CHAPTER 5

STATES OF MATTER

Q1. Give postulate of gas

POSTULATE OF GAS

1. The molecules in gases are widely separated from each other.
2. The molecules hove negligible volume.
3. The gas molecules are in constant random motion.
4. The gas molecules move in straight line until they collide with each other or wall of container
5. On collision molecules do not lose energy because they ore elastic in nature.
6. Pressure Produced when molecules collide with the wall of container.
7. There are attractive and repulsive forces between molecules.

Q2. Give postulate of liquid

POSTULATE OF LIQUID

1. The molecules of a liquid are randomly arranged like gases.
2. The molecules of liquids have less kinetic energy than gases.
3. The molecules of liquids are fairly free to move.
4. The Liquids has no definite shape but assumes the shape of container.
5. The Boiling point of liquids depends on the external atmospheric pressure.
6. The Liquids are denser and not compressible like gasses.

Q3. Give postulate of solid

POSTULATE OF SOLID

1. The molecules in solids are closely packed due to stronger forces of attraction.
2. The molecules are unable to move freely as they have little space between them.
3. The molecules can vibrate and rotate in their fixed position.
4. Solids have definite shape and definite volume.
5. Pure solids have sharp melting point.

Q4. State and explain Boyle's law. Also establish a relation between volume and pressure of a gas

BOYLES LAW

According to Boyle's law the volume (V) of a given mass of a gas decreases with the increase of pressure (P) at constant temperature.

EXPLANATION

$$V \alpha \frac{1}{P}$$

$$V = \frac{K}{P}$$

$$PV = K$$

The product of pressure and volume of a gas at constant temperature is always constant where K is same as amount of given gas. Therefore, product of pressure and volume of a fixed mass of a gas is constant at a constant temperature.

If

$$P_1V_1 = k$$

then

$$P_2V_2 = k$$

Where

P_1 = Initial pressure

P_2= Final pressure

V_1= Initial volume

V_2= Final volume

As both equations have constant therefore their variable are also depended to each other so

$$P_1V_1 = P_2V_2$$

Q5. State and explain Charles's law. Also establish a relation between volume and temperature of a gas

CHARLES LAW

According to Charles law if temperature of a gas is increased, its volume will also increase.

MATHEMATICALLY IT IS REPRESENTED AS

$$V \alpha T$$

$$V = KT$$

$$\frac{V}{T} = K$$

Where K is proportionality constant. Then when temperature increases the volume also increases.

You have a gas at a certain temperature (T_1) and volume (V_1). If you change the temperature (T_1) to a new value (T_2), the volume (V_1) changes to a new value (V_2). We can use Charles's law to describe both sets of conditions.

$$\frac{V_1}{T_1} = K$$

$$\frac{V_2}{T_2} = K$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Q6. Define evaporization. Discus the factor of evaporation

EVAPORIZATION

The process by which a liquid change to a gas phase is called evaporization.

Water (liquid) → Vapours (gas)

FACTORS AFFECTING EVAPORATION:

I. SURFACE AREA:

The evaporation is a surface-based process. Greater the surface area greater is evaporation.

FOR EXAMPLE

Water left in bowl evaporate slowly than water left in a large tub. A saucer is used to cool the tea quickly than tea cup.

II. TEMPERATURE:

The rate of evaporation increases with the increase in temperature. Because temperature increases the kinetic molecular energy which overcome the intermolecular forces and makes evaporation rapidly.

FOR EXAMPLE

Clothes dry quickly in a sunny day than a cloudy day.

III. INTERMOLECULAR FORCES:

The rate of evaporation increases with less intermolecular forces. If intermolecular forces are stronger evaporation is lesser.

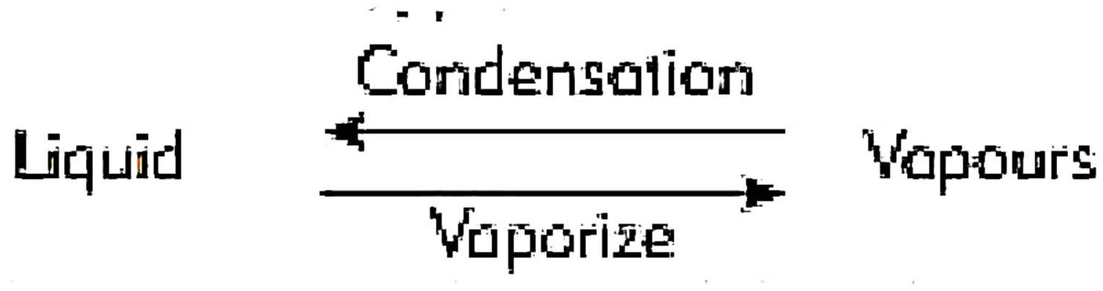
FOR EXAMPLE,

perfume have lesser intermolecular forces than water therefore they it evaporates quickly

Q7. Define vapor pressure. Discus the factor of vapor pressure

VAPOUR PRESSURE

The pressure exerted by vapors in equilibrium with its pure liquid at a particular temperature is called Vapours Pressure.



FACTORS AFFECTING VAPOUR PRESSURE:

I. NATURE OF LIQUID:

The vapour pressure depends upon the nature of liquids. Polar liquids have low vapour pressure than nonpolar liquids at the same temperature. It is because of strong intermolecular forces of molecules and high boiling point in the polar liquids.

FOR EXAMPLE

water (polar liquid) has less vapour pressure than alcohol (non-polar liquid).

II. SIZE OF MOLECULES:

The vapour pressure is more in small size molecules because small sized molecules evaporate easily and exert more vapour pressure.

FOR EXAMPLE

Hexane (C_6H14) has a small size molecule as compared to decane ($C_{10}H_{22}$), due to this hexane evaporate rapidly and exert more pressure.

III. TEMPERATURE:

The vapour pressure increases with raise in temperature. The average kinetic energy of molecules increases with temperature which causes increase in vapour pressure.

FOR EXAMPLE

Vapour pressure of water at 0 is 4.58 mm Hg while at 100°C it increases up to 760mm Hg.

Q8. Define boiling point. What are the factors on which it depends?

BOILING POINT

The temperature at which vapour pressure of a liquid become equal to atmospheric pressure is called boiling point of the liquid.

I. ATMOSPHERIC PRESSURE:

The boiling point is directly proportional to atmospheric pressure. Boiling point can be increased by increasing atmospheric pressure.

FOR EXAMPLE

Working of pressure cooker

II. NATURE OF LIQUID:

The boiling point depends upon the nature of liquid as polar liquids hove high boiling point than nonpolar liquids, because polar liquids have stronger intermolecular forces than nonpolar liquids.

II. INTERMOLECULAR FORCES:

The intermolecular forces play very important role in the boiling points of liquids. Substances having stronger intermolecular forces have high boiling points, because such liquids attain a level of vapour pressure equal to external pressure at high temperature.

Q9. Define Diffusion in liquid. Write its factors.

DIFFUSION

The diffusion is spreading out of the liquid molecules throughout the vessel. The liquids diffuse less rapidly than gases.

FACTORS AFFECTING DIFFUSION

I. INTER MOLECULAR FORCES:

liquids have weaker intermolecular forces than solid due to this diffuses faster than solid but less rapidly than gases.

II. SIZE OF MOLECULES:

Diffusion depends upon size of molecules small size of molecules diffuses rapidly than bigger one.

FOR EXAMPLE

Diffusion is slow in water than alcohol.

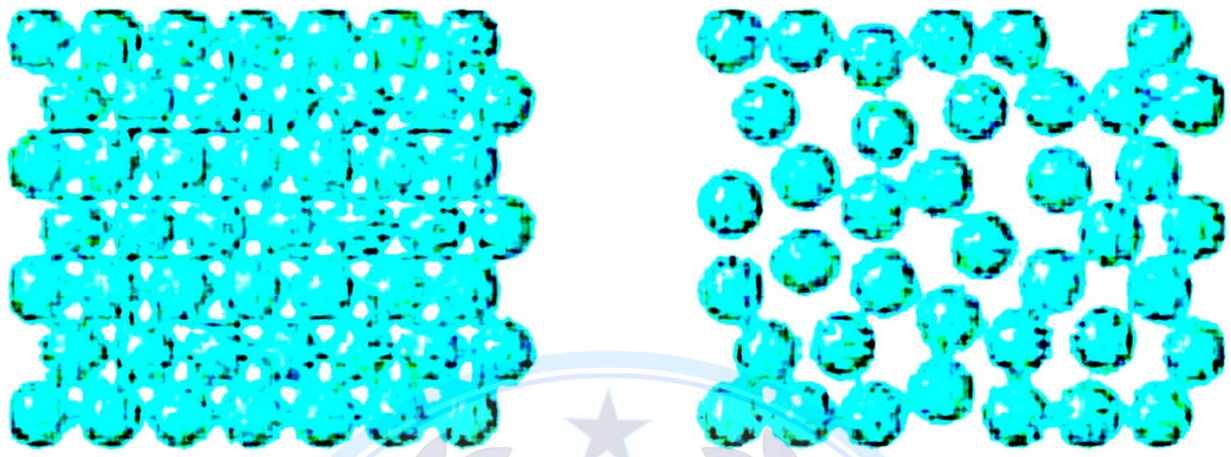
II. SHAPE OF MOLECULES:

Molecules with irregular shape diffuses slowly while regular shaped molecules diffuse foster because they can easily slip over and move faster.

IV. TEMPERATURE:

Diffusion increases by increasing temperature because at high temperature intermolecular forces becomes weak due to high kinetic energy of the molecules.

Differentiate between Amorphous and crystalline solid



Crystalline Amorphous

AMORPHOUS SOLIDS	CRYSTALLINE SOLIDS
They don't have definite geometrical shape.	They have characteristic geometrical shape.
Amorphous solids do not have particular melting point.	They have sharp melting point.
Amorphous solids are isotropic.	Crystalline solids are anisotropic.
Amorphous solids are unsymmetrical.	Crystalline solids are symmetrical.
Amorphous solids do not break at fixed cleavage planes.	Crystalline solids break along particular direction at fixed cleavage planes.

Q10. Define Allotropy. Name the different allotropies of carbon

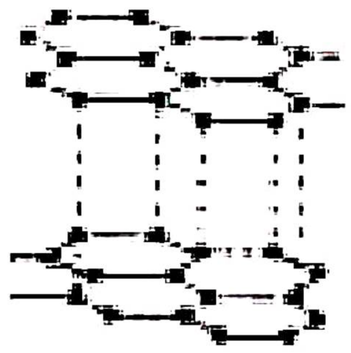
ALLOTROPY: The existence of an element in more than one crystalline form is known as allotropy. These forms of the element are called allotropes or allotropic forms.

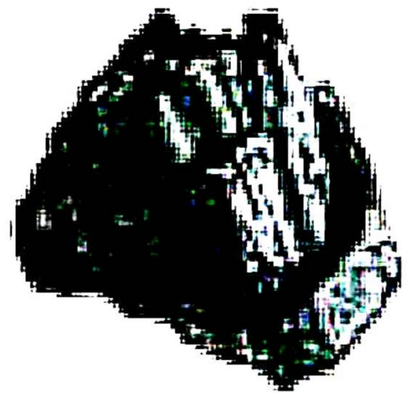
DIAMOND

Where the carbon atoms are bonded together in a four-cornered lattice arrangement.

GRAPHITE

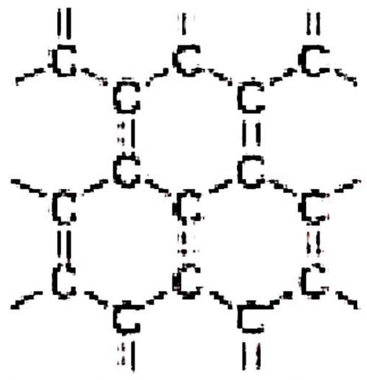
Graphite, where the carbon atoms are bonded together in sheets of a six-sided lattice.





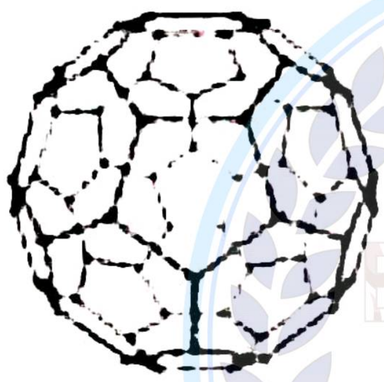
GRAPHENE

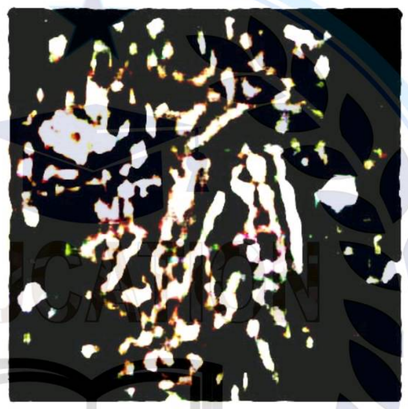
Single sheets of graphite.



FULLERENES

Where the carbon atoms are bonded together in spheres, cylinders or egg-shaped formations.





Q11. What do you know about plasma state? Also give examples of plasma state.

PLASMA

It was discovered by adding energy to a gas. As a result, some electrons left their atoms and formed positive and negative ions by ionization. In plasma these charged particles react strongly to electric and magnetic fields

SOME EXAMPLES OF DAILY LIFE ARE AS FOLLOW:

1. The lightning makes plasma naturally.
2. The Artificial (man-made) uses of plasma include fluorescent light bulbs, Neon signs.
3. The use of plasma display of television or computer screens.
4. The plasma lamps and globes are popular in children's toys and room decoration.
5. Scientists are experimenting with plasma to make a new kind of nuclear power, called fusion, which will be much better and safer than ordinary nuclear power with less radioactive waste

Q12. What is Bose Einstein Condensate?

BOSE EINSTEIN CONDENSATE

Condensation happens when several gas molecules come together and form a liquid. It all happens because of a loss of energy. Gases are really excited or energetic atoms. When they lose energy, they slow down and begin to gather. They can gather into one drop

Exercise/ Numerical

Q1. Convert the following units:

(a)100 °C to K

(b) 150°C to K

(c) 780K to °C

(d) 170 K to °C

Q2. The pressure of a sample gas is 3 atm and the volume is 5 liters. If the pressure is reduced to 2 atm, what will be the new volume?

Q3. The 700 cm^3 of a gas is enclosed in a container under a pressure of 650 mm of Hg. If the volume is reduced to 350 cm^3 , what will be the pressure then?

Q4. A 600 ml sample of gas is heated from 27 °C to 77 °C at constant pressure. What is the final volume?

Q5. A sample of Hydrogen gas has a volume of 350 cm3 at 40OC. If gas is allowed to expand up to 700 cm at constant pressure. Find out its final temperature?

Q6. it is desired to increase the volume of a fixed amount of gas from 90.5 $cm^3$to 120 cm^3 while holding the pressure constant. What would be the final temperature if initial temperature is 33 ^OC.

Q7. A 78ml sample of gas is heated from 35°C to 80°C at constant pressure. What is the final volume?

Q8. A gas occupies a volume of 40.0 dm^3 at standard temperature (0^OC) and pressure (1 atm), when pressure is increases up to 3 atm unchanged temperature what would be the new volume?

Q9. The 800 cm^3 of a gas is enclosed in a container under a pressure of 750 mm. If the volume is reduced to 250 cm^3, what will be the pressure?

Q10. The pressure of a sample gas is 8 atm and the volume is 15 liters. If the pressure is reduced to 6 atm, what is the volume?