Matter and Materials

11 February 2026 13:00

Concept 1: Matter – Definition and States

Definition

Matter is anything that has mass and occupies space.

Examples

Air

Water

Stone

Wood

Metal

Properties of Matter

Has mass.

Occupies space.

Made up of particles.

States of Matter

1. Solid

Fixed shape.

Fixed volume.

Particles closely packed.

Very little space between particles.

Very strong intermolecular force.

Examples

Stone

Iron

Wood

2. Liquid

No fixed shape.

Fixed volume.

Takes shape of container.

Particles loosely packed.

Moderate intermolecular force.

Examples

Water

Oil

Milk

3. Gas

No fixed shape.

No fixed volume.
Fills entire container.
Particles very far apart.
Very weak intermolecular force.
Examples
Air
Oxygen
Carbon dioxide
Change of State
Melting
Solid to liquid due to heat.
Freezing
Liquid to solid due to cooling.
Evaporation
Liquid to gas at any temperature.
Boiling
Liquid to gas at fixed temperature.
Condensation
Gas to liquid on cooling.
Sublimation
Solid changes directly to gas without becoming liquid.
Example
Camphor
Naphthalene balls
Diffusion
Movement of particles from high concentration to low concentration.
Fastest in gases.
Slow in liquids.
Very slow in solids.
Physical Change
Change in shape or state without forming new substance.
Example
Melting of ice.
Chemical Change
Change in which new substance is formed.
Example
Burning of paper.
Common Examination Traps
Air is not matter. Incorrect. Air has mass and occupies space.

Gas has no mass. Incorrect. It has mass.
Evaporation occurs only at boiling point. Incorrect. It occurs at any temperature.
Advanced Understanding
Increase in temperature increases particle movement.
Intermolecular force determines state of matter.
Concept Linkage
States of matter explain properties of materials.
Physical and chemical changes are based on particle arrangement.

Concept 2: Properties of Solids, Liquids and Gases

Solid
Shape
Fixed shape.
Volume
Fixed volume.
Mass
Fixed mass.
Compressibility
Negligible.
Rigidity
Rigid.
Particle Arrangement
Closely packed.
Very small intermolecular space.
Examples
Iron
Wood
Stone
Liquid
Shape
No fixed shape.
Takes shape of container.
Volume
Fixed volume.
Mass
Fixed mass.
Compressibility
Very low.
Fluidity

Can flow.
Particle Arrangement
Loosely packed.
Moderate intermolecular space.
Examples
Water
Milk
Oil
Gas
Shape
No fixed shape.
Volume
No fixed volume.
Expands to fill container.
Mass
Fixed mass.
Compressibility
Highly compressible.
Particle Arrangement
Very far apart.
Weak intermolecular force.
Examples
Air
Oxygen
Carbon dioxide
Comparison Summary
Solids
Definite shape and volume.
Strong intermolecular force.
Liquids
Definite volume, no definite shape.
Moderate intermolecular force.
Gases
No definite shape or volume.
Very weak intermolecular force.
Diffusion
Fastest in gases.
Slower in liquids.
Very slow in solids.

Compressibility
Gas
High compressibility due to large empty space.
Liquid
Very slight compressibility.
Solid
Almost incompressible.
Evaporation
Process by which liquid changes into gas at any temperature.
Factors Affecting Evaporation
Surface area
Higher surface area increases evaporation.
Temperature
Higher temperature increases evaporation.
Wind speed
Higher wind speed increases evaporation.
Humidity
Lower humidity increases evaporation.
Condensation
Gas changes into liquid on cooling.
Freezing
Liquid changes into solid on cooling.
Melting
Solid changes into liquid on heating.
Sublimation
Solid changes directly into gas.
Example
Camphor
Naphthalene
Common Examination Traps
Liquids are compressible like gases. Incorrect. Liquids are only slightly compressible.
Gases have no mass. Incorrect. They have mass.
Evaporation and boiling are same. Incorrect. Boiling occurs at fixed temperature; evaporation occurs at any temperature.
Advanced Understanding
Particle motion increases with temperature.
Expansion occurs due to increased intermolecular space.

Concept 3: Different Materials – Properties and Uses

Definition

Materials are substances used to make objects.

Choice of material depends on its properties.

Physical Properties of Materials

Hardness

Hard materials resist scratching and cutting.

Examples: iron, stone.

Soft materials are easily scratched or cut.

Examples: sponge, rubber.

Strength

Ability to withstand force without breaking.

Example: steel is strong.

Elasticity

Ability to regain original shape after stretching.

Example: rubber band.

Solubility

Ability to dissolve in water.

Soluble substances

Salt

Sugar

Insoluble substances

Sand

Oil

Transparency

Transparent

Allows light to pass through clearly.

Example: glass.

Translucent

Allows partial light to pass.

Example: butter paper.

Opaque

Does not allow light to pass.

Example: wood.

Conductivity

Conductor

Allows heat or electricity to pass.

Example: copper.

Insulator

Does not allow heat or electricity to pass.
Example: plastic, wood.
Magnetic Property
Magnetic materials
Iron
Nickel
Cobalt
Non-magnetic materials
Wood
Plastic
Density
Heavier materials sink in water.
Example: iron.
Lighter materials float.
Example: wood.
Uses Based on Properties
Cooking utensils
Made of metals like aluminium or steel.
Reason: good conductor of heat.
Electrical wires
Made of copper.
Reason: good conductor of electricity.
Window panes
Made of glass.
Reason: transparent.
Tyres
Made of rubber.
Reason: elastic and flexible.
Furniture
Made of wood.
Reason: strong and durable.
Packaging
Plastic used due to light weight and water resistance.
Comparison Example
Iron
Hard, strong, conductor.
Plastic
Light, insulator, water resistant.
Glass

Transparent, brittle.
Wood
Opaque, insulator.
Common Examination Traps
All metals are magnetic. Incorrect. Only iron, nickel and cobalt are magnetic.
Plastic conducts electricity. Incorrect. It is an insulator.
Transparent materials are always strong. Incorrect. Glass is transparent but brittle.
Advanced Understanding
Material selection in engineering depends on mechanical, thermal and electrical properties.
Composite materials combine properties of different substances.
Concept Linkage
Properties determine suitability for specific use.
Understanding materials helps in manufacturing and safety.

Concept 4: Physical and Chemical Changes

Definition
Physical change
A change in which no new substance is formed and the change is usually reversible.
Chemical change
A change in which a new substance is formed and the change is usually irreversible.
Characteristics of Physical Change
No new substance formed.
Change in shape, size or state only.
Usually reversible.
Temporary change.
Examples
Melting of ice.
Freezing of water.
Dissolving sugar in water.
Tearing paper.
Stretching a rubber band.
Characteristics of Chemical Change
New substance formed.
Permanent change.
Usually not reversible.
Often accompanied by change in color, heat, gas or light.
Examples
Burning of paper.

Rusting of iron.
Cooking food.
Curd formation from milk.
Formation of ice from water is physical, not chemical.
Rusting
Definition
Slow chemical reaction of iron with oxygen and moisture forming iron oxide.
Conditions Required
Oxygen
Water (moisture)
Prevention
Painting
Oiling
Galvanization
Burning
Chemical reaction between substance and oxygen producing heat and light.
Example
Burning of wood produces ash and smoke.
Indicators of Chemical Change
Change in color.
Formation of gas.
Formation of precipitate.
Change in temperature.
Irreversibility.
Reversible and Irreversible Changes
Reversible
Can be undone.
Example: melting and freezing.
Irreversible
Cannot be undone easily.
Example: burning.
Difference Summary
Physical change
No new substance.
Reversible.
Temporary.
Chemical change
New substance formed.
Irreversible.

Permanent.

Common Examination Traps

Dissolving salt in water is chemical change. Incorrect. It is physical change.

Freezing water is chemical change. Incorrect. It is physical change.

Rusting requires only air. Incorrect. It requires air and moisture.

Advanced Understanding

In chemical change, atoms rearrange to form new molecules.

Mass is conserved in both physical and chemical changes.

Concept Linkage

States of matter explain physical changes.

Chemical changes involve chemical reactions.