CHEMISTRY XI

Intermediate Part 1 Short Questions

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CHAPTER NO. 3

GASES

Q.1: Why Boyle's Law is only applicable to ideal gases?

Ans: Experimental verification of Boyle's Law shows that if we double the pressure the volume become half and if we increase the pressure three times then volume decrease to 1/3 of the volume. But it is only possible incase of ideal gases not in case of real gases. So, Boyle's Law is applicable to ideal gases only.

Q.2: Define atm and give its relationship with other units.

Ans: The force exerted by 760mm of Hg or 76cm long column of Hg on $1cm^2$ at OC^o is called atm. Units of atm:

$$\begin{aligned} 1 \text{ atm} &= 760 \text{ mm of Hg} \\ &= 760 \text{ torr} \\ &= 101325 \text{ Nm}^{-2} \\ &= 101325 \text{ Pa (Pascal)} \\ &= 14.7 \text{ (Psi) pounds inch}^{-2} \\ &= 1.01325 \times 10^{-3} \text{ millibar} \end{aligned}$$

Q.3: What are isotherms? What happens to the positions of isotherms when they are plotted at high temperature?

Ans: The curves obtained when a graph is plotted between pressure and volume at constant temperature, are called isotherms. At high temperature, volume of gases increases and hence curves moves away from both the axes.

Q.4: The product of pressure and volume of a gas at constant temperature and number of moles is a constant quantity. Why?

Ans: According to Boyle's Law:

$$V \propto 1/P \quad (n, T) \qquad V = K/P \qquad PV = K$$

So, if we double the pressure then volume become half and value of K remains constant. If we triple the pressure then volume decrease to one third and again value of K remains constant. Hence the product of pressure and volume at constant temperature is a constant quantity.

Q.5: Why Charles's Law is only applicable in Kelvin Scale not in Celsius scale?

Ans: According to Charles Law:

$$V \propto T \quad (n, P)$$

$$V = KT$$

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

Similarly: $\frac{V_1}{T_1} = K$ & $\frac{V_2}{T_2} = K$

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

In Celsius Scale:

$T_1 = 10C^o$ $\qquad$ $T_2 = 100C^o$

$V_1 = 566cm^3$ $\qquad$ $V_2 = 746cm^3$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \rightarrow \frac{566}{10} \neq \frac{746}{100}$$

In Kelvin Scale:

$T_1 = 283K = 10C^o$ $T_2 = 373K = 100C^o$

$V_2 = 566cm^3$ $V_2 = 746cm^3$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \rightarrow \frac{566}{283} = \frac{746}{373}$$

$$2 = 2$$

Hence proved Charles law is applicable only in Kelvin scale.

Q.6: What is absolute zero? What happen's to real gases while approaching it?

Ans: Absolute Zero: $(-273.16c^o) = (OK)$

The hypothetical lowest temperature at which the volume of gas would become zero is called absolute zero. This temperature never achieved because all the gases liquefy or solidify before reaching this temperature $(-273.16c^o)$. Hence all the real gases liquefy or solidify while approaching absolute zero $(-273.16c^o)$.

Q.7: Justify that volume of given mass of gas become theoretically zero at $-273.16c^o$.

Ans: "At constant pressure, the volume of a given mass of gas increases or decreases by 1/273 of its original volume at 0Co for every 1Co rise or fall in temperature."

The volume of gas at 0Co = 546 cm3. It is twice of the 273 (in Kelvin scale).

$273 \times 2 = 546\ cm^3$

At 273Co, the volume is= $1092\ cm^3$

At -273Co, the volume is = $0\ cm^3$

Equation to calculate volume at different temperatures is:

$$V_t = V_o\left(1 + \frac{t}{273}\right)$$

When $t = -273C^o$ then

$$V_t = V_o\left(1 + \frac{273}{273}\right)$$

$$= V_o\left(\frac{273 - 273}{273}\right)$$

$$= V_o\ (0)$$

$$= 0$$

Hence volume becomes theoretically zero at $-273C^o$.

Q.8: Throw some light on the factor 1/273 in Charles's Law?

Ans: This factor shows that at constant pressure, the volume of a given mass of gas increase or decreases by 1/273 of its original volume at $0C^o$ for every $1C^o$ rise or fall in temperature respectively. The general equation to know the volume of the gas at different temperatures is: $V_t = V_o\left(1 + \frac{t}{273}\right)$

V_t = Volume at any temperature (t).

V_o = Volume at $0C^o$

t = any Temperature (in celsius scale)

Q.9: What are different scales of thermometry? How are they interconverted?

Ans: ***Centigrade Scale:***

It start from 0Co to 100co. It has 100 equal parts. Each part is equal to one degree centigrade.

For example: $0C^o$ = Freezing temperature of ice (water)

100 = Boiling temperature of water

Fahrenheit Scale:

It start from 32F° to 212F°. It has 180 equal parts and each part is 1F°.

Kelvin Scale:

It start from 273K to 373K. It has 100 equal parts. Each part is 1K.

e.g. water freeze at = 273K and Boils at = 373K.

Q.10: How value of "R" general gas constant can be derived from Avogadro's Law?

Ans: According to Avogadro's Law, the volume occupied by one mole of an ideal gas at STP is 22.414dm^3. Putting the values of P, V, T and "n" in general gas equation:

Pv = nRT

$$R = \frac{PV}{nT} = \frac{1\,atm \times 22.414\,dm^3}{1\,mole \times 273}$$

$$R = 0.0821 \text{ atm dm}^3 \text{ mol}^{-1} \text{ K}^{-1}$$

Q.11: Calculate the value of "R" is S.I units.

Ans: The S.I units of pressure = Nm^{-2}

The S.I units of volume = m^3

The S.I units of temperature = K (Kelvin)

Hence 1 atom = 101325 Nm^{-2}

22.414 dm^3 = 0.022414 m^3

PV = nRT

$$R = \frac{PV}{nT}$$

$$= \frac{101325\,Nm^{-2} \times 0.02414\,m^3}{1\,mole \times 273\,K}$$

R = 8.3143 Nm mol^{-1} K^{-1}

R = 8.3143 J mol^{-1} K^{-1}

Because (1Nm = 1J)

Q.12: How does the process of respiration obeys the Dalton's Law of partial pressures?

Ans: When human being inhale air then oxygen moves into the lungs easily because the partial pressure of O_2 in air is 159 torr and in lungs is 116 torr. Similarly, the CO_2 production during respiration moves out because of high partial pressure of CO_2 in the lungs than in the air.

Q.13: Dalton's Law of partial pressures is only obeyed by those gases which do not have attractive forces among their molecules? Justify it.

Ans: When gas molecules are near to collide with the wall of container then these are attracted by the neighbouring molecules. As a result, the pressure exerted by the gas would be less than that of ideal gas therefore, gases having attractive forces among the molecules do not obey Dalton's Law of partial pressures which is only obeyed by ideal gases.

Q.14: Justify that the sum of mole fractions of all the gases in a mixture is always equal to unity?

Ans: The ratio of no. of moles of any gas to the total no. of moles of mixture of gases is called mole fraction.

$$XH_2 = \frac{nH_2}{nH_2 + nCH_4 + no_2}$$

We have three gases “1”, “2” and “3”.

$$X_1 = \frac{n_1}{n_1 + n_2 + n_3} \qquad X_2 = \frac{n_2}{n_1 + n_2 + n_3} \qquad X_3 = \frac{n_3}{n_1 + n_2 + n_3}$$

Sum of all mole fractions:

$$X_t = X_1 + X_2 + X_3$$

$$= \frac{n_1}{n_1 + n_2 + n_3} + \frac{n_2}{n_1 + n_2 + n_3} + \frac{n_3}{n_1 + n_2 + n_3}$$

Hence proved sum of moles fractions is equal to unity.

Q.15: Why deep sea driver feel uncomfortable breathing in depth of sea?

Ans: Actually, is sea after every 100 feet depth, pressure of O2 increase 3 atm. So, normal air cannot be breathed in depth of sea. Moreover, pressure of N2 increase in depth of sea and it diffuses in the blood. So, deep sea diver: Take oxygen cylinders mixed with an inert gas say He, for normal breathing.

Q.16: Differentiate between diffusion and effusion.

Ans: ***Diffusion:*** “The spontaneous intermixing of non-reacting gases to form homogeneous mixture is called diffusion.”

1. Mixing of NO_2 and O_2.
2. Spreading of perfumes.

Effusion: “The escape of gas molecules one by one without collision through a small hole is called effusion.” E.g. Leakage of air (gas_ from tubes of bicycles).

Q.17: Lighter gases diffuses more rapidly than heavier gases. Give reason.

Ans: According to Graham’s Law:

$$r \quad x \quad \frac{1}{\sqrt{M}}$$

Therefore, Gases having small molecular masses diffuse more rapidly than the gases having large molecular masses at a given temperature and pressure. Hence, rate of diffusion of H_2 gas (lighter gas) is more than O_2 gas (heavier gas).

Q.18: The rate of diffusion of NH3 is 1.5 times greater than HCl gas. Justify.

Ans: (Prove that $r_{NH3} = 1.5\, r_{HCl}$)

According to Graham’s Law of Diffusion, the rates of diffusion of gases are inversely proportional to the square roots of their molecular masses.

Molecular mass of NH_3 = M_{NH3} = 14 + 3 = 17 g/mol

Molecular mass of HCl = M_{HCL} = 1 + 35.5 g/mol = 36.5 g/mol

Thus: $$\frac{r_{NH3}}{r_{HCL}} = \frac{\sqrt{M_{HCl}}}{\sqrt{M_{NH3}}} = \frac{\sqrt{36.5}}{\sqrt{17}} = 1.46 = 1.5200$$

$$\frac{r_{NH3}}{r_{HCL}} = 1.5$$

$$r_{NH3} = 1.5\ r_{HCl}$$

Hence diffusion of NH_3 is 1.5 times of HCl gas.

Q.19: Define and give the expressions of (i) Mean square velocity (ii) Root mean square velocity.

Ans: Mean Square Velocity: (C^2)

The average of the squares of all the possible velocities of gas molecules is called mean square velocity.
If there are n1 molecules with velocity C_1
If there are n2 molecules with velocity C_2

$$C^2 = \frac{n_1 c_1^2 + n_2 c_2^2 + n_3 c_3^2 --------}{n_1 + n_2 + n_3 --------}$$

Kinetic Expression of C^2 is:

C^2 =

Root Mean Square Velocity: $\left(\sqrt{\bar{C}^2}\right)$

The under – root of the mean square velocities of the gas molecules is called root mean square velocity. ($\sqrt{\bar{C}^2}$)

$$C_{rms} = \sqrt{\bar{C}^2} = \sqrt{\frac{\bar{C}_1^2 + \bar{C}_1^2 + \bar{C}_3^2}{N}}$$

Kinetic expression of $\sqrt{\bar{C}^2}$ is:

$$C_{rms} = \sqrt{\frac{3RT}{M}}$$

Q.20: How will you derive the Boyle's Law from Kinetic gas equation?

Ans: Kinetic gas equation:

$$PV = \frac{1}{3} mNC^2$$

Multiplying and Dividing by 2 on R.H.S.

$$PV = \frac{2}{3}\left(\frac{1}{3} mN\bar{C}^2\right)$$

$$PV = \frac{2}{3}\left(\frac{1}{2} mN\bar{C}^2\right) \rightarrow (1)$$

According to Kinetic Molecular theory of gases:

$$K.E \propto T$$

$$\frac{1}{2} mN\bar{C}^2 \propto T$$

$$\frac{1}{2} mN\bar{C}^2 = KT$$

Equation (1) becomes:

$$PV = \frac{2}{3} KT$$

In Boyle's Law

T = Constant

K = Constant

$\frac{2}{3}$ = Constant

Hence

$$PV = \text{Constant}$$

$$V \;\text{x}\; \frac{1}{P} \quad \text{(Proved)}$$

Q.21: How will you derive Charles's Law from kinetic gas expression or equation?

Ans: Kinetic gas equation:

$$PV = \frac{1}{3}mN\overline{C}^2$$

Multiplying and Dividing by 2 on R.H.S.

$$PV = \frac{2}{3}\left(\frac{1}{3}mN\overline{C}^2\right)$$

$$PV = \frac{2}{3}\left(\frac{1}{2}mN\overline{C}^2\right) \rightarrow (1)$$

According to Kinetic Molecular theory of gases:

$$K.E \;\text{x}\; T$$

$$K.E = KT$$

$$\frac{1}{2}mN\overline{C}^2 = KT$$

Equation (1) becomes:

$$PV = \frac{2}{3}\,KT$$

$$V = \frac{2}{3}\,\frac{KT}{P}$$

In Charles's Law

$$P = \text{Constant}$$

$$K = \text{Constant}$$

$$\frac{2}{3} = \text{Constant}$$

Hence

$$V = \text{Constant }(T)$$

$$V \propto T \quad \text{(Proved)}$$

Q.22: Derive Avogadro's Law from Kinetic theory of gas equation?

Ans: "The equal volume of all ideal gases at same temperature and pressure contain equal no. of molecules." i.e. V x n (P,T) consider two gases "1" and "2" at same temerpature and pressure have,

Number of molecules N_1 & N_2

mass of gases m_1 & m_2

Mean square velocities $C^2{}_1$ & $C^2{}_2$

Therefore, Kinetic gas equation for two gases:

$$PV = \frac{1}{3}\,m_1N_1C^2{}_1 \rightarrow (1)$$

$$PV = \frac{1}{3}\,m_2N_2C^2{}_2 \rightarrow (2)$$

Comparing equation (1) & (2)

$$\frac{1}{3}\,m_1N_1C^2{}_1 = \frac{1}{3}\,m_2N_2C^2{}_2$$

$$m_1N_1C^2{}_1 \quad = \quad m_2N_2C^2{}_2 \quad \rightarrow \quad (3)$$

At same temperature, K.E of both the gases.

$$\frac{1}{3}\, m_1C^2{}_1 \quad = \quad \frac{1}{2}\, m_1C^2{}_1$$

$$m_1C^2{}_1 \quad = \quad m_2C^2{}_2 \quad \rightarrow \quad (4)$$

Dividing equation (3) by (4)

$$\frac{m_1N_1C^2{}_1}{m_1C^2{}_1} \quad = \quad \frac{m_2N_2C^2 2}{m2C^2 2}$$

$$N_1 \quad = \quad N_2$$

Hence proved. Equal volumes contain equal no. of molecules.

Q.23: Derive Graham's Law of diffusion from Kinetic theory of gases.

Ans: Kinetic gas equation is:

$$PV \quad = \quad \frac{1}{2}\, mNC^2$$

For one mole of an ideal gas

$$N \quad = \quad NA \ \text{(no. of molecules)}$$

$$PV \quad = \quad \frac{1}{2}\, mN_AC^2$$

$$PV \quad = \quad \frac{1}{3}\, MC^2 \quad \text{(Where } M = mN_A\text{)}$$

$$C^2 \quad = \quad \frac{3PV}{M}$$

$$\sqrt{\bar{C}^2} \quad = \quad \sqrt{\frac{3PV}{M}}$$

$$\sqrt{\bar{C}^2} \quad = \quad \sqrt{\frac{3P}{\frac{M}{V}}}$$

$$\sqrt{\bar{C}^2} \quad = \quad \sqrt{\frac{3P}{d}}$$

$\sqrt{\bar{C}^2}$ is proportional to rate of diffusion. (r)

$$r \quad = \quad \sqrt{\frac{3P}{d}}$$

at constant pressure

$$r \quad x \quad \sqrt{\frac{3P}{d}} \quad \text{(Hence proved)}$$

**Q.24: Give two causes for deviation of gases from ideality. (OR)
What are faulty points in kinetic molecular theory of gases?**

Ans: The deviation of real gases from the ideality is due to two faulty points.

1. The actual volume of gas molecules is negligible as compared to the volume of vessel.
2. There are no forces of attraction among the molecules of a gas.

Q.25: Why gases donot settle?

Ans: According to kinetic molecular theory of gases. The gas molecules are in a constant random motion, they collide with one another and their collisions are perfectly elastic i.e. There is no loss or gain of energy during their collisions. Therefore, gases donot settle.

Q.26: Why do real gases deviate from the ideal behaviour at low temperature and high pressure?

Ans: High pressure brings the molecules close to each other and low temperature decrease the kinetic energy of gas molecules and forces of attraction become significant between the molecules and gas become non-ideal at high pressure and low temperature.

Q.27: What are vander-waal constants? Give their significance.

QAns: The vander-waal constants "a" is called measure of the intermolecular forces of attraction. The vander-waal constant "b" is called excluded volume and defined as: "The volume occupied by one mole of gas molecules in highly compressed state but not in liquid state is called excluded volume." The value of constants "a' and "b" increase with increase.

(i) of mass of molecules
(ii) in the complexity in structure

The units of "a" : $atm\,dm^6\,mol^{-2}$
S.I units of "a" : $Nm^4\,mol^{-2}$
The units of "b" : $dm^3\,mol^{-1}$
S.I units of "b" : $m^3\,mol^{-1}$

Q.28: Define temperature in case of gases, liquids and solids.

Ans: ***In case of gases and liquids:***

"The measure of average translational kinetic energy of molecules in a system is called temperature."

In Case Solids:

"The measure of vibration kinetic energy of the molecules in a system is called temperature."

Q.29: Water vapours donot behave ideally at 273k. Why?

Ans: 273K is below the critical temperature of H_2O, so water has sufficient intermolecular forces. Therefore, water vapours donot behave ideally at 273K because it is equal to $0C^o$, freezing pint of water.

Q.30: SO_2 is comparatively non-ideal at 273K but behave ideally at $327C^o$ why?

Ans: SO_2 is non-ideal at 273K = $0C^o$ because this temperature is low and intermolecular forces become significant at this temperature among the gas molecules. While $327C^o$ is very high temperature and intermolecular forces are negligible at this temperature and hence SO_2 behave ideally at $327C^o$.

Q.31: What is critical temperature? Give its significance.

Ans: ***Critical Temperature:***

"The maximum temperature above which a gas cannot be liquefied is called critical temperature."

e.g: Tc for CO_2 = $31.1C^o$
Tc for NH_3 = 405.6K

Significance:

The critical temperature of CO_2 = 31.1C^o. If we increase the temperature than critical temperature (31.1C^o) then gas cannot be liquefied, no matter how much pressure is applied. If temperature of CO_2 is maintained below 31.1C^o, then lower pressure than critical pressure is sufficient to liquefy it.

Q.32: H_2 and He are ideal at room temperature but SO_2 and Cl_2 are non-ideal. Justify it.

Ans: H_2 and He have very low boiling points than the room temperature. Moreover the molecules of H_2 and He have very small masses. So, due to high temperature and small masses, intermolecular forces of attraction become negligible and they behave ideally. While the boiling points of SO_2 and Cl_2 are close to room temperature and their molecular masses are relatively high, hence sufficient attractive forces are present between SO_2 and Cl_2, So, they become non-ideal.

Q.33: What are characteristics of plasma?

Ans: 1. Plasma must have sufficient numbers of charged particles and motion of these particles generate electric and magnetic fields which produce electric current. This complex set of interactions makes plasma a unique, fascinating and complex state of matter.

2. Although plasma consist of electrons ions and conducts electricity, it is macroscopically neutral.

Q.34: What is density of CH4 gas at 0Co and 1 atm pressure?

Ans:

T = 0C^o = 273K

P = 1 atm

R = 0.0821 atm dm^3 k^{-1} mol^{-1}

M = 16 g/mol (M = molar mass)

We know that

$$d = \frac{PM}{RT} = \frac{1 \times 16}{0.0821 \times 273} = 0.712 \text{ gm/dm}^3$$

Q.35: How various scales of thermometry can be inter converted?

Ans: There are three scales of thermometry i.e. centigrade, Fahrenheit and absolute or Kelvin scale. These scales can be converted as follows:

$$K = C^o + 273 \rightarrow \text{(i)}$$

$$F^o = \frac{9}{5} C^o + 32 \rightarrow \text{(ii)}$$

$$C^o = \frac{9}{5} (F^o - 32) \rightarrow \text{(iii)}$$

Q.36: Give two uses of plasma.

Ans: (i) Plasma can be used to destroy bacteria.

(ii) Plasma can be used for c leaning and sterilization of food and medical equipments.

Q.37: Why H_2 and He cannot be liquefied by Linde's Method?

Ans: The critical temperatures of H2 and He are very low i.e close to absolute zero, so, much low temperature can not be achieved by Linde's method. So, it is unable to liquefy H_2 and He.

Q.38: Why Joule's Thomson effect causes cooling?

Ans: When a highly compressed gas is allowed to expand suddenly, then cooling occurs, called Joule's Thomson Effect. During sudden expansion, the gas molecules require energy to move away from each other, hence this energy comes from surrounding and ultimately temperature of surrounding falls, cooling occurs (K.E $\propto$ T).

Q.39: Prove that excluded volume is four times the actual volume of gas (b = 4Vm) molecules?

Ans: At the closest approach of two gas molecules. The collision diameter is $= \delta = 2r$

$$\text{Excluded volume per molecule} = \frac{4}{3}\pi\delta^3$$

$$b = \frac{4}{3}\pi(2r)^3$$

$$b = \frac{4}{3}\pi(8r^3)$$

$$b = 8\left(\frac{4}{3}\pi r^3\right)$$

$$\text{Excluded volume per atom (b)} = \frac{8}{2}\left(\frac{4}{3}\pi r^3\right)$$

$$b = 4\left(\frac{4}{3}\pi r^3\right)$$

$$b = 4\,Vm$$

Hence proved $\quad b = 4\,Vm$

CHAPTER NO. 4

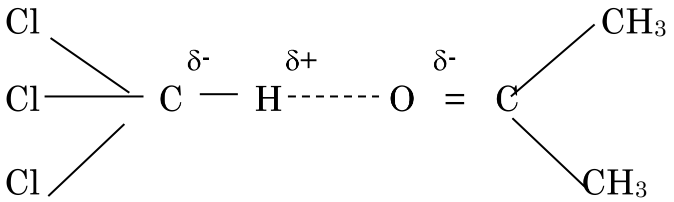
Liquids

Q.1: Why Dipole – Dipole forces are stronger than London dispersion forces?

Ans: Dipole – dipole forces exist between polar molecules which are permanent dipoles and are strong attractive forces whereas London dispersion forces exist between non-polar molecules which form temporary dipoles and are weak attractive forces and short lived. Therefore dipole-dipole forces are stronger than London dispersion forces.

Q.2: Chloroform and Acetone are miscible to each other. Justify.

Ans: Both chloroform and acetone are polar molecules. Hydrogen in Chloroform ($CHCl_3$) has a partial positive charge and oxygen in acetone has partial –ve charge and an unshared electron pair and thus partial positively charged hydrogen can form hydrogen bond with a partial negatively charged '0xygen' of acetone.



(Chloroform) *(Acetone)*

Q.3: Why boiling needs constant heat of supply?

Ans: At boiling point K.E of molecules becomes maximum and further heating at boiling point will not increase temperature rather this heat will only be utilized to break the intermolecular forces and covert liquids into its vapours. If heat is not continuously supplied then the boiling stops. Therefore boiling needs a constant heat of supply.

Q.4: How liquid crystals are used as a locator of tumors?

Ans: Liquid crystal substances are used to locate tumors. When a layer of liquid crystal is painted on surface of breast, a tumor shows up as a hot area, which is coloured blue. It is useful in diagnosing breast cancer.

Q.5: Define molar heat of vaporization. Give example.

Ans: The amount of heat absorbed when one mole of a liquid is changed into vapours at its boiling point at 1atm is called ΔHv.

Q.6: London dispersion forces are weaker than dipole-dipole forces. Why?

Ans: London dispersion forces are created between instantaneous dipde and induced dipoles. These London forces are short range forces and is momentary force of attraction. These forces can exist between non-polar molecule. While the dipole-dipole forces are electrostatic forces of attraction and exist between neutral polar molecules. Therefore, London dispersion forces are weaker than dipde-dipole forces.

Q.7: Give significance of lower density of ice than water.

Ans: Lower density of ice than water means ice forms on top of water when freezing occurs. When ice forms on a body of water, it insulates the underlying water from the cold air and limits further freezing. Fish depends on this for winter survival.

Q.8: Boiling point of H_2O is higher than HF. Why?

Ans: It is because fluorine atom can make only one hydrogen bond with electropositive hydrogen of neighbouring molecule, while water can form two hydrogen bonds per molecule, as it has two hydrogen atoms and two lone pairs on oxygen atom.

Q.9: Give two applications of liquid crystals?

Ans: (i) Liquid crystals can be used as temperature sensors.

(ii) Liquid crystals are used in the display of electrical devices such as digital watches, calculators.

Q.10: Why the vapour pressure of water, ethyl alcohol and diethyl ether are different from each other at 0°C?

Ans: the vapour pressure depends in part on the strength of intermolecular forces in the liquid. Water can form two hydrogen bonds per molecule, ethyl alcohol can form one hydrogen bond per molecule and diethyl alcohol has no hydrogen bonding. The strength of intermolecular forces increased with increased number of hydrogen bonds per molecule. Since the strengths of intermolecular forces are different therefore, the vapour pressure of water, ethyl alcohol and diethyl ether are different from each other at 0°C.

Q.11: Why melting and boiling points of halogens increase down the group?

Ans: In general, larger molecules tend to have greater polarizability because they have greater number of electrons. Moreover, because molecular size and mass are generally parallel to each other, London dispersion forces tend to increase in strength with increasing molecular mass. Thus the melting and boiling points of the halogens increase with increasing molecular mass down the group.

Q.12: Why ice floats on surface of water?

Ans: The low density of ice compound to that of water can be explained in terms of hydrogen bonding. The interactions in water are random. However, when water freezes, the molecule assumes the ordered, open arrangements, creating empty spaces in ice. Thus when water freezes, it occupies more space and density decreases. The result is that ice has low density compared to that of water and ice floats on water. The structure of ice permits the maximum number of hydrogen-bonding between the H_2O molecules.

Q.13: Earthenware vessels keep water cool. Why?

Ans: Earthenware vessels are porous, when water is kept in Earthenware vessels, water evaporates through these pores. The more energetic water molecules leave the vessel. As a result, the average K.E of the remaining water molecules decreases and hence the temperature falls. Therefore, earthenware vessel keeps water cool.

Q.14: Heat of sublimation of iodine is very high. Why?

Ans: The value of ΔH_v for I_2 is very high due to its greater polarizability and van der walls forces, which are sufficient strong.

Q.15: What are dipole – dipole interactions?

Ans: The electrostatic forces of attraction between the positive end of one polar molecule and negative end of other polar molecule are called dipole – dipole forces. The strength of these forces depends upon the electronegativity difference between molecules. The shorter the distance and greater the electronegativity difference between the bonded atoms, the stronger will be the dipole – dipole forces. A dipole – dipole force exists between neutral polar molecules. For example, HCl and $CHCl_3$.

Q.16: Evaporation cause cooling. Explain?

Ans: Temperature is a measure of average kinetic energy of the molecules of a liquid. As the liquid evaporates, the escape of high-energy molecules from the liquid lowers the average kinetic energy of the remaining molecules in the liquid. As a result; the temperature of liquid falls down and heat moves from surroundings to the liquid, so temperature of liquid of surroundings also decreases. Thus evaporation cause cooling.

Q.17: Why heat of vaporization of hexane is greater than that of ethane?

Ans: Both hexane and ethane are non-polar and have London dispersion forces. The strength of dispersion forces increases with molecular mass. The molecular mass of hexane is greater than that of ethane. Therefore, heat of vaporization of hexane is greater than that of ethane.

Q.18: Evaporation takes place at all temperatures. Explain with reason.

Ans: The molecules of liquid are in constant state of motion and possess kinetic energy at all temperatures, therefore, evaporation takes place at all temperatures. However, if temperature increases the rate of evaporation also increases.

Q.19: Why boiling point of H_2O is different at Murree hills and Mount Everest?

Ans: The boiling point of a liquid changes as the external pressure changes. The atmospheric pressure at Mount Everest is lower than that at Murree hills. Since atmospheric pressure at murree hills and at Mount Everest are different, therefore, boiling point of water at Murree hills and Mount Everest are different. Water boils at 98°C at Murree hills and at 69°C at Mount Everest.

Q. 20. Why melting and boiling points of Alkanes increases with increase in molar masses?

Ans: Alkanes are non-polar molecules and only London dispersion forces exist among their molecules. Alkanes have chain of C-atoms with hydrogen atoms. An alkane molecule with a larger chain length has stronger attractive forces due to more places along its length where they can be attracted to other molecules. As the molar masses of molecule increases, the London dispersion forces become more prominent. Therefore, melting and boiling points of alkanes increase with increase in molar mass.

Q.21: Lower alcohols are water soluble but corresponding alkanes are insoluble in water. Why?

Ans: Lower alcohols and water both have O-H groups and have an unshared electron pair on a small electronegative 'O' atom and can form hydrogen bonding extensively which develop solubility. Thus lower alcohols are water soluble but corresponding Alkanes are non-polar molecules and can not form hydrogen bonding with water and hence are insoluble in water.

Q.22: Liquid crystal can act as temperature sensors?

Ans: Liquid crystals can diffract light. When one of wavelengths of white light is reflected, it looks coloured. The distance between layers of the molecules of liquid changes with change in temperature. Therefore, colour of reflected light changes accordingly. Therefore, liquid crystals can act as temperature sensors.

Q.23: Why HF is a weaker acid then HCl?

Ans: HF is weaker acid than HCl due to strong hydrogen bonding in HF, because partial positive charge is entrapped between two highly electronegative atom. Therefore, HF does not release proton H^+ easily as compared to HCl in which hydrogen bonding is absent. So HF is weaker acid than HCl.

Q.24: Water is liquid at room temperature but H2S is gas. Give reason.

Ans: Oxygen atom is H_2O is small and more electronegative as compared to sulphur in H_2S. Because '0' is so electronegative, a bond between hydrogen and '0' atom is quite polar with hydrogen at positive end, thus, H_2O has hydrogen bonding. Therefore H_2O is a liquid at room temperature due to H-bonding and H_2S is gas due to absence of H-bonding.

Q.25: Why do we feel cooling effect after taking bath?

Ans: We feel cooling effect after taking bath, because the more energetic water molecules on the surface of body evaporates and heat of body is used up to evaporate water which gives a sense of cooling

Q.26: How rate of evaporation depends upon surface area?

Ans: Since evaporation occurs from liquid surface, so greater the surface area, greater will be rate of evaporation. They are directly proportional to each other.

Q27: What are London dispersion forces?

Ans: The momentary forces of attraction created between instantaneous dipole and induced dipole are called London dispersion forces.

Q.28: Define vapour pressure of a liquid.

Ans: The pressure exerted by the vapours in equilibrium with its liquid at a given temperature is called vapour pressure of the liquid. It increases with increasing temperature. The stronger the intermolecular forces, the lower is the vapour pressure.

Q.29: Polar compounds are soluble in polar solvents. Justify it.

Ans: Both polar compounds and polar solvents have separation of positive and –ve charges. Ion-dipole forces are responsible for the dissolution of polar compounds in polar solvents. The +ve and –ve charges of polar compounds are then attracted by opposite poles of polar solvent molecules. These interactions make polar compounds to become soluble in polar solvents. Like is dissolved by like.

SOLIDS

Q.1: Molecular solids are soft and easily compressible. Why?

Ans: Molecular solids are composed of atoms or molecules held together by intermolecular forces. Therefore, molecular solids are weak and easily compressible.

Q.2: Define amorphous solid. Give example?

Ans: A solid whose atoms, ions or molecules have no orderly structure is called an amorphous solid. These solids lack well=defined faces and shapes. They do not have sharp melting points. For example glass, rubber.

Q.3: A fresh cut metal has shiny look. Justify.

Ans: The shining appearance of a metal, its luster, is caused by the mobile electrons. Most of metals possess luster, whenever are freshly cut. When light falls on metallic surface, the incident light collides with mobile electrons and they are excited. These electrons when deexcited give off some energy in the form of light. This light is reflected from metal surface at all angles giving metals its peculiar luster.

Q.4: Define crystal and crystalline?

Ans: A crystal is a kind of solid which has regular three dimensional arrangement of atoms, molecules or ions. A long range regularity does not exist in amorphous solids but they can possess small regions of orderly arrangement. The regions where orderly arrangement is present in amorphous solids are crystallites.

Q5: What is unit cell?

Ans: The smallest part of crystal lattice which has all the characteristics feature of entire crystal is called unit cell

Q.6: Why ionic rystalline solids have high melting points?

Ans: In ionic crystals, the cations and anions are held together by ionic bonds. Very high energy is required to separate the cations and anions from each other against forces of attraction. That is why ionic crystals are very hard, have low voltality and high melting and boiling points.

Q.7: Vapour pressure of solids is far less than those of liquids. Give reason.

Ans: The vapour pressure of solids is for less than those of liquids because of strong intermolecular forces due to close packing of the particles in solids as compared to those of liquids.

Q.8: Cleavage of crystals is itself on isotropic behaviour. Justify.

Ans: Cleavage is the breakage of crystal along definite planes. Since cleavage of crystals can take place only in particular directions, so it exhibits anisotropic behaviour.

Q.9: Ionic crystals don't conduct electricity is solid state. Give reason.

Ans: Ionic solids do not conduct electricity because the cations and anions are strongly held by electrostatic forces of attraction, hence ions occupy fixed positions and can not freely move.

Q.10: Define lattice energy. Give example.

Ans: The energy released when one mole of ionic crystals is formed from gaseous ions under standard conditions is called lattice energy.

Q.11: The crystals showing isomorphism mostly have the same atomic ratio. Justify.

Ans: A crystalline form depends only on the number of atoms and their way of combination and is independent of nature of atoms. Therefore, crystals showing isomorphism mostly have same atomic ratio. $NaNO_3$ and KNO_3 are isomorphs and the atomic ratio is 1 : 1 : 3.

Q.12: Metallic crystals are good conductors of electricity. Explain.

Ans: The delocalized electrons in a metal give rise to electrical and thermal conductivity. When electric field is applied between two ends of metal then mobile electrons begin to move towards the positive pde and new electrons from negative pole take their place passage of electrons from one end to the other constitutes electrical conduction.

Q.13: Define symmetry. Name any two symmetry elements.

Ans: The repetition of faces, angles or edges when a crystal is rotated by 360^o along it axis is called symmetry. The more important symmetry elements are centre of symmetry and axis of symmetry.

Q.14: Why graphite is anisotropic in electrical conductivity?

Ans: Graphite is an-isotropic in electrical conductivity because electrons in graphite are mobile for electrical conduction parallel to the layers only. Therefore, its electrical conductivity in this direction is greater than perpendicular to the other direction.

Q.15: Diamond is hard and electrical insulator. Explain it.

Ans: The hardness of diamond is accounted for by its closely interlocked three dimensional structure. The four valence electrons of each carbon are shared with electrons of four adjacent carbon atoms in sp^3 (tetrahedral) hybrid orbitals to form covalent bond which run through crystal to give three dimensional covalent network. Diamond is an electrical insulator since all valence electrons are fully involved in single (sigma) bond formation, thus no free electrons available.

Q.16: Why the metals are malleable and ductile?

Ans: Metals are malleable, which means they can be hammered into thin sheets and ductile, which means they can be drawn into wires. When a stress is applied on surface of metal, its layers slip pass each other, changing the structure of the metals without fracturing. Due to this reason metal are malleable and ductile.

Q.17: Explain with reason that ionic crystals are highly brittle.

Ans: Ionic crystals are highly brittle because ionic crystals consists of parallel layers of cations and anions in alternate position so that opposite ions in the various parallel layers lie over each other. When an external force is applied, one layer of ions slides a bit over the other layer along a plane and so, a light shifts brings the like ions in front of each other and thus interionic repulsions cause brittleness.

Q18: Define polymorphism in crystallines solids and give example.

Ans: A phenomenon in which a compound exist in more than one crystalline forms is called polymorphism. Such compounds are called polymorphs. For example, CaCO3, exists in trigonal and orthorhombic forms. AgNO3 exists

Q.19: Define isomorphism. Give one example.

Ans: A phenomenon in which two different substances exist in the same crystalline form is called isomorphism and these different substances are called isomorphs. $NaNO_3$ and KNO_3 both exist in rhombohedral crystals because both have same atomic ratio, i.e., 1 : 1 : 3.

Q.20: A fresh cut metal has shiny look. Justify.

Ans: The shining appearance of a metal, its luster, is caused by the mobile electrons. Most of metals possess luster, whenever are freshly cut. When light falls on metallic surface, the incident light collides with mobile electrons and they are excited. These electrons when deexcited give off some energy in the form of light. This light is reflected from metal surface at all angles giving metals its peculiar luster.