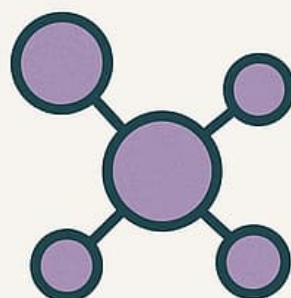
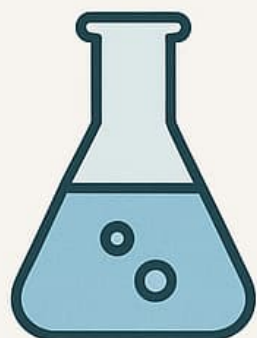
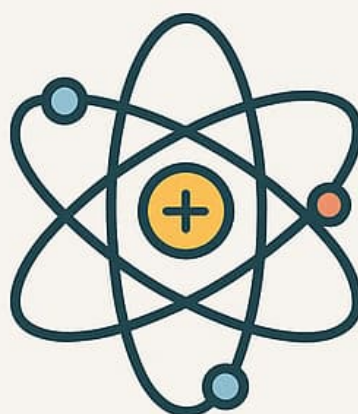


# CHEMISTRY

## CLASS 9 NOTES

Based on NCERT 2025-26

- Comprehensive notes
- Easy to understand language



**JAGDISH BHAKAT**

M.Sc. (Physics), B.Ed.

## CONTENTS

Chapter 01  
NCERT Chapter 01  
Page No. 2-5

### **Matter In Our Surroundings**

Chapter 02  
NCERT Chapter 02  
Page No. 6-10

### **Is Matter Around Us Pure?**

Chapter 03  
NCERT Chapter 03  
Page No. 11-15

### **Atoms And Molecules**

Chapter 04  
NCERT Chapter 04  
Page No. 16-19

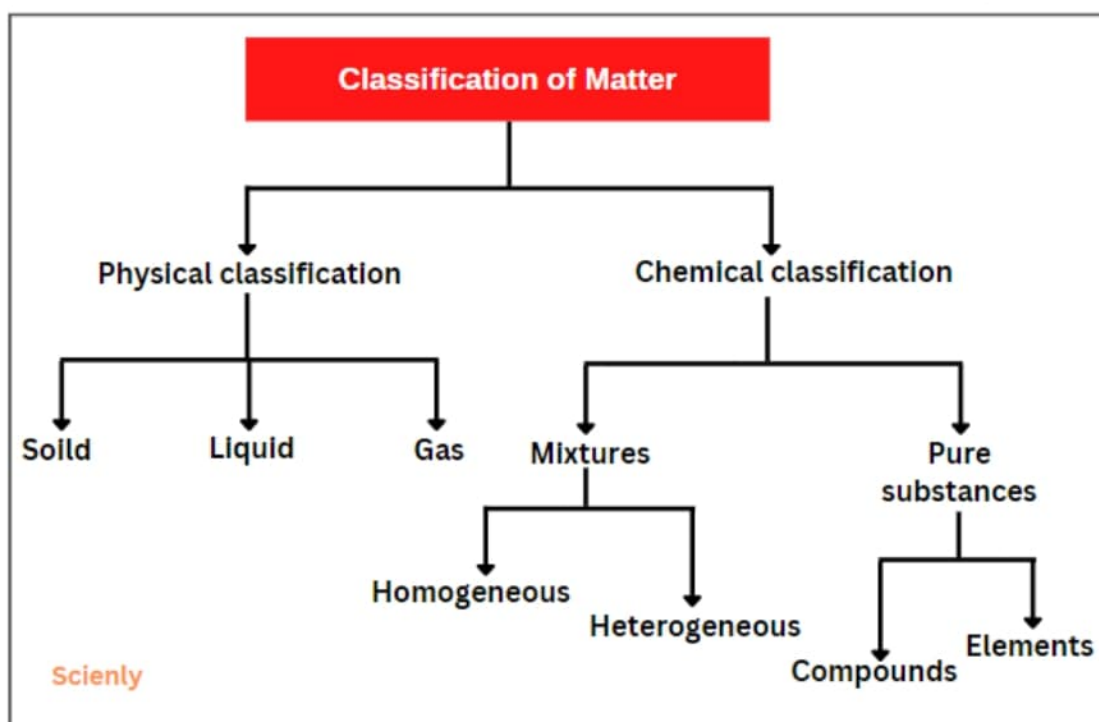
### **Structure Of The Atom**

## Ch 01 – MATTER IN OUR SURROUNDING

⇒ **Matter:** Matter is anything that has mass and occupies space (i.e., has volume).  
Examples: Air, Water, Ice, Wood, Iron, Milk, Sand, Stone, Oil, Sugar, Oxygen, Gold etc.

⇒ **Classification of Matter**

Modern day scientists have evolved two types of classification of matter based on their physical properties and chemical nature.



⇒ *Note: This chapter is all about matter based on physical properties i.e. physical classification of matter.*

⇒ **Physical Nature of Matter**

- Matter is Made Up of Particles
- Particles of Matter are Very Small *(they are small beyond our imagination!!!!)*

⇒ **Characteristics of Particles of Matter**

- Particles of Matter Have Spaces Between Them
- Particles of Matter are Constantly Moving
- Particles of Matter Attract Each Other

⇒ Particles of matter are continuously moving, that is, they possess kinetic energy.

⇒ Particles of matter move faster with the rise of temperature. So, we can say that with increase in temperature the kinetic energy of the particles also increases.

⇒ Particles of matter intermix on their own with each other. They do so by getting into the spaces between the particles. This intermixing of particles of two different types of matter on their own is called **diffusion**.

⇒ Particles of matter have force acting between them. This force keeps the particles together. The strength of this force of attraction varies from one kind of matter to another.

⇒ **States of Matter:** matter around us exists in three different states – solid, liquid and gas. These states of matter arise due to the variation in the characteristics of the particles of matter.

⇒ **Characteristics of Solids:**

- Fixed shape and fixed volume.
- Particles are tightly packed and arranged in a regular pattern.
- Strong forces of attraction between particles.
- Cannot be compressed easily.
- Do not flow like liquids or gases.
- Particles only vibrate at their fixed positions.

⇒ **Characteristics of Liquids:**

- Liquids have a fixed volume but no fixed shape.
- They take the shape of the container they are kept in.
- Particles are loosely packed and can move past each other.
- Liquids can flow easily.
- They have less force of attraction between particles compared to solids.
- Examples: Water, milk, oil.

⇒ **Characteristics of Gas:**

- No fixed shape (they take the shape of the container).
- No fixed volume (they spread out to fill the container).
- Particles are far apart and move freely.
- Very weak forces between particles.
- Easily compressible (can be pressed into smaller spaces).
- Flow easily and can mix quickly with other gases.

⇒ **What is Compressibility?**

- Compressibility is the ability of a substance to be pressed or squeezed into a smaller volume.
- Gases are highly compressible, liquids are very slightly compressible, and solids are almost incompressible.
- The liquefied petroleum gas (**LPG**) cylinder that we get in our home for cooking or the oxygen supplied to hospitals in cylinders is compressed gas.
- Compressed natural gas (**CNG**) is used as fuel these days in vehicles. Due to its high compressibility, large volumes of a gas can be compressed into a small cylinder and transported easily.

⇒ **What is Fluidity?**

- Fluidity is the ability of a substance to flow easily.
- Liquids and gases show fluidity because their particles can move past each other.

⇒ **Diffusion of Particles of Solid, Liquid and Gas**

- The gases from the atmosphere diffuse and dissolve in water. These gases, especially oxygen and carbon dioxide, are essential for the survival of aquatic animals and plants.
- Solids, liquids and gases can diffuse into liquids. The rate of diffusion of liquids is higher than that of solids. This is due to the fact that in the liquid state, particles move freely and have greater space between each other as compared to particles in the solid state.

⇒ **Change in States of Matter:** Matter can change from one state to another (solid, liquid, gas) when we change its temperature or pressure.

- Heating increases the movement of particles and changes solids to liquids and liquids to gases.
- Cooling slows down the particles and changes gases to liquids and liquids to solids.

⇒ *On increasing the temperature of solids, the kinetic energy of the particles increases. Due to the increase in kinetic energy, the particles start vibrating with greater speed. The energy supplied by heat overcomes the forces of attraction between the particles. The particles leave their fixed positions and start moving more freely. A stage is reached when the solid melts and is converted to a liquid. This process is known as **Fusion**.*

⇒ *The minimum temperature at which a solid melt to become a liquid at the atmospheric pressure is called its **melting point**. The melting point of ice is 273.15 K.*

⇒ *Kelvin is the SI unit of temperature,  $0^{\circ}\text{C} = 273.15\text{ K}$ . For convenience, we take  $0^{\circ}\text{C} = 273\text{ K}$  after rounding off the decimal. To change a temperature on the Kelvin scale to the Celsius scale you have to subtract 273 from the given temperature, and to convert a temperature on the Celsius scale to the Kelvin scale you have to add 273 to the given temperature.*

**Celsius to Fahrenheit:**

$$F = \frac{9}{5} \times C + 32$$

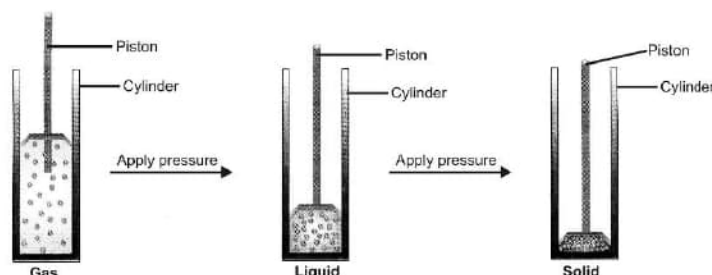
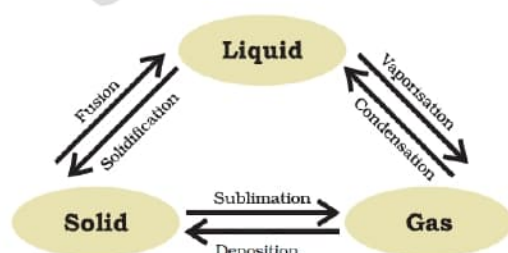
⇒ **Interconversion of States of Matter**

- **Fusion:** Changing of a solid into a liquid by heating.
  - (Example: Ice melting into water.)
- **Vaporisation:** Changing of a liquid into a gas by heating.
  - (Example: Water boiling into steam.)
- **Deposition:** Changing of a gas directly into a solid without becoming a liquid.
  - (Example: Frost forming from water vapor.)
- **Solidification:** Changing of a liquid into a solid by cooling.
  - (Example: Water freezing into ice.)
- **Sublimation:** Changing of a solid directly into a gas without becoming a liquid.
  - (Example: Dry ice turning into gas.)
- **Condensation:** Changing of a gas into a liquid by cooling.
  - (Example: Steam cooling into water.)

*How Pressure Helps in Change of States of Matter?*

⇒ **Liquefaction:** When we increase pressure and lower temperature, a gas can turn into a liquid, this is called liquefaction. Example: Oxygen gas is turned into liquid oxygen by cooling and applying high pressure.

⇒ Decreasing pressure can help a solid directly change into a gas, like dry ice (solid  $\text{CO}_2$ ) turning into gas. – *Fire Extinguisher*



- ⇒ **Melting Point:** The minimum temperature at which a solid changes into a liquid.
  - (Example: Ice melts at 0°C.)
- ⇒ **Boiling Point:** The minimum temperature at which a liquid changes into a gas.
  - (Example: Water boils at 100°C.)
- ⇒ **Condensation Point:** The minimum temperature at which a gas changes into a liquid.
  - (Example: Steam condenses into water at 100°C.)
- ⇒ **Freezing Point:** The minimum temperature at which a liquid changes into a solid.
  - (Example: Water freezes at 0°C.)
  
- ⇒ **Latent Heat of Fusion:** The amount of heat required to change 1 kg of a solid into a liquid without changing its temperature.
  - (Example: Heat needed to melt ice into water.)
  - Particles in water at 0°C (273 K) have more energy as compared to particles in ice at the same temperature.
  - This is because particles in liquid have absorbed extra energy in the form of latent heat of fusion.
- ⇒ **Latent Heat of Vaporisation:** The amount of heat required to change 1 kg of a liquid into gas without changing its temperature.
  - (Example: Heat needed to boil water into steam.)
  - Particles in steam, that is, water vapour at 373 K (100°C) have more energy than water at the same temperature.
  - This is because particles in steam have absorbed extra energy in the form of latent heat of vaporisation.
  
- ⇒ **Evaporation:** Evaporation is the process in which a liquid change into a gas at any temperature below its boiling point. It takes place only at the surface of the liquid. During evaporation, the particles of the liquid absorb heat energy from the surroundings and escape into the air as gas. This process also causes cooling.
- ⇒ **Factors Affecting Evaporation**
  - **Temperature:** Higher temperatures increase the kinetic energy of liquid molecules, allowing more to escape into the gas phase.
    - Water evaporates faster on a hot day compared to a cold day.
  - **Surface Area:** A larger surface area exposes more molecules to the air, facilitating greater evaporation.
    - Spreading a wet cloth out to dry will evaporate faster than if it is bunched up.
  - **Humidity:** Lower humidity levels in the surrounding air allow more liquid molecules to evaporate, as dry air can hold more water vapor.
    - Clothes dry faster on a dry, sunny day than on a humid, rainy day.
  - **Wind Speed:** Increased air movement removes saturated air from the liquid's surface, replacing it with drier air and enhancing evaporation.
    - A breeze helps sweat on your skin evaporate faster, cooling you down.
  - **Atmospheric Pressure:** Lower atmospheric pressure makes it easier for particles to escape from the liquid, so evaporation happens faster.
    - Water boils at a lower temperature on a mountain (lower pressure), and evaporation happens faster at higher altitudes.

## Ch 02 – IS MATTER AROUND US PURE?

⇒ **Pure Substance:** A pure substance is a matter that consists of only one type of particle—either a single element or a single compound—and has uniform properties throughout.

### Types of Pure Substances:

- Elements – made of only one kind of atom (e.g., oxygen, gold).
- Compounds – made of two or more elements chemically bonded in fixed proportions (e.g., water, carbon dioxide).

### Characteristics of Pure Substance:

- Cannot be separated into other substances by physical means.
- Has consistent physical and chemical properties (like boiling point, melting point).

⇒ **Mixture:** A mixture is a combination of two or more substances that are physically combined but not chemically bonded. Each substance in a mixture retains its own chemical identity and properties.

### Types of Mixtures:

- Homogeneous Mixture – uniform composition throughout (e.g., salt water, air).
- Heterogeneous Mixture – non-uniform composition with visibly different parts (e.g., salad, sand and iron filings).

### Characteristics of Mixture:

- Components can usually be separated by physical methods (like filtration, evaporation).
- The composition can vary (unlike a pure substance).
- Physical properties depend on the nature and ratio of components.

⇒ **Solution:** A solution is a type of homogeneous mixture in which one substance (**the solute**) is uniformly dissolved in another substance (**the solvent**).

### Examples:

- Salt water – salt is the solute; water is the solvent.
- Air – oxygen and other gases dissolved in nitrogen.
- Sugar in tea – sugar is the solute; tea is the solvent.

**Solute and Solvent:** The component of the solution that dissolves the other component in it (usually the component present in larger amount) is called the solvent. The component of the solution that is dissolved in the solvent (usually present in lesser quantity) is called the solute.

### Examples of Solutions:

- A solution of sugar in water is a solid in liquid solution. In this solution, sugar is the solute and water is the solvent.
- A solution of iodine in alcohol known as '**tincture of iodine**', has iodine (solid) as the solute and alcohol (liquid) as the solvent.
- Aerated drinks like soda water, etc., are gas in liquid solutions. These contain carbon dioxide (gas) as solute and water (liquid) as solvent.
- Air is a mixture of gas in gas. Air is a homogeneous mixture of a number of gases. Its two main constituents are: oxygen (21%) and nitrogen (78%). The other gases are present in very small quantities.

⇒ **Alloys:** Alloys are mixtures of two or more metals or a metal and a non-metal and cannot be separated into their components by physical methods. But still, an alloy is considered as a mixture because it shows the properties of its constituents and can have variable composition. For example, brass is a mixture of approximately 30% zinc and 70% copper.

⇒ **Properties of a Solution:**

- A solution is a homogeneous mixture.
- The particles of a solution are smaller than 1 nm ( $10^{-9}$  metre) in diameter. So, they cannot be seen by naked eyes.
- Because of very small particle size, they do not scatter a beam of light passing through the solution. So, the path of light is not visible in a solution.
- The solute particles cannot be separated from the mixture by the process of filtration.
- The solute particles do not settle down when left undisturbed, that is, a solution is stable.
- A solution can be solid, liquid, or gas. Solutions exist in all three states, depending on the solute and solvent.

⇒ **Concentration of a Solution:**

- Dilute solution: Small amount of solute in a large amount of solvent.
- Concentrated solution: Large amount of solute in a small amount of solvent.
- Saturated Solution: Maximum amount of solute in solvent at a given temperature.
- Unsaturated Solution: Amount of solute less than saturation level.
- Solubility: Solubility is the maximum amount of a solute that can dissolve in a given amount of solvent at a specific temperature and pressure to form a saturated solution.

The concentration of a solution is the amount (mass or volume) of solute present in a given amount (mass or volume) of solution. There are various ways of expressing the concentration of a solution.

$$\text{Mass by mass percentage of a solution} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$\text{Mass by volume percentage of a solution} = \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$$

$$\text{Mass by mass percentage of a solution} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$$

⇒ **Suspension:** A suspension is a heterogeneous mixture in which solid particles are dispersed in a liquid or gas but are not dissolved. The particles in a suspension are large enough to be seen and will settle out over time if left undisturbed.

**Example:**

- Muddy water – soil particles suspended in water.
- Sand in water – sand does not dissolve and settles at the bottom.

**Properties of a Suspension**

- Suspension is a heterogeneous mixture.
- The solute particles can be separated from the mixture by the process of filtration.
- The particles of a suspension can be seen by the naked eye.
- The particles of a suspension scatter a beam of light passing through it and make its path visible.
- The solute particles settle down when a suspension is left undisturbed, that is, a suspension is unstable.
- When the particles settle down, the suspension breaks and it does not scatter light any more.