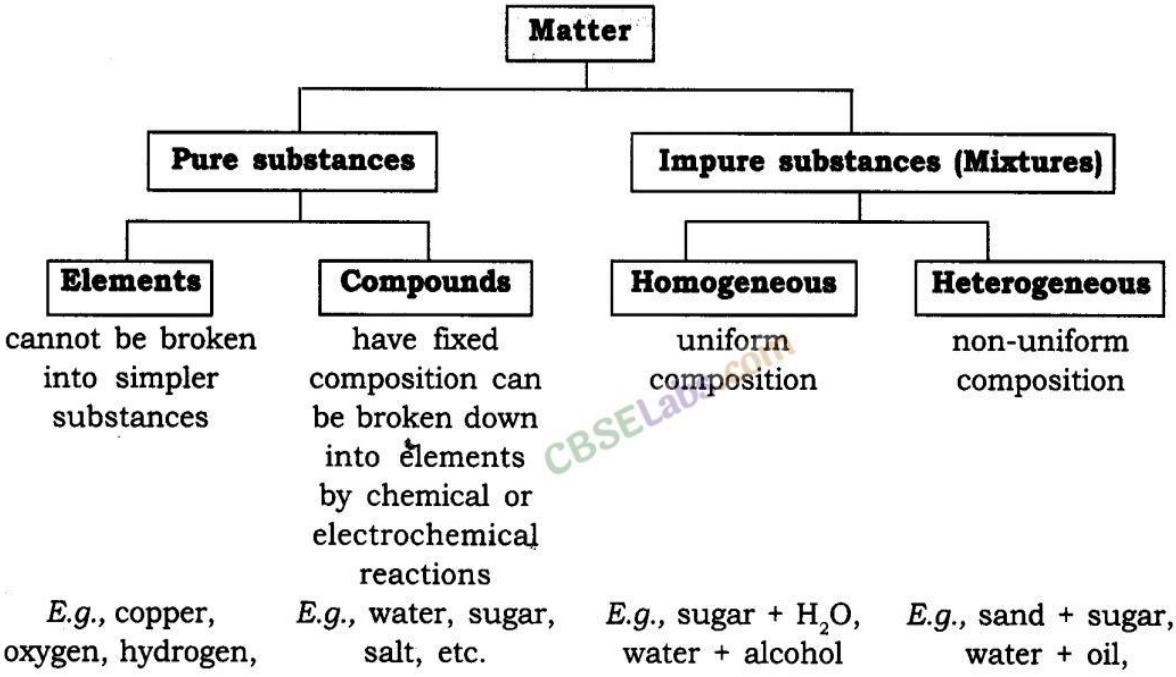
INTERNATIONAL INDIAN SCHOOL BURAIDAH

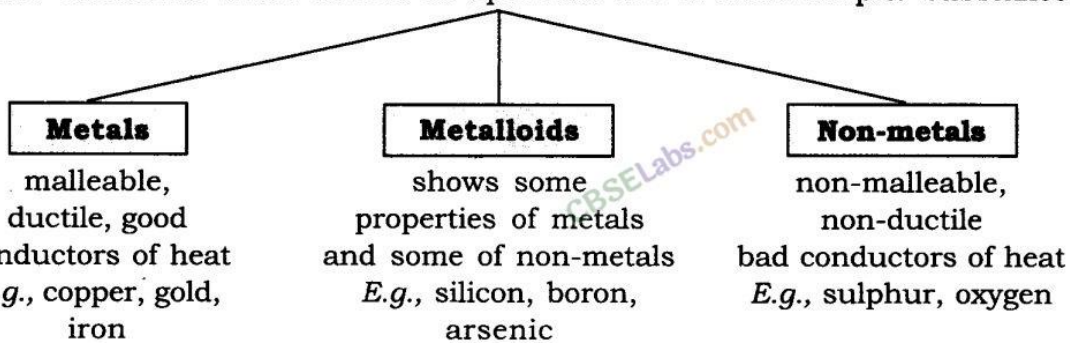
Chapter 2 Chemistry Class 9

CHAPTER 2 IS MATTER AROUND US PURE?



Elements

It is a pure substance which cannot be split into two or more simpler substances.



Compounds
The compound is a **pure substance** made up of two or more elements combined chemically in a definite ratio.

Characteristics:

- The properties of compound differ from those of its constituents.
- Compound has fixed melting point and boiling point.
- Compound is a homogeneous substance.
- Constituent elements can be separated by chemical process.

Mixtures
It is made up of two or more elements or compounds mixed in any ratio/proportion.

Properties:

- It may be homogeneous or heterogeneous.
- The properties of constituent substances are retained.
- No new compound is formed.
- Elements can be separated by simple physical processes.
- It does not have a fixed melting and boiling point.

Concentration of solution:

What is concentration?

C**oncentration** refers to the amount of a substance per defined space or can be defined as the ratio of solute in a solution to either solvent or total solution.

To calculate the concentration consider the formulae below:

- Concentration of solution = $\frac{\text{Amount of solute}}{\text{Amount of solution}}$ or $\frac{\text{Amount of solute}}{\text{Amount of solvent}} \times 100$
- Mass by mass percentage of a solution

$$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

- Mass by volume percentage of a solution

$$= \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$$

Suspension	***Colloidal Solution***
• Size of solute particles are visible with naked eyes • Shows tyndall effect • Translucent • Solute particles settle down	Size of solute particles are not visible with naked eyes. Shows tyndall effect Translucent Colloidal particles do not settle down

Homogenous Mixtures

- When we add sugar, water and lemon juice together they all uniformly mix with each other. Now it is not possible to separate these substances from the mixture. Such mixtures in which the components mix with each other uniformly are called **Homogeneous Mixtures**.
- The ratio of compositions of homogeneous mixtures can be different. **For Example**, one may add two spoons of sugar in lemonade while someone else may add only one spoon of sugar in their lemonade. Still, lemonade is a homogeneous mixture. A mixture of water and milk

Heterogeneous Mixtures

- The components in a heterogeneous mixture do not completely dissolve in each other and we can separate them by physical means. In other words, the composition of such mixtures is not uniform.
- **For Example**, If we mix sand in water the sand settles down in water after some time and we can separate it by filtration. A mixture of oil in water.

SOLUTION

solution is a uniform mixture of two or more substances. Homogenous Mixtures are solutions.

Solution of -

- **Liquid into a liquid:** Water and Ink
- **Solid into solid:** Alloys
- **Gas into gas:** Air
- **Solid into a liquid:** Sugar and Water

- **Solid into gas:** Hydrogen and Metals
- **Liquid into gas:** Carbon Dioxide and Water

What is an alloy?

An alloy is a mixture of different metals or nonmetals and metals that cannot be separated from each other using physical methods. **For Example**

Brass – Copper with up to 50% zinc

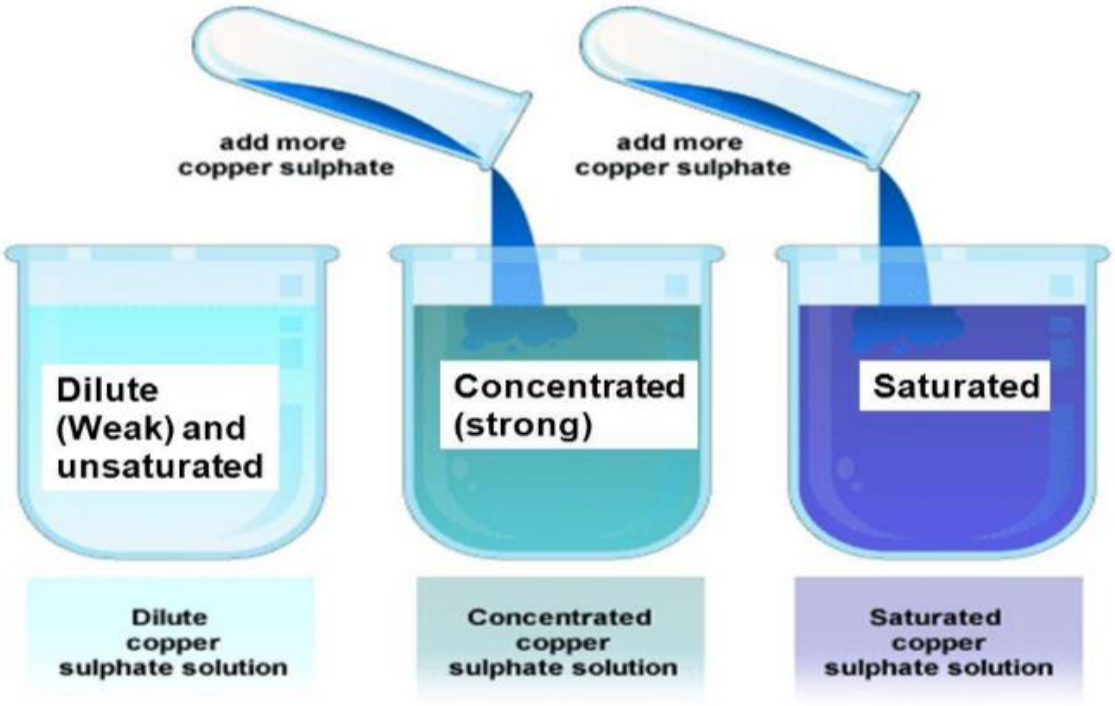
Bronze – Copper with up to 12% tin

Properties of a Solution:

- A solution is a homogeneous mixture.
- We cannot see the particles of a solution through naked eyes as they are as small as 1 nanometer in diameter.
- The path of light is not visible through the solution. The particles of a solution do not scatter light through them as they are extremely small.
- We cannot separate the particles of a solution by methods of filtration.

Different Types of Solutions

- **Dilute** – A solution in which the concentration of the solute is much less than that of the solvent. **For Example**, If we mix 1gm of salt in 500 ml of water, the salt solution thus obtained will be diluted. If we keep on adding the solute in a solution there comes a point when no more solute dissolves in the solution. This is called the **Saturation Point of a Solution**.
- **Unsaturated Solution** – A solution, in which we can add more solute as it has not achieved its saturation level yet, is called an Unsaturated Solution. A dilute solution can be called an **Unsaturated Solution**.
- **Concentrated Solution** – A solution with a large amount of solute is called a **Concentrated Solution**.
- **Saturated Solution** – A solution in which no more solute can be added since it has already dissolved the maximum amount of solute it can is called a **Saturated Solution**.



What is a suspension?

A suspension is formed when two or more substances are mixed in a non-uniform manner. Heterogeneous mixtures are suspensions. The solute does not mix with the solvent and can be viewed through naked eyes.

Properties of Suspensions:

- A suspension is a heterogeneous mixture.
- We can see the particles of suspensions through naked eyes.
- We can see the path of light through the particles of a suspension.
- The particles of suspension tend to settle down when left undisturbed. Then, they can be separated using filtration.

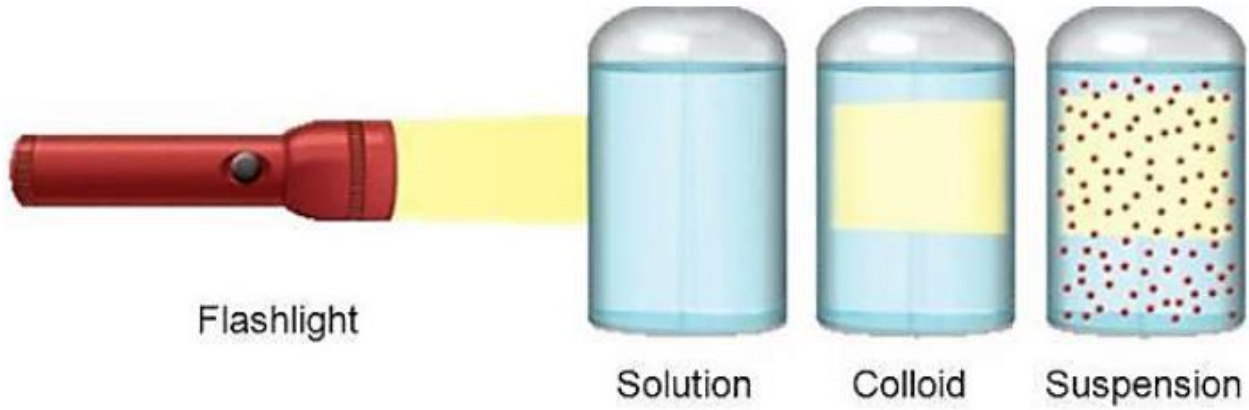
What are colloids or colloidal solutions?

A colloidal solution or a colloid is a uniform solution of two or more substances. The particles are relatively very small and the solution appears as a homogeneous mixture but it is not.

Properties of colloids:

- Colloids are heterogeneous in nature.
- The particles of a colloid cannot be seen through naked eyes.
- The particles scatter a beam of light passed through a colloid and produce the Tyndall effect.

- Colloids are stable in nature. The particles of colloids do not settle down if left uninterrupted.
- We cannot separate the particles of a colloid through filtration. We use a method called **Centrifugation** to separate the particles of a colloid



What is the Tyndall Effect?

When a beam of light is passed through a colloid the particles of the colloid scatter the beam of light and we can see the path of light in the solution. **For Example**, when a ray of light enters a dark room it is scattered by the dust particles present in the air and we can see the path of light clearly.

Classification of Colloids

Dispersed Phase – The dispersed particles or the solute-like components in a colloid
Dispersing Medium – The substance in which these solute-like particles are added
Based on the state of the dispersing medium colloids are classified as:

Types of Colloids

Example	Dispersing Medium	Dispersed Substance	Colloid Type
Fog, Aerosol sprays	Gas	Liquid	Aerosol
Smoke, Airborne bacteria	Gas	Liquid	Aerosol
Whipped cream, Soapsuds	Liquid	Gas	Foam
Milk, Mayonnaise	Liquid	Liquid	Emulsion
Paints, Clays, Gelatin	Liquid	Solid	Sol
Marshmallow, Styrofoam	Solid	Gas	Solid foam
Butter, cheese	Solid	Liquid	Solid emulsion
Ruby glass	Solid	Solid	Solid sol

Physical Change and Chemical Change

Physical Property of a Substance:

Properties of a substance such as rigidity, colour, fluidity, boiling point, melting point, density and hardness which we can observe are called **Physical Properties**.

Physical Change:

When the physical properties of a substance change it is known as a **Physical Change**. When we convert a substance from one state to another, such as a solid into a liquid or vice-versa, it is also a physical change as only the physical nature of the substance changes without affecting its chemical nature.

For Example, Change of ice into water. The chemical properties of water remain the same.

Chemical Property of a Substance:

The chemical nature of a substance is known as its **Chemical Property** such as its odour or its chemical composition.

Chemical Change:

When the chemical properties or chemical composition of a substance gets altered it is called a chemical change. It is also called a **Chemical Reaction**.

For Example, Burning paper

Types of Pure Substances

Pure substances are classified as elements and compounds

Elements

An element is the simplest form of matter. Elements cannot be broken down into further elements by chemical reactions. Elements are further characterised as Metals, Nonmetals and Metalloids

Metals – Silver, Mercury, Copper, Gold

1. Metals are lustrous (shiny)
2. Metals conduct heat and electricity
3. Metals have a silver-grey or gold-yellow colour
4. We can hammer metals and form thin sheets (Malleability)
5. We can convert metals into wires (Ductility)
6. Metals always produce a ringing sound if they are hit (Sonorous)

Non-Metals – Carbon, Iodine, Chlorine, Oxygen, Hydrogen

1. Non-Metals do not conduct heat and electricity
2. Non-Metals are not sonorous, lustrous or ductile
3. Non-Metals have varied colours

Metalloids – Silicon, Germanium

They show some properties of metals and some of the non-metals.

Quick Facts –

1. There are 100 elements known to us
2. 92 elements out of them occur naturally
3. Rest, 8 are man-made elements
4. Most of the elements are solid in nature

5. At room temperature, 11 elements exist in the gaseous state
6. At room temperature, 2 elements exist in the liquid state – bromine and mercury
7. At a temperature slightly higher than room temperature, 2 elements exist in the liquid state – calcium and gallium

Compounds

It is a substance that consists of two or more substances. These substances are combined chemically with each other in fixed proportions. The properties of a compound are different from that of its constituents. **For Example**, Ammonium Sulphate, Sulphur Chloride, Water.

Mixtures vs. Compounds

Mixtures	*Compounds*
Properties of a mixture Reflect the properties of the materials it contains.	Different properties from that of the elements that make up the compounds.
No uniform composition	Definite composition. Definite ratio/formula
Can be separated by physical means.	Cannot be separated by physical means

Q.Differentiate between homogeneous and heterogeneous mixtures with examples.
Answer:

Homogeneous mixtures	***Heterogeneous mixtures***
• It has uniform composition.	It does not have a uniform composition.
• No visible boundaries of separation.	Shows visible boundaries of separation.
• They consist of only one phase. Example: sugar + water → sugar solution.	They consist of more than one phase. Example: sugar + sand

How are sol, solution and suspension different from each other?
Answer:

Sol. (colloid)	***Solution***	***Suspension***
1. Size of solute particles between 1 nm to 100 nm.	Size of solute particles less than 1 nm (10^{-9} m)	Size of solute particles is more than 100 nm.
2. It is stable.	Stable.	Unstable.
3. It scatters a beam of light.	It does not scatter light.	It scatters a beam of light.
4. Solute particles pass through filter paper.	Solute particles pass through filter paper.	Solute particles do not pass through filter paper.

Q. To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293 K. Find its concentration at this temperature.
Answer: Mass of solute (sodium chloride) = 36 g
Mass of solvent (water) = 100 g

Mass of solution = Mass of solute + Mass of solvent
= 36 g + 100 g = 136 g

$$\text{Concentration} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$= \frac{36}{136} \times 100 = 26.47\%$$

Q. Try segregating the things around you as pure substances or mixtures
Answer: Pure substances—Water, bread, sugar and gold.
Mixtures—Steel, plastic, paper, talc, milk

Q. Explain the following giving examples:
(a) Saturated solution
(b) Pure substance
(c) Colloid
(d) Suspension
Answer: (a) Saturated solution: In a given solvent when no more solute can dissolve further at a given temperature is called saturated solution.
(b) Pure substance: A pure substance consists of a single type of particles. E.g., gold, silver.
(c) Colloid: A colloid is a solution in which the size of solute particles are bigger than that of true solution. These particles cannot be seen with our naked eyes, they are stable, e.g., ink, blood.
(d) Suspension: It is a heterogeneous mixture in which the solute particles are big enough to settle down, e.g., chalk-water, paints, etc.

Q. Classify each of the following as a homogeneous or heterogeneous mixture: soda water, wood, air. soil, vinegar, filtered tea.
Answer: Homogeneous: Soda water, vinegar, filtered tea.
Heterogeneous: Wood, air, soil.

Question . How would, you confirm that a colourless liquid given to you is pure water?
Answer: By finding the boiling point of a given colourless liquid. If the liquid boils at 100°C at atmospheric pressure, then it is pure water. This is because pure substances have fixed melting and boiling point.

Question . Which of the following materials fall in the category of a "pure substance"?
(a) Ice (b) Milk (c) Iron
(d) Hydrochloric acid (e) Calcium oxide (f) Mercury
(g) Back (h) Wood (i) Air.
Answer: Pure substances are: Ice, iron, hydrochloric acid, calcium oxide and mercury.

Question . Identify the solutions among the following mixtures.
(a) Soil (b) Sea water
(c) Air (d) Coal
(e) Soda water.
Answer: Solutions are: Sea water soda water and air.

Question . Which of the following will show "Tyndall effect"?
(a) Salt solution (b) Milk
(c) Copper sulphate solution (d) Starch solution.
Answer: Milk and starch solution.

Question . Classify the following into elements, compounds and mixtures.
(a) Sodium (b) Soil (c) Sugar solution
(d) Silver (e) Calcium carbonate (f) Tin
(g) Silicon (h) Coal (i) Air
(j) Soap (k) Methane (l) Carbon dioxide
(m) Blood
Answer: Elements – Compounds – Mixtures
Sodium – Calcium carbonate – Sugar solution
Silver – Methane – Soil
Tin – Carbon dioxide – Coal
Silicon – Soap – Air ,Blood

Question . Which of the following are chemical changes?
(a) Growth of a plant (b) Rusting of iron
(c) Mixing of iron filings and sand (d) Cooking of food
(e) Digestion of food (f) Freezing of water
(g) Burning of a candle.

Answer: Chemical changes are:
(a) Growth of a plant (b) Rusting of iron
(c) Cooking of food (d) Digestion of food
(e) Burning of a candle