

Model answer lesson 5 chapter 2

Question	Answer	Question	Answer
1	D	13	C (Steps ↓)
2	B (Steps ↓)	14	D (Steps ↓)
3	B (Steps ↓)	15	D (Steps ↓)
4	A (Steps ↓)	16	B (Steps ↓)
5	D (Steps ↓)	17	A (Steps ↓)
6	C (Steps ↓)	18	A (Steps ↓)
7	A (Steps ↓)	19	A (Steps ↓)
8	C (Steps ↓)	20	A (Steps ↓)
9	A (Steps ↓)	21	D (Steps ↓)
10	A (Steps ↓)	22	A (Steps ↓)
11	C (Steps ↓)	23	D (Steps ↓)
12	B (Steps ↓)		

Steps:

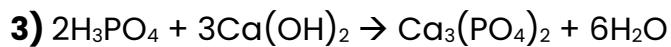


$$\frac{Ma Va}{na} = \frac{\text{no.of moles}}{nb}$$

$$\frac{0.1 \times 1500 \times 10^{-3}}{1} = \frac{\text{no.of moles}}{1}$$

Acid (HCl)	Base (NaOH)
Ma = 0.1 M	No. of moles = x
Va = $1500 \times 10^{-3} \text{ L}$	nb = 1
na = 1	

No. of moles of NaOH = 0.15 moles



$$\frac{Ma Va}{na} = \frac{Mb Vb}{nb}$$

$$\frac{Ma \times 80 \times 10^{-3}}{2} = \frac{0.4 \times 60 \times 10^{-3}}{3}$$

$$Ma = 0.2 \text{M}$$

Acid (H_3PO_4)	Base (Ca(OH)_2)
Ma = x	Mb = 0.4 M
Va = $80 \times 10^{-3} \text{ L}$	Vb = $60 \times 10^{-3} \text{ L}$
na = 2	nb = 3

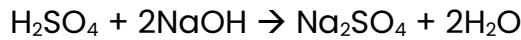
4) 1 mole NaOH → molar mass (23+16+1) = 40g

$$X \text{ moles} \rightarrow 8\text{g}$$

X = 0.2 moles of NaOH

Acid (H₂SO₄)	Base (NaOH)
M _a = 0.5 M	M _b = 1 M
V _a = x L	V _b = 30 × 10 ⁻³ L
n _a = 1	n _b = 2

$$\text{Concentration} = \frac{\text{no.of moles}}{\text{volume of solution (L)}} = \frac{0.2}{200 \times 10^{-3}} = 1\text{M}$$



$$\frac{M_a V_a}{n_a} = \frac{M_b V_b}{n_b}$$

$$\frac{0.5 \times V_a}{1} = \frac{1 \times 30 \times 10^{-3}}{2}$$

$$V_a = 0.03\text{L}$$

5) H₂SO₄ + 2NaHCO₃ → Na₂SO₄ + 2H₂CO₃

$$\frac{M_a V_a}{n_a} = \frac{\text{no.of moles}}{n_b}$$

$$\frac{0.1 \times 7.15 \times 10^{-3}}{1} = \frac{\text{no.of moles}}{2}$$

Acid (H₂SO₄)	Base (NaHCO₃)
M _a = 0.1 M	No. of moles = x
V _a = 7.15 × 10 ⁻³ L	n _b = 2
n _a = 1	

No. of moles of NaHCO₃ = 0.00143 moles

1 mole NaHCO₃ → molar mass = 84g

$$0.00143 \text{ moles} \rightarrow x\text{g}$$

$$X = 0.12012\text{g}$$

$$\text{Mass \% of NaHCO}_3 = \frac{\text{mass of NaHCO}_3}{\text{total mass}} \times 100$$

$$\text{Mass \% of NaHCO}_3 = \frac{0.12012}{1} \times 100 = 12.012\%$$

6) H₂SO₄ + 2NaOH → Na₂SO₄ + 2H₂O

$$\frac{M_a V_a}{n_a} = \frac{M_b V_b}{n_b}$$

Acid (H₂SO₄)	Base (NaOH)
M _a = 0.1 M	M _b = x
V _a = 25 × 10 ⁻³ L	V _b = 15 × 10 ⁻³ L
n _a = 1	n _b = 2

$$\frac{0.1 \times 25 \times 10^{-3}}{1} = \frac{Mb \times 15 \times 10^{-3}}{2}$$

$$Mb = 0.33M$$

$$\text{Concentration} = \frac{\text{no.of moles}}{\text{volume of solution (L)}}$$

$$0.33 = \frac{x}{450 \times 10^{-3}}, x = 0.1485 \text{ moles of NaOH}$$

$$1 \text{ mole NaOH} \rightarrow \text{molar mass } (23+16+1) = 40\text{g}$$

$$0.1485 \text{ moles} \rightarrow x\text{g}$$

$$X = 5.94\text{g}$$



$$\frac{Ma Va}{na} = \frac{\text{no.of moles}}{nb}$$

$$\frac{0.1 \times 30 \times 10^{-3}}{1} = \frac{\text{no.of moles}}{1}$$

Acid (HCl)	Base (KOH)
Ma = 0.1 M	No. of moles = x
Va = 30×10^{-3} L	nb = 1
na = 1	

$$\text{No. of moles of KOH} = 0.003 \text{ moles}$$

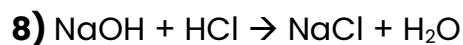
$$1 \text{ mole KOH} \rightarrow \text{molar mass } (39+16+1) = 56\text{g}$$

$$0.003 \text{ moles} \rightarrow x\text{g}$$

$$X = 0.168\text{g}$$

$$\% \text{ of purity} = \frac{\text{mass of pure KOH}}{\text{total mass of impure sample}} \times 100$$

$$\% \text{ of purity} = \frac{0.168}{0.3} \times 100 = 56\%$$



$$\frac{Ma Va}{na} = \frac{\text{no.of moles}}{nb}$$

$$\frac{0.1 \times 10 \times 10^{-3}}{1} = \frac{\text{no.of moles}}{1}$$

Acid (HCl)	Base (NaOH)
Ma = 0.1 M	No. of moles = x
Va = 10×10^{-3} L	nb = 1
na = 1	

No. of moles of NaOH = 0.001 moles

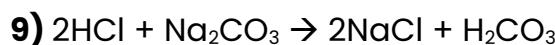
1 mole NaOH → molar mass (23+16+1) = 40g

0.001 moles → xg

$$X = 0.04\text{g}$$

$$\text{Mass \% of NaOH} = \frac{\text{mass of NaOH}}{\text{total mass}} \times 100$$

$$\text{Mass \% of NaOH} = \frac{0.04}{0.1} \times 100 = 40\%$$



$$\frac{Ma Va}{na} = \frac{\text{no.of moles}}{nb}$$

$$\frac{0.05 \times 20 \times 10^{-3}}{2} = \frac{\text{no.of moles}}{1}$$

Acid (HCl)	Base (Na ₂ CO ₃)
Ma = 0.05 M	No. of moles = x
Va = 20×10^{-3} L	nb = 1
na = 2	

No. of moles of Na₂CO₃ = 0.0005 moles

1 mole Na₂CO₃ → molar mass (23×2) + 12 + (16×3) = 106g

0.0005 moles → xg

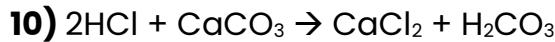
$$X = 0.053\text{g}$$

Mass of NaCl = Mass of mixture – mass of Na₂CO₃

$$\text{Mass of NaCl} = 0.4 - 0.053 = 0.347\text{g}$$

$$\text{Mass \% of NaCl} = \frac{\text{mass of NaCl}}{\text{total mass of mixture}} \times 100$$

$$\text{Mass \% of NaCl} = \frac{0.347}{0.4} \times 100 = 86.75\%$$



$$\frac{Ma Va}{na} = \frac{\text{no.of moles}}{nb}$$

$$\frac{0.8 \times 15 \times 10^{-3}}{2} = \frac{\text{no.of moles}}{1}$$

Acid (HCl)	Base (CaCO ₃)
Ma = 0.8 M	No. of moles = x
Va = 15×10^{-3} L	nb = 1
na = 2	

No. of moles of $\text{CaCO}_3 = 0.006$ moles

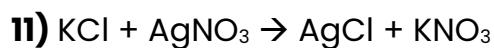
1 mole $\text{CaCO}_3 \rightarrow$ molar mass $40+12+(16\times 3) = 100\text{g}$

$0.006\text{moles} \rightarrow x\text{g}$

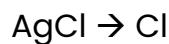
$$X = 0.6\text{g}$$

$$\text{Mass \% of } \text{CaCO}_3 = \frac{\text{mass of } \text{CaCO}_3}{\text{total mass of mixture}} \times 100$$

$$\text{Mass \% of } \text{CaCO}_3 = \frac{0.6}{1.5} \times 100 = 40\%$$



*Molar mass of $\text{AgCl} = 108 + 35.5 = 143.5\text{g}$



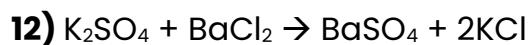
$6.7\text{g} \rightarrow x\text{g}$

$143.5\text{g} \rightarrow 35.5\text{g}$

$X = 1.65\text{ g of Cl}$

$$\text{Mass \% of Cl} = \frac{\text{mass of Cl}}{\text{total mass}} \times 100$$

$$\text{Mass \% of Cl} = \frac{1.65}{3.4} \times 100 = 48.5\%$$



*Molar mass of $\text{K}_2\text{SO}_4 = (39\times 2) + 32 + (16\times 4) = 174\text{g}$

*Molar mass of $\text{BaSO}_4 = 137 + 32 + (16\times 4) = 233\text{g}$



$x\text{g} \rightarrow 4.66\text{g}$

$174\text{g} \rightarrow 233\text{g}$

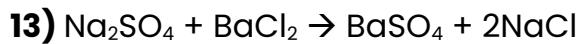
$X = 3.48\text{ g of K}_2\text{SO}_4$

Mass of impurities = Mass of impure sample – mass of K_2SO_4

$$\text{Mass of impurities} = 4 - 3.48 = 0.52\text{g}$$

$$\% \text{ of impurities} = \frac{\text{mass of impurities}}{\text{total mass of mixture}} \times 100$$

$$\% \text{ of impurities} = \frac{0.52}{4} \times 100 = 13\%$$



$$*\text{Molar mass of BaCl}_2 = 137 + (35.5 \times 2) = 208\text{g}$$

$$*\text{Molar mass of BaSO}_4 = 137 + 32 + (16 \times 4) = 233\text{g}$$



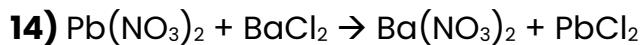
$$x\text{g} \rightarrow 2.734\text{g}$$

$$208\text{g} \rightarrow 233\text{g}$$

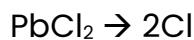
$$X = 2.44 \text{ g of BaCl}_2$$

$$\% \text{ of BaCl}_2 = \frac{\text{mass of BaCl}_2}{\text{total mass}} \times 100$$

$$\% \text{ of BaCl}_2 = \frac{2.44}{3.725} \times 100 = 65.5\%$$



$$*\text{Molar mass of PbCl}_2 = 207 + (35.5 \times 2) = 278\text{g}$$



$$1\text{g} \rightarrow x\text{g}$$

$$278\text{g} \rightarrow 2 \times 35.5\text{g}$$

$$X = 0.255 \text{ g of Cl}$$

$$\text{Mass \% of Cl} = \frac{\text{mass of Cl}}{\text{total mass}} \times 100$$

$$\text{Mass \% of Cl} = \frac{0.255}{2} \times 100 = 12.75\%$$

15) *Molar mass of BaCl₂ = 137 + (35.5×2) = 208g

*Molar mass of H₂SO₄ = (1×2) + 32 + (16×4) = 98g



$$0.5\text{g} \rightarrow x\text{g}$$

$$208\text{g} \rightarrow 98\text{g}$$

$$X = 0.235 \text{ g of H}_2\text{SO}_4$$

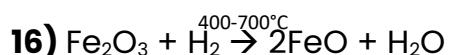
$$1 \text{ mole H}_2\text{SO}_4 \rightarrow 98\text{g}$$

$$X \text{ moles} \rightarrow 0.235\text{g}$$

$$X = 0.00239 \text{ moles}$$

$$\text{Concentration} = \frac{\text{no.of moles}}{\text{volume of solution (L)}}$$

$$1 = \frac{0.00239}{x}, x = 0.00239 \text{ L} = 2.39 \text{ ml} = 2.4 \text{ ml}$$



*Molar mass of FeO = 55.8 + 16 = 71.8g

*Molar mass of Fe₂O₃ = (2×55.8) + (16×3) = 159.6g



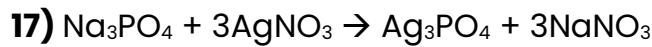
$$x\text{g} \rightarrow 0.58\text{g}$$

$$159.6\text{g} \rightarrow 2 \times 71.8\text{g}$$

$$X = 0.64 \text{ g of Fe}_2\text{O}_3$$

$$\text{Mass \% of Fe}_2\text{O}_3 = \frac{\text{mass of Fe}_2\text{O}_3}{\text{total mass}} \times 100$$

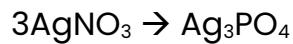
$$\text{Mass \% of Fe}_2\text{O}_3 = \frac{0.64}{0.7} \times 100 = 91.4\% = 92\%$$



Yellow ppt. soluble in ammonia solution $\rightarrow \text{Ag}_3\text{PO}_4$

$$^*\text{Molar mass of AgNO}_3 = 108 + 14 + (16 \times 3) = 170\text{g}$$

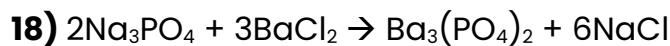
$$^*\text{Molar mass of Ag}_3\text{PO}_4 = (108 \times 3) + 31 + (16 \times 4) = 419\text{g}$$



$$x\text{g} \rightarrow 2.25\text{g}$$

$$3 \times 170\text{g} \rightarrow 419\text{g}$$

$$X = 2.738 \text{ g of AgNO}_3$$



White ppt. soluble in dil. HCl $\rightarrow \text{Ba}_3(\text{PO}_4)_2$, therefore name of anion is phosphate

$$^*\text{Molar mass of BaCl}_2 = 137 + (35.5 \times 2) = 208\text{g}$$

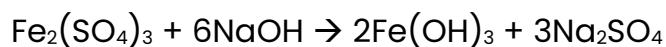
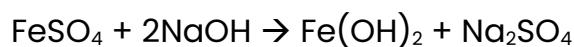
$$^*\text{Molar mass of Ba}_3(\text{PO}_4)_2 = (137 \times 3) + ((31 + (16 \times 4)) \times 2) = 601\text{g}$$



$$x\text{g} \rightarrow 1.21\text{g}$$

$$3 \times 208\text{g} \rightarrow 601\text{g}$$

$$X = 1.256 \text{ g of BaCl}_2$$



1 mole of Fe_3O_4 gives 1 mole of each of FeSO_4 and $\text{Fe}_2(\text{SO}_4)_3$

0.1 moles of Fe_3O_4 gives 0.1 moles of each of FeSO_4 and $\text{Fe}_2(\text{SO}_4)_3$



1 mole $\text{Fe(OH)}_2 \rightarrow 90\text{g}$

0.1 moles $\rightarrow x\text{g}$

$$X = 9\text{g}$$



1 mole $\text{Fe(OH)}_3 \rightarrow 107\text{g}$

0.2 moles $\rightarrow x\text{g}$

$$X = 21.4\text{g}$$

Total mass of precipitates = Mass of $\text{Fe(OH)}_2 + \text{Mass of } \text{Fe(OH)}_3$

$$\text{Total mass of precipitates} = 9 + 21.4 = 30.4\text{g}$$



*Molar mass of $\text{AgCl} = 108 + 35.5 = 143.5\text{g}$

$\text{AgCl} \rightarrow \text{Cl}$

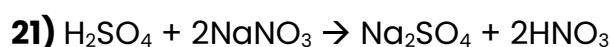
$3.52\text{g} \rightarrow x\text{g}$

$143.5\text{g} \rightarrow 35.5\text{g}$

$X = 0.87 \text{ g of Cl}$

$$\text{Mass \% of Cl} = \frac{\text{mass of Cl}}{\text{total mass}} \times 100$$

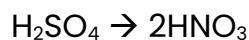
$$\text{Mass \% of Cl} = \frac{0.87}{4} \times 100 = 21.75\%$$



1 mole $\text{H}_2\text{SO}_4 \rightarrow 98\text{g}$

0.125 moles $\rightarrow x\text{g}$

$$X = 12.25\text{g}$$



$$12.25\text{g} \rightarrow x\text{g}$$

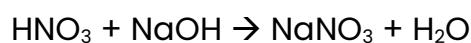
$$98\text{g} \rightarrow 2 \times 63\text{g}$$

$$X = 15.75 \text{ g of HNO}_3$$

$$1 \text{ mole HNO}_3 \rightarrow 63\text{g}$$

$$x \text{ moles} \rightarrow 15.75\text{g}$$

$$X = 0.25 \text{ moles}$$



$$\frac{\text{no.of moles}}{na} = \frac{Mb Vb}{nb}$$

$$\frac{0.25}{1} = \frac{Mb \times 200 \times 10^{-3}}{1}$$

Acid (HNO_3)	Base (NaOH)
No. of moles = 0.25	Mb = x
na = 1	Vb = $200 \times 10^{-3} \text{ L}$
	nb = 1

$$Mb = 1.25\text{M}$$



Mass of water = Mass of hydrated sample – mass of anhydrous sample

$$\text{Mass of water} = 6.6 - 4.2 = 2.4\text{g}$$

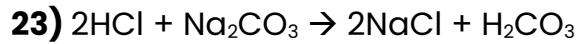


$$4.2\text{g} \rightarrow 2.4\text{g}$$

$$(55+35.5x)\text{g} \rightarrow 4 \times 18\text{g}$$

$$X = 2$$





$$\frac{Ma Va}{na} = \frac{Mb Vb}{nb}$$

$$\frac{0.1 \times 25 \times 10^{-3}}{2} = \frac{Mb \times 25 \times 10^{-3}}{1}$$

Acid (HCl)	Base (Na ₂ CO ₃)
Ma = 0.1 M	Mb = x
Va = 25×10^{-3} L	Vb = 25×10^{-3} L
na = 2	nb = 1

$$Mb = 0.05\text{M}$$

$$\text{Concentration} = \frac{\text{no.of moles}}{\text{volume of solution (L)}}$$

$$0.05 = \frac{x}{1}, x = 0.05 \text{ moles of Na}_2\text{CO}_3$$

$$*\text{Molar mass of Na}_2\text{CO}_3 = (23 \times 2) + 12 + (16 \times 3) = 106\text{g}$$

$$1 \text{ mole Na}_2\text{CO}_3 \rightarrow 106\text{g}$$

$$0.05 \text{ moles} \rightarrow x\text{g}$$

$$X = 5.3\text{g}$$

Mass of water = Mass of hydrated sample – mass of anhydrous sample

$$\text{Mass of water} = 14.3 - 5.3 = 9\text{g}$$

$$\text{Mass \% of water} = \frac{\text{mass of water}}{\text{total mass of hydrated sample}} \times 100$$

$$\text{Mass \% of water} = \frac{9}{14.3} \times 100 = 62.93\%$$

