



## Introduction

In our daily life we come across several types of matters in our surroundings. It is very difficult to say which of the matters is pure. Even the eatables, which we purchase from the market is not found to be pure and is adulterated with undesirable materials that are harmful for us. The pure substance is the substance which are made up of only one type of atoms or particles. All the matters are divided into two categories as mixture and pure substance.



## Mixture

When two or more different types of substance are mixed together, not in any fixed proportion, it is called mixture. Mixture is of two types Homogenous and heterogenous mixtures. In mixtures the components cannot be separated by physical means.



## Homogenous Mixture

The mixture having uniform composition is called the **homogenous mixture**. If we dissolve sugar or salt in water, it gets dissolved completely in water and particles of sugar are not visible to us our naked eyes. Hence it is a homogenous mixture. It has no visible boundaries of separation between various constituents and usually exist in one phase.

### Illustrative EXAMPLE



- (1) Air is a mixture of gas in gas.
- (2) Aerated water ( $CO_2 + H_2O$ ) is a mixture of gas in liquid.
- (3) Kerosene, petrol, alcohol, water, etc are mixture of liquid in liquid.
- (4) Alloys such as bronze, steel, brass etc are mixture of solid in solid.
- (5) Sugar solution, salt solution are mixture of solid in liquid.
- (6) Amalgamated Zinc is a mixture of liquid in solid.
- (7) Adsorption of hydrogen gas in palladium is a mixture of gas in solid.



## Heterogenous Mixture

The mixture having non uniform composition are called heterogenous mixture. In this case, each constituent particles are visible in our naked eyes. We can separate them by physical means. For example if we mix rice, sand and pulse the mixture will be heterogenous and each constituent is visible in our naked eyes and we can separate them either by hand picking or any other means.



## Properties of Mixture

**Following are the properties of mixtures:**

- ❖ The constituents in the mixtures are not present in any fixed proportion.
- ❖ Each constituents in the mixture shows it own properties.
- ❖ The constituents of the mixtures can be separated by physical methods.
- ❖ Mixtures do not have any fixed melting and boiling points.
- ❖ No energy is either absorbed or evolved during the formation of mixtures.

## Commonly Asked QUESTIONS



Which one of the following is a homogenous mixture?

- (a) Salt solution
- (b) Muddy water
- (c) Chalk in water
- (d) All
- (e) None of these

**Answer: (A)**



Which one of the following is a heterogenous mixture?

- (a) Steel
- (b) Brass
- (c) Smoke
- (d) Air
- (e) None of these

**Answer: (C)**



Which one of the following is a mixture?

- (a) Salt
- (b) Water
- (c) Sugar
- (d) Air
- (e) None of these

**Answer: (D)**



Which one of the following is most difficult to separate?

- (a) Sawdust and stones
- (b) Sand and Water
- (c) Rice and pulse
- (d) Nitrogen and Hydrogen
- (e) None of these

**Answer: (D)**



### Pure Substance

The substances which are made up of only one kind of particles are called the pure substance or we can say that the substance which is made up of only one kind of atoms are called the pure substance. For example, elements of oxygen, carbon, calcium, sodium chloride, etc are considered to be pure substance. The pure substance have some specific properties, such as, they have definite colours like gold appears yellow, bromine gas is brown in color, iodine is violet in colour etc. Other properties are that they have fixed melting and boiling points. For example, water boils at  $100^{\circ}\text{C}$  and has a refractive index of 1.333 and density of  $0.999\text{ g/ml}$  at  $20^{\circ}\text{C}$ . Pure ice melts at  $0^{\circ}\text{C}$ .



## Properties of Pure Substance

The properties of pure substance are:

- ❖ It has certain fixed density.
- ❖ It has fixed melting and boiling points.
- ❖ Refractive index can be measured accurately.
- ❖ They are either conductors, insulators or semiconductor.
- ❖ Normally have high viscosity.



## Types of Pure Substance

Pure substance is normally of two types: element and compound. The elements are further classified as metals, non metals and metalloid. Elements: The first definition of elements was given by Robert Boyle in the year 1661 in Britain. According to him, element is the simplest form of the matter and cannot be further simplified and broken into simpler pieces. The elements are further classified as metals, non metals and metalloids.



## Properties of Metals

Following are the properties of metals:

- ❖ Metals are generally solid at room temperature, except for mercury.
- ❖ Metals are lustrous.
- ❖ Metals have normally golden yellow or silver grey colours.
- ❖ Metals are generally good conductor of electricity, except for lead and mercury, which are poor conductor of electricity. Silver is the best conductor of electricity.
- ❖ Metals are generally hard, except for sodium and potassium.
- ❖ Metals have generally high tensile strength.
- ❖ Metals have generally high melting and boiling points except for mercury, sodium, gallium and potassium.
- ❖ Metals are malleable and ductile.
- ❖ Metals are sonorous.



## Properties of Non-Metals

- ❖ It exist in all the three states at normal temperature and pressure. The nonmetal like sulphur, carbon, and phosphorus are found in solid states; non metal like bromine is found in liquid states and oxygen, chlorine hydrogen are found in gaseous states.
- ❖ Non metals are generally soft except for diamond.
- ❖ Non metal are non lustrous except for iodine.
- ❖ Non metals are non sonorous and usually have low tensile strength.
- ❖ They have generally low melting and boiling points, except for graphite whose melting point is 3700°C.
- ❖ Non metals are poor conductor of heat and electricity except for diamond which is a good conductor of heat. Also graphite, which is good conductor of electricity. They are normally good insulators.
- ❖ They are founded in variety of colours, such as, bromine is red brown/sulphur is yellow, graphite is black, phosphorus is red or white, chlorine is yellowish green in colour.
- ❖ They are neither malleable nor ductile.

## Metalloids

There are some elements, which show the properties of both metal and non metals. They are called the metalloids. For example the elements like boron, silicon, germanium, arsenic, antimony, etc. are metalloids.

### Commonly Asked Questions



**Name the metal which is founded in liquid form?**

- (a) Bromine
- (b) Mercury
- (c) Antimony
- (d) Tin
- (e) None of these

**Answer: (b)**



**Who give the first defination of elements?**

- (a) Robert Boyles
- (b) Robert Charles
- (c) Mendleev
- (d) Bhors
- (e) None of these

**Answer: (a)**



**Which one of the following is a Compound?**

- (a) Brass
- (b) Steel
- (c) Chlorine
- (d) Carbon dioxide
- (e) None of these

**Answer: (d)**



**Martin was given a mixture of benzene and methyl benzene and asked to separate the components of the mixture. Which one of the following method will he use?**

- (a) Decentation
- (b) Sublimation
- (c) Distillation
- (d) Evaporation
- (e) None of these

**Answer: (c)**



**Identify the pure substance from the given material.**

- (a) Calcium oxide
- (b) Wood
- (c) Air
- (d) All
- (e) None of these

**Answer: (a)**



## Compounds

It is a pure substance, in which two or more elements combine chemically together in a fixed proportion by mass to form the compound. The properties of compound are different from the properties of the elements. For example, the elements like hydrogen and oxygen are found in gaseous state, but when they combine to form water, it turns to liquid state. Similarly if we heat iron filing and sulphur powder, a black compound of iron sulphide is formed. Now, if we bring a bar magnet near the compound we find that it is not attracted by the iron in the compound so formed. The other example, if we add carbon disulphide to the sulphur, we find it is not dissolved in it, which shows that sulphur is not showing its property. Thus, we can say that the properties of compound is entirely different of the it's elements forming it.



### Properties of Compound

Following are the properties of compound:

- ❖ It is formed by the reaction between two or more different elements.
- ❖ It is homogenous in nature.
- ❖ We cannot separate the components of compound by physical methods.
- ❖ The compounds have different physical and chemical properties.
- ❖ They have generally fixed melting and boiling points.
- ❖ Formation of compound is associated with either evolution or absorption of heat and light.

Normally we have two types of compounds, that is, organic and inorganic compounds. Those compounds which are obtained from non living sources such as rocks, minerals, etc are inorganic compounds. The compounds which are obtained from living sources such as plants, animals etc are called organic compound. For example, petroleum, carbohydrates, proteins, waxes, oils, etc. are all organic compounds.



### Solutions

It is a homogenous mixture of two or more substance in which one substance is liquid. It consists of two parts, solvent and solute. The solvents are that part of solution in which something has been dissolved and the substance which has been dissolved into it, is called the solute. For example, in the solution of salt and water, salt is solute as it is dissolved in water and water is solvent.

The solution is basically of two types, such as saturated and unsaturated. Saturated solutions are those in which no more solute can be dissolved. On the other hand, the solution in which more solutes can be dissolved are called the unsaturated solution. The amount of solute present in the saturated solution at the given temperature is called its solubility.

The concentration of solution is defined as the amount of solute presents in the given volume of solvent.

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

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

$$\text{Percentage by volume} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$$



## Properties of Solution

- ❖ It is homogenous in nature.
- ❖ The particles of solute cannot be seen in naked eyes.
- ❖ They cannot scatter the beam of light passing through it.
- ❖ We cannot separate the particles of solute by physical methods, such as filtrations.
- ❖ It is very stable in nature i.e. the particles of solute do not settle down when left undisturbed.



## Suspension

It is a heterogenous mixtures in which particles of solute are dispersed throughout the medium, without dissolving into it. For example, if we mix sand in water it forms suspension, as the sand particles remains suspended in the water without dissolving into it.



## Properties of Suspension

- ❖ It is heterogenous in nature.
- ❖ The particles of solute can be seen in naked eyes.
- ❖ The particles of suspension can be separated by filtration.
- ❖ It is opaque in nature.
- ❖ It is very unstable in nature i.e. the particles of solute settles down when left undisturbed.



## Colloids

It is a heterogenous mixture in which particles having size between  $10^{-7}$  to  $10^{-4}$  cm are dispersed in a continuous medium. The continuous medium is called dispersion medium and the particle in the medium forms dispersed phase. They are also called as sols. If the dispersion medium is water then it is called hydrosols and if it is alcohol, it is called alcosols. Colloids can be classified on the basis of the affinity of dispersed phase and dispersion medium for each other. On the basis of this it is of two types: Lyophilic colloids and Lyophobic colloids.

The colloid which shows affinity towards the dispersion medium is called lyophilic colloids. For example, gelatin and starch are lyophilic colloids. The colloids which do not shows affinity towards the dispersion medium is called lyophobic colloids. For example, metals and their hydroxide and sulphide are lyophobic colloids.



## Properties of Colloids

- ❖ It is heterogenous in nature.
- ❖ The particles of colloids cannot be seen by naked eyes.
- ❖ The particles of colloids cannot be separated by filtration.
- ❖ The particle of colloids shows Brownian motion.
- ❖ It is very unstable in nature i.e. the particles of solute settles down when left undisturbed.
- ❖ It shows tyndall effect i.e. it scatters the beam of light passing through it.
- ❖ It shows electrophoresis. i.e. it shows the movement of particles under the influence of electric field towards the opposite charged electrodes.
- ❖ It shows the coagulation i.e. the colloidal particles precipitate and settles down if all the charge is removed from it. It can be done by adding oppositely charged electrolytes.

## Commonly Asked QUESTIONS



Which one of the following will show tyndall effect?

- (a) Salt solution
- (b) Milk
- (c) Sulphuric acid solution
- (d) HCl
- (e) None of these

**Answer: (b)**



Which one of the following will show the properties of electrophoresis?

- (a) Arseneous Sulphide
- (b) Carbon dioxide
- (c) Chalk in water
- (d) Hydrosols
- (e) None of these

**Answer: (a)**



A solution is prepared by dissolving 80 g of salt in 500 g of water. Find the concentration of the solution.

- (a) 10%
- (b) 12.6%
- (c) 13.8%
- (d) 14.2%
- (e) None of these

**Answer: (c)**



Which one of the following is an aerosols?

- (a) Mist
- (b) Vapour
- (c) Egg Yolk
- (d) Sugar solution
- (e) None of these

**Answer: (a)**



If 10 g of sodium hydroxide is dissolved in 150 g of water, then calculate the mass percent of sodium hydroxide in the solution?

- (a) 5%
- (b) 6.25%
- (c) 7.5%
- (d) 8.2%
- (e) None of these

**Answer: (b)**



If  $30\text{CM}^3$  of aldehyde is added to water to make its volume of  $363\text{cm}^3$ , then find the percentage of volume of aldehyde in this solution.

- (a) 9.1% (b) 7.96%  
(c) 8.26% (d) 6.65%  
(e) None of these

**Answer: (c)**



## Separating the Components of Mixtures

The different methods by which we can separate the components of mixtures are : Evaporation, Centrifugation, Decantation, Distillation, Fractional Distillation, Using separation funnel, Chromatography, and Sublimation. The method used is determined by the nature of mixtures. We will discuss each methods separately as below:



### Evaporation

This methods is used to separate the dissolved material from the solvent. When we evaporate the solution, the solvent get evaporated and the solute is left behind. For example, we can separate the mixture of salt and water by this methods.



### Centrifugation

In this method, when the mixture is spun rapidly, the denser particles are forced to settle at the bottom and lighter particles stays at the top. Therefore, can be separated from each other. For example, we can separate cream from milk by this method.



### Decantation

In this method we can separate the insoluble solid from a liquid by allowing the solid to settle down and pouring out the liquid off it. For example, we can separate the mixture of sand and water or gravel and water etc.



### Distillation

This method is used to separate a mixture of two liquid of different boiling points. In this method, we first heat the mixture of liquids and collect the vapour of the liquid/ which has low boiling points and evaporate first and then condensed it to get back the liquid.



### Fractional Distillation

This method is used for separating the mixture of two or more liquids having different boiling points. It is done by using fractionating column. In this process distillates are collected in fractions, boiling at different temperatures.





### Using Separating Funnel

This method is used to separate the mixture of two liquids, which are not miscible. In this method the mixture is put into the funnel and is allowed to settle. When it settles down the lighter liquid forms the upper layers and the heavier liquid forms the lower layers. The tap of the funnel is open and the lower layer is carefully drained out and thus, the liquids is separated.



### Chromatography

This method is used to separate the mixture of solute formed by distribution of dissolved materials between two immiscible phases, in which one is movable and other is stationary. For example, we can separate the components of dyes by this method.



### Sublimation

In this method the solid directly gets converted into gas without getting into liquid, when heated. This method can be used to separate the mixture of two solids, in which one sublimes easily. For example, the mixture of ammonium chloride and salts. The other compound which undergoes sublimation are **Camphor, Iodine, Naphthalene, anthracene etc.**

## Commonly Asked QUESTIONS



**A house wife wants to separate cream from milk. How can she separate the cream from milk?**

- (a) Distillation
- (b) Chromatography
- (c) Centrifugation
- (d) Evaporation
- (e) None of these

**Answer: (c)**



**How can we separate two miscible liquid having different boiling points?**

- (a) Distillation
- (b) Chromatography
- (c) Centrifugation
- (d) Evaporation
- (e) None of these

**Answer: (a)**



**Which one of the following pair of gases cannot be separated by diffusion method?**

- (a)  $CO_2$  and  $NO_2$
- (b)  $CO_2$  and  $N_2O_2$
- (c)  $CO_2$  and  $N_2O$
- (d)  $CO_2$  and  $H_2$
- (e) None of these

**Answer: (c)**



Martin takes out gun powder from a cartilage and wants to separate the mixture constituents. How can he separate the constituent of gun powder?

- (a) Solvent Extraction
- (b) Decantation
- (c) Evaporation
- (d) Sublimation
- (e) None of these

**Answer: (A)**



Mary saw some greasy spot on the shirt of her husband which cannot be removed by simple washing. If she wants to remove the greasy spot from the shirt, what she needs to do?

- (a) Solvent Extraction
- (b) Sublimation
- (c) Evaporation
- (d) Using suitable solvent
- (e) None of these

**Answer: (D)**

## SUMMARY



- ❖ The matter containing only one kind of substance is called pure matter.
- ❖ The simplest form of pure matter is called element.
- ❖ When two or more elements combines together in a fixed ratio it forms a compound.
- ❖ Elements are classified as metals, non metals and metalloid.
- ❖ Combination of two or more substance not in any fixed proportion is called mixture.
- ❖ The changes which are reversible and temporary are called physical changes.
- ❖ The changes which are permanent and are irreversible are called chemical changes.

# Self Evaluation **TEST**



Duration  
**10 Minutes**

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1. Which among the following has strongest intermolecular force of attraction?

- (a) Water
- (b) Alcohol
- (c) Carbon dioxide
- (d) Sodium chloride
- (e) None of these

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2. Identify the non metal which is a good conductor of electricity.

- (a) Copper
- (b) Graphite
- (c) Aluminium
- (d) Silver
- (e) None of these

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3. Which one of the metal is not a good conductor of electricity?

- (a) Lead
- (b) Graphite
- (c) Aluminium
- (d) Silver
- (e) None of these

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4. Identify the non metal which is lustrous.

- (a) Sulphur
- (b) Graphite
- (c) Iodine
- (d) Phosphorus
- (e) None of these

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5. A solution contains  $4.5\text{ cm}^3$  of alcohol mixed with  $125\text{ cm}^3$  of water.

Find the concentration of the solution.

- (a) 15.25%
- (b) 15%
- (c) 10.5%
- (d) 12.75%
- (e) None of these

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6. 450 g of solution contains 25 g of salt. Find the percentage by mass of sugar in the solution.

- (a) 5.25%
  - (b) 5%
  - (c) 5.5%
  - (d) 5.75%
  - (e) None of these
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**7. Identify metalloids among the following elements.**

- (a) Sulphur
- (b) Zinc
- (c) Carbon
- (d) Arsenic
- (e) None of these

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**8. A solution is prepared by mixing a white powder in the distilled water. As soon as the powder was added to the solution it turns blue. Identify the powder.**

- (a) Sulphur
- (b) Copper
- (c) Bromine
- (d) Potassium
- (e) None of these

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**9. Which one of the following is yellowish green in colour?**

- (a) Chlorine
- (b) Copper
- (c) Bromine
- (d) Potassium
- (e) None of these

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**10. Which one of the following is likely to be a pure substance?**

- (a) A colour less liquid having boiling point  $60^{\circ}\text{C}$  to  $70^{\circ}\text{C}$
  - (b) A green solid having melting point  $80^{\circ}\text{C}$  to  $110^{\circ}\text{C}$
  - (c) Chromatograph of a white solid which gives only one spot
  - (d) A brown liquid soluble in water.
  - (e) None of these
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**Answers – Self Evaluation Test**

<b>1.</b>	<b>D</b>	<b>2.</b>	<b>B</b>	<b>3.</b>	<b>A</b>	<b>4.</b>	<b>C</b>	<b>5.</b>	<b>A</b>	<b>6.</b>	<b>C</b>	<b>7.</b>	<b>D</b>	<b>8.</b>	<b>B</b>	<b>9.</b>	<b>A</b>	<b>10.</b>	<b>C</b>
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