Class 6-7 Chemistry: Complete Guide to Matter

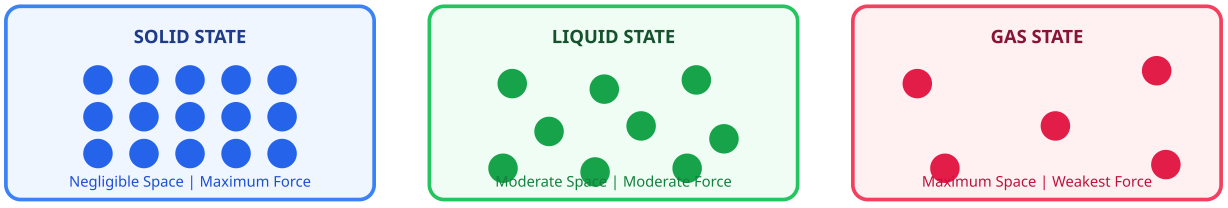
Comprehensive 5-Page Master Class • Theory, Experiments & Practice Worksheets

MODULE 1

✨ **Golden Rule of Chemistry:** Matter is defined as anything that has **mass** (weight) and occupies **space** (volume). Sound, light, heat, and thoughts are energies, NOT matter!

1. What is Matter Made Of? (Atoms & Molecules)

All matter in the universe is built from microscopic building blocks called **atoms** and **molecules**. An **atom** is the smallest fundamental unit of matter. When two or more atoms combine chemically, they form a **molecule** (e.g., 2 Hydrogen atoms + 1 Oxygen atom = 1 Water molecule, H_2O).



2. Two Forces That Rule Matter

1. Intermolecular Space

The distance or tiny empty gaps present between adjacent particles of a substance. In solids, space is almost zero; in liquids, it is larger; in gases, it is huge.

2. Intermolecular Force of Attraction

The invisible pull holding molecules together. Cohesive force acts between same molecules (water-water); adhesive force acts between different molecules (water-glass).

3. Hands-On Experiments: Proving Particle Properties

🧪 EXPERIMENT 1: Do Liquid Particles Have Empty Gaps?

Objective: To demonstrate that intermolecular space exists in water.

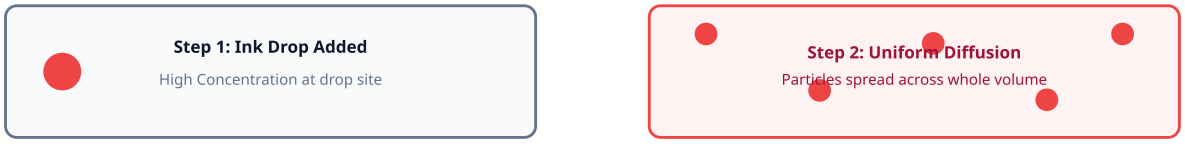
- **Procedure:** Take a 250 mL graduated cylinder and fill it with exactly 100 mL of water. Carefully add 50 grams of fine sugar and stir gently until completely dissolved.
- **Observation:** Surprisingly, the water volume mark remains at exactly 100 mL! It does NOT increase.
- **Conclusion:** The sugar particles broke down into individual molecules and slipped right into the empty intermolecular spaces present between the water molecules!

🧪 EXPERIMENT 2: Brownian Motion & Diffusion in Liquids

Objective: Prove that particles of matter are continuously moving.

- **Procedure:** Take a clean beaker filled with still water. Add a single drop of red ink or Potassium Permanganate crystal into one corner without shaking.
- **Observation:** Slowly, the red color spreads throughout the entire liquid on its own until the whole solution turns uniformly pinkish-red!
- **Conclusion:** Water molecules are constantly moving and bumping into ink particles, causing **Diffusion** (mixing of particles on their own).

4. Visualizing Diffusion & Gas Spreading



💡 **Key Fact:** Gases diffuse much faster than liquids because gas molecules zip around at high speeds with almost zero attractive forces between them! (This is why perfume spray is smelled across a room instantly).

5. Exhaustive Comparison Matrix of the 3 States

Property	Solids 🧱	Liquids 💧	Gases 🎈
Definite Shape	Yes (Fixed rigid structure)	No (Takes container shape)	No (Fills available space)
Definite Volume	Yes (Constant space)	Yes (Constant space)	No (Expands / Contracts)
Intermolecular Space	Negligible (Extremely tiny)	Slightly larger than solids	Very large (Maximum)
Force of Attraction	Strongest (Tightly bound)	Moderate (Can slide)	Negligible / Extremely weak
Compressibility	Incompressible	Negligible / Slightly	Highly Compressible
Fluidity & Flow	Cannot flow	Flows from high to low	Flows in all directions
Free Surfaces	Infinite free surfaces	Only ONE upper free surface	NO free surfaces

6. Lab Experiment: Syringe Compressibility Test

🧪 EXPERIMENT 3: Comparing Compressibility of Solid, Liquid & Gas

Procedure: Take 3 identical 50 mL plastic syringes. Remove plungers and plug their nozzles tightly with rubber corks.

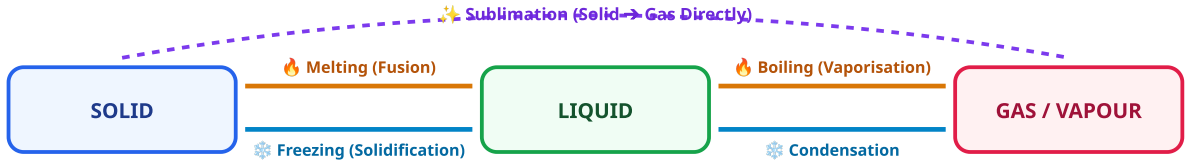
- **Syringe A:** Fill with fine dry sand (Solid). Push plunger. ➔ *Result: Plunger does not budge at all.*
- **Syringe B:** Fill with water (Liquid). Push plunger. ➔ *Result: Plunger does not move inwards.*
- **Syringe C:** Leave full of air (Gas). Push plunger. ➔ *Result: Plunger pushes easily halfway inside!*

Conclusion: Gases are highly compressible because of huge empty gaps between their molecules.

7. Classification of Matter: Living vs. Non-Living & Natural vs. Synthetic

Matter can be classified based on origin: **Natural Matter** occurs directly in nature (e.g., Wood, Water, Cotton, Coal), whereas **Man-Made (Synthetic) Matter** is artificially manufactured by humans (e.g., Plastics, Medicines, Nylon, Glass, Detergents).

8. Interconversion of States of Matter



9. Essential Terms & Definitions

- **Melting Point:** The fixed temperature at which a solid changes into liquid at standard pressure (e.g., Ice melts at 0 °C).
- **Boiling Point:** The fixed temperature at which a liquid rapidly turns into gas throughout its volume (e.g., Pure water boils at 100 °C).
- **Evaporation vs. Boiling:** Evaporation is a slow surface phenomenon occurring at *any* temperature, causing cooling. Boiling is a fast bulk process occurring only at a fixed temperature.
- **Sublimation:** Direct change of a solid into gas on heating without turning liquid first (e.g., Camphor, Dry Ice, Ammonium Chloride, Naphthalene).
- **Deposition:** Direct conversion of a gas back into a solid on cooling.

10. Kitchen Experiment: Demonstrating Sublimation

🧪 **EXPERIMENT 4: Sublimation of Ammonium Chloride / Camphor**

Procedure: Place crushed camphor in a china dish covered with an inverted glass funnel whose neck is plugged with cotton. Heat gently with a burner.

Observation: Camphor vaporizes directly into white fumes without melting into liquid. Fumes cool on cold funnel walls and deposit back into pure solid crystals!

11. End-of-Chapter Master Practice Worksheet

SECTION A: Fill in the Blanks

1. The temperature at which a pure liquid turns into steam is called its _____ point.
2. Substances like camphor and dry ice undergo _____ on heating.
3. Gases have _____ intermolecular spaces and _____ force of attraction.
4. The continuous zig-zag random movement of particles in liquids/gases is known as _____ motion.

SECTION B: Give Scientific Reasons

1. **Why does the smell of hot fried food reach us several meters away?**
   Answer: Higher temperature increases kinetic energy of gas particles, causing extremely rapid diffusion through air.
2. **Why are liquids called fluids while solids are rigid?**
   Answer: Liquids have weaker intermolecular forces and larger spaces allowing molecules to slide over each other, whereas solid molecules are locked tightly in position.
3. **Why does water level remain unchanged when sugar dissolves?**
   Answer: Sugar molecules fit into pre-existing intermolecular spaces between water molecules.

SECTION C: Match Column A with Column B

Column A	Column B	Correct Match
(a) Solid ➔ Gas directly	(i) Evaporation	(a) ➔ (ii) Sublimation
(b) Surface cooling process	(ii) Sublimation	(b) ➔ (i) Evaporation
(c) Single free surface	(iii) Gas	(c) ➔ (iv) Liquid
(d) No free surfaces	(iv) Liquid	(d) ➔ (iii) Gas

🏆 **Chapter Summary:** Matter = Mass + Volume. 3 States: Solid (Rigid, definite shape/volume), Liquid (Flows, fixed volume), Gas (Compressible, expands completely). Heat increases particle motion to convert states!