

CHEMISTRY

For JEE MAIN + JEE ADVANCED

SOLUTIONS BOOKLET

1. SOME BASIC PRINCIPLE OF CHEMISTRY
2. ATOMIC STRUCTURE
3. STATES OF MATTER
4. PERIODIC TABLE
5. CHEMICAL BONDING
6. THERMODYNAMICS
7. THERMOHEMISTRY
8. CHEMICAL EQUILIBRIUM
9. IONIC EQUILIBRIUM
10. REDOX REACTION

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MAINS+ADVANCED

TOPIC

MOLE CONCEPT

SOLUTIONS

SOME BASIC PRINCIPLE OF CHEMISTRY

Exercise-01

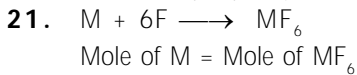
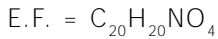
4. No. of molecule (v.kvka dh I ; k) = Mole \times N_A
 $N = nN_A$
5. At STP or NTP volume of any gas (STP ; k NTP ij fdl h xj dk vk; ru) = 22.4 L
6. 1 gram ion = 1 mole ion = N_A ion
 1 mol Al^{3+} ion = $N_A \times 3$
 Charge (e) on 1 mol Al^{3+} ion = $N_A \times 3 \times e$ columb.
 (1 esy Al^{3+} ion ij vkosk = $N_A \times 3 \times e$ columb.)
7. No. of molecules (v.kvka dh I ; k) = mole \times N_A
 i.e., mole is equal then no. of molecules are also equal (vfkir-esy cjkcj gksus ij v.kvka dh I ; k Hkh cjkcj gksrh gS)
8. Mole of Al = $\frac{wt}{At\ wt} = \frac{54}{27} = 2\text{mol}$
 that is same for Mg atom (; g Mg ijek.kq ds fy, Hkh I eku gS)
 So mol of Mg = $\frac{wt}{24}$
 $wt = 2 \times 24 = 48\text{ g}$.
10. No. of oxygen atom = mole \times N_A \times atomicity.
 (vkDI htU ijek.kq ds I ; k = esy \times N_A \times ijek.kq rk)
- (A) = $\frac{1}{16} \times N_A \times 1 = \frac{N_A}{16}$
 (B) = $\frac{1}{32} \times N_A \times 2 = \frac{N_A}{16}$
 (C) = $\frac{1}{48} \times N_A \times 3 = \frac{N_A}{16}$
 all are same.
11. $(NH_4)_3PO_4$
 12 mol hydrogen atom contain = 4 atom of oxygen
 (12 esy gkbMst u ijek.kq eagS 4 ijek.kq vkDI htU ds)
 1 mol hydrogen atom contain = $\frac{4}{12}$
 3.18 mol hydrogen atom contain (3.18 esy gkbMst u ijek.kq ea gS) = $\frac{4}{12} \times 3.18 = 1.08$ mole
12. Mass of 1 e^- (1 e^- dk ;e0; eku) = 9.31×10^{-31} kg

13. 100 g compound contain (100 g ; ksd eagS) = 5.37 g Nitrogen (ukbVst u)
- 1 g Nitrogen = $\frac{100}{5.37} \times 14 = 260.7$
15. H_2 : He : O_2 : O_3
 no. of atoms = $2N_A$: $1N_A$: $2N_A$: $2N_A$
 ijek.kvka dh I ; k
 = 2 : 1 : 2 : 3
16. ^{63}Cu ^{65}Cu
 % abundance(% i kfr) x 100 - x
 Avg. mass (vkf r ;e0; eku) = $\frac{M_1x_1 + M_2x_2}{x_1 + x_2}$
 $63.546 = \frac{63 \times x + 65(100 - x)}{100}$
 $6354.6 = 63x + 6500 - 65x$
 $2x = 145.4 \Rightarrow x = 70\%$
17. % by wt. of H_2O (H_2O ds Hkj %) = $\frac{wt.\ of\ H_2O(H_2O\ dk\ Hkj)}{\text{Total wt. of compound}(\ ;\ ksd\ dk\ dgy\ Hkj)} \times 100$
 $13 = \frac{18x}{18x + 120} \times 100$
 $x = 1$
18. % Mol Simple ratio (I jy vuqkr)
 C 85.7 $85.7/12 = 7.14$ $7.14/7.14 = 1$ 1
 H 14.3 $14.3/1 = 14.3$ $14.3/7.14 = 2$ 2
 \therefore Empirical formal (enykuq krh I #) = CH_2
 \therefore PMw = DRT
 $Mw = \frac{DRT}{P} = \frac{2.5 \times .0821 \times 273}{1} = 56$
 $n = \frac{\text{Molecular wt. (vkf. od Hkj)}}{\text{Ewt. (enykuq krh Hkj)}} = \frac{56}{14} = 4$
 Molecular formula (vkf. od I #) = $n \times$ E.F.

$$= 4 \times \text{CH}_2$$

$$= \text{C}_4\text{H}_8$$

19.	Element (rRo)	% (elsy)	Mole (elsy)	Simplest ratio (l jy vuikr)
	C	70.8	70.8/12 = 6	6/3 = 20
	H	6.2	6.2/1 = 6	6/3 = 20
	N	4.1	4.1/14 = .3	1
	O	18.9	18.9/16 = 1.2	4



$$\frac{\text{wt}}{\text{Mole wt}} = \frac{\text{wt}}{\text{Mol. wt}}$$

$$\frac{.25}{x} = \frac{.547}{x + 19 \times 6}$$

$$28.5 + .25x = .547x$$

$$28.5 = .297x \Rightarrow x = 95.959$$

so element (rRo) is = Mo

22. NaOH contain 3 mole of O atoms (NaOH ea O i j ek. kg ds 3 elsy gš)

so mol of NaOH (vr% NaOH ds elsy) = 3 mol

wt. of NaOH (NaOH dk Hkkj) = $3 \times 40 = 120$ g

$$\% \text{ purity (\% 'k) rk)} = \frac{120}{1000} \times 100 = 12\%$$

23. Molarity of Cl^- (Cl^- dh elsyjrk)

$$= \frac{M_1V_1 + M_2V_2}{\text{Total vol. (dy vk; ru)}}$$

$$= \frac{15 \times .2 \times 2 + 45 \times .45 \times 3}{15 + 45} = \frac{60}{60} = 1\text{M}$$

24. $X_{\text{C}_2\text{H}_5\text{OH}} = .25$

$$X_{\text{H}_2\text{O}} = .75$$

$$n_{\text{C}_2\text{H}_5\text{OH}} = .25$$

$$w_{\text{C}_2\text{H}_5\text{OH}} = .25 \times 46 = 11.5\text{g}$$

$$n_{\text{H}_2\text{O}} = .75$$

% wt of $\text{C}_2\text{H}_5\text{OH}$ ($\text{C}_2\text{H}_5\text{OH}$ d9% Hkkj)

$$= \frac{11.5}{11.5 + 13.5} \times 100 = 45\%$$

25. Mole of NO_3PO_4 (NO_3PO_4 ds elsy) = $20 \times .40$

$$= 8 \text{ m mol} = .008 \text{ mol}$$

Na_3PO_4 contain 3Na^+ ion (Na_3PO_4 e03 Na^+ vk; u gš)

$$= 3 \times .008 = .024 \text{ mol}$$

27. Molality of H_2SO_4 is 9 (H_2SO_4 dh elsyjrk 9 gš)

i.e. 9 mole of H_2SO_4 in 1 kg solvent (vFkr ~1 kg foyk; d e0 elsy H_2SO_4 gš)

1 kg solvent contain = 9 mole H_2SO_4 (1 kg foyk; d ea gš = 9 mole H_2SO_4)

1 kg solvent contain = 9×98 wt of H_2SO_4 (1 kg foyk; d ea gš = 9×98 wt H_2SO_4)

1000 kg solvent contain (1000 kg foyk; d ea gš = $9 \times 98/1000 \times 910$

910 kg solvent contain (910 kg foyk; d ea gš = 802.62 g

wt. of solvent (foys dk Hkkj) = 910 g

wt. of solution (foy; u dk Hkkj) = 802.62 + 910 = 1712.62 g

x% by wt (Hkkj dk x%)

$$= \frac{\text{wt of solute (foys dk Hkkj)}}{\text{wt of solution (foy; u dk Hkkj)}} \times 100$$

$$= \frac{802.62}{1712.62} \times 100 = 46.87$$

28. R.D. = $\frac{\text{Density (?kuRo) of O}_3}{\text{Density (?kuRo) of O}_2}$

at same temp. & pressure of density \propto Mw
?kuRo ds l eku rki o nkc ij \propto Mw

$$= \frac{\text{Mw (vkf.od Hkkj) of O}_3}{\text{Mw (vkf.od Hkkj) of O}_2} = \frac{48}{32} = \frac{3}{2} = 1.5$$

29. $x_A = 0.2$

$$x_{\text{H}_2\text{O}} = 1 - 0.2 = 0.8$$

wt of $\text{H}_2\text{O} = 0.8 \times 18 = 14.4$ g

Molality (elsyjr)k

$$= \frac{\text{moles of solute (foys dsel) y)}{\text{wt. of solvent (foyk; d) (H}_2\text{O) in kg}}$$

$$= \frac{.2 \times 1000}{14.4} = 13.8$$

30. 2.8 % by mass volume solution of KOH (KOH dsæ0; eku vk; ru foy; u dk 2.8 %)

i.e., 2.8 g KOH in 100 ml solution (vFkr ~ 100 ml foy; u ea 2.8 g KOH)

$$\text{molarity (elsyjr)k} = \frac{2.8}{56 \times .1} = .5 \text{ M}$$

31. Molality of H_2SO_4 (H_2SO_4 dh elsyjrk) = .2 mol/kg

.2 mol H_2SO_4 then wt (.2 elsy H_2SO_4 rks Hkkj)

$$= .20 \times 98 = 19.6 \text{ g}$$

wt. of solvent (foyk; d dk Hkkj) = 1 kg = 1000 g

wt of solution (foy; u dk Hkkj) = 19.6 + 1000

$$= 1019.6 \text{ g}$$

32. Molarity (elsyjr)

$$= \frac{\text{moles of solute (foys dsely)}}{\text{vol of solution (foy; u dk vk; ru)}}$$

$$\begin{aligned} \text{mol of solution (foy; u ds ely)} &= \frac{100 \times 10^{-3}}{.8} \\ &= 125 \text{ mL} \end{aligned}$$

33. Moles of solute (foys ds ely)

$$= \frac{6.02 \times 10^{22}}{N_A} = 0.1 \text{ mol}$$

concentration of solution (foy; u dh l lark)

$$\begin{aligned} &= \frac{\text{moles}}{\text{vol}} \\ &= \frac{.1 \times 1000}{500} = .2 \end{aligned}$$

Exercise-02

1. $38.5\% \left(\frac{w}{w}\right) \text{Ag}$ i.e. 38.5 g Ag contain in 100 g solution

$$38.5\% \left(\frac{w}{w}\right) \text{Ag} \text{ vflk} \sim 100 \text{ g foy; u ea } 38.5 \text{ g Ag}$$

Molarity (elsyjr)

$$= \frac{\text{moles of solute (foys dsely)}}{\text{Vol. of solution foy; u dk vk; ru}}$$

$$= \frac{38.5 \times 146}{108 \times 1} = 52.1 \text{ mol L}^{-1}$$

2. $\text{ppm} = \frac{\text{moles of solute (foys dsely)}}{\text{mass of solution (foy; u dk æ; eku)}} \times 10^6$

$$\frac{400}{100} \times 100 = \frac{\text{moles of solute (foys dsely)}}{\text{mass of solution (foy; u dk æ; eku)}} \times 100$$

$$\text{Mass (æ; eku) \%} = 0.04$$

3. Molarity (elsyjr)

$$= \frac{(w/w) \times d \times 10}{\text{Molar mass of solute (foys dk elsyj æ; eku)}}$$

$$= \frac{12 \times 1.313 \times 10}{40}$$

$$\therefore \frac{\text{mol of solute (foys dsely)}}{\text{Vol vk; ru}} = \frac{12 \times 1.313 \times 10}{40}$$

$$\text{Vol} = 1.47 \text{ L}$$

4. Molarity (elsyjr) = $\frac{48 \times 1.150 \times 10}{81} = 8.9 \text{ mol L}^{-1}$ 5. Molarity (elsyjr) = $\frac{40 \times 1.05 \times 10}{62} = 6.77 \text{ M}$

6. Molality (elsyjr)

$$\frac{\text{moles of solute (foys dsely)}}{\text{mass of solvent in kg (foyk; d dk kg ea æ; eku)}}$$

$$= \frac{160 \times 1000}{32 \times 200} = 25 \text{ m}$$

7. $7 \text{XeF}_6 + 3\text{I}_2 \longrightarrow 6 \text{IF}_7 + 7\text{Xe}$

7 mol 6 mol

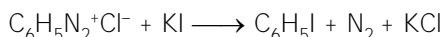
1

$$210 \qquad \qquad \qquad \frac{6}{7} \times 210 = 180 \text{ m mol}$$

11. $\text{KClO}_3 \xrightarrow{\Delta} \text{KCl} + \frac{3}{2} \text{O}_2$ 1 mole $\frac{3}{2}$ mol1 × 122.5 g $\frac{3}{2} \times 32$

$$1 \longrightarrow \frac{\frac{3}{2} \times 32}{122.5} = 0.3918$$

$$\% \text{ Loss (glfu)} = 0.3918 \times 100 = 39.18$$

13. $\text{C}_6\text{H}_5\text{NH}_2 + \text{HNO}_2 + \text{HCl} \longrightarrow \text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- + 2\text{H}_2\text{O}$ 

$$n_p = n_r \times R_1 \times R_2$$

$$\text{moles of C}_6\text{H}_5\text{I} = \text{mole of C}_6\text{H}_5\text{NH}_2 \times R_1 \times R_2$$

$$\frac{\text{wt.}}{204} = \frac{9.3}{93} \times 1 \times 1$$

$$\text{wt.} = 20.4 \text{ g}$$

% yield of $\text{C}_6\text{H}_5\text{I}$ ($\text{C}_6\text{H}_5\text{I}$ dh % yf/k)

$$= \frac{16.32}{20.4} \times 100 = 80\%$$

14. Let assume % of H is x (H dk %, x eku)

$$\% \text{ of H (H dk %) = } x$$

% of C (C dk %) = 6x

% of N (N dk %) = $\frac{7x}{1.5}$

Element (rRo)	%	Ratio of mol (eky dk vujkr)	Simplest (l jyre)
---------------	---	-----------------------------	-------------------

H x x/1 = 1 6

C 6x 6x/12 = 1/2 3

N $\frac{7x}{1.5}$ $\frac{7x}{1.5 \times 14} = \frac{1}{3}$ 2

∴ F.F = C₃H₆N₂

atomic mass (ijekf.od æ0; eku) = 70

molar mass (ekyj æ0; eku) = 140

15. mole simple ratio (eky) (l jy vujkr)

% X 50 50/10 2

% Y 50 50/20 1

E.F = X₂Y

16. 7 g Na contain salt (7 g Na eami flkr yo.k)=100g

1 g $\rightarrow = \frac{100}{7} \times 23$

23 g $\rightarrow = 329$

17. mole (eky) atom (ijek.k)

% N = 12.8 12.8/14 $\frac{12.8}{14} \times N_A$

% S = 9.8 9.8/32 $\frac{9.8}{32} \times N_A$

% Na = 7 7/23 $\frac{7}{23} \times N_A$

∴ $\frac{7}{23} \times N_A$ atom of Na contain

(Na ds $\frac{7}{23} \times N_A$ i jek.k ea gš) = $\frac{12.8}{14} \times N_A$ of N

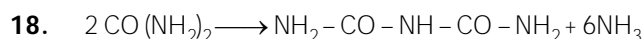
∴ 1 atom of Na contain (Na ds 1 i jek.k ea gš) = 3 atom of N

∴ $\frac{7}{23} \times N_A$ atom of Na contain = $\frac{9.8}{32} \times N_A$ of S

(Na ds $\frac{7}{23} \times N_A$ ea gš) = S ds $\frac{9.8}{32} \times N_A$)

∴ 1 atom of Na contain

(Na ds 1 i jek.k ea gš) = $\frac{9.8}{32} \times \frac{23}{7} = 1$ atom

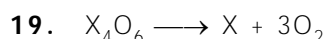


2 molecule \leftarrow 1 molecule

$\frac{2}{1} \times 10^{22}$ molecule \leftarrow 10^{22}

mol = $\frac{2 \times 10^{22}}{6.02 \times 10^{23}}$

mass = $\frac{2 \times 10^{22}}{6.02 \times 10^{23}} \times 60 = 1.99$

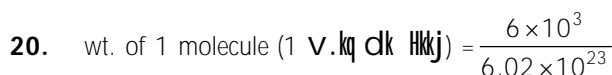


$4x n_x \text{O}_6 = n_x$

$4x \frac{10}{4x+96} = \frac{5.72}{x}$

$40x = 5.72 \times 4x + 96 \times 5.72$

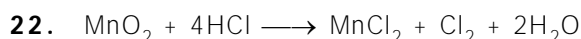
$17.12x = 549.12$ x = 32 amu



volume occupied by its (bl ds }kjk ?kjk x; k vk; ru)

= $\frac{\text{mass}(\text{æ0; eku})}{\text{density}(\text{?kuRo})} = \frac{6 \times 10^3 / 6.03 \times 10^{23}}{1.1}$ mL

= 9.1×10^{-21} cc



L.G

$4 \times 36.5 \rightarrow 71$

$1 \rightarrow \frac{71}{4 \times 36.5} = 0.486 \text{ g}$

23. molality (ekyyrk)

= $\frac{M \times 1000}{1000d - MM_w} = \frac{18 \times 1000}{1000 \times 1.8 - 18 \times 98} = 500$



$3 \rightarrow 4$

$1 \rightarrow \frac{4}{3} \times \frac{3}{2}$

$\frac{3}{2} \rightarrow = 2 \text{ mol} \times 27 = 54 \text{ g}$

25. % by wt. of H₂O (H₂O ds Hkkj dk %)

= $\frac{\text{wt. of H}_2\text{O}(\text{H}_2\text{O dk Hkkj})}{\text{Total wt.}(\text{dy Hkkj})} \times 100$

$50 = \frac{18x}{142+18x} \times 100$

$$71 + 9x = 18x$$

$$x = 71/9 = 7.88 \approx 8$$

26. wt. of carbon = 21×12 g

\therefore 69.98 g carbon contain 100 g cortisone (69.98 g $\text{C}_x\text{H}_y\text{O}_z$ ea 100 g $\text{C}_x\text{H}_y\text{O}_z$ g)

\therefore 1 g carbon contain 100 g cortisone (1 g $\text{C}_x\text{H}_y\text{O}_z$ ea

$$100 \text{ g } \text{C}_x\text{H}_y\text{O}_z \text{ g} = \frac{100}{69.98}$$

$$\therefore 21 \times 12 \text{ g} \longrightarrow = \frac{100}{69.98} \times 21 \times 12 = 360.10$$

27. no. of mol = $\frac{\frac{4}{3}\pi r^3 \times \frac{56}{100} \times 1.4}{56}$

$$= \frac{4}{3} \times 3.14 \times (7)^3 \times \frac{1.4}{100} \approx 20$$

30. 10% (v/v) HCl

100 ml contain 10 ml HCl (100 ml ea 10 ml HCl)

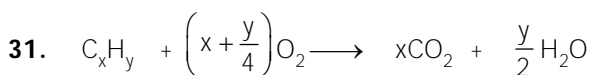
10% (v/v) NaOH i.e. 100 ml contain 10 mL NaOH

density (ρ) of NaOH = 1.5 density of HCl

$$\left(\frac{M}{V}\right)_{\text{NaOH}} = 1.5 \left(\frac{M}{V}\right)_{\text{HCl}}$$

Resultant = Basic

(i f j . k l e r %) = { k l j h ;



$$a \left(x + \frac{y}{4}\right) a \quad ax \quad \frac{ay}{2}$$

$$a + \left(x + \frac{y}{4}\right) a = 600$$

$$ax + a\frac{y}{2} = 700$$

$$6x + 3y = 7 + 7x + 7y/4$$

$$\boxed{7 + x = 5y / 4}$$

$$x < 5$$

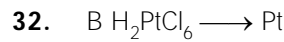
put the value (eku j [kus i j)

if $x = 3$

$$10 = 5y/4$$

$$y = 8$$

Ans is C_3H_8



POAc on Pt

$$M_B = \left[\frac{w_1}{w_2} \times 195 - 410 \right] \frac{n}{2},$$

$n =$ diacidic org. base (f) v E y h; d k c f u d {k j} = 2

$$= \left(\frac{12}{5} \times 195 - 410 \right) = 58$$

33. (a) In 100 mL (140 g) solution mass of solute (100 mL

(140 g) f o y ; u e a f o y s d k æ 0 ; e k u = 70

$$= \frac{70}{140} \times 46 = 23 \text{ g}$$

(b) $10 \text{ M} = \frac{\text{Mass of solute (f o y s d k æ 0 ; e k u)} / 46}{\frac{50}{1 \times 1000}}$

$$\text{Mass of solute (f o y s d k æ 0 ; e k u)} = 23 \text{ g}$$

(c) 100 g solution contain 25 g of solute mass of

$$\text{solute} = \frac{25}{100} \times 50 = 12.5]$$

(100 g f o y ; u e a 25 g f o y s g s f o y s d k æ 0 ; e k u)

(d) $5 \text{ M} = \frac{\text{Mass of solute (f o y s d k æ 0 ; e k u)} / 46}{46 / 1000}$

$$\text{Mass of solute (f o y s d k æ 0 ; e k u)} = 10.58 \text{ g}$$

34. Molarity (e l s y j r k)

$$= \frac{X(\text{volume (v k ; r u)})}{11.2} = \frac{28}{11.2} = 2.5$$

$$m = \frac{M \times 1000}{d \times 1000 - M M_w}$$

$$m_{\text{H}_2\text{O}_2} = 13.8$$

2.5 moles in 1 L solution (1 L f o y ; u e a 2.5 e l s y)

$d = 265 \text{ g/L}$, mass (æ 0 ; e k u) = 265 solution (f o y ; u)

$$n_{\text{H}_2\text{O}} = 10 = \frac{2.5}{10 + 2.5} = 0.2$$

$$\% \frac{w}{V} = \frac{\text{wt. of solute (foys dk Hkkj)}}{\text{volume of solution (foys; u dk vk; ru)(mL)}}$$

$$= \frac{10 \times 18}{1000} \times 100$$

$$= \% \frac{w}{V} = 18\%$$

Exercise-03

COMPREHENSION # 1

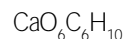
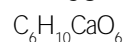
- The cost of 1000 gm KCl is 50 kg
(1000 gm KCl dh dher 50 kg g\$)
The cost of 74.5 g KCl is (74.5 g KCl dh dher)
$$= \frac{50}{1000} \times 74.5 \Rightarrow 3.73 \text{ mol}^{-1}$$
- the price of K_2SO_4 (K_2SO_4 dh dher)
$$= \frac{50}{174} \times 74.5 \times 2 \Rightarrow \text{Rs. } 42.82 \text{ kg}^{-1}$$
- mole of K in KCl (KCl ea K ds esky) = $\frac{1000}{74.5}$
$$\Rightarrow 13.42$$

mole of K_2O form 13.42 mole of K (K_2O ds esky K ds
13.42 esky cukrs g\$) = $\frac{13.42}{2} = 6.71$
mass of K_2O (K_2O dk æ0; eku)
$$= 6.71 \times 94 = 630.8 \text{ gm} = 0.631 \text{ kg}$$

COMPREHENSION # 2

- | 1. | amt | mole | fraction | |
|----|--------|--------|----------|----|
| | | esky | fhku | |
| C | 0.2732 | 0.0227 | 1 | 6 |
| H | 0.0382 | 0.0382 | 1.68 | 10 |
| Ca | 0.152 | 0.0038 | 0.167 | 1 |
| O | 0.3540 | 0.0227 | 1 | 6 |

Simplest formula (I jyre I #)



- Formula weight (I # Hkkj)
- The molecular mass of lactate pentahydrate = 308
(yDVV i DVkgbM\$ dk vkf.od æ0; eku = 308)
218 gm anhydrous salt recovered = 308 g lactate pentahydrate
$$1 \text{ gm anhydrous salt recovered} = \frac{308}{218} = 1.41 \text{ gm}$$

COMPREHENSION # 3

- 8 mole NaBr obtain from (8 esky NaBr i Itr glrk g\$)

= 3 mole Fe (Fe ds 3 esky I \$)

$$\text{mole of Fe} = \text{mole NaBr} = \frac{2.06 \times 10^3}{103 \times 8} \times 3$$

$$\text{mass of Fe} = \frac{2.06 \times 10^3}{103} \times 56 \times \frac{3}{8} = 420 \text{ kg}$$

- mole of Fe_3Br_8 (Fe_3Br_8 ds esky) = $\frac{100 \times 2.06 \times 10^6}{103 \times 70 \times 8}$

$$\text{mole of Fe} = \text{mole FeBr}_2 = \frac{2.06 \times 10^3 \times 100 \times 100}{103 \times 70 \times 60 \times 8} \times 3$$

$$\text{mass of Fe} = \frac{2.06 \times 10^3 \times 100 \times 100}{103 \times 70 \times 60} \times 56 \times \frac{3}{8}$$

mass of Fe = 10^3 kg

- mole of CO_2 (CO_2 ds esky) = $\frac{\text{mole of NaBr}}{2}$

$$= \frac{2.06 \times 10^3}{103 \times 2} = 10$$

COMPREHENSION # 4

- $\text{CO}_2 = 22 \text{ g} = 0.5 \text{ mol}$
 $\text{H}_2\text{O} = 13.5 \text{ g} = \frac{13.5}{18} \text{ mol.}$
 $\text{C} = 0.5 \text{ mol} = 6 \text{ g}$
 $\text{H} = 1.5 \text{ mol} = 1.5 \text{ g}$
 $\text{O} = 8 \text{ gm} = 0.5 \text{ mol}$
E.F. = CH_3O
let molar mass = M
$$\frac{27}{108} = \frac{41.75}{M - 1 + 108}$$

$$\Rightarrow M = -107 + 167 = 60$$

E.F. mass = $12 + 3 + 16 = 31$
$$n = \frac{274}{31} \approx 2$$

M.F. = $(\text{CH}_3\text{O})_2$
$$= \text{C}_2\text{H}_6\text{O}_2$$

COMPREHENSION # 5

- $\text{Ba(OH)}_2 + 2\text{HNO}_3 \longrightarrow \text{Ba(NO}_3)_2 + 2\text{H}_2\text{O}$
0.4 mole 0.4mole
In resultant sol. Ba(OH)_2 is remaining, therefore nature

of sol. basic.

(ifjek.kh foy; u ea Ba(OH)₂ 'kšk jgrk gš rksfoy; u dh idfr {kjh;})

2. Vol. of Ba(OH)₂ (Ba(OH)₂ dk vk; ru)

$$= \frac{342}{0.57} = 600 \text{ mL}$$

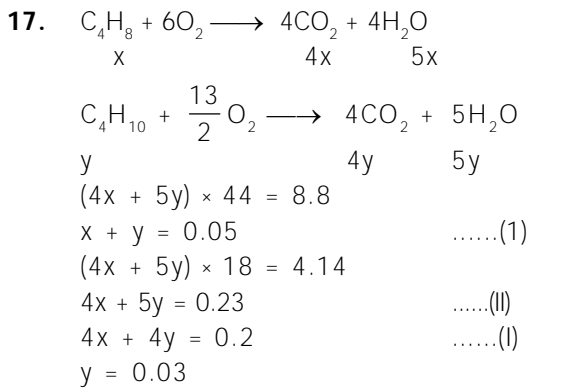
$$\text{mole of OH}^- (\text{OH}^- \text{ ds esy}) = 0.2 \times 2 = 0.4$$

$$\text{molarity of OH}^- (\text{OH}^- \text{ ds esy jrk}) = \frac{0.4}{0.8} = 0.5$$

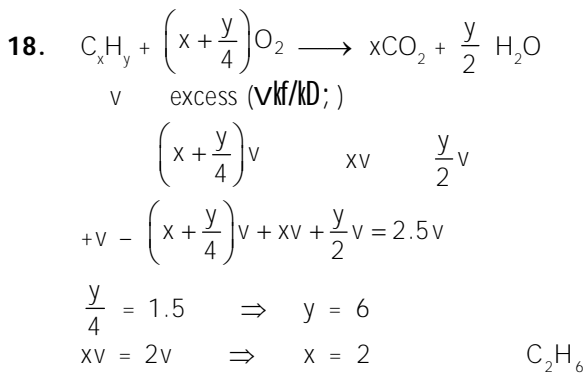
Exercise-4(A)

1. Ist exp. CuO = 1.375 gm
Cu = 1.098 gm
O = 0.277 gm
IInd exp. Cu = 1.179 gm
CuO = 1.4476 gm
O = 0.2686 gm
- $$\frac{\text{Cu}}{\text{O}} = 3.9638 \approx 4 \qquad \frac{\text{Cu}}{\text{O}} \approx 4$$
- In both the cases ratio of Cu/O is same
(nksuka fLFkr; ka ea Cu/O dk vuqkr l eku gš)
2. $\left(\frac{Y}{X}\right) = \frac{0.471}{0.324} = 1.4537 = r_1$
 $\left(\frac{Y}{X}\right) = \frac{0.509}{0.117} = 4.350 = r_2$
 $\frac{r_2}{r_1} = 2.9926 \approx 3$
so satisfy law of multiple proposition.
(vr% xq.kr vuqkr ds fu; e dks l urqV djrk g)
3. = 35.125 × 28 = 983.5 gm
4. molecular (vkf.od) = $\left(\frac{0.07}{18}\right) \times N_A \times 3 = 2.34 \times 10^{21}$
5. $n_{\text{NaClO}_3} = \frac{106.5}{106.5} = 1 \text{ mole}$
NO. of atom of (NO ds ijek.kq dh l q; k)
Na = 1 × N_A
Cl = 1 × N_A
O = 1 × N_A
6. $n_{\text{P}_4} = \frac{92.9}{4 \times 31} = 0.75 \text{ mole}$
 $N_{\text{P}_4} = 0.75 \times N_A = 4.52 \times 10^{23} \text{ molecules}$
 $N_{\text{P}} = 18.04 \times 10^{23} \text{ molecules}$
7. $n_{\text{Na}} = \frac{5.75}{23} = 0.25 \text{ mole}$
8. (a) 1 × 23 gm (b) 1 × 35.5 gm
(c) 1 × 63.5 gm
9. $m_{\text{Hg}} = 13.6 \times 1000 \text{ gm}$
 $n_{\text{Hg}} = m_{\text{Hg}} / 200 = 68 \text{ mole}$
10. $3\text{CaCO}_3 + 2\text{H}_3\text{PO}_4 \longrightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{O} + 3\text{CO}_2$
50/100mole 70/98 mole
= 0.5 0.7142

- $$- - \quad 0.7142 - \frac{2}{3} \times 0.5 = 0.3808 \left(\frac{0.5}{3}\right)$$
- Limiting reactant (l hekr vfkdkjd)
- $$m_{\text{CaCO}_3} = \frac{0.5}{3} \times M_{\text{Ca}_3(\text{PO}_4)_2} = 51.66 \text{ gm}$$
- $$m_{\text{H}_3\text{PO}_4} = 0.3808 \times M_{\text{H}_3\text{PO}_4} = 31.31 \text{ gm}$$
11. $\text{CaNH}_2 + 2\text{NH}_3 \longrightarrow \text{N}_2\text{H}_4 + \text{NH}_4\text{Cl}$
 $\frac{1000}{51.5} \text{ mole excess (vkf/kD;)}$
= 19.417
19.417 mole
% yield (ikflr) = $\frac{14.781}{19.417} \times 100 = 76.125\%$
12. $5\text{C} + 2\text{SO}_2 \xrightarrow{82\%} \text{CS}_2 + 4\text{CO}$
excess (vkf/kD;) $\frac{450}{64} = 7.03 \text{ Kmole}$
 $0.82 \times \frac{7.03}{2} = 2.88 \text{ Kmole} = 219.09 \text{ kg}$
13. $\text{BaO} + \text{CaO}$
 $x \times [153] + y \times [56] = 28 \quad \dots\dots(I)$
 $\text{BaO} + 2\text{HCl} \longrightarrow \text{BaCl}_2 + \text{H}_2\text{O}$
x 2x
 $\text{CaO} + 2\text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2\text{O}$
y 2y
 $2x + 2y = 6 \times 0.1008 = 0.6048 \quad \dots\dots(II)$
% of BaO = $\frac{x \times 153}{29} \times 100 = 65.65\%$
14. $\frac{x \times 0.95}{106} = 5 \times 0.5$
 $x = \frac{2.5 \times 106}{0.95} = 278.947 \text{ gm}$
15. $M = \frac{(27/98)}{(100/1.2)} \times 1000 = 3.8$
16. $\text{C}_n\text{H}_{2n+2} + \frac{(3n+1)}{2}\text{O}_2 \longrightarrow n\text{CO}_2 + (n+1)\text{H}_2\text{O}$
 $\frac{(3n+1)/2}{n} = \frac{7}{4} \Rightarrow 6n+2=7n \Rightarrow n=2 \quad \text{C}_2\text{H}_6$



%by mass of C_4H_{10} (C_4H_{10} ds æl; eku dk %) = $\frac{0.03 \times 58}{2.86} \times 100 = 60.8\%$



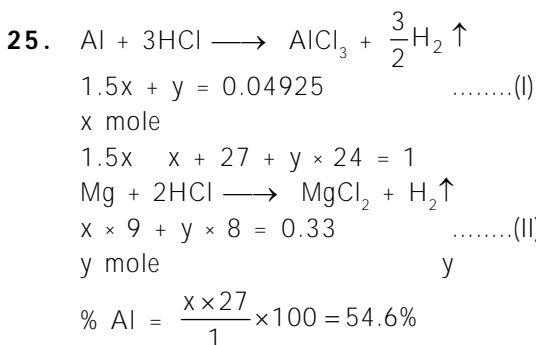
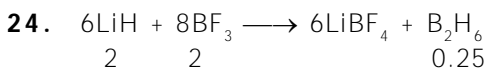
19. Molar mass (ekyj æl; eku) = $3.2707 \times 10^{-22} \times 6.023 \times 10^{23} = 196.99426\text{gm}$

20. $M = \pi \times (75 \times 10^{-8} \text{ cm})^2 \times (5000 \times 10^{-8} \text{ cm})$
 $\times \frac{1}{0.75 \text{ cm}^3 / \text{gm}} \times 6.023 \times 10^{23} = 7.09 \times 10^7 \text{ gm}$

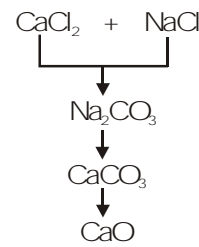
21. $\frac{M_{\text{gas}}}{M_{\text{air}}} = 1.17 \Rightarrow M_{\text{gas}} = 1.17 \times 29 = 33.93 \text{ gm}$

22. $\text{Y}_3\text{A}_5\text{O}_{12}$
 $200 \times 200 \times 10^{-3}$
 (a) $y = 44.95\%$, $\text{Al} = 22.73\%$, $\text{O} = 32.32\%$
 (b) 17.98 gm

23. $n = \frac{28.3 \times 10^{-4}}{100} = 8.8 \times 10^{-8} \text{ mole}$



Mg = 45.4%



26. $n_{\text{CaCl}_2} = n_{\text{CaO}} = \frac{1.62}{56} = 0.02892$
 $m_{\text{CaCl}_2} = 0.02892 \times 111 = 3.211 \text{ g}$
 $m_{\text{NaCl}} = 6.7889 \text{ gm}$
 $\% \text{ NaCl} = 67.9\%$

27. $n_{\text{O}_2} = 625$
 $n_{\text{C}} = 1 \text{ mole}$
 $\frac{n_{\text{O}_2}}{n_{\text{C}}} = 0.625$
 $\text{O}_2 + \text{C} \longrightarrow \text{CO} + \text{CO}_2$
 $2 \times n_{\text{O}_2} = n_{\text{CO}} + 2n_{\text{CO}_2}$ (I)

$2 \times n_{\text{C}} = n_{\text{CO}} + n_{\text{CO}_2}$ (II)
 $\Rightarrow \frac{n_{\text{CO}} \times 28}{n_{\text{CO}_2} \times 44} = \frac{21}{11}$

element	mass per 100 gm	mole	simplest ratio
C	58.77	58.77 / 12	5
H	13.81	13.81 / 1	14
N	27.42	27.14 / 2	2

28. E.F. = $\text{C}_5\text{H}_{14}\text{N}_2 = 102 = \text{M.F.}$

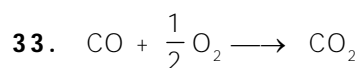
30. $n_{\text{N}_2} = \frac{(774.5 - 14.5)}{760} \times \frac{82.1}{1000} = 3.3786 \times 10^{-3} \text{ mole}$
 $n_{\text{N}_2} = \frac{0.081 \times 300}{760} = 3.3786 \times 10^{-3} \text{ mole}$

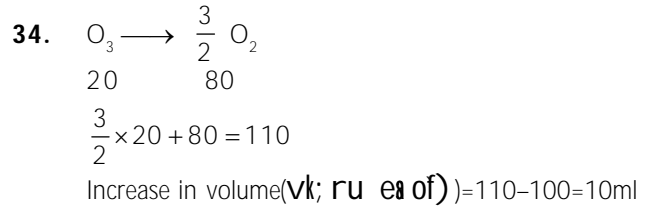
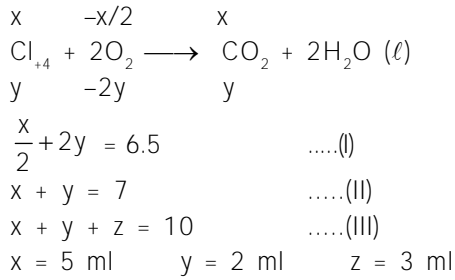
$m_{\text{N}_2} = 0.0946 \text{ gm}$
 $\% \text{ N}_2 = \frac{0.0946}{0.14} \times 100 = 66.7\%$

31. (a) $M = \frac{4/40}{0.2} = 0.5$
 (b) $M = \frac{5.3/106}{0.1} = 0.5$

(c) $M = \frac{0.365/36.5}{0.05} = 0.2$

32. $X_{\text{ethanol}} = \frac{46/46}{46/46 + 54/18} = 0.25$





Exercise-4(B)

1. Empirical formula **eykuijkrh I # :**
- | | | | | | |
|-----------------------------|-------|-------|-------|------|-----------------|
| = KAIS_2O_8 | Al | K | S | O | Elements rRo |
| | 10.5 | 15.1 | 24.8 | 49.6 | Mass percentage |
| | 0.388 | 0.387 | 0.775 | 3.1 | Mole ratio |
| | 1 | 1 | 2 | 8 | Simple ratio |
- I jyre vujkr**

Empirical formula weight **eykuijkrh I # Hkj**) = 258
 From weight loss information : 54.4 g anhydrous salt = 45.6 g H₂O

- (Hkj eadeh dh I puk I s 54.4 g futyh; yo.k = 45.6 g H₂O)
- ⇒ 258 g anhydrous salt = 216.26 g = 12 mol H₂O
 (258 g futyh; yo.k = 216.26 g = 12 esy H₂O)
- ⇒ Empirical formula of hydrated salt = **KAIS₂O₈ · 12 H₂O**
ty; kstr yo.k dk eykuijkrh I # = KAIS₂O₈ · 12 H₂O

2. 1.0 mole of KClO₃ = 3.0 mole of Zn
- $$\frac{5.104}{122.5} \text{ mole KClO}_3 = \frac{3 \times 5.104}{122.5}$$
- mole of Zn = $\frac{3 \times 5.104 \times 65}{122.5} = 8.124 \text{ g Zn}$

3. Apply conservation of moles of silver before and after precipitate exchange reaction as :
- (vo{kj .k fofue; vfkf; k ds i gysrFk ckn esfl Yo j esy/ka dk I j{k.k bl idkj ykxwfd; k tkrk gS)

$$\frac{1.8}{143.5} = \frac{x}{188} + \frac{2.052 - x}{143.5}$$

where, x is mass of AgBr in mixed precipitate.

(tgkP x feJr vo{kj ea AgBr dk æ0; eku)

⇒ $x = 1.064$

Also, moles of CuBr₂ = $\frac{1}{2}$ moles of AgBr = $\frac{1}{2} \times \frac{x}{188}$

(vlsj, CuBr₂ ds esy = $\frac{1}{2}$ AgBr ds esy = $\frac{1}{2} \times \frac{x}{188}$)

- ⇒ Mass of CuBr₂ = $\frac{1}{2} \times \frac{x}{188} \times 223.5 = 0.6324$
 (on substituting x)

(CuBr₂ dk æ0; eku = $\frac{1}{2} \times \frac{x}{188} \times 223.5 = 0.6324$
 (x dk eku j [kusi j])

Mass % of CuBr₂ (CuBr₂ dk æ0; eku %) = **34.18**

4. Moles of NaCl in sample = 0.01 = moles of AgCl from NaCl in precipitate (ueusea NaCl dk esy = 0.01 = vo{kj ea NaCl I s i klr AgCl ds esy)
- Total moles of AgCl precipitate (vo{kj r gq AgCl ds dy esy) = $\frac{2}{143.5} = 0.01393$

- ⇒ Moles of AgCl from KCl = 0.00393 = moles of KCl (KCl I s i klr AgCl ds esy = 0.00393 = KCl ds esy)
- ⇒ Mass of KCl in sample = 0.00393 × 74.5 = 0.2928g (ueusea KCl dk æ0; eku = 0.00393 × 74.5 = 0.2928g)
- Mass % of KCl in the sample = **29.28** (ueusea KCl dk æ0; eku %)

5. Let the mixture contain x g CuSO₄ · 5H₂O. (ekukfd feJ.k ea x g CuSO₄ · 5H₂O. mi fLFkr gS)

⇒ $\frac{x}{249} \times 159 + \frac{5-x}{246} \times 120 = 3 \Rightarrow x = 3.72$

- ⇒ Mass percentage of CuSO₄ · 5H₂O (CuSO₄ · 5H₂O dk æ0; eku i fr'kr) = **74.4**

6. Mass % of Ca (Ca dk æ0; eku %)

$$= \frac{0.16}{100} \times 40 \times \frac{100}{0.25} = 25.6$$

Mass % of S (S dk æ0; eku %)

$$= \frac{0.344}{233} \times \frac{32 \times 100}{0.115} = 41$$

Mass % of N (N dk æ0; eku %)

$$= \frac{0.155}{17} \times \frac{14 \times 100}{0.712} = 17.9$$

- ⇒ Mass % of C (C dk æ0; eku %) = 15.48

Now :

Elements (rRo)	Ca	S	N	C
Mass % (æ0; eku %)	25.6	41	17.9	15.48
Mol ratio (esy vujkr)	0.64	1.28	1.28	1.29

Simple ratio (l j y v u i k r) 1 2 2 2

Empirical formula (e y k u i k r h l #) = CaC₂N₂S₂,

Empirical formula weight (e y k u i k r h l # H k j) = 156

Hence, molecular formula (b l i d k j, v k f. o d l #) = CaC₂N₂S₂

7. Working in backward direction (i r h i f n' k e a d k; l d j u s i j)

In the last step moles of (AgBr + AgI) = moles of AgI
(v f l r e i n e a (AgBr + AgI) d s e k y = AgI d s e k y)

$$\Rightarrow \frac{0.4881 - x}{188} + \frac{x}{235} = \frac{0.5868}{235} \Rightarrow x = 0.0933 \text{ g}$$

Mass % of NaI (N a l d k æ 0; e k u i f r' k r)

$$= \frac{0.0933}{235} \times 150 \times \frac{100}{0.2} = 29.77$$

Now subtracting mass of AgI from 1st and 2nd precipitate gives (v c 1 s t o 2 n d v o { k i l s A g I d s æ 0; e k u d k s ? k v k u s i j i k r g k r k g a) :

Mass of (AgCl + AgBr) = 0.3187 g

((AgCl + AgBr) d k æ 0; e k u = 0.3187 g)

and mass of AgBr = 0.3948 g

(v k j A g B r d k æ 0; e k u = 0.3948 g)

$$\text{Again } \frac{y}{143.5} + \frac{0.3187 - y}{188} = \frac{0.3948}{188} \Rightarrow y = 0.245 \text{ g}$$

⇒ Mass % of NaCl (N a C l d k æ 0; e k u i f r' k r)

$$= \frac{0.245}{143.5} \times 58.5 \times \frac{100}{0.2} = 50$$

Mass % of NaBr (N a B r d k æ 0; e k u i f r' k r) = 20.23

8. Weight loss is due to conversion of NaHCO₃ into Na₂CO₃ : 31 g weight is lost per mole of NaHCO₃.

(N a H C O ₃ d s N a ₂ C O ₃ e a i f j o r u d s d k j . k H k j e a d e h

: N a H C O ₃ d s i f r e k y 31 g H k j e a d e h g k r h g a)

⇒ 0.3 g wt. loss from $\frac{0.3}{31}$ mol of NaHCO₃ producing $\frac{0.3}{62}$ moles of Na₂CO₃.

$$\left(\frac{0.3}{31} \text{ e k y N a H C O }_3 \text{ l s } 0.3 \text{ g H k j e a d e h } \right) \text{ k j k } \frac{0.3}{62}$$

e k y N a ₂ C O ₃ m R i l u g k r s g a)

Total moles of carbonate (d k k l u v d s d y e k y) = 15 × 10⁻³

⇒ Moles of carbonate in original sample (o k l r f o d f e J . k

$$\text{e a d k l u v d s e k y) = } 0.015 - \frac{3}{620} = 0.01$$

Mass of Na₂CO₃ in original sample (o k l r f o d u e u s e a

N a ₂ C O ₃ d k æ 0; e k u) = 1.06 ⇒ 42.4 % N a ₂ C O ₃

9. If M is molar mass of (CH₃)_x AlCl_y ; f n M, (CH₃)_x AlCl_y

d k e k y j æ 0; e k u g a)

$$m(\text{CH}_4) = \frac{0.643x}{M} \times 16 = 0.222$$

$$\text{and } m(\text{AgCl}) = \frac{0.643y}{M} \times 143.5 = 0.996$$

$$\text{dividing (H k k x n s u s i j) : } \frac{x}{y} = 2,$$

$$\text{Also } M = 15x + 27 + 35.5y = 15x + 27 + \frac{35.5x}{2} = 32.75x + 27$$

$$\Rightarrow \frac{0.643x \times 16}{32.75x + 27} = 0.222 \Rightarrow x = 1.98 \approx 2 \Rightarrow y = 1$$

10. Mass of AgCl = 0.09 × 143.5 = 12.915 g which is 95.77 % of total ppt.

(A g C l d k æ 0; e k u = 0.09 × 143.5 = 12.915 g t k s d y v o { k i d k 95.77 % g a)

⇒ Total mass of precipitate (v o { k i d k d y æ 0; e k u) = 13.485g and mass of impurity (o v' k o / k a d k æ 0; e k u) = 0.57 g

⇒ Mass of NaCl + KCl = 5.9 g

(N a C l + K C l d k æ 0; e k u = 5.9 g)

$$\Rightarrow \frac{x}{58.5} + \frac{5.9 - x}{74.5} = 0.09$$

⇒ x = 2.94 g NaCl, 2.96 g KCl

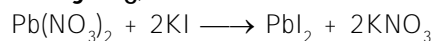
m (Na₂O) = 1.558 g ⇒ m% (Na₂O) = 31.16

m (K₂O) = 1.867 g ⇒ m% (K₂O) = 37.34

11. In order to obtain maximum yield from a reaction, the reactants must be supplied in stoichiometric amount so that no reactant should be left unreacted.

(v f l k o ; k l s v f k d r e y f o k i k r d j u s d s f y,] f o ; k d j d k a d h i e r j l l e h d j . k f e r h ; e k = k e a g k u h p k f g, r k f d d k b z H h f o ; k d j d v u v f l k d r u g h a j g u k p k f g, A)

The balanced chemical reaction is, (l u r t y r j k l k ; f u d l e h d j . k g s)



Let x g of KI is taken (e k u l f d x g K I y r s g a)

⇒ moles of KI = $\frac{x}{166} \Rightarrow$ moles of Pb(NO₃)₂ present

$$= \frac{x}{2 \times 166}$$

⇒ $\frac{x}{2 \times 166} = \frac{5 - x}{330} \Rightarrow x = 2.5 \text{ g} \Rightarrow$ mass of PbI₂

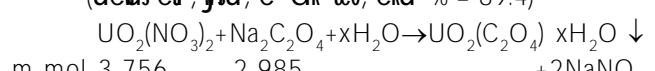
$$= \frac{x}{332} \times 460 = 3.464 \text{ g}$$

12. Mass of uranium in the sample (u e u s e a ; y f u ; e d k

$$\text{æ 0; e k u) = } \frac{1.48}{394} \times 238 = 0.894 \text{ g}$$

Mass % of uranium in the sample = 89.4

(u e u s e a ; y f u ; e d k æ 0; e k u % = 89.4)



m mol 3.756 2.985 +2NaNO₃
Here Na₂C₂O₄ is the limiting reagent, therefore, m mol of UO₂(C₂O₄).xH₂O formed is 2.985.

(; gk; Na₂C₂O₄ l heklr vflkdežl gš bl idkj fufer UO₂(C₂O₄).xH₂O ds m mol 2.985 gA)

$$\Rightarrow M(\text{UO}_2(\text{C}_2\text{O}_4)) \cdot x\text{H}_2\text{O} = \frac{1.23}{2.985} \times 1000 = 412$$

$$= 238 + 32 + 88 + 18x$$

$$\Rightarrow x = \frac{54}{18} = 3$$

13. Volume of smallest cell = $\pi r^2 l = \pi (60 \times 10^{-8} \text{ cm})^2 (6000 \times 10^{-8} \text{ cm}) = 6.785 \times 10^{-17} \text{ cm}^3$

(Nk/h dks'kdk dk vk; ru = $\pi r^2 l = \pi (60 \times 10^{-8} \text{ cm})^2 (6000 \times 10^{-8} \text{ cm}) = 6.785 \times 10^{-17} \text{ cm}^3$)

mass of one smallest cell (, d Nk/h dks'kdk dk æ0; eku) = $7.6 \times 10^{-17} \text{ g}$

⇒ Molar mass of mother cell (ekr' dks'kdk dk esyj æ0; eku) = $7.6 \times 10^{-17} \times 24 \times 60 \times 6.023 \times 10^{23} = 6.6 \times 10^{10} \text{ amu}$

14. Let the sample contain (ekulfd ueus ep x g Mohr's salt (ekgj yo.k) [FeSO₄(NH₄)₂SO₄ · 6H₂O] mi flFkr gA)

$$\Rightarrow \frac{x}{392} \times 2 \times \frac{0.5 - x}{132} = \frac{0.75}{233}$$

Solving x = 0.23 g ⇒ Mohr's salt = $\frac{0.23}{0.50} \times 100 = 46 \%$, (NH₄)₂SO₄ = 54%

(gy djus ij x = 0.23 g ⇒ ekgj yo.k = $\frac{0.23}{0.50} \times 100 = 46 \%$, (NH₄)₂SO₄ = 54%)

Also moles of Fe in 0.2g sample = $\frac{x}{392} \times \frac{0.2}{0.5}$

$$= 2.347 \times 10^{-4}$$

(vlsj 0.2 g ueus ep Fe ds esy = $\frac{x}{392} \times \frac{0.2}{0.5}$

$$= 2.347 \times 10^{-4}$$

⇒ mass of Fe₂O₃ obtained on ignition of 0.2 sample

$$= \frac{2.347 \times 10^{-4}}{2} \times 160 = 18.77 \text{ mg}$$

(0.2 ueus dks tykus ij Fe₂O₃ dk æ0; eku)

15. Smallest volume of AgNO₃ would be required when the entire mass is due to highest molecular weight constituent.

(AgNO₃ dk U; ure vk; ru vko'; d gksk tc l Ei wkl æ0; eku vfl/dre vlf.od Hkkj okys?kVd ds dkj .k gkrk gA)

Hence, for smallest volume, the whole mass should be of BaCl₂ · 2H₂O

(vr%U; ure vk; ru dsfy, . BaCl₂ · 2H₂O dk l Ei wkl æ0; eku gkuk plfg, A)

m mol of BaCl₂ · 2H₂O = $\frac{0.3}{244} \times 1000 = 1.229 \text{ m mol}$
 m mol of AgNO₃ required = $2 \times 1.229 = 2.458$ (vko'; d AgNO₃ ds m mol)

Volume of AgNO₃ required = $\frac{2.458}{0.15} = 16.38 \text{ mL}$ (smallest)

(vko'; d AgNO₃ dk vk; ru = $\frac{2.458}{0.15} = 16.38 \text{ mL}$ (U; ure))

Largest volume of AgNO₃ would be required when entire mass is due to lowest molecular weight constituent, i.e., NaCl.

(AgNO₃ ds vfl/dre vk; ru dh vko'; drk gksk tc l Ei wkl æ0; eku U; ure vlf.od Hkkj okys?kVd vflkr ~ NaCl ds dkj .k gkrk gA)

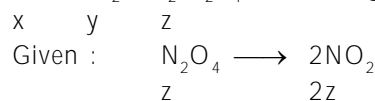
m mol of NaCl = $\frac{0.3}{58.5} \times 1000 = 5.128 = \text{m mol of AgNO}_3 \text{ required}$

(NaCl ds m mol = $\frac{0.3}{58.5} \times 1000 = 5.128 = \text{vko'; d AgNO}_3 \text{ ds m mol}$)

⇒ Volume of AgNO₃ required = $\frac{5.128}{0.15} = 31.18 \text{ mL}$ (largest)

(vko'; d AgNO₃ dk vk; ru = $\frac{5.128}{0.15} = 31.18 \text{ mL}$ (vfl/dre))

16. Mixture (N₂, NO₂, N₂O₄) has mean molar mass = 55.4. (feJ .k (N₂, NO₂, N₂O₄) dk ek/; esyj æ0; eku = 55.4.)



$$\therefore 55.4 = \frac{28x + 46(y + 2z)}{x + y + z}$$

$$\left\{ \text{mean molar mass} = \frac{\text{wt.} \times \text{mole}}{\text{Total mole}} \right\}$$

$$\left\{ \text{ek/; esyj æ0; eku} = \frac{\text{Hkkj} \times \text{esyj}}{\text{dty esy}} \right\}$$

Given : x + y + z = 1 (mole)

$$\text{so } 55.4 = 28x + 46(y + 2z) \quad \dots(1)$$

$$\therefore 39.3 = \frac{28x + 46(y + 2z)}{x + y + 2z}$$

$$\therefore 39.6(x + y + 2z) = 28x + 46(y + 2z)$$

From eq (1) & x + y + z = 1

$$\text{or } 39.6(1 + z) = 59.4$$

$$\text{or } 1 + z = \frac{59.4}{39.6}$$

$$\text{or } z = 0.4$$

from eq. (1)

$$55.4 = 28x + 46(y + 2z)$$

$z = 0.4$ put (j) [kus ij]

$$55.4 = 28x + 46y + 36.8$$

$$28x + 46y = 18.6 \quad \dots(2)$$

$$\therefore x + y + z = 1$$

$$x + y + 0.4 = 1 \quad (\because z = 0.4)$$

$$x + y = 0.6 \quad \dots(3)$$

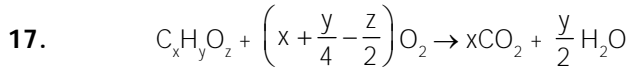
eq. (2) $\times 1$ eq. (3) $\times 28$

$$\begin{array}{r} 28x + 46y = 18.6 \\ - 28x + 28y = 16.8 \\ \hline 18y = 1.8 \end{array}$$

$$y = 0.1$$

$$\therefore x + y + z = 1$$

$$x = 0.5$$



Given vol. 10mL + 100mL 0 + 0
(fn; k vk; ru)

After reaction - + 100-10 $\left(x + \frac{y}{4} - \frac{z}{2}\right) 10x$ -

(vflkfØ; k ds i'pr)

$$100 - 10 \left(x + \frac{y}{4} - \frac{z}{2}\right) + 10x = 90$$

$$\frac{y}{4} - \frac{z}{2} = 1$$

$$y - 2z = 4 \quad \dots(1)$$

Property of KOH has to absorbed all CO₂.
(KOH dk xqk l Ei wlk CO₂ dksvo'kfk'kr djuk gkrk gA)

$$\therefore 10x = 20$$

$$x = 2$$

V.D. of compound (C_xH_yO_z) = 23 \therefore V.D. = $\frac{M_w}{2}$

(; kfxd dk ok'i ?kuRo (C_xH_yO_z) = 23)

$$M_w = 46 \quad M_w = 2 \times 23 = 46$$

$$12x + y + 16z = 46$$

$$12 \times 2 + y + 16z = 46$$

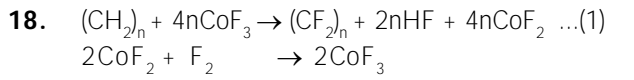
$$y + 16z = 22 \quad \dots(2)$$

from eq. (1) & (2)

$$\begin{array}{r} y - 2z = 4 \\ - y + 16z = 22 \\ \hline -18z = -18 \end{array}$$

$$z = 1, y = 6$$

Molecular formula (vlf.od l #) = C₂H₆O.



wt. \Rightarrow F = 19, C = 12, Co = 59, $M_{wt.} (CF_2)_n = 50n$
 from eq. (1) $(CF_2)_n = 4nCoF_2$

$$\frac{w}{E} = \frac{w}{E}$$

$$\frac{1000}{50n} = \frac{w}{4n \times 97}$$

$$w = \frac{1000}{50n} \times 4n \times 97$$

$$w = 80 \times 97 \text{ g (CoF}_2\text{)}$$

$$\therefore 2CoF_2 + F_2 \rightarrow 2CoF_3$$

$$2 \times 97 \rightarrow 1 \times 38$$

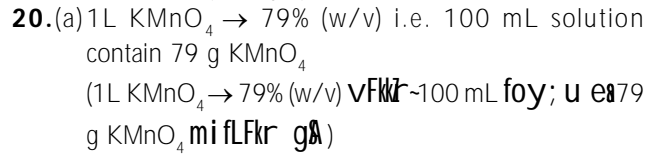
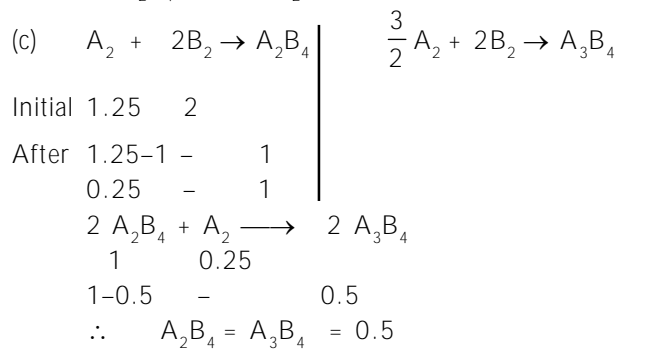
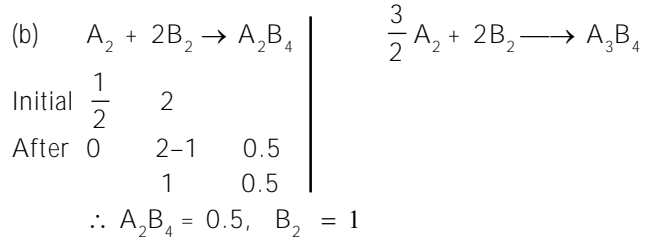
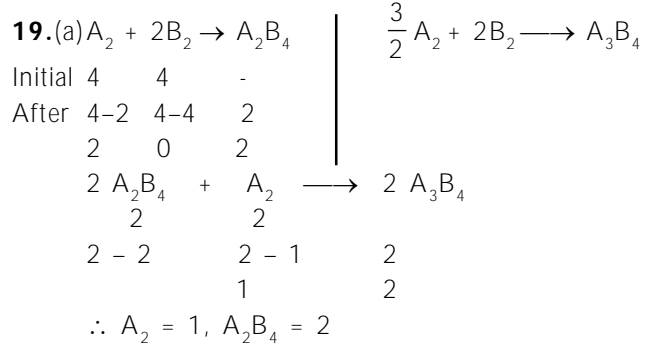
$$= 80 \times 97 \rightarrow \frac{1 \times 38}{2 \times 97} \times 80 \times 97 = 1520 \text{ g} = 1.52 \text{ kg.}$$

$$2HF \rightarrow H_2 + F_2 \quad \left\{ \begin{array}{l} \therefore (CF_2)_n \text{ moles} = \frac{1000}{50n} = \frac{20}{n} \text{ moles of } (CF_2)_n \\ 2n HF = \frac{20}{n} \times 2n = 40 \text{ mol} \end{array} \right.$$

$$40 \quad 20$$

$$1 \rightarrow \frac{20}{40} \times 1.52$$

$$1.52 = 0.76 \text{ kg}$$



$$\text{moles of KMnO}_4 = \frac{\text{wt.}}{M_w} = \frac{79}{158} = 0.5$$

$$(\text{KMnO}_4 \text{ ds esy}) = \frac{79}{M_w} = \frac{79}{158} = 0.5$$

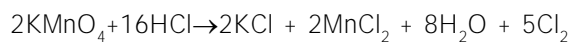
$$\text{Molarity (esyjrk) (M)} = \frac{0.5}{100} \times 1000 = 5M$$

HCl → 10% (w/w) i.e. 100 g solution contain 10g HCl
(HCl → 10% (w/w) vFlkr - 100 g foy; u ea 10 g HCl
mi fLkr gA)

$$D = 1.825 \text{ g/mL}$$

$$V = \frac{M}{D} = \frac{100}{1.825 \times 1000}$$

$$\text{Molarity (esyjrk)} = \frac{10 \times 1.825 \times 1000}{36.5 \times 100} = 5 M$$



$$M \times V_1 = M \times V_2$$

$$5 \times 1 = 5 \times 9$$

$$5 = 45$$

$$- \quad 5 \quad 12.5$$

$$\text{Cl}_2 = 12.5 \times \frac{80}{100} = 10 \text{ mol.}$$



$$1 \times \frac{710}{28.4} = 25L$$

(c) $\eta = \frac{\text{vol. of water treated}}{\text{vol. of total feed}}$

$$= \frac{25}{\text{vol. of KMnO}_4 + \text{HCl}} = \frac{25}{1+9} = 2.5$$

21. $D = 1.03 \text{ g/cm}^3$

2.8% NaCl → 100 g solution contain 2.8 g NaCl.

(2.8% NaCl → 100 g foy; u ea 2.8 g NaCl gA)

$$V = \frac{100}{1.03 \times 1000} L$$

$$1 L \rightarrow \frac{2.8 \times 1.03 \times 1000}{100} g$$

$$\text{moles} = \frac{2.8 \times 10.3}{58.5} = 0.493$$

$$M_2 V_2 = M_1 V_1$$

$$0.493 \times 10^6 = 5.45 \times V_1$$

$$V_1 = 9 \times 10^4$$

so water evaporated (vr% ok'ir ty) = $10^6 - 9 \times 10^4$
= $9.095 \times 10^5 L$

22. Let free $\text{SO}_3 \rightarrow xg$ (ekuk fd eDr $\text{SO}_3 \rightarrow xg$)

SO_3 in form of H_2SO_4 (H_2SO_4 ds : i ea SO_3)

$$\rightarrow \frac{x}{80} \times 98 = 1.225 x$$

so total (vr% dy)

$$x + 1.225 x = 100$$

$$x = 449.49$$

$$\text{water required} = \frac{44.94}{80} \times 18 = 10.11 \text{ g \% oleum}$$

$$= 100 + 10.11 = 110.11\%$$

$$(\text{vko'; d ty}) = \frac{44.94}{80} \times 18 = 10.11g \Rightarrow \% \text{ vky; e}$$

$$= 100 + 10.11 = 110.11\%$$

23. 100 mL milk → 4mL fat (100mL nmk → 4 mL ol k)

1 L milk → 40 mL fat (1 L nmk → 40 mL ol k)

density of fat = $875 \text{ kg/m}^3 = 0.875 \text{ g/mL}$

(ol k dk ?kuRo = $875 \text{ kg/m}^3 = 0.875 \text{ g/mL}$)

mass of fat = $40 \times 0.875 = 35g$

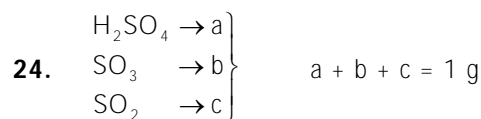
(ol k dk æ0; eku = $40 \times 0.875 = 35 g$)

fat free milk mass = $1035 - 35 = 1000g$

(ol k jfgr nmk dk vk; ru = $1035 - 35 = 1000 g$)

Vol.(vk; ru) = $1000 - 40 = 960 \text{ mL}$

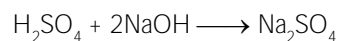
$$\rho = \frac{1000}{960} = 1.0416 \text{ g/mL}$$



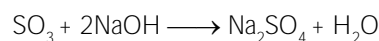
$\text{SO}_2 \rightarrow 1.5\%$

so, $C = 0.015 g \rightarrow \text{SO}_2$

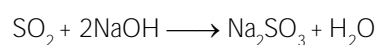
$$a + b = 0.985 g$$



$$\frac{a}{98}$$



$$\frac{b}{80}$$



$$\frac{0.015}{64}$$

$$\left(\frac{a}{98} + \frac{b}{80} + \frac{0.015}{64}\right) = 23.47 \times 10^{-3}$$

$$0.0102 a + 0.0125 b + 0.00234 = 0.011735$$

$$a + 1.225 b = 1.1275$$

$$a + b = 0.985$$

$$0.225 b = 0.1425$$

$$b = 0.633 \text{ g} \rightarrow \text{SO}_3$$

$$a = 0.35 \text{ M g} \rightarrow \text{H}_2\text{SO}_4$$

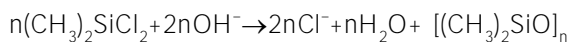
$$\text{Combined (I a Qr) SO}_3 = \frac{0.3514}{98} \times 80 = 0.2868 \text{g}$$

25. Volume(vk; ru) = $1 \times 3 \times 300 \times 6 \times 10^{-10}$

$$= 5.4 \times 10^{-7} \text{ m}^3 = 0.54 \text{ cm}^3$$

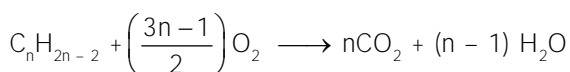
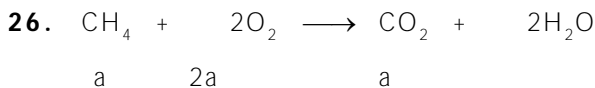
$$\rho = 1 \text{ g/cm}^3$$

$$\text{mass (æ0; eku)} = 0.54 \text{ g}$$



$$\frac{w}{129} = \frac{w}{129n} \times \{74n\}$$

$$\frac{74w}{129} = 0.54 \Rightarrow w = 0.9413 \text{ g}$$



$$(20-a) \left(\frac{3n-1}{2}\right)(20-a) = n(20-a)$$

For methane(eflu ds fy, $a + n(20-a) = 40 \dots(1)$)

For oxygen(vk01htu ds fy,)

$$\left[100 - 2a - \left(\frac{3n-1}{2}\right)(20-a)\right] = 40$$

$$2a + \left(\frac{3n-1}{2}\right)(20-a) = 60$$

$$2a + 30n - 1.5na - 10 + 0.5a = 60$$

$$2.5a - 1.5na + 30n = 70$$

$$2.5a - 1.5n(a-20) = 70$$

$$2.5a + 1.5n(20-a) = 70 \dots(2)$$

from (1) & (2)

$$a = 10$$

$$n = 3$$



% composition (% I æVU) $\rightarrow 50\%$

27. $\text{CaCl}_2 \rightarrow 5\text{M} = 555 \text{ g in 1 L solution or in 1050g solution}$

$$(\text{CaCl}_2 \rightarrow 5\text{M} = 1 \text{ L foyk; u; k } 1050\text{g foyk; u ea } 555\text{g})$$

$$\text{wt. of (solvent + MgCl}_2) = 1050 - 555 = 495 \text{ g}$$

$$(\text{foyk; d + MgCl}_2) \text{ dk Hkj} = 1050 - 555 = 495\text{g}$$

$$\text{MgCl}_2 \rightarrow 5 \text{ m}$$

$$1000 \text{ g solvent} \rightarrow 5 \text{ mol of MgCl}_2$$

$$(1000 \text{ g foyk; d} \rightarrow \text{MgCl}_2 \text{ ds } 5 \text{ eky})$$

$$= 5 \times 95 = 475 \text{ g MgCl}_2$$

$$\text{i.e., } 1475 \text{ (solvent + MgCl}_2) \rightarrow 475\text{g MgCl}_2$$

$$(\text{vFlr; } 1475 \text{ (foyk; d + MgCl}_2) \rightarrow 475\text{g MgCl}_2)$$

$$495 \text{ (solvent + MgCl}_2) \rightarrow \frac{475}{1475} \times 495$$

$$= 159.4 \text{ g MgCl}_2$$

$$(495 \text{ (foyk; d + MgCl}_2)$$

$$\text{moles of MgCl}_2 (\text{MgCl}_2 \text{ ds eky}) = \frac{159.4}{95} = 1.678$$

Total moles of Cl^- (Cl⁻ ds dly ely)

$$= (5 + 1.678) \times 2 = 13.356$$

volume of solution (foy; u dk vk; ru) = 1 L

Molarity of Cl^- (Cl⁻ dh elyjr) = 13.356 M