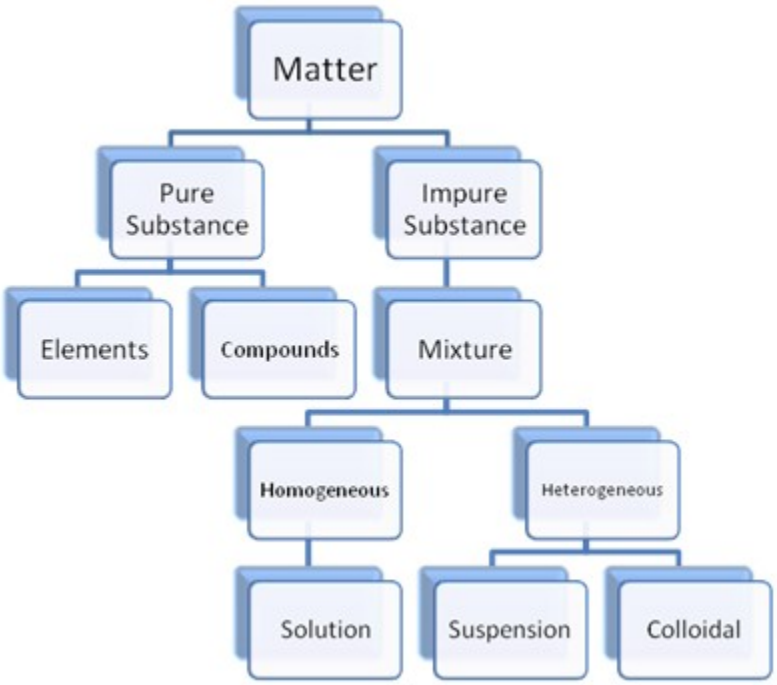
DELHI PUBLIC SCHOOL,GREATER NOIDA

CLASS 9

SUBJECT- CHEMISTY

CHAPTER- IS MATTER AROUND US PURE



Matter

Anything which has mass and occupies space is called matter. It may be solid, liquid or gas.

1. Pure Substance: It may be defined as a material which contains only one kind of atoms or molecules.

Pure substances are again of two types:

(A)Elements **(B) Compounds**

(A) Elements:

- Pure substances which are made up of only one kind of atoms are known as elements.
- They cannot be split up into two or more simpler substances by any of the usual chemical methods.

- For example, Iron, gold, silver, carbon, oxygen, nitrogen and sodium etc.

Elements are further grouped into the following three categories:
(i) Metals, for example: Iron, copper, gold, sodium, silver, mercury, etc.

(ii) Non – metals, for example: Carbon, oxygen, sulphur, nitrogen, oxygen, hydrogen, etc.

(iii) Metalloids : Boron, silicon, germanium, etc.

Properties of Metals:

- These are lustrous (shine).
- They conduct heat and electricity.
- All metals are malleable and ductile.
- They are sonorous.
- All metals are hard except sodium and potassium.
- All metals are solids at room temperature except mercury which is a liquid.

Properties of Non-metals:

- These are dull in appearance.
- They are poor conductors of heat and electricity except diamond which is a good conductor of heat and graphite which is a good conductor of electricity.
- They are neither malleable nor ductile.
- They are generally soft except diamond which is the hardest natural substance known.
- They may be solids, liquids or gases at room temperature.

Metalloids: The elements that have properties intermediate between those of metals and non-metals, are called metalloids.

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

Characteristics:

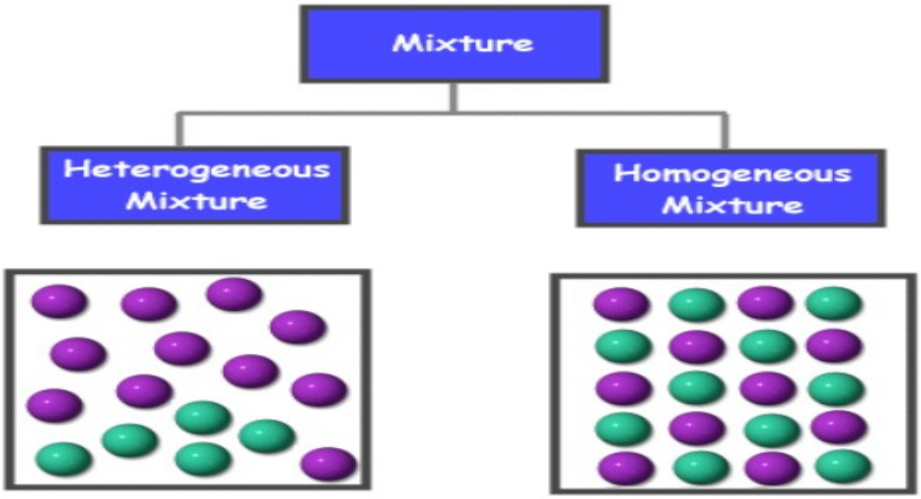
- The properties of compound differ from those of its constituents.
- Compound has fixed melting point and boiling point.
- Compound is a homogeneous substance.
- Constituent elements can be separated by chemical process.

S.N.	Element	Compound
1.	An element cannot be broken into simpler substances by any physical or chemical process.	Compound is composed of two or more elements chemically combined in definite proportion by mass.
2.	Elements have their own fixed physical and chemical properties.	Physical and chemical properties of a compound are different from those of its constituent elements.
3.	An atom is the smallest particle of an element taking part in a chemical reaction.	A compound cannot be separated into its constituents by simple mechanical means.

2. Impure Substance: It may be defined as a material which contains only one kind of atoms or molecules.
It is also named as mixture.

Mixtures:
A mixture is a material which contains two or more different kinds of particles (atoms or molecules) which do not react chemically but are physically mixed together in any proportion.
Types of mixture
It is of two types :

(a) Homogeneous mixture (b) Heterogeneous mixture



Homogenous Mixtures

- When we add sugar, water and lemon juice together they all uniformly mix with each other. Now it is no possible to separate these substances from the mixture. Such mixtures in which the components mix with each other uniformly are called **Homogenous 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.

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.

Homogenous Mixtures	Heterogeneous Mixtures
They have a uniform composition throughout	They have a non-uniform composition
We cannot separate the components of the mixture through physical processes	We can separate the components through physical processes
Components cannot be seen through naked eyes	Components can easily be seen through naked eyes
The mixture is in single phase throughout	The substances can be of two different phases and we may see separate layers of the substances
Example: A mixture of water and milk	**Example**: A mixture of oil in water

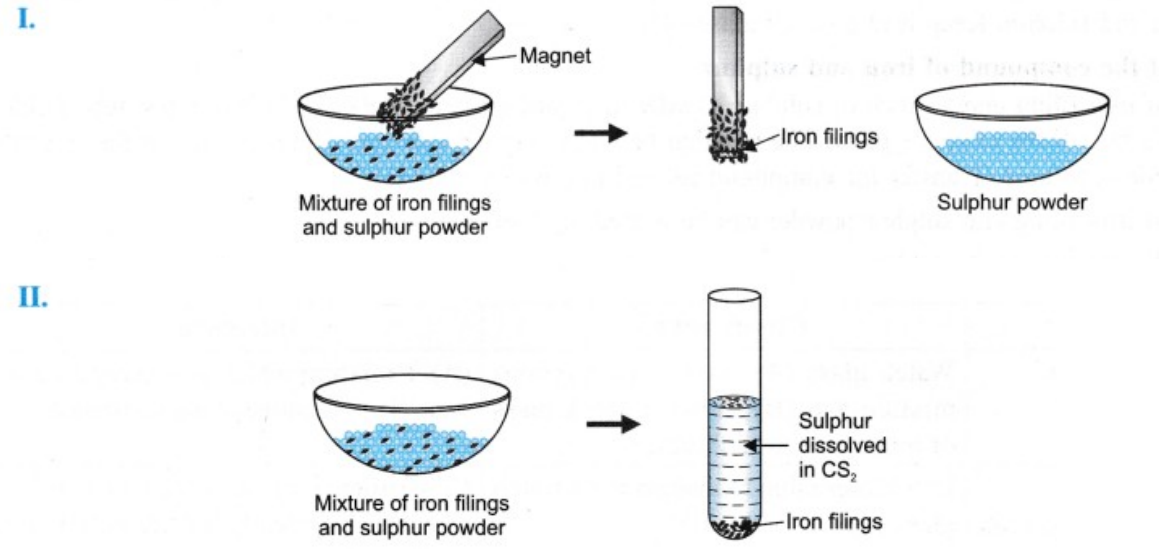
Mixture: When two or more than two substances mix together in any proportion physically and do not show any chemical change, retain their individual properties, then they form a mixture.
Compound: When two or more than two substances combine together chemically in a fixed ratio, such that they can be separated only by chemical means, then a compound is formed.

Differnces between Mixture and Compound:

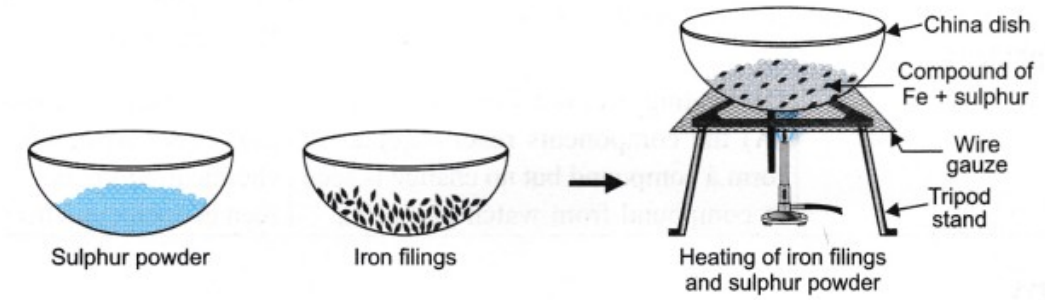
S.No.	Mixtures	Compound
1.	Components mix physically.	Components mix chemically.
2.	Constituents mix in any ratio.	Constituents mix in fixed ratio.
3.	The constituents retain their properties.	The constituents do not retain their properties.
4.	Separation of constituents can be done physically.	Separation of constituents is done chemically.

Mixture

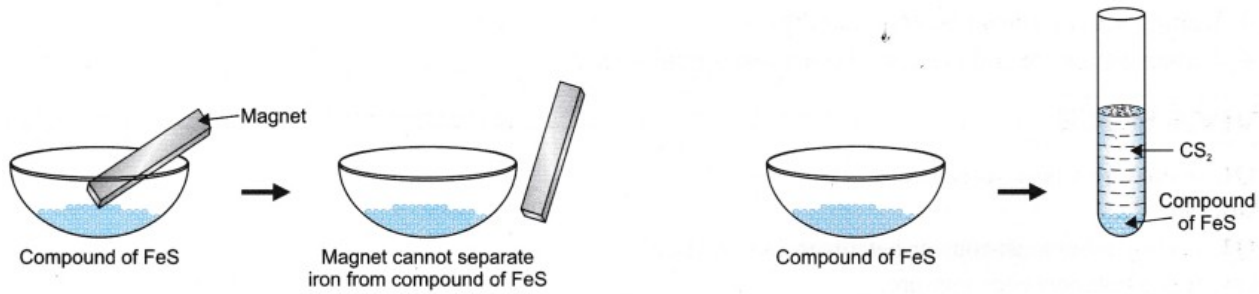
Separation of Iron and Sulphur from its Mixture



Compound



Separation of Iron and Sulphur from its compound



Materials Required

Test tubes, test tube stand, test tube holder, hard glass test tube, Bunsen burner, tripod stand, wire gauze, magnet, China dish and a watch glass.

Chemicals Required

Iron filings, sulphur powder, carbon disulphide.

Procedure

1. **Preparation of a mixture of iron and sulphur powder.**
   Take a pinch of iron filings and two pinch of sulphur powder, mix them thoroughly. The product obtained is mixture of iron and sulphur. Keep it in a watch glass (A).
2. **Preparation of the compound of iron and sulphur.**
   Take a pinch of iron filing and a pinch of sulphur powder in a hard glass test tube. Hold it in a test tube holder, heat it on the flame till the contents glow. The reaction between sulphur and iron filings is seen in the test tube and iron sulphide is formed. Transfer the compound formed in a watch glass (B).
   (The mixture of iron filing and sulphur powder can be heated in China dish)
   Record your observations in the table.

Observations

	Experiment	Observations	Inference
1.	**Observe for appearance**	Watch glass (A) shows heterogenous mixture and (B) shows a black mass of homogeneous substance.	(A) is mixture which is heterogeneous and (B) is homogeneous substance.
2.	**Action with Magnet.** A bar magnet is rolled over both the watch glasses A and B.	Iron filings cling to magnet from watch glass (A) but not in (B).	Constituents of mixture (A) can be separated physically but not in (B) *i.e.*, compound.
3.	**Behaviour towards carbon disulphide.** Take components from watch glass (A) and (B) in separate test tubes and add carbon disulphide in it.	In test tube (A) sulphur dissolves in carbon disulphide and iron filings settles down. Whereas in other test tube (B) nothing dissolves.	Components of mixture can be separated by physical means. A is mixture. B is compound.
4.	**Effect of heat**	On heating mixture from watch glass (A) the components react together to form a compound but no change is seen in compound from watch glass (B).	The mixture components from watch glass (A) react together to form a chemical compound, but no change is seen in compound from watch glass (B).

Reference source : https://youtu.be/C2RqAE0wbqk

Solution

It is a homogeneous mixture of two or more substances. For example: Lemon water, sugar solution, soda water, etc.

Components of Solution:

(1) Solvent: The component of the solution that dissolves the other component in it and is usually present in larger amount, such component of solution is called the solvent.
For example: Water, alcohol etc.
(2) Solute: The component of the solution that is dissolved in the solvent and is usually present in lesser quantity, such component is called the solute.For example: Salt, sugar, iodine etc.

Properties of solutions :

(i) It is a homogeneous mixture.
(ii) Particle size in a solution is less than 1 nm in diameter.
(iii) Particles of a solution cannot be seen even with a microscope.
(iv) A true solution does not scatter the light.
(v) Solution is stable.
(vi) The solute particles cannot be separated from the mixture by the process of filtration.

Examples:

- **Liquid into liquid:** Water and Ink
- **Solid into solid:** Alloys
- **Gas into gas:** Air
- **Solid into liquid:** Sugar and Water
- **Solid into gas:** Hydrogen and Metals
- **Liquid into gas:** Carbon Dioxide and Water

What is an alloy?

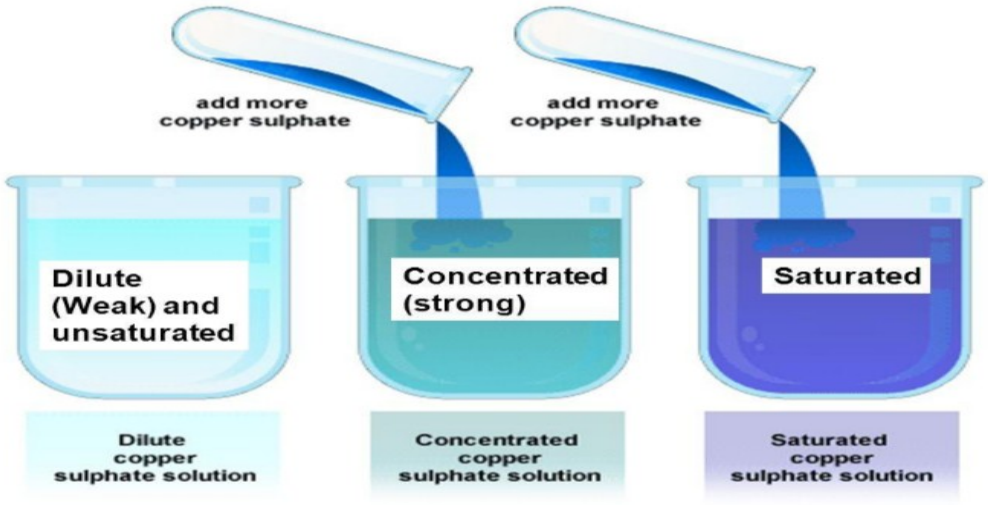
An alloy is a mixture of different metals or non-metals and metals that cannot be separated from each other using physical methods. **For Example:**

Brass – Copper with up to 50% zinc

Bronze – Copper with up to 12% tin

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 amount of solute as it has not achieved its saturation level yet, is called an Unsaturated Solution. A dilute solution can be called as an **Unsaturated Solution**.
- **Concentrated Solution** – A solution with a large amount of solvent 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**.



Solubility:
The maximum amount of the solute which can be dissolved in 100 grams of a solvent at a particular temperature is known as its solubility in that particular solvent.

Condition affecting solubility:

Temperature: Solubility of solids in liquids increases with the increase in temperature, whereas solubility of gases in liquids decreases on increasing the temperature.

Concentration of a Solution
It is defined as the mass of the solute in grams present in 100 grams of the solution.

Mathematical expression for concentration of solution:

- Concentration of solution = $\frac{\text{Amount of solute}}{\text{Amount of solution}}$ or $\frac{\text{Amount of solute}}{\text{Amount of solvent}}$
- 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:

A suspension is a heterogeneous mixture in which small particles of a solid are spread throughout a liquid without dissolving in it.

For Ex: Chalk+ water, Muddy Water, sand+ water, Flour+ water etc.

Properties of Suspension

- A suspension is a heterogeneous mixture.

The size of solute particles in a suspension is quite large. The size of solute particles is large that is more than 100 nm.

- The particles of a suspension can be seen easily.
- The particles of a suspension do not pass through a filter paper. ...
- The suspension is unstable.

COLLOIDS:

A solution in which the size of solute particles is intermediate between those in true solution and suspension is called as Colloids

Properties of Colloids

- They appear to be homogeneous but actually they are heterogeneous when observed under microscope.

- They are not perfectly transparent,it is somewhat translucent.
- The particles cannot be seen by naked eyes or microscope.
- The particles do not settle on keeping.
- They generally represent a solution system in which the particles comprising that system have a particle size intermediate that of a true solution and a coarse dispersion, roughly ranging between 1nm to 500 nm.

TYNDALL EFFECT:

The **phenomenon of scattering of light by particles in a colloid** or in a very fine suspension is called tyndall effect. The individual suspension particles scatter and reflect light, making the beam visible. ... As with Rayleigh scattering, blue light is scattered more strongly than red light by the Tyndall effect.

7) Tyndall effect :-

When a beam of light is passed through a colloidal solution, the colloid particles scatter the beam of light and the path of light becomes visible in the solution. This effect is called Tyndall effect.

Tyndall effect can be seen when light enters a room through a small hole due to scattering of light by the dust and smoke particles.

Tyndall effect can be seen in a dense forest due to scattering of light by water droplets in the mist.



Dispersed phase: The phase that is scattered or present in the form of colloidal particles is known as dispersed phase.

Dispersion medium: The medium in which the colloidal particles are dispersed is called dispersion medium.

FOR EXAMPLES:

Cheese: Cheese is made up of fats suspended or dispersed in water.
Dispersed phase: Fat (Solid)
Dispersion medium: Water (Liquid)

Soda water: Soda water generally contains water and gas.
Dispersed phase: Bubbles of soda water (Gas)
Dispersion medium: Water (Liquid)

Smoke: Smoke generally contains unburnt carbon particles. It is a collection of tiny solid, liquid and gas particles.
Dispersed phase: Unburnt particles of smoke (Solid)
Dispersion medium: Gases (Gas)

Dispersed Phase	***Dispersing Medium***	***Type***	***Example***
Liquid	Gas	Aerosol	Fog, clouds, mist
Solid	Gas	Aerosol	Smoke, automobile exhaust
Gas	Liquid	Foam	Shaving cream
Liquid	Liquid	Emulsion	Milk, face cream
Solid	Liquid	Solution	Milk of magnesia, mud
Gas	Solid	Foam	Sponge, pumice
Liquid	Solid	Gel	Jelly, cheese, butter
Solid	Solid	Solid sol	Coloured gemstone, milky glass