# Is Matter around us pure

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## Types of Matter

1. What is Matter?
    - Matter is anything that occupies space and has mass.
    - Examples: Air, water, sugar, pen, your body – sab matter ke examples hain.
2. Types of Matter (Based on Composition)
    - Matter can be divided into two main types:
        I. Pure Substances
        II. Mixtures

I. Pure Substances :-

👉 Definition:

- A pure substance is made up of only one kind of particles (atoms or molecules).
- It has fixed composition and constant properties throughout.
- Example: Distilled water, gold, oxygen gas, carbon dioxide

✅ Characteristics of Pure Substances :-

- Fixed composition
- Same physical and chemical properties throughout
- Cannot be separated into other substances by physical methods
- Homogeneous in nature (same throughout)

Types of Pure Substances:

a) Elements

- Made up of only one kind of atom
- Cannot be broken into simpler substances
- Example: Oxygen ($O_2$), Iron (Fe), Gold (Au)

Types of Elements :-

I. Metals: Shiny, conduct electricity (e.g. Copper, Iron)
II. Non-Metals: Dull, non-conductors (e.g. Oxygen, Sulphur)
III. Metalloids: Properties of both (e.g. Silicon)

b) Compounds

- Formed when two or more elements combine chemically in a fixed ratio
- Properties are different from their elements
- Can be broken down into elements by chemical methods
- Example: Water ($H_2O$) – made of hydrogen & oxygen, but has different properties from both

II. Mixtures

👉 Definition:

- Mixture is a combination of two or more substances (elements or compounds) that are physically combined, not chemically.
- Example: Salt water, air, milk, sand and iron filings

✅ Characteristics of Mixtures:

- No fixed composition
- Can be separated by physical methods (like filtration, evaporation)
- Substances retain their individual properties
- Can be homogeneous or heterogeneous

Types of Mixtures:

I. Homogeneous Mixture

- A mixture in which the components are uniformly distributed and you cannot see the individual substances.
- Example: Salt dissolved in water, air

✅ Characteristics :-

- Same composition throughout
- Components are not visible separately
- Also called solutions
- Particles are very small
- No Tyndall effect (no scattering of light)

II. Heterogeneous Mixture

- A mixture in which the components are not uniformly mixed and you can see the different substances.
- Example: Sand in water, oil and water

✅ Characteristics:

- Different composition in different parts
- Components are visibly separate
- Easy to separate components
- Often shows Tyndall effect
- Particles are large enough to scatter light

Comparison Table: Homogeneous vs. Heterogeneous Mixture :-

| Property | Heterogeneous mixtures | Homogeneous mixture |
|---|---|---|
| Composition | Non uniform | Uniform |
| Visibility of components | Visible | Not visible |
| Separation | Easy | Difficult |
| Tyndall effect | Often shown | Not shown |
| Example | Oil and water, sand in water | Salt, water, air |

🔁 Real-Life Examples :-

| Mixture type | Example | Type |
|---|---|---|
| Salt in water | Transparent liquid | Homogeneous |
| Air | Gas mixture | Homogeneous |
| Milk (colloid) | Looks uniform but no solution | Heterogeneous (colloid) |
| Soil | Particles visible | Heterogeneous |
| Lemonade with pulp | Pulp floats, not uniform | Heterogeneous |

## Solutions

- A solution is a homogeneous mixture of two or more substances.
- The particles are so small that they cannot be seen with the naked eye and do not settle down.
- Example:
    - Salt in water
    - Sugar in tea
    - Lemon juice in water

Components of a Solution :-

- Every solution has two main components:
    (a) Solute – The substance that gets dissolved
        - Example: Salt or sugar

(b) Solvent – The substance in which the solute is dissolved

- Example: Water

👉 Solution = Solute + Solvent

Properties of a True Solution :-

| Property | Description |
|---|---|
| Nature | Homogeneous (uniform throughout) |
| Visibility of particles | Particles are not visible to neaked eye |
| Particles size | Very small (less than 1 manometer) |
| Scattering of light (tyndall effect) | Does not scatter of light |
| Filtration | Can't be separated by filtration |
| Stability | Stable-solute does not settle down |

Types of Solutions (Based on States) :-

| Solute | Solvent | Example | Type |
|---|---|---|---|
| Gas | Gas | Air ($O_2$ in $N_2$) | Gas solution |
| Liquid | Liquid | Alcohol in water | Liquid solution |
| Solid | Liquid | Sand in water | Liquid solution |
| Solid | Solid | Alloys (brass) | Solid solutions |

Concentration of a Solution :-

- Concentration means how much solute is present in the solution.

I. Dilute solution:

- Very little solute in a large amount of solvent.

II. Concentrated solution:

- Large amount of solute in less solvent.

Saturated and Unsaturated Solutions :-

I. Saturated Solution:

- A solution in which no more solute can be dissolved at a given temperature.

II. Unsaturated Solution:
    - A solution in which more solute can still be dissolved.

✅ Example:
- If you keep adding sugar to tea and it stops dissolving — it's saturated.
- If it's still dissolving — it's unsaturated.

Solubility :-
- Solubility is the maximum amount of solute that can be dissolved in a fixed amount of solvent at a given temperature.
- Solubility increases with temperature (for most solids in liquids).
- Gases are less soluble at higher temperatures.

## Types of Solutions (Based on Particle Size)

There are three types of solutions :-

I. True Solution
II. Colloidal Solution (Colloid)
III. Suspension

True Solution :-
- A homogeneous mixture of solute and solvent where solute particles are very small (less than 1 nanometer).

Properties :-
- Clear and transparent
- No Tyndall effect
- Particles don't settle down
- Cannot be filtered
- Very stable

✅ Example :-
- Salt in water
- Sugar in water
- Air ($O_2$ in $N_2$)

Colloidal Solution :-
- A colloidal solution (or colloid) is a heterogeneous mixture in which the particles are larger than those in a true solution, but smaller than those in a suspension. The particles are spread evenly and do not settle down on standing.
- Particles are intermediate in size (1–1000 nm) and do not settle.

Properties :-

- Heterogeneous in nature but appears homogeneous
- Particle size is intermediate (1 nm – 1000 nm)
- Do not settle down on standing
- Cannot be separated by ordinary filtration
- Scatters light (Tyndall effect)
- Stable mixture – particles stay suspended
- Particles can be seen only under a microscope

✅ Examples :-

- Milk, Fog, Shaving cream, Starch in water

Components of a Colloidal Solution :-

- A colloidal solution has two parts:
  (a) Dispersed Phase
  - The substance that is distributed (like solute)
  - Example: Milk fat in milk

  (b) Dispersion Medium
  - The substance in which the dispersed phase is spread (like solvent)
  - Example: Water in milk

🧪 *Colloid = Dispersed Phase + Dispersion Medium*

Types of Colloids (Based on the State of Dispersed Phase & Medium) :-

| Dispersed phase | Dispersion medium | Type of Colloidal | Example |
|---|---|---|---|
| Solid | Solid | Solid sol | Coloured glass |
| Solid | Liquid | Sol | Paint, ink |
| Solid | Gas | Aerosol | Smoke |
| Liquid | Solid | Gel | Jelly, cheese |
| Liquid | Liquid | Emulsion | Milk, cream |
| Liquid | Gas | Aerosol | Fog, mist |
| Gas | Solid | Foam | Pumice stone |
| Gas | Liquid | Foam | Shaving cream |

Suspension :-

- A heterogeneous mixture in which large particles are visible and settle down over time.

Properties :-

- Cloudy and opaque appearance
- Particles visible to naked eye
- Shows Tyndall effect
- Particles settle down on standing
- Can be separated by filtration
- Unstable mixtures

✅ Examples :-

- Mud in water
- Chalk in water
- Sand in water

Comparison Table :-

| Property | True solution | Colloidal solution | Suspension |
|---|---|---|---|
| Type of mixture | Homogeneous | Heterogeneous (appears homo) | Heterogeneous |
| Particles size | < 1 nm | 1-1000 nm | < 1000 nm |
| Particles visibility | Not visible | Not visible | Visible |
| Tyndall effect | No | Yes | Yes |
| Filtration posible | No | No | Yes |
| Stability | Stable | Stable | Unstable |
| Example | Sugar in water | Milk, fog | Mud in water |

## Tyndall Effect in Colloidal Solutions

- Tyndall Effect is the scattering of a beam of light when it passes through a colloidal solution.

*Is effect ke karan light ka path visible ho jata hai.*

🔶 Why does it happen?

- Colloidal particles have intermediate size (1–1000 nm) — it is large enough to scatter the light but small enough to remain suspended.

*Jab light in particles se takraati hai, to woh scatter ho jaati hai aur humein light ka path dikhai deta hai.*

🔍 Conditions for Tyndall Effect :-

- Size of particles must be in colloidal range (1–1000 nm)
- Difference in refractive index between dispersed phase and dispersion medium
- The colloid must be stable and not settled

✅ Examples in Daily Life :-

| Situation | Discrimination |
|---|---|
| Light beam in a dark, dusty room | Dust particles scatter light like colloids |
| Headlights of a vehicle in fog | Fog is a colloid – water droplets scatter light |
| Sunlight through tree leaves (morning mist) | Mist contains tiny water droplets (colloid) |
| Light through a projector in a cinema hall | Dust or smoke in air shows Tyndall effect clearly |

# Physical and Chemical Changes :-

I. What is a Physical Change?

- A physical change is a change in which the form or appearance of a substance changes, but its chemical composition remains the same.
- 📌No new substance is formed.
- 📌 It is usually temporary and reversible.

🔷 Characteristics of Physical Change :-

- No new substance is formed
- Only physical properties like shape, size, state, or appearance change
- Change is temporary
- Usually reversible
- Energy change is small

✅ Examples of Physical Change :-

- Melting of ice
- Boiling of water
- Breaking of glass

II. What is a Chemical Change?

- A chemical change is a change in which new substances with different chemical properties are formed.

📌 Chemical composition changes.
📌 It is usually permanent and irreversible.

🔷 Characteristics of Chemical Change:

- New substance is formed
- Chemical properties change
- Irreversible change
- Often heat, light, gas, or sound is released
- Energy change is large (exothermic or endothermic)

✅ Examples of Chemical Change :-

- Burning of papers
- Rusting of iron
- Reaction between vinegar & baking soda, Gas ($CO_2$) is released
- Curdling of milk

## Difference Between Physical and Chemical Change

| Feature | Physical changes | Chemical changes |
|---|---|---|
| New substance formed | ❌No | ✅Yes |
| Reversibility | Usually reversible | Usually irreversible |
| Composition | Remains same | Changes |
| Energy change | Very little | Often large (heat, light release) |
| Example | Melting, boiling, dissolving | Burning, rusting |