8th Class

Chapter - 3

Particulate Nature of Matter

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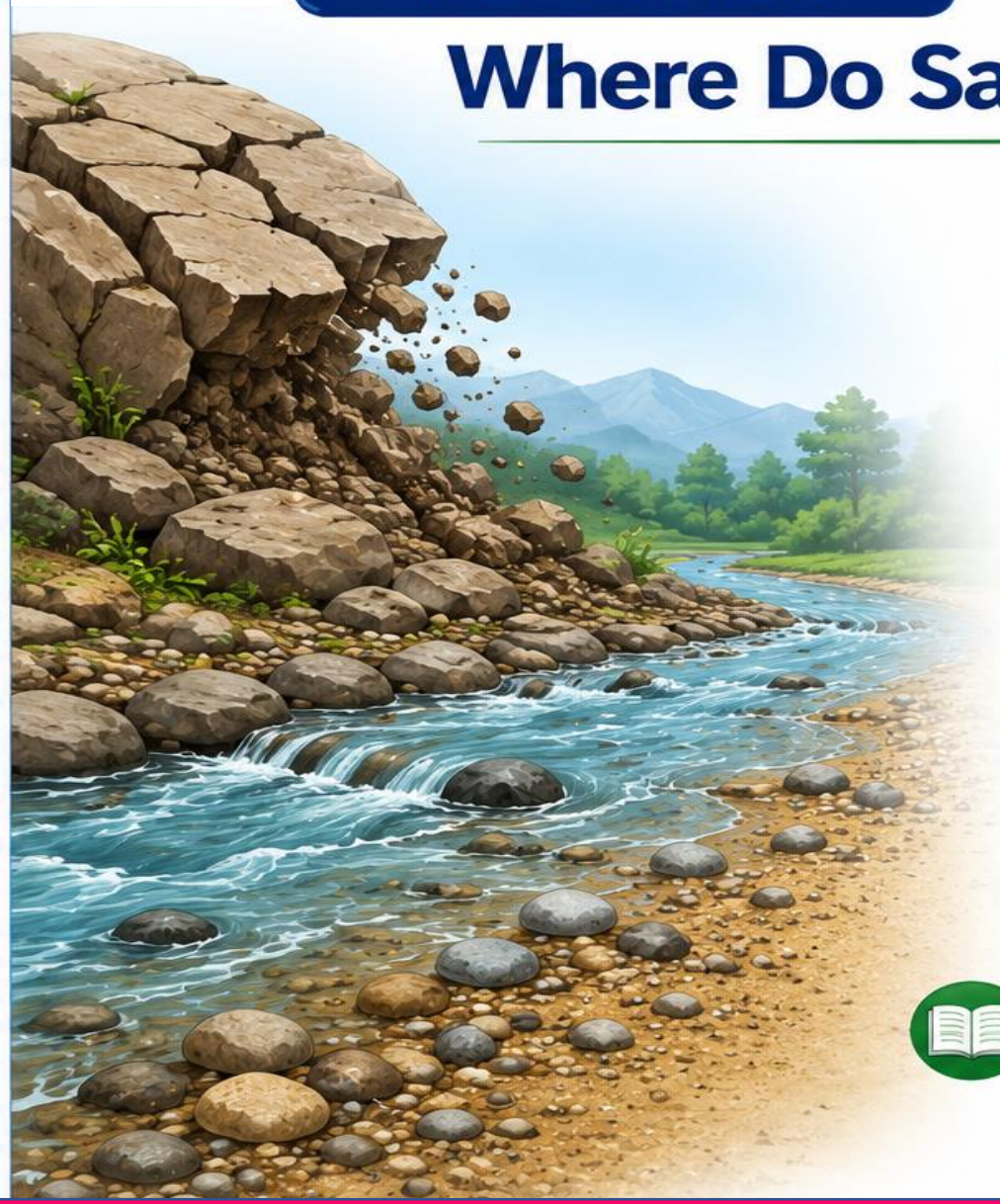
Introduction

Where Do Sand and Pebbles Come From?



Large rocks **break down** naturally.

Rivers and **wind** carry these rock pieces.

Rocks become:

Pebbles	Stones	Sand	Clay
			

Think

Can these particles be broken into even smaller particles?

We Will Learn

Matter is made up of extremely tiny particles.

3.1 What is Matter Composed of?

Activity 3.1 – Let Us Explore

Procedure

1. Take a stick of chalk.
2. Break it into two pieces.
3. Break the pieces again.
4. Grind them into powder.
5. Observe the powder using a magnifying glass.

Observation

- Every tiny speck is still chalk.

Conclusion

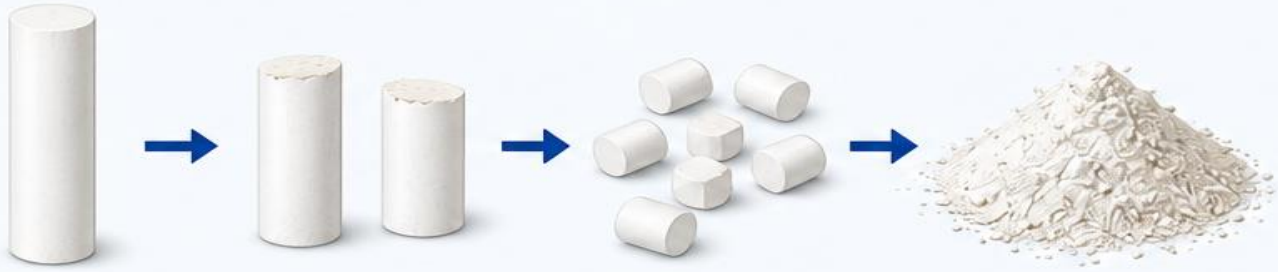
- Breaking changes only the size, not the substance.

Matter is made up of extremely tiny particles.

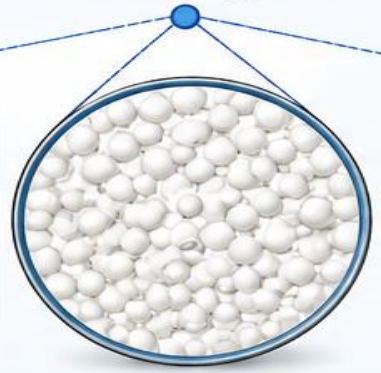
Matter is Made of Tiny Particles

Key Concept

Everything around us is made up of **extremely tiny particles.**



These particles are so small that we cannot see them with our eyes.



They can be seen only with a magnifying glass or microscope.

Observation

- The chalk powder can be broken into smaller and smaller particles.

Conclusion

- Matter is made up of very **tiny particles.**
- These tiny particles are called **constituent particles.**

Important Point

- The nature of the substance **does not change** even when broken into smaller pieces.

Activity 3.2 – Sugar in Water

Let Us Perform

Procedure

1. Take a glass of water.

2. Add two spoons of sugar.

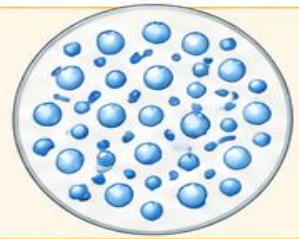
3. Stir well.

Observation

- Sugar disappears.
- Water tastes sweet.

Why?

Sugar particles spread throughout the water.



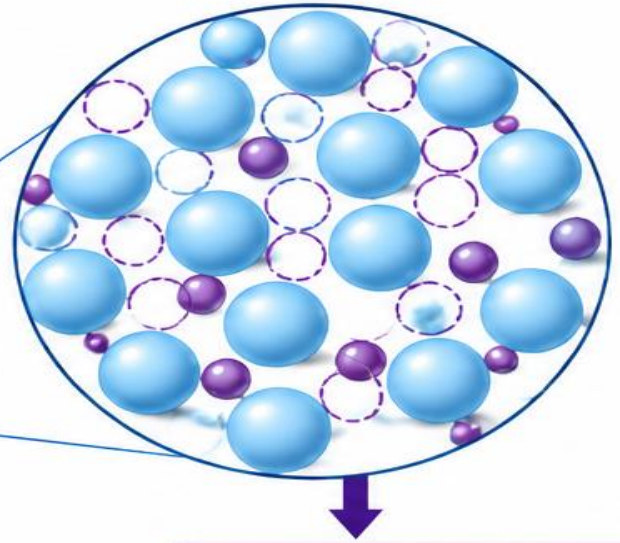
Conclusion

Matter contains very **tiny particles** that cannot be seen with the naked eye.

Interparticle Spaces

Where Did the Sugar Go?

The dissolved sugar particles occupy the **spaces between** water particles.



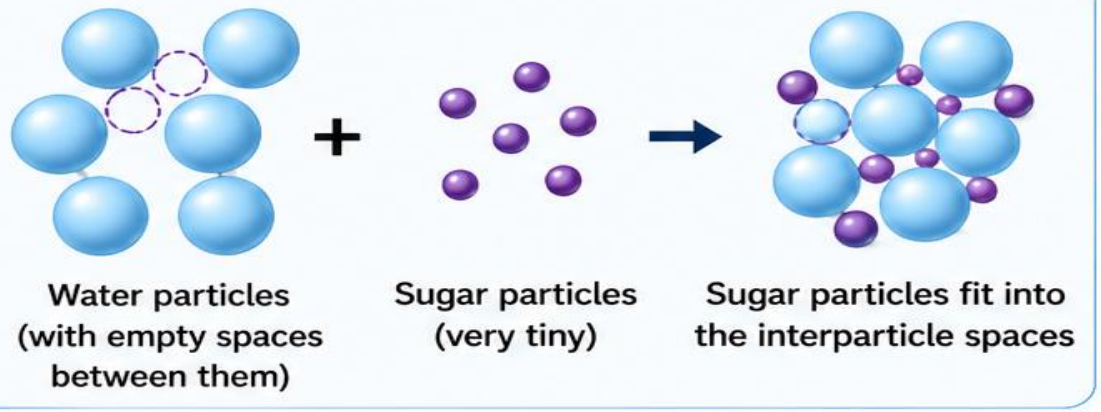
Water particle

Sugar particle

Empty space

These spaces are called

Interparticle Spaces



Key Points

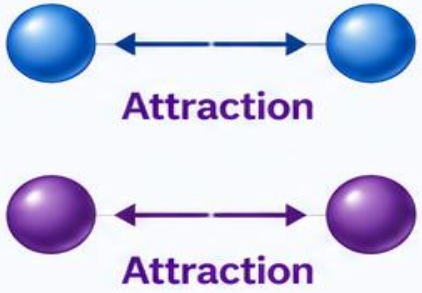
- Matter contains **empty spaces**.
- Tiny particles **occupy these spaces**.
- Matter is made of **extremely small particles**.

3.2 What Decides Different States of Matter?

Interparticle Forces

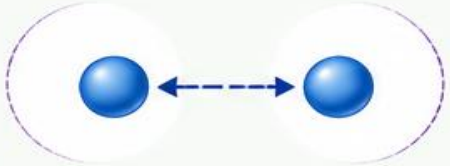
- Particles in matter **attract** one another.

This attractive force is called **Interparticle Attraction**



The Strength Depends On

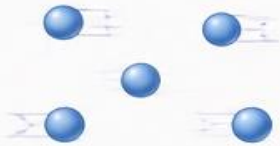
Nature of the substance



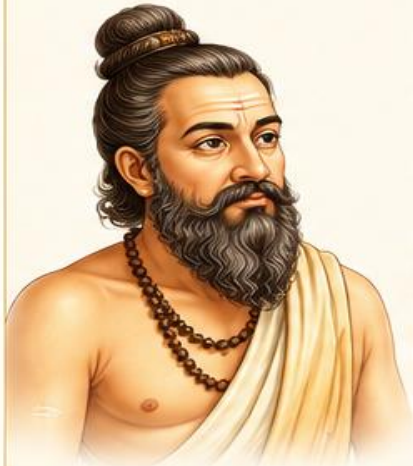
Distance between particles

Result

The strength of attraction decides whether matter is a

Solid	Liquid	Gas
		
Very strong attraction	Moderate attraction	Very weak attraction
↓	↓	↓
Particles are very close	Particles are close	Particles are far apart
↓	↓	↓
Fixed shape and volume	Fixed volume, no fixed shape	No fixed shape or volume

Our Scientific Heritage



Ancient Indian philosopher **Acharya Kanad** proposed that matter is made up of tiny indivisible particles called **Parmanu.**

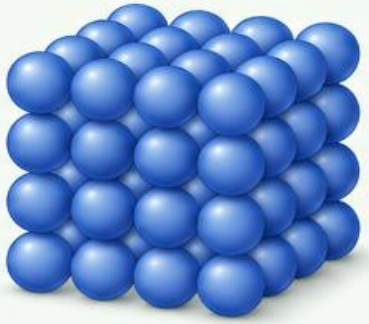
Parmanu

Solid State

3.2.1 Solids

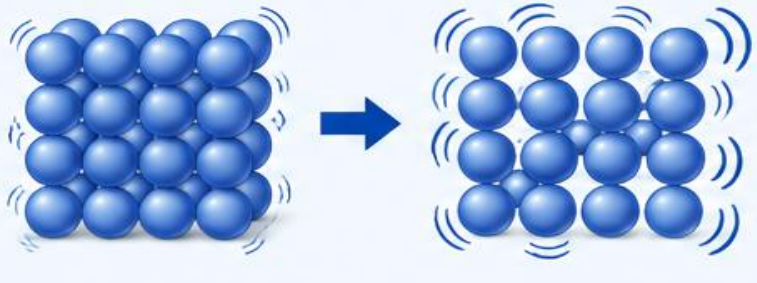
Characteristics

- Definite shape
- Definite volume
- Particles are closely packed.
- Strong interparticle attraction.
- Particles vibrate but do not move freely.



Solid

Heating a Solid



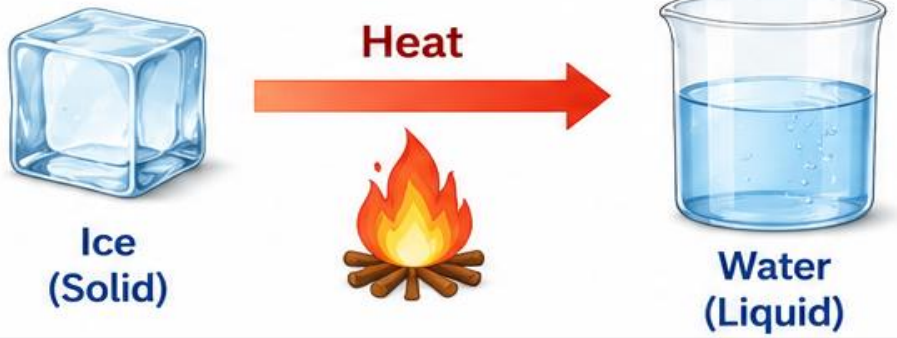
Particles vibrate faster.

Attraction decreases.

Solid changes into liquid.

Key Term

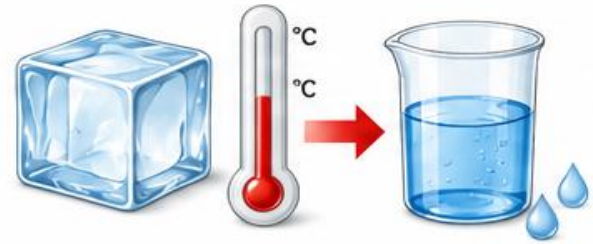
Melting Point – Temperature at which a solid changes into a liquid.



Ice (Solid)

Water (Liquid)

Melting Point of Solids



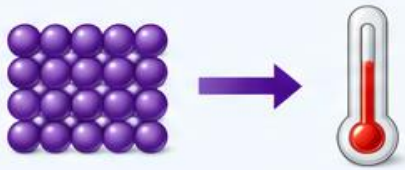
What is Melting Point?

Melting Point is the temperature at which a **solid** changes into a **liquid**.

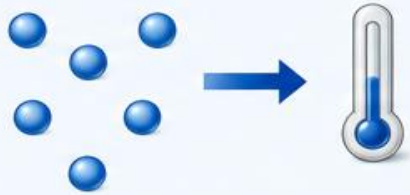
Key Points

- Different solids have different melting points.

- Stronger interparticle attraction → **Higher melting point.**



- Weaker attraction → **Lower melting point.**



Examples

Material	Melting Point
Ice	0°C
Urea	133°C
Iron	1538°C

Remember

Solids melt **only after** reaching their melting point.

3.2.2 Liquid State

Activity 3.4 – Let Us Try and Find Out

Procedure

1. Take three containers of different shapes.
2. Pour 200 mL of water into each container.

Observation

- Water changes its shape according to the container.
- The volume remains 200 mL in all containers.

Conclusion

- ✓ Liquids have no fixed shape.
- ✓ Liquids have a definite volume.

Liquids flow and take the shape of their container, but their volume does not change.

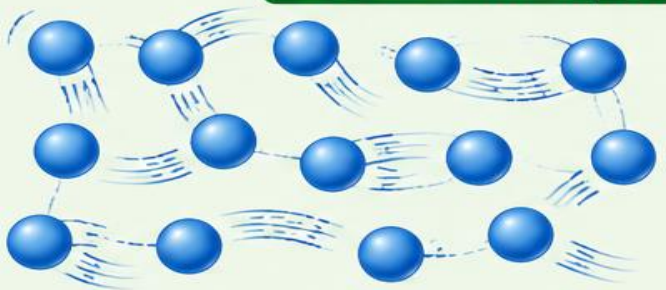
Properties of Liquids

Characteristics of Liquids

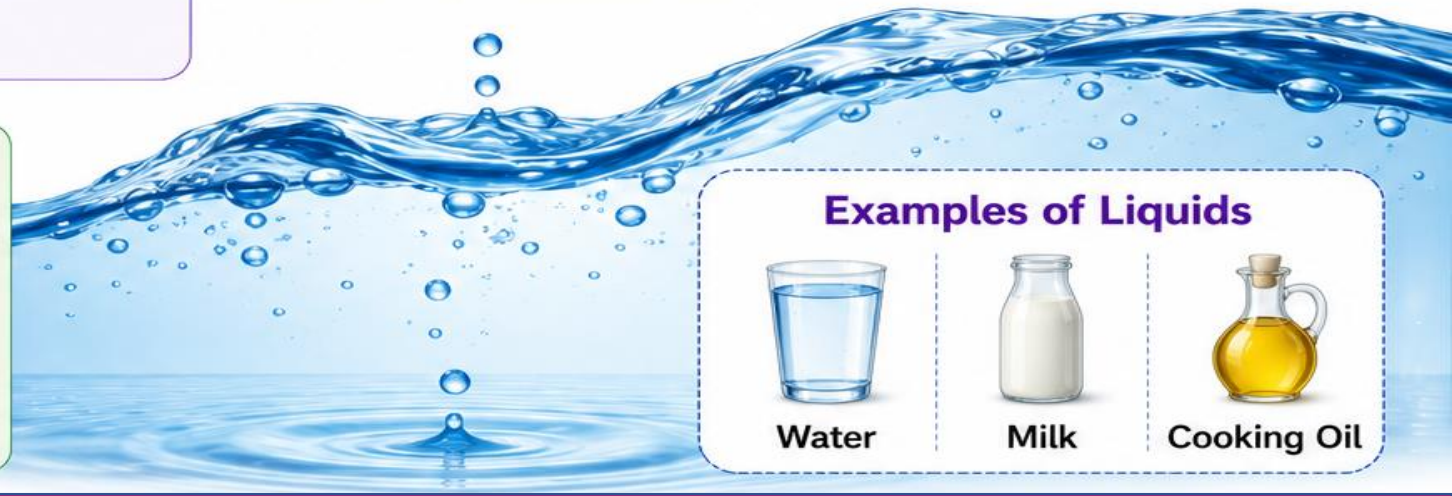
- No fixed shape.
- Definite volume.
- Particles are loosely packed.
- Particles can slide over one another.
- Interparticle attraction is weaker than in solids.

Liquids take the **shape** of their container but their **volume** remains the same.

Particles in Liquids



Particles are **loosely packed** and can move or slide past one another.



Examples of Liquids

Water

Milk

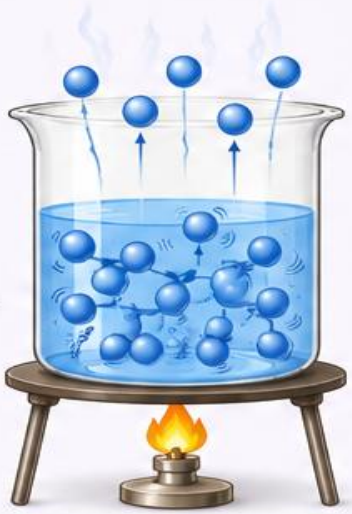
Cooking Oil

Boiling and Evaporation

Heating a Liquid

When a liquid is heated:

- Particles move **faster**.
- Interparticle attraction **decreases**.
- The liquid changes into a **gas**.



Boiling

- Occurs **throughout** the liquid.
- Takes place at a fixed temperature (**boiling point**).

Evaporation

- Occurs only at the **surface**.
- Can occur at **any temperature**.

Key Difference

	Boiling	Evaporation
	Fixed temperature	Any temperature
	Whole liquid	Surface only

3.2.3 Gaseous State

Activity 3.5 – Let Us Investigate

Procedure

1. Collect smoke in **Gas Jar A**.

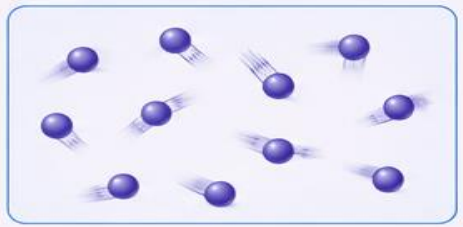
2. Transfer it to **Gas Jar B**.

Observation

Smoke **spreads** throughout the gas jar.

Conclusion

Gas particles:



- Move **freely**.
- Occupy **all available space**.
- Have **no fixed shape**.
- Have **no fixed volume**.

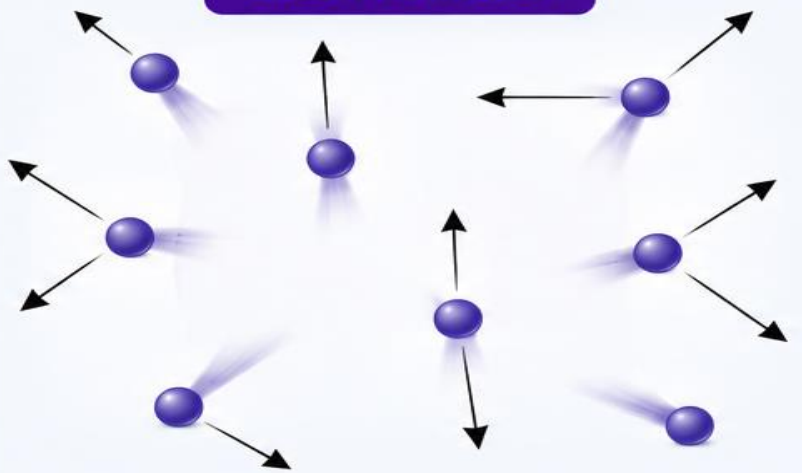
Gases have **no fixed shape** and **no fixed volume**. They expand to fill the **entire space** available.

Properties of Gases

Characteristics of Gases

- No fixed shape.
- No fixed volume.
- Particles are far apart.
- Very weak interparticle attraction.
- Particles move freely in all directions.

Gas Particles



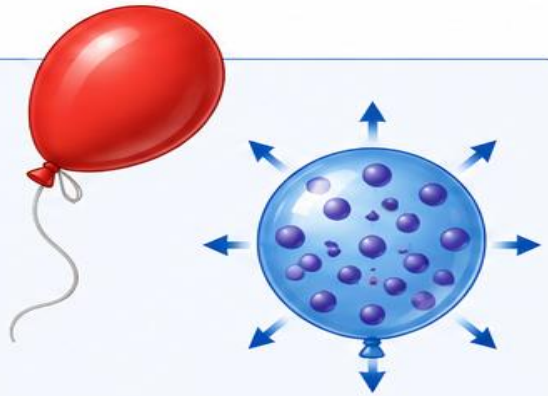
Gas particles are **far apart** and move **freely** in all directions, filling **all the available space**.

Examples

Air | Oxygen | Carbon dioxide | Water vapour

Key Points

- Gases **expand** to fill their container **completely**.
- They can **flow** easily.
- Different gases may have different **odours** and **uses**.

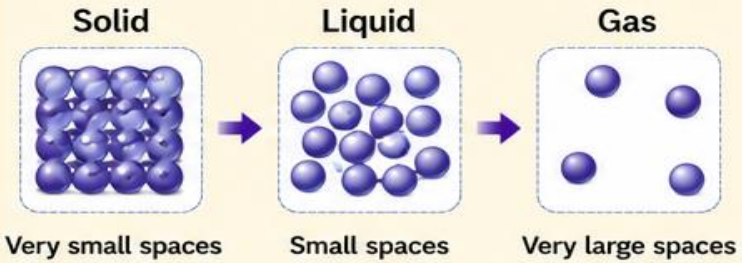


Remember: Gases are **highly compressible**.

3.3 Interparticle Spacing

Activity 3.6 – Syringe Experiment

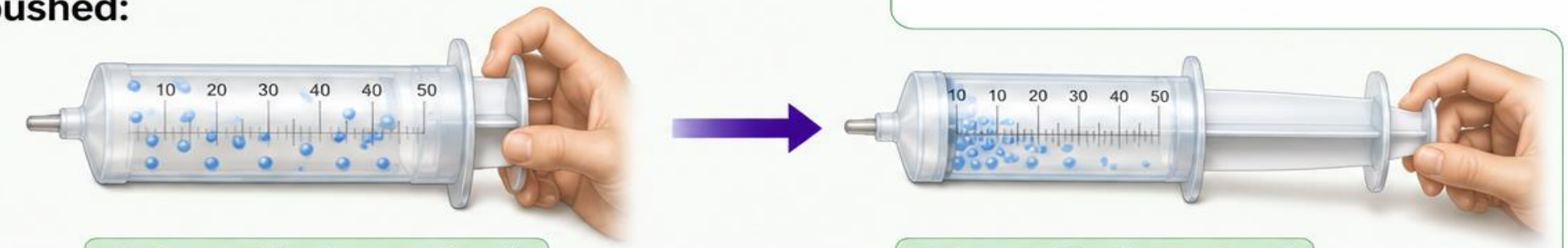
Interparticle Spacing in Different States



Observation

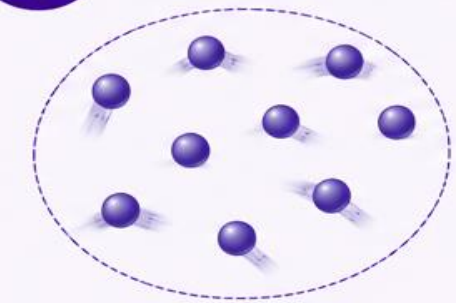
When the plunger is pushed:

- Air is compressed.
- Volume decreases.



Before pushing (more volume) | After pushing (less volume)

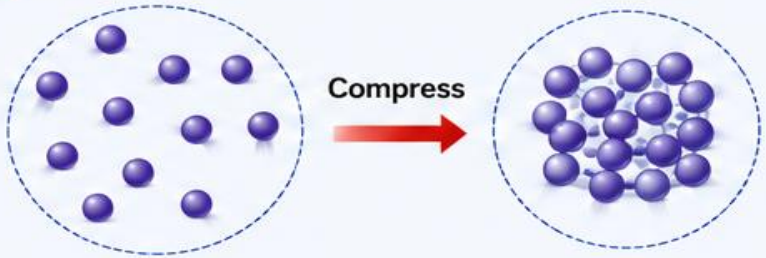
Conclusion



Gas particles have large spaces between them.

Important Point

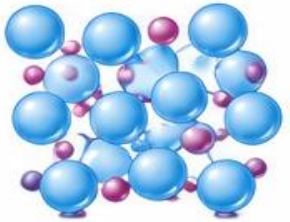
Gases are compressible because of large interparticle spaces.



Interparticle Spaces in Liquids

Activity 3.7

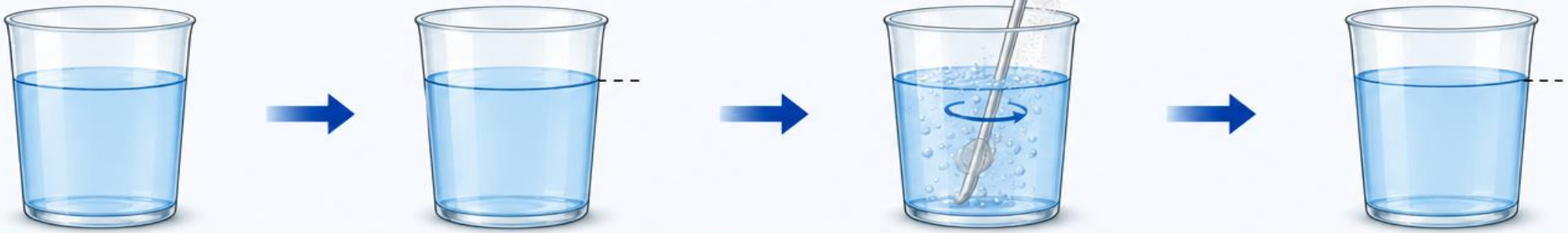
Interparticle Spaces in Liquids



- Water particles
- Sugar particles occupying spaces

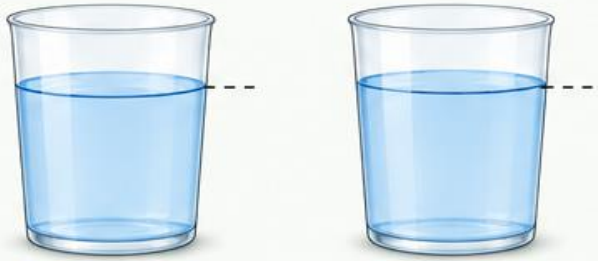
Procedure

1. Fill a glass with water.
2. Mark the water level.
3. Add sugar and stir.
4. Let it settle for a while.



Observation

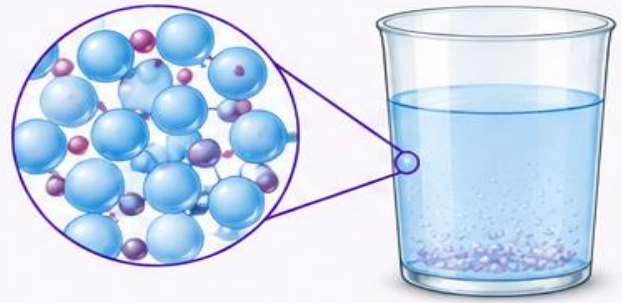
- The water level changes only slightly.



Before adding sugar | After adding sugar

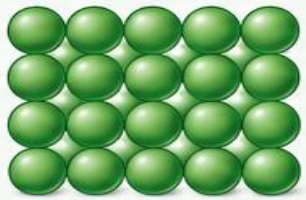
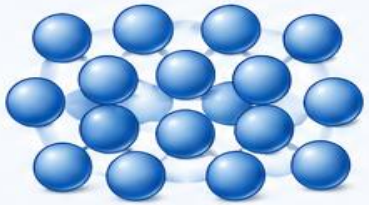
Conclusion

- Sugar particles occupy the spaces between water particles.
- This proves that liquids also have interparticle spaces.



Interparticle Spacing in Solids, Liquids and Gases

Comparison

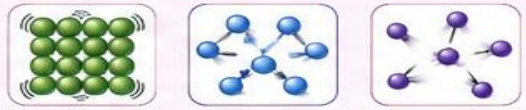
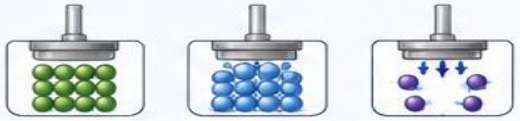
	Solid	Liquid	Gas
Interparticle Spacing	 Very little space	 Moderate space	 Maximum space
Arrangement of Particles	Closely packed	Loosely packed	Far apart
Interparticle Attraction	Strong attraction	Moderate attraction	Very weak attraction

Key Point

Interparticle spacing increases from:

Comparison of the Three States of Matter

States of Matter

Property	Solid	Liquid	Gas	
Shape	Fixed	No fixed shape	No fixed shape	
Volume	Fixed	Fixed	No fixed volume	
Particle Arrangement	Closely packed	Loosely packed	Very far apart	
Particle Movement	Vibrate	Slide	Move freely	
Compressibility	Very low	Low	High	

Summary

- **Solids:** Strong attraction, fixed shape and volume.
- **Liquids:** Definite volume, take the shape of the container.
- **Gases:** No fixed shape or volume; particles move freely.



3.4 How Particles Move in Different States of Matter

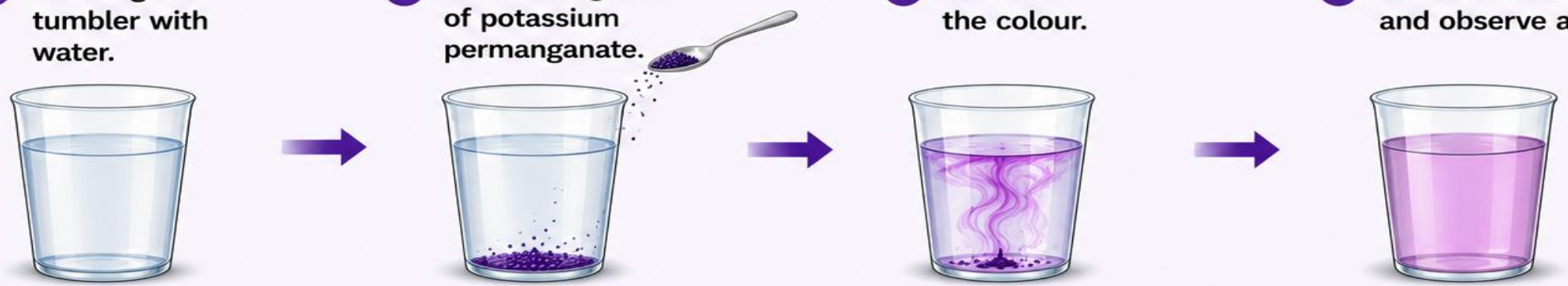
Movement of Particles

Matter is made up of tiny particles that are **always in motion**.

Activity 3.8 – Let Us Experiment

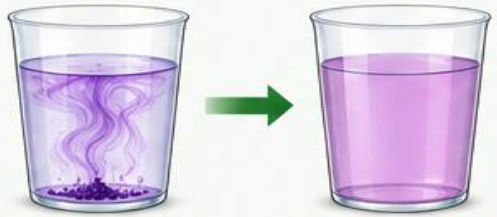
Procedure

1. Take a glass tumbler with water.
2. Add a few grains of potassium permanganate.
3. Observe the colour.
4. Wait for some time and observe again.



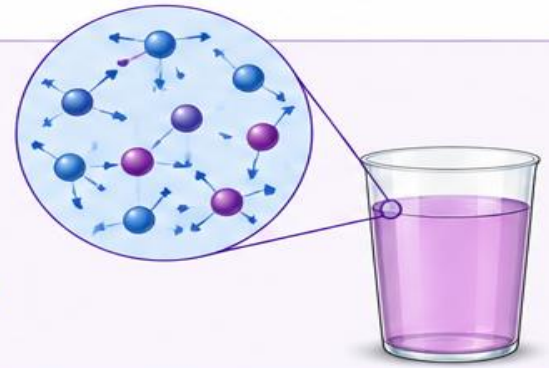
Observation

- Purple streaks spread slowly.
- After some time, the entire water becomes uniformly pink/purple.



Conclusion

- Water particles are **continuously moving**.
- Potassium permanganate particles **spread throughout the water**.



Continuous Motion of Particles

Why Does the Colour Spread?

The colour spreads because the particles of water and potassium permanganate are in constant motion.

Key Points

- Particles move continuously.

- They mix on their own.

- Movement is called diffusion.

How Diffusion Occurs

1. Particles of potassium permanganate are added.

2. Particles start moving in different directions.

3. They spread through the water.

4. Finally, the particles are evenly mixed everywhere.

Think Like a Scientist

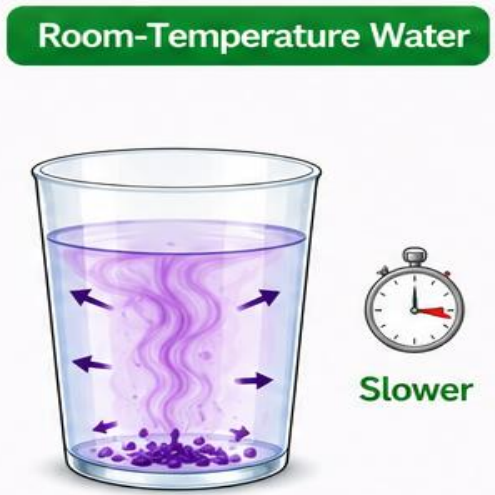
Effect of Temperature on Particle Movement

Activity

Take three glasses containing:

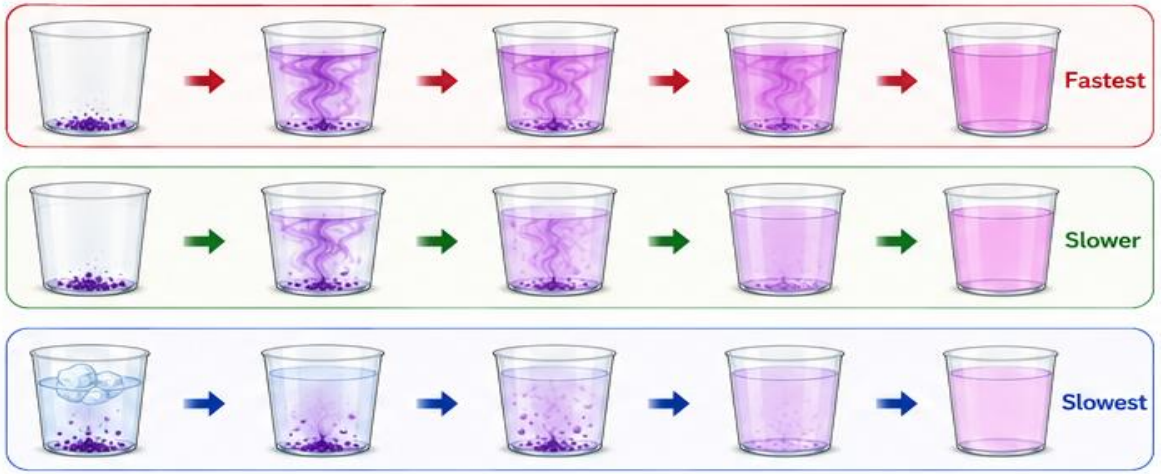
- Hot water
- Water at room temperature
- Ice-cold water

Add potassium permanganate to each.



Observation

- Colour spreads fastest in hot water.
- Spreads slowly in room-temperature water.
- Spreads slowest in cold water.



Conclusion

- Heating increases the movement of particles.
- Higher temperature ⟶ Faster diffusion.

Activity 3.9 – Fragrance of an Incense Stick

Diffusion in Gases

Procedure

1. Light an incense stick.

2. Place it in one corner of the room.

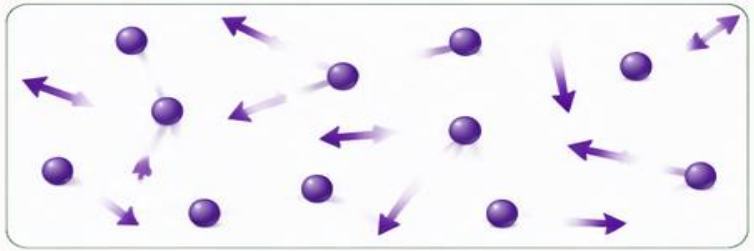
3. Wait for a few minutes.

Observation

- The fragrance spreads throughout the room.

Conclusion

- Gas particles move freely and spread in all directions.

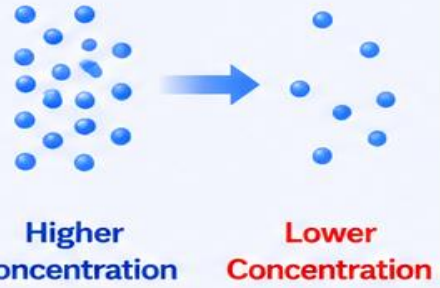


Diffusion in Gases

Diffusion explains how particles of a gas spread and mix on their own.

What is Diffusion?

Diffusion is the movement of particles from a region of higher concentration to lower concentration.



Examples

How Diffusion Occurs in Gases

1. Particles are released in one place.
2. Particles move in all directions.
3. Particles spread throughout the space.

Key Points

- Diffusion is fastest in gases.
- Gas particles move continuously.
- They occupy all available space.
- Temperature increases the rate of diffusion.

Everyday Applications

Particulate Nature of Matter in Daily Life

Examples

Washing clothes with soap

Soap particles spread through water and remove dirt from clothes.

Perfume spreading in a room

Perfume particles diffuse through air and reach every part of the room.

Sugar dissolving in tea

Sugar particles mix with tea particles and spread throughout.

Salt dissolving in water

Salt particles fit into the spaces between water particles and dissolve.

Ink mixing with water

Ink particles move through water and spread in all directions.


thank you