

# Some Basic Concepts of Chemistry

## Single Correct Type Questions

1. Hemoglobin contains 0.34% of iron by mass. The number of Fe atoms in 3.3 g of hemoglobin is (Given: Atomic mass of Fe is 56 u,  $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$ .)

[26 July, 2022 (Shift-II)]

- (a)  $1.21 \times 10^5$  (b)  $12.0 \times 10^{16}$   
(c)  $1.21 \times 10^{20}$  (d)  $3.4 \times 10^{22}$

2. Match List-I with List-II. [10 April, 2023 (Shift-II)]

### List - I

- (A) 16g of  $\text{CH}_4(\text{g})$   
(B) 1g of  $\text{H}_2(\text{g})$   
(C) 1 mole of  $\text{N}_2(\text{g})$   
(D) 0.5 mol of  $\text{SO}_2(\text{g})$

### List - II

- (I) Weighs 28 g  
(II)  $60.2 \times 10^{23}$  electrons  
(III) Weighs 32g  
(IV) Occupies 11.4 L volume at STP

Choose the correct answer from the options given below:

- (a) (A)-(I), B-(III), C-(II), D-(IV)  
(b) (A)-(II), B-(III), C-(IV), D-(I)  
(c) (A)-(II), B-(IV), C-(III), D-(I)  
(d) (A)-(II), B-(IV), C-(I), D-(III)

3. Production of iron in blast furnace follows the following equation  $\text{Fe}_3\text{O}_4(\text{s}) + 4\text{CO}(\text{g}) \longrightarrow 3\text{Fe}(\text{l}) + 4\text{CO}_2(\text{g})$

When 4.640 kg of  $\text{Fe}_3\text{O}_4$  and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is:

[Given: Molar Atomic mass ( $\text{g mol}^{-1}$ ); Fe = 56

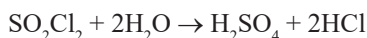
Molar Atomic mass ( $\text{g mol}^{-1}$ ); O = 16

Molar Atomic mass ( $\text{g mol}^{-1}$ ); C = 12]

[29 June, 2022 (Shift-I)]

- (a) 1400 (b) 2200  
(c) 3360 (d) 4200

4.  $\text{SO}_2\text{Cl}_2$  on reaction with excess of water results into acidic mixture



16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of  $\text{SO}_2\text{Cl}_2$  used is:

[25 July, 2022 (Shift-I)]

- (a) 16 (b) 8  
(c) 4 (d) 2

5. 250 g solution of D-glucose in water contains 10.8% of carbon by weight. The molality of the solution is nearest to (Given : Atomic weights are, H, 1u ; C, 12u ; O, 16u)

[27 July, 2022 (Shift-I)]

- (a) 1.03 (b) 2.06  
(c) 3.09 (d) 5.40

6. 5 moles of  $\text{AB}_2$  weigh  $125 \times 10^{-3} \text{ kg}$  and 10 moles of  $\text{A}_2\text{B}_2$  weigh  $300 \times 10^{-3} \text{ kg}$ . The molar mass of  $\text{A}_{(\text{M}_A)}$  and molar mass of  $\text{B}_{(\text{M}_B)}$  in  $\text{kg mol}^{-1}$  are: [12 April, 2019 (Shift-I)]

- (a)  $\text{M}_A = 50 \times 10^{-3}$  and  $\text{M}_B = 25 \times 10^{-3}$   
(b)  $\text{M}_A = 25 \times 10^{-3}$  and  $\text{M}_B = 50 \times 10^{-3}$   
(c)  $\text{M}_A = 5 \times 10^{-3}$  and  $\text{M}_B = 10 \times 10^{-3}$   
(d)  $\text{M}_A = 10 \times 10^{-3}$  and  $\text{M}_B = 5 \times 10^{-3}$

7. 120 g of an organic compound that contains only carbon and hydrogen gives 330 g of  $\text{CO}_2$  and 270 g of water on complete combustion. The percentage of carbon and hydrogen, respectively are [24 June, 2022 (Shift-I)]

- (a) 25 and 75 (b) 40 and 60  
(c) 60 and 40 (d) 75 and 25

8. Compound A contains 8.7% Hydrogen, 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is, Given : Atomic masses of C, H and N are 12, 1 and 14 amu respectively. The molar mass of the compound A is  $162 \text{ g mol}^{-1}$ . [28 June, 2022 (Shift-II)]

- (a)  $\text{C}_4\text{H}_6\text{N}_2$  (b)  $\text{C}_2\text{H}_3\text{N}$   
(c)  $\text{C}_5\text{H}_7\text{N}$  (d)  $\text{C}_{10}\text{H}_{14}\text{N}_2$

9. Complete combustion of 1.80 g of an oxygen containing compound ( $\text{C}_x\text{H}_y\text{O}_z$ ) gave 2.64 g of  $\text{CO}_2$  and 1.08g of  $\text{H}_2\text{O}$ . The percentage of oxygen in the organic compound is

[25 Feb, 2021 (Shift-I)]

- (a) 53.33 (b) 50.33  
(c) 63.53 (d) 51.63

10. When a hydrocarbon A undergoes combustion in the presence of air, it requires 9.5 equivalents of oxygen and produces 3 equivalents of water. What is the molecular formula of A? [29 Jan, 2023 (Shift-II)]

(a)  $C_8H_6$  (b)  $C_9H_9$   
(c)  $C_6H_6$  (d)  $C_9H_6$

11. When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A? [31 Jan, 2023 (Shift-II)]

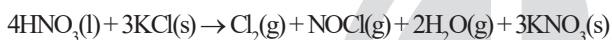
(a)  $C_9H_8$  (b)  $C_{11}H_4$   
(c)  $C_5H_8$  (d)  $C_{11}H_8$

12. If a rocket runs on a fuel ( $C_{15}H_{30}$ ) and liquid oxygen, the weight of oxygen required and  $CO_2$  released for every litre of fuel respectively are: [24 June, 2022 (Shift-I)]

(Given: density of the fuel is 0.756 g / mL)

(a) 1188 g and 1296 g (b) 2376 g and 2592 g  
(c) 2592 g and 2376 g (d) 3429 g and 3142 g

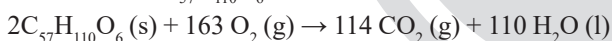
13. Consider the reaction



The amount of  $HNO_3$  required to produce 110.0 g of  $KNO_3$  is (Given: Atomic masses of H, O, N and K are 1, 16, 14 and 39, respectively) [29 July, 2022 (Shift-II)]

(a) 32.2g (b) 69.4g  
(c) 91.5g (d) 162.5g

14. For the following reaction, the mass of water produced from 445 g of  $C_{57}H_{110}O_6$  is:



[9 Jan, 2019 (Shift-II)]

(a) 490 g (b) 445 g  
(c) 495 g (d) 890 g

15. 5 g of zinc is treated separately with an excess of  
(A) dilute hydrochloric acid and  
(B) aqueous sodium hydroxide.

The ratio of the volumes of  $H_2$  evolved in these two reactions is: [9 Jan, 2020 (Shift-II)]

(a) 1 : 4 (b) 1 : 1  
(c) 1 : 2 (d) 2 : 1

### Integer Type Questions

16. CNG is an important transportation fuel. When 100 g CNG is mixed with 208 g oxygen in vehicles, it leads to the formation of  $CO_2$  and  $H_2O$  and produces large quantity of heat during this combustion, then the amount of carbon dioxide produced in grams is \_\_\_\_\_. (nearest integer) [Assume CNG to be methane] [26 June, 2022 (Shift-II)]

17. Chlorophyll extracted from the crushed green leaves was dissolved in water to make 2 L solution of Mg of concentration 48 ppm. The number of atoms of Mg in this solution is  $x \times 10^{20}$  atoms. The value of x is \_\_\_\_\_. (Nearest Integer)

(Given: Atomic mass of Mg is 24 g  $mol^{-1}$ ;  $N_A = 6.02 \times 10^{23} mol^{-1}$ ) [26 July, 2022 (Shift-I)]

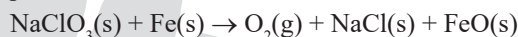
18. 1 L aqueous solution of  $H_2SO_4$  contains 0.02 m mol  $H_2SO_4$ . 50% of this solution is diluted with deionized water to give 1 L solution (A). In solution (A), 0.01 m mol of  $H_2SO_4$  are added. Total m mols of  $H_2SO_4$  in the final solution is \_\_\_\_\_  $\times 10^3$  m moles. [25 June, 2022 (Shift-I)]

19. Two elements A and B forms 0.15 moles of  $A_2B$  and  $AB_3$  type compounds. If both  $A_2B$  and  $AB_3$  weigh equally, then the atomic weight of A is \_\_\_\_\_ times of atomic weight of B. [27 June, 2022 (Shift-I)]

20. Ferrous sulphate heptahydrate is used to fortify foods with iron. The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat is \_\_\_\_\_  
Atomic weight : Fe = 55.85; S = 32.00; O = 16.00

[8 Jan, 2020 (Shift-I)]

21.  $NaClO_3$  is used, even in spacecraft, to produce  $O_2$ . The daily consumption of pure  $O_2$  by a person is 492L at 1 atm, 300 K. How much amount of  $NaClO_3$ , in grams, is required to produce  $O_2$  for the daily consumption of a person at 1 atm, 300 K?



$R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$ . [8 Jan, 2020 (Shift-II)]

22. Aluminium reacts with sulfuric acid to form aluminium sulfate and hydrogen. What is the volume of hydrogen gas in liters (L) produced at 300 K and 1.0 atm pressure, when 5.4 g of aluminium and 50.0 mL of 5.0 M sulfuric acid are combined for the reaction?

(Use molar mass of aluminium as 27.0 g  $mol^{-1}$ ,  $R = 0.082 \text{ atm L mol}^{-1} \text{ K}^{-1}$ ) [JEE Adv 2020]

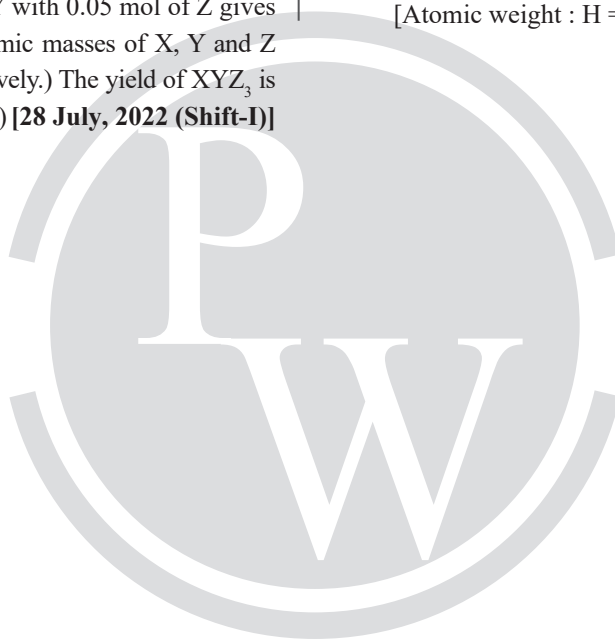
23. 116 g of a substance upon dissociation reaction yields 7.5 g of hydrogen, 60g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C are 1, 16 and 12 g/mol respectively. The data agrees with how many formulae of the following? [27 June, 2022 (Shift-II)]

(a)  $CH_3COOH$  (b)  $HCHO$   
(c)  $CH_3OOCH_3$  (d)  $CH_3CHO$

24. The complete combustion of 0.492 g of an organic compound containing 'C', 'H' and 'O' gives 0.793g of  $CO_2$  and 0.442 g  $H_2O$ . The percentage of oxygen composition in the organic compound is \_\_\_\_\_. (nearest integer)

[28 June, 2022 (Shift-II)]

25. Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP from the reaction of 11.5 g of zinc with excess HCl is \_\_\_\_\_ L (Nearest integer)  
(Given : Molar mass of Zn is  $65.4 \text{ g mol}^{-1}$  and Molar volume of  $\text{H}_2$  at STP =  $22.7 \text{ L}$ ) [31 Jan, 2023 (Shift-I)]
26. Assume carbon burns according to following equation :  
 $2\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow 2\text{CO}_{(g)}$   
When 12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is \_\_\_\_\_  $\times 10^{-1} \text{ L}$  at STP [nearest integer]  
[Given : Assume CO as ideal gas, Mass of C is  $12 \text{ g mol}^{-1}$ , Mass of O is  $16 \text{ g mol}^{-1}$  and molar volume of an ideal gas at STP is  $22.7 \text{ L mol}^{-1}$ ] [31 Jan, 2023 (Shift-II)]
27. In the given reaction,  $\text{X} + \text{Y} + 3\text{Z} \rightleftharpoons \text{XYZ}_3$   
If one mole of each of X and Y with 0.05 mol of Z gives compound  $\text{XYZ}_3$ . (Given: Atomic masses of X, Y and Z are 10, 20 and 30 amu, respectively.) The yield of  $\text{XYZ}_3$  is \_\_\_\_\_ g. (Nearest integer) [28 July, 2022 (Shift-I)]
28. When 200 mL of 0.2 M acetic acid is shaken with 0.6 g of wood charcoal, the final concentration of acetic acid after adsorption is 0.1M. The mass of acetic acid adsorbed per gram of carbon is \_\_\_\_\_ g. [24 June, 2022 (Shift-II)]
29. The formula of a gaseous hydrocarbon which requires 6 times of its own volume of  $\text{O}_2$  for complete oxidation and produces 4 times its own volume of  $\text{CO}_2$  is  $\text{C}_x\text{H}_y$ . The value of y is \_\_\_\_\_. [24 Feb, 2021 (Shift-II)]
30. 100 g of propane is completely reacted with 1000 g of oxygen. The mole fraction of carbon dioxide in the resulting mixture is  $x \times 10^{-2}$ . The value of x is \_\_\_\_\_. (Nearest integer)  
[Atomic weight : H = 1.008; C = 12.00; O = 16.00]  
[27 August 2021 (Shift-II)]



## ANSWER KEY

1. (c)    2. (d)    3. (c)    4. (c)    5. (b)    6. (c)    7. (d)    8. (d)    9. (a)  
 10. (a)    11. (a)    12. (c)    13. (c)    14. (c)    15. (b)    16. [143]    17. [24]    18. [0]  
 19. [2]    20. [496]    21. [2130]    22. [6.15]    23. [2]    24. [46]    25. [4]    26. [227]    27. [2]  
 28. [2]    29. [8]    30. [19]

## EXPLANATIONS

1. (c) Number of iron atoms in 3.3 g of hemoglobin

$$= \frac{0.34}{100} \times \frac{3.3}{56} \times 6.022 \times 10^{23}$$

$$= 1.206 \times 10^{20}$$

2. (d)  $n = \frac{\text{Weight}}{\text{Molar mass}}$

$$16 \text{ g CH}_4 = 1 \text{ mole CH}_4$$

$$1 \text{ mole CH}_4 \rightarrow 10 \times 6.02 \times 10^{23} \text{ electrons}$$

$$= 60.2 \times 10^{23} \text{ electrons}$$

$$1 \text{ g H}_2 = 0.5 \text{ mole H}_2$$

$$1 \text{ mole H}_2 \text{ at STP} \rightarrow 22.4 \text{ L}$$

$$0.5 \text{ mole H}_2 \text{ at STP} \rightarrow 11.2 \text{ L} \approx 11.4 \text{ L}$$

$$1 \text{ mole of N}_2 = 28 \text{ g}$$

$$(\because M_{\text{N}_2} = 28 \text{ g/mol})$$

$$0.5 \text{ mole of SO}_2 = 32 \text{ g}$$

$$(\because M_{\text{SO}_2} = 64 \text{ g/mol})$$

3. (c) Molar mass of  $\text{Fe}_3\text{O}_4 = 232 \text{ g/mol}$

$$\text{Molar mass of CO} = 28 \text{ g/mol}$$

$$\text{Moles} = \frac{\text{Given weight}}{\text{Molar mass}}$$

$$\text{Moles of Fe}_3\text{O}_4 = \frac{4.64 \times 10^3}{232} = 20$$

$$\text{Moles of CO} = \frac{2.52 \times 10^3}{28} = 90$$

According to the reaction:

$$4 \text{ moles of CO reacts with 1 mol of Fe}_3\text{O}_4$$

$$\Rightarrow 90 \text{ moles of CO reacts with 22.5 mole of Fe}_3\text{O}_4$$

$$\text{Thus, limiting reagent} = \text{Fe}_3\text{O}_4$$

$$\text{Thus, moles of Fe formed} = 60$$

$$\text{Weight of Fe} = 60 \times 56 = 3360 \text{ g}$$

4. (c)  $\text{SO}_2\text{Cl}_2 + 2\text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + 2\text{HCl}$

(Given: Moles of NaOH required for complete neutralisation = 16)

Let a moles of  $\text{SO}_2\text{Cl}_2$  is taken

Then no. of moles of  $\text{H}_2\text{SO}_4 = a$  moles

No. of moles of HCl =  $2a$  moles

No. of moles of NaOH required =  $2a + 2a = 4a = 16$

$$\Rightarrow a = 4 \text{ moles}$$

5. (b)  $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{Glucose}$

$$\% \text{ of C} = 10.8 = \frac{\text{Mass of C}}{\text{mass of solution}} \times 100$$

$$\text{Mass of C} = \frac{10.8 \times 250}{100} = 27 \text{ g}$$

$$\therefore \text{Mass of glucose} = 67.5 \text{ gm}$$

$$\therefore \text{Moles of glucose} = 0.375 \text{ moles}$$

$$\text{Mass of solvent} = 250 - 67.5 = 182.5 \text{ gm}$$

$$\therefore \text{Molality} = \frac{0.375}{0.1825} = 2.06 \text{ m}$$

6. (c)  $5[M_A + 2M_B] = 125$

$$M_A + 2M_B = 25 \quad \dots(i)$$

$$2M_A + 2M_B = 30 \quad \dots(ii)$$

from eq. (i) & (ii)

$$M_A = 5$$

$$M_B = 10$$

7. (d) Number of moles of C = Number of moles of  $\text{CO}_2$

$$= \frac{\text{Given weight}}{\text{Molar mass}} = \frac{330}{44} \text{ moles}$$

Number of moles of H =  $2 \times$  no. of moles of  $\text{H}_2\text{O} =$

$$\left(\frac{270}{18} \times 2\right) \text{ moles}$$

$$\text{Mass of C} = \frac{330}{44} \times 12 \text{ gm} = 90 \text{ gm}$$

$$\text{Mass of H} = \frac{270}{18} \times 2 \times 1 \text{ gm} = 30 \text{ gm}$$

$$\% \text{ of C} = \frac{90}{120} \times 100\% = 75\%$$

$$\% \text{ of H} = \frac{30}{120} \times 100\% = 25\%$$

8. (d) The empirical formula for the compound A can be calculated as:

	Mass	Moles = $\frac{\text{Weight}}{\text{Molar Mass}}$	Simplest Ratio
C	74g	$\frac{74}{12} = 6.17$	$\frac{6.17}{1.24} = 4.9 \approx 5$
H	8.7g	$\frac{8.7}{1} = 8.7$	$\frac{8.7}{1.24} = 7$
N	17.3g	$\frac{17.3}{14} = 1.24$	$\frac{1.24}{1.24} = 1$

Hence, empirical formula is  $\text{C}_5\text{H}_7\text{N}$  and empirical mass is 81 g/mol

Given: Molecular mass = 162 g/mol

$$\Rightarrow n = \frac{\text{Molecular Mass}}{\text{Empirical Mass}} = \frac{162}{81} = 2$$

Molecular formula =  $n \times$  Empirical formula =  $\text{C}_{10}\text{H}_{14}\text{N}_2$

9. (a) First calculate the percentage of C and H as:

% of C

$$= \frac{\text{Wt of CO}_2}{\text{Wt of comp.}} \times \frac{12}{44} \times 100 = \frac{2.64}{1.8} \times \frac{12}{44} \times 100 = 40\%$$

% of H

$$= \frac{\text{Wt of H}_2\text{O}}{\text{Wt of comp.}} \times \frac{2}{18} \times 100 = \frac{1.08}{1.8} \times \frac{2}{18} \times 100 = 6.67\%$$

Now, % of O =  $100 - (40 + 6.67) = 53.33\%$

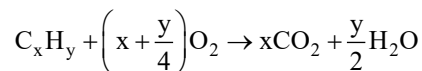
10. (a)  $\text{C}_x\text{H}_y + \left(x + \frac{y}{4}\right) \text{O}_2 \rightarrow x\text{CO}_2 + \frac{y}{2} \text{H}_2\text{O}$

$$x + \frac{y}{4} = 9.5$$

$$\frac{y}{2} = 3 \quad (\because \text{given 3 equivalents of water})$$

$$\Rightarrow x = 8, y = 6$$

11. (a) The general form of combustion reaction is:



$$\frac{y}{2} = 4 \therefore y = 8$$

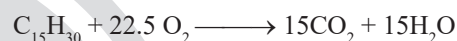
$$x + \frac{8}{4} = 11$$

$$\therefore x = 9$$

Hydrocarbon formula will be =  $\text{C}_9\text{H}_8$

12. (c) Mass of  $\text{C}_{15}\text{H}_{30}$  = volume  $\times$  Density

$$= 1000 \text{ mL} \times 0.756 \text{ gm / mL} = 756 \text{ gram}$$



$$\text{No. of moles of C}_{15}\text{H}_{30} \text{ needed} = \frac{756}{210} \text{ moles}$$

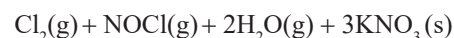
$$\text{No. of moles of O}_2 \text{ needed} = \left(22.5 \times \frac{756}{210}\right) \text{ moles}$$

$$\text{Mass of O}_2 \text{ needed} = 22.5 \times \frac{756}{210} \times 32 = 2592 \text{ gm}$$

$$\text{No. of moles of CO}_2 \text{ liberated} = 15 \times \left(\frac{756}{210}\right) \text{ moles}$$

$$\text{Mass of CO}_2 \text{ liberated} = 15 \times \frac{756}{210} \times 44 = 2376 \text{ gm}$$

13. (c)  $4\text{HNO}_3(\ell) + 3\text{KCl}(\text{s}) \longrightarrow$



According to the reaction

4 moles of  $\text{HNO}_3$  gives 3 mol of  $\text{KNO}_3$

$$\text{Here, mole of produced KNO}_3 = \frac{110}{101}$$

$$(\because M_{\text{KNO}_3} = 101 \text{ g/mol})$$

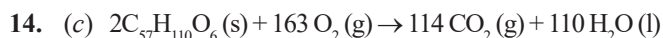
If 3 mol of  $\text{KNO}_3$  produced by 4 moles of  $\text{HNO}_3$

$$\therefore 1 \text{ mole of KNO}_3 \text{ produced by } \frac{4}{3} \text{ moles of HNO}_3$$

$$\text{and } \frac{110}{101} \text{ mole of KNO}_3 \text{ produced by } \frac{4 \times 110}{3 \times 101} \text{ moles}$$

$$\text{of HNO}_3 = 1.45 \text{ mole of HNO}_3$$

Hence, the mass of  $\text{HNO}_3 = \text{mole} \times \text{molecular weight}$   
 $= 1.45 \times 63 = 91.48 \approx 91.5 \text{ g}$

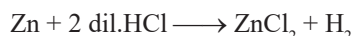


$$\frac{\text{Moles of } \text{C}_{57}\text{H}_{110}\text{O}_6}{2} = \frac{\text{Moles of } \text{H}_2\text{O}}{110}$$

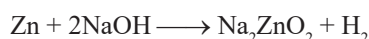
$$\frac{445}{890} = \frac{\frac{\text{mass of } \text{H}_2\text{O}}{18}}{110}$$

$$\text{Mass of } \text{H}_2\text{O} = 495 \text{ g}$$

15. (b) The reaction between Zn and dil. HCl is,



The reaction between Zn and aq. NaOH is,



$$\text{Mole of Zn} = \frac{\text{Mole of dil. HCl}}{2} = \frac{\text{Mole of NaOH}}{2}$$

$$\frac{\text{volume of HCl}}{\text{volume of NaOH}} = \frac{1}{1}$$



$$\text{Mole} \frac{100}{16} \frac{208}{32} \left( \text{Moles} = \frac{\text{Mass}}{\text{Molar mass}} \right)$$

$\downarrow \quad \downarrow$   
 6.25    6.5 (Here,  $\text{O}_2$  is the limiting reagent)

$$\text{Mole of } \text{CO}_2 \text{ formed} = \frac{6.5}{2}$$

$$\text{Mass of } \text{CO}_2 \text{ in gm} = \frac{6.5}{2} \times 44 = 143 \text{ g}$$

17. [24] Mass of solute =  $48 \times 2 \times 10^{-3} \text{ gram}$

$$\left( \because \text{ppm} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^6 \right)$$

$$\text{Atoms of Mg} = 24.08 \times 10^{20}$$

18. [0] 50% of 0.02mmol and 1L of  $\text{H}_2\text{SO}_4 = 0.01 \text{ m mol}$

$$\begin{aligned} \text{Total moles of } \text{H}_2\text{SO}_4 \text{ after adding } 0.01 \text{ mol of } \text{H}_2\text{SO}_4 \\ = 0.01 + 0.01 = 0.02 \text{ mmol} \\ = 0.00002 \times 10^3 \text{ mmol} \end{aligned}$$

19. [2] According to question, molecular weight of  $\text{A}_2\text{B}$  =  
 Molecular weight of  $\text{AB}_3$

$$\text{Thus, } 2\text{A} + 3 = \text{A} + 3\text{B}$$

$$\Rightarrow \text{A} = 2\text{B}$$

Hence, atomic weight of A is two times of atomic weight of B.

20. [496]

Ferrous sulphate heptahydrate is  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ .

$$\text{PPM} = \frac{\text{Mass of Iron}}{\text{Mass of Wheat}} \times 10^6$$

$$10 = \frac{\text{Mass of Iron}}{100 \times 10^3} \times 10^6$$

$$\text{Mass of Fe} = 1 \text{ gm}$$

$$\text{Mole of Fe} = \frac{1}{56}$$

$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  contain = 1 mole of Fe atom

$\therefore$  56 g in 1 mole

$$1 \text{ g in } \frac{1}{56} \text{ mole}$$

$$\therefore \text{Mass} = \frac{1}{56} \times 277.85 = 496$$

21. [2130] Acc. to reaction, moles of  $\text{NaClO}_3$  = moles of  $\text{O}_2$

$$\text{Moles of } \text{O}_2 = \frac{1 \times 492}{0.082 \times 300} = 20 \text{ mole } (\because n = \frac{PV}{RT})$$

$$\text{Mass of } \text{NaClO}_3 = 20 \times 106.5 = 2130 \text{ g.}$$

22. [6.15]



$$\text{Moles of Al takes} = \frac{5.4}{27} = 0.2$$

$$\text{Moles of } \text{H}_2\text{SO}_4 \text{ taken} = \frac{50 \times 5.0}{1000} = 0.25$$

$$\text{As } \frac{0.2}{2} > \frac{0.25}{3}, \text{H}_2\text{SO}_4 \text{ is limiting reagent}$$

$$\text{Now, moles of } \text{H}_2 \text{ formed} = \frac{3}{3} \times 0.25 = 0.25$$

$$\therefore \text{Volume of } \text{H}_2 \text{ gas formed} = \frac{nRT}{P}$$

$$= \frac{0.25 \times 0.082 \times 300}{1} = 6.15 \text{ L}$$

23. [2] The empirical formula of the given compound can be calculated as:

$$\% \text{ of element} = \frac{\text{Amount of element}}{\text{Amount of substance}} \times 100$$

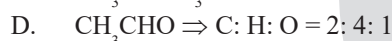
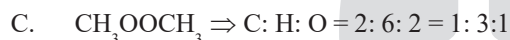
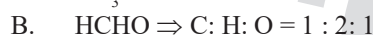
$$\text{Hence, \% of C} = \frac{48.5}{116} \times 100 = 41.8\%$$

$$\% \text{ of H} = \frac{7.5}{116} \times 100 = 6.5\%$$

$$\% \text{ of O} = \frac{60}{116} \times 100 = 51.7\%$$

	Mass	Moles = $\frac{w}{m}$	Simplest Ratio
C	41.8g	$\frac{41.8}{12} = 3.48$	$\frac{3.48}{3.23} \approx 1$
H	6.5g	$\frac{6.5}{1} = 6.5$	$\frac{6.5}{3.23} \approx 2$
O	51.7g	$\frac{51.7}{16} = 3.23$	$\frac{3.23}{3.23} = 1$

Given the ratio of moles of C, H and O is 1:2:1



So, only two compounds  $\text{CH}_3\text{COOH}$  and  $\text{HCHO}$  agrees with given data.

Hence, 13%  $\text{MnO}_2$  is present in the sample.

24.

[46] Moles of C = moles of  $\text{CO}_2$

$$= \frac{\text{Weight of } \text{CO}_2}{\text{Molar mass of } \text{CO}_2} = \frac{0.793}{44} \text{ mol}$$

Mass of C = Moles of  $\text{CO}_2 \times \text{Molar mass of C}$

$$= \frac{0.793}{44} \times 12 \text{ g} = 0.216 \text{ g}$$

$$\text{Moles of H} = 2 \times \frac{0.442}{18} \text{ mol}$$

$$\text{Mass of H} = 2 \times \frac{0.442}{18} \times 1 \text{ g} = 0.049 \text{ g}$$

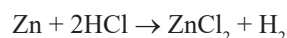
Given: Total mass of compound = 0.492g

So; mass of O = (0.492 – 0.216 – 0.049)g = 0.227g

$$\% \text{ of O} = \frac{\text{Mass of oxygen}}{\text{Total mass of compound}} \times 100$$

$$= \frac{0.227}{0.492} \times 100 = 46.14\% \approx 46\%$$

25. [4] The reaction takes place as follows:



$$\text{Moles of Zn} = \frac{11.5}{65.4} \text{ moles}$$

According to the reaction,

1 mole of Zn produces 1 mole of  $\text{H}_2$  gas

Thus,  $\left(\frac{11.5}{65.4}\right)$  moles of Zn produce  $\left(\frac{11.5}{65.4}\right)$  moles of  $\text{H}_2$  gas.

At STP

1 mol of  $\text{H}_2$  produces 22.7 L of volume.

Hence, for  $\left(\frac{11.5}{65.4}\right)$  moles of  $\text{H}_2$ , Volume

$$= 22.7 \times \left(\frac{11.5}{65.4}\right) = 3.99 \text{ L} = 4 \text{ L}$$



1mol 1.5 mol

Here, C acts a limiting reagent.

1 mol C = 1 mol CO

Hence, volume at STP is  $22.7 \times 10^{-1}$  litre



1 mole 1mole 0.05 mole

$$\therefore n_x = 1$$

$$n_y = 1$$

$$n_x = \frac{0.05}{3} = 0.0167 \text{ (Here, Z acts as a limiting reagent).}$$

$$\therefore \frac{0.05}{3} \text{ mole Z gives 1 mole XYZ}_3$$

$\therefore$  Mass of  $\text{XYZ}_3 = n \times \text{molecular mass}$

$$= \frac{0.05}{3} \times 120 = 0.05 \times 40 = 2 \text{ g}$$

28. [2] Mass of charcoal = 0.6g

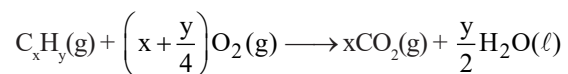
$$\text{Mass of acetic acid adsorbed} = \frac{M_1 V_1 - M_2 V_2}{1000} \times 60$$

$$= \frac{0.2 \times 200 - 200 \times 0.1}{1000} \times 60 = 1.2 \text{ g}$$

$$\text{Mass of acetic acid adsorbed/per gram} = \frac{1.2}{0.6} = 2 \text{ g}$$



29. [8] The general combustion reaction is:



$$\begin{array}{cccc} V & 6V & - & - \\ - & - & 4V & - \end{array}$$

According to question,

$$\text{Volume of } CO_2 = 4 \times VC_{xH_y}$$

$$V_x = 4V$$

$$x = 4$$

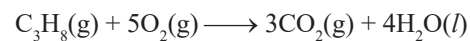
$$\text{Volume of } O_2 = 6 \times VC_{xH_y}$$

$$V\left(x + \frac{y}{4}\right) = 6V$$

$$\frac{y}{4} = 2; y = 8$$

$$30. [19] \quad n_{C_3H_8} = \frac{100}{44} = 2.27 \text{ mol}$$

$$n_{O_2} = \frac{1000}{32} = 31.25 \text{ mol}$$



$$\text{At } t = 0; \quad 2.27 \text{ mol} \quad 31.25 \text{ mol} \quad 0 \quad 0$$

$$\text{At } t = \infty; \quad 0 \quad 19.9 \text{ mol} \quad 6.81 \text{ mol} \quad 9.08 \text{ mol}$$

$$x_{CO_2} = \frac{6.81}{19.9 + 6.81 + 9.08} = 0.1902 = 19.02 \times 10^{-2}$$

$$\approx 19 \times 10^{-2}$$

Hence,  $x = 19$ .

