CHEMISTRY REVISION QUESTIONS-HeLP, 2022.

Diffusion/Effusion

1. Oxygen diffuses 1.19 times faster than gas X. X contains 53.3 % carbon, 15.56 % hydrogen and the rest being nitrogen.

Calculate the:

(i).Empirical formula of X

(ii). Relative molecular mass of X

b(i). Determine the molecular formula of X

(ii). Write the structural formulae and names of isomers of X.

2. A certain volume of gaseous hydride of silicon Si_nH_{2n+2} diffused through a narrow hole in 17.08 seconds. Under the same conditions, the same volume of carbon dioxide diffused through the hole in 20 seconds.

(a). Calculate the relative molecular mass of the hydride.

(b). Determine the molecular formula of the hydride

(c). Draw the structure and name the shape of the hydride

3. A sample of methylamine was placed at one end A of a 0.8 meter-long glass tube, concentrated hydrochloric acid was placed at the other end B. After sometime, a white ring was formed inside the tube.

(a). Write the equation for the formation of the white ring.

(b). Calculate the distance of the white ring from B.

4. 50 cm3 of gas X diffused through a tiny hole in 146 seconds. Under the same conditions, the same volume of carbondioxide diffused through the hole in 115 seconds. Find the relative molecular mass of X.

5. 50 cm3 of an amine Y $C_nH_{2n+1}NH_2$ diffused through a small hole through 126 seconds. Under the same conditions, the same volume of hydrogen took 26.57 seconds.

(a). Calculate the relative molecular mass of Y.

(b). Determine the molecular formula of Y.

(c). Write the structural formulae and IUPAC names of all isomers of Y.

6. A certain volume of oxugen diffused through a porous membrane in 120 seconds. Under the same conditions, the same volume of gas X diffused through the membrane in 112 seconds. Calculate the relative molecular mass of X.

7. An alkene R diffuses through a porous partition in 2 minutes. Under the same conditions, the same volume of oxygen diffuses in 1.75 minutes.

(a). Calculate the formula mass of R.

(b). Determine the molecular formula of R

(c) i). Write the structural formula and IUPAC name of R.

Eudometry

1. 15 cm3 of hydrocarbon X was exploded with 120 cm3 of excess oxygen. Cooling to room temperature, the residual gas occupied 90 cm3. When passed through potassium hydroxide solution, 45 cm3 of the residual gas remained.

(a). Write an equation for the reaction that took place.

(b). Calculate the volume of:

(i). Oxygen that reacted.

(ii). Carbon dioxide that was formed.

(c) Determine the molecular formula of X.

2. 25 cm3 of a hydrocarbon Y was exploded with 250 cm3 of excess oxygen. Cooling to room temperature, the residual gas occupied 187.5 cm3. When passed through potassium hydroxide solution, 87.5 cm3 of the residual gas remained.

(a). Write an equation for the reaction that took place.

(b). Calculate the volume of:

(i). Oxygen that reacted.

(ii). Carbon dioxide that was formed.

(c). Determine the molecular formula of X.

3. 20 cm3 of a hydrocarbon Z was exploded with 200 cm3 of excess oxygen. It burnt with a sooty flame. After cooling to room temperature, the volume of the residual gas was 160 cm3. When aqueous potassium hydroxide was added, the volume of the residual gas that finally remained was 20 cm3.

Calculate the molecular formula of Z.

4. 15 cm3 of a gaseous hydrocarbon Q was exploded with 65 cm3 of oxygen. After cooling to room temperature, the residual gas occupied 50 cm3. When passed through potassium hydroxide solution, there was a further domination of 30 cm3 on the residual gas.

(a). Determine the molecular formula of Q.

(b). Write the structural formula and names of 2 isomers of Q.

5. 8 cm3 of a hydrocarbon R was exploded with 50 cm3 of oxygen. After cooling to room temperature, the residual gas occupied 38 cm3. On treatment with potassium hydroxide solution, 14 cm3 of the residual gas remained.

(a). determine the molecular formula of R

Mass spectrometry

1. Element Y has 3 naturally occurring isotopes. The isotopic masses and their relative abundances are shown below.

Isotopic mass	Percentage abundance
23.98	78.60
24.98	10.11
25.98	11.29

Calculate the atomic mass of Y.

2. The table below shows the information about the mass spectrum of lead.

Isotopic mass	Detector current
204	0.16
206	2.72
207	2.50
208	5.92

a). describe the main steps leading to the formation of a mass spectrum

b). Calculate the:

i). relative abundance of each isotope

ii). relative atomic mass of lead

c). State 2 advantages of using a mass spectrometer.

3. a). Describe how relative atomic mass of an element is determined using a mass spectrum.

b). The mass spectrum of an element A contained four peaks at mass/charge ratio of 54, 56, 57 and 58 with relative intensities of 5.84, 91.68, 2.17 and 0.31 respectively.

i). Explain what the term relative intensity means

ii). Calculate the relative atomic mass of A.

Radioactivity

1. The half-life of a radioactive element is 30 days.

(a). Calculate the decayconstant

(b). Calculate the time for its activity measured on a Geiger-Muller counter to drop from 4800 to 300 cpm.

2. a). Describe briefly how radioactivity is used in

(i). Determining the age of an archeological object

(ii). studying the mechanism for the reaction between a carboxylic acid an alcohol

(b). Mention three other uses of radioactivity.

(c). Carbon-14 has a half life of 5600 years. The activity of an old tree that was felled in the glaciations periods was found to be 12.5 % of that that felled in a similar tree felled now. When was the old tree felled.

3. A sample of fresh wood gave an activity of 20 cps per gramme due to the disintegration of carbon-14. A sample of wood from a pre-historic site gave an activity of 5 cps per gramme. If the half-life of cabon-14 is 5600 years.

(a). Write an equation for beta decay of carbon-14.

(b). Calculate the age of the rock.

4. The disintegration constant for the disintegration if radioactive sodium to magnesium is $2.85x10^{-3}s^{-1}$. Find the fraction of the original sample left after 150 seconds.

5. (a). Write an equation for the alpha decay of ^{226}Ra.

(b). Calculate the fraction of ^{226}Ra remaining after 100 years if its half life is 1620 years.

6. The activity of ^{236}Th was reduced by 75 % in 50 days. Find the half life of ^{236}Th.

7. 8 g of a radioactive isotope decayed to 4 g in a year. Find the time taken for 6 g of the same isotope to decay to 2.3 g.

RMM by vapourisation

1. The empirical formula of a fluoride of Sulphur Z is SF4. 0.1g of Z occupied 22.10 cm3 when vapourised at 20oC and 766mmHg.

(a). Calculate the relative molecular mass of Z.

(b). Determne the molecular formula of Z.

2. A compound Q contains 62.1 % carbob, 10.3 % hydrogen and the rest being oxygen. The density of Q is $2.59x10^{-3}gcm^{-3}$ at stp.

(a). Calculate the

(i). Empirical formula of Q

(ii). molecular formula of Q.

3. Compound P contains 52.2% carbon, 13 % hydrogen and the rest being oxyen. When vapourised, 0.1 g of P occupied 78.8 cm3 at 157 oC and 740 mmHg.

(a). Determine the:

(i). Empirical formula of P

(ii). relative molecular mass of P.

(iii). Molecular formula of P

4. 0.135g of gas Z was vapourised at 90oC and 101.3 kPa. It occupied 56cm3. Calculate the relative molecular mass of Z.

(b). 2.20 g of gas X occupied 1.24 litres at 25 oC and 100kPa. Calculate the relative molecular mass of X.

Colligative properties

1. A solution containing 0.911g of carbon tetrachloride in 50 g of benzene reduced the freezing point of benzene by 0.659^{o}C. Calculate the relative molecular mass of carbon tetra chloride. Comment on your answer. (Kf=5.5^{o}C per 1000 g).

2. 3 g of solute X was dissolved in 20 g of naphthalene and the freezing point of the solution was 46oC. Given that the freezing point of Naphthalene is 54^{o}C and Kf= 7.0^{o}C/mol/1000g. Calculate the RMM of solute X. Ans. 131.25

3. A solution containing 1.2 g of acetic acid in 80 g of water freezes at -0.46°C. Calculate the RMM of acetic acid (Kf of water/1000g = 1.86°C/mol).

4. 0.48 g of substance X dissolved in 50 g of benzene and caused a freezing point depression of 0.44°C. Calculate the RMM of X from these observations. (Freezing point depression constant of benzene/1000g = 5.5°C/mol).

5. If the freezing point constant of 1000g of water is 1.86°C/mol. At what temperatures will a solution of 3.33g of ethylenoglycol-$C_2H_4(OH)_2$-in 14 g of water begin to freeze.

6. Liquid camphor freezes at 1.75°C. A solution of 1.54g of naphthalene ($C_{10}H_8$) in 18 g of camphor freezes at 148.3°C. What is the freezing point constant /1000g of camphor.

7. In how much water should 10 g of glucose ($C_6H_{12}O_6$) be dissolved to obtain a solution freezing at -0.35°C.

8. 0.55 g of Nitrobenzene in 22 g of acetic acid depressed the freezing point of the latter by 0.78°C. Calculate the RMM of nitrobenzene (Cryoscopicconstant for 1000g of acetic acid is 3.90°C/mol).

9. The freezing points of various concentrations of a non-volatile solute X in water are given below.

Concentration (g/1000g)	0	20	40	60	80	100	120	140
Freezing point	0	-0.11	-0.22	-0.32	-0.43	-0.54	-0.65	-0.76

a). Plot a graph of freezing point depression against concentration

b). Calculate the relative molecular mass of X (Kf=1.86°C per 1000g)

10. The osmotic pressure of various concentrations of solute X in methylbenzene at 25°C are given in the table below.

Concentration g/dm^3	**1**	**2**	**3**	**4**	**5**	**6**
Osmotic pressure , N/m^{-2}	23	37	53	75	92	109

(a). Plot a graph of osmotic pressure against concentration

(b). Use the graph drawn, to determine the RMM of X (R=8.314J/K/mol)

11. An aqueous solution of cane sugar containing 19.15 g of sugar per dm^3 has an osmotic pressure of 136300Nm^{-2} at 20℃. Find the RMM of cane sugar.

12. A solution containing 20g of a polymer X in 1 litre of a solvent exerts an osmotic pressure of 1.4 mmHg at 25 ℃.

(a). Calculate the RMM of X

(b). If the monomer of X is CH2=CHCN. Determine the number of monomer units.

13. Calculate the RMM of sucrose if a solution containing 19.15g of solution per dm3 has an osmotic pressure of 136300Pa at 20℃

6. A solution containing 14g/l of polyvinyl Chloride polymer in 1 litre of dioxane was found to have an osmotic pressure of 6 × 10−4 atmospheres at 27℃. Find the approximate molecular weight of this polymer.

14. The Osmotic pressure of a solution containing 1.24% of a polymer is 3.1 × 10-3 atmospheres of 25℃. Determine the RMM of the polymer.

15. 18.04g of an organic compound is dissolved in 100 g of water. The vapour pressure of the solution at 20ºC was 17.226 mmHg. If the vapour pressure of pure water is 17.535 mmHg. Find the RMM of the compound.

16. The vapour pressure of a solution containing 108.2 g of a compound Y in 1000 g of water at 20ºC was reduced by 0.186 mmHg. If the vapour pressure of pure water at 20ºC is 17.54 mmHg.

(i). Calculate the RMM of Y

(ii). State the assumptions made

(iii). Explain why the vapour pressure of the solution containing a non-volatile solute is less than the vapour pressure of the solvent.

17. A solution of 100g of solute in 1dm3 of water has a Vapour pressure of 2.27 × 10 -3 Nm-2 at 20 ºC. The vapour pressure of water at 20 ºC is 2.34 × 10-3 Nm-2. Calculate the molecular mass of the solute.

18. The vapour pressure of Benzene is $9.97 \times 103\ Nm^{-2}$ at 20 ^{o}C. What is the VP of the solution of 12.8 g of naphthalene, $C_{10}H_8$ in 100 g of Benzene (C_6H_6).

END