

Chapter 3: Particulate Nature of Matter

RUNNING NOTES

Introduction: Everything around us occupies space and has mass. Such things are called matter.

Examples: Air, Water, Stone, Milk, Wood, Iron, Sand

Scientists discovered that matter is not continuous. It is made of millions of tiny particles called constituent particles.

3.1 What is Matter Composed of?

Activity 3.1 – Breaking Chalk

Procedure

1. Take a chalk piece.
2. Break it into small pieces.
3. Grind into powder.
4. Observe using a magnifying glass.

Observation

1. The chalk remains chalk.
2. Only the size decreases.

Conclusion

1. Breaking or grinding does not produce a new substance.
2. It is a physical change.

Constituent Particles

When chalk is broken repeatedly,

↓
smaller pieces

↓
very tiny particles

↓
constituent particles

These particles cannot be broken further by ordinary physical methods.

Important Point: Every substance is made up of a huge number of extremely small particles.

Examples: Chalk, Sugar, Salt, Water, Iron

Activity 3.2 Dissolving Sugar

Procedure

1. Add sugar to water.
2. Taste water.
3. Stir.
4. Observe.

Observation

1. Sugar disappears.
2. The water becomes sweet.

Conclusion

1. Sugar particles occupy spaces between water particles.

Interparticle Spaces

1. Tiny spaces exist between particles.
2. These spaces are called

Interparticle Spaces

Because of these spaces,

1. Sugar dissolves.
2. Salt dissolves.
3. Gases mix easily.

Our Scientific Heritage: Ancient Indian philosopher **Acharya Kanada** proposed that matter consists of tiny indivisible particles called **Parmanu**. This idea appears in **Vaisheshika Sutras**.

3.2 What Decides Different States of Matter?

Particles are held together by **Interparticle Attractive Forces**

The strength of attraction determines whether matter is

1. Solid
2. Liquid
3. Gas

3.2.1 Solid State

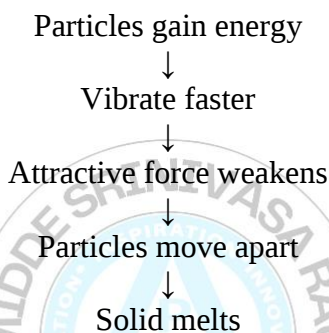
Examples: Iron, Stone, Salt, Wood, Aluminium

Properties of Solids

- Definite shape
- Definite volume
- Closely packed particles
- Strong attractive forces
- Very little space between particles
- Vibrate about fixed positions
- Cannot move freely

Heating a Solid

When heated,



Melting Point: The temperature at which a solid changes into liquid.

Examples: Ice $\rightarrow$ 0°C , Urea $\rightarrow$ 133°C , Iron $\rightarrow$ 1538°C

3.2.2 Liquid State

Water is poured into different containers.

Observation

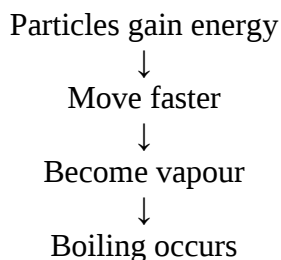
1. Water changes its shape according to the container.
2. Volume remains the same.

Properties of Liquids

- No fixed shape
- Fixed volume
- Particles move freely
- Moderate attractive forces
- Moderate interparticle spaces
- Flow easily

Boiling

When heated,



Boiling Point: Temperature at which a liquid changes into vapour.

Evaporation: Evaporation occurs

1. At all temperatures
2. From the surface only
3. Slowly

Examples: Wet clothes dry, Sweat evaporates, Water spills and disappears.

3.2.3 Gaseous State

Activity 3.5

Smoke spreads inside gas jars.

Observation

1. Smoke fills the entire container.

Conclusion

1. Gas particles move in all directions.

Properties of Gases

- No fixed shape
- No fixed volume
- Large interparticle spaces
- Negligible attractive forces
- Highly compressible
- Move freely

3.3 Interparticle Spacing

Activity 3.6 Syringe Experiment

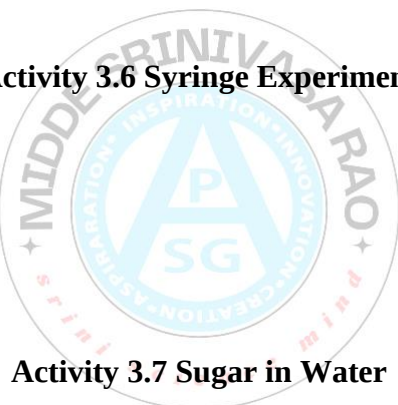
Compress air in a syringe.

Observation

1. Air volume decreases.

Conclusion

1. Gas particles have large spaces.
2. Therefore, Gases are compressible.



Activity 3.7 Sugar in Water

Observation

1. Water level changes only slightly after sugar dissolves.

Reason

1. Sugar particles occupy spaces between water particles.

Comparison of Interparticle Spaces

Solids

- Minimum space
- Closely packed

Liquids

- Moderate space
- Less closely packed

Gases

- Maximum space
- Very loosely packed

3.4 Movement of Particles

Particles are always moving.

Movement increases with temperature.

Activity 3.8 Potassium Permanganate

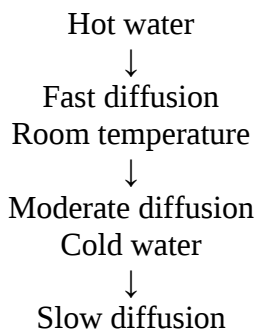
Observation

1. Purple colour spreads throughout water.

Conclusion

1. Water particles are continuously moving.

Temperature Effect



Activity 3.9 Incense Stick

Observation

1. Fragrance spreads throughout the room.

Reason

1. Air particles continuously move and carry fragrance particles.
2. This process is called **Diffusion**

Diffusion: The spontaneous mixing of particles due to their continuous random motion.

Examples: Perfume smell, Incense stick, LPG smell, Air freshener, Food aroma

Everyday Applications

- ✓ Soap removes dirt because soap particles surround oil particles.
- ✓ Sugar dissolves in tea.
- ✓ Salt dissolves in water.
- ✓ Perfume spreads throughout a room.
- ✓ Wet clothes dry by evaporation.
- ✓ Balloons can be compressed slightly because gases contain spaces.

Differences Among Solids, Liquids and Gases

Property	Solid	Liquid	Gas
Shape	Fixed	No fixed shape	No fixed shape
Volume	Fixed	Fixed	No fixed volume
Particle spacing	Minimum	Moderate	Maximum
Attractive force	Maximum	Moderate	Minimum
Movement	Vibrations only	Limited movement	Free movement
Compressibility	Negligible	Very little	High

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