TEST NO.1

1. **Isotopes differ in:**
   (a) properties which depend upon mass.
   (b) arrangement of electrons in orbitals.
   (c) chemical properties.
   (d) the extent to which they may be affected in electrical field.

Explanatory Answer: **(A)**

Isotopes have same chemical properties but have different physical properties, these depend upon their different masses.

2. **Which of the following statement is not true?**
   (a) Isotopes with even atomic masses are comparatively abundant.
   (b) Isotopes with odd atomic masses are comparatively abundant.
   (c) Isotopes with even atomic masses and even atomic numbers are comparatively abundant.
   (d) Isotopes with even atomic masses and odd atomic numbers are comparatively abundant.

Explanatory Answer: (C)

3. **Many elements have fractional atomic masses. This is because:**
   (a) the mass of atom is itself fractional.
   (b) atomic masses are average masses of isobars.
   (c) atomic masses are masses of isotopes.
   (d) atomic masses are average masses of isotopes proportional to their relative abundance.

Explanatory Answer: (D)

The atomic mass depends upon number of isotopes and their relative percentage abundance. Its formula is:

$$\text{Average atomic mass} = \Sigma \frac{\text{Mass} \times \text{Natural abundance}}{100}$$

That's why many elements have fractional atomic masses usually.

4. **The mass of one mole of electrons is:**
   (a) 1.008 mg *(b)* 0.55 mg
   (c) 0.184 mg *(d)* 1.673 mg

Explanatory Answer: (D)

Mass of one electron $= 9.1 \times 10^{-31} \times 10^{6}$
$= 9.1 \times 10^{-31} \times 10^{6}$
$= 9.1 \times 10^{-25}$ mg

Mass of one mole of electrons $= 6.02 \times 10^{23} \times 9.1 \times 10^{-25}$
$= 0.55$mg

5. **27g of Al will react completely with how much mass of O_2 to produce Al_2O_3?**
   (a) 8g of oxygen
   (b) 16g of oxygen
   (c) 32g of oxygen
   (d) 24g of oxygen

Explanatory Answer: (D)

$4Al + 3O_2 \rightarrow 2Al_2O_3$
1 mole of Al = 27 g
$\Rightarrow$ 4 moles of Al react with $= 3$ moles of O_2

1 moles of Al react with $= \frac{3}{4} = 0.75$ moles

Mass of 0.75 moles of 'O_2' $= 0.75 \times 32 = 24$ g

6. **The number of moles of CO_2 which contain 8.0g of oxygen:**
   (a) 0.25 *(b)* 0.50
   (c) 1.0 *(d)* 1.50

Explanatory Answer: (A)

Molecular mass of CO_2 = 44g
32g of 'O' = 1 mole of CO_2

1 g 'O' $= \frac{1}{32}$

$$8 \text{ g 'O'} = \frac{1}{32} \times 8$$

$= 0.25$ moles of CO_2

7. **The largest number of molecules are present in:**

(a) 3.6g of H_2O (b) 4.8g of C_2H_5OH

(c) 2.8g of CO (d) 5.4g of N_2O_5

Explanatory Answer: (A)

$$\text{Moles} = \frac{\text{Mass is grams}}{\text{Molar mass}}$$

$$\text{Moles of } H_2O = \frac{3.6}{18} = 0.2 \text{ moles}$$

$$\text{Moles of } C_2H_5OH = \frac{4.8}{28} = 0.1 \text{ mole}$$

$$\text{Moles of CO} = \frac{2.8}{28} = 0.1 \text{ mole}$$

$$\text{Moles of } N_2O_5 = \frac{5.4}{108} = 0.05 \text{ mole}$$

No. of molecules = No. of moles × N_A

Large the no. of moles, larger will be the no. of molecules.

8. **One mole of SO_2 contains:**

(a) 6.02×10^{23} atoms of oxygen (b) 18.1×10^{23} molecules of SO_2

(c) 6.02×10^{23} atoms of sulphur (d) 4 gram atoms of SO_2

Explanatory Answer: (C)

One mole of SO_2 contain 'O' = 2 moles

Atoms of 'O' = $2 \times 6.02 \times 10^{23}$ atoms

One mole of SO_2 contain molecules = 6.02×10^{23}

One mole of SO_2 contain = 6.02×10^{23} atoms of S

9. **The volume occupied by 1.4g of N_2 at STP is:**

(a) 2.24 dm^3 (b) 22.4 dm^3

(c) 1.12 dm^3 (d) 112 dm^3

Explanatory Answer: (C)

1 mole of N_2 = 28 g molar mass

28 g N_2 occupy volume at S.T.P = 22.414 dm^3

1 g N_2 occupy volume at S.T.P $= \frac{22.414}{28}$

1.4 g N2 occupy volume at S.T.P $= \frac{22.414}{28} \times 1.4 = 1.12 dm^3$

10. **A limiting reactant is the one which:**

(a) is taken in lesser quantity in grams as compared to other reactants.

(b) is taken in lesser quantity in volume as compared to the other reactants.

(c) gives the maximum amount of the product which is required.

(d) gives the minimum amount of the product under consideration.

Explanatory Answer: (D)

A reactant which is consumed earlier and limitise the amount of products is called limiting reactant.

11. **A filtration process could be very time consuming if it were not aided by a gentle suction which is developed:**
    - *(a)* if the paper covers the funnel up to its circumference.
    - *(b)* if the paper has got small sized pores in it.
    - *(c)* if the stem of the funnel is large so that it dips into the filtrate.
    - *(d)* if the paper fits tightly.

Explanatory Answer: (D)

When filtration paper is inserted into moistened funnel, paper fits tightly to its circumstance and gentle suction is developed. In this case filtration is faster, otherwise slow and time consuming.

12. **During the process of crystallization, the hot saturated solution:**
    - *(a)* is cooled very slowly to get large sized crystals.
    - *(b)* is cooled at a moderate rate to get medium sized crystals.
    - *(c)* is evaporated to get the crystals of the product.
    - *(d)* is mixed with an immiscible liquid to get the pure crystals of the product.

Explanatory Answer: (B)

Slow cooling produces big crystals which has following disadvantages:

(i) Crystals include large amount of solvent making the drying process difficult.

(ii) Crystals may include impurities hindering the process of purification. Fast (rapid) cooling leads to improper crystallization. Hence, cooling is done at moderate rate to get medium sized crystals.

13. **Solvent extraction is an equilibrium process and it is controlled by:**
    - *(a)* law of mass action.
    - *(b)* the amount of solvent used.
    - *(c)* distribution law.
    - *(d)* the amount of solute.

Explanatory Answer: (C)

According to distribution law, solute distributes itself between two immiscible solvents in constant ratio of concentration irrespective of the amount of solute added.

14. **Solvent extraction method is a particularly useful technique for separation when the product to be separated is:**
    - *(a)* non-volatile or thermally unstable.
    - *(b)* volatile or thermally stable.
    - *(c)* non-volatile or thermally stable.
    - *(d)* volatile or thermally unstable.

Explanatory Answer: (D)

For separation of volatile or thermally unstable product solvent extraction is employed, since no other technique involving heat is useful. Because on heating volatile product evaporates and thermally unstable product decomposes.

15. **The comparative rates at which the solutes move in paper chromatography, depend on:**
    - *(a)* the size of per used.
    - *(b)* R_f values of solutes.
    - *(c)* temperature of the experiment.
    - *(d)* size of the chromatographic tank used.

Explanatory Answer: (B)

TEST NO. 2

1. Pressure remaining constant, at which temperature the volume of a gas will become twice of what it is at 0°C?

(a) 546°C *(b)* 200°C *(c)* 546K *(d)* 273K

Explanatory Answer: (C)

$T_1 = 0°C$ or $T_1 = 0 + 273 = 273$ K

$T_2 = ?$

Consider any value of initial volume $V_1 = 8\ dm^3$ and twice of it as final volume $V_2 = 16\ dm^3$ of it as final volume $V_2 = 16\ dm^3$.

$V_1 = 8\ dm^3$, $V_2 = 16\ dm^3$

At constant pressure, we know from Charles law:

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

$$= \frac{16dm^3}{8dm^3} \times 273K$$

$$T_2 = 2 \times 273 = 546\ K$$

Under these conditions, the answer of $\frac{V_2}{V_1}$ will be 2 when multiplied with 273 will give 546.

2. Number of molecules in one dm^3 of water is close to:

(a) $\frac{6.02}{22.4}$ *(b)* $\frac{12.04}{22.4} \times 10^{23}$ *(c)* $\frac{18}{22.4} \times 10^{23}$ *(d)* $55.6 \times 6.02 \times 10^{23} \times 10^{23}$

Explanatory Answer: (D)

Density of water is 1 g/cm^3 means $1g = 1cm^3$ and $1000m^3$ ($1\ dm^3$) = 1000 g mass of 1 dm^3 of water = 1000g.

No. of moles of 1 dm^3 of water (n) = $\frac{m}{M} = \frac{1000}{18}$ = 55.5moles

No. of molecules is 1 dm^3 of water (N) = $n \times N_A$

$= 55.5 \times 6.02 \times 10^{23}$ molecules

3. Which of the following will have the same number of molecules at STP?

(a) 280 cm^3 of CO_2 and 280 cm^3 of N_2O
(b) 11.2 dm^3 of O_2 and 32 g of O_2
(c) 44 g of CO_2 and 11.2 dm^3 of CO
(d) 28 g of N_2 and 5.6 dm^3 of oxygen

Explanatory Answer: (A)

We know that same volumes of all different gases at STP have equal no. of molecules. So, in (a)
both gases CO_2 and N_2O have same volume at STP and hence have same no. of molecules.

4. If absolute temperature of a gas is doubled and the pressure is reduced to one half, the volume of the gas will:

(a) remain unchanged *(b)* increase four times
(c) reduce to ¼ *(d)* be doubled

Explanatory Answer: (B)

Since $PV = nRT$

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

Firstly P_1, V_1 and T_1 So, $V1 = \frac{nRT_1}{P_1}$

The temperature of gas becomes double ($2T_1$) and pressure reduces to one half $\left(\frac{P_1}{2}\right)$

$$V_2 = \frac{nRT_2}{P_2} \quad \text{or} \quad V_2 = \frac{nR(2T_1)}{\frac{P_1}{2}}$$

$$V_2 = \frac{4nRT_1}{P_1}$$

Result shows that final volume is 4 times larger than initial volume.

5. How should the conditions be changed to prevent the volume of a given gas from expanding when its mass is increased?

(a) Temperature is lowered and pressure is increased.
(b) Temperature is increased and pressure is lowered.
(c) Temperature and pressure both are lowered.
(d) Temperature and pressure both are increased.

Explanatory Answer: (A)

Increase is mass increases the no. of moles (n) and volume is volume is directly proportional to no. of molecules or moles $V \propto n$.
It means volume will increase with increasing the no. of molecules. We can maintain the volume
by increasing the pressure and decreasing the temperature

6. The molar volume of CO_2 is maximum at:

(a) STP *(b)* 127°C and 1 atm
(c) 0°C and 2 atm *(d)* 273°C and 2 atm

Explanatory Answer: (B)

(a) At STP:

Molar volume of CO_2 = 22.414 dm3

(b) n = 1 mole, R = 0.821 dm^3 atm K^{-1} mol^{-1}, P = 1 atm

T = 127°C = 127 + 273 = 400 K, V = ?

$$PV = nRT, V = \frac{nRT}{P} = = \frac{1\times0.0821\times400}{1} = 32.84dm^3$$

(c) T = 0°C = 273 + 0 = 273 K, P = 2 atm.

n = 1 mole, R = 0.082 dm^3 atm K^{-1} mol^{-1}, V = ?

$$PV = nRT, V = \frac{nRT}{P} = \frac{1\times0.0821\times273}{2} = 11.2dm^3$$

(d) T = 273°C = 273 + 273 = 546K, P = 2 atm, n = 1 moles

R = 0.0821 atm dm^3 K^{-1} mol^{-1}, V = ?

$$PV = nRT, V = \frac{nRT}{P} = \frac{1\times0.0821\times546}{2} = 22.413dm^3$$

Thus molar volume of CO^2 is maximum at 127°C and 1 atm.

7. The order of the rate of diffusion of gases NH_3, SO_2, Cl_2 and CO_2 is:

(a) $NH_3 > SO_2 > Cl_2 > CO_2$ *(b)* $NH_3 > CO_2 > SO_2 > Cl_2$

(c) $Cl_2 > SO_2 > CO_2 > NH_3$ *(d)* $NH_3 > CO_2 > Cl_2 > SO_2$

Explanatory Answer: **(B)**

Molar mass of NH_3 = 17 g/mole

Molar mass of SO_2 = 64 g/mole

Molar mass of Cl_2 = 71 g/mole

Molar mass of CO_2 = 44 g/mole

According to Graham's law rate $\propto \frac{1}{\sqrt{M}}$

Means, lesser the molar mass, greater will be the rate. The correct order of rate of diffusion is:

$NH_3 > CO_2 > SO_2 > Cl_2$

17 g/mole 44 g/mole 64 g/mole 71 g/mole

8. Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of total pressure exerted by oxygen is:

(a) $\frac{1}{2}$ *(b)* $\frac{8}{9}$ *(c)* $\frac{1}{9}$ *(d)* $\frac{16}{17}$

Explanatory Answer: **(A)**

The fraction of total pressure exerted by a gas (say O_2) in a mixture of gases (say O_2 and CH_4) is equal to its mole fraction in the mixture. Equal mass of O_2 and CH_4 is 32 g

$n_{o2} = \frac{32}{32}$ = 1 mole and

$n_{CH4} = \frac{32}{16}$ = 2 moles and

Mole fraction (X_{O2} and X_{CH4}) are

$$X_{O2} = \frac{n_{O2}}{n_{O2}+n_{CH4}} = \frac{1}{1+2} = \frac{1}{3}$$

$$X_{CH4} = \frac{n_{CH4}}{n_{O2}+n_{CH4}} \frac{2}{1+2} = \frac{2}{3}$$

Hence fraction of total pressure exerted by O_2 is $\frac{1}{3}$

9. Gases deviate form ideal behaviour at high pressure. Which of the following is correct for non-ideality?

(a) At high pressure, the gas molecules move in one direction only.
(b) At high pressure, the collisions between the gas molecules are increased manifold.
(c) At high pressure, the volume of the gas becomes insignificant.
(d) At high pressure, the intermolecular attractions become significant.

Explanatory Answer: (D)

Any change that can bring gas molecules closer, will help attractive forces to dominate and gases deviate from ideality. At higher pressure, molecules come closer and attractions becomes significant responsible for non-ideality.

10. The deviation of a gas from ideal behaviour is maximum at:

(a) −10°C and 5.0 atm *(b)* −10°C and 2.0 atm
(c) 100°C and 2.0 atm *(d)* 0°C and 2.0 atm

Explanatory Answer: (A)

Deviation of a gas from ideal behavior is maximum at highest pressure and lowest temperature. Because under these conditions attractions are maximum.

11. A real gas obeying van der Waals' equation will resemble ideal gas if:

(a) both 'a' and 'b' are large *(b)* both 'a' and 'b' are small
(c) 'a' is small and 'b' is large *(d)* 'a' is large and 'b' is small

Explanatory Answer: (B)

Small value of factor "a" and "b" shows that weak forces and small value of excluded volume. Means lesser deviation resemble ideal gas

TEST NO.3

1. The nature of positive rays depend on:

(a) The nature of electrode *(b)* The nature of discharge tube
(c) The nature of residual gas *(d)* All of the above

Explanatory Answer: (C)

Positive rays produced in the discharge tube are the cations of gas used in the tube. Different gases have different masses and e/m value. That is the reason why when gas in the tube is changed, nature of positive rays also changes.

- Nature of cathode do not disturb the nature of positive as well as cathode rays.
- Nature of the discharge tube may affect the colour of fluorescence produced.

2. The velocity of photon is:

(a) Independent of its wavelength
(b) Depends on its wavelength
(c) Equal to square of its amplitude
(d) Depends on its source.

Explanatory Answer: (A)

Velocity of photon (light) has a constant value of 3×10^8 ms^{-1}. It does not depend upon its