

Matter in Our Surroundings

Class 9 Science

The image features a young woman with blonde hair, wearing a red t-shirt with the text "chemistry ABC.com" printed on it. She is standing in front of a background that includes several logos and images related to chemistry and education. On the left, there are logos for "CSIR-NET", "GATE", and "IIT-JAM" in orange text. Below these is a green square logo for "IIT JAM Joint Admission Test for M.Sc.". On the right, there is a blue rounded square logo for "GATE" and a black rounded rectangle with a white "i" icon and the text "VIEW Details". At the bottom left, there are four pieces of laboratory glassware (a round-bottom flask with red liquid, a beaker with green liquid, a graduated cylinder with yellow liquid, and a small flask with blue liquid). At the bottom right, there is a large pink Erlenmeyer flask with the text "chemistry ABC.com" on it. A vertical watermark "www.ChemistryABC.com" is visible on the right side of the image.

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MATTER IN OUR SURROUNDINGS

→ Physical Nature of Matter :

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- 1] Matter is made up of particles.
- 2] The particles of matter are very small, they are small beyond our imagination.

→ Characteristics of Particles of Matter :

- 1] Particles of matter have space between them.
 - When we make tea or coffee or lemonade (nimbu pani) particles of one type of matter get into spaces between particles of the other. This shows that there is enough space between particles of matter.
- 2] Particles of Matter are continuously moving.
 - Particles of matter are continuously moving, that is, they possess what we call the kinetic energy. As the temperature rises, particles move faster.
- 3] Particles of matter attract each other.

QUESTIONS :

Q-1 Which of the following are matter?
Chair, air, love, smell, hate, almonds, thought, cold, lemon water, smell of perfume.

Answer : Chair, air, smell, lemon water.

Q-2 A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

Answer : The diver is able to cut through water in a swimming pool. This observation shows that the matter has spaces between them so that the particles can move from one place to another to accommodate the body of the diver.

→ States of Matter :

- Matter around us exist in three different states :



SOLID

LIQUID

GAS

1. Constituent particles are closely packed.

Constituent particles are less closely packed.

Constituent particles are far apart from each other.

2. Force of attraction between particles is very strong.

Force of attraction between particles is less strong.

Force of attraction between particles is negligible.

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3.

Kinetic energy between particles is more than maximum kinetic energy that in solids.

4. Have definite shape and volume.

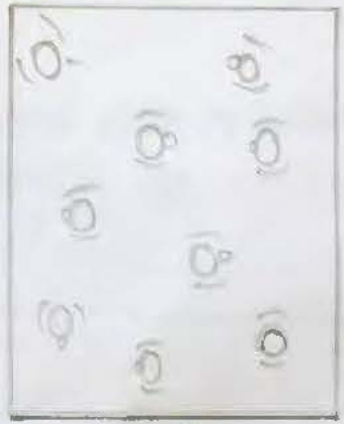
Do not have definite shape but definite volume.

Neither have definite shape nor definite volume.

5. Have high density and cannot be diffused.

Density is lower than solids and can diffuse.

Density is least and can easily diffuse.



(a)
Solid

(b)
Liquid

(c)
Gas

→ Can Matter Change its State?

- We all know from our observation that water can exist in 3 states of matter:

- Solid, as ice.
- Liquid, as the familiar water.
- Gas, as water vapour.

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- Effect of change of Temperature:

- On increasing the temperature of solids, the kinetic energy of the particles increases.
- Due to the increase in kinetic energy, the particles start vibrating with greater speed.
- The energy supplied by heat overcomes the forces of attraction between the particles.
- The particles leave their fixed positions and start moving more freely.
- A stage is reached when the solid melts and is converted to a liquid.
- The minimum temperature at which a solid melts to become a liquid at the atmospheric pressure is called its **melting point**.
- The melting point of a solid is an indication of the strength of the force of attraction between its particles.

8. The melting point of ice is 273.15K .

9. When a solid melts, its temperature remains the same, so where does the heat energy go?

- You must have observed, during the experiment of melting, that the temperature of system does not change after the melting point is reached, till all the ice melts.
- This happens even though we continue to heat the beaker, i.e. we continue to supply heat.
- This heat gets used up in changing the state by overcoming the forces of attraction between the particles.
- As this heat energy is absorbed by ice without showing any rise in temperature.
- It is considered that it gets hidden into the contents of the beaker and is known as the 'latent heat'.
- The word latent means hidden.
- The amount of heat energy that is required to change 1kg of a solid into liquid at atmosphere pressure at its melting point is known as the latent heat of fusion.
- So, particles in water at 0°C (273K) have more energy as compared to particles in ice at same temperature.

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- The temperature at which a liquid starts boiling at the atmosphere pressure is known as its Boiling point.

- Boiling is a bulk phenomenon.
- Particles from the bulk of the liquid gain enough energy to change into the vapour state.

* For water this temperature is 373K ($100^\circ\text{C} = 273\text{K} + 100 = 373\text{K}$).

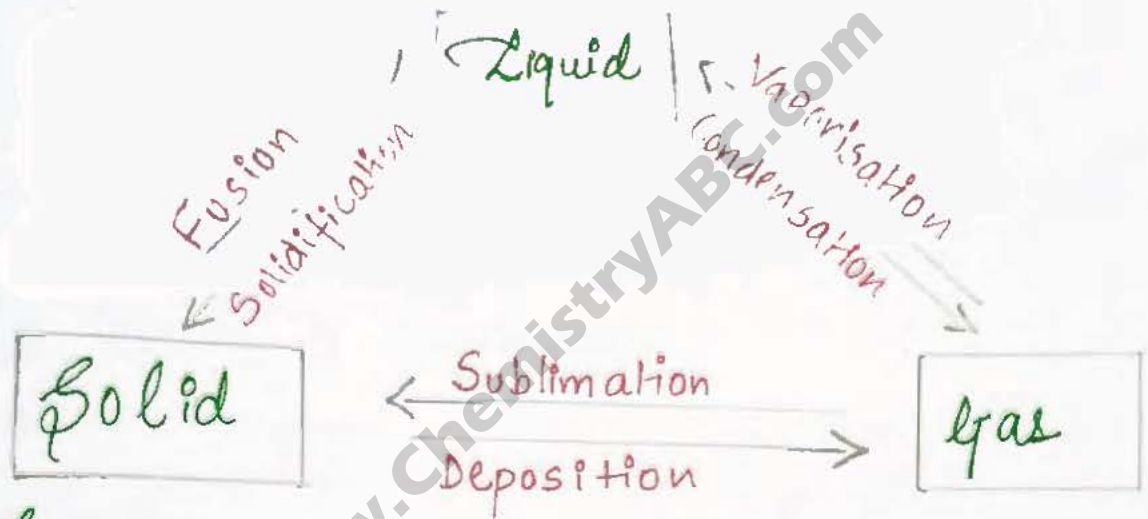
- Effect of Change of Pressure :

- Applying pressure and reducing temperature can liquefy gases.

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- Thus, we can say that pressure and temperature determine the state of a substance, whether it will be solid, liquid or gas.

* Interconversion of the three states of Matter :



→ Evaporation :

- We know that particles of matter are always moving and are never at rest.

- At a given temperature in any gas, liquid or solid, there are particles with different amounts of kinetic energy.

- In any case of liquids, a small fraction of particles at the surface, having higher kinetic energy, is able to break away from the forces of attraction of other particles and gets converted into vapour.

- This phenomenon of change of a liquid into vapour at any temperature below its boiling point is called **Evaporation**.

- Factors Affecting Evaporation :

- You must have observed that the rate of evaporation increases with

- Factors Affecting Evaporation :

- We must have observed that the rate of evaporation increases with :

A) An increase of Surface Area :

- We know that evaporation is a surface phenomenon.

- If the surface area is increased the rate of evaporation increases. E.g. while putting clothes for drying up we spread them out.

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B) An increase of Temperature :

- With the increase of temperature, more number of particles get enough kinetic energy to go into the vapour state.

C) A decrease in Humidity :

- Humidity is the amount of water vapour present in air.

- The air around us cannot hold more than a definite amount of water vapour at a given temperature.

- If the amount of water in air is already high, the rate of evaporation decreases.

Q] An increase in wind speed : www.ChemistryABC.com

- It is a common observation that clothes dry faster on a windy day.

- With the increase in wind speed, the particles of water vapour move away with the wind, decreasing the amount of water vapour in the surrounding.

→ How does evaporation cause cooling ?

- In an open vessel, the liquid keeps on evaporating.

- The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation.

Question : Why should we wear cotton clothes in summer ?

Answer : We sweat more in the summer season.

- Cotton is a strong water absorber, helps to absorb the sweat and introduce to the environment of evaporation.

- Our body takes out heat as the sweat evaporates from our body.

- Therefore, our body loses heat & is cooled.