# ICSE Class VIII

## Chemistry Syllabus

### Theme 1: Matter

**In earlier classes, Matter was introduced and discussed as composed of atoms/molecules and that it is found in the forms of solids, liquids and gases. In this class the aim of the theme is to enable children to understand that these states are compared on the basis of inter particle state and inter particle collision. The Kinetic theory of matter will be introduced to explain the change of state. They will understand that in a physical and chemical change, the total mass before and after the change remains the same which is known as the law of conservation of mass. Explanation of this theory and law would help them in understanding other behaviour of matter.**

### Learning Outcomes:

Children will be able to:

- describe the main postulates of the kinetic theory of matter;
- explain the reason of change of one state of the matter to another and vice-versa on the basis of inter particle space and inter particle attraction and collision;
- define and explain the law of conservation of mass using an example.

| Matter | | |
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| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| Main postulates of kinetic molecular theory of matter. | Describing and discussing the main postulates of kinetic theory of matter.<br>Discussing inter particle space and inter particle attraction and collision.<br>(Inter particle space and inter particle attraction varies from one state of matter to another. Hence the conditions of change of state of a matter are different from the other.) | Film on the collision of particles and the exchange of energy. |
| Explanation of change of state of the matter on the basis of inter particle space and inter particle attraction and collision. | | |
| Law of conservation of mass. (statement and explanation with examples). | Stating the law of conservation of mass.<br>Activity to show that there is no change in total mass when a physical and chemical change takes place. (If the reaction involves combustion in presence of air, the mass of $O_2/N_2$ is also to be considered)<br>Total mass of reactants including the mass of atmospheric gases if any, will be equal to the mass of the products formed.<br>☛ Taking the example of reaction of barium chloride with sodium sulphate. | Chemicals and glass wares, barium chloride, sodium sulphate, weighing balance, test tubes, distilled water, filter paper, funnel and beaker. |

**Integration:** Physics

# Theme 2: Physical and Chemical Changes

**This theme will enable children to understand that there are different types of changes in our surroundings which as slow/fast, reversible/irreversible, periodic/non-periodic and physical/chemical. In physical changes, no new substance is formed while in chemical change, a new substance with properties different from the element forming that substance is formed. Learning of these changes will also help in developing different scientific skills amongst them.**

## Learning Outcomes:

Children will be able to:

- ☑ illustrate different changes occurring in nature with examples learned in previous classes;
- ☑ perform some activities to show some well-known changes;
- ☑ differentiate between physical and chemical changes and classify the changes.

| Physical and Chemical Changes | | |
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| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| ▸ Revise and review the topic on Physical and Chemical Changes taught in earlier classes.<br>▸ Physical and Chemical changes – Classification with examples. | ▸ Providing opportunities to children to recapitulate their previous knowledge during group discussion. Bridging any gaps in their understanding.<br>▸ Building on children's previous learning.<br>▸ Providing a list of changes like- inflated balloon will burst when brought near a lighted bulb. | ▸ List of physical and chemical changes:<br>☛ Formation of curd form milk<br>☛ Curdling of milk<br>☛ Rotting of eggs<br>☛ Rusting of iron<br>☛ Melting of ice<br>☛ Formation of vapours<br>☛ Sublimation of camphor |

**Integration:** Geography, Biology, Languages

# Theme 3: Elements, Compounds and Mixtures

**In previous classes, children were informed about the classification of matter into – elements, compounds and mixtures. Mixture is an important class of matter as most of the matter in nature is found in the form of mixture. In this class children will be enabled to understand that there are various techniques by which components of mixture can be separated.**

## Learning Outcomes:

Children will be able to:

- recall previous knowledge related to elements, compounds and mixtures;
- classify substances into elements, compounds and mixtures on the basis of their properties;
- perform activities to separate components of a mixture;
- explain the principle involved in using a particular technique in separating a mixture.

| Elements, Compounds and Mixtures | | |
|---|---|---|
| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| ▸ Revision of Elements, Compounds and Mixtures taught in earlier classes.<br>▸ Elements, compounds and mixture – a brief explanation.<br>▸ Separation of the components of a mixture.<br>▸ Emphasis on the principle of separation. | ▸ Revisiting earlier concepts.<br>▸ Building on children's previous learning.<br>▸ Organising the discussion of the topic concerned by question- answer method.<br>▸ Give feedback to the children about the gaps found in their learning.<br>▸ Activities performed by children to separate the components of 2-3 mixtures involving different techniques. E.g.-<br>☛ $CaCO_3$ and NaCl<br>☛ kerosene and water<br>▸ Discussing the principle of the techniques involved in separation of different mixtures. | ▸ Collection of samples of some elements, compounds and mixtures. |

# Theme 4: Atomic Structure

**This theme focuses on developing children's understanding about the atom as the building block of all types of matter. Therefore, in science, it becomes important to know about the atom and its structure.**
**In fact, everything on this earth is made up of atoms. It is the atom of an element that takes part in chemical reactions.**

## Learning Outcomes:

Children will be able to:

- describe that an atom consists of electrons, protons and neutrons;
- define atomic number and mass number;
- discuss valency of elements and radicals with respect to the number of hydrogen atoms combining with one atom of the element.

| Atomic Structure | | |
|---|---|---|
| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| ▸ Fundamental subatomic particles present in an atom: electrons, protons, neutrons.<br>▸ Nucleus and extra nuclear parts.<br>▸ Atomic number and mass number. | ▸ Discussing historical perspective of discovery of electrons, protons and neutrons.<br>▸ Identifying that a nucleus consists of protons and neutrons. Electrons are present in its extra nuclear part.<br>▸ Describing that atomic number (Z) is the number of protons in an atom. It is also equal to the number of electrons in an atom.<br>▸ Mass number: it is the sum of the number of protons and neutrons in an atom. | ▸ Books of science /Chemistry<br>▸ Charts/Models showing the structure of atom |

**Integration:** Physics.

# Theme 5: Language of Chemistry

**In previous classes, discussions about the symbols of elements and the formulae of compounds help in expressing their long names as short-hand notations which forms the language of Chemistry. In this class children will develop the ability to derive the Formulae of compounds if symbols of elements/radicals forming the compound and their valencies are known. They will also be able to write chemical equations if the reactants and products and their symbols/ formulae are known to them.**

## Learning Outcomes:

Children will be able to:

- recall the symbols of different elements;
- derive the formulae of compounds on the basis of valencies of elements and radicals;
- write chemical equation of a reaction;
- balance chemical equations by applying the law of conservation of mass.

| Language of Chemistry | | |
|---|---|---|
| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| Symbols of elements.<br>Formulae of compounds.<br>Chemical equations (from word equations).<br>Law of conservation of mass.<br>Balancing simple equations<br>Relate the law to the balancing of simple equations.<br>Information gathered from a chemical equation.<br>Limitations of a chemical equation: Catalyst, conditions for the reaction, state of the reactants and products, nature of the chemical reaction are not gathered from the equation. | Revisiting earlier concepts.<br>Building on children's previous learning.<br>Organising competitions to recapitulate the symbols of elements in the class by using valency cards. (symbols and valency of first twenty elements).<br>Encouraging children to derive Formulae of compounds from valency and symbols/ formulae of elements/ radicals under the guidance of teacher.<br>Writing word equations followed by writing the chemical equation.<br>Explaining the law of conservation of mass and its importance in balancing a chemical equation.<br>Giving practice in balancing simple equations.<br>Specifying the state of the reactants and products as (s), (l) and (g) for solid, liquid and gas respectively by writing them after their symbols/ formulae.<br>Using an equation to discuss with children the information provided and the limitations by/of a chemical equation. | Valency cards.<br>Charts depicting the important and simple chemical equations in which the state of reactants and products is also shown. |

**Integration:** Mathematics, Physics

# Theme 6: Chemical Reaction

**This theme will enable children to understand that several oxides, carbonates and hydrates on heating are converted to other compounds. Oxides of metals and non-metals have basic and acidic character respectively. They will also realize and appreciate that there are different types of reactions such as combinations, decomposition, displacement, double displacement, exothermic and endothermic reactions.**

## Learning Outcomes:

Children will be able to:

- describe different types of chemical reactions with examples;
- identify the type of chemical reaction;
- identify different oxides as basic, acidic, amphoteric and neutral;
- explain the effect of heat on oxides of some metals.

## Chemical Reactions

| Key Concepts / Concerns | Pedagogy/ Transactional Strategies* | Suggested Learning Resources |
|---|---|---|
| ▸ Types of reactions:<br>☛ Combination<br>☛ Decomposition<br>☛ Displacement<br>☛ Double displacement.<br><br>▸ Reactivity series:<br>☛ In reactivity series metals are arranged in order of their reactivity.<br>☛ The metal that displaces the metal ion from the solution is more reactive.<br>▸ Predict the reactivity of metals. | ▸ Explaining that chemical reactions involve breaking of existing bonds and formation of new bonds with absorption or release of energy normally in the form of heat or light. Explaining with examples using chemical equations.<br>▸ Giving examples of reactions from daily life - burning of fuel.<br>▸ Showing burning of a magnesium ribbon.<br>▸ Explaining the different types of reactions with examples and activities:<br>☛ **Synthesis**<br>$CaO + H_2O \rightarrow Ca(OH)_2$<br>$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$<br>$C + O_2 \rightarrow CO_2$<br>☛ **Decomposition**<br>Decomposition of $CaCO_3$, PbO.<br>☛ **Displacement**<br>Displacement of Cu from $CuSO_4$ by Zn.<br>☛ **Double displacement**<br>Both the ions are displaced - NaCl + $AgNO_3$<br>▸ Asking children to arrange metals - Cu, Ag, Al, Mg, Fe in decreasing order of their reactivity by consulting the table of reactivity series.<br>▸ Conducting experiments for different metals with metal salt solution.<br>▸ Demonstrating through activity: | ▸ Magnesium wire, match box.<br>▸ Limestone, tongs, test tube, burner.<br>▸ CuO, ZnO, $Al_2O_3$, litmus paper. |

## Chemical Reactions

| Key Concepts / Concerns | Pedagogy/ Transactional Strategies* | Suggested Learning Resources |
|---|---|---|
| ▸ Endothermic and exothermic processes/ reactions.<br>▸ Neutralization reaction.<br>▸ Decomposition reactions to form Oxides.<br>▸ Classification of oxides:<br>☛ Acidic<br>☛ Basic<br>☛ Amphoteric<br>☛ Neutral.<br>Metal oxides are basic; non-metal oxides are acidic in nature.<br>Acidic oxides react with base and basic oxides react with acids. some oxides such as ZnO, PbO react both with acids and bases. These are amphoteric oxides. | ☛ neutralization of an acid with a base as an exothermic reaction.<br>☛ dissolution of $NH_4Cl$ in water is an endothermic process.<br>▸ Heating metal carbonates, nitrates, sulphates yield oxides and carbon dioxides.<br>Oxides are also formed by heating element in presence of air.<br>☛ Activity-1 Heating limestone strongly over the flame - CaO is formed<br>☛ Activity-2: Heating Lead carbonate strongly - PbO is formed.<br>▸ Dissolving the oxide in water and testing the acidic, basic and neutral oxide with litmus paper. | |

**Life skills:** Critical thinking, observation, interpretation, analysis

# Theme 7: Hydrogen

**This theme focuses on enabling children to know about one gas- Hydrogen and that it is an important constituent of several compounds. It is found in acids and organic compounds. It acts as a fuel which makes its study useful.**

## Learning Outcomes:

Children will be able to:

- describe the preparation of hydrogen from electrolysis of water;
- prepare hydrogen in the lab. using zinc and acid;
- describe properties and uses of hydrogen;
- correlate concepts of oxidation and reduction with addition and removal of oxygen or removal and addition of hydrogen.

| Hydrogen | | |
|---|---|---|
| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| Preparation of hydrogen, from water – electrolysis (Introduction to terms electrode, electrolyte, electrolysis - detailed process not required).<br>Preparation of hydrogen in the laboratory.<br>Preference of zinc as the metal to be used (with reasons).<br>Choice of dilute acids (other than dil. nitric acid).<br>Bosch's process.<br>Properties and uses of hydrogen.<br>Oxidation and Reduction. | Preparing hydrogen by the electrolysis of acidified water.<br>Demonstrating activity to prepare hydrogen by the reaction of Zinc with acid. (It is collected by the downward displacement of water as it is lighter than air)<br>Discussing properties and uses of hydrogen.<br>Correlating the concept of oxidation and reduction with addition and removal of oxygen or removal and addition of hydrogen.<br>Explaining the concept by using the example of one student gaining oxygen and the other losing oxygen, thereby getting oxidised and reduced respectively. | Experimental assembly set up in the lab.<br>Charts on preparation of Hydrogen. |

**Integration:** Physics

# Theme 8: Water

**Water is the one of the most important resources and is a universal solvent. Children will know and understand that water is important for all living beings (animals, human beings, plants and trees), comes from different sources and has many uses. There are different sources of water such as sea, well, river, lake, pond, rain. We use it daily for washing, bathing, drinking and in industries. Water helps in controlling the temperature of the atmosphere.**

## Learning Outcomes:

Children will be able to:

- describe that water dissolves many substances and it is a universal solvent;
- identify a solution, suspension and colloid on the basis of properties;
- state the differences between saturated, unsaturated and supersaturated solutions;
- describe water of crystallization;
- write equations of metals with cold water and steam;
- describe hard and soft water;
- discuss the different methods of softening of water.

| Water | | |
|---|---|---|
| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| ▸ Dissolution of salts in water – meaning and explanation.<br>▸ Universal solvent – meaning.<br>▸ Solutions, suspensions, colloids.<br>▸ Differentiate unsaturated/saturated and supersaturated solutions.<br>▸ Suspensions and colloids.<br>▸ Water of crystallisation.<br>▸ Hydrated and Anhydrous substances, hygroscopic.<br>▸ Reactivity of metals with cold water, hot water and steam (with products formed).<br>▸ Hard and soft water and methods of softening of hard water.<br>▸ Disadvantage of using hard water.<br>▸ Removing hardness of water by boiling or by treating with washing soda. | ▸ Revisiting earlier concepts.<br>▸ Building on children's previous learning.<br>▸ Recognising dissolving capacity of water by conducting experiments on dissolving a number of salts in water.<br>▸ Differentiating between suspension and colloid on the basis of the size of solute particles.<br>▸ Asking children to collect samples of colloids and suspensions under guidance and supervision.<br>▸ Differentiating between saturated, unsaturated and supersaturated solutions on the basis of the quantity of the solute dissolved.<br>▸ Showing children that by heating blue crystals of hydrated copper sulphate, when it turns white due to the loss of water of crystallisation.<br>▸ Showing reaction of metals (e.g. iron, calcium) with cold water and steam.<br>▸ Taking example of CaCl2 for absorbing water from salts.<br>▸ Discussing the presence of silica gel in bottles to absorb moisture.<br>▸ Determining the reactivity of Na, Mg, MgO, CaO etc. with water to show different chemical reactivity.<br>▸ Differentiating between the ability to form lather by hard and soft water to be shown by an activity. | ▸ NaCl, KCl, $Na_2CO_3$ etc.<br>Sugar, water, broken glass rod, burner.<br>▸ Collection of samples of solutions, suspensions, colloids.<br>▸ Copper sulphate crystals.<br>▸ Soap solution, clay in water<br>▸ CaCl2.<br>▸ Silica gel pouch in water bottles.<br>▸ Sodium metal, magnesium ribbon, MgO, CaO.<br>▸ Washing soda. |

# Theme 9: Carbon and its Compounds

**In this theme children will learn the importance of carbon and some of its compounds. It is a constituent of all plants and animals. In fact, a large number of compounds are made up of carbon. It is a very versatile element.**
**Products such as paper, wooden furniture, soaps, food items are made up of carbon as one of their elements and used extensively in daily life activities. The fuel that is used in cars and trucks is also made of carbon.**

## Learning Outcomes:

Children will be able to:

- explain the term allotropy;
- describe different Allotropes of Carbon;
- state the properties of Graphite and Diamond;
- prepare carbon dioxide in a laboratory;
- describe the uses of carbon dioxide;
- demonstrate different reactions of carbon dioxide with lime water and litmus solutions.

| Carbon and its Compounds | | |
|---|---|---|
| **Key Concepts / Concerns** | **Pedagogy/ Transactional Strategies*** | **Suggested Learning Resources** |
| ▸ Allotropes of Carbon - definition and explanation.<br>▸ Crystalline and amorphous nature of allotropes of carbon.<br>▸ Uses of diamond, graphite, coke, coal, soot.<br>▸ Laboratory preparation, properties and uses of carbon dioxide<br>▸ Physical properties of Carbon dioxide.<br>▸ Chemical properties of | ▸ Defining allotropes and explaining it with different examples, -diamond, graphite, coal, etc.<br>▸ Emphasising on different physical properties but same chemical properties of allotropes.<br>▸ Explaining that the properties such as electric and thermal conductivity of the two allotropes are different.<br>▸ Emphasising that the difference in physical properties is due to their different structures. Showing the models of structures and discussing the differences.<br>▸ Making models using clay dough / other molecular models.<br>▸ Discussing the classification of crystalline and amorphous nature of carbon.<br>▸ Defining Allotropes on the basis of their Crystalline and amorphous nature.<br>▸ Making a list of the uses of diamond, graphite, coke, coal, soot from the literature and internet.<br>▸ Demonstrating the preparation of $CO_2$ from marble/ $Na_2CO_3$ and dil. HCl and showing its collection by upward | ▸ Models of structures of Diamond and Graphite.<br>▸ Sample of Graphite as an electrode.<br>▸ Woulff bottle/ R.B. flask, delivery tube, thistle funnel, jar. Dil. HCl, marble pieces/ $Na_2CO_3$ |

## Carbon and its Compounds

| Key Concepts / Concerns | Pedagogy/ Transactional Strategies* | Suggested Learning Resources |
|---|---|---|
| Carbon Dioxide.<br>▸ Acidic nature.<br>▸ Reaction with lime water.<br><br>▸ Properties and uses of Carbon monoxide.<br><br>▸ Emphasis on use as reducing agent in the extraction of iron.<br>▸ Emphasize the harmful properties of Carbon monoxide when inhaled - Asphyxia. | displacement of air.<br>▸ Showing physical properties of $CO_2$ with its sample along with its fire extinguishing properties.<br>▸ $CO_2$ shows many important chemical reactions such as:<br>☛ It reacting with basic oxides such as $Na_2O$, MgO to form metal carbonates.<br>☛ Action on lime water: - showing that it turns lime water milky and on passing excess $CO_2$, the milkiness disappears.<br>▸ Explaining Fuel, if not burnt in a good supply of oxygen may lead to the formation of CO. (*traditional cooking methods in villages using cow dung or wood*).<br>▸ Using it in industries as a reducing agent- in metallurgy of iron.<br>▸ Explaining why we should not stand behind a running engine of a vehicle.<br>▸ Discussing Government's efforts to spread the use of LPG even to remote areas of the country. | |

**Integration:** Geography, Biology