

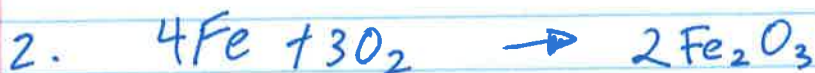
Chem 11 - Stoich Unit Review

Pt 1.



$$1. \quad 17 \text{ g CaCO}_3 \times \frac{1 \text{ mol CaCO}_3}{100.1 \text{ g}} \times \frac{1 \text{ CO}_2}{1 \text{ CaCO}_3} \times \frac{22.4 \text{ L}}{1 \text{ mol}} =$$

3.8 L



$$21.5 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol}}{159.6 \text{ g}} = 0.135 \text{ mol Fe}_2\text{O}_3 \text{ produced.}$$

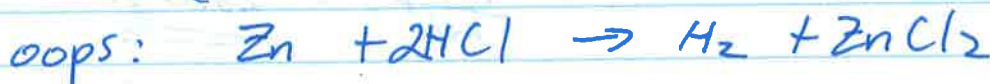
$$0.135 \text{ mol Fe}_2\text{O}_3 \times \frac{3 \text{ O}_2}{2 \text{ Fe}_2\text{O}_3} \times \frac{22.4 \text{ L}}{1 \text{ mol O}_2} = \underline{4.53 \text{ L}}$$

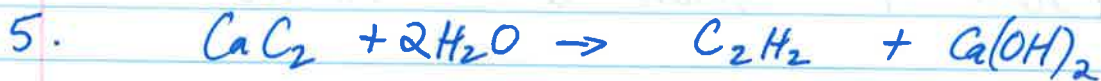


$$1.80 \text{ mol O}_2 \times \frac{2 \text{ KClO}_3}{3 \text{ O}_2} \times \frac{122.6 \text{ g}}{1 \text{ mol}} =$$

147 g

$$4. \quad 12.35 \text{ g Zn} \times \frac{1 \text{ mol}}{65.4 \text{ g}} \times \frac{1 \text{ H}_2}{1 \text{ Zn}} = 0.189 \text{ moles.}$$





$$30\text{L C}_2\text{H}_2 \times \frac{1\text{mol}}{22.4\text{L}} \times \frac{2\text{H}_2\text{O}}{\text{C}_2\text{H}_2} \times \frac{18.02}{1\text{mol}} = \underline{\underline{48\text{g}}}$$

pt 2.



H_2 is limiting b/c it requires twice as much.

$$20\text{ H}_2 \text{ molec.} \times \frac{2\text{H}_2\text{O}}{2\text{H}_2} = 20\text{ H}_2\text{O's.}$$



$$\text{Al: } 10.45\text{g} \times \frac{1\text{mol}}{27.0\text{g}} \times \frac{3\text{Cu}}{2\text{Al}} = 0.581\text{ mol Cu}$$

$$\text{CuSO}_4: 66.55\text{g} \times \frac{1\text{mol}}{159.6\text{g}} \times \frac{3\text{Cu}}{3\text{CuSO}_4} = \underline{\underline{0.417\text{ mol Cu}}}$$

• limiting reactant is CuSO_4 // Al is in excess

b) $0.417\text{ mol Cu} \times \frac{63.5\text{g}}{\text{mol}} = \underline{\underline{26.5\text{g.}}}$

c) $10.45\text{g Al} - \left(0.417\text{ Cu} \times \frac{7.506}{3\text{Cu}} \times \frac{27\text{g}}{1\text{mol}} \right) = \underline{\underline{2.94\text{g}}}$



$$\text{Pb}(\text{NO}_3)_2: 15.50\text{g} \times \frac{1\text{mol}}{331.2} \times \frac{1\text{PbCl}_2}{1\text{Pb}(\text{NO}_3)_2} = 0.0468 \text{ mol PbCl}_2$$

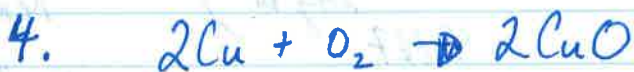
$$\text{NaCl}: 3.84\text{g} \times \frac{1\text{mol}}{58.5} \times \frac{1\text{PbCl}_2}{2\text{NaCl}} = \underline{0.0328 \text{ mol PbCl}_2}$$

• lim: NaCl // Excess: $\text{Pb}(\text{NO}_3)_2$

$$b) \quad 0.0328 \text{ mol PbCl}_2 \times \frac{278.2\text{g}}{1\text{mol}} = \underline{9.13\text{g}}$$

$$c) \quad \text{Pb}(\text{NO}_3)_2: 15.50\text{g} - \left(0.0328 \text{ mol PbCl}_2 \times \frac{1\text{Pb}(\text{NO}_3)_2}{1\text{PbCl}_2} \times \frac{331.2\text{g}}{1\text{mol}} \right) = \underline{4.64\text{g}}$$

10.86g



$$\text{Cu}: 6.52\text{g} \times \frac{1\text{mol}}{63.5\text{g}} \times \frac{2\text{CuO}}{2\text{Cu}} = \underline{0.103 \text{ mol CuO}}$$

$$\text{O}_2: 25.4\text{L} \times \frac{1\text{mol}}{22.4\text{L}} \times \frac{2\text{CuO}}{1\text{O}_2} = 2.27 \text{ mol CuO}$$

• lim: Cu // XS: O_2

$$b) \quad 0.103 \text{ mol CuO} \times \frac{79.5\text{g}}{\text{mol}} = \underline{8.19\text{g}}$$

$$c) \quad 25.4\text{L} - \left(0.103 \text{ mol CuO} \times \frac{1\text{O}_2}{2\text{CuO}} \times \frac{22.4\text{L}}{\text{mol}} \right) = \underline{24.2\text{L}}$$

1.15L



$$\text{AlBr}_3: 17.25 \text{ mL} \times 0.525 \frac{\text{mol}}{\text{L}} \times \frac{3\text{AgBr}}{1\text{AlBr}_3} = 27.2 \text{ mmol}$$

$$\text{AgNO}_3: 19.72 \text{ mL} \times 0.633 \frac{\text{mol}}{\text{L}} \times \frac{3\text{AgBr}}{3\text{AgNO}_3} = 12.5 \text{ mmol}$$

Lim: AgNO_3 // XS: AlBr_3 .

$$b) \quad 12.5 \text{ mmol} \times \frac{187.8 \text{ g}}{\text{mol}} = \underline{\underline{2.348 \text{ g}}}$$

$$c) \quad 9.056 \text{ mol} - \left(12.5 \text{ mol} \times \frac{1\text{AlBr}_3}{3\text{AgBr}} \right) = \frac{5.34 \text{ mmol}}{\text{remaining}}$$

in 36.97 mL

so ... $\underline{\underline{0.144 \text{ M}}}$ or $\underline{\underline{1.424 \text{ g}}}$

Pt. 3.



$$\text{Fe}: 6.57 \text{ g} \times \frac{1 \text{ mol Fe}}{55.8 \text{ g}} \times \frac{1 \text{ FeCl}_2}{1 \text{ Fe}} = 0.118 \text{ mol} \times \frac{126.8 \text{ g}}{\text{mol}}$$

~~14.99~~ = 14.99

$$b) \quad \frac{14.63 \text{ g}}{14.99} \times 100\% = 97.8\%$$



$$\text{Cu: } 12.5\text{g} \times \frac{1\text{mol}}{63.5\text{g}} \times \frac{1\text{CuCl}_2}{1\text{Cu}} = \underline{0.197\text{ mol}} \leftarrow \text{Lim}$$

$$\text{Cl}_2: 15.3\text{L} \times \frac{1\text{mol}}{22.4\text{L}} \times \frac{1\text{CuCl}_2}{1\text{Cl}_2} = \underline{0.683\text{ mol}} \leftarrow \times 5$$

$$0.197\text{ mol CuCl}_2 \times \frac{134.5\text{g}}{\text{mol}} = 26.5\text{g} \leftarrow \text{theoretical yield.}$$

$$\frac{25.4\text{g}}{26.5\text{g}} \times 100\% = 95.9\%$$

$$3. \quad 0.830\text{ M} \Rightarrow 0.830 \frac{\text{mol}}{\text{L}} \times \frac{60.0\text{g}}{\text{mol}} \times \frac{1000\text{mL}}{1\text{L}}$$

49.8g of acetic acid

↖ how much does
1 L weigh?

1 L = 1000 mL ; 1 mL = 1 g.
So... 1000 g.

$$\frac{49.8\text{g}}{1000\text{g}} \times 100\% = \underline{4.98\%}$$

Pt. 4



$$\text{moles of NaOH} = 0.253 \frac{\text{mol}}{\text{L}} \times 0.02145\text{L} = 5.43 \times 10^{-3}\text{ mol}$$

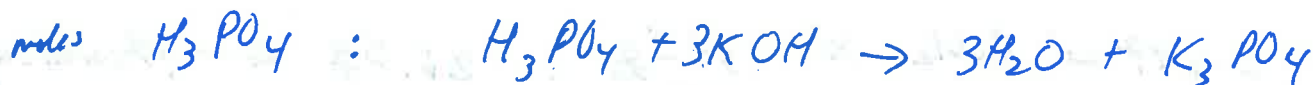
$$\text{moles of HCl} = 5.43 \times 10^{-3}\text{ mol NaOH} \times \frac{1\text{HCl}}{1\text{NaOH}} \leftarrow \text{from Bal. eq.}$$

$$[\text{HCl}] = \text{M} = \frac{n}{V} \quad \text{so} \quad \frac{5.43 \times 10^{-3}\text{ mol HCl}}{2.5 \times 10^{-2}\text{L HCl}} = \underline{0.217\text{M}}$$

2. use trials 2, 3, 4 - trial 1 is overshoot & not precise

$$\frac{19.09 + 19.11 + 19.24}{3} = 19.15 \text{ mL avg.}$$

$$\text{moles KOH} = 19.15 \text{ mL} \times 0.500 \frac{\text{mol}}{\text{L}} = 9.57 \text{ mmoles.}$$



$$\text{so } 9.57 \text{ mmol KOH} \times \frac{1 \text{ H}_3\text{PO}_4}{3 \text{ KOH}} = 3.19 \text{ mmol H}_3\text{PO}_4$$

$$[\text{H}_3\text{PO}_4] = \frac{3.19 \text{ mmol}}{25 \text{ mL}} = \underline{0.128 \text{ M}}$$

3. Difficult - not on test * - good for practice 😊

• $\text{Na}_2\text{CO}_3 = 106 \text{ g/mol}$ so for $\text{Na}_2\text{CO}_3 \cdot x \text{H}_2\text{O}$, anything greater than $106 \text{ g/mol} = \text{water}$.

• need to find molar mass of hydrate. $\therefore \frac{\text{g}}{\text{mol}}$.

Calculate # of moles. $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + 2\text{NaCl}$

$$\text{moles HCl} = \frac{36.92 \text{ mL}}{1000 \text{ mL/L}} \times 0.103 \frac{\text{mol}}{\text{L}} = 3.80 \times 10^{-3} \text{ mol HCl}$$

$$\text{moles Na}_2\text{CO}_3 = 3.80 \times 10^{-3} \text{ mol HCl} \times \frac{1 \text{ Na}_2\text{CO}_3}{2 \text{ HCl}} = 1.90 \times 10^{-3} \text{ mol Na}_2\text{CO}_3$$

$$\text{molar mass} = \frac{0.54 \text{ g}}{1.90 \times 10^{-3} \text{ mol}} = 284 \frac{\text{g}}{\text{mol}} \quad \text{so ...}$$

$$284 - 106 = \text{mass of water} = 178 \text{ g} \div \frac{18 \text{ g}}{\text{mol}} = 9.9 \text{ or } \underline{\underline{10}}$$

$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$