DRAFT

Science

Grades 4-5

Suggested Guidelines - Grade 4

DOMAIN: Life Science

Grade 4

Unit: Life Processes of Plants and Animals
Student Learning Outcomes **Students will be able to:** • Recognize that living things grow, take in nutrients, breathe, have sensitivity, reproduce, and eliminate waste. • Know that living things need energy to grow, live. and be healthy, and plants get their energy from light (photosynthesis) while animals get their energy from eating plants, and other animals. • Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow).

Knowledge:

Students will know:

- that plants and animals need energy to grow, live and be healthy.
- common life processes (respiration, nutrition, growth, reproduction, sensitivity, elimination of waste) of all living things.

Note:

*Assessment of the term *photosynthesis is not required.*

Key Vocabulary

energy, air, water, light, nutrition, respiration, soil, reproduction, sensitivity, movement, food, grow, growth, energy, eliminate waste, life stages, air, water, light, nutrients, wilts, healthy, soil, root, shoot, *photosynthesis*.

Skills:

Students will be able to:

- Use observations to identify and compare the processes of life of familiar plants and selected animals.
- Analyze eating patterns of familiar/ selected animals to know they get their energy from eating plants and other animals.
- Ask questions to begin scientific enquiry on whether plants need energy from light to make their food.
- Plan and carry out fair tests to investigate that plants need light, air, nutrients from soil and water to survive and make food.
- Follow safety rules while doing practical work.
- Ask questions and make predictions regarding the requirements of a seed to germinate.
- Plan and carry out fair tests to investigate the requirements of a seed to germinate.
- Follow safety rules while doing practical work.
- Observe, collect, and record, observations and/or measurements of the germinating seed in tables and diagrams;
    - describe patterns in results, and
    - make a conclusion from results and relate it to the scientific question being investigated.

Assessments

Formative Assessments are commonly referred to as assessment for learning, in which the focus is on monitoring student response to and progress with instruction. Formative assessments provide immediate feedback to both the teacher and student regarding the learning process including: Where the student is going. Where the student is now. How can the student get there? Multiple strategies can be used for formative assessment, such as:

- KWL charts for assessing prior knowledge of students
- Checking for misconceptions regarding the requirements of a seed to germinate
- Discussion questions on life processes
- Think-pair-share to discuss similarities and differences in life processes
- Recording measurements and observations while carrying out experiments.
- Oral and written responses on predictions
- Sequencing picture cards for stages in the germination of a seed
- Entry and Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Self and peer assessments
- Marked Quizzes
- Teacher observations

Summative Assessments are commonly referred to as assessment of learning, in which the focus is on determining what the student has learned at the end of a unit of instruction or at the end of a grade level.

- Projects/ performance tasks with rubrics
- (E.g., 1- Prepare fact cards/ videos/ report etc. to support the claim regarding the requirements of a seed to germinate. 2- Prepare a presentation supporting the claim (based on data collected) that light is essential for a plant to survive)
- End of unit tests including a variety of questions based on knowing, applying and reasoning.

Learning Activities

Activity 1. What are the common life processes of living things?

Ask students: *Are they alive or not alive? How do they know?*

Record students' ideas and create a 'criteria for life'.

Show students a plant and a*sk: Is the plant alive or not alive? How do they know?*

Show students some dried leaves and wood and ask: *Are the dried leaves and wood alive or not alive? How do they know?*

Discuss students' ideas. Establish that they are *not* alive (i.e., they do not react to an external stimulus, they do not grow) *Were the dried leaves and wood once alive? How do they know?*

Discuss students' ideas. Establish that they were *once* alive (i.e., they used to react to external stimuli and grew)

Collect and show a few things which have never lived (e.g., stones, glass). Ask: *Are the stones alive or not alive? Have the stones ever been alive?*

Ask students to draw an animal, plant, something that was 'once alive' (e.g. a fallen leaf) and something that never lived (e.g. a stone). Ask students to label their drawings as either 'alive', 'once alive', 'never lived'. Ask students to add the following labels to the drawings:

- *Moves, grows, reproduces, requires nutrition*
- *Once moved, once grew, once reproduced, once required nutrition*
- *Never moved, never grew, never reproduced, never required nutrition*

Activity 2. Do all living things need energy to grow?

Explain 'fair test' as one of the five types of enquiry.

Provide students with resources (seeds, pots with soil) to investigate plant growth. Ask: *What condition could you change for one of your pots? What are you going to keep the same?* Such as the quantity of water that each pot receives.

Ask students to make predictions and record observations over a period of time by measuring the size of plants and recording these in tables and diagrams. Ask students to *identify the conditions that a seed needs to germinate? Where does the seedling get its energy from?* Encourage students to link observations with reasoning.

Activity 3 Do plants need light and water to survive and make their own food?

Set up fair test investigations as a whole class or in small groups.

At the end of the observation period, ask students to compare each plant to the one that was kept in normal conditions, identifying differences and similarities.

Encourage students to link observations with reasoning.

Which plant is the healthiest? How do you know?

Which plant is the least healthy? How do you know? Why is the one that was uncovered healthier? Where do you think a plant gets its energy from?

Introduce the term 'photosynthesis' and explain it as a process by which plants make their own food.

Further Qs:

1. How does a seedling grow into a bigger plant? Where do the materials that make up a tree trunk come from?
2. Have students then turn to a partner to discuss their responses or discuss students' responses as a whole class.

Activity 4. Where do animals get their energy from?

Explain to students that animals get energy from eating plants or other animals. When we eat and drink, we consume stores of energy. Our bodies turn energy into other forms including movement (e.g., breathing, running)

Ask students: *What is our food made of? What food do other animals eat? What would happen if there were no plants?*

Establish the importance of plants for survival of life. Encourage care of plants in the school grounds buildings and at home.

Cross Curricular Links:

English

Students may use drama to represent the stages of seed germination.

Students may assume the role of a seedling and explain the essential things that they would need to grow and write a story.

Entrepreneurship: Let's Grow our own Food –Project

Students can plant easily grown seasonal vegetables and other plants in recycled shoe boxes, empty milk cartons, recycled plastic bottles and set up a sale at their school. Students can prepare fact cards and care instructions for the plants that they have grown.

Suggested vegetables include: Garlic, onion, coriander, lettuce, tomatoes, etc.

Suggested Links:

https://k8schoollessons.com/germination/

DOMAIN: Life Science

Grade 4

Unit: Plants – Structure and Function

Student Learning Outcomes

Students will be able to:

- Classify the plants into two major groups (flowering, non-flowering), and give examples of each group.
- Identify and describe the functions of different parts of flowering plants: roots, stem/ trunk, leaves and flowers.
- Investigate the way in which water is transported within plants.
- Identify the parts of the plant transport system and describe their functions. -stem, -leaf, -root.
- Identify the parts of a flower and describe their functions (limited to petals, sepals, anthers, filaments, stamens, stigma, style, carpel, and ovary).

- Explore the role flowers play in the life cycle of flowering plants, including pollination, fruit and seed formation and seed dispersal.
- Describe seed germination and know that seeds require water and an appropriate temperature to germinate.
- Identify stages in the life cycles of common flowering plants.
- Demonstrate an understanding of why plants are vital to sustaining life on earth

Knowledge:

Students will be able to know about:

- Plants that do not produce flowers
- The names and functions of different parts of flowering plants; roots, stem/ trunk, leaves, seeds and flowers

a. roots help support the plant and take in water and nutrient

b. leaves help plants utilize sunlight to make food for the plant

c. stems, stalks, trunks, and other similar structures provide support for the plant

d. flowers as reproductive structures of plants that produce fruit which contain seeds

e. seeds contain stored food that aids in germination and the growth of young plants.

- The functions of the different parts of a flower including petals, sepals, anthers, filaments, stamens, stigma, style, carpel and ovary.
- The stages in the life cycle of flowering plants.
- Parts of the plant transport system and describe their functions; stem, leaf, root.
- Transportation of water from the roots to other parts of the plant
- People who use science, professionally, (e.g., botanists) and know how they use it.

Note:

- Recall of the relative positions of water and food carrying tubes is not required.

Skills:

Students will be able to:

- Complete a key based on easily observed differences of a flowering and a non-flowering plant found in the local environment.
- Design models/ draw and label diagrams to show parts of a plant and a familiar flower (e.g., hibiscus).
- Design models/ draw and label diagrams to show the stages in the life cycle of a flowering plant (pollination, fertilization, seed development, seed dispersal, germination).
- Make predictions on how different seeds are dispersed (wind, water, hooked to animals, etc.).
- Test predictions and measure the results.
- Investigate the way in which water is transported within a plant;
    - record observations and changes over time.
    - carry out practical work safely.
    - communicate findings.
    - draw a conclusion from results informed by reasoning.

- *The use of specific terms ("xylem" and "phloem") is not required.* **Key Vocabulary** stem/ trunk, stalk, leaves and flowers, root, reproductive structures, reproduction, nutrients, stored food, seed, transported, transport system, transpiration, petals, sepals, anthers, filaments, stamens, stigma, style, carpel, ovary, ovule, pollination, fertilization, seed germination, seed development, seed dispersal, germination, pollinators, botanist, florist	• Use secondary sources of information to find out about the role of florists and botanists. • Design a 3-dimensional model of an imaginary plant showing its different functions. (STEM/STEAM) • Design a 3 D Model of a seed and explain its method of dispersal. (STEM/ STEAM)

Assessments

Formative Assessments are commonly referred to as assessment for learning, in which the focus is on monitoring student response to and progress with instruction. Formative assessments provide immediate feedback to both the teacher and student regarding the learning process including: Where the student is going. Where the student is now. How can the student get there? Multiple strategies can be used for formative assessment, such as:

- KWL charts for assessing prior knowledge of students on functions of seed and seed germination
- Discussion questions to identify misconceptions
- Recording measurements and observations
- Oral and written responses
- Sequencing picture cards regarding life cycle stages of a flowering plant
- Entry and Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Self and peer assessments
- Designing fact cards
- Marked Quizzes
- Presentations on deigned models
- Projects with criteria/ rubrics

Summative Assessments are commonly referred to as assessment of learning, in which the focus is on determining what the student has learned at the end of a unit of instruction or at the end of a grade level.

Projects/ performance tasks such as:

1. Use diagrams and models to describe parts of a flower and the stages in the life cycle of a flowering plant.
2. Fact cards on different methods of seed dispersal with examples and illustrations.
3. Scientific poster presentations supporting the claim with evidence from scientific investigation (transportation of water).

End of unit test including a variety of questions based on knowing, applying and reasoning.

Learning Activities

Activity 1 Plant Walk

How can you tell if something is a plant? What features are you looking for? Identify with students that all plants are green, have roots and a stem. In pairs, students discuss and write answers to the following questions: *Are trees plants? Do all plants have flowers?*

Select answers at random and read to the whole class. Discuss whether there was a consensus and address any misconceptions. Take students on a walk in your local area (within the school grounds or further afield) and look for different plants. Try to find examples of non-flowering plants such as mosses, ferns and conifers.

Ask them to sketch (or photograph, if cameras are available) the plants. Focus on plants that have no flowers and discuss if they are still plants. *Did you find more flowering or non-flowering plants? Are there similarities or key features of non-flowering plants?*

As a class, classify all the plants seen as 'flowering' or 'non-flowering'. student s can use images of plants, or label plants in their environment, rather than removing plants from their environment and make a key for flowering and non-flowering plants.

Activity 2 Mind Mapping

Bring a plant to your classroom. Prepare a class mind map on plants. Explain that a mind map is a diagram that shows what we know. Ask them to share what they know about plants, the functions of their parts including root, stem, leaf and flower.

Provide students with information on the functions of different parts or use video clips or explain using questions like. What will happen if the root of the plant is cut by mistake? What would happen if there were no leaves or stems?

Ask students to draw a plant in their notebooks and write the function of each part of the plant taking help from the information provided.

Activity 3. Flower dissection

Provide a large flower to the students (individually or in small groups) and ask them to identify the different parts through external observation only. Highlight that the internal parts of a structure cannot be seen by external observation. Highlight the risks of dissection and discuss how students can minimize the risk to themselves. Demonstrate how to use dissection to identify the parts of a flower, A magnifying glass can be used to see pollen on the anthers. students can then dissect and label a flower themselves, then annotate a summary diagram. Discuss with students how the diagram acts as a model of a flower.

Activity 4 Research on Functions of the Parts of a Flower

What is the function of the petals? The other? Ask students to think about and share their ideas and then discuss as a whole class. Discuss how we can find and use a range of secondary information sources (i.e., information that other people have found and written down

In pairs, assign students different parts of the flower to research on using books, encyclopedias or online web pages.

Activity 5 Practical Investigation

How water is transported in a flowering plant? How does a tree get water from the ground up to its leaves?

Ask students about their understanding regarding how water from the soil reaches different parts of the plant. You may use the KWL chart. Record their observations.

Show students a cross-section of the stem to observe coloured water. Conclude that water flows through the stem.

Step 1: Put a few flowers with a long stem in coloured water. Ask students to observe the colour of the flower petals on the second day and tie a bunch of straws with a rubber band and explain that the stem of the flower has tubes inside just like the bundle of straw. Conclude that water flows upwards from the roots to the stem and then to the leaves.

Step 2: Model using a drinking straw how the plant sucks the water upwards just like we use a drinking straw to drink juice.

Step 3: Put a dry sponge in a small tub with little water in it. Soon the sponge will absorb all the water. Ask students how they think this is related to water moving upwards in plants.

Most of the water is evaporated through the leaves of a plant (through transpiration) water from the roots move upwards towards the leaves.

Notes for teachers ***Transport system in plants*** (University of York, Heslington, York Y010 5DD)

Plants have a simple system of tubes that carry water and food around the plant. Towards the outside of the stem, are the phloem tubes. Smaller than the width of a hair, they're packed closely together, and run the whole length of the plant. Each tube is made of living cells, joined end to end, forming a continuous tube. Their thin walls are perforated, like a sieve, to allow sugars made in the leaves to flow to all the other parts of the plant. Further inside the stem is the xylem – dead cells that form a hollow tube.

Water and minerals are drawn up inside these tubes, from the roots to the leaves. But how does this happen? Deep underground, root hair cells project into the soil, seeking moisture…

Because the inside of the cell contains less water than the soil solution, water moves into the root hair cells by osmosis. And towards the xylem in the root.

Once water is in the xylem, another force comes into play…it's generated right at the top of the plant… Transpiration: the evaporation of water from leaves. Transpiration: 90% of water from roots lost through leaves. As water leaves the leaf cells, more water is drawn out of the xylem to replace it... … And because it forms a continuous tube, the hollow xylem acts like a thin drinking straw, sucking water up from the roots. So the secret to how water can move upwards, is that it's pulled, not pushed. The powerful suction force generated by transpiration can draw water to the tops of the tallest trees…NOTE: Xylem and phloem terms are not to be assessed

If resources are available, play the video on the plant transport system.

Activity 5. What is the role of flowers in the life cycle of flowering plants?

Students can use diagrams of different plants to show understanding that not all plants produce flowers. students can make and/or annotate a life cycle diagram of a flowering plant with captions for each stage.

Show students an animation of the life cycle of a flowering plant and ask students to annotate a diagram of the stage in the life cycle. Encourage students to collect seeds to examine closely. Encourage students to make and/or use models of different types of seed to demonstrate dispersal methods; paper helicopters, hook-and-loop fasteners (e.g., Velcro), and parachutes.

Activity 6 What are the different ways of pollination (animal and wind)? What is the role of pollinators? Use Entry tickets to assess students' prior knowledge.

Ask students to use secondary sources to find out about different ways of pollination. Encourage students to do research on how bees and bats help in pollination.

Activity 7 Fertilisation

Ask students to observe flowers near the home and school. Look for the ones that they think are fertilized and changing into fruit. Compare these with the ones that are not fertilized yet.

Ask students to record their observations in the form of notes and diagrams and share with the class.

Activity 8 Role of a Botanist

Ask students what they know about a botanist and/or a farmer?

Ask students to list 4 to 5 questions that they would like to find the answers to. Invite these professionals either online or as guests to your school. Ask students to answer the following questions in their notebooks:

Ask students to imagine that they have been trained as botanists. How do they think as a botanist they can help people in the country? Make a list of ideas. Imagine that they have been trained as farmers. How do they think as a farmer they can help people in the country? Make a list of ideas.

Cross Curricular Links: ARTS & ENGLISH

Word Dictionary about plants/ Crossword puzzles

Encourage students to start preparing a small paper dictionary with all the new terms regarding plants, add a brief, colourful description.

DOMAIN: Life Science

Grade 4

Unit: Animals - Structure and function

Student Learning Outcomes

Students will be able to:

- Distinguish between major groups of animals with backbones (vertebrates: fish, amphibians, reptiles, birds and mammals) and without backbones (invertebrates: e.g. insects, snails, earthworm, jellyfish and corals) on the basis of their characteristics.
- Know that some animals (spider, crab, beetles) have an exoskeleton.
- Describe some of the important functions of the skeleton.
- Describe the human digestive system including the simple functions of the organs involved (mouth, esophagus, stomach, small and large intestine).
- Recognize that humans have different types of teeth (molar, premolar, incisors, canine) and know their functions in digestion of food.
- Investigate the causes and prevention of tooth decay and gum diseases.
- Know that many vertebrates have a digestive system similar to humans.

Knowledge

Students will be able to know about:

- Vertebrates as animals with a backbone (and invertebrates as animals without a backbone (insects, snails, earthworm, jellyfish and corals.
- The important functions of skeletons (limited to protecting and supporting organs, enabling movement and giving shape to the body).
- Exoskeleton and its functions and examples of animals with exoskeleton.
- How bones move because the attached pair of muscles contract and relax.
- Humans have different types of teeth (molar, premolar, incisors, canine) and know their functions in digestion of food.
- The function of the human digestive system and simple functions of the organs involved (mouth, esophagus, stomach, small and large intestine).
- Name an animal that has a similar digestive system to humans.

Key Vocabulary:

backbone, vertebrates, invertebrates, exoskeleton, endoskeleton, skeleton, bone(s), function, major organs, support, protect, movement, muscles, skull, radius, ulna, femur, tibia, fibula, ribs, molar, premolar, incisors, canines

Skills

Students will be able to:

- Collect and record observations and/or measurements in tables and diagrams.
- Label diagrams of the human skeleton.
- Label diagrams of the Human Digestive System.
- Design a 3 D model of a human arm. (STEAM)
- Distinguish between major groups of animals with backbones and without backbones.
- Differentiate between endoskeleton and exoskeleton.
- Use diagrams/ models to locate muscles and bones in the human body. (STEM/ STEAM)
- Label major bones on the diagram of the human body or a physical model.
- Design models to show how muscles in the arm contract and relax and work in pairs. (STEM/ STEAM)
- Construct models to describe the functions of main organs of the digestive system.
- Construct models of different types of teeth (molar, premolar, incisors, and canines) and describe their functions.

Assessments

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- KWL charts for assessing prior knowledge of students regarding skeletons
- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Sequencing picture cards on the way the digestive system processes food
- Entry and Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Self and peer assessments
- Marked Quizzes
- Presentations
- Projects with criteria/ rubrics

Summative Assessments are commonly referred to as assessment of learning, in which the focus is on determining what the student has learned at the end of a unit of instruction or at the end of a grade level.

Projects/ performance tasks with rubrics

(e.g., 1. Use diagrams and components of your models to describe the functions of a skeleton or how muscles work, etc. 2. Fact cards on animals with exoskeleton.

3. Making a model of the digestive system with play dough, labelling its components with scientific words and recording a video clip on how the digestive system works. End of unit tests including a variety of questions based on knowing, applying and reasoning.

Learning activities

Activity 1 Using Identification Keys

Use classification keys to sort animals in different groups based on their physical and behavioral characteristics (vertebrates and invertebrates).

Activity 2 Human Skeleton

Students could label the main bones on a picture or a model of a human skeleton.

Students could use straws (or sticks) to make a physical model of a human skeleton. They could then label the main bones.

Students could add labels to a diagram of a human skeleton with its main functions. For example:

· The skull/: protects the brain.

· The spine gives shape to the body.

· The bones in the arms and legs help the limbs to move.

Sudents could construct a shelter to protect a soft object to represent how the skull (or rib cage) protects the brain (or other major organs).

Students could make a simple model of a hand using cards, straws and string to demonstrate how the skeleton helps to enable movement. Guidance on how to make a simple model of the hand can be found on the internet.

Activity 3 Vertebrates

Students could make a model of vertebrae (or a whole spine) using modelling clay. Alternatively, a piece of tubing and card could be used; the card could be cut into the shape of the vertebrae and slotted along the tubing).

Students could draw diagrams of the skeletons of different vertebrates and label the backbone.

Activity 4 Animals with Exoskeleton

Students could draw animals that have exoskeletons (e.g. insects, snails and shellfish) and label the different types of exoskeleton. Including animals such as tortoises and turtles will add challenges as they have both internal skeletons and an exoskeleton feature (a shell). Clarify that as they have a backbone turtles and tortoises are classed as vertebrates.

Students can create physical models of animals with and without an exoskeleton and use them to discuss how the functions of an exoskeleton is similar to an endoskeleton.

Activity 5 What do teeth look like? What is their function?

This activity focuses on the different types of teeth and their functions. Ask students to look at their teeth in mirrors, to use their tongue to feel their teeth and to discuss what they notice.

Are all your teeth the same shape?

How are they different from each other?

How many teeth do you have?

Using a large model (or diagram) of human teeth, show students the different types of teeth and their functions, introducing and discussing the terms 'incisors', 'canines', 'premolars' and 'molars'. Ask them to use their mirrors to find these different kinds of their teeth in their own mouths.

You could give students a piece of food to eat that is large enough to require taking a bite out of it using incisors and canines (e.g., a piece of bread, a cracker/biscuit, a piece of fruit). As they bite and chew, discuss which teeth are doing which jobs: firstly, the incisors bite off chunks or canines rip food, then the premolars and molars grind down the food so it is small and soft enough to swallow.

On a black and white drawing of a human set of teeth, students colour in the different types of teeth different colours. Students create a key at the side so it is clear which teeth have been given which colour. Then they label the diagram with the function of each type of tooth. Finally, highlight how the diagrams are useful as they clearly show the locations of the different types of teeth, but they differ from the real thing as our teeth are not many different colours.

Resources: Mirrors, black and white diagrams of human teeth.

Activity 6 How can we care for our teeth?

This activity focuses on caring for our teeth. Explain that it is important to take good care of our teeth and discuss the reasons why.

What do you do to take care of your teeth?

What might happen if we do not take care of our teeth?

Using the student's suggestions, create a list of all the things we can do to care for our teeth (e.g., regular brushing, avoiding eating or drinking too many sugary foods). Explain germs in the plaque on our teeth and eat the sugar in our foods. This process produces substances that damage our teeth. Regular brushing of our teeth removes these germs (and plaque) to make sure our teeth are not damaged.

Cross Curricular Links

Language Arts

Students can design cartoon strips as public service messages raising awareness regarding the importance of brushing teeth regularly and the proper way of brushing.

Students can make models of a set of teeth and gums and practice ‘brushing’ making sure they brush each tooth as well as lightly brushing the gums.

Resources: Modelling clay, toothbrushes.

Domain: Life Science

Grade 4

Unit: Ecosystem- Adaptations
Student Learning outcomes: ● Recognize that ecosystems (e.g., forests, ponds, rivers, grasslands and deserts) consist of habitats that provide living things with what they need. ● Recognize and explain that living things respond to environmental conditions. ● Describe how plants and animals are adapted to environments that are hot, cold, wet and/ or dry and describe common physical adaptations of plants (e.g., a thick stem, a waxy coating helps it survive with less water) and animals e.g., colours of animals help in camouflage. ● Associate behaviors of animals with the environments in which they live and describe how these behaviors help them to survive (e.g., migration and hibernation). ● Explore how human actions such as urbanization and population growth can affect a habitat. ● Explain that when a habitat changes, organisms living in it are affected as well.

Knowledge

Students will be able to know:

- Ecosystem is an environment where plants and animals naturally live (e.g., forests, ponds, rivers, grasslands and deserts).
    - Plants and animals are adapted to environments that are hot, cold, wet and/ or dry and describe common physical adaptations of predators and prey.
    - Animals' behavior is associated with the environments in which they live and describe how these behaviors help them to survive (e.g., hibernation or migration).
    - At some places animals are kept in captivity and suggest ways to help animals survive in habitats other than their natural habitat.
    - Behaviors of animals are associated with the environments in which they live and describe how these behaviors help them to survive (e.g., hibernation or migration)
    - some professionals are involved in this area of study (e.g. ecologists, botanists, zoologist, zoo keepers)
    - explore how human actions such as urbanization and population growth can affect a habitat
    - Explain that when a habitat changes, organisms living in it are affected as well.

Key Vocabulary

habitat, environment, forest, pond, river, grasslands, desert, conditions, non-living, environment, adapted, hibernation, migration, adaptation, survive, resources, ecologist, botanists, zoologists, zoo keepers

Skills

Students will be able to:

- Identify similarities and differences between different local environments in terms of hot, cold, dry, wet, few plants, many animals and few animals.
- Ask questions about adaptation.
- Use a range of secondary information sources to research and find about ecosystems.
- Identify and name a variety of living things in their local and wider environment.
- Use classification keys to sort animals as carnivores, herbivores and omnivores, predators, and prey.
- Compare similarities and differences between animals and plants found in different habitats.
- Compare the physical adaptations of a predator and a prey in a given habitat.
- Use science/ scientific reasoning to support points when discussing adaptation.
- Use a model of their animal/plant to illustrate adaptation. (STEM)

Assessments

Formative Assessments:

KWL charts for assessing prior knowledge of students

Discussion questions to address misconceptions

Recording measurements and observations

Oral and written responses

Sequencing picture cards

Entry and Exit tickets

Class Tests including short question answers, labeling diagrams etc.

Self and peer assessments

Marked Quizzes

Presentations

Projects with criteria/ rubrics

Summative Assessments:

End of unit tests

Projects/Performance assessments

Mid Year-End of Year Exams

Learning Activities

Activity 1 What does an ecosystem give living things? Compare 3 to 4 contrasting ecosystems from the wider environment like desert, mountains, grasslands, oceans, etc. Ask students to list the living things and describe the conditions that help them live there. For e.g., Ask: *Where a camel lives? What features does a camel have that help it to live in that habitat?*

Discuss with students and collectively describe some of the ways a camel is suited to living there (e.g., wide feet so they can walk on sand more easily; long eyelashes to protect their eyes from sand and sunlight; a colour that helps them to blend in with their surroundings).

Show students a list of habitats (e.g., desert, meadow, woodland, grassland, forest, seashore, ocean). Ask them to choose two habitats and to research answers to the following questions: *What is the difference between an ecosystem and a habitat? What is the habitat like? What animals live in the habitat?*

Ask students to use identification keys to sort the animals as mammals, reptiles, amphibians, birds, etc. Select one animal and research its eating habits and behavior. Provide students with information sheets or video clips to carry out their research.

Activity 2 Habitats in the Local Environment

Explain the term 'microhabitat' to students. Take students outside to the school grounds (or local area) so that they can explore and identify different microhabitats (e.g., under a log/rock, the branch/canopy of a tree). Provide them with identification keys and empty plastic containers; if available, magnifying glasses or hand lenses, and digital cameras can also be used. Explain that they are going to survey different microhabitats. They describe what the microhabitat is like and what they find there in a table.

What is the habitat like? What animals live in the habitat? How are they suited to the habitat? How are the animals in one habitat different to those in another?

Give students time to survey different microhabitats and identify/record what they find in a table. students then present their findings in bar charts and identify simple patterns.

Make sure all students wash their hands after handling animals and that they understand why this is important.

Resources: Secondary information sources, containers, identification keys.

Activity 3 Scientists and the Environment

Introduce the scientists 'ecologists' and/or 'environmentalists. Explain that scientists who study habitat and living things in them are ecologists. Ecologists use their observations to explain how human actions affect the living things and the environment they live in. Discuss 'What sort of work would an ecologist do in the area where you live?

Activity 4 Plants Adaptation

How are they suited to their habitat? Ask students how we might know a plant is in an environment other than its natural habitat, for example considering how well suited it is to the environment. Show students an image of a rose, a cactus, a pine tree, and a desert environment, a grassland environment, a forest environment.

Can the plant survive those environments? Which environment is its natural habitat? Which environment is it suited to the most? How do we know?

Support students in identifying features of the plant which indicate the environment it originally comes from (e.g., cactus).

Provide students with two sets of cards; plant cards which show images of a plant per card, environment cards which show an environment (e.g., a desert, a forest, a river)

What ecosystem *can each plant survive in?*

Students then match the cards first showing what each plant's natural habitat is and then to show the range of ecosystems each plant or animal can survive in. students can use secondary information sources to support the grouping activity.

Resources: Plant cards, ecosystem cards, secondary information sources

Activity 5 Animals' adaptation- How are they suited to their habitat?

Scientific Enquiry Activity

Recap what the terms 'ecosystem' and 'habitat' mean. Show students an image of a camel which is in a desert ecosystem, a grassland, a forest ecosystem. Can the camel survive in those ecosystems? Which ecosystem is its natural habitat? Which environment is it suited to the most? How do we know?

Provide students with two sets of cards; animal cards which show images of a plant or animal per card, ecosystem cards which show an ecosystem t (e.g., a desert, a forest, a river) *What* ecosystem *can each plant and animal survive in?*

students then match the cards first showing what each plant and animal's natural habitat is and then to show the range of environments each plant or animal can survive in. students can use secondary information sources to support the grouping activity.

Resources: Picture cards of animals and the environment.

Scientific Enquiry Questions

Why do dogs wag their tails? Why do birds fly in flocks? Is there safety in numbers?

How does a polar bear survive in snow? How does a monkey live in the forest? Why do birds have different shaped beaks? Why is the beak of a duck different from an eagle or crow?

Students share their prior understanding and then using secondary sources they learn about animal adaptation.

Scientific Enquiry Activity

Share pictures of animals that are in bad conditions and have difficulty to find food and shelter or are being mistreated by humans. Explain that many plants and animals can survive in environments other than their habitats, but may not thrive. (If required define the difference between survival and thrive for students) Provide an example, such as animals that are kept in zoo enclosures.

Ask students to select any ONE animal found in their locality a dog, a cat, a donkey etc. or select any ONE animal from the local ZOO. Ask students to prepare a set of questions using the key words:

What? Why? How? What if? When? Where? Who?

Ask students to draw the habitat of the animal and prepare a brief report on the conditions that the animal is living in.

Cross Curricular Links with English: Write a diary entry for the selected animal explaining its needs and how the habitat is fulfilling its needs.

Note for teachers: Habitat is the place where living things live: find food, water and shelter. Environment includes everything around us including weather and landscape.

Activity 6 Hibernation and Migration

KWL charts

Provide students with videos or written text to help them answer their questions. Use Videos and text on: Deosai -Home of the brown bear and/or news reports on migratory birds arriving at the coastal wetlands of Pakistan.

Students can role play to show their understanding about 'Migration' of animals.

Activity 7 How we can help living things around us? (STEM)

Discussion question: How do some animals adapt to avoid predators? Ask students to brainstorm ideas on how they can help the animals in their local area.

Tell students that they have been contacted by a local zoo (wild animals) or a person who wants to keep a pet (cat, dog), they want students to support them in designing a habitat enclosure for a few selected animals (For e.g. camel, tiger, monkey etc.). Working in groups, students are required to design a 3D diorama model of the habitat of the selected animal and explain how both the behavior and physical adaptation of the animal will help it survive. Students may also prepare a list of steps regarding how to take care of the animal in its enclosure.

Teachers need to take students through all the steps of the Engineering Design Process.

Note for teachers: Habitat is the place where living things live, find food, water and shelter. Environment includes everything around us including weather and landscape

Suggested Links:

DOMAIN: Physical Science

Grade 4

Unit: Matter and its Characteristics

Student Learning Outcomes

Students will be able to:

- Identify and describe three states of matter and their characteristics.
- Investigate the conditions that cause matter to change states (heating or cooling) and explain the processes associated with it. (i.e., melting, freezing, and boiling).
- Compare and sort the materials on physical properties (mass, volume, density, states of matter, conduction of heat and electricity).
- Identify physical properties of metals (appearance, texture, color, density, conduction of heat and electricity).
- Relate the properties to the uses of metals.

Knowledge:	**Skills:**
Students will know about: ● Three states of matter (i.e., a solid has a definite shape and volume, a liquid has a definite volume but not a definite shape, and a gas has neither a definite shape nor a definite volume). ● Properties of metals and their uses. **Key Vocabulary** mass, volume, matter, states of matter, physical properties, conduction of heat, electricity, density, solid, liquid and gas.	Students will be able to: ● Identify the states of matters by their characteristics. ● Compare and sort the materials on physical properties (mass, volume, states of matter, conduction of heat, electricity, density). ● Investigate the conditions that cause matter to change states (heating or cooling) and explain the processes associated with it. (i.e., melting, freezing, and boiling). ● Describe trends and patterns in results. ● Draw conclusions by interpreting results informed by reasoning. ● Evaluate experiments and investigations, and suggest improvements, explaining any proposed changes. ● Present and interpret observations and measurements, appropriately. ● Identify physical properties of metals (appearance, texture, color, density, conduction of heat and electricity). ● Relate the properties to the uses of metals.

Assessments

Formative Assessments

- Impromptu quizzes, think-pair-share or anonymous voting
- KWL charts for assessing prior knowledge of students
- Short comparative assessments to see how pupils are performing against their peers
- One-minute papers on a specific subject matter
- Lesson exit tickets to summarize what pupils have learnt
- Silent classroom polls
- Ask students to create a visualization or doodle map of what they learnt
- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply when
- Ask students to communicate in several modes (e.g., words and drawings)

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End-of-unit or chapter test

Learning Activities

- Give pairs of students' cards of common substances (a range of solids and liquids including, but not limited to, oxygen, carbon dioxide, water (vapor), nitrogen, and hydrogen). They use secondary information sources to support them finding out about, and then sorting, unknown substances into those that naturally occur as solids, liquids, and gases.
- Ask students to work in groups and create a human model of three states of matter: solid, liquid, and gas.

Suggested Links:

http://howtofunda.com/states-of-matter-modelmolecule-arrangement-in-solid-liquid-gas/

DOMAIN: Physical Science

Grade 4

Unit: Forms of Energy and Energy Transfer

Student Learning Outcomes

Students will be able to:

- Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) as the ability to cause motion or create change.
- Describe the properties of light (travels in straight line, travel very fast and in all directions).
- Use light travelling in a straight line to explain the formation of shadows and reflection.
- Demonstrate the production of sound.
- Relate familiar physical phenomena (vibrating objects) to the behavior of sound.
- Identify the different sounds on the basis of softness and loudness.
- Understand temperature as the degree of hotness or coldness of an object or place.
- Demonstrate that the warmer objects have higher temperature than cooler objects.
- Demonstrate changes occur when hotter objects are brought closer to the cooler objects.
- Describe the ways to measure the temperature and its units.
- Use various instruments (room thermometers, anemometer, clinical thermometer, etc.), and measure and record temperature using different scales.
- Recognize that electrical energy in a circuit can be transformed into other forms of energy (light, heat, sound).
- Demonstrate that simple electrical systems (e.g., a flashlight) require a complete (unbroken) electrical pathway.

Knowledge:	**Skills:**
Students will know: • That energy is needed to do work. • That energy exists in many forms such as light, sound, heat and electricity. • The properties of light (travels in a straight line, travel very fast and in all directions). • That light travelling in a straight line results in reflection and formation of shadows. • How familiar physical phenomena (vibration objects, echoes) are related to the behavior of sound. • Ways to measure the temperature and its units. • That electric energy in a circuit can be transformed into other forms of energy (light, heat, sound). **Key Vocabulary:** reflection, temperature, vibration, conservation, rainbow, electrical pathway, electric system, electric energy, vibration, echoes, energy conservation	Students will be able to: • Relate familiar physical phenomena (shadow, reflection, and rainbow) to the behavior of light by demonstration. • Investigate the formation of shadow making and reflection in shiny surfaces. • Investigate that warmer objects have higher temperature than cooler objects. • Investigate changes occur when hot objects are brought closer to cooler objects. • Apply mathematical concepts (for example; percentages and ratios) to analyze data and present the data collected in the form of graphs, charts and tables. • Describe trends and patterns in results. • Make conclusions by interpreting results informed by reasoning. • Evaluate experiments and investigations, and suggest improvements, explaining any proposed changes. • Present and interpret observations and measurements, appropriately. • Investigate that simple electric systems (e.g., a flashlight) require a complete (unbroken) electrical pathway. • Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. (STEM)

Assessments

What I **K**now	What I **W**ant to know	What I **L**earned
An oven is hot A pot gets hotter on flame We measure temperature/heat with thermometer When a toasted sandwich is prepared, the cheese inside is hotter than the bread. When rubbing the hand, they get hotter. 1 Students skim the text and writes what they know	How rubbing the hand increases the temperature What is heat/temperature What is the difference between heat and temperature How fire makes object hotter How thermometers work Why does preparing a toasted sandwich the cheese inside is hotter than the bread. 3 Students ask their questions to the text	Temperature is the average kinetic energy of the molecules Heat is the energy transferred from hotter object to the other one. Temperature is measured by thermometer. $Q=m.c.\Delta t$ When the molecules of the liquid jiggles faster with increasing temperature, the liquid expand and gets higher through the scale. Fire gives heat energy to the object, then the object jiggle faster and temperature- average kinetic energy increase. 4 The answers of questions asked in W are written and

Categories
Heat/Temperature
Change in the temperature
Thermometer

2 The information known is categorized

Formative Assessments

- Impromptu quizzes or anonymous voting
- KWL charts for assessing prior knowledge of students
- Short comparative assessments to see how pupils are performing against their peers
- One-minute papers on a specific subject matter
- Lesson exit tickets to summarize what pupils have learnt. A
- (/www.researchgate.net/figure)
- A simple but effective formative assessment is the Exit Ticket. Exit Tickets are small pieces of paper, or index cards, that students deposit as they leave the classroom. **Students are required to write down an accurate interpretation of the main idea behind the lesson taught that day, and then provide more detail about the topic.** Teachers review the responses, and gain insight as to which

students have fully learned the concept, and those that are still struggling. The information obtained can be used to plan a whole-group or partial-group lesson to re-teach the concept.

Admit Tickets are done at the very beginning of the class. Students may respond to questions about homework, or on the lesson taught the day before.

- Silent classroom polls
- Ask students to create a visualization or doodle map of what they learnt
- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply when
- Ask students to communicate in several modes (e.g., words and drawings)

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End-of-unit or chapter tests

Learning Activities

- Explain to students that they are going to go on an 'energy hunt'. Ask them to identify different types of energy in the school buildings and grounds and record their findings in a table.

- Give students different types of percussion and string musical instruments. Ask them to explore how movement energy is transferred into sound energy when they play the instruments (e.g., when they hit the drum with their hands movement energy is transferred into sound energy).
- Design an activity to show transmission of energy. Make a paper windmill/pinwheel. Demonstrate that blowing air into the pinwheel generates motion and is a transmission of energy.
- Use string/paper cups to create a simple telephone.
- Use rubber bands with a small box to create a simple music instrument.
- In pairs, students stretch some plastic film over a bowl and hold it in place with a rubber band. The plastic film should be stretched quite tightly like the skin of a drum. Sprinkle some rice (or dried beans) on top. Ask students to tap the side of the bowl with a spoon, demonstrating that energy is transferring from spoon to rice through plastic film.
- Take a steel spatula and place it in hot water. Heat will transfer from the tip of the spatula to the handle.
- Student s could stretch a rubber band without letting go, to demonstrate potential energy
- Students could use drama to demonstrate the process by which we see an object which is not a light source. In groups students role-play a light source (e.g., the Sun), a light ray', an object and an eye. The student representing the light ray leaves the student representing the light source, walks towards the student representing the object, bounces off the 'object' and moves towards the student representing the eye.
- Divide students into groups; give each group a battery, two wires and a lamp. Model how to make a simple circuit and ask students to make their own. Ensure that every group has been able to make their lamp light up. Ask students to carefully place their hand near to the lamp, warning them not to actually touch the lamp, demonstrating that electricity transforms into heat and light.

Suggested Links:

https://www.globalcallforwarding.com/learn/how-to-make-a-telephone-with-paper-and-plastic-cups/

https://www.kennedy-center.org/education/resources-for-educators/classroom-resources/media-and-interactives/media/music/strike-up-the-band-creating-homemade-instruments/

https://layers-of-learning.com/heat-conduction-experiment/

http://homeschoolfridays.com/how-to-see-sound-experiments-for-kids/

https://learning-center.homesciencetools.com/article/simple-circuits-activity/

DOMAIN: Physical Science

Grade 4

Unit: Force and Motion

Student Learning Outcomes

Students will be able to:

- Describe different types of forces (friction, resistance, muscular forces, applied, gravitational, magnetic, electric).
- List uses of different types of forces in our daily life.
- Explore how forces can make objects start or stop moving.

- Know that an object may have multiple forces acting on it, even when at rest.
- Compare the effects of forces of different strengths in the same or opposite directions acting on an object.

Knowledge:

Students will be able to:

- Describe different types of forces (friction, muscular forces, gravitational, magnetic, and electric).
- List uses of different types of force in our daily life.

Key Vocabulary

push, pull, friction, gravity, magnetic. gravitational, magnetic, and electric

Skills:

Students will be able to:

- Investigate forces with examples.
- Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. Examples could include an unbalanced force on one side of a ball can make it start moving; balanced forces pushing on a box from both sides will not produce any motion at all.
- Describe trends and patterns in results; draw conclusions by interpreting results informed by reasoning.
- Evaluate experiments and investigations, and suggest improvements, explaining any proposed changes.
- Present and interpret observations and measurements, appropriately apply mathematical concepts (for example; percentages and ratios) to analyze data and present the data collected in the form of graphs, charts and tables.
- Make parachutes from tissue paper and string and experiment with toy skydivers to explore "invisible" forces like gravity and resistance. (STEM)

Assessments

Topic: GRAVITY

K	W	L
It keeps us from floating around.	What is gravity?	Gravity is the force that pulls objects towards Earth.
It makes things fall.	Why is there less gravity on the moon?	The amount of gravity there is depends on the masses of the objects involved. The moon is a lot less massive than the earth, so there is less gravity on the moon than there is on earth.
There is less gravity on the moon.	How did Newton discover gravity?	
Isaac Newton discovered gravity.	What determines how fast something will fall to the ground? *(teacher question)*	Air resistance determines how fast something will fall to the ground.

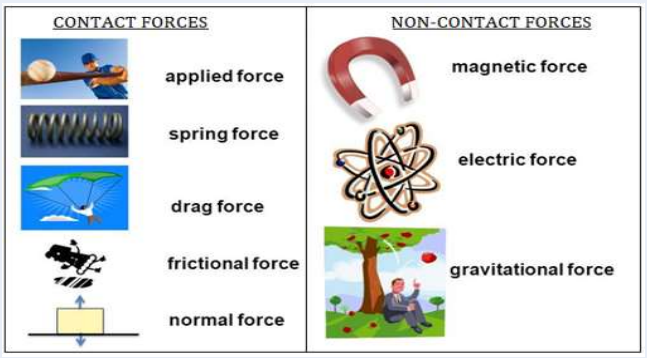
* The students' question about Newton was not answered in the text. Students should be encouraged to consult other sources to find out the answer to this question.

-Formative Assessments

- Impromptu quizzes or anonymous voting
- KWL charts for assessing prior knowledge of students

- Short comparative assessments to see how pupils are performing against their peers

- One-minute papers on a specific subject matter



(/goprep.co/)

- Silent classroom polls
- Lesson exit tickets to summarize what pupils have learnt
- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to
- apply and when
- Ask students to communicate in several modes (e.g., words and drawings) that are accessible and interesting

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End-of-unit or chapter tests

Learning Activities

- Present a range of force diagrams to the students, each showing a different way to represent the forces. Students discuss, in pairs, the advantages and disadvantages of each type of force diagram.
- Explain to the students that there is a standardized way to represent the forces acting on an object; these standard force diagrams show the name, direction and size of each force acting on an object.
- Set up the scenarios below and discuss with students what forces are acting on the object. Get them to draw accurate force diagrams for each situation. Place a toy car on the table and leave it alone. (Balanced forces: Gravity pulls it down; the normal force pushes it up. Roll a ball slowly across a table. (Balanced forces: Gravity pulls it down; the normal force pushes it up. Unbalanced forces: A push, applied force causes it to roll; friction slows it down by pulling it. The applied force is larger than friction to start with which is why it moves.)
- Students could use Newton meters to measure the force it takes to make four different objects move.
- Give students a small whiteboard (or a piece of card), a magnet and a paperclip. Ask them to draw a maze with a start and a finish. Then they use the magnet (underneath the whiteboard) to guide the paper clip through the maze, from the start to the finish.
- Students could make a catapult and investigate by changing different variables.

Suggested Links:

- https://www.parents.com/toddlers-preschoolers/everything-kids/irresistible-activities-to-do-with-magnets/
- https://www.youtube.com/watch?v=PL1SoBIBVv8

DOMAIN*:* Earth and Space Sciences

Grade 4

Unit: Earth and its Resources
Student Learning Outcomes **Students will be able to:** ● Define natural resources. ● Explore the use of natural resources and how they are useful in our daily lives. ● Differentiate between renewable and non-renewable resources. ● Suggest ways to conserve natural resources. (Practice 3Rs) ● Recognize that air and water are valuable resources. ● Recognize that earth's surface is made up of land and water and is surrounded by a layer of air called the atmosphere which is a mixture of different gases (nitrogen, carbon dioxide, and oxygen, etc.). ● Describe the sources of water on the planet.

Knowledge:	**Skills:**
Students will: ● Define natural resources. ● Explore the use of natural resources and how they are useful in our daily lives. ● Differentiate between renewable and non-renewable resources. ● Suggest ways to conserve natural resources. (Practice 3Rs) ● Recognize that air and water are valuable resources. ● Recognize that Earth's surface is made up of land and water and is surrounded by a layer of air called the atmosphere which is a mixture of different gases (nitrogen, carbon dioxide, and oxygen, etc.). ● Describe the sources of water on Earth. **Key Vocabulary** natural resources, nitrogen, carbon dioxide, oxygen, atmosphere, fossils, renewable resources, non-renewable resources	Students will be able to: ● Sort, group, and classify different types of natural resources through testing, observation and using secondary information. ● Use evidence to explain that humans depend on many limited natural resources that may not be renewed over human lifetimes. ● Investigate the impact of human activities on earth's natural resources. ● Explain and make predictions about what will happen if natural resources finish using scientific knowledge and understanding. ● Draw conclusions by interpreting results informed by reasoning from secondary information.

Assessments

Formative Assessments

- Think-pair-share
- Exit Tickets
- One-minute papers
- Quizzes and silent polls
- Dipsticks
    - Write a letter explaining the key idea to a friend
    - Draw a sketch to represent new knowledge

Summative Assessments

- End of unit or chapter tests
- Final project
- Mid-term or end of term exams

Learning Activities

Activity 1

Take the students on a nature walk in the school playground or nearby park and ask students to identify 5 natural resources around them.

Activity 2

Scavenger Hunt: Divide the class in groups of 4 or 5 and give them a worksheet with different natural resources on it. Take them out in the school playground or nearby park and ask them to find these natural resources in their surroundings and put a tick next to it when they have found it. Ask them to return to their class when they have discovered all of them.

Activity 3

Instruct students to explore their school, homes, surrounding areas, and find out different ways the water is being wasted. Divide them into groups and ask them to make a report/project/poster/pamphlet on how to conserve water and run a campaign in school (through morning assembly or class room visits).

Activity 4

Ask students to identify an unused item in their household and determine a new way to use it and give students the choice to prepare a report, poster, oral presentation, or multi-media presentation to share what they did and talk about recycling and its importance.

Activity 5

Split the students into groups and instruct them to make bird feeders out of recycled materials and ask them to discuss why recycling is important for conservation of resources. Picture attached below as

Retrieved from:

DOMAIN*:* Earth and Space Sciences

Grade 4

Unit: Earth's Weather and Climate
Student Learning Outcomes **Students will be able to:** ● Understand the difference between weather and climate. ● Recognize that average temperature and precipitation can change with seasons and location. ● Apply knowledge of changes of state of water to common weather events (e.g., cloud formation, dew formation, the evaporation of puddles, snow, and rain), and understand the water cycle. ● Define climate change and describe how it affects the world. ● Suggest some ways to reverse climate change in your country.

Knowledge:	**Skills:**
Students will: ● Recognize the difference between weather and climate. ● Recognize that average temperature and precipitation can change with seasons and location. ● Recognize temperature as the degree of hotness or coldness of an object or place. ● Define climate change and describe how it affects the world. ● Suggest some ways to reverse climate change in our country. **Key Vocabulary** weather, climate, temperature, humidity, precipitation, geographical location, season, climate change, evaporation, dew, water cycle, thermometer	Students will be able to: ● explore the weather and climate in their geographical area. ● Use and share observations of local weather conditions to describe patterns over time. ● Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. ● Use evidence to analyze how weather changes during the year. ● Apply knowledge of changes of state of water to common weather events (e.g., cloud formation, dew formation, the evaporation of puddles, snow, and rain), and explore the water cycle. ● Use various instruments (room thermometers, anemometer, clinical thermometer etc.), and measure and record temperature using different scales. ● Analyze how climate change affects the weather. ● Analyze a problem, and choose an innovative and relevant solution in order to remedy, or alter, the problem. ● Make predictions of likely outcomes for a scientific enquiry ● Make predictions about what would happen to earth, animals and plants if we do not reverse climate change. ● Analyze evidence of human-induced climate change.

Assessments

Formative Assessments

- In-class discussions
- Weekly quizzes
- Exit tickets
- 1-minute reflective writing assessment
- Silent classroom polls
- Art work to represent what they learned

Summative Assessments

- Teacher designed quizzes and tests
- Group presentation
- Writing:
- Research Paper
- Letter to the future generation

Learning Activities

Activity 1

Ask students to obtain weather data such as temperature by watching the news for one week (for the city they live in) and analyze in the classroom how typical weather during a particular season looks like in their area.

Activity 2 Using a Thermometer

Step 1: Before going outside, demonstrate how students should safely use and read a thermometer. These are tools, not toys.

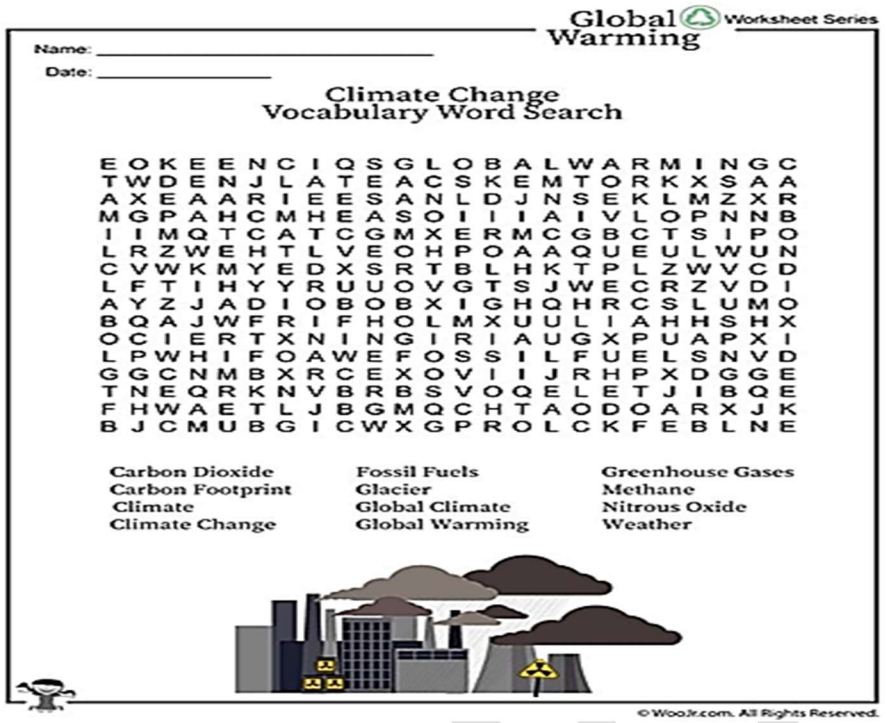
Step 2: Once outside, pass on the thermometer in small groups and ask students to measure and record the temperature in their science notebooks.

Step 3: Gather the class to share temperature results and discuss why it is this temperature? What month is it? Does it look like this everywhere in the world? Why not?

Arrange various instruments such as room thermometer and clinical thermometer and make students measure temperature in their classroom, in the ground and the Principal's room.

Activity 3

Ask students to hold a campaign in their school where they can go to each classroom to teach students about climate change and how it can be reversed.



Activity 4

Ask students to make a weather journal using recycled material.

Activity 5

Ask students to do a word search and then discuss the meaning/definition of the terms in pairs.

DOMAIN*:* Earth and Space Sciences

Grade 4

Unit: Earth in the Solar System
Student Learning Outcomes **Students will be able to:** ● Name the 8 planets- their order and size; describe the solar system, orbit, asteroid, stars, and comets. ● Recognize that earth has a moon that orbits around it, and looks different at different times of the month, and understand how lunar eclipse and solar eclipse occur.

Knowledge:	**Skills:**
Students will: ● Describe the Solar System with the Sun at the center and the planets revolving around the Sun. ● Understand that planetary systems can contain stars, planets, asteroids and comets. ● Recognize that the Earth has a Moon that revolves around it, and from Earth the Moon looks different at different times of the month (Phases of the Moon). ● Investigate and describe how day and night are related to Earth's daily rotation about its axis and provide evidence of this rotation from the changing appearance of shadows during the day. ● Illustrate and explain how Solar and Lunar Eclipses occur. **Key Vocabulary** solar system, stars, asteroids, comets, planets, shadows, lunar eclipse, solar eclipse	Students will be able to: ● Demonstrate the Solar System with the Sun at the center and the planets revolving around the Sun (through model or diagram). ● Differentiate between inner planets and outer planets on the basis of distance from the Sun. ● Determine the relative position of the planets from the Earth. ● Use best approach for their research (library, online, newspaper, etc.) to write and present a research paper on any one planet. ● Investigate and describe how day and night are related to earth's daily rotation about its axis, and provide evidence of this rotation from the changing appearance of shadows during the day.

Assessments

Formative Assessments

- Five-minute interview assessment
- Casual chats with students
- Thumbs up and thumbs down activities
- Keep the question going: Ask one student a question and then ask another student if the answer seems reasonable or correct? Then ask a third student for an explanation for why there is an agreement or not.
- 30 second share

Summative Assessments

- Final project/presentation
- Graded unit tests
- Mid-term or end of year exams

Learning Activities

Activity 1

Modeling Planetary Orbit: Create models of the planets using balloons.

- Step 1: Use a large yellow balloon to represent the sun and balloons of eight different colors to represent the planets.
- Step 2: Use a large open area and mark the orbits of each planet using chalk or string.
- Step 3: Make one child hold the yellow big balloon and stand in the center representing the sun.
- Step 4: Assign other eight children different planets and make them stand on the line representing their planet's orbit.
-

Activity 2

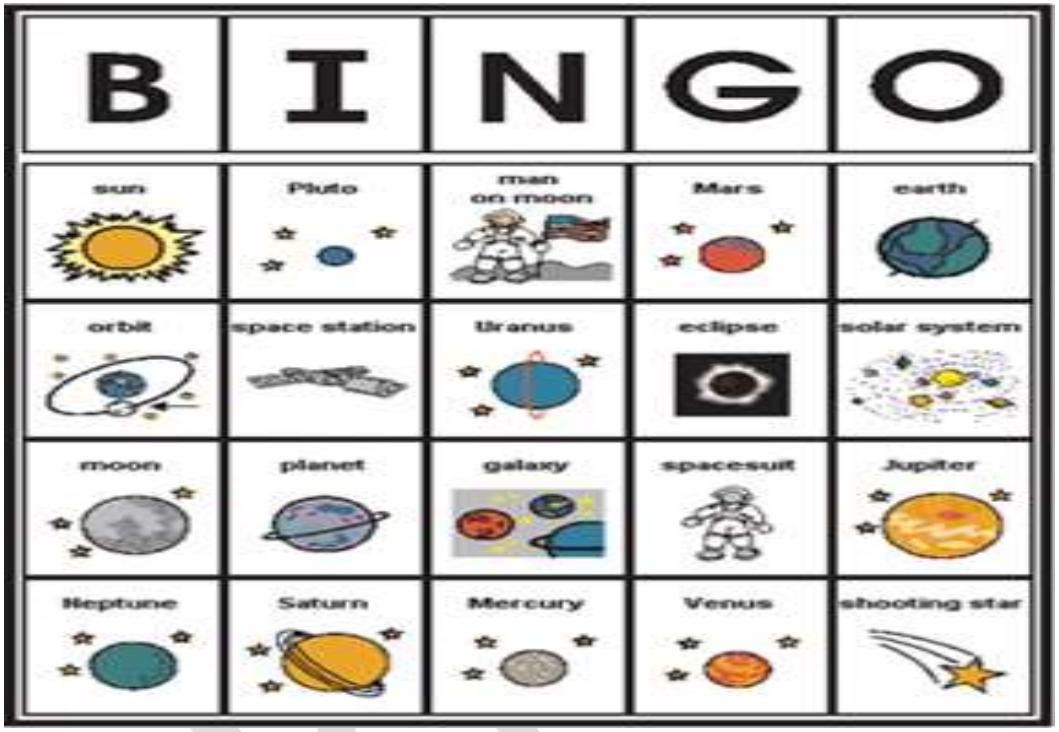
Planet Jumble:

Hand over eight pictures of the planet and one picture of the sun and one picture of the Earth's moon and ask the students to direct each other where to stand, placing the sun first and the eight planets in their order and the moon right next to the Earth.

Activity 3

Solar System Bingo:

Create bingo cards with different vocabulary words in the unit and make sure that each student has a different card. Call out the definitions of the vocabulary words and continue the play until one student has five terms covered in vertical, horizontal or diagonal row. One sample of bingo card is given below:



BINGO GAME 1 (BINGO)

Activity 4

Make models to explain the Lunar and Solar Eclips,e and different phases of the Moon. Some examples of the models are given below:

MODEL MAKING 1 Retrieved from: (modelmaking)

Activity 5

Group presentations on the Solar System - Booklet/Report/Group project.

NCP - Science

Suggested Guidelines - Grade 5

DOMAIN: Life Science

Grade 5

Unit: Structure and Function- Human Body Systems

Student Learning Outcomes

Students will be able to:

- Know that the human body has a number of systems, each with its own function.
- Recognize the integration of the different systems (digestive, respiratory, and circulatory) in carrying out life processes.
- Use a model to describe how we receive different types of information through our senses, process the information in our brain and respond to the information in different ways.
- Describe the human respiratory system in terms of oxygen from the air moving into the blood in the lungs and know that many vertebrates have a similar respiratory system.
- Identify by name the main parts of the Human Circulatory System, and describe briefly the functions of the heart, blood vessels and blood.
- Know that many animals have a circulatory system similar to humans.

Knowledge:

Students will be able to know:

- The human body has a number of systems, each with its own function.
- The Human Respiratory System in terms of oxygen from the air moving into the blood in the lungs.
- The main parts of the Human Circulatory System, and describe the functions of the heart, blood vessels, and blood.
- The senses and related sense receptors and describe the different types of information that they gather from the surroundings (e.g., sound, light, odor, temperature).
- The information gathered is processed in the brain and this leads to our actions.

Note: Detailed knowledge of the respiratory system (e.g., alveoli, bronchioles) and circulatory system (e.g., chambers and valves of the heart) is not to be assessed.

Key Vocabulary

life processes, digestive system, respiratory system, circulatory system, oxygen, nutrients, waste, blood vessels, circulate, blood cells, pulse, heart rate, arteries, capillaries, veins, gas exchange, breathing, diaphragm, trachea, bronchi, exhale, inhale, exhalation, inhalation, breathing rate, sensory, sense organs, brain and nervous system, receptors

Skills

Students will be able to:

- Ask questions about the relationship between different structures in the human body.
- Recognize the integration of the different systems (digestive, respiratory, and circulatory) in carrying out life processes.
- Use secondary information to find answers to scientific inquiry questions about the integration of systems (digestive, respiratory, circulatory).
- Illustrate through diagrams or *3d physical models the functions of the respiratory, and circulatory system. (STEM/ STEAM)
- Practice taking your own and others' pulse.
- Use a model to describe how animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

*Note: *Use recycled materials to make physical models.*

Assessments

Formative Assessments

KWL charts for assessing prior knowledge of students

- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Sequencing picture cards
- Entry and Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Self and peer assessments
- Marked Quizzes
- Presentations
- Projects with criteria/ rubrics

Summative Assessments

End of unit tests

- Performance assessments/ projects STEM/STEAM

Learning Activities

Activity 1

Respiratory System

KWL Charts

- Discussion questions: *Why is breathing so important? What do animals (including humans) need from the air? How does air move into our body? What is contained in exhaled air? How does the lung work? What are the functions of lungs?*
- Show simulations of how lungs work. Provide students with a diagram of the respiratory system and ask students to label it.
- Ask students to make a model of lungs and explain how they work.
- Ask students to construct a physical model of the respiratory system with a cardboard sheet, tube and balloons. Use the tube to model the trachea; ensure it is sealed at one end and make two holes (opposite each other). Attach the balloons to the tube so the opening of one balloon is secure against one hole. Attach the balloons to two pieces of card so the balloons are sandwiched between them. Students holding the model securely can model muscles moving by pulling the cards apart, inflating the balloons in the process.
- Oxygen moving from the lungs into the blood can be modelled by students: Some student s wear something red (i.e., blood); others form a line and link arms (i.e., the lining of the lungs) and others hold balls of the same colour (i.e., oxygen). As the 'blood' student's move in a circle past the 'lungs' the students with the 'oxygen' balls pass the oxygen over the student's being the lining of the lungs to the blood.
- Ask students to use the model to explain how the body pushes air out of the lungs.

Activity 2

Circulatory System

- Students watch a video (or animation) of the human circulatory system and ask students to note the main parts of the system and what they do. Discuss: *What does the heart do? What are the different types of blood vessels and what do they do?*
- Students can do research to find out different ways they can keep their hearts healthy.
- Students can use secondary sources to find answers to their questions. students demonstrate their understanding of circulatory systems by drawing (or using) the circulatory systems of a range of different animals (e.g., mouse, cat, bat, fish).
- STEM/ STEAM Simple pumps can be used to model the heart. The pump can be attached to pipes with different diameters to model the flow of blood through different types of blood vessels.
- Ask students which parts of the model worked well.
- Ask students to use the model to explain how blood transports oxygen, nutrients and waste.

Activity 3

Functions of the Two Systems

A large diagram of the circulatory system (including capillaries) could be drawn with chalk on a large outdoor surface. students then move around the diagram, following the arteries, capillaries and veins like a one-way road system. Balls of different colours can be used to represent nutrients, oxygen and carbon dioxide. students pick up nutrients at the intestine, swap carbon dioxide for oxygen at the lungs, and swap oxygen and nutrients for carbon dioxide at the muscles.

Activity 4

Senses and Sense Receptors

- Show students videos/ text on different animals and how they sense different information and react accordingly. e.g., frogs with their amazing sense of hearing; chameleons with a unique sense of sight. Some bats, whales, and dolphins use echolocation to find their prey, etc.
- Ask students to share what they know about the human sense organs and what sort of information they gather.
- Explain that our eyes, ears, nose all help to gather sensory information. Each organ has special structures that collect information and then send it to the brain. The brain in turn tells us how to act. Brain is part of the nervous system. The nervous system also includes the spinal cord with miles of nerves spread throughout the body.
- Ask students to prepare a scientific poster showing their understanding of the sensory receptors.

Activity 5

Demonstrate Learning using Models (STEM/STEAM)

Cross- curricular Links with Robotics /Using Sensors

Ask student s to design a model to demonstrate that reflected light allows objects to be seen by the eye, which relates to animals' use of sense receptors. Take students through the steps of the engineering design process.

DOMAIN: Life Science

Grade 5

Unit: Microorganisms & Diseases
Student learning Outcomes **Students will be able to:** ● Define and describe main groups of microorganisms (bacteria, virus and fungi) and give examples of each. ● Recognize some common diseases of each group (bacteria, virus and fungi) caused by microorganisms. ● Recognize that microorganisms get transmitted into humans and spread infectious diseases. ● Differentiate between infectious and non-infectious diseases and relate the transmission of common infectious diseases to human contact and explain some methods of preventing their transmission. ● Recognize the advantages of microorganisms. ● Investigate the role of microorganisms in producing or breaking down/ decomposing materials.

Knowledge:

Students will be able to know:

- The main groups of microorganisms (bacteria, virus and fungi), and give examples of each.
- That some common diseases caused by each group of microorganisms (bacteria, virus and fungi).
- That humans have defense mechanisms against infectious disease, including skin, stomach acid, and mucus.
- The effects of too much sugar in their diet, and how it can lead to health problems.
- How good hygiene, and a range of other measures, can control the spread of diseases transmitted in water, food and body fluids; describe ways to avoid being bitten by insects.
- How vaccines can provide protection against diseases like malaria, polio, and COVID-19.

Key Vocabulary

diseases, microorganisms, germs, microscopic, transmitted, infectious, defense mechanism, skin, mucus, stomach acid, hygiene, control measures, COVID 19, virus, bacteria, fungi, mold, vaccine, vaccination

Skills:

Students will be able to:

- Ask questions that would lead to scientific investigations about how the body defends itself against disease.
- Make predictions on how a mould would grow on a piece of bread, using scientific ideas.
- Use secondary sources (videos, text, and simulations) to research microorganisms that cause diseases.
- Investigate sneezing as a defense mechanism.
- Record observations using appropriate tools, and share the findings in a variety of modes Reach conclusions about mold growth on bread from the results they collect.
- Communicate findings using scientific vocabulary and evidence-based reasoning.
- Research coronavirus and share findings explaining why it was declared a pandemic.

Assessments

Formative Assessments

KWL charts for assessing prior knowledge of students

- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Sequencing picture cards
- Entry and Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Self and peer assessments
- Marked Quizzes
- Presentations
- Projects with criteria/ rubrics

Summative Assessment

End of unit tests

Projects/ Performance Assessments

Learning Activities

Activity 1: Infections and Diseases

- KWL charts
- Ask students: *What diseases do they know about? What causes them? How are they spread?*
- Explain that our body systems work together to perform important life functions. Ask students how they can keep their body organs healthy.

Activity 2: Research

- Introduce the terms infection and infectious diseases and ask students to carry out research, using secondary information sources.
- students may prepare fact cards or Scientific posters for some common diseases, including what causes them and how they are spread.
- Digital etiquettes - Remind students to mention the source of the information collected.

Activity 3: Grouping Common Infectious Diseases

- Explain that infectious diseases are one of the leading causes of death across the world.
- Ask student s to group the diseases that they are familiar with in different ways e.g., *What causes the disease? How does it spread? How can it be prevented?* etc.,

Activity: Investigating Sneeze – A Defense Mechanism

- Explain that scientists use models to study a phenomenon. Ask students to investigate through a model how far a sneeze travels.
- Provide students with coloured water in a spray bottle. Ask them to press the bottle and mark how far the coloured water is sprayed. Measure and record the distance. Ask students to repeat the process a number of times and record how far the coloured water drops spread.
- Ask students to plot a graph of their findings. Discuss sneezing as a defense mechanism of the body.

Activity 5

- Discussion with a physician or specialist in infectious diseases (if possible)
- students can prepare questions (regarding what causes the disease and how it can be prevented) to ask specialists in the field.

Activity 6: Research Project

- Ask student s to do research to find out:

1. How are microorganisms used to make yogurt?

2. How are microorganisms important in the human digestive system?
3. history of penicillin

- students can share their findings in the form of presentations or scientific posters.

Activity 7

- What does the term ‘pandemic’ mean?
- Ask students to prepare a mind map regarding what they all know about COVID 19 and how it spread and still spreading around the world.
- Share newspaper articles by WHO on COVID 19 pandemic.
- Ask students to note down key points from the report regarding how the virus spreads and the role of vaccines.
- Ask students to carry out surveys in their local area to find out what percentage of individuals are vaccinated. students can prepare ‘Public service messages’ to raise awareness on the importance of vaccines.

DOMAIN: Life Science

Grade 5

Unit: Ecosystems
Student Learning Outcomes **Students will be able to:** ● Describe food chains as being made of producers and consumers and classify consumers as herbivores, omnivores, carnivores, predators, and/or prey. ● Describe a food web and its relation to a food chain. ● Explain how energy is passed through a food chain, and how to represent this in an energy flow diagram. ● Explain how human activities add toxic substances to an ecosystem. ● Know that some substances in our environment can be toxic and these substances can move through the food webs/ chains and can be harmful for living things. ● Explore the main causes of water, air and land pollution in the local and wider community. ● Explain the effects of water, air and land pollution. (unclean/ toxic water, smoke, smog, excess CO2/other gases, open garbage dumps, industrial waste, etc.) on the environment and life. ● Discuss and explain the effects of burning fossil fuels and releasing greenhouse gases in air. ● Differentiate between biodegradable and non-biodegradable materials and their impact on the environment.

Knowledge:

Students will be able to know about:

- Food chains in different ecosystems.
- How energy is passed through a food chain, and how to represent this in an energy flow diagram.
- How human activities add toxic substances (e.g., DDT) to food chains and webs and can be damaging to an ecosystem.
- The main causes of water, air and land pollution (unclean/ toxic water, smoke, smog, excess CO2/other gases, open garbage dumps, industrial waste, etc.), in the local and wider community.
- The difference between biodegradable and non-biodegradable materials, and describe their impact on the environment.
- People who use science, including professionally, in their area and describe how they use it (e.g., conservationists).

Key Vocabulary

ecosystem, energy, energy flow diagram, feeding relationship, food web, producer, primary consumer, secondary consumer, tertiary consumer, bioaccumulation, toxic, concentration, ingestion, substance, microorganisms, toxic, harmful, smog, environment, smoke, fossil fuels, greenhouse gases, biodegradable, non-biodegradable, micro plastics, single use plastic, decompose, decomposing, conserve, conservationists

Skills:

Students will be able to:

- Use models to explain how food chains link in an ecosystem to make a food web.
- Plan and conduct experiments to investigate the role of microorganisms in breaking down/ decomposing materials.
- Describe how energy moves through an ecosystem.
- Use graphic organizers to present findings.
- Ask questions to begin scientific enquiry regarding causes of pollution.
- Describe a range of toxic materials and how they can be harmful for the environment.
- Carry out research using secondary sources which organisms have been damaged by toxic substances.
- Use models to explain how toxic substances get accumulated in an ecosystem and can be harmful.
- Apply mathematical concepts (e.g., percentages and ratios) to analyze data and present the data collected in the form of graphs, charts, scatter diagrams and tables.

Assessments

Formative Assessments

- KWL charts for assessing prior knowledge of students
- Discussion questions
- Recording measurements and observations
- Oral and written responses
- Sequencing picture cards
- Entry and Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Self and peer assessments
- Marked Quizzes
- Presentations
- Projects with criteria/ rubrics

Summative Assessment

- End of unit tests
- Projects/ Performance assessments

Learning Activities

Activity 1: **Mind Maps of Food Chains and Food Webs**

Students will draw food webs in different ecosystems (e.g., arctic, forest, desert, sea, river etc.) to show different food chains and feeding relationships.

Activity 2: **Energy Flow in Ecosystems**

- Qs for discussion:
  - Where do plants get their energy from?
  - Where do animals get their energy from?
  - Where does energy within the food chain come from originally?
- Students can participate in role play to demonstrate how energy is transferred through food chains/webs in different ecosystems.
- Ask students to make energy flow diagrams/ food webs for different ecosystems.

Activity 3: **Role of Decomposers**

- Students will conduct experiments to investigate the role of microorganisms in breaking down/decomposing materials.

Activity 4: **Toxic Substances in Food Chains**

- Introduce the word 'toxic' to the students. *What does the word 'toxic' mean? If a substance is 'toxic' what does that substance do?*
- Focus the discussion with students on how toxic substances can damage living things leading to illness and even death. students will do research to find out the problems caused by at least two toxic substances, e.g., mercury and DDT (an insecticide).
- Students can produce a comic strip to show how toxic substances move through a food chain/web.

Activity 5: **Constructing Models of Feeding Relationships**

- Ask students to make their own models of food chains and explain the feeding relationship.
- Investigating food chains
  - Give pairs of students' pictures of a wide variety of animals, including a picture of a human; ensure that there are herbivores, carnivores and omnivores.
  - *Which animals eat only plants? Which animals eat only meat? Which animals eat both plants and meat?*
- Ask them to sort the animals into three groups: 'eats plants'; 'eats meat' and 'eats both plants and meat'. Once students have sorted the pictures, discuss their choices and address any misconceptions. students could be supported with information books and/or keys about

animals. Introduce the terms ‘herbivore’, ‘carnivore’ and ‘omnivore’ defining each one. Reinforce student's' understanding by displaying pictures of more animals and asking them to say whether each animal is either a herbivore, a carnivore or an omnivore.

- Display a food chain which shows the Sun, grass, a grasshopper, a frog, a python and an eagle. Explain that food chains show feeding relationships and how energy is transferred from one living thing to another. They show what is eaten by what: Each arrow means ‘is eaten by’ and shows the direction in which the energy is transferred. In this food chain, grass is eaten by a grasshopper, the grasshopper is eaten by a frog, the frog is eaten by a python, and the python is eaten by an eagle. At each stage energy is transferred from the living thing that is being eaten to the thing that is eating it. Explain that food chains always start with the Sun because it is the source of all energy on Earth. Sunlight is not eaten by plants but the energy in sunlight is required for a plant to make food.
- Introduce the terms ‘predator’ and ‘prey’. Explain that predators are animals that eat other animals. Prey are animals that get eaten by predators. Sometimes, a predator can also be prey. The terms predator and prey are usually only applied to animals. Look at the food chain again.
    - *Which animal is a predator? Which animal is prey?*
- Identify the terms that apply to each living thing: the grass is the producer
    - the grasshopper is a consumer, a herbivore and prey
    - the frog is a consumer, carnivore, predator and prey
    - the python is a consumer, carnivore, predator and prey
    - the eagle is a consumer, carnivore and predator
- Display a new food chain (e.g., the Sun, a bush, a goat, a jackal, and a lion). Ask students to identify the producer, consumers, predator(s), prey, herbivores and carnivores. Discuss students' choices and address any misconceptions.
- Display another food chain that includes an omnivore (e.g., the Sun, a plant with berries, a slug, a crow, a fox). Ask students to identify the producer, consumers, predator(s), prey, herbivores, carnivores and omnivores. Discuss students' choices and ensure that they identify the crow as the omnivore because it will eat berries from a plant as well as the slug. Discuss the role of the Sun in food chains in different ecosystems.
- Introduce the terms ‘producer’ and ‘consumer’ and define them. Plants are producers because they make their own food. Animals are consumers because they do not make their own food; they eat plants and/or other animals.
- Provide pairs of students with the picture of an environment with (add labels to show the producer, consumer, herbivore, omnivore, carnivore, predator and prey. Model how to research different animals and find out what they eat (i.e., their diet).
- Resources: Pictures of animals, secondary information sources

Activity 6:

- How can you protect your environment?
- Explain the role of conservationists and ask students what they can do to protect ecosystems.
- Students carry out surveys in their own school to analyze waste and identify the use of plastics. Ask students to write their own questions.
- Suggested questions:

    - How many classrooms have a paper recycling bin?
    - How many classrooms collect junk material for model making?
    - Does the school have a compost bin?
    - Does the school encourage students to bring their refillable bottles to school?
    - Does the school encourage students to bring only unpacked lunch (without wrappers) to school? Does the school separate its litter into recyclable and non-recyclable materials?
- Ask students to present the data collected in bar charts and tables.
- Suggest ways to reduce use of non-biodegradable materials and lower the reliance on micro plastics/single-use plastics at home and in schools.
- Students can design information leaflets on toxic substances and the problems they cause.
- Students can carry out awareness raising campaigns to reduce the use of toxic substances and save the ecosystem.

Activity 7: **Burning Fossil Fuels and their Harmful Effects**

- Students will do research to discuss and explain the effects of burning fossil fuels and releasing greenhouse gases in air.
- Students will go through news reports on smog in Lahore and other cities of the country and identify its causes.
- Students will explore the causes of pollution in their local area and suggest ways to reduce it.

DOMAIN: Physical Science

Grade 5

Unit: Physical and Chemical Changes of Matter
Student Learning Outcomes **Students will be able to:** ● Observe the changes in materials that do not result in new materials (dissolving, crushing, change in state). ● Identify observable changes in materials that make new materials with different properties (e.g., decaying, such as food spoiling; burning; rusting). ● Compare physical and chemical changes

Knowledge: Students will: ● Describe the changes in states of matter due to heat gain and loss. **Key Vocabulary** melting, freezing, boiling, condensation, evaporation, rusting, decomposition	**Skills:** Students will be able to: ● Observe the changes in materials that do not result in new materials (dissolving, crushing). ● Investigate that matter can be changed from one state to another by heating, or cooling. ● Identify different states of water (melting, freezing, boiling, evaporation, condensation). ● Identify observable changes in materials that make new materials with different properties (e.g., decaying, such as food spoiling; burning; rusting etc.). ● Compare physical and chemical change. ● Describe trends and patterns in results. ● Reach conclusions by interpreting results informed by reasoning. ● Evaluate experiments and investigations, and suggest improvements, explaining any proposed changes. ● Present and interpret observations and measurements, appropriately. ● Apply mathematical concepts (e.g., percentages and ratios) to analyze data, and present the data collected in the form of graphs, charts, and tables.

Assessments

Formative Assessments

- Impromptu quizzes or anonymous voting
- Short comparative assessments to see how pupils are performing against their peers
- One-minute papers on a specific subject matter
- Lesson exit tickets to summarize what pupils have learnt
- Silent classroom polls
- Ask students to create a visualization or doodle map of what they learnt
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply when
- Ask students to communicate in several modes (e.g., words and drawings)
- Are accessible and interesting

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End of unit tests

Learning Activities

Activity 1

Demonstrate physical change by melting a candle and ice melting.

Activity 2

Ask students to observe various objects on the school premises that display signs of wear and tear and discuss whether these changes are chemical or physical – what caused these changes.

Activity 3

Show the students a glass of water and have them list its physical properties. Next show them some salt and have them list its properties. Pour approximately one tablespoon of table salt into the water and stir until all the salt has dissolved. Ask the students to describe the salt water. Say: "You can't see the salt; where did the salt go?" Have someone taste the salt water and describe how it tastes. Ask: "Where has the salt gone?" (It's still in the water; you can taste it.) Have the students suggest ways that could be used to get the salt back out of the water.

Activity 4

Items needed:

- Large bowl
- Mug or plastic cup
- Plastic wrap
- String or large rubber band
- Water

- Place the mug or cup in the center of the bowl. Fill the bowl with water about 2/3 of the way up the cup, do not pour water inside the cup.

- Cover the bowl with a plastic wrap and either tie it with string or place a large rubber band around it to secure the plastic wrap.


- Place it outside in a sunny area for a few hours.

- After several hours. Allow students to observe the bowl. The plastic wrap will have condensation and some of the condensation will have dripped or fallen into the cup/mug.


- This experiment demonstrates the heat of the sun turning the water in the bowl to vapor (evaporation). The vapor turns back to water droplets on the plastic wrap (condensation), drops getting too heavy and falling back down in the cup. Put the cup containing this water in the freezer, it will turn into ice (freezing).
  (Water-cycle-rain-cycle-science-experiments, n.d.)

Activity 5

Demonstrate chemical change by burning a paper, boiling an egg and heating sugar to form caramel.

Activity 6

Take baking soda and vinegar in separate bowls. Then combine the two together in a large bowl. (Be sure students stand away from the bowl). Explain that when baking soda and vinegar are combined, they go through a chemical change. Bubbles form because a gas is released, which is a byproduct of the chemical change. Ask students to draw the process.

Activity 7

- Fill a clear plastic cup about 1/2 full of cream. Observe the cream and record its properties.
- Pour about 15 ml of vinegar into another cup. Observe the vinegar and record its properties. The cream and the vinegar are the reactants in this activity.
- Find the combined weight of the reactants by placing the cup of cream and the cup with vinegar on the scale. Record the combined weight.
- Pour the vinegar into the cream and stir once or twice. Observe the mixture. Describe what you see, feel and smell. (Make sure students understand that while it is safe to smell cream and vinegar, it is unsafe to smell or inhale some chemicals. Caution them never to smell unknown chemicals.) Is there evidence of new substances being formed? Explain. Record your observations. New substances formed from a chemical reaction are called products.
- Find the combined weight of the products by placing both cups on the scale. Record the weight. (Make sure students understand that it is necessary to weigh the empty cup because its weight was included when the vinegar was weighed.)
- Compare the combined weight of the reactants to the combined weight of the products. Record what you have learned.

After the students have completed the activity, lead a discussion. The following questions may be helpful.

Did a chemical reaction take place when the vinegar and cream were mixed?

What evidence suggests that a chemical reaction has taken place? (Formation of a solid after two liquids have been mixed.)

Is it possible to get the cream and vinegar back after they have been mixed? (No)Why? (They have chemically changed into a completely different substance.)

Challenge students to write an equation to show the relationship between the weight of the reactants and the products. Combined weight of reactants + (cups) =Combined weight of products + (cups).

Have students write a statement to explain the relationship between the weight of the reactants and the products. The combined weight of the reactants in a chemical reaction is always equal to the combined weight of the products.

References:

1. *water-cycle-rain-cycle-science-experiments*. (n.d.). Retrieved from lessons4littleones: https://lessons4littleones.com/2015/04/15/water-cycle-rain-cycle-science-experiments/

DOMAIN: Physical Science

Grade 5

Unit: Light and Sound
Student Learning Outcomes **Students will be able to:** ● Identify natural, artificial light sources. ● Sort out luminous and non-luminous objects. ● Identify transparent, translucent and opaque objects. ● Demonstrate that sound can travel through different states of matter with different speed. ● Describe the structure and discuss the mechanism of the conduction of sound waves through human ears. ● Describe the intensity of sound. ● List the harmful effects of noise on human health. ● State the role of humans in reducing noise pollution.

Knowledge: Students will: ● Describe the structure and discuss the mechanism of the conduction of sound waves through human ears. ● List the harmful effects of noise on human health. ● State the role of humans in reducing noise pollution. **Key Vocabulary** vibrations, reflection, luminous, transparent, translucent, opaque	**Skills:** Students will be able to: ● Identify natural, artificial light sources. ● Sort out luminous and non-luminous objects. ● Identify transparent, translucent, and opaque objects. ● Illustrate the function of human ears through the model of ear. ● Compare the intensity of sound at different places by using instruments. ● Reach conclusions by interpreting results informed by reasoning. ● Evaluate experiments and investigations, and suggest improvements, explaining any proposed change. ● Present and interpret observations and measurements, appropriately.

Assessments

Formative Assessments

- Impromptu quizzes or anonymous voting
- Short comparative assessments to see how pupils are performing against their peers
- One-minute papers on a specific subject matter
- Lesson exit tickets to summarize what pupils have learnt
- Silent classroom polls
- Ask students to create a visualization or doodle map of what they learnt
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply when
- Ask students to communicate in several modes (e.g., words and drawings)
- Are accessible and interesting

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End of unit tests

Learning Activities

Light

Activity 1

- Make a chart after discussing artificial and natural sources of light.

Activity 2

- Do a sorting activity by using picture cards of sources of light and board so they could really see and understand the difference between the two terms.

Activity 3

Light up a torch and throw its light on the mirror.

Ask the students:

Does the mirror glow with its own light? (Expected response: It doesn't glow, it reflects the torch)

Now ask the student to throw the light of torch on the white ball. It becomes bright.

Ask the students:

Is the ball bright due to its own light? (Expected Response: no)

Now light up the candle and ask the student s:

Is the candle light of its own? (Expected response: yes.)

Tell the students that some objects have their own light e. g. candle torch, stars and the Sun. Some objects have no light and they simply reflect the light of other objects e. g., mirror, ball, Moon, and the earth.

The objects which have their own light are called luminous objects and the objects which have no light of their own are called non-luminous objects.

Activity 4

Step 1

a) Hold up an opaque object and ask students: What happens to the light that shines on it? (Most of it is reflected back into the room and our eyes, but some of it is absorbed by the object. And a shadow will form opposite to the light source) Write the terms reflected and absorbed on the board.

b) Hold up a translucent object and ask students: What happens to the light that shines on it? (Most of the light is scattered by the object and then reflected back. Some of the light is absorbed, and some of it passes through the object.) Ask students to give evidence from their observations to support each of the explanations for what happens to light.

c) Hold up a transparent object and ask students: *What happens to the light that shines on it?* (Most of it passes through the object, but some light is reflected back to our eyes, which is why we can see the glass.)

Step 2

a) Take a brief in-school field trip. Ask students to look for the different types of objects and share as they find an item that is transparent, translucent, or opaque.

b) After returning to the classroom, have students brainstorm items around the community or in their homes that are transparent, translucent, and opaque.

Make a chart on the board of the different items that are transparent, translucent, and opaque.

Sound

Activity 1

Demonstrate the sound vibration through the wiggling of a rubber band.

Ask students to stretch a rubber band between two fingers. pluck it.

Ask following question:

What do you see?

Then ask them to hold the rubber band close to their ear and pluck it.

What do you hear?

Activity 2

Ask student s to explain the function of the ear using a model of the human ear.

DOMAIN*:* Physical Science

Grade 5

Unit*:* Electricity and Magnetism
Student Learning Outcomes **Student will be able to:** ● Describe flow of electric current in an electric circuit. ● Draw circuit diagram with symbols. ● Demonstrate magnets have two poles (opposites attract and like poles repel). ● Recognize the difference between a magnet and a magnetic material. ● Relate properties of magnets (i.e., two opposite poles, attraction/repulsion, and strength of the magnetic force varies with distance) to uses in everyday life (e.g., a directional compass). ● Construct a magnetic compass. (STEM/STEAM)

Knowledge: Students will: • Describe flow of electric current in an electric circuit. • Recognize the difference between a magnet and a magnetic material. • Relate properties of magnets (i.e., two opposite poles, attraction/repulsion, and strength of the magnetic force varies with distance) to uses in everyday life (e.g., a directional compass). **Key Vocabulary** attract, repel, electromagnets, temporary/permanent, circuit diagram, battery, wires, switch	**Skills:** Students will be able to: • Construct an electric circuit with its components. • Draw circuit diagrams with symbol. • Demonstrate that magnets have two poles (opposites attract and like poles repel). • Construct a magnetic compass. • Draw conclusions by interpreting results informed by reasoning. • Evaluate experiments and investigations, and suggest improvements, explaining any proposed changes. • Present and interpret observations and measurements, appropriately.

Assessments

Formative Assessments

- Impromptu quizzes or anonymous voting
- Short comparative assessments to see how pupils are performing against their peers
- One-minute papers on a specific subject matter
- Lesson exit tickets to summarize what pupils have learnt
- Silent classroom polls
- Ask students to create a visualization or doodle map of what they learnt
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply when
- Ask students to communicate in several modes (e.g., words and drawings)
- Are accessible and interesting

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End of unit tests

Learning Activities

Magnetism

Activity 1

Show the simple demonstration of attraction and repulsion using two bar magnets. Place one magnet on the table and then slide the other magnet towards it. The magnet will either be attracted or repelled.

Ask questions like:

Why are the magnets pulled together or pushed apart?

What will happen if I turn the magnet around?

Have the students explain what they already know about poles and the principles of attraction and repulsion.

Activity 2

How to Build a Simple Compass

- Sewing Needle (go with fairly large sewing needles so it is easy for little hands to hold).
- Magnets (the stronger the better).
- Cork (other options may work if you don't have a cork, see below in Troubleshooting).
- A medium to large sized bowl.
- Water
- Pliers.

Build a Compass

1. **Magnetize a Needle**
   Hold the needle, and take your magnet and stroke it down the length of your needle 50 times. If you are using a weaker magnet you may need to do this more than 50 times. But for most good quality magnets 50 should be about right.

1. **Magnetize the other end with the Reverse**
   Now this is very important, take note of which side of the magnet you were using. Flip the needle around so you are holding the other end, and flip over the magnet so you are using the other side of the magnet. Now repeat on the non-magnetized end of the needle.

1. **Prepare the Cork**
   Cut a cork so it is about 1 to 2 cm thick.

1. **Insert the Needle**
   Carefully push the needle through the cork. This is best done by an adult with a pair of pliers. I found it easiest if I used a thumb tack to start the hole, then pushed the needle through. You want the cork to be centered on the needle.

1. **Fill a Bowl with Water**
   Set out your bowl and fill it with a few inches of water.

1. **Test the Compass!**
   Place your cork and needle in the water and see how it moves. It should align itself so it points North.

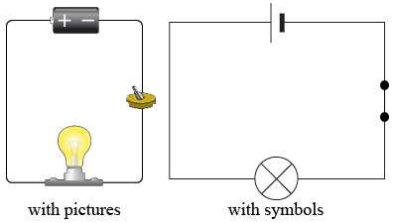
1. **Extra fun!**
   Create a second compass and add it to the same bowl of water. What happens? What happens if you bring your magnet near the water? What happens if you spin the compass?

- (How-to-make-a-compass, n.d.)

Activity 3

Ask students to construct simple circuits by providing them with wires, bulbs and batteries.

Ask students to draw a schematic diagram of a simple circuit.



(drawing-circuits, n.d.)

Students will test a variety of materials in a circuit to determine whether each item behaves as an insulator or a conductor. Students will make predictions about each item and discuss the results in teams and as a class. Student teams will also construct their own circuit tester using wires, batteries, and a bulb.

Materials

- 3 pieces of wire (strip the ends)
- Battery (size D)
- 1.5 volt bulb and socket
- 2 paper fasteners (split pins)
- Variety of materials that are either conductors or insulators; enough for each team to select ten items from a pool of at least 40. (Suggestions: metal paper clip, paper, eraser, aluminum foil, metal pen, rubber band, pencil, coin, hairclip, key.)

Procedure

- Set up for the class a model of an electric circuit, using wires, bulbs, and a battery. Demonstrate the properties of insulation and conductivity by testing several different materials.
- Have one set-up displayed along with an object that insulates and one that conducts electricity.
- Divide students into small groups of 3-4 students.
- Provide each group with wires, a bulb, and a battery and have them assemble their own conductivity tester.
- Ask student groups to select five materials they believe will conduct electricity from the assorted materials available (see materials list). Groups will also select five materials they believe will not conduct electricity.
- Student groups will provide their predictions to another team for testing - so each team will be testing another team's predictions.
- Ask students to record the results and share with the group.

References:

1. *how-to-make-a-compass*. (n.d.). Retrieved from steampoweredfamily: https://www.steampoweredfamily.com/activities/how-to-make-a-compass/
2. *drawing-circuits*. (n.d.). Retrieved from k8schoollessons: https://k8schoollessons.com/drawing-circuits/

Unit: Forces and Simple Machines

Student Learning Outcomes

Student will be able to:

- Recognize that friction force works against the direction of motion (e.g., friction working against a push or a pull makes it more difficult to move an object along a surface).
- Reasoning with evidence that friction can either be detrimental or useful under different circumstances (ways to reduce friction).
- Recognize that simple machines (e.g., levers, pulleys, gears, ramps) help make motion easier (e.g., make lifting things easier, reduce the amount of force required, change the direction of the force).

Knowledge:	**Skills:**
Students will: • Recognize that friction works against the direction of motion (e.g., friction working against a push or a pull makes it more difficult to move an object along a surface). **Vocabulary** push, pull, friction, levers, pulleys, gears, ramps, simple machines	Students will be able to: • Reason with evidence that friction can either be detrimental, or useful, under different circumstances (ways to reduce friction). • Recognize that simple machines, (e.g., levers, pulleys, gears, ramps) help make motion easier (e.g., make lifting things easier, reduce the amount of force required, change the distance, change the direction of the force). • Apply mathematical concepts (e.g., percentages and ratios) to analyze data and present the data collected in the form of graphs, charts and tables. • Make moveable wagon, bus, trolley, etc. (STEM/STEAM)

Assessments

Formative Assessments

- Impromptu quizzes or anonymous voting
- Short comparative assessments to see how pupils are performing against their peers
- One-minute papers on a specific subject matter
- Lesson exit tickets to summarize what pupils have learnt
- Silent classroom polls
- Ask students to create a visualization or doodle map of what they learnt
- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply when

- Ask students to communicate in several modes (e.g., words and drawings)
- Are accessible and interesting

Summative Assessments

- End-of-term or midterm exam
- Cumulative work over an extended period such as a final project or creative portfolio
- End of unit tests

Learning Activity

Activity 1

Set-up simple machine stations and ask students to visit each station to explore the workings of the machine and make notes in notebooks. Ask students to explain their ideas how each machine makes work easier.

Examples of simple machines are:

- Levers: Light switch, stapler, door, binder clip, scissors, clip board, clothespin, can opener, bottle opener, tongs
- Inclined plane: Slide, stairway, wheelchair ramp, ladder, roof (if inclined).
- Wedges: Knife, fork, can opener
- Pulley: Blinds, shoelace eyelet
- Wheel and axle: Door knob, large pencil sharpener, tape dispenser, wheels on the office chair

Activity 2

Walk for Simple Machines

Begin the search for simple machines in the classroom. Then take the class outside in the playground, and then to the library, office, computer lab etc. When finished, return to the classroom. Ask students to sketch and make notes during their walk for simple machines.

Follow with whole class discussion and reflection.

Activity 3

Investigate how Force applied to Lift an Object Changes when a Single Pulley or More than one Pulley is used.

Provide materials and ask students to first sketch the design of a single and double pulley system. Then with teachers' support construct a pulley system to carry out their investigation.

(a-simple-pulley-system, n.d.)

Examples of single pulley

Suggested questions:

How can pulleys make our lives easier?

What are some examples of modern items that engineers have designed with pulleys?

Activity 4

Plan, design and construct a chain reaction using more than 2 simple machines and explain its working: wedge, pulley, inclined plane, lever, wheel and axle. (See STEM project notes)

Activity 5

- Students could choose different surfaces to test the force of friction (gravel, carpet, tiled floor, grass, concrete floor, etc.).

References:

1. *a-simple-pulley-system*. (n.d.). Retrieved from scprolab: https://www.scprolab.com/post/a-simple-pulley-system

DOMAIN: Earth and Space Sciences

Grade 5

Unit: Structure of the Earth

Student Learning Outcomes

Student will be able to:

- Describe the structure of the earth (i.e., crust, mantle, and core) and the physical characteristics of these distinct parts.
- Describe common features of volcanoes and know they are found at breaks in the Earth's crust.
- Understand that the Earth's crust moves and when parts move suddenly this is called an earthquake.

Knowledge: Students will: • Describe the structure of the earth (i.e., crust, mantle, and core) and the physical characteristics of these distinct parts. • Describe common features of volcanoes and know they are found at breaks in the Earth's crust. • Recognize that the Earth's crust moves and when parts move suddenly this is called an earthquake. **Key Vocabulary** crust, mantle, core, volcanoes, earthquake	**Skills:** Students will be able to: • Demonstrate the structure of the Earth using an egg. • Construct an explanation with evidence to explain why it is impossible to dig through the ground to the other side of the Earth. • Investigate and compare models of Earth's internal structure. • Observe the image of the structure of the earth and analyze how the layers of the Earth are different on the basis of distance. • Differentiate between the distinct parts of the structure of the Earth based on their physical characteristics. • Construct a model or diagram of the structure of the Earth • Develop questions about the Earth's layers for further research and inquiry. • Write a paragraph detailing their understanding of the Earth's layers. • Construct scientific explanation by scaffolding information. • Make predictions of likely outcomes for a scientific enquiry.

Assessments

Formative Assessments

- Classroom polls
- Pictionary
- Discussion Questions

Summative Assessments

- Final project
- Weekly classroom quizzes
- End of unit tests

Learning Activities

Activity 1: Understanding the Layers of Earth

Using a hardboiled egg, demonstrate the layers of Earth to the students describing that just like an egg, Earth too has 3 layers; crust, mantle and core. Carefully tap along the middle or equator of the egg explaining that the hard shell is like the rocky solid crust of the Earth. Slice the egg showing its inside to the students. Tell them that the egg white is a solid mantle and the yolk is like the molten core of the Earth.

Activity 2: Moving Plates of the Planet

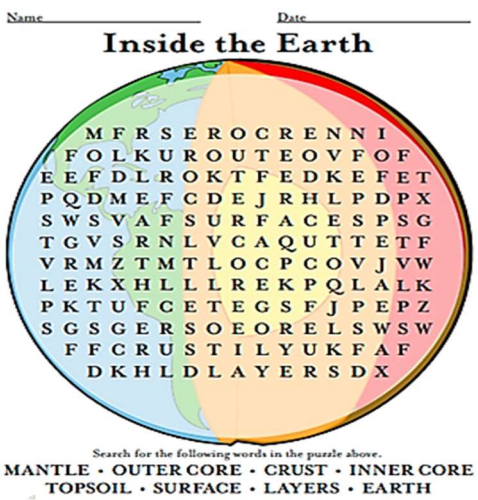
Explain that the crust of the Earth is made of large plates of rocks that are covered with sand, soil and water. The rock plates beneath are always moving about 2 to 15cm every year. Give students paper plates and instruct them to cut it in half. Tell them to tape the edge of a rectangle shaped paper onto one half of the plate and then tape the loose end of the paper to the other half of the plate making the paper stretch across the both halves. Instruct the students to slide one side of the plate under the other. This makes the rectangle taped paper rise. Explain it to the students that this is how mountains are formed and earthquakes occur when the moving plates beneath the crust get stuck and build pressure until they slip and release earthquake energy.

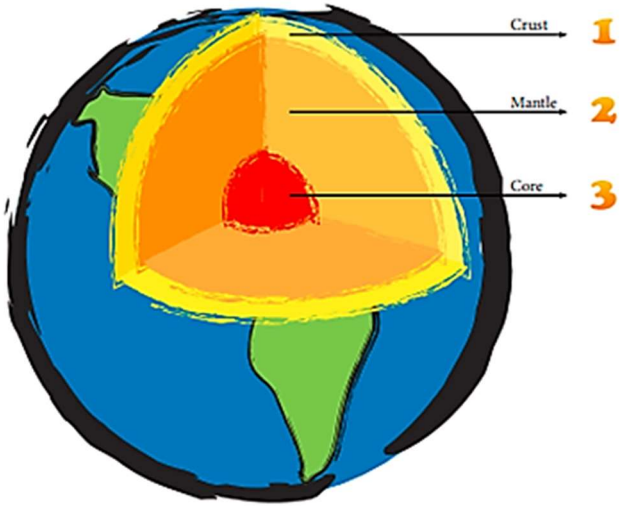
Activity 3: Run to the Layer!

Draw a diagram or show a picture of the layers of Earth. Pointing towards the crust tells the students that it is the thinnest layer making up 1% of the Earth. It is hard and we live on the crust. Explain that the mantle makes up two-third of the Earth's mass and is the second layer or the middle layer. Further, tell them that the core is made of 2 parts; outer core and inner. While the outer is solid, the inner is liquid known as molten core or magma. You can also use a piece of bread and peanut butter to explain that bread is like the outer core and peanut butter is like the thick liquid inner core. Tell the students that you will read aloud different features of the 3 layers. Label one wall of the classroom with crust and the other wall with core. Tell the students that they have to carefully listen to the features and have to run towards the respective sides. If the feature belongs to the mantle layers, then they shall all gather in the middle.

Activity 4: Inside of the Earth.

Ask the students to think of their own analogies to the Earth and its layers and tell them to share their examples with you and their peers. Give them the 'Inside of the Earth Worksheet'. You can use this as a sample:





(/layers-of-learning.com, n.d.)

(Inside-the-earth, n.d.)

References:

1. Retrieved from: *https://studylib.net/doc/25204703/inside-the-earth*
2. Retrieved from: *https://handygeography.wordpress.com/gcse/the-restless-earth-revision-materials/structure-of-the-earth/*

DOMAIN*:* Earth and Space Sciences

Grade 5

Unit: Soil
Student Learning Outcomes **Students will be able to:** ● Identify similarities and differences among the different types of soil and classify them based on their clay, sand, and organic content. ● Investigate the composition and characteristics of different soils. ● Comprehend that soil composition can change, which can support, or hinder, plant growth. ● Identify various causes of soil pollution. ● Identify professions related to Earth Science i.e., paleontologists, seismologists, geologists.

Knowledge:

Students will know:

- There are different types of soil.
- Soil composition can change.
- Plant growth is affected by change in soil composition.
- Causes and effects of soil pollution.
- The people who use science, including professionally, and how they use it.

Key Vocabulary

clay, sand, loam, organic, environment, soil pollution, paleontologists, seismologists, geologists

Skills:

Students will be able to:

- Classify soils on the basis of their clay, sand, and organic content.
- Investigate the composition and characteristics of different soils.
- Recognize causes and effects of soil pollution.
- Recognize how soil composition can change and support or hinder plant growth.
- Sort, group, and classify soil types, through testing and observations.
- Decide when observations and measurements need to be repeated.
- Take measurements and record them.
- Describe patterns in results.
- Draw a conclusion from results, informed by reasoning.

Assessments

Formative Assessments

- Fish bowl
- Classroom polling and quizzes
- Pictionary and KWL charts

Summative Assessments

- End of unit oral and written test

- Final STEM Project
- Midterm examination

Learning Activities

Activity 1

- Show students some soil samples in the classroom (or collect samples together from the school grounds).
- *Ask students: What is soil? Why is soil important? What do you know about soil?* Students can use diagrams to represent their understanding of the different types of soil.

Activity 2

- Give students samples of different types of soil from the local area: ask them to investigate the sample by first touching them and then using a magnifying glass. Ask students to record their observations using scientific vocabulary and compare the types of soil. Follow safety rules.
- Give vocabulary cards: Consistency- loose, friable, firm
- Texture – grainy, silky, sticky
- Students can also describe the colour of the soil sample and which materials (e.g., pieces of organic material, decaying leaves) are present in the sample.
- Provide students with containers of water. Students add some water to a small portion of each soil sample and try to mould it into a ball. They discuss the differences between the samples.
- *Do they feel sticky? Can you make a ball? Does the ball break easily?*

Activity 3

Students put a small amount of each soil sample into a clear container with a lid (such as a plastic bottle or jar). They add water and shake the container; they leave the contents to settle until the following lesson. Distinct layers will form: The bottom layer will consist of pebbles and sand

and the top layer will be silt, clay and water (discolored by soluble organic material,) and there will be floating organic material on the top. Students measure the heights of the layers using a ruler and use this to inform if the soil is mostly clay, sand or organic material.

DOMAIN*:* Earth and Space Sciences

Grade 5

Unit: Space and Satellite

Student Learning Outcomes

Students will be able to:

- Define the term 'space' and emphasize the need to explore it.
- Define the term 'satellite' and describe its importance.
- Describe the natural satellites of the planets of the Solar System.
- Define artificial satellites and explain their importance in exploring the earth and space.
- Recognize the role of NASA (National Aeronautics and Space Administration), and explore the contribution of SUPARCO in space exploration.
- Predict and comprehend how astronauts explore space, how do astronauts survive and research in space.
- Recognize the key milestones in space technology.
- Identify professions related to earth science i.e., astronauts, physicists, space scientists, etc.

Knowledge:

Students will:

- Define the term 'space' and emphasize the need to explore it.
- Define the term 'satellite' and describe its importance.
- Describe the natural satellites of the planets of the Solar System.
- Define artificial satellites and explain their importance in exploring the Earth and Space.
- Recognize the role of NASA (National Aeronautics and Space Administration) and SUPARCO in space exploration.
- Recognize the key milestones in space technology.

Key Vocabulary

space, satellite, natural satellite, artificial satellite, astronauts, physicists, space scientist

Skills:

Students will be able to:

- Ask questions to begin scientific enquiry.
- Use secondary information to find answers to scientific inquiry questions about space and satellites.
- Research and present a paper on satellites and their uses.
- Design and construct a satellite using recyclable household items. (STEM/STEAM)
- Investigate why artificial satellites exist.
- Predict and comprehend how astronauts explore space, how they survive, and research in space.
- identify professions related to earth science, i.e., astronauts, physicists, space scientists, etc.

Assessments

Formative Assessments

- Fish bowl
- Classroom polling and quizzes
- Pictionary and KWL charts

Summative Assessments

- End of unit oral and written test
- Final STEM Project
- Midterm examination

Learning Activities

Activity 1: Concept of a Satellite

Define satellites to the students with the help of a big and a small ball. Revolve the small ball around the big one telling students that bodies that rotate around the other bigger mass bodies are called satellites. Give them the example of the moon being a natural satellite around the Earth and Earth being one around the sun.

Activity 2: Artificial Satellites

Tell the students that these are artificial man-made satellites manufactured on the Earth and sent into outer space for different purposes. Categorize the artificial satellites as:

Research Satellites: To explore and measure properties of outer space.

Weather Satellites: To measure, predict and study the weather.

Communication Satellites: Used for link up and networking worldwide like television, radio and telephones.

Navigation Satellites: Helps in regulating navigations of aircrafts, ships and submarines.

Earth Observation Satellites: Help explore and study about our planet's ever changing chemical life changing.

Engage the students in a classroom discussion by asking the following questions:

-Have you ever seen boosters and antennas on rooftops of buildings?

-Have you ever watched a live hockey or a cricket match? How are we able to watch a live match living in another region?

-Which satellite do you think is the one that enables us to watch a live match?

-Have you ever watched news on weather forecasts?

DRAFT

Science

Grades 6-8

Below what follows are Curriculum Unit Planners (not lesson plans) to help educators visualise how they could design learning experiences that implement the Curriculum in letter and spirit.

Note: The Units mentioned below are not numbered because they are meant to be flexibility incorporated into the Scheme of Studies of the school. Educators may teach these sample Units in any sequence they find to be suitable.

NCP - Science - Grade 6

Suggested Guidelines

DOMAIN: Life Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: Cellular Organisation

Student Learning Outcomes:

Students will be able to:

1. Recognize cells as the basic unit of life that are organised into tissues, organs, systems and organisms.
2. Arrange and rank different levels of cellular organisations – cells to tissues, organs and organisms.
3. Relate the structures of some common cells (nerve, muscle, epithelium and blood cells) to their functions.
4. Identify the structures present in an animal cell and plant cell as seen under a simple microscope and relate them to their functions (only cell membrane, cytoplasm, nucleus, cell wall, chloroplast, mitochondria and sap vacuole).
5. Describe the similarities and differences between the structures of plant and animal cells.
6. Sketch the animal and plant cells and label key organelles in each.
7. Compare and contrast an animal cell and plant cell by preparing slides using onion peels and cheek cells.

Knowledge:	**Skills:**
Students will be able to: 1 - Recognize cells as the basic unit of life that are organised into tissues, organs, systems and organisms. 3 - Relate the structures of some common cells (nerve, muscle, epithelium and blood cells) to their functions. 4 - Identify the structures present in an animal cell and plant cell as seen under a simple microscope and relate them to their functions. 5 - Describe the similarities and differences between the structures of plant and animal cells **Key Vocabulary** cells, tissues, organs, organisms, organelles, cell wall, cell membrane, nucleus, cytoplasm, mitochondria, chloroplast, vacuole, nerve cells, muscle cells, epithelial cells, blood cells, microscope, reproduction.	Students will be able to: 2 - Arrange and rank different levels of cellular organisations – cells to tissues, organs and organisms. 6 - Sketch the animal and plant cells and label key organelles in each. 7 - Compare and contrast an animal cell and plant cell by preparing sides using onion peels and cheek cells.

Assessments:

Formative Assessments

KWL charts for assessing prior knowledge of students

Discussion questions to address misconceptions

Recording measurements and observations

Oral and written responses

Sequencing picture cards

Entry and Exit tickets

Class Tests including short question answers, labeling diagrams etc.

Self and peer assessments

Marked Quizzes

Presentations

Projects with criteria/ rubrics

Summative Assessments

are commonly referred to as assessment of learning, in which the focus is on determining what the student has learned at the end of a unit of instruction or at the end of a grade level.

End of unit tests

Projects/ performance assessments

Mid Year-End of Year Exams

Learning Activities

Activity 1

Explain cellular organization through a chart.

Activity 2

Observing the Cellular Tissue Structure of an **Onion Cell through a Microscope**

Materials:

1. A thin onion membrane,
2. Microscopic glass slides,
3. Microscopic cover slips,
4. A needle,
5. Blotting paper,
6. Dropper,
7. Iodine Solution,
8. Water,
9. Microscope

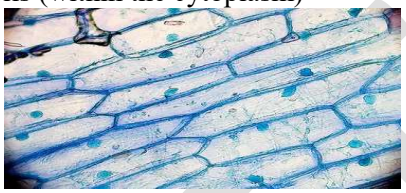
Procedure:

1. Add a drop of water at the center of the microscopic slide.
2. Having pulled off a thin membrane from the onion layer, lay it at the center of the microscopic slide (the drop of water will help flatten the membrane).
3. Add a drop of iodine solution on the onion membrane (or methylene blue).
4. Gently lay a microscopic cover slip on the membrane and press it down gently using a needle to remove air bubbles.
5. Touch a blotting paper on one side of the slide to drain excess iodine/water solution.
6. Place the slide on the microscope stage under low power to observe.
7. Adjust focus for clarity to observe.

Observations

- Large, rectangular interlocking cells,
- Clearly visible distinct cell walls surrounding the cells,

- Dark stained nucleus,
- Large vacuoles at the center,
- Small granules may be observed inside the cells (within the cytoplasm)



(onion-cells-microscope, n.d.)

Activity 3

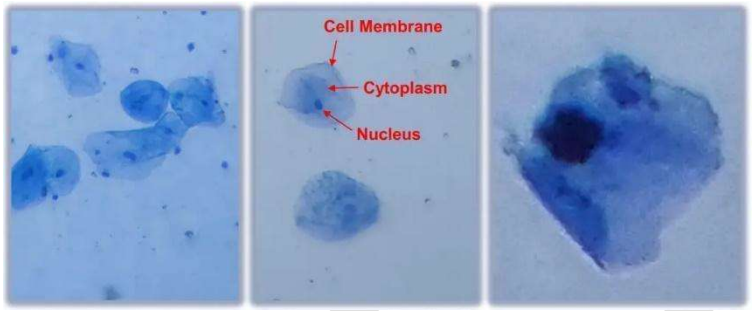
Human Cheek Cell Experiment

Materials

1. Glass microscope slides
2. Plastic coverslips
3. Paper towels or tissue
4. Methylene Blue solution (0.5% to 1% (mix approximately 1 part stock solution with 4 parts of water))
5. Plastic pipette or dropper
6. Sterile, individually packed cotton swabs

Methods

1. Take a clean cotton swab and gently scrape the inside of your mouth.
2. Smear the cotton swab on the centre of the microscope slide for 2 to 3 seconds.
3. Add a drop of methylene blue solution and place a coverslip on top. Concentrated methylene blue is toxic if ingested. Wear gloves and do NOT allow children to handle methylene blue solution or have access to the bottle of solution.
4. Remove any excess solution by allowing a paper towel to touch one side of the coverslip.
5. Place the slide on the microscope, with 4 x or 10 x objective in position and find a cell. View at higher magnification.
6. Methylene blue stains negatively charged molecules in the cell, including DNA and RNA. This dye is toxic when ingested and it causes irritation when in contact with the skin and eyes.
7. The cells seen are squamous epithelial cells from the outer epithelial layer of the mouth. The small blue dots are bacteria from our teeth and mouth.



(microcosmos.foldscope, n.d.)

Activity 4

1. Ask students to make charts of animal and plant cells and compare them.

References:

- *onion-cells-microscope*. (n.d.). Retrieved from microscopemaster: https://www.microscopemaster.com/onion-cells-microscope.html#gallery[pagegallery]/0/
- (n.d.). Retrieved from microcosmos.foldscope: https://microcosmos.foldscope.com/?p=98800

DOMAIN: Life Sciences

*** The additional/advanced SLOs are written in Italics.**

Unit: Development in Plants

Student Learning Outcomes:

Students will be able to:

1. Describe the different types of reproduction of plants.
2. Compare and contrast types of reproduction (sexual and asexual) in plants.
3. Distinguish between artificial and natural asexual reproduction in plants (budding, grafting, bulbs, tuber, runners, cutting, and layering).
4. Explain how artificial propagation can lead to better quality yield in agriculture.
5. Identify various professions associated with this unit of science. For e.g. botanists, farmers, gardeners, florists, etc.

Knowledge:	**Skills:**
Students will be able to: 1 - Describe the different types of reproduction of plants 2 - Compare and contrast types of reproduction (sexual and asexual) in plants 4 - Explain how artificial propagation can lead to better quality yield in agriculture. 5 - Identify various professions associated with this unit of science. For e.g. botanists, farmers, gardeners, florists, etc. **Key Vocabulary:** reproduction, asexual reproduction, sexual reproduction, bryophytes, trichophytes, natural propagation, artificial propagation, cross pollination, cross fertilization, gametes	Students will be able to: 3 - Distinguish between artificial and natural asexual reproduction in plants (budding, grafting, bulbs, tuber, runners, cutting, and layering).

Assessments

Formative Assessments

KWL charts for assessing prior knowledge of students

Discussion questions to address misconceptions

Recording measurements and observations

Oral and written responses

Sequencing picture cards

Entry and Exit tickets

Class Tests including short question answers, labeling diagrams etc.

Self and peer assessments

Marked Quizzes

Presentations

Projects with criteria/ rubrics

Summative Assessments are commonly referred to as assessment of learning, in which the focus is on determining what the student has learned at the end of a unit of instruction or at the end of a grade level.

End of unit tests

Projects/ performance assessments

Mid Year-End of Year Exams

Learning Activities

Activity 1

As your students to work in groups to create charts on the five stages of the life cycle of plants:

seed, germination, growth, reproduction, pollination, and seed spreading.

Activity 2

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1. Ask your students to work in groups to dissect flowers and record their observations, working from the outermost whorl to the innermost whorl.
2. In particular, ask them to create and label cross-section diagrams of the dissected flowers, including an explanation of how each part of the flower labeled affects flower reproduction.

Activity 3

1. Ask your students to work in pairs to brainstorm ways that plants are pollinated.
2. When they have finished discussing, have them share their ideas with the class.
3. Discuss, using their ideas as a guide, how the structure of plants contribute to pollination.
4. Ask your students to consider the role of outside sources (insects, other animals, wind etc.) in pollination.
5. Then, on the basis of their observations and the class discussion, ask them to develop their own hypotheses about how flower pollination occurs.
6. Have them write their hypothesis on their observation sheets and tell them to be prepared to share and defend their hypothesis with the class.
7. Time permitting, have a class discussion on various student ideas about how flowers are pollinated.

8. After discussing their hypotheses, have students research how their plant is pollinated.

Activity 4

Guide the student as they conduct seed germination experiments over the span of several weeks.

Activity 5

Bring plants to class that can be grown from parts other than seeds, for example onions, potatos, ginger, etc.

DOMAIN: Life Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: Variation and Diversity
Student Learning Outcomes: **Students will be able to:** 1. Describe variation and adaptation in living organisms and how they contribute to diversity. 2. Explain and illustrate the differences between variation and adaptation. 3. State that species are organisms which share common characteristics. 4. Observe and infer forms of variations in plants and demonstrate how variation exists within species. 5. Identify sources of variation from environmental and genetic factors 6. Explain how adaptation affects the chances of survival of different species of organisms 7. Illustrate through specific examples how animals and plants have structurally (for instance, how succulent plants are able to retain water in desert environments through their fleshy water storing tissues) or behaviorally (for instance, migration, bird calls) adapted to increase their chances of survival. 8. Explain how fossils can help us understand animals from long ago and their habitats.

Knowledge:	**Skills:**
Students will be able to: 1 - Describe variation and adaptation in living organisms and how they contribute to diversity. 2 - Explain and illustrate the differences between variation and adaptation. 3 - State that species are organisms which share common characteristics. 8 - Explain how fossils can help us understand animals from long ago and their habitats. 6 - Explain how adaptation affects the chances of survival of different species of organisms 5 - Identify sources of variation including differences in the lifestyles and habitats of individuals. 7 - Illustrate through specific examples how animals and plants have structurally (for instance, how succulent plants are able to retain water in desert environments through their fleshy water storing tissues etc.) or behaviorally (for instance, migration, bird calls) adapted to increase their chances of survival. **Key Vocabulary**	Students will be able to: 4 - Observe and infer forms of variations in plants and demonstrate how variation exists within species. • • Differentiate between continuous and discontinuous variation. • Design a research study, analyze data and compile a report on variation in their class cohort on the basis of continuous variables (height, heart rate, length of finger) and discontinuous variables (blood group, eye color, ability to roll tongue etc). • Reflect on behavioral adaptations humans can make for the collective survival of our planet, and design a plan of action. • Draw conclusions about the relative length of time major groups of organisms have existed on Earth using fossil evidence. .

variation, adaptation, diversity, genes, fossils, structural adaptation, behavioral adaptation, continuous variation, discontinuous variation	

Assessments

Formative Assessments

KWL charts for assessing prior knowledge of students

Discussion questions to address misconceptions

Recording measurements and observations

Oral and written responses

Sequencing picture cards

Entry and Exit tickets

Class Tests including short question answers, labeling diagrams etc.

Self and peer assessments

Marked Quizzes

Presentations

Projects with criteria/ rubrics

Summative Assessments are commonly referred to as assessment of learning, in which the focus is on determining what the student has learned at the end of a unit of instruction or at the end of a grade level.

End of unit tests

Projects/ performance assessments

Mid Year-End of Year Exams

Learning Activities

Activity 1

Materials

1. Specimens from the same species (1 per student).
2. Student field journal (1 per student).
3. Pencils.

Introduction

1.
1. Ask your studentswhether they think all individuals of the same species look the same. Then ask, why they think there is variation within species.
2. Tell students that in this activity they will use scientific observation skills to observe a range of natural variation within a single species, and then think about what environmental factors might influence the survival of specific variations over another.

Scientific Sketching & Asking Questions

1. Select as many specimens of the same species as there are students and place them in a central location.
2. Explain that these are specimens of a single species.
3. Let all students examine all specimens. Ask them to look for variation.
4. Ask each student to select a specimen.
5. Pass out the student field journals and tell students to sketch their specimen. Encourage students to measure the specimen and add any descriptive notes that will help them identify their specimen.
6. When they have finished the field journal, have small groups (5 to 8 students) mix their specimens up and try to find them again based on their sketches.
7. Have students reflect on what parts of the sketch helped them identify their specimen. Then, give them a chance to add a few more details to their sketch.
8. Mix the specimens back together again, and have students switch sketches with a classmate. Can someone who didn't observe the same specimen identify it based on the sketch and notes of the first student?
9. Teacher Tips: This emphasizes the importance of acute observation and detailed documentation, especially when other scientists will be using your work.

1. Ask questions such as:
    1. What observations were particularly useful in finding your specimen or your classmate's specimen?
    2. What other details, words or measurements could have made it easier to find the correct specimen?
11. How does sketching vs. taking a picture help you notice the details of a specimen?

Constructing Explanations for Variation

1. Have students read about a specific example of species variation that scientists have studied: www.mothscount.org/text/63/peppered_moth_and_natural_selection.html

2. Ask students to use the 2nd side of their field journal to think about how the variations they observed in their specimens might be beneficial or detrimental for an individual.
    a. Then, discuss and reflect upon the following questions:*What types of variations did we see in the specimens?* (Color, size, shape, number of spots, etc.)
    b. *How do you think variation in these species comes to be?*
    c. *Why is variation important in populations?* (Variation increases the likelihood that at least some individuals will survive to reproduce no matter how environmental conditions change. Variation is also a key step in the evolutionary process. It is a prerequisite for evolution to occur.)
    d.

Activity 2

Structural and Behavioral Adaptation

1. Share an example of a bird and explain structural and behavioral adaptation.
2. Ask students to imagine a bird species. One day a bird is born with a beak that is longer than the beak of other birds of the species. The longer beak helps the bird catch more food. Because the bird can catch more food, it is healthier than the other birds, lives longer and breeds more. The bird passes its traits for a longer beak on to its offspring. They also live longer and have more offspring and the traitscontinues to be inherited generation after generation.
3. Eventually the longer beak can be found in all of the species. This doesn't happen overnight. It takes thousands of years for a mutation to be found in an entire species.
4. Over time, animals that are better adapted to their environment survive and breed. Animals that are not well adapted to an environment may not survive.

5. The characteristics that help a species survive in an environment are passed onto future generations. Those characteristics that don't help the species survive slowly disappear.

Activity 3

How similar and how different are we all?

1. Create cross curricular links with Mathematics by researching interesting biostatistical tables and graphs. for example, you could find infographics on the below topics ask questions
    a. *Do we all have the same blood group? Are we all of the same height?*
2. Ask students to organize themselves according to their a) eye colour b) gender c) height etc and then have them reflect on how their observations connection with what they have learnt about variation.

Activity 4

Think-Pair-Share

Ask what you notice? Any patterns that you see?

1. Explain that when you organized yourselves into groups according to height, you arranged yourselves into one big group standing in height order – shortest to tallest. A characteristic that can take any value within a range is known as **continuous variation.**
2. Explain to students the difference between Continuous and Discontinuous variations with examples. Examples of discontinuous variation include a person's blood group or the color of a species of bird. These variations can exist for two major reasons. They could be purely random genetic changes, or they can be traits that have been influenced and selected by the environment.
3. Ask students to work in small groups and plan a study to collect data from their class regarding both continuous and discontinuous variation and present their findings.
4. Ask students to design questionnaires to collect and record data.
5. Students may collect data from their class fellows and from other sections. Several sections may be included in data collection. Students can use Google forms for collecting and recording data.
6. Students construct graphs of the data collected.
7. Students can analyze the data, observe patterns and draw conclusions.
8. Ask students to share their conclusions supporting these with the data/ evidence collected from the research study.

DOMAIN: Life Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: Structure and Function- Human Body Systems
Student Learning Outcomes: **Students will be able to:** 1. State the importance of digestion in the human body and describe physical and chemical digestion. 2. Sequence the main regions of the Alimentary Canal, its associated organs, and describe the functions of different parts of the Alimentary Canal. 3. Briefly describe the role of enzymes in digestion. 4. Explain that blood transports the products of digestion to other parts of the body and the undigested products get egested/defecated. 1. Briefly describe some major digestive disorders.

Knowledge	**Skills**
Students will be able to: 1 - State the importance of digestion in the human body and describe physical and chemical digestion. ● *2 - Sequence the main regions of the Alimentary Canal, its associated organs, and describe the functions of different parts of the Alimentary Canal.* 3 - Briefly describe the role of enzymes in digestion. 5 - Briefly describe some major digestive disorders. 4 - Explain that blood transports the products of digestion to other parts of the body and the undigested products get egested/defecated. **Key Vocabulary** digestive system, alimentary canal, physical digestion, chemical digestion, biological catalyst, organs, enzyme, amylase, egested, defecated, feces	Students will be able to: 1. Use secondary sources to sequence the main regions of the Alimentary Canal, and its associated organs. 2. Use a model to show the functions of different parts of the Alimentary Canal. 3. Ask questions to initiate scientific inquiry. 4. Investigate the effect of the enzyme amylase on starch solution. 5. Make predictions using scientific knowledge and understanding. 6. Test predictions with reference to evidence gained. 7. Use a range of equipment correctly. ● Compare results with predictions.

Assessments

Formative Assessments

KWL charts for assessing prior knowledge of students

Discussion questions

Oral and written responses

Exit tickets

Class Tests including short question answers, labelling diagrams etc.

Marked Quizzes

Observation of student interaction with lab equipment / apparatus and adherence to usage and safety guidelines

Summative Assessments

Journal to see the connections between different topics about plants

Lab reports prepared by students

Model and presentation of the Alimentary Canal by students

Midterm or Final Exam

Learning Activities

Activity 1

Model of the Alimentary Canal

1. Make a set of recycled materials available to students such as cardboard cut-outs (rectangular), cardboard rolls, tape, scissors, paint etc.
2. Guide the students in making a model of the alimentary canal that shows how each organ is positioned and connected to the next and indicates the pathway of food in the process of digestion from the mouth to the rectum.

Activity 2

Pass the Parcel Role Play

1. Sort students into groups of 7 to 8, where one learner plays the human eating a certain food, while the other 7 play one of the following organs: mouth, pharynx, esophagus, stomach, small intestine, large intestine and rectum.
2. Use a small bowl of shredded paper to indicate the masticated food passed from the mouth and traveling through the alimentary canal.
3. Each learner should act the part of their organ and talk about how they are processing the food onward. Depending on the food item selected by the human, they can be encouraged to speak to the challenge of processing the chosen food.

Activity 3

Jigsaw for Digestive Disorders

1. Sort students into groups of six, where each group becomes the expert of a specific digestive disorder. Depending on the number of students in the class, the number of digestive disorders or number of students in the expert groups can be varied. Recommended digestive disorders are: Diarrhoea, Constipation, Gastroenteritis and Ulcers. Others that may be considered are: Celiac Disorder and GERD.
2. The teacher should prepare a one pager on each disorder, which addresses their causes, symptoms and remedies / prevention strategies.
3. Once the expert group has discussed their disorder and explored answers to the guiding questions, they are then reorganized into Jigsaw groups where each member represents a different expert group. These experts then brief the rest of their group members on the digestive disorder they have learnt about.

Activity 5: Food Pathways

1. For independent practice, give students worksheets of an unlabeled diagram of the digestive system and have them label organs, and chart the path of food through the various organs through arrows and descriptors of the various processes happening at each step of the process including physical and chemical digestion at various stages, absorption of nutrients, egestion and excretion.

DOMAIN: Life Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit**: Human Health and Disease**
Student Learning Outcomes: **Students will be able to:** 1. Identify the constituents of a balanced diet for humans as including protein, carbohydrates, fats and oils, water, minerals (limited to calcium and iron) and vitamins (limited to A, C and D), and describe the functions of these nutrients. 2. Identify the essential nutrients, their chemical composition and food sources. 3. Identify and describe essential nutrients' deficiency disorders. 4. Explain how a healthy diet contains a balance of foodstuffs. 5. Correlate diet and fitness.

Knowledge:	**Skills**

Students will be able to:
 	
4 - Explain how that a healthy diet contains a balance of foodstuffs.
•
5 - Correlate diet and fitness.
 	
1 - Identify the constituents of a balanced diet for humans as including protein, carbohydrates, fats and oils, water, minerals (limited to calcium and iron) and vitamins (limited to a, c and d), and describe the functions of these nutrients.
2 - Identify the essential nutrients, their chemical composition and food sources.
3 - Identify and describe essential nutrients' deficiency disorders.
 	
Key Vocabulary
 	
healthy diet, balanced, food stuff, nutrients, essential nutrients, proteins, carbohydrates, fats, minerals, vitamins, fiber, deficiency disorders, chemical composition, food source, food habit, calcium, iron, budget,
	Students will be able to:
	
	• Identify all food groups.
	• Consult the key recommendations of Pakistan's healthy food guidelines 2019.
	• Deconstruct a meal into food groups and serving sizes.
	• Research using secondary sources the functions of all the components of a balanced diet for e.g.,
	  ◦ protein is used for growth and repair
	  ◦ fats store energy;
	  ◦ carbohydrates (sugar and starch) are an energy source;
	• Present findings in tables and charts citing the source;
	• Create/ design healthy meal menus within a budget;
	
	• Research the symptoms that they would have, if there is a deficiency of any component;
	  ◦ vitamin A
	  ◦ vitamin C
	  ◦ vitamin D
	  ◦ iron
	  ◦ calcium
	  ◦ fiber
	  ◦ water
	• Learn how to cook a healthy meals;

	• Learn how to adapt a recipe to make it healthier; • Think critically about their own food choices; • Identify social aspects that influence food habits.

Assessments

Formative Assessments

KWL charts for assessing prior knowledge of students

Discussions with specific questions / prompts

Oral and written responses

Exit tickets

Class Tests including short question answers, labelling diagrams etc.

Marked Quizzes

Observation of student interaction with lab equipment / apparatus and adherence to usage and safety guidelines

Summative Assessments

Student logs of their eating habits and nutritional plans.

Midterm or Final Exam

Learning Activities

Activity 1: Barrier Game: Mapping Nutrients with their Sources

1. In this activity, students work in pairs and sit back-to-back with each other. Learner 1 has a set of food items that they need to explain to learner 2. They cannot explicitly name the food item but can talk about its smell, shape, taste, colour etc.
2. Learner 2 will have a worksheet that will only have the names of nutrients (Carbohydrates, Proteins, Fats, Water, Iron, Calcium and Vitamins (A, B, C and D).
3. Learner 2 has to guess both the food item Learner 1 is relaying to them and then align them with the nutrients they provide in their worksheet.

Activity 2: My Food Journal

1. Independent Practice: students will prepare a journal of their daily meals, and log all the food they have eaten.
2. After completing one week, they will reflect on their nutritional consumption and identify which nutrients they may not be consuming sufficiently.
3. They will then prepare a plan for the next week with some changes and monitor their nutritional consumption in week 2.
4. Since there are many differences in the quality and quantity of food consumed by students, particularly in classrooms where students come from varying degrees of socioeconomic advantage / disadvantage, parental investment and care etc., this should be guided as an individual reflective activity with no report outs to the larger class.

Activity 3: Jigsaw for Diseases related to Nutritional Deficiencies

1. Sort students into groups of six, where each group becomes the expert of a specific disease caused by a nutritional deficiency.
2. Depending on the number of students in the class, the number of diseases / disorders or number of students in the expert groups can be varied.
3. Recommended diseases are: Malnutrition (Protein-Energy Malnurtrition), Anaemia, Goitre and Scurvy. Others that may be considered are: Osteoporosis and Night Blindness. The teacher should prepare a one pager on each disorder, which addresses their causes, symptoms and remedies / prevention strategies.
4. Once the expert group has discussed their disease and explored answers to the guiding questions, they are then reorganized into Jigsaw groups where each member represents a different expert group. These experts then brief the rest of their group members on the nutritional disease they have learnt about.

Activity: Fit for a Queen / King

1. Organize a role play activity in which the whole class participates.
2. One learner can be selected as the King or Queen of the class, while 5-6 students can assume various roles as advisors such as the Royal's fitness instructor, their mother, their doctor etc. Everyone else is vying to become the Royal's new personal chef.
3. Each candidate must pitch an ideal meal to the King, and talk about its nutritional benefits along with its taste and other features.
4. The royal after consulting their advisors will hire their new chef.

DOMAIN*:* Physical Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: Elements and Compounds

Student Learning Outcomes:

Students will be able to:

1. Describe the structure of matter in terms of particles (i.e., atoms and molecules).
2. Describe molecules as a combination of atoms (e.g, H_2o, O_2 & C_2).
3. Differentiate that some elements are made of atoms and some elements exist as molecules and have different properties to a single atom of the element.
4. Recognize the names and symbols for some common elements.
5. Identify that compounds are substances that contain two or more different types of elements.
6. Explain that compounds are formed by different types of elements joining together chemically forming a new substance e.g burning magnesium or steel wool in air/oxygen.
7. Illustrate the formation of a compound with the help of a word equation.
8. Distinguish between elements and compounds.
9. Describe the role of common elements and compounds in our daily life-(Carbon, Nitrogen, Hydrogen, Aluminium, Water, Common Salt, Sugar).
10. Categorise elements into metals and non-metals based on their physical properties.

Knowledge:	**Skills:**
Student will be able to: 1. 1 - Describe the structure of matter in terms of particles (i.e., atoms and molecules). 2. 2 - Describe molecules as a combination of atoms (e.g., H_2O, O_2 & CO_2). 3. 6 - Explain that compounds are formed by different types of elements joining together chemically forming a new substance. 4. 8 - Distinguish between elements and compounds. 5. 4 - Recognize the names and symbols for some common elements (first 18 elements of periodic table). 10 - Categorize elements into metals and non-metals based on their physical properties. 6. 9 - Describe the role of common elements and compounds in our daily life- (Carbon, Nitrogen, Hydrogen, Aluminum, Water, Common Salt, Sugar) 7. 3 - Differentiate that some elements are made of atoms and some elements exist as molecules and have different properties to a single atom of the element. *(Advanced SLO)* *Describe an atom as an electrically neutral entity.* **Key Vocabulary**	Students will be able to: • Differentiate between atoms and molecules by making models using play dough/ flour. • Explore the elements present around us. • Compare and contrast properties of elements and relate them with their uses. • Explore the common elements and compounds in our daily life (Carbon, Nitrogen, Hydrogen, Aluminum, Water, Common Salt, Sugar). • Make a simple poster presenting common elements, their names, and symbols • Conduct internet research for material on mixtures and compounds. • Make predictions of likely outcomes for a scientific inquiry. • Interpret results using scientific knowledge and understanding. • Draw a conclusion from their findings.

atom, subatomic particle, electrons, nucleus, proton, neutron, atomic number, molecule, element, compound, , metals, non-metals, melting point, boiling point, good/poor conductors, ductile, malleable, chemical symbols, chemical formula, chemical bonding	

Assessments

Formative Assessments

- Brainstorming/mind maps/graphic organizers
- Model making (use of wooden/skewer sticks and play dough to make molecules of different compounds)
- students' responses on exploring simulation activities on web resources
- Activity sheets
- Booklet making (individual or in groups)
- students' responses during discussion on watching YouTube videos
- students' responses on demonstration of chemical reactions for making compounds
- Exit tickets (Write one sentence what you have learned today)
- Projects

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination

Learning Activities

1. Molecules of water can be made by using wooden toothpicks and play dough (different colours can be used to represent a specific element). Make equal size small balls of play dough. According to the chemical formula of a compound, different students can be assigned different compounds like H_2O, O_2 & CO_2.
2. Students can be asked to play an interactive simulation game 'how to build a molecule'
3. Demonstrate the formation of simple compounds, like burning sugar. Show simple combinations of elements, e.g., burning magnesium or steel wool in air/oxygen. Alternatively, YouTube videos can be shown. Discuss that magnesium combined with oxygen to give magnesium oxide. students can also heat the mixture of iron filings and sulphur to form a compound iron sulphide.
4. Make a booklet of commonly found elements and compounds and mention their uses.
5. An activity sheet can be used where students can compare and contrast the properties of elements and compounds.

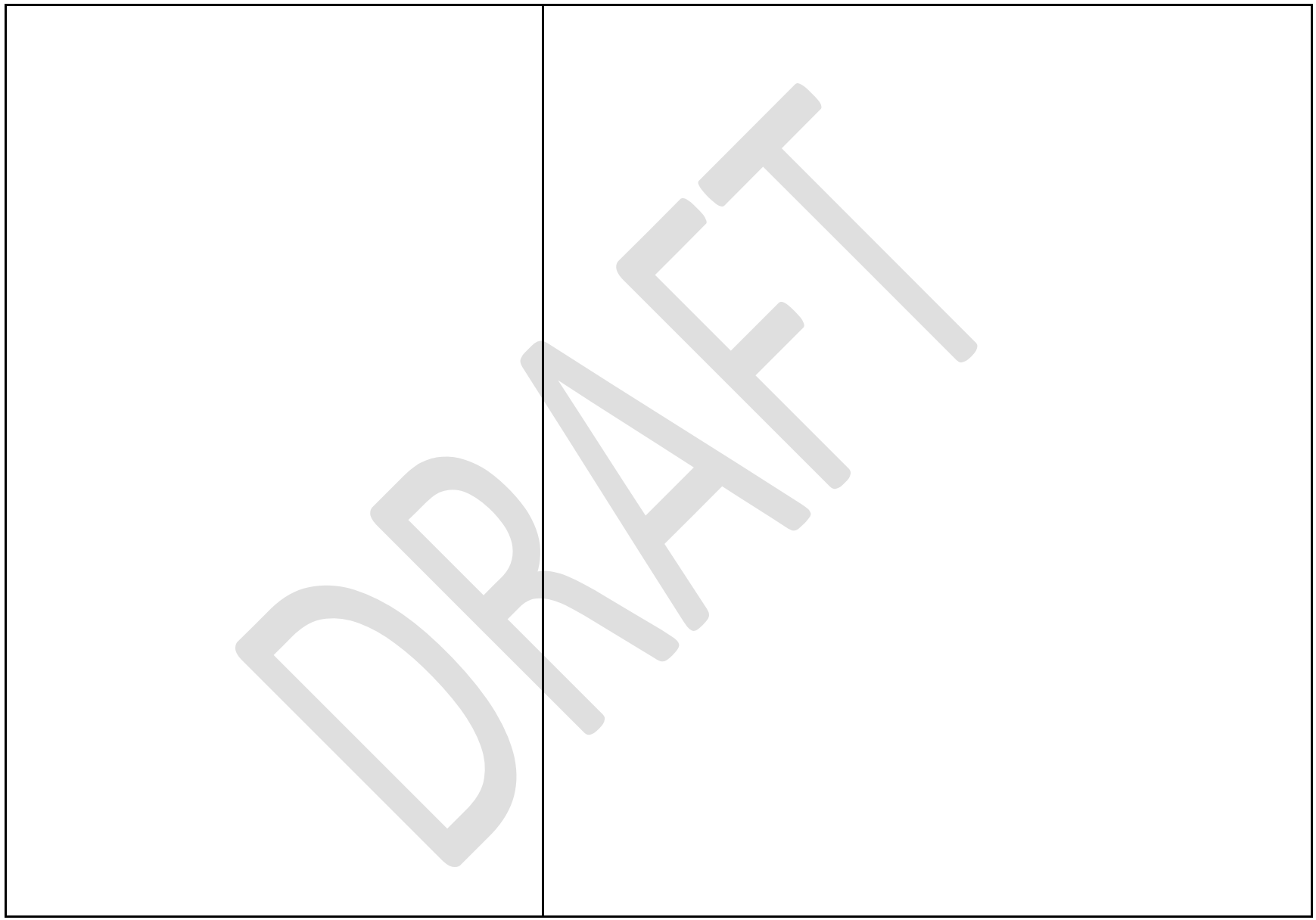
DOMAIN: Physical Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: The Particle Theory of Matter
Student Learning Outcomes: **Students will be able to:** 1. Explain the Particle Theory of Matter. 2. Use a particle model of matter to investigate the movement and arrangement of particles in three states. 3. Explain why gases and liquids take the shape of their containers but solids do not, in terms of the particle theory of matter. 4. Explain why liquids and gases flow easily. 5. Discuss, using the particle theory of matter, why liquids and gases can flow easily but solids cannot. 6. Interpret the evidence for the existence of the particles in matter by observing daily life examples (adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water). 7. Apply the particle theory of matter to explain diffusion. 8. Explain the changes in states: melting, freezing, evaporation, condensation and sublimation using the particle model of matter.

Knowledge:	**Skills:**
Students will be able to: 1 - Explain the Particle Theory of Matter. 3 - Explain why gases and liquids take the shape of their containers but solids do not, in terms of the particle theory of matter. 4 - Explain why liquids and gases flow easily. 5 - Discuss, using the particle theory of matter, why liquids and gases can flow easily but solids cannot. 7 - Apply the Particle Theory of Matter to explain diffusion. 8 - Explain the changes in state: melting, freezing, evaporation, condensation and sublimation using the particle model of matter. **Key Vocabulary** freezing, melting, evaporation, solidification, condensation, sublimation, diffusion, particles, atoms.	Students will be able to: ● Create and use of models to describe gases, liquids and solids. ● Explore the idea that matter is made of particles that are too small to be seen by observing materials. 2 - Use a particle model of matter to investigate the movement and arrangement of particles in three states. 6 - Interpret the evidence for the existence of the particles in matter by observing daily life examples (adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water). ● ● Investigate the factors which affect the rate of evaporation and communicate findings. ● Choose equipment to carry out scientific investigations (burner, beaker, tripod stand etc) to measure the temperature during the heating or cooling of a substance and communicate findings. ● Use models to explain expansion and contraction of matter during these processes. ● Use the particle model to identify changes in melting, freezing, evaporation, condensation and sublimation. ● Relate the changes in states of matter with real life situations. ● Make observations about phenomena related to diffusion around them. ● Make predictions of likely outcomes for a scientific inquiry. ● Interpret results using scientific knowledge and understanding. ● Draw conclusions from their findings (factors affecting evaporation, condensation).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Assessments

Formative Assessments

- Brainstorming/mind maps/graphic organizers
- Model making (use of wooden/skewer sticks and play dough to make molecules of different compounds)
- Students' responses on exploring simulation activities on web resources
- Activity sheets
- Booklet making (individual or in groups)
- Students' responses during discussion on watching YouTube videos
- Students' responses on demonstration of chemical reactions for making compounds
- Exit tickets (Write one sentence what you have learned today)
- Project

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination

Learning Activities

1. Students should create a mind map showing what they understand by the terms ‘solids’, ‘liquids’ and ‘gases’.
1. Introducing the term ‘particle theory’; ask students: What do you think of when I say particle? Are solids, liquids and gases all made of particles? Are particles everywhere? Ask students to present their understanding of particles in relation to solids, liquids and gases. They can do a poster, a drama activity, or a stand-up talk – key focus is their understanding. When looking at explanations, unpick any misconceptions studentsmay hold.
3. Demonstrate the movement and spacing of particles in solids, liquids and gases using a simulation/web.
4. Use of air freshener to demonstrate the process of diffusion. students can be asked to come up with examples from dailylife.
5. Illustrate that diffusion occurs in liquids and gases (show mixing of ink in water, Opening the Soda/Cold Drinks bottle and the CO_2 diffuses in the air, dipping the tea bags in hot water will diffuse the tea in hot water). Relate it with air pollution (small dust particles or smoke diffuse into the air and cause air pollution).
6. Discuss with students about Brownian motion and how Robert Brown discovered the movement of pollen in water.7. Demonstrate theBrownian motion by using the movement of a pollen on the surface of water using a microscope.
8. Demonstrate changes in states of matter (condensation by putting a saucer on a hot cup of water, evaporation by boiling water and showing steam, melting by putting the ice on a teacher’s table etc.
9. Use photographs/slideshow/flash cards to show examples of changes in state of water. (Clouds and snow, windows with frost, water boiling in a pot etc.) followed by asking students to identify each process/state.
10. Discuss how wet washing hung on a line outside, dries – and the factors that might affect how quickly it dries. Devise classroom tests for testing the variables affecting drying washing, e.g. one ‘control’ cloth lying on the bench and others, a) on the radiator/heater, b) hanging near the window, c) hanging near the door, d) hanging near a fan, etc.

DOMAIN: Physical Sciences

Grade 6

DOMAIN: Physical Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Learning Activities

(Note: All experiments where light source is used are suggested to be done in a comparatively darker room)

1. A torch or any other light source can be used to show students the incident ray and reflected ray from a surface.
2. students in groups can be asked to measure the angle of incident ray and reflected ray by using a protractor after tracing the path of both rays on a piece of paper.
3. Use of illustrations/flashcards/secondary resources (YouTube videos, simulations) to show how we see the apparent color of the objects when light is reflected or absorbed light.
4. Project work can be assigned in groups to plan how to use the Law of Reflection to build a working periscope.
5. students can be asked to explore the speed of light through different mediums. They can make a booklet of different materials and search from the internet about the speed of light, through each of them and conclude their findings.
6. First-hand experience can be given to students about the use of plane mirrors in microscopes and ask them how the law of reflection works here.

DOMAIN: Physical Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Standard: Electricity
Student Learning Outcomes: **Students will be able to:** 1. Explain the phenomena of static electricity in everyday life. 2. Describe electric current as a flow of charges. 3. Describe a simple circuit as a path for flow of charges. 4. Differentiate between open and closed circuits. 5. Draw and interpret simple circuit diagrams (using symbols). 6. Describe the characteristics of series and parallel circuits. 7. Draw and construct series and parallel circuits. 8. Identify the use of series and parallel electric circuits in daily life. **1.** Explain the factors that affect the brightness of bulbs or speed of motors: number of batteries, number of bulbs, type of wire, length of wire, thickness of wire.

Knowledge:	**Skills:**
Students will be able to: 1 - Describe electric current as a flow of charges. 2 - Describe a simple circuit as a path for flow of charges. 3 - Differentiate between open and closed circuits. ● Understand symbols of circuit components. 6 - Describe the characteristics of series and parallel circuits. ● Differentiate between series and parallel circuit. 8 - Identify the use of series and parallel electric circuits in daily life. 1 - Explain the phenomena of static electricity in everyday life. ● Explain the factors that affect the brightness of bulbs or speed of motors: ● Number of batteries ● Number of Bulbs ● Type of wire ● Length of wire ● Thickness of wire **Key Vocabulary**	Students will be able to: ● Draw and interpret simple circuit diagrams (using symbols). ● Construct simple circuits. ● Compare and contrast open and closed circuits. ● Predict how the current through the battery with the switch closed compares to the current through the battery with the switch open. ● Construct and compare series and parallel circuits. ● Justify the use of series and parallel electric circuits in daily life. ● Compare the flow of current through different bulbs in a circuit. ● Make predictions about the effect of some variables on the current in a circuit. ● Investigate the factors that affect the brightness of bulbs or speed of motors (number of batteries, number of bulbs, type, length and thickness of wire). ● Make predictions of likely outcomes for a scientific inquiry. ● Interpret results using scientific knowledge and understanding. ● Draw conclusions from their findings (i.e. the current is the same at each place in a series circuit). ● Assemble and operate a trip wire security alarm system using simple items (STEAM).

electricity, current, charge, parallel circuit, series circuit, component, wire, bulb, battery, switch, motor	

Assessments

Formative Assessments

- Mind maps
- Role play (students forming a circle to present electric circuit)
- Activity sheet (how circuits work and mention the role of each component of a circuit)
- By students' verbal and written responses
- Discussions and think pair and share (Why would the fairy lights not work if one of the bulbs is removed from the string?)
- Project work (construction of circuits)
- Exit tickets (What are the factors that affect the brightness of the bulb)

Summative Assessments

- Class tests
- Marked Quizzes
- End of unit tests
- Term wise examination
- Projects

Learning Activities

1. Complete a mind map showing what they understand about circuits and their components.
2. Ask students to stand in a large circle around the room. Nominate one learner as the cell and give them a container full of ping pong balls. Tell the class that the ping pong balls represent parcels of energy. Nominate two or three other students to be light bulbs; the rest of the students are parts of the connecting wire. The battery starts to pass out the ping pong balls and they are passed around the circle. The light bulbs pass some on but throw some at random out into the room (risk assessing your choice of 'bulbs' and where they are standing). The balls keep going round and round the circuit until eventually all the ping pong balls will have been thrown out into the room and the battery has nothing left to pass on. Ask the class to look around for the parcels of energy and see that they are still there – they have not disappeared, they have just spread out. That is how an electrical circuit transfers energy. Now nominate two or three students to be insulators – they have to stand with their hands behind their backs, make sure they are between the battery and the first of the bulbs. They cannot pass on the energy so it never gets to the bulb so the bulbs cannot light.
3. Demonstrate how to set up the circuits and encourage students to construct a simple circuit and not down their findings about on and closed circuit on an activity sheet.
3. Show students a set of fairy lights (the sort where they all go out if one bulb goes out). Turn on the lights and then disconnect one bulb, so that all of the lights go out. Ask students to explain what has happened by using their knowledge of electrical circuits. Pose this question as a think/pair/share activity where students have one minute to think for themselves, two minutes to discuss with a partner and then five minutes to share their ideas with another pair.
4. Encourage students to explore series and parallel circuits in their classrooms.
5. Have students construct a series and parallel circuits in groups and present it to the class. (Teacher can ask questions during their presentation:

    - In which kind of circuit are the components all connected one after the other? (Series)
    - In which kind of circuit can you switch off or disconnect one component without breaking the whole circuit? (Parallel)

6. Encourage students to battle energy vampires by creating reminders to unplug appliances for their schools and homes. They can design some reminder cards and hang them around the room near energy vampires.
7. Plan and conduct an investigation to study factors that affect the brightness of bulbs or speed of motors (number of batteries, number of Bulbs, type, length and thickness of wire) and make circuit diagrams, accordingly.

8. Make a paper circuit card using LED, aluminium foil and battery. (STEAM)

DOMAIN: Physical Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: Magnetism

Student Learning Outcomes:

Students will be able to:

1. Explain that electric currents have magnetic fields around them and that this can be experimentally verified using a magnetic compass.
2. Describe how to magnetize a magnetic material.
3. Construct an electromagnet and identify the factors that affect the strength of an electromagnet.
4. Describe briefly the working principles of electromagnetic devices such as a speaker, a doorbell.
5. Compare different types of magnets (permanent, temporary and electromagnets).
6. Recall that a magnetic field is a space around a magnet where the effect of magnetic force can be observed.
7. Draw the magnetic field of a bar magnet using iron filings.
8. Explain how the Earth's magnetic field can be investigated through the attraction that a freely-pivoted magnet experiences and then aligns up in the north-south direction
9. Recall that a freely-moving magnet comes to rest pointing in a north-south direction and explain why.

Knowledge:	**Skills:**
Students will be able to: • Understand properties of permanent magnets (i.e, two opposite poles, attraction/repulsion, and strength of the magnetic force varies with distance) and make connections to uses in everyday life (e.g., a directional compass). 6 - Recall that a magnetic field is a space around a magnet where the effect of magnetic force can be observed 7 - Draw the magnetic field of a bar magnet using iron filings. 8 - Explain how the Earth's magnetic field can be investigated through the attraction that a freely-pivoted magnet experiences and then aligns up in the north-south direction 9 - Recall that a freely-moving magnet comes to rest pointing in a north-south direction and explain why. 1 - Explain that electric currents have magnetic fields around them and that this can be experimentally verified using a magnetic compass. 2- Describe how to magnetize a magnetic material. 3 - Construct an electromagnet and identify the factors that affect the strength of an electromagnet. • Describe briefly the working principles of electromagnetic devices such as speakers, doorbells.	Students will be able to: • Compare magnets, non-magnets and magnetic materials. • Predict the motion of magnets, based on knowledge that they repel and attract. • Make a magnet by the 'stroke' method and the electrical method. • Plot magnetic field of a bar magnet using iron filings. • Compare and contrast permanent magnets and electromagnets • Draw the combined fields created when like and unlike magnetic poles interact. • Relate properties of permanent magnets to everyday use. • Design a method for measuring magnetic strength. • Relate the electromagnets used in industries and households. • Make a toy car that uses magnetic force to move. • Identify important variables; choose which variables to change, control and measure. • Present results as appropriate in tables and graphs. *AdditionalSLO* • *Describe the properties that are unique to electromagnets (i.e., the strength varies with current, number of coils, and type of metal in the core; the magnetic attraction can be turned on and off; the poles can switch).*

Key Vocabulary

stroke method, compass needle, permanent magnet, poles, magnetic force, compass, attraction, repulsion, bar magnet, magnetic field, iron fillings, electromagnet, current, coil, electromagnetic devices, telephone, speaker, electric motor and electric generator

Assessments

Formative Assessments

- KWL charts
- Students' responses in discussion, assessing web resources and doing scientific inquiry
- Projects
- Students' responses in plotting of a magnetic field and making of temporary magnets
- Exit tickets (what have you learned today?)
- Written tasks/worksheets

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

Learning Activities

1. Revise prior learning on magnets by showing students some examples of effects caused by magnets (e.g. a video). Assess whether students can correctly use the term 'magnet', 'magnetic', 'attract' and 'repel'. Attraction and repulsion can be seen very easily if magnets are suspended. This is also an opportunity to check which pole points to the north of the Earth.
2. Students can be asked to magnetize a nail by stroking it with a permanent magnet. They demonstrate that it is magnetic by using it to pick up paper clips (or similar). Use an animation so students can visualize the domains becoming arranged in the nail. What would happen if you stroked the magnet in different directions? If there is time, students investigate whether their predictions are correct.
3. Show students an example of magnets exerting a force at a distance. In pairs, students discuss what they think is happening. They share their ideas and feedback to the class.
4. Use a simulation to demonstrate how a magnetic field can be mapped. Start by showing the simulation without the field. Demonstrate that the compass experiences a force that is in different directions depending on where it is in the field.
5. Demonstrate that the field has different strengths in different places;

    - the field is stronger near the poles (shown by the field lines being closer together);
    - the field is weaker further away from the poles (shown by the field lines being further apart).

1. Show students how to use a plotting compass to detect the field around a bar magnet. Ask the students to, in pairs, draw the fields around the bar magnets. Compare results.
1. Use the simulation again with the magnetic field visible. Ask students to compare the shape of this field with the one they have drawn. Ask students to identify where the magnetic field is strongest. Ask them to predict which part of a bar magnet, iron filings would be most attracted to. Demonstrate placing a bar magnet beneath a piece of card. Sprinkle iron filings on the top. These will produce patterns. The filings will be concentrated around the poles.
1. Students make their own electromagnet using a low voltage applied to an insulated copper wire wrapped around an iron nail. They test this with a compass to detect magnetism. Is the shape of the field the same as with a permanent magnet? Is magnetism permanent? Does the magnetism 'disappear' when the current stops? Does the magnetism 'disappear' when the nail is removed but current kept on?
1. **Scientific inquiry Activity**: Students use their electromagnet to pick up small items like paper clips. By using the 'number of paper clips picked up' as their dependent variable, they design an investigation to find out:
    - How does the number of coils of copper wire affect the strength of the electromagnet?
    - How does the current in the wire affect the strength of the electromagnet?

    This is an opportunity for students to demonstrate a wide range of scientific inquiry skills by planning, doing, interpreting and evaluating their own investigation.

2. Students summarize their learning by making a table that compares and contrasts permanent magnets and electromagnets.

3. Students research the uses of magnets and electromagnets, for example in: medical contexts, route finding, security, sorting steel from other materials for recycling.

DOMAIN*:* Earth and Space Sciences

Grade 6

*** The additional/advanced SLOs are written in Italics.**

Unit: Solar System
Student Learning Outcomes: **Students will be able to:** 1. Differentiate between the characteristics of different planets. 2. Describe the characteristics of asteroids, meteorites and comets. 3. Describe the uses of various satellites in space i.e. geostationary, weather, communication and Global Positioning System (GPS). 4. Investigate how artificial satellites have improved our knowledge about space and are used for space research. 5. Differentiate between planets and dwarf planets. **1.** Account for the significance of Halley's Comet across the world in terms of its visibility with the naked eye and its 75 year orbital period

Knowledge:	**Skills:**
Students will: 3 - Describe the uses of various satellites in space i.e. geostationary, weather, communication and Global Positioning System (GPS). ● *Recognize the structure of the sun.* *2* - Describe the characteristics of asteroids, meteorites and comets. 1 - Differentiate between the characteristics of different planets. 5 - Differentiate between planets and dwarf planets. 6 - Account for the significance of Halley's Comet across the world in terms of its visibility with the naked eye and its 75 year orbital period **Key Vocabulary** geostationary, weather, communication, Global Positioning system (GPS), Artificial Satellites, core, Radiative Zone, Convection Zone, Photosphere, Chromosphere, Corona, Sunspots, Granulation, Prominence.	Students will be able to: ● Differentiate between the characteristics of different planets. ● Observe images of different planets to analyze the characteristics of each planet. ● *Construct and design all the planets.* ● Investigate how artificial satellites have improved our knowledge about space and are used for space research. ● Investigate how the satellite knows where we are. ● Differentiate between planets and dwarf planets on the basis of their characteristics. ● Investigate if Pluto is a dwarf planet. ● Differentiate between asteroids, meteorites and comets.

Assessments

Formative Assessments

- KWL chart
- Exit slips
- One minute summary on satellites
- Ask students to create a visualization or doodle map of what they learnt
- Presentations

Summative Assessments

- Creative portfolio on planets
- End of term or midterm exam
- Podcast or oral presentation- a five-to-ten-minute speech about the core concepts of the unit.

Learning Activities

Activity 1- Creating a Model of the Solar System

1. Ask students to create a model of the solar system.
2. They will use different colored balloons/playdough to model each planet and present their models to the class.

Activity 2- Characteristics of Planets

1. Divide students into groups and assign each group one planet.
2. Ask students to prepare a one-page advertisement on chart paper to persuade someone to visit their planet.
3. They should describe the characteristics of the planet and how the planet is different from other planets in their presentations.

Activity 3- Differentiate between Asteroids, Meteorites and Comets

1. Place three boxes labelled asteroids, meteorites and comets.
2. Write down the characteristics of asteroids, meteorites and comets on paper strips and ask students to put them in the correct bucket.

Activity 4- Learn how a Satellite works

1. Divide students into groups and provide them with construction material to build a satellite.
2. Then make larger teams and have each team prepare a signal ball on paper.
3. Divide students into satellites, space rocks and signal rocks. students must pass their signal ball from the starting satellite to the final satellite.

Activity 5- Roleplay

1. Ask students to prepare a short play on their favorite topic from the unit and present it to class.
2. Ask students to tell how they would feel if they saw the planet, comet, or space rock in real life.

Suggested Links:

- https://laney.edu/cheli-fossum/wp-content/uploads/sites/210/2012/01/10-Enzymes.pdf
- https://phet.colorado.edu/sims/html/build-a-molecule/latest/build-a-molecule_en.html
- https://littlebinsforlittlehands
- https://www.sciencekiddo.com/paper-circuit-cards/
- https://phet.colorado.edu/en/simulation/legacy/magnet-and-compass
- https://phet.colorado.edu/en/simulation/legacy/magnet-and-compass

NCP - SCIENCE Grade 7

Suggested Guidelines

DOMAIN: Life Sciences

Grade 7

*** The additional/advanced SLOs are written in Italics.**

Unit: Transport and Respiration Systems in Plants

Student Learning Outcomes:

Students will be able to:

1. Explain the root and shoot system in plants and label different parts of leaf, stem and root (external and internal structure).
2. Predict the role of xylem and phloem in transport of water and food in plants by observing the cross section of the stem.
3. Define the process of photosynthesis and derive word equations for it.
4. Describe how plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein).
5. Explain that the structure of leaves is adapted to the process of photosynthesis.
6. Describe the process of respiration and write word equations for it and compare and contrast the processes of photosynthesis and respiration.
7. Describe the phenomenon of transpiration and explain its importance for plants. Explain how wind, temperature, light, and humidity affect the rate of transpiration in plants.
8. Explain how the process of transpiration accounts for the natural rise of water levels

Knowledge:	**Skills:**
Students will be able to: • Briefly describe the structure and function of the following plant organs; roots, stem and leaves, and how they come together to constitute the root and shoot systems of the plant. • Identify the three types of plant tissue and describe their function. • Explain that living organisms have a complex transport system for transfer of water, nutrients and other matter across the body. • Describe how plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein). • Describe the two transport systems in plants – xylem and phloem, and explain how they work together to help the plant survive and grow. • Describe the process of photosynthesis and respiration in plants. • *Explain that the structure of leaves is adapted to the process of photosynthesis.* • *Illustrate through examples how plants have evolved in their structure and features to survive in their ecological context (for instance, vascular plants in deserts, some flora in the antarctica or vascular plants in the Himalayas).* **Key Vocabulary** organs, cells, tissues, vascular tissue, ground tissue, epidermis, xylem, phloem, vascular bundle stem, roots, leaves, root hair, stomata, cuticle, chlorophyll, *palisade mesophyll, spongy mesophyll*, oxygen, carbon dioxide, sugar molecule, photosynthesis, respiration, chemical energy, heat energy, light energy, transpiration, translocation, magnesium, nitrates	Students will be able to: • Sketch and label the different parts of leaf, stem and root – both external and internal structure. • Map, sequentially, the series of steps taken in the transport of water, minerals, chemicals and nutrients in xylem and phloem. • Compare and contrast xylem and phloem. • Derive an equation to show how plants convert light energy into chemical energy during photosynthesis. • Demonstrate how plants break down food to produce energy during respiration through an equation. • Compare and contrast the processes of respiration and photosynthesis. • Imagine what would happen if plants were unable to use carbon dioxide during photosynthesis. • Hypothesize and investigate how various environmental factors such as light intensity, wind, temperature and humidity affect the rate of water uptake by a plant.

Assessments

Formative Assessments

- KWL charts for assessing prior knowledge of students
- Discussion questions
- Oral and written responses
- Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Marked Quizzes

Summative Assessments

- Journal to see the connections between different topics about plants
- Final Project/ Presentations
- Midterm or Final Exam

Learning Activities

Activity 1: Visualizing Movement of Water through the Xylem

Take cabbage or celery leaves (their ends should be intact) and place them in clear containers filled with water. Add a few drops of food coloring in the water and let the leaves sit for 8 hours or overnight. Observe how the veins of the leaves are colored, starting from the bottom to the top. Discuss xylem's role in water transportation in plants through this demonstration.

Activity 2: Xylem and Phloem Model

Using a paper cup, a toilet paper tube, a set of thin white straws and a set of thick, colored straws, arrange a model of the inside of a plant. The paper cup can represent the outer bark of the plant. Within the paper cup, arrange the toilet paper tube so that it is in the center. Outside the toilet paper tube, arrange the thick, colored straws to represent phloem, and the thin white straws should be placed inside the tube to represent xylem.

Activity 3: Sticky Note Revision

Draw a table with two columns on a chart, and label one column as 'Xylem' and the other as 'Phloem'. Write down different features and functions of xylem and phloem separately on sticky notes, so that one sticky note has only one feature/ function of either xylem or phloem written on them. Have the students come up to the chart one-by-one. Each learner should correctly identify the feature/ function written on the sticky note and paste it in the relevant column.

Activity 4: Paint The Process

Divide students into groups and ask each group to paint the diagrams of xylem and phloem and detail each step of the transport process alongside the diagrams.

Activity 5: Plant Food

Prepare 'plant food' using old banana peels. Bury the peels in a hole a few inches below the surface next to plants like rose bushes or other plants that require high levels of potassium. Discuss the importance of food in plants and humans and discuss how food will be transported in plants.

Suggested Links:

https://www.pinterest.com/pin/260716265898074573/]

https://www.plt.org/educator-tips/diy-model-to-explain-inner-tree-parts]

DOMAIN: Life Sciences

Grade 7

*** The additional/advanced SLOs are written in Italics.**

Unit: Transport and Respiratory Systems in Humans

Student Learning Outcomes:

Students will be able to:

1. Explain that living organisms have a complex transport system for transfer of various solids, liquids and gases across the body.
2. Explain the processes of breathing and respiration and illustrate how air moves in and out of our body.
3. Differentiate between the processes of respiration and breathing.
4. Differentiate between aerobic and anaerobic respiration.
5. Describe the role and function of major organs in the human respiratory system including trachea, lungs and alveoli (air sacs).
6. Describe the structure and function of the human heart.
7. Sketch and label the human circulatory system.
8. Explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gases, nutrients, wastes and heat.
9. Compare and contrast arteries, veins and capillaries.
10. Describe the composition of blood and the functions of red cells, white cells, platelets and plasma.
11. Compare and draw connections between the transport systems in plants and humans.

Knowledge:	**Skills:**
Students will be able to: Explain that living organisms have a complex transport system for transfer of various matter across the body. Explain the processes of breathing and respiration and illustrate how air moves in and out of our body. Describe the role and function of major organs in the human respiratory system including trachea, lungs and alveoli (air sacs). Describe the structure and function of the human heart. Explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gases, nutrients, wastes and heat. Describe the composition of blood and the functions of red cells, white cells, platelets and plasma. *Advanced SLOs* *Identify practices that help keep the respiratory system healthy.*	Students will be able to: • Compare and draw connections between the transport systems in plants and humans. • Differentiate between the processes of respiration and breathing. • Differentiate between aerobic and anaerobic respiration. • Sketch and label the human circulatory system. • Sketch and label the human respiratory system. • Compare and contrast arteries, veins and capillaries. • Trace the path of air in and out of the body and how it converts during the process of respiration. • Design a model of a lung to demonstrate how air moves in and out of the lungs. • Use storytelling to illustrate how various practises – both harmful (e.g., smoking) and helpful (regular swimming etc.,) impact the respiratory system. • Hypothesise how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate, test their hypothesis, calculate their pulse rate and record their findings. *Advanced SLOs* • *Trace the path of air in and out of the body and how the oxygen it contains is used during the process of respiration.* • *Hypothesise how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate, test their hypothesis, calculate their pulse rate and record their findings.*

Describe respiratory illnesses (asthma, emphysema and pneumonia) and how they affect lungs. **Key Vocabulary** breathing, respiration, *nasal cavity, pharynx,* larynx, trachea, lungs, diaphragm, chest wall, ribcage, alveoli, chest cavity, contraction, relaxation, inhalation, exhalation, heart, atrium, ventricle, valve, oxygenated blood, deoxygenated blood, red cells, white cells, platelets, plasma, haemoglobin	• *Explore the natural balance in the processes of inhalation and exhalation, in respiration and in photosynthesis and synthesize why, in their opinion, balance is beneficial and how it aids life and survival on Earth.* • *Explore careers in science such as Sleep Therapists, Respiratory Therapists, Pulmonologists etc.*

Assessments

Formative Assessments

- KWL charts for assessing prior knowledge of students
- Think- pair- share activities to compare the processes of respiratory and circulatory systems
- Discussion questions
- Oral and written responses
- Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Marked Quizzes

Summative Assessments

- Journal to see the differences between transport in humans and transport in plants
- Final Project/ Presentations
- Midterm or Final Exam

Learning Activities

Activity 1: Model of Lungs

1. Create a model of lungs using a plastic bottle, two balloons, scissors, and tape.
2. Measure an inch or two from the bottom of the plastic bottle and cut the bottom off carefully.
3. Take one balloon and put it inside the bottle. Then fold the bottom of the balloon around the rim of the bottle so the balloon hangs from the top.
4. Wrap tape around the top to tighten the balloon in place.
5. Tie a knot at the end of the remaining balloon and cut the large part of the balloon in half horizontally.
6. Using the balloon half with the knot, stretch the open end over the bottom of the bottle. Use tape to secure if necessary.
7. Gently pull down on the balloon from the knot. This should cause air to flow into the balloons within the lung model.
8. Release the balloon with the knot and watch as the air is expelled from the lung model.

Activity 2: Storytelling Activities

1. Divide students in groups and ask each group to create two stories each: one that demonstrates the negative effects on lungs (through smoking, pollution etc.) and one that demonstrates the positive effects on lungs (through exercising, swimming, taking precautionary measures such as masks etc.).

Activity 3: Model of Heart

1. Make a working model to demonstrate how the heart pumps blood. Using two bottle caps, four juice-box straws, three plastic bottles and water mixed with red food coloring, design a model.
2. Make two straw-sized holes in one bottle cap, whereas in the second bottle cap, one hole should be straw-sized and one hole should be smaller. Take two straws, stretch, and bend them to create a 90-degree angle. Slide one straw into the other straw, then tape up the join. Repeat with the second set of straws.
3. Place the three bottles on the table. Fill the first two with red-colored water to about 80% full. Leave the third one empty. On the first bottle place the cap with one straw hole and one small hole. On the middle bottle place the cap with two straw holes.
4. Leave the third bottle without a cap. Place the straws in the bottles so that the middle bottle is connected with the other two bottles with the straws.
5. Squeeze the middle bottle to see how “blood” moves from one part of the body into the other.

Activity 4: Measuring the Pulse

1. Teach students how they can measure their heart rate by placing the index and third fingers on their neck to the side of their windpipe.
2. To check the pulse at the wrist, place two fingers between the bone and the tendon over the radial artery — which is located on the thumb side of the wrist.
3. Ask students to count the heartbeats up to 15 at least.
4. Ask students to engage in some activity, such as running around the ground, doing jumping jacks etc. and ask them to recheck their pulse.
5. Compare the differences by calculating the pulse rate before and after exercise.

Activity 5: Capillaries, Veins and Arteries

1. Make a yarn model to understand the size and roles of capillaries, veins, and arteries.
2. Take thick yarn in blue and red color to represent veins and arteries respectively.
3. Thinner white colored yarn can be used to represent the capillaries.

Activity 6: Who Does What?

1. Divide students in groups and ask each student to research the people who work in relation to the respiratory and circulatory systems (pulmonologists, cardiologists, respiratory therapists etc.).
2. Ask the groups to prepare a short presentation to present their findings.

Suggested Links:

https://ctsciencecenter.org/blog/science-at-play-make-your-own-lung-model/]

https://www.steampoweredfamily.com/activities/heart-model-heart-stem/]

https://www.steampoweredfamily.com/activities/heart-model-heart-stem/]

DOMAIN: Life Sciences

Grade 7

*** The additional/advanced SLOs are written in Italics.**

Unit: Healthy Living and Immunity

Student Learning Outcomes:

Students will be able to:

1. Describe the three types of immunity in humans – innate, adaptive, and passive.
2. Illustrate how adaptive immunity develops over time.
3. Identify the various types of pathogens that cause infectious diseases.
4. Explain the various defences that the body has against pathogens, before the innate immune system is activated.
5. Describe the parts of the immunity system and how they function to produce an immune response.
6. Visualise and map the various lines of defence the human body has against pathogens and ideate how they can add additional layers of defence (such as wearing masks, using sanitizers, etc.).
7. Propose some common strategies for strengthening their immune system.
8. Explain how infectious diseases such as hepatitis, covid-19, typhoid, whooping cough, measles and dengue are caused /contracted, how they are tested and diagnosed, and how they can be prevented.
9. Suggest ways in which communities of people can safeguard against the spread of infectious diseases.

Knowledge:

Students will be able to:

- Describe the three types of immunity in humans – innate, adaptive, and passive.
- Identify the various types of pathogens that cause infectious diseases.
- Explain the various defenses that the body has against pathogens, before the innate immune system is activated.
- Describe the parts of the immunity system and how they function to produce an immune response.
- Illustrate how adaptive immunity develops over time.
- Explain how infectious diseases such as hepatitis, covid-19, typhoid, whooping cough, measles and dengue are caused / contracted, how they are tested and diagnosed, and how they can be prevented.

(Advanced SLOs)

- *Describe the role of vaccines in immunity, and explore some strategies on how vaccines can be created.*

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Key Vocabulary

innate immunity, adaptive immunity, passive immunity, pathogens, immune system, *leukocytes, lymphocytes, phagocytes, neutrophils, eosinophil, T-cells, B-cells*, natural killer cells, virus, bacteria, antibodies, daily infection rate (*/ R^o*), infectious diseases, non-infectious diseases, vaccine

Skills:

Students will be able to:

- Differentiate between infectious and non-infectious diseases.
- Differentiate between specific and nonspecific immune responses.
- Visualise and map the various lines of defense the human body has against pathogens and ideate how they can add additional layers of defense (such as wearing masks, using sanitizers, etc.).
- Estimate how quickly a disease is likely to spread using the base number of infected population and the daily infection rate.
- Relate the cause and effect in the contraction of an infection.
- Predict how quickly diseases are likely to spread based on how they are transmitted (air, skin-skin contact, bodily fluids like blood, contact with animals etc.).
- Ideate and write ways in which communities of people can safeguard against the spread of infectious diseases.
- Propose some common strategies for strengthening their immune system.

(Advanced SLOs)

- *Explore what happens to an astronaut's immune system when they are in space.*
- *Explore careers in science such as immunologists, public health statisticians, etc.*

	• *Apply their knowledge of the various cells to determine which should be deployed to fight against various pathogens.* • *Read and interpret basic blood reports to determine the state of infection.*

Assessments

Formative Assessments

- KWL charts for assessing prior knowledge of students
- Think- pair- share activities to compare the types of immunity
- Discussion questions
- Oral and written responses
- Exit tickets
- Class Tests including short question answers, labeling diagrams etc.
- Marked Quizzes

Summative Assessments

- Journal to keep their health log, along with reflections on measures that they specifically took to protect themselves and others during flu season.
- Final Project/ Presentations
- Midterm or Final Exam

Learning Activities

Activity 1: Pathogen Recognition

Fill a container with sand. In the sand, place medium-sized pieces of paper, dry pasta, pom-poms etc. use two differently sized tweezers, a small tweezers and a large one, for this activity. Ask students to come one by one and use the small tweezers to try and pick up any of the different things in the sand (paper, pasta etc.) with their eyes closed. After that, repeat the activity but with the bigger tweezers and with the students' eyes open. Compare the difficulty and ease of picking up the materials before and after with the reaction of the human body to pathogens before and after developing antibodies.

Activity 2: Immunity Enhancer

Ask students to research and bring possible things that can help to enhance the immunity of the human body. These things can be used externally (masks, sanitizers) and internally (medicines, supplements). Discuss the functions of each thing with the whole class.

Activity 3: DIY Immunity Builders

Make cloth masks and face shields with students. Ask them to keep a logbook of all the healthy food they take to build their immunity.

Activity 4: Charting the Infection

Divide students in groups and ask them to make two charts, one that represents the spread of an unmitigated infection and the other that represents how infections can be curbed using vaccines etc. Each group should prepare for a different disease.

Activity 5: Skit Preparation

Divide students in groups and ask them to prepare a skit that demonstrates how a sick person should be taken care of in case of different diseases. Each group should prepare for at least one disease.

Suggested Links:

https://www.immunology.org/sites/default/files/Pathogen%20buster%21%20.pdf]

DOMAIN: Physical Sciences

Grade 7

*** The additional/advanced SLOs are written in Italics.**

Unit: Structure of an Atom
Student Learning Outcomes: **Students will be able to:** ● Describe and draw the structure of an atom in terms of electrons, protons and neutrons. ● Describe an atom as an electrically neutral entity. ● Differentiate between atomic number and mass number. ● Determine the atomic number and mass number of elements on the basis of the number of protons, electrons and neutrons. ● Show the arrangement of electrons in K, L and M shells of elements. ● Draw the atomic structure of the first eighteen elements of the periodic table.

Knowledge:	**Skills:**
Students will: ● Describe and draw the structure of an atom in terms of electrons, protons and neutrons. ● Describe an atom as an electrically neutral entity. ● Differentiate between atomic number and mass number. ● Determine the atomic number and mass number of elements on the basis of number of protons, electrons and neutrons. ● Show the arrangement of electrons in K, L and M shells of elements. ● Know about atomic structures of elements in the periodic table. ● Define Valency and explain the formation of ions. ● Write chemical formulae on the basis of constituent elements (H_2O, CO_2, CO, NaCl). **Key Vocabulary** atom, molecule, symbol, atomic number, mass number, electrons, protons, neutrons, nucleus, orbit/shell, neutral, elements, periodic table, groups, periods, metals, non-metals, transition elements, valence shell, valence number, ions, cations, anions, compound, formulae	Students will be able to: ● Make a model of the structure of an atom using play dough. ● Compare the size of an atom with the sizes of everyday objects. ● Draw atomic structures of atoms of given elements by knowing their atomic number. ● Draw atomic structures of elements in the periodic table. ● Make chemical formulae. ● Compare and contrast atomic structures of different elements. ● Make a 3-D atomic structure model of few elements. ● Make a chronological timeline for atomic structures proposed by different scientists by doing research on the internet.

Assessments

Formative Assessments

- Brainstorming/mind maps/graphic organizers
- Model making (use of play dough to make atomic structure)
- Students' responses on exploring simulation activities on web resources
- Activity sheets
- Biography/Scrapbook making (individual or in groups)
- Students' responses during discussions and questions answer sessions
- Plenary (two stars and a wish)
- Projects

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

Learning Activities

1. Structure of an atom can be explained by using 3-D models of atomic structure of any atom followed by students making the 3-D models of different atoms in groups.
2. A large sized periodic table can be displayed in front of the students to study groups, periods, atomic and mass numbers.
3. Draw the atomic structure of your own choice by dragging the number of protons, neutrons and electrons. You keep on dragging the protons and neutrons into the nucleus and it automatically gives you the symbol of the element.
4. Activity/Lab sheets can be given to students to fill up the shells of the atom after predicting the number of electrons from given atomic numbers followed by peer assessment and discussion.
5. Students can be asked to research some factual information on a particular atom and make its biography. (Project)
6. A scrapbook can be made by students, about five different atoms (writing information about atomic number, protons, neutrons, electrons, charges, atomic masses, etc.). (Project)

Suggested Links:

https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html

DOMAIN: Physical Sciences

Grade 7

*** The additional/advanced SLOs are written in Italics.**

Standard: Chemicals Bonds

Student Learning Outcomes:

Students will be able to:

- Define valency and explain the formation of ions.
- Write chemical formulae on the basis of valency of the constituent elements such as H_2O NaCl, NH_3, CO_2, CO etc.
- Explain that a chemical bond results from the attraction between atoms in a compound and that the atoms' electrons are involved in this bonding.
- Discuss formation of ionic bond as a result of electrostatic forces between atoms (e. g., NaCl).
- Discuss types and formation of covalent bond as a result of mutual sharing of electrons between atoms (e. g., H_2, O_2, N_2).
- Name certain ionic and covalent compounds.
- Draw cross and dot structures showing formation of ionic compounds and covalent compounds.

Knowledge: Students will be able to: ● Explain that a chemical bond results from the attraction between atoms in a compound and that the atoms' electrons are involved in this bonding. ● Discuss formation of ionic bonds as a result of electrostatic forces between atoms. (e. g., NaCl). ● Discuss types and formation of covalent bond as a result of mutual sharing of electrons between atoms. (e. g., H_2, O_2, N_2). ● Name certain ionic and covalent compounds ● Understand cross and dot structures showing formation of ionic compounds and covalent compounds. **Key Vocabulary**	**Skills:** Students will be able to: ● Draw cross and dot structures showing formation of ionic compounds and covalent compounds. ● Explore the formation of ionic and covalent bonds through simulations. ● Illustrate the formation of ionic and covalent bonds in a booklet. ● Make 3-d models of ionic and covalent bonds by using straws, skewer sticks, ping pong balls, etc. ● Relate the formation of chemical bonds with valency. ● Compare ionic and covalent bonding.

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

Assessments

Formative Assessments

- Brainstorming
- Graphic organizers
- Think pair and share followed by discussion
- Model making (making of chemical bonds)
- Students' responses on exploring simulation activities on web resources

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

Learning Activities

1. Brainstorm with students about their prior knowledge of atomic structure and make a mind map on board based on their responses.
2. Think pair and share; how do valence electrons relate to chemical bonds?
3. Use of illustrations/flashcards/secondary resources (YouTube videos, simulations) to show the types of chemical bonds and how they are formed.
4. Students can be asked to illustrate the formation of ionic and covalent bonds in a booklet.
5. Make 3-d models of ionic and covalent bonds by using straws, skewer sticks, ping pong balls etc. (in groups/pairs/individual)

DOMAIN: Physical Sciences

Grade 7

*** The additional/advanced SLOs are written in Italics.**

Unit: Physical and Chemical Changes
Student Learning Outcomes: **Students will be able to:** ● Differentiate between physical and chemical changes while considering daily life examples. ● Explain why oxygen is needed in combustion, rusting and tarnishing. ● Explore methods of preventing rusting. ● Relate uses of materials to their chemical properties (e.g., tendency to rust, flammability). ● Evaluate impact of combustion reaction on environment. ● Relate uses of materials to their physical properties (e.g., melting point, boiling point, solubility, thermal conductivity). ● Distinguish between physical and chemical properties of matter.

Knowledge:	**Skills:**
Students will: ● Differentiate between physical and chemical changes while considering daily life examples. ● Distinguish between reversible and non-reversible chemical changes. (formation of ammonia) ● Explain why oxygen is needed in combustion, rusting and tarnishing. ● Evaluate Impact of combustion reaction on environment. ● Know the methods of preventing rusting. ● Distinguish between physical and chemical properties of matter. ● Relate uses of materials to their physical properties (e.g., melting point, boiling point, solubility, thermal conductivity). ● Relate uses of materials to their chemical properties (e.g., tendency to rust, flammability). **Key Vocabulary** flammability, rust, reversible, non-reversible, chemical change, physical change, melting point, boiling point, solubility, thermal conductivity, tendency to rust, flammability, reversible, irreversible reaction, reactant, products, combustion, burning, rusting, tarnishing, iron oxide, galvanizing	Students will be able to: ● Compare and contrast physical and chemical changes ● Apply understanding of physical and chemical changes to everyday situations. ● Evaluate Impact of combustion reaction on environment. ● Explore methods of preventing rusting. ● Relate the use of materials to everyday life, based on their physical and chemical properties. ● Plan and conduct simple experiments to analyze physical and chemical changes. ● Sort and classify data and information using drawings, pictographs and tables. ● Communicate observations and ideas using oral or written language, drawing or role-play. ● Draw conclusions from their findings.

Assessments

Formative Assessments

- Brainstorming (recall of previous knowledge about physical and chemical changes)
- By students' verbal and written responses during experiments/investigations
- Group work (measure the angle of incidence and reflection on a paper using protractor and light source)
- Making of a booklet
- Poster making
- Quick quiz

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

Learning Activities

1. Students' prior knowledge can be assessed by asking questions about chemical and physical changes around us.
2. The teacher may then use a PowerPoint presentation to review physical and chemical properties and the criteria for each.
3. Demonstrate a few of the chemical processes (burning, rusting and combustion) and encourage students to identify how they are different from physical processes. Students can be asked to make predictions and note down the observations for each of the processes.
4. Make a list/booklet of chemical and physical changes of different materials.
5. Students work in groups to investigate the use of chemical changes and their application in everyday life by exploring the recycling process. Each group will choose one material (plastic, glass or paper) and research the origin, process, and end product.
6. Make a poster highlighting the impact of combustion on the environment.
7. A quick quiz can be taken.

NCP - SCIENCE Grade 8

Suggested Guidelines

DOMAIN: Physical Sciences

Grade 8

*** The additional/advanced SLOs are written in Italics.**

Unit: Reflection & Refraction of Light

Student Learning Outcomes:

Students will be able to:

- Identify basic properties of light (i.e speed, transmission through different media, absorption, reflection and dispersion).
- Describe and show how an image is formed by a plane mirror.
- State the Laws of Reflection
-
- Describe different optical instruments using plane mirrors (microscope, telescope, binocular).
-
- Relate the apparent color of objects to reflected or absorbed light
- Explain that light is refracted at the boundary between air and any transparent material.
- Distinguish between reflection and refraction of light with daily life examples.
-
-
-
- illustrate the characteristics of an image formed by a plane mirror.
-
- identify spherical mirrorescribe the characteristics of image(s) formed by concave mirror and convex mirror.
- Describe different optical instruments in which spherical mirrors are used.

Knowledge:	**Skills:**

Students will:
 	
Describe a ray of light.
 	
behavior of light
 	
State the Laws of Reflection.
 	
Interpret a simple ray diagram to identify the path of light in reflection from a plane mirror.
 	
Describe different optical instruments using plane mirrors (microscope, telescope, binocular).
 	
Explain how a periscope works.
 	
Identify basic properties of light (i.e. speed, transmission through different media, absorption, reflection and dispersion.)
 	
- Relate the apparent color of objects to reflected or absorbed light.
 	
• refraction of light at the boundary between air and any transparent material.
• reflection and refraction of light with daily life examples.
• the dispersion of light through a glass prism.
• dispersion in everyday life
 	
Key vocabulary:
 	
refraction, reflection, transparent,, medium,, mirror image, rare-view mirror, optical instruments, diminished, magnified, refraction, refracted ray, emergent ray, object, image, dispersion, rainbow spectrum
	Students will be able to:
	
	• Illustrate a ray of light passing from one medium to another.
	•
	• Predict the effect of transparent media of varying densities on the angle of refraction of light.
	• Compare refraction with reflection of light
	• Investigate how light refracts differently through different materials.
	• Apply understanding of refraction to everyday situations.
	• Apply understanding of dispersion to real life situations;
	  ○ make and discuss observations;
	  ○ interpret results using scientific knowledge and understanding;
	  ○ draw conclusions from their findings.
	• Compare and contrast images formed by a plane mirror, concave mirror and convex mirror.
	• Interpret a simple ray diagram to identify the path of light in reflection from a plane mirror.
	• Make a periscope using plane mirror strips.
	• Investigate that light is made up of many colours.
	• Apply understanding of images formed by different mirrors to real life situations;
	  ○ use tools and apparatus safely;

	○ carry out practical work safely; ○ ○ **(Advanced SLO)**

Assessments

Formative Assessments

- Students' oral, verbal and written responses
- Evaluating students' prior knowledge through brainstorming
- Students' responses in making of different models/projects to apply the knowledge of about refraction
- Exit cards (What have you learned today?)

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

Learning Activities

Show the effect of refraction using one of more of these demonstrations.

The bending pencil.

Fill three identical glasses with different amounts of water. Then put a pencil in each glass of water and students make careful observations, drawing what they see. The pencils can be moved from one side of the glass to another.

The disappearing coin trick.

Put a coin into the bottom of an empty glass. Slowly add water and watch the apparent position of the coin as the water level rises.

Investigating the law of refraction

Scientific inquiry Activity

- Demonstrate how to accurately record the path of a ray of light as it enters and exits a rectangular block. This can be done with optical pins (as in the reflection investigations). Show how to find the normal line for the point of entry and exit. Then show how to use a protractor to measure the angle of incidence and the angle of refraction at the entry and exit point.
- Students, in groups, draw the path of the light as it enters and exits a block. They should do this for several angles of incidence. It may help to darken the room.
- They measure the angle of incidence and the angle of refraction for a ray of light as it enters and leaves a block.
- They should record their results in a table and draw a graph of their results.
- Alternatively, a simulation can be used to investigate refraction. Again, results should be recorded in a table and a graph drawn.

Extension Activity

An application of refraction: Spear fishing.

Use a ray diagram to show the refraction of light. Ask: What would happen if the fisherman speared the place where the fish appears to be? Does the fisherman need to stab above or below the image of the fish?

2. Create Newton's disc.

3. Show students the types of mirrors and through a video demonstrate the type of image formed. They can be asked to make a list of places where they have seen concave and convex mirrors.

Suggested Links: https://gosciencegirls.com/how-to-make-an-electric-newtons-disc/

DOMAIN: Physical Sciences

Grade 8

*** The additional/advanced SLOs are written in Italics.**

Unit: Effect of Force
Student Learning Outcomes: **Students will be able to:** • Recall and analyze situations using the concept that several forces may act on an object and that they may or may not balance each other. • Examine the effect of an unbalanced force on an object. • Differentiate between floating and sinking objects in terms of density. • Define 'pressure' with examples. • Relate pressure with force and area. • Investigate effects related to pressure (e.g., water pressure increasing with depth, a balloon expanding when inflated, etc.). • Examine the effect of force in the presence of air pressure.

Knowledge:	**Skills:**
Students will: • several forces may act on an object which may or may not balance each other. • the effect of an unbalanced force on an object. • floating and sinking objects in terms of density. • • pressure as ratio of force to area. • mass and weight. • the effect of force in the presence of air pressure. **Key Vocabulary** pressure, density, pressure, balanced, unbalanced, weight, Newton, pascals, mass, weight	Students will be able to: • • Differentiate between balanced and unbalanced forces. • Examine the effect of an unbalanced force on an object. • • Conduct an experiment to distinguish between floating and sinking objects in terms of density. • Investigate effects related to pressure (e.g.,water pressure increasing with depth, a balloon expanding when inflated, etc.). • • Predict and reflect on the results. • Solve numerical problems related to pressure and area, mass, and weight. • • Develop scientific skills such as observation, hypothesizing, articulation of scientific understanding with evidence. • • Make a hydraulic elevator. (STEAM) • Build a two stage rocket model . (STEAM)

Assessments

Formative Assessments

- Brainstorming about prior knowledge
- Students' oral, verbal and written responses
- Evaluating students understanding through quizzes
- Exit cards (what have you learned today)

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

Learning Activities

1. Start the lesson by simply asking which is easier, walking in air or swimming in water.
2. Floating Egg Demonstration

   Ask students to predict what will happen when an egg is placed in equal volumes of salt and fresh water. Add water to two beakers or cups. Mix five to six teaspoons of salt into one beaker to create a saltwater solution. Place an egg into the freshwater and saltwater beakers. students will observe that the egg sinks in the fresh water and floats in the saltwater solution. Ask students why the egg sinks in fresh water and floats in salt water.

1. Explore the relationship among force, area, and pressure by using a large rectangular wooden block, coins or washers, and a small container of sand or flour to model different pressures by changing just one variable (for example, laying a block in the sand on its smallest side will create a slightly deeper impression than laying it on one of its larger sides).
1. Use of secondary resources/ ppt/ simulations to study
1. Make a hydraulic elevator. (STEAM)
1. Build a two-stage rocket.(STEAM)

Suggested Links:	**Hydraulic Elevator- STEM Engineering Project** **https://www.teachengineering.org/populartopics/designprocess** **https://www.teachengineering.org/curricularunits/view/cub_rockets_curricularunit**

DOMAIN: Physical Sciences

Grade 8

*** The additional/advanced SLOs are written in Italics.**

Unit: Electricity

Student Learning Outcomes:

Students will be able to:

- Define voltage and state the SI unit of voltage.
- Define resistance and its SI unit.
- Formulate that resistance is the ratio of voltage to current.
- Analyze current variations by introducing different resistances.
- Define electric power and state its unit.
- Recognize the electric power of various electrical appliances.
- Estimate the cost of using electrical appliances (electricity bill) in daily life.
- Recognize the terms earth wire, fuse, circuit breaker.
- Analyze the danger of overloading and short circuit and identify the importance of earth wire, fuses and circuit breakers.
- List precautionary measures to ensure the safe use of electricity.

Knowledge:	**Skills:**
• voltage and SI unit of voltage. • resistance and its SI unit. • resistance as the ratio of voltage to current. • current variation by introducing different resistance. • electric power and its unit. • the electric power of various electric appliances. • costing of electricity bill. • the terms earth wire, fuse, circuit breaker. • the danger of overloading and short circuit and the importance of earth wire, fuses and circuit breakers. • precautionary measures regarding the safe use of electricity. **Key Vocabulary** earth wire, fuse, circuit breaker, switch, ampere, electric power, battery, attraction, repulsion, electric charge, positive electric charge, negative electric charge, neutral, friction, conductors, insulators, circuit, circuit symbols, circuit diagrams, closed and open circuit, electric current, ammeter, ampere (symbol A)voltage, resistance, volts, voltmeter, resistor, variable resistor, positive, negative terminals,.	Students will be able to: • Draw and interpret circuit diagrams and set up circuits containing electrical sources, switches, lamps, resistors (fixed and variable), ammeters, and voltmeters. • Investigate the effect of varying resistance on the current in the circuit using fixed or variable resistors (note: formula V=IR is not required). • • Calculate the cost of electricity consumption s, using kilowatt-hour as a unit of electrical energy consumption. • Analyze the danger of overloading and short circuits. • Explore the importance of earth wires, circuit breakers and fuses. • Identify important variables; choose which variables to change, control, and measure.

Assessments

Formative Assessments

- Brainstorming about prior knowledge
- Students' oral, verbal and written responses
- Evaluating students understanding through quizzes
- Exit cards (what have you learned today

Summative Assessments

- Class tests
- Marked Quiz
- End of unit tests
- Term wise examination
- Marked projects

suggested **Learning Activities**

- Brainstorming to access students' prior knowledge about circuit components and types of circuits.
- Students will be demonstrating the use of ammeter and voltmeter in series and parallel circuits and record their observations on activity sheets.
- Students will be asked to search from the internet the electric power required by different electrical appliances and relate it with the electricity bill.
- Students can estimate the cost of using daily life electrical appliances (electricity bill) and suggest ways to reduce electricity bills and conserve energy.
- Ask students to make an awareness brochure to highlight the danger of overloading and short circuit and identify the importance of earth wire, fuses and circuit breakers.

Suggested Links: https://www.sci-ed-ga.org/the-electric-bill-project

DOMAIN: Earth and Space Sciences

Grade 8

*** The additional/advanced SLOs are written in Italics.**

Unit: Astronomy
Student Learning Outcomes: **Students will be able to:** • Explore and understand the terms star, galaxy, milky way and the black holes. • Compare the types of galaxies. • Relate the life of a star with the formation of the Black Hole, Neutron Star. Pulsar White Dwarf, Red Giant. • Discuss the birth and eventual death of our Sun. • Describehow information is collected from space by using telescopes (e.g., Hubble Space Telescope) and space probes (e.g.,Galileo). • Describe advancements in space technology and analyze the benefits generated by the technology of space exploration.

Knowledge:	**Skills:**
Students will: • Explore and recognize the terms star, galaxy, milky way and the black hole. • Explain the birth and death of our Sun. • Relate the life of a star with the formation of the Black Hole, Neutron Star, Pulsar White Dwarf, Red Giant. • Describe how information is collected from space by using telescopes (e.g., Hubble Space Telescope) and space probes (e.g.,Galileo). • describe advancements in space technology and analyze the benefits generated by the technology of space exploration **Key Vocabulary** star, galaxy, Milky Way, Black Hole, Neutron Star, Pulsar White Dwarf, Red Giant, telescope, Hubble Space Telescope, space probes, Galileo	Students will be able to: • Ask questions to begin scientific inquiry. • • Compare the types of galaxies. • • Imagine what would happen if the sun dies. • *Use a telescope to view stars and planets.* • *Research the latest advancements in space technology and present it in the classroom.* • Interpret results using scientific knowledge and understanding. • Draw a conclusion from their findings.

Assessments

Formative Assessments

- KWL Chart
- Venn Diagram to compare and contrast
- Exit slips
- Silent poll
- Discussion and written questions

Summative Assessments

- Midterm or final exam
- End of unit tests
- Portfolio

Suggested **Learning Activities**

Activity 1- Theory Development of the Big Bang

Divide students into groups and provide each group with the required materials to demonstrate the big bang theory as a story.

Activity 2- What if the Sun dies?

Ask students to prepare a short play on what would happen if they woke up one day and found out the sun had died. Ask them to show what the earth would be like if there was no sun in their plays and the impact it would have on the environment.

Activity 3- Using a Telescope to view the Stars and Planets.

If possible, arrange for a telescope and take turns to look at the sky through the telescope. Ask students to describe what they see. Otherwise, build a telescope in class using cardstock/chart paper and ask students to use that to look at the sky. Ask students to draw what the sky looks like through the telescope.

Activity 4- Research on Space Advancement

Ask students to use the computer lab, if available or find articles in newspapers or magazines regarding space advancement. Ask students to come to the front of the class and summarize what they read in the article.