Theme 1: Matter

Building on previous learning in Classes VI and VII, in this class the theme aims at introducing children to the Kinetic Theory which will help them in understanding the difference in the three states of Matter. The theory states that all matter is made of tiny particles which in an object are always in motion that may move slow or fast. In solids, the particles have less energy hence do not move around freely. In liquids, they have relatively more energy and move about freely within the container. The particles of gases have much more energy and move freely at high speeds. The increase or decrease in the movement of energy is the result of heating or cooling of an object. Heating an object increases the energy of particles whereas cooling decreases the energy of particles of an object.

Learning outcomes:

Children will be able to:

- distinguish the three states of matter in terms of movement of particles;
- relate the three states of matter with energy of movement of particles in them;
- describe the change of state using Kinetic theory:
  - Boiling
  - Vaporization
  - Melting
  - Fusion
  - Evaporation
  - Condensation
  - Sublimation
  - Deposition
  - Freezing
- identify appropriate observable parameters in experiments;
- collect data and make careful observation;
- present the results in the form of tables;
- consider results using scientific knowledge and communicate these.

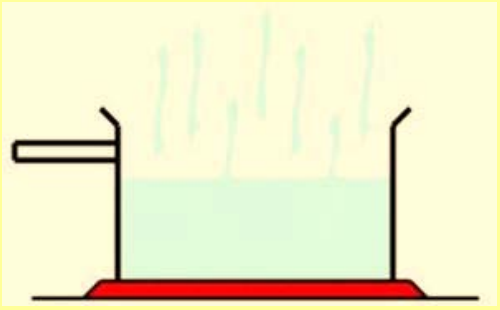
Matter

Key Concepts	Suggested Transactional Processes	Suggested Learning resources

Kinetic Theory of Matter.
• Three states of matter in terms of movement of particles.
• Energy content in the three states of matter.
• Change of state in matter using the Kinetic theory:
  - Boiling
  - Vaporization
  - Melting
  - Fusion
  - Evaporation
	• Revising previous concepts learnt by children.
	• Building on children's previous learning.
	• Demonstrating matter in three states.
	• Demonstrating change of state, solid to liquid, liquid to gas, etc.
	• Demonstrating the phenomenon of melting and boiling.
	• Engaging children in undertaking activities related to melting and boiling, condensation and freezing and
		• Samples of three states of matter
		• A beaker
		• Tripod stand with mesh
		• Burner
		• Thermometer
		• Laboratory stand
		• Naphthalene balls
		• Videos on states of matter and change of state

Matter		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning resources**
☛ Condensation ☛ Sublimation ☛ Deposition ☛ Freezing ➢ Change of state diagrams (using the terms mentioned above).	making observations followed by discussion. ➢ Engaging children (individually /in groups) to observe change of state; solid to liquid, liquid to gas and record what is observed. ➢ Explaining different terms, such as, boiling, melting, freezing, condensation, sublimation, etc. with examples from daily life. ➢ Observation of above mentioned phenomena in possible classroom situations (using different samples) ➢ Children observing solids and liquid (Compare and contrast the physical characteristics). ➢ Encouraging children to prepare a comparison table of different states based on (shape, texture and volume). ➢ Asking children to describe the interconversion of states using examples like water, naphthalene balls etc. and additional examples of all types of change of state. ➢ Engaging children in pairs or in small groups in investigation of the related change of state due to addition of energy (heating) or cooling due to a substance. ➢ Engaging children (individually/ in groups/in pairs) in the design of activities to show that melting or boiling occurs at a fixed temperature for a substance.	

Integration: Chemistry, Geography, Technology in daily life.
Life Skills: Cooperation and working together, Problem-solving.



Theme 2: Physical Quantities and Measurement

Previous learning demonstrated the measurement of the density of regular solids. In this class children will develop the ability to measure the, density of an irregular solid and also of a given liquid. They will also understand that due to the difference in the value of densities of a solid and liquid, a piece of solid can float or sink in a liquid.

Learning outcomes:

Children will be able to:

- measure density of an irregular solids;
- measure density of a liquid;
- discuss the concept of floatation based on relative densities of solid and liquid;
- express result of measurement in proper unit with proper symbol;
- solve simple numerical problems based on formula of density;
- compare densities of matter in three states, solid, liquid and gas;
- make careful observations including measurements;
- gather data using formal units;
- make conclusions from collected data;
- make predictions using scientific knowledge and effectively communicating the same.

Physical Quantities and Measurement

Key Concepts	Suggested Transactional Processes	Suggested Learning resources

▸ Measurement of Density of irregular solids using:
  ☛ Eureka Can
  ☛ Measuring Cylinder
▸ Measurement of Density of Fluids:
  ☛ Basic Concept
  ☛ Concept of Floatation and sinking of a substance (relate to density)
  ☛ Comparison of densities in the three states of matter.
	▸ Revising previous concepts learnt by children.
	▸ Building on children's previous learning.
	▸ Demonstrating the process of measurement of density of an irregular solid.
	▸ Demonstrating the process of measurement of density of a liquid
	▸ Engaging children in practical tasks involving measurement of density of an irregular solid and a liquid
	▸ Engaging children (in groups/pairs/individually) in an investigation to find out which object floats in which liquid, given solids of different densities and liquids of different densities. This is to be followed by discussion.
	▸ Guiding children to predict the result of the previous investigation and comparing predictions with the outcomes.
		▸ Graduated cylinder
		▸ Eureka can
		▸ Graduated beaker
		▸ Water
		▸ Objects of different densities
		▸ Liquids of different densities
		▸ Balance to measure mass
		▸ Objects of irregular shapes
		▸ Video on volume measuring devices
		▸ Video on determination of density of solid and liquid

Life Skills: Cooperation and working together, Problem-solving.
Integration: Chemistry, Technology in daily life.

Theme 3: Force and Pressure

A force is a push or pull upon an object resulting from the object's interaction with another object. Turning effect of a force is more if the distance between the point of application of force and the pivot is more. It is given a special name, Moment of force. Pressure is defined as force per unit area. Solids, liquids and gases, all exert pressure. Atmosphere also exerts pressure.

Learning outcomes:

Children will be able to:

- explain the turning effect of a force, with examples from daily life;
- define moment of force;
- express moment of force in proper units;
- solve simple numerical problems based on moment of force;
- define pressure;
- express pressure in proper units;
- solve simple numerical problems based on formula for pressure;
- describe pressure exerted by a liquid;
- demonstrate that liquids exert pressure;
- describe pressure exerted by a gas;
- describe atmospheric pressure;
- express thoughts that reveal originality, speculation, imagination, a personal perspective, flexibility in thinking, invention or creativity;
- present ideas clearly and in logical order.

Force and Pressure

Key Concepts	Suggested Transactional Processes	Suggested Learning resources

▸ Turning effect of force (moment of force): concept, definition and calculation
▸ Pressure:
  ☛ Definition
  ☛ Unit
  ☛ Calculation of pressure in simple cases
  ☛ Pressure exerted by liquids (Qualitative only).
  ☛ Pressure exerted by gases- Atmospheric pressure (Qualitative only).
	▸ Revising previous concepts learnt by children.
	▸ Building on children's previous learning.
	▸ Demonstration of turning effect of force.
	▸ Explanation of turning effect and factors on which it depends.
	▸ Engaging children in task for calculation of turning effect.
	▸ Demonstration of pressure exerted by a force on an object.
	▸ Explanation: pressure depend on the area of surface on which the force acts.
	▸ Demonstration of pressure exerted by a liquid.
	▸ Demonstration of pressure exerted by a gas.
	▸ Explanation of pressure exerted by atmosphere.
		▸ A nut fixed in an object
		▸ Spanner
		▸ Doors of classroom
		▸ Nails
		▸ Hammer
		▸ Transparent glass tube or plastic pipe
		▸ Rubber balloon
		▸ Strong thread
		▸ Water
		▸ A plastic bottle with a hole bear the bottom
		▸ Rubber sucker

Force and Pressure		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning resources**
	➢ Engaging children in tasks to show that: (i) pressure depends on area (ii) liquids exert pressure (iii) gases exert pressure. ➢ Observation/Experimentation/ Analysis ➢ Student led experiments (reasoning to be given by children individually) Investigate the effect on pressure when walking on flat shoes and pointed heels on our body support system. For e.g. Children reasoning as to- Why is it easier to hammer a sharp pin respective to a blunt pin?	

Integration: Geography, Technology in daily life.
Life Skills: Cooperation and working together, Problem-solving.

Theme 4: Energy

Building on previous learning on Energy, the emphasis in this class is on the introduction of gravitational potential energy to children. Look at a swinging bob of a pendulum. When it is at its extreme position (the highest point of its motion), it has gravitational potential energy. When it reaches its mean position (lowest point), it has maximum speed and it has high kinetic energy. In this case, one form of energy changes into other, according to the law of conservation of energy. Energy is the ability to do work. Work is said to be done when a force acting on an object changes the position of the object. For the special case when the object changes its position along the direction of the force, work is given by the product of the force and distance moved by the object. But different persons may take different time to do the same work. Rate of doing work is called power. So energy and power are two different physical quantities, having different units. In many situations, the focus is on the power and not energy. For e.g. the power of a motor which works is paid for the electricity consumed, is actually paid for the energy consumed.

Learning outcomes:

Children will be able to:

- define work;
- express work in proper unit;
- calculate work done in simple cases;
- define kinetic energy;
- express kinetic energy in proper units;
- solve simple problems based on kinetic energy;
- define potential energy;
- define gravitational potential energy;
- solve simple problems based on gravitational potential energy;
- describe energy transformation in daily life situation;
- distinguish between energy and power;
- can plan an experimental investigation or demonstration using Scientific processes;
- can identify /select on the basis of attributes.

Energy

Key Concepts	Suggested Transactional Processes	Suggested Learning resources
▸ Concept of Work ▸ Unit of Work (Joule) ▸ Calculation of Work done in simple cases ▸ Kinetic Energy ☛ Basic Concept ▸ Potential Energy ☛ Basic Concept ☛ Gravitational Potential Energy ▸ Calculation of kinetic and potential energies from a set of given data (Simple problems and assuming $g=10\ m/s^2$) ▸ Energy transformation in common daily life situations	▸ Revising previous concepts learnt by children. ▸ Building on children's previous learning. ▸ Explaining concept of work done with examples from daily life. ▸ Calculating work done in simple cases and expressing result in proper unit. ▸ Explaining of kinetic energy and potential energy ▸ Explaining of gravitational potential energy ▸ Solving of problems on kinetic and potential energy	▸ Video on work done in simple cases from daily life. ▸ A simple pendulum. ▸ Video on Kinetic and potential energy. ▸ Video on transformation of energy.

Energy		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning resources**
▸ Difference between Energy and power	▸ Demonstrating kinetic and potential energy using a simple pendulum ▸ Engaging children in problem solving tasks on KE and PE ▸ Explaining and discussing with children energy transformation in daily life situations / activities. ▸ Explaining the difference between energy and power. ▸ Citing examples of different applications of conservation of energy (roller coaster, production of hydroelectricity etc.) with children making energy conversion diagrams and deducing that energy is conserved.	

Integration: Technology in daily life
Life Skills: Cooperation and working together, Problem solving

Theme 5: Light Energy

An object lying at the bottom of a vessel filled with water usually appear to be at different depth than it actually is. This is due to bending of light rays when it travels from water to air. This phenomenon is called refraction. Light bends when it passes obliquely from one medium to the other. Due to refraction, a mirage is observed on a hot sandy desert. Atmosphere also refract the rays coming from the sun. This causes advanced sunrise and delayed sunset. Previous learning emphasized on reflection of light by a plane mirror. how images are formed by a curved (concave) mirror is now dwelt upon along with rules used to construct ray diagrams.

Learning outcomes:

Children will be able to:

- define refraction;
- discuss examples of refraction;
- describe a spherical mirror;
- describe a concave and a convex mirror;
- define the terms, principal axis, centre and radius of curvature, focus and focal length for a spherical mirror;
- describe rules for making ray diagrams for spherical mirror;
- distinguish between real and virtual images;
- use a ray diagram to show formation of a real image by a spherical mirror;
- describe the characteristics of a real image formed by a spherical mirror;
- describe dispersion of white light by a prism into constituent colours;
- display a scientific attitude while making models;
- show a creative mind set while studying real world optical phenomena;
- communicate logical reasoning and explanations effectively using scientific terms.

Light Energy

Key Concepts	Suggested Transactional Processes	Suggested Learning resources

▸ Refraction:
  ☛ Definition
  ☛ Examples of Refraction.
▸ Curved Mirrors:
  ☛ Convex
  ☛ Concave
  ☛ Reflecting surface (Convex and Concave)
  ☛ Uses of Curved mirrors
  ☛ Terms related to Curved mirrors –Focus, Principal Axis, centre of curvature, radius of curvature
  ☛ Rules for making ray diagrams of Spherical mirrors.
  ☛ Real and Virtual Images
	▸ Revising and revisiting previous concepts learnt by children.
	▸ Building on children's previous learning.
	▸ Demonstrating the phenomenon of refraction
	▸ Engaging children in pairs, individually or small groups in activities related to refraction.
	▸ Explaining refraction with suitable examples.
	▸ Demonstrating how concave and convex mirrors work.
	▸ Representing of concave and convex mirrors through diagrams
	▸ Explaining the terms i.e. Focus, principal axis, centre of curvature,
		▸ A glass slab
		▸ A laser pencil
		▸ White sheet of paper
		▸ Drawing board
		▸ Drawing pins
		▸ Pencil
		▸ Scale
		▸ Eraser
		▸ A glass tumbler with water
		▸ Concave mirror
		▸ Convex mirror
		▸ Candle
		▸ Mirror stand
		▸ Candle stand
		▸ Match box
		▸ Screen with stand
		▸ A sharp pin with stand
		▸ A prism

Light Energy		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning resources**
☛ Ray diagrams with curved mirrors where real images are formed. ➢ Dispersion of white light into constituent colours.	radius of curvature with the help of diagrams to children. ➢ Engaging children in activities related to image formation by a concave mirror using ray diagram. ➢ Explaining real and virtual images. ➢ Demonstrating the dispersion of white light into component colours.	

Integration: Geography, Technology in daily life.
Life Skills: Cooperation and working together, Problem-solving.

Theme 6: Heat Transfer

In both boiling and evaporation, matter changes from liquid to gas. But the two processes are quite different. When temperature of a matter increases, the particles of the matter gain energy and move with greater speed. In evaporation, the particles at the surface escape and form gas. Other particles, inside the liquid, do not have enough energy. So the process of evaporation occurs at the surface. It happens at all temperatures. In boiling, all particles of the liquid are at the same temperature and are involved in the process. It happens in the whole volume of the liquid and it happens at a fixed temperature, particular to a liquid. But before change of states takes place due to supply of heat, there is another effect which is commonly observed. That is the expansion of matter. Matters in all form, except some exceptions, expand on heating. In solids, the effect is less, in liquids more, and in gases maximum. Classification of expansion into three types- linear, superficial and volume are explained with examples from daily life.

Learning outcomes:

Children will be able to:

- compare and contrast Boiling and Evaporation;
- describe thermal expansion of matter;
- describe, linear, area(superficial) and volume expansion;
- compare expansivity in Solids, Liquids and Gases;
- construct models based on scientific process;
- observe and cite multiple physical phenomena from one experiment.

Heat Transfer

Key Concepts	Suggested Transactional Processes	Suggested Learning resources

▸ Difference between Boiling and Evaporation.
▸ Thermal Expansion:
  ☛ Linear Expansion
  ☛ Volume Expansion
  ☛ Superficial Expansion
  ☛ Compare expansivity in Solids, Liquids and Gases.
  ☛ Examples and real-world applications.
	▸ Revising and revisiting previous concepts learnt by children.
	▸ Building on children's previous learning.
	▸ Demonstrating points of boiling and evaporation.
	▸ Engaging children in tasks related to boiling and evaporation.
	▸ Explaining the difference in boiling and evaporation.
	▸ Demonstrating linear expansion, area expansion and volume expansion through simple experiments for children.
	▸ Explaining expansion with the help of examples from daily life activities.
		▸ A flask
		▸ Tripod stand with mesh
		▸ Burner
		▸ Water
		▸ Experimental set up to show linear and area thermal expansions
		▸ Videos on thermal expansion

Integration: Chemistry, Technology in daily life.
Life Skills: Problem-solving, Critical thinking.

Theme 7: Sound

In the previous classes children were made aware of and enabled to understand that a sound wave is characterised by its frequency and amplitude. Parameters that focus on loudness and pitch and are commonly used to characterise sound produced by different sources were also highlighted. The loudness depends on the amplitude, hence when the amplitude of sound is large, sound is loud. Pitch is related to the frequency so when the frequency is high, the pitch is high or the sound is shrill. In this class the theme focusses on showing how sound produced by different musical instruments have different pitch and loudness.

Learning outcomes:

Children will be able to:

- relate pitch and frequency;
- understand pitch and frequency in relation to working of musical instruments. (wind, membrane and string);
- explain mono tone;
- relate loudness and amplitude;
- state the unit of loudness in decibels.

Sound

Key Concepts	Suggested Transactional Processes	Suggested Learning resources
Pitch and Frequency Pitch and frequency in relation to working of musical instruments. (Wind, membrane and String) Monotone Loudness and amplitude unit of loudness in decibels	Revising and revisiting previous concepts learnt by children. Building on children's previous learning Explaining terms related to pitch and frequency. Demonstrating the relation between pitch and frequency Demonstrating of pitch and frequency of some common musical instruments Demonstrating monotone sound Demonstrating the relation between loudness and amplitude Explaining units of loudness i.e. decibel. Engaging children in tasks/ activities related to pitch, loudness, frequency and amplitude. Engaging children in the design of musical toys.	A rubber band A metal tumbler filled with water A pencil Musical instruments Video on Pitch and loudness of sound Video on musical instruments Tuning a guitar using a programme available on the internet

Integration: Music, Technology in daily life.
Life Skills: Cooperation and working together, Problem solving

Theme 8: Electricity

In this theme the aim is to develop the ability to estimate consumption of electricity by knowing the power rating of appliances used. Children will also be able to appreciate and understand the need and importance of taking certain precautions and use of safety devices to protect themselves and others against electrical hazards. Previous learning stressed on electricity due to charges in motion, i.e. current electricity. However, objects can be charged, where charges are static not in motion. This is known as static electricity. This leads to many phenomena in nature, like lightning and thunder during rainy season. How an object that is charged may be detected using a simple device known as an electroscope.

Learning outcomes:

Children will be able to:

- describe household consumption of electricity;
- identify live wire, neutral wire and earth wire in terms of their energy and path they travel;
- describe safety components (fuses, circuit breakers);
- describe phenomenon of static electricity;
- explain conservation of charges;
- describe conduction and induction of charges;
- describe construction and working of an electroscope;
- describe a lighting conductor;
- identify dangers of electricity;
- conduct scientific experiments keeping in mind all the parameters;
- study the impact of energy consumption and draw conclusions from the same and suggest alternate approaches;
- learn the use of safety precautions while dealing with electrical appliances.

Electricity

Key Concepts	Suggested Transactional Processes	Suggested Learning resources
▸ Household consumption of electric energy (kilowatt hour) ▸ Identify live wire, neutral wire and earth wire in terms of their energy and path they travel ▸ Safety components (fuses/circuit breakers (Qualitative approach only)/ grounding) ▸ Static Electricity ☛ Conservation of charges ☛ Conduction ☛ Induction ☛ Electroscope (Gold Leaf Electroscope) ☛ Lightning Conductor	▸ Revising and revisiting previous concepts learnt by children. ▸ Building on children's previous learning ▸ Calculating energy consumption using household electricity bills by children. ▸ Helping children identify live, neutral and earth wires ▸ Demonstrating safety components and their uses ▸ Demonstrating static electricity ▸ Demonstrating induction and conduction ▸ Engaging children in activities related to static electricity ▸ Demonstrating the construction and working of an electroscope	▸ Household appliances with rated power ▸ Household electricity bill ▸ Fuses and circuit breakers ▸ Balloons ▸ Threads, Laboratory stands ▸ Video on electricity and safety measures ▸ Interactive Video on static electricity ▸ Interactive video on lighting conductor

Electricity		
Key Concepts	**Suggested Transactional Processes**	**Suggested Learning resources**
▸ Battery as a collection of cells connected in series. ▸ Dangers of electricity	▸ Engaging children in design of a simple electroscope ▸ Demonstrating the functioning of a battery ▸ Explaining a lightning conductor and its use ▸ Explaining the dangers of electricity and the safety precautions required	

Integration: Geography, Technology in daily life.
Life Skills: Problem solving, Critical thinking.