

Gas laws

1. $X: t_1 = 28.3 \text{sec}$ $RMM = ?$
 $Q_2: t_2 = 20.0 \text{sec}$ $RMM = 32$

$$T \mu \quad MM \quad P$$

$$\frac{T_1}{T_2} = \frac{X}{32}$$

$$\frac{T_1^2}{T_2^2} = \frac{X}{32} P$$

$$\frac{28.3^2}{20^2} = \frac{X}{32} P$$

$$X = \frac{28.3^2 \times 32}{400} P$$

$$X = 64 P$$

2. (a) *The rate of diffusion of a gas is inversely proportional to the square root of its density under the same conditions of temperature and pressure*
 (b) Rate of gas $V = \frac{1}{5} \times \frac{100 \text{cm}}{10 \text{sec}}$

$$\begin{aligned} &= 2 \text{cm/sec} \quad P^{1/2} \\ \text{Rate of } W &= \frac{10 \text{cm}}{10 \text{sec}} \\ &= 1 \text{cm/sec} \quad P^{1/2} \end{aligned}$$

$$\frac{RV}{RW} = \frac{MW}{MV} = \frac{2}{1} = \frac{MW}{16}$$

$$2^2 = \frac{MW}{16}$$

$$\begin{aligned} \frac{4}{1} &= \frac{MW}{16}; = \frac{4}{1} \times 16 \\ MW &= 64 \end{aligned}$$

3. (a) *The volume of a fixed mass of a gas is directly proportional to its absolute temperature at constant Pressure*
 (b) Apply combined gas law; $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$$V_1 = 3.5 \times 10^{-2} \text{m}^3 \quad V_2 = 2.8 \times 10^{-2} \text{m}^3$$

$$P_1 = 1.0 \times 10^5 \text{ Pa} \quad P_2 = 1.0 \times 10^5 \text{ Pa} \quad P^{1/2}$$
$$T_1 = 291 \text{ K} \quad T_2 = ?$$

$$T_2 = \frac{P_2 V_2 T_1}{P_1 V_1}$$

$$T_2 = \frac{1.0 \times 10^5 \text{ Pa} \times 2.8 \times 10^{-2} \text{ m}^3 \times 291 \text{ K}}{1.0 \times 10^5 \text{ Pa} \times 3.5 \times 10^{-2} \text{ m}^3}$$

$$T_2 = 232.8 \text{ K} \quad P$$

4. $T_{SO_2} = \frac{R.M.N.SO_2}{P^{1/2}}$

$$TO_2 \quad R.M.MO_2$$

$$SO_2 = 32 + (16 \times 2) = 64 P^{1/2}$$

$$O_2 = (16 \times 2) = 32 P^{1/2}$$

$$TsO_2 = \frac{64}{50} P^{1/2} = 70.75 P^{1/2}$$

5. a) *The rate of diffusion of a fixed mass of a gas is inversely proportional to the square root of its density at constant temperature and pressure*

b) $RHCl = \frac{30cm^3}{20 se} = 1.5 cm^3 \quad see$

$$\frac{RHCL}{RSO_2} = \frac{\sqrt{MSO_2}}{\sqrt{MHCL}}$$

$$\frac{(1.5)^2}{(RSO_2)^2} = \frac{\sqrt{64}}{\sqrt{36.5}}$$

$$RSO_2 = \sqrt{2.25 \times 36.5}$$

$$(RSO_2)^2 = \frac{2.25 \times 36.5}{64}$$

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6. a) *Boyles' law For a fixed mass of a gas, volume is inversely promotional to pressure at constant temperature*

b)

$$c) \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad V_2 = \frac{P_1 V_1}{P_2} \times \frac{T_2}{T_1}$$

$$= \frac{250 \times 273 - 23}{273 + 127} \quad \text{Ö } 1/2$$

$$= 156.5 cm^3$$

7. a) *RFM of CaCO₃ = 40 + 12 + 48 = 100kg. ^{√/2}*

$$\therefore 100 kg \text{ of } CaCO_3 \equiv 22.4 dm^3 \text{ of } CO_2(g)$$

$$\begin{aligned} & 1000 \text{ kg } \text{''} \text{''} \quad ? \\ & = \frac{22.4 \times 1000}{100} \sqrt{l} = 224 \text{ dm}^3 \sqrt{l/2} \end{aligned}$$

8. $T_1 = 23 + 273 = 296$ $T_2 = -25 + 273 = 248$
 $V_1 = 200 \text{ cm}^3$ $V_2 = ?$
 $P_1 = 740 \text{ mmHg}$ $P_2 = 780 \text{ mmHg}$
 $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$$\frac{740 \times 200}{296} \sqrt{1} = \frac{780 \times x}{248} \sqrt{1}$$

$$\sqrt{x} = \frac{740 \times 200 \times 248}{296 \times 780}$$

$$= 158.974 \text{ cm}^3 \sqrt{1} \text{ (penalize } \frac{1}{2} \text{ mark for units)}$$

9. $\frac{Rk}{R_s} = \frac{\sqrt{M_s}}{\sqrt{M_k}}$

$$\sqrt{\frac{12}{7.2}} = \frac{\sqrt{16}}{\sqrt{M}}$$

$$X = \frac{12^2}{7.2^2} \times 16 \sqrt{\frac{1}{2}}$$

$$= 44.464 \sqrt{\frac{1}{2}}$$

10. (a) When gases combine they do so in volume which bear a simple ratio to one another and to the product if gaseous under standard temperature and pressure

11. a) Rate of diffusion is whereby proportional to molecular mass of a gas. $\sqrt{1}$

b) $\frac{T_{CO_2}}{T_{CO}} = \frac{M_{CO_2}}{M_{CO}} \sqrt{\frac{1}{2}}$

$$\Rightarrow 200 = \frac{44}{28} = \frac{44}{28} \sqrt{\frac{1}{2}}$$

$$\Rightarrow \frac{200}{T} = \frac{11}{7}$$

$$\Rightarrow T = \frac{200 \times 7}{11}$$

$$\Rightarrow T = 200 \times 0.79772 \sqrt{\frac{1}{2}} = 159.5 \text{ Seconds. } \sqrt{\frac{1}{2}}$$

12. a) $Y \sqrt{1}$

b) Z and W $\sqrt{1}$ have same atomic number but different mass number. $\sqrt{1}$

13. (a) Gas P

(b) $\frac{RQ}{RP} = \frac{RMP}{RMMQ}$

$$\frac{18}{54} = \frac{x}{17}$$

$$\frac{1^2}{3^2} = \frac{x}{17}$$

$$L = x$$

$$9x = 17$$

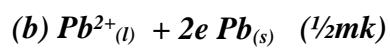
$$9x = 17$$

$$x = \frac{17}{9}$$

$$x = 1.88$$

$$Q = It$$

$$= 5 \times 386 = 1930C$$



$$\text{If } 2 \times 96500C = 207 \quad (\frac{1}{2}mk)$$

$$1930C = \frac{1930 \times 207}{2 \times 96500} \quad (\frac{1}{2} mk)$$

$$= \frac{399510}{193000C} \quad (\frac{1}{2}mk)$$

$$= 2.07g \quad (\frac{1}{2}mk)$$

14. i) Delocalized electrons
 ii) Mobile ions
 iii) Mobile ions

15. $\frac{TNH_3}{TB} = \frac{MNH_3}{MB} \ddot{O} \frac{1}{2}$

$$\frac{TNH_3}{TB} = \frac{17}{34}$$

$$\frac{TNH_3}{110} = \frac{17}{34} \ddot{O} \frac{1}{2}$$

$$TNH_3 = 110 \times \frac{17}{34} \ddot{O} \frac{1}{2} = 77.78 \text{ seconds } \ddot{O} \frac{1}{2}$$

16. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$$\frac{1 \times 5}{246} = \frac{2 \times V_2}{400}$$

$$V_2 = \frac{400 \times 1 \times 5}{2 \times 246}$$

$$= 4.065 \text{ dm}^3$$

17. a) $V_1 = 200 \text{ cm}^3$ $V_2 = ?$
 $T_1 = 296 \text{ K}$ $T_2 = 284 \text{ K}$
 $P_1 = 740 \text{ mmHg}$ $P_2 = 780 \text{ mm Hg}$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{740 \text{ mmHg} \times 200 \text{ cm}^3 \times 284 \text{ K}}{296 \text{ K} \times 780 \text{ mm Hg}}$$

$$= 158.97 \text{ cm}^3$$

b) 60 l **P1**

18. a) Grahams law states
 Under the same conditions of pressure and temperature, the rate of diffusion of a gas is inversely proportional to the square root of its density

b) $\frac{\text{Time } CO_2}{\text{Time } NO_2} = \frac{\sqrt{M_r CO_2}}{\sqrt{M_r NO_2}}$

Where 100cm³ of CO₂ takes 30 seconds
 \ 150cm³ of CO₂ takes $\frac{30}{100} \times 150$
 = 45 seconds $\sqrt{}$

$$\underline{45}^2 = 0.975$$

TNO_2

$$\underline{45} \underline{\quad} = \underline{0.44} \quad \underline{\quad} TNO_2 = \underline{45}$$

$$TNO_2 \quad 46 \quad \quad \quad 0.978$$

$$TNO_2 = 46 \text{ sec}$$

OR

$$\underline{RCO_2} = \underline{0.44} \underline{NO_2}$$



$$\text{But } RCO_2 = \frac{100\text{cm}^3}{30\text{ s}} = 3.33\text{ cm}^3 \text{ per sec}$$

$$\frac{3.33}{RNO_2} = \frac{0.46}{44}$$

$$= 1.0225$$

$$RNO_2 = \frac{3.33}{1.0225}$$

$$= 3.26\text{ cm}^3 \text{ per second}$$

$$\text{Time for No} = \frac{150\text{cm}^3}{3.26\text{cm sec}^{-1}} = 46\text{ secs}$$

1. When a magnesium ribbon is heated in air it combines with oxygen forming magnesium oxide. When potassium manganate (VII) is heated it decomposes giving off oxygen which escapes in air

2. RFM of NaOH = 40
 Moles of NaOH = $\frac{8}{40} = 0.2M_P$

Moles of NaOH in 25cm³

$$\frac{25 \times 0.2}{1000} = 0.005_P$$

Mole ratio 1:2

$$\text{Moles of acid} = \frac{0.005}{2}$$

$$= 0.0025$$

$$\frac{1 \times 0.245}{0.0025} = 98 \quad P$$

3. No. Of moles of HNO₃ acid

$$\frac{50 \times 2}{1000} = 0.1\text{moles}$$

Mole ratio 1:1 P

$$\text{The KOH will have } 0.1\text{moles; } \frac{0.1 \times 100}{50} = 0.2\text{moles}$$

$$\text{Then D grams is } 0.2 \times 56$$

$$= 11.2\text{g}$$

4. Number of moles of Q = $\frac{960\text{cm}^3 \times 1\text{mole}}{24000\text{cm}^3}$

$$= 0.04 \text{ moles}$$

Equation:



Mole ratio $\text{Na}_2\text{SO}_3 : \text{SO}_2$ is 1:1

\ No. of moles of $\text{Na}_2\text{SO}_3 = 0.04$ moles

**Mass of $\text{Na}_2\text{SO}_3 = 126 \text{ g mol}^{-1} \times 0.04$
 $= 5.04 \text{ g}$**

5. **From the equation**

- (3x24) litres of chlorine react with iron to produce [(56 x 2) + (35.5 X3)] g of FeCl_3 .

325 g of $FeCl_3$ is produced by 72 litres of Cl_2

Then 0.5g of $FeCl_3$ is produced by:

$$\frac{0.5 \times 72}{325} = 0.11078 \text{ litres}$$

$$= 110.78 \text{ cm}^3$$

6. $RMM (CH_3OOH) = 60$ $P^{1/2}$ $P^{1/2}$

Mass of 15 cm^3 and = $1.05 \times 15 = 15.75 \text{ g}$

Moles in 500 cm^3 solution = $\frac{15.75}{60} = 0.2625$ P^1

$$\text{Molarity} = \frac{1000 \times 0.2625}{5000} = 0.525 \text{ M } P^{1/2}$$

7. If $24000 \text{ cm}^3 = 1 \text{ mole}$

$150 \text{ cm}^3 = ?$ P

$$\frac{150 \times 1}{24000} = 0.00625 \text{ moles of } CO_2$$

Since the ratio of Na_2CO_3 ; O_2 produced is 1:1 the mass of $Na_2CO_3 = 0.00625 \times 106 = 0.6625 \text{ g}$

Na_2CO_3	H_2O
Mass 0.6625g	1.0125g
RFM 106	18
Mole 0.6625 = $\frac{0.00625}{106}$	$\frac{1.0125}{18} = 0.5625$
Ratio $\frac{0.00625}{0.00625} = 1$	$\frac{18}{0.05625} = 9$
$Na_2CO_3 \cdot 9H_2O$	

8. $MgCl_2$ $Mg^{2+}_{(s)} 2Cl^-$

$$R.F.M \text{ of } MgCl_2 = 24 + 71 = 95$$

Moles of Mass = $\frac{1.7}{95}$

$$\frac{R.F.M}{95} = 0.01789 \text{ moles}$$

1 mole of $MgCl_2 = 2 \text{ moles of } Cl^- \text{ ions}$

$$0.01789 \text{ moles of } MgCl_2 = 0.01789 \times 2 = 0.03478 \text{ moles of } Cl^- \text{ ions}$$

1mole = 6.0×10^{23} ions

$$0.03578 \text{ moles} = \frac{0.03578 \times 6.0 \times 10^{23}}{1}$$

$$= 2.1468 \times 10^{22} \text{ ions of } Cl^-$$

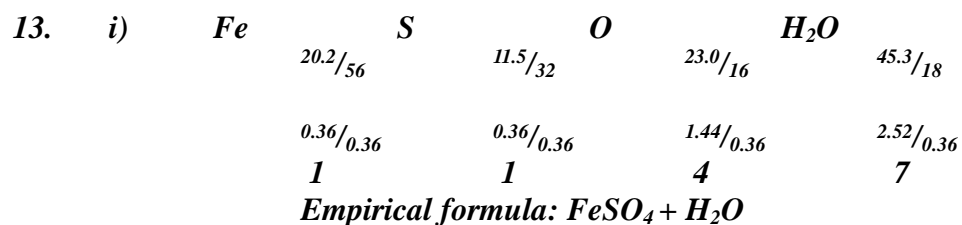
12. $Mass\ of\ O_2 = (4.0 - 2.4) = 1.6g$
 $Moles\ of\ O_2 = \frac{1.6}{16} = 0.1$

If 1 mol O_2 _____ $24000cm^3$
 $0.1\ Mol\ Mg = 0.5\ mol\ o_2 = 1200cm^3$

OR

$2mg$:	O_2
$2(24)$		24000

$$X = \frac{2.4/2(24)}{2(2.4)} = \frac{x/240000}{2(2.4)} = 1200\text{cm}^3$$



ii) $6.95\text{g} = \frac{6.95}{278} = 0.025$
 \backslash $0.05 \text{ moles in } 250\text{cm}^3 = 0.025 \times \frac{1000}{250} = 0.1$

14. R.F.M of $PbI_2 = 207 + (127 \times 2) = 461$
 2 moles of Ions produces 1 mole of PbI_2
 Moles of Ions = $\frac{0.1 \times 300}{1000} = 0.03$ mole
 Mole ratio PbI_2 : I = $\frac{0.03}{2} = 0.015$
 Mole of PbI_2 formed = $\frac{0.03}{2} = 0.015$
 Mass of PbI_2 formed = $0.015 \text{ mole} \times 461 = 6.915 \text{ g}$

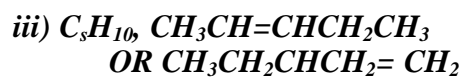
d(i) Yellow precipitate

15. a) i) ii) At 25°C, sodium chloride is in solid form. Ions cannot move. Between 801 and 1413°C sodium chloride is in liquid state, ions are mobile
- b) Both ammonia and water are polar molecules and hydrogen bonds are formed
- c) N _____ H // co-ordinate bond / Dative bond
- d) i) Allotrope
- ii) Add methylbenzene to soot in a beaker. Shake and filter. Warm the filtrate to concentrate it. Allow the concentrate to cool for crystals to form. Filter to obtain crystals of fullerene
- iii) $\frac{720}{12} = 60$

16. Mass of $O_2 = (4.0 - 2.4) = 1.6 \text{ g}$
 Moles of $O_2 = \frac{1.6}{16} = 0.1$

If 1 mol O_2 _____ 24000 cm³
 0.1 Mol $O_2 = 0.1 \text{ mol } O_2 = 1200 \text{ cm}^3$
 OR
 $\frac{2.4}{2(24)} = \frac{x}{24000}$
 $X = \frac{2.4 \times 24000}{2(2.4)} = 1200 \text{ cm}^3$

17. i) C_nH_{2n} , where n = No. of carbon atoms
 ii) 70



18.	i)	Fe	S	O	H₂O
		20.2/56	11.5/32	23.0/16	45.3/18
		0.36/0.36	0.36/0.36	1.44/0.36	2.52/0.36
		1	1	4	7

Empirical formula: $FeSO_4 + H_2O$

$$\begin{aligned}
 \text{ii) } 6.95\text{g} &= \frac{6.95}{278} = 0.025 \\
 \backslash \quad 0.05 \text{ moles in } 250\text{cm}^3 &= 0.025 \times \frac{1000}{250} = 0.1 \\
 \text{Concentration} &= \frac{6.95}{278} \times \frac{1000}{250} = 0.1
 \end{aligned}$$

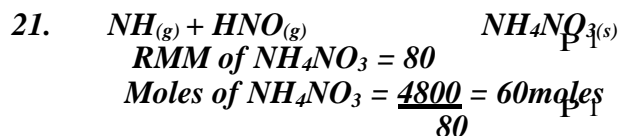
19. a) Zinc is more reactive// higher reduction potential than copper it will react with// get oxidized in preference to iron oxygen to form Zinc Oxide coat which protects iron from rusting
 ii) Sacrificial protection or cathodic protection

$$\begin{aligned}
 20. \quad \text{Mole of Mg that reacted} &= \frac{\text{Answer in (c)(ii)} \times 2}{1000} \\
 &= \frac{26}{1000} = 0.026 \checkmark^{1/2}
 \end{aligned}$$

$$\begin{aligned}
 \text{Mass of Mg in the alloy} &= 0.026 \times 24 \\
 &= 0.624\text{g} \checkmark^{1/2}
 \end{aligned}$$

$$\begin{aligned}
 \text{Mass Cu in the alloy} &= (1.0 - 0.624) \\
 &= 0.376\text{g} \checkmark^{1/2}
 \end{aligned}$$

$$\begin{aligned}
 \% \text{ of Cu} &= \frac{0.376}{1.0} \times 100 \\
 &= 37.6\% \checkmark^{1/2}
 \end{aligned}$$



$$\begin{aligned}
 \text{RMM of } \text{NH}_3 &= 17 \\
 \text{Mass of } \text{NH}_3 &= 60 \times 17 = 1020\text{kg}
 \end{aligned}$$

22. From the equation of step 3



$$\text{RFM of } \text{H}_2\text{S}_2\text{O}_7 = 2 + (2 \times 32) + (7 \times 16) = 178 \checkmark^{1/2} \text{ mark}$$

$$178\text{g of Oleum are produced by } 22.4 \text{ liters of } \text{SO}_3 \checkmark^{1/2} \text{ mark}$$

$$178 \text{ kg} \quad \text{“} \quad \text{“} \quad \text{“} \quad \text{“} \quad \text{“} \quad \text{“} \quad \text{“} \quad \frac{178 \times 1000 \times 22.4\text{L}}{178\text{g}} \checkmark^{1/2} \text{ mark}$$

$$\begin{aligned}
 &= 22,4000 \text{ liters} \checkmark^{1/2} \text{ mark} \\
 &\text{(Total 13 marks)}
 \end{aligned}$$

23. i) Moles of copper = $\frac{0.635}{63.5} = 0.01 \text{ moles}$

$$\text{Volume of 1M Nitric acid } \frac{40}{0.01} = 4000\text{cm}^3 \quad \text{1/2 mark}$$

- Use value in d(ii) above

$$\text{ii) } \frac{480\text{cm}^3}{0.01} \quad \text{1/2 mark} \quad = 48,000 \text{ cm}^3 \quad \text{1/2 mark}$$

$$\text{OR } \underline{4000 \times 480} \quad = 48,000\text{cm}^3 \quad \text{1/2 mark}$$

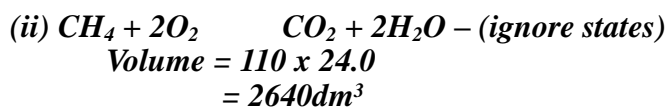
$$40\text{cm}^3$$

i.e. Answerine(i)X480cm³
 Answer in d(i)

[Total = 11 marks]

24. (i) $\frac{35.2 \times 1000}{100 \times 16}$ P ½
 = 10 Moles P ½
 Or mass of CH₄ = $\frac{35.2 \times 5}{1000}$ = 1.76g P ½
 Mass in g = 1.76 x 1000 = 1760kg

Moles of methane = $\frac{1760}{16}$ P ½
 = 110 Moles P ½



Mark consequential from equation and b(ii) (Without equation max *TZM*)

25. Volume of Cl₂ used
 = 0.047 x 24 P 1
 = 1.128dm³ P ½

26. Mass due Carbon in CO₂ = $\frac{12}{4} \times 35.2$
 = 0.96
 Moles carbon = $\frac{0.96}{12}$ = 0.08
 Mass due Hydrogen in H₂O = $\frac{2}{18} \times 1.40$
 = 0.156
 Moles hydrogen = $\frac{0.156}{1}$ = 0.156
 Mole ratio C:H = 1: 1.95
 E.F = CH₂

27.	Na ₂ CO ₃ x H ₂ O	Na ₂ CO ₃ + H ₂ O	√1	
	34.8g	<u>15.9g</u>	<u>18.9g</u>	
		106	18	
		<u>0.15</u> √1	<u>1.15</u>	3
		0.15	0.15	
		x	=	7 √1

28. % of H₂O lost = 14.5%[^]
 5 of anhydrous Na₂CO₃ = 85.5% (½mk)

$$R.F.M \text{ of } Na_2CO_3 = 106 \quad (\frac{1}{2}mk)$$

$$RMM \text{ of } H_2O = 18 \quad (\frac{1}{2}mk)$$

$NaCO_3$	H_2O	
<u>85.5</u>	<u>14.5</u>	
106	18	($\frac{1}{2}mk$)
<u>0.8066</u>	<u>0.8055</u>	
0.8055	0.8055	($\frac{1}{2}mk$)

$$n = 1 \text{ (Na}_2\text{CO}_3, \text{H}_2\text{O)} \quad (1/2mk)$$

29. Moles of $\text{Na}_2\text{CO}_3 = \frac{20 \times 0.1}{1000} = 0.002 \text{ moles}$



Mole ratio 1 : 1

$$\begin{aligned} \text{Moles of H}_2\text{SO}_4 &= \text{Moles of Na}_2\text{CO}_3 \\ &= 0.002 \text{ moles} \end{aligned}$$

$$\text{Molarity of H}_2\text{SO}_4 = \frac{10000 \times 0.002}{13} = 0.154 \text{ moles}$$

30.

Element	C	H	O
%	68.9	13.5	21.6
Molar mass	12	1	16
Moles	$\frac{68.9}{12}$ 5.403	$\frac{13.5}{1}$ 13.5	$\frac{21.6}{16}$ 1.35
MR	$\frac{5.43}{1.33}$ 4	$\frac{13.5}{1.35}$ 10	$\frac{1.35}{1.35}$ 1
Ratio	4	10	1

$$h (\text{C}_4\text{H}_{10}\text{O}) = 74$$

$$h (12 \times 4) + (10 \times 1) + 16 = 74$$

$$74h = 74$$

$$H = 1$$

Formula $\text{C}_4\text{H}_{10}\text{O}$

31. Moles $\text{C}_4\text{H}_{10} = \frac{1.12}{22.4} = 0.05 \text{ mol}$

$$\text{Heat produced} + 0.05 \times (3000) = 150 \text{ kj}$$

$$\text{Usefull heat} = \frac{75 \times 150}{100} = 112.5 \text{ kj}$$

$$\text{Let volume of water} = V$$

$$\text{Room temperature} = 25^\circ\text{C}$$

$$\text{Boiling point} = 100^\circ\text{C}$$

$$\text{Change in temperature, } \Delta T = 100 - 25 = 75^\circ\text{C} \quad 1/2 \text{ mk}$$

$$\Delta T \times \text{mass} \times C = Q \quad 315V = 112500$$

$$= \frac{75 \times V \times 4.2}{1000} = 112.5 \quad V = \frac{112500}{315} \quad 1/2 \text{ mk}$$

$$V = 357. \text{km}^3 \quad 1/2 \text{ mk}$$

32. $RFM\ Na_2CO_3 = 43 + 12 + 48 = 106$
 $Mol.\ Na_2CO_3 = \frac{19.6}{106} = 0.1849057$
 $Molarity\ of\ Na_2CO_3 = \frac{0.1849057}{0.25} = 0.73962m$
 $Na_2CO_{3(aq)} + MgCl_{2(aq)} + MgCO_{3(s)}$
 $Mole\ ratio\ Na\ CO_3 : Mg\ Cl_2\ is\ 1:1$
 $\ \ mol.\ Mg\ Cl_2\ Reacted = 0.1849$

$$\begin{aligned} \text{If } 2.0 \text{ mol.} &= 1000\text{cm}^3 \text{ solution mg } \text{Cl}_2 \\ = 0.1849\text{mol} &= \frac{0.1849 \times 1000}{2} \\ &= 92.45 \text{ or } 92.5 \text{ cm}^3 \end{aligned}$$

33. i)

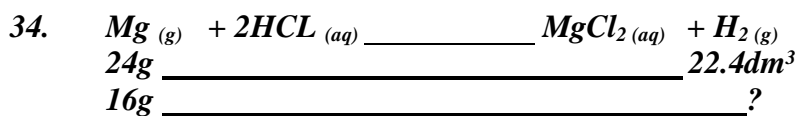
ACID	BASE	
1	2	
$\frac{1}{2} \times 0.004$	$\frac{20\text{cm}^3}{1000\text{cm}^3} \times 0.2 \text{ moles}$	$= 0.004 \text{ moles}$
$= 0.002 \text{ moles } \ddot{\text{O}} \frac{1}{2}$		

$$\begin{aligned} 25\text{cm}^3 &\text{ ————— } 0.002 \text{ moles } \ddot{\text{O}} \frac{1}{2} \\ 1000\text{cm}^3 &\text{ ————— } ? \\ 1000\text{cm}^3 \times 0.002 \text{ moles} &= 0.08 \text{ M } \ddot{\text{O}} \frac{1}{2} \end{aligned}$$

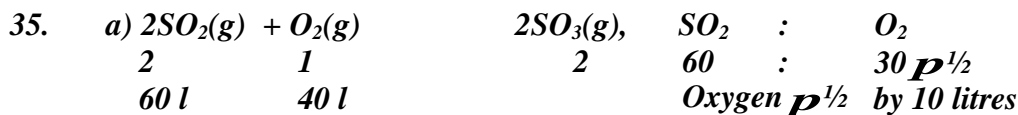
ii) $0.08 \text{ moles } \text{ ————— } 10.08_g \text{ H}_2\text{C}_2\text{O}_4 \cdot x\text{H}_2\text{O } \ddot{\text{O}} \frac{1}{2}$
 $1 \text{ mole } \text{ ————— } ?$

$$\begin{aligned} \frac{1 \text{ mole}}{0.08 \text{ moles}} \times 10.08 &= 126 \ddot{\text{O}} \frac{1}{2} \\ 126 \text{ ————— } \text{H}_2\text{C}_2\text{O}_4 \cdot x\text{H}_2\text{O} \end{aligned}$$

$$\begin{aligned} 18x &= 126 - 90 \ddot{\text{O}} \frac{1}{2} \\ 18x &= 36 \\ x &= 2 \ddot{\text{O}} \frac{1}{2} \end{aligned}$$



$$1.6g \times 22.4\text{dm}^3 \ddot{\text{O}} \frac{1}{2} = 1.4933 \text{ dm}^3$$



36. Mass of Oxygen = $12 - 8.4 = 3.5g$

<i>Element</i>	<i>Fe</i>	<i>O</i>
<i>Mass</i>	<u>8.4</u>	<u>3.6</u>
<i>R.A.M</i>	56	16
<i>No. of moles</i>	<u>8.4</u>	<u>3.6</u> $\text{p} \frac{1}{2}$

	56 0.15	16 0.225 P^{1/2}
Mole ration	<u>0.15</u> 0.15	<u>0.225</u> 0.15 P^{1/2}
	1	1.5 x2
	2	3 P^{1/2}

\ *The empirical formula is Fe₂O₃*