

Physics

Theme 1: Physical Quantities and Measurement

In the earlier classes, teaching-learning emphasised on the measurement of length, mass, time and temperature using devices made for such measurements and how a particular unit and symbol are used to express the result of measurement of each physical quantity. In continuity, this theme aims at enabling children to develop the ability to measure volume and determine the density of a regular solid. They will be introduced to the concept of speed, that contains simple problems to provide an idea of the speed of objects around us and also to know how fast or slow an object is moving.

Learning outcomes:

Children will be able to:

- ☒ define volume;
- ☒ express volume of an object in a proper unit with proper symbols;
- ☒ measure volume of a liquid using a graduated cylinder and a graduated beaker;
- ☒ estimate the area of an object of irregular shape using a graph paper;
- ☒ measure the volume of an irregular solid using a graduated cylinder / a graduated beaker;
- ☒ define density and write its formula;
- ☒ express density in a proper unit and symbol;
- ☒ measure density of a regular/irregular solids;
- ☒ express result of measurement in a proper unit with proper symbol;
- ☒ define speed and write its formula;
- ☒ express speed in proper units with proper symbol;
- ☒ solve simple numerical problems based on formulas of density and speed.

Physical Quantities and Measurement

Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Measurement of Volume (3D concept): ☛ Concept of unit volume ➤ Measurement of Area: ☛ Estimate the Area of irregular shape using a Graph paper ➤ Measurement of Density of regular solids: ☛ Basic concept ☛ Formula ☛ Simple Numericals (SI units not required) ➤ Calculation of Speed: ☛ Basic Concept ☛ Formula ☛ Simple Numericals (SI units not required).	➤ Demonstration of graduated cylinder and graduated beaker ➤ Explanation of process of measurement of volume ➤ Explaining use of graph paper to measure area of irregular shape ➤ Explanation of process of measurement of density of a regular solid ➤ Explanation of concept of speed with examples from daily life ➤ Explaining calculation of speed ➤ Engaging children in activities involving measurement of volume, area, and density. ➤ Engaging children in simple problem solving involving the concepts of density and speed.	➤ Graduated cylinder ➤ graduated beaker in activities ➤ a small piece of stone ➤ a regular object ➤ objects of irregular shape ➤ use of graph papers ➤ video on volume measuring devices ➤ video on motion and speed

Integration: Chemistry, Technology in daily life

Life Skills: Creative thinking, Problem-solving

Theme 2: Force and Pressure: Motion

An object is said to be in motion if its position changes with time. When walking, running or cycling or when a bird is flying, there is motion involved. Various objects have different types of motion. They can be classified into translatory motion, circular motion and oscillatory motion. Motion of an object can also be classified as periodic and non-periodic. If an object travels equal distance in equal time, its motion is said to be uniform, if not, the motion is said to be non-uniform. A physical quantity used to distinguish between uniform and non-uniform motion is average speed.

Learning outcomes:

Children will be able to:

- ✓ define motion;
- ✓ identify objects in motion and at rest;
- ✓ describe different types of motion, with examples from daily life;
- ✓ define uniform and non-uniform motion with examples from daily life;
- ✓ define the concept of speed (average speed);
- ✓ calculate average speed of objects based on data provided;
- ✓ define weight;
- ✓ relate weight of an object with its mass.

Force and Pressure: Motion

Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Motion as a change in position of an object with respect to time. ➤ Types of motion: ☛ Translatory ☛ Circulatory ☛ Oscillatory ☛ Repetitive (Periodic and Non Periodic) ☛ Random ➤ Uniform and Non Uniform Motion: concept of distance and speed (average speed) ➤ Weight: ☛ Concept ☛ Differences between Mass and Weight.	➤ Demonstrating objects at rest and in motion. ➤ Demonstrating different types of motion. ➤ Asking children to work in groups and list objects in different types of motion in a table. ➤ Demonstrating motion of a pendulum as case of a periodic motion. ➤ Demonstrating uniform and non-uniform motion using examples from daily life ➤ Explaining the concept of speed; unit of speed. Simple numericals for calculating average speed of objects in daily life. ➤ Explaining the concept of weight. ➤ Explaining the difference between mass and weight.	➤ A ball. ➤ A stop watch. ➤ A bob with hook. ➤ Thread. ➤ Laboratory stand. ➤ Video on motion and types of motion. ➤ Video on uniform and non-uniform motion. ➤ Video on speed of objects in daily life. ➤ Videos on ocean currents, cyclones/ anti cyclones, atmospheric pressure

Integration: Mathematics, Chemistry, Geography, Technology in daily life.

Life Skills: Problem-solving, Cooperation and working together.

Theme 3: Energy

This theme aims at enabling children to know about energy and the different its forms namely, kinetic energy, potential energy, heat energy and electrical energy. They will also understand that one form of energy can be converted into another form and that this is known as transformation of energy. Energy is conserved during transformation. This is known as the law of Conservation of Energy.

Learning outcomes:

Children will be able to:

- ✓ define energy;
- ✓ express energy in proper units;
- ✓ discuss about different forms of energy;
- ✓ describe conversion of energy from one form to another in different situations;
- ✓ state law of conservation of energy, with examples.

Energy		
Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Energy: ☛ Energy as capacity to do work. ☛ Units of energy (joule and calorie). ☛ Different forms of energy. ☛ Inter-conversion of energy ➤ Law of Conservation of Energy: ☛ Real world examples.	➤ Explanation of the term Energy and encouraging children to share their experiences with examples from daily life. ➤ Explanation of relation between Work and Energy. ➤ Discussion with children about the different forms of Energy, with examples. ➤ Demonstration of inter-conversion of Energy, examples from daily life ➤ Demonstration of the conservation of Energy ➤ Providing examples of different applications of conservation of energy (Roller coaster, production of hydroelectricity etc.) and encouraging children to carefully make energy conversion diagrams and deduce that energy is conserved.	➤ A simple pendulum. ➤ Charts showing different forms of energy. ➤ Video/s showing interconversion of different forms of energy.

Integration: Chemistry, Biology, Technology in daily life.

Life Skills: Cooperation and working together, problem-solving.



Theme 4: Light Energy

Light travels in a straight line. Light from an object can move through space and reach the human eye which enables one to see this page, or a face in a mirror. This process is known as reflection. It obeys a law known as law of reflection. Light travels in air at a constant speed of 3×10^8 m/s or 3 lakh kilometre per second. In other mediums, like glass or water, it slows down. Light from sun is composed of seven colours. The colours of objects fascinates everybody, Physicists have found that all colours can be explained as addition of three primary colours. The primary colours are red, green and blue. Colours that is seen on a TV or computer screen arise due to combination of these primary colours. Appearance of colour of an object is due to process of absorption and reflection of different colours by the object.

Learning outcomes:

Children will be able to:

- ☒ explain the phenomenon of reflection;
- ☒ define the terms, plane, normal to the plane, point of incidence, angle of incidence and angle of reflection;
- ☒ state the law of reflection;
- ☒ describe reflection of light from a plane mirror;
- ☒ use law of reflection to show formation of image by a plane mirror;
- ☒ describe the characteristics of image formed by a plane mirror;
- ☒ state the value of speed of light;
- ☒ state primary colours;
- ☒ describe formation of secondary colours by addition of primary colours;
- ☒ explain the observed colour of an object based on reflection and absorption of light of different colours from the object.

Light Energy		
Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Reflection: ☛ Definition and Examples. ☛ Terms related to reflection - normal, plane, point of incidence, angle of incidence, angle of reflection. ➤ Laws of Reflection. ➤ Plane mirror: ☛ Uses. ☛ Ray Diagram (no mention of virtual image). Characteristics of the image formed (Lateral Inversion, same size, distance is preserved). ➤ Speed of light (3×10^8 m/s). ➤ Primary colours (RGB). ➤ Formation of secondary colours by colour addition. ➤ Appearance of colour of an object (based on reflection and absorption) ➤ Colour subtraction.	➤ Demonstrating on plane mirror and reflection of light. Explaining the point of incidence, normal, angle of incidence and angle of reflection. ➤ Engaging children in activities to show reflection of light. ➤ Helping children to draw a diagram to show a reflection by mirror. ➤ Demonstrating primary colours and formation of secondary colours using primary colours and asking children to do the same in pairs/groups. ➤ Explaining the colour of an object based on absorption and reflection. ➤ Showing children a video on primary colours and mixing of primary colours and then discussing the same with them. ➤ Explaining to children how rainbow is formed.	➤ A plane mirror. ➤ Reflecting surfaces. ➤ A laser pencil pointer. ➤ Pencil, scale, eraser, marker. ➤ White paper sheet. ➤ A set of primary colours. ➤ A set of colour filters. ➤ A source of white light. ➤ Interactive video on primary colours and mixing of primary colours. ➤ Picture/ video on rainbow.

Integration: Art, Mathematics, Technology in daily life.

Life Skills: Cooperation and working together, problem-solving.

Theme 5: Heat

Heat is a form of energy. Sunlight carries heat that gives warmth when exposed to it. When water is heated, its energy in the form of heat increases and becomes hot. When heat energy of an object increases, it can result in (i) change of temperature, (ii) change in size and/or (iii) change in state of an object. Some materials like aluminium are good conductors of heat and some, like wood are bad conductors of heat. Heat from a hot object is transferred to a cold object in three different ways- conduction, convection and radiation. Previous learning included topics on temperature and its measurement in degree Celsius. Further, two other frequently used temperature scales, Fahrenheit scale and Kelvin scale have been introduced in this theme for a better understanding of concepts related to temperature.

Learning outcomes:

Children will be able to:

-  define heat as energy;
-  define units of heat;
-  describe temperature scales: degree Celsius, Fahrenheit and Kelvin;
-  describe different effects of heat;
-  explain different modes of heat transfer;
-  decide about conductor and insulator of heat in different applications;
-  describe construction and working of thermos flask.

Heat		
Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Heat as a form of energy and its units, joule(J) and calorie (cal). ➤ Different units of Temperature (°C, °F, K). ➤ Effects of Heat: ☛ Change in Temperature. ☛ Change in Size (Expansion and contraction). ☛ Change in State. ☛ Good Conductors and Bad Conductors of Heat and their examples. ☛ Choice of conductors and insulators in day to day life (Pan handles, metal cooking utensils etc.) ➤ Methods of Heat Transfer: ☛ Conduction ☛ Convection ☛ Radiation ➤ Thermos Flask: (Application of Heat Transfer) ☛ Construction ☛ Working	➤ Demonstration and explanation of use of Thermometers marked in F. ➤ Engaging children in activity to measure temperature of water in F. ➤ Demonstration of heat transfer through different modes, conduction, convection and radiation. ➤ Children have to deduce where conduction, convection and radiation is taking place in some real world applications. ➤ Children use thermocol and other materials to make a cooling pack (emphasizing on the process of heat transfer). ➤ Explanation of the construction and working of a thermos flask.	➤ Thermometer graduated in °C and °F. ➤ Water in beaker. ➤ A tripod with mesh screen. ➤ A burner for heating. ➤ A set up to show heat transfer by conduction. ➤ A round flask. ➤ Potassium Permanganate Crystals. ➤ Test tube. ➤ Test tube holder. ➤ Thermos flask. 

Integration: Geography, Biology, Technology in daily life.

Life Skills: Cooperation and working together, problem-solving.

Theme 6: Sound

Sound is produced by the vibration of objects and different types of instruments are used to produce sound. In humans, sound is produced by the voice box or larynx. Sound needs a medium to propagate hence in vacuum it is not possible to hear one another. Sound wave is a longitudinal wave. A wave is characterised by an amplitude and a frequency. Like light, sound is also reflected from a surface. Sound is also absorbed by a medium. Therefore, walls of a theatre are lined with layers of materials that absorb sound. Sound travels with different speeds in different mediums and travels fastest in solids. This theme will enable children to know and understand 'Sound', different sources of sound and how it travels.

Learning outcomes:

Children will be able to:

-  identify different sources of sound;
-  describe sound as a longitudinal wave;
-  define amplitude and frequency of sound;
-  demonstrate that sound requires a medium to transmit;
-  list examples of reflection and absorption of sound;
-  analyse the relative speed of Sound in different mediums;
-  design a sound-proof box.

Sound		
Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Sources of sound. ➤ Sound as a longitudinal wave. ➤ Characteristics of a sound wave: Amplitude (Relate amplitude with loudness) and Frequency. ➤ Sound needs a medium to propagate. ➤ Reflection and Absorption of sound. ➤ Relative speed of sound in different mediums.	➤ Demonstration of production of sound using simple objects within the classroom followed by discussion ➤ Children place their hand on their throats and when they speak they feel vibration. ➤ Explanation of the characteristics of sound. ➤ Demonstration that sound needs a medium to propagate. ➤ Engaging children in design of an activity to show that sound need a medium to propagate, using two mobiles and a tumbler. ➤ Demonstration of reflection of sound ➤ Demonstration of absorption of sound ➤ Explanation of relative speed of sound in solid, liquid and gas. ➤ Design of sound proof box.	➤ Different sources of sound. ➤ A setup to show that sound need a medium to propagate. ➤ Materials for reflecting sound. ➤ Materials for absorbing sound. ➤ Videos on sound, sources, need of a medium, characteristic, reflection, absorption.

Life Skills: Cooperation and working together, Problem solving, Critical thinking.

Integration: Music, Mathematics, Technology in daily life.

Theme 7: Electricity and Magnetism

The basic law of electromagnetism states that "Like poles of magnets repel one another and unlike poles attract". When an electric current is passed through a coil, the coil behaves like a magnet. This magnet is called an electromagnet. The strength of this magnet is increased by inserting a core of suitable material. Many objects around us, like electric bell, electric motor, loudspeaker, etc. have electromagnets in them. A cell is a source of electricity and are used in torches, watches, calculators, etc. When connected to a device like bulb, it sends current through the bulb and the bulb lights up. Flow of charges constitute current. Materials that allow current to flow through them are called conductors whereas materials that do not allow passage of current through them are called insulators. Children will learn how electric components are arranged in simple series and simple parallel arrangements.

Learning outcomes:

Children will be able to:

- ✓ state the Law of Magnetism;
- ✓ describe test for a magnet;
- ✓ explain the phenomenon of electromagnetism;
- ✓ describe an electromagnet and its uses;
- ✓ explain construction and working of an electric bell;
- ✓ relate current to flow of charge;
- ✓ recognize electric cell as a source of electricity;
- ✓ define resistors as the component that opposes the flow of current;
- ✓ represent different components like cell, battery, key, bulb, connecting wire, resistor by standard symbols;
- ✓ make simple series circuits and simple parallel circuits;
- ✓ recognize battery as series combination of cells;
- ✓ define conductors and insulators of electricity.

Electricity and Magnetism

Key Concepts	Suggested Transactional Processes	Suggested Learning resources
➤ Law of Magnetism ➤ Test for a magnet (by repulsion) ➤ Electromagnetism, Electromagnets and their applications- Electric bell ➤ Electric current as a flow of charges ➤ Electric cell as source of electricity ➤ Resistors as components that oppose the flow of current. ➤ Symbolic representation of electrical components (key,	➤ Revisiting previous concepts. ➤ Building on children's previous learning. ➤ Demonstrating and explaining the law of electromagnetism. ➤ Demonstrating simple electromagnets. ➤ Engaging children to demonstrate electromagnets. ➤ Description of use of electromagnets. ➤ Demonstrating the construction and working of electric bells. ➤ Demonstrating electric cell and explanation of its working. ➤ Familiarizing children with symbols for electric components.	➤ Two bar magnets ➤ Laboratory stand ➤ Thread and hook for magnet ➤ An iron nail ➤ A cell ➤ A coil of wires ➤ A compass ➤ Core for electromagnet ➤ Dry cell ➤ Key ➤ Connecting wires ➤ Three bulb ➤ Banana clips

Electricity and Magnetism		
Key Concepts	Suggested Transactional Processes	Suggested Learning resources
battery, bulb, conducting wire, resistor) ➤ Simple electric circuit- Series and Parallel ➤ Battery as a collection of cells connected in series. ➤ Good and Bad conductors of electricity	➤ Explaining the role of key in electric circuits. ➤ Explaining the precautions to be taken before an electric circuit is switched-on. ➤ Engaging children in making simple electric circuits. ➤ Engaging children in practical tasks involving Series and Parallel combinations. ➤ Engaging children in design of activity to test whether a given object is good or bad conductor of electricity. ➤ Showing video on earth's magnetic declination from the true north.	➤ Video showing electromagnets and electric bells ➤ Video showing series and parallel circuits ➤ Video on earth's magnetic declination

Integration: Chemistry, Geography, Technology in daily life.

Life Skills: Problem-solving, Critical thinking, Cooperation and working together.

