

Theme 1: Matter and its Composition

This theme focuses on informing and making children aware of the different types of matter/objects found in their surroundings such as stones, water, soil, oil, sugar, air. Some of them have common characteristics in terms of states, some are solids, liquids and some are gases. These states vary in their shape, volume and texture. All these are made up of some materials which have mass and occupy space. Children will also realize that the study of their composition is of great importance in their daily lives.

Learning Outcomes:

Children will be able to:

- ☑ describe matter;
- ☑ discuss the constituents (atoms/molecules) of matter;
- ☑ explain the forces which keep atoms/molecules in matter together.

Matter and its Composition

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<ul style="list-style-type: none"> ➤ Definition of matter. ➤ Matter has mass and occupies space - Explanation. ➤ Composition of matter – brief introduction 	<ul style="list-style-type: none"> ➤ Demonstrating that air in a balloon occupies space. It can be shown that any matter like a solid or liquid has mass. ➤ Discussing that matter is made up of tiny particles. They are tightly packed in solids, loosely packed in liquids and have random motion in gases. The intermolecular attraction between the particles keeps them together (reference: solids, liquids and gases). ➤ Asking children to prepare charts showing above. 	<ul style="list-style-type: none"> ➤ Samples of solids, liquids and examples of gases. ➤ Charts. ➤ Experiments.

Integration: Physics

Life skills: Cooperation and working together, drawing conclusion.



Theme 2: Physical and Chemical Changes

The theme focuses on informing children and making them aware about the different types of changes physical and chemical that are regularly observed occurring in the environment. Some occur on their own and some are caused due to human activities to meet their requirements. Keeping in view the unending role of these changes, it becomes worthwhile that children learn about them.

Learning Outcomes:

Children will be able to:

- ☑ differentiate between physical and chemical changes;
- ☑ perform activities related to physical and chemical changes;
- ☑ classify changes such as respiration, preparation of solution of sugar, burning of paper ripening of fruit, spoiling of food materials as physical and chemical changes;
- ☑ discuss that in a chemical change, a new substance with different properties is formed.

Physical and Chemical Changes

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<ul style="list-style-type: none"> ▶ Physical and chemical changes. ▶ Chemical change - formation of a new product with new properties. ▶ Differentiating between physical and chemical change. ▶ Classification as physical & chemical change. ▶ Types of change involved when there is a change of state of matter. ▶ Types of change involved when there is a change of energy. 	<ul style="list-style-type: none"> ▶ Asking children to classify the following changes as: (i) Desirable and Undesirable (ii) Physical and Chemical change: drying of clothes; melting of ice; evaporation of water as physical changes; rusting of iron; burning of fuels & fireworks; curd from milk; reaction of iron powder with sulphur powder as chemical changes. Discussing about the formation of a new compound in a chemical change. ▶ Conducting demonstrations/ experiments and discussing with children to classify changes: respiration, burning, dissolution of sugar, boiling an egg, other daily life examples into physical and chemical changes. ▶ Conducting simple experiments with children and asking them to observe and study the interchange of state of water, sublimation of ammonium chloride or iodine. ▶ Demonstrating and discussing the processes of: melting, boiling, reversible, irreversible, dissolution of quick lime in water, ammonium chloride in water, burning of match stick, etc. 	<ul style="list-style-type: none"> ▶ Experiments to show that changes in state, colour, size, shape, evolution of heat, light, gases and change in taste indicate physical and chemical changes. ▶ Assembly of apparatus. (<i>to show sublimation of ammonium chloride.</i>) ▶ Paper, common salt, chalk, iron, sulphur, ice, copper.

Integration: Physics, Geography, Biology

Life skills: Problem solving, critical thinking

Theme 3: Elements, Compounds and Mixtures (experimental techniques)

This theme will enable children to understand that the earth mainly consists of mixtures containing elements and compounds. These are of different types and many a times the separation of components of mixtures is required for practical utility. They will also know about and discuss the different techniques for separation of the components of a mixture to get the pure components.

Learning Outcomes:

Children will be able to:

- ☑ identify elements and compounds on the basis of their properties and the type of atoms present in them;
- ☑ differentiate between mixtures and compounds on the basis of their properties and composition of constituents;
- ☑ provide examples of elements, compounds and mixtures from daily life;
- ☑ discuss different techniques for separation of components of mixtures;
- ☑ justify the reason for the use of a particular technique in separation of a mixture;
- ☑ explain chromatography and its importance.

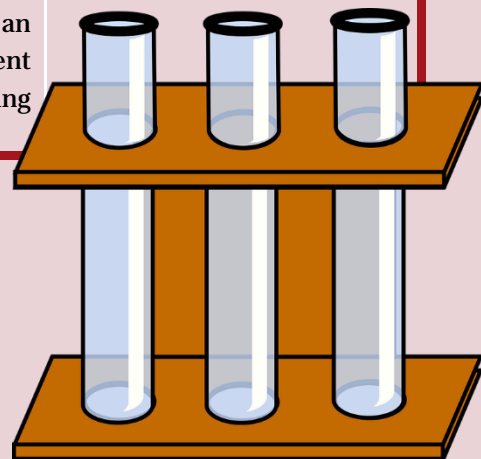
Elements, Compounds and Mixtures (experimental techniques)

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<ul style="list-style-type: none"> ▶ Identification of elements, and compounds from representation of their symbols and formulae. ▶ Mixtures and compounds: difference between mixtures and compounds on the basis of the chemical composition of constituents. ▶ Recall that a mixture is formed when two or more substances are mixed in any proportion such that their particles are in intimate contact with one another without 	<ul style="list-style-type: none"> ▶ Revisiting previous concepts Building on children's previous learning. ▶ Preparing a list of elements and compounds with their symbols & formulae by the teacher and then asking children to classify them as elements and compounds. On the basis of their knowledge of class VI, they should be able to do this classification. Discussing the basis of classification to strengthen the concept. Classification using the names may also be attempted. ▶ Illustrating the meaning of the terms mixtures and compounds based on the proportions of their components using common examples from daily life such as honey, water, milk, rust, etc. ▶ Demonstrating through the activity of mixing of iron and sulphur. It is a mixture when mixed in any proportion. Next take iron and sulphur in 	<ul style="list-style-type: none"> ▶ List of the symbols and formulae of elements and compounds. ▶ List- elements: iron, aluminium, copper and compounds: water, plaster of paris, sodium chloride, calcium oxide, sodium sulphate, sodium hydrogen carbonate. ▶ Different Mixtures e.g.: mixture of (i) salt and sugar, (ii) sand and salt, honey, milk, butter, cough syrup, etc. ▶ Iron powder, sulphur, burner, tongs. ▶ Some homogeneous mixtures- alloys, sugar solution and acetic acid in water, milk. ▶ Heterogeneous mixtures: - sand & salt, sand & water, kerosene & water, chalk powder & water etc.

Elements, Compounds and Mixtures (experimental techniques)

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<p>undergoing a chemical change.</p> <p>▶ Types of mixtures: -</p> <ul style="list-style-type: none"> ☛ Homogeneous & Heterogeneous mixtures ☛ On the basis of State: Solid –solid; Solid-liquid; Liquid-liquid. <p>▶ Separation techniques:</p> <ul style="list-style-type: none"> ☛ evaporation, ☛ distillation, ☛ use of separating funnel, ☛ sublimation, ☛ fractional distillation. <p>▶ Examine the principle behind each separation technique.</p> <p>▶ Chromatography as a separation technique; Paper chromatography.</p>	<p>stoichiometric quantities and heat. The compound iron sulphide is formed.</p> <p>▶ Differentiating some mixtures as homogeneous and heterogeneous and explaining the differences between them.</p> <p>▶ Collecting samples of solid-solid, solid-liquid, liquid-liquid types of mixtures from daily life.</p> <p>▶ Demonstrating some separation techniques:</p> <ul style="list-style-type: none"> ☛ Evaporation - separate salt from water. ☛ Distillation - obtain pure liquid (water) from impure liquid (impure water). ☛ Separating funnel - two immiscible liquids (kerosene/oil & water). ☛ Sublimation- ammonium chloride. ☛ Fractional distillation - two miscible liquids (alcohol & water) <p>▶ Organising a discussion of the preference and order of use of separation techniques in the separation of two or three component mixtures and explaining the reason for preferring that particular order of technique.</p> <p>▶ Discussing the principle of Paper Chromatography, and characteristics of stationary phase, mobile phase; – demonstration: Performing an experiment for separation of different colours of a marker pen. Discussing the solvent system used.</p>	<p>▶ Apparatus: beaker, china dish, glass rod, tripod stand, wire gauze, R.B. flask, cork, bent glass tube, boiling tube funnel, distillation apparatus, Separating funnel.</p> <p>▶ Chemicals: alcohol, ammonium chloride, kerosene, common salt.</p> <p>▶ A small jar/ petri dish, pigment/ ink, suitable solvent/ water. Whatman no. 1 paper.</p>

Integration: Geography



Theme 4: Atomic Structure

This theme will enable children to understand that every matter is made up of tiny particles known as atoms and molecules. Molecules are also made up of atoms. Hence atoms are the building blocks of matter. The physical and chemical properties of matter are governed by atoms. Therefore, the knowledge of the concepts of atoms of elements, molecules of elements and compounds and radicals of compounds is necessary to understand different processes and principles of Chemistry.

Learning Outcomes:

Children will be able to:

- define atom, molecule and radical;
- discuss the significance of valency of elements and radicals;
- define valency in terms of number of hydrogen atoms combined or replaced by one atom of the element;
- apply the definition based on hydrogen atom to find out the valency of other elements and radicals;
- correlate the valency of the elements with group number of periodic table.

Atomic Structure		
Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<p>Atoms, Molecules and Radicals</p> <ul style="list-style-type: none"> ▶ An atom is the smallest particle of an element. ▶ It is not capable of independent existence. ▶ The properties of an element depend upon the atoms constituting it. ▶ A molecule is the smallest particle of an element or compound, capable of independent existence. It consists of one or more than one atom of the same or different elements. ▶ A radical is a single atom of an element or a group of atoms of different elements behaving as single charged unit. ▶ Atomicity (no. of atoms in an entity) of elements and compounds – mono atomic, di atomic, tri atomic, polyatomic. ▶ Associate the first 20 elements in the periodic table with their names and symbols ▶ Valency is the combining capacity of an element or the number of hydrogen atoms with which it combines or replaces. 	<ul style="list-style-type: none"> ▶ Discussing about atoms, molecules and radicals and explain the difference between them. ▶ Discussing different examples of elements having mono, di, tri and poly atomicity. ▶ Preparing a list of some elements and radicals which have valency of 1, 2, 3 and 4. ▶ Explaining the meaning of valency and correlating the valency with the group number of the periodic table. ▶ Discussing that development of the periodic table is a classification of the element and is based on their physical and chemical properties. 	<ul style="list-style-type: none"> ▶ Periodic table. ▶ Valency cards made by writing name, symbol and valency of an element. Children can play a game of identifying the card of a specific element and score a point.

Integration: Physics

Theme 5: Language of Chemistry

Chemistry involves the study of a large number of elements and compounds that also have been learnt earlier with their representation by their short hand notations i.e. symbols and formulae. This theme will enable children to understand that it is not convenient to write the full names of the elements and compounds, and the use of symbols has made the job of the chemists much easier. In addition, they will further realize that Chemistry also involves the occurrence of a large number of chemical reactions that are written in the form of equations known as chemical equations. The writing of chemical equations involves writing of reactants and products as their symbols and formulae. Thus symbols and formulae have also made writing of chemical equations in Chemistry very convenient.

Learning Outcomes:

Children will be able to:

- ☑ identify the names of reactants and products of different chemical reactions;
- ☑ write a chemical reaction in the form of a chemical word equation;
- ☑ recognize the usefulness of a word equation.

Language of Chemistry

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<p>Chemical reactions</p> <ul style="list-style-type: none"> ▶ A chemical reaction may take place when two or more reactants come in contact with one another and transfer of energy takes place. ▶ Characteristics of occurrence of a chemical reaction: Change of: <ul style="list-style-type: none"> ☛ Colour ☛ State ☛ Smell ☛ Evolution of gas ☛ Precipitate formed ☛ Heat evolved / released ▶ Chemical Equations: <ul style="list-style-type: none"> ☛ Writing word equations for chemical reactions and emphasize on the observational skills and the names of products formed ☛ Some examples of word equations for practice. 	<ul style="list-style-type: none"> ▶ Demonstration by teacher: Adding dilute HCl to solid sodium carbonate taken in a test tube. A reaction takes place with the evolution of gas. ▶ Demonstration by teacher of these changes through activities: <ul style="list-style-type: none"> ☛ Colour: KI + Lead acetate reaction. Yellow colour formed. Precipitate is also formed. ☛ Heat NH_4Cl. NH_3 gas is evolved. ☛ $\text{HCl} + \text{NaOH}$; heat is evolved. ▶ Guiding children to identify the reactants and products of the reaction, put an arrow in between the reactants and products with the arrow pointing towards the products side. ▶ Involving each child to write word equations of some simple reactions. 	<ul style="list-style-type: none"> ▶ HCl, solid Na_2CO_3, ▶ KI, Lead acetate, NH_4Cl, NaOH, Dilute HCl. ▶ Test tube, burner.

Integration: Physics

Theme 6: Metals and Non-Metals

In day-to-day life many elements are commonly found such as iron, aluminium, zinc, lead, chlorine, carbon, sulphur etc. and their compounds. The elements have been classified in two classes, namely metals and non-metals. In this theme children will learn the classification of elements as metals and non-metals on the basis of their properties.

Learning Outcomes:

Children will be able to:

- ☑ differentiate between metals and non-metals on the basis of their physical properties such as lustre, conduction of electricity and heat, malleability, ductility, sonority, melting point, boiling point, density, strength;
- ☑ describe common uses of some of the metals and non-metals;
- ☑ describe the cause of corrosion of iron and other metals;
- ☑ list different ways of preventing corrosion of metallic articles used in daily life;
- ☑ list some properties and uses of metalloids.

Metals and Non-Metals

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<p>Metals, non-metals</p> <ul style="list-style-type: none"> ➤ Properties ➤ Distinguish between metals and non-metals with the general properties (lustre, conduction of electricity, heat, malleability, ductility, sonority, melting point, boiling point, density, strength.) ➤ Classification of elements as metals & non-metals. ➤ Corrosion of iron (rusting); ways to prevent rusting (oiling, painting, chrome plating, galvanization, tinning) (avoiding contact with air and water vapour). ➤ Uses of certain metals (iron, gold, copper, aluminium, zinc, lead, magnesium). ➤ Metalloids: elements that show the properties of both metals and non-metals – e.g. silicon, germanium, 	<ul style="list-style-type: none"> ➤ Asking children to name some metals that they know of/have seen being used in daily life. ➤ Examining the properties of metals and non-metals through activity: <ul style="list-style-type: none"> ☛ Taking a small iron nail, a coal piece, aluminium wire, and pencil lead. Beating each separately with a hammer and recording the observations. (malleability). ☛ Making separate electric circuits using a metal and a non-metal (Al wire, coal piece) - (conductivity). ☛ Dropping the above samples one by one. Noting the sound produced –(sonority). ➤ Classifying elements on the basis of their properties. ➤ Demonstrating that moisture and oxygen in air are responsible for the corrosion; reaction of corrosion in words: <p>Activity: Take three test tubes. Iron nails are placed in them. In 1st iron nails are dipped in water, in 2nd, put a piece of quick lime so as to make the tube moisture free, in 3rd tube, add water and a few drops of dilute acid. Keep the test tubes aside for a few days and ask</p> 	<ul style="list-style-type: none"> ➤ Collection of some metals such as copper, iron nail, a coal piece, aluminium wire, and pencil lead. ➤ Collection of rusted articles made of iron. ➤ Article made of copper. ➤ Water pipes used in houses to show that they are galvanized to prevent rusting. ➤ Iron pieces, grease, paint.

Metals and Non-Metals

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
tungsten, antimony); uses.	<p>children to observe and then draw conclusions.</p> <p>The basic nature of rust can be tested using litmus paper.</p> <ul style="list-style-type: none"> ➤ In case of copper, green deposit on the surface of articles made of copper can be observed. ➤ Discussing examples such as the iron pillar at Qutab Minar which has not rusted for the last 1600 years. It highlights the achievements of ancient India in technology. ➤ Discussing that rusting of iron can be prevented if the metal does not come in direct contact with air and water. This can be shown experimentally by applying grease/ coating of paint on the surface of an iron object. ➤ Iron pipes used in homes to carry water are galvanized to prevent rusting. Refer to cooler in homes. ➤ Asking children to identify some metals used in daily life. ➤ Discussing some properties of silicon, germanium, tungsten and antimony to justify them as metalloids. 	

Integration: Physics, Geography



Theme 7: Air and Atmosphere

Air is a mixture of some gaseous components which have wide use in daily life. For example, nitrogen is an important constituent of fertilizers and oxygen is essential for our body for sustenance of life. These gases have important physical and chemical properties and uses.

Learning Outcomes:

Children will be able to:

- ☑ review that air is a mixture of gases;
- ☑ recall the components of air;
- ☑ discuss the use of oxygen and nitrogen in different life processes;
- ☑ explain from an activity that mass change takes place on combustion;
- ☑ express the reaction in the form of word equation;
- ☑ describe the preparation of oxygen in the laboratory using potassium chlorate/ hydrogen peroxide and manganese dioxide as a catalyst;
- ☑ understand the concept of catalyst.

Air and Atmosphere

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<ul style="list-style-type: none"> ➤ Air a mixture of gases. ➤ Composition of air and uses of its components. ➤ Oxygen is needed for combustion. ➤ Mass change during burning (burning of magnesium and candle). ➤ Word equations for reactions of metals and non-metals (S, C, P, Na, K, Ca, Mg) with O. ➤ Products formed in acid rain; effects of acid rain. ➤ Air quality. 	<ul style="list-style-type: none"> ➤ Revisiting earlier concepts. ➤ Building on children's previous learning. ➤ Discussing that concentration of components of air is not fixed at all places. Hence it is a mixture. ➤ Making a Pie chart presentation to show the composition of air and discussing the same with children. ➤ Preparing a list of the uses of oxygen, nitrogen and carbon dioxide. ➤ Activity: placing a candle in a plate of water. Candle goes off when oxygen is used up. (Recall demonstration in class VI). ➤ Demonstration: Weighed quantity of magnesium is burnt in air and magnesium dioxide so formed is weighed. There is an increase in mass due to gain of oxygen from the atmosphere in the formation of MgO. ➤ Guiding the children to write word equations of the reactions. ➤ Identifying that in acid rain, the acidic oxides, namely SO₂, CO₂, nitrogen oxides dissolve in rain water. The acids so formed damage the heritage 	<ul style="list-style-type: none"> ➤ Pie chart. ➤ Candle in plate of water. ➤ Magnesium ribbon. ➤ Burner, tongs, weighing scale. ➤ Apparatus to prepare O₂ gas. ➤ Potassium chlorate, manganese dioxide and hydrogen peroxide. ➤ Project.

Air and Atmosphere

Key Concepts / Concerns	Pedagogy/ Transactional Strategies*	Suggested Learning Resources
<ul style="list-style-type: none"> ▶ Study the properties of oxygen: (physical properties to include colour, odour). ▶ Distinguish between: <ul style="list-style-type: none"> ▶ Respiration and combustion, ▶ Combustion and rusting. 	<p>buildings like the Taj Mahal. The stone of Taj Mahal is CaCO_3 which reacts with acids present in rain.</p> <ul style="list-style-type: none"> ▶ Preparing a report in groups on the effects of acid rain on Taj Mahal and the efforts of the Government. Waste gases from factories, emission from vehicles contributing to the change in the composition of air and damaging environment. ▶ Organising children's activity – assigning in groups on a Project on the consequences of acid rain on bridges, cars, machines, coral reef, aquatic organisms, agriculture and presenting the findings in class. ▶ Demonstrating reactions of combustion of wood and rusting of spade. 	

Integration: Physics, Geography, Biology, Languages

