CHEMISTRY

For JEE MAIN + JEE ADVANCED

SOLUTIONS BOOKLET

1. SOME BASIC PRINCIPLE OF CHEMISTRY
2. ATOMIC STRUCTURE
3. STATES OF MATTER
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10. REDOX REACTION

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TOPIC

MOLE CONCEPT

S O L U T I O N S

SOME BASIC PRINCIPLE OF CHEMISTRY

Exercise-01

4. No. of molecule (v.kvk dh l[;k) = Mole × N_A

N = nN_A

5. At STP or NTP volume of any gas (STP ;k NTP ij fdlh xSl dk vk;ru) = 22.4 L

6. 1 gram ion = 1 mole ion = N_A ion

1 mol Al^{3+} ion = N_A × 3

Charge (e) on 1 mol Al^{3+} ion = N_A × 3 × e columb.

(1 eksy Al^{3+} ion ij vkos'k = N_A × 3 × e columb.)

7. No. of molecules (v.kvk dh l[;k) = mole × N_A

i.e., mole is equal then no. of molecules are also equal (vFkkZr eksy cjkcj gksu ij v.kvk dh l[;k Hkh cjkcj gksrh g)

8. Mole of Al = $\dfrac{wt}{At\ wt} = \dfrac{54}{27} = 2mol$

that is same for Mg atom (;g Mg ijek.kq d fy, Hkh leku g)

So mol of Mg = $\dfrac{wt}{24}$

wt = 2 × 24 = 48 g.

10. No. of oxygen atom = mole × N_A × atomicity.

(vkDlhtu ijek.kq d l[;k = eksy × N_A × ijek.kqdrk)

(A) = $\dfrac{1}{16}$ × N_A × 1 = $\dfrac{N_A}{16}$

(B) = $\dfrac{1}{32}$ × N_A × 2 = $\dfrac{N_A}{16}$

(C) = $\dfrac{1}{48}$ × N_A × 3 = $\dfrac{N_A}{16}$

all are same.

11. $(NH_4)_3PO_4$

12 mol hydrogen atom contain = 4 atom of oxygen

(12 eksy gkbMkstu ijek.kq e g=4 ijek.kq vkDlhtu d)

1 mol hydrogen atom contain = $\dfrac{4}{12}$

3.18 mol hydrogen atom contain (3.18 eksy gkbMkstu ijek.kq e g) = $\dfrac{4}{12}$ × 3.18 = 1.08 mole

12. Mass of 1 e^- (1 e^- dk æO;eku) = 9.31 × 10^{-31} kg

$$1\ kg = \frac{1}{9.31\times10^{-31}\times6.02\times10^{23}}$$

$$= \frac{10^8}{9.31\times6.023}$$

13. 100 g compound contain (100 g ;kfxd e g) = 5.37 g Nitrogen (ukbVkstu)

$$1\ g\ Nitrogen = \frac{100}{5.37}\times14 = 260.7$$

15.

	H_2	:	He	:	O_2	:	O_3
no. of atoms= ijek.kvk dh l[;k	$2N_A$	:	$1N_A$	:	$2N_A$	:	$2N_A$
	= 2	:	1	:	2	:	3

16.

	^{63}Cu	^{65}Cu
% abundance(% ikfIr)	x	100 – x

Avg. mass (vkSlr æO;eku) = $\dfrac{M_1x_1 + M_2x_2}{x_1 + x_2}$

$$63.546 = \frac{63\times x + 65(100 - x)}{100}$$

6354.6 = 63x + 6500 – 65 x

2x = 145.4 $\Rightarrow$ x = 70%

17. % by wt. of H_2O (H_2O d Hkkj %)

$$= \frac{\text{wt. of } H_2O(H_2O \text{ dk Hkkj})}{\text{Total wt. of compound} (\text{;kfxd dk dy Hkkj})}\times100$$

$$13 = \frac{18x}{18x+120}\times100$$

x = 1

18.

	%	Mol	Simples ratio(ljy vuikr)	
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

∴ Emperical formal (eykuikrh l=) = CH_2

∴ PMw = DRT

$$Mw = \frac{DRT}{P} = \frac{2.5\times.0821\times273}{1} = 56$$

$$n = \frac{\text{Molecular wt.(vkf.od Hkkj)}}{\text{Ewt.(eykuikrh Hkkj)}} = \frac{56}{14} = 4$$

Molecular formula (vkf.od l=) = n × E.F.

$= 4 \times CH_2$

$= C_4H_8$

19.

Element (rRo)	%	Mole (ekY)	Simplest ratio (ljy vuikr)	
C	70.8	70.8/12 = 6	6/03 = 20	20
H	6.2	6.2/1 = 6	6/03 = 20	20
N	4.1	4.1/14 = .3	1	1
O	18.9	18.9/16 = 1.2	4	4

E.F. = $C_{20}H_{20}NO_4$

21. $M + 6F \longrightarrow MF_6$

Mole of M = Mole of MF_6

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

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

28.5 + .25x = .547x

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

so element (rRo) is = Mo

22. NaOH contain 3 mole of O atoms (NaOH e O ijek.kq d 3 ekY g)

so mol of NaOH (vr% NaOH d ekY) = 3 mol

wt. of NaOH (NaOH dk Hkkj)= 3 x 40 = 120 g

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

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

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

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

24. $X_{C_2H_5OH} = .25$

$X_{H_2O} = .75$

$n_{C_2H_5OH} = .25$

$w_{C_2H_5OH} = .25 \times 46 = 11.5g$

$n_{H_2O} = .75$

% wt of C_2H_5OH (C_2H_5OH d9% Hkkj)

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

25. Mole of NO_3PO_4 (NO_3PO_4 d ekY) = 20 x .40

= 8 m mol = .008 mol

Na_3PO_4 contain $3Na^+$ ion (Na_3PO_4 e0 $3Na^+$ vk;u g)

= 3 x .008 = .024 mol

27. Molality of H_2SO_4 is 9 (H_2SO_4 dh ekyyrk 9 g)

i.e. 9 mole of H_2SO_4 in 1 kg solvent (vFkkr 1 kg foyk;d e0 9 ekY H_2SO_4 g)

1 kg solvent contain = 9 mole H_2SO_4 (1 kg foyk;d e g = 9 mole H_2SO_4)

1 kg solvent contain = 9 x 98 wt of H_2SO_4 (1 kg foyk;d e g = 9 x 98 wt H_2SO_4)

1000 kg solvent contain (1000 kg foyk;d e g)

= 9 x 98/1000 x 910

910 kg solvent contain (910 kg foyk;d e g)

= 802.62 g

wt. of solvent (foy; dk Hkkj) = 910 g

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

= 1712.62 g

x% by wt (Hkkj dk x%)

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

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

28. R.D. = $\frac{\text{Density (?kuRo) of } O_3}{\text{Density (?kuRo) of } O_2}$

at same temp. & pressure of density α Mw

?kuRo d lekU rki o nkc ij α 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. $x_A = 0.2$

$x_{H_2O} = 1 - 0.2 = 0.8$

wt of H_2O = 0.8 x 18 = 14.4 g

Molality (ekyyrk)

$$= \frac{\text{moles of solute (foy; d ekY)}}{\text{wt. of solvent (foyk; d)}(H_2O)\text{in kg}}$$

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

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

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

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

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

.2 mol H_2SO_4 then wt (.2 ekY H_2SO_4 rk Hkkj)

= .20 x 98 = 19.6 g

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

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

= 1019.6 g

32. Molarity eksyjrk

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

mol of solution (foy ;u d eky) $= \dfrac{100 \times 10^{-3}}{.8}$

$= 125 \text{ mL}$

33. Moles of solute (foy ; d eky)

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

concentration of solution(foy ;u dh lkUærk)

$$= \frac{\text{moles}}{\text{vol}}$$

$$= \frac{.1 \times 1000}{500} = .2$$

Exercise-02

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

$38.5\% \left(\frac{w}{w}\right)$Ag vFkkr 100 g foy ;u e 38.5 g Ag

Molarity (eksyjrk)

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

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

2. $\text{ppm} = \dfrac{\text{moles of solute (foy ; d eky)}}{\text{mass of solution (foy ; u dk æ0; eku)}} \times 10^6$

$$\frac{400}{100} \times 100 = \frac{\text{moles of solute (foy ; d eky)}}{\text{mass of solution (foy ; u dk æ0; eku)}} \times 100$$

Mass (æ0; eku) % = 0.04

3. Molarity (eksyjrk)

$$= \frac{(w / w) \times d \times 10}{\text{Molar mass of solute (foy ; dk eksyj æ0; eku)}}$$

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

$$\because \frac{\text{mol of solute (foy ; d eky)}}{\text{Vol vk; ru}} = \frac{12 \times 1.131 \times 10}{40}$$

Vol = 1.47 L

4. Molarity (eksyjrk) $= \dfrac{48 \times 1.150 \times 10}{81} = 8.9 \text{ mol L}^{-1}$

5. Molarity (eksyjrk) $= \dfrac{40 \times 1.05 \times 10}{62} = 6.77 \text{ M}$

6. Molality (eksyyrk)

$$\frac{\text{moles of solute (foy ; d eky)}}{\text{mass of solvent in kg (foyk; d dk kg e æ0; eku)}}$$

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

7. $7\ XeF_6 \quad + \quad 3I_2 \longrightarrow 6\ IF_7 \quad + \quad 7Xe$

7 mol   6 mol

1

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

11. $KClO_3 \xrightarrow{\Delta} KCl + \frac{2}{2}O_2$

1 mole $\frac{3}{2}$ mol

1 x 122.5 g $\frac{3}{2} \times 32$

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

% Loss (gkfu) = 0.3918 x 100 = 39.18

13. $C_6H_5NH_2 + HNO_2 + HCl \longrightarrow C_6H_5N_2^+Cl^- + 2H_2O$

$C_6H_5N_2^+Cl^- + KI \longrightarrow C_6H_5I + N_2 + KCl$

$n_P = n_r \times R_1 \times R_2$

moles of C_6H_5I = mole of $C_6H_5NH_2 \times R_1 \times R_2$

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

wt. = 20.4 g

% yield of C_6H_5I (C_6H_5I dh % yfC/k)

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

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

% of H (H dk %) = x

% of C (C dk %) = 6x

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

Element	%	Ratio of mol	Simplest
(rRo)		(eky dk vuikr)	(ljyre)
H	x	x/1 = 1	6
C	6x	6x/12 =1/2	3
N	$\frac{7x}{1.5}$	$\frac{7x}{1.5\times14}=\frac{1}{3}$	2

$\therefore$ F.F = $C_3H_6N_2$

atomic mass (ijekf.od æ0;eku) = 70

molar mass (ekyj æ0;eku) = 140

15.

			mole (eky)	simple ratio (ljy vuikr)
%	X	50	50/10	2
%	Y	50	50/20	1

E.F = X_2Y

16. 7 g Na contain salt (7 g Na e mifLFkr yo.k)=100g

1 g $\longrightarrow$ = $\frac{100}{7}\times23$

23 g $\longrightarrow$ = 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	$\frac{9.8}{14}\times N_A$
% Na = 7	7/23	$\frac{7}{23}\times N_A$

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

(Na d $\frac{7}{23}\times N_A$ ijek.k e g) = $\frac{12.8}{14}\times N_A$ of N

$\therefore$ 1 atom of Na contain (Na d 1 ijek.k e g)

= 3 atom of N

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

(Na d $\frac{7}{23}\times N_A$ e g = S d $\frac{9.8}{32}\times N_A$)

$\therefore$ 1 atom of Na contain

(Na d 1 ijek.k e g) = $\frac{9.8}{32}\times\frac{23}{7}$ = 1 atom

18. $2\,CO(NH_2)_2 \longrightarrow NH_2-CO-NH-CO-NH_2+6NH_3$

2 molecule $\longleftarrow$ 1 molecule

$\frac{2}{1}\times10^{22}$ molecule $\longleftarrow$ 10^{22}

mol = $\frac{2\times10^{22}}{6.02\times10^{23}}$

mass = $\frac{2\times10^{22}}{6.02\times10^{23}}\times60$ = 1.99

19. $X_4O_6 \longrightarrow X + 3O_2$

$4_X\ n_XO_6 = n_X$

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

40x = 5.72 x 4x + 96 x 5.72

17.12 x = 549.12 x = 32 amu

20. wt. of 1 molecule (1 v.k dk Hkkj) = $\frac{6\times10^3}{6.02\times10^{23}}$

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

$=\frac{\text{mass (æ0;eku)}}{\text{density (?kuRo)}}=\frac{6\times10^3/6.03\times10^{23}}{1.1}$ mL

= 9.1×10^{-21} cc

22. $MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$

L.G

4 x 36.5 $\longrightarrow$ 71

1 $\longrightarrow$ $\frac{71}{4\times36.5}=0.486\,g$

23. molality (eksyyrk)

$=\frac{M\times1000}{1000\,d-M\,M_w}=\frac{18\times1000}{1000\times1.8-18\times98}=500$

24. $3O_2 + 4Al \longrightarrow 2Al_2O_3O$

3 $\longrightarrow$ 4

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

$\frac{3}{2}$ $\longrightarrow$ = 2 mol x 27 = 54 g

25. % by wt. of H_2O (H_2O d Hkkj dk %)

$=\frac{\text{wt. of } H_2O\,(H_2O \text{ dk Hkkj})}{\text{Total wt. (dy Hkkj)}}\times100$

$50=\frac{18x}{142+18x}\times100$

$71 + 9x = 18x$

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

26. wt. of carbon = 21 x 12 g

$\because$ 69.98 g carbon contain 100 g cortisone (69.98 g dkcu e 100 g dkfVlku g)

$\therefore$ 1 g carbon contain 100 g cortisone (1 g dkcu e 100 g dkfVlku g) $= \frac{100}{69.98}$

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

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

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

30. 10% (v/v) HCl

100 ml contain 10 ml HCl (100 ml e 10 ml HCl)

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

density (?kuRo) of NaOH = 1.5 density of HCl

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

Resultant = Basic

(ifj.kker) = {kkjh;

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

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

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

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

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

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

$x < 5$

put the value (eku j[ku ij)

if x = 3 $\quad 10 = 5y/4 \quad y = 8$

Ans is C_3H_8

32. B $H_2PtCl_6 \longrightarrow Pt$

POAc on Pt

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

n = diacidic org. base (f}vEyh; dkcfud {kkj) = 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) foy;u e foy; dk æO;eku) = 70

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

(b) $10\ M = \dfrac{\text{Mass of solute (foy; dk æO;eku)} / 46}{\frac{50}{1 \times 1000}}$

Mass of solute (foy; dk æO;eku) = 23 g

(c) 100 g solution contain 25 g of solute mass of solute $= \frac{25}{100} \times 50 = 12.5$]

(100 g foy;u e 25 g foy; g foy; dk æO;eku)

(d) $5\ M = \dfrac{\text{Mass of solute (foy; dk æO; eku)} / 46}{46/1000}$

Mass of solute (foy; dk æO;eku) = 10.58 g

34. Molarity (eksyjrk)

$= \frac{X(\text{volume(vk;ru)})}{11.2} = \frac{28}{11.2} = 2.5$

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

$m_{H_2O_2} = 13.8$

2.5 moles in 1 L solution (1 L foy;u e 2.5 eky)

d = 265 g/L, mass (æO;eku) = 265 solution (foy;u)

$n_{H_2O} = 10 = \frac{2.5}{10+2.5} = 0.2$

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

$= \frac{10\times18}{1000}\times100$

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

Exercise-03

COMPREHENSION # 1

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)

$= \frac{50}{1000}\times74.5 \quad \Rightarrow 3.73\ mol^{-1}$

2. the price of K_2SO_4 (K_2SO_4 dh dher)

$= \frac{50}{174}\times74.5\times2 \quad \Rightarrow$ Rs. 42.82 kg^{-1}

3. mole of K in KCl (KCl e K d eky) $= \frac{1000}{74.5}$

$\Rightarrow 13.42$

mole of K_2O form 13.42 mole of K (K_2O d eky K d 13.42 eky cukr g) $= \frac{13.42}{2} = 6.71$

mass of K_2O (K_2O dk æO;eku)
= 6.71 × 94 = 630.8 gm = 0.631 kg

COMPREHENSION # 2

1.

	amt	mole eky	fraction fHkUu	
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 (ljyre l=)
$C_6H_{10}CaO_6$
$CaO_6C_6H_{10}$

2. Formula weight (l= Hkkj)

3. The molecular mass of lactate pentahydrate = 308
(yDVV iUVkgkbMV dk vkf.od æO;eku = 308)
218 gm anhydrous salt recovered = 308 g lactate pentahydrate

1 gm anhydrous salt recovered $= \frac{308}{218} = 1.41\,gm$

COMPREHENSION # 3

1. 8 mole NaBr obtain from(8eky NaBr iklr gkrk g)
= 3 mole Fe (Fe d 3 eky l)

mole of Fe = mole NaBr $= \frac{2.06\times10^3}{103\times8}\times3$

mass of Fe $= \frac{2.06\times10^3}{103}\times56\times\frac{3}{8}$ = 420 kg

2. mole of Fe_3Br_8 (Fe_3Br_8 d eky) $= \frac{100\times2.06\times10^6}{103\times70\times8}$

mole of Fe = mole $FeBr_2$ $= \frac{2.06\times10^3\times100\times100}{103\times70\times60\times8}\times3$

mass of Fe $= \frac{2.06\times10^3\times100\times100}{103\times70\times60}\times56\times\frac{3}{8}$

mass of Fe = 10^3 kg

3. mole of CO_2 (CO_2 d eky $= \frac{\text{mole of NaBr}}{2}$

$= \frac{2.06\times10^3}{103\times2} = 10$

COMPREHENSION # 4

1. CO_2 = 22 g = 0.5 mol

H_2O = 13.5 g $= \frac{13.5}{18}$ mol.

C = 0.5 mol = 6 g

H = 1.5 mol = 1.5 g

O = 8 gm = 0.5 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. = $(CH_3O)_2$
= $C_2H_6O_2$

COMPREHENSION # 5

1. $Ba(OH)_2 + 2HNO_3 \longrightarrow Ba(NO_3)_2 + 2H_2O$
0.4 mole 0.4mole
In resultant sol. $Ba(OH_2)$ is remaning, therefore nature

of sol. basic.

(ifjek.kh foy;u e $Ba(OH_2)$ 'k"k jgrk g] rk foy;u dh idfr {kkjh;)

2. Vol. of $Ba(OH)_2$ ($Ba(OH)_2$ dk vk;ru)

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

mole of OH^- (OH^- d eksy) = 0.2 x 2 = 0.4

molarity of OH^- (OH^- d eksyjrk) $= \frac{0.4}{0.8} = 0.5$

Exercise-4(A)

1. Ist exp. CuO = 1.375 gm
Cu = 1.098 gm
O = 0.277 gm

IInd exp. Cu = 1.179gm
CuO = 1.4476 gm
O = 0.2686 gm

$\frac{Cu}{O} = 3.9638 \simeq 4$ $\frac{Cu}{O} \simeq 4$

In both the cases ratio of Cu/O is same
(nkuk fLFkfr;k e Cu/O dk vuikr leku g)

2. $\left(\frac{Y}{X}\right) = \frac{0.471}{0.324} = 1.4537 = r_1$

$\left(\frac{Y}{X}\right) = \frac{0.509}{0.117} = 4.350 = r_2$

$\frac{r_2}{r_1} = 2.9926 \simeq 3$

so satisfy law of multiple proposition.
(vr% xf.kr vuikr d fu;e dk lUr"V djrk g))

3. = 35.125 x 28 = 983.5 gm

4. molecular (vkf.od)$=\left(\frac{0.07}{18}\right) \times N_A \times 3$ =2.34 x 10^{21}

5. $n_{NaClO_3} = \frac{106.5}{106.5} = 1$ mole

NO. of atom of (NO d ijek.k dh l[;k)
Na=1 x N_A
Cl = 1 x N_A
O = 1 x N_A

6. $n_{P_4} = \frac{92.9}{4 \times 31} = 0.75$ mole

$N_{P_4} = 0.75 \times N_A = 4.52 \times 10^{23}$ molecules

$N_P = 18.04 \times 10^{23}$ molecules

7. $n_{Na} = \frac{5.75}{23} = 0.25$ mole

8. (a) 1 x 23 gm (b) 1 x 35.5 gm
(c) 1 x 63.5 gm

9. m_{Hg} = 13.6 x 1000 gm
n_{Hg} = m_{Hg}/200 = 68 mole

10. $3CaCO_3 + 2H_3PO_4 \longrightarrow Ca_3(PO_4)_2 + 3H_2O + 3CO_2$
50/100mole 70/98 mole
= 0.5 0.7142

-- $0.7142 - \frac{2}{3} \times 0.5 = 0.3808 \left(\frac{0.5}{3}\right)$

Limiting reactant (lhekUr vfHkdkjd)

$m_{CaCO_3} = \frac{0.5}{3} \times M_{Ca_3(PO_4)_2} = 51.66$ gm

$m_{H_3PO_4} = 0.3808 \times M_{H_3PO_4} = 31.31$gm

11. $ClNH_2 + 2NH_3 \longrightarrow N_2H_4 + NH_4Cl$

$\frac{1000}{51.5}$ mole excess (vkf/kD;)
= 19.417
19.417 mole

% yield (ikflr) = $\frac{14.781}{19.417} \times 100 = 76.125\%$

12. $5C + 2SO_2 \xrightarrow{82\%} CS_2 + 4CO$

excess (vkf/kD;) $\frac{450}{64} = 7.03$ Kmole

$0.82 \times \frac{7.03}{2} = 2.88\ \text{Kmole} = 219.09\ \text{kg}$

13. BaO + CaO
x x [153] + y x [56] = 28 ......(I)
$BaO + 2HCl \longrightarrow BaCl_2 + H_2O$
x 2x
$CaO + 2HCl \longrightarrow CaCl_2 + H_2O$
y 2y
2x + 2y = 6 x 0.1008 = 0.6048 ......(II)

% of BaO = $\frac{x \times 153}{29}$ x 100 = 65.65%

14. $\frac{x \times 0.95}{106} = 5 \times 0.5$

$x = \frac{2.5 \times 106}{0.95} = 278.947$gm

15. $M = \frac{(27/98)}{(100/1.2)} \times 1000 = 3.8$

16. $C_nH_{2n+2} + \frac{(3n+1)}{2} O_2 \longrightarrow nCO_2 + (n+1)\,H_2O$

$\frac{(3n+1)/2}{n} = \frac{7}{4} \Rightarrow 6n + 2 = 7n$ $\Rightarrow n = 2$ C_2H_6

17. $C_4H_8 + 6O_2 \longrightarrow 4CO_2 + 4H_2O$

x 4x 5x

$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O$

y 4y 5y

$(4x + 5y) \times 44 = 8.8$

$x + y = 0.05$ ......(1)

$(4x + 5y) \times 18 = 4.14$

$4x + 5y = 0.23$ ......(II)

$4x + 4y = 0.2$ ......(I)

$y = 0.03$

%by mass of C_4H_{10} (C_4H_{10} d æ0;eku dk %)

$= \frac{0.03 \times 58}{2.86} \times 100 = 60.8\%$

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

v excess (vkf/kD;)

$\left(x + \frac{y}{4}\right)v$ xv $\frac{y}{2}v$

$+v - \left(x + \frac{y}{4}\right)v + xv + \frac{y}{2}v = 2.5v$

$\frac{y}{4} = 1.5 \Rightarrow y = 6$

$xv = 2v \Rightarrow x = 2$ C_2H_6

19. Molar mass (eksyj æ0;eku)

$= 3.2707 \times 10^{-22} \times 6.023 \times 10^{23} = 196.99426$gm

20. $M = \pi \times (75 \times 10^{-8}\ cm)^2 \times (5000 \times 10^{-8}\ cm)$

$\times \frac{1}{0.75\ cm^3 / gm} \times 6.023 \times 10^{23} = 7.09 \times 10^7$ gm

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

22. $Y_3A_5O_{12}$

$200 \times 200 \times 10^{-3}$

(a) y = 44.95%, Al = 22.73%, O = 32.32%

(b) 17.98 gm

23. $n = \frac{\frac{28.3 \times 1 \times 10^{-4}}{100}}{[12 \times 12 + 4 + 35.5 \times 4 + 16 \times 2]} = 8.8 \times 10^{-8}$ mole

24. $6LiH + 8BF_3 \longrightarrow 6LiBF_4 + B_2H_6$

2 2 0.25

25. $Al + 3HCl \longrightarrow AlCl_3 + \frac{3}{2}H_2\uparrow$

$1.5x + y = 0.04925$ ....(I)

x mole

1.5x x + 27 + y × 24 = 1

$Mg + 2HCl \longrightarrow MgCl_2 + H_2\uparrow$

$x \times 9 + y \times 8 = 0.33$ ....(II)

y mole y

$\% Al = \frac{x \times 27}{1} \times 100 = 54.6\%$

Mg = 45.4%

26. $CaCl_2 + NaCl$

↓

Na_2CO_3

↓

$CaCO_3$

↓

CaO

$n_{CaCl_2} = n_{CaO} = \frac{1.62}{56} = 0.02892$

$m_{CaCl_2} = 0.02892 \times 111 = 3.211$ g

$m_{NaCl} = 6.7889$ gm

% NaCl = 67.9%

27. $n_{O_2} = 625$

$n_C = 1$ mole

$\frac{n_{O_2}}{n_C} = 0.625$

$O_2 + C \longrightarrow CO + CO_2$

$2 \times n_{O_2} = n_{CO} + 2n_{CO_2}$ ....(I)

$2 \times n_C = n_{CO} + n_{CO_2}$ ....(II)

$\Rightarrow \frac{n_{CO} \times 28}{n_{CO_2} \times 44} = \frac{21}{11}$

28.

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

E.F. = $C_5H_{14}N_2$ = 102 = M.F.

30. $n_{N_2} = \frac{\frac{(774.5 - 14.5)}{760} \times \frac{82.1}{1000}}{0.081 \times 300} = 3.3786 \times 10^{-3}$ mole

$m_{N_2} = 0.0946$ gm

$\% N_2 = \frac{0.0946}{0.14} \times 100 = 66.7\%$

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

33. $CO + \frac{1}{2}O_2 \longrightarrow CO_2$

$$\begin{array}{ccc} x & -x/2 & x \\ CI_{+4} + 2O_2 & \longrightarrow & CO_2 + 2H_2O\ (\ell) \\ y & -2y & y \end{array}$$

$\frac{x}{2}+2y = 6.5$ .....(I)

$x + y = 7$ .....(II)

$x + y + z = 10$ .....(III)

$x = 5$ ml $y = 2$ ml $z = 3$ ml

34. $O_3 \longrightarrow \frac{3}{2} O_2$

20 80

$\frac{3}{2}\times 20+80=110$

Increase in volume(vk;ru e of))=110–100=10ml

Exercise-4(B)

1. Empirical formula eykuikrh l= :

Al	K	S	O	Elements rRo
10.5	15.1	24.8	49.6	Mass percentage æ0;eku ifr'kr
0.388	0.387	0.775	3.1	Mole ratio eky vuikr
1	1	2	8	Simple ratio ljyre vuikr

$= KAlS_2O_8$

Empirical formula weight eykuikrh l= Hkkj) = 258

From weight loss information : 54.4 g anhydrous salt ≡ 45.6 g H_2O

(Hkkj edeh dh lpuk l: 54.4 g futyh; yo.k≡ 45.6g H_2O)

⇒ 258 g anhydrous salt ≡ 216.26 g = 12 mol H_2O

(258 g futyh; yo.k ≡ 216.26 g = 12 eky H_2O)

⇒ Empirical formula of hydrated salt= $KAlS_2O_8 \cdot 12\ H_2O$

ty;kftr yo.k dk eykuikrh l==$KAlS_2O_8$.12 H_2O)

2. 1.0 mole of $KClO_3$ ≡ 3.0 mole of Zn

$\frac{5.104}{122.5}$ mole $KClO_3 \equiv \frac{3\times 5.104}{122.5}$

mole of Zn $=\frac{3\times 5.104\times 65}{122.5}$ **= 8.124 g Zn**

3. Apply conservation of moles of silver before and after precipitate exchange reaction as :

(vo{ki.k fofue; vfHkfØ;k d igy rFkk ckn e flYoj ekyk dk lj{k.k bl idkj ykx fd;k tkrk g)

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

where, x is mass of AgBr in mixed precipitate.

(tgkP x fefJr vo{ki e AgBr dk æ0;eku)

⇒ x = 1.064

Also, moles of $CuBr_2$= $\frac{1}{2}$ moles of AgBr = $\frac{1}{2}$ x $\frac{x}{188}$

(vkj,$CuBr_2$ d eky = $\frac{1}{2}$ AgBr d eky = $\frac{1}{2}$ x $\frac{x}{188}$)

⇒ Mass of $CuBr_2$ = $\frac{1}{2}$ x $\frac{x}{188}$ x 223.5 = 0.6324

(on substituting x)

($CuBr_2$ dk æ0;eku = $\frac{1}{2}$ x $\frac{x}{188}$ x 223.5 = 0.6324

(x dk eku j[ku ij))

Mass % of $CuBr_2$($CuBr_2$ dk æ0;eku %) **= 34.18**

4. Moles of NaCl in sample = 0.01 = moles of AgCl from NaCl in precipitate (ueu e NaCl dk eky = 0.01 = vo{ki e NaCl l iklr AgCl d eky)

Total moles of AgCl precipitate (vo{kfir g, AgCl d dy eky) = $\frac{2}{143.5}$ = 0.01393

⇒ Moles of AgCl from KCl= 0.00393 = moles of KCl (KCl l iklr AgCl d eky = 0.00393 = KCl d eky)

⇒ Mass of KCl in sample = 0.00393x 74.5= 0.2928g (ueu e KCl dk æ0;eku = 0.00393 x 74.5= 0.2928g)

Mass % of KCl in the sample **= 29.28**

(ueu e KCl dk æ0;eku %)

5. Let the mixture contain x g $CuSO_4 \cdot 5H_2O$.

(ekukfd feJ.k e x g $CuSO_4 \cdot 5H_2O$. mifLFkr gA)

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

⇒ Mass percentage of $CuSO_4.5H_2O$

($CuSO_4.5H_2O$ dk æ0;eku ifr'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 (eky vuikr)	0.64	1.28	1.28	1.29

Simple ratio (ljy vuikr) 1 2 2 2

Empirical formula (eykuikrh l=) = $CaC_2N_2S_2$,

Empirical formula weight (eykuikrh l= Hkkj) =156

Hence, molecular formula(blidkj,vkf.od l=)=$CaC_2N_2S_2$

7. Working in backward direction(irhi fn'kk e dk; dju ij)

In the last step moles of(AgBr+AgI) = moles of AgI (vfUre in e (AgBr + AgI) d eky = AgI d eky)

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

Mass % of NaI (NaI dk æ0;eku ifr'kr)

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

Now subtracting mass of AgI from 1st and 2nd precipitate gives (vc 1st o 2nd vo{ki l AgI d æ0;eku dk ?kVku ij ikIr gkrk gA) :

Mass of (AgCl + AgBr) = 0.3187 g

((AgCl + AgBr) dk æ0;eku = 0.3187 g)

and mass of AgBr = 0.3948 g

(vkj AgBr dk æ0;eku = 0.3948 g)

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

$\Rightarrow$ Mass % of NaCl (NaCl dk æ0;eku ifr'kr)

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

Mass % of NaBr (NaBr dk æ0;eku ifr'kr) = **20.23**

8. Weight loss is due to conversion of $NaHCO_3$ into Na_2CO_3 : 31 g weight is lost per mole of $NaHCO_3$. ($NaHCO_3$ d Na_2CO_3 e ifjoru d dkj.k Hkkj e deh : $NaHCO_3$ d ifr eky 31 g Hkkj e deh gkrh gA)

$\Rightarrow$ 0.3 g wt. loss from $\frac{0.3}{31}$ mol of $NaHCO_3$ producing $\frac{0.3}{62}$ moles of Na_2CO_3.

($\frac{0.3}{31}$ eky $NaHCO_3$ l 0.3 g Hkkj e deh }kjk $\frac{0.3}{62}$ eky Na_2CO_3 mRiUu gkr gA)

Total moles of carbonate(dkckuV d dy eky)=15$\times 10^{-3}$

$\Rightarrow$ Moles of carbonate in original sample (okLrfod feJ.k e dkckuV d eky) = 0.015 – $\frac{3}{620}$ = 0.01

Mass of Na_2CO_3 in original sample (okLrfod ueu e Na_2CO_3 dk æ0;eku) = 1.06 $\Rightarrow$ **42.4 % Na_2CO_3**

9. If M is molar mass of $(CH_3)_x AlCl_y$ (;fn M, $(CH_3)_x AlCl_y$ dk eksyj æ0;eku gA)

$m(CH_4) = \frac{0.643x}{M} \times 16 = 0.222$

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

dividing (Hkkx nu ij) : $\frac{x}{y} = 2$,

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

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

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

(AgCl dk æ0;eku = 0.09 × 143.5 = 12.915 g tk dy vo{ki dk 95.77 % gA)

$\Rightarrow$ Total mass of precipitate(vo{ki dk dy æ0;eku) = 13.485g and mass of impurity (o v'kf¼;k dk æ0;eku) = 0.57 g

$\Rightarrow$ Mass of NaCl + KCl = 5.9 g

(NaCl + KCl dk æ0;eku = 5.9 g)

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

$\Rightarrow$ x = 2.94 g NaCl, 2.96 g KCl

m (Na_2O) = 1.558 g $\Rightarrow$ m% (Na_2O) = **31.16**

m (K_2O) = 1.867 g $\Rightarrow$ m% (K_2O) = **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. (vfHkfØ;k l vf/kdre yfC/k ikIr dju d fy,] fØ;kdkjdk dh i£r jllehdj.kferh; ek=k e gkuh pkfg, rkfd dkb Hkh fØ;kdkjd vuvfHkdr ugh jguk pkfg,A)

The balanced chemical reaction is,(lUrfyr jklk;fud lehdj.k g)

$Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$

Let x g of KI is taken (ekukfd x g KI yr g)

$\Rightarrow$ moles of KI = $\frac{x}{166} \Rightarrow$ moles of $Pb(NO_3)_2$ present $= \frac{x}{2 \times 166}$

$\Rightarrow \frac{x}{2 \times 166} = \frac{5 - x}{330} \Rightarrow$ x = 2.5 g $\Rightarrow$ mass of PbI_2 $= \frac{x}{332} \times 460 =$ **3.464 g**

12. Mass of uranium in the sample (ueu e ;jfu;e dk æ0;eku) = $\frac{1.48}{394} \times 238$ = 0.894 g

Mass % of uranium in the sample = 89.4

(ueu e ;jfu;e dk æ0;eku % = 89.4)

$UO_2(NO_3)_2 + Na_2C_2O_4 + xH_2O \rightarrow UO_2(C_2O_4)\ xH_2O \downarrow + 2NaNO_3$

m mol 3.756 2.985

Here $Na_2C_2O_4$ is the limiting reagent, therefore, m mol of $UO_2(C_2O_4).xH_2O$ formed is 2.985.

(;gk $Na_2C_2O_4$ lhekUr vfHkdeKd g, bl idkj fu£er $UO_2(C_2O_4).xH_2O$ d m mol 2.985 gA)

⇒ $M(UO_2(C_2O_4)).xH_2O = \frac{1.23}{2.985} \times 1000 = 412$

= 238 + 32 + 88 + 18 x

⇒ $x = \frac{54}{18} = 3$

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

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

mass of one smallest cell (,d NkVh dkf'kdk dk æO;eku) = 7.6×10^{-17} g

⇒ Molar mass of mother cell (ekr dkf'kdk dk eksyj æO;eku) = $7.6 \times 10^{-17} \times 24 \times 60 \times 6.023 \times 10^{23}$ = **6.6×10^{10} amu**

14. Let the sample contain (ekukfd ueu e) x g Mohr's salt (ekgj yo.k) $[FeSO_4(NH_4)_2SO_4 . 6H_2O]$ mifLFkr gA

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

Solving x = 0.23 g ⇒ Mohr's salt $= \frac{0.23}{0.50} \times 100$ = 46 %, $(NH_4)_2SO_4$ = 54%

(gy dju ij x = 0.23 g ⇒ ekgj yo.k $= \frac{0.23}{0.50} \times 100$ = 46 %, $(NH_4)_2SO_4$ = 54%)

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

= 2.347×10^{-4}

(vkj 0.2 g ueu e Fe d eksy $= \frac{x}{392} \times \frac{0.2}{0.5}$

= 2.347×10^{-4})

⇒ mass of Fe_2O_3 obtained on ignition of 0.2 sample $= \frac{2.347 \times 10^{-4}}{2} \times 160$ = **18.77 mg**

(0.2 ueu dk tyku ij Fe_2O_3 dk æO;eku)

15. Smallest volume of $AgNO_3$ would be required when the entire mass is due to highest molecular weight constituent.

($AgNO_3$ dk U;ure vk;ru vko';d gksxk tc lEi.k æO;eku vf/kdre vkf.od Hkkj oky ?kVd d dkj.k gkrk gA)

Hence, for smallest volume, the whole mass should be of $BaCl_2 . 2H_2O$

(vr% U;ure vk;ru d fy,. $BaCl_2 . 2H_2O$ dk lEi.k æO;eku gkuk pkfg,A)

m mol of $BaCl_2.2H_2O = \frac{0.3}{244} \times 1000$ = 1.229 m mol

m mol of $AgNO_3$ required = 2 × 1.229 = 2.458 (vko';d $AgNO_3$ d m mol)

Volume of $AgNO_3$ required $= \frac{2.458}{0.15}$ = 16.38 mL (smallest)

(vko';d $AgNO_3$ dk vk;ru $= \frac{2.458}{0.15}$ = 16.38 mL (U;ure))

Largest volume of $AgNO_3$ would be required when entire mass is due to lowest molecular weight constituent, i.e., NaCl.

($AgNO_3$ d vf/kdre vk;ru dh vko';drk gksxh tc lEi.k æO;eku U;ure vkf.od Hkkj oky ?kVd vFkkr NaCl d dkj.k gkrk gA)

m mol of NaCl $= \frac{0.3}{58.5} \times 1000$ = 5.128 = m mol of $AgNO_3$ required

(NaCl d m mol $= \frac{0.3}{58.5} \times 1000$ = 5.128 = vko';d $AgNO_3$ d m mol)

⇒ Volume of $AgNO_3$ required $= \frac{5.128}{0.15}$ = **31.18 mL (largest)**

(vko';d $AgNO_3$dk vk;ru $= \frac{5.128}{0.15}$ = **31.18 mL (vf/kdre)**)

16. Mixture(N_2,NO_2,N_2O_4)has mean molar mass=55.4.

(feJ.k (N_2, NO_2, N_2O_4) dk ek/; eksyj æO;eku= 55.4.)

x y z

Given : $N_2O_4 \longrightarrow 2NO_2$

z 2z

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

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

{ek/; eksyj æO;eku = $\frac{\text{Hkkj} \times \text{eksy}}{\text{dy eksy}}$}

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

so 55.4 = 28x + 46 (y + 2z) ...(1)

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

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

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

or 39.6 (1 + z) = 59.4

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

or z = 0.4

from eq. (1)

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

$\boxed{z = 0.4}$ put (j[ku i j)

$55.4 = 28x + 46y + 36.8$

$28x + 46y = 18.6$ ...(2)

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

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

$x + y = 0.6$ ...(3)

eq. (2) × 1 ..... eq. (3) × 28

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

$\boxed{y = 0.1}$

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

$\boxed{x = 0.5}$

17. $C_xH_yO_z + \left(x + \frac{y}{4} - \frac{z}{2}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

Given vol. 10mL + 100mL 0 + 0

(fn;k vk;ru)

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

(vfHkfØ;k d i'pkr)

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

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

$y - 2z = 4$ ...(1)

Property of KOH has to absorbed all CO_2.

(KOH dk x.k lEi.k CO_2 dk vo'kksf"kr djuk gkrk gA)

$\therefore$ $10x = 20$

$\boxed{x = 2}$

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

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

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

$12x + y + 16z = 46$

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

$y + 16z = 22$ ...(2)

from eq. (1) & (2)

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

$\boxed{z = 1}$, $\boxed{y = 6}$

Molecular formula (vk.od l=) = C_2H_6O.

18. $(CH_2)_n + 4nCoF_3 \rightarrow (CF_2)_n + 2nHF + 4nCoF_2$ ...(1)

$2CoF_2 + F_2 \rightarrow 2CoF_3$

wt. ⇒ F = 19, C = 12, Co = 59, $M_{wt.}$ $(CF_2)_n = 50n$

from eq. (1) $(CF_2)_n = 4nCoF_2$

$$\frac{w}{E} \qquad \frac{w}{E}$$

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

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

$w = 80 \times 97$ g (CoF_2)

$\because$ $2CoF_2 + F_2 \longrightarrow 2CoF_3$

$2 \times 97 \longrightarrow 1 \times 38$

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

$2HF \rightarrow H_2 + F_2$ $\because (CF_2)_n$ moles$= \frac{1000}{50n} = \frac{20}{n}$ moles of $(CF_2)_n$

40 20 2n HF $= \frac{20}{n} \times 2n = 40$ mol

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

1.52 = 0.76 kg

19.(a) $A_2 + 2B_2 \rightarrow A_2B_4$ | $\frac{3}{2}A_2 + 2B_2 \longrightarrow A_3B_4$

	A_2	$2B_2$	A_2B_4
Initial	4	4	-
After	4–2	4–4	2
	2	0	2

$2\ A_2B_4 + A_2 \longrightarrow 2\ A_3B_4$

$2\ A_2B_4$	A_2	$2\ A_3B_4$
2	2	
2 – 2	2 – 1	2
	1	2

$\therefore$ $A_2 = 1$, $A_2B_4 = 2$

(b) $A_2 + 2B_2 \rightarrow A_2B_4$ | $\frac{3}{2}A_2 + 2B_2 \longrightarrow A_3B_4$

	A_2	$2B_2$	A_2B_4
Initial	$\frac{1}{2}$	2	
After	0	2–1	0.5
		1	0.5

$\therefore$ $A_2B_4 = 0.5$, $B_2 = 1$

(c) $A_2 + 2B_2 \rightarrow A_2B_4$ | $\frac{3}{2}A_2 + 2B_2 \rightarrow A_3B_4$

	A_2	$2B_2$	A_2B_4
Initial	1.25	2	
After	1.25–1	–	1
	0.25	–	1

$2\ A_2B_4 + A_2 \longrightarrow 2\ A_3B_4$

$2\ A_2B_4$	A_2	$2\ A_3B_4$
1	0.25	
1–0.5	–	0.5

$\therefore$ $A_2B_4 = A_3B_4 = 0.5$

20.(a) 1L $KMnO_4 \rightarrow$ 79% (w/v) i.e. 100 mL solution contain 79 g $KMnO_4$

(1L $KMnO_4 \rightarrow$ 79% (w/v) vFkkr 100 mL foy;u e 79 g $KMnO_4$ mifLFkr gA) moles of $KMnO_4 = \frac{wt.}{M_w} = \frac{79}{158} = 0.5$

($KMnO_4$ d eksy $= \frac{\quad}{M_w} = \frac{79}{158} = 0.5$)

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

HCl→10%(w/w)i.e.100 g solution contain 10g HCl

(HCl → 10% (w/w) vFkkZr 100 g foy;u e 10 g HCl mifLFkr gA)

D = 1.825 g/mL

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

Molarity eksyjrk $= \frac{10 \times 1.825 \times 1000}{36.5 \times 100} = 5$ M

$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

$M \times V_1 \qquad M \times V_1$

$5 \times 1 \qquad 5 \times 9$

$5 \qquad 45$

$– \qquad 5 \qquad 12.5$

$Cl_2 = 12.5 \times \frac{80}{100} = 10$ mol.

(b) $2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

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

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

$= \frac{25}{\text{vol. of } KMnO_4 + HCl} = \frac{25}{1+9} = 2.5$

21. D = 1.03 g/cm^3

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

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

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

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

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

$M_2V_2 = M_1V_1$

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

$V_1 = 9 \times 10^4$

so water evaporated (vrk okf"ir ty)$=10^6 – 9 \times 10^4$

$= 9.095 \times 10^5$ L

22. Let free $SO_3 \rightarrow xg$ (ekuk fd eqDr $SO_3 \rightarrow xg$)

SO_3 in form of H_2SO_4 (H_2SO_4 d :i e SO_3)

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

so total (vrk dy)

x + 1.225 x = 100

x = 449.49

water required $= \frac{44.94}{80} \times 18 = 10..11$ g % oleum

= 100 + 10.11 = 110.11%

(vko';d ty $= \frac{44.94}{80} \times 18 = 10..11g \Rightarrow$ % vkfy;e

= 100 + 10.11 = 110.11%)

23. 100 mL milk → 4mL fat (100mL n/k → 4 mL olk)

1 L milk → 40 mL fat (1 L n/k → 40 mL olk)

density of fat = 875 kg/m^3 = 0.875 g/mL

(olk dk ?kuRo = 875 kg/m^3 = 0.875 g/mL)

mass of fat = 40 x 0.875 = 35g

(olk dk æO;eku = 40 x 0.875 = 35 g)

fat free milk mass = 1035 – 35 = 1000g

(olk jfgr n/k dk vk;ru = 1035 – 35 = 1000 g)

Vol.(vk;ru) = 1000 – 40 = 960 mL

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

24. $\left.\begin{matrix} H_2SO_4 \rightarrow a \\ SO_3 \rightarrow b \\ SO_2 \rightarrow c \end{matrix}\right\}$ a + b + c = 1 g

$SO_2 \rightarrow 1.5\%$

so, C = 0.015 g $\longrightarrow SO_2$

a + b = 0.985 g

$H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4$

$\frac{a}{98}$

$SO_3 + 2NaOH \longrightarrow Na_2SO_4 + H_2O$

$\frac{b}{80}$

$SO_2 + 2NaOH \longrightarrow Na_2SO_3 + H_2O$

$\frac{0.015}{64}$

$$\left(\frac{a}{98}+\frac{b}{80}+\frac{0.015}{64}\right)=23.47\times10^{-3}$$

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

$a + 1.225\ b = 1.1275$

$a + b = 0.985$

$0.225\ b = 0.1425$

$b = 0.633\ g \rightarrow SO_3$

$a = 0.35\ M\ g \rightarrow H_2SO_4$

Combined (l;Dr) $SO_3 = \dfrac{0.3514}{98}\times 80 = 0.2868g$

25. Volume(vk;ru)$=1\times3\times300\times6\times10^{-10}$

$= 5.4\times10^{-7}\ m^3 = 0.54\ cm^3$

$\rho = 1\ g/cm^3$

mass (æO;eku) = 0.54 g

$n(CH_3)_2SiCl_2 + 2nOH^- \rightarrow 2nCl^- + nH_2O + [(CH_3)_2SiO]_n$

$\dfrac{w}{129}$ $\qquad\qquad$ $\dfrac{w}{129n}\times\{74n\}$

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

26. $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

a $\quad$ 2a $\quad$ a

$C_nH_{2n-2} + \left(\dfrac{3n-1}{2}\right)O_2 \longrightarrow nCO_2 + (n-1)\ H_2O$

$(20-a)$ $\quad$ $\left(\dfrac{3n-1}{2}\right)(20-a)$ $\quad$ $n(20-a)$

For methane(eFksu d fy, $a + n(20 - a) = 40$ ...(1)

For oxygen(vkWDlhtu d fy,)

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

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

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

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

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

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

from (1) & (2)

$a = 10$

$n = 3$

C_3H_4

% composition (% l?kVu) $\rightarrow$ 50%

27. $CaCl_2 \rightarrow 5M = 555$ g in 1 L solution or in 1050g solution

($CaCl_2 \rightarrow 5M = 1$ L foy;u ;k 1050g foy;u e 555g)

wt. of (solvent + $MgCl_2$) = 1050 – 555 = 495 g

((foyk;d + $MgCl_2$) dk Hkkj = 1050 – 555 = 495g)

$MgCl_2 \rightarrow 5\ m$

1000 g solvent $\rightarrow$ 5 mol of $MgCl_2$

(1000 g foyk;d $\rightarrow$ $MgCl_2$ d 5 eky)

$= 5\times95 = 475$ g $MgCl_2$

i.e., 1475 (solvent + $MgCl_2$) $\rightarrow$ 475g $MgCl_2$

(vFkkr, 1475 (foyk;d + $MgCl_2$) $\rightarrow$ 475g $MgCl_2$)

495 (solvent + $MgCl_2$) $\rightarrow \dfrac{475}{1475}\times495$

= 159.4 g $MgCl_2$

(495 (foyk;d + $MgCl_2$)

moles of $MgCl_2$ ($MgCl_2$ d eky) $= \dfrac{159.4}{95} = 1.678$

Total moles of Cl^- (Cl^- d dy eky)

= (5 + 1.678) x 2 = 13.356

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

Molarity of Cl^- (Cl^- dh ekyjrk) = 13.356 M