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, $N_A = 6.022 \times 10^{23}$ mol^{-1}.)

[26 July, 2022 (Shift-II)]

(*a*) 1.21×10^5 (*b*) 12.0×10^{16}

(*c*) 1.21×10^{20} (*d*) 3.4×10^{22}

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

	List - I		**List - II**
(A)	16g of $CH_4(g)$	(I)	Weighs 28 g
(B)	1g of $H_2(g)$	(II)	60.2×10^{23} electrons
(C)	1 mole of $N_2(g)$	(III)	Weighs 32g
(D)	0.5 mol of $SO_2(g)$	(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 $Fe_3O_4(s) + 4CO(g) \longrightarrow 3Fe(l) + 4CO_2(g)$

When 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is:

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

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

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

[29 June, 2022 (Shift-I)]

(*a*) 1400 (*b*) 2200

(*c*) 3360 (*d*) 4200

4. SO_2Cl_2 on reaction with excess of water results into acidic mixture

$$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$$

16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of SO_2Cl_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 AB_2 weigh 125×10^{-3} kg and 10 moles of A_2B_2 weigh 300×10^{-3} kg. The molar mass of $A_{(M_A)}$ and molar mass of $B_{(M_B)}$ in kg mol^{-1} are: **[12 April, 2019 (Shift-I)]**

(*a*) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$

(*b*) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$

(*c*) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$

(*d*) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$

7. 120 g of an organic compound that contains only carbon and hydrogen gives 330 g of 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 g mol^{-1}. **[28 June, 2022 (Shift-II)]**

(*a*) $C_4H_6N_2$ (*b*) C_2H_3N

(*c*) C_5H_7N (*d*) $C_{10}H_{14}N_2$

9. Complete combustion of 1.80 g of an oxygen containing compound ($C_xH_yO_z$) gave 2.64 g of CO_2 and 1.08g of H_2O. 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

$$4HNO_3(l) + 3KCl(s) \rightarrow Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3(s)$$

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:

$$2C_{57}H_{110}O_6\ (s) + 163\ O_2\ (g) \rightarrow 114\ CO_2\ (g) + 110\ H_2O\ (l)$$

[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?

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$

$R = 0.082$ L atm mol^{-1} 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 atm L mol^{-1} 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 65.4g mol^{-1} and Molar volume of H_2 at STP = 22.7L) **[31 Jan, 2023 (Shift-I)]**

26. Assume carbon burns according to following equation :
$2C_{(s)} + O_{2(g)} \rightarrow 2CO(g)$
When 12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is ______ $\times 10^{-1}$ L at STP [nearest integer]
[Given : Assume CO as ideal gas, Mass of C is 12 g mol^{-1}, Mass of O is 16 g mol^{-1} and molar volume of an ideal gas at STP is 22.7 L mol^{-1}] **[31 Jan, 2023 (Shift-II)]**

27. In the given reaction, $X + Y + 3Z \rightleftharpoons XYZ_3$
If one mole of each of X and Y with 0.05 mol of Z gives compound XYZ_3. (Given: Atomic masses of X, Y and Z are 10, 20 and 30 amu, respectively.) The yield of 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 O_2 for complete oxidation and produces 4 times its own volume of CO_2 is C_xH_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]
[27August 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*) $n = \dfrac{\text{Weight}}{\text{Molar mass}}$

$16g\ CH_4 = 1$ mole CH_4

1 mole $CH_4 \rightarrow 10 \times 6.02 \times 10^{23}$ electrons

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

$1g\ H_2 = 0.5$ mole H_2

1 mole H_2 at STP $\rightarrow 22.4$ L

0.5 mole H_2 at STP $\rightarrow 11.2\ L \approx 11.4$ L

1 mole of $N_2 = 28$ g

($\because M_{N_2} = 28$ g/mol)

0.5 mole of $SO_2 = 32$ g

($\because M_{SO_2} = 64$ g/mol)

3. (*c*) Molar mass of $Fe_3O_4 = 232$ g/mol

Molar mass of CO = 28 g/mol

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

$$\text{Moles of } Fe_3O_4 = \frac{4.64 \times 10^3}{232} = 20$$

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

According to the reaction:

4 moles of CO reacts with 1 mol of Fe_3O_4

$\Rightarrow$ 90 moles of CO reacts with 22.5 mole of Fe_3O_4

Thus, limiting reagent = Fe_3O_4

Thus, moles of Fe formed = 60

Weight of Fe = 60 × 56 = 3360g

4. (*c*) $SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

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

Let a moles of SO_2Cl_2 is taken

Then no. of moles of H_2SO_4 = a moles

No. of moles of HCl = 2a moles

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

$\Rightarrow$ a = 4 moles

5. (*b*) $C_6H_{12}O_6 \longrightarrow$ Glucose

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

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

$\therefore$ Mass of glucose = 67.5 gm

$\therefore$ Moles of glucose = 0.375 moles

Mass of solvent = 250 – 67.5 = 182.5 gm

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

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

$M_A + 2M_B = 25$ ...(i)

$2M_A + 2M_B = 30$ ...(ii)

from eq. (i) & (ii)

$M_A = 5$

$M_B = 10$

7. (d) Number of moles of C = Number of moles of CO_2

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

Number of moles of H = 2 × no. of moles of H_2O = $\left(\frac{270}{18} \times 2\right)$ moles

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

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

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

% of H = $\frac{30}{120}$ × 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 C_5H_7N 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 × Empirical formula = $C_{10}H_{14}N_2$

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

$$= \frac{\text{Wt of } H_2O}{\text{Wt of comp.}} \times \frac{2}{18} \times 100 = \frac{1.08}{1.8} \times \frac{2}{18} \times 100 = 6.67\%$$

Now, % of O = 100 – (40 + 6.67) = 53.33%

10. (*a*) $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

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

$\frac{y}{2} = 3$ (∴ given 3 equivalents of water)

$\Rightarrow$ x = 8, y = 6

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

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$$

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

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

$\therefore$ x = 9

Hydrocarbon formula will be = C_9H_8

12. (*c*) Mass of $C_{15}H_{30}$ = volume × Density

= 1000 mL × 0.756 gm / mL = 756 gram

$$C_{15}H_{30} + 22.5\ O_2 \longrightarrow 15CO_2 + 15H_2O$$

No. of moles of $C_{15}H_{30}$ needed = $\frac{756}{210}$ moles

No. of moles of O_2 needed = $\left(22.5 \times \frac{756}{210}\right)$ moles

Mass of O_2 needed = 22.5 × $\frac{756}{210}$ × 32 = 2592 gm

No. of moles of CO_2 liberated = 15 × $\left(\frac{756}{210}\right)$ moles

Mass of CO_2 liberated = 15 × $\frac{756}{210}$ × 44 = 2376 gm

13. (*c*) $4HNO_3(\ell) + 3KCl(s) \longrightarrow$

$$Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3(s)$$

According to the reaction

4 moles of HNO_3 gives 3 mol of KNO_3

Here, mole of produced $KNO_3 = \frac{110}{101}$

($\because M_{KNO_3}$=101g/mol)

If 3 mol of KNO_3 produced by 4 moles of HNO_3

$\therefore$ 1 mole of KNO_3 produced by $\frac{4}{3}$ moles of HNO_3

and $\frac{110}{101}$ mole of KNO_3 produced by $\frac{4 \times 110}{3 \times 101}$ moles of HNO_3 = 1.45 mole of HNO_3

Hence, the mass of HNO_3 = mole × molecular weight
= 1.45 × 63 = 91.48 ≈ 91.5 g

14. (*c*) $2C_{57}H_{110}O_6(s) + 163\,O_2(g) \rightarrow 114\,CO_2(g) + 110\,H_2O(l)$

$$\frac{\text{Moles of } C_{57}H_{110}O_6}{2} = \frac{\text{Moles of } H_2O}{110}$$

$$\frac{\frac{445}{890}}{2} = \frac{\frac{\text{mass of } H_2O}{18}}{110}$$

Mass of H_2O = 495 g

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

$$Zn + 2\text{ dil.}HCl \longrightarrow ZnCl_2 + H_2$$

The reaction between Zn and aq. NaOH is,

$$Zn + 2NaOH \longrightarrow Na_2ZnO_2 + H_2$$

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

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

16. [143] $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

$$\text{Mole}\ \underset{6.25}{\underset{\downarrow}{\frac{100}{16}}}\ \ \underset{6.5}{\underset{\downarrow}{\frac{208}{32}}}\ \left(\text{Moles} = \frac{\text{Mass}}{\text{Molar mass}}\right)$$

(Here, O_2 is the limiting reagent)

$$\text{Mole of } CO_2 \text{ formed} = \frac{6.5}{2}$$

$$\text{Mass of } CO_2 \text{ in gm} = \frac{6.5}{2} \times 44 = 143\text{ g}$$

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

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

Atoms of Mg = 24.08×10^{20}

18. [0] 50% of 0.02mmol and 1L of H_2SO_4 = 0.01 m mol

Total moles of H_2SO_4 after adding 0.01 mol of H_2SO_4
= 0.01 + 0.01 = 0.02 mmol
= 0.00002×10^3 mmol

19. [2] According to question, molecular weight of A_2B = Molecular weight of AB_3

Thus, 2A + 3 = A + 3B

⇒ A = 2B

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

20. [496]

Ferrous sulphate heptahydrate is $FeSO_4 \cdot 7H_2O$.

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

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

Mass of Fe = 1 gm

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

$FeSO_4\,7H_2O$ contain = 1 mole of Fe atom

∴ 56 g in 1 mole

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

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

21. [2130] Acc. to reaction, moles of $NaClO_3$ = moles of O_2

$$\text{Moles of } O_2 = \frac{1 \times 492}{0.082 \times 300} = 20 \text{ mole } \left(\because n = \frac{PV}{RT}\right)$$

Mass of $NaClO_3$ = 20 × 106.5 = 2130 g.

22. [6.15]

$$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$$

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

$$\text{Moles of } H_2SO_4 \text{ taken } = \frac{50 \times 5.0}{1000} = 0.25$$

As $\frac{0.2}{2} > \frac{0.25}{3}$, H_2SO_4 is limiting reagent

$$\text{Now, moles of } H_2 \text{ formed } = \frac{3}{3} \times 0.25 = 0.25$$

$$\therefore\ \text{Volume of } H_2 \text{ gas formed} = \frac{nRT}{P}$$

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

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

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

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

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

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

	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

A. $CH_3COOH \Rightarrow$ C: H:O = 2: 4:2 = 1: 2: 1

B. $HCHO \Rightarrow$ C: H: O = 1 : 2: 1

C. $CH_3OOCH_3 \Rightarrow$ C: H: O = 2: 6: 2 = 1: 3:1

D. $CH_3CHO \Rightarrow$ C: H: O = 2: 4: 1

So, only two compounds CH_3COOH and HCHO agrees with given data.

Hence, 13% MnO_2 is present in the sample.

24. [46]Moles of C = moles of CO_2

$= \frac{\text{Weight of } CO_2}{\text{Molar mass of } CO_2} = \frac{0.793}{44}$ mol

Mass of C = Moles of CO_2 × Molar mass of $C = \frac{0.793}{44} \times 12\text{g} = 0.216\text{g}$

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

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:

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

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

According to the reaction,

1 mole of Zn produces 1 mole of H_2 gas

Thus, $\left(\frac{11.5}{65.4}\right)$ moles of Zn produce $\left(\frac{11.5}{65.4}\right)$ moles of H_2 gas.

At STP

1 mol of H_2 produces 22.7 L of volume.

Hence, for $\left(\frac{11.5}{65.4}\right)$ moles of H_2, Volume

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

26. [227] $2C(s) + O_2(g) \rightarrow 2CO(g)$

1mol 1.5 mol

Here, C acts a limiting reagent.

1 mol C = 1 mol CO

Hence, volume at STP is 227 × 10^{-1} litre

27. [2] X + Y + 3Z = XYZ_3

1 mole 1mole 0.05 mole

$\therefore n_X = 1$

$n_Y = 1$

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

$\because \frac{0.05}{3}$ mole Z gives 1 mole XYZ_3

$\therefore$ Mass of XYZ_3 = n × molecular mass

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

28. [2] Mass of charcoal = 0.6g

Mass of acetic acid adsorbed $= \frac{M_1V_1 - M_2V_2}{1000} \times 60$

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

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

29. [8] The general combustion reaction is:

$$C_xH_y(g)+\left(x+\frac{y}{4}\right)O_2(g)\longrightarrow xCO_2(g)+\frac{y}{2}H_2O(\ell)$$

V	6V	-	-
-	-	4V	-

According to question,

Volume of $CO_2 = 4 \times VC_xH_y$

$Vx = 4V$

$x = 4$

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] $^{n}C_3H_8=\frac{100}{44}=2.27\text{ mol}$

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

	$C_3H_8(g)$ +	$5O_2(g) \longrightarrow$	$3CO_2(g)$ +	$4H_2O(l)$
At t = 0;	2.27 mol	31.25 mol	0	0
At t = ∞;	0	19.9mol	6.81mol	9.08 mol

$$^{x}CO_2=\frac{6.81}{19.9+6.81+9.08}=0.1902=19.02\times10^{-2}$$

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

Hence, x = 19.