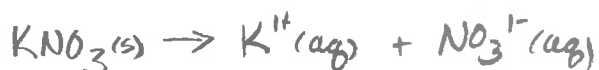


1. Assume 1L volume for each solution



$$1\text{L} \times \frac{0.120 \text{ mol KNO}_3}{1\text{L}} \times \frac{1 \text{ mol NO}_3^-}{1 \text{ mol KNO}_3} = 0.120 \text{ mol NO}_3^-$$



$$1\text{L} \times \frac{0.160 \text{ mol Fe}(\text{NO}_3)_3}{1\text{L}} \times \frac{3 \text{ mol NO}_3^-}{1 \text{ mol Fe}(\text{NO}_3)_3} = 0.480 \text{ mol NO}_3^-$$

$$n_{\text{NO}_3^-} = n_{\text{KNO}_3} + n_{\text{Fe}(\text{NO}_3)_3}$$

$$n_{\text{NO}_3^-} = 0.120 \text{ mol NO}_3^- + 0.480 \text{ mol NO}_3^-$$

$$n_{\text{NO}_3^-} = 0.600 \text{ mol NO}_3^-$$

$$V_T = V_{\text{KNO}_3} + V_{\text{Fe}(\text{NO}_3)_3}$$

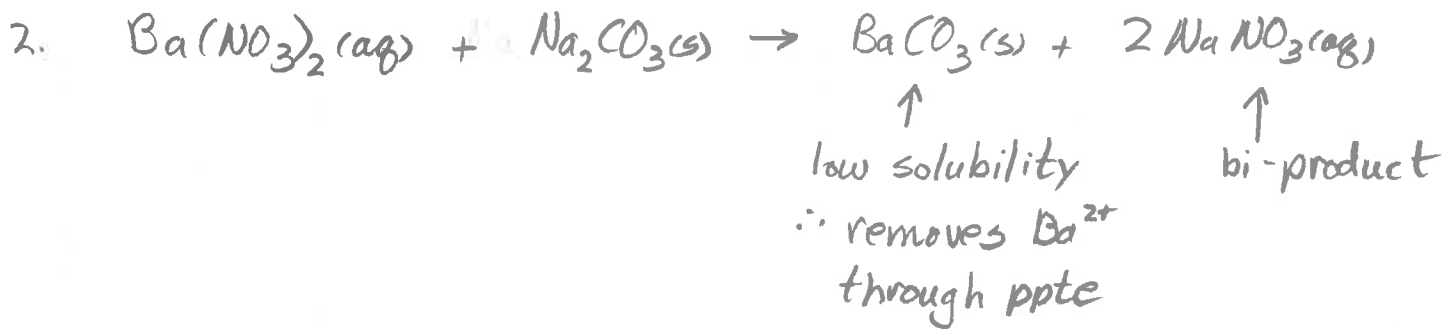
$$V_T = 1\text{L} + 1\text{L}$$

$$V_T = 2\text{L}$$

$$[\text{NO}_3^-] = \frac{n_{\text{NO}_3^-}}{V_T}$$

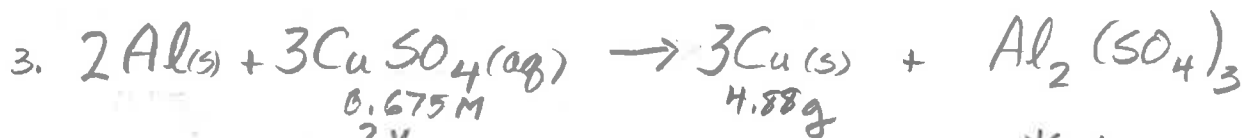
$$= \frac{0.600 \text{ mol NO}_3^-}{2\text{L}}$$

$$= 0.300 \text{ mol NO}_3^- / \text{L} \Rightarrow 0.300 \text{ M NO}_3^-$$



$$120 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.0500 \text{ mol Ba}(\text{NO}_3)_2}{1 \text{ L}} *$$

$$\times \frac{1 \text{ mol Na}_2\text{CO}_3}{1 \text{ mol Ba}(\text{NO}_3)_2} \times \frac{105.99 \text{ g Na}_2\text{CO}_3}{1 \text{ mol Na}_2\text{CO}_3} = 0.636 \text{ g Na}_2\text{CO}_3$$



$$4.88 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \times \frac{3 \text{ mol CuSO}_4}{3 \text{ mol Cu}} **$$

$$\times \frac{1 \text{ L CuSO}_4}{0.675 \text{ mol CuSO}_4} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 113.8 \text{ mL CuSO}_4 \text{ solution}$$

\uparrow
 optional

* alternate to this point

$$n = ?$$

$$C = 0.0500 \text{ mol/L}$$

$$V = 120 \text{ mL} \rightarrow 0.120 \text{ L}$$

$$n = CV$$

$$n = 0.0500 \text{ mol/L} \times 0.120 \text{ L}$$

$$n = 0.006 \text{ mol Ba}(\text{NO}_3)_2$$

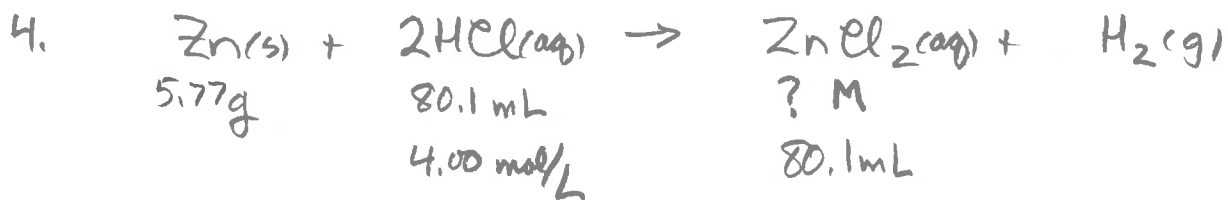
** alternate

route - stop

at mol CuSO_4

and use

$$n = CV$$



Consider Zn

$$5.77\text{g Zn} \times \frac{1\text{ mol Zn}}{65.41\text{ g Zn}} = 0.0882\text{ mol Zn available}$$

$$0.0882\text{ mol Zn} \times \frac{2\text{ mol HCl}}{1\text{ mol Zn}} = 0.176\text{ mol HCl required}$$

Consider HCl

$$80.1\text{ mL HCl} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{4.00\text{ mol HCl}}{1\text{ L}} = 0.320\text{ mol HCl available}$$

$$0.320\text{ mol HCl} \times \frac{1\text{ mol Zn}}{2\text{ mol HCl}} = 0.160\text{ mol Zn required}$$

∴ Zn is the limiting reagent

$$0.0882\text{ mol Zn} \times \frac{1\text{ mol ZnCl}_2}{1\text{ mol Zn}} = 0.0882\text{ mol ZnCl}_2$$

$$n = 0.0882\text{ mol ZnCl}_2$$

$$C = ?$$

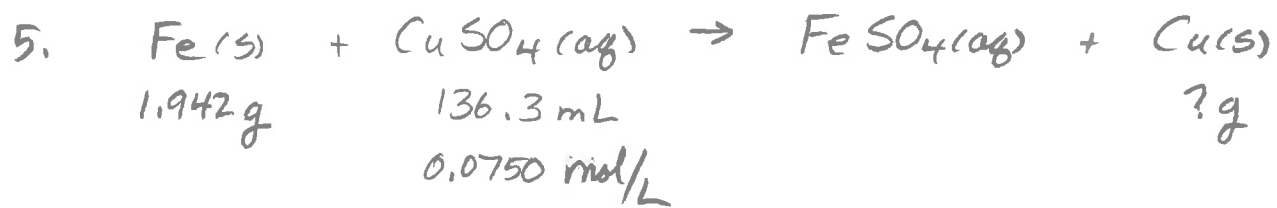
$$V = 80.1\text{ mL} \rightarrow 0.0801\text{ L}$$

$$C = \frac{n}{V}$$

$$C = \frac{0.0882\text{ mol ZnCl}_2}{0.0801\text{ L}}$$

$$C = 1.101\text{ mol ZnCl}_2/\text{L}$$

$$C = 1.101\text{ M ZnCl}_2$$



Consider Fe: $1.942 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.85 \text{ g Fe}} = 0.0348 \text{ mol Fe available}$

$$0.0348 \text{ mol Fe} \times \frac{1 \text{ mol CuSO}_4}{1 \text{ mol Fe}} = 0.0348 \text{ mol CuSO}_4 \text{ required}$$

Consider CuSO₄: $136.3 \text{ mL CuSO}_4 \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.0750 \text{ mol CuSO}_4}{1 \text{ L}} = 0.0102 \text{ mol CuSO}_4 \text{ available}$

$$0.0102 \text{ mol CuSO}_4 \times \frac{1 \text{ mol Fe}}{1 \text{ mol CuSO}_4} = 0.0102 \text{ mol Fe required}$$

∴ CuSO₄ is the limiting reagent

$$0.0102 \text{ mol CuSO}_4 \times \frac{1 \text{ mol Cu}}{1 \text{ mol CuSO}_4} \times \frac{63.55 \text{ g Cu}}{1 \text{ mol Cu}} = 0.650 \text{ g Cu}$$



$$0.10 \text{ g Mg}(\text{OH})_2 \times \frac{1 \text{ mol Mg}(\text{OH})_2}{58.33 \text{ g Mg}(\text{OH})_2} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Mg}(\text{OH})_2} \quad *$$

$$\times \frac{1 \text{ L HCl}}{0.10 \text{ mol HCl}} = 0.0343 \text{ L HCl}$$

$$\text{or } 34.3 \text{ mL HCl}$$

* could stop at mol HCl and use $n=CV$



$$0.400 \text{ mol Pb}^{2+} \times \frac{1 \text{ mol Pb}(\text{C}_2\text{H}_3\text{O}_2)_2}{1 \text{ mol Pb}^{2+}}$$

$$\times \frac{1 \text{ L Pb}(\text{C}_2\text{H}_3\text{O}_2)_2}{1.50 \text{ mol Pb}(\text{C}_2\text{H}_3\text{O}_2)_2} = 0.267 \text{ L Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$$

$$\text{or } 267 \text{ mL Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$$