

# 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 x\$ dk vk; ru) = 22.4 L

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

$$1 \text{ mol Al}^{3+} \text{ ion} = N_A \times 3$$

Charge (e) on 1 mol  $\text{Al}^{3+}$  ion =  $N_A \times 3 \times e$  columb.(1  $\text{Al}^{3+}$  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 (v.fkr~eky cjkcj gksus ij v.kvka dh I ; k Hkh cjkcj gksrh g\$)8. Mole of Al =  $\frac{\text{wt}}{\text{At wt}} = \frac{54}{27} = 2\text{mol}$ 

that is same for Mg atom (; g Mg ijek.kq ds fy, Hkh I eku g\$)

$$\text{So mol of Mg} = \frac{\text{wt}}{24}$$

$$\text{wt} = 2 \times 24 = 48 \text{ g.}$$

10. No. of oxygen atom = mole  $\times$   $N_A$   $\times$  atomicity.  
(vkDI htu ijek.kq ds I ; k =  $\text{eky} \times N_A \times \text{ijek.kprk}$ )

$$(A) = \frac{1}{16} \times N_A \times 1 = \frac{N_A}{16}$$

$$(B) = \frac{1}{32} \times N_A \times 2 = \frac{N_A}{16}$$

$$(C) = \frac{1}{48} \times N_A \times 3 = \frac{N_A}{16}$$

all are same.

11.  $(\text{NH}_4)_3\text{PO}_4$   
12 mol hydrogen atom contain = 4 atom of oxygen  
(12  $\text{eky}$  gkbMst u ijek.kq eag\$ 4 ijek.kqvkDI htu ds)

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

3.18 mol hydrogen atom contain (3.18  $\text{eky}$  gkbMst u

$$\text{ijek.kq ea g$} = \frac{4}{12} \times 3.18 = 1.08 \text{ mole}$$

12. Mass of 1  $e^-$  (1  $e^-$  dk ;e0; eku) =  $9.31 \times 10^{-31}$  kg

$$1 \text{ kg} = \frac{1}{9.31 \times 10^{-31} \times 6.02 \times 10^{23}}$$

$$= \frac{10^8}{9.31 \times 6.023}$$

13. 100 g compound contain (100 g ; k\$xd eag\$ = 5.37 g Nitrogen (ukbVst u)

$$1 \text{ g Nitrogen} = \frac{100}{5.37} \times 14 = 260.7$$

15.  $\text{H}_2$  : He :  $\text{O}_2$  :  $\text{O}_3$   
no. of atoms =  $2N_A$  :  $1N_A$  :  $2N_A$  :  $2N_A$   
ijek.kvka dh I ; k

$$= 2 : 1 : 2 : 3$$

16.  $^{63}\text{Cu}$   $^{65}\text{Cu}$   
% abundance(% i kfr) x 100 - x

$$\text{Avg. mass (vk$ r ;e0; eku)} = \frac{M_1x_1 + M_2x_2}{x_1 + x_2}$$

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

$$6354.6 = 63x + 6500 - 65x$$

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

17. % by wt. of  $\text{H}_2\text{O}$  ( $\text{H}_2\text{O}$  ds Hkj %) )

$$= \frac{\text{wt. of } \text{H}_2\text{O} (\text{H}_2\text{O} \text{ dk Hkj})}{\text{Total wt. of compound} (; k$xd dk d$y Hkj)} \times 100$$

$$13 = \frac{18x}{18x + 120} \times 100$$

$$x = 1$$

18. % Mol Simple ratio (I jy vuqkr)

C 85.7  $85.7/12 = 7.14$   $7.14/7.14 = 1$  1H 14.3  $14.3/1 = 14.3$   $14.3/7.14 = 2$  2 $\therefore$  Empirical formal (enykuq krh I #) =  $\text{CH}_2$  $\therefore$  PMw = DRT

$$M_w = \frac{\text{DRT}}{P} = \frac{2.5 \times 0.821 \times 273}{1} = 56$$

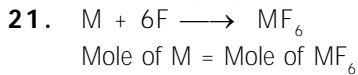
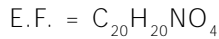
$$n = \frac{\text{Molecular wt. (vkf. od Hkj)}}{\text{Ewt. (enykuq krh Hkj)}} = \frac{56}{14} = 4$$

Molecular formula (vkf. od I #) =  $n \times \text{E.F.}$

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

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

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  $\text{Cl}^-$  ( $\text{Cl}^-$  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  $\text{NO}_3\text{PO}_4$  ( $\text{NO}_3\text{PO}_4$  ds elsy) =  $20 \times .40$

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

$\text{Na}_3\text{PO}_4$  contain  $3\text{Na}^+$  ion ( $\text{Na}_3\text{PO}_4$  e03 $\text{Na}^+$  vk; u gš)

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

27. Molality of  $\text{H}_2\text{SO}_4$  is 9 ( $\text{H}_2\text{SO}_4$  dh elsyjrk 9 gš)

i.e. 9 mole of  $\text{H}_2\text{SO}_4$  in 1 kg solvent (vFkr ~1 kg foyk; d e0 elsy  $\text{H}_2\text{SO}_4$  gš)

1 kg solvent contain = 9 mole  $\text{H}_2\text{SO}_4$  (1 kg foyk; d ea gš = 9 mole  $\text{H}_2\text{SO}_4$ )

1 kg solvent contain =  $9 \times 98$  wt of  $\text{H}_2\text{SO}_4$  (1 kg foyk; d ea gš =  $9 \times 98$  wt  $\text{H}_2\text{SO}_4$ )

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  $\text{H}_2\text{SO}_4$  ( $\text{H}_2\text{SO}_4$  dh elsyjrk) = .2 mol/kg

.2 mol  $\text{H}_2\text{SO}_4$  then wt (.2 elsy  $\text{H}_2\text{SO}_4$  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 (ekyjrk)

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

$$\text{mol of solution (foyy; u ds ely)} = \frac{100 \times 10^{-3}}{.8}$$

$$= 125 \text{ mL}$$

33. Moles of solute (foys ds ely)

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

concentration of solution (foyy; u dh l lark)

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

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

## Exercise-02

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

$$38.5\% \left(\frac{w}{w}\right) \text{Ag} \text{ vflkr } 100 \text{ g foyy; u ea } 38.5 \text{ g Ag}$$

Molarity (ekyjrk)

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

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

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

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

$$\text{Mass (æl; eku) \%} = 0.04$$

3. Molarity (ekyjrk)

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

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

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

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

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

6. Molality (ekyyrk)

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

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

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

7 mol 6 mol

1

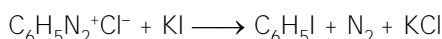
$$210 \quad \frac{6}{7} \times 210 = 180 \text{ m mol}$$

11.  $\text{KClO}_3 \xrightarrow{\Delta} \text{KCl} + \frac{3}{2} \text{O}_2$ 1 mole  $\frac{3}{2}$  mol

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

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

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

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

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

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

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

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

% 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)	% (eky dk vujkr)	Ratio of mol (l jyre)	Simplest
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 = C<sub>3</sub>H<sub>6</sub>N<sub>2</sub>

atomic mass (ijekf.od æ0; eku) = 70

molar mass (ekyj æ0; eku) = 140

15.

	mole (eky)	simple ratio (l jy vujkr)
% X	50	50/10 = 2
% Y	50	50/20 = 1

E.F = X<sub>2</sub>Y

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

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

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	$\frac{9.8}{32} \times N_A$
% 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

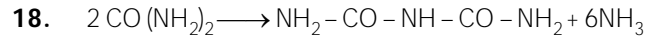
∴ 1 atom of Na contain (Na ds 1 i jek.k ea gš) = 3 atom of N

∴  $\frac{7}{23} \times N_A$  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

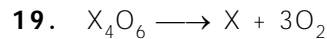


2 molecule  $\longleftarrow$  1 molecule

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

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

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

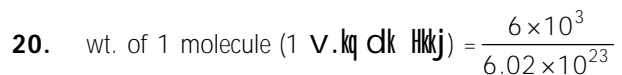


$4x \text{ n}_x\text{O}_6 = n_x$

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

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

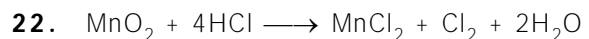
$17.12x = 549.12 \quad x = 32 \text{ amu}$



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

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

=  $9.1 \times 10^{-21} \text{ cc}$



L.G

$4 \times 36.5 \longrightarrow 71$

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

23. molality (ekyyrk)

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



$3 \longrightarrow 4$

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

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

25. % by wt. of H<sub>2</sub>O (H<sub>2</sub>O ds Hkkj dk %)

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

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

$$71 + 9x = 18x$$

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

26. wt. of carbon =  $21 \times 12$  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)

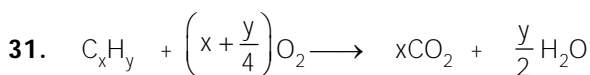
10% (v/v) NaOH i.e. 100 ml contain 10 mL NaOH

density ( $\rho$ ) 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 ;



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

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

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

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

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

$$x < 5$$

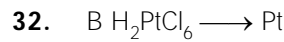
put the value (eku j [kus i j)

if  $x = 3$

$$10 = 5y/4$$

$$y = 8$$

Ans is  $\text{C}_3\text{H}_8$



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

Mass of solute (f o y s d k æ 0 ; e k u) = 23 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)  $5 \text{ M} = \frac{\text{Mass of solute (f o y s d k æ 0 ; e k u) / 46}}{46 / 1000}$

Mass of solute (f o y s d k æ 0 ; e k u) = 10.58 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  $\text{K}_2\text{SO}_4$  ( $\text{K}_2\text{SO}_4$  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  $\text{K}_2\text{O}$  form 13.42 mole of K ( $\text{K}_2\text{O}$  ds esky K ds  
13.42 esky cukrs g\$) =  $\frac{13.42}{2} = 6.71$   
mass of  $\text{K}_2\text{O}$  ( $\text{K}_2\text{O}$  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 #)  
 $\text{C}_6\text{H}_{10}\text{CaO}_6$   
 $\text{CaO}_6\text{C}_6\text{H}_{10}$
- Formula weight (I # Hkkj)
  - The molecular mass of lactate pentahydrate = 308  
(yDVV iDVkgbM\$ 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 iitr 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  $\text{Fe}_3\text{Br}_8$  ( $\text{Fe}_3\text{Br}_8$  ds esky) =  $\frac{100 \times 2.06 \times 10^6}{103 \times 70 \times 8}$

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

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

$$\text{mass of Fe} = 10^3 \text{ kg}$$

- mole of  $\text{CO}_2$  ( $\text{CO}_2$  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. =  $\text{CH}_3\text{O}$   
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.  $\text{Ba(OH)}_2$  is remaining, therefore nature



of sol. basic.

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

2. Vol. of Ba(OH)<sub>2</sub> (Ba(OH)<sub>2</sub> dk vk; ru)

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

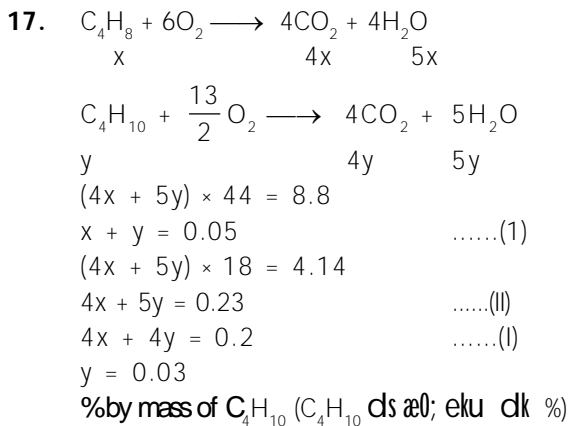
$$\text{mole of OH}^- (\text{OH}^- \text{ ds esy}) = 0.2 \times 2 = 0.4$$

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

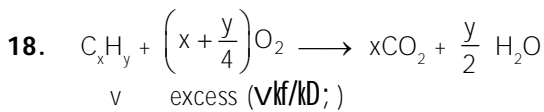
### Exercise-4(A)

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<sub>A</sub>  
Cl = 1 × N<sub>A</sub>  
O = 1 × N<sub>A</sub>
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 vfkldjd)
- $$m_{\text{CaCO}_3} = \frac{0.5}{3} \times M_{\text{Ca}_3(\text{PO}_4)_2} = 51.66 \text{ gm}$$
- $$m_{\text{H}_3\text{PO}_4} = 0.3808 \times M_{\text{H}_3\text{PO}_4} = 31.31 \text{ gm}$$
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 (iflr) =  $\frac{14.781}{19.417} \times 100 = 76.125\%$
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.  $\text{BaO} + \text{CaO}$   
 $x \times [153] + y \times [56] = 28 \quad \dots\dots(I)$   
 $\text{BaO} + 2\text{HCl} \longrightarrow \text{BaCl}_2 + \text{H}_2\text{O}$   
 $x \quad 2x$   
 $\text{CaO} + 2\text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2\text{O}$   
 $y \quad 2y$   
 $2x + 2y = 6 \times 0.1008 = 0.6048 \quad \dots\dots(II)$   
% 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.  $\text{C}_n\text{H}_{2n+2} + \frac{(3n+1)}{2}\text{O}_2 \longrightarrow n\text{CO}_2 + (n+1)\text{H}_2\text{O}$   
 $\frac{(3n+1)/2}{n} = \frac{7}{4} \Rightarrow 6n+2=7n \Rightarrow n=2 \quad \text{C}_2\text{H}_6$



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

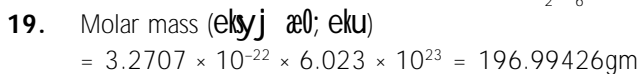


$$\left(x + \frac{y}{4}\right)v \quad xv \quad \frac{y}{2}v$$

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

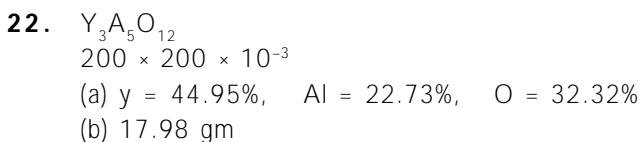
$$\frac{y}{4} = 1.5 \Rightarrow y = 6$$

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

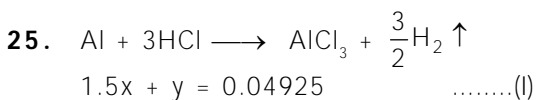
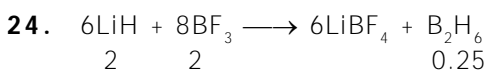


20.  $M = \pi \times (75 \times 10^{-8} \text{ cm})^2 \times (5000 \times 10^{-8} \text{ cm})$   
 $\times \frac{1}{0.75 \text{ cm}^3 / \text{gm}} \times 6.023 \times 10^{23} = 7.09 \times 10^7 \text{ gm}$

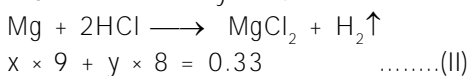
21.  $\frac{M_{\text{gas}}}{M_{\text{air}}} = 1.17 \Rightarrow M_{\text{gas}} = 1.17 \times 29 = 33.93 \text{ gm}$



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

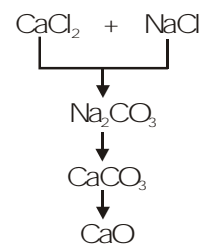


$$1.5x \quad x + 27 + y \times 24 = 1$$



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

$$Mg = 45.4\%$$



26.

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

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

$$m_{NaCl} = 6.7889 \text{ gm}$$

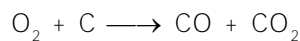
$$\% NaCl = 67.9\%$$

27.

$$n_{O_2} = 625$$

$$n_C = 1 \text{ mole}$$

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



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

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

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

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.

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

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

$$m_{N_2} = 0.0946 \text{ gm}$$

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

31.

(a)  $M = \frac{4/40}{0.2} = 0.5$

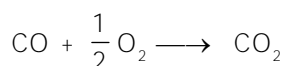
(b)  $M = \frac{5.3/106}{0.1} = 0.5$

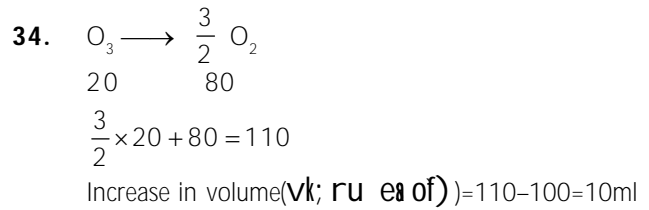
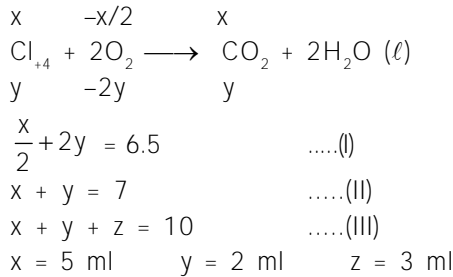
(c)  $M = \frac{0.365/36.5}{0.05} = 0.2$

32.

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

33.





Exercise-4(B)

1. Empirical formula **eykuijkrh l # :**
- |                             |       |       |       |      |                 |
|-----------------------------|-------|-------|-------|------|-----------------|
| = $\text{KAIS}_2\text{O}_8$ | 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 l # Hkj** = 258  
 From weight loss information : 54.4 g anhydrous salt = 45.6 g H<sub>2</sub>O

- (Hkj eadeh dh l puk l s 54.4 g futyh; yo.k = 45.6 g H<sub>2</sub>O)
- ⇒ 258 g anhydrous salt = 216.26 g = 12 mol H<sub>2</sub>O  
 (258 g futyh; yo.k = 216.26 g = 12 esy H<sub>2</sub>O)
- ⇒ Empirical formula of hydrated salt =  $\text{KAIS}_2\text{O}_8 \cdot 12 \text{H}_2\text{O}$   
**ty; kstr yo.k dk eykuijkrh l # = KAIS<sub>2</sub>O<sub>8</sub> · 12 H<sub>2</sub>O**

2. 1.0 mole of KClO<sub>3</sub> = 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; vflkfo; k dsi gysrFlk ckn esfl Yoj esy/ka dk l 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.

(tgkpx feJr vo{kj ea AgBr dk æ0; eku)

⇒  $x = 1.064$

Also, moles of CuBr<sub>2</sub> =  $\frac{1}{2}$  moles of AgBr =  $\frac{1}{2} \times \frac{x}{188}$

(vlj, CuBr<sub>2</sub> ds esy =  $\frac{1}{2}$  AgBr ds esy =  $\frac{1}{2} \times \frac{x}{188}$ )

- ⇒ Mass of CuBr<sub>2</sub> =  $\frac{1}{2} \times \frac{x}{188} \times 223.5 = 0.6324$   
 (on substituting x)

(CuBr<sub>2</sub> dk æ0; eku =  $\frac{1}{2} \times \frac{x}{188} \times 223.5 = 0.6324$   
 (x dk eku j [kusi j])

Mass % of CuBr<sub>2</sub> (CuBr<sub>2</sub> 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 l s iklr 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 l s iklr 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 CuSO<sub>4</sub> · 5H<sub>2</sub>O. (ekukfd feJ.k ea x g CuSO<sub>4</sub> · 5H<sub>2</sub>O. mi flFkr gS)

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

⇒ Mass percentage of CuSO<sub>4</sub> · 5H<sub>2</sub>O (CuSO<sub>4</sub> · 5H<sub>2</sub>O 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 #) =  $\text{CaC}_2\text{N}_2\text{S}_2$ ,

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 #) =  $\text{CaC}_2\text{N}_2\text{S}_2$

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 t 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 l 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  $\text{NaHCO}_3$  into  $\text{Na}_2\text{CO}_3$  : 31 g weight is lost per mole of  $\text{NaHCO}_3$ .

(N a H C O <sub>3</sub> d s N a <sub>2</sub> C O <sub>3</sub> e a i f j o r ù d s d k j . k H k j e a d e h : N a H C O <sub>3</sub> 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  $\text{NaHCO}_3$  producing  $\frac{0.3}{62}$  moles of  $\text{Na}_2\text{CO}_3$ .

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

e k y N a <sub>2</sub> C O <sub>3</sub> 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) =  $15 \times 10^{-3}$

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

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

Mass of  $\text{Na}_2\text{CO}_3$  in original sample (o k l r f o d u e u s e a

$\text{Na}_2\text{CO}_3$  d k æ 0; e k u ) = 1.06 ⇒ 42.4 %  $\text{Na}_2\text{CO}_3$

9. If M is molar mass of  $(\text{CH}_3)_x \text{AlCl}_y$ ; (f n M,  $(\text{CH}_3)_x \text{AlCl}_y$  d k e k y j æ 0; e k u g a)

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

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

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 =  $0.09 \times 143.5 = 12.915 \text{ g}$  which is 95.77 % of total ppt.

(A g C l d k æ 0; e k u =  $0.09 \times 143.5 = 12.915 \text{ g}$  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

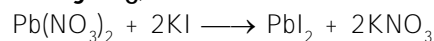
m ( $\text{Na}_2\text{O}$ ) = 1.558 g ⇒ m% ( $\text{Na}_2\text{O}$ ) = 31.16

m ( $\text{K}_2\text{O}$ ) = 1.867 g ⇒ m% ( $\text{K}_2\text{O}$ ) = 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 t r d j u s d s f y, ] f o ; k d k j d 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 k 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  $\text{Pb}(\text{NO}_3)_2$  present

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

⇒  $\frac{x}{2 \times 166} = \frac{5 - x}{330} \Rightarrow x = 2.5 \text{ g} \Rightarrow$  mass of  $\text{PbI}_2$

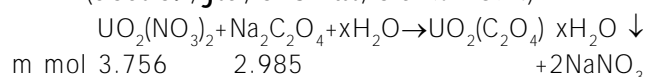
$$= \frac{x}{332} \times 460 = 3.464 \text{ g}$$

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 +2NaNO<sub>3</sub>  
Here  $\text{Na}_2\text{C}_2\text{O}_4$  is the limiting reagent, therefore, m mol of  $\text{UO}_2(\text{C}_2\text{O}_4) \cdot x\text{H}_2\text{O}$  formed is 2.985.

(; gk; Na<sub>2</sub>C<sub>2</sub>O<sub>4</sub> l heklr vflkdežl gš bl idkj fufer UO<sub>2</sub>(C<sub>2</sub>O<sub>4</sub>).xH<sub>2</sub>O 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) [FeSO<sub>4</sub>(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> · 6H<sub>2</sub>O] 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 =  $\frac{0.23}{0.50} \times 100 = 46 \%$ , (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> = 54%

(gy djus ij x = 0.23 g ⇒ ekgj yo.k =  $\frac{0.23}{0.50} \times 100 = 46 \%$ , (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> = 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 Fe<sub>2</sub>O<sub>3</sub> 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 Fe<sub>2</sub>O<sub>3</sub> dk æ0; eku)

15. Smallest volume of AgNO<sub>3</sub> would be required when the entire mass is due to highest molecular weight constituent.

(AgNO<sub>3</sub> 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 BaCl<sub>2</sub> · 2H<sub>2</sub>O

(vr%U; ure vk; ru dsfy, . BaCl<sub>2</sub> · 2H<sub>2</sub>O dk l Ei wkl æ0; eku gkuk plfg, A)

m mol of BaCl<sub>2</sub> · 2H<sub>2</sub>O =  $\frac{0.3}{244} \times 1000 = 1.229 \text{ m mol}$   
 m mol of AgNO<sub>3</sub> required =  $2 \times 1.229 = 2.458$  (vko'; d AgNO<sub>3</sub> ds m mol)

Volume of AgNO<sub>3</sub> required =  $\frac{2.458}{0.15} = 16.38 \text{ mL}$  (smallest)

(vko'; d AgNO<sub>3</sub> dk vk; ru =  $\frac{2.458}{0.15} = 16.38 \text{ mL}$  (U; ure))

Largest volume of AgNO<sub>3</sub> would be required when entire mass is due to lowest molecular weight constituent, i.e., NaCl.

(AgNO<sub>3</sub> 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)

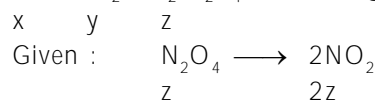
m mol of NaCl =  $\frac{0.3}{58.5} \times 1000 = 5.128 = \text{m mol of AgNO}_3 \text{ required}$

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

⇒ Volume of AgNO<sub>3</sub> required =  $\frac{5.128}{0.15} = 31.18 \text{ mL}$  (largest)

(vko'; d AgNO<sub>3</sub> dk vk; ru =  $\frac{5.128}{0.15} = 31.18 \text{ mL}$  (vfl/dre))

16. Mixture (N<sub>2</sub>, NO<sub>2</sub>, N<sub>2</sub>O<sub>4</sub>) has mean molar mass = 55.4. (feJ.k (N<sub>2</sub>, NO<sub>2</sub>, N<sub>2</sub>O<sub>4</sub>) 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]

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

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

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

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

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

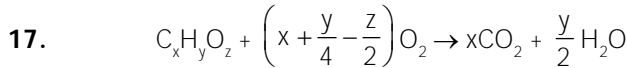
eq. (2)  $\times$  1 ..... eq. (3)  $\times$  28

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

$$[y = 0.1]$$

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

$$[x = 0.5]$$



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  $CO_2$ .  
(KOH dk xqk l Ei wlk  $CO_2$  dks vo'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)

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

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

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

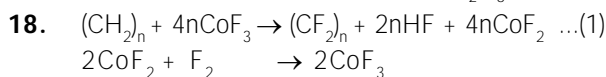
$$y + 16z = 22 \quad \dots(2)$$

from eq. (1) & (2)

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

$$[z = 1], [y = 6]$$

Molecular formula (vlf.od l #) =  $C_2H_6O$ .



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

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

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

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

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

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

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

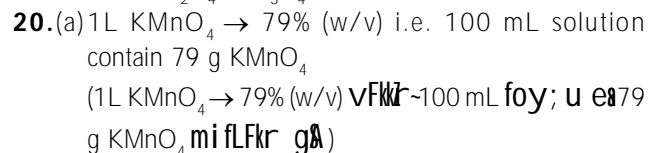
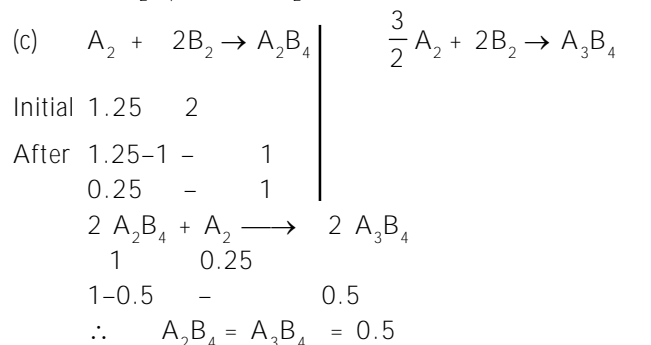
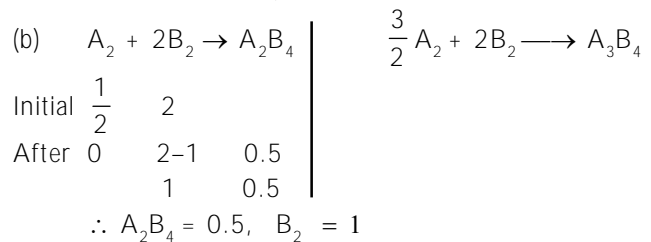
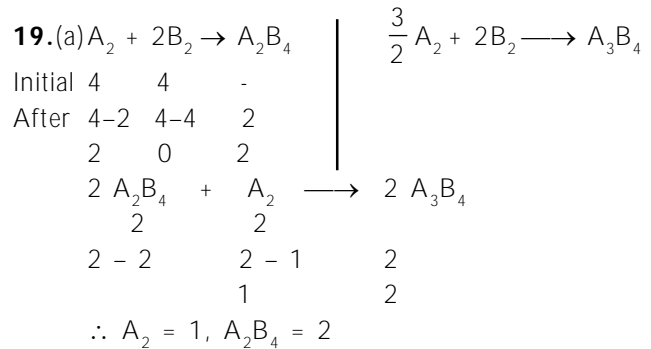
$$= 80 \times 97 \rightarrow \frac{1 \times 38}{2 \times 97} \times 80 \times 97 = 1520 \text{ g} = 1.52 \text{ kg.}$$

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

$$40 \quad 20$$

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

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



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

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

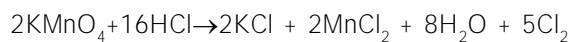
$$\text{Molarity (esyjrk) (M)} = \frac{0.5}{100} \times 1000 = 5M$$

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  $\text{SO}_3 \rightarrow xg$ )

$\text{SO}_3$  in form of  $\text{H}_2\text{SO}_4$  ( $\text{H}_2\text{SO}_4$  ds : i ea  $\text{SO}_3$ )

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

so total (vr% dy)

$$x + 1.225 x = 100$$

$$x = 449.49$$

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

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

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

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

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 =  $40 \times 0.875 = 35g$

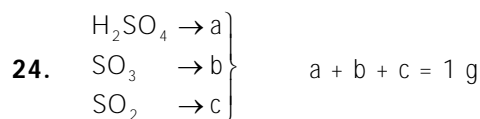
(ol k dk æ0; eku =  $40 \times 0.875 = 35 g$ )

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

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

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

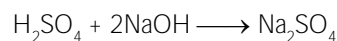
$$\rho = \frac{1000}{960} = 1.0416 \text{ g/mL}$$



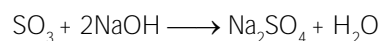
$\text{SO}_2 \rightarrow 1.5\%$

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

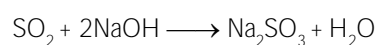
$a + b = 0.985 g$



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



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



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

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

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

$$a + 1.225 b = 1.1275$$

$$a + b = 0.985$$

$$0.225 b = 0.1425$$

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

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

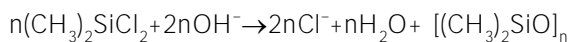
$$\text{Combined (I a Qr) SO}_3 = \frac{0.3514}{98} \times 80 = 0.2868\text{g}$$

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

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

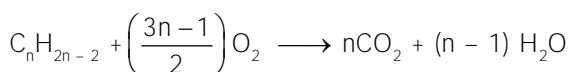
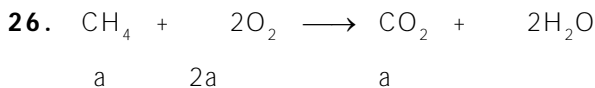
$$\rho = 1 \text{ g/cm}^3$$

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



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

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



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

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  $\text{Cl}^-$  ( $\text{Cl}^-$  ds dy ely)

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

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

Molarity of  $\text{Cl}^-$  ( $\text{Cl}^-$  dh ely jrk) = 13.356 M