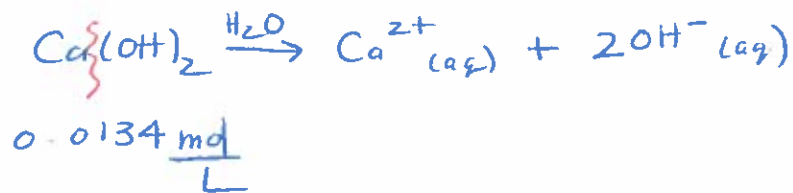


1. a) $\text{Ca}(\text{OH})_2$ $0.0134 \frac{\text{mol}}{\text{L}}$



$\therefore [\text{Ca}^{2+}]$ is $0.0134 \frac{\text{mol}}{\text{L}}$
and $[\text{OH}^{-}]$ is $0.0268 \frac{\text{mol}}{\text{L}}$

$$C_{\text{Ca}^{2+}} = 1 \times C_{\text{Ca}(\text{OH})_2}$$

$$= 0.0134 \text{ mol/L}$$

$$C_{\text{OH}^{-}} = 2 \times C_{\text{Ca}(\text{OH})_2}$$

$$= 2 \times 0.0134 \frac{\text{mol}}{\text{L}}$$

$$= 0.0268 \frac{\text{mol}}{\text{L}}$$

b) $\text{pOH} = -\log[\text{OH}^{-}]$
 $= -\log(0.0268)$
 $= 1.57$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - \text{pOH}$$

$$= 14 - 1.57$$

$$= 12.43$$

\therefore the pH is 12.43

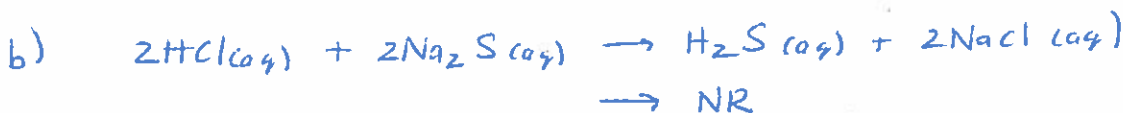
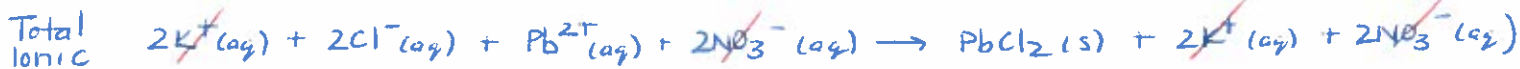
2. $\text{AgI}(\text{s})$ insoluble in water

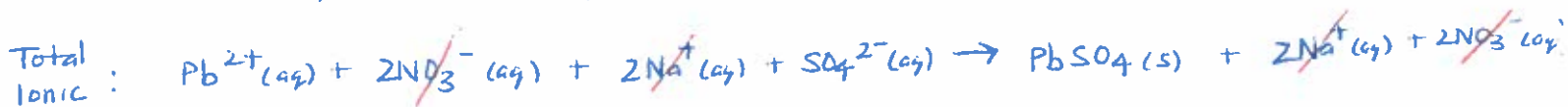
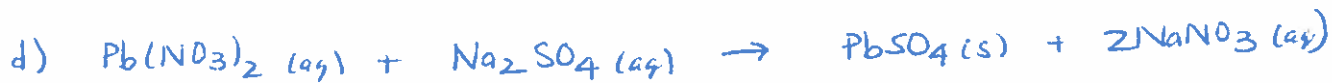
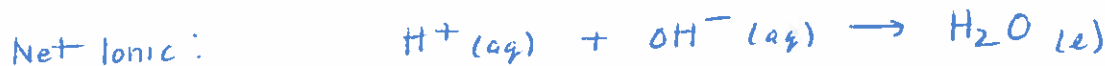
$\text{Na}_2\text{SO}_4(\text{aq})$
 $\text{KNO}_3(\text{aq})$

$\text{NaOH}(\text{aq})$

$\text{HC}_2\text{H}_3\text{O}_2(\text{aq})$

} soluble in water





$$5. \quad c_c = 11.6 \text{ mol/L} \quad c_d = 0.100 \text{ mol/L}$$

$$v_c = ? \quad v_d = 1.00 \text{ L}$$

$$c_c v_c = c_d v_d$$

$$v_c = \frac{c_d v_d}{c_c}$$

$$= \frac{(0.100 \text{ mol/L})(1.00 \text{ L})}{11.6 \text{ mol/L}}$$

$$= 0.00862 \text{ L}$$

$$= 8.62 \text{ mL}$$

∴ the volume of concentrated acid you will add to each flask is 8.62 mL

Lab Steps

1. pipette 40 mL of the 9.0 mol/L HCl solution into a 200 mL volumetric flask

2. Fill to the mark with deionized water

3. cap + shake.

∴ 40 mL of solution are required.

$$6. \quad c_c = 9.0 \text{ mol/L} \quad c_d = 2.0 \text{ mol/L}$$

$$v_c = ? \quad v_d = 200 \text{ mL}$$

$$v_c = \frac{c_d v_d}{c_c} = \frac{(2.0 \text{ mol/L})(200 \text{ mL})}{9.0 \text{ mol/L}} = 44.44 \text{ mL}$$

$$= 40 \text{ mL (sf)}$$

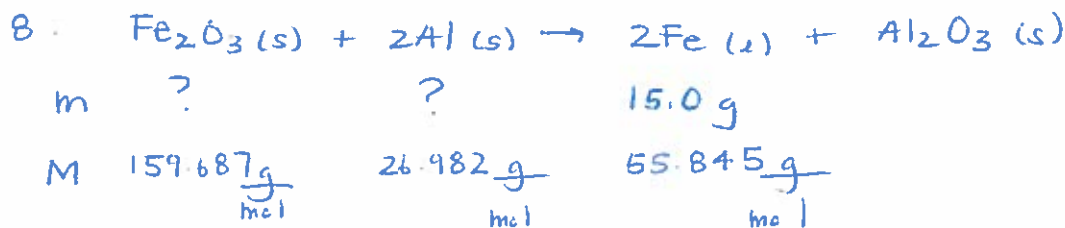
7. NaOH V = 250 mL
 $M_{NaOH} = 39.997 \frac{g}{mol}$ = 0.25 L

$$M_{NaOH} = 0.25 \cancel{L} \times \frac{0.8 \cancel{mol}}{\cancel{L}} \times \frac{39.997 g}{mol} = 8 g$$

∴ you will need 8g of NaOH

Lab steps:

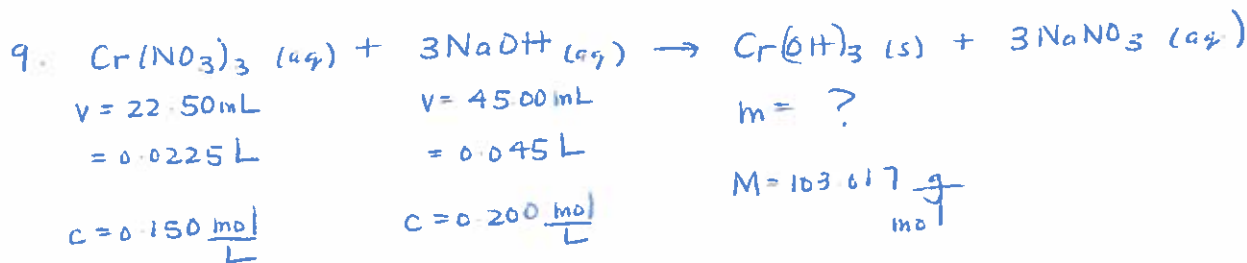
1. mass out 8g of NaOH
2. dissolve in a min. amount of deionized water
3. transfer with rinsings to a 250 mL volumetric flask
4. fill to the mark with deionized water
5. cap & shake.



$$M_{Al} = 15.0 g Fe \times \frac{1 mol Fe}{55.845 g Fe} \times \frac{2 mol Al}{2 mol Fe} \times \frac{26.982 g Al}{mol Al} = 7.25 g$$

$$M_{Fe_2O_3} = 15.0 g Fe \times \frac{1 mol Fe}{55.845 g Fe} \times \frac{1 mol Fe_2O_3}{2 mol Fe} \times \frac{159.687 g Fe_2O_3}{mol Fe_2O_3} = 21.4 g$$

∴ you will need 7.25g of Al and 21.4g of Fe₂O₃.



$$n = 0.0225 L \times 0.150 \frac{mol}{L} = 0.003375 mol$$

1

0.003375

$$n = 0.045 L \times 0.2 \frac{mol}{L} = 0.009 mol$$

3

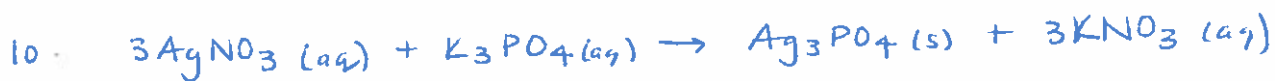
0.003

↑ LR smaller #

$$M_{\text{Cr(OH)}_3} = 0.009 \text{ mol NaOH} \times \frac{1 \text{ mol Cr(OH)}_3}{3 \text{ mol NaOH}} \times \frac{103.017 \text{ g Cr(OH)}_3}{1 \text{ mol Cr(OH)}_3}$$

$$= 0.309 \text{ g}$$

∴ 0.309 g of Cr(OH)₃ will be produced.



m 3.44 g

4.22 g

m = ?

M $\frac{169.872 \text{ g}}{\text{mol}}$

$\frac{212.264 \text{ g}}{\text{mol}}$

$\frac{418.574 \text{ g}}{\text{mol}}$

n $\frac{0.020250 \text{ mol}}{3}$

$\frac{0.019881 \text{ mol}}{1}$

0.010125

0.019881

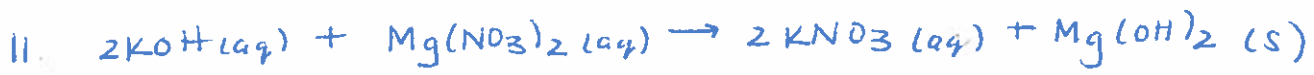
↑ smaller #

∴ LR

$$M_{\text{Ag}_3\text{PO}_4} = 0.020250 \text{ mol AgNO}_3 \times \frac{1 \text{ mol Ag}_3\text{PO}_4}{3 \text{ mol AgNO}_3} \times \frac{418.574 \text{ g Ag}_3\text{PO}_4}{1 \text{ mol Ag}_3\text{PO}_4}$$

$$= 2.83 \text{ g}$$

∴ 2.83 g of Ag₃PO₄ is produced.



$$V = 0.1 \text{ L}$$

$$V = 0.1 \text{ L}$$

? M

$$C = 0.2 \frac{\text{mol}}{\text{L}}$$

$$C = 0.2 \frac{\text{mol}}{\text{L}}$$

$$58.319 \frac{\text{g}}{\text{mol}}$$

$$n = 0.1 \cancel{\text{L}} \times \frac{0.2 \text{ mol}}{\cancel{\text{L}}}$$

$$n = 0.1 \text{ L} \times 0.2 \frac{\text{mol}}{\text{L}}$$

$$= 0.02 \text{ mol}$$

$$= 0.02 \text{ mol}$$

2

1

$$0.01$$

$$0.02$$

↑ smaller #

∴ LR

$$m_{\text{Mg}(\text{OH})_2} = 0.02 \text{ mol KOH} \times \frac{1 \text{ mol Mg}(\text{OH})_2}{2 \text{ mol KOH}} \times \frac{58.319 \text{ g Mg}(\text{OH})_2}{\text{mol Mg}(\text{OH})_2}$$

$$= 0.583 \text{ g}$$

$$n_{\text{Mg}(\text{NO}_3)_2 \text{ excess}} = 0.02 \text{ mol} - 0.01 \text{ mol} = 0.01 \text{ mol}$$

$$n_{\text{Mg}^{2+}} = 0.01 \text{ mol}$$

$$n_{\text{NO}_3^-} = 2(0.01) \text{ mol} = 0.02 \text{ mol}$$

$$n_{\text{KNO}_3} = 0.02 \text{ mol KOH} \times \frac{2 \text{ KNO}_3}{2 \text{ mol KOH}} = 0.02 \text{ mol}$$

$$n_{\text{K}^+} = 0.02 \text{ mol}$$

$$n_{\text{NO}_3^-} = 0.02 \text{ mol}$$

$$C_{\text{Mg}^{2+}} = \frac{0.01 \text{ mol}}{\text{total } V} = \frac{0.01 \text{ mol}}{0.2 \text{ L}}$$

$$= 0.05 \frac{\text{mol}}{\text{L}}$$

$$C_{\text{K}^+} = \frac{0.02 \text{ mol}}{0.2 \text{ L}}$$

$$= 0.1 \frac{\text{mol}}{\text{L}}$$

$$C_{\text{NO}_3^-} = \frac{0.02 + 0.02}{0.2 \text{ L}}$$

$$= \frac{0.04 \text{ mol}}{0.2 \text{ L}}$$

$$= 0.2 \frac{\text{mol}}{\text{L}}$$



$$c = 0.2042 \frac{\text{mol}}{\text{L}}$$

$$c = ?$$

$$v = 25 \text{ mL}$$

$$= 0.025 \text{ L}$$

$$v = 10.42 \text{ mL}$$

$$= 0.01042 \text{ L}$$

$$C_{\text{NaOH}} = 0.025 \text{ L } \cancel{\text{H}_2\text{C}_2\text{O}_4} \times \frac{0.2042 \text{ mol } \cancel{\text{H}_2\text{C}_2\text{O}_4}}{\text{L } \cancel{\text{H}_2\text{C}_2\text{O}_4}} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol } \cancel{\text{H}_2\text{C}_2\text{O}_4}} \times \frac{1}{0.01042 \text{ L}}$$

$$= 0.9798 \frac{\text{mol}}{\text{L}}$$

∴ the concentration of NaOH is $0.9798 \frac{\text{mol}}{\text{L}}$

$$13. a) \quad c_c = 3.0 \frac{\text{mol}}{\text{L}}$$

$$c_d = ?$$

$$c_c v_c = c_d v_d$$

$$v_c = 10 \text{ mL}$$

$$v_d = 250 \text{ mL}$$

$$c_d = \frac{c_c v_c}{v_d} = \frac{(3.0 \text{ mol/L})(10 \text{ mL})}{250 \text{ mL}}$$

$$= 0.12 \text{ mol/L}$$

∴ the concentration is $0.12 \frac{\text{mol}}{\text{L}}$ of KOH



$$v = 38.5 \text{ mL}$$

$$= 0.0385 \text{ L}$$

$$c = 0.12 \text{ mol/L}$$

$$c = ?$$

$$v = 10.0 \text{ mL}$$

$$= 0.01 \text{ L}$$

$$C_{\text{H}_3\text{PO}_4} = 0.0385 \text{ L } \cancel{\text{KOH}} \times \frac{0.12 \text{ mol } \cancel{\text{KOH}}}{\text{L } \cancel{\text{KOH}}} \times \frac{1 \text{ mol H}_3\text{PO}_4}{3 \text{ mol } \cancel{\text{KOH}}} \times \frac{1}{0.01 \text{ L H}_3\text{PO}_4}$$

$$= 0.154 \frac{\text{mol}}{\text{L}}$$

∴ the concentration of H_3PO_4 is $0.154 \frac{\text{mol}}{\text{L}}$