



SINDH CURRICULUM FOR

GENERAL SCIENCE

GRADE IV–VIII

2023-24



GOVERNMENT OF SINDH

SCHOOL EDUCATION & LITERACY DEPARTMENT

DIRECTORATE OF CURRICULUM, ASSESSMENT & RESEARCH SINDH

JAMSHORO



PREFACE

The General Science Curriculum 2023-24 for Grades IV-VIII has been developed as a collaborative effort between the Directorate of Curriculum, Assessment and Research, Sindh, and the School Education & Literacy Department, Government of Sindh. This initiative stems from a comprehensive needs assessment survey involving a diverse group of experts, working teachers, assessment experts, curriculum experts, and the PRC, ensuring that the curriculum is tailored to the specific requirements of the children in Sindh.

Drawing from updated curriculums at regional, national, and international levels, the General Science Curriculum 2023-24 is designed to align with both national standards and global trends, including the integration of STEAM and the cultivation of 21st-century skills essential for success in the modern world.

The curriculum comprehensively covers six domains: Life Science, Physical Science, Earth & Space Science, Skills, Attitudes, and Science Technology Engineering Arts Mathematics (STEAM), with clear explanations of standards and benchmarks. This vertical and horizontal alignment ensures the coherence and practical applicability of the curriculum.

Furthermore, the General Science Curriculum 2023-24 is based on and aligned with the National Curriculum 2022-23, with the aim of facilitating seamless integration with other subjects taught in schools. It is our hope that this curriculum will empower teachers in Sindh to effectively deliver high-quality science education, ultimately benefiting the students and preparing them for the challenges and opportunities of the future.

Piara Khan Saharan

Director

Directorate of Curriculum, Assessment and Research Sindh,
Jamshoro.

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CHAPTER - 01

Introduction:

In the diverse tapestry of Pakistan, children across different regions and backgrounds share a common trait: an innate curiosity and an eagerness to engage with the world around them. Through their everyday activities, such as playing with paper airplanes, rolling rubber tires, or interacting with nature, they unknowingly embark on their first scientific explorations, delving into the forces of aerodynamics, friction, sound reflection, and the interconnectedness of ecosystems. These young minds, analogous to potential scientists without lab coats, are at the forefront of their earliest experiments, driven by an insatiable thirst for understanding and discovery.

The vision of the Sindh Curriculum, aligned with the National vision, is to nurture and harness this inherent curiosity, empowering learners to meaningfully comprehend, experience, and interact with their surroundings, encompassing the natural world, human-designed environments, and the universe.

In today's rapidly evolving landscape, characterized by climate change, global health challenges, technological advancements, and shifting labor market dynamics, the need for a scientifically literate workforce in Pakistan has never been more pressing. As we prepare the generation set to enter the workforce in the mid-2030s, we recognize the imperative to equip them with the ability to think critically, innovate, and devise solutions essential for Pakistan's sustainability and progress.

The Science Curriculum is founded on the conviction that scientific literacy is fundamental to comprehending the world. It serves as a guide for the structured exploration of scientific subjects in schools, encompassing the systematic study of biological, physical, material, and technological facets of our environment. The curriculum's purpose is to furnish learners with the skills and language to comprehend and navigate their surroundings, pose questions, and apply their knowledge in problem-solving and decision-making, thereby enhancing their lives and those of others.

By imparting a broad foundation of scientific knowledge and cultivating essential scientific thinking and learning attitudes, the curriculum aims to equip students who have completed the IV to VIII educational journey with transferable skills and a solid grounding for their academic and professional pursuits in the future. It aspires to inspire the next generation of scientists, innovators, researchers, educators, and leaders, laying the groundwork for their contributions to the field of formal scientific research.



CHAPTER - 02

Domains, Standards & Benchmarks:

Domains	Standards	Benchmarks
<p>Life Science: The Life Sciences domain focuses on the level of organization, life processes of plants and animals, as well as their unique demands. This domain begins with basic understandings of a system and progresses to more complex understandings at the cell and ecosystem levels. The domain's key topics include organisms' basic needs and life processes, as well as their physical traits and orderly changes in life cycles. A general classification of living creatures and the concept of kingdoms of living things are also presented.</p> <p>Other key subjects covered in this domain include the various types of interactions that exist between organisms in a food chain and with their non-living environments.</p>	<p>Students will recognize types of living organisms understand their life processes, their body structures and functions to survive, reproduction in plants, the parts of the transport system, and describe their functions. Structure and function of the major human organ systems (Human Digestive system, Respiratory system and Nervous system) and relate them to the basic biological processes necessary to sustain life. Interactions of living organisms in environment, energy flows in ecosystems. Advantages and disadvantages of microorganisms, the causes and prevention of infectious diseases and how the natural immune system responds. Structure of DNA, its modification (cell division, variation and heredity) and application in modern world of biotechnology.</p>	<p>By the end of Grade 5, students will be able to:</p> <ul style="list-style-type: none"> Describe the life process of animals and plants <p>By the end of Grade 8, students will be able to:</p> <ul style="list-style-type: none"> Research and describe the structure and function of specialized plant and animal cells, including cell division. Describe how the genetic information stored in DNA, received from parents, determines our physical characteristics. <p>By the end of Grade 5, students will be able to:</p> <ul style="list-style-type: none"> Explain how plants use their body structures to survive, identify the parts of the plant transport system, and describe their functions. Describe the parts of the flower and their functions. <p>By the end of Grade 8, students will be able to:</p> <ul style="list-style-type: none"> Explain the root and shoot system of plants emphasizing the process of photosynthesis, respiration, and transpiration. Compare and contrast the artificial and natural reproduction in plants and investigate ways in which artificial propagation of plants can lead to food production and food security. <p>By the end of Grade 5, students will be able to:</p> <ul style="list-style-type: none"> Explain how organ systems work together to help human bodies get what they need and carry out life processes. Describe that animals receive different types of information through their senses, and respond by processing it in their brains. Describe the diversity among animals.



By the end of Grade 8, students will be able to:

- Compare and contrast the transport system of animals and plants. Explore and explain the structure and function of major human organ systems, and relate them to the basic biological processes required to sustain life. Explain how the brain controls and coordinates with other organ system (s).

By the end of Grade 5, students will be able to:

- Describe some of the causes of infectious diseases and suggest measures that can control the spread of the diseases. Recognize the advantages and disadvantages of microorganisms.

By the end of Grade 8, students will be able to:

- Describe the causes and prevention of infectious diseases and how the natural immune system responds. Understand the constituents of a balanced diet and analyze the consequences of dietary deficiencies which lead to different disorders.

By the end of Grade 5, students will be able to:

- Explore the interaction of living things in an ecosystem. Use diagrams to explain how energy flows in an ecosystem. Identify the causes and effects of environmental pollution and suggest measures to reduce it.

By the end of Grade 8, students will be able to:

- Explain the interdependence of non-living and living components in an ecosystem. Describe the energy flow and nutrients cycles in an ecosystem. Communicate solutions that will reduce the impact of humans on land, water, air and /or other living things in the local environment.

By the end of Grade 8 students will be able to:

- Describe the structure of DNA, its modification and application, in biotechnology in various fields



Physical Science: This Domain focuses on helping students understand what force, motion, and energy are and how these concepts are connected. The major topics developed in this Domain include simple machines, types of motion, forms of energy and their transformations, electricity and magnetism. Another focus is on the description, physical properties, and basic structure of matter. The major topics developed in this Domain include concepts related to the basic description of objects, states of matter (solid, liquid, and gase), phase changes, and the classification of matter.

Students develop an understanding of the properties of objects and materials they encounter every day. Students develop an understanding of the forms of matter and energy, the changes they undergo, and their interactions.

At all grade levels, students develop the ability to communicate clearly about science and technology concepts using appropriate vocabulary related to the physical world.

Students will describe and explain common properties, forms, and interaction of energy and matter, their transformation and application in chemical and physical system.

By the end of Grade 5, students will be able to:

- Investigate matter and explore its chemical and physical properties through daily life examples. Recognize the importance of science and technology to solve everyday problems. Integrate scientific concepts/ STEAM in daily life to improve the quality of their own life and lives of others. Understand how scientific concepts/ STEAM affect their life and society. Compare the properties of different states of matter and identify the conditions that cause matter to change states.

By the end of Grade 8, students will be able to:

- Recognize the importance of science and technology to solve everyday problems. Integrate scientific concepts/ STEAM in daily life to improve the quality of their own life and lives of others. Understand how scientific concepts/ STEAM affect their life and society. Analyze the complexity of matter and energy, particle model of matter, different states of matter and its conversion from one state to another. Investigate mixtures and apply the separating techniques.
- Differentiate solution and suspension and identify the characteristic property of matter such as Solubility. Compare the systematic organization of elements in the periodic table, constructing formula and forming chemical bonds. Distinguish between physical and chemical reactions, types of chemical reactions and acids, alkalis and salt Describe chemical equations, symbols and its relationship to molecules, atoms, isotopes and ions.

By the end of Grade 5, students will be expected to:

- Demonstrate the effects of heat on the states of matter.
- Describe the forms of energy, simple energy transformation and the uses of energy. Investigate and describe the flow of electric current in an electric circuit and relationship between electricity and magnetism.



		<p>Demonstrate the characteristics of light and sound with the physical phenomena.</p> <p>By the end of Grade 8, students will be expected to:</p> <ul style="list-style-type: none">• Use evidence to construct an explanation on how energy is transferred, transformed, and conserved. Compare types and properties of waves and explain how they interact with matter. Investigate that light can be reflected, refracted, and/or absorbed. Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits. <p>By the end of Grade 5, students will be expected to:</p> <ul style="list-style-type: none">• Investigate different types of forces and their effects. Demonstrate the understanding that simple machines help make motion and work easier. Apply scientific skills to solve problems and suggest solutions. <p>By the end of Grade 8, students will be expected to:</p> <ul style="list-style-type: none">• Investigate and describe types of forces, including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational. Measure and record data from experiments to produce speed-time graphs and interpret them to accurately describe motion. Evaluate through investigation the relationship between pressure, force and area.
<p>Earth & Space Science: In Earth and Space Science Domain, students recognize the relationship between the Earth, the solar system, and the universe. They know that the sun, moon, and other stars appear to be moving relative to the Earth, and that these movements correspond to patterns of day, night, and seasons.</p> <p>Students are naturally interested in everything around them. This curiosity leads them to observe, collect, and record information about the Earth and other objects visible in the sky.</p>	<p>Student will knowledgeable of the composition, resources, processes and interaction the earth's systems; they will know about physical feature of celestial bodies and formation of stars and explain how we will learn about the universe.</p>	<ul style="list-style-type: none">• By grade 5, students will be expected to:• Describe the structure of the Earth and recognize that Earth's surface is made up of land, water, and is surrounded by air. Identify the Earth's resources that we use in our everyday life and how to conserve them.• Describes the composition and characteristics of soil types, providing examples of their uses. <ul style="list-style-type: none">• By grade 8, students will be expected to:



In Grades 4 - 5, students explore the laws of interconnected systems in nature. In doing so, they develop understanding of the fundamental laws, theories, and models that explain the world. By studying the Earth, students can make informed decisions about issues affect the planet they live on. They recognize that new technologies and observations are changing our explanations of how things work in nature.

- Demonstrate the understanding of movement of the Earth, Sun, Moon, Solar System and its relationship.

By the end of Grade 5, students will be expected to:

- Demonstrate how the relationship of the Earth, Sun, and Moon, causes eclipses and moon phases. Explore and investigate the importance of space exploration and the uses of various satellites.
- Describes how the Earth spins around its axis in 24 hours resulting in day and night.

By the end of Grade 8, students will be expected to:

- Describe the physical features of celestial bodies. Explain how gravity is the force that keeps objects in the Solar System in regular and predictable motion and describe the resulting phenomena.
- Describe the formation of black hole in the life of a star. Recognize space exploration as an active area of scientific and technological research and development.



CHAPTER - 03

Grade-wise Learning Units Distribution Matrix:

	Life Science	Physical Science	Earth & Space Science
GRADE - IV	<ul style="list-style-type: none"> • Life process • Plant structure and function • Animal structure and function • Ecosystem – adaptations 	<ul style="list-style-type: none"> • Matter and its characteristics • Forms of Energy and its transfer • Force and Simple machines • Technology in Everyday Life 	<ul style="list-style-type: none"> • Earth and its Resources • Earth in the Solar System
GRADE - V	<ul style="list-style-type: none"> • Structure and function human body system • Microorganisms and diseases • Ecosystem 	<ul style="list-style-type: none"> • Physical and Chemical changes of Matter • Light and Sound • Electricity and Magnetism • Technology in Everyday Life 	<ul style="list-style-type: none"> • Structure of the Earth • Soil • Space and Satellites
GRADE - VI	<ul style="list-style-type: none"> • Cellular Organization • Reproduction in plants • Balanced diet • Human digestive system 	<ul style="list-style-type: none"> • Matters as Particles • Elements and compounds • Mixtures • Energy • Electricity • Magnetism • Technology in Everyday Life 	<ul style="list-style-type: none"> • Solar System
GRADE - VII	<ul style="list-style-type: none"> • Plant systems • Human respiratory and circulatory system • Immunity and Diseases 	<ul style="list-style-type: none"> • Structure of an Atom • Physical and Chemical Changes • Chemical Bonds • Solutions • Force and Motion • Waves and energy • Heat and Temperature • Technology in Everyday Life 	<ul style="list-style-type: none"> • Earth & Space
GRADE - VIII	<ul style="list-style-type: none"> • Cell division • Variations, Heredity • Biotechnology • Ecology • Human Nervous system 	<ul style="list-style-type: none"> • Periodic Table • Chemical Reactions • Acids, Bases and Salts • Force and Pressure • Reflection & Refraction of Light • Electricity & Magnetism • Technology in Everyday Life 	<ul style="list-style-type: none"> • Our Universe



CHAPTER - 04

Progression Grid:

The following progression grid incorporates specifications from the Science Curriculum of Pakistan and globally recognized curricula. Science for grades 4-8 is organized in the following domains:

- A. Life Sciences
- B. Physical Sciences
- C. Earth and Space Sciences

Thinking and Working Scientifically Overarching SLOs that will be addressed during the course of teaching different scientific concepts.	
By the end of Grade 5 students should be able to:	By the end of Grade 8 students should be able to:
<p>Scientific Enquiry:</p> <ul style="list-style-type: none"> • Ask questions • Know the five main types of scientific enquiry (observe over time, identify and classify, compare and contrast, fair test, research-by finding information). • Use equipment to carry out scientific investigations. • Take measurements and record them. • Enlist and practice safety procedures while carrying out practical activities. • Make a conclusion from results informed by reasoning. 	<p>Scientific Enquiry:</p> <ul style="list-style-type: none"> • Ask questions • Know the five main types of scientific enquiry (observe over time, identify and classify, compare and contrast, fair test, research-by finding information). • Use equipment to carry out scientific investigations. • Take measurements and record them. • Enlist and practice safety procedures while carrying out practical activities. • Make a conclusion from results informed by reasoning.
<p>Engineering Design Process - STEM/ STEAM Models and Representations</p> <ul style="list-style-type: none"> • Use models to show scientific ideas and what happens in science. • Use a variety of technologies following the design process to identify and solve problems, to interpret data and present the data collected in the form of graphs and charts. 	<p>Engineering Design Process - STEM/ STEAM Models and Representations</p> <ul style="list-style-type: none"> • Describe the strengths and limitations of a model. • Use symbols and formulae to represent scientific ideas. • Use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions to challenges/ enquiry questions. • Apply mathematical concepts (e.g., percentages and ratios) to analyze data and present the data collected in the form of graphs, charts and tables.
<p>Science in Context:</p> <ul style="list-style-type: none"> • Describe how science is used in their local area. • Identify people who use science, including professionally, in their area and describe how they use science. • Discuss how the use of science and technology can have positive and negative environmental effects locally and globally. 	<p>Science in Context:</p> <ul style="list-style-type: none"> • Describe how science is applied across societies and industries, and in research. • Discuss issues which involve and/or require scientific understanding. • Describe how people develop and use scientific understanding. • Discuss how the uses of science can have a global environmental impact.



Domain A: Life Science

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<ul style="list-style-type: none"> Life processes Plant structure and functions Animal Structure and Functions Ecosystem-adaptions 	<ul style="list-style-type: none"> Structure and function-human body system Microorganisms and diseases Ecosystem 	<ul style="list-style-type: none"> Cellular Organization Re-production in plants Nutrition and Balanced diet Human digestive system 	<ul style="list-style-type: none"> Plant systems Human respiratory and circulatory systems Immunity and Diseases 	<ul style="list-style-type: none"> Cell division Variations, Heredity Biotechnology Ecology Human Nervous system

1. Organisms- Characteristics and Life Process of Living Things

Benchmark - 01	Benchmark - 01
<p>By the end of Grade 5, students will be able to:</p> <p>Describe the life process of animals and plants</p>	<p>By the end of Grade 8, students will be able to:</p> <p>Research and describe the structure and function of specialized plant and animal cells, including cell division.</p> <p>Describe how the genetic information stored in DNA, received from parents, determines our physical characteristics.</p>

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-A-01] Understand that living things grow, take in nutrients, breathe, reproduce, eliminate waste and die.</p> <p>[SLO:S-04-A-02] Discuss 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.</p> <p>[SLO:S-04-A-03] Explore the requirements of plants for life and growth (air, light, water, nutrients from</p>		<p>[SLO:S-06-A-01] Recognize cells as the basic unit of life that are organized into tissues, organs, systems and Organisms.</p> <p>[SLO:S-06-A-02] Arrange and rank different levels of cellular organizations — cells to tissues, organs and organisms.</p> <p>[SLO:S-06-A-03] Relate the structures of some common cells (nerve, muscle, epithelium and blood cells) to their functions.</p> <p>[SLO:S-06-A-04] Identify the structures</p>		<p>[SLO:S-08-A-01] Describe cell division and its types-mitosis and meiosis and relate them to the passage of genetic information through reproduction.</p> <p>[SLO:S-08-A-02] Explain the process of mitosis and meiosis and identify their key phases.</p> <p>[SLO:S-08-A-03] Describe the composition and structure of DNA.</p> <p>[SLO:S-08-A-04] Design a model of DNA to demonstrate its structure, functions, and various components.</p>



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
soil, and room to grow).		<p>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).</p> <p>[SLO:S-06-A-05] Compare and contrast an animal cell and plant cell by preparing slides using onion peels and cheek cells.</p> <p>[SLO:S-06-A-06] Describe the similarities and differences between the structures of plant and animal cells. Sketch the animal and plant cells and label key organelles in each.</p>		<p>[SLO:S-08-A-05] Recognize Genetics as the study of Heredity and understand and define heredity as the transfer of genetic information that specifies structure, characteristics, and functions, from parents to offspring.</p> <p>[SLO:S-08-A-06] Differentiate between the concept of genes and chromosomes and relate them to how genetic characteristics are inherited.</p> <p>[SLO:S-08-A-07] Describe variation and adaptation in living organisms.</p> <p>[SLO:S-08-A-08] Explain and illustrate the differences between variation and adaptation.</p> <p>[SLO:S-08-A-09] Identify sources of variation from environmental and genetic factors.</p> <p>[SLO:S-08-A-10] Explain how different adaptations affect the chances of survivals of different species of organism.</p>



2. Organism- Structure and functions (plants) How plants use their body structures to survive?

Benchmark II:

By the end of Grade 5, students will be able to:

Explain how plants use their body structures to survive, identify the parts of the plant transport system, and describe their functions.
Describe the parts of the flower and their functions.

Benchmark II:

By the end of Grade 8, students will be able to:

Explain the root and shoot system of plants emphasizing the process of photosynthesis, respiration, and transpiration.
Compare and contrast the artificial and natural reproduction in plants and investigate ways in which artificial propagation of plants can lead to food production and food security.

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-A-04] Classify the plants into two major groups (flowering, non-flowering), and give examples of each group.</p> <p>[SLO:S-04-A-05] Describe the functions of different parts of flowering plants: Roots, stem/trunk, leaves and flowers.</p> <p>[SLO:S-04-A-06] Identify the parts of the plant transport system and describe their functions (Stem, leaf, -root).</p> <p>[SLO:S-04-A-07] Investigate the way in which water is transported within plants.</p> <p>[SLO:S-04-A-08] Identify the parts of a flower and describe their functions (limited to petals, sepals, anthers, filaments, stamens, stigma, style, carpel, and ovary).</p> <p>[SLO:S-04-A-09] Identify stages in the life cycles of</p>		<p>[SLO:S-06-A-07] Describe different types of reproduction in plants.</p> <p>[SLO:S-06-A-08] Compare and contrast types of reproduction (sexual and asexual) in plants.</p> <p>[SLO:S-06-A-09] Distinguish between artificial and natural asexual reproduction in plants. (grafting, cutting and layering /Bulbs, Tuber, runners and budding.)</p> <p>[SLO:S-06-A-10] Inquire how artificial propagation can lead to better quality yield in agriculture.</p>	<p>[SLO:S-07-A-01] Explain that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein)</p> <p>[SLO:S-07-A-02] Explain the root and shoot system in plants. Label different parts of leaf, stem and root (external and internal structure).</p> <p>[SLO:S-07-A-03] Predict the role of xylem and phloem in transport of water and food in the cross section of the stem.</p> <p>[SLO:S-07-A-04] Explain that the structure of leaves are adapted to the process of photosynthesis.</p> <p>[SLO: S-07-A-05] Define the process of photosynthesis and derive word equations for it.</p>	



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>common flowering plants.</p> <p>[SLO:S-04-A-10] Explore the role of flowers in the life cycle of flowering plants, including pollination, fruit and seed formation and seed dispersal.</p> <p>[SLO:S-04-A-11] Describe seed germination and know that seeds require water and an appropriate temperature to germinate.</p> <p>[SLO:S-04-A-12] Relate that why plants are vital to sustaining life on Earth.</p> <p>[SLO:S-04-A-13] Identify various professions associated with this unit of science. E.g., botanist, farmers, gardeners, florists, etc.</p>			<p>[SLO:S-07-A-06] Describe the process of respiration and write word equations for it. Compare and contrast the processes of photosynthesis and respiration.</p> <p>[SLO:S-08-07-A-07] Investigate the phenomena of transpiration and its importance in a plant (wind, temperature, light, humidity affecting rate of transpiration in plants).</p> <p>[SLO:S-07-A-08] Explain the raise of water based on the principle of transpiration.</p>	



3. Organisms- Structure and Functions (Animals)

Benchmark III

By the end of Grade 5, students will be able to:

Explain how organ systems work together to help human bodies get what they need and carry out life processes.
Describe that animals receive different types of information through their senses, and respond by processing it in their brains.
Describe the diversity among animals.

Benchmark III

By the end of Grade 8, students will be able to:

Compare and contrast the transport system of animals and plants.
Explore and explain the structure and function of major human organ systems, and relate them to the basic biological processes required to sustain life.
Explain how the brain controls and coordinates with other organ system (s).

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-A-14] Distinguish between major groups of animals with backbones (vertebrates: Fish, amphibians, reptiles, birds and mammals) and without backbones (invertebrates: Insects, snails, earthworm, jellyfish and corals) on the basis of their characteristics.</p> <p>[SLO:S-04-A-15] Identify that some animals (spider, crab, beetles) have an exoskeleton.</p> <p>[SLO:S-04-A-16] Describe some of the important functions of the skeleton.</p> <p>[SLO:S-04-A-17] Describe the Human Digestive System including the simple functions of the organs involved (mouth, esophagus, stomach, small and large intestine).</p>	<p>[SLO:S-05-A-01] identify that the human body has a number of systems, each with its own function.</p> <p>[SLO:S-05-A-02] Recognize the integration of the different systems (Respiratory, and Circulatory) in carrying out life processes.</p> <p>Note: <i>Detailed knowledge of the respiratory system (e.g., alveoli) and circulatory system (e.g. heart chambers and valves) is not required.</i></p> <p>[SLO:S-05-A-03] Use a model to describe how we receive, process and respond to different types of information through our senses in different ways.</p>	<p>[SLO:S-06-A-11] State the importance of digestion in the human body and describe physical and chemical digestion.</p> <p>[SLO:S-06-A-12] Sequence the main regions of Alimentary Canal, its associated organs and describe the functions of different parts of the Alimentary Canal.</p> <p>[SLO:S-06-A-13] Briefly describe the role of enzymes in digestion.</p> <p>[SLO:S-06-A-14] Conclude that blood transports the products of digestion to other parts of the body and the undigested products get egested/defecated.</p>	<p>[SLO:S-07-A-09] Differentiate between the processes of respiration and breathing.</p> <p>[SLO:S-07-A-10] Differentiate between aerobic and anaerobic respiration.</p> <p>[SLO:S-07-A-11] Trace the path of air in and out of the body and how the oxygen it contains is used during the process of respiration.</p> <p>[SLO:S-07-A-12] Sketch and label the human circulatory system.</p> <p>[SLO:S-07-A-13] Hypothesize how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate, test their hypothesis, calculate their pulse rate and record their findings.</p>	<p>[SLO:S-08-A-11] Describe the type and function of neurons in transmitting messages through the body.</p> <p>[SLO:S-08-A-12] Identify the organs, functions and processes of the Human Nervous System.</p> <p>[SLO:S-08-A-13] Sketch and label a diagram of the Human Nervous System.</p> <p>[SLO:S-08-A-14] Explain how the brain works as the control station of the human body.</p> <p>[SLO:S-08-A-15] Identify the three major parts of the brain, the fore- brain, midbrain and hind-brain, & describe their various functions.</p> <p>[SLO:S-08-A-16] Describe the structure of the cerebrum, its division into two hemispheres (left</p>



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-A-18] Recognize that humans have different types of teeth (molar, premolar, incisors, canine) and know their functions in digestion of food.</p> <p>[SLO:S-04-A-19] Investigate the causes and prevention of tooth decay and gum diseases.</p> <p>[SLO:S-04-A-20] Identify that many Vertebrates (Cat and Goat) have a digestive system similar to humans.</p>	<p>[SLO:S-05-A-04] Describe the Human Respiratory System in terms of oxygen from the air moving into the blood in the lungs and know that many vertebrates (Cat and Goat) have a similar respiratory system.</p> <p>[SLO:S-05-A-05] Identify by name the main parts of the Human Circulatory System, and describe briefly the functions of the heart, blood vessels and blood.</p> <p>[SLO:S-05-A-06] Identify that many animals (Cat and Goat) have a circulatory system similar to humans.</p>		<p>[SLO:S-07-A-14] Describe the role and function of major organs in the human respiratory system including trachea, lungs and alveoli (air sacs).</p> <p>[SLO:S-07-A-15] Explain that living organisms have a complex transport system for transfer of various solids, liquids, and gasses across the body.</p> <p>[SLO:S-07-A-16] Describe the structure and function of the human heart.</p> <p>[SLO:S-07-A-17] Explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gasses, nutrients, wastes and heat.</p> <p>[SLO:S-07-A-18] Compare and contrast arteries, veins and capillaries.</p> <p>[SLO:S-07-A-19] Describe the composition of blood and the functions of red cells, white cells, platelets and plasma.</p>	<p>and right) and the role of each hemisphere in the control of the body.</p> <p>[SLO:S-08-A-17] Describe the reflex arc with example.</p> <p>[SLO:S-08-A-18] Develop some plans and activities to maintain a healthy brain (Physical and mental exercise)</p> <p>[SLO:S-08-A-19] Match various body functions with the relevant part of the brain that controls or regulates them (For instance, associating breathing with the brain stem).</p> <p>[SLO: S-08-A-20] Explain and represent how messages flow through the body from and to the brain, and how the brain collaborates with the sensory organs to regulate this process.</p> <p>[SLO:S-08-A-21] Map the various steps in the transmission of messages through the body and to the brain.</p> <p>[SLO:S-08-A-22] Predict what would happen if a nerve connection broke.</p>



4. Human health and disease

Benchmark IV:

By the end of Grade 5, students will be able to:

Describe some of the causes of infectious diseases and suggest measures that can control the spread of the diseases.

Recognize the advantages and disadvantages of microorganisms.

Benchmark IV:

By the end of Grade 8, students will be able to:

Describe the causes and prevention of infectious diseases and how the natural immune system responds.

Understand the constituents of a balanced diet and analyze the consequences of dietary deficiencies which lead to different disorders.

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
	<p>[SLO:S-05-A-07] Define and describe main groups of microorganisms (bacteria, virus and fungi) and give examples of each.</p> <p>[SLO:S-05-A-08] Recognize some common diseases of each group (virus, bacteria, and fungi) caused by microorganisms.</p> <p>[SLO:S-05-A-09] Recognize that microorganisms get transmitted into humans and spread infectious diseases.</p> <p>[SLO:S-05-A-10] Differentiate between contagious and noncontagious diseases.</p> <p>[SLO:S-05-A-11] Relate the transmission of Common contagious diseases to humans</p> <p>[SLO:S-05-A-12] Explain some methods of preventing the transmission of contagious diseases COVID-19 & Polio.</p>	<p>[SLO:S-06-A-15] Identify the constituents of a balanced diet for humans i.e. 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.</p> <p>[SLO:S-06-A-16] Identify the essential nutrients, and sources.</p> <p>[SLO:S-06-A-17] Recognize that a healthy diet contains a balance of foodstuffs.</p> <p>[SLO:S-06-A-18] Correlate diet and the fitness.</p> <p>[SLO:S-06-A-19] Identify and describe deficiency of Essential nutrients .</p>	<p>[SLO:S-07-A-20] Explain the various lines of defenses that the body has against pathogens.</p> <p>[SLO:S-07-A-21] Describe the two types of immunity in humans innate and adaptive.</p> <p>[SLO:S-07-A-22] Identify the various types of pathogens that cause infectious diseases.</p> <p>[SLO:S-07-A-23] Describe the parts of the immune system and how they function to produce an immune response.</p> <p>[SLO:S-07-A-24] Illustrate how adaptive immunity develops over time.</p> <p>[SLO:S-07-A-25] Visualize the ways to add additional layers of defense (such as wearing masks, using sanitizers, etc.).</p> <p>[SLO:S-07-A-26] Propose some common strategies for strengthening their immune system.</p>	



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
	<p>[SLO:S-05-A-13] Recognize the advantages of microorganisms.</p> <p>[SLO:S-05-A-14] Investigate the role of microorganisms as decomposer</p> <p>[SLO:S-05-A-15] Recognize the items of the first aid box.</p> <p>[SLO:S-05-A-16] Use a first aid box to dress a wound.</p>		<p>[SLO:S-07-A-27] Explain how infectious diseases such as hepatitis, covid-19, typhoid, and dengue are caused, diagnosis, and preventions.</p> <p>[SLO:S-07-A-28] Suggest ways in which people can safeguard against the spread of infectious diseases.</p>	



5. Ecosystem- Conditions for life on earth/ biodiversity and interdependence

Benchmark V:

By the end of Grade 5, students will be able to:

Explore the interaction of living things in an ecosystem.
Use diagrams to explain how energy flows in an ecosystem.
Identify the causes and effects of environmental pollution and suggest measures to reduce it.

Benchmark V:

By the end of Grade 8, students will be able to:

Explain the interdependence of non-living and living components in an ecosystem.
Describe the energy flow and nutrients cycles in an ecosystem.
Communicate solutions that will reduce the impact of humans on land, water, air and /or other living things in the local environment.

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-A-21] Recognize that ecosystems (e.g., forests, ponds, rivers, grasslands and deserts) consist of habitats that provide living things with what they need it.</p> <p>[SLO:S-04-A-22] Recognize and explain that living things respond to environmental condition.</p> <p>[SLO:S-04-A-23] Describe how plants and animals adapt 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.</p> <p>[SLO:S-04-A-24] 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).</p>	<p>[SLO:S-05-A-17] Describe food chains as being made of producers and consumers, and classify consumers as herbivores, omnivores, carnivores, predators, and/or prey.</p> <p>[SLO:S-05-A-18] Describe a food web and its relation to a food chain.</p> <p>[SLO:S-05-A-19] Explain how human activities add toxic substances to an ecosystem.</p> <p>[SLO:S-05-A-20] Identify 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.</p> <p>[SLO:S-05-A-21] Explore the main causes of water, air and land pollution in the local and wider community.</p>			<p>[SLO:S-08-A-23] Describe the role of living things in cycling oxygen and carbon through an ecosystem, citing the processes of respiration, photosynthesis, and combustion.</p> <p>[SLO:S-08-A-24] Relate how oxygen and carbon cycles are complementary processes that bring balance and symmetry to life on Earth.</p> <p>[SLO:S-08-A-25] Describe global warming and explain how threats to the carbon-oxygen balance such as overpopulation, reliance on fossil fuels, and deforestation are contributing to global warming and climate change.</p> <p>[SLO:S-08-A-26] Describe how energy flows from producers to consumers, and how only part of the energy flows from one level of the pyramid to the next.</p>



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-A-25] Explore how human actions such as urbanization and population growth can affect a habitat.</p> <p>[SLO:S-04-A-26] Explain that when a habitat changes, organisms living in it are affected as well.</p>	<p>[SLO:S-05-A-22] Explain the effects of water, air and land pollution. (Unclean/ Toxic water, smoke, smog, excess CO/ other gasses, open garbage dumps, industrial waste, etc.) on the Environment and life.</p> <p>[SLO:S-05-A-23] Discuss the effects of burning fossil fuels and releasing greenhouse gasses in the air.</p> <p>[SLO:S-05-A-24] Differentiate between biodegradable and non-biodegradable materials and their impact on the environment.</p>			<p>[SLO:S-08-A-27] Draw a food web diagram to illustrate the food relationships between organisms.</p> <p>[SLO:S-08-A-28] Describe and illustrate through examples key ecological relationships between organisms, including competition, predation and symbiosis.</p> <p>[SLO:S-08-A-29] Predict how changes in an ecosystem (e.g., changes in the water supply, the introduction of a new population, hunting, migration) can affect available resources, and thus the balance among populations.</p> <p>[SLO:S-08-A-30] Hypothesize what would happen in the ecosystem if the population of one of the participants (Prey-predator and symbionts) in different ecological relationships is affected.</p> <p>[SLO:S-08-A-31] Explain ways in which human behavior (e.g., replanting forests, reducing air and water pollution, protecting endangered species) can have positive effects on the local environment.</p>



6. Biotechnology

Benchmark VI:

By the end of Grade 8, students will be able to:

Describe the structure of DNA, its modification and application, in biotechnology in various fields

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				<p>[SLO:S-08-A-32] Define biotechnology as the use of living cells and organisms in products and processes that can improve the quality of life.</p> <p>[SLO:S-08-A-33] Illustrate how biotechnology is a discipline/field that has the potential to transform how we live.</p> <p>[SLO:S-08-A-34] Discuss the applications of biotechnology in the Pakistani context and their effects on the people and the environment of Pakistan over time. Illustrative examples: bread-making, making of yogurt and cheese, vaccines for immunization, insulin production, dyes, etc.</p> <p>[SLO:S-08-A-35] Relate the use of biotechnology in food sciences in producing foods with higher nutritional value and improved taste and quality (how fermentation has been improved by genetically modified organisms or the introduction of certain genes to raise iron content in rice, can be taken as examples).</p>



Student Learning Outcomes

Grade – IV

Grade – V

Grade – VI

Grade – VII

Grade – VIII

Domain B: Physical Science

Grade – IV

Grade – V

Grade – VI

Grade – VII

Grade – VIII

- Matter and its characteristics
- Forms of Energy and its transfer
- Force and Simple machines
- Technology in Everyday Life

- Physical and Chemical changes of Matter
- Light and Sound
- Electricity and Magnetism
- Technology in Everyday Life

- Matters as Particles
- Elements and compounds
- Mixtures
- Energy
- Electricity
- Magnetism
- Technology in Everyday Life

- Structure of an Atom
- Physical and Chemical Changes
- Chemical Bonds
- Solutions
- Force and Motion
- Waves & energy
- Heat and Temperature
- Technology in Everyday Life

- Periodic Table
- Chemical Reactions
- Acids, Bases and Salts
- Force & Pressure
- Reflection & Refraction of Light
- Electricity & Magnetism
- Technology in Everyday Life

Benchmark VII:

By the end of Grade5, students will be able to:

Investigate matter and explore its chemical and physical properties through daily life examples.

Recognize the importance of science and technology to solve everyday problems.

Integrate scientific concepts/STEAM in daily life to improve the quality of their own life and lives of others.

Understand how scientific concepts/STEAM affect their life and society.

Compare the properties of different states of matter and identify the conditions that cause matter to change states.

Benchmark VII:

By the end of Grade8, students will be able to:

Recognize the importance of science and technology to solve everyday problems.

Integrate scientific concepts/ STEAM in daily life to improve the quality of their own life and lives of others.

Understand how scientific concepts/STEAM affect their life and society.

Analyze the complexity of matter and energy, particle model of matter, different states of matter and its conversion from one state to another.

Investigate mixtures and apply these separating techniques.

Differentiate solution and suspension and identify the characteristic property of matter such as Solubility.

Compare the systematic organization of elements in the periodic table, constructing formula and forming chemical bonds.

Distinguish between physical and chemical reactions, types of chemical reactions and acids, alkalis and salt.

Describe chemical equations, symbols and its relationship to molecules, atoms, isotopes and ions.



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
[SLO:S-04-B-01] Design models of sphere, cube, prism, cylinder and cone with clay or playdough/ environment friendly materials.	[SLO:S-05-B-01] Design a model of a footbridge using the given specifications (e.g., can sustain a given weight).			
	[SLO:S-05-B-02] Design a model of a bookshelf using the given specifications (e.g. can occupy space.)			
[SLO:S-04-B-02] Identify and describe Three states of matter	[SLO:S-05-B-03] Prepare LED light strings working with 3-volt battery.	[SLO:S-06-B-01] Describe the structure of matter in terms of particles (i.e., atoms and molecules).	[SLO:S-07-B-01] Describe and draw the structure of an atom in terms of electrons, protons and neutrons.	
			[SLO:S-07-B-02] Demonstrate how an atom is electrically neutral	
			[SLO:S-07-B-03] Differentiate between atomic number and mass number.	
			[SLO:S-07-B-04] Determine the atomic number and mass number of elements on the basis of the number of protons, electrons and neutrons.	
			[SLO:S-07-B-05] Describe isotopes and their uses in medicine and agricultural	
			[SLO:S-07-B-06] 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.	
		[SLO:S-06-B-02] Describe molecules as a combination of atoms (e.g., H ₂ O, O ₂ & CO ₂).	[SLO:S-07-B-07] Explain that the Periodic Table is a way to organize elements in a systematic order.	[SLO:S-08-B-01] Recognize Periodic Table as a way of classifying the elements in groups and periods.



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
		[SLO:S-06-B-03] Recognize the names and symbols for some common elements (first 10 elements of the Periodic Table) and recognize their physical properties.	[SLO:S-07-B-08] Recognize periods and groups in the Periodic Table.	[SLO:S-08-B-02] Identify the names and location of the first 18 elements only.
			[SLO:S-07-B-9] Define valency and explain the formation of ions.	
		[SLO:S-06-B-04] 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.		
		[SLO:S-06-B-05] Explain that compounds are formed by different types of elements joining together chemically forming a new substance.	[SLO:S-07-B-10] Write chemical formula on the basis of valency of the constituent elements. Such as H ₂ O, NaCl, NH ₃ , CO ₂ , CO, etc.	
		[SLO:S-06-B-06] Illustrate the formation of a compound with the help of a word equation.		
		[SLO:S-06-B-07] Distinguish between elements and compounds.		
		[SLO:S-06-B-08] Explore the common elements and compounds in our daily life (Carbon, Nitrogen, Hydrogen, Aluminum, Water, Common salt, Sugar).		
[SLO:S-04-B-03] Compare and sort the materials on physical properties (mass, volume, density, states of matter).	[SLO:S-05-B-04] Observe the changes in materials that do not result in new materials (dissolving, crushing).			



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
[SLO:S-04-B-04] Properties of metals (appearance, texture, color, density, conduction of heat and electricity using daily life examples).		[SLO:S-06-B-09] Categorize elements into metals and non-metals of first 10 elements based on their physical properties.		[SLO:S-08-B-03] Identify properties of metals and non-metals. [SLO:S-08-B-04] Relate the properties to the uses of metals.
		[SLO:S-06-B-10] Explain the Particle Theory of Matter.		
	[SLO:S-05-B-05] Describe how matter can be changed from one state to another by heating or cooling.	[SLO:S-06-B-11] Use particle model of matter to investigate the movement and arrangement of particles in three states.		
		[SLO:S-06-B-12] Explain why gases and liquids take the shape of their containers but solids do not, in terms of the Particle Theory of Matter.		
		[SLO:S-06-B-13] Discuss, using the particle theory of matter, why liquids and gases can flow easily but solids cannot.		
		[SLO:S-06-B-14] Interpret the evidence for the existence of the particles in matter by observing daily life examples (adding air to expand a balloon compressing air in a syringe, dissolving sugar in water, and evaporating salt water). [SLO:S-06-B-15] Apply the particle theory of matter to explain diffusion.		



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
			[SLO:S-07-B-11] Recognize that a chemical bond results from the attraction between atoms in a compound and the electrons of atom are involved in the bond formation.	[SLO:S-08-B-05] Identify chemical reactions and give examples.
				[SLO:S-08-B-06] Define the Law of Conservation of Mass and demonstrate the law with an experiment.
				[SLO:S-08-B-07] Write and balance chemical equations.
				[SLO:S-08-B-08] Distinguish between different types of reactions (combination, displacement, double displacement, combustion).
				[SLO:S-08-B-09] Distinguish between endothermic and exothermic reactions.
				[SLO:S-08-B-10] Recognize the importance of exothermic and endothermic reactions in daily life.
				[SLO:S-08-B-11] Design a car that is powered solely by a chemical reaction and can travel. (STEAM)
				[SLO:S-08-B-12] Discuss formation of ionic bonds as a result of electrostatic forces between atoms (e. g., NaCl).
				[SLO:S-08-B-13] Discuss types and formation of covalent bond as a result of mutual sharing of electrons between



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				atoms (e.g., H ₂ , O ₂ , N ₂).
				[SLO:S-08-B-14] Name certain ionic and covalent compounds.
				[SLO:S-08-B-15] Draw cross and dot structures showing formation of ionic compounds and covalent compounds.
	[SLO:S-05-B-06] Identify observable changes in materials that make new materials with different properties (e.g., decaying, such as food spoiling, burning, rusting).		[SLO:S-07-B-12] Differentiate between physical and chemical changes while considering daily life examples.	
			[SLO:S-07-B-13] Recognize that oxygen is needed in combustion, rusting and corrosion.	
			[SLO:S-07-B-14] Explore methods of preventing rusting.	
			[SLO:S-07-B-15] Relate uses of materials to their chemical properties (e.g., tendency to rust, flammability).	
			[SLO:S-07-B-16] Evaluate Impact of combustion reaction on environment.	
[SLO:S-04-B-05] Investigate the conditions that cause matter to change states (heating or cooling), and explain the processes associated with it (i.e., melting, freezing & boiling).		[SLO:S-06-B-16] Explain the changes in states: Melting, freezing, evaporation, condensation, and sublimation, using the particle model of matter.	[SLO:S-07-B-17] Relate uses of materials to their physical properties (e.g., melting point, boiling point, solubility, thermal conductivity).	
	[SLO:S-05-B-07] Compare physical and chemical changes.		[SLO:S-07-B-18] Distinguish between physical and chemical properties of matter.	



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
		[SLO:S-06-B-17] Demonstrate that mixtures are formed when two or more substances mix with each other without the formation of a new substance.	[SLO:S-07-B-19] Demonstrate the process of solution formation (using water as universal solvent as well as other solvents like alcohol).	
		[SLO:S-06-B-18] Identify different types of mixtures.	[SLO:S-07-B-20] Distinguish among solute, solvent and solution; saturated and unsaturated solution.	
		[SLO:S-06-B-19] Describe the difference between elements, compounds, and mixtures.	[SLO:S-07-B-21] Differentiate between solution and suspension and identify uses of solutions and suspension in daily life	
		[SLO:S-06-B-20] Differentiate between pure substances and mixtures on the basis of their formation and composition.		
		[SLO:S-06-B-21] Describe alloys as mixtures of metals and some other elements.		
		[SLO:S-06-B-22] Identify and explain examples of common mixtures from daily life.		
		[SLO:S-06-B-23] Justify why air is considered as a mixture of gases.		
		[SLO:S-06-B-24] Demonstrate ways of separating different mixtures.		
		[SLO:S-06-B-25] Demonstrate the process of solution formation (using water as universal solvent).	[SLO:S-07-B-22] Define solubility.	



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
			[SLO:S-07-B-23] Recognize that the amount of solute which dissolves in a given solvent.	
			[SLO:S-07-B-24] Identify the factors which affect the solubility of a solute in a solvent and recognize the importance of these factors in homes and industries.	
			[SLO:S-07-B-25] Explain what is meant by a concentrated and dilute solution.	
			[SLO:S-07-B-26] Identify ways of accelerating the process of dissolving materials in a given amount of water and provide reasoning (i.e., increasing the temperature, stirring, and breaking the solid into smaller pieces increases the process of dissolving).	
			[SLO:S-07-B-27] Explore the effectiveness of various cleaning solutions in cleaning tarnished and oxidized coins. (STEAM)	
				[SLO:S-08-B-16] Classify acids, alkalis, and salts and give examples of each.



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				[SLO:S-08-B-17] Identify the physical properties of acids, alkalis, and salts.
				[SLO:S-08-B-18] Define pH and its ranges with reference to indicators.
				[SLO:S-08-B-19] Interpret the pH scale and identify acids, alkalis, and salts.
				[SLO:S-08-B-20] Describe neutralization reaction with real life examples.
				[SLO:S-08-B-21] Observe and write the uses of acids, bases, and salts in daily life.



<p>Benchmark VII:</p> <p>By the end of Grade 5, students will be able to:</p> <p>Demonstrate the effects of heat on the states of matter.</p> <p>Describe the forms of energy, simple energy transformation and the uses of energy.</p> <p>Investigate and describe the flow of electric current in an electric circuit and relationship between electricity and magnetism.</p> <p>Demonstrate the characteristics of light and sound with the physical phenomena.</p>	<p>Benchmark VII:</p> <p>By the end of Grade 8, students will be able to:</p> <p>Use evidence to construct an explanation on how energy is transferred, transformed, and conserved.</p> <p>Compare types and properties of waves and explain how they interact with matter.</p> <p>Investigate that light can be reflected, refracted, absorbed.</p> <p>Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits.</p>
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Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-B-06] Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) and show heat, electrical, and magnetic energy as the ability to cause motion or create change.</p>		<p>[SLO:S-06-B-26] Recognize energy as a physical quantity.</p>		
		<p>[SLO:S-06-B-27] Recognize and relate potential and kinetic energy.</p>		
		<p>[SLO:S-06-B-28] Demonstrate an energy transfer such as a bouncing ball by energy transfer diagram, e.g., gravitational potential energy -> kinetic -> elastic potential energy + thermal + sound -> kinetic -> gravitational potential energy, etc.</p>		
		<p>[SLO:S-06-B-29] State the Law of Conservation of Energy and explain how the law applies to different situations.</p>		



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
		<p>[SLO:S-06-B-30] Compare the Renewable Energy Sources (wind, water, Sun and plants) and Non-Renewable Sources of energy (coal, natural gas, crude oil).</p>		
		<p>[SLO:S-06-B-31] Identify the advantages of using renewable energy resources.</p>		
		<p>[SLO:S-06-B-32] Assemble and demonstrate a solar panel to operate a small fan. (STEAM)</p> <p>[SLO:S-06-B-33] Design and make a solar water heater. (STEAM)</p>		
<p>[SLO:S-04-B-07] Describe the properties of light (travels in a straight line, travels very fast and in all directions).</p>				<p>[SLO:S-08-B-22] Identify basic properties of light (i.e., speed, transmission through different media, absorption, reflection and dispersion).</p> <p>[SLO:S-08-B-23] Describe and show how an image is formed by the plane mirror.</p> <p>[SLO:S-08-B-24] State the Laws of Reflection.</p> <p>[SLO:S-08-B-25] Describe different optical instruments which use curved mirrors. (concave and convex mirror).</p>



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				<p>[SLO:S-08-B-26] Relate the apparent color of objects to reflected or absorbed light.</p> <p>[SLO:S-08-B-27] Explain that light is refracted at the boundary between air and any transparent material.</p>
				<p>[SLO:S-08-B-28] Distinguish between reflection and refraction of light with daily life examples.</p> <p>[SLO:S-08-B-29] Illustrate the characteristics of image formed by plane mirror.</p>
<p>[SLO:S-04-B-08] Relate familiar physical phenomena (shadow, reflection, rainbow) to the properties of light.</p>				<p>[SLO:S-08-B-30] Investigate that light is made up of many colors. Relate the apparent color of objects to reflected or absorbed light.</p> <p>[SLO:S-08-B-31] Identify spherical mirror.</p> <p>[SLO:S-08-B-32] Describe the characteristics of image(s) formed by concave mirrors and convex mirrors.</p> <p>[SLO:S-08-B-33] Describe use of plane and spherical mirrors in different optical instruments.</p>
	<p>[SLO:S-05-B-08] Identify natural, artificial light sources.</p>			



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
	[SLO:S-05-B-09] Sort out luminous and non-luminous objects.			
	[SLO:S-05-b-10] Identify transparent, translucent and opaque objects.			
[SLO:S-04-B-09] Demonstrate the production of sound.	[SLO:S-05-B-11] Demonstrate that sound can travel through different states of matter			
[SLO:S-04-B-10] Relate familiar physical phenomena (vibrating objects) to the behavior of sound.	[SLO:S-05-B-12] Describe the structure and discuss the travelling mode of the sound waves.			
[SLO:S-04-B-11] Identify the different sounds on the basis of softness and loudness.	[SLO:S-05-B-13] Describe the echo of sound.			
	[SLO:S-05-B-14] Define noise and its effects on human health. [SLO:S-05-B-15] State the role of humans in reducing noise pollution.			
[SLO:S-04-B-12] Describe the temperature as degree of hotness or coldness of an object or place.				
[SLO:S-04-B-13] Demonstrate that the warmer objects have higher temperature than cooler objects.			[SLO:S-07-B-28] Describe the expansion of the three states of matter on heating, and contraction on cooling, in terms of particles. [SLO:S-07-B-29] Predict the effects of heat gain and heat loss in daily life example.	



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
[SLO:S-04-B-14] Demonstrate changes occur when hotter objects are brought closer to the cooler objects.			[SLO:S-07-B-30] Compare all three scales of temperature (including inter-conversion of temperature scales).	
[SLO:S-04-B-15] Describe the ways to measure the temperature and its units.			[SLO:S-07-B-31] Define the terms heat and temperature on the basis of Kinetic Molecular Theory.	
[SLO:S-04-B-16] Use various instruments (room thermometers, clinical thermometer, etc.) and measure and record temperature using different scales.			[SLO:S-07-B-32] Explain why metals are good thermal conductors and nonmetals are Insulators of heat using the particle model.	
			[SLO:S-07-B-33] Construct the concept of heat conduction, convection and radiation by applying particle theory including daily life examples.	
			[SLO:S-07-B-34] Identify the effects of thermal expansion and contraction with their applications in daily life.	
			[SLO:S-07-B-35] State and explain the practical methods of thermal insulation used for constructing buildings. (STEAM)	
[SLO:S-04-B-17] Recognize that electrical energy in a circuit can be transformed into other forms of energy (light, heat, sound).		[SLO:S-06-B-34] Explain the phenomena of static electricity in everyday life.		



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
[SLO:S-04-B-18] Demonstrate that simple electrical systems (e.g., a flashlight) require a complete (unbroken) electrical pathway.	[SLO:S-05-B-16] Draw circuit diagram with symbols.	[SLO:S-06-B-35] Recognize electric current as a flow of charges. [SLO:S-06-B-36] Describe a simple circuit as a path for flow of charges. [SLO:S-06-B-37] Differentiate between open and closed circuits.		
	[SLO:S-05-B-17] Describe flow of electric current in an electric circuit.	[SLO:S-06-B-38] Draw and interpret simple circuit diagrams (using symbols).		
		[SLO:S-06-B-39] Describe the characteristics of series and parallel circuits. [SLO:S-06-B-40] Draw and construct a series and parallel circuits.		
		[SLO:S-06-B-41] Identify the use of series and parallel electric circuits in daily life.		
		[SLO:S-06-B-42] Investigate the factors that affect the brightness of bulbs or speed of motors <ul style="list-style-type: none"> • Number of batteries • Number of Bulbs • Type of wire • Length of wire • Thickness of wire 		
		[SLO:S-06-B-43] Assemble and operate a trip wire security alarm system using simple items. (STEAM)		



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				[SLO:S-08-B-34] Define resistance and its SI unit.
				[SLO:S-08-B-35] Define voltage & current state their SI units
				[SLO:S-08-B-36] Formulate that resistance is the ratio of voltage to current.
				[SLO:S-08-B-37] Define electric power and state its SI unit.
				[SLO:S-08-B-38] Recognize the electric power of various electrical appliances.
				[SLO:S-08-B-39] Recognize the terms earth wire, fuse, circuit breaker.
				[SLO:S-08-B-40] Analyze the danger of overloading and short circuit and identify the importance of earth wire, Fuses and circuit breakers.
			[SLO:S-07-B-36] Define a wave. [SLO:S-07-B-37] Compare the types of waves (mechanical and electromagnetic) with daily life examples. [SLO:S-07-B-38] Distinguish between Longitudinal and Transverse waves.	



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
			<p>[SLO:S-07-B-39] Identify; 1. water wave and Sound wave as mechanical wave; 2. light wave as electromagnetic wave.</p>	
			<p>[SLO:S-07-B-40] Define the terms: Wave length, frequency, and time period of wave. (transverse wave)</p> <p>[SLO:S-07-B-41] Define and relate: 1. Pitch & frequency. 2. Amplitude and frequency.</p> <p>[SLO:S-07-B-42] Explain the factors affecting pitch and loudness of sound.</p>	<p>[SLO:S-08-B-41] List precautionary measure stone sure the safe use of electricity.</p>
			<p>[SLO:S-07-B-43] Compare and interpret waveforms in terms of pitch and loudness.</p> <p>[SLO:S-07-B-44] Construct the inverse relation between time period and frequency</p> <p>[SLO:S-07-B-45] Relate common phenomenon (e.g., echo, hearing thunder after seeing lightning) to the properties of sound.</p>	



<p>Benchmark VII:</p> <p>By the end of Grade 5, students will be able to:</p> <p>Investigate different types of forces and their effects.</p> <p>Demonstrate the understanding that simple machines help make motion and work easier.</p> <p>Apply scientific skills to solve problems and suggest solutions.</p>	<p>Benchmark VII:</p> <p>By the end of Grade 8, students will be able to:</p> <p>Investigate and describe types of forces, including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.</p> <p>Measure and record data from experiment stop reduce speed-time graphs and interpret them to accurately describe motion.</p> <p>Evaluate through investigation the relationship between pressure, force and area.</p>
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Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
			[SLO:S-07-B-46] Describe the effect of force on changing the speed and direction of motion with time.	
			[SLO:S-07-B-47] Define and state the SI unit of force.	
			[SLO:S-07-B-48] Formulate the relationship between speed, distance and time.	
			[SLO:S-07-B-49] State SI (System International) unit of speed.	
			[SLO:S-07-B-50] Calculate average speed.	
			[SLO:S-07-B-51] Interpret a distance-time graph.	
[SLO:S-04-B-19] Describe different types of force (friction, applied, gravitational, magnetic).				
[SLO:S-04-B-20] Investigate that friction can either be detrimental or useful under different circumstances (ways to reduce friction).				



Student Learning Outcomes				
Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<p>[SLO:S-04-B-21] List uses of different types of force in our daily life.</p>				
<p>[SLO:S-04-B-22] Explore how force can move or stop objects, change direction, shape, & speed.</p>			<p>[SLO:S-07-B-52] Give examples of contact forces and non-contact forces.</p>	
<p>[SLO:S-04-B-23] Describe that an object may have multiple forces acting on it, even when at rest. (free body diagram)</p> <p>[SLO:S-04-B-24] Compare the effects of force of different strengths in the same or opposite directions acting on an object.</p>				
<p>[SLO:S-04-B-25] 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).</p> <p>[SLO:S-04-B-26] Design hammer, wheels, rollers and gears using clay or playdough/ cardboard/ environment friendly material. (STEAM)</p>				
			<p>[SLO:S-07-B-53] Demonstrate that forces always work in action & reaction pairs (equal in magnitude, opposite in direction).</p>	<p>[SLO:S-08-B-42] Recognize that several forces may act on an object and that they may or may not balance each other.</p>



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				[SLO:S-08-B-43] Examine the effect of an unbalanced force on an object.
				[SLO:S-08-B-44] Differentiate between floating and sinking objects in terms of density.
				[SLO:S-08-B-45] Define 'pressure' with examples and its unit
				[SLO:S-08-B-46] Relate pressure with force and area.
				[SLO:S-08-B-47] Investigate effects related to pressure (e.g., water pressure increasing with depth, a balloon expanding when inflated, etc.)
				[SLO:S-08-B-48] Examine the effect of Force in the presence of air pressure.
				[SLO:S-08-B-49] Make a hydraulic elevator. (STEAM)
				[SLO:S-08-B-50] Build a two-stage rocket model. (STEAM)
	[SLO:S-05-B-18] Demonstrate magnets have two poles (opposites attract and like poles repel).	[SLO:S-06-B-44] Recognize by the use magnetic compass that electric current has a magnetic field around it. [SLO:S-06-B-45] Recognize that a freely-moving magnet comes to rest pointing in a North-South direction.		[SLO:S-08-B-51] Investigate the factors that affect the strength of an electromagnet.



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
	[SLO:S-05-B-19] Recognize the difference between a magnet and a magnetic material.	[SLO:S-06-B-46] Describe how to magnetize a magnetic material. Describe how to de-magnetize a magnet.		[SLO:S-08-B-52] Describe the properties that are unique to electromagnets (i.e., the strength varies with current, number of coils, and type of metal in the core; the magnetic attraction can be turned on and off; and the poles can switch).
	[SLO:S-05-B-20] 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).	[SLO:S-06-B-47] Construct an electromagnet and identify its application in daily life		[SLO:S-08-B-53] Describe briefly the working principles of electromagnetic devices such as speaker, doorbell.
		[SLO:S-06-B-48] Compare different types of magnets (permanent, temporary and electromagnets).		
	[SLO:S-05-B-21] Construct a magnetic compass. (STEM/STEAM)	[SLO:S-06-B-49] Recognize that there is a space around a magnet where effect of magnetic force can be observed.		
		[SLO:S-06-B-50] Draw magnetic field of a bar magnet using iron filings.		
		[SLO:S-06-B-51] Recognize Earth's magnetic field which attracts a freely pivoted magnet to line up with it.		



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
Technology in Everyday Life	Technology in Everyday Life	Technology in Everyday Life	Technology in Everyday Life	Technology in Everyday Life
<p>[SLO:S-04-B-27] Use scientific instruments/ apparatus in everyday life (e.g. thermometer, digital balance, stop watch, calculator, available digital devices).</p> <p>[SLO:S-04-B-28] Use a plumb line to install a flagpole vertically.</p>	<p>[SLO:S-05-B-22] Use scientific instruments/ apparatus in everyday life (Use spirit level/water level to level different objects i.e. table, picture, frame etc.).</p> <p>[SLO:S-05-B-23] Practice safety measures for earthquake and fire drill.</p>	<p>[SLO:S-06-B-52] Grow seasonal plants and vegetables in earthen pots and demonstrate the effect of use of fertilizers on the growth of plants.</p> <p>[SLO:S-06-B-53] Prepare yogurt and cheese from milk to demonstrate the beneficial microorganisms.</p> <p>[SLO:S-06-B-54] Design a solar oven to convert solar energy into heat energy.</p> <p>[SLO:S-06-B-55] Assemble a circuit to demonstrate the working of an electric bell.</p>	<p>[SLO:S-07-B-54] Design a model to demonstrate drip & sprinkle reirrigation system for conservation of water.</p> <p>[SLO:S-07-B-55] Use different techniques of preserving foods like orange juice, apple jam and pickles.</p> <p>[SLO:S-07-B-56] Make a simple Stethoscope.</p> <p>[SLO:S-07-B-57] Make a sanitizer using suitable substances.</p>	<p>[SLO:S-08-B-54] Make bioplastic from milk and vinegar as an application of biotechnology.</p> <p>[SLO:S-08-B-55] Make toothpaste, soap and detergent as an application of acids and bases in daily life.</p> <p>[SLO:S-08-B-56] Assemble a concave mirror type solar cooker to convert solar energy into heat energy</p> <p>[SLO:S-08-B-57] Assemble and operate a simple wind turbine to produce electricity.</p> <p>[SLO:S-08-B-58] Demonstrate the working of UPS and use it to operate a fan or energy saver bulb.</p>



Domain C: Earth and Space Science

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
<ul style="list-style-type: none"> • Earth and its Resources • Earth in the Solar System 	<ul style="list-style-type: none"> • Structure of the Earth • Soil • Space and Satellites 	<ul style="list-style-type: none"> • Solar System 	<ul style="list-style-type: none"> • Earth and Space 	<ul style="list-style-type: none"> • Our Universe
<p>Benchmark – X</p> <p>By the end of Grade 5, students will be able to:</p> <p>Describe the structure of the Earth and recognize that Earth's surface is made up of land, water, and is surrounded by air.</p> <p>Identify the Earth's resources that we use in our everyday life and how to conserve them.</p> <p>Describes the composition and characteristics of soil types, providing examples of their uses.</p>		<p>Benchmark - X</p> <p>By the end of Grade 8, students will be able to:</p> <p>Demonstrate the understanding of movement of the Earth, Sun, Moon, Solar System and its relationship.</p>		

Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
[SLO:S-04-C-01] Define natural resources	[SLO:S-05-C-01] Describe the structure of The Earth (i.e., crust, mantle, and core) and the Physical characteristics of these distinct parts.	[SLO:S-06-C-01] Describe the Solar System with the Sun at the center and the planets revolving around the Sun.	[SLO:S-07-C-01] Know that a satellite is an object in space that orbits a larger object and a moon is a natural satellite that orbits a planet.	
	[SLO:S-05-C-02] Describe common features of volcanoes and know they are found at breaks in the Earth's crust.	[SLO:S-06-C-02] Understand that planetary systems can contain stars, planets, asteroids, and comets.		
[SLO:S-04-C-02] Recognize that the 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.).	[SLO:S-05-C-03] Understand that the Earth's crust moves and when parts move suddenly this is called an earthquake.			



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
[SLO:S-04-C-03] Describe the sources of water on earth.				
[SLO:S-04-C-04] 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				
[SLO:S-04-C-05] Understand the water cycle and draw its diagram				
[SLO:S-04-C-06] Recognize that most water on Earth is not pure and has dissolved substances in it.	[SLO:S-05-C-04] Identify similarities and differences among the different types of soil and classify them based on their clay, sand, and organic content.			
	[SLO:S-05-C-05] Investigate the composition and characteristics of different soils.			
	[SLO:S-05-C-06] Comprehend that soil composition can change, which can support, or hinder, plant growth.			
	[SLO:S-05-C-07] Identify various causes of soil pollution.			
	[SLO:S-05-C-08] Identify professions related to Earth Science i.e., paleontologists, seismologists, geologists.			



<p>Benchmark VII:</p> <p>By the end of Grade 5, students will be able to:</p> <p>Demonstrate how the relationship of the Earth, Sun, and Moon, causes eclipses and moon phases.</p> <p>Explore and investigate the importance of space exploration and the uses of various satellites.</p> <p>Describes how the Earth spins around its axis in 24 hours resulting in day and night.</p>	<p>Benchmark VII:</p> <p>By the end of Grade 8, students will be able to:</p> <p>Describe the physical features of celestial bodies.</p> <p>Explain how gravity is the force that keeps objects in the Solar System in regular and predictable motion and describe the resulting phenomena.</p> <p>Describe the formation of black hole in the life of a star.</p> <p>Recognize space exploration as an active area of scientific and technological research and development</p>
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Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
			[SLO:S-07-C-02] Recognize that the force of gravity keeps planets and moons in their orbits.	
			[SLO:S-07-C-03] Differentiate between mass and weight, using examples of weightlessness experienced by astronauts on the surface of the Moon.	
		[SLO:S-06-C-03] Differentiate between the characteristics of different planets.		
		[SLO:S-06-C-04] Describe the characteristics of asteroids, meteorites and comets.		[SLO:S-08-C-01] Explore and understand the terms star, galaxy, Milky Way and the black holes
				[SLO:S-08-C-02] Compare the types of galaxies.
				[SLO:S-08-C-03] Relate the life of a star with the formation of black hole, neutron star, Pulsar White Dwarf, Red Giant.



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
				[SLO:S-08-C-04] Discuss the birth and eventual death of our sun.
			[SLO:S-07-C-04] Recognize that tides are caused by the gravitational pull of the Moon	
				[SLO:S-08-C-05] Show how information is collected from space by using telescopes (e.g., Hubble Space Telescope, <i>James web space telescope</i>) and space probes (e.g., Galileo).
[SLO:S-04-C-07] Recognize that the Earth has a Moon that revolves around it, and from the Earth the Moon looks different at different times of the month (Phases of the Moon).	[SLO:S-05-C-9] Describe the natural satellite soft the planets of the Solar System.	[SLO:S-06-C-05] Describe the uses of various satellites in space i.e., geostationary, weather, communication and Global Positioning System (GPS).		
[SLO:S-04-C-08] 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.		[SLO:S-06-C- 06] Identify using secondary sources the key milestones in space technology in the past 10 years.	[SLO:S-07-C-05] Describe the effects of the Earth's annual revolution around the Sun, given the tilt of its axis (e.g., different seasons, different constellations visible at different times of the year).	
[SLO:S-04-C-09] Illustrate and explain how Solar and Lunar Eclipses occur.		[SLO:S-06-C-07] Identify professions related to the Earth Science i.e., Astronauts, Physicists, Space Scientists, etc.		
	[SLO:S-05-C-10] Define artificial satellites and explain their importance in exploring the Earth and Space.	[SLO:S-06-C-08] Investigate how artificial satellites have improved our knowledge about space and are used for space research		



Student Learning Outcomes

Grade – IV	Grade – V	Grade – VI	Grade – VII	Grade – VIII
	[SLO:S-05-C-11] Recognize the role of NASA (National Aeronautics and Space Administration); explore the contribution of SUPARCO in space exploration.			
			[SLO:S-07-C-06] Describe how seasons in Earth's Northern and Southern Hemispheres are related to Earth's annual movement around the Sun.	
		[SLO:S-06-C-09] Differentiate between planets and dwarf planets.		
	[SLO:S-05-C-12] Predict and comprehend how astronauts explore space, how do astronauts survive and research in space.			
		[SLO:S-06-C-10] Inquire into the sighting of Halley's Comet; describe what they would feel if they saw it.		
				[SLO:S-08-C-06] Describe advancements in space Technology and analyze the benefits generated by the technology of space exploration.



CHAPTER - 05

Domain: Life Science

Learning Contents and Students' Learning Outcomes:

5.1. Grade-IV

Contents	Students' Learning Outcomes
<p>Life Processes:</p> <ul style="list-style-type: none"> • Introduction to life • Characteristics of living things • Requirement of Energy for Life • Needs of Plant 	<ul style="list-style-type: none"> • Understand that living things grow, take in nutrients, breathe, reproduce, eliminate waste and die. • Discuss 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)
<p>Plant Structure and Functions:</p> <ul style="list-style-type: none"> • Classification of plants • Parts of Flowering plant • Transport In plant • Parts of Flower • Pollination and its types • Sexual reproduction in plants • Structure of Seed • Dispersal of Seed • Germination of seed • Life cycle of flowering plant • Importance of Plants for sustaining life on Earth • Professions Associated with Plants 	<ul style="list-style-type: none"> • Classify the plants into two major groups (Flowering, non-flowering), and give examples of each group. • Describe the functions of different parts of flowering plants: Roots, stem/ trunk, leaves and flowers. • Identify the parts of the plant transport system and describe their functions (Stem, leaf and root). • Investigate the way in which water is transported within plants. • Identify the parts of a flower and describe their functions (limited to petals, sepals, anthers, filaments, stamens, stigma, style, carpel, and ovary by diagram). • Identify stages in the life cycles of common flowering plants. • Explore the role of flowers in the life cycle of flowering plants, including pollination, fruit and seed formation and seed dispersal. • Describe seed germination and know that seeds require and know that seeds require water and an appropriate temperature to germinate. • Relate that why plants are vital for sustaining life on earth • Identify various professions associated with this unit of science. E.g., botanist, farmers, gardeners, florists, etc.
<p>Animal Structure and Functions:</p> <ul style="list-style-type: none"> • Animals and its Classification • Groups of Vertebrates • Groups of Invertebrates • Skeleton • Importance of Skeleton • Human Digestive system • Tooth Decay and Gum Diseases • Digestive system of some vertebrates similar to humans 	<ul style="list-style-type: none"> • Distinguish between major groups of animals with backbones (vertebrates: Fish, amphibians, reptiles, birds and mammals) and without backbones (invertebrates: Insects, snails, earthworm, jellyfish and corals) on the basis of their characteristics. • Identify 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. • Identify that many Vertebrates (Cat and Goat) have a digestive system similar to humans. •



Ecosystem- adaptations:

- Ecosystem and its types
 - Response of living thing to environment.
 - Adaptation of plant and animals to environment.
 - Effects of human activities on habitat.
 - How changes in habitat Effect on living organisms
- Recognize that ecosystems (e.g., forests, ponds, rivers, grasslands and deserts) consist of habitats that provide living things with what they need it.
 - Recognize and explain that living things respond to environmental conditions.
 - Describe how plants and animals adapt 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.



5.2. Grade-V

Learning contents and students' Learning Outcome Knowledge, Skills, Attitudes, STEM and STSE.

Contents	Students' Learning Outcomes
Human Body Systems: <ul style="list-style-type: none">• Introduction to Organ and Organ system• Systems to carryout life processes• Reception of Information• Respiratory system• Circulatory system	<ul style="list-style-type: none">• Identify that the human body has a number of systems, each with its own function.• Recognize the integration of the different systems (Respiratory, and Circulatory) in carrying out life processes.• Use a model to describe how we receive, process and respond to different types of information through our senses in different ways.• Describe Human Respiratory System in terms of movement of air in lungs, then transport of oxygen into the blood. Correlate that many vertebrates (Cat and Goat) 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.• Identify that many animals (Cat and Goat) have a circulatory system similar to humans.
Microorganisms and Diseases: <ul style="list-style-type: none">• Introduction• Major groups of Microorganisms.• Diseases cause by microorganism.• Spread of Infectious diseases and transmission to humans.• Prevention of infectious diseases• Prevention against insect bites• Useful role of Microorganism• Role of microorganisms as Decomposers• Defense against infectious diseases• First Aid Box	<ul style="list-style-type: none">• Define and describe main groups of microorganisms (Virus, Bacteria and fungi) and give examples of each.• Recognize some common diseases of each group (Virus, Bacteria and fungi) caused by microorganisms including polio, T.B and ring worm• Recognize that microorganisms get transmitted into humans and spread infectious diseases.• Differentiate between contagious and noncontagious diseases.• Relate the transmission of Common contagious diseases to humans• Explain some methods of preventing the transmission of polio and contagious disease COVID-19• Recognize the advantages of microorganisms.• Investigate the role of microorganisms as decomposer• Recognize the items of the first aid box.• Use a first aid box to dress a wound.
Ecosystem: <ul style="list-style-type: none">• Introduction• Food chain• Predator-prey relationship• Food web• Energy flow in food chain• Decomposers• Adverse effect of Human activities on ecosystem.• Causes of pollution• Effects of pollution	<ul style="list-style-type: none">• 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 human activities add toxic substances to an ecosystem.• Identify 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 CO/other gases, open garbage dumps, industrial waste, etc.) on the Environment and life.• Discuss the effects of burning fossil fuels and releasing greenhouse gasses in the air.• Differentiate between biodegradable and non-biodegradable materials and their impact on the environment.



5.3. Grade-VI

Learning contents and students' Learning Outcome Knowledge, Skills, Attitudes, STEM and STSE.

Contents	Students' Learning Outcomes
<p>Cellular Organization:</p> <ul style="list-style-type: none"> • Introduction to Cell • Comparison of Animal and plant cells. • Tissues and its types • Organ and Organ system • Organisms 	<ul style="list-style-type: none"> • Recognize cells as the basic unit of life that are organized into tissues, organs, systems and Organisms. • Arrange and rank different levels of cellular organizations — cells to tissues, organs and organisms. • Relate the structures of some common cells (nerve, muscle, epithelium and blood cells) to their functions. • 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). • Compare and contrast an animal cell and plant cell by preparing slides using onion peels and cheek cells. • Describe the similarities and differences between the structures of plant and animal cells. Sketch the animal and plant cells and label key organelles in each.
<p>Reproduction in Plants:</p> <ul style="list-style-type: none"> • Introduction • Types of Reproduction • Natural propagation of plants • Artificial propagation of plants • Advantages of vegetative propagation. 	<ul style="list-style-type: none"> • Describe the different types of reproduction in plants. • Compare and contrast types of reproduction (Sexual and asexual) in plants. • Distinguish between artificial and natural asexual reproduction in plants. (grafting, cutting and layering /Bulbs, Tuber, runners and budding). • Inquire how artificial propagation can lead to better quality yield in agriculture.
<p>Nutrition and Balanced Diet:</p> <ul style="list-style-type: none"> • Introduction to nutrition and food • Different types of Nutrients • Nutrition and their Composition. • Balanced Diet • Diet and fitness 	<ul style="list-style-type: none"> • Identify the constituents of a balanced diet for humans i.e. 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. • Identify the essential nutrients and their food sources. • Recognize that a healthy diet contains a balance of Foodstuffs. • Correlate diet and the fitness. • Identify and describe deficiency of essential nutrients.
<ul style="list-style-type: none"> • Human Digestive system • Introduction of digestion • Human digestive system • Digestive disorders 	<ul style="list-style-type: none"> • State the importance of digestion in the human body and describe physical and chemical digestion. • Sequence the main regions of Alimentary Canal, its associated organs and describe the functions of different parts of the Alimentary Canal. • Briefly describe the role of enzymes in digestion. • Conclude that blood transports the products of digestion to other parts of the body and the undigested products get egested/defecated.



5.4. Grade-VII

Learning contents and students' Learning Outcome Knowledge, Skills, Attitudes, STEM.

Contents	Students' Learning Outcomes
Systems of Plant: <ul style="list-style-type: none">• Introduction• Root system• Shoot system• Transport• Transpiration• Photosynthesis• Respiration• Minerals for growth of plants	<ul style="list-style-type: none">• Explain the root and shoot system in plants. Label different parts of leaf, stem and root (external and internal structures).• Predict the role of xylem and phloem in transport of water and food in the cross section of the stem.• Explain that the structure of leaves is adapted to the process of photosynthesis.• Define the process of photosynthesis and derive word equations for it.• Describe the process of respiration and write word equations for it. Compare and contrast the processes of photosynthesis and respiration.• Investigate the phenomena of transpiration and its importance in a plant (wind, temperature, light, humidity affecting rate of transpiration in plants).• Explain the raise of water based on the principle of transpiration.• Mention the main minerals and their role in plants growth (with the support of activity).• Explain that plants require minerals to maintain healthy growth and life processes (limited to magnesium to make chlorophyll and nitrates to make protein)
Human Respiratory and Circulatory system: <ul style="list-style-type: none">• Introduction to Respiration• Types of Respiration (Aerobic and anaerobic)• Circulatory system• Human Heart	<ul style="list-style-type: none">• Differentiate between the processes of respiration and breathing.• Differentiate between aerobic and anaerobic respiration.• Trace the path of air in and out of the body and how the oxygen it contains is used during the process of respiration.• Describe the role and function of major organs in the human respiratory system including trachea, lungs and alveoli (air sacs).• Sketch and label the human circulatory system.• Describe the structure and function of the human heart.• Hypothesize how exercises of varying intensity (from rest to high-intensity interval training) would impact their pulse rate, test their hypothesis, calculate their pulse rate and record their findings.• Explain that living organisms have a complex transport system for transfer of various solids, liquids, and gasses across the body.• Explain how blood circulates in the human body through a network of vessels (arteries, veins and capillaries), and transports gasses, nutrients, wastes and heat.• Compare and contrast arteries, veins and capillaries.• Describe the composition of blood and the functions of red cells, white cells, platelets and plasma.
Immunity and Diseases: <ul style="list-style-type: none">• Introduction to Immunity• Types of Immunity• Mechanisms of Antibodies formation• Passive Immunity• Ways to boost Immunity• Infectious Diseases	<ul style="list-style-type: none">• Explain the various lines of defenses that the body has against pathogens.• Describe the two types of immunity in humans innate and adaptive.• Identify the various types of pathogens that cause infectious diseases.• Describe the parts of the immune system and how they function to produce an immune response.• Illustrate how adaptive immunity develops over time.• Explain infectious diseases such as hepatitis, covid-19, typhoid, and dengue are caused diagnoses, and their prevention.• Visualize the ways to add additional layers of defense (such as wearing masks, using sanitizers, etc.).• Propose some common strategies for strengthening their immune system.



- Suggest ways in which people protected against the spread of infectious diseases.

5.5. Grade-VIII

Learning contents and students' Learning Outcome Knowledge, Skills, Attitudes, STEM.

Contents	Students' Learning Outcomes
<p>Cell division:</p> <ul style="list-style-type: none"> • Introduction to Cell division • Types of cell division • Mitosis • Meiosis • Role of meiosis in variation 	<ul style="list-style-type: none"> • Describe cell division and its types mitosis and meiosis and relate them to the passage of genetic information through reproduction. • Explain the process of mitosis and meiosis and identify their key phases.
<p>Variation and Heredity:</p> <ul style="list-style-type: none"> • Introduction to Genetics • Chromosome and DNA • Variation • Adaptation 	<ul style="list-style-type: none"> • Describe the composition and structure of DNA. • Design a model of DNA to demonstrate its structure, functions, and various components. • Recognize Genetics as the study of Heredity, understand heredity as the transfer of genetic information that specifies structure, characteristics and functions, from parents to offspring. • Differentiate between the concept of genes and chromosomes and relate them to how genetic characteristics are inherited. • Describe variation and adaptation in living organisms. • Explain and illustrate the differences between variation and adaptation. • Identify sources of variation from environmental and genetic factors. • Explain how different adaptations affect the chances of survivals of different species of organism.
<p>Human Nervous system:</p> <ul style="list-style-type: none"> • Introduction • Neurons • Components of Nervous system • Voluntary and involuntary actions. • Reflex action • Activities to keep your brain healthy 	<ul style="list-style-type: none"> • Describe the type and function of neurons in transmitting messages through the body. • Identify the organs, functions and processes of the Human Nervous System. • Sketch and label a diagram of the Human Nervous System. • Explain how the brain works as the control station of the human body. • Identify the three major parts of the brain, the forebrain, midbrain and hindbrain, & describe their various functions. • Describe the structure of the cerebrum, its division into two hemispheres (left and right) and the role of each hemisphere in the control of the body. • Describe the reflex arc with example. • Develop some plan and activities to maintain a healthy brain. (Physical and mental exercises) • Match various body functions with the relevant part of the brain that controls or regulates them (For instance, associating breathing with the brain stem). • Explain and represent how messages flow through the body from and to the brain, and how the brain collaborates with the sensory organs to regulate this process. • Map the various steps in the transmission of messages through the body and to the brain. • Predict what would happen if a nerve connection broke.
<p>Ecology:</p> <ul style="list-style-type: none"> • Introduction to ecology • Interaction in ecosystem • Oxygen cycle 	<ul style="list-style-type: none"> • Describe the role of living things in cycling oxygen and carbon through an ecosystem, citing the processes of respiration, photosynthesis, and combustion.



<ul style="list-style-type: none">• Carbon cycle• Global warming• Flow of Energy in ecosystem• Changes in ecosystem and its effects.• Positive impact of human on ecosystem	<ul style="list-style-type: none">• Relate how oxygen and carbon cycles are complementary processes that bring balance and symmetry to life on Earth.• Describe global warming and explain how threats to the carbon-oxygen balance such as overpopulation, reliance on fossil fuels, and deforestation are contributing to global warming and climate change.• Describe how energy flows from producers to consumers, and how only part of the energy flows from one level of the pyramid to the next.• Draw a food web diagram to illustrate the food relationships between organisms.• Describe and illustrate through examples key ecological relationships between organisms, including competition, predation and symbiosis.• Predict how changes in an ecosystem (e.g., changes in the water supply, the introduction of a new population, hunting, migration) can affect available resources, and thus the balance among populations.• Hypothesize what would happen in the ecosystem if the population of one of the participants in different ecological relationships is affected.• Explain ways in which human behavior (e.g., replanting forests, reducing air and water pollution, protecting endangered species) can have positive effects on the local environment.
<p>Biotechnology:</p> <ul style="list-style-type: none">• Introduction to Biotechnology• Biotechnology in the field of food and agriculture.• Fermented food• Role of Biotechnology in medicine• Applications of Biotechnology	<ul style="list-style-type: none">• Define biotechnology as the use of living cells and organisms in products and processes that can improve the quality of life.• Illustrate how biotechnology is a discipline/field that has the potential to transform how we live.• Discuss the applications of biotechnology in the Pakistani context and their effects on the people and the environment of Pakistan over time. Illustrative examples: bread-making, making of yogurt and cheese, vaccines for immunization, insulin production, dyes, etc.• Relate the use of biotechnology in food sciences in producing foods with higher nutritional value and improved taste and quality (how fermentation has been improved by genetically modified organisms or the introduction of certain genes to raise iron content in rice, can be taken as examples).



Domain: Physical Science

Learning Contents and Students' Learning Outcomes:

5.6. Grade-IV

Contents	Students' Learning Outcomes
<p>Matter and its characteristics:</p> <ul style="list-style-type: none"> States of Matter with characteristic and conditions that cause matter to change states. Physical properties of matter Arrangements of particles in matter Physical properties of metals 	<ul style="list-style-type: none"> Identify and describe three states of matter (i.e. solid, liquid & gas). Compare and sort the materials on physical properties (mass, volume, density, states of matter, conduction of heat and electricity). Design models of sphere, cube, prism, cylinder and cone with clay or play dough/ environment friendly materials. Compare and sort the materials on physical properties (mass, volume, density, states of matter, conduction of heat and electricity). Properties of metals (appearance, texture, color, density, conduction of heat and electricity using daily life examples). 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)
<p>Forms of Energy and its transfer:</p> <ul style="list-style-type: none"> Energy and its forms Light <p>Sound Energy:</p> <ul style="list-style-type: none"> Production of sound <p>Behavior of sound</p> <ul style="list-style-type: none"> Characteristics of sound <p>Heat Energy:</p> <ul style="list-style-type: none"> Temperature Thermometer and different scales of Temperature <p>Electrical Energy:</p> <ul style="list-style-type: none"> Transform of electrical energy into other forms. Electrical Pathway. 	<ul style="list-style-type: none"> 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 a straight line, travels very fast and in all directions). Relate familiar physical phenomena (shadow, reflection, rainbow) to the properties of light. 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. Describe the temperature as 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, 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.
<p>Force and Simple machines:</p> <ul style="list-style-type: none"> Force and their types Multiple forces acting on an object Simple machines 	<ul style="list-style-type: none"> Describe different types of force (friction, applied, gravitational, magnetic). Investigate that friction can either be detrimental or useful under different circumstances (ways to reduce friction). List uses of different types of force in our daily life. Explore how force can move or stop objects, change direction, shape, & speed. Describe that an object may have multiple forces acting on it, even when at rest. (free body diagram). Compare the effects of force of different strengths in the same or opposite directions acting on an object. Recognize that simple machines, (e.g., levers, pulleys, gears, ramps) help make motion easier (e.g., make lifting things easier, reduce the



	<p>amount of force required, change the distance, change the direction of the force).</p> <ul style="list-style-type: none">• Design hammer, wheels, rollers and gears using clay or playdough/ cardboard/ environment friendly material.• (STEAM)
<p>Technology in Everyday Life:</p> <ul style="list-style-type: none">• Use scientific instruments	<ul style="list-style-type: none">• Use scientific instruments/ apparatus in everyday life (e.g. thermometer, blood pressure apparatus, digital balance, stop watch, calculator, available digital devices).• Use a plumb line to install a flagpole vertically.• Design models of sphere, cube, prism, cylinder and cone with clay or playdough/ environment friendly materials. (STEAM)



5.7. Grade-V

Contents	Students' Learning Outcomes
<p>Physical and Chemical changes of matter:</p> <ul style="list-style-type: none"> Physical and chemical changes in Matter Changes in States of Matter with involved processes 	<ul style="list-style-type: none"> Observe the changes in materials that do not result in new materials (dissolving, crushing) Matter can be changed from one state to another by heating or cooling. 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.
<p>Light and sound:</p> <ul style="list-style-type: none"> Light sources luminous and non-luminous objects. Transparent, translucent and opaque objects. Sound and its travelling in different mediums Characteristics of sound Noise pollution. 	<ul style="list-style-type: none"> 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. Describe the structure and discuss the travelling mode of the sound waves. Describe the intensity of sound List the harmful effects of noise on human health. State the role of humans in reducing noise pollution.
<p>Electricity and magnetism:</p> <ul style="list-style-type: none"> Electric circuit Magnets and its poles Magnetic material properties of magnets 	<ul style="list-style-type: none"> Draw circuit diagram with symbols. Describe flow of electric current in an electric circuit 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)
<p>Technology in Everyday Life:</p> <ul style="list-style-type: none"> Design models LED light strings Use scientific instruments Practice safety measures 	<ul style="list-style-type: none"> Design a model of a footbridge using the given specifications (e.g. nature of the material use). Design a model of a bookshelf using the given specifications (e.g. can occupy space). Prepare LED light strings working with 3-volt battery. Use scientific instruments /apparatus in everyday life (Use spirit level/water level to level different objects i.e. table, picture, frame etc.). Practice safety measures for earthquake and fire drill.



5.8. Grade-VI

Contents	Students' Learning Outcomes
<p>Matter as particles:</p> <ul style="list-style-type: none">• State of matter, changes in states• Particle theory of matter• Diffusion	<ul style="list-style-type: none">• Describe the structure of matter in terms of particles (i.e., atoms and molecules).• Explain the Particle Theory of Matter• Use particle model of matter to investigate the movement and arrangement of particles in three states• Explain why gases and liquids take the shape of their containers but solids do not, in terms of the Particle Theory of Matter• Discuss, using the particle theory of matter, why liquids and gases can flow easily but solids cannot• 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).• Apply the particle theory of matter to explain diffusion• Explain the changes in states: Melting, freezing, evaporation, condensation, and sublimation, using the particle model of matter
<p>Elements and compounds:</p> <ul style="list-style-type: none">• Elements, their classification and uses• Difference in atom, element and molecule• Compound (water, table salt, sugar)	<ul style="list-style-type: none">• Describe molecules as a combination of atoms (e.g., H₂O, O₂ & CO₂).• Recognize the names and symbols for some common elements (first 10 elements of the Periodic Table) and recognize their physical properties• 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.• Explain that compounds are formed by different types of elements joining together chemically forming a new substance.• Illustrate the formation of a compound with the help of a word equation• Distinguish between elements and compounds• Explore the common elements and compounds in our daily life (Carbon, Nitrogen, Hydrogen, Aluminum, Water, Common salt, Sugar).• Categorize elements into metals and non-metals of first 10 elements based on their physical properties.
<p>Mixtures:</p> <ul style="list-style-type: none">• Mixture, its types and applications in daily life• Comparison between element, compound and mixture• Differences between pure substances and mixtures• Separating techniques of mixture• Solution and suspension	<ul style="list-style-type: none">• Demonstrate that mixtures are formed when two or more substances mix with each other without the formation of a new substance• Identify different types of mixtures• Describe the difference between elements, compounds, and mixtures• Differentiate between pure substances and mixtures on the basis of their formation and composition• Describe alloys as mixtures of metals and some other elements• Identify and explain examples of common mixtures from daily life• Justify why air is considered as a mixture of gases.• Demonstrate ways of separating different mixtures.• Demonstrate the process of solution formation (using water as universal solvent)



<p>Energy:</p> <ul style="list-style-type: none"> • Energy as a physical quantity • Potential and kinetic energy • Energy transfer • Law of Conservation of Energy • Renewable energy and its resources 	<ul style="list-style-type: none"> • Recognize energy as a physical quantity. • Recognize and relate potential and kinetic energy • Demonstrate an energy transfer such as a bouncing ball by energy transfer diagram, e.g., gravitational potential energy → kinetic → elastic potential energy + thermal • + sound → kinetic → gravitational potential energy, etc. • State the Law of Conservation of Energy and explain how the law applies to different situations. • Compare the Renewable Energy Sources (wind, water, Sun and plants) and Non-Renewable Sources of energy (coal, natural gas, crude oil). • Identify the advantages of using renewable energy resources. • Assemble and demonstrate a solar panel to operate a small fan. (STEAM) • Design and make a solar water heater. (STEAM)
<p>Electricity:</p> <ul style="list-style-type: none"> • Static electricity • Electric current • Simple circuit and its types • Simple circuit diagrams • Series and parallel circuits. • Use of series and parallel electric circuits in daily life. • Factors that affect the brightness of bulbs and speed of motors 	<ul style="list-style-type: none"> • Explain the phenomena of static electricity in everyday life. • Recognize electric current as a flow of charges. • Describe a simple circuit as a path for flow of charges. • Differentiate between open and closed circuits. • Draw and interpret simple circuit diagrams (using symbols). • Describe the characteristics of series and parallel circuits. • Draw and construct a series and parallel circuits. • Identify the use of series and parallel electric circuits in daily life. • Investigate 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 • Assemble and operate a trip wire security alarm system using simple items. (STEAM).
<p>Magnetism:</p> <ul style="list-style-type: none"> • Magnetic compass and electric current • Freely-moving magnet and earth's magnetic field • Ways of magnetize and demagnetize of magnet • Electromagnet and its applications • Types of magnets • Magnetic field 	<ul style="list-style-type: none"> • Recognize by the use of magnetic compass that electric current has a magnetic field around it. • Recognize that a freely-moving magnet comes to rest pointing in a North-South direction. • Describe how to magnetize a magnetic material. • Describe how to de- magnetize a magnet. • Construct an electromagnet and identify its application in daily life • Compare different types of magnets (permanent, temporary and electromagnets). • Recognize that there is a space around a magnet where effect of magnetic force can be observed. • Draw magnetic field of a bar magnet using iron filings. • Recognize Earth's magnetic field which attracts a freely pivoted magnet to line up with it.
<p>Technology in everyday life:</p> <ul style="list-style-type: none"> • Plant growth in earthen pots • Curd and cheese preparation • Solar oven design • Circuit assembling 	<ul style="list-style-type: none"> • Grow seasonal plants and vegetables in earthen pots and demonstrate the effect of use of fertilizers on the growth of plants. • Prepare curd and cheese from milk to demonstrate the beneficial microorganisms. • Design a solar oven to convert solar energy into heat energy. • Assemble a circuit to demonstrate the working of an electric bell.



5.9. Grade-VII

Contents	Students' Learning Outcomes
Structure of an atom: <ul style="list-style-type: none">• Structure of an atom• Atomic number, mass number and distribution of electrons in the shells	<ul style="list-style-type: none">• Describe and draw the structure of an atom in terms of electrons, protons and neutrons.• Describe how an atom is electrically neutral• Differentiate between atomic number and mass number.• Determine the atomic number and mass number of elements on the basis of the number of protons, electrons and neutrons• Describe isotopes and their uses in medicine and agriculture.• Show the arrangement of electrons in K, L and M shells of elements.• Draw the atomic structure of the first eighteen elements of the Periodic Table.• Explain that the Periodic Table is a way to organize elements in a systematic order.• Recognize periods and groups in the Periodic Table
Physical and chemical changes: <ul style="list-style-type: none">• Physical and chemical changes• Physical and chemical properties of the matter	<ul style="list-style-type: none">• Differentiate between physical and chemical changes in daily life with examples• Recognize that oxygen is needed in combustion, rusting and corrosion• 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)• Recall & distinguish between physical and chemical properties of matter
Chemical bond: <ul style="list-style-type: none">• Valency, ions and chemical formula• Chemical bonds	<ul style="list-style-type: none">• Define valency and explain the formation of ions• Write chemical formulae on the basis of valency of the constituent elements.<ul style="list-style-type: none">• such as H_2O, $NaCl$, NH_3, CO_2, CO, etc.• Recognize that a chemical bond results from the attraction between atoms in a compound and the electrons of atom are involved in the bond formation
Solutions: <ul style="list-style-type: none">• Solution and suspension• Types of solutions• Solubility and factors affecting solubility	<ul style="list-style-type: none">• Demonstrate the process of solution formation (using water as universal solvent as well as other solvents like alcohol).• Distinguish among solute, solvent and solution; saturated and unsaturated solution• Differentiate between solution and suspension and identify uses of solutions and suspension in daily life• Define solubility• Recognize that the maximum amount of solute which dissolves in a given solvent• Identify the factors which affect the solubility of a solute in a solvent and recognize the importance of these factors in homes and industries.• Explain what is meant by a concentrated and dilute solution• Identify ways of accelerating the process of dissolving materials in a given amount of water and provide reasoning (i.e., increasing the temperature, stirring, and breaking the solid into smaller pieces increases the process of dissolving)• Explore the effectiveness of various cleaning solutions in cleaning tarnished coins. (STEAM)
Force and motion:	



<ul style="list-style-type: none"> • Effect of force • Relationship between speed, distance and time. • Average speed • Distance-time graph. • Contact and non-contact forces • Pair of force 	<ul style="list-style-type: none"> • Describe the effect of force on changing the speed and direction of motion with time. • Define and state the SI unit of force. • Formulate the relationship between speed, distance and time. • State SI (System International) unit of speed. • Calculate average speed. • Interpret a distance-time graph. • Give examples of contact forces and non-contact forces. • Demonstrate that forces always work in action and reaction pairs (equal in magnitude, opposite in direction).
<p>Wave and energy:</p> <ul style="list-style-type: none"> • Wave and its types • Wavelength, frequency, and time period of wave. • Factors affecting pitch and loudness of sound. • Waveforms in terms of pitch and loudness. • Relation between time period and frequency • Properties of sound. 	<ul style="list-style-type: none"> • Define a wave • Compare the types of waves (mechanical and electromagnetic) with daily life examples. • Distinguish between Longitudinal and Transverse waves. • Identify; <ul style="list-style-type: none"> - water wave and sound wave as mechanical wave; - light wave as electromagnetic wave • Define the terms: wavelength, frequency, and time period of wave. (transverse wave) • Define and relate: <ul style="list-style-type: none"> -Pitch and frequency. -Amplitude and frequency. • Explain the factors affecting pitch and loudness of sound. • Compare and interpret waveforms in terms of pitch and loudness. • Construct the inverse relation between time period and frequency • Relate common phenomenon (e.g., echo, hearing thunder after seeing lightning) to the properties of sound.
<p>Heat and temperature:</p> <ul style="list-style-type: none"> • Expansion and contraction of the three states of matter • Effects of heat gain and heat loss • Scales of temperature • Heat and temperature on the basis of Kinetic Molecular Theory. • Good thermal conductors and poor conductors. • Transfer of heat (conduction, convection and radiation) 	<ul style="list-style-type: none"> • Describe the expansion of the three states of matter on heating, and contraction on cooling, in terms of particles. • Predict the effects of heat gain and heat loss in daily life example. • Compare all three scales of temperature (including inter-conversion of temperature scales) • Define the terms heat and temperature on the basis of Kinetic Molecular Theory. • Explain why metals are good thermal conductors and fluids are poor conductors of heat using the particle model. • Construct the concept of heat conduction, convection and radiation by applying particle theory including daily life examples. • Identify the effects of thermal expansion and contraction with their applications in daily life. • State and explain the practical methods of thermal insulation used for constructing buildings (STEAM).
<p>Technology in everyday life:</p> <ul style="list-style-type: none"> • Drip & sprinkler design • Food preserving and its techniques • Stethoscope making • sanitizer making 	<ul style="list-style-type: none"> • Design a model to demonstrate drip & sprinkler irrigation system for conservation of water. • Use different techniques of preserving foods like orange juice, apple jam and pickles. • Make a simple Stethoscope. • Make a sanitizer using suitable substances



5.10. Grade-VIII

Contents	Students' Learning Outcomes
Periodic Table: <ul style="list-style-type: none">• Introduction of periodic table• Periods and groups• Classification of elements into the groups• Metals and non-metals• Applications of metals	<ul style="list-style-type: none">• Recognize Periodic Table as a way of classifying the elements in groups and periods• Identify the names and location of the first 18 elements only• Identify properties of metals and non-metals• Relate the properties to the uses of metals
Chemical Reactions: <ul style="list-style-type: none">• Chemical reactions and its types• Balancing of chemical equations• Law of conservation of mass• Exothermic and Endothermic reactions• Chemical bonds and their types	<ul style="list-style-type: none">• Describe types of chemical reactions and give examples• Define the Law of Conservation of Mass and demonstrate the law with an experiment• Write and balance chemical equations• Distinguish between different types of reactions (combination, decomposition, displacement, double displacement, combustion)• Distinguish between endothermic and exothermic reactions.• Recognize the importance of exothermic and endothermic reactions in daily life• Design a toy car/ toy boat that is powered solely by a chemical reaction and can travel. (STEAM)• Discuss formation of ionic bonds as a result of electrostatic forces between ions (e. g., NaCl)• Discuss types and formation of covalent bond as a result of mutual sharing of electrons between atoms (e. g., H₂, O₂, N₂).• Name certain ionic and covalent compounds• Draw cross and dot structures showing formation of ionic compounds and covalent compounds
Acids, Bases and Salts: <ul style="list-style-type: none">• Acid, bases and salts and their properties• Uses of acid, bases and salts• Neutralization reactions• pH scale and its range	<ul style="list-style-type: none">• Classify acids, alkalis(base), and salts and give examples of each• Identify the physical properties of acids, alkalis, and salts.• Define pH and its ranges with reference to indicators• Interpret the pH scale and identify acids, alkalis, and salts• Describe neutralization reaction with real life examples• Observe and write the uses of acids, bases, and salts in daily life
Force and Pressure: <ul style="list-style-type: none">• Effects of force• Floating and sinking of object in terms of density• Pressure and its unit• Effects of pressure	<ul style="list-style-type: none">• Recognize 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 and its unit• 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.• Make a hydraulic elevator (STEAM).• Build a two-stage rocket model (STEAM).
Reflection & Refraction of Light: <ul style="list-style-type: none">• Properties of light; transmission, absorption, and dispersion• Image formation on mirrors• Laws of reflection• Types of mirrors• Light and color of object• Refraction of light	<ul style="list-style-type: none">• Identify basic properties of light (i.e., speed, transmission through different media, absorption, reflection and dispersion).• Describe and show how an image is formed by the plane mirror.• State the Laws of Reflection.• Describe different optical instruments which use curved mirrors (concave and convex mirror).• Relate the apparent color of objects to reflected or absorbed light.



	<ul style="list-style-type: none"> • 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 image formed by plane mirror.
<p>Electricity & Magnetism:</p> <ul style="list-style-type: none"> • Strength of electromagnet and its factors • Properties of electromagnets • Electromagnetic devices 	<ul style="list-style-type: none"> • Investigate the factors that affect the strength of an electromagnet. • Describe the properties that are unique to electromagnets (i.e., the strength varies with current, number of coils, and type of metal in the core; the magnetic attraction can be turned on and off; and the poles can switch). • Describe briefly the working principles of electromagnetic devices such as speaker, doorbell.
<p>Technology in Everyday Life:</p> <ul style="list-style-type: none"> • Application of biotechnology • Application of acids, bases in daily life • Solar and heat energy • Production of electricity • Working of UPS 	<ul style="list-style-type: none"> • Make bioplastic from milk and vinegar as an application of biotechnology. • Make toothpaste, soap and detergent as an application of acids and bases in daily life. • Assemble a concave mirror type solar cooker to convert solar energy into heat energy • Assemble and operate a simple wind turbine to produce electricity. • Demonstrate the working of UPS and use it to operate a fan or energy saver bulb.



Domain: Earth & Space Science

Learning Contents and Students' Learning Outcomes:

5.11. Grade-IV

Contents	Students' Learning Outcomes
Earth & its Resources: <ul style="list-style-type: none">• Composition of earth and atmosphere• Water cycle• Types of water	<ul style="list-style-type: none">• Define natural resources• Recognize that the 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.• 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.• Recognize that most water on Earth is not pure and has dissolved substances in it.
Earth in the Solar System: <ul style="list-style-type: none">• Position of sun and planets• Planetary System• Moon and Phases• Earth's Rotation• Lunar and Solar Eclipse	<ul style="list-style-type: none">• 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 the 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



5.12. Grade-V

Contents	Students' Learning Outcomes
<p>Structure of the Earth:</p> <ul style="list-style-type: none"> • Structure of earth; crust, mantle and core • Volcano • Earthquake 	<ul style="list-style-type: none"> • 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.
<p>Soil:</p> <ul style="list-style-type: none"> • Soil and types of soil • Composition of soil • Soil Pollution • Professions relate to earth science; paleontologists, seismologists, geologists 	<ul style="list-style-type: none"> • 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.
<p>Space and Satellites:</p> <ul style="list-style-type: none"> • Satellite • Types of Satellite • Importance of Satellite • Space exploration and role of NASA and SUPARCO • professions related to the Earth Science i.e. Astronauts, Physicists, Space Scientists. 	<ul style="list-style-type: none"> • Know that a satellite is an object in space that orbits a larger object and a moon is a natural satellite that orbits a planet. • 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); explore the contribution of SUPARCO in space exploration. • Predict and comprehend how astronauts explore space, how do astronauts survive and research in space. • Identify using secondary sources the key milestones in space technology in the past 10 years. • Identify professions related to the Earth Science i.e., Astronauts, Physicists, Space scientists, etc.



5.13. Grade-VI

Contents	Students' Learning Outcomes
<ul style="list-style-type: none">• Solar System:• Planets• Characteristics of planets• Characteristics of asteroids, meteorites and comets• Satellites• Importance of Satellite• Dwarf planets• Hally comet	<ul style="list-style-type: none">• Differentiate between the characteristics of different planets.• Describe the characteristics of asteroids, meteorites and comets.• Describe the uses of various satellites in space i.e., geostationary, weather, communication and Global Positioning System (GPS).• Investigate how artificial satellites have improved our knowledge about space and are used for space research• Differentiate between planets and dwarf planets.• Inquire into the sighting of Halley's Comet; describe what they would feel if they saw it.

5.14. Grade-VII

Contents	Students' Learning Outcomes
<ul style="list-style-type: none">• Earth and Space:• Gravity keeps planets and moons in their orbit• Weightlessness• Tides and gravity• Tilt of earth and seasons• Movement of earth and Seasons on north and south hemispheres	<ul style="list-style-type: none">• Recognize that the force of gravity keeps planets and moons in their orbits.• Differentiate between mass and weight, using examples of weightlessness experienced by astronauts on the surface of the Moon.• Recognize that tides are caused by the gravitational pull of the Moon.• Describe the effects of the Earth's annual revolution around the Sun, given the tilt of its axis (e.g., different seasons, different constellations visible at different times of the year).• Describe how seasons in Earth's Northern and Southern Hemispheres are related to Earth's annual movement around the Sun.

5.15. Grade-VIII

Contents	Students' Learning Outcomes
<ul style="list-style-type: none">• Our Universe:• Milky way galaxy• Types of galaxies• Life of star• Birth and death of our sun• Telescope and space advancement• Benefits of space exploration	<ul style="list-style-type: none">• 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 black hole, neutron star, Pulsar White Dwarf, Red Giant.• Discuss the birth and eventual death of our sun.• Show 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.



CHAPTER - 06

Teaching & Learning:

The General Science Curriculum aims to foster in students two key areas of knowledge acquisition: scientific literacy and a favourable attitude towards science as a means of inquiry. It will be expected of students to learn how to apply science, explain to others the findings of scientific investigations, and apply the concepts and principles they have learned to reason scientifically and solve issues in practical settings. The future of science education demands a change in emphasis for the environment of instruction and learning. The only way to achieve this is by giving students the chance to investigate the context of science and its applications and to comprehend the relationships that exist between science, technology, society, and the environment.

6.1 PROMOTING SCIENTIFIC LITERACY IN TEACHING AND LEARNING PROCESS

Being scientifically literate requires a person to have a basic understanding of important scientific ideas, as well as an ability to use the language and terminology used to describe them. The general science curriculum will place particular emphasis on age-appropriate critical thinking or inquiry skills as demonstrated by student learning outcomes for each content standard. Students and teachers have the opportunity to make in-depth explorations that provide insight into how scientific knowledge is created, validated, and communicated. This will help students not only understand scientific principles but also develop a lifelong desire to learn more. Therefore, the goal is also to provide students with the means to learn independently instead of depending on the teacher, the sole source of imparting knowledge. Therefore, the teacher is not a sage on the stage but a guide at the side. Therefore, it is important for teachers to understand that students are not empty vessels but are more capable and capable of achieving higher academic standards. Hattie (2009) believes that student learning outcomes would be much better if teachers' expectations were also higher.

6.2 The 21st CENTURY LEARNING SKILLS– 4 Cs

The concept of globalization has introduced rapid changes in social structures, communities, and society. Teachers are required to not only to cater the individual needs of students but also to prepare them to cope with increasingly changing global society. The 21st century learning skills are vital skills required to prepare the learner for the global society and can be practiced naturally in science lessons across all age groups. These skills encompass a comprehensive set of behavioral learning, knowledge, and attitudes that can be attained by all stakeholders including students, teachers, school leadership and policy leaders. These skills are elaborated below:

CRITICAL THINKING	In science lessons critical thinking can be developed through focused learning activities. These skills can be developed by engaging students in scientific enquiry including: <ol style="list-style-type: none">1. Identifying a problem and asking questions about that problem.2. Selecting information to respond to the problem and evaluating it.3. Drawing conclusions from the evidence.
CREATIVE THINKING	Creative thinking is the ability to look at things in a different way and discover the new solutions of problems. This ability enables the students to use imagination to develop new ideas and create something new.

COMMUNICATING	Communicating is the clear exchange of information and ideas between student-student and student-teachers. Science lesson planning should have opportunities for students to interact and communicate with each other a number of times so that any misconceptions regarding scientific concepts can be addressed.
COLLABORATING	The classroom of global citizens is being driven by the idea of fostering a collaborative culture to encourage students to work together to solve problems. The 21st century classrooms are designed with flexibility of seating so that students rearrange seats to re-group, other ways for collaboration could be through online groups, video conferencing, Google meet, Google hangouts etc.

6.3 WHAT IS ACTIVE LEARNING?

Active learning is an important part of the science curriculum. Teachers should be encouraged to use and explore different teaching methods and learning activities, primarily based on active teaching approaches, to engage learners and increase their motivation to learn. Active learning refers to an approach to teaching that recognizes that learners actively participate in the learning process and construct knowledge and understanding by responding to learning opportunities presented by the teacher. In reality, active learning refers to activities introduced in the classroom. This is in contrast to the instructional model, where knowledge is transferred from the teacher to the learner. Active learning means that learners take increasing responsibility for their learning and teachers enable and activate learning.

Active learning is based on a learning theory called constructivism, which emphasizes the fact that learners construct or construct their own understanding. Learners replace or adapt their existing knowledge and understanding (based on prior knowledge) with a deeper and more sophisticated level of understanding. Skilled instruction is active and provides learning environments, opportunities, interactions, tasks, and instruction that foster deep learning. Another aspect of constructivism is the theory of social constructivism, which states that learning occurs primarily through social interactions with others, such as teachers and the learner's classmates. The prominent social constructivist Lev Vygotsky (1896–1934) described the zone of proximal development (ZPD). This is the area on which learning activities should focus, between what learners can achieve independently and what can be achieved with the professional guidance of teachers. By providing scaffolding tasks, providing instruction and support those challenges learners based on their current abilities, and providing comprehensive feedback through learning assessments, teachers help learners reach deeper levels of understanding. We will actively support you in moving forward. Active learning is an active, dynamic process in which connections (between different facts, ideas, and processes) are constantly changing. These connections are fostered through dialogue between teachers and students, and between students and their peers.

6.4 TERMS ASSOCIATED WITH ACTIVE LEARNING

Active learning is a concept used as an umbrella term to combine various learning theories into one pedagogical approach. It was a common theme evident in the work of many educators, including Dewey, Piaget, and Vygotsky. Although it is difficult to provide internationally accepted definitions for all terms related to active learning, below are some commonly accepted high-level definitions.

Terms associated with active learning	
Collaborative learning	Cooperative learning
<p>In this approach, learners work in groups of two or more toward a common goal.</p> <p>The emphasis is on evaluating the contributions of individuals within the group and the performance of the group as a whole.</p>	<p>This approach is similar to collaborative learning, although it is a more structured form of group work in which learners pursue common goals while being assessed individually.</p>



In collaborative learning situations, learners not only understand information, but also collaborate to create something new.	
Problem based learning	Experiential learning
In this approach, relevant issues are introduced and used to provide context and motivation for subsequent learning. Overall, this is a collaborative and cooperative process and involves a significant amount of self-directed learning by the learner.	According to this approach, learning involves learning from experience. Learners are encouraged to predict, explore, create, identify and interact with their surroundings. This form of learning is unstructured and requires only minimal guidance from the teacher.

6.5 ACTIVE LEARNING STRATEGIES

There are a variety of methods that teachers can integrate into their daily teaching and learning activities to support a positive approach:

Paired/ group discussion	Questioning techniques	Whole class instruction
Debates	Role play	Group work & presentation

6.6 ACTIVE LEARNING IN THE CLASSROOM

The features of active learning in the classroom are listed below.

A range of teaching and learning approaches are used.

A diverse range of instructional strategies should be used with students. The tasks are demanding, imaginative, and research-based. Learners participate in activities with assurance and are willing to take chances.

Learning is made relevant and meaningful to pupils

New topic explanations should be pertinent to the learner's context and establish appropriate connections with prior knowledge. It is urged of learners to provide their own explanations of important ideas and concepts. Curriculum subjects are given significance by being connected to actual circumstances.

Learning outcomes are understood.

Questions posed by teachers encourage students to reflect on important learning objectives and results. Students comprehend these goals and achievement criteria and are able to articulate them.

Active participation of learners in activities.

Through tasks and activities like field trips, interviews, and group studies, learners learn by doing and thinking instead of by memorization. Knowledge is transferable to novel contexts. Students are capable of working both individually and together.

Class discussions are interactive.

Interactive class discussions involve a diverse spectrum of students in the classroom. Every student is aware that their unique answers will be respected. Teachers and students alike pose questions to one another. Even those who choose not to join in the discussion nevertheless actively listen, consider, and reflect. Answering questions outside of books should be promoted rather than restricting learning to textbooks.



Learners lead their own learning.

Instructors use strategies that guarantee students take the lead in their own education. Students are capable of independent learning and self-reflection. They make their own well-informed judgments. They ask for assistance when needed and are aware of the goals they have in mind. Students can choose how they want to learn. At any point, it is best to discourage cramming. It is important to promote students' comprehension of the lesson and its ideas.

Use of technology

Students can be made to feel engaged and challenged by computers and related technology. With the use of numerous websites and software programmes, simulations, graphics, pod casting, data processing, and model creation, it is a highly valuable tool for teaching scientific ideas and procedures.

Values and attitudes in classroom

The formation, reinforcement, and extension of attitudes that promote scientific inquiry—such as open-mindedness and respect for the facts, initiative and perseverance, creativity and inventiveness—are also highlighted in science education.

Home assignment

The formation, reinforcement, and extension of attitudes that promote scientific inquiry—such as open-mindedness and respect for the facts, initiative and perseverance, creativity and inventiveness—are also highlighted in science education.

6.7 SHIFTING ROLE OF A TEACHER

A teacher's position in an active classroom setting is frequently that of a facilitator who supports a learner-centered approach. Through conversation, reading, and writing, it should help students increase their knowledge. Group projects, debates, and dialogue are also crucial for promoting understanding among the entire class. Teachers will situate their instruction within real-world scenarios and, prior to devising a plan to facilitate learning, ascertain the learners' initial level of comprehension. For this reason, a learner-centered approach will emphasize differentiation and employ learning assessment tools, such as:

- Effective questioning
- Sharing of assessment criteria
- Provision of feedback
- Provision of peer assessment and self-assessment
- Using assessment information to adapt their teaching
-

Teacher-centered classroom	→	Learner-centered classroom
Product-centered learning	→	Process-centered learning
Teacher as a transmitter of knowledge	→	Teacher as an organizer of knowledge
Teacher as a 'doer' for learners	→	Teacher as an 'enabler'
Subject-specific focus	→	Teacher as an 'enabler'

6.8 SHIFTING ROLE OF A LEARNER

The dynamic classroom setting encourages students to become lifelong learners and inquirers.

Being passive recipients of knowledge	→	Active and participatory learners
Answering questions	→	Asking questions
Being 'spoon-fed'	→	Taking responsibility for their own learning
Competing with other learners	→	Collaborating with other learners
Learners of individual subjects	→	Connecting their learning



More examples of active learning:

6.8.1. THE FLIPPED CLASSROOM

The goal of the flipped classroom approach is to move the emphasis from passive to active learning. The phrase "flipped classroom" has several definitions, and it can change depending on factors like class size, availability of resources, level of assistance, etc. The classroom flipping approach can promote:

- Students should assume greater ownership for their education by investigating basic material alone or in groups, at home or at school, and then applying what they have learned to a variety of tasks requiring higher-order thinking.
- Learner-centered learning, collaboration, and substantial learning opportunities can be achieved by using a variety of pedagogical strategies to promote active learning, engage students, guide learning, correct misconceptions, and provide timely feedback. Concept exploration, meaning-making, and the demonstration or application of knowledge while in the classroom should be given more attention than didactic teaching.
- Thanks to technological improvements, educators are now able to experiment more with this paradigm and give students access to resources outside of the classroom, such as instructional films and audio recordings.

6.8.2. PROBLEM-BASED LEARNING

Problem-based learning (PBL) is a type of classroom organization that supports a constructive approach to teaching and learning. Guided by a teacher acting as a cognitive coach, learners develop critical thinking, problem solving, and collaborative skills by identifying problems, formulating hypotheses, and conducting research. Data, perform experiments, develop solutions and determine the “best suited” solution for environmental conditions. Problem-based learning will enable learners to grasp complexity, find relevance and enjoyment in their learning, and improve their ability to solve real-world problems creatively. The teacher will assume the role of cognitive coach rather than the holder and disseminator of knowledge and the learner will be an active problem solver, decision maker and opinion maker. conscious rather than a passive listener. To design a problem-based learning experience for learners, various sequential steps are needed, such as:

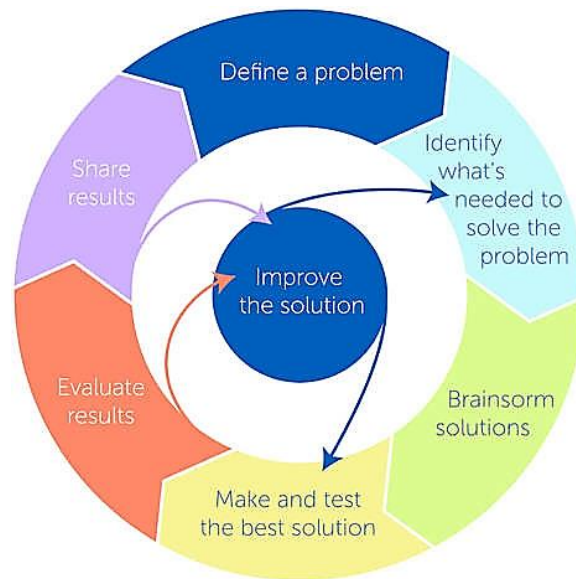
- Identify a problem suitable for the learners.
- Connect the problem with the context of the learner’s world so that it presents real/authentic opportunities.
- Organize the subject matter around the problem, not the discipline.
- Give learners the responsibility for defining their learning experience and planning to present among peers.

6.8.3. STEM/ STEAM

The science curriculum has been designed on STEAM framework which enables more creative, innovative thinkers to identify and address the needs of the society and the environment and it also validates the arts in education.

The key component of the STEAM approach is teaching science content with behavioral objectives at increasing levels of cognitive challenge (Bloom’s taxonomy) and following the Engineering Design Process (EDP) that leads to technological solutions. STEM/ STEAM is an interdisciplinary approach well aligned with the problems in our daily lives making it an exceptional way of learning and finding solutions.

The following illustration represents the recommended steps of the Engineering Design process.



Essential Elements of High-Quality STEM Curricula



When designing STEM/ STEAM challenges subject teachers need to work together involving students in exploratory learning where teacher-talk is at a minimum and students driven interaction and discovery is the focus. There are different ways of implementing STEM/ STEAM in school. One way to plan STEM/STEAM learning experiences is collaborative lesson planning by Mathematics, Science and Arts teachers so that desired concepts/lessons are taught across all relevant classrooms (science and mathematics) in parallel. Several STEM/ STEAM opportunities have been designed in the curriculum for teachers' reference. Project based learning approach is being widely used around the world to implement STEM/STEAM. Some of the advantages of following the STEM/ STEAM approach are as follows:



1. PBL helps students bridge thinking across disciplines

Great PBL focuses learning around real world problems, providing a clear connection between what is learned in school and how it is relevant beyond the classroom. The authentic nature of these problems and issues means they are both complex and messy, requiring students to draw on knowledge across disciplines and expertise in many areas.

2. PBL promotes deeper connections to content

The goal of project-based learning isn't to cover; it's to uncover. Project-based learning is an inquiry approach that requires time for students to make connections between the problems they are facing, to think about what they already know, and to develop lines of inquiry for new content they "need to know." This specific context and need to know helps them not only identify and avoid misconceptions, but connect facts and information as they apply knowledge to solve, evaluate, and reflect on specific situations.

3. PBL fosters the inquiry skills necessary for success in STEM

The open-ended nature of a project-based approach, one that isn't looking for a correct answer, fosters both the analytical and creative thinking necessary for innovation. Great questions for project-based learning don't lead to students jumping into answers; they lead to even more questions.

For example, a project-based approach to learning might ask students to consider: "How do we make cafeteria lunch healthier?" In response, students may ask, "Do you mean healthier for students or do you mean healthier for the planet?" Even if students only focused on healthier for students, they need ask:

- What is the calorie and vitamin content of existing meals?
- Which lunches are favorites?
- How much of any lunch do students eat?
- What types of food get thrown away?

Teachers can support their questioning skills with graphic organizers, like KWL charts and 5 Whys organizers.

As a result of their questioning, students work may focus on finding ways to make existing lunch options healthier or their work may focus on developing new options entirely. The real-world problems and challenges used in a project-based approach, don't provide the content and ask for an expected response, they require intensive questioning as well as the analytical thinking and creative problem solving needed for success in STEM.

4. PBL fosters reflection and metacognition

"We don't learn from experience; we learn from reflecting on experience." John Dewey

The process of project-based learning is recursive and requires extensive reflection for successful solution development. As student work to develop ideas and implement them, they are constantly asking questions like:

- What do we know? What do we need to know?
- What do we think will happen? Why?
- What really happened? Where did our thinking go wrong?
- What worked? What didn't work?
- What really happened? Where did our thinking go wrong?
- What worked? What didn't work?



The reflective nature of the project-based process helps students make connections between content they are learning and how it impacts their thinking and problem solving. How well they can find and utilize that knowledge helps them better understand not only what they are learning but how they are learning. Taking a project-based approach to STEM learning can help students form deeper connections to content, connect ideas across disciplines, and build the questioning, thinking, and metacognitive skills necessary for success in today's rapidly-changing world.

The following progression grid incorporates specifications from the Science Curriculum of Pakistan and globally recognized.



CHAPTER - 07

Assessment and Evaluation:

7.1. Assessment

Assessment is a systematic process that measures the outcomes of students' learning in terms of knowledge acquired, understanding developed, and skills gained. It determines their progression through their learning experiences and enables them to demonstrate that they have achieved the intended learning outcomes. Assessment usually collects information on demographic and other background factors to allow comparison to be made between the achievement of the subgroup in the population. This information when related statistical analysis to student achievement, can answer questions that are central to the role of National Assessment, such as, the following:

- What factors are associated with low achievement?
- Is the system serving any particular group?
- All gaps between groups in performance leads to remedial action.

In this way, we can relate outcomes to inputs that are provided and processes being used. Recommended activities for conducting assessment:

- Describe in detail the content and cognitive skills of achievement and the background variable to be assessed.
- Entrust test development to persons who are familiar with both curriculum standard and learning level of student.
- Use assessment instrument adequately to assess the knowledge and skills about which information is required and what will provide information on sub-domains of knowledge or skills (for example, problem solving rather than just overall score).
- Develop clear and unambiguous test and questionnaire items, and present them in a clear and attractive manner.

Assessment provides all stakeholders with information as to how well students, schools and programs are succeeding, and it identifies areas that need improvement. Thus, the focus of assessment shifts from judgment to continuous improvement.

7.2. Evaluation

Evaluation is the process of analyzing, reflecting upon, and summarizing assessment information, and making judgments or decisions based upon the information gathered.

Evaluation is effective when it is integrated into the teaching-learning process and carried out regularly and comprehensively through the use of a variety of assessment techniques. Assessment and evaluation are essential components of teaching and learning in science. Without effective assessment and evaluation, it is not possible to know whether students have learned, whether teaching has been effective, or how best to address students' learning needs.

7.3. Assessment Student Learning in Science

The General Science Curriculum emphasizes having a classroom environment in which students will be encouraged to learn scientific processes and knowledge within meaningful contexts. It is important that assessment strategies reflect this emphasis and are consistent in approach. An assessment program, which provides regular feedback, and is part of the learning process, is

important to both student and teacher. Feedback tells students if they demonstrate understanding of scientific concepts and if their actions display expected performance levels for inquiry, decision making, and problem solving. Regular feedback inspires confidence in learning science and in becoming scientifically literate.

Therefore, the assessment of students' learning must be aligned with curriculum outcomes. The General Science Curriculum provides suggestions for developing student learning across the four general curriculum outcome areas: knowledge; skills; attitudes; and science, technology, society and environment. These outcomes describe a balance of inquiry problem solving, and decision making, within a suggested social-environmental context, for a given set of scientific knowledge.

7.4. Objectives of Assessment

The assessment objectives are classified into the following three major performance expectations:

7.4.1. Understanding Science Principles

Students should be able to:

- 7.4.1.1. Describe knowledge and understanding of scientific phenomena, facts, and principles.
- 7.4.1.2. Develop relationships among science principles.
- 7.4.1.3. Use scientific vocabulary, terminology and conventions.

7.4.2. Conducting Scientific Inquiry

Students should be able to:

- 7.4.2.1. Follow and carry out instructions accurately and safely.
- 7.4.2.2. Locate, select, organize and present relevant information from a variety of sources.
- 7.4.2.3. Identify patterns, report trends and draw inferences.
- 7.4.2.4. Make predictions and hypotheses and deduce relationships.
- 7.4.2.5. Identify the problem, plan and carry out an investigation to solve the problem.
- 7.4.2.6. Conduct scientific investigation using appropriate tools and technologies.
- 7.4.2.7. Apply and communicate information through science process skills.

7.4.3. Applying Science Principles

Students should be able to:

- 7.4.3.1. Apply science principles to both familiar and unfamiliar situations/problems.
- 7.4.3.2. Shows understanding of connections between science and technology and the world outside the school as well as their implications.
- 7.4.3.3. Propose solutions to problems with respect to science & technology and its relation with society and environment.

7.5. Incorporating Assessment into the Learning Process

Assessment of students' learning must be part of every teaching and learning experience. Students should learn to evaluate their own learning. Traditional student testing programs, which rely on final, one-time evaluations, provide data that is of limited use to students as they construct knowledge. Meaningful assessment, like meaningful learning, must be authentic and connected to real-life problems.

A constructivist approach to learning and teaching has profound implications for the way learning is measured. Traditional classroom practice relies heavily on paper-and-pencil tests to measure students' learning and ability to apply knowledge. Learning is a process of connecting prior understanding with new learning. Consequently, an assessment strategy that measures the acquisition of facts and elements cannot serve a constructivist model.



Linking assessment to instruction - embedding it in the process of learning - is vital for an effective implementation of the "Inquiry based and Outcome focused" Science Curriculum.

To allow students to construct learning in the classroom through authentic experiences, assessment must be:

1. Valid, leading to attainment of multi-dimensional science learning;
2. Open-ended, allowing for discussion and revision of new understanding;
3. Tolerant of divergent thinking and promote the notion of no "one right answer";
4. Presented in alternative modes, not just paper-and-pencil responses to limiting questions;
5. Designed to promote analysis, comparison, generalization, prediction, and modification;
6. Capable of promoting collaboration and team effort in demonstration of competence; and
7. Ongoing and cumulative, showing development over time.

7.6. Types of Assessment

Assessment serves many important purposes. Some of them are given below:

1. Diagnostic (to plan instruction to fit the student's prior knowledge)
2. Formative (to improve performance and adapt instruction)
3. Summative (to report on final performance)

7.7. Purpose of Assessment

7.8.1.1. To Guide Instruction

Assessments should provide continuous data about student learning so teachers can identify student needs and plan appropriate instructional strategies by obtaining feedback on their own practice, finding out the gaps between teaching (what was taught) and learning (what has been learned).

7.8.1.2. To Inform Progress of Students

The purpose of assessment is to provide information and feedback on students' progress to the students and their parents.

7.8.1.3. To Provide Information on the Effectiveness of Curriculum

The purpose of assessment is to provide information on the effectiveness of science curriculum to all stakeholders in order to improve curricula, teaching standards and students' learning environment. Teachers, students, and parents need feedback on student progress. School administrators, educational planners, and the community need information to determine the overall effectiveness of the science program.

7.8. Classroom Assessment

The primary purpose of classroom assessment is not only to evaluate and classify students' performance but also to inform of teaching methods and learning environment, and to monitor student progress in achieving year-end learning outcomes. Therefore, classroom assessment is used for various purposes:



1. Assessment AS learning
2. Assessment FOR learning
3. Assessment OF learning

Each of the purpose requires a different role for teachers and different planning (for details refer Appendix A.). Traditionally, the focus of classroom assessment has been on assessment of learning (summative assessment). Assessment for learning has been used only for diagnostic processes and for feedback. In order to enhance science learning of all students, the role of assessment as learning must provide an opportunity to students whereby, they become critical and analysts of their own learning.

7.8.1. Classroom Assessment Strategies

Teachers learn about students' progress not only through formal tests, examinations, and projects, but also through moment-by-moment observation of students. To assess students' science knowledge, skills, and attitudes, teachers require a variety of tools and approaches, such as:

7.8.1.1. Selected Response

Multiple-choice, matching, completion tests, etc.

7.8.1.2. Self-constructed Response Question

Fill-in-the-blank phrase(s), essay (restricted and extended response), reports, procedures, explanations, short answer sentence(s), paragraph(s), label a diagram, and graph/table, etc.

7.8.1.3. Performance based Assessment

Presentation, illustrations, science lab, demonstration, process skills, enactment, project, debate, model, exhibition, table, graph, portfolios, etc.

7.8.1.4. Personal Communication Assessment

Oral questioning, observation, interview, conference, process description, checklists, etc.

7.9. Students' Self-Assessment

Students recognize the relationship between content achievement, skill proficiency, and assessment opportunities by setting their sights on their own demonstration. They can do self-assessment if they are provided with the knowledge-related checklists as well as checklists specific to applications and attitudes. Students assume the role of a researcher and use critical thinking skills as they find facts and make inferences to reach more conclusions about their learning. They are not receiving information passively and then simply giving it back to the teacher after memorizing it. Assessment should allow students to monitor their progress in various scientific skills: initiating and planning; performing and recording; analyzing and interpreting; communication and teamwork. The curriculum calls for students to be actively involved in their learning, using the tools of science and of information processing during classroom/ laboratory activities.



7.10. Quality in Assessment

Assessment of science learning must change as science instruction moves from a focus on facts to a focus on in-depth understanding of major concepts and processes of science. Whereas the Quality Assessment will have the following major objectives:

- Measurement of what students should know and are able to do according to the Learning Outcomes of science;
- Objective verification of the application of scientific principles to familiar and unfamiliar situations; and
- Alignment with the Learning Outcomes and the Teaching/Learning Strategies.

Therefore, assessment and evaluation of the students' learning of science according to predetermined Standards and Benchmarks will ensure the quality of their academic achievements.

7.11. Construction of Test Items

Written test items (selected response and creative response) should adhere to the following criteria:

1. Items should be clearly written.
2. Each test items should be written on the understanding level of learners.
3. Test items should cover what learners have had opportunities to learn.

Too frequently, these test items measure students' gains in recall of factual information. There are other relevant facts for students to acquire. These are higher levels of thinking or cognition that students should also develop.

These test items should measure students' achievement in:

- Understanding basic science concepts and acquired learning;
- Evaluating contents in terms of criteria or standards;
- Problem-solving skills;
- Analytical and creative thinking;
- Positive attitudes developed toward science and scientific methods of thinking;
- Ability to work together with others;
- Relevant concepts and generalizations developed; and
- The ability to manipulate and utilize science equipment.

Results from achievement tests may be utilized, along with other data-gathering techniques, to appraise students' progress in the science curriculum.

7.12. Reporting

Reporting on student learning should focus on the extent to which students have achieved the curriculum outcomes. Reporting involves communicating the summary and interpretation of information about students' learning to various audiences who require it. Teachers have a special responsibility to explain accurately what progress students have made in their learning and to respond to parents' and students' inquiries about learning.



Narrative reports on progress and achievement can provide information on students' learning that letter or number grades alone cannot. Such reports might, for example, suggest ways in which students can improve their learning and identify ways in which teachers and parents/guardians/ caregivers can best provide support.

Effective communication with parents/ guardians/ caregivers regarding their children's progress is essential in fostering successful home-school partnerships. The report card is one means of reporting individual student progress. Other means include the use of conferences, notes, and phone calls etc.

7.12.1. Guidelines Principles for Reporting

In order to provide accurate, useful information about the achievement and instructional needs of students, certain guiding principles for the development and use of assessment must be followed. For example:

7.12.1.1.

Assessment strategies should be appropriate and compatible with the purpose and context of the assessment.

7.12.1.2.

Students should be provided with sufficient opportunity to demonstrate the knowledge, skills, attitudes, or behaviours being assessed.

7.12.1.3. As

Procedures for judging or scoring student performance should be appropriate for the assessment strategy used and be consistently applied and monitored.

7.12.1.4.

Procedures for summarizing and interpreting assessment results should yield accurate and informative representations of a student's performance in relation to the curriculum outcomes for the reporting period.

7.12.1.5.

Assessment reports should be clear, accurate, and of practical value to the audience for whom they are intended.

7.13. Attitude and Values

Attitudes and values cannot be assessed directly. They are embedded in what students do and say. Teaching methods and learning activities that encourage students to recognize the value and relevance of what they are learning go a long way towards motivating students to work and to learn effectively.

Activities that involve students in investigating issues related to science and technology outside the school environment provide them opportunities to develop the attitudes and values so as to make informed and responsible decisions.



A SUMMARY OF ASSESSING SCIENCE LEARNING IS PRESENTED AS FOLLOWS:

What?	When?	How?	Recording
Science Knowledge and Understanding:			
<ul style="list-style-type: none"> • Biological science • Earth and space Science • Physical Science 	<ul style="list-style-type: none"> • Ongoing during and after science lessons • On completion of units • On completion of projects or practical investigations 	<ul style="list-style-type: none"> • Observation • Student work samples • Oral reports • Talking with students • Diagnostic tasks • Student designed tests • Self-assessment • Modelling • Teacher-constructed tests 	<ul style="list-style-type: none"> • Anecdotal records • Annotated class lists • Knowledge-related checklists • Science journals • Cumulative checklists • Photographs, videos

Application of Scientific Knowledge:			
<ul style="list-style-type: none"> • Explaining • Predicting • Analyzing 	<ul style="list-style-type: none"> • Ongoing during and after science lessons • On completion of units • During class discussions 	<ul style="list-style-type: none"> • Concept mapping • Open-ended Questions • Problem-solving Activities • Debates • Teacher-constructed tests 	<ul style="list-style-type: none"> • Explaining • Predicting • Analyzing



What?	When?	How?	Recording
Skills, Processes and Procedures:			
<ul style="list-style-type: none">• Observation• Posing questions or hypothesizing• Identifying and controlling variables• Planning investigations• Classifying• Using equipment correctly• Justifying measurement procedures• Collecting and recording data• Drawings• Presenting data• Analyzing data• Drawing conclusions	<ul style="list-style-type: none">• During and after practical sessions• When planning and carrying out investigations• During and after excursions	<ul style="list-style-type: none">• Observation• Practical tests• Fieldwork• Practical investigations• Surveys and interviews• Practical reports	<ul style="list-style-type: none">• Annotated class lists specific to processes identified• Anecdotal records• Portfolio of student's practical reports• Photographs, video, audio recordings

Scientific Attitudes and Acting Responsibly:			
<ul style="list-style-type: none">• Flexibility• Curiosity• Respect for evidence• Critical reflection	<ul style="list-style-type: none">• Ongoing during and after science lessons• During individual and group projects	<ul style="list-style-type: none">• Science journals• Questionnaires• Talking informally with students• Practical reports• Library research tasks, including using the internet and authoring Tools	<ul style="list-style-type: none">• Anecdotal records detailing attitudes• Portfolio of student practical report• Checklist specific to attitudes• Listed



What?	When?	How?	Recording
Scientific Communication:			
<ul style="list-style-type: none"> • Appropriate language and vocabulary 	<ul style="list-style-type: none"> • Ongoing during discussions • Following completion of project reports • During individual or group presentations 	<ul style="list-style-type: none"> • Oral presentations • Practical reports • Drawing • Research project Reports • Role-plays, performances • Peer-assessment • Creative writing • Using authoring tools for accessing presenting and communicating information 	<ul style="list-style-type: none"> • Video, audio recordings • Anecdotal records • Portfolio of students' practical and research reports



CHAPTER - 08

Guidelines to the Textbook Authors

8.1. Guidelines for Writing a Textbook:

A textbook is a crucial resource for teaching and learning. It provides fundamental scientific information for acquiring knowledge. Writing a textbook is a highly important and technical task, as it requires translating curriculum learning outcomes to the appropriate cognitive level of students. Textbook authors should consider the following guidelines:

- Begin with an introduction that explains the structure and format of the book, the organization of concepts in connection with the curriculum objectives, and directions for using the textbook.
- Ensure accurate, authentic, and up-to-date material.
- Write in a conversational tone.
- Provide students with sufficient knowledge to understand the concepts, develop inquiry skills, and engage in higher-order thinking.
- Help students understand the world they live in and prepare for lifelong learning.
- Ensure the material is error-free and unbiased.
- Make the book attractive and engaging, with illustrations, tables, graphs, etc.
- Ensure illustrations are clearly, accurately, appropriately, and neatly drawn, and must be properly labeled and captioned.
- Include a variety of practical and thinking activities to engage students in learning.
- Encourage students to think, develop skills, and use information for a variety of purposes by including exercises.
- Include a table of contents and glossary.
- Ensure the textbook is contextually relevant and feasible to use in a normal classroom environment.
- Ensure the figures, illustrations, and pictures are of high quality.

8.2. Guidelines for Writing a Chapter:

To enhance science education engagement and establish a strong foundation, science textbooks should include:

- **Introduction:** Start each chapter with a captivating title, colorful images, trigger questions, and Specific Learning Outcomes (SLOs).
- **Clear Objectives:** Define learning outcomes at the chapter's outset.
- **Emphasis on Key Terms:** Highlight important words and their definitions.
- **Structured Presentation:** Use color-coded headings for clarity.
- **Fascinating Tidbits:** Include interesting science snippets throughout.
- **Visual Engagement:** Incorporate vibrant illustrations and student-drawn diagrams.
- **Interactive Questions:** Pose "Do You Know?" questions for recall and application.
- **Relatable Context:** Integrate everyday experiences for relevance.
- **Hands-On Exploration:** Include activities for student inquiry.
- **Real-Life Connections:** Demonstrate practical applications of scientific principles.
- **Values and Ethics:** Infuse lessons with ethical considerations.
- **Technology Integration:** Encourage internet resource use with IT-related activities.



- Mini-Exercises: Connect science with technology, society, and the environment.
- Beyond Classroom Awareness: Expand horizons with additional information and accessible advanced concepts.
- Summarizing Key Points: Conclude chapters with concise summaries.
- Review Questions: Foster creativity and higher-order thinking with end-of-chapter questions.

8.3. Criteria for Review & Analysis of Textbooks:

Consider the following criteria when choosing educational materials for textbooks. Positive responses to most of these questions indicate a high-quality textbook:

1. Does the book align with curriculum goals?
2. Is the content accurate and current?
3. Are the contents relevant to the students' needs, age, and comprehension level?
4. Do text, activities, and assessments develop science process skills?
5. Do illustrations (pictures, drawings, graphs, etc.) enhance content understanding?
6. Do end-of-chapter exercises encourage students to think, develop skills, and be creative?
7. Are learning activities suitable for the learners' needs?
8. Do learning activities involve student participation in real-life issues and promote scientific inquiry?
9. Are various assessment strategies suggested, such as multiple choice, CRQs, project work, exhibitions, open-ended responses, and think tank activities?
10. Do the text, questions, and suggested activities stimulate interest that leads to further study?
11. Is the book free from biases related to religion, nationality, gender, occupation, and social class?
12. Does the textbook include a teacher's guide?
13. Is it visually attractive and appealing to children?
14. Is the language readable, understandable, and suitable for the intended age group?
15. Does it include an introduction and key points/summary?
16. Does it have an introduction on how to use the book, a table of contents, and a glossary?
17. Are the following adequate?
 - a. Paper quality (80gm, white)
 - b. Picture quality (Resolution and colours)
 - c. Page size 23x36/8
 - d. Line spacing 1.25
 - e. Titles and sub-titles 28-32, 18-22
 - f. Font size 14 Ariel

8.4. Criteria for Review & Analysis of Textbooks:

Teacher's guides, accompanying textbooks, provide in-depth explanations of key concepts and offer insights on effective teaching methods. They include additional activities, web links, examples, and answers to questions, serving as valuable resources for facilitating student learning. Alternatively, textbooks may contain concise notes for teachers on specific topic instruction.



Appendices

A. Planning Classroom Assessment

	Assessment as Learning	Assessment for Learning	Assessment of Learning
Why Assess?	<ul style="list-style-type: none"> To guide and provide opportunities for each student to monitor and critically reflect on their learning and identify next steps. 	<ul style="list-style-type: none"> To enable teachers to determine the next steps in advancing student learning. 	<ul style="list-style-type: none"> To certify or inform parents or others of the student's proficiency in relation to curriculum learning outcomes.
Assess What?	<ul style="list-style-type: none"> Each student's thinking about their learning, the strategies used to support or challenge that learning, and the mechanisms employed to adjust. Learning. 	<ul style="list-style-type: none"> Each student's progress and learning needs in relation to the curricular outcomes. 	<ul style="list-style-type: none"> The extent to which students can apply the key concepts, knowledge, skills, and attitudes related to the curricular outcomes.
What Methods?	<ul style="list-style-type: none"> Utilize a range of methods in different modes to elicit students' learning. 	<ul style="list-style-type: none"> Utilize a range of methods in different modes that make students' skills and understanding visible. 	<ul style="list-style-type: none"> Utilize a range of methods in different modes that assess both product and process.
Ensuring Quality	<ul style="list-style-type: none"> Ensure accuracy and consistency of students' self-reflection, self-monitoring, and self-adjustment. Engage students in considering and challenging their thinking. Encourage students to record their own learning. 	<ul style="list-style-type: none"> Ensure accuracy and consistency of observations and interpretations of student learning. Provide clear, detailed learning expectations. 	<ul style="list-style-type: none"> Ensure accuracy, consistency, and fairness of judgments based on high-quality information. Provide clear, detailed learning expectations.
Using the Information	<ul style="list-style-type: none"> Provide each student with accurate descriptive feedback to develop independent learning habits. Encourage each student to focus on the task and learning, not solely on getting the right answer. 	<ul style="list-style-type: none"> Maintain accurate, detailed notes for descriptive feedback to each student. Provide each student with accurate descriptive feedback to further their learning. Differentiate instruction by continually checking where each student is in relation to the curricular outcomes. 	<ul style="list-style-type: none"> Offer fair and accurate summative reporting. Indicate each student's level of learning. Provide the foundation for discussions on placement or promotion.



	Assessment as Learning	Assessment for Learning	Assessment of Learning
	<ul style="list-style-type: none"> • Offer each student ideas for adjusting, rethinking, and articulating their learning. • Provide conditions for teachers and students to discuss alternatives. • Facilitate students' reporting on their learning. 	<ul style="list-style-type: none"> • Supply parents or guardians with descriptive feedback about student learning. • Offer ideas for support to enhance student learning. 	<ul style="list-style-type: none"> • Generate a fair, accurate, and detailed report providing information for deciding the next steps in a student's learning.

B. Developing Science Skills & Process

Fostering the growth of science skills and processes empowers students to tackle problems, engage in critical thinking, make informed decisions, seek solutions, and satiate their curiosity. The subsequent skills and processes form the core foundation for presenting content and conducting instructional and assessment activities within classrooms.

Science Skills and Processes	
Observation	Observation entails gathering information about objects, situations, or events using multiple senses. These observations can be either qualitative or quantitative, serving as a foundation for new hypotheses and a means to test existing ones.
Measurement	Quantification of observations is achieved using both non-standard and standard units. Various measurements, including length, area, volume, mass, time intervals, and force, are employed. Appropriate instruments and units within the metric system are chosen for precision.
Classification	Classification involves grouping objects, concepts, or events based on observable properties to reveal similarities, differences, and inter-relationships.
Inference	Inference entails proposing conditions beyond what is directly observed, relying on observed data and past experience. Inferences may emerge from both direct and indirect evidence and can be adjusted based on new information.
Prediction	Predictions involve forecasting future events based on organized data. This process includes extrapolating beyond observed patterns and testing predictions against new evidence..

C. Developing Critical & Creative Thinking Skills (Cited from Malaysia Curriculum)

Fostering critical and creative thinking enables students to solve problems, make decisions, and satisfy curiosity. These skills are fundamental in classroom instruction and assessment activities.

Critical Thinking Skill

Brief descriptions of each critical thinking skill are as follows:

- **Attributing:** Identifying criteria such as characteristics, features, qualities, and elements of a concept or object.
- **Comparing and Contrasting:** Finding similarities and differences based on criteria like characteristics, features, qualities, and elements of a concept or event.
- **Grouping and Classifying:** Separating and categorizing objects or phenomena based on criteria such as common characteristics or features.
- **Sequencing:** Arranging objects and information based on common characteristics or features like size, time, shape, or number.
- **Prioritizing:** Organizing objects and information based on their importance or priority.
- **Analyzing:** Examining information in detail by breaking it down into smaller parts to uncover implicit meanings and relationships.
- **Detecting Bias:** Identifying views or opinions that tend to support or oppose something in an unfair or misleading way.
- **Evaluating:** Making judgments on the quality or value of something based on valid reasons or evidence.
- **Making Conclusions:** Formulating a statement about the outcome of an investigation based on a hypothesis

Creative Thinking Skill

Brief descriptions of each creative thinking skill are as follows:

- **Generating Ideas:** Producing or presenting ideas in a discussion.
- **Relating:** Making connections in a situation to identify a structure or pattern of relationships.
- **Making Inferences:** Drawing conclusions and providing explanations for events using past experiences or previously collected data.
- **Predicting:** Stating the outcome of a future event based on prior knowledge gained through experiences or collected data.
- **Making Generalizations:** Formulating general conclusions about a group based on observations or information from samples of the group.
- **Visualizing:** Recalling or creating mental images about an idea, concept, situation, or vision.
- **Synthesizing:** Combining separate elements or parts to create a general picture in various forms such as writing, drawing, or artifacts.
- **Making Hypotheses:** Formulating a general statement on the relationship between manipulated variables and responding variables to explain a phenomenon. This statement is considered true and can be tested for validity.
- **Making Analogies:** Understanding an abstract or complex concept by relating it to a simpler or concrete concept with similar characteristics.
- **Inventing:** Creating something new or adapting an existing idea to solve problems in a systematic manner.



Glossary

This glossary is intended to ensure that terms commonly used in the context of learning outcomes are appropriately interpreted. Words and terms defined in the glossary are found throughout the document. The curriculum review committee provided definitions for users to ensure that the meaning of each term is consistent. These definitions are not vocabulary words to be taught to students in isolation; they represent the terminology students will learn through the lessons prepared by the teacher.

Bloom's Taxonomy Level	Term	Description
Remembering	Recognize	Identifying or recalling information from memory.
	Recall	Retrieving information without prompting or assistance.
Understanding	Explain	Providing reasoning or reference to theory, depending on the context.
	Describe	Stating in words, with or without diagrams, the main points of a topic.
Applying	Apply	Using information in a new and different situation.
	Carry Out	Putting into practice or effect.
Analyzing	Analyze	Examining information in detail by breaking it down into smaller parts to find implicit meanings and relationships.
	Differentiate	Perceiving or showing the difference in or between discrimination.
Evaluating	Evaluate	Making judgments on the quality or value of something based on valid reasons or evidence.
	Assess	Evaluating or estimating the nature, ability, or quality of something.
Creating	Generate	Producing or creating ideas or solutions.
	Invent	Producing something new or adapting something already in existence to overcome problems in a systematic manner.

Term	Description
Carry Out	To put into practice or effect.
Classify	To arrange or organize according to grade or category.
Compare	To provide both similarities and differences between things or concepts.
Define	To give a formal statement or equivalent paraphrase.
Demonstrate	To show clearly one's learning.
Describe	To state in words (using diagrams where appropriate) the main points of the topic.
Determine	To make a firm decision, often implying that the quantity concerned cannot be measured directly.
Differentiate	To perceive or show the difference in or between discrimination.
Discuss	To involve close examination of a subject with interchange of opinions, providing a critical account.
Distinguish	To make noticeable differences, such as identifying a pass.



Term	Description
Draw	To formulate or devise from evidence and data at hand.
Explain	To provide reasoning or reference to theory, depending on the context.
Find Out	In general terms, it may be interpreted as calculating, measuring, determining, etc.
Illustrate	To draw or provide visual representation.
Inquire	To seek information by asking questions, investigating, or questioning.
Interpret	To conceive the significance of what is presented or to conceptualize the meaning, often through art.
List	To provide a sequence of points, generally one-word each, with no elaboration.
Measure	To obtain a quantity concerned from a suitable measuring instrument, e.g., length, using a rule.
Plan	To identify and perform the steps necessary to find the answer to a question.
Predict	To state a likely future event, process, or situation based on given information.
Recognize	To know or identify from past experience or knowledge.
Relate	To bring or link logical or rational associations
Show	To demonstrate a procedure or concept.
State	To provide a concise answer with little or no supporting argument.
Suggest	To provide ideas for a problem or situation. To apply knowledge to a new situation.
Use	To apply the concept, idea, and knowledge.
Write	To put words, figures, or signs on something on paper with a pen or pencil



Acknowledgment

National Level

General Science Curriculum	Experts	Year
National Curriculum	Writing and Framework Team, and Panel of Experts	2006
National Curriculum of Pakistan	Writing and Framework Team, and Panel of Experts	2022-23

Provincial Level

In addition, the Directorate of Curriculum, Assessment & Research Sindh Jamshoro highly appreciates the efforts and involvement of all stakeholders, including educators, working teachers, students, and parents at various levels of the adaptation, review, and aligned Sindh Curriculum for General Science-2023-24. with the National Standards-2022-23. Moreover, the PRC members are highly thankful to the Dr. Fouzia Khan, Chief Advisor Curriculum Wing Sindh and Mr. Piaro Khan Saharan, Director, DCAR Sindh, Jamshoro for providing guidance and facilitation throughout the whole process of review and adaptation.

Provincial Review Committee of General Science Curriculum 2023-24

Sr.#	Name of Members		Signature
1.	Prof. Dr. Murad Ali Khaskheli Associate Professor, Physics Department	Chairman	
2.	Prof. Dr. Nasiruddin Shaikh Ex-Vice Chancellor, Govt. College University, Principal Public School Hyderabad.	Co-Opt Member	
3.	Prof: Muhammad Nawaz Shaikh Deputy Director, DCAR Sindh, Jamshoro.	Member	
4.	Dr. Muhammad Junaid Khilji Lecturer, Govt Workers Intermediate College for Girls Site Kotri.	Member	
5.	Mr. Sarwaruddin Jamali Assistant Professor Govt. Elementary College of Education (M) Hyderabad.	Member	
6.	Mr. Zaheer Hussain Abbasi Subject Specialist, DCAR Sindh, Jamshoro.	Member	
7.	Ms. Humera Zia Subject Specialist (Science) Beaconhouse College Campus Qasimabad, Hyderabad.	Member	
8.	Syed Muhammad Kashif Assistant Professor Govt. Degree College Kohsar, Latifabad, Hyderabad.	Member	
9.	Mr. Naresh Kumar Shivani Assistant Subject Specialist, Sindh Textbook Board, Jamshoro.	Member	
10.	Mr. Muhammad Khan Gopang Assistant Subject Specialist, Sindh Textbook Board, Jamshoro	Co-Opt Member	
11.	Ms. Majida Parveen Soomro Subject Specialist, PEACe DCAR Sindh Jamshoro.	Desk Officer	



GENERAL SCIENCE CURRICULUM ADVISORY TEAM

Mrs. Rana Hussain	Minister of Education and Women Empowerment Government of Sindh.
Dr. Shereen Mustafa	Secretary, School Education and Literacy Department Government of Sindh
Dr. Fouzia Khan	Chief Advisor (Curriculum Wing) School Education and Literacy Department Government of Sindh
Mr. Piaro Khan Saharan	Director Directorate of Curriculum, Assessment and Research Sindh Jamshoro



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**GOVERNMENT OF SINDH
SCHOOL EDUCATION & LITERACY DEPARTMENT**

Karachi, dated the 1st, February 2024.

NOTIFICATION

NO. SELD/HCW/18/2018: In compliance with the Section 3, sub-section (4), (e) of Sindh School Education Standards & Curriculum Act 2014, Sindh Act No. IX of 2015. School Education & Literacy Department, Government of Sindh is pleased to accord **No Objection Certificate** for approval of **General Science Curriculum for Grade IV to VIII and developing & printing of Textual Material as per the approved Curriculum**, after review by the review committee for General Science.

**DR. SHEREEN MUSTAFA
SECRETARY TO GOVERNMENT OF SINDH**

NO. SELD/HCW/18/2018:

Karachi, dated the 1st, February 2024.

A copy for information and necessary action to:

1. The Chairman, Sindh Textbook Board, Jamshoro.
2. The Director, Directorate of Curriculum, Assessment & Research, Jamshoro.
3. The Director, Directorate of Non-Formal Education, Sindh Karachi
4. The P.S to Secretary School Education & Literacy Department, Gov. of Sindh, Karachi.
5. The official website.
6. The office file.


(ZULFIQAR ALI MIRANI)
SECTION OFFICER (CURRICULUM-A&T)
For SECRETARY TO GOVERNMENT OF SINDH.



SCHOOL EDUCATION &
LITERACY DEPARTMENT
SINDH

