



CLASS 11 PHYSICS • KINETIC THEORY

Molecular Nature Of Matter

Understanding the microscopic particles
that make up our macroscopic world.

NEET / JEE Prep

The Atomic Hypothesis



“All things are made of atoms—little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another.”

— Richard Feynman

6th - 4th Century BC

Kanada (India) & Democritus (Greece) conjecture indivisible constituents of matter.

19th Century

John Dalton proposes the scientific 'Atomic Theory' to explain chemical combinations.

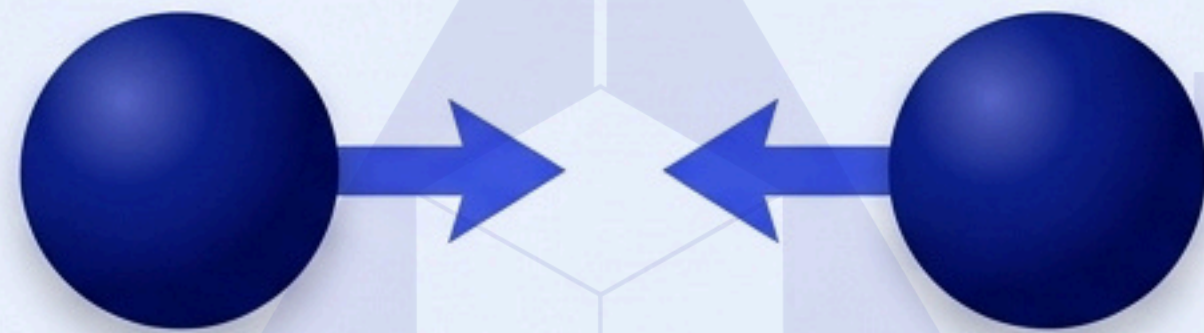
Modern Day

Electron & Scanning Tunnelling Microscopes allow us to visually observe and verify individual atoms.

The Forces Between Particles

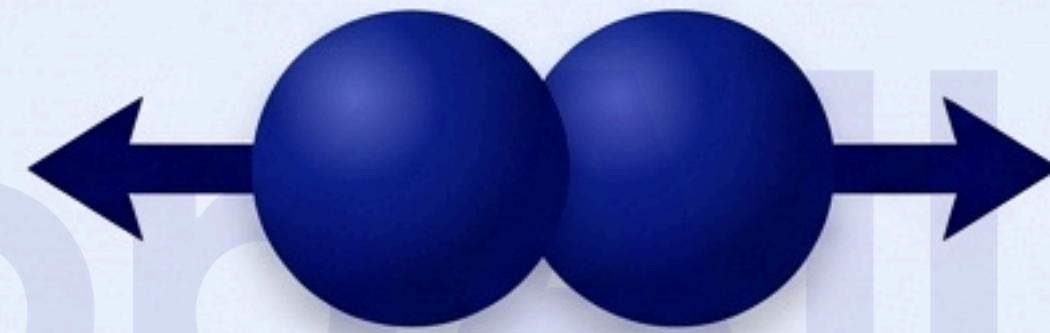
Dynamic Equilibrium in Matter

Matter may look static, but internally it is full of non-stop activity and perpetual motion.



Pair A

Moderate Separation: Particles exert a long-range attraction (pulling together).



Pair B

Very Small Separation: Particles exert a short-range repulsion (pushing apart).

EXAM TIP: The balance of these attractive and repulsive forces determines if a substance is a solid, liquid, or gas.



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



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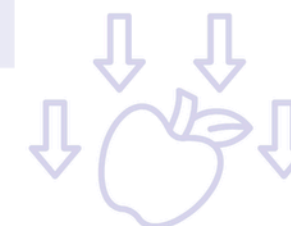
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Key Highlights

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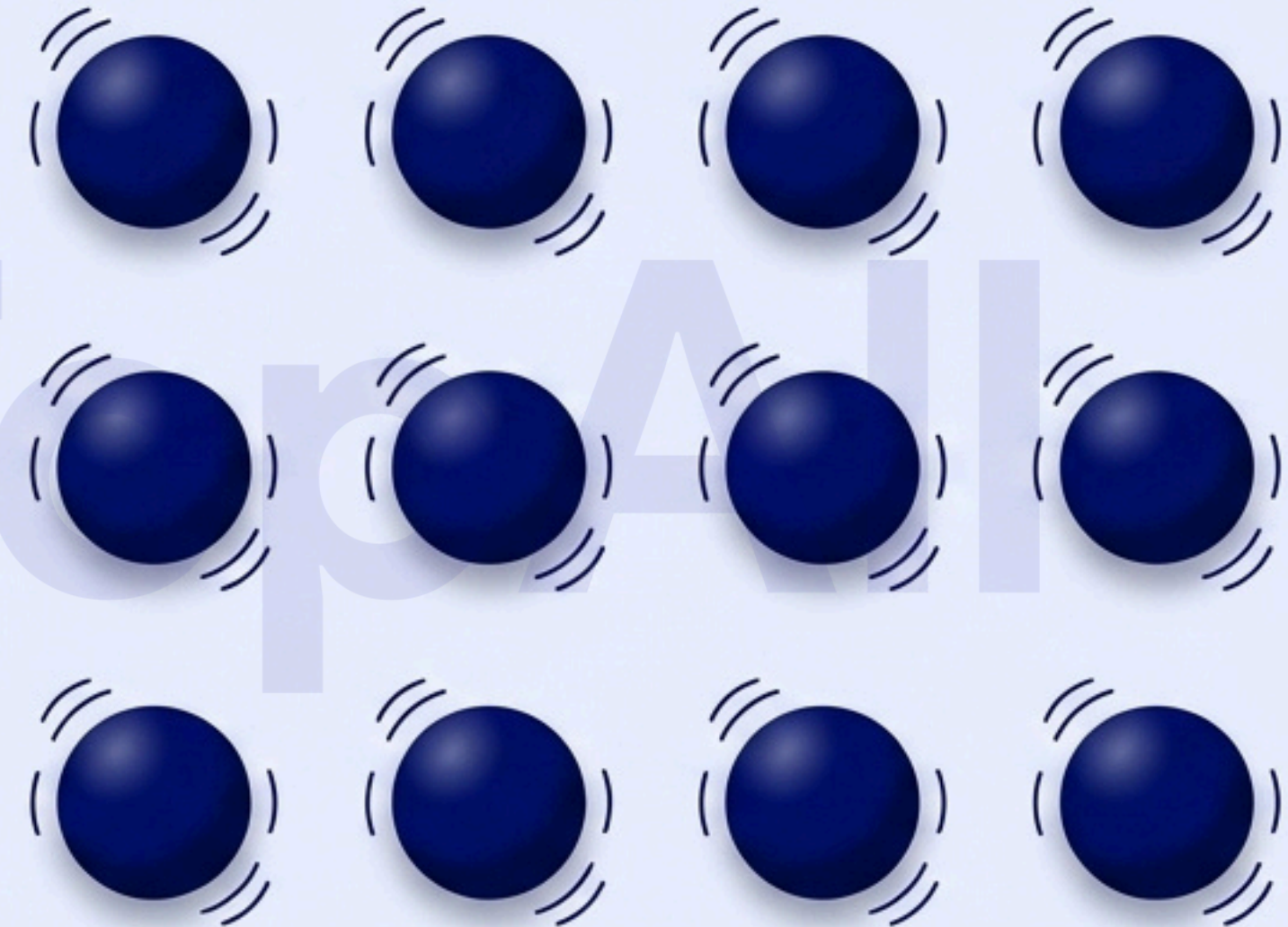


Solids: Tightly Packed & Rigid

Restricted Freedom of Motion

- Atoms are rigidly fixed in an ordered structure.
- Particles cannot move around freely; they only vibrate in place.
- Strong interatomic forces lock the shape and volume.

Interatomic Spacing:
~2 Å (Angstroms)

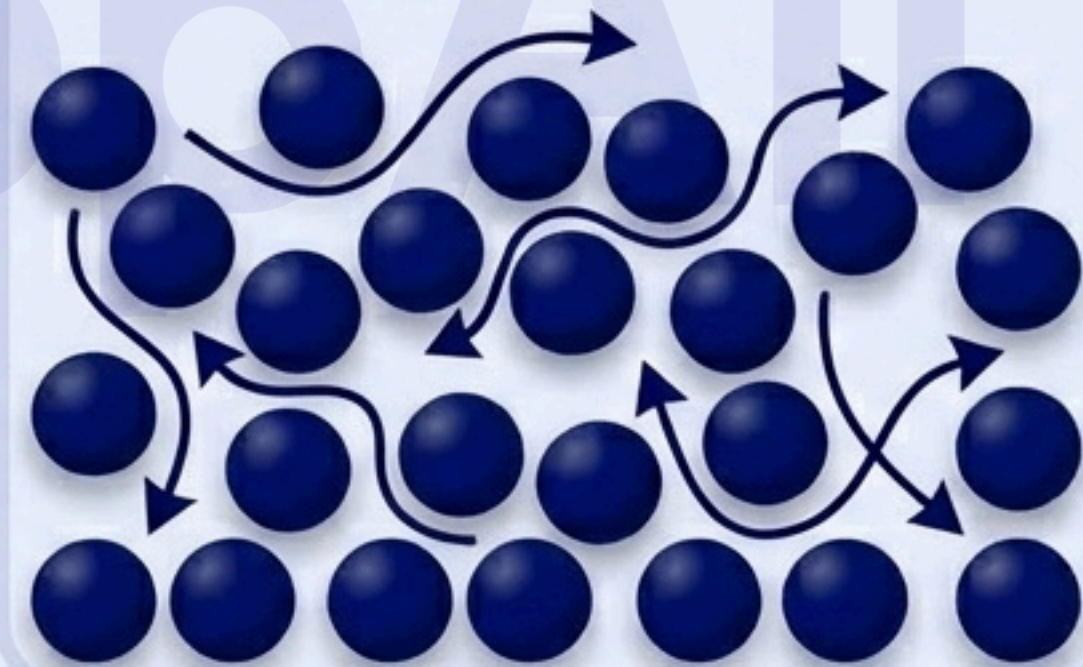


Liquids: Close but Mobile

Freedom to Flow

- Atoms are no longer rigidly fixed to specific positions.
- Particles can move around and slip past one another.
- This mobility allows the liquid to flow and take the shape of its container.

Interatomic Spacing:
~2 Å (Angstroms) — Same as solids!



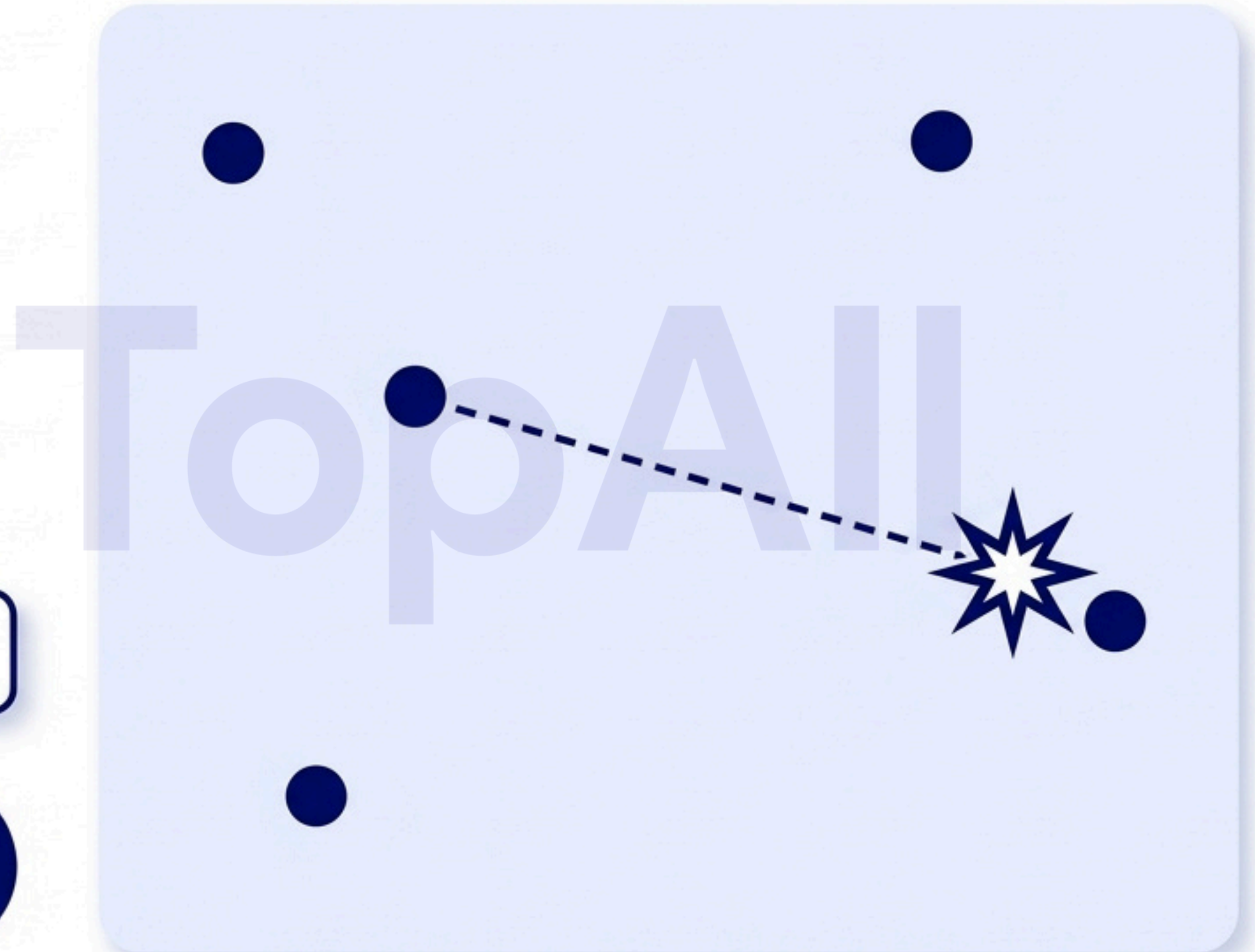
Gases: Far Apart & Free

Unhindered Motion & Collisions

- Particles are mostly free from interatomic forces due to massive separation.
- Molecules travel in straight lines at high speeds until they collide.
- Without an enclosed container, gases will completely disperse.

Interatomic Spacing: Tens of Angstroms

LAW/CONCEPT: Mean Free Path — The average long distance a molecule travels without colliding (Order of thousands of Å).



Key Takeaways



Chapter 12.2 Summary

- **Atomic Hypothesis:** All matter consists of moving particles governed by short-range repulsion and moderate-range attraction.
- **Dynamic Equilibrium:** Even static-looking objects are full of molecular activity and collisions.
- **Particle Spacing:** Solids and liquids have similar spacing ($\sim 2 \text{ \AA}$), while gases are separated by tens of Ångstroms.
- **Mean Free Path:** The average distance a gas molecule travels freely before a collision.

[Try Chapter 12 MCQs Next →](#)



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