

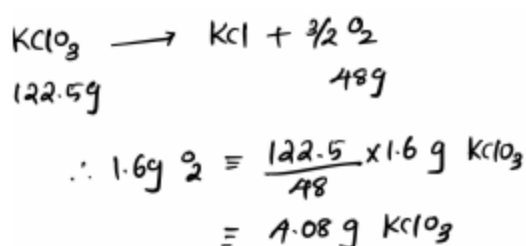
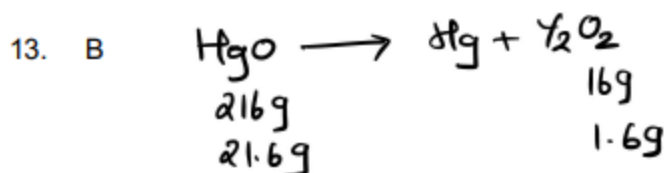
CHAPTER - 01

SOME BASIC CONCEPTS OF CHEMISTRY

1. 3 $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$
1 mol contains 19 mol atoms
 \therefore Total number of atoms = $19 \times N_A = 114.42 \times 10^{23}$
2. 4 Mass of a given amount of a substance is a constant quantity
3. 4 $22.4 \text{ L N}_2 \text{ at NTP} \equiv 1 \text{ mol N}_2$
 $5.6 \text{ L O}_2 \text{ at NTP} \equiv \frac{1}{4} \text{ mol O}_2$
According to Avogadro's hypothesis, equal volumes of all gases contain equal number of molecules under similar conditions of temperature and pressure.
4. 3 $5[M_A + 2M_B] = 125$
 $M_A + 2M_B = 25 \quad \dots (1)$
 $2M_A + 2M_B = 30 \quad \dots (2)$
From eq. (1) and (2), $M_A = 5$, $M_B = 10$
5. 2 100g compound contains 40g C, 6.66 g H and 53.34 g O. i.e., 3.33 mol C, 6.66 mol H and 3.33 mol O
Molar ratio, C : H : O = 3.33 : 6.66 : 3.33 = 1 : 2 : 1
Thus, empirical formula = CH_2O
Molecular formula = $\text{CH}_2\text{O} \times \frac{60}{30} = \text{C}_2\text{H}_4\text{O}_2$
6. 2 $\text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3$
According to Gay Lussac's law, 1L of N_2 reacts with 3L of H_2 to form 2L of NH_3 . Here, 30 L of N_2 and 30L of H_2 are taken for reaction. Then a maximum of 10L of N_2 can react with 30 L of H_2 to form 20L of NH_3 (Since H_2 is the limiting reagent). Since the yield is only 50%, 5L of N_2 has reacted with 15L of H_2 and 10L of NH_3 has formed.
Final mixture will contain : $30 - 5 = 25 \text{ L N}_2$; $30 - 15 = 15 \text{ L H}_2$ and 10 L NH_3
7. 1 1L solution $\equiv 1250 \text{ g solution}$
 $3\text{M NaCl} \Rightarrow 3 \text{ mol NaCl in } 1250\text{g solution or } 3 \text{ mol NaCl in } 1074.5\text{g solvent}$
Thus, molality = $\frac{3 \text{ mol}}{1.0745\text{kg}} = 2.79 \text{ mol/kg}$
8. 10 $\text{ppm} = \frac{10.3 \times 10^{-3} \text{ g O}_2}{1030 \text{ g solution}} \times 10^6 = 10 \text{ ppm}$
9. 160 $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
1 mol CH_4 gives 44g CO_2 and 36g H_2O
 \therefore 2mol CH_4 gives 88g CO_2 and 72 g H_2O
Thus, total mass of CO_2 and $\text{H}_2\text{O} = 88 + 72 = 160\text{g}$
10. 1 $3\text{BaCl}_2 + 2\text{Na}_3\text{PO}_4 \longrightarrow \text{Ba}_3(\text{PO}_4)_2 \downarrow + 6\text{NaCl}$

11. A 6.022×10^{23} Atoms $\equiv 40g$
 $\therefore 3.00 \times 10^{24}$ Atoms $= \frac{40}{6.022 \times 10^{23}} \times 3.00 \times 10^{24} g$
 $\equiv 199g$

12. C A) $74u$ $G(OH)_2 \equiv 32u$ O
 B) Atomic mass $= 3.82 \times 10^{-23} \times 6 \times 10^{23}$
 $= 22.92u$
 C) $100g$ $CaCO_3 \equiv 3g$ atom of oxygen
 D) Number of atoms of
 $S = 2N_A \times 8 = 16N_A$
 $S = 55N_A \times 1 = 55N_A$



14. A Weight gain $= 75kg - \frac{75 \times 10}{100} + \frac{75 \times 10 \times 2}{100}$
 $= 75kg - 7.5kg + 15kg$
 $= 75kg + 7.5kg$

15. A Number of equivalents of Al = n_{eq} of HCl

$$\begin{aligned}
 &= NV \\
 &= 12 \times 0.05 \\
 &= 0.6 \text{ meq} \\
 &= 0.6 \times 10^{-3} \text{ eq} \\
 &= 6 \times 10^{-4} \text{ eq}
 \end{aligned}$$

$$\begin{aligned}
 W_{Al} &= n_{eq} \times E_q \cdot \text{mass} \\
 &= 6 \times 10^{-4} \times 9 \\
 &= 54 \times 10^{-4} \text{ g}
 \end{aligned}$$

$$\text{Volume} = \text{Area} \times \text{thickness}$$

$$\begin{aligned}
 \text{Volume} &= \frac{\text{mass}}{\text{density}} = \frac{54 \times 10^{-4} \text{ g}}{2.7 \text{ g cm}^{-3}} \\
 &= 2 \times 10^{-3} \text{ cm}^3
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Area} &= \frac{\text{Volume}}{\text{thickness}} = \frac{2 \times 10^{-3}}{10^{-2}} \\
 &= 2 \times 10^{-1} \text{ cm}^2
 \end{aligned}$$

16. A $\text{HCl} + \text{AgNO}_3 \longrightarrow \text{AgCl} + \text{HNO}_3$
 m.equivalents of HCl left = 0.5
 m. equivalents of HNO_3 formed = 1.5
 $V_a N_a = V_b N_b$; $2 = V_b \times 0.05$
 Volume of NaOH = 40 ml

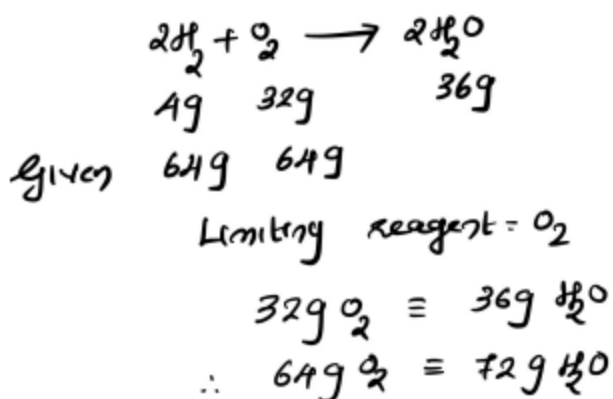
17. B $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$
 x litres of propane produce 3x litre of CO_2
 $\text{C}_4\text{H}_{10} + 6.5\text{O}_2 \rightarrow 4\text{CO}_2 + 5\text{H}_2\text{O}$
 (3-x) litres of butane produce 4(3-x) lit of CO_2
 $3x + 4(3-x) = 11$; $3x + 12 - 4x = 11$
 $12 - x = 11$; $x = 1$ litre
 volume of butane : propane = 2:1

18. A,D No of atoms in A = $\frac{16}{32} N_A \times 2 = N_A$
 No of atoms in B = $\frac{16}{48} N_A \times 3 = N_A$
 No of molecules in A = $\frac{16}{32} N_A = \frac{N_A}{2}$
 No of molecules in B = $\frac{16}{48} N_A = \frac{N_A}{3}$

19. A,B,D

- A) Minimum molar mass of a hydrocarbon is
 164 (C₁₄H₄)
 B) 18g H₂O(g) \equiv 22.4L at STP
 C) No of Cl atoms = $\frac{5.6}{22.4} N_A \times 2$
 = 3.011×10^{23}
 D) 1 molecule of HNO₃ contains 5 atoms

20. B, C



21. AD

Let molar mass of M₂O be 'x' and molar mass of M be 'y'

Now, $x \times \frac{36.4}{100} = 16g \rightarrow x = 43.95$

$\therefore 2y + 16 = 43.95 \Rightarrow y = 13.98 \approx 14g$

Let formula of second oxide be M_aO

$$\text{Now, } (14a + 16) \times \frac{53.4}{100} = 16 \Rightarrow a = 1$$

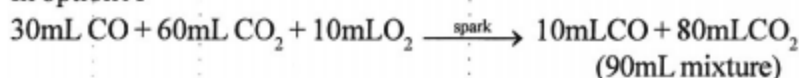
Thus, second oxide is 'MO'

The ratio of mass of metal that reacts with a fixed mass of oxygen to form the two oxides is 2:1

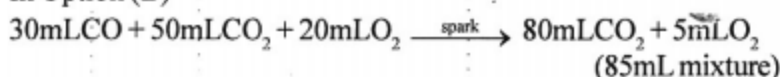
22. AB

On sparking CO is converted to CO_2 according to the equation, $\text{CO} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_2$

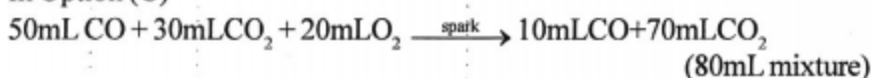
In option A



In Option (B)



In Option (C)



In Option (D)



On passing the final mixture through KOH solution, all CO_2 gets absorbed in the solution. Clearly final mixture in option (A) and option (B) contain 80mL CO_2 . So in these cases, contraction in volume occurs by 80mL.

23. C $8\text{g O}_2 \equiv \frac{1}{4} \text{ mol O}_2 \equiv \frac{1}{4} \times 16 \text{ mol protons (i.e., 4 mol protons)}$

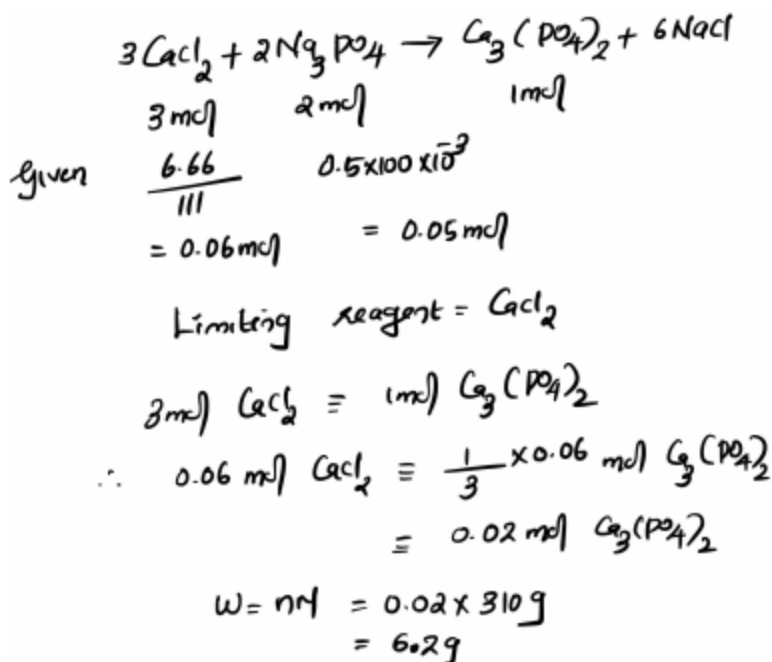
$$11\text{g CO}_2 \equiv \frac{1}{4} \text{ mol CO}_2 \equiv \frac{1}{4} \times (6 + 16) \text{ mol protons (i.e. 5.5 mol protons)}$$

$$22\text{g CO}_2 \equiv 2 \times 5.5 \text{ mol protons (i.e. 11 mol protons)}$$

$$7\text{g CO} \equiv \frac{1}{4} \text{ mol CO} \equiv \frac{1}{4} \times (6 + 8) \text{ mol protons (i.e. 3.5 mol protons)}$$

$$14\text{g CO} \equiv 2 \times 3.5 \text{ mol protons (i.e. 7 mol protons)}$$

24. 6.20



25. 0.21

$$n_{\text{HCl(g)}} = \frac{V}{V_m} = \frac{1120}{22400} = 0.05 = n_{\text{eq HCl}}$$

$$\begin{aligned}
 n_{\text{eq H}_2\text{SO}_4} &= NV \\
 &= n_{\text{factor}} \times N \times V \\
 &= 2 \times 0.15 \times 20 \times 10^{-3} \\
 &= 6 \times 10^{-3}
 \end{aligned}$$

$$n_{\text{eq NaOH remains unreacted}} = 6 \times 10^{-3} \text{ eq}$$

$$n_{\text{eq NaOH initial}} = NV = N \times 265 \times 10^{-3} \text{ eq}$$

$$\begin{aligned}
 n_{\text{eq HCl(g)}} &= N \times 265 \times 10^{-3} - 6 \times 10^{-3} = 0.05 \\
 N \times 265 \times 10^{-3} &= 0.056
 \end{aligned}$$

$$N = 0.21$$

26. 32 1.6g metal \rightarrow 2.0g metal oxide (i.e. 1.6g metal + 0.4g oxygen)
 Mass of metal that combines with 16g of oxygen = $1.6 \times 40 = 64$ g
 \therefore Equivalent mass of metal = $\frac{64}{2} = 32$ g

27. 2 $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 Initial: 1mol 1mol 0 0
 Final: 0.5mol 0 0.5mol 1mol
 Total no. of moles in the final mixture = $0.5 + 0.5 + 1 = 2$ mol

28. 540.47 - 540.48

Wt. of S_8 in sample = 160g;

$$\text{Moles of } \text{S}_8 = \frac{160}{32 \times 8} = 0.625$$

No. of moles of O_2 required = 0.625×8

Vol. of O_2 required at STP = 22.7×5

$$\therefore \text{Vol. of air required at STP} = 22.7 \times 5 \times \frac{100}{21}$$

29. C Molar mass of urea = 60, $\text{HNO}_3 = 63$, $\text{H}_2\text{SO}_4 = 98$ and $\text{CH}_3\text{COOH} = 60 \text{ g mol}^{-1}$
 Solution I

$$\text{Molarity} = \frac{(120/60) \text{ mol}}{1\text{L}} = 2\text{M}$$

Mass of solution = $1\text{L} \times 1.2 \text{ kg/L} = 1.2 \text{ kg}$ or 1200g

Mass of solvent = $1200\text{g} - 120\text{g} = 1080\text{g}$ or 1.08kg

$$\therefore \text{molality} = \frac{2 \text{ mol}}{1.08 \text{ kg}} = 1.85 \text{ m}$$

Solution II:

Data insufficient to calculate molarity of the solution

30. A 1 mol of gas at NTP will occupy 22.4L
 Molar mass of $\text{SO}_2 = 64$, $\text{H}_2 = 2$, $\text{O}_3 = 48$ and $\text{O}_2 = 32 \text{ g mol}^{-1}$,