can be used in a va of ways to informally assess students gather information to inform instructio

Follow up: 1 Minute

- Paste leaves of monocot and dicot plants in the scrapbook.
- Paste dried and preserved flowering and non-flowering plants in the scrapbook.

Glossary

Monocotyledonous	Any member of the flowering plants having a single cotyledon in the seed.
Dicotyledonous	Any member of the flowering plants having a pair of cotyledons in the seed.
Floral leaf	One of the modified leaves forming the perianth (calyx or corolla) of a flower, as a sepal or petal.

Teacher Guide
Grade-5

Lesson Plan
3

CLASSIFICATION OF LIVING ORGANISMS
Difference between Vertebrates and Invertebrates

Duration: 40 Minutes

Students Learning Outcome:

- Differentiate between vertebrates and invertebrates based on their characteristics

Materials:

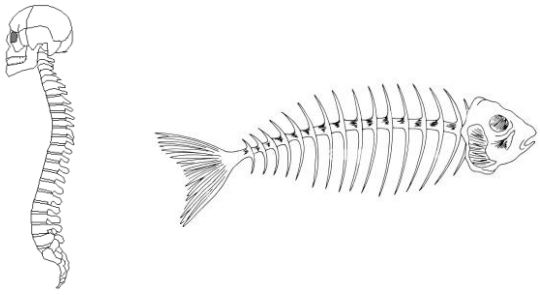
- Old newspapers or magazines or books having pictures of animals in them (animals with a backbone and without a backbone)
- 2 scissors
- 2 glue sticks
- 12 white paper sheets
  Stapler

Information for Teachers:

- Vertebrates are the most advanced species in the animal kingdom. Members possess a well-defined internal skeleton system, which includes a backbone. Examples of vertebrates include all chordates such as mammals, birds, fish, reptiles, amphibians etc.
- Invertebrates can be simply identified as animals that do not have a backbone. They are found almost everywhere, from the hottest deserts and the deepest seabed to the darkest caves and the tallest mountains. Invertebrates are animals which mainly lack a skeletal system. This means most of them do not possess a rigid body structure and as a result, cannot grow very large. Prominent examples include sponges, snails, and octopuses.

Introduction: 15 Minutes

- Begin the class by asking students to put their hands on their back and feel the long bone going down their neck.
- Ask students, what is this long bone called.
- Take students' responses and tell them this is the backbone.
- Now, draw the following diagrams on the board.

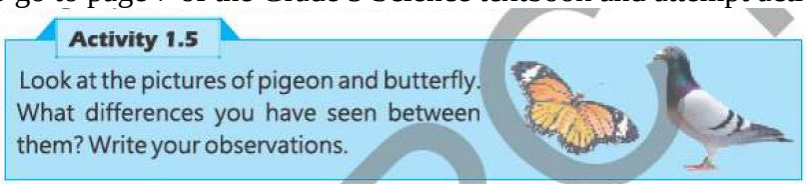


- Tell students (pointing at the first diagrams) that this is what the backbone looks like in our body. It keeps our body upright. Besides human beings, there are other animals who have the backbone to support their body. E.g., (pointing at the second diagram) fish has a backbone too.
- Tell students that in today's lesson, you will learn about two types of living organisms; one with the backbone and the other without the backbone.

Development 15 Minutes

Activity 1 – Vertebrates and Invertebrates

- Ask students to go to page 7 of the Grade 5 Science textbook and attempt activity 1.5.



- Ask students to write the differences between a pigeon and a butterfly in their notebooks.
- Ask a few volunteers to share their answers.
  [Students might come up with a number of differences. Guide students' responses towards the presence or absence of the backbone]
- Write on the board that a pigeon has a backbone so it is called a vertebrate whereas, a butterfly does not have a backbone so it is called an invertebrate.
- Elaborate on the concept of vertebrates and invertebrates using the description given on page 7 of the textbook.

Sum up the activity

- At the end, ask students to come up with some examples of vertebrates and invertebrates from their surroundings.

Activity 2 – Album of Animals 20 Minutes

- Divide the class into two groups.
- Give each group some old newspapers or magazines or books that have pictures of animals in them and a set of 6 white paper sheets.
- Ask each group to select pictures of three animals with a backbone and three animals without a backbone and paste them on individual white sheets.
- Instruct students to identify each animal as vertebrate or invertebrate and write a few of its characteristics with its picture.
  E.g., Fish
  - It has a backbone so it is a vertebrate.
  - It has fins and tails.
  - It lives in water.

- Monitor students during the activity and guide where required.

Sum up the activity

By asking them reasons of placing these animals in their respective groups

Conclusion / Sum up / Wrap up: 10 Minutes

Sum up the lesson by focusing on the following points:

- Animals with a backbone are called vertebrates. E.g., frog, shark, snake, crocodile, eagle, elephant.
- Animals without a backbone are called invertebrates. E.g., butterfly, spider, earthworm, snail, starfish.

Assessment: Example/Non-Example 19 Minutes

- Use the given link to play the online game on vertebrates and invertebrates. https://www.ecosystemforkids.com/games/2nd-grade/vertebrates-and-invertebrates/activity.html

Alternative (in case there is no internet facility):

- Divide the board into two columns. Label one column as vertebrates and the other as invertebrates.
- Say aloud the name of an animal (e.g., sparrow) and ask a randomly selected student to write the name of the animal in its correct column.
- Repeat the above step using several examples of vertebrates and invertebrates.

Examples/ Non-Examples

The examples and non-exar provide you with inform regarding the depth of understar of your students.

Follow up: 1 Minute

- Write down the definitions of vertebrates and invertebrates with examples in the notebooks.

Glossary

Vertebrate	An animal with a backbone.
Invertebrate	An animal without a backbone.

CLASSIFICATION OF LIVING ORGANISMS
Classification of Vertebrates

Duration: 40 Minutes

Students Learning Outcome:

- Classify vertebrates into fish, amphibians, reptiles, birds and mammals on the basis of their characteristics.

Materials:

- 2 chart papers
- 5 A4 size papers with examples and non-examples of vertebrates written on them
- 2 markers
  An adhesive tape

Information for Teachers:

- Vertebrates are divided into five major groups i.e., fishes, amphibians, reptiles, birds and mammals.
- Fish have no legs and they swim and live in water. They have fins for swimming.
- Amphibians have legs. Their skin is moist. They can live both in water and on land. They swim in the water and hop on land e. g., frog.
- Reptiles have legs. Their skin has scales. They crawl on land e.g., snake.
- Birds have legs. Their skin has feathers. They live on land and can fly in the air e.g., sparrow.
- Mammals have legs. They have hair on their skin. They feed their young ones on milk. Most mammals live on land and can run e.g., goat, cow.

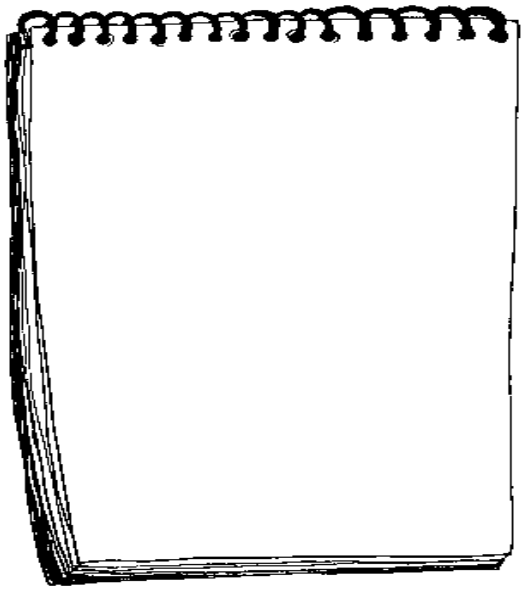
Introduction: 10 Minutes

- Begin the lesson by telling students that we have learned about vertebrates i.e., animals with a backbone. E.g., frog, monkey, dove, snake and shark.
- Ask students, do you think these animals are similar in terms of their bodies, the place they live or the food they eat.
- Obtain students' responses on how these animals are different from each other.
- Note down relevant points on the board. [E.g., a frog lives in water whereas, a monkey lives on land or a dove has two legs but a snake does not have any legs, etc.]
- Tell students that you will learn about different groups of vertebrates in today's lesson.

Development:

Activity 1 – Scanning 20 Minutes

- Divide the class into two groups. Assign one group of vertebrates to each as follows:
  Group 1: Fish
  Group 2: Amphibians
- Give each group a chart paper and a marker.
- Draw a Find Facts chart on the board and ask students to copy it on their chart paper.



- Tell both the groups to go to pages 7 and 8 of the Grade 5 Science textbook.
- Instruct students to read collectively about their assigned group of animals and fill in the Find Facts chart in their notebooks.
- Ask both the groups to paste their chart papers side by side on a wall.
- Ask group 1 to read the Find Facts chart of group 2 and vice versa. Both the groups should find out at least two similarities between Fish and Amphibians.
- Ask both groups to share their responses one by one.

Sum up the activity

- Conclude the activity by appreciating students' efforts using positive remarks.

Activity 2 – Role-Play 20 Minutes

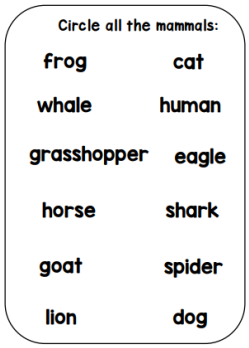
- Divide the class into three groups. Assign a group of animals to each group as follows:
  Group 1: Reptiles
  Group 2: Birds
  Group 3: Mammals
- Tell students that they have to read the description of their assigned group of animals provided on pages 8, 9 and 11 in the Grade 5 Science textbook. Subsequently, select an example (of animal) and role-play it.
- Guide students on how to act in a role-play. Give them an example such as:
  Suppose that I am a goldfish.

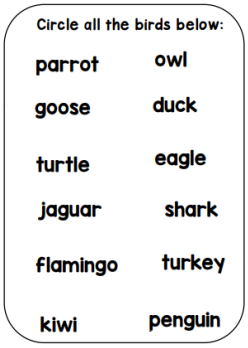
I am a goldfish. I belong to the group Fish. I live in water. Both ends of my body are pointed. I have scales on my skin. I breathe through my gills. I have fins and tails to help me swim. I lay eggs.

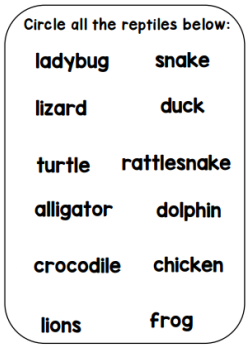
- Encourage all the students to participate in the activity. [In a group one student should tell only one characteristic to give chance to other group members.]

Activity 3 – Reinforcement 10 Minutes

- Divide the class into five groups.
- Give each group one of the following sets of examples/non-examples of vertebrates written on A4 size papers.







- Ask each group to identify the examples of their respective group of vertebrates by circling them on the paper.
- Collect the papers and display them on the board one by one.
- Take students' responses on each other's paper and guide where required.

Conclusion / Sum up / Wrap up: 10 Minutes

Sum up the lesson by focusing on the following points:

- Animals with a backbone are divided into five groups, namely Fish, Amphibians, Reptiles, Birds and Mammals.
- They possess characteristics which make them different from each other.
- Examples of Fish are shark, goldfish, rohu.
- Examples of Amphibians are frog, newt and toad.
- Examples of Reptiles are snake, lizard and tortoise.
- Examples of Birds are sparrow, dove and eagle.
- Examples of Mammals are horse, lion and cat.

Assessment: Drag and Drop 9 Minutes

- Use the given link to play the online game by dragging and dropping the animals into their correct groups.
  https://www.sheppardsoftware.com/science/animals/games/animal-characteristics/

Online Games
Using games in teaching can help increase student participation, foster social and emotional learning, and motivate students to take chances.

Alternative (in case there is no internet facility):

- Jumble up the characteristics of animals of different groups on the board.
- Divide the board into five columns. Label the columns as Fish, Amphibians, Reptiles, Birds, Mammals.

- Ask students to read the first characteristic and tell in which of the five columns it should be placed.
- Repeat the above step till all the characteristics of the animals (written on the board) are placed in the correct columns.

Follow up: 1 Minute

- Do question 3 on page 18 of the textbook in the notebook.

Glossary

Reproduction	The process of producing offspring that are genetically similar to the parent organism.
Creeping animals	Animals that go on their belly, or move with small, short legs.
Webbed feet	Having the toes connected by a membrane.

CLASSIFICATION OF LIVING ORGANISMS
Classification of Invertebrates

Duration: 40 Minutes

Students Learning Outcome:

- Classify invertebrates into five groups (sponge, worms, insects, molluscs, echinoderms on the basis of their characteristics)

Materials:

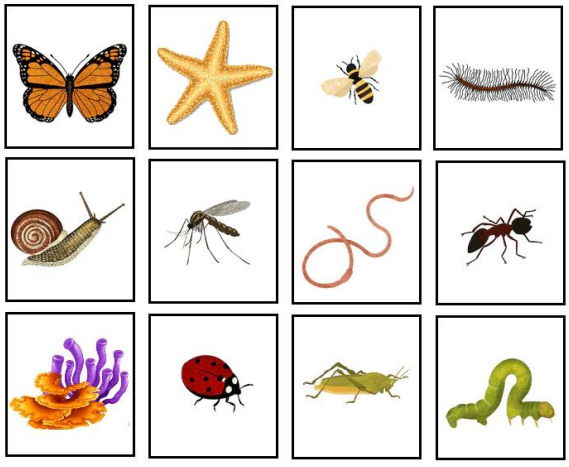
- 2 sets of flashcards showing pictures of different invertebrates
- 5 chart papers
- 5 markers
- An adhesive tape

Information for Teachers:

- All invertebrates do not have a spinal cord or vertebral column, instead, most of them possess an exoskeleton that encompasses the entire body.
- Normally, these are tiny and don't grow very large.
- They do not possess lungs since they respire through their skin.
- They cannot make their own food. Instead, they take nutrition from other sources of organic carbon, mainly plant or animal matter.
- They reproduce by two reproductive cells, or gametes, coming together to produce a new organism of their species.

Introduction: 10 Minutes

- Divide the class into two groups.
- Provide a set of flashcards (with pictures of invertebrates) to each group.
- Without telling students how to sort, ask students to divide the given invertebrates' pictures into different groups. Tell them to try to guess by looking at the pictures.
- Let students divide the pictures into as many groups as they want.
- Ask a few students the reason for placing the invertebrates in the same group or in different groups.

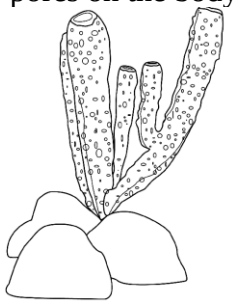


- Tell students that you will learn to classify invertebrates into different groups in today's lesson.

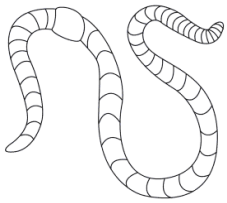
Development:

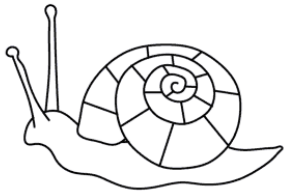
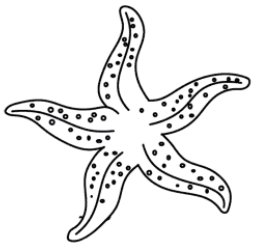
Activity 1 – Draw and Explain 20 Minutes

- Draw the picture of a sea sponge on the board. Explain the characteristics of sponges using the explanation provided on page 12 of the Grade 5 Science textbook. Highlight the features in the diagram such as pores on the body and internal canals.



- Subsequently, draw the picture of any one member of each of the invertebrate groups and explain its characteristics.



- At the end, give students the set of flashcards (with pictures of invertebrates) again and ask them to sort it into different groups.
- Monitor students during the activity and guide them where required.

Sum up the Activity

Activity 2 – Watching Video 20 Minutes

- Play the following video link to describe the diversity of invertebrates.
  The Diversity of Invertebrates - YouTube
- Ask the follow-up questions after the video.
  - What are invertebrates?
  - How is the body of a worm?
  - Which group of invertebrates does not have any internal organs?
  - To which group snail belongs?
  - What does the word 'echinoderm' mean?

Alternative (in case there is no internet facility)

- Divide the class into suitable groups.
- Ask each group to read the characteristics of five groups of invertebrates and discuss them in the group.
- Ask the follow-up questions to see how much students have grasped about the classification of invertebrates.
  - What are invertebrates?

- How is the body of a worm?
- Which group of invertebrates have a body full of pores?
- To which group snail belongs?
- Which group of invertebrates have a spiny covering?

Conclusion / Sum up / Wrap up: 15 Minutes

Sum up the lesson by focusing on the following points:

- Animals without a backbone are divided into five groups, namely Sponges, Worms, Insects, Molluscs and Echinoderms
- Sponges live in water and their body is full of pores.
- Worms have soft, round and cylindrical bodies.
- Insects have jointed legs.
- Molluscs have soft bodies. The body of some molluscs is covered with a shell.
- Echinoderms are found in oceans. Their body has a spiny covering.

Assessment: Graffiti Wall 14 Minutes

- Paste five chart papers on the walls of the classroom at an adequate distance.
- Divide the class into five groups and assign each one a group of invertebrates.
  - Group 1: Sponges
  - Group 2: Worms
  - Group 3: Insects
  - Group 4: Molluscs
  - Group 5: Echinoderms
- Provide a marker to each group and ask them to label one of the chart papers on the wall with their group number.
- Ask the students to draw an example of the invertebrate from the assigned group and with the help of drawing show its characteristics. (Instruct them to draw not to write the characteristics.)
- Check the drawings of all groups. Observe if there appear to be gaps in students' understanding.
- Give feedback to each group; appreciate their efforts, highlight shortcomings and suggest ways to fill up the gaps.
- Leave the graffiti wall up for some time (e.g., a week) and tell students that they can continue to add points and drawings.

Graffiti Wall

The graffiti wall is a fun activity for students and gives you a visual representation of what your students have learned during a unit of study.

Follow up: 1 Minute

- Do question 1 on page 17 of the textbook.

Glossary

Cylindrical	Having the shape of a cylinder (straight parallel sides and a circular or ova cross-section)
Segments	Each of the parts into which the body of a worm is divided.
Exoskeleton	A hard external covering for the body in some invertebrate animals.

CLASSIFICATION OF LIVING ORGANISMS
Biodiversity

Duration: 40 Minutes

Students Learning Outcome:

- Understand the concept of extinction and endangered species and the role of human action in the loss of biodiversity.

Materials:

- A chart showing various plants and animals
- 4-5 chart papers
- An adhesive tape

Information for Teachers:

- Ecosystem function is important for supporting plant and animal communities and ensuring our long-term survival.
- The main threats facing biodiversity globally are:
  - Destruction, degradation and fragmentation of habitats, or homes, for plants and animals.
  - Reduction of the ability of life to survive and reproduce because of exploitation, pollution and introduction of new species.
- Biodiversity conservation refers to the protection, upliftment, and management of biodiversity to derive sustainable benefits for present and future generations.
- Following are the important strategies for biodiversity conservation:
  - All the varieties of food, timber plants, livestock, microbes and agricultural animals should be conserved.
  - All the economically important organisms should be identified and conserved.
  - Unique ecosystems should be preserved first.
  - The resources should be utilized efficiently.
  - Poaching and hunting of wild animals should be prevented.
  - The reserves and protected areas should be developed carefully.
  - The levels of pollutants should be reduced in the environment.
  - Deforestation should be strictly prohibited.
  - Environmental laws should be followed strictly.
  - The useful and endangered species of plants and animals should be conserved in their nature as well as artificial habitats.
  - Public awareness should be created regarding biodiversity conservation and its importance.

Introduction: 20 Minutes

[Take a chart paper. Cut pictures of various plants and animals from old newspapers or magazines and paste them on the chart paper.]

- Paste the chart on the board and ask students, what is this?
- Take students' responses. [Students may name most of them such as a rose/sunflower plant or a cat/dog/fish/butterfly/bear]
- Ask students to elaborate on what this variety of animals and plants tell them.
- Take students' responses. [Students may say, there are several plants and animals on the earth/ there are a variety of animals on the earth which swim or fly or run, etc.]
- Tell students that the number of kinds of living things present in a particular place is called biodiversity. Describe the meaning of the word by splitting it into 'bio' (means life) and 'diversity' (means variety).
- Tell students that in today's lesson you will learn about the loss of biodiversity due to human activities.
- Play the following video link to make students watch the variety of living organisms on the earth and understand the term biodiversity.
  What is Biodiversity? - YouTube

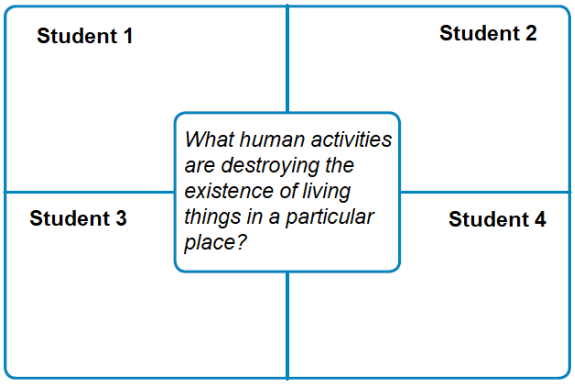
Development:

Activity 1 – Extinct vs Endangered 10 Minutes

- Ask students if they have heard about dinosaurs. (If possible, show a picture of a dinosaur).
- Take students' responses and tell them that about 66 million years ago there were very big creatures living on the earth called dinosaurs. We know about them from their fossil teeth and bones. So, dinosaurs are said to be extinct. The living organisms that are no longer found in this world are called extinct. On the other hand, there are many living organisms that are very likely to become extinct in near future. Such organisms are called endangered. E.g., Panda, Bengal Tiger.
- Ask students to name a few extinct or endangered animals or plants in Pakistan if they know.
- Write their names on the board. [snow leopard, green turtle, hawk, Indus dolphin, markhor, pine trees, juniper trees, mangrove plants]

Activity 2 – Placemats 20 Minutes

- Divide the class into groups of four students.
- Provide a chart paper (prepared as shown below) to each group.



- Write the target question in the centre of the chart paper (centre mat).
  What human activities are destroying the existence of living things in a particular place?
- Ask students to divide the chart paper up so they each have a section (individual placemat) to write in their answers. In the end, write the collaborative answer on the centre mat.
- Provide appropriate time to the students for the activity.
- Meanwhile, divide the board into two columns and label them as follows.

S. No.	Human Impact on Biodiversity	Conservation of Biodiversity
1		
2		
3		

- Once all the groups have completed their task, ask them to share their centre mat answers with the class one by one.
- Write students' responses in the left-hand side column.
- Guide students where required.

Activity 3 – Conservation of Biodiversity 15 Minutes

- Ask students to remain in the same groups and discuss among themselves the ways of saving living organisms from being extinct or endangered. Guide them to read the first impact on biodiversity in the table on the board and suggest a way for conservation accordingly. Give them an example as follows:

S. No.	Human Impact on Biodiversity	Conservation of Biodiversity
1	Forests are being cut for making house industries.	Strict laws should be made to bar cutting of trees.
		Plant more and more trees every year.
2	Animals are being hunted for fun make leather goods.	
3	Oil spills by ships are causing har aquatic animals.	

- Give students appropriate time for discussion.
- Ask each group to share their responses with the class.
- Write students' responses in the table.

Sum up the activity

- Conclude the activity by adding some innovative ways of conservation to students' list.

Conclusion / Sum up / Wrap up: 10 Minutes

Sum up the lesson by focusing on the following points:

- The number of kinds of living things present in a particular place is called biodiversity.
- The type of plants and animals no longer found in this world are called extinct. E.g., dinosaurs.
- Many organisms that are very likely to become extinct in near future are called endangered organisms such as the Bengal tiger and panda.

- The forests are being cut for cultivation and urbanization. The cutting of forests has destroyed the habitats of animals.
- Hunting of animals has also contributed to the loss of biodiversity.
- For the conservation of biodiversity, the trade of endangered animals has been regularized.
- National parks have been made all over the world where endangered animals are kept.

Assessment: One-Minute Essay **4 Minutes**

- Ask students to respond to the given question in one minute in their notebooks.

  What one suggestion you can provide to the management of a zoo to save the animals who are affected by pollution and lack of care?
- Collect students' notebooks for checking and provide them feedback in the next class.

One-Minute Essay

The one-minute essay is a quick formative assessment strategy that allows a teacher to gauge student understanding of a particular topic. Use questions that cause students to reflect on learning and make personal connections with their own lives.

Follow up: **1 Minute**

- Make a colourful poster to bring awareness about the conservation of biodiversity among people.

Glossary

Biodiversity	The number of kinds of living things present in a particular place is called biodiversity.
Fossil	The remains or impression of a prehistoric plant or animal embedded in rock and preserved in petrified (stone-like) form.
Extinct	The type of plants and animals no longer found in this world are called extinct.
Endangered	Organisms that are very likely to become extinct in near future are called endangered organisms.
Conservation	The protection, upliftment, and management of biodiversity to derive sustainable benefits for present and future generations.

MICROORGANISMS
Groups of Microorganisms

Duration: 40 Minutes

Students Learning Outcome:

- Identify the main groups of microorganisms and give examples for each.

Materials:

- 2 sets of flashcards with characteristics of viruses, bacteria and fungi
- 6 empty boxes (of biscuits/cereals can be taken)
- 2 markers
- An adhesive tape

Information for Teachers:

- Microorganisms are divided into various groups on the basis of their size, structure and need for food. The main groups of microorganisms are viruses, bacteria and fungi.
- Viruses are acellular, meaning they do not have a cellular structure. They are a link between living and non-living things. They can reproduce only within a living organism called the host. Outside the host viruses are non-living.
- Bacteria are single-celled organisms. Bacteria are microbes with a cell structure simpler than that of many other organisms. They are found in air, water, soil and inside living things. Some bacteria are harmful, but most of them serve a useful purpose. They support many forms of life, both plant and animal, and they are used in industrial and medicinal processes.
- Fungi can be single-celled or very complex multicellular organisms. They are found in just about any habitat but most live on the land, mainly in soil or on plant material rather than in sea or freshwater. A group called the decomposers grow in the soil or on dead plant matter where they play an important role in the cycling of carbon and other elements. Some are parasites of plants causing diseases such as mildews, rusts, etc.

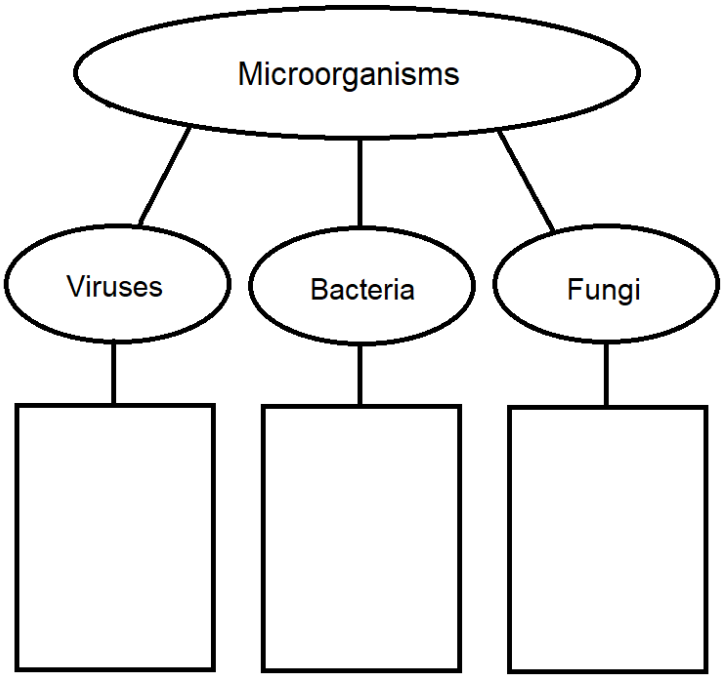
Introduction: 5 Minutes

- Begin the lesson with brainstorming. Ask students to tell what things are present everywhere. (Students may say, Allah/God or air)
- Use hints to guide students. For example, they are present in water, air, soil, food and even inside our bodies. We cannot see them with a naked eye and use a microscope.
- Encourage students to come up with as many answers as they could. Keep directing their attention towards the correct answer (microorganisms) by giving away clues.
- Eventually, tell students that in today's lesson you will learn about microorganisms. Explain the meaning of microorganisms to the student i.e., 'micro' means 'small' and 'organisms' means 'living things'. Microorganisms are so small that can be seen through a microscope only.

Development:

Activity 1 — 30 Minutes

- Draw the following organization chart on the board.



- Tell students that there are many types of microorganisms. They are divided into various groups on the basis of their size, structure and need for food. The three main types of microorganisms are viruses, bacteria and fungi.
- Divide the class into three groups. Assign students a group of microorganisms as follows:
  - Group 1: Viruses
  - Group 2: Bacteria
  - Group 3: Fungi
- Ask each group to read the description of their assigned group of microorganisms given in the textbook on pages 22 and 23.
- Instruct students to discuss the characteristics of the microorganisms and underline difficult words.
- Monitor students during the activity and explain to them the meaning of difficult words or terminologies they have underlined.
- Now, ask each group to fill in the organization chart on the board by writing the characteristics of their respective microorganisms and explain them to the class.
- Step in at any point if more clarification or explanation is needed.
- Appreciate students' efforts using positive remarks.

Sum up the Activity

- Repeat the description using additional information (information for teachers) about microorganisms.

Activity 2 — 30 Minutes

- Divide the class into two groups.
- Give a jumbled set of flashcards with characteristics of viruses, bacteria and fungi to each group.

Jumbled Characteristics to Make Flashcards

1. They are neither like plants nor like animals.
2. They are a link between living and non-living things.
3. They grow on dead organisms.
4. They can be spiral-shaped.
5. They can cause tuberculosis.
6. They can cause polio.
7. They help in the digestion of our food.
8. They can cause athlete's foot.
9. Yeast is an example of this group.
10. They are divided into three types on the basis of shape.

- Give each group three empty boxes (of biscuits/cereals/or any other thing) and ask students to label them as Viruses, Bacteria and Fungi (shown below).

- Instruct students to read the characteristics written on the flashcards, discuss them among the group and put them into the right box. For example, if a flashcard says, they can be rod-shaped, it should be placed in the box labelled as Bacteria.
- Monitor students during the activity and guide them where required.
- In the end, ask both groups to exchange their boxes and check whether the flashcards are put into the right boxes.
- In the case of wrong placements, repeat the characteristics of the relevant microorganisms to reach the right answer.
- Play the following video link to describe the types of microorganisms.
  Microorganisms | The Dr. Binocs Show | Educational Videos For Kids - YouTube
- Ask the follow-up questions after the video.
  - How can we see microorganisms?
  - Which group of microorganisms is present in our mouth?
  - Name a disease caused by viruses.
  - Which group of microorganisms feed through microscopic threads?

Alternative (in case there is no internet facility)

- Draw the following table on the board and ask students to copy it in their notebooks.

Drawing	Shape of Bacteria
	
	
	

- Ask students to write down the shape of each type of bacteria in the table.

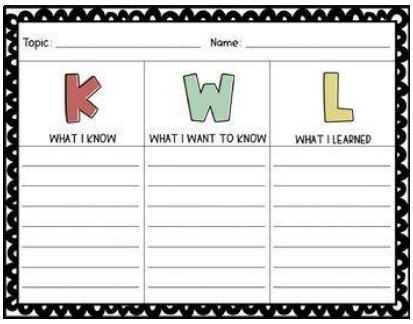
Conclusion / Sum up / Wrap up: 5 Minutes

Sum up the lesson by focusing on the following points:

- Microorganisms are very small living organisms that can be seen through a microscope only.
- Microorganisms are divided into various groups on the basis of their size, structure and need for food. The main groups of microorganisms are viruses, bacteria and fungi.
- Viruses are living when they are inside a living organism whereas, they are non-living when they are outside a living organism. They are very harmful.

Assessment: KWL Chart 9 Minutes

- Draw the KWL chart on the board and explain it as follows:
  - The first column is K. In this column write what you had already known about microorganisms.
  - In the second column W, write about what you wanted to know about microorganisms.
  - In the third column L, write what you have learned about different types of microorganisms.
- Ask students to copy the KWL chart in their notebooks and fill it out.
- Select a few students randomly and take their responses.
- From students' answers evaluate how much they have grasped about the topic.
- Address the grey areas by repeating key points.



Follow up: 1 Minute

- Do question 2 on page 30 of the textbook.

Glossary

Microorganisms	Microorganisms or microbes are organisms of microscopic size, which may exist in their single-celled form or as a colony of cells.
Acellular	Not made up of cells or divided into cells.
Habitat	The natural home or environment of an animal, plant, or other organisms.
Decomposers	Decomposers are a group of organisms that essentially break down decaying organic matter.
Infectious	Communicable by infection, as from one person to another or from one part of the body to another.

Teacher Guide
Grade-5

Lesson Plan
8

MICROORGANISMS
Role of Microorganisms as Decomposers

Duration: 40 Minutes

Students Learning Outcome:

- Describe the role of microorganisms in decomposition and discuss its harmful and beneficial effects.

Materials:

- ABC brainstorming chart

Information for Teachers:

- Decomposers play a critical role in the flow of energy through an ecosystem. They break apart dead organisms into simpler inorganic materials, making nutrients available to primary producers.
- Decomposers are the ecological cleansers that disintegrate the dead, plants as well as animals. By decomposing the dead, decomposers also help to create a biosphere for the new life. Thus, decomposers play a crucial role in creating a balance in the ecosystem.
- Compostable or biodegradable waste is waste that can be broken down and recycled by decomposers.
- Decomposers are also used in industrial applications such as oil spill clean-ups.

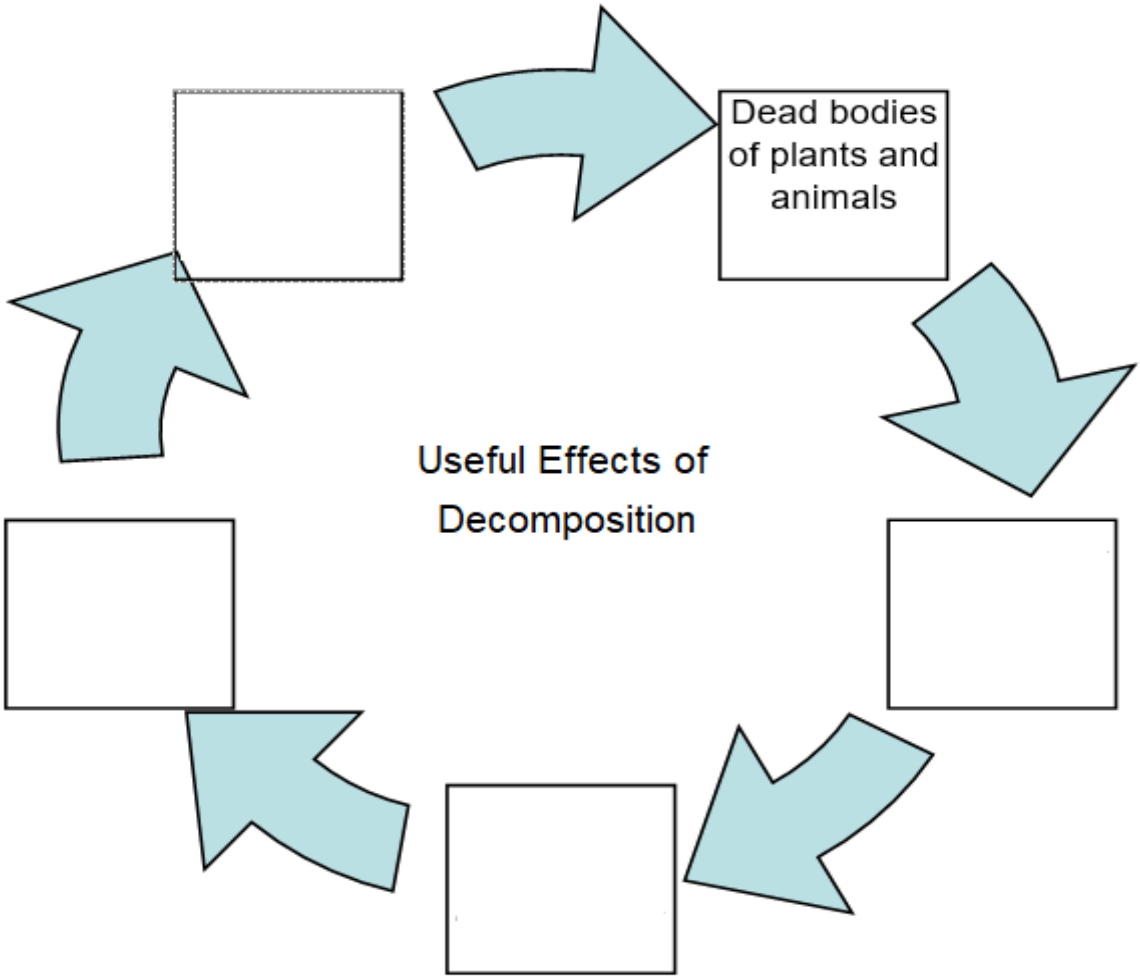
Introduction: 3 Minutes

- Begin the lesson with brainstorming. Ask students, what may happen to all the litter/rubbish in the world if it is not recycled. (Students may say, it will pile up/there will be rubbish all around us.)
- Tell students that we recycle waste such as used cans, glass bottles, paper and turn them into useful things. This helps us to manage waste on our land.
- Ask students, to think of a way in which the process of recycling waste takes place naturally.
- Take students' responses and tell them that in today's lesson you will learn about a process called decomposition. Explain the meaning of decomposition to the students i.e., decompose means to break down. Decomposition is the process by which complex substances are broken down into simpler substances, especially by the action of living things (bacteria and fungi).

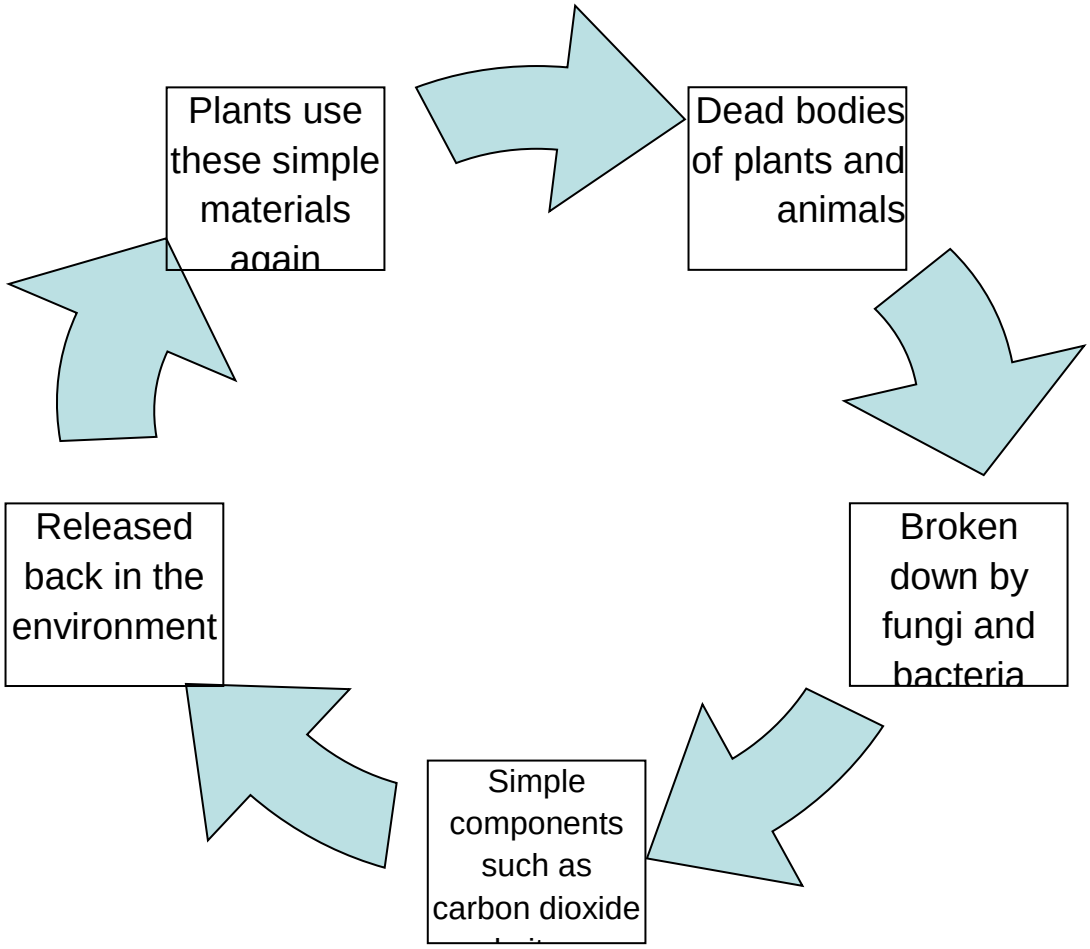
Development: 10 Minutes

Activity 1 – Cyclic Process

- Draw the following diagram on the board. Tell students that the diagram is called a cycle. It is used to show the steps of a process that goes on and on.
- Ask students to copy it in their notebooks.



- Make students sit in pairs.
- Ask students to go to page 24 of the Grade 5 Science textbook and read about the *useful effects of decomposition*.
- Guide students by explaining the meaning of difficult words/terminologies in the text.
- Once all the students have finished reading, instruct them to fill in the missing information of the process in the boxes by picking up steps from the text. Remind them to work in pairs.
- Select 4-5 pairs randomly and ask them to share their answers on the board one by one.
- Explain each step of the process to cover the points students have missed.
- Appreciate students' efforts using positive remarks and fill out the diagram with the best answers.



Activity 2 – Real-Life Examples 5 Minutes

- Ask students to come up with real-life examples of the harmful effects of decomposition. Guide them to think of things that are destroyed or spoiled with time.
- Write down students' responses on the board.
- Categorize students' responses as food items, material, etc.

Food items	Material
Milk is spoiled.	Wood is destroyed.
Bread gets molds.	Leather goods are destroyed.
Fruits and vegetables are decomposed.	

Activity 3 – Microbial Diseases 9 Minutes

- Play the following video link to describe the types of microorganisms.
  Diseases Caused By Microbes - Health and Hygiene (CBSE Grade 6 Science) - YouTube
- Ask students to make the following table in their notebooks.

Bacteria	Fungi	Virus

- Instruct students to fill in the table with the names of diseases that each type of microorganism causes.

Alternative (in case there is no internet facility)

- Ask students to go to page 25 of the Grade 5 Science textbook and read the list of diseases caused by viruses, bacteria and fungi.
- Meanwhile, paste the following ABC brainstorming chart on the board.

Diseases Caused by Microorganisms		
A	_____	
C	_____	_____
F	_____	
H	_____	
M	_____	
P	_____	_____
R	_____	_____
S	_____	
T	_____	_____

Three Things

The three things strategy involves giving each student a piece of paper and having them visually represent, through words or drawings, three things they have learned in the unit/topic so far. Tell students to provide as many details as possible to determine the depth of their understanding.

- Ask students to name a microbial disease(s) that start with the given alphabets.
- Write students' responses in the chart.
- Give students hints in case they miss out on any disease.

Conclusion / Sum up / Wrap up: 2 Minutes

Sum up the lesson by focusing on the following points:

- During decomposition, bacteria and fungi break the complex molecules of food and dead bodies into simple components, carbon dioxide and nitrogen gases. Plants use these simple materials again to make their food.
- Microorganisms damage food and wood. They also spoil milk, bread, fruits and vegetables.
- Microorganisms cause diseases in plants and animals and are called pathogens.
- Infectious diseases can spread quickly from one organism to the others.

Assessment: Three Things 10 Minutes

- Draw the following Three Things table on the board.

ONE Useful Effect of Decomposers	TWO Harmful Effects Decomposers	THREE Diseases Caused b Microorganisms

- Ask students to copy the table in their notebooks.
- Ask students to write one useful effect of decomposers, two harmful effects of decomposers and three diseases caused by microorganisms in the table.
- Give them 5 minutes to complete the table.
- Select a few students randomly and ask them to share their answers.
- Guide students' where necessary.

Three Things

The three things strategy involves giving each student a piece of paper and having them visually represent, through words or drawings, three things they have learned in the unit/topic so far. Tell students to provide as many details as possible to determine the depth of their understanding.

Follow up: 1 Minute

- Write short answers to the following questions in the notebooks.
  - Why some bacteria and fungi are called decomposers?
  - What is a pathogen?

Glossary

Decomposition	The process of breaking down organic material, such as dead plant or animal tissue, into smaller molecules that are available for use by the organisms of an ecosystem.
Producers	Producers are organisms (mainly green plants) that produce food for themselves and other organisms. They use energy and simple inorganic molecules to make organic compounds.
Abiotic	Abiotic components include physical conditions and non-living resources that affect living organisms in terms of growth, maintenance, and reproduction. E.g., water, air, light.
Biotic	Biotic components are all the living things in an ecosystem. E.g., animals, plants and microorganisms.
Pathogen	An agent that causes infection or disease, especially a microorganism.

Teacher Guide
Grade-5

Lesson Plan
9

MICROORGANISMS
Diseases Caused by Microorganism

Duration: 40 Minutes

Students Learning Outcome:

- Recognize that microorganisms get transmitted into humans and cause infectious diseases.

Materials:

- A balloon
- Some tiny pieces of paper
- Paper chits with names of infectious diseases

Information for Teachers

- Infection occurs when germs (viruses, bacteria, or other microbes) enter the body and begin to multiply.
- Germs can spread through:
  - the air as small droplets or tiny aerosol particles (airborne spread)
  - contact with faeces
  - contact with the skin or mucus membranes (the thin moist lining of many parts of the body such as the nose, mouth and throat) (contact spread)
  - blood or other body fluids (for example, saliva)
- Germs can spread:
  - directly from person to person or
  - indirectly from an infected person to the environment (for example toys, door handles, benchtops and bedding) and then to another person who comes in contact with the contaminated environmental source.

Introduction: 10 Minutes

- Begin the lesson by asking students some basic hygienic practices they follow at home and at school.
- Take students' responses and list them down on the board.
- Ask students, what may happen if we would not follow these healthy practices.
- Take students' responses and write the keywords on the board. (infection/ diseases/ sick/germs)
- Now, take a balloon and put some tiny pieces of paper inside the balloon. Then inflate the balloon and close the mouth of the balloon with two fingers.
- Open the mouth of the balloon. The pieces of paper will scatter out of the balloon.

- Tell students that in this manner the germs spread when an infected person coughs or sneezes.
- Tell students that in today's lesson you will learn how microorganisms get transmitted to humans and cause infectious diseases.

Development: 30 Minutes

Activity 1 – Case Study

- Divide the class into 4 groups.
- Provide one of the following case studies to each group.

Case Study 1 – Group 1	Case Study 2 – Group 2
Hamza and Ahad sit next to each other in the classroom. One Monday, Ahad came to school coughing and sneezing. He wiped his nose with his hand and sleeves most of the time. Hamza and Ahad sat beside each other as usual. They played together and had their lunch together. On Wednesday, Hamza came to school coughing and sneezing too. i. Why, do you think, Hamza came to school coughing and sneezing? ii. How could Ahad have saved Hamza (or any other class fellow) from getting ill?	Sana and Bushra went to the market for shopping. On their way, they decided to drink orange juice from a stall. The man on the stall rinsed the used glasses in a bucket of water. He squeezed two oranges into the glass and added water from an open container. The next day, both the girls complained about stomach upset. i. Why, do you think, Sana and Bushra complained about stomach upset after drinking orange juice? ii. What should the man on the stall do to save people from getting ill?
Case Study 3 – Group 3	**Case Study 4 – Group 4**
One day, Yasir decided to eat fruit chaat from the school's canteen. He saw that the fruits were cut and placed uncovered near the canteen's window. Ignoring the flies on the fruits, he bought a bowl of fruit chaat and ate it. The next day, Yasir could not attend school because he got a high fever and vomiting. i. Do you think Yasir should have eaten the fruit chaat? Why? ii. What suggestion you would give to the canteen staff to prevent students from getting ill?	Saleem, the watchman, was suffering from malaria recently. Last night, he slept in open and was disturbed by mosquitoes most of the time. After two days, he heard that the neighbour's watchman, Danish, has also caught malaria. i. How do you think Danish has caught malaria? ii. How could Saleem have saved Danish from getting ill?

- Instruct each group to read the case study and discuss it. In the end, answer the given questions collectively.
- Guide students by explaining the meaning of difficult words/terminologies in the text.
- Once all the groups have finished the task, call them one by one to share their answers.
- Elaborate on the ways of the spread of infectious diseases and their transmission. Tell students that some diseases are transmitted by shaking hands or by touching articles used by the patient such as COVID-19, flu and hepatitis.

- In the end, ask students to relate each case study to one of the following types of diseases (based on their way of transmission):
  - Food-borne diseases (case study 3)
  - Airborne diseases (case study 1)
  - Animal-borne diseases (case study 4)
  - Waterborne diseases (case study 2)
- Guide students where necessary.
- Appreciate students' efforts using positive remarks.

Activity 2 – Guess the Way 15 Minutes

- Write the names of the following diseases on the board as follows.

cholera, malaria, COVID-19, typhoid, flu, hepatitis, plague, tuberculosis (TB), diarrhoea, rabies

Airborne Diseases	Waterborne Diseases	Food-borne Diseases	Animal-borne Diseases

- Give hints to students for each disease and ask them to guess whether it is an airborne or waterborne or food-borne or animal-borne disease.
  For example, Cholera is an infection of the small intestine. The patient experiences pain in the abdomen and watery stools. Ask students to think about how germs can enter into the small intestine, through air, food, water or an animal.
- Write students' answers on the board in the correct boxes.

Conclusion / Sum up / Wrap up: 5 Minutes

Sum up the lesson by focusing on the following points:

- There are five main ways of the transmission of infectious diseases are air, water, food, animals and direct contact.
- Airborne diseases are transmitted through coughs, sneezes or talks of the infected person with others.
- Waterborne diseases are transmitted through polluted water for drinking or in food.
- Food-borne diseases are transmitted through contaminated food.
- Animal-borne diseases are transmitted through animals such as mosquitoes and rats.

Assessment: Four Corners 19 Minutes

- Tag the four corners of the classroom with one of the following labels.
  - Waterborne Diseases
  - Airborne Diseases
  - Food-borne Diseases
  - Animal-borne Diseases
- Make paper chits of several infectious diseases (typhoid, cholera, malaria, COVID-19, flu,

Four Corners
A great way to get students out of their desks and moving is the four corners strategy. Some students learn better when they are moving so this strategy appeals to their learning preference.

hepatitis, plague, tuberculosis (TB), diarrhoea, rabies, dengue).

- Pick up a paper chit and read aloud the name of the infectious disease written on it.
- Tell students to identify the disease as water/air/food/animal-borne disease and move to the respective corner.
- Let students move and find their corner and enjoy the activity.
- Guide where required.

Follow up: 1 Minute

- Do question 2 (part v) on page 30 of the textbook in the notebook.

Glossary

Airborne	Transmitted by air
Polluted	Unclean or impure substance, usually air and water
Contaminated	Having been made impure by exposure to or addition of a poisonous or polluting substance.

MICROORGANISMS
Preventing the Infection

Duration: 40 Minutes

Students Learning Outcome:

- Suggest preventive measures to protect themselves from these infections.

Materials:

- A chart showing the steps of hand washing
- Story-telling gloves (optional)

Information for Teachers:

- Staying healthy involves many different day-to-day habits. Avoiding infections is an important aspect of preventing both the short-term inconvenience of being sick and the long-term complications. Preventive measures can reduce the risk of spreading infections to others who might be especially exposed to severe illness.
- Wash your hands well. You probably wash your hands after using the bathroom, before preparing or eating food, and after gardening or other dirty tasks. You should also wash up after blowing your nose, coughing, or sneezing; feeding or stroking your pet, or visiting or caring for a sick person.
- Cover your mouth and nose with a tissue when you sneeze or cough, then dispose of it. If no tissue is handy, cough or sneeze into your elbow rather than in to your hands.
- Wash and bandage cuts. Any serious cut or animal bite should be examined by a doctor.
- Do not pick at healing wounds, or squeeze pimples.
- Do not share glasses, dishes and other eating utensils.
- Avoid direct contact with napkins, tissues, handkerchiefs or similar items used by others.
- Children should receive the recommended childhood vaccinations and adults should make sure their vaccinations are up to date.

Introduction: 20 Minutes

- Paste the chart showing the steps of handwashing on the board.

- Ask students to be ready to follow the instructions.
- Demonstrate the steps of handwashing to the students and ask them to perform simultaneously. Say aloud the steps for students to get a better understanding.
- Perform the procedure one more time.
- Ask students to have a round of applause for each other.
- Tell students that in today's lesson you will learn the ways to keep yourselves protected from infections.

Development: 20 Minutes

Activity 1 – Think-Pair-Share

- Write the following question on the board.
  - What hygienic practices do you follow at home and school? How do they help you to remain healthy?
- Make students sit in pairs.
- Ask each pair to discuss the answer to the given question. Instruct them to make two columns as follows to write their answers in their notebooks.

Hygienic Practices at Home	Hygienic Practices at School

- Give students appropriate time to complete the task (10 minutes).
- Once all the pairs have finished the task, call them one by one to share anyone point out of their list. (In each pair, one student should share hygienic practices at home and the other should share hygienic practices at school.)
- List down students' answers on the board.
- Add more points if students have missed out on any important aspect (e.g., vaccination).
- Appreciate students' efforts using positive remarks.

Activity 2 – Story Time 20 Minutes

- Play the following video link to show students the story, **Monster C on the Hands' Planet.** Monster C on the Hands' Planet | A CREATIVE STORY TO TEACH KIDS ABOUT HAND WASHING AND HYGIENE - YouTube
- Ask the follow-up questions after the story.
  - What bad habit did Monster C have?
  - How did Great Mount help the Hands get rid of Monster C?
  - What lesson did you learn from the story?

Alternative (in case there is no internet facility)

- Read aloud the story (script attached as annexure) to the students and ask follow-up questions. [Make story-telling gloves and use them to show the characters of the story.]

Conclusion / Sum up / Wrap up: 5 Minutes

Sum up the lesson by focusing on the following points:

- It is essential to wash hands before cooking and eating food and after using toilets.
- Avoid touching your eyes, nose and mouth, as these are the points for germs to enter your body.
- Get vaccinated at the proper time. It is an important way to prevent many diseases.
- Stay at home, if you have signs and symptoms of an infection so that you can take rest and prevent others from infection.
- In case of any injury, cover the wound immediately with a bandage and consult a physician.

Assessment: 30 Second Share 5 Minutes

- Divide the class into six groups.
- Ask students to discuss in groups their favourite part of the lesson and the reason for liking it.
- Give each group 30 seconds to share their findings with their class fellows.
- Allow one or more than one speaker from each group (within 30 sec).

30 Second Share

Asking students to share their favourite part within a given time provides you with information on what your students enjoy doing in the class. This helps you in selecting activities for future lessons making them more effective.

Follow up: 10 Minutes

- Draw the following entry journal on the board and ask students to copy it in their notebooks.

my healthy habits		
1	I wash my hands with soap before eating a after the toilet.	M T W Th F Sa Su
2	I do not touch my eyes, nose and mouth unnecessarily.	M T W Th F Sa Su
3	I do not use napkins, tissue paper and handkerchiefs used by others.	M T W Th F Sa Su
4	I cover my mouth when I cough and my n when I sneeze.	M T W Th F Sa Su
5	I took a bath today.	M T W Th F Sa Su

- Instruct students to fill in their entry journals for the next week and submit them for checking.

Glossary

Hygiene	Hygiene refers to conditions and practices that help to maintain healt prevent the spread of diseases.
Vaccine	A substance used to stimulate the production of antibodies and provi immunity against one or several diseases.
Vaccination	It is the administration of a vaccine to help the immune system devel immunity from a disease.

Annexure – Story Script

MONSTER C ON THE HANDS' PLANET

Written and designed by Loreta Yono

While humans lived on the Earth, a very strange planet rotated around the Nameless Star. Its inhabitants were Hands! The Lefts and the Rights.

The Hands called their planet Handee – and they named it so for a reason. In fact, the planet was also hand-shaped, only with its fist clenched to be able to rotate smoothly around its star. Moreover, this planet's mountains, trees, lakes and clouds were also hand-shaped.

Since the birth of the planet, the Hands have lived happily as friends. Sure, they used to quarrel at times, but they reconciled the next morning. They could not stay mad for a long time, for their planet's fate depended on their agreement.

For Handee to rotate and survive, the Hands had to charge the planet daily. There was only one way to load it: The Hands had to greet each other by shaking at the same time every morning. As a result of such greeting, the planet would charge and spin until the next morning.

But one day, a nasty creature crashed into the planet from space. It was all tangled in a round bale. In space, it was called Monster C.

Monster C was real rubbish. It did not like to bathe and infect others with this bad habit. The monster was very dangerous to the Hands because washing themselves was of the utmost importance to them!

"Unwashed hands equal death to the planet", the Great Mount gestured every day.

So, the unexpected guest really scared the Hands. And Monster C did not waste its time. *"Why engage in such a useless pursuit. Don't be silly!"* Monster C whispered to the Hands. It circled around them, grumbling until they believed there was no need to wash themselves at all. By the morning, half of the hands were already unwashed. And then strange things started to occur. The planet Handee began to cover itself in mucus, its fresh lakes began to acidify, and there was an unfavourable odour spreading for thousands of kilometers.

When it was time for greeting and charging the planet, it just wouldn't start! It completely stopped rotating. The Hands realized the end was right there – and the evil Monster C was to blame for everything!

The inhabitants of the Handee were furious. But what could be done to get rid of Monster C. Suddenly, the Great Mount mumbled. All the hands leaned toward it. The mountain gestured furiously: *"Bring Monster C to the Little Finger Lake and bathe it until there is not the smallest drop of mud left. Then, bathe yourselves thoroughly and greet each other immediately."*

After listening to the Great Mount's instructions, the Hands raced to catch Monster C. the Hands grabbed it fast and dragged it into the lake. They bathed the monster to the very last drop of mud. And one could hear its last moans, even on Earth.

When Monster C was gone, the Hands bathe quickly and shook each other cheerfully. Their planet started again. Since then, the Hands remembered this forever:

You must never forget to wash yourselves!

The End

Teacher Guide
Grade-5

Lesson Plan
11

FLOWERS AND SEEDS
Pollination and Its Types

Duration: 40 Minutes

Students Learning Outcome:

- Describe pollination and describe its types with examples.

Materials:

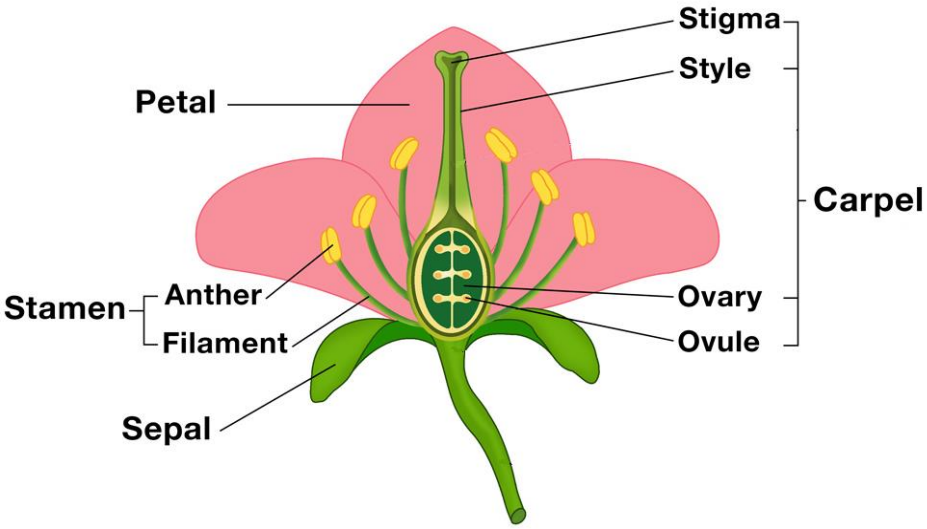
- 2 cricket balls (or any other balls of a similar size)

Information for Teachers:

- Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma. The goal of every living organism, including plants, is to create offspring for the next generation. One of the ways that plants can produce offspring is by making seeds. Seeds can only be produced when pollen is transferred between flowers of the same species.
- Pollination can be of two types; self-pollination and cross-pollination.
- Self-pollination is the more basic type of pollination because it only involves one flower. This type of pollination occurs when pollen grains from the anther fall directly onto the stigma of the same flower. Although this type of pollination is simple and quick, it does result in a reduction in genetic diversity because the sperm and egg cells of the same flower share genetic information.
- Cross-pollination is a more complex type of pollination that involves the transfer of pollen from the anther of one flower to the stigma of a different flower. This type of pollination results in an increase in genetic diversity because the different flowers are sharing and mixing their genetic information to create unique offspring. Cross-pollination is always dependent on another agent such as wind or water to cause the transfer of pollen.

Introduction: 15 Minutes

- Begin the lesson by drawing the diagram of a flower.
- Ask students to recall the parts of a flower. With the help of students label the parts of the flower drawn on the board.

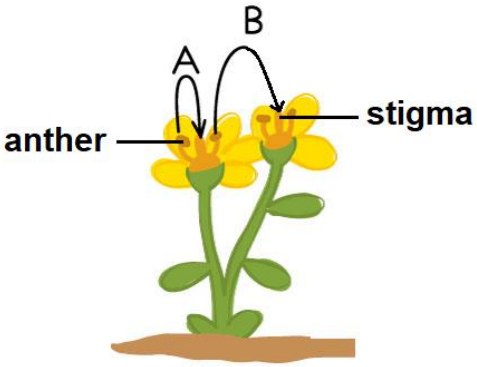


- Ask students to read the names of the flower in repetition 3-4 times.
- Ask students to recall the function of each part of the flower.
- Select a few students randomly and ask them to share the function of different parts of a flower one by one. When students tell the function of anther and stigma, write that on the board.
- Tell students that in today's lesson you will learn about a type of process in plants called pollination which involves anther and stigma.

Development:

Activity 1 – Pollination 25 Minutes

- Draw the following diagram on the board.



- Draw students' attention toward the labels. Tell students that there are many pollen grains in the anther. Pollen grains are male reproductive cells of a plant. In the diagram, the arrow A shows the movement of pollen grains from the anther to the stigma of the flower. This process is called pollination.
- Repeat the description for students to grasp effectively.
- Ask a volunteer to come to the board and describe the process of pollination to the class.
- Guide the student where necessary.
- Play the following video link to describe the process of pollination.
  https://www.youtube.com/watch?v=djPVgip_bdU

Activity 2 – Types of Pollination 25 Minutes

- Draw the following diagrams on the board.

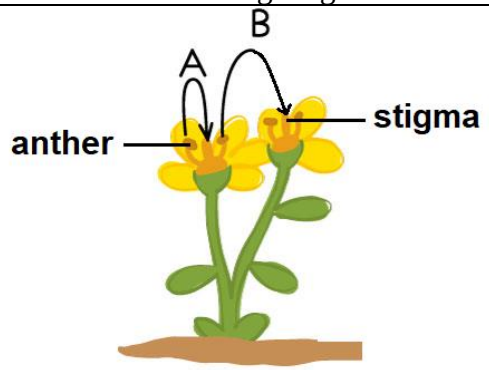
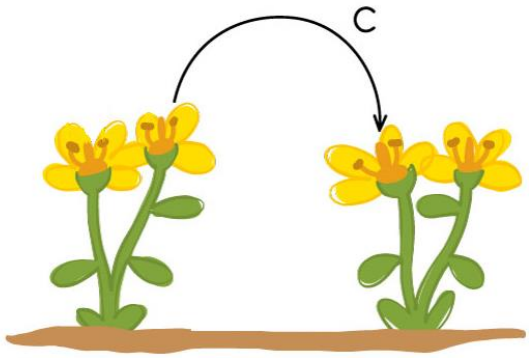
	

Diagram 1	Diagram 2

- Tell students that diagram 1 and diagram 2 show two types of pollination.
- Ask students to look closely at the two diagrams and tell the difference between them.
- Take students' responses and write relevant points on the board. In case students are unable to point out the difference, provide clues such as: look at the number of plants and the arrows.
- Explain to students the difference between self-pollination and cross-pollination using the description given on page 36 of the Grade 5 Science textbook.
- In addition, call three students to stand in front of the class. Label them with numbers 1, 2 and 3.
- Make student 1 stand at a distance from the two. Instruct students 2 and 3 to stand beside each other at two feet of distance.
- Give one ball to student 1 and one ball to student 2.
- Ask student 1 to raise his/her one hand with the ball. Then, drop the ball and catch it with the other hand. Tell student 1 to do this 3-4 times.
- Ask the class the following question:
  Suppose that the student is a plant, his/her hands are flowers and the ball is pollen grains. Tell what the action of the student shows.
- Take students' responses.

- Now, ask student 2 to throw his/her ball to student 3. Ask student 3 to catch it. Tell students 2 and 3 to repeat the step 3-4 times.
- Ask the class the following question:
  Suppose that students 2 and 3 are two different plants, their hands are flowers and the ball is pollen grains. Tell what the action of the students shows.
- Take students' responses.

Sum up the Activity

- Conclude the activity by describing the phenomenon of self-pollination and cross-pollination as shown by student 1 and students 2 and 3 respectively.

Conclusion / Sum up / Wrap up: 7 Minutes

Sum up the lesson by focusing on the following points:

- During reproduction, pollen grains are transferred from the anther of a flower to the stigma. This process is called pollination.
- If pollen grains are transferred from the anther of a flower to the stigma of the same flower or to the stigma of the other flower of the same plant, it is called self-pollination. It takes place in pea, cotton and tomato.
- If pollen grains are transferred from the flower of one plant to the stigma of the flower of another plant (of the same type), it is called cross-pollination. It takes place in maize, papaya and rose.

Assessment: Show of Hands 5 Minutes

- Ask students: How many of you have understood the process of pollination and its types? Show your hands.
- Observe how many students have raised their hands. If only a few students have raised their hands, repeat the description. If most of the students have raised their hands, review the concept with the selected students only.

Show of Hands

A simple strategy to gauge the understanding level of your students is through a show of hands. Through a quick show of hands you can decide whether you need to review with a few students the or with whole class.

Follow up: 3 Minutes

- Draw the diagrams showing self-pollination and cross-pollination in the notebooks.

Glossary

Anther	It is a part of the male reproductive part of a flower called the stamen that produces and stores pollen.
Stigma	It is the part of the pistil where pollen germinates.
Pollen grains	These are male reproductive cells of a plant.
Pollination	It is a process in which pollen grains are transferred from the anther of a flower to the stigma.

Teacher Guide
Grade-5

Lesson Plan
12

FLOWERS AND SEEDS
Types of Reproduction in Plants

Duration: 40 Minutes

Students Learning Outcome:

- Define reproduction and differentiate between sexual and asexual reproduction.

Materials:

- A chart showing asexual reproduction
- 3 chart papers
- 3 markers
- An adhesive tape
- Sticky notes (or paper chits with tape)
- An onion
- A potato

Information for Teachers:

- Reproduction is a biological process by which an organism reproduces an offspring who is biologically similar to the organism. Reproduction enables and ensures the continuity of species, generation after generation. It is the main feature of life on earth.
- Asexual reproduction only requires DNA from one parent. It creates offspring that are genetically identical to the parent. There are different methods of asexual reproduction. They include vegetative propagation. Vegetative propagation does not require seeds or spores. Instead, offspring grow from a part of the parent plant.
- Garlic, onions and tulip plants all reproduce using bulbs. These short underground stems are also called scaly bulbs. They have a basal plate that is usually surrounded by modified leaves. These leaves form a papery covering. New bulbs grow off of the parent bulb's basal plate.
- Potato plants reproduce using tubers. These underground growths produce new plants from stems or growing points called eyes.
- Layering is a method in which a stem attached to the plant is bent and covered with soil. Young stems that can be bent easily without any injury are the preferred plant for this method. Jasmine can be propagated this way.

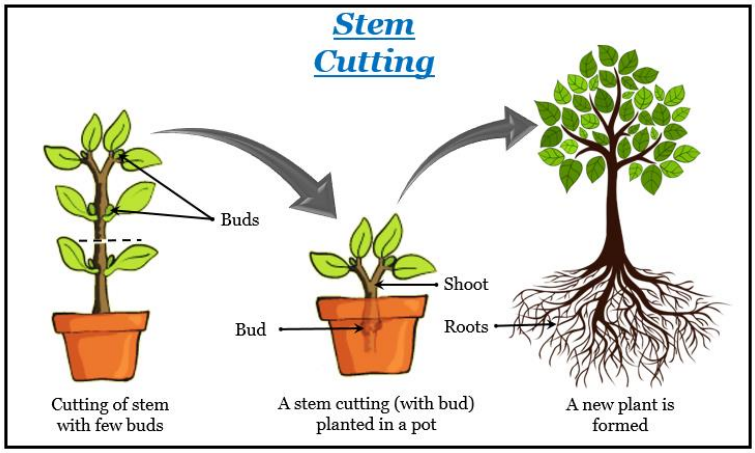
Introduction: 10 Minutes

- Begin the lesson by asking students to tell the characteristics of living things that make them different from non-living things.
- Take students' responses and write them on the board. (Expected responses: grow, breathe, move, eat, sense and reproduce).
- Encircle the word 'reproduce' and ask students, what reproduce means.
- Take students' responses and write down the key points on the board. If students are unable to tell, provide hints to them. (The prefix 're' means again and 'produce' means to make something.)
- Write the definition of reproduction on the board as follows:
  Reproduction is a process by which living beings produce young ones of their own kind. The process takes place in animals as well as in plants.
- Tell students that in today's lesson you will learn about types of reproduction.

Development: 20 Minutes

Activity 1 – Asexual Reproduction

- Tell students that there are two types of reproduction; asexual reproduction and sexual reproduction. First, we will learn about asexual reproduction.
- Paste the following chart on the board.



- Describe the steps shown on the charts as follows:
  i. There is a plant from which part of the stem is taken with few buds.
  ii. It is then planted in a pot.
  iii. After a few days, it is observed that a new plant is formed.
- Repeat the description for students to grasp effectively.
- Ask students the following questions:
  - Are there two plants or one plant involved in this process?
  - Are there any flowers seen in the diagram?
  - Which part of the plant is mainly used in this process?
  - Does the newly grown plant look similar to the parent plant?
- Take students' responses and tell them that the process shown is called asexual reproduction. In this type of reproduction, only one plant produces new plants. Flowers do not take part in this type of reproduction. The other parts of the plant e.g., root, stem and leaves give rise to a new plant. The plants produced from these parts have a great similarity with the parent plant.
-

Sum up the Activity

- Ask a volunteer to describe the process to the class using the diagram.
- Guide him/her where required.

Activity 2 – Ways of Asexual Reproduction 20 Minutes

- Divide the class into three groups.
- Assign each group a method of asexual reproduction as follows:
  Group 1: Layering
  Group 2: Bulb
  Group 3: Tuber
- Give each group a chart paper and a maker. Also, give an onion to group 2 and a potato to group 3. [This will enable students to see what they read about bulb and tuber.]
- Ask students to read the description of their assigned methods of asexual reproduction given on pages 37 and 38 of the Grade 5 Science textbook.
- Instruct students to draw the diagram of the process in the center of the chart paper and write its description around it. Guide students to label the particular part of the diagram with its description for better understanding.
- Provide appropriate time to the students for the activity.
- Once all the groups have completed their drawing with a description, ask them to paste it on different walls of the classroom.
- Ask each group to read the description of the methods of the other groups and match it with their diagrams. Encourage students to comment on other groups' work using sticky notes.
- Next, ask each group to go back to their chart paper and read their class fellow's comments.
- In the end, explain the ways of asexual reproduction using students' chart papers and make corrections where required.
- Play the following video link about asexual reproduction.
  Asexual Reproduction in Plants (Bulbs, Runners, Tubers) - YouTube

Conclusion / Sum up / Wrap up: 10 Minutes

Sum up the lesson by focusing on the following points:

- Reproduction is a process by which living beings produce young ones of their own kind. The process takes place in animals as well as in plants.
- Layering is a method of asexual reproduction in plants that consists of rooting the stems of a parent plant, without cutting the stems from the parent plant.
- Bulbs are shortened underground storage structures. They are stems that are enclosed with thick fleshy leaves. The roots develop at the base which can grow into a new plant when buried in the soil.
- A tuber is the underground thick stem of plants. A tuber functions in asexual reproduction as a result of the tiny scale leaves with buds that grow on its surface.

Assessment: 3-2-1 17 Minutes

- Ask students to respond to the given sentences in their notebooks.
  - Three things you learned in today's lesson.
  - Two interesting things about asexual reproduction in plants.
  - One question you still have about today's lesson.

3-2-1
The 3-2-1 strategy is a quick way to gain information about all the students in your class and the level of understanding they have about a current topic/unit of study.

- Collect students' notebooks for checking and answer their questions (bullet 3) in the next class.

Follow up: 3 Minutes

- Try to grow an onion or potato at home.
  Cut the base of an onion with its root and bury it 2 inches deep in the soil in a container. Place it in sunlight. Keep the soil moist and see what happens.

FLOWERS AND SEEDS
Types of Reproduction in Plants

Duration: 40 Minutes

Students Learning Outcomes:

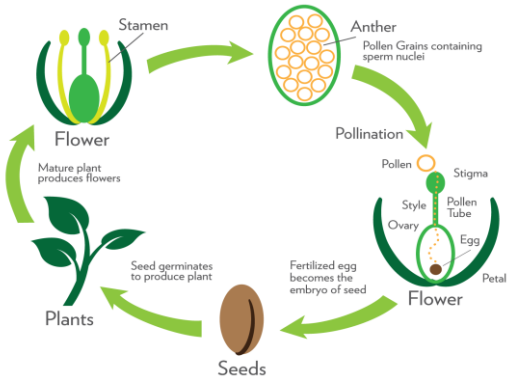
- Define reproduction and differentiate between sexual and asexual reproduction.

Materials:

- 2-3 sets of paper chits with steps of sexual reproduction
- 2-3 small boxes

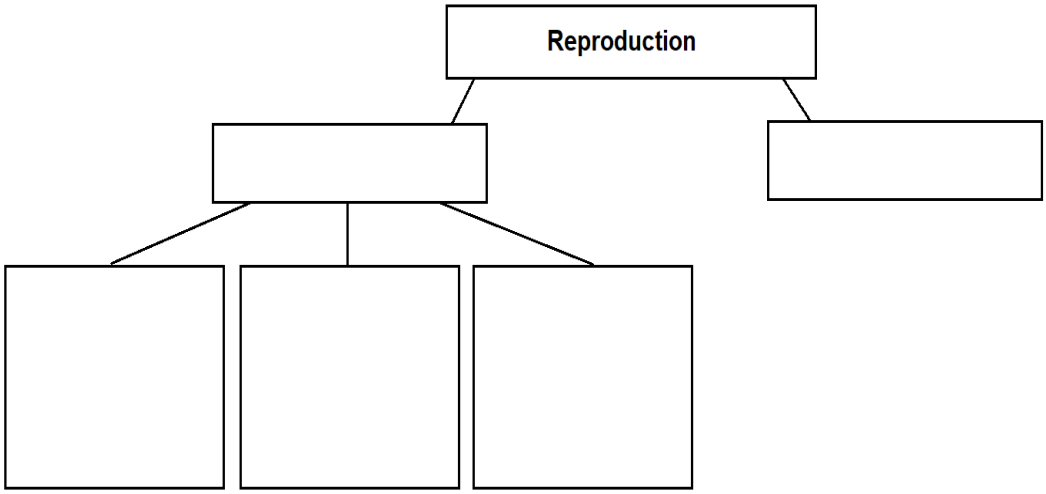
Information for Teachers:

- Sexual reproduction requires genetic material (DNA) from two parents. The parent plants have male and female sex cells, called gametes. The genetic material from the male and female gametes combines to produce offspring. This process is called fertilization.
- Once the pollen grain carrying the male gamete reaches the stigma of the same or different flower, it is transported downwards via a pollen tube that arises from the pollen grain to reach the ovary. The ovary is present at the base of the flower and is lobed. These lobes contain the ovules carrying the female gamete.
- The male gamete from the pollen now fuses with the female gamete in the ovule to form a zygote. This zygote undergoes cell division to form an embryo. Once the embryo starts developing, the ovary develops into the fruit and the other structures like the calyx and corolla fall off. The embryo becomes the seed which has the potential to give rise to a new plant.



Introduction: 10 Minutes

- Begin the lesson with a recap.
- Draw the following flowchart on the board.

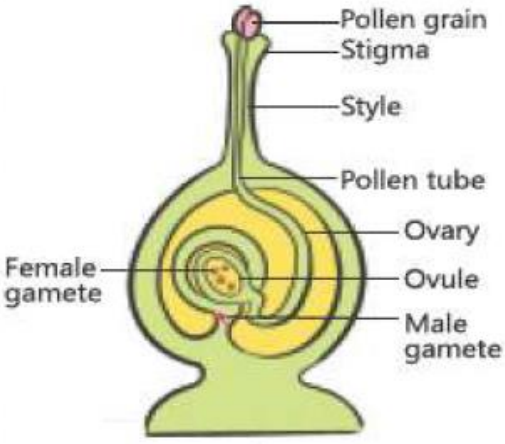


- Ask students to recall and define reproduction.
- Take students' responses and correct them where required.
- Ask students to name the two types of reproduction. Select a student randomly and ask him/her to fill in the two boxes with the types of reproduction.
- Ask three volunteers to fill in each box with one of the methods of asexual reproduction.
- Now, ask students to recall and tell the main points of layering, bulb and tuber and write them in their respective boxes on the board.
- Repeat the description of the method where students show a lack of understanding.
- Appreciate students' participation in the activity.
- Tell students that in today's lesson you will learn about sexual reproduction.

Development:

Activity 1 – Sexual Reproduction 20 Minutes

- Ask students to name the different parts of a flower.
- Take students' responses and ask them to tell the parts of the carpel.
- Draw the diagram of the carpel on the board.



- Tell students that in flowering plants, sexual reproduction takes place through flowers.
- Using the above diagram of the carpel, describe the steps of sexual reproduction as follows:
  - As a result of pollination, the pollen grain reaches stigma.
  - Here, the pollen grain germinates and forms a thin tube in the style called pollen tube.
  - After passing through the style, the pollen tube reaches the ovary.

- It then enters the ovule.
- Male gametes are formed in the pollen tube and female gametes are formed in the ovule.
- The male and female gametes fuse to form a zygote.
- The zygote divides many times to form the embryo.
- The ovule becomes a seed and the ovary ripens to form the fruit.

- Describe the steps of sexual reproduction once again for students to develop a better understanding.
- Guide him/her where required.
- Play the following video link to show the process of sexual reproduction in plants.
  Sexual Reproduction in Plants | Plants | Biology | FuseSchool - YouTube

Sum up the activity

- Ask a volunteer to describe the process to the class using the diagram.

Activity 2 – Asexual vs Sexual Reproduction 20 Minutes

- Draw the following table showing characteristics of asexual reproduction on the board.

Asexual Reproduction	Sexual Reproduction
It involves one parent.	
There is no fusion of male and female gamet	
New plants are identical to their parents.	
It is a quick process.	

- Ask students to think of characteristics of sexual reproduction that make them different from asexual reproduction.
- Ask volunteers to come to the board and fill in the table.
- Guide students where required.

Conclusion / Sum up / Wrap up: 10 Minutes

Sum up the lesson by focusing on the following points:

- In flowering plants, sexual reproduction takes place through flowers.
- In sexual reproduction, male and female gametes fuse to form a new plant.
- The part of the flower where sexual reproduction takes place is the carpel.
- The pollen grain germinates and forms a thin tube in the style called pollen tube.
- After passing through the style, the pollen tube reaches the ovary. It then enters the ovule.
- Male gametes are formed in the pollen tube and female gametes are formed in the ovule.
- The male and female gametes fuse to form a zygote which divides many times to form the embryo.
- The ovule becomes a seed and the ovary ripens to form the fruit.

Assessment: Sequencing 18 Minutes

- Take some paper chits and write down one step of sexual reproduction on each of them. Fold the paper chits and place them into a box. [Make at least 2-3 sets]

Sequencing

The sequencing activity assists students to remember a process. It also promotes student sharing of their understanding if used with pairs or small groups.

- Divide the class into suitable groups (depending upon the number of sets of paper chits).
- Give one set of paper chits to each group and ask them to unfold all the paper chits, read the step of sexual reproduction and put them in order from the beginning to the end. [The first step should be on the top of the stack followed by the other.]
- Once all the groups have sequenced the steps of sexual reproduction, tell them the correct sequence. Ask students to self-assess their work.
- Address misconceptions if any.

Follow up: 2 Minute

- Write down the differences between asexual and sexual reproduction in the notebooks.

Glossary

Pollination	It is a process in which pollen grains are transferred from the anther of a flower to the stigma.
Ovule	The part of the ovary of seed plants that contains the female reproductive cell and after fertilization becomes the seed.
Zygote	A zygote, also known as a fertilized ovum or fertilized egg, is the union of a sperm cell and an egg cell.
Embryo	A plant embryo is an undeveloped plant inside a seed. It contains the earliest forms of a plant's roots, stem and leaves.

Teacher Guide
Grade-5

Lesson Plan
14

FLOWERS AND SEEDS
Germination of Seed

Duration: 40 Minutes

Students Learning Outcome:

- Describe the structure of seed and demonstrate its germination.

Materials:

- 7-8 bean seeds (soaked in water overnight)
- 6 maize and gram seeds
- 1 glass bottle
- Cotton wool

Information for Teachers:

- The seed in a plant is the part that develops from the ovules after fertilization. They are enclosed in the fruit. The seeds are formed as a result of sexual reproduction and contain the young embryo which can develop into a new plant.
- A typical seed consists of the following parts:
  - **Testa:** It is the outer coat of the seed that protects the embryonic plant.
  - **Micropyle:** It is a tiny pore in the testa that lies on the opposite of the tip of the radicle. It permits water to enter the embryo before active germination.
  - **Hilum:** Is a scar left by the stalk which attached the ovule to the ovary wall before it became a seed.
  - **Cotyledon:** In some plants, this contains high quantities of starch and will provide a source of food for the developing embryo before germination, in other plants this role is performed by an endosperm.
  - **Radicle:** This is the embryonic root which will develop into the primary root of the plant. It is usually the first part of the embryo to push its way out of the seed during germination.
  - **Plumule:** This is the embryonic shoot. It appears as a bud which will give rise to the shoot and the remaining structures in the plant.
  - **Endosperm:** In many plants, a separate part for the storage of starch develops and this is called the endosperm. It is seen in maize and wheat.
- During the beginning stage of germination, the seeds take up water rapidly and this results in swelling and softening of the seed coat at an optimum temperature. The seed starts to respire and metabolizes the stored food. By rupturing the seed coat, radicle emerges to form a primary root. The seed starts absorbing underground water. After the emerging of the

radicle and the plumule, shoot starts growing upwards. In the final stage of seed germination, the cell of the seeds become metabolically active, elongates and divides to give rise to the seedling.

Introduction: 5 Minutes

- Ask students to name their favourite fruits.
- Take students' responses and ask them, have you ever tried to grow any of your favourite fruits in your garden or backyard.
- Take students' responses and ask them, what you did to grow them.
- Take students' responses and tell them that in today's lesson you will learn about seeds and their germination.

Development: 20 Minutes

Activity 1 – Structure of a Seed

- Divide the class into three groups.
- Give each group two bean seeds.
- Describe the outer structure of the bean seeds using the following points.
  [Point out the characteristics of the seed to the students using a bean seed. Ask students to observe the characteristics in the sample seeds given to them.]
  - The outer covering of a seed is called the seed coat. It protects the tiny embryo which is present inside the seed.
  - There is a pore on the seed coat. It is called the micropyle.
  - Embryo consists of cotyledons, which store food.
  - The axis of the embryo is between the two cotyledons. The end of the axis towards the pointed end of the seed is called the radicle. It forms roots.
  - The other end of the axis is called the plumule. It gives rise to the shoot.
- Ask students to remove the seed coat of the given seeds and open them longitudinally.
- Ask students, how many cotyledons do you see?
- Take students' responses and tell them that there are two cotyledons so it is a dicot seed.

Sum up the Activity

Ask students to name the parts of a seed

Activity 2 – Germination of Seeds 20 Minutes

- Take a glass bottle and put moist cotton inside it.
- Place the 2-3 bean seeds carefully on the moist cotton around the edge of the glass bottle so can still be seen. Make sure they are firmly held in place. (As shown in the picture)

- Place the set up on a cupboard in the classroom for 4-5 days and observe what happens. DO NOT cap the bottle.
- Explain germination of seeds using the text given on page 39 of the Grade 5 Science textbook.

[The bean seeds should sprout in 4 days. Students can observe and record when root nodules are visible.]

Activity 3 – Maize Seed vs Gram Seed 20 Minutes

- Divide the class into three groups. Give each group two maize and gram seeds.
- Ask students to observe the differences between the two types of seeds with respect to the following characteristics. Instruct students to fill in the table collectively in their notebooks.

Characteristic	Maize Seed	Gram Seed
Shape		
Colour		
Number of Cotyledon		
Seed Coat (thick/thin)		
Endosperm (present/absent)		
Embryo (centre/side)		

- Meanwhile, draw the above table on the board.
- Once all the groups have completed the activity, ask each group to fill in any two of the characteristics of maize and gram seeds on the board.

Characteristic	Maize Seed	Gram Seed
Shape	It is oval and flat in shape.	It is conical and pear-shaped.
Colour	It is yellow.	It is white or brown.
Number of Cotyledon	It has one cotyledon.	It has two cotyledons.
Seed Coat (thick/thin)	It has a thin seed coat.	It has a thick seed coat.
Endosperm (present/absent)	Endosperm is present.	Endosperm is absent.
Embryo (centre/side)	Embryo is present on one side of the seed.	Embryo is present in the centre of the seed.

- Guide students where required.

Conclusion / Sum up / Wrap up: 5 Minutes

Sum up the lesson by focusing on the following points:

- The seed in a plant is the part that develops from the ovules after fertilization.
- The outer covering of a seed is called the seed coat. It protects the tiny embryo which is present inside the seed.
- There is a pore on the seed coat. It is called the micropyle.
- Embryo consists of cotyledons, which store food.
- The axis of the embryo is between the two cotyledons. The end of the axis towards the pointed end of the seed is called the radicle. It forms roots.
- The other end of the axis is called the plumule. It gives rise to the shoot.
- All seeds need water, air (oxygen) and proper temperature to germinate.

Assessment: Self-Marking Quiz 9 Minutes

- Attempt the quiz about the structure and germination of seeds (Q1-7 only) by clicking on the following link. https://k8schoollessons.com/seed-germination-quiz/
- Instruct students to check their answers after attempting the quiz. In case of wrong answers, note down the questions with correct answers in their notebooks and share them with the teacher.

Self-Marking Quiz
Students are able to determine their level of understanding regarding a particular topic or unit of study. They can also identify areas they need to spend more time learning by taking the self-marking quizzes.

Alternative (in case there is no internet facility):

- Provide the set of multiple-choice questions (attached as an annexure) to the students and ask them to mark the correct answers.
- Share the correct answers with the students at the end of the quiz and ask them to self-assess their work.
- Address students' misconceptions, if any.

Quiz key: 1. C – 2. B – 3. A – 4. C – 5. D – 6. A

Follow up: 1 Minute

- Answer question 3 (part i) on page 46 of the textbook in the notebooks. **Glossary**

Cotyledon	It is part of the embryo within the seed of a plant. Often when the seed germinates, or begins to grow, the cotyledon may become the first leaves of the seedling.
Germination	Germination in plants is the process by which a seed begins to sprout and grow into a seedling under the right growing conditions.
Embryo	A plant embryo is an undeveloped plant inside a seed. It contains the earliest forms of a plant's roots, stem and leaves.
Endosperm	The part of a seed which acts as a food store for the developing plant embryo, usually containing starch with protein and other nutrients.

Annexure – Quiz

Science Quiz – Structure and Germination of Seeds

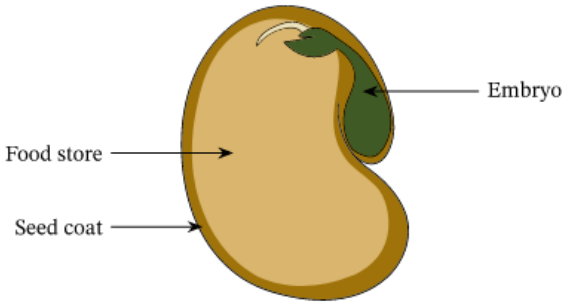
Name of the Student: _____ **Class & Section**: _____

Read the questions and mark the correct answer.

1. What are the three main parts of a seed?

   A. Food store, seed coat, roots
   B. Embryo, food store, roots
   C. Embryo, food store, seed coat
   D. Embryo, seed coat, roots

2. What is meant by the embryo in the seed?



   A. Food stored by the parent plant
   B. The baby plant
   C. A hard cover around the food store
   D. Roots of the plant

3. What is meant by the food store in the seed?

   A. Food stored by the parent plant
   B. Baby plant
   C. Hard cover around the embryo
   D. Roots of the plant

4. What is meant by the seed coat?

   A. Hard cover around the food stored
   B. Hard cover around the baby plant
   C. Hard cover around the embryo and food store
   D. Hard cover around the roots of the plant

5. What is germination?

   A. The growth of roots of a young plant
   B. The growth of new leaves of a young plant
   C. A new plant coming out of the soil
   D. The overall growth of a seed into a young plant

6. What are the conditions that plants need to germinate?

   A. Water, warmth, air
   B. Water, sunlight, air
   C. Water, warmth, sunlight
   D. Water, sunlight, carbon dioxide

Source: https://k8schoollessons.com/seed-germination-quiz/

Teacher Guid
Grade-5

Lesson Plan
15

ENVIRONMENTAL POLLUTION
Environmental Pollution and Its Types

Duration: 40 Minutes

Students Learning Outcome:

- Define pollution and its types.

Materials:

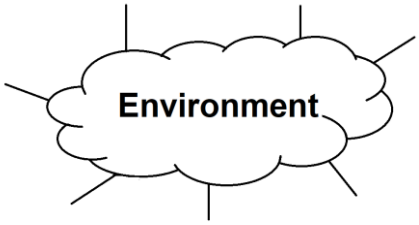
- 3 chart papers
- 3 markers
- An adhesive tape

Information for Teachers:

- Pollution is the introduction of harmful materials into the environment. These harmful materials are called pollutants. Pollutants can be natural, such as volcanic ash. They can also be created by human activity, such as trash or runoff produced by factories. Pollutants damage the quality of air, water, and land.
- **Air pollution** refers to the release of harmful contaminants (chemicals, toxic gases, particulates, biological molecules, etc.) into the earth's atmosphere. These contaminants are quite detrimental and, in some cases, pose serious health issues. Among the other types of pollution, air pollution is theorized to have a planet-wide implication.
- **Water pollution** is said to occur when toxic pollutants and particulate matter are introduced into water bodies such as lakes, rivers and seas. These contaminants are generally introduced by human activities like improper sewage treatment and oil spills. The effects of water pollution are very pronounced in our environment. Furthermore, toxic chemicals can bioaccumulate in living beings, and these chemicals can travel their way up the food chain, ultimately reaching humans.
- **Land pollution** refers to the degradation of land due to the presence of chemicals or other man-made substances in the soil. Land pollutants alter the natural composition of soil and affect it negatively. These can drastically impact life directly or indirectly. For instance, any toxic chemicals present in the soil will get absorbed by the plants. Since plants are producers in an environment, it gets passed up through the food chain.

Introduction: 10 Minutes

- Begin the lesson with brainstorming. Draw the following brainstorming web on the board.



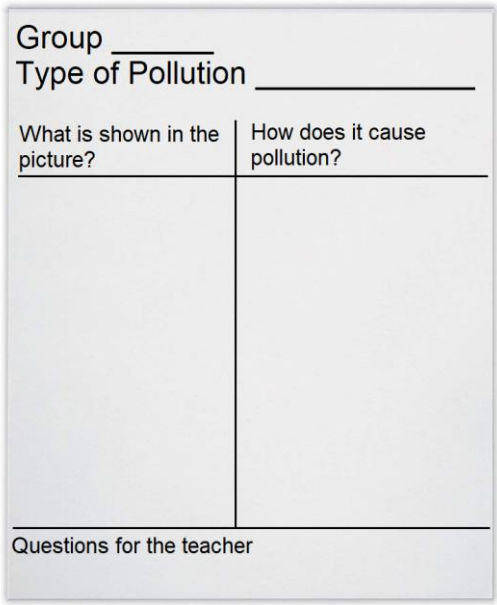
- Ask students, what is the environment made up of.
- Take students' responses and write them around the web. [Students may say animals, plants, humans, sunlight, water, air, soil]
- Ask students, what will happen if there is no clean air or water around us.
- Take students' responses. [Students may say we will have difficulty in breathing or lung/abdominal diseases, etc.]
- Tell students that any change in the environment which is harmful to living things is called environmental pollution and in today's lesson, you will learn about pollution and its types.

Development: 30 Minutes

Activity 1 – Types of Pollution

- Divide the class into three groups.
- Give each group a chart paper and a marker.
- Assign a type of pollution to each group as follows:
  - Group 1: Air Pollution
  - Group 2: Water Pollution
  - Group 3: Land Pollution
- Ask students to carry out the activity as follows:
  - Divide the chart paper into rows and columns and label them as shown.
  - Look at the pictures of the assigned type of pollution on page 50 of the Grade 5 Science textbook and read the description.
  - Discuss the description within the groups.
  - Now, write in your own words how the event(s) in the picture cause pollution on the chart paper.
  - In the end, write questions that you would like your teacher to answer or to explain a point that is not clear to you.
  - Once you have finished with the group work, paste your chart paper on the board.

  Once all the groups have pasted their chart papers on the board, call them one by one to share their description with the class.
- Make notes of students' presentations (e.g., any misconception or skipping a key point).


Group _____
Type of Pollution _____

What is shown in the picture?	How does it cause pollution?

Questions for the teacher

Sum up the Activity

- At the end of each presentation,
  i. address students' misconceptions or add the missing points.
  ii. answer students' questions that they have written on their chart papers.
- Conclude the activity with a round of applause and appreciate students' efforts using positive remarks.

Activity 2 – Fill in the Table 20 Minutes

- Draw the following table on the board.

Reason of Pollution	Air Pollution	Water Pollution	Land Pollution
Cutting of trees	Yes	No	Yes
Smoke from cars			
Garbage			
Industrial wastes			
Use of chemical fertilizers			
Use of insecticides			
Plastic			
Smoke from factories			
Burning garbage			

- Ask students to read the reason for pollution and tell which type of pollution it causes in 'yes' or 'no'. [One is done for you]
- Guide students if required.
- Assist students in attempting the quiz about pollution by clicking on the following link. https://www.softschools.com/quizzes/science/pollution_and_conservation/quiz809.html

Conclusion / Sum up / Wrap up: 8 Minutes

Sum up the lesson by focusing on the following points:

- Any change in the environment which is harmful to living things is called pollution.
- There are three types of pollution; Air, water and land pollution.
- Air pollution is caused by smoke emitted from vehicles and factories which burn fuels. Carbon dioxide is a major pollutant of the air.
- Water pollution is caused by sewage, wastes from factories, insecticides and fertilizers. Oil leakages from oil tankers and petroleum refineries also pollute water.
- Land pollution is caused by garbage from houses and cities which remains scattered on the land and is not disposed of properly. Moreover, insecticides and fertilizers remain in the soil for long periods and cause land pollution.

Assessment: Reflection 10 Minutes

- Make students sit in pairs.
- Ask students to express their thoughts about today's lesson. Give them guiding questions to write their responses.
  i. What did you find challenging/difficult in learning about pollution?

Reflection

Reflection encourages students to think about what they have learned and make connections to their own lives. Reading students' reflections gives information that can be used to plan future lessons.

ii. How do you link pollution to your daily life?

- Give students 3-4 minutes to write their responses.
- Collect students' responses for lesson evaluation.

Follow up: 2 Minutes

- Answer question 2 (part i) on page 57 of the textbook in the notebooks.

Glossary

Pollution	Any change in the environment which is harmful to living things is called pollution.
Vehicle	A thing used for transporting people or goods, especially on land, such as a car, lorry, or cart.
Kiln	A furnace or oven for burning, baking, or drying.
Sewage	Sewage is waste matter such as dirty water from homes and factories, which flows away through waste pipes.
Chemical fertilizer	A synthetic compound substance that is made to increase crop yield.
Insecticides	Insecticides are substances used to kill insects.

ENVIRONMENTAL POLLUTION
Effects of Pollution on Life

Duration: 40 Minutes

Students Learning Outcome:

- Explain the effects of water, air and land pollution (unclean or toxic water, smoke, smog, excess carbon dioxide or other gases, open garbage dumps, industrial water, etc.) on the environment and life.

Materials:

- 3 paper chits with a situation
- Response cards with YES on one side and NO on the other side written on them (quantity should be half of the number of students in the class)

Information for Teachers:

- Pakistan is today the world's fourth most polluted country. Air pollution shortens the average Pakistani's life expectancy by 4.3 years, relative to what it would have been if the World Health Organization (WHO) guideline was met. (https://aqli.epic.uchicago.edu/country-spotlight/pakistan/)
- Environmental issues in Pakistan include air pollution, water pollution, noise pollution, climate change, pesticide misuse, soil erosion, natural disasters, desertification and flooding.
- The climatic changes and global warming are the most alarming issues risking millions of lives across the country. The major reasons for these environmental issues are carbon emissions, population explosion and deforestation.

Introduction 5 Minutes

- Begin the lesson with a recap.
- Draw the following table on the board.

Type of Pollution	Causes of Pollution	Effects of Pollution

- Ask students to name the different types of pollution.
- Take students' responses and write them on the board in the table.
- Ask students to tell the causes of each type of pollution.
- Take students' responses and write them in the table.
- Tell students that in today's lesson you will learn about the effects of pollution on our health and other life forms.

Development:

Activity 1 – Effects of Pollution 15 Minutes

- Divide the class into three groups.
- Give each group a situation on a paper chit as follows.
  Group 1: There is a lot of dust in the air you breathe in.
  Group 2: You observe that the water coming out of the kitchen tap gives a bad odour.
  Group 3: There is large amount of waste just outside your house.
- Ask all the groups to read their situation and answer the given question.
  What could be the possible effects of the situation (provided on the paper chit) on your health?
- Give appropriate time to the students to answer the question.
- Once all the groups have finished their work, ask them to come to the board one by one and fill in the third column of the table (drawn at the beginning of the lesson).

Type of Pollution	Causes of Pollution	Effects of Pollution

- Read students' responses and address students' misconceptions or add the missing points.
- Conclude the activity with a round of applause and appreciate students' efforts using positive remarks.

Activity 2 – Reading Comprehension 10 Minutes

- Ask students to read about the effects of pollution on life on pages 51 and 52 of the Grade 5 Science textbook and answer the following questions in their notebooks.
  - How can the bacteria present in sewerage kill aquatic animals?
  - Name the gas that may cause eye and skin diseases.
  - Why is smog harmful to our health?
  - What is acid rain?
  - What is the main source of land pollution?
- Instruct students to do this as an individual task.
- In the end, collect students' notebooks for checking.

Conclusion / Sum up / Wrap up: 2 Minutes

Sum up the lesson by focusing on the following points:

- Germs present in polluted water cause diseases.
- The poisonous substances present in the factory wastes pollute water and land environment.
- Bacteria present in sewerage use most of the dissolved oxygen present in water. The aquatic animals die due to a lack of oxygen.
- The pollutants such as chemicals, carbon dioxide and other gases can cause throat, skin and eye diseases.
- Pollutant gases present in smog cause lung diseases and allergies.
- The poisonous substances emitting from the chimneys of factories and smoke dissolve in rain water and produce acid rain. It is harmful to buildings, trees and aquatic animals.

- Poisonous substances and gases are produced by open garbage dumps. These substances cause air and water pollution.

Assessment: Response Cards 5 Minutes

- Make students sit in pairs.
- Give one card to each pair with YES written on one side and NO written on the other side.
- Read aloud the following statements one by one and ask students to respond in YES or NO by showing the respective side of the card. In the case of NO, ask students to correct the statements.

  - Open garbage dumps cause air pollution.
  - Oxygen gas causes eye infections.
  - Acid rain damages trees and buildings.
  - Germs in polluted water make us healthy.
  - Smog causes allergies.

Response Cards

There are so many uses for response cards in a classroom. Ask a question and students respond by holding up a card. The most common response cards are yes/no questions. Glance around the room and quickly assess student understanding.

Follow up: 3 Minutes

- Ask students to make a 2-minute video (using parents' mobile phone) to show an example of any type of pollution in their area or street or home. Share the video with their friends and/or relatives.

Glossary

Pollutants	Substances or conditions that contaminate air, water, or soil.
Sewerage	It is the removal and disposal of sewage and surface water by waste pipes.
Smog	The word 'smog' is a combination of the words 'smoke' and 'fog'. It is a mixture of smoke, gases and chemicals.
Acid rain	When atmospheric pollutants like oxides of nitrogen and sulphur react with rainwater and come down with the rain, then this results in acid rain.

ENVIRONMENTAL POLLUTION
Green House Effect

Duration: 40 Minutes

Students Learning Outcome:

- Explain the effects of fossil fuels and releasing greenhouse gases in the air.

Materials:

- 2 small plants, watering can, polythene bag, digital scale, candle, glass or beaker

Information for Teachers:

- **Global warming** is a gradual increase in the earth's temperature generally due to the greenhouse effect caused by increased levels of carbon dioxide, Chlorofluorocarbons, and other pollutants.
- **Fossil fuels** are substances used as fuels such as petroleum, coal, or natural gas formed from the remains of organisms under the earth
- **Greenhouse gases** are gases in Earth's atmosphere that absorb radiation and absorb heat. Some greenhouse gases are naturally occurring compounds like water vapor, carbon dioxide and methane while others are man-made.
- To explore the related activities and concepts, visit the following website: **https://climatekids.nasa.gov/greenhouse-effect/**
- For further information, explore the following link: **https://byjus.com/chemistry/effects-of-burning-fossil-fuels/.**

Introduction: 5 Minutes

Ask the following questions for brainstorming sessions and in order to check the understanding of the students related to the topic:

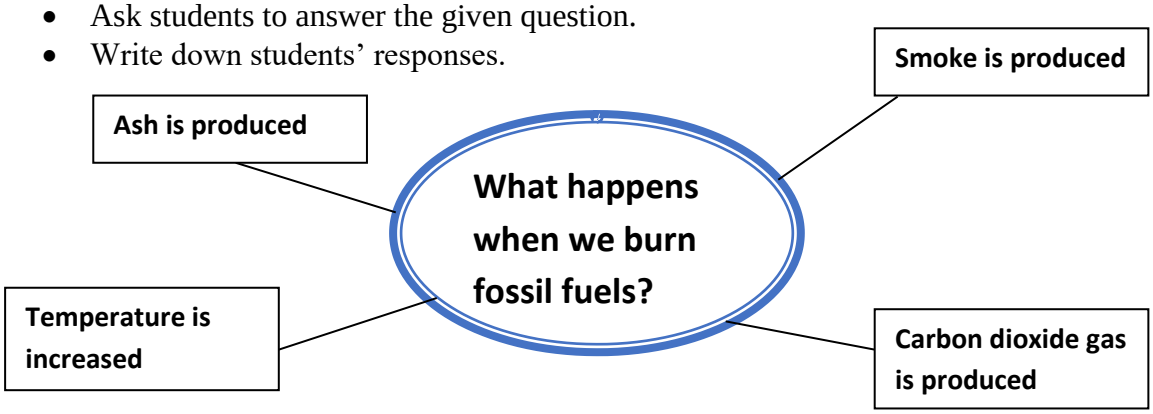
- Do you use wood, coal, or gas to cook food at home?
- Where do coal and gas come from?
- What are Fossil Fuels? (Ask them to read the "Do you know?" on page 53)
- Which gas is usually released from the burning of fuels? (Carbon dioxide)
- What are greenhouse gases? (Ask them to read the "For your information" on page 53)

Development:

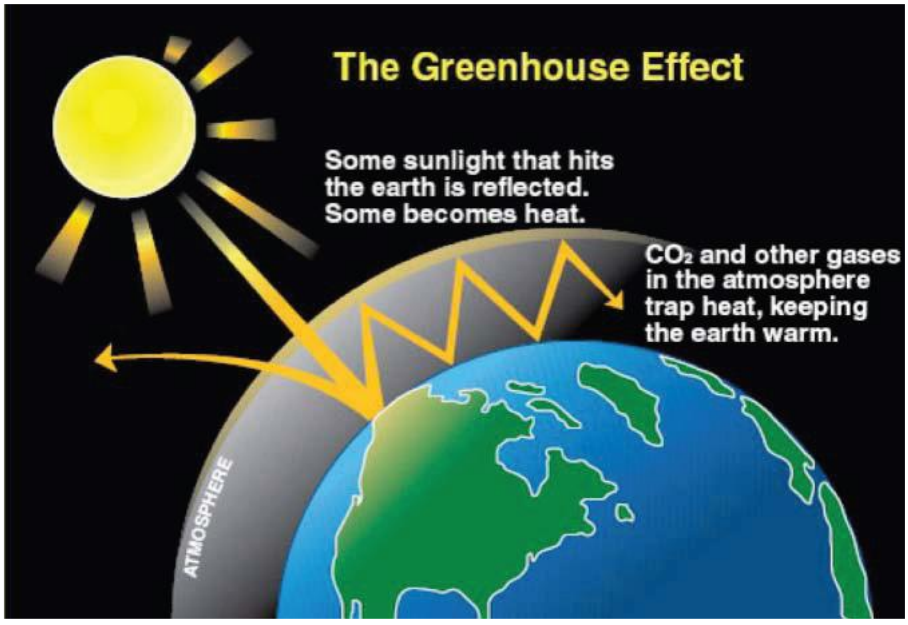
Activity1 5 Minutes

Part 1 (Lead-in)

- As an opening activity, review the term fossil fuels and their burning.
- Make a mind-map on the board.
- Ask students to answer the given question.
- Write down students' responses.



- Explain with the help of diagram shown below that **carbon dioxide and other gases are released which absorb heat from the sun and increase the temperature of the environment and these gases are called greenhouse gases.**



Part 2

Candle Pollution

- Light a candle and let it burn for a few seconds.
- Hold the glass jar or beaker above the flame so that the glass touches the top of the flame.
- After soot has covered most of the surface, set it upside down to cool. Repeat as many times as you want jars to show to students. (Tip: Warn students that the glass will get hot.)
- Pass jars around so that students can see (or touch it if they want) the black substance covering the jar.

- Ask students about the substance on the jar. What is it? How is it formed?
- Explain to students what soot is and how it is created.
- **The soot is the buildup of carbon particles from burning a candle. This is a small-scale version of the air pollution resulting from the burning of fossil fuels.**
- Ask them how burning of such fossil fuels can lead to global warming
- Facilitate the students to understand the greenhouse effect with the help of a video on your phone or laptop (**https://www.youtube.com/watch?v=SN5-DnOHQmE**)

Activity 2 — 10 Minutes

- Tell students that they are going to do a **Mini-Greenhouse Activity**
- Ask the students if they have ever visited a plant nursery.
- Ask them why some plants are wrapped in plastic sheet or kept in glass boxes.
- Provide them 2 small plants, preferably with broad leaves.
- Ask them to water both plants.
- Use a scale to weigh both the plants.
- Ask them to cover 1 plant with a plastic bag completely.
- Place both the plants in sunlight for 1 hour.
- Use a scale to weigh both the plants

Plant Number	Weight Before	Weight After
1		
2		

- Ask students to explain the difference in weight of both the plants
- Ask students how covering the plant with plastic bag helps the plant.
- Explain that **Mini-Greenhouse helps the plants to retain moisture and provides them suitable temperature range.**

Activity 3 — 10 Minutes

Part 1 (Lead-in)

- Ask students to look at the pictures and think about "what causes floods?
- After a minute ask them to share their thoughts in pairs.
- Now ask a few of them to share with the whole class.
- **This situation is produced from the effect of greenhouse gases, which increase the temperature of the environment, resulting in the melting of ice and mass floods.**


Part 2

- Facilitate the students to understand the global warming with the help of the following videos on your phone or laptop:

https://www.youtube.com/watch?v=Vztjbm6HA58
https://www.youtube.com/watch?v=PqxMzKLYrZ4

- Ask students what we can do to stop the global warming.
- How does global warming cause flooding?
- **Climate change warms up the atmosphere, the air can hold 7% more water vapors for every one-degree Celsius rise in temperature. When this air rapidly cools, water vapor turns into droplets which join together to form heavy rainfall which can lead to flooding.**

Conclusion / Sum up / Wrap up: 4 Minutes

- Ask them to summarize the topic in a few sentences.
- Repeat the main points given below to conclude the lesson:
  - Global warming is a gradual increase in the earth's temperature generally due to the greenhouse effect caused by increased levels of carbon dioxide, Chlorofluorocarbons, and other pollutants. It can lead to extreme climatic conditions such as flooding.
  - Fossil fuels are substances used as fuels such as petroleum, coal, or natural gas formed from the remains of organisms under the earth
  - Greenhouse gases are gases in Earth's atmosphere that absorb radiation and absorb heat. Some greenhouse gases are naturally occurring compounds like water vapor, carbon dioxide and methane while others are man-made.

Assessment: 5 Minutes

- Give 1 green and 1 blue post-it-notes to each student.
- Tell them that they will write down the names of the concepts that they fully understand on green post-it-notes and concepts that are not fully clear to them on blue post-it-notes.
- On teaching board, draw this table and ask them to paste their post-it-notes in the relevant box.

Today I learnt about:	I want to learn more about:

- Read the comments on the post-it-notes.
- Ask questions and provide support if needed.

Follow up and Homework: 1 Minute

- Ask students to read pages 52 and 53 of the **Science textbook Grade 5** at home.
- Refer to the weblink on Greenhouse Effect given on page 56 for homework.
- Assign students to think of "**ways to reduce emission of greenhouse gases**" and write them on their notebooks.

Glossary

Soot	A black, powdery substance chiefly composed of carbon, produced by incomplete combustion of coal, oil, wood or other materials
Global warming	It is a gradual increase in the earth's temperature generally due to the greenhouse effect caused by increased levels of carbon dioxide, Chlorofluorocarbons, and other pollutants.
Fossil Fuels	Substances used as fuels such as petroleum, coal, or natural gas formed from the remains of organisms under the earth
Greenhouse Gases	Gases in Earth's atmosphere that absorb radiation and absorb heat. Some greenhouse gases are naturally occurring compounds like water vapor, carbon dioxide and methane while others are man-made.

ENVIRONMENTAL POLLUTION
Biodegradable and Non- Biodegradable Material

Duration: 40 Minutes

Students Learning Outcome:

- Differentiate between biodegradable and non-biodegradable materials.

Materials:

- Samples of biodegradable and non-biodegradable materials such as fruit, leather, water, bread, foam plastic, etc.

Information for Teachers:

- **Biodegradable** substances are those that decompose or break down naturally into simple components by bacteria or any other natural organisms and then are mixed in air or soil not causing any pollution.
- **Non-biodegradable** substances are those that do not decompose or break down naturally into simple components by bacteria or any other natural organisms and cause pollution.
- Materials like plants, animals, paper, fruits, flowers, vegetables, etc. fall under biodegradable substances. On the other hand, rubber, plastic, chemicals, paint, plastic, etc. are non-biodegradable.
- **Decomposition** is a process that takes place when bacteria and other micro-organisms consume biodegradable materials. Temperature and sunlight play a crucial role in initiating decomposition of the biodegradable substances. Decomposition is a crucial phenomenon in order to remove toxic substances, which may have a hazardous impact on the soil and water. Without decomposition, the non-biodegradable pollutants may harm both the organisms as well as the surroundings.
- Visit the following website to explore the topic in greater detail: **https://biodifferences.com/difference-between-biodegradable-and-non-biodegradable-substances.html**

Introduction: 5 Minutes

- Ask the following questions:

  1. Have you seen a loaf of bread lying in one place for a long time?
  2. Have you seen plastic bags lying in one place for a long time?
  3. What happens to them after a few days?

- To prepare the students for the activities ahead, ask them to imagine how materials change over time?

- Tell them that those materials which change their shape and size and change into other components and are decomposed easily by bacteria or any other natural organisms and do not become part of pollution are called biodegradable materials like food materials, plants and animals' materials while those materials which do not change their shape and composition and do not change into other materials are called non-biodegradable materials.

Development:

Activity1 10 Minutes

Part 1

- Put some samples such as fruit, leather, water, bread, foam plastic, etc. on the table and ask the students to observe and separate the samples lying on the table into biodegradable and non-biodegradable.
- In case of unavailability of any sample, use pictures.
- Ask them to work in pairs and complete the given table on their notebooks.
- After sharing in pairs, ask a few of them to share with the whole class.

Biodegradable Materials	Non-biodegradable Materials

Fruits

Leather

Water

Bread

Wood

Foam plastic

Part 2

"Happy Earth, Sad Earth" Sorting Game

- Do a sorting exercise with students.
- Tell them Biodegradable Material can be beneficial for the Earth as they enrich the soil with minerals and nutrients while Non-biodegradable Material can be harmful for the Earth as they cause pollution.

HAPPY EARTH

SAD EARTH

- Biodegradable material make earth happy and Non-biodegradable materials make earth sad.

- Show them pictures of Biodegradable or Non-biodegradable materials (given below) and ask them to choose which category they should go to.
- You can conduct this activity in small groups, or as a whole class.

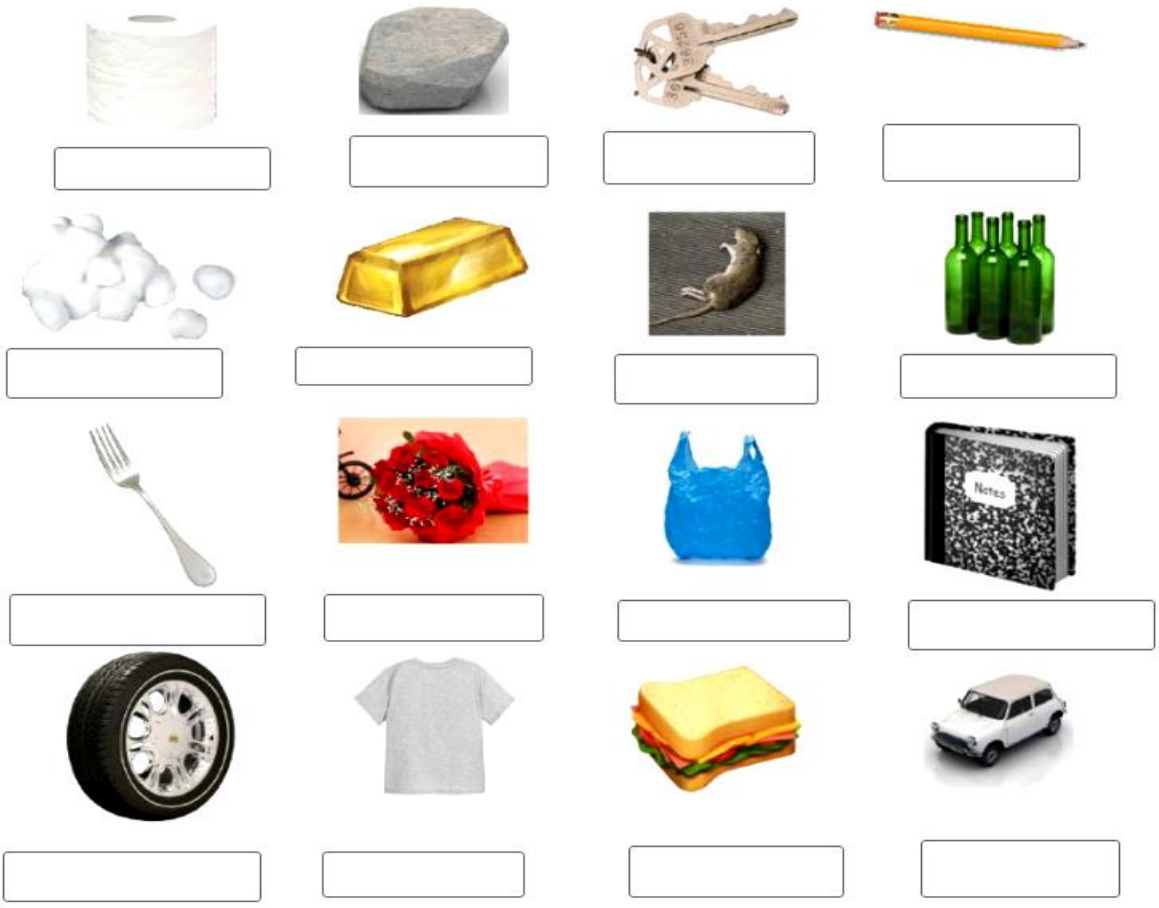
Activity 2 — 10 Minutes

- Show students a video on your phone or laptop in order to enhance their learning and interest about the topic.
- Tell them to pay attention as you would ask them some questions after they watch the video. (**https://www.youtube.com/watch?v=YeVLBkypPRU**
- Ask them to share the answers of the following questions in pairs:
    - What are biodegradable materials?
    - What are non-biodegradable materials?
    - Which one of them does not change its composition?
    - Which one can cause pollution?

Activity 3 — 5 Minutes

- Provide students with the following activity sheet. Ask them to complete this activity in pairs.
- After they complete, ask them to compare their work with other pairs.

1. Write **BIODEGRADABLE** or **NON-BIODEGRADABLE** under each picture below. Be careful of your spelling.



Conclusion / Sum up / Wrap up: 4 Minutes

- Ask them to summarize the topic in a few sentences.
- To conclude the lesson, repeat the main points of the lesson:
  - Biodegradable substances are those that decompose or break down naturally into simple components by bacteria or any other natural organisms and then are mixed in air or soil not causing any pollution.
  - Non-biodegradable substances are those that do not decompose or break down naturally into simple components by bacteria or any other natural organisms and cause pollution.
  - Materials like plants, animals, paper, fruits, flowers, vegetables, etc. fall under biodegradable substances. On the other hand, rubber, plastic, chemicals, paint, plastic, etc. are non-biodegradable.

Assessment: 5 Minutes

- Play **Board Race** with the students
- Split the class into two teams and give each team a colored marker. If you have a very large class, it may be better to split the students into teams of 3 or 4.
- Draw a line down the middle of the board.
- Give students a fixed time in which students must write as many words as you require related to the topic in the form of a relay race.
- Each team wins one point for each correct word. Any words that are unreadable or misspelled are not counted.
- To understand the rules of Board Race, visit the link: **https://teachingrecipes.com/board-race/**

Team 1		Team 2	
Biodegradable Materials	**Non-biodegradable Materials**	**Biodegradable Materials**	**Non-biodegradable Materials**

- Ask the students to answer Q. 4 Investigate on page 57 of the General Science textbook in groups of three.
- Monitor them. Support and guide, if needed.
- Ask a few of them to share the answers with the whole class.

Follow up and Homework: 1 Minute

- Ask students to read pages 52 and 53 of the **Science textbook Grade 5** at home.
- Refer to the weblink on "**Pollution due to plastic**" given on page 56 for homework.
- Carry out the following project at school with the help of students. Ask students to record their observations on their notebooks.
- Ask students to look at **4R Formula** on page 55 and think of five ways to apply it. Encourage them to share their ideas with two other students in the class.

Glossary

Biodegradable Materials	Substances are those that decompose or break down naturally into simple components by bacteria or any other natural organisms and then are mixed in air or soil not causing any pollution.
Non-Biodegradable Materials	Substances are those that do not decompose or break down naturally into simple components by bacteria or any other natural organisms and cause pollution.

PHYSICAL AND CHEMICAL CHANGES OF MATTER
Process Involved in Changes in the States of Matter

Duration: 40 Minutes

Students Learning Outcome:

- Describe and demonstrate the processes of melting, freezing, boiling, evaporation and condensation.

Materials:

- Ice cubes, glass, string, clear cups, glue sticks

Information for Teachers:

- When a solid turns into a liquid it is called **melting**. The temperature at which this happens is called the melting point. As the energy in the molecules increases from a rise in temperature, the molecules start moving faster. Soon they have enough energy to break free of their structure and start moving more easily. The matter becomes a liquid. The melting point for water is 0 °C.
- **Freezing** occurs when a liquid is cooled and turns to a solid. Eventually the particles in a liquid stop moving about and settle into a stable arrangement, forming a solid. It occurs at the same temperature as melting. Hence, the melting point and freezing point of a substance are the same temperature.
- **Evaporation** is a natural process which occurs when particles in a liquid pass directly into the gas state, at a temperature below the boiling point of the liquid. Evaporation doesn't always need a high temperature to occur. Even though the overall energy and temperature of a liquid may be low, the molecules on the surface that are in contact with the air and gases around them, can be high energy. These molecules on the surface will slowly become gases through evaporation. You can see evaporation when water on your skin dries.
- When a liquid becomes a gas it is called **boiling**. Again, at a certain temperature called the boiling point, the molecules will gain enough energy to break free and become a gas. The boiling point for water is 100 °C. When the opposite occurs and a gas becomes a liquid, it is called condensation. If a gas is cooled, its particles will eventually stop moving about so fast and form a liquid. This is called condensation and occurs at the same temperature as boiling. Hence, the boiling point and condensation point of a substance are the same temperature.

Introduction: 5 Minutes

Ask the following questions:

1. Ask the following questions to get the attention of students:

- Does matter change its form or state?
- What happens to ice when it is kept at room temperature?
- If you throw some water on the floor, what will happen to it after some time?

2. After discussing the above questions, announce the topic "Processes involved in Changes in states of Matter"

Development: 5 Minutes

Activity 1 (Evaporation Activity)

- Place a full cup of water in front of a sunny window.
- Use a marker to make a line at the beginning water level.
- Each hour mark the water level and begin to look for changes.
- As the sun heats the water, it should begin to evaporate.
- **Evaporation is a slow process. It occurs only from the surface of the liquid, does not produce bubbles, and leads to cooling.**
- Do you feel cold when you sit under a fan after a shower?

Activity 2 (Condensation Activity)

- Fill a cup approximately two-thirds full of hot water.
- Take another cup, flip it upside down, and place it on top of the cup with hot water.
- Then place an ice cube on top of the upside down cup.
- Condensation will begin to form at the top of the upside down cup, just like a cloud.
- Ask students to observe water droplets on the external surface of the cup.
- Ask them "where does this water come from? Take responses.
- Tell them when water in the air touches the cup surface, it loses heat and becomes liquid. This process is called Condensation.
- Ask them to think of some other examples of condensation from daily life.

Activity 3 (Phase changes) 5 Minutes

- Facilitate the students to understand the changes in states of matter with the help of a video on your phone or laptop. (https://www.youtube.com/watch?v=ydBcvY2Omkc)
- After they finish watching the video, ask them to share their learning about melting, boiling, freezing, condensation, and evaporation with each other in pairs.

Activity 4 (Boiling vs Evaporation) 14 Minutes

- Provide students with the following activity sheet (individually or in pairs)
- Give them paper cut-ups of the following statements and ask them to paste the statements in the relevant columns of the given table:

• Bubbles form throughout liquid.
• Takes place throughout the liquid.
• Faster process.
• Boils at a specific temp.(boiling point).
• Temperature remains constant.
• Heat energy from a source.
• No bubbles.
• Takes place only on surface of liquid.
• Slower process.
• Occurs at any temperature.
• Temperature can change.
• Heat energy from surroundings.
• Involve liquids changing to gases.
• Need energy to take place.
• Physical changes.

Evaporation	Boiling	Similarities

Conclusion / Sum up / Wrap up: 5 Minutes

- Ask them to summarize the topic in a few sentences.
- To conclude the lesson, repeat the main points of the lesson:
    - When a solid turns into a liquid it is called melting. The temperature at which this happens is called the melting point.
    - Freezing occurs when a liquid is cooled and turns to a solid. Eventually the particles in a liquid stop moving about and settle into a stable arrangement, forming a solid.
    - Evaporation is a natural process which occurs when particles in a liquid pass directly into the gas state, at a temperature below the boiling point of the liquid. Evaporation doesn't always need a high temperature to occur.

- When a liquid becomes a gas it is called boiling. Again, at a certain temperature called the boiling point, the molecules will gain enough energy to break free and become a gas.

Assessment: 5 Minutes

- Make **Exit Tickets** for students.
- Write one question on each exit ticket choosing from the given questions:
  - Define evaporation and give examples from everyday life.
  - Define condensation and give examples from everyday life.
  - Define Melting.
  - Define Boiling.
- Tell the students that they have to write the answer and submit the exit slip before leaving the class.

Follow up and Homework: 1 Minute

- Ask students to read pages 61 and 62 of the **Science Textbook Grade 5** at home.
- Solve questions 2 (parts i and ii) from the exercise given in the General Science textbook on page 69 in your notebooks.
- Write down as many examples of melting, freezing, evaporation, boiling, and condensation from daily life as possible.

Glossary

Melting	When a solid turns into a liquid it is called melting.
Melting Point	The temperature at which solid turns into liquid is called the melting point.
Freezing	Freezing is the process in which something changes from liquid to solid as the temperature becomes lower.
Evaporation	**I**t is a natural process which occurs when particles in a liquid pass directly into the gas state, at a temperature below the boiling point of the liquid.
Condensation	Condensation is the process where water vapor becomes liquid. It is the reverse f evaporation, where liquid water becomes a vapor.
Boiling	Boiling is the process by which a liquid turns into a vapor when it is heated to its boiling point.

PHYSICAL AND CHEMICAL CHANGES OF MATTER
Dissolving Substances in Water

Duration: 40 Minutes

Students Learning Outcome:

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

Materials:

- Salt, sugar cubes, powdered sugar, chocolate powder, water, kettle, stirrer, clear containers such as cups, and spoons

Information for Teachers:

- A solute is the primary substance that is dissolved in a liquid called the solvent. When a solute in a solvent form a solution, the process is called dissolution. This means when something dissolves in something else.
- There are many factors that affect the rate at which a solute will dissolve.
- Solid substances with greater surface areas and smaller particle size dissolve faster than solid substances with smaller surface area. A good example is powdered sugar versus sugar cubes. When the sugar in two different forms is added to water, the powdered sugar will dissolve faster. Each individual sugar crystal is able to interact with the water. In the sugar cube, the sugar crystals in the middle will not come in contact with the water until the exterior ones dissolves.
- In general, solids dissolve faster with increased temperature. As heat is added, the solute particles move around more, getting closer to the solvent molecules. This helps the solid dissolve faster in a liquid. Adding energy (heating) increases molecular motion. Increased molecular motion causes more solvent molecules to contact solute molecules and pull on them with more force, usually resulting in more dissolving. That is why sugar dissolves more readily in room temperature water as compared to cold water.
- Stirring allows the solute to dissolve faster. When a solid such as chocolate powder or sugar is added to hot water, string helps dissolution. Increased molecular motion competes with the attraction between solute molecules and tends to make them come apart more easily. Without stirring, clumps of solid can form which prevents even contact between solute and the solvent.

Introduction: 5 Minutes

Ask the following questions to motivate students towards the topic:

- What happens when some amount of salt is mixed in water?

- What happens when some amount of sugar is mixed in water?
- Which substance will take more time for its dissolution in water?
- At home, do you mix sugar in cold water? Why not?

Development: 10 Minutes

Activity1

- Take 6 clear containers such as cups and label them as 1 to 6
- Put tap water and 1 tablespoon sugar cubes in cups 1 and 2
- Use the stirring rods to mix the contents in cup no. 1. Do not stir contents in cup no. 2.
- After a minute, ask students to observe the difference in dissolution in the two cups and record.
- **Remind them that stirring a solute into a solvent speeds up the rate of dissolving because it helps distribute the solute particles throughout the solvent.**
- Put tap water and 1 tablespoon sugar cubes in cups 3 and hot water from a kettle and 1 tablespoon sugar cubes in cup 4
- After 2 minutes, ask students to observe the difference in dissolution and record.
- **Remind them that the addition of more heat facilitates the dissolving reaction by providing energy to break bonds in the solid. This is the most common situation where an increase in temperature produces an increase in solubility for solids.**
- Put tap water and 1 tablespoon sugar cubes in cups 5 and tap water and 1 tablespoon powdered sugar in cup 4
- After a minute, ask students to observe the difference in dissolution and record.
- **Remind them that solid substances with greater surface areas and smaller particle size dissolve faster than solid substances with smaller surface area.**
- Ask students to share their findings with the whole class.

Activity 2 10 Minutes

- Take 2 clear glasses.
- Take cold milk in one clear glass and hot milk in the other glass. (be careful with the hot milk)
- Make sure the glasses have an equal amount of milk.
- Put chocolate powder into the cold milk and stir with the spoon until the chocholate disappears. Repeat this process (remembering the amount of chocolate powder you put into the milk) until it stops dissolving, you are at this point when powder starts to gather on the bottom of the glass rather than dissolving.

- Write down how much chocolate powder you could dissolve in the cold milk.
- Repeat the same process for the hot milk, compare the amount of chocolate powder dissolved in each liquid, which dissolved more?

Activity 3 5 Minutes

- Facilitate the students to understand the dissolution and factors affecting it with the help of a video on your phone or laptop **(https://www.youtube.com/watch?v=0SQySg9ShGU)**
- In this video we look at the factors that affect the rate of dissolving. These are size of the pieces that we're dissolving, stirring or agitation, and temperature. The smaller the size of

the pieces, the faster the dissolving process. That is because surface area increases as the pieces get smaller. More surface area allows the solute inside the pieces to contact solvent on the outside. Stirring or agitation allows fresh solvent to contact the solute. And increasing the temperature increases the kinetic energy of the solvent particles, so they move faster, and collide with the solute more often and with more force. It's also important to note that temperature affects both the solubility and the rate of dissolving.

- After they finish watching the video, ask them to share their learning with each other in pairs.

Conclusion / Sum up / Wrap up: 2 Minutes

- Ask them to summarize the topic in a few sentences.

Assessment: 7 Minutes

- Write the following questions on the board.
- Carry out **3-2-1 activity** with students.
- Ask students to share **3** things that they have learnt, **2** things they want to know more about, and **1** question they want to ask.
- Provide support and address any questions they might have.

Follow up and Homework: 1 Minute

- Ask students to read pages 63 and 64 of the **Science Textbook Grade 5** at home.
- Ask students to prepare a list of substances in your kitchen that dissolve in water. Study their dissolving capabilities and how they are increased by stirring, increasing temperature, and grinding.

Teacher Guide
Grade-5

Lesson Plan
21

PHYSICAL AND CHEMICAL CHANGES OF MATTER
Difference between Physical and Chemical Changes

Duration: 40 Minutes

Students Learning Outcome:

- Differentiate between physical and chemical change with examples.

Materials:

- Samples of vinegar, Baking soda, lemon juice, water, ice, matchbox, burner, Iron filings, sand, and magnet, yeast, hydrogen peroxide, a stirring stick, a thermometer, a bowl

Information for Teachers:

- In a chemical change, a new substance is made, like when you burn a candle.
- Signs of a chemical reaction include:
  - Unexpected color change
  - Change in temperature as energy is released or absorbed
  - Gas created
  - Irreversible
- In a physical change, no new substance is made, like when water turns to ice.
- Signs of a physical change include:
  - Expected color change
  - Change in size or shape
  - Change in state of matter
  - Reversible
- For more information, explore the link: **https://www.generationgenius.com/learn-physical-and-chemical-changes/**

Introduction: 5 Minutes

Ask the following questions to create interest:

- What happens to salt when it is mixed in water?
- What happens when water is kept in the freezer? Can we change it back to water?
- What happens when a piece of paper is burnt? Can we restore burnt paper?

Development:

Activity 1: 9 Minutes

- Remind them the previous concept that materials change from one form to another. A change in a matter which is reversible is called physical change and a change that is not reversible by ordinary chemical methods is called a chemical change.
- Demonstrate the activity by taking a piece of ice and heat it on the burner.
- Ask students to observe that ice has changed from solid to liquid which is a **'physical change'**.
- Tell the students when the same water is placed in the freezer it will again freeze to solid ice form so it is a physical change.
- Ask the students to repeat the experiment.
- Ask some of them to share their observations with each other.

Activity 2: 5 Minutes

- In order to enable your students to differentiate between physical and chemical change, set up 2 different work stations for students to work on.
- Provide Iron filings, sand, and magnet on work station 1
- Ask students to mix the sand and iron filings and then use the magnet to separate the mixture.
- Ask them to record their observations and decide if the change is physical and chemical.
- Remind them that **physical change is reversible**

Activity 3: 5 Minutes

- Provide Baking soda, 25 mL of lemon juice in beakers, spoon, and thermometer on work station 2.
- Ask students to mix the baking soda and lemon juice and then record the temperature change with a thermometer after every minute.
- Ask them to record their observations and decide if the change is physical and chemical.
- Ask the students to share their results and conclusions with the class.
- If needed, **remind them that chemical changes are usually accompanied with a change in temperature.**

Activity 4 5 Minutes

- To reinforce the above chemical phenomenon (Chemical change), demonstrate another activity.
- Take a piece of paper and burn it, as a result, ash and carbon dioxide will be formed.
- Ask them what kind of change has taken place.
- Explain that burning is also a chemical change.

Conclusion / Sum up / Wrap up: 5 Minutes

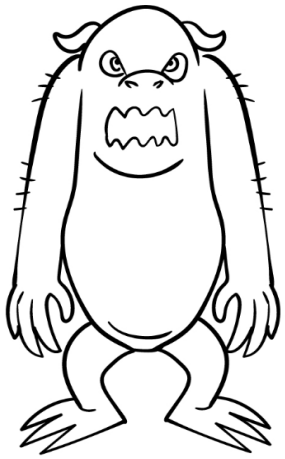
- Ask them to summarize the topic in a few sentences.

To conclude the lesson focus on the following points:

- Physical change is a temporary change. In this, the internal composition of a matter does not change. It is easily reversible.
- A chemical change is a permanent change. In this change, the internal composition of materials is changed, and new materials are formed. It is not reversible.

Assessment: 5 Minutes

- Draw a big monster on the board.
- Ask the students to think about the whole lesson and write names of all the things they have fully understood in Monster's belly and all the things they need to learn more about in Monster's arms and legs.
- Read students feedback and provide support, if needed.



Follow up and Homework: 1 Minute

- Ask students to read pages 63 and 64 of the **Science Textbook Grade 5** at home.
- Ask them to write down Q 2 (part iii, iv, and v) on page 69 on their notebooks as homework.
- Now, ask them to share the answers to these questions in pairs.
- Tell the students to record/write five physical changes and five chemical changes that are taking place in their surroundings in their notebooks.
- Assign them the activity 5.9 on page 67 of the General Science textbook.
  Refer to the weblink on **Conservation of Matter** given on page 68 for homework.

Teacher Guide
Grade-5

Lesson Plan
22

LIGHT AND SOUND
Light and Sources of Light

Duration: 40 Minutes

Students Learning Outcome:

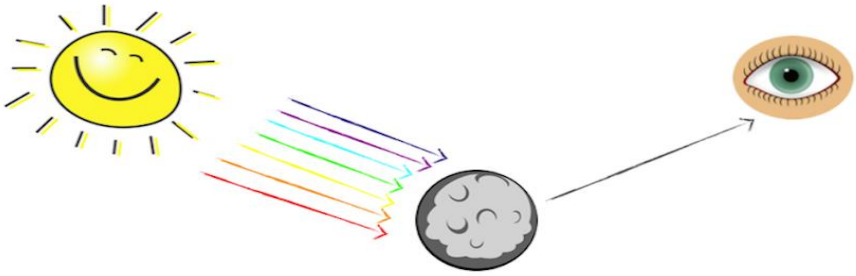
- Identify natural and artificial sources of light.

Materials:

- Handouts of activity sheets

Information for Teachers:

- Light is a type of energy that makes it possible for us to see the world around us. We need light to see.
- A light source is anything that makes light. There are natural and artificial light sources. A few examples of natural light sources include the Sun and stars. A few examples of artificial light sources include light bulbs, lamp posts and televisions. Without light sources we could not see the world around us, however, not every object we see is a light source.
- Many objects simply reflect light from a light source like the Moon. The Moon is not a light source, it does not make its own light. The Moon reflects light from the Sun.



Light from the Sun hits the moon it is reflected back to Earth and enters our eyes allowing us to see the Moon.

Introduction: 5 Minutes

- Ask the following questions for brainstorming sessions and in order to check the understanding of the students related to the topic:
    - Can you see stars and the Moon in the daytime? Why/why not?

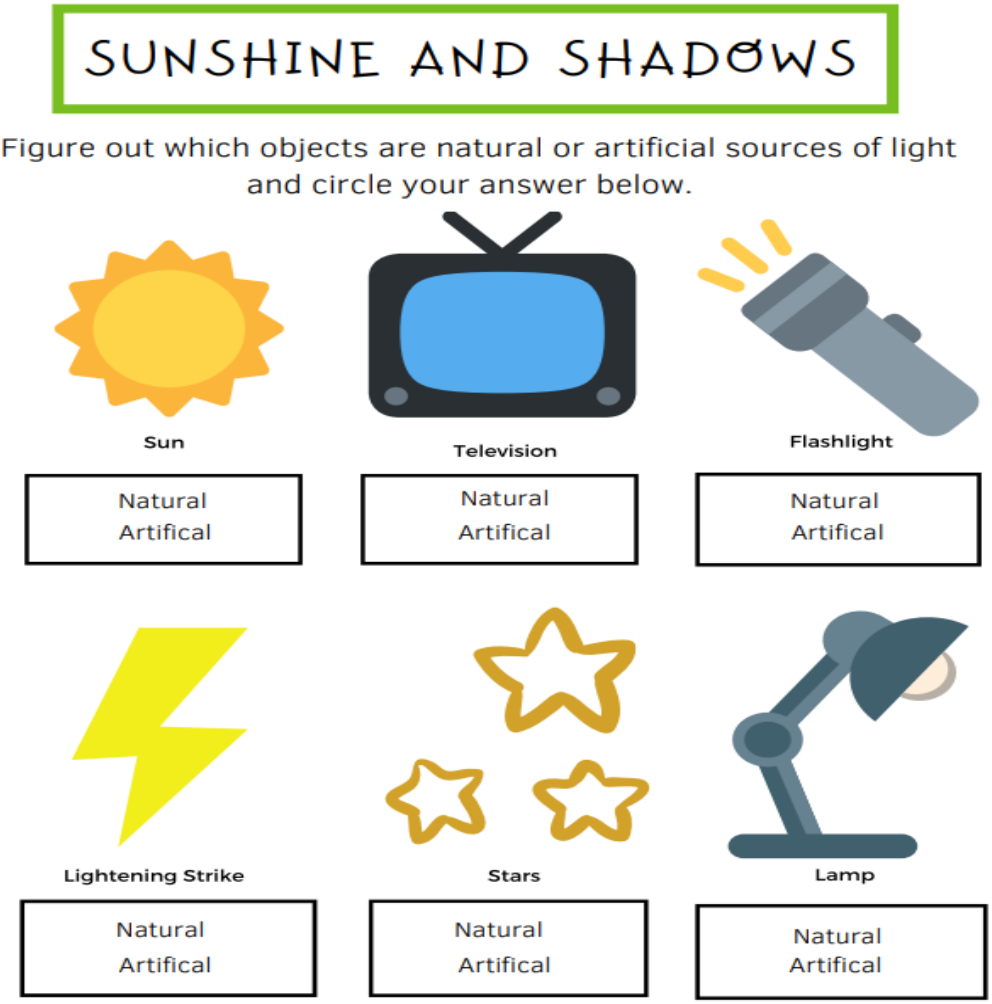
- Why do we see stars and Moon at night?
- What causes light in the day time?
- How do you get light at night (in the absence of sun)?

- Ask students to share the answers in pairs.
- Ask some of them to share their thoughts with the whole class.

Development: 5 Minutes

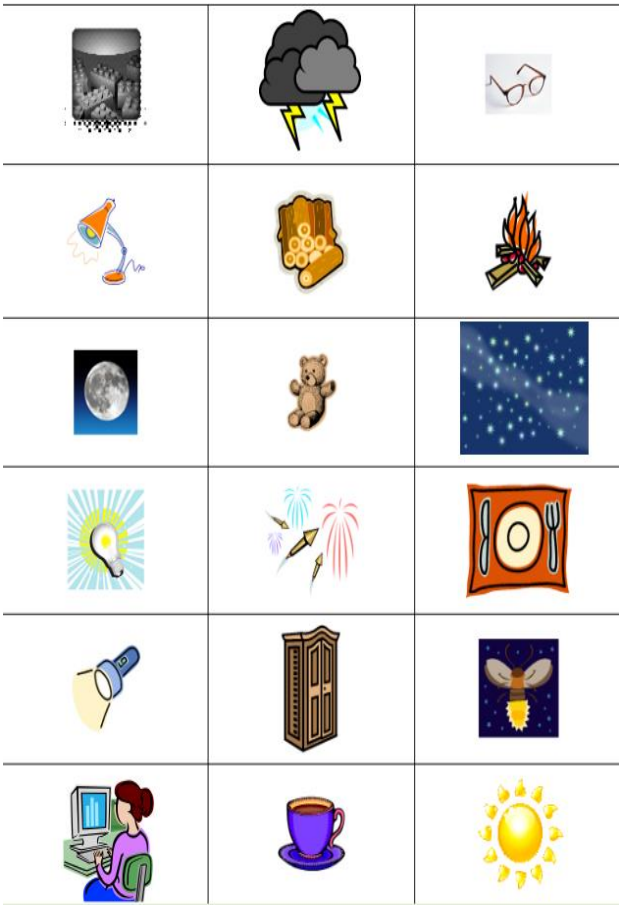
Activity1

- Give each students the following worksheet and ask them to circle the right answer:



Activity 2 10 Minutes

- Ask students to sort the pictures and place them under the correct headings in the table.
- Ask students to check each other's work. (in pairs or groups of 3)



Natural light source	Artificial light source	Not a light source

Activity 3 — 10 Minutes

Part 1

- Show students the video and help them to attempt the quiz using the following link: **https://study.com/academy/lesson/light-energy-sources-lesson-for-kids.html**
- Monitor and support if needed.

Part 2

- Help students to attempt the online quiz using the following link: **https://www.kidsacademy.mobi/worksheets-check/natural-and-manmade-light-sources/**
- Monitor and support if needed.

Conclusion / Sum up / Wrap up: — 5 Minutes

- Ask them to summarize the topic in a few sentences.
- Repeat the main points given below to conclude the lesson:
  - Light is a type of energy that makes it possible for us to see the world around us. We need light to see.
  - A light source is anything that makes light. There are natural and artificial light sources. A few examples of natural light sources include the Sun and stars. A few examples of artificial light sources include light bulbs, lamp posts and televisions. Without light sources we could not see the world around us, however, not every object we see is a light source.

Assessment: 9 Minutes

- Give students instructions for **'Onion Rings'** activity
- Divide the students into two equal-sized groups.
- Ask Group 1 to make an inner circle and Group 2 to make an outer circle, so that each learner is facing a partner.
- Give each of them a page. Instruct them to ask their partners any 1 question each of their choice about the topic. For each correct answer, one point will be given. Ask them to record the scores of other students on the given page.
- Tell each pair to practice their questions and answer other students' questions and then, on the teacher's signal (a clap or ringing a bell), all the outer circle learners move one place to their right and form new pairs. The new partners repeat the task.
- If needed, check the scores at the end and appreciate the high scorers.

Follow up and Homework: 1 Minute

- Ask students to read pages 73 of the **Science textbook Grade 5** at home.
- Ask them to complete activity 6.1 on page 73.
- Ask them to think about and answer the following questions.
    1. Name at least three natural sources of light?
    2. Name three artificial sources of light?

Glossary

Artificial	Made or produced by human beings rather than occurring naturally, especially as a copy of something natural.

Teacher Guide
Grade-5

Lesson Plan
23

LIGHT AND SOUND
Luminous and Non-Luminous Objects

Duration: 40 Minutes

Students Learning Outcome:

- Investigate the luminous and non-luminous objects in daily life.

Materials:

- Glue stick, handouts and cut-ups

Information for Teachers:

- The objects that emit light are called **luminous** objects.
- The objects that do not have their own source of light are **non-luminous**. They reflect the light of luminous objects that is why we can see them.
- Examples of luminous objects are the sun, flame in a lamp, tube light, etc.
- Examples of non-luminous objects are the earth, moon, a piece of cloth, etc.

Introduction: 5 Minutes

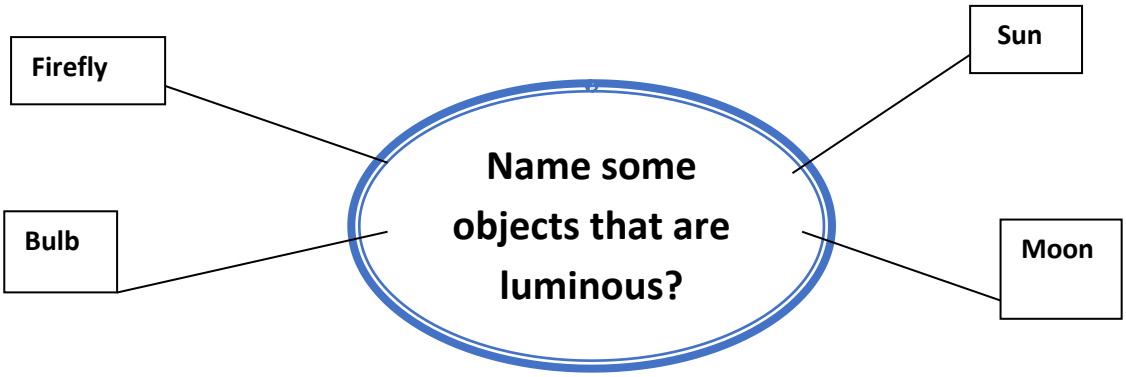
- Ask the following questions for brainstorming sessions and in order to check the understanding of the students related to the topic:
  - Name something that shines.
  - Why is light important for us?
  - What is the biggest source of light on earth?
  - Ask them if they know the meaning of the word “luminous”.
- After taking some responses, announce the topic “luminous and non-luminous objects”.

Development: 5 Minutes

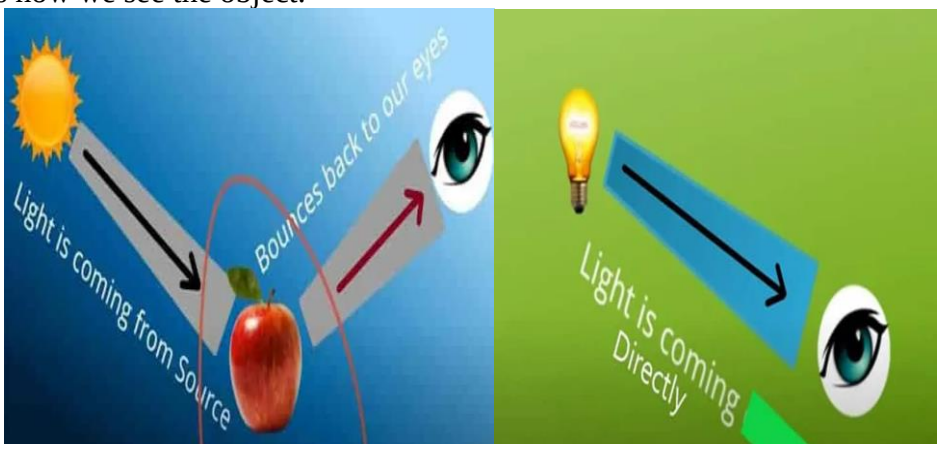
Activity1

Part 1 (Lead-in)

- As an opening activity, review the terms luminous and non-luminous objects.
- Make a mind-map on the board
- Invite students to come to the board and answer the given question.



- Comment on students' responses, if needed.
- Explain that moon is not a luminous object itself. It just reflects light from the sun.
- Ask them how we see luminous objects.
- Ask them how we see non-luminous objects.
- We can see only when there is light coming from the object and falling in our eyes (Luminous Objects. Not all objects can produce light of their own, some reflect light falling on them. When light falls on a non-luminous object, it is reflected by the surface towards us and that is how we see the object.



Activity 2 — 10 Minutes

- Facilitate the students to understand the difference between luminous and non-luminous objects with the help of a video on your phone or laptop.
  https://www.youtube.com/watch?v=DPk3y43GMVY
- After they finish watching the video, ask them to share their learning with each other in pairs.
- To check students' learning, attempt the following online quiz:
  https://www.liveworksheets.com/cj1639633bq
- Monitor and support, if needed.
- Non-luminous objects are objects that do not have their own light but visible only when light from luminous source reflects from them.
- The computer screen is luminous, but the page of a book is non-luminous, which is why you need a light on to read.

Activity 4 — 5 Minutes

- Give each student the following handout.

- Ask them to think and write the correct title “luminous” or “non-luminous” under each picture.
- Check their work and give feedback.

Conclusion / Sum up / Wrap up: 4 Minutes

- Ask them to summarize the topic in a few sentences.
- To conclude the lesson, repeat the main points of the lesson:
  1. The objects that emit light are called luminous objects.
  2. The objects that do not have their own source of light are non-luminous. They reflect the light of luminous objects that is why we can see them.

Assessment: 10 Minutes

- Tell students that they are going to participate in a **Group competition**.
- Divide students in groups of 4
- Give each group a handout with the given table on it.
- Provide each group with the pieces of paper with names of the following objects on them and ask them to classify them as luminous and non-luminous objects:

Sun, mirror, firefly, CD, candle flame, notebook, torch, rock, flame in a lamp, tube light, electric bulb, the Earth, moon, a piece of cloth, coal, table, marker, shoes, knife, window, pencil, paper, stone, book,

- Provide them with glue sticks so they can paste the names in the correct column on the handout.
- Tell them the group that completes the task first and makes correct table will be the winner.
- Check their answers and appreciate all students, especially the group that finishes first.

Luminous objects	Non-luminous objects

Follow up and Homework: 1 Minute

- Ask students to read pages 74 of the **Science Textbook Grade 5** at home.
- Ask them to complete activity 6.2 on page 74.
- Write the answer to the question:

Differentiate between luminous and nom-luminous objects.

Glossary

Luminous	Something that emits light; bright or shining.

Teacher Guide
Grade-5

Lesson Plan
24

LIGHT AND SOUND
Transparent, Opaque, and Translucent Object

Duration: 40 Minutes

Students Learning Outcome:

- Identify and differentiate between transparent, opaque, and translucent objects in surroundings.

Materials:

- Books, several hand mirrors, magnifying glasses, clear glasses full of water, empty glasses, wax paper, several paper and plastic sheets, flash light.

Information for Teachers:

- Materials like air, water, and clear glass are called **Transparent**. When light encounters transparent materials, almost all of it passes directly through them. Clear glass, for example, is transparent to all visible light.
- **Translucent** objects allow some light to travel through them. Materials like frosted glass and some plastics are translucent. When light strikes translucent materials, only some of the light passes through them. Therefore, we cannot see clearly through them and objects on the other side of a translucent object appear unclear.
- **Opaque** objects block light completely from traveling through them. Most of the light is either reflected by the object or absorbed and converted to thermal energy. Materials such as wood, stone, and metals are opaque to visible light.

Introduction: 5 Minutes

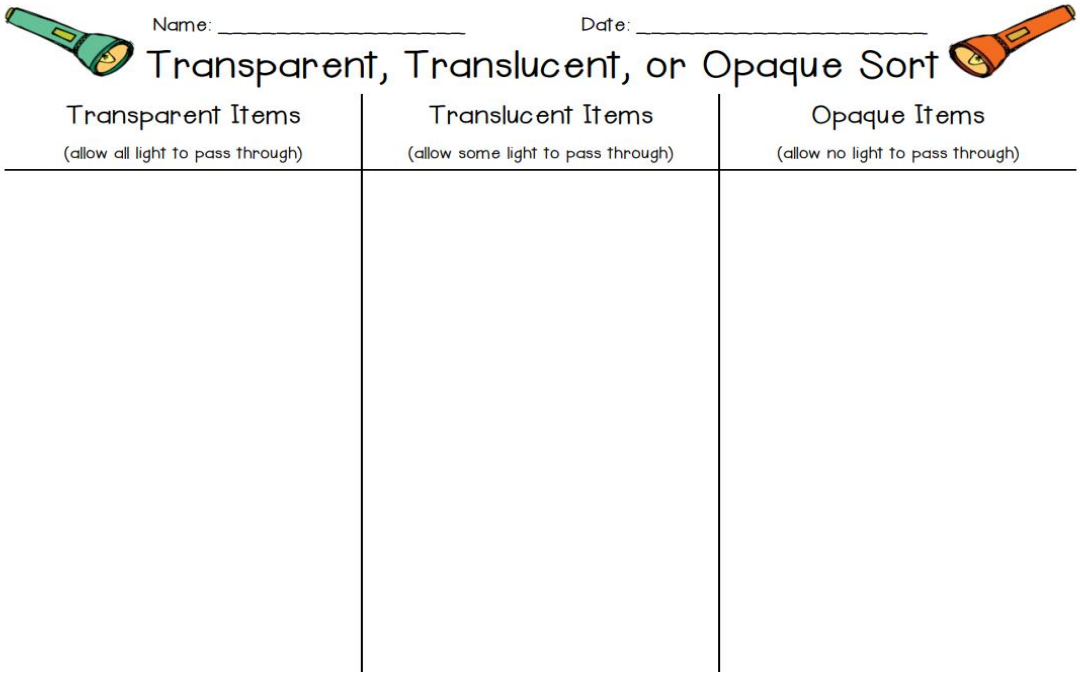
- Point to the window and ask the students, how light is passing through the window.
- Ask the following questions for brainstorming sessions and in order to check the understanding of the students related to the topic:
  - How does light travel into the classroom?
  - Name some objects through which light passes completely?
  - Name some objects through which light cannot pass?

Development:

Activity1 5 Minutes

Part 1

- Show students a video on your phone or laptop in order to enhance their learning and interest about the topic.
- Tell them to pay attention as you would ask them some questions after they watch the video.



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

- Ask students what they have learnt from the video.
- A transparent material allows visible light to pass through it. Some of the light may be absorbed, but it is possible to see objects through the material. Familiar examples of transparent materials are air, water, some plastics and clear glass.
- Translucent materials allow some light through them but it is scattered so it is impossible to see a clear image through the material. Examples of translucent materials are some plastics and frosted glass.
- Opaque materials don't let light through them at all. The light is either reflected or absorbed. Absorbed light heats up the material. Examples of opaque materials are stone, metals and some plastics.
- Translucent materials allow some light through them but it is scattered so it is impossible to see a clear image through the material. Examples of translucent materials are some plastics and frosted glass.

Part 2 **5 Minutes**

- Show students a variety of transparent objects (such as reading glasses, plastic wraps, light bulb. plastic sheets, and water etc.), a variety of translucent objects (such as tinted sunglasses, notebook paper, wax paper, stained glass, a lampshade, and vegetable oil, etc.) and a variety of opaque objects (such as a books, notebooks, aluminum paper, fabric, and various spoons) placed carefully on a table.
- Provide students with the following table printed on handouts. Instruct them to look at all the shown objects carefully and decide in which column each item should be placed.
- Ask them to complete this activity in pairs.
- After they complete the task, ask them to compare with other pairs.
- Remind them the following:
  - Transparent objects allows light to pass through completely.
  - Translucent objects allows some light to pass through.

- Opaque objects allows no light to pass through so we see their shadow. Shadow is a dark area created when something blocks light.

Activity 2 — 10 Minutes

- This activity is for students to investigate different materials and see if they are translucent, transparent or opaque.
- Divide the class into groups of two or three students each.
- Hand out the worksheets. Encourage and help students, as needed, as they examine the objects listed on the worksheet.
- Provide students books, several hand mirrors, magnifying glasses, clear glasses full of water, empty glasses, wax paper, several paper and plastic sheets, and flash light.
- Instruct them to use light on all the given material and see if light can pass through them or not.
- Remind them that transparent means clear; translucent means a little harder to see through; opaque means you cannot see through it at all.
- Once students have completed the worksheets, gather the class back together. Grouping the transparent, translucent and opaque objects together, ask students to help you arrange the objects in a line from transparent to opaque according to how easy it is to see through the object. Discuss the differences in transparencies of the various objects.
- Give students time to share what they discovered through this activity.
- Objects differ in how they transfer light through them.
    1) Transparent objects permit almost all the light to pass through them. Materials such as water, and clear glass are transparent.
    2) On the other hand, when light strikes translucent materials, it changes direction multiple times and is scattered as it passes through. Therefore, one cannot see clearly through them. Objects on the other side of a translucent object appear unclear. Plastic and frosted glass are examples of translucent material.
    3) Opaque objects allows no light to pass through so we see their shadow only.

Light Scavenger Activity –
Light Scavenger Worksheet

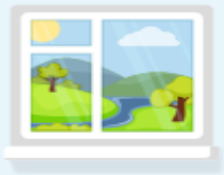
I Observed	Interaction with Light (opaque, transparent, translucent, reflected, refracted)	My Notes
Shadows		
A book		
A window		
A mirror		
A magnifying glass		
A clear glass of water with a pencil in it		
An empty glass		
Wax paper		

Activity 3 — 5 Minutes

- Provide students with the following handouts. Instruct them to look at all the shown objects carefully and check the box in the right column.
- After they complete the task, ask them to compare with other students.

TRANSPARENT, TRANSLUCENT, OR OPAQUE?

For each object check off whether it's transparent, translucent, or opaque.

	TRANSPARENT	TRANSLUCENT	OPAQUE
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Conclusion / Sum up / Wrap up: — 4 Minutes

- Ask them to summarize the topic in a few sentences.
- To conclude the lesson, repeat the main points of the lesson:

- Materials like air, water, and clear glass are called **Transparent**. When light encounters transparent materials, almost all of it passes directly through them. Clear glass, for example, is transparent to all visible light.
- **Translucent** objects allow some light to travel through them. Materials like frosted glass and some plastics are translucent. When light strikes translucent materials, only some of the light passes through them.
- **Opaque** objects block light completely from traveling through them. Most of the light is either reflected by the object or absorbed and converted to thermal energy. Materials such as wood, stone, and metals are opaque to visible light.

Assessment: 5 Minutes

- Play **Board Race** with the students
- Split the class into two teams and give each team a colored marker. If you have a very large class, it may be better to split the students into teams of 3 or 4.
- Draw a line down the middle of the board.
- Give students a fixed time in which students must write as many words as you require related to the topic in the form of a relay race. Use stop watch to start and stop the game.
- Each team wins one point for each correct word. Any words that are unreadable or misspelled are not counted.
- To understand the rules of Board Race, visit the link: **https://teachingrecipes.com/board-race/**

Team 1			Team 2		
Transparent,	**Translucent**	**Opaque**	**Transparent**	**Translucent**	**Opaque**

Follow up and Homework: 1 Minute

- Ask students to read pages 75 and 76 of the **Science Textbook Grade 5** at home.
- Assign activity 6.4 given on page 76 for homework.
- Assign Q 4 (part ii) from exercise given on page 90 for homework.
- Ask the following questions to assess the Learning of students
  - Can you differentiate between transparent, translucent, and opaque objects?
  - Give two examples of each: transparent, translucent, and opaque objects.

Glossary

Translucent	Translucent objects allow only some light to travel through them. Materials frosted glass and some plastics are called translucent.

LIGHT AND SOUND
Formation of Shadows

Duration: 40 Minutes

Students Learning Outcome:

- Explain the formation of shadows.

Materials:

- Cardboard, chart paper, building blocks, markers, torch or flashlight, white screen, paper tape

Information for Teachers:

- Shadows are formed when opaque objects or materials are placed in the path of rays of light. The opaque material does not let the light pass through it. The light rays that reflect the edges of the opaque material outline the shadow.

Introduction: 5 Minutes

Ask students the following questions to reflect on their previous knowledge and write their responses one by one on the writing board:

- Do you see your shadow? How is it formed?
- What happens when light falls on a smooth /polished object?
- What happens when light falls on an opaque object?

Development: 5 Minutes

Activity 1

- Teach students to make a **shadow frame** using cardboard or chart paper. This is great for experimenting with different shapes and types of materials to make shadows.
- Instruct students to try translucent and opaque materials in front of a light source such as flashlight or bulb to investigate how different shadows are formed.
- Ask students to observe the shadows.

Activity 2 — 10 Minutes

- Provide students a torch, a few small opaque and transparent objects of different shapes and sizes and a white screen (a piece of cardboard covered with white paper)

- Demonstrate in front of the students how to obtain a shadow.
- Turn on the torch and place the object (whose shadow you want to study) in front of it.
- Hold the screen on the other side of the object to get the shadow.
- Ask a student to observe what happens when we place a transparent object such as a plastic sheet in front of the light. (No shadow is formed.)

- Ask a student to observe what happens when we place an opaque object such as a plastic sheet in front of the light. (Shadow is formed.)
- Repeat for different objects.
- An opaque object blocks the light falling on it. This creates an area of darkness on the side of the object away from the source of light. A translucent object also creates a faint area of darkness. An area of darkness formed by an opaque object obstructing light is called a shadow. The following three things are required for a shadow to form:
    - a source of light
    - an opaque object
    - a screen or surface behind the object.

Activity 3 — 5 Minutes

- Hand shadow puppets are easy to do and can be created just about anywhere. With a bit of practice, you will be able to teach students how to make hand shadows.
- Tell students that all they need to make their own shadow puppets are their hands, a wall and a light source. A flashlight or lamp works perfectly.
- Put one hand between the light and the wall so that you can clearly see the shadow of your hand.
- Then, simply by changing the shape of your hand, you can make animals, birds and other characters come to life.
- To learn how to create some simple shadow puppets, visit the following link to see a useful and fun video:

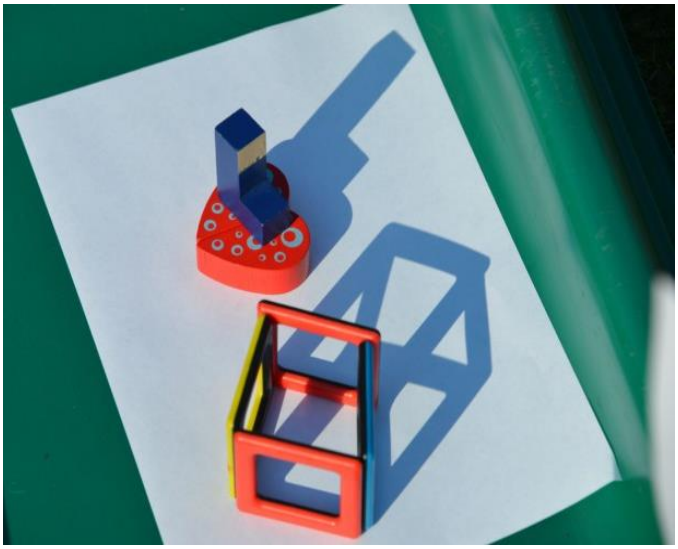
https://www.youtube.com/watch?v=Kz8wP2RYy64&t=1s

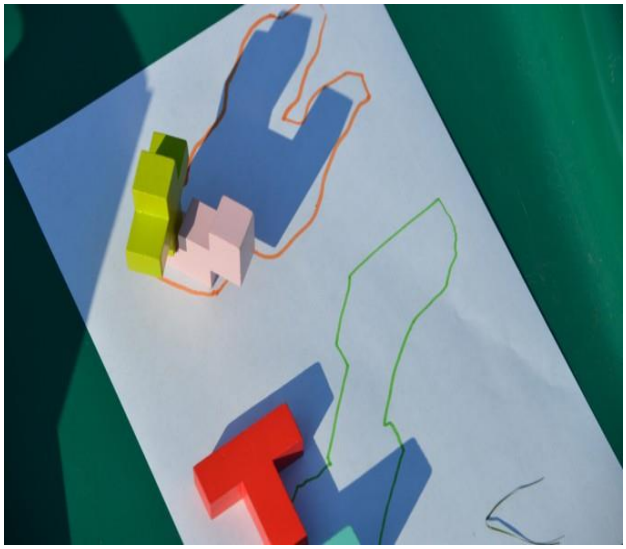
Conclusion / Sum up / Wrap up: — 4 Minutes

- Ask them to summarize the topic in a few sentences.
- To conclude the lesson, repeat the main points of the lesson:
    - When an opaque object or material is placed in the path of a ray of light, a shadow is formed.

Assessment: — 10 Minutes

- Provide students with building blocks of different shapes and sizes.
- Instruct students to place building blocks in front of a light source such as a torch or a flashlight and trace the shadows on a white paper.
- Ask them to draw the shadows on the paper using different color markers.
- Ask them to display their drawings on the soft board or classroom walls using paper tape.
- Ask students to do a **Gallery Walk** and observe other students' drawings.
- Ask them to think about "what is required to form a shadow?" and share with each other.





Follow up and Homework: 1 Minute

- Ask students to read topic **Formation of Shadows** on pages 77 and 78 of the **Science textbook Grade 5** at home.
- Ask them to complete activity 6.6 on page 78.
- Ask them to try and make as many different shapes of birds using their hands as they can.
- Ask them to write the answer to the question:
    - How are shadows formed?

Glossary

Shadows	A dark shade formed behind an opaque object when light falls on it.

Teacher Guide
Grade-5

Lesson Plan
26

LIGHT AND SOUND
Formation of Shadows

Duration: 40 Minutes

Students Learning Outcome:

- Predict the location, size and shape of a shadow from a light source relative to the position of objects.

Materials:

- Torch or flashlight, cardboard, various opaque classroom objects, white screen, markers, handouts, sample of sundial

Information for Teachers:

- Shadows are formed when opaque objects or materials are placed in the path of rays of light. The opaque material does not let the light pass through it.
- The shadow becomes bigger when the object is moved closer to the torch and smaller when it is moved closer to the screen.

Introduction: 5 Minutes

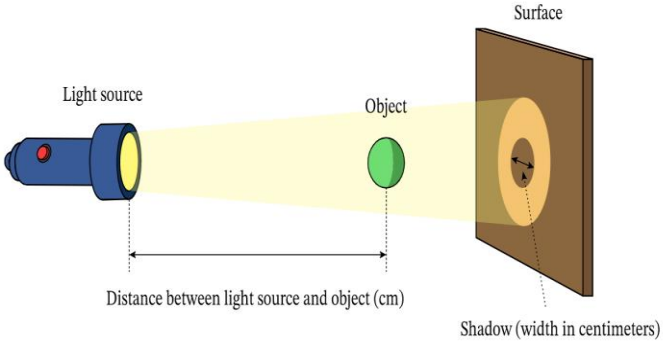
- Ask the following questions from the students to reflect on their previous knowledge about size of shadows.
  - Do you see your shadow during sunset and sunrise?
  - Are the shadows same in size throughout the day? Why/why not?

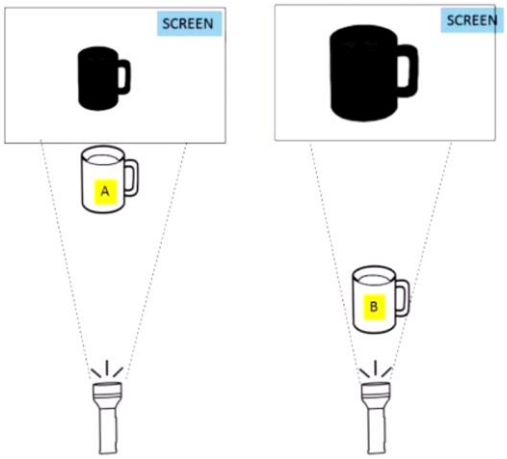
Development: 10 Minutes

Activity1

- Provide students some opaque classroom objects and a torch or a flashlight.
- Tell students that they are going to obtain a shadow and study its characteristics such as size and color.
- Turn on the torch and place the object (whose shadow you want to study) in front of it.
- Ask them to trace out the outline of the shadow on the screen.
- Now, change the positions of the torch and the screen and note the size of the shadow.
- Repeat steps 1 to 5 for different objects.
- Ask students to observe how the shadows becomes bigger when the object is moved closer to the torch and smaller when it is moved closer to the screen. The color of the shadow is always black.

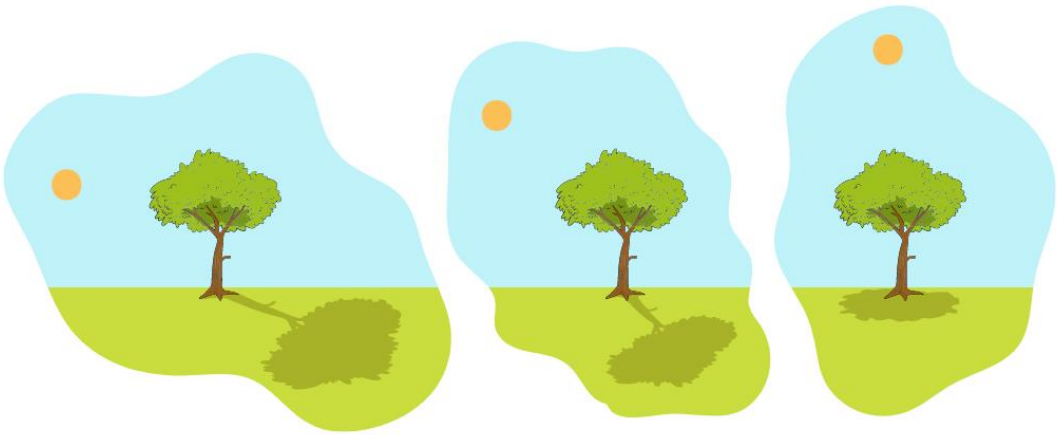
- Ask students what happens to a shadow when you move the light source farther away from an object?
- The shadow becomes bigger when the object is moved closer to the torch and smaller when it is moved closer to the screen.





Activity 2 **5 Minutes**

- Give each student a task to observe the shadows of given objects inside or outside school (trees, flags, poles, etc.) at different times.

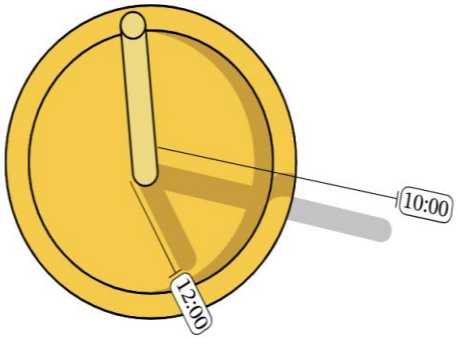


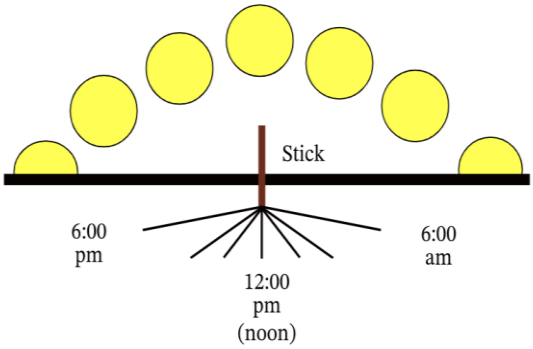
- Ask students to observe the shadows at given times such as:
  a) Sunrise
  b) 12:00 pm (noon)
  c) Sunset
- Ask students to record their observations on the given table

Objects	Position of sun	Size of shadow (in inches)
	Sunrise	
	Sun at 12:00 Noon	
	Sunset	

Activity 3 — 10 Minutes

- Visit the given link to see how to **make your own sundial**: **https://www.pbs.org/parents/crafts-and-experiments/diy-sundial**
- Use the classroom objects to make a sundial.
- Show students the sundial.
- Tell students that sundials were used in the past as a way of telling time using shadows.
- Ask students to try and make their own sundials.
- Ask students to draw the shadows on the sundial at different times of the day and write corresponding time of the day such as 9 AM, 12 PM, etc.



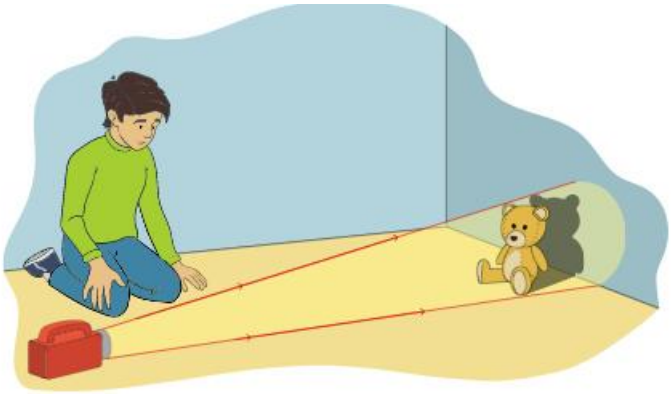


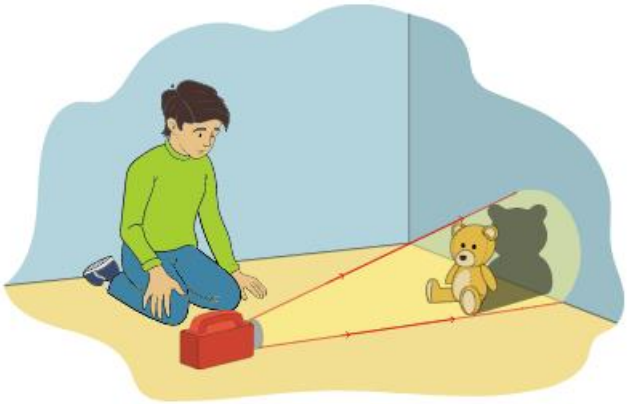
Conclusion / Sum up / Wrap up: — 4 Minutes

- Ask them to summarize the topic in a few sentences.
- To conclude the lesson, repeat the main points of the lesson:
  - The shadow becomes bigger when the object is moved closer to the torch and smaller when it is moved closer to the screen.

Assessment: — 5 Minutes

- Provide students some opaque classroom objects.
- Ask them to find out what happens to a shadow when you move a flashlight closer to and farther from an object.
- Give them a scale to measure the size of the shadow.





- Ask student to use the following table.

	Object a	**Object b**	**Object c**
Distance of object from flashlight			
Size of the shadow			

- Ask students to compare their tables with other students.

- Give them feedback and ask them what they learnt from this activity.
- **The shadow becomes bigger when the object is moved closer to the torch and smaller when it is moved closer to the screen.**

Follow up and Homework: 1 Minute

- Ask students to read pages 78 of the **Science Textbook Grade 5** at home.
- Ask them to try activity 6.6 on page 78.
- Ask them to share the use of sundials with their family members.

Glossary

Sundial	An instrument showing the time by the shadow of a pointer cast by the sun on to a plate marked with the hours of the day.

Teacher Guide
Grade-5

Lesson Plan
27

LIGHT AND SOUND
Reflection of Light

Duration: 40 Minutes

Students Learning Outcome:

- Demonstrate that shining surfaces reflect light better than dull surfaces.

Materials:

- Activity 1 – a rubber ball. Activity 2 – small square pieces of aluminum foil. Activity 3 – a mirror, handkerchief, bowl of water, small steel ball, wooden spoon, a newspaper, etc.

Information for the Teacher

- The surface of an object is its top layer. Light rays or photons travel in straight lines. When they hit the top layer of an object, they may be transmitted (pass through the surface into the object) or bounce back from the surface (do not pass through the surface). Some materials contain matter that does not allow light rays to pass through it. That is why light gets reflected.

- Some surfaces are very smooth and reflect light rays at the same angle at which they hit the surface. This makes them look very shiny. The more the light rays reflected by a surface at the same angle at which they hit it, the shinier that surface.

- Dull surfaces are not as smooth as shiny surfaces. When light rays hit them, they reflect these rays in different directions scattering them. This makes them looks dull. This is why we cannot see our image on a dull surface like sand paper. The light rays get scattered in different directions and do not reach our eyes.

- Extension: When the reflected light rays enter our eyes, they form an image which is sent to the brain. Our brain then identifies that image and that is how we know what we are seeing.

Introduction 10 Minutes

- Begin the lesson by revising the idea that light travels in straight lines (discussed in previous sub-topics from this chapter).

Development

Activity 1: What is meant by the term "surface" of an object? 5 minutes

- Ask students to look at their desks and point what they think is the surface of the desk. Explain that the top layer of anything is its surface. Then show them a bowl or a glass of clean water and ask them to point out where is its surface. Explain the idea that both liquids and solids have surfaces. Use the following image to explain liquid surfaces. (Do mention the source from where the image has been used. They get to be familiar with the idea of academic honesty).

Figure 1

- Explain them that a surface is like a wall. Hit a ball at the wall. It bounces back. Explain that a ray of light bounces back from a surface just like a ball because there is matter inside that object. Some kinds of matter do not allow light rays to go through them just like this ball. So, the rays just bounce back in different directions.

Activity 2: Why do we see clear images on shiny surfaces like mirrors, the surface of a lake, etc.? 15 minutes

Divide the students into pairs and give them a chart paper and markers and a piece of smooth aluminum foil. Ask them to hold the piece in front of their faces and describe or draw what they see. Next, ask them to crumple the foil piece and then straighten it a bit. Now ask them to hold it in front of their faces and describe or draw what they see. Ask them to discuss and write possible explanations and then present them in front of the whole class.
Winding up this activity, ask students to write answers to the following questions in their notebooks:

1. What do you understand by the term "surface"? Which part of an object is its surface?
2. What do you understand by the term "reflection" of light? (Possible responses could include "bouncing of light rays from the surfaces")

3. Why does light get reflected from a surface? (Possible responses could include

"Some surfaces contain matter which does not allow light rays to pass through them").

Activity 3: What are the features of shiny surfaces? 14 minutes

Divide students in pairs and give them a chart paper, a marker, a mirror, a newspaper, a bowl of water and a handkerchief. Ask them to draw a table with four columns, like shown below.

Shiny Surface	What does it feel like?	Dull Surface	What does? it feel like

Ask them to divide the objects into shiny or dull and complete the table. Later, ask them to share their findings with the class. Add more materials like a steel ball, sand paper, scissors, wooden spoon, etc.

Activity 4: Why do we need shiny materials? 15 minutes

This activity is more of a discussion. Show them an image of cat's eyes in the dark. Ask them why do they appear to shine at night? Explain that the inner surface of a cat's eye is very smooth (name not needed) and reflects light rays just like a plain mirror.

Show them another image of reflective metal studs on roads at night. Ask them what makes these studs shiny? Why these metal studs are useful?

Conclusion 5 Minutes

- Draw a table on the board with two columns like the one shown.

What I knew about this topic before this class?	What new things have I learnt about this topic today?

Ask students to fill these up. Or, they may speak and you can write them. Lastly, review each point with the whole class.

Formative Assessment Mind Map 10 minutes

- Divide students into pairs. Ask them to draw a mind map of the key concepts they have understood in class. Later, ask them to present it briefly in front of the whole class.

Follow-up 01 Minute

HW: Ask students to draw an annotated diagram of reflection of light rays from a smooth, shiny surface and a dull surface (like the one in teacher's notes).

Glossary

Surface	The top layer of an object
Shiny	Reflecting or glowing in the dark
Dull	Not shiny or bright
Rough	Having an irregular surface
Reflect	Bounce back from something
Bright	Giving out or reflecting a lot of light
Dark	Absence of light

Teacher Guide
Grade-5

Lesson Plan
28

LIGHT AND SOUND
Propagation of Sound

Duration: 40 Minutes

Students Learning Outcome:

- Describe and demonstrate how sound is produced by a vibrating body.

Materials:

- Activity 1 – a plastic bowl, cellophane cover, candy sprinkle, rubber band. Activity 2 – an empty plastic or metal can, rubber bands, a table tennis ball, a cricket ball, a drum, etc.

Information for the Teacher:

- Sound is a form of energy, just like light and electricity. We cannot see or feel it but we can hear it.
- Whenever a surface vibrates, it creates sound energy as waves. These waves cause particles around them to vibrate as well. Then these particles cause other nearby particles to vibrate. In this way, sound waves travel through matter.
- We can make models to explain how sound works.
- Different materials produce different sounds when they vibrate.

Introduction 5 Minutes

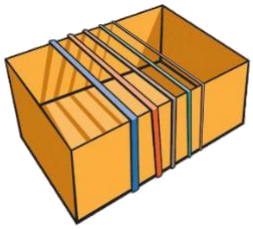
- Begin the lesson by asking students to cover their eyes with their hands and just listen to the sounds around them. Ask them to tell which sounds they can hear (sounds of birds, traffic, etc.). Explain that sounds are all around us but how is sound made?

Development

Activity 1: What is sound? How is it produced? 15 minutes

- Cover the bowl with cellophane cover tightly and put the rubber band around its edges as shown below. You may show the video to students. It is preferable, however, to let the students do activity themselves.

- Put some candy sprinkles of different colours on the surface of the cellophane cover.
- Now place your lips very close to the cellophane surface and sing a song.
- Note what happens to the sprinkles. Come up with explanations as to why sprinkles behave in this way. (Sample responses could include that sound energy from the student's voice causes vibrations on the cellophane surface. When it vibrates, the sprinkles move with the vibrations.)
- Discuss with students how does this model demonstrate the presence of sound as energy? Have them talk about why do we need models to explain scientific facts? (Sample responses include "We need models in some cases because it is difficult to see or feel sound. By making a model, we can explain the nature of sound to people.)
- This activity may be done in groups or pairs or simply a class demonstration by the teacher.
- They can make a musical instrument themselves. Take an empty plastic or metal can and put a rubber band around it as shown.



Source: https://www.highlights.com/parents/family-activities/sound-experiment

Now pluck the rubber band and see what happens. The band moves back and forth very quickly – it vibrates. That produces a peculiar sound. Note that if you pluck the band strongly, it vibrates faster and makes a louder sound. Have students add more rubber bands and pull multiple bands together to make sounds.

Activity 2: Why do different materials make different sounds? 15 minutes

Begin by explaining that any vibrating surface can produce sound. For example, the surface of a drum, strings of a guitar, vocal cords in our throat, etc.

Have students try out a number of different objects to make different sounds. Hit a tennis ball, then a cricket ball on the wall. Why do they do make different sounds? (Sample response – When they hit the wall, they vibrate with different frequencies). Drop a pencil on the floor, hit the surface of a drum, then the surface of a wooden table, a steel plate, etc. explain that some surfaces naturally vibrate faster than others.

Next, have them make different sounds from their throat. Ask them why each one of them has a different voice? How can a person make different sounds like speaking, whispering, shouting,

screaming, etc.? (Sample response - We have muscles linked with our vocal cords. They make them vibrate at different speeds. When we exhale air, it carries the sound waves out of our mouth.)

Conclusion 4 Minutes

- Ask students to make a bulleted list of the key words that they learnt during the lesson.

Follow-up 1 Minute

Students may be asked to make a list of adjectives that describe different sounds.
They could refer to a dictionary if needed.

Glossary

Surface	The top layer of an object
Vibration	When something moves back and forth between two fixed points.
Medium	Anything that is present between the source of a sound and its destination. For example, air, ocean, etc.
Solid	Anything that has a definite shape and volume.
Liquid	Anything that has a definite volume but can change shape.
Gas	Anything that has no definite volume or shape.
Vacuum	Anything that does not have any particles in it.
Sound wave	A pattern of disturbance carried forward in all directions when a surface vibrates.
Propagation of sound	When sound waves move forward through a medium.

Teacher Guide
Grade-5

Lesson Plan
29

LIGHT AND SOUND
Speed of Sound

Duration: 40 Minutes

Students Learning Outcome:

- Identify that speed of sound differs in solids, liquids and gases.

Materials:

- Activity 1 – Multimedia/laptop/mobile. Activity 2 – drum and stick, stop watch. Activity 3 – Computer lab.

Information for the teacher:

- Sound waves can travel through solids, liquids and gases because all three have particles.
- Sound moves fastest through solids because they have lots of closely packed particles. Vibrations can transfer quickly from one particle to another. It travels slowest in gases because they have less particles which are very far from each other. Vibrations transfer slowly from one particle to another.
- Space is a vacuum. It does not have any particles to carry sound waves. This is the reason why we cannot sound from the space.
- An unpleasant sound is called noise. It is very loud. We have noise pollution in urban areas.
- A pleasant sound is called music.
- Unit of measurement for sound loudness is decibel (dB).

Persistent exposure to noise levels higher than 85 decibels (dB) can cause permanent hearing loss.

Introduction 5 Minutes

- Begin the lesson by a brief review of the concepts taught in previous lesson.

Development

Activity 1: How sound travels across different mediums? 15 minutes

Have the students watch the video – https://www.youtube.com/watch?v=AxNdr0Bcx20
Divide them into pairs and discuss these points: Does sound travel faster or slower in warm air? Suggest possible reasons. (Sample response – Particles in warm air move faster and hit each other more frequently. Vibrations of sound transfer quickly from one particle to another). Have them read their responses in front of the whole class.
Explain that although sound travels faster in warm air, it travels farther in cold air. That is because cold air has particles closer to each other. That is why we can hear distant sounds in winters.

Activity 2: Let's measure the speed of sound in air 15 minutes

Ask learners work in pairs. Make them stand around 500 metres apart in the school ground. One partner stands with a drum and stick while the other holds a stopwatch (the timer on mobile phone may be used as an alternative). Make sure they face each other and can see each other clearly. The second partner starts the stopwatch immediately when he/she sees the first one hitting the drum with a stick. He/she stops the stopwatch immediately after hearing the sound of the drum.

Ask them take at least five measurements. Explain that it is necessary to eliminate or minimize the effects of possible errors while taking measurements. Ask them to suggest possible sources of errors during this experiment. Sample responses could include human error – difficulty in seeing the partner hitting the drum, delay in starting the stopwatch, or equipment error – an error in the stop watch.

Activity 3: What is noise pollution? What can we do to prevent / minimize noise pollution? 35 minutes

Install the app "Sound Meter" in your mobile phone and demonstrate to learners as you measure noise levels across different points of the school campus (playground, cafeteria, library, etc.). Explain that noise levels above 85 decibels may cause permanent hearing loss.

Have students design a poster to raise awareness against noise pollution using "canva" (https://www.canva.com/posters/). You may divide them in small groups of three. This activity may be combined with ICT and must be done in the computer lab. The posters can be put at various points of the school campus. This activity can also be carried out as a formative assessment with the following rubrics/marks distribution:

- Content – 10
- Presentation – 10
- Team collaboration – 10
- Time management – 10

Conclusion 7 Minutes

- Ask students questions orally to assess the meaning of key concepts. You may use information in the teacher notes section for this purpose. Write their responses as bulleted points on the board.

Follow-up 3 Minutes

Noise	Any sound that is unpleasant to hear
Decibels	Units to measure how loud a sound is
Noise pollution	Harmful levels of noise, like traffic nois

HW: Worksheet attached with the lesson plan. You may choose selective questions from textbook as well.

Glossary

Sound Words Search

Find the words in upward, downward, sideways or diagonal directions by following the cues given below the word puzzle. One has been done for you.

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

- All sound waves require a _____
- Sound travels fastest through _____
- Unit used to measure sound _____
- Sound is a form of _____
- Sound produces _____ in solid, liquid and gas particles
- Sound cannot pass through a _____
- An unpleasant sound _____
- A pleasant sound _____

Mark Scheme (for teacher only)

Sound Words Search

Find the words in upward, downward, sideways or diagonal directions by following the cues given below the word puzzle. One has been done for you.

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

1. All sound waves require a medium.
2. Sound travels fastest through solids.
3. Unit used to measure sound - decibel.
4. Sound is a form of energy.
5. Sound produces vibrations in solid, liquid and gas particles
6. Sound cannot pass through a vacuum.
7. An unpleasant sound - noise.
8. A pleasant sound - musi

Teacher Guide
Grade-5

Lesson Plan
30

ELECTRICITY & MAGNETISM
Charges and their Properties

Duration: 40 Minutes

Students Learning Outcome:

- Describe charges & their properties.

Materials:

Activity 1 – a few inflated balloons & small pieces of paper.

- Activity 2 – ICT/Computer lab.

Information for the Teacher:

- Electricity is a form of energy.
- There are different types of electricity – static electricity and electric current.
- When electrical charge builds up on the surface of something but does not move, we call it static electricity. Static means "not moving" – charges do not flow or move from one place to another.
- When two objects rub against each other, electrons move from one surface to another. So, one surface becomes negatively charged because it has more electrons now while the other surface becomes positively charged because it has less electrons now. In other words, static electricity is made when positive and negative charges are unbalanced.
  Atoms of solids, liquids and gases have electrons and protons. Protons are positively charged and located in the nucleus whereas electrons are negatively charged and revolve around the nucleus in orbits. Atoms always have equal number of protons and electrons, so they are always neutral.
  In some materials, electrons are loosely bound to the nucleus, they can jump from one place to another easily. When such materials rub against other materials their electrons hop on to other materials making these objects positively charged.
- If two objects have the same charge on their surface, they repel each other meaning they move away from each other. If two objects have opposite charges on their surface, they attract each other meaning they move towards each other.

- Objects have charge just like they have mass, temperature colour or speed. We have given them positive and negative labels for our convenience. They are not really positive or negative.

Introduction 5 minutes

- Begin the lesson by a brief review of the structure of an atom, the names of its parts and their charge.

Development 10 Minutes

Activity 1: What is charge? Why do materials have positive and negative charges?

- Ask the students rub their hair with an inflated balloon for 30 seconds. Ask them to slowly pull the balloon away. What happens? Ask them to give possible explanations.
- Explain that when our hair rub against the balloon, the freely moving electrons from our hair hop onto the balloon surface. Since our hair have less electrons and more protons now, they become positively charged while the balloon becomes negatively charged because it has lots of electrons now. Also, our hair all have the same charge so they repel each other. They stand straight towards the balloon because they attract its surface.
- Explain the charge on our hair is not really "positive". We call it positive to show that it is opposite to the charge on the balloon (which is also not exactly negative). These names have been given to show that these charges are opposite to each other in their behaviour. Explain that anything that has more electrons will have negative charge and vice versa.

Now place some pieces of paper on the table and bring this charged balloon closer to them. Ask them why do the pieces of paper lift towards the balloon. Explain that it is because the balloon makes the paper pieces charged as well. Follow up with simulations in activity 2 for deeper understanding.

Activity 2: Properties of charges – opposite charges attract whereas same charges repel each other 20 minutes

Ask students explore the following simulations in ICT lab:

- https://www.physicsclassroom.com/Physics-Interactives/Static-Electricity/Aluminum-Can-Polarization/Aluminum-Can-Polarization-Interactive

- https://phet.colorado.edu/sims/html/balloons-and-static-electricity/latest/balloons-and-static-electricity_en.html

Ask them to discuss why the aluminum can moves towards glass road. What happens when the negatively charged rubber rod is brought closer to the can? What happens when the positively charged glass road is brought closer to the can? In the second model, what happens to the balloon when we remove the wall?

Conclusion 5 Minutes

- Ask students work in pairs to explain to their partner what they have learned about charges in this lesson.

Glossary

Charge	A property of an object that makes it.
Electrons	Negatively charged particles of an atom.
Protons	Positively charged particles of an atom.
Static electricity	A kind of electricity produced in an object when charges
	accumulate on its surface and do not move.
Attract	Move towards something.
Repel	Move away from something.

Teacher Guide
Grade-5

Lesson Plan
31

ELECTRICITY AND MAGNETISM
Electric Circuit and Its Components

Duration: 40 Minutes

Students Learning Outcome:

- Describe & design an electric circuit and explain its components.

Materials:

Activity 1 – a card with the display "battery", another card with a "switch on" display on one side and a "switch off" display on the other. All other cards have the display "electron" on them.

Activity 2 – a battery, a switch, a miniature light bulb, a small folded piece of aluminum foil, a small wooden piece and a small rubber.

Information for the Teacher:

- When electrons move or flow from one area to another, they create electric current.
- Metals are good conductors of electricity because they have lots of freely moving electrons which can flow from one point to another.
- Insulators hold on to their electrons very tightly and do not allow them to move freely. So, they do not conduct electricity. Plastic, wood, rubber, etc. are examples of insulators.
- Movement of electrons is completed in an electric circuit. A circuit has all the parts needed to move electrons from one point to another to create electric current. It provides an uninterrupted path through which electrons can move.
- If we break the circuit at any point, the flow of electron will stop and the bulb will not light up.
- Different parts of an electric circuit are: battery which provides the power to move electrons through the circuit, a light bulb which glows when current passes through it and a switch which controls the movement of current through the circuit.

Introduction 5 Minutes

- Begin the lesson by reviewing about electrons, charge and static electricity. Move on to ask students if they have heard about any other kind of electricity? Ask them what makes the light bulbs in the classroom light up? What moves the fan to keep us cool? Why doesn't it work when there is no electricity? Ask them do they know where is electricity made?

Development

Activity 1: What is electric current? Role Play 10 minutes

Begin by explaining electrons flow just like water flows in a river. It will be easier for students to imagine the flow of electrons with this example. Explain further that water flows through pipes in our homes. It moves from the water tank through the pipes into the taps. Electrons move in a similar way in metallic wires.

- Now have the students stand in a circle. One student plays the role of a battery and has the card titled "battery" on it. Another student at the opposite end of the circle has the card titled "bulb" while another on one side has card titled "switch on" one side and "switch off" on the other side. All others act as the conductor or wire. They have cards titled "electron".
- Have the student holding the switch card display the "switch on" side and ask students to pass on their electrons to their next partner when this card is displayed. Even the students holding the bulb card and the battery cards help to pass on the electron cards to their next person without giving their original card, of course. When the "switch" student is asked to change his/her display to "switch off", all students immediately stop passing their electron cards to others.
- This simple role play activity helps students to understand how current flows and why switch is used. Explain to them that when we turn on a switch in our homes, it completes the circuit and our rooms light up whereas when we turn off the switch, it breaks the circuit and the bulbs or tube-lights in our rooms stop lighting.

Activity 2: Designing a simple electric circuit. Testing for conductors and insulators.

18 minutes

- This activity may be done as a P-O-E (Predict – Observe – Explain) activity. Provide students with a small battery, wires, one miniature light bulb and a switch.
- Ask them to arrange these in such a way that the bulb lights up. Encourage them to make a prediction or a plan and explain why they think it will work. After that, they shall write down their observations and compare them with their predictions to see if their strategies worked or not.
- Explain that the current always flows from the positive terminal of the battery to its negative one in the circuit. Give them a switch.
- Ask them to connect it at any spot in the circuit with a third wire. They may connect the positive or negative terminal of the battery with the switch. For such small batteries and simple circuits, the switch can be placed anywhere in the circuit.
- Encourage them to discuss why is a switch needed in a circuit? What would happen if we did not have switches in our homes? Sample responses could be that a lot electricity would be wasted because the appliances would be turned on even when we didn't need them.
- Give them metallic (like aluminum foil, metallic clip, etc.) and rubber or plastic or woody materials as switches and ask them which one helps light up the bulb. Ask them to explain what could possibly be the reason.

Conclusion 5 Minutes

- Ask students to draw a map of the circuit they have designed in class. Follow up with a HW worksheet.

Follow-up 2 Minutes

HW: Worksheet attached at the end.

Glossary

Electrons	Negatively charged particles of an atom.
Current	Flow of electrons in one direction along a path or circuit.
Electric circuit	A pathway that provides a route to the electrons to move or flow from one point to another.
Battery	A device that pushes the electrons to move in the circuit.
Switch	A device that controls the flow of electrons in a circuit.
Conductor	Anything that allows electrons to pass through it. For example, copper wire, gold chain, etc.
Insulator	Anything that does not allow electrons to pass through it. For example, a wooden table, a plastic handle, a rubbery slipper, etc.

Concept Check: Electric circuits

Refer to the symbols for different parts of a circuit given below.

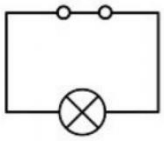
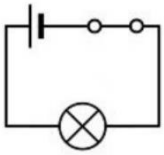
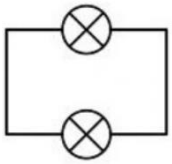
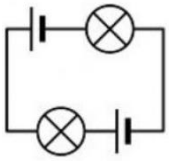
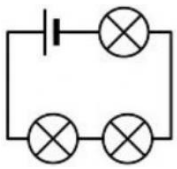
Bulb

Wire

Battery

Switch

Write a yes or no to show if the bulbs in the circuits shown below will light up.

Sr.	Circuit	Yes/No	Reason
1			
2			
3			
4			
5			

Concept Check: Electric circuits (Mark scheme for teachers)

Refer to the symbols for different parts of a circuit given below.

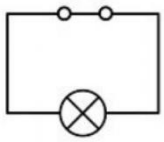
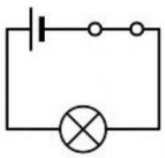
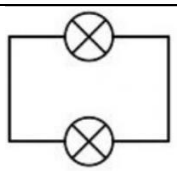
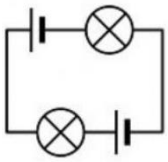
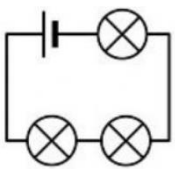
Bulb

Wire

Battery

Switch

Write a yes or no to show if the bulbs in the circuits shown below will light up.

Sr.N	Circuit	Yes/No	Reason
1.		No	There is no battery to push electrons through t circuit.
2.		Yes	The circuit is complete.
3.		No	There is no battery.
4.		Yes	There are two batteries to provide the power to move electrons and the circuit is unbroken.
5.		Yes	There is battery to provide power to move elect and the circuit is complete.

ELECTRICITY AND MAGNETISM
Properties of a Magnet

Duration: 40 Minutes

Students Learning Outcome:

- Describe and demonstrate that magnets have two poles and like poles repel and opposite poles attract.

Materials:

Iron filings, 2 bar magnets, a white piece of paper.

Information for the Teacher:

- Magnets have magnetic fields and they interact with each other and materials that contain iron.
- Poles are the strongest points on a magnet and all magnets have two poles, where same poles repel and opposite poles attract.
- Magnetic fields cannot be observed directly, therefore observations of how magnets interact with other magnets is necessary to learn about magnetism.
- A quick recap of magnets is necessary here so students can understand the concept of magnetic poles.
- The magnetic field of a magnet is the area around it in which objects that are metal are affected.
- If a magnet is hung so that it is free to turn, it will turn in the north-south direction.
- North magnetic poles are those that are attracted towards the Earths geographic north pole and vice versa.
- The assessment strategy used in this lesson in 3-2-1. Students will write down 3 things they found out, 2 interesting things and 1 question they still have.
- This SLO has been covered in two lesson plans.

Introduction 10 Minutes

- Begin the lesson by revising the introduction of magnets (previous SLO in the academic calendar) to ensure all students have similar understanding of magnets.
- Draw 2 columns on the board, one named ‘Magnetic materials’ and the other named ‘Non-magnetic materials’. A sample is attached below.

Magnetic materials	Non-magnetic materials

- Now write the following words on the board: eraser, pencil, iron nails, paper clips, metallic wire, stone, steel pins, books, wood, glass.
- Ask a few students randomly to come forward and write the words under the appropriate column. When one student answers, ask the remaining students if they agree with the answer. Inquire for reasons in case of any disagreement.
- Encourage maximum participation and use positive reinforcement.

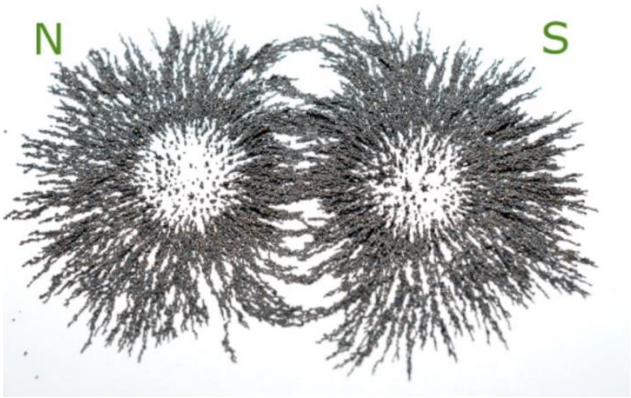
Development

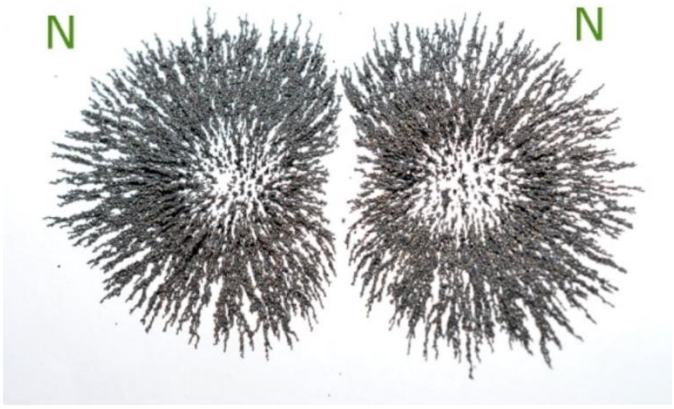
Activity 1 — 20 Minutes

- Call students forward to your desk where the resources are placed.
- Show them the magnets and iron filings and inform them that they will learn about the poles of magnets through this activity.
- Put 2 magnets underneath a piece of paper that are 1 inch apart.

- Carefully and slowly shake some iron filings onto the piece of paper above the magnets.
- If the iron filings are too far apart from the magnets, gently tap or shake the paper to move them closer so they are close to the magnets.

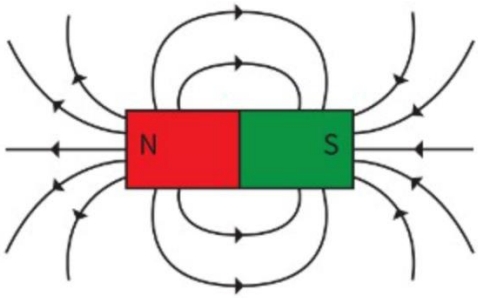
- Ask students to carefully observe how the filings move on the paper.
- Now remove the iron filings from the paper.
- Flip one of the magnets upside down.
- Repeat steps 1-4 to see what iron filing pattern is formed this time.



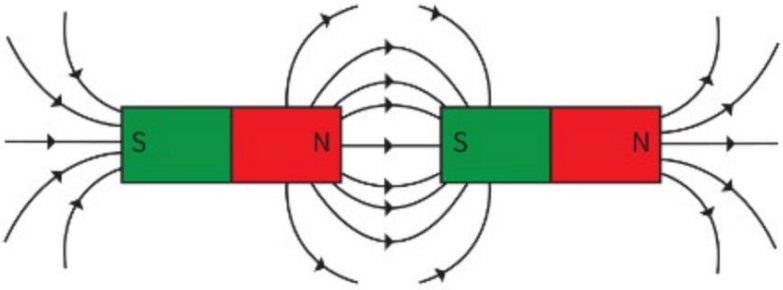


- Explain that this experiment shows that magnets attract iron and the magnetism can act through different materials, such as paper in this case.
- When iron filings are spread over magnets, you can observe an outline of the magnetic force also known as the magnetic field. Draw the following pathway on the board.

Magnetic Field of a Bar Magnet

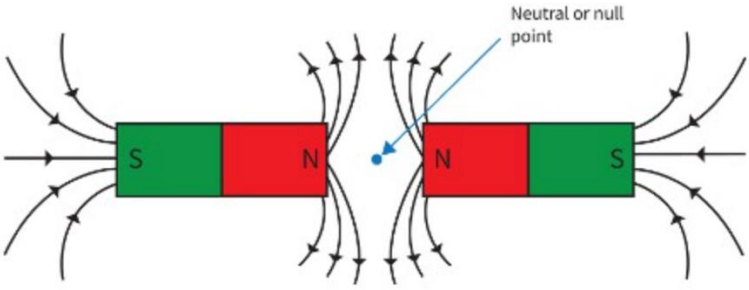


- Tell students there are 2 poles in a magnetic, a north pole (N) and a south pole (S). Reinforce this from the diagram on the board.
- Similarly, explain that opposite poles attract. When the magnets are placed in a way that opposite poles face each other (north and south), a magnetic force is created between them. Iron filings are then aligned with the force field between the two magnets.
- Demonstrate by bringing 2 opposite poles of two magnets together. They will be attracted to each other.
- Pass these amongst students so they can also feel the pull between the magnets.



Attraction between opposite poles

- Now explain that same poles (north and north or south and south) repel.
- When 2 magnets with the same poles face each other, the magnetic field of each magnet moves away from the other.



Repulsion between like poles

- Demonstrate this by bringing 2 similar poles of two magnets together. They will repel each other.
- Pass these amongst students so they can also feel the push between the magnets.
- Reiterate that the end of the bar magnet that points towards the north is called its north pole and the end pointing towards south is called its south pole. Therefore, a magnet has two poles. Ask students to repeat after you.
- Ask the class if they have any confusion or questions so far and repeat the concept where necessary.

Conclusion 3 Minutes

- Write the word 'Magnets' on the board, encircle it and ask volunteers to state one thing they learnt today.
- Write the given answers and sum up the lesson by repeating their answers and adding the information that might have been missed.
- If multimedia and internet facility is available, show students the following video link: https://www.youtube.com/watch?v=yXCeuSiTOug. This will clarify their concepts further.

Assessment 3-2-1 5 Minutes

- Ask students to take out a piece of paper and write 3 new things about the lesson that they found out, 2 things they found interesting and one question that they still have.
- Once they are done writing, collect their responses and quickly glance through them to address as many questions as possible.

- If majority of students have not understood the lesson, demonstrate the concept again with the same hands-on activity performed earlier. Try to simplify it as much as you can.

Follow up 2 Minutes

- Ask students to attempt Q1 part (iii) and (iv) given on page no. 108 in their Science textbooks.

Glossary

North magnetic pole	The end of the magnet that is attracted towards the Earths geographical north pole.
South magnetic pole	The end of the magnet that is attracted towards the Earths geographic south pole.

Teacher Guide
Grade-5

Lesson Plan
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ELECTRICITY AND MAGNETISM
Properties of a Magnet

Duration: 40 Minutes

Students Learning Outcome:

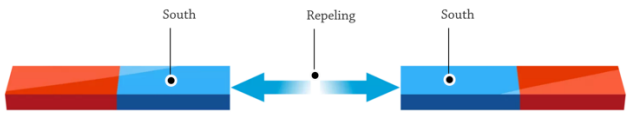
- Describe and demonstrate that magnets have two poles and like poles repel and opposite poles attract.

Materials:

a few paperclips, two bar magnets, 6-8 ring magnets, 2 markers/wooden dowels, clay (optional, to support the marker).

Information for the Teacher

- Magnets interact with each other and materials that have iron, steel or nickel.
- Magnets vary in shapes and strengths and have magnetic fields.
- Strength of magnets can decrease over time.
- The magnetic field of a magnet is the area around which objects that are metal are affected.
- The strongest points on a magnet are its poles (north and south).
- Opposite poles attract while same poles repel each other. This is similar to electric charges. Like charges repel and unlike charges repel.
- A freely hanging magnet will always face north, hence magnets have been used for finding direction since decades.



- If a magnet breaks in half, you get two magnets, each with poles.
- Placemat strategy is used in 'Introduction' where students will be given a chart paper and asked to answer questions on it after discussion amongst the group.

Introduction 8 Minutes

- Divide the class into two groups and provide a chart paper to each group. If chart paper is not available, provide a plain white sheet to each group.
- Write the following question on the board:

Can you describe any 3 properties of magnets?

- Now instruct students to quickly discuss the answer amongst themselves and then write it down.
- After a few minutes, call one member from each group to present his/her answer to the whole class.
- Motivate students with positive remarks and guide them where necessary.

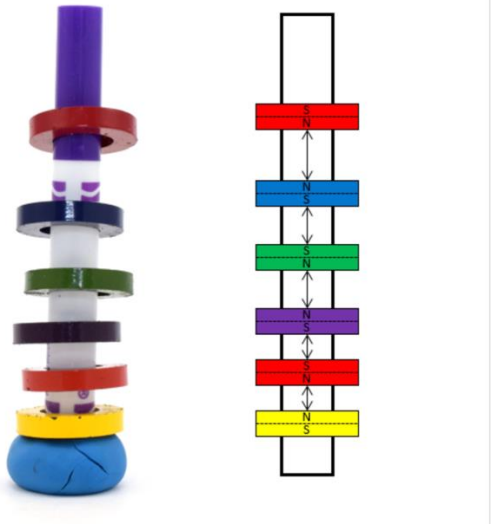
Development 25 Minutes

Activity 1

- It has already been established that magnets have north and south poles and that like poles repel each other while opposite poles attract each other. This activity is a reinforcement of the above-mentioned concept.
- Divide the class into 2 groups.
- Provide each group with a marker, 3-4 ring magnets and clay (optional) to stabilize the model and keep it upright.
- Ask students: what would happen if you put 2 ring magnets on an upright marker/dowel?
- Have students make predictions on what will happen and discuss them.
- Now instruct students to try different ways of stacking two magnets on each pencil.

- Ask students to think about their predictions to find out how close they were.
- Allow students to use all their magnets to fill up with their markers with the ring magnets and record what they see.
- Now ask them the following questions:
  - *Why do some magnets float while others do not? (The ones that repel each other float)*
  - *What happens if you put your fingers between the floating magnets? (The magnets will fall on each other as the magnetic field disappears)*

- *Why does the magnet float when it is on one side but not when it is on the other? (opposite poles attract, similar poles repel and therefore, float)*
- *What are the positive and negative poles on the ring magnets?*

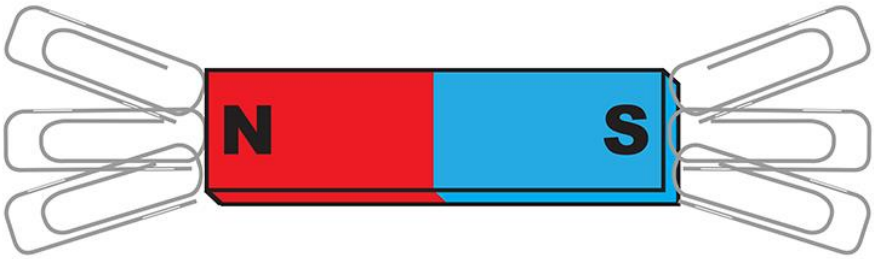


- Appreciate their efforts and guide where necessary.
- Reinforce:

Two like magnetic poles repel each other while opposite poles attract each other.

Activity 2

- To reinforce the concept of magnetic attraction and repulsion, carry out the following experiment.
- Put the paperclips in a small bowl or box.
- Call all the students to the front to observe the experiment.
- Ask one volunteer to hold a magnet and bring it closer to the paperclips.
- The following is the likely outcome; some paperclips will attract the North pole, while others will attract the South pole.



- Now ask the students the following questions one by one:
  i. *What do you think happened here? (The magnet attracted the paperclips; a magnetic field was created that pulled the paperclips).*
  ii. *Why did this happen? (Because the paperclips are made out of steel that are attracted by magnets).*
  iii. *Why are some paperclips attracted to one pole while the others are attracted to the other pole? (Just like the magnet, the paperclip also has a north and south pole, hence similar poles repel and opposite poles will attract each other).*
- Appreciate their efforts and clarify and misconceptions that the students might have.

Conclusion 2 Minutes

- Sum up the lesson by briefly recapping the following points:
  Every magnet has a north and south pole.
  When two magnets come close to each other, a magnetic field is created. It is important to remember that similar poles repel each other while opposite poles attract each other.

Assessment- Questionnaire 5 Minutes

- Distribute the following worksheet among students and verbally provide instructions on how to attempt it.
- If printing/photocopying facility is not available, draw it on the board and ask students to answer the questions in their notebooks/copies.

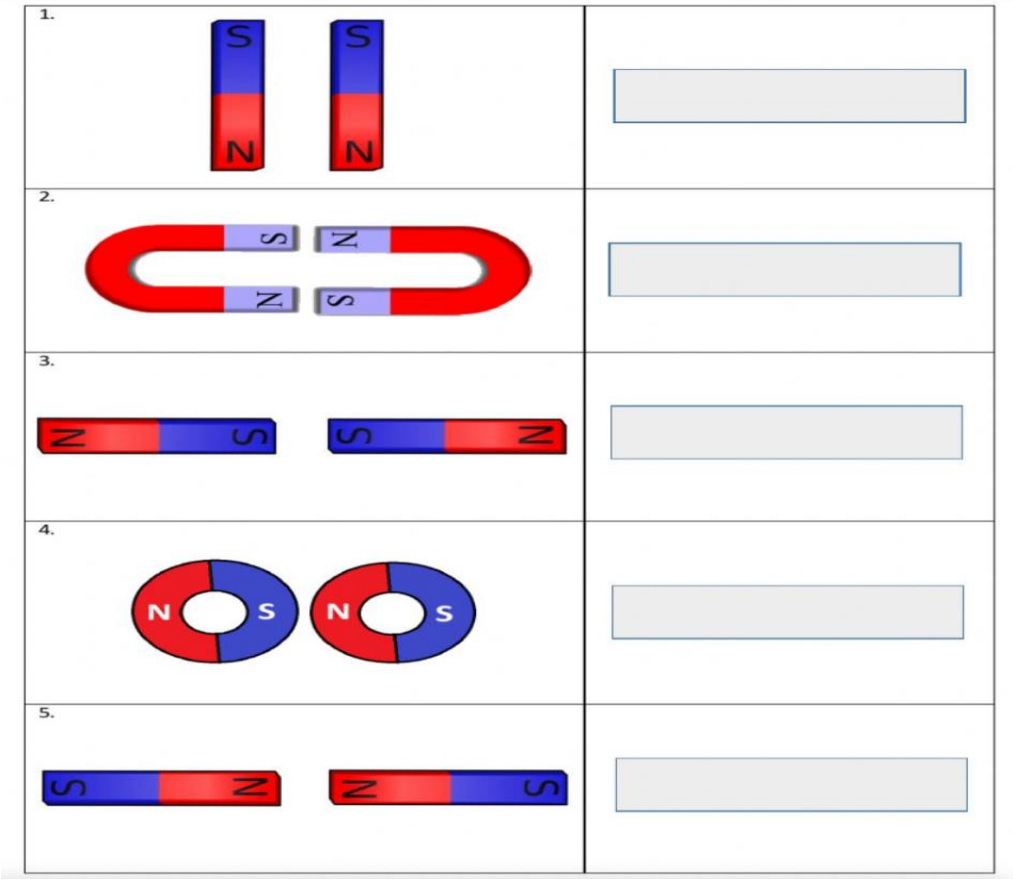
Worksheet 2.1

Chapter 7: Electricity and Magnetism

SLO: Describe and demonstrate that magnets have two poles and like poles repel and opposite poles attract.

Name: _____ Class V

Instructions: For each pair of magnets, write whether they will attract or repel each other.



Answers for the teacher:

1. Repel
2. Attract
3. Repel
4. Attract

5. Repel

Follow up- Homework 1 Minute

- Ask students to write the similarities and differences, if any, that they observed in both the activities conducted in class. They may tabulate their observations.

Glossary

Attract	To cause to draw nearby physical force
Magnetic pole	One of the two ends of a magnet where the magnetic field is most intense.
Repel	To push back away by a force

ELECTRICITY AND MAGNETISM
Types of Magnets

Duration: 40 Minutes

Students Learning Outcome:

- Explain different types of magnets (permanent, temporary and electromagnet).

Materials:

A stand to suspend the magnet, a bar magnet, a few iron nails, a few steel nails, a 3-inch or longer nail (made of zinc, iron or steel but not aluminium), 2 feet long insulated copper wire, D cell battery, a few paper clips/pins, wide rubber band.

Information for the Teacher:

- There are 3 kinds of magnets; permanent, temporary and electromagnets.
- Permanent magnets always retain their magnetic properties, they can convert ordinary pieces of iron into temporary magnets and they are usually made up of steel, cobalt or nickel. They create their own magnetic field without an external source of magnetism.
- Permanent magnets find applications in generators, electric accelerators and electric motors. Examples of permanent magnets are Alnico and ferrite magnets.
- Temporary magnets only become magnetized in the presence of a magnetic field and lose their magnetism when the magnetic field is removed. Most temporary magnets are made up of iron. Examples of temporary magnets are iron nails and paper clips.
- Electromagnets consist of a coil of wire wrapped around the metal core made from iron. When this material is exposed to an electric current, the magnetic field is generated making the material behave like a magnet. The strength of the magnetic field can be controlled by controlling the electric current. Their magnetism can be controlled and turned off and on at the flick of a switch as their magnetism depends upon a constant flow of electricity. Electromagnets are used in speakers, electric bells etc.
- The assessment strategy used in this lesson plan is 'Muddiest point'. Students will then ask questions about the concepts/topics they are still unsure of.

Introduction 5 Minutes

- Inform students that today they will learn about the different types of magnets with the help of two very interesting activities.
- Write the following question on the board and ask students to think of possible answers:

What are the different types of magnets?

- Give them 1-2 minutes for brainstorming and then take responses from a few students.
- Appreciate correct answers and then write the following on the board in 3 columns:

Permanent magnets	Temporary magnets	Electromagnets

- Tell them that magnets can be categorized into three basic types; permanent, temporary and electromagnets. Ask them to repeat these names after you.
- Now divide the class into 3 groups, assign one type of magnet to each group and ask them to discuss and write down possible description of the magnets (they should keep the name in mind and can refer to the textbook; however, the textbook only contains experiments regarding the topic, not the description).
- Allow 5-6 minutes for this group task.
- Now call one member from each group to come forward and discuss answers.
- Motivate students with positive remarks.
- Tell students that as the name suggests, permanent magnets stay magnetic for a very long time, they don't lose their magnetic properties. They create their own magnetic field and hence they can convert ordinary pieces of iron into temporary magnets. Ask them if they can think of any permanent magnets, they've come across recently? (Bar magnet).
- Temporary magnets only become magnetized in the presence of a magnetic field and lose their magnetism when the magnetic field is removed. Most temporary magnets are made up of iron. Ask students if they can think of any temporary magnet? (Paperclips, iron nails)
- Electromagnets require electricity in order to behave as a magnet. Their magnetism can be controlled and turned off and on at the flick of a switch as their magnetism depends upon a constant flow of electricity.

Permanent magnets	Temporary magnets	Electromagnets
• Retain magnetism long time. • Create their magnetic field. • Convert iron temporary magnets.	• Become magnetized in presence of a mag field. • Usually made up of cobalt or nickel.	• Require electricity become magnets. • Lose magnetism absence of electricity

- If multimedia and internet facility is available, show students this video (1:23 min onwards) to reinforce the information given so far.
  Link: https://www.youtube.com/watch?v=SCmZVk3GsQg
- Ask them if they have any questions or ambiguities so far.

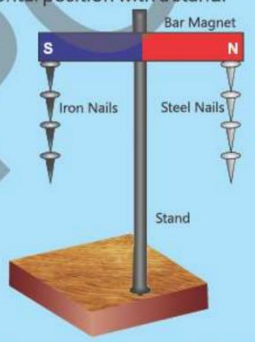
Development 19 Minutes

Activity 1

- Nominate any two students who haven't had a chance before to set up the materials as shown in Activity 7.14 on page no.105 in their Science textbooks. The remaining students will carefully observe and provide input.

Activity 7.14

1. Clamp a strong bar magnet in a horizontal position with a stand.
2. Bring a tiny iron nail near its one pole (say S). Does it stick to the magnet?
3. Take another iron nail and try to hang it with the first nail. Why does it stick to the first nail? The reason is that the first nail has become a magnet under the effect of strong magnetic force of the bar magnet.
4. Continue hanging as many as nails one by one as could be held by the magnet. It forms a chain of nails.
5. Now hang some steel nails to the other pole of the magnet in the same manner. What do you observe?
6. Now remove the iron chain by pulling the top nail away from the magnet. What happened and why? The iron nails will no longer support each other and fall down. Now remove the steel chain from the top. What do you observe?



- Observe and guide them if they need help.
- In step 3, when the second iron nail hangs to the first nail, ask students the reason for this (the first nail becomes a magnet under the effect of the strong magnetic force of the bar magnet). Reiterate the information you gave earlier regarding temporary magnets so students can relate to it practically as well.
- Emphasize on step 6; when students remove the top nail away from the magnet, disrupting the chain, all nails will fall down as they are temporary magnets and only retain their magnetism in the presence of a magnetic field, whereas in step 5, students observe that that the steel chain does not collapse as it is a permanent magnet.
- When the activity is completed, nominate any 2 students to recap the activity step by step to ensure they have understood the concept. Only then move on to the next activity.

Activity 2 — 10 Minutes

- Inform students that now that they have learnt about the working of permanent and temporary magnets, they will learn about electromagnets through an interesting activity.
- Reinforce that electromagnets consist of a coil of wire wrapped around the metal core made from iron. When this material is exposed to an electric current, the magnetic field is generated making the material behave like a magnet. The strength of the magnetic field can be controlled by controlling the electric current. Their magnetism can be controlled and turned off and on at the flick of a switch as their magnetism depends upon a constant flow of electricity. Electromagnets are used in speakers, refrigerators, washing machines, fans, clocks, doorbells, electric bells etc.
- If multimedia and internet facility is available, show them the following video on 'creating an electromagnet':
  https://www.teachengineering.org/activities/view/cub_mag_lesson2_activity1
  Otherwise, you may watch it and perform it accordingly.
- Now perform this activity along with students as it might be difficult for them to manage on their own.
- Show students the nail, insulated wire, D cell battery, paper clips/pins and the rubber band and ask them to guide you to perform the activity keeping the video link in mind.
- Take their responses' and perform simultaneously. Ask them to observe carefully.
- Wrap the wire around the nail at least 20 times as shown below. Ensure that no gaps are left between the wires and there is no overlapping of wires.

- Now connect the ends of the coiled wire to each end of the battery using the rubber band to hold the wires in place.
- Ask the students: What should be done next? (Pick up paperclips). Test the strength of the electromagnet by seeing how many paperclips it can pick up.
- Ask students what did they observe?
- Disconnect the wire from the battery and repeat your question. Can the electromagnet pick up paperclips when the current is disconnected? (No)
- Appreciate their guidance during the activity.
- Ask if they have any questions and guide them in case there are still any confusions.

Further elaboration of the activity (optional)

- Change the number of coils around the nail to assess the strength of the electromagnet. Ask students to observe the number of paperclips when the number of coils are increased and vice versa.

Conclusion 2 Minutes

- Refer to the table drawn on the board (given above) and quickly sum up the types of magnets and the differences between them.

Assessment- Muddiest point 3 Minutes

- Ask students to write down any questions they have or any concept they are still unsure of and one by one ask these questions.
- Address the questions in a simplified manner.
- Now ask them to illustrate the activity performed in their notebooks by drawing a battery, wire coil and paperclips. Positive and negative ends of the battery must be clearly labelled.
- If majority of the students have ambiguities, re-teach the topic in the next lesson and then move forward once they have all understood the topic.

Follow up- Homework 1 Minute

- Ask students to attempt Q3 (i) a & b and Q3 (ii) given on page 109 in their Science textbooks.

Glossary

Battery	A cell that carries a charge that can power an electric current
Current	A flow of electrons

Teacher Guide
Grade-5

Lesson Plan
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STRUCTURE OF THE EARTH
Structure and Characteristics of the Earth

Duration: 40 Minutes

Students Learning Outcome:

- Describe the Structure of the Earth (i.e., crust, mantle and core) and the physical characteristics of these distinct parts.

Materials:

A painting/drawing or representation of Earth on a chart paper or any recycled paper, 3 boiled eggs (any 3 volunteers can be asked to bring one egg each but ask them a day in advance), butter knife, 3 chart papers.

Information for the Teacher

- Prepare a chart by painting or drawing an image representing Earth. Recycled or coloured paper can be used on a paper plate or any resource might be used to make the following:

- The blue colour represents water; green represents land. Water is approximately 3 parts while land is one part.
- You may also use a globe if it is available.

Introduction 5 Minutes

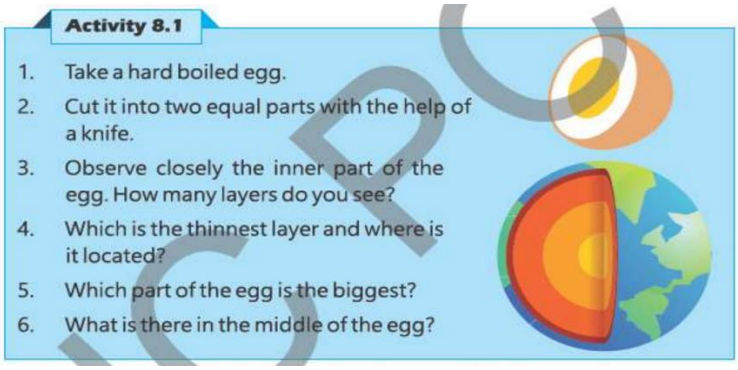
- Begin the lesson by displaying the chart paper (Earth) on the board.
- Ask students what the painting/image/drawing represents.
- Take a few responses and then ask them: what do the blue and green colours denote?

- Explain that blue colour here denotes water while the green shows land on Earth. The surface of the Earth is made up of water and land where water constitutes around three parts and land is only one part.
- Water, soil, air, suitable temperature and light on Earth provide basic requirements for the living environment.
- Inform them that today they will learn about the structure of the Earth.

Development 20 Minutes

Activity 1

- Ask students to open their Science textbooks on page 112 and read the instructions given in Activity 8.1.



- Divide the class into 3 groups and provide each group with a hard-boiled egg.
- Assign the group leader the task of cutting the boiled egg into halves using a butter knife.
- Instruct students to carefully observe the layers of the egg and then pass it forward so all group members can see.
- Now ask them:
    1. *How many layers do you see?*
    2. *Which is the thinnest layer and where is it located?*
    3. *Which part of the egg is the biggest?*
    4. *What is there in the middle of the egg?*
- After taking their responses, tell them that that are three layers within the egg. The outmost thin layer is its rind. There is yolk in the middle of the egg and in between the two layers is its white layer. Geologists suggest that parts of an egg resemble the inner structure of the earth. The rind of the egg is like crust, the white part is like the mantle and the yolk is like the core of the Earth.

Activity 2 10 Minutes

- Now take out 3 pieces of paper and write ‘crust’, ‘mantle’ and ‘core’ on them respectively and then fold them.
- Ask one student from each group to choose any one folded piece of paper; the name of the layer written will be the topic assigned to them to prepare a presentation.
- Instruct each group to read the relevant topic according to the chit they chose (page no 112-113 in their Science textbooks). If multimedia and internet facilities are available show them the following video/videos for further clarification. You may choose any one link as per your liking.
  Link: https://www.youtube.com/watch?v=eXiVGEEPQ6c
  https://www.youtube.com/watch?v=_iUfi8XqEos
- Provide a chart paper and colour pencils/crayons to each group for preparing the presentation.

- When all groups have completed the task, ask them to come forward one by one to explain their work.
- Reinforce:

Crust	Mantle	Core
Outermost surface of Earth	Lies underneath the crust; middle layer	Inner layer
Made of soil with a thick layer of rock underneath	Thickness is about 3900 km thick	It has 2 parts; outer core and inner core
It is where we live	It is extremely hot and has thick fluid like honey that comes out of the Earth's surface as lava during volcano eruption	It is the hottest part of the Earth; temperature is about 5000 degrees.
It contains mountains, oceans, rivers, deserts and rural and urban housing		Internal core is almost solid while the external core is in the form of a thick black molten fluid which contains elements like iron and nickel
The average thickness varies from 5 to 70 km		

- Appreciate their efforts and guide where necessary.

Conclusion

This has already been concluded in the above step.

Assessment- Questioning 4 Minutes

Ask students the following questions:

1. How many layers does Earth have?
2. What are the names of the layers?
3. Is the temperature on all the layers the same?
4. Which layer do humans live on?
5. Which layer contains lava?
6. Which layer is the hottest?

- Select a few students randomly and ask them to respond.
- Guide students where necessary.
- Use positive reinforcement.

Follow up 1 minute

- Ask students to bring of any fruit or vegetable that denotes planet Earth (e.g., onion, cantaloupe, peach, etc.)
- If not readily available, they can alternatively also make a list of such items.

Glossary

Crust	Hard outer covering of Earth
Mantle	The part of Earth's interior beneath the crust and above the central core
Core	The hot, dense centre of Earth
Geologist	Scientists who study the Earth

Teacher Guide
Grade-5

Lesson Plan
36

STRUCTURE OF THE EARTH
Structure and Characteristics of the Earth

Duration: 40 Minutes

Students Learning Outcome:

- Describe the Structure of the Earth (i.e., crust, mantle and core) and the physical characteristics of these distinct parts.

Materials:

4 Styrofoam balls, 4 boxes of paints/crayons (red, orange, yellow, blue, green), 4 chart papers, 4 markers.

Information for the Teacher

- In this lesson plan, your role is merely that of a facilitator where you will observe and guide students in a project-based activity.
- This hands-on activity will allow students to have a strong grasp regarding the structure of the Earth.
- In the previous lesson, they read about the layers and presented in groups; now they will create a model of the Earth along with its layers and details, thereby, reinforcing the concepts in an effective manner.
- The assessment strategy used here is 'Gallery Walk'. It engages all students in the feedback and reflection process, allowing them to offer constructive peer feedback. Each group will display their work for their peers to review and will receive feedback using the criteria established at the beginning of the task. They may also leave little notes of appreciation or suggestions for the group that has displayed their work.
- Ensure that all resources are available beforehand. A sample of the Styrofoam ball is given below:

- If Styrofoam is not available, the same activity can be done with clay. Instructions remain the same. The wedge will be cut before the clay hardens/sets.

- If multimedia and internet facility is available, show students the following video for reinforcement:
  https://www.youtube.com/watch?v=WjXSCumeqxo

Introduction 5 Minutes

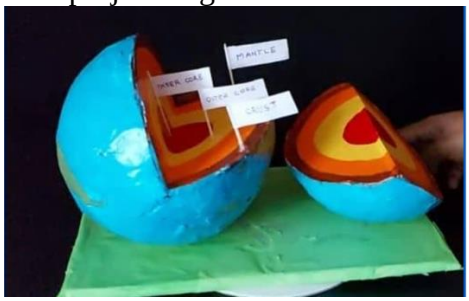
- Tell students that they are going to make their own model of Earth today.
- Ask them to brainstorm ideas about how they can make it while you distribute materials.
- Divide the class into 4 groups and provide each group with one Styrofoam ball, chart paper, marker and paints.
- Cut a wedge in the Styrofoam ball to keep students from using a knife.

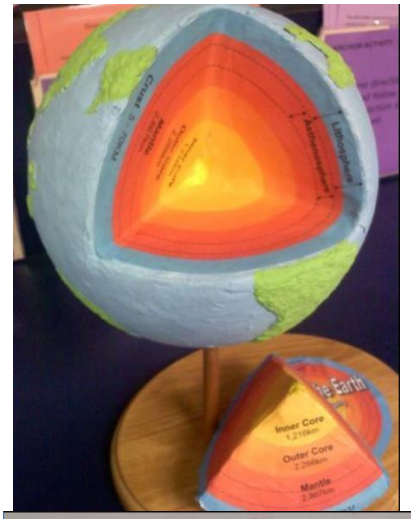
- Explain that the wedge is cut so it is easier for students to get an idea of where each layer fits inside the Earth.

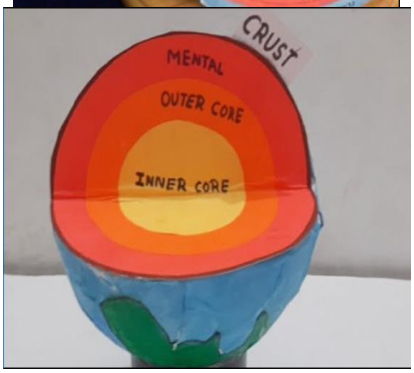
Development 24 Minutes

Activity 1

- Instruct students to ensure that no layers are missed out; they may refer to their Science textbooks for information.
- Ask all groups to draw 4 circles on the inside of the Styrofoam ball with a marker or pen to show the relative thickness for each of the 4 layers.
- All layers should be properly coloured and marked; details of every layer must be given. These can either be written on the chart paper or small chits attached to each layer.
- Encourage them to be as creative as possible.
- Provide ample time for completion of activity.
- Take a round to assess their work; guide and scaffold where necessary.
- Observe group dynamics and encourage maximum participation.
- Once all the groups have completed the task, ask them to display their projects on a desk placed in each corner of the classroom.
- Examples of what the completed project might look like:







Conclusion 3 Minutes

- If multimedia and internet facilities are available, show students the follow video: https://www.youtube.com/watch?v=2Kku4Ifcl7w
- In case of unavailability of resources, conclude the lesson by engaging the students by giving them sentence prompts:
  The Earth has _____ layers.
  The sequence of the layers is _____.
  Humans dwell on the _____.
  Lava is present in the _____.
  The core is divided into _____.
  _____ is about 3900 km thick.
  This layer contains mountains, rivers and oceans _____.
  This is the hottest part of Earth _____.
- Motivate students with positive remarks.

Assessment- Gallery walk 7 Minutes

- The Earth models are now placed on desks in all 4 corners of the classroom.
- Ask students to move to one desk each in the groups formed earlier.
- Instruct them to assess the project based on the correct labelling and thickness of layers, colouring, details of layers and visual appeal.
- Encourage them to give feedback; they may write short notes of appreciation or give suggestions accordingly.
- Take a round with the students to assess their work and take notes of the best presented work.
- Appreciate their efforts and use positive reinforcement.

- Provide constructive feedback to all groups and announce one group as the winner.

Follow up- Homework 1 minute

- Attempt Q2 (i) given on page no. 122 in the Science textbook.

Glossary is not given here as this is a project-based lesson plan which is a continuation of the previous lesson plan. Glossary has been given there.

Teacher Guide
Grade-5

Lesson Plan
37

STRUCTURE OF THE EARTH
Sources of Water

Duration: 40 Minutes

Students Learning Outcome:

- Describe the sources of water on Earth.

Materials:

Chart papers or any white paper and colour pencils/crayons according to the number of groups.

Information for the Teacher

- Water is a very useful natural resource and is used in everyday life.
- Sources of water include: rain, well, tap, river, glacier, stream, lake, ocean and sea.
- Sources of water in the locality include: rain, well, spring, borehole, pond, lake, pipe/tap.
- Natural sources of water are those that can be found on earth naturally and cannot be made by humans; examples include surface water, under river, slow groundwater and frozen water, pond water, streams, sea.
- Artificial sources of water are those that are constructed by humans; these are also known as man-made sources of water and these include tube wells, hand pumps, canal water, tap water, treated wastewater and desalinated water.
- Water resources are under threat from water pollution, water scarcity and climate change.
- About 2% of water is frozen in the form of glaciers, about 97% is the salted water in the oceans. This water is not drinkable because of its high salt content.
- Only 1% of water is fresh water that is available to mankind, which shows that there is little water available therefore, efforts must be made to ensure we do not waste water.

Introduction 5 Minutes

- Ask students to think of any 3 basic things that humans and animals cannot live without. Possible answers: food, water, air, light, etc.
- Take their responses and write them on the board.
- Circle ‘water’ and ask them why is water so important? What would happen if we don’t get enough water?
- They may discuss answers with their neighbours.
- Tell them that all living things need water to live. If there was no water, humans, animals and plants all would die.

- Inform them that today they will learn about the importance of water and the different sources of water.

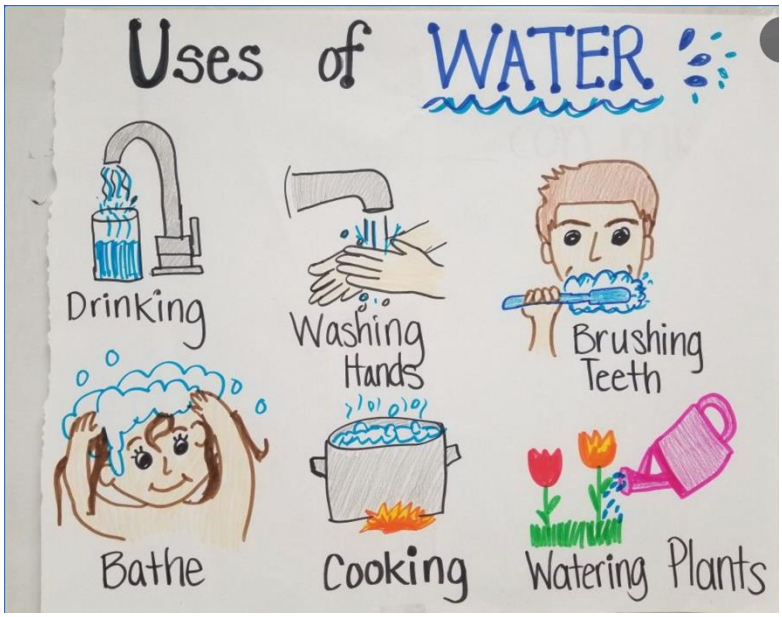
Development 18 Minutes

Activity 1

- Write the following question on the board:

What are the different uses of water?

- Starting from any one corner, ask a student to give any one use of water and then move to the next student until all students have answered.
  Possible answers: drinking, gardening, used in vehicles, bathing, cooking, for animals, cleaning, washing dishes and clothes, agriculture, leisure such as swimming, fishing, boating etc.



- Add any use of water they might have missed.
- Use positive reinforcement for their answers.
- Tell students that about 70% of the Earth's surface is covered by water. Ask them if they can recall the chart shown to them in the previous lesson where the Earth was denoted by blue and green colours. Emphasize that blue colour was more than green, indicating that there is more water than land on Earth. (You may display the chart again as a reminder).
- Tell them that about 2% of water is frozen in the form of glaciers, about 97% is the salted water in the oceans. This water is not drinkable because of its high salt content.
- Only 1% of water is fresh water that is available to mankind, which shows that there is little water available therefore, efforts must be made to ensure we do not waste water.

Activity 2 10 Minutes

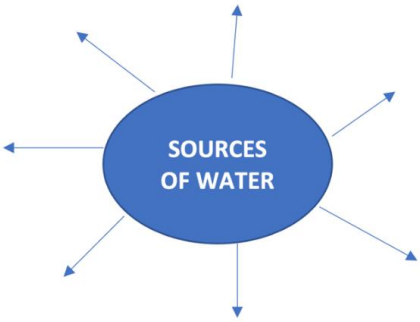
- Divide the class into suitable groups (3-4).
- Give each group a chart paper and colour pencils/crayons.
- Now ask them to think of different sources of water. They must first think individually, then discuss it with group members and then illustrate them on the chart paper.
- They may refer to their textbooks for information.
- Take a round to assess their work.

- Guide where necessary.
- When all groups have completed the task, call one member from each group, preferable the quieter students to come forward and present the group's work. All charts should be displayed on the board.
  Example of what their work should look like:

- Repeat that sources of water include: rain, glaciers, well, tap, river, stream, lake, ocean, pond, reservoir and sea.
- As a reinforcement of this activity, show students the following video:
  Link: https://www.youtube.com/watch?v=n2LZwhWGdio
- Name all the sources of water they have mentioned and ask them to categorize them under natural and artificial/man made sources of water (refer to information for teachers). This can be done verbally or written on the board.
- Now give them a brain teaser by asking: when some sources of water are being reduced, how are water levels refilled in the world?
- Take students' responses and tell them that the snow falling on mountains also melts and becomes water. This water also flows to rivers and streams and finally falls into lakes and oceans.
- Clap for all groups and motivate them with positive remarks.
- Ask if they have any queries or ambiguities.

Conclusion 3 minutes

- To sum up the lesson show the following video to students:
  https://www.youtube.com/watch?v=n5oE0GUoUVc
- If multimedia and internet facilities are not available, make a concept map on the board like the following:



- Fill this with the help of students.

Assessment- One minute essay 3 minutes

- Ask students to take out a piece of paper and write what they learnt in today's lesson in one minute.
- Collect the responses and review them after the class.
- Provide feedback before the next lesson.

Follow up- Homework 1 minute

- Ask students to attempt Q2 (iv) given in their Science textbooks on page no. 122.
- Tell them to jot down a list of sources of water in the school and at home.

Glossary

Borehole	A deep hole drilled in the ground to locate water
Reservoir	Open air storage area where water is stored so it can be used later
Glacier	A body of dense ice that slowly moves under its own weight

STRUCTURE OF THE EARTH
Sources of Water

Duration: 40 Minutes

Students Learning Outcome:

- Describe the sources of water on Earth.

Materials:

Clear plastic container, room temperature water (warm water if done in winters), cling film or a plastic sheet that can be wrapped around the plastic container, large rubber band, a small plastic bag/Ziploc, ice cubes (2-3)

Information for Teachers

- The water cycle is an acyclic pattern of water from the sea to the atmosphere to the land and back to the sea.
- The heat from the sun strikes the earth causing evaporation of the surface of water.
- The water cycle depends on the processes of evaporation and condensation.
- Evaporation occurs when water molecules at the surface of a liquid move fast enough to break away from other water molecules and escape from the liquid into the air.
- Condensation occurs when water molecules in the air slow down enough to join together to form liquid water.
- Eventually the water condenses to a liquid form that falls back to the earth's surface in the form of rain or snow if it solidifies.

Introduction 5 Minutes

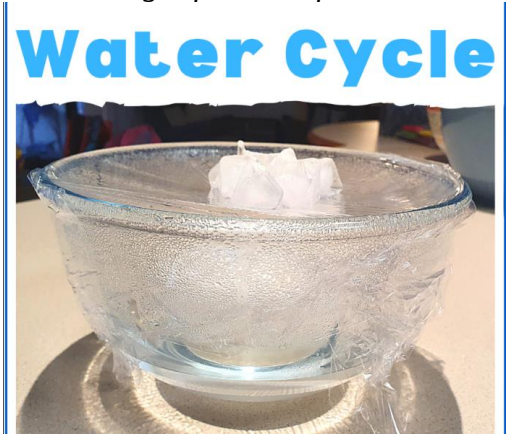
- Ask students to imagine what would happen if water became extinct on earth?
- Take their responses, emphasize the importance of water and now ask them about the different sources of water on earth.
- Instruct them to write their answers on a piece of paper and hold it up so everyone can see.
- Take a round to read the answers and use positive reinforcement.
- Now ask them if they have ever washed their clothes or observed their mothers doing it? Most students will answer in the affirmative.
- Ask inquire: what happens when clothes are hung outside to dry on a hot sunny day? And what happens when they are hung outside in cold winters?
  Expected response: on a hot day, clothes dry very quickly, while on a cold day, it takes much longer for the clothes to dry.
- Inform that today they will learn about this phenomenon and discuss the water cycle in detail.

Development 25 Minutes

Activity 1

- Display all materials on your desk and call students to gather around the desk.
- Pour room temperature water into the clear plastic container so it is about 1/4 full. Tell them this denotes a model of a lake or an ocean.
- Place a piece of plastic wrap over the container. Use a rubber band to secure the plastic wrap on the container. Tell them this plastic wrap is a model of the level of sky where most of the weather changes.
- Now put 2-3 ice cubes in a small plastic bag or Ziploc and place it on the plastic wrap on the container. Tell students that ice is used here to make the plastic wrap cold because the area of the sky where this happens is cold.

- Let the model sit for about 5 minutes. During this time, ask students to carefully observe the changes that are taking place.
- Now ask them:
  - *What happened to the water? Did it stay the same or changed its form? (changed form)*
  - *How do the water particles reach the plastic wrap? (they evaporated and then condensed on the cold plastic sheet)*
  - *What form did it change to? (vapour or gas, liquid)*
  - *How did the water change from vapour form into liquid form? (it cooled down from the ice cubes/condensation occurred)*
  - *Do you think if left in this state, the water will disappear entirely? (no)*
  - *Why or why not? (because it changes from one form to another)*



- Explain that water molecules leave the liquid state and form water vapour, a gas. This process is called evaporation. Give some examples with this so students can understand better e.g. what happens to a puddle on a hot sunny day? (it becomes dry, it disappears) OR what happens if you put water in a pan on the stove and forget to check it for a while?
- Now tell them, after evaporation, the process of condensation occurred. This was when the water particles were found on the plastic sheet underneath the ice cubes. Point out to the water droplets and ensure that all students have a clear view and can relate the information to the experiment.
- Tell them that when water molecules in the air are cooled, they move more slowly and come together to form tiny droplets of water. This process is called condensation.
- Similarly, rivers are filled up with rain water and water from glaciers and ice. In summers, the warmth of the sun evaporates water from water bodies to form clouds.
- The clouds then release water as rain or snow, also called precipitation. The rain water again flows through the lakes, streams and rivers and finally to the sea.
- Some water of the rain is absorbed by land and becomes part of underground water. The process repeats again and is known as the water cycle.

Conclusion 3 minutes

- Make a concept map on the board by giving students prompts. The following information should be covered:
  Water cycle is a cyclical process → water undergoes evaporation and condensation→ water melted from glaciers and ice and rain water fill up rivers and oceans → this water evaporates from the warmth of the sun → it is converted into water vapour → these vapours reach the clouds where the temperature is cooler → condensation occurs here where water vapours are converted to liquid again → clouds now release this liquid as rain, also known as precipitation.

Assessment 6 minutes

- Distribute the following worksheet to all students.

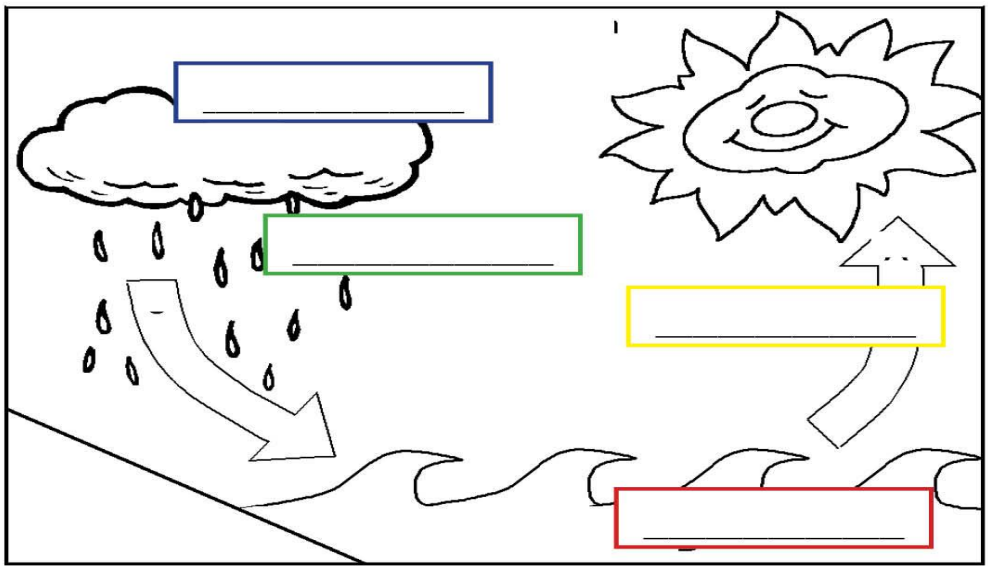
If printing or photocopying facility is not available, you may draw it on the board and ask students to copy it.

Chapter 8: Structure of the Earth
Topic: Water Cycle

Name: _____ **Grade 5**

Instructions: Label the following boxes and match the appropriate term with its

The Water Cycle



Water vapour in the air gets cold and changes into liquid, forming clouds.	Precipitation
Water falls from the sky as rain, hail, or snow.	Condensation
Water flows into rivers, lakes and oceans.	Evaporation
The Sun's energy causes water to change into a gas.	Collection

definition.

- Collect the worksheets/notebooks and review the answers.
- Use positive reinforcement and correct them where necessary.

Follow up – Homework 1 minute

- Ask students to attempt Q2 (v) and Q 3 (i) given on page 122 in their science textbooks.

Glossary

Evaporation	The process of turning from liquid into vapour
Condensation	Conversion of vapour or gas into liquid
Precipitation	Rain or snow that falls into the ground
Water cycle	Path that water follows as it moves around the earth

Teacher Guide
Grade-5

Lesson Plan
39

STRUCTURE OF THE EARTH
Soil, Characteristics of Soil

Duration: 40 Minutes

Students Learning Outcome:

- Investigate the composition and characteristics of different soils.

Materials:

Images/flashcards of flowers with soil, 3 plastic or metal trays, magnifying glass, light microscope (optional), 3 sieves, flashlight/torch if needed.

Information for Teachers:

- Soil is formed by a process known as weathering whereby rocks are broken down by strong sunshine, winds and rain over many years. This process converts rocks into small particles leading to formation of soil.
- The composition of soil mainly includes: organic matter, minerals, living organisms, water and air.
- Minerals come from rocks below the soil, whereas organic matter comes from the remains of plants and animals. Air is found in the pore spaces between rock grains and water is also found in pore spaces.
- Soil is the uppermost layer of Earth. It varies in depth in different places.
- Soil has different properties such as particle size, texture, water-holding capacity, colour, acidity and alkalinity.
- This lesson plan will mainly focus on the first part of the SLO, that is, the composition of soil.

Introduction 5 Minutes

Begin the lesson by showing flashcards/images of flowers embedded in soil and ask students what is common between both the flashcards.

Expected response: both are flowers, both are embedded in soil.

- Ask them if they know the importance of soil?
  Expected response: provides nutrients/food to the flower, helps it grow and provides support.
- Appreciate their answers.
- Tell them soil is one of the most important natural resources. It is the home for billions of organisms; most of our food grows in soil and we build homes and buildings on it. Soil is also essential for growth of trees and plants.
- Inform them that today they will learn more about the composition of soil.

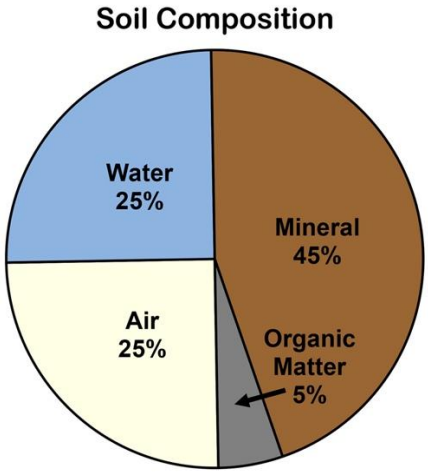
Development 20 minutes

Activity 1

- Divide the class into 3 groups and give each group a tray lined with a plain white paper for clear visibility.
- Tell them they will go outside in the ground and collect samples of soil.
- Take them to the ground where they can collect soil in their trays that is sufficient for all group members to observe.
- When all 3 groups are done bring them back to the class and provide a magnifying glass to each group and ask them to first observe the sand with naked eye and then with the magnifying glass. They must also feel the texture. If students have access to a light

microscope, prepare a slide and show them one by one. Otherwise, a magnifying glass would be enough.

- Ensure that all students get a chance to observe the soil.
- Now ask them to record their observations in their notebooks. They must focus on the colour, texture and the presence of little rocks, worms etc.
- Take a round to assess their progress. Guide them where necessary.
- Now ask a few students what they observed.
- After taking their responses, explain that soil is made up of mineral particles (45%), water (25%), air (25%) and organic matter (5%). The organic matter consists of remains of plants and animals. Some particles are bigger in size while others are smaller.



Activity 2 — 10 Minutes

- To reinforce the above mentioned point regarding particle size, tell students they will conduct another activity in the same groups.
- Provide a sieve to each group and a clean white paper for their trays.
- Ask students to move all the sand to one corner in their trays.
- Students will separate the large and small components by scooping a small amount of soil into the sieve.

- Shake the sieve over the clean white paper so that the small components remain in the sieve. The separated components will make it easier to study what the soil is made up of. They may use a magnifying glass here.

- Ask students to record their observations in their notebooks.
- Now ask each group for their answers.
  Expected answers: tiny pieces of leaves, roots of plants, insects, rocks, sand, moist soil, etc.
- Add any information they might have missed.
- Motivate students with positive remarks.

Conclusion 2 minutes

- Wind up the lesson by giving sentence prompts to students such as 'Soil is important because it…', 'Soil is composed of…' and 'The percentage of the components is…'
- Write the answers on the board for their reinforcement.
- Ask if there are any queries or ambiguities and answer them in a simple manner.

Assessment- Thumbs up, thumbs down 2 minutes

- Ask students if they understood the lesson taught today. Instruct them to show their thumbs up if they did and thumbs down if they did not.
- If majority display thumbs down, re-teach the lesson in the next class.
- If majority show thumbs up, ask follow up questions to ensure they understood the topic.

Follow up 1 minute

- Ask all students to collect a sample of soil from their homes and observe it.
- They may use a torch or flashlight for their ease.
- Instruct them to write down their observations and then compare it to the sample they observed in school.
- They will tabulate their observations under the headings of 'similarities' and differences'.

Glossary

Weathering	Breaking down of rocks and minerals on Eart surface
Organic matter	Refers to carbon-based compounds found wit natural environments
Minerals	Naturally occurring solids with a definite chemical composition and a highly ordered atomic arrangement
Magnifying glass	A lens that produces an enlarged image

Teacher Guide
Grade-5

Lesson Plan
40

STRUCTURE OF THE EARTH
Soil, Characteristics of Soil

Duration: 40 Minutes

Students Learning Outcome:

- Investigate the composition and characteristics of different soils.

Materials:

3 trays lined with white paper, 3 samples of soil taken from different areas placed in trays labelled A, B and C, magnifying glass, soil thermometer (you may use regular thermometer if soil thermometer is not available), vinegar, baking soda, 3 jars/old jam bottles with lids, 3 spoons, 3 different samples of soil, jug/pitcher of water, magnifying glass (preferably 3 but 1 will work if they can share)

Information for Teachers

- Soil may be similar or different based on the properties it possesses.
- Soil particles are greyish in colour, light in weight and larger in size, then the soil is called sandy soil. Since the particles are light in weight, it can't hold water and nutrients and can be easily drained.
- If the soil particles are bluish grey or bluish green, smooth and silky, heavier in weight and smaller in size, then this soil is called loam or silty loam. Soil particles can hold water and this kind of soil is hard to drain.
- If the particles of the soil are bluish green or bluish grey, smooth and soapy, smallest in size and are heaviest in weight then soil is called clay soil. Clay particles hold water well, can become heavy and water logged and can hold onto nutrients.
- Different types of soils have different characteristics. In this lesson plan only the characteristics will be observed and a brief introduction to the types of soil is given.
- Ensure that soil is taken from different places to achieve a variety of results for comparison.
- When soil is mixed with water and allowed to settle, it forms layers. The lower most layer consists of gravel and then sand; above it is a sticky kind of soil suspended in water and the top surface is a layer of dead vegetation matter. Water pours through the soil which shows it is porous and can retain a certain amount of water.

Introduction 4 minutes

- Quickly recap the previous lesson on 'composition of soil' to build a solid foundation for this lesson.

- Ask students: Why is soil so important for mankind? What are the main components of soil? What did you observe in the activity you did yesterday with the magnifying glass? Were you able to observe all the components of soil?
- Take students' responses and inform that today they will learn about the different characteristics of soil. Instruct them to remain careful and observant during the activity.

Development 20 minutes

Activity 1

- Take 3 samples of soil from different places and dump them on the separate plastic trays labelled A, B and C.
- Divide the students in 3 groups and call them forward where the trays are placed.
- Ask students to pick some quantity of soil from all the trays and note down their characteristics in the table given below. This table must be copied in their notebooks and filled accordingly.
- Each group will get 5-7 minutes to note their observations and then they will move towards the next tray in their respective groups.

Properties	Sample A	Sample B	Sample C
Colour (grey, dark grey, reddish etc)			
Appearance? How big are the particles? (small, medium, large)			
Texture (coarse, smooth, sticky, silky etc)			
Weight (heavy, light)			
How would you describe the smell?			
Temperature (use thermometer)			
Moisture (dry, damp)			
Acidic or alkaline? (Bubbles with vinegar or baking soda?)*			
What happens if you squeeze it?			
What else did you observe in the samples?			
Where was the sample taken from? (teacher will answer)			

***This step can be done per group. Each group can take a small sample of sand and add vinegar and baking soda to it and collectively write the answer in the table. Bubble formation in the presence of vinegar means that soil is alkaline while in the presence of baking soda, it will be acidic.

- Ask students to discuss the answers amongst their group members and ask them to come forward so each member can give one answer from their table.
- When all 3 groups have participated, inform that if the soil particles are greyish in colour, light in weight and larger in size, then the soil is called sandy soil. Since the particles are light in weight, it can't hold water and nutrients and can be easily drained.

- If the particles are bluish grey or bluish green, smooth and silky, heavier in weight and smaller in size, then this soil is called loam or silty loam. Soil particles can hold water and this kind of soil is hard to drain.
- If the particles of the soil are bluish green or bluish grey, smooth and soapy, smallest in size and are heaviest in weight then soil is called clay soil. Clay particles hold water well, can become heavy and water logged and can hold onto nutrients.
- In the end appreciate their efforts and ask if they have understood the lesson so far.
- Now inform students they will perform an activity to further explore the points mentioned above.

Activity 2 — 10 Minutes

- Ask students to remain seated in the same groups made earlier.
- Give each group a jar, soil sample, spoon, magnifying glass and water.
- Instruct them to fill the jar halfway with soil. Add water nearly to the top of the jar. Put the lid on and tighten it securely.
- Shake the jar vigorously for a minute and then let it settle down. Let the jar stand until the dirt and water settle. The soil will settle into layers.

- In the meanwhile, ask students to predict what will happen.
- Once the soil has settled into layers, ask them to observe the layers and tell what has happened. Ask them: How many layers are there? Which layer is made of the biggest particles? Which layer has the smallest particles? Can you guess why?
- Take students' responses and correct them where necessary.
- Now instruct them to further examine the layers; use a spoon to skim off the objects floating in water. Place them on a white paper.

- Then carefully pour off the water on the top and scoop out the grains of the next level onto another white paper. Do the same if there is another level.
- After each layer has been placed onto the white paper, they can be examined with the magnifying glass.

- Ask them to write down about the characteristics of the different layers after further examination.
- Now ask all groups to explain what they observed and in the end, enlist how all 3 samples differed in terms of formation of layers.
- Tell them that the lower most layers consists of gravel and then sand; above it is a sticky kind of soil suspended in water and the top surface is a layer of dead vegetation matter. Water pours through the soil which shows it is porous and can retain a certain amount of water.

Conclusion 2 minutes

- Call 3 volunteers to the front and ask them to recap the lesson in 5 sentences. Ask the remaining students to correct them where needed.
- Add any information they might have missed and motivate them with positive words.

Assessment- KWL Chart 3 minutes

- Ask students to take out a piece of paper and copy the following table on it:

What I know	What I want to know	What I have learned

- Instruct them to fill these columns; the first column will be what they already knew about the topic, the second topic will consist of questions they have in mind or want to learn and the third column will consist of new knowledge that they gained in the lesson.
- Collect their responses at the end of the class and review them.
- Provide feedback and respond to their queries before commencing the next lesson.

Follow up 1 minute

- Ask students to find out what characteristics of soil are most useful to grow plants. They may ask a gardener, a family member or use other resources such as the internet or books.

Glossary

Clay	Soft, loose, earthy material that consists of particles with a grain size of less than 4 micrometres
Silty loam	A kind of soil that contains sand, silt and clay particles to support the growth of plants as it is very fertile
Gravel	Small, irregular pieces of rock and stone

Teacher Guide
Grade-5

Lesson Plan
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STRUCTURE OF THE EARTH
Types of Soil

Duration: 40 Minutes

Students Learning Outcome:

- Identify similarities and differences among the different types of soil.

Materials:

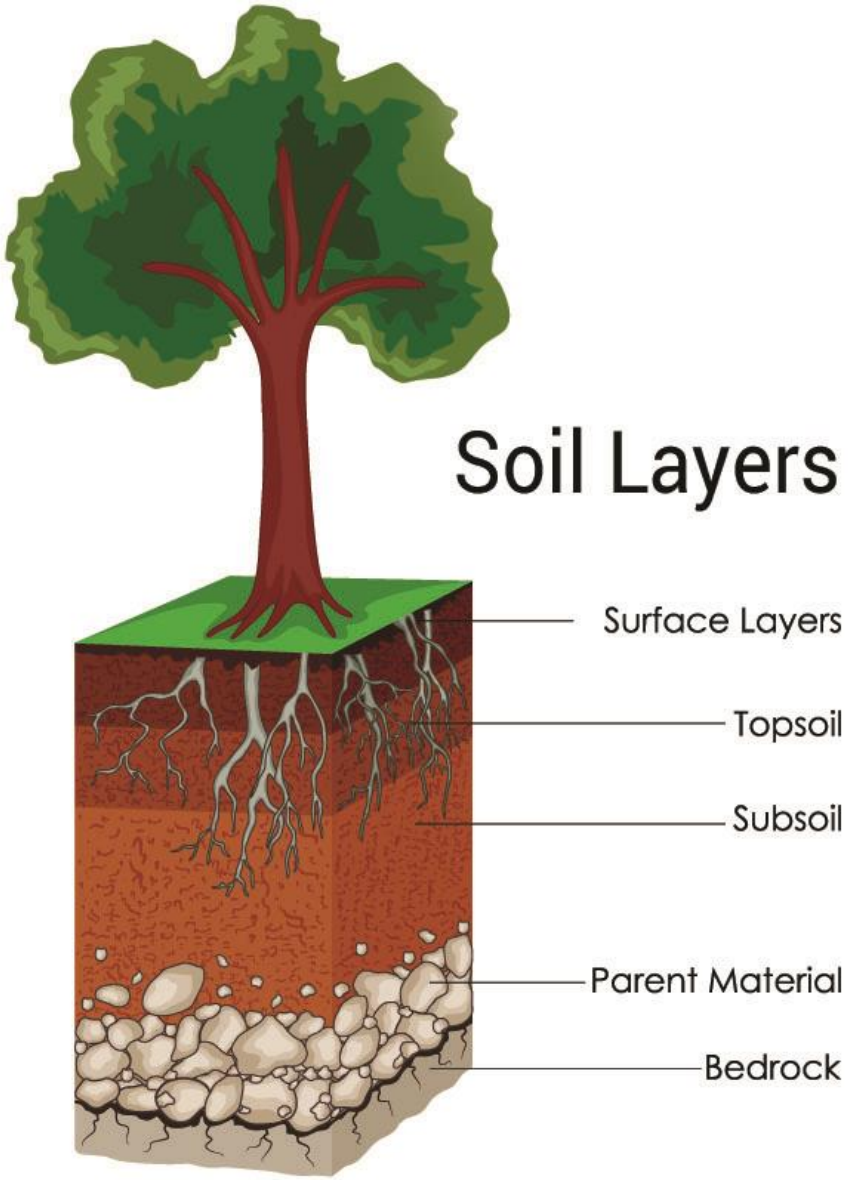
3 samples of clay in a clear plastic bag, 3 samples of sand in a clear plastic bag, 3 samples of silt in a clear plastic bag, 3 white papers, 3 magnifying glasses, 3 torches/flashlight, wooden stirrer or any spoon, flashcard of layers of soil.

Information for Teachers

- All kinds of soil consist of mineral particles, organic matter, air and water; they mainly differ due to how and where they are formed.
- Soil contains the nutrients (nitrogen, potassium, phosphorous) crops need in order to grow and prosper; organic matter such as dead plants and insects also provide some of the nutrients in the soil.
- A soil profile consists of 3 layers: topsoil, subsoil and bedrock. Topsoil is the top layer and is made up of small grains of rocks and minerals. It is usually darker in colour as is contains the most dead and decayed organisms. This is where plants can absorb water, nutrients and air.
- Subsoil is the layer below the topsoil. It is usually lighter in colour because it has fewer living organisms. It is denser than topsoil as it contains larger rocks or pebbles. Plants grow poorly in subsoil.
- Bedrock is the lowest layer that lies underneath the soil. It is the parent material from which much of the soil is formed.

Introduction 5 Minutes

- Ask students to quickly recap the composition of soil (done previously).
- Display the following flashcard on the board and ask students to read out loud the layers of soil.



- Ask them to guess the function or description of each layer from the name.
- Appreciate their efforts.
- Take a few responses and then tell them about the different layers of soil. Read out the names of layers and their description (refer to information for teachers for the description).

Development 15 minutes

Activity 1

- Write 'Clay', 'Sand' and 'Silt' on three small pieces of paper and fold them.
- Divide the class into 3 groups and nominate one student to come forward and select one folded paper.
- When all 3 groups have selected one chit each, inform them that this is the topic which is assigned to them.
- Instruct them to read their assigned topics given on page no. 118 in the science textbook and then discuss the salient features of all three kinds of soils amongst their group members and note them down.

- In the meanwhile, make 3 columns on the board, and write Clay, Sand and Silt on top of each column.
- When the discussion is over, invite one volunteer from each group to come to the board and explain what they discussed and write the salient features on the board. He/she may bring the notes made earlier for assistance.
- Group members must be encouraged to add anything the volunteer might have missed out on or correct him if required.
- Repeat the activity with all 3 groups.
- Use positive reinforcement and appreciate their efforts.
- Recap the activity by repeating the following information:

Sand	Clay	Silt
Big particles	Fine particles	Very fine particles
Low nutrients	Good for farm land	Very useful for gardening
Large pores	Small pores	Small pores
Limited water holding capacity	Large water holding capacity	Moderate water holding capacity
Particles are grey in colour and light in weight	It is soft, sticky and brownish in colour	It is smooth and silky; it is a mixture of sand, clay and humus

- Ask students if they have any queries or confusions regarding the types of soil.

Activity 2 — 10 Minutes

- Ask students to remain seated in the same groups.
- Provide resources to each group.
- Also, distribute Worksheet 11.1 amongst all students. If printing/photocopying facilities are not available, you may draw the table on the board.
- Make sure students keep the different soil samples separate.
- Have the students spend time experimenting with the different soil samples. With each sample, they should use their various senses to feel the soil with their fingers and make visual observations.
- Students should observe the soil parts with the magnifying glass.
- Now ask them to attempt the worksheet after discussing answers in pairs. Tell them to write similarities and differences they observe in all the three types of soil. They should particularly focus on the colour, texture, smell and grain size.
  Appearance- what is the colour? What size granules does it have? How does it look different from the other two samples?
  Texture- investigate how it feels between their fingers. Can they roll it into a ball? Which is the hardest? Can it be crushed?

Science
Worksheet 11.1
Topic: Types of Soil, Similarities and Differences among different types of soil

Name: _____ **Grade V**

Instructions: Fill in the columns with relevant information after observing the three types of soil. Write both similarities and differences observed.

My observations about types of soil

	Sand	Silt	Clay
What I see			
What I feel			
What I smell			

Additional comments/observations:

_____

_____

Conclusion **5 Minutes**

- Draw the following table on the board and conclude the lesson by asking students one by one to fill in the relevant information about all types of soil.

Sand	Clay	Silt

Assessment- List 10 things 5 Minutes

Ask students to list 10 things that they have learnt during the lesson, on a piece of paper.

- Collect their responses and review them after class.
- Look for gaps in learning and address these gaps before the next lesson.

Glossary

Sand	Loose material consisting of rock or mineral grains.
Clay	A fine grained material that is plastic when wet and gets hard when dried or baked.
Silt	It is a combination of sand and clay; loose sedimentary material consisting of rock particles.

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Grade-5

Lesson Plan
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STRUCTURE OF THE EARTH
Types of Soil

Duration: 40 Minutes

Students Learning Outcome:

- Identify similarities and differences among the different types of soil.

Materials:

3 samples of sand, clay and silt, 9 measuring cylinders or beakers, 9 funnels, water, 9 pieces of filter paper, 3 stop watches (these resources are meant for 3 groups; however, if there is a scarcity of resources, you may demonstrate it yourself and students can observe).

Information for Teachers

- Soil water holding capacity is controlled primarily by the soil texture and its organic matter. When the percentage of soil organic matter is increased, the soil water holding capacity also increases.
- Water holding capacity varies for each type of soil.
- Silty soil has approximately 30% sand, 60% silt and 10% clay sized particles.
- Clay has small, fine particles, which is why it retains the most amount of water, whereas sand contains the least amount of water. Silt contains medium sized particles, therefore, retains a moderate amount of water.
- The higher the percentage of silt and clay sized particles, the higher the water holding capacity.
- Water retention by soil is critical for plants and acts as the chief source of moisture for it in all habitats.
- Sand has the lowest water holding capacity, making it unsuitable for growth of plants.

Introduction 5 Minutes

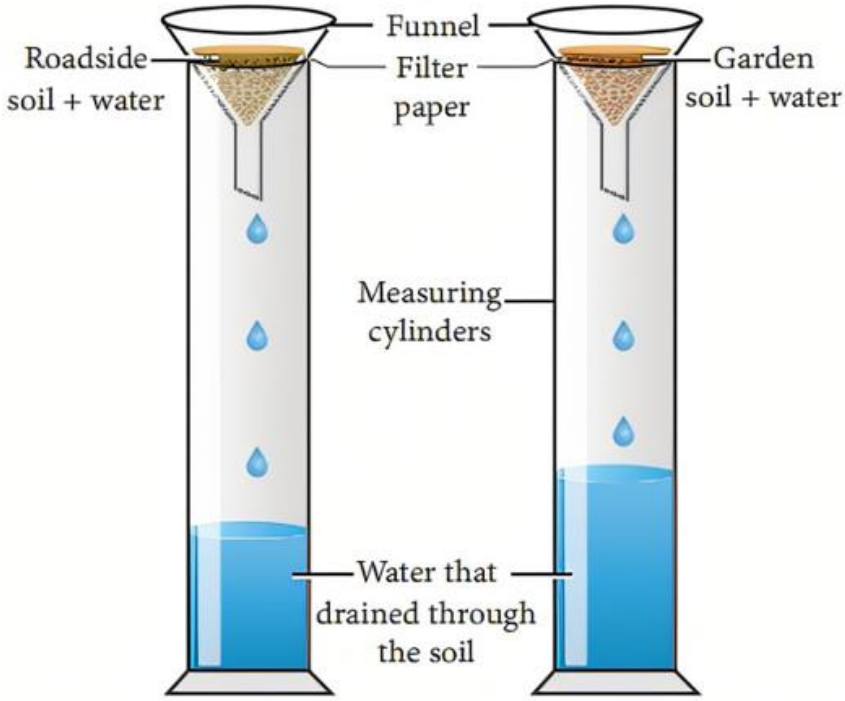
- Ask students to brainstorm and recap the differences between the 3 kinds of soil they covered in the previous lesson (sand, clay, silt). They may discuss with their partners.
- Make 3 columns on the board with these headings and jot down their answers on the board.
- Inform them that this lesson is a continuation of the same topic where they will explore another difference between the different kinds of soil.
- Now ask them if they think plants/fruits/vegetables can grow in any kind of soil? (No, they can grow only in fertile soil). If they have difficulty in coming up with the correct answer, guide them.

- Ask them what should be the characteristics of fertile soil? (It should be rich in terms of nutrients, it should contain moisture/water, it must have good soil drainage, it must have sufficient depth etc).
- Appreciate their answers and proceed to Activity 1.

Development

Activity 1 — 30 Minutes

- Divide the class into 3 groups.
- Distribute the resources to each group (3 measuring cylinders, 1 sample of each kind of soil, 3 filter papers, 3 bottles of water (250 ml), 3 funnels and a stop watch (If there aren't enough resources for each group, you may perform it yourself while students can stand around the table and observe).
- Ask students to set up the apparatus as shown below.



- Instruct them to put a sample of sand, clay and silt on the filter paper placed in the beakers. They must ensure that the samples are not mixed with each other.
- Now instruct them to add 250 ml of water in each cylinder and wait for 20 minutes (volume of water can be reduced if capacity of cylinder/beaker is less).
- In the meanwhile, ask students to predict what will happen and what will they be expected to do next?
- Ask them to draw the apparatus in their notebooks.
- After 20 minutes, they will measure the volume of water which drains through all the 3 measuring cylinders/beakers.
- Ask them to compare these volumes and observe which cylinder has the most water and what does it indicate? (Sand drains quickly and has a small water holding capacity; clay retains most water while silty soil drains water less than sandy soil).
- Inquire for reasons of difference in water holding capacity (sand particles are the largest, silt is medium sized and clay particles are the smallest, therefore, pore sizes are different,

leading to different water holding capacities for each kind of soil- this was covered in the previous lesson plan).

- Tell students to record their observations in their notebooks under the drawings they made earlier.

Conclusion 3 Minutes

- Divide the class into two teams.
- Ask a member from team A to recap one thing/concept they learnt today, starting from the beginning.
- Now ask one member from Team B if he/she agrees with the member from Team A. If no, ask them to rectify their answer, if yes, ask this member (from team B) to continue and recap another point from the lesson.
- Continue this game until all the information has been briefly covered.
- Ensure both teams get equal chance of participation.
- Clap for the team with the most correct answers.
- You may also show them the following video as a reinforcement of the activity done: https://youtu.be/N_pARn50GHo

Assessment- Oral questioning 2 Minutes

- Ask students the following questions:
  What is a garden like with too much clay? (No water can go through)
  What is a garden like with too much sand? (Water goes through too quickly)
  Why did results vary in all 3 measuring cylinders? (Different pore size)
  What component of soil is responsible for its water holding capacity? (Organic matter and soil texture)

Follow up- Project

- Attempt the project 5 (ii) in groups, given on page 123 in their science textbooks.
- They may take the leftover samples after the lesson.
- This activity can be done during break time or in a free period.
- Take their responses/observations in the next lesson.

Glossary

The terms used in this lesson plan are same as those in the previous lesson plan therefore no new words/terms are used here.

Teacher Guide
Grade-5

Lesson Plan
43

SPACE AND SATELLITES
Space Exploration

Duration: 40 Minutes

Students Learning Outcome:

- Define the term 'space' and emphasize the need to explore it.

Materials:

3-4 flashcards of space, 2-3 small mineral water empty bottles or any plastic light weight bottles, one large bottle of vinegar, one box of baking soda, 2-3 corks (same size as the bottle opening), tissue paper, 3 pencils, tape.

Information for Teachers

- Space is the area that exists beyond Earth and its atmosphere and between heavenly bodies (galaxies, stars, planets).
- Humans can survive 15-30 seconds in space; they become unconscious after that due to lack of oxygen.
- A rocket is a spacecraft that obtains thrust from a rocket engine by burning fuel. It turns the fuel into hot gas. Pushing the gas out of the back of the engine makes the rocket move forward.
- Satellites may be natural or artificial. Moon is a natural satellite that orbits the Earth; artificial satellites are man-made objects that are launched into orbit using rockets. There are over a thousand active satellites orbiting the Earth.
- Artificial satellites are used to obtain information from outer space.
- Sputnik-1 was the first artificial satellite that was successfully launched into the orbit around the Earth on October 4th, 1957. It was launched from Kazakhstan and it managed to remain in orbit for 3 months before it fell back into the Earth's atmosphere.

Introduction 5 Minutes

- Begin the class by asking students the following questions:
  Have you ever observed the sky during the day? What do you usually see? (Sun, clouds).
  How is it different from the sky at night? (We can see the moon and stars).
- Now show them the following flashcards (if multimedia is available, you may also display there via mobile phones).

- Ask them:
  What do you see in these pictures? (Start from the first picture and move on to the next one once they have responded). Focus on asking names of the objects/contents shown. If they are unable to answer, guide them.
  Expected responses: bright stars, starry night, planets, earth, moon, astronaut, spaceship, outer space etc).
- Now ask them to imagine what is it like in outer space? What do you think it feels like in outer space? Would you be able to hear or taste anything? Encourage them to be creative and use their imagination in their answers.
- Appreciate their answers and use positive reinforcement.

Development

Activity 1 — 10 Minutes

- Show students the following video:
  https://youtu.be/BU9IOXjJogQ

- Tell them when we observe the sky at night, we see many tiny lights that we assume to be stars. However, not all are stars. They can be galaxies, stars, planets and other objects. These are known as heavenly bodies. These heavenly bodies are a part of the vast space around us which is collectively known as the universe.
- Explain that space is defined as the physical universe that exists beyond earth and between these heavenly bodies. It occurs about 100 km above the planet.
- Stress on the importance of exploring space; tell them different countries have sent artificial satellites in space for research and surveillance purposes.
- Now ask them to think in pairs, why space needs to be explored? What would happen if we did not know what was happening in space?
- Give them 2-3 minutes to brainstorm.
- After taking a few responses, tell them space exploration increases our knowledge and expands our horizons about questions we don't have answers to, yet. It also helps us in developing new technology and gives us an opportunity to discover new worlds which would allow species to survive on other planets. Without space exploration we wouldn't have GPS, accurate weather prediction, solar cells or the ultraviolet filters in sunglasses and cameras. Lastly, there is also medical research happening in space that could cure diseases and prolong human lives.
- Ask them: Now that we have talked about the importance of exploring space, how do you think we get there? Can we go into space in an airplane? (No, because it cannot fly above a certain height).
- After taking a few responses, tell them we need a special kind of aircraft called a rocket to go into space. People who go into space are called astronauts. If someone has given the correct answer, praise them.

Activity 2 — 15 Minutes

- Show them the following flashcard of a rocket:

- Explain that a rocket is a specialized vehicle with a specialized engine that produces thrust by burning fuel into hot gas. Pushing the gas out of the back engine makes the rocket move forward.
- Show students the following flashcard for clarity:

- Tell them that the space age began on 4th October 1957 when Soviet Union launched Sputnik-1 in the orbit of the Earth. Sputnik-1 was the first artificial satellite. Explain that satellite is placed in orbit round the earth in order to collect information or for communication (this will be covered in the following lesson plans).
- Ask them if they have understood the concept so far.
- Answer any queries they have.

- Now tell them they will perform an interesting activity where they will make a simple model of a rocket.
- Tape the pencils around the bottle with tape as shown in the following picture to create a standing base.

- Fill the bottle with 1/3 vinegar.
- Pour 2 tablespoons of baking soda in the middle of a paper and twist it neatly like a candy or fold it so it is small enough to easily fit through the bottle opening.
- While doing this step, ensure that students are not standing too close to the model. They must observe from a distance.
- Slowly insert the baking soda parcel through the bottle and put the cork in.
- Shake the bottle, place it in an open space at least 5 meters away from students and get away.
- Wait for a few seconds and observe the action.
- Ask students to describe what happened in light of the information you gave them regarding functioning of rockets.
- Explain this is similar to how rockets are launched in space (you may also give the example of fire crackers as they propel/fly in the sky).
- Ask for any queries and clarify any ambiguities they have.
- You may watch the video given on the website to have a clear understanding of how to perform the activity:
  Quick Bottle Rockets With Baking Soda & Vinegar - Teach Beside Me

Conclusion 5 Minutes

- Quickly recap the lesson by writing the following terms on the board:
  - *Space*
  - *Heavenly bodies*
  - *Rocket*
  - *Sputnik- 1*
  - *Astronaut*

- Ask students to describe these terms and write their correct answers on the board. Add any information that has been missed out and repeat the description for every term.
- Use positive reinforcement to encourage them.

Assessment- True/False 4 Minutes

- Write the following statements on the board and ask students whether these are true or false. You may also ask verbally in case of shortage of time.

1. Shining lights seen in the sky at night time are all stars. True/**False**
2. Heavenly bodies include galaxies, stars and planets. **True**/False
3. Rockets and airplanes are commonly sent into space. True/**False**
4. Sputnik-1 was launched in the orbit of the Earth on 4th October 1967. True/**False**
5. Satellites are sent in space to collect information. **True**//False

Follow up- Homework 1 Minutes

- Ask students to read page no. 125 and 126 of their science textbook for reinforcement of information and draw an image of a rocket in their notebooks along with a short note regarding how it works.

Glossary

Space	Physical universe that exists beyond earth and between heavenly bodies.
Satellite	An object that moves around the Earth.
Universe	All of space and everything in it including stars, planets, galaxies etc.
Galaxy	A huge collection of stars, gas, dust and the solar system held together by gravity.

SPACE AND SATELLITES

Artificial Satellites

Duration: 40 Minutes

Students Learning Outcome:

- Define artificial satellite and explain their importance in exploring the Earth and Space.

Materials:

Flashcards of a satellite (1 flashcard is used here, you may use more)

Information for Teachers

- A satellite is a moon, planet or machine that orbits or moves in a curved path around a planet or star. For example, Earth is a satellite because it orbits the sun. Likewise, the moon is a satellite because it orbits Earth.
- Earth and the moon are examples of natural satellites. Thousands of artificial, or man-made, satellites orbit Earth. Some take pictures of the planet that help meteorologists predict weather and track hurricanes. Some take pictures of other planets, the sun or faraway galaxies. These pictures help scientists better understand the solar system and universe.
- Satellites are mainly used for communications such as in television signals and phone calls. They can also see into space better than telescopes at Earth's surface as they fly above the clouds and dust in the atmosphere that usually block the view from ground level.
- Many NASA satellites carry cameras and scientific sensors that sometimes point towards Earth to collect information about its land, water and air, while sometimes they point towards space to gather data from the solar system and universe.

Introduction 5 Minutes

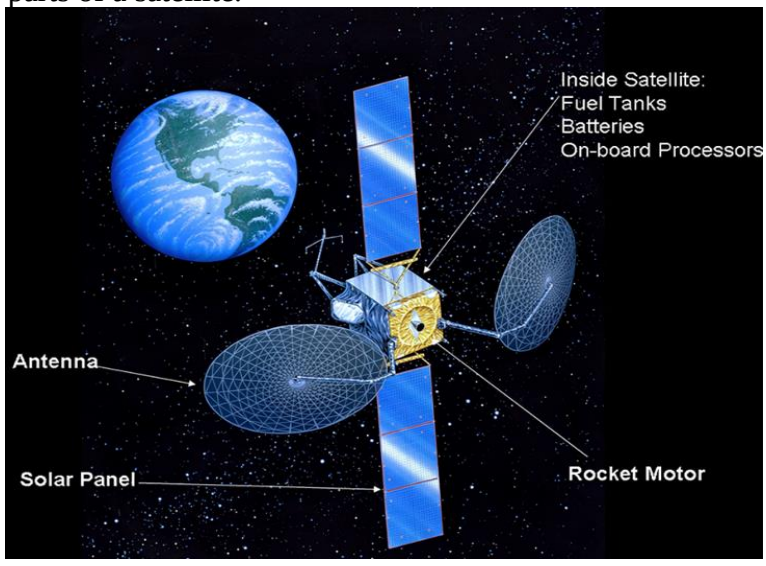
- Start the lesson by telling students an interesting story.
- Spacewomen Ayesha and Amina are heading off on a 6 month trip to an area far away with unexplored waters. They are both very excited about the trip but their parents are extremely worried.
- Ask students: If you were their parents, what would you be worried about? And if you were in Ayesha or Amina's place, what would you be worried about?
- Take a few responses. There is no incorrect answer here but the answer you are looking for is 'communication'.
- If someone gives this answer, appreciate them. Explain that the parents are worried about communicating with their daughters, to know where they are and whether they both are safe.

- Stress on the importance of communication; it is how we are able to get or send ideas across to another person.
- Ask students different methods of communication (speaking, body gestures, sign language, via telephones, internet, letters, radio, etc.).
- Now ask them: how can we find out the location of other people? (By using maps, satellite navigation). If students are unable to answer, guide them (satellites have been briefly mentioned in the previous lesson plan).
- Explain that communication over long distances requires complex methods and gadgets such as satellite systems and radars.

Development

Activity 1 — 15 Minutes

- Write the word satellite on the board and encircle it. Ask students if they remember what a satellite is?
- Take a few responses and reinforce: a satellite is a body or a machine that orbits the Earth or another body in space under the influence of a gravitational force. For example, Earth is a satellite because it orbits the sun. Similarly, the moon is a satellite because it orbits the Earth. These are examples of natural satellites.
- Satellites work by transmitting information from an originating ground station to the satellite, followed by a retransmission of the information from the satellite back to the ground.
- Likewise, there are thousands of man-made or artificial satellites that orbit the Earth. These satellites are sent into space by a rocket and are given the right speed for their height. The higher the satellite, the slower its speed and the longer is the time required to complete its one orbit.
- Now show them the following video to reinforce the concept: https://youtu.be/sFZGZLRr6Dk (Play uptil the first 56 seconds and then pause).
- Ask them what did they see and understand from the video?
- After taking a few responses, display the following flashcard on the board and tell students it is showing the parts of a satellite.



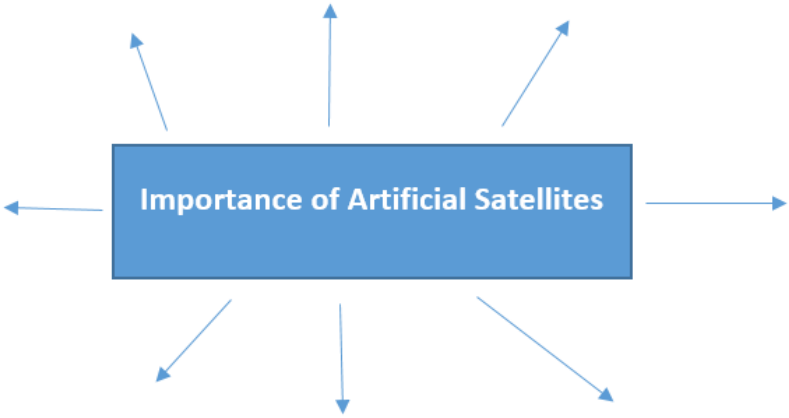
- Nominate one student to read out the parts mentioned.
- Tell them that satellites come in different shapes and sizes, but most have at least two parts in common- an antenna and a power source. The antenna sends and receives information,

often to and from Earth (point towards the flashcard and show them). The power source can be a solar panel or battery. Solar panels make power by turning sunlight into electricity.

- Now ask students to think about why these satellites don't crash into each other considering thousands of satellites are sent into space? (Organizations such as NASA keep track of satellites in space- collisions are rare because when a satellite is launched, it is placed into an orbit designed to avoid other satellites).
- Ask if they have understood the concept so far and whether they have any questions.

Activity 2 — 10 Minutes

- Draw the following concept map on the board.



- Tell students to take 2-3 minutes and discuss in pairs about the importance of artificial satellites. They may refer to their textbooks for ideas.
- Instruct them to write down their answers on a piece of paper and hold them up for the rest of the students to see.
- Take a round and glance at their answers. Write the correct answers next to the arrows on the board.
- Enlist the following uses of artificial satellites on the board:
  - Transmitting and receiving signals of mobile phones to facilitate communication.
  - To help forecast weather. This helps us deal with floods, storms and other disasters effectively.
  - To study the universe by collecting information about outer space.
  - To collect information about natural resources of Earth such as oil wells, minerals, coal deposits, natural gas etc.
  - Assist in ship and aircraft navigation.
  - Receive radio signals from one location and send them to another.

Conclusion — 4 Minutes

- Show the remaining video to students to recap the lesson: https://youtu.be/sFZGZLRr6Dk
- Ask students to raise their hands and tell what the video was about.

Assessment- Sentence prompts — 5 Minutes

- Give the following sentence prompts to students and ask them to complete the sentence:
  'A satellite is defined as a _____'
  'Different methods of communication include _____'
  'Satellites are of _____ types'

'An example of a natural satellite is _____'
'Artificial satellites are made by _____'
'Satellites work by _____'
'Parts of a satellite include _____'
'Artificial satellites are important because they _____'

Follow up- Homework 1 Minutes

Attempt Q4 given on page no. 134 in the science textbooks.

Glossary

Gravitational force	Force by which a planet or a body draws objects towards its centre.
Navigation	The science of finding the position and directing the course of an aircraft
Orbit	The path of a satellite as it revolves around another body
Satellite	An object that orbits around another object under the influence of gravitational force
Radar	Sensor that uses radio waves to detect the presence, direction, distance and speed of aircrafts, motor vehicles and ships etc.

Teacher Guide
Grade-5

Lesson Plan
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SPACE AND SATELLITES
Uses of Various Satellites

Duration: 40 Minutes

Students Learning Outcome:

- Describe the uses of various satellites in space i.e. geostationary, weather, communication and global positioning system (GPS).

Materials:

4 chart papers, 4 packs of colouring pencils/crayons, tape flashcards (as shown in introduction)

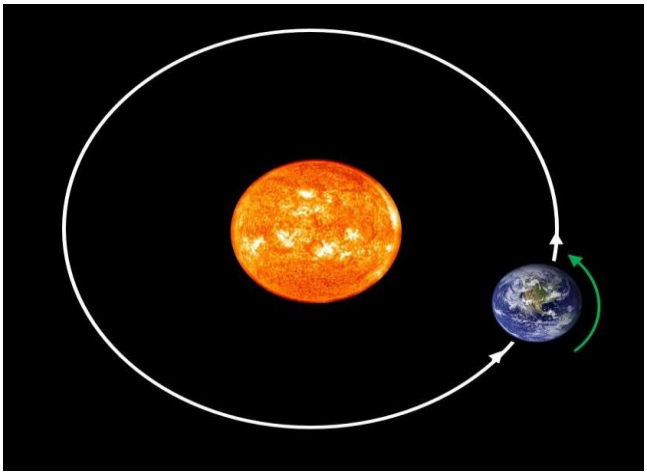
Information for Teachers

- The bird's-eye view that satellites have allows them to see large areas of Earth at one time. This indicates that satellites are able to collect more data, more quickly than instruments on the ground.
- Most satellites orbiting Earth are used for communication such as beaming TV signals and phone calls around the world.
- TV signals didn't go very far before the advent of satellites. They travel in relatively straight lines and quickly trail off into space rather than following Earth's curve. Making phone calls to faraway places was also a problem; setting up telephone wires over long distances or underwater is expensive and difficult. With satellites, TV signals and phone calls can be sent up towards a satellite and instantly bounced back to different locations on Earth (These two are the most relatable uses that students will understand easily).
- The Global Positioning System (GPS), a key navigation tool, is a group of more than 30 satellites. If you have a GPS receiver, these satellites can determine your exact location.
- Artificial satellites are used for weather forecasting. This is done by fitting special instruments and powerful cameras in the satellites which monitor various climatic factors such as air pressure, air temperature and humidity etc. the satellites used for weather forecasting are called weather satellites.
- Geostationary satellites are used for communication purposes and transmit TV signals across the world. Additionally, they also provide infrared images of the Earth's surface and atmosphere.

Introduction 5 Minutes

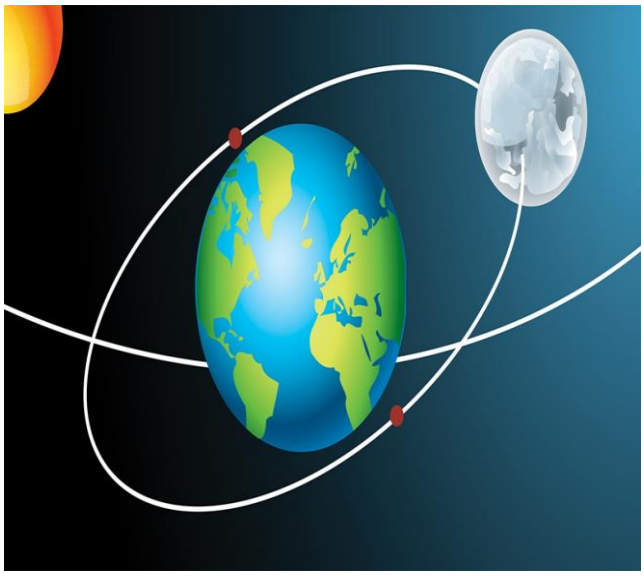
- This is mainly a brainstorming/revision activity.
- Show students the following flashcards one by one and ask them the questions written underneath.

Flashcard 1:



What do you see in this flashcard/image? (Earth orbiting the sun)
Which one of these is a satellite? (Earth)
What kind of a satellite is it? (Natural satellite)
What else do you observe here? (It follows a fixed path)

Flashcard 2:



What is this image showing? (Moon orbiting the Earth)
Is this satellite sent into space by man? (No, it's a natural satellite)

Flashcard 3:

Describe this image (expect several answers here in description)
What are the components of the artificial satellite? (Antenna and power source)
How does it work? (Receives and sends signals)

- Encourage maximum participation and ask a different student to answer every time.
- Appreciate their responses and inform them that now that they have studied about satellites in the previous lessons, today's lesson will be about the various uses of satellites.

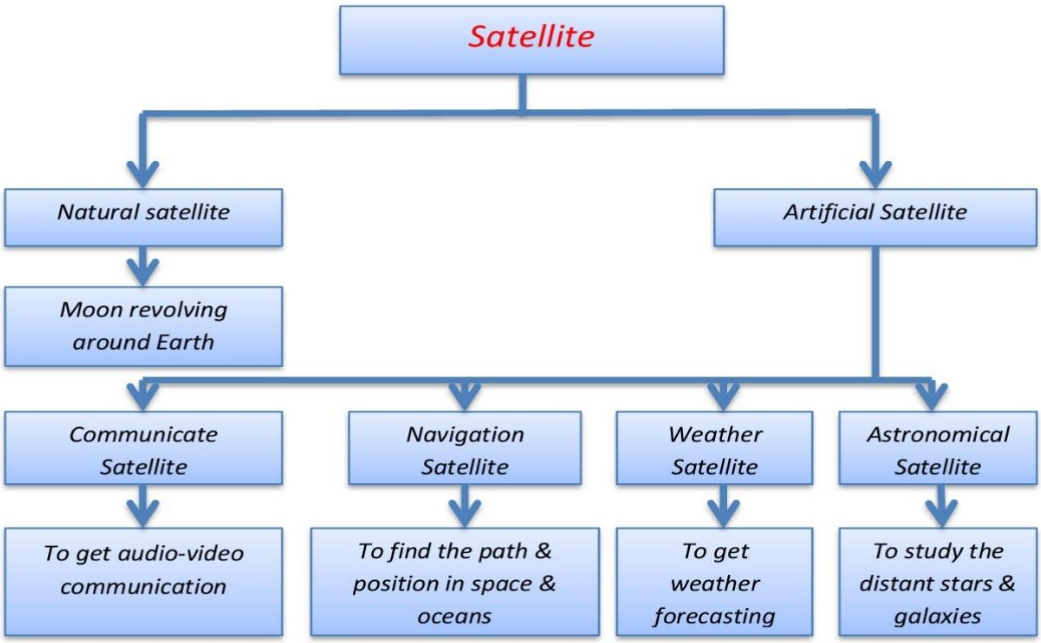
Development

Activity 1 — 22 Minutes

- Divide the class into 4 groups.
- Provide resources to each group.
- Instruct them to thoroughly read page no. 129, 130 and 131 from the science textbook (uses of various satellites).
- Nominate one group leader who will speak on behalf of whole group and present everyone's point of view, one chosen writer/sciber who will write down all the ideas and the remaining will be participants. They will all brainstorm and discuss ideas together.
- Now ask them to illustrate the 'Uses of Satellites' on the chart paper. It can be in the form of a mind map or with drawings and notes.
- Encourage them to be as creative as they like.
- They must note down the key points on a rough page first and then refine them into a final presentation form. The group with the most comprehensive and visually appealing chart will be the winner.
- Provide adequate time to all groups.
- Take a round to assess their progress. Assist students who need help.
- Ensure maximum participation from all students.
- When the allotted time is over, ask all 4 groups to paste their charts on one wall each and return to their seats.
- Reinforce the following uses of satellites:
    - Geostationary satellites- appears stationary as it orbits the Earth with the same speed as that of Earth- used for communication purposes and transmit TV signals across the world.
    - To help forecast weather. This helps us deal with floods, storms and other disasters effectively- polar orbiting satellites are used. These are also used to survey the Earth, for navigation and observing other satellites. These assist in ship and aircraft navigation.
    - Communication satellites- these are used for transmitting and receiving signals of TV and mobile phones to facilitate communication. They also receive radio signals from one location and send them to another. Signals can be picked up directly from these satellites through dish antennas.
    - To locate people via a technology called GPS (global positioning system); it is a navigation system that uses a special kind of satellite that records locations of signals and sends them to a transmitter or computer.
    - To collect information about natural resources of Earth such as oil wells, minerals, coal deposits, natural gas etc.
    - Some artificial satellites are used by military for spying of enemy troops to locate their position.

Conclusion 4 Minutes

- Quickly draw a mind map on the board similar to the following image to recap the lesson.



- Encourage students to participate and help you.
- This is merely a sample, you may modify according to your expertise.

Assessment- Gallery walk 8 Minutes

- Now ask students to move in the same groups and assess each other's work, keeping in mind the information you delivered.
- Encourage them to provide constructive feedback on the charts for the group to see later. This may be in the form of little/sticky notes where they mention 2 things they like and 2 areas that need improvement.
- Each group will get 2-3 minutes to provide feedback.
- During this activity, you must assess their work and provide feedback as well.
- Address any gaps you observe in their work.
- Use positive reinforcement for all groups and announce one group as the winner.
- Ask if they have any questions or ambiguities.

Follow up 1 Minute

- Ask students to do Q2 (i) and (iii) given on page no. 133 and 134 in the science textbook.

Glossary

Geostationary satellite	Satellite that moves in a circular orbit and appears nearly stationary in the sky as seen by a ground based observer.
GPS	It is a system of 30 plus navigation satellites orbiting Earth.

SPACE AND SATELLITES
Importance of Artificial Satellites

Duration: 40 Minutes

Students Learning Outcome:

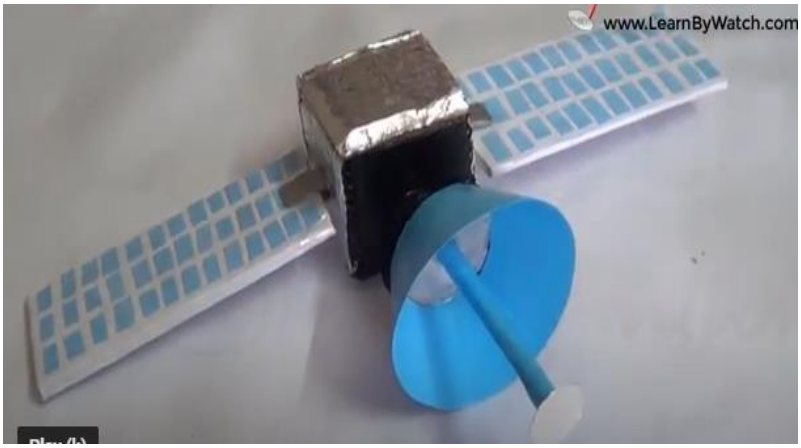
- Define artificial satellite and explain their importance in exploring the Earth and Space.

Materials:

Cardboard, aluminium foil, A4 sheet paper (blue colour/paint it blue if the sheet is not available in blue), glue, 4 straws, 4 scissors.

Information for Teachers

- This is a project based planner where you are expected to act merely as a facilitator and allow students to take the lead by exploring their creativity.
- Theory has been covered in the previous planners, therefore, this planner will serve as a reinforcement for the concept of artificial satellites.
- Ensure that internet facility is available; otherwise, you may watch the video carefully and guide students step by step regarding the activity.
- The end product must look similar to this model, hence it is requested that resources are arranged accordingly for 4 groups so all students can have the opportunity to participate actively in this hands on activity.



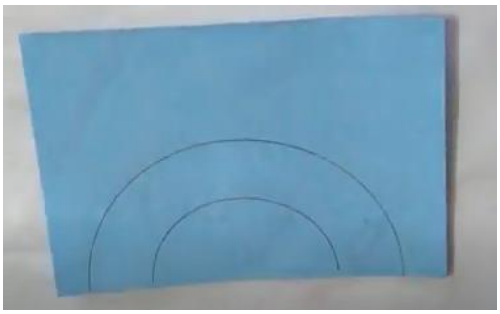
Introduction 3 Minutes

- Ask students to identify the kind of artificial satellite by reading the following statements (write them on the board):
  - It transmits signals of mobile phones from one place to another _____.
  - It tells the location of a person at a place _____.
  - It is used to transmit TV signals across the world _____.
  - It provides information about the weather _____.
  - The first artificial satellite launched in 1957 was called _____.
- Ask students to recall the parts of an artificial satellite.
- Appreciate their efforts with positive remarks.
- Inform them that they have covered the topic of satellites and their importance and today they will be conducting an interesting activity, whereby they will make their own artificial satellites in class.

Development 30 Minutes

Activity

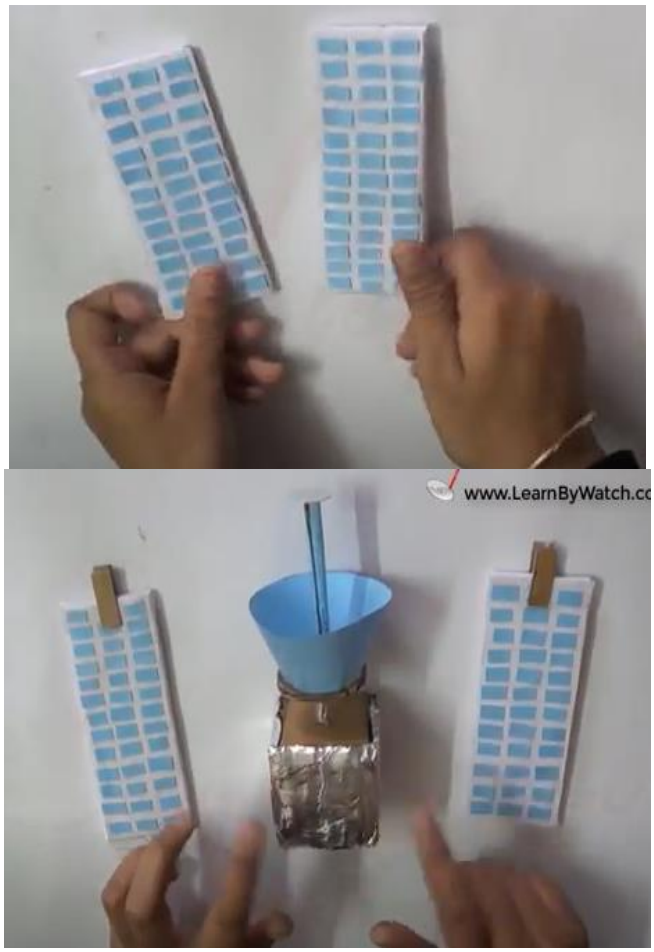
- Divide the class into 4 groups.
- Provide resources to each group.
- Show them the following video: https://youtu.be/7Jz1qpv3Pm8
- Pause in the middle and explain the steps to students. Ask them to identify the parts of the satellite and state their functions from the video.
- Instruct them to fold the blue sheet/paper in half, and cut a semi-circle and stick it from the corners.



- Paste this circle onto the base box as shown in the video.

- Make the box following the given steps, by using cardboard and cover it with aluminium foil and make 2 holes on the opposite sides.

- Now instruct them to take two rectangle shaped cardboard sheets, cover it with white paper and stick some small pieces of blue paper on it. Stick these two cardboard sheets into that box.



- Assemble the model by inserting a straw in the middle which will act as an antenna. The model is now ready.
- Assist and guide students where required.
- Watch the video again in case of any ambiguity.

Conclusion 2 Minutes

- Nominate one student to repeat the first step of this activity and the reasoning behind it. Similarly, the student next to him/her will describe the next step and so on and so forth until all the steps are repeated.

Assessment 4 Minutes

- Since this is a class project, it will be assessed accordingly.
- Ask students to display their models group-wise in the front and ask the rest of the class to give them scores according to the relevance, creativity, neatness and visual appeal. You may also do the same and record your observations.
- Encourage students to ask questions from the group presenting.
- Provide constructive feedback.
- Appreciate efforts of all groups using positive remarks.

- Announce one group as the winner after reviewing all remarks.

Follow up- Homework 1 Minute

- Enlist 5 uses of satellites that are used in everyday routine.

Glossary

No new terms were introduced in this planner as this was a hands on activity for reinforcement of artificial satellites, therefore, glossary is not given.

Teacher Guid
Grade-5

Lesson Plan
47

TECHNOLOGY IN EVERYDAY LIFE
Safety Measurement While Working in a Laboratory

Duration: 40 Minutes

Students Learning Outcome:

- Enlist and practice safety procedures while carrying out the activities.

Materials:

4 chart papers, assorted markers, crayons/paints, sticky notes, and scissors.

Information for Teachers

- This is a simple and straightforward planner with general safety measures.
- You may take the lesson in the science lab and show students the equipment mentioned in the video/textbook, such as proper use of safety goggles, wearing an apron, fire extinguisher, first aid box, signs of wet floor, proper handling of glassware, test tubes or beakers, etc. However, this is optional.

Introduction 4 Minutes

- Begin the lesson by narrating a story to students. Tell them while on your way today to school, you witnessed a man on a motorbike cross a red light signal and then he bumped into a rickshaw which made him fall on the ground with bruises (or any similar story that indicates breaking of rules/law).
- Ask them why did it happen and whose fault was it? (The man on the bike was responsible because he broke a rule by crossing the red light).
- Appreciate their responses and emphasize on following rules and protocols.
- Explain that every place has a code of conduct and one needs to follow protocols and rules for their own safety; otherwise chaos is created and people can be harmed.
- Give them an example of rules while visiting a patient in the hospital. Ask them to think of rules that must be followed (we must be quiet, knock the door before entering, not disrupt the patients privacy, no smoking, talk in a low voice so other patients don't get disturbed, too many people should not crowd the patients room etc.)
- Another example can be rules in a classroom (maintain discipline, wait for your turn to speak, no shouting, respect others, finish assigned work on time, share things etc.)
- Tell them similarly, there are safety protocols or rules to work in a laboratory. It is necessary to follow them to ensure safety and avoid hazards, which may not only hurt them but also their class fellows.

Development 28 Minutes

Activity

- Tell students they will be watching an interesting video on safety procedures while carrying out activities.
- Show them the following video and ask them to jot the key points on a piece of paper:
  https://youtu.be/VXB1HWnjQBA
- Repeat every point written in the video to ensure all students understand the protocols.
- Now divide the class into 4 groups.
- Provide each group with a chart paper, markers, crayons/paints, scissors and a few sticky notes.
- Instruct them to make a poster on safety procedures focusing on general safety measures and safety in the laboratory.
- Give them adequate time and encourage them to be as creative as possible.
- They must refer to the notes they made while watching the video and may also refer to page no. 136 of their science textbook. They can also add any information from their previous knowledge.
- Inform them that posters will be assessed on content, organization of content, relevance, clarity of language and visual appeal. The group with the most points written in a logical manner will be the winner.
- When the allotted time is over, call one group forward at a time and ask them to present their work.
- Encourage other groups to ask questions.
- Choose one group as the winner based on the pre-set criterion (mentioned above) and clap for them.
- Samples of what the posters may look like:

Conclusion 3 Minutes

- Recap the key points as follows. Safety procedures include:
  - Proper attire or dressing.
  - Wear safety goggles.
  - Follow the directions given by the teacher very carefully.
  - Know the proper use of lab equipment; don't hesitate to ask for help.
  - Do not take food or drinks to the lab.
  - Work under your teacher's supervision.
  - Tie back long hair.
  - Keep your area clean and dry.
  - Immediately report any accidents to your teacher.
  - Handle glassware carefully
  - Be careful while using sharp tools; put them away when you are done using them.

- Be careful and attentive while working with fire. Do not wear polyester or nylon clothes.
- Avoid using electrical appliances and devices in the absence of supervision.
- Be aware of safety equipment such as the fire extinguisher, water storage and the first aid box.
- Do not use unlabelled chemical bottles.
- Do not look directly into a test tube or beaker.

Assessment- Paper pass 4 Minutes

- Circulate a sheet of paper starting from one end of the class and ask students to write one safety measure on the paper and then pass it to the next student.
- All students must write at least one safety measure.
- When all the students have answered, collect the paper and quickly review the answers.
- Provide feedback to students.
- Address gaps you have identified in their answers.

Follow up- Homework 1 Minute

- Enlist the safety measures learnt today in your science notebooks.

Glossary

Hazard	A risk or danger
Safety goggles	Goggles that provide protection to eyes

Teacher Guid
Grade-5

Lesson Plan
48

TECHNOLOGY IN EVERYDAY LIFE
Plumb Line

Duration: 40 Minutes

Students Learning Outcome:

- Use a plumb line to install a flag pole vertically.

Materials:

Pakistan's flag, plumb line (with a plumb bob), shovel, gravel, cement, water, bucket to mix cement.

Information for Teachers

- Arrange the plumb line well in advance. It can be sourced from a mason or any builder.
- A plumb bob is a pointed weight attached to the end of a string and is used to find a vertical reference line called plumb.

- Plumb bob has been used since decades, especially in Ancient Egypt.
- It is used in surveying, allowing the user to find the vertical direction pointing towards gravity, and in tools such as steel tapes.
- While using it, measure 2-3 inches away from the top of the wall and make a mark. Then set a nail in the mark. Now hang the plumb bob on the nail, letting gravity draw a vertical reference line for you.

- When the bob has stopped oscillating, measure the distance from the wall. If it matches the measurement at the top of the wall, your wall is plumb.
- Video demonstration for reference on how to use a plumb line:

https://youtu.be/0XXiSC7Kq54

- Ideally, select the area for flag installation beforehand and get it surveyed to avoid any hazards regarding underground wiring or plumbing. This will also save time.

Introduction 3 Minutes

- Display the flag in front of the class so it is visible to everyone.

- Ask students: What is this? (flag of Pakistan)
- Ask them: Where do you commonly see the flag? (On top of houses, on the television, decorated outside on national occasions such as 23rd March and 14th August).
- Explain that flags are used throughout all cultures to represent a vast range of ideas and intentions. They can be simple in nature that represent a group or can be representations of more abstract concepts.
- Now ask them: Have you ever wondered how flags stay upright on our rooftops when we install them there? How do they not fall when wind blows?
  Expected answers: it is installed securely, it is installed with the help of cement/material that keeps it strong and vertical.
- Appreciate their responses and inform them that today they will learn how to install a flag using a plumb line.
- Show them the plumb line and explain that it is a cord with a weight attached to one end and it is used to determine the vertical reference on an upright surface. The free end of the string passes through a hole in the centre of a square plate having each side equal to the diameter of the bob as shown in the picture. It is commonly used during construction of buildings.

Development

Activity 1 — 33 Minutes

- Ask students to line up and take them outside to the ground. Take the flag and plumb line with you.
- Select an appropriate location to install the flagpole. It should not be too close to trees as that might hamper wind from making the flag fly. Choose a location that will allow wind to reach the flag from multiple directions. You may ask students to suggest places to keep them involved.
- Ensure that the location selected is safe to dig. Wires and pipes underneath can be a health hazard therefore, it's best to have the potential area surveyed before you start digging.
- Once the location is finalized, ask 2 volunteers to dig a hole with the help of a shovel/spade. The hole should be 4-6 times the butt diameter of the flagpole. The depth must be 6 inches more than the length of the portion that will go into the soil.
- Now ask another student to put about 6 inches gravel in the bottom of the hole and then stand the ground sleeve on top of it (this is a plastic or steel sleeve that comes with the flagpole).
- The next step is to set the ground sleeve in place and prepare to add cement. To do this, set your ground sleeve in the center of the hole. Ensure that it doesn't move when you add cement to the hole.
- Mix the cement. The amount of cement will vary depending on how big the flag pole and hole are. You may ask a gardener to assist you with this step.
- When the cement is mixed, gently shovel it into the hole around the ground sleeve and continue filling the hole. Stop when you have filled the hole to 1 or 2 inches below ground level.
- When the foundation is starting to set (it may take up to a few hours to set), carefully erect the flagpole in a vertical position with the help of a few students.
- Ensure that it is straight to hold it securely in the place. Use the plumb line; hold its square plate horizontally in contact with any side of the pole. Allow the plumb bob to fall downward.
- Ask students to observe the bob carefully whether the hanging bob touches the pole or stays away. The pole will be vertical when the bob touches the pole (refer to Activity 10.4 given on page no. 139 in the science textbook).
- Ask one student to hoist the flag.
- Appreciate the students' efforts in helping you with the activity.
- Return to the classroom.
- Encourage them to ask questions and clarify their ambiguities.

Conclusion 2 Minutes

- Wrap up the lesson by asking students to briefly describe the activity in their own words.
- One student may explain one step, then move on to the next student.
- In the end, to reinforce how a plumb line works, show students the following video:

https://youtu.be/0XXiSC7Kq54

Assessment- YES/NO cards 2 Minutes

- Divide the class into 2 groups.
- Give group A, a flashcard that says 'YES'. You may write it on a plain white sheet. Similarly, give group B a flashcard that says 'NO'.
- Tell them you will read out a few statements and the answers will be given via the cards provided to them. If the statement is correct, group A will hold up their card and if it is incorrect, Group B will hold up their card.
- Read out the following statements:
  - A plumb line has weights attached to it on both ends.
  - Flags are used to represent different cultures.
  - Plumb lines are commonly used in construction of buildings.
  - Plumb lines help us determine a horizontal reference.
  - A mason uses a plumb line to keep a wall vertical.
- The responses by students will give you an idea of their level of understanding.
- If majority answers are incorrect, re-teach the theory by demonstrating the structure and uses of the plumb line. You may use it to show them the vertical reference of any wall in the classroom.
- If majority answers are correct, appreciate their responses with positive words.

Follow up 1 Minute

- Illustrate the activity done in your science notebooks. Draw the steps carried out, followed by a brief description (one-liner underneath the drawings).
- Focus should be more on the plumb line and how it was used to ensure vertical standing of the flag.

Glossary

Plumb line	A line with a plumb bob attached to it, to find the vertical reference of an upright surface
Plumb bob	a pointed weight attached to the end of a string
Gravel	A loose aggregation of pounded stones
Ground sleeve	It is a base that is designed to support a flagpole

TECHNOLOGY IN EVERYDAY LIFE
Making a Model of a Movable Wagon

Duration: 40 Minutes

Students Learning Outcome:

- Make moveable wagon, bus, trolley, etc.

Materials:

4 rectangle boxes (shoe boxes), brown paper enough to cover the boxes from all sides, paints and popsicle sticks (optional), glue, dowels/skewers/pipe cleaners, cardboard, black marker, scissors, a few pieces of bendable wire/cardboard/pipe cleaners, plain white fabric.

Information for Teachers

- Before cars, trains and planes, people had to travel in a different way. Covered wagons were like the trucks of their time.
- A covered wagon is a large wooden vehicle covered with a canvas tent stretched over the top.
- The first covered wagons were built around 1717 in Pennsylvania.
- They were used as a major mode of transportation for about two centuries.

Introduction 2 Minutes

Begin the lesson by asking students if they can name vehicles used in land transport or how things can be moved or carried from one place to another.

Expected responses: car, bus, wagon, van, motorcycle, cycle.

- Ask students: Do you know how all of these work? How do they move on roads? What is common amongst a car, bus, wagon and van?
  Expected responses: they move because they all have wheels.
- Explain to them that fuel is needed for them to work, they all have a place where people can sit or things can be loaded, a driver has to drive them, these vehicles have specialized machinery specific to each kind of vehicle- some are more complex as compared to others. Tell them they do move with the help of wheels and even wheels come in different sizes depending upon the kind of vehicle.
- Inform them that they will be making their own models of moveable wagons today.

Development

Activity 33 Minutes

- Divide the class into 4 groups.

- Provide resources to each group.
- Instruct them to create the wagon base first- if the boxes are too tall, trim them a little.

- Cover the sides of the box with brown paper- they can do this by tracing the sides of the box onto the sheet of brown paper and then cut them out. Use glue to stick the paper to the box.
- Allow them to paint the box if they like; encourage creativity and teamwork. They may also cover the box with wood craft sticks or Popsicle sticks. However, ask them to leave enough space at the bottom edge to poke holes for the axles.

- Instruct them to poke 4 holes into the long sides of the box for axels using scissors or a hole puncher. There must be 2 holes on each side of the box and they must be as close to the bottom as possible.

- Now ask them to cut the rod into 2 equal pieces of about 1 inch longer than the narrow end of the wagon. If rods are not available, you may use straws or skewers instead.
- Once they are done with this step, tell them to slide the rods through the holes to make the axels. Ensure that the rods have enough space to spin around the holes made; if not, use scissors to make the holes bigger.

- The base of the wagon is ready. Now ask them to prepare the wheels by adding the wheels. Cut 4 identical circles out of cardboard. The height of the circles should be the same as the wagons height. They may paint the wheels brown or black.

- Now ask them to draw black spokes onto the wheels as shown below.

- Once they have drawn them, assist them in cutting the spaces between the spokes for a realistic effect. Only the triangular wedges need to be cut with a sharp cutter.
- The next step is to glue the wheels onto the rods/skewers/straws by poking a hole in the centre of each wheel. Slide the wheels onto the rods and secure them with glue so they don't fall off.

- The base and wheels are ready. Now ask them to prepare a covering for the wagon by using the wires provided to them. Alternatively, thin cardboard or pipe cleaners can also be used if wires are not available.
- Take a round to monitor students' work and guide them where needed.
- Ask them to 2-3 strips of thin cardboard, long enough to create arches when they hold the ends against the sides of the wagon. The arches must be around 3 times the height of the wagon. Then glue the strips in the front and back of the wagon in a U-shape.

- Now instruct them to cut a rectangle out of the fabric provided to them, big enough to cover the frame. If fabric is not available, white plain paper may also be used. Shade the fabric/paper over the arches frame and secure it with glue. Smooth out any wrinkles. Let the

glue dry and then trim away any excess fabric. You may add a harness if desired, by gluing a string to the inside of the front wall of the wagon.

- Appreciate the efforts of all groups with positive remarks.
- Assist them where necessary especially during cutting of the wheels as it can be tricky to cut wedges from the middle.

Conclusion 2 Minutes

- To wrap up, write the following terms on the board and ask students to describe the steps they followed during the activity:
  - *Base creation*
  - *Preparation of wheels*
  - *Covering the wagon*

Assessment- Project demonstration 2 Minutes

- Ask each group to present their model in front of the class.
- Provide feedback and encourage other groups to do the same based on the ability of the wagon model to move and overall aesthetic.
- If any model is unable to move, explore the reason and guide them on how to fix it.
- Motivate students with positive comments.

Follow up 1 Minute

- Briefly enlist the steps used to create a model of a moveable wagon in your notebooks. You may illustrate your work by drawing pictures.

Glossary

Vehicle	Any conveyance in which people or goods are transported from one place to another
Harness	Arrangement of straps used to hold something together

TECHNOLOGY IN EVERYDAY LIFE
Preparing LED Light Strings

Duration: 40 Minutes

Students Learning Outcome:

- Prepare LED light strings working with 12-volt battery.

Materials:

flashcard of LED, 64 LED bulbs, 2 12 Volt batteries, 2 cardboard strips that are at least 1 metre long and 5 cm wide, 2 steel nails/scissors, connecting wires, 2 pliers, 2 cutters. (If resources are limited, you may perform the activity and students can observe, therefore, resources will be reduced by half)

Information for Teachers

- LED stands for light emitting diode; it is a particular type of diode that converts electrical energy into light.
- LEDs are like tiny light bulbs that require a lot less power to light up in comparison with regular light bulbs.
- They are commonly used in mobile phones, televisions and cars.
- While performing the activity, ensure that the positive legs of all LEDs are at one side of the cardboard strip and the negative legs on the other side. If an LED is not glowing, change its leg sides and check again. If it still does not glow, it is a faulty LED, therefore, needs to be replaced.
- Never connect the LED light string to 220V A.C. the circuits of LED light strings to be operated with 220V A.C supply are different.
- LED strings are commonly powered on 5V, 12V and 24V. Strips can be 30, 32, 60, 144 or more per meter.

Introduction 3 Minutes

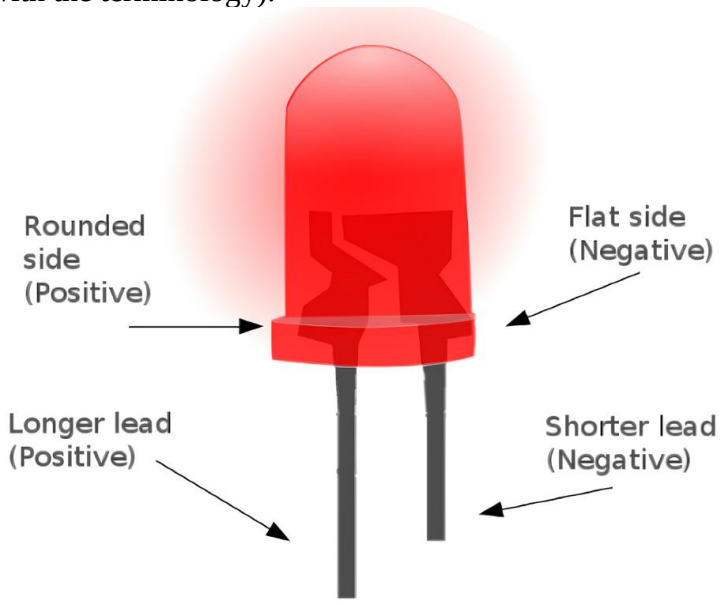
- Write the word LED on the board and encircle it.
- Ask students if they are familiar with what it stands for? (Light emitting diode)
- If they are unable to answer, tell them it stands for light emitting diode. It is a semiconductor device with two terminals that allows current to flow in one direction and it glows when current is provided. LEDs are like tiny light bulbs and are commonly used in our homes, phones and cars.
- Show them the LED string and ask if they know how it will light up.
  Expected response: by connecting it to an electrical source.

- Appreciate their answers and tell them another way is to light it up using a battery, which they will be performing today.

Development

Activity 30 Minutes

- Divide the class into 2 groups and provide resources to each group.
- Show them the following flashcard and explain that an LED has 2 legs; the longer one is positive and the shorter one is negative (they have already studied electricity, therefore are familiar with the terminology).



- Refer to Activity 10.5 in the science textbook. Tell all the students to open page no. 40-41 and follow the steps by looking at the images given in the textbook.
- Ask them to take the cardboard strip and make 32 pairs of holes in it at equal distances with the help of a steel nail or scissors.
- Insert all LEDS in the holes made, keeping positive legs at one end of the strip and the shorter negative legs at the other side.
- Now ask them to join all the 8 positive legs of set 1 together. Similarly, join their negative legs on the other side. Repeat the same process for set 2, 3 and 4.
- Instruct them to join the negative side of set 1 to the positive side of set 2. Similarly join the negative side of set 2 to the positive side of set 3 and negative side of set 3 to positive side of set 4.
- Finally, connect the positive side of set 1 to the positive terminal of the 12V battery and negative side of set 4 to the negative terminal of the battery. The battery acts as a power supply.
- The LED strip is now ready.
- Ask students: what did you all observe? (The LEDs start glowing); what do you think would happen if the voltage of the battery was less than 12V? (They won't light at all or would be very dim); what do you think would happen if the voltage of the battery was more than 12V? (LED may fuse or burn)
- Now ask them to disconnect the battery and then describe what happens (LEDs stop glowing)

Conclusion 3 Minutes

- Show students the following video as a wrap up activity:
  https://youtu.be/8CGEoHSHduc
- Tell them the steps in the video are a little different from the ones in the activity they performed, however, the concept is the same.
- Ask them to draw a comparison between the similarities and differences they observed in both.

Assessment- Sentence prompts 3 Minutes

- Read out the following statements and ask students to complete them:
  - In the activity done today the voltage of the battery was _____.
  - LED is the abbreviation of _____.
  - LED is a _____ that converts _____ energy into _____.
  - LEDs are commonly used in _____.
  - The longer leg of the LED is _____ and the shorter is _____.
  - Predict the outcome of connecting the LEDs to a battery with voltage higher than 12V _____.
- Use positive reinforcement and guide them where required.

Follow up 1 Minute

- Ask students to attempt Q4 (Investigate) given on page no. 148 in their science textbooks.
- This may be done in groups in any free period.

Glossary

LED	A semi-conductor that converts electrical energy into light.
Voltage	The rate at which energy is drawn from a source that produces a flow of electricity in a circuit.

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Science
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