Matter

Points to Remember:

- Matter has mass and occupies space.
- Matter is made up of atoms and molecules.
- Atoms are the smallest particles of matter which may or may not have independent existence.
- Molecules are capable of independent existence. They are made up of atoms of same kind or different kinds.
- The atoms and molecules are in random motion.
- There are gaps between the molecules of matter called as intermolecular space.
- There exists a force of attraction between the molecules known as intermolecular force of attraction.
- Matter exists in three states: solids, liquid and gas.
- Matter can change from one state to another on changing temperature and pressure.
- The change of state of a matter from one form into another is called interconversion of states of matter.
- Matter can neither be created nor be destroyed. Only it can be changed from one form to another during a chemical reaction. This is known as law of conservation of mass.

Exercise

Question 1.
Define:
(a) matter
(b) intermolecular force of attraction.
Answer:
(a) Matter is anything which has mass, occupies space and can be percieved by our senses.
Example: Air, Book.
(b) The molecules of matter are always in motion and attract each other with a force called intermolecular force of attraction due to which they are held together.

Question 2.
What are the three states of matter ? Define each of them with two examples.
Answer:
The three states of matter are:
solids, liquids and gases

- **Solids** — A solid has a definite shape and definite volume.
  Example – wood, stone, iron, ice etc.

- **Liquid** — A liquid has a definite volume but not definite shape.
  Example — water, juice, milk, oil, etc.
- **Gases** — A gas neither has definite shape nor a definite volume.
  Example – air, hydrogen, oxygen, watervapour etc.

Question 3.
Define interconversion of states of matter. What are the two factors responsible for the change of states of matter?
Answer:
The process by which matter changes from one state to another and back to original state, without any change in its chemical composition is called interconversion state of matter.
Two factors responsible for change of state of matter are: change in
(i) Temperature (ii) Pressure

Question 4.
State the main postulates of kinetic theory of matter.
Answer:
The main postulates of the theory are:

1. Matter is composed of very small particles called atoms and molecules.
2. The constituent particles of a kind of matter are identical in all respects.
3. These particles have space or gaps between them which is known as interparticular or intermolecular space.
4. There exists a force of attraction between the particles of matter which holds them together. This force of attraction is known as interparticular or intermolecular force of attraction.
5. Particles of matter are always in a state of random motion and possess kinetic energy, which increases with increase in temperature and vice-versa.

Question 5.
What happens to water if
(a) it is kept in a deep freezer
(b) it is heated
Explain the phenomenon of change of state of water.
Answer:
(a) When water is kept in a deep freezer, it gets cooled and change into ice at 0°C ice.

$$\text{water} \xrightarrow[\text{freezer}]{\text{deep}} \text{ice (0°C)}$$

(b) Water on heating changes into steam at 100°C

$$\text{water} \xrightarrow{\text{heating}} \text{steam (100°C).}$$

Phenomenon of change of state of water:
Water is a liquid under ordinary conditions but, when it is kept in a deep freezer, it changes into ice at 0°C and when ice is kept at room temperature again changes back into liquid water.

Similarly, water on heating change into steam at 100°C, which on cooling changes back into liquid water. But there is no change in the chemical composition of water. When its state changes from liquid to solid or liquid to gaseous state.

$$\underset{\text{(solid)}}{\text{Ice}} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \underset{\text{(liquid)}}{\text{Water}} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \underset{\text{(gas)}}{\text{Steam}}$$

Question 6.

(a) State the law of conversation of mass.

(b) What do you observe when, barium chloride solution is mixed with sodium sulphate solution ?

Answer:

(a) "Matter can neither be created nor be destroyed in a chemical reaction". However, it may change from one form to another in the process.

It can also be stated as, "In a chemical reaction, the total mass of the reactants is equal to the total mass of the products".

(b)

$$\underset{\text{(aq.)}}{BaCl_2} + \underset{\text{(aq.)}}{Na_2SO_4} \rightarrow \underset{\text{(ppt.)}}{BaSO_4} + \underset{\text{(aq.)}}{2NaCl}$$

We will observe that a white insoluble solid (precipitate) of barium sulphate is formed along with a solution of sodium chloride. Wait for ten minutes to complete the reaction and the solid formed to settle down.

Weigh the content again and note the reading.

We will observe that,

total mass of the apparatus + reactants = total mass of apparatus + products

Hence the law of conservation of mass is verified.

Question 7.

Give reasons:

(a) A gas can fill the whole vessel in which it is enclosed.

(b) Solids cannot be compressed.

(c) Liquids can flow.

(d) When magnesium is burnt in air, there is an increase in mass after the reaction.

Answer:

(a) Because, in gases, the molecules are free to move.

They are not stuck to each other and the intermolecular force of attraction is least in the gases. So the gas almost filled the whole vessel in which it is enclosed.

(b) In solids, particles are closely packed. There is a strong force of attraction and the intermolecular space is almost zero. Therefore the molecules are not free to move, which makes them hard and rigid. So solids can not be compressed.

(c) In liquids intermolecular force is weaker because the particles are not closely packed and hence there is large intermolecular space. So molecules in a liquids can move randomely and hence liquids can flow easily.

(d) When magnesium ribbon is burnt in air, a white solid, magnesium oxide is formed. The mass of magnesium oxide is
more than the mass of magnesium. This is because mass of oxygen used is not taken. If that is considered, the total mass of the reactants and the products is found to be almost equal.

$$2Mg + O_2 \xrightarrow{\text{¾®}} 2MgO$$

(magnesium) (air) (magnesium oxide)

Question 8.
Fill in the blanks:

(a) The change of a solid into a liquid is called melting or **fusion.**
(b) The process in which a solid directly changes into a gas is called **sublimation.**
(c) The change of water vapour into water is called **condensation.**
(d) The temperature at which a liquid starts changing into its vapour state
is **evaporation** or **vaporisation.**

Question 9.
Give two examples for each of the following:
(a) The substances which sublime.
(b) The substances which do not change their state on heating.
Answer:
(a) Camphor, iodine, naphthalene, ammonium chloride, dry ice (solid carbon dioxide), etc.
(b) Gases do not change their state on heating.
Example: O_2.

Question 10.
Define:
(a) Diffusion.
(b) Brownian motion.
Answer:
(a) Diffusion: The intermixing of two or more substances due to the motion of their particles in order to get a uniform mixture is called ‘diffusion’.
(b) Brownian motion: The haphazard, random motion of suspended particles on the surface of a liquid or in air is called ‘Brownian motion’.

Question 11.
When sodium chloride is added to a definite volume of water and stirred well, a solution

is formed, but there is no increase in the level of water. Why?

Answer:

This is because there is some space between the particles of water in which the salt particles get accomodated when dissolved.

Question 12.

What do you observe when a gas jar which appears empty is inverted over a gas jar containing Bromine vapours? Name the phenomenon.

Answer:

When a gas jar full of bromine vapours (reddish brown) is inverted over a gas jar containing air over it. It is observed that after sometime, the reddish brown vapours of bromine also spread out into the upper jar. This mixing is called diffusion. The rate of diffusion is the fastest in gases and the slowest in solids. It increases with an increase in temperature.

Question 13.

Why can a piece of chalk be broken easily into smaller pieces while a coal piece cannot be broken easily?

Answer:

The particles of matter have force acting between them. This force keeps the particles together. The strength of this force of attraction is lesser in chalk, hence it could be broken easily into smaller pieces.

But the strength of inter-molecular force of attraction is very strong in coal, therefore it is not possible to break them into small pieces.

ADDITIONAL QUESTIONS

Question 1.

Define matter.

Answer:

Anything that has mass and occupies space is called matter.

Question 2.

What is volume ?

Answer:

The amount of space occupied by a matter is called its volume.

Question 3.

What is mass ?

Answer:

Mass is the quantity of matter contained in the body.

Question 4.

If an object weighs 6 kg on earth. What will be its weight on moon ?

Answer:
Weight of body on moon = 1/6 th of its weight on earth
∴ Body will weigh 1/6 x 6 = 1 kg on moon

Question 5.
If an object is taken to the moon from the earth what will be its mass ?
Answer:
Mass of a body does not change with change in gravity. So mass of a body will remain the same on moon.

Question 6.
Name the smallest particle from which matter is made up.
Answer:
The smallest particle from which matter is made up is atom.

Question 7.
What are molecules ?
Answer:
Molecules are made of atoms. Molecules exhibit the properties of that kind of matter and has independent existance.

Question 8.
Give one difference between atoms and molecules.
Answer:
Atoms may or may not have independent existance.
Molecules have independent existance.

Question 9.
Define:
(a) Intermolecular force of attraction.
(b) Intermolecular space.
Answer:
(a) The molecules of matter are always in motion and attract each other with a force called intermolecular force of attraction due to which they are held together.
(b) The molecules can move only when there are gaps or space between them, this space is called intermolecular space.

Question 10.
Classify the following into solids, liquids and gases.
Oxygen, milk, common salt, wax, stone, water vapour, carbon-dioxide, sugar, mercury, coal, blood, butter, copper, coconut oil, kerosene.
Answer:

Solids	Liquids	Gases
Common salt	Milk	Oxygen
Wax	Mercury	Water vapour
Stone	Blood	Carbondioxide
Sugar	Coconut oil	
Coal	Kerosene	
Butter		
Copper		

Question 11.
Why do solids, liquids and gases differ in their physical states ?
Answer:
Intermolecular force of attraction.
Intermolecular spaces are two important properties of matter that account for the different states of matter.

Question 12.
What are fluids ? Give two examples.
Answer:
Substances that can flow are called fluids, e.g. gases (oxygen, hydrogen), liquids (water, petrol, sulphuric acid).

Question 13.
Define interconversion of states of matter.
Answer:
The process by which matter changes from one state to another and back to original state, without any change in its chemical composition.

Question 14.
What are the two conditions for the interconversion of states of matter ?
Answer:
Two conditions are: change in
(i) Temperature (ii) Pressure

Question 15.
How a liquid changes into its gaseous state ? Explain ?
Answer:
As a liquid is heated, its particles starts gaining energy and move more vigorously which increases the gaps between the particles and decreasing the force of attraction. Ultimately a liquid changes into gaseous state.

Question 16.
Water cycle is an example of inter conversion of states of water. Explain.
Answer:
Water from oceans, rivers lakes from leaves of trees (transperation) changes into vapours when temperature increases or evaporates and enters the atomsphere as clouds when temperature falls the vapours change into water and some of it in the form of snow fall on mountains and earth in the form of water and hales and this continues. Thus water cycle is example of inter convertion of states of water.

Question 17.
State the general properties of a solid.
Answer:
General Properties of a Solid:

- Solids are hard that is, they have a definite shape and volume.
- Solids are generally incompressible.
- Solids are rigid, that is, they do not flow.

Question 18.
What is the relation between intermolecular space and intermolecular force ?
Answer:
The force of attraction between the molecules of a given substance is called intermolecular force and the space between these molecules is called intermolecular space.
The basic relation between the two is that they are inversely proportional to each other. More is the intermolecular force lesser is the intermolecular space and vice-versa.

Question 19.
Why liquids do not have a definite shape ?
Answer:
Molecules of a liquid are held by weak intermolecular forces. This force is strong enough to hold the molecules together but not strong enough to hold them at fixed positions. As a result liquids have a fixed volume but not shape.

Question 20.
What happens when a solid is heated ?
Answer:
When a solid is heated, its molecules gain energy and vibrate faster. A stage comes when they overcome intermolecular force of attraction and start moving from each other. This results in melting of solid.

Question 21.
Give reasons for the following.

1. Gases can be compressed easily.
2. Liquids can flow easily.
3. We need to classify things.
4. Pure substances have fixed melting or boiling points.
5. Electricity is not considered matter.

Answer:

1. The reason for this property of gases is that there is very large intermolecular space between gas molecules. On mere applying pressure, they are easily compressed.
2. In liquids intermolecular force is weaker than that of solids. So molecules in a liquids can slip over one another and liquids can flow unlike solids.
3. We need to classify things in order to distinguish them. In this way, things can be categorized and can be easily studied.
4. Pure substances consists of only one kind of matter. All the particles of a pure substance are alike. It has a definite composition and similar properties. This is the reason that pure substances have fixed melting or boiling points.
5. Electricity neither has mass nor it occupies space. Beside it can not be seen by our eyes. This is why electricity is not considered matter.

Question 22.
Define the following terms.

1. Matter
2. Intermolecular force
3. Element
4. Atom
5. Molecule

Answer:

1. **Matter** — Anything that has mass and occupies space is called matter.
2. **Intermolecular force** — The force of attraction between the molecules of a given substance is called intermolecular force.
3. **Element** — It is defined as that pure substance which contains only one type of atoms e.g. hydrogen, chlorine.
4. **Atom** — An atom is the smallest part of an element that takes place in a chemical reaction.
5. **Molecule** — A molecule is a smallest part of a compound that exists independently.

Question 23.
Write your observation and conclusion for the following:

1. When a small stone is gently dipped into a glass filled with water.
2. When one of the balloons suspended to the metre scale is punctured while other remains inflated ?

Answer:

1. You will see that some water flows out of the tumbler and collects in the bowl. Remove the stone from the tumble. The level of water in the tumbler comes down. Now, pour the water collected in the bowl back into the tumbler. The glass tumbler is filled again.
   This is because the stone occupied space and therefore drives the water out of the tumbler. This proves that not only solids but liquids also occupy space.
2. Take two similar balloons and inflate them equally. Suspend one balloon to the left of a metre scale and the other one to the right of it, as shown in the figure below. Balance the scale in the middle with the help of a peg.

Question 24.
How will you prove by an experiment that solids occupy space ?
Answer:
Experiment to show that solids occupy space:
Take a glass bowl. Place a glass tumbler full of water in it. Now tie a stone with thread and lower into the water. Some water flows out of tumbler into bowl. When we remove stone from tumbler the level of water in tumbler comes down. This shows that solids occupy space.

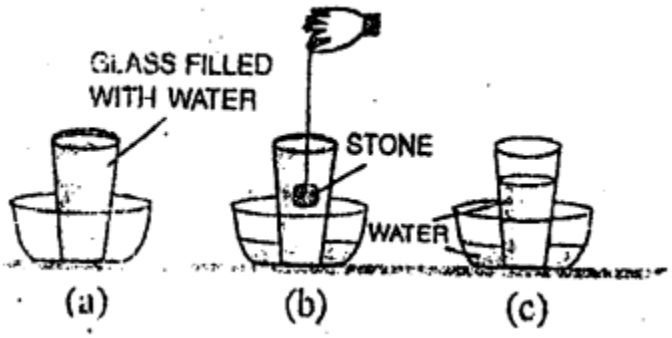
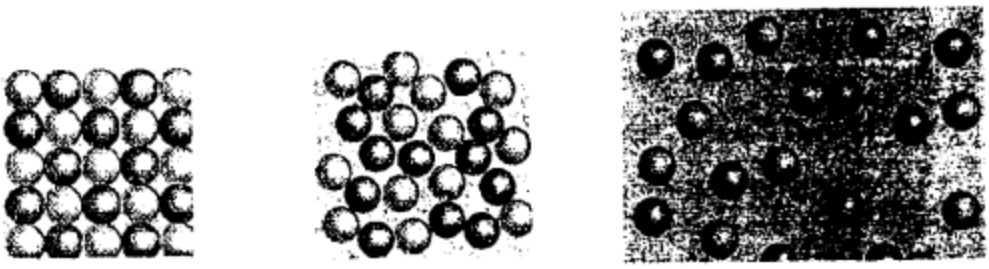


Fig. Both water (liquid) and stone (solid) occupy space

Question 25.
Name the three states of matter and define them.
Answer:
There are three states of matter
(i) Solid (ii) Liquid (iii) Gas

1. **Solid State:** The molecules are very close to each other hence intermolecular spaces are small and intermolecular force is. strong.



(a) Molecules lie closely packed together, with great force of attraction between them

(b) Molecules lie fairly less apart from each other, with little force of attraction between them

(c) Molecules lie very far from each other with very little force of attraction between them

Hence solids have definite volume, rigid, retain definite shape and are incompressible.

2. **Liquids:** The molecules are less closely packed have more intermolecular spaces than solid, less stronger forces than solids.
   Hence liquids have definite volume but no definite shape. They take the shape of container in which they are put.
3. **Gases:** The molecules in the gases are for apart with weakest force of attraction.
   Hence gases have neither definite volume nor definite shape and compressible.

Question 26.

Give reasons:

(a) Why do liquids and gases flow but solids do not ?
(b) A gas fills up the space available to it
(c) The odour of scent spreads in a room.
(d) We can walk through air.
(e) Liquids have definite volume but no difinite shape.

Answer:

(a) The molecules of liquids and gases are far apart i.e. have more gaps, intermolecular attraction force is very less as compared to solids, hence liquids and gases can flow but solids do not as gaps in solid molecules is less and molecular force of attraction very strong.
(b) Intermolecular force of attraction is least and intermolecular spaces are very large, hence gases can fill up the space available to them.
(c) Scent fumes (molecules) being gases fill the spaces between air molecules and the molecules of air fill the spaces between scent molecules due to diffusion, fumes spread into a room.
OR
Due to inter-mixing of scent molecules and air molecules, scent fumes spread into the room.

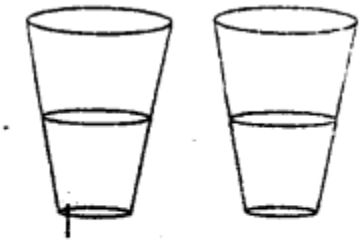
(d) The molecules of air are far. apart i.e. large gaps and we can walk through air easily.
(e) The molecules of liquid are loosely packed and intermolecular force of attraction is small but number of molecules in it remain the same. Hence liquids have definite volume but no definite shape.

Question 27.
Give reasons:
(a) When a teaspoon of sugar is added to half a glass of water and stirred, the water level in the glass does not rise.
(b) When an empty gas jar is inverted over a gas jar containing a coloured gas, the gas also spreads into the empty jar.
(c) A red ink drop added to small amount of water in a glass turns water red in some time.

Answer:

(a) Add one teaspoon of sugar to it and stir. The sugar disappear but the level of water in the glass does not rise that means the volume of water has not increased. Because the sugar particles are adjusted between the water molecules. The shows that there are intermolecular gaps in water.
(b) This shows that gases can fill up all the space that they get, and they have neither a fixed shape nor a fixed volume. They have no free surfaces, either.
(c) If we put a drop of red ink in a glass of water, its particles diffuse with particles of water slowly but continuously and the water turns red.

Question 28.
Give an experiment to explain that there are intermolecular spaces between water molecules.
Answer:



WATER LEVEL DOES NOT RISE

Take a completely filled glass of water. Add a spoon full of sugar. Stir it well. The volume of water hence the level of water in glass remains the same where has gone the volume of sugar added? Actually the sugar molecules took the spaces (gaps) between the molecules of water and level of water in glass remains the same. This shows that there are intermolecular spaces between the water molecules.

Question 29.
Differentiate between the following.
(a) Liquids and gases
(b) Atoms and molecules
Answer:
(a) Liquids and Gases
Liquids

1. Have definite volume but no definite shape
2. Intermolecular force of attraction is weaker than that in solids
3. Molecules are not as tightly packed as in solids and intermolecular space is more than that in solids.
4. Molecules have no fixed position
5. Can be compressed slightly
6. Are capable of flowing

Gases

1. Have no definite shape or volume
2. Intermolecular force of attraction is the weakest (almost negligible)
3. Intermolecular space is the maximum and the molecules are far apart.
4. Molecules move around freely
5. Can be easily compressed
6. Can flow in all directions.

(b) Atoms and molecules
Atoms

1. It is the smallest part of an element.
2. It does not have independent existence

Molecules

1. It is the smallest part of a compound.
2. It has an independent existence.

OBJECTIVE TYPE QUESTIONS

1. Fill in the blanks:

(a) Water is a matter because it has mas and occupies **space.**
(b) Any matter which has a definite **volume** but no definite shape is called a **liquid.**
(c) Fluid can flow.
(d) The molecules are at a greater distance in **gases** compared to liquids.

(e) Water boils at **100 °C.**
(f) The physical state of a substance, which has a fixed volume but no fixed shape is **liquid.**
(g) All matter is made up of tiny particles called **atoms.**
(h) Liquids have a definite **Volume.**
(i) The temperature at which a liquid boils is called the **boiling** point of that liquid.
(j) Molecules in a **solid** are packed very closely.
(k) Liquids have no definite **shape.**
(l) When a gas is cooled, its molecules **loose** energy.
(m) Matter is anything that has **mass** and occupies **space.**

2. I. Write whether the following statements are true or false.
(a) Only water can exist in three different states.
(b) If the container in which a gas is collected has an opening, the gas will flow out and spread itself indefinitely.
(c) Solids have the largest inter-molecular space.
(d) There is no difference between evaporation and boiling.
(e) All solids, on heating, first change to the liquid and then to the gaseous state always.
(f) The intermolecular force of attraction is the weakest in gases.
(g) A gas has no free surface.
(h) Intermolecular force of attraction is greater in gases than in liquids.

Answer:

(a) True
(b) True
(c) False
(d) False
(e) False
(f) True
(g) True
(h) False.

II. Write true or false for each statement. Rewrite the false statements correctly.

(a) Matter cannot exist in different states.
(b) If the intermolecular space is more than the intermolecular force will be weaker.
(c) Solids and liquids can flow.
(d) Solids can be compressed easily.
(e) The smallest part of an element capable of independent existence 4s called an atom.
(f) The intermolecular space in a gas is almost negligible.

Answer:

(a) False. Matter can exist in different states.
(b) True.
(c) False. Gases and liquids can flow.
(d) False. Solids cannot be compressed easily.
(e) True
(f) False. The intermolecular space in a gas is very large.

3. For each of the following statements, say whether it describes a solid, a liquid or a gas.

(a) Particles move about very quickly.
(b) Particles are quite close together.
(c) Particles are far apart and move in all directions.

Answer:

(a) Liquid
(b) Solid
(c) Gas

4. I. Match the following:

I.	**Column A**		**Column B**
(a)	**Solids**	***(i)***	**Can flow in all directions.**
(b)	**Sublimation**	***(ii)***	**The temperature at which a liquid changes into its gaseous state.**
(c)	**Boiling point**	***(iii)***	**Any number of free surfaces.**
(d)	**Gases**	***(iv)***	**Gaps between particles.**
(e)	**Intermolecular space**	***(v)***	**Change of state from solid to gas.**

Ans.	**Column A**		**Column B**
(a)	Solids	(iii)	Any number of free surfaces.
(b)	Sublimation	(v)	Change of state from solid to gas.
(c)	Boiling point	(ii)	The temperature at which a liquid changes into its gaseous state.
(d)	Gases	(i)	Can flow in all directions.
(e)	Intermolecular space	(iv)	Gaps between particles.

II. Match the columns.

1. iron and gold	**a. molecules are very far apart**
2. melting	**b. pure substance**
3. intermolecular space	**c. non-metals**
4. compound	**d. the space between the molecules**
5. gases	**e. change from solid to liquid**
	f. metals

Ans.

1. iron and gold	f. metals
2. melting	e. change from solid to liquid
3. intermolecular space	d. the space between the molecules
4. compound	b. pure substance
5. gases	a. molecules are very far apart

5. Name the phenomenon which causes the following changes:
(a) Formation of water vapour from water.
(b) Disappearance of camphor.
(c) Conversion of ice into water.
(d) Conversion of water into steam.

Answer:

(a) Formation of water vapour from water is **vaporation.**
(b) Disappearance of camphor is **sublimation.**
(c) Conversion of ice into water is **melting.**
(d) Conversion of water into steam is **boiling.**

6. Give two examples for each of the following:
(a) Substances which sublime
(b) Substances which do not change their states.
(c) Substances which are rigid and not compressible.

Answer:

(a) Naphthalene, camphor, dry ice.
(b) Paper, sugar.
(c) Glass, stone, pen.

MULTIPLE CHOICE QUESTIONS

1. Which one is a kind of matter:

1. light
2. **petroleum**
3. sound
4. heat

2. The state of matter which has no definite shape or volume is called

1. solid
2. liquid
3. **gas**
4. water

3. There are large intermolecular gaps in

1. water
2. iron ball
3. common salt
4. **air**

4. All kinds of matter

1. **occupy space and have definite mass**
2. have mass and definite shape
3. can change their states
4. have definite volume

5. A kind of matter which can sublinje is

1. water
2. plastic
3. milk
4. **iodine**

6. A substance which can change its state

1. wood
2. **oxygen**
3. paper
4. cloth

7. The process by which a solid changes into a liquid is called

1. freezing
2. **melting**
3. condensation
4. evaporation

8. A solid is a state of matter that has

1. no definite shape.
2. large intermolecuiar space.
3. **high intermolecuiar force of attraction.**
4. no definite volume.

9. Which of the following is a property of the liquids ?

1. **they can flow**
2. they are malleable
3. they have a definite shape
4. they are rigid

10. Gases

1. cannot be compressed easily,
2. **occupy the entire space of the container.**
3. have definite shapes.
4. cannot flow.