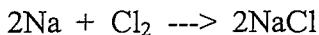


XIII. Stoichiometry (Chapter 10)



1. Calculate the number of moles of NaCl produced from:

a) 3.0 moles Na mole Na \rightarrow mole NaCl

$$3.0 \text{ moles Na} \times \frac{2 \text{ mole NaCl}}{2 \text{ mole Na}} = \boxed{3.0 \text{ moles NaCl}}$$

b) .018 mole Cl₂ mole Cl₂ \rightarrow mole NaCl

$$0.018 \text{ mole Cl}_2 \times \frac{2 \text{ mole NaCl}}{1 \text{ mole Cl}_2} = \boxed{0.036 \text{ mole NaCl}}$$

2. How many moles of NaCl can be produced from

a) 18 grams Na g Na \rightarrow mole Na \rightarrow mole NaCl

$$18 \text{ g Na} \times \frac{1 \text{ mole Na}}{22.9898 \text{ g Na}} \times \frac{2 \text{ mole NaCl}}{2 \text{ mole Na}} = 0.78296 \text{ mole NaCl} = \boxed{0.78 \text{ mole NaCl}}$$

b) 4.8 grams Cl₂ g Cl₂ \rightarrow mole Cl₂ \rightarrow mole NaCl

$$4.8 \text{ g Cl}_2 \times \frac{1 \text{ mole Cl}_2}{70.906 \text{ g Cl}_2} \times \frac{2 \text{ mole NaCl}}{1 \text{ mole Cl}_2} = 0.135391 \text{ mole NaCl} = \boxed{0.14 \text{ mole NaCl}}$$

3. How many grams of NaCl can be produced from

a) 2.0 grams Na g Na \rightarrow mole Na \rightarrow mole NaCl \rightarrow g NaCl

$$2.0 \text{ g Na} \times \frac{1 \text{ mole Na}}{22.9898 \text{ g Na}} \times \frac{2 \text{ mole NaCl}}{2 \text{ mole Na}} \times \frac{58.4428 \text{ g NaCl}}{1 \text{ mole NaCl}} = 5.08424 \text{ g NaCl} = \boxed{5.1 \text{ g NaCl}}$$

b) 19.8 grams Cl₂ g Cl₂ \rightarrow mole Cl₂ \rightarrow mole NaCl \rightarrow g NaCl

$$19.8 \text{ g Cl}_2 \times \frac{1 \text{ mole Cl}_2}{70.906 \text{ g Cl}_2} \times \frac{2 \text{ mole NaCl}}{1 \text{ mole Cl}_2} \times \frac{58.4428 \text{ g NaCl}}{1 \text{ mole NaCl}} = 32.63948 \text{ g NaCl} = \boxed{32.6 \text{ g NaCl}}$$

4. If 128 grams Na and 155 grams Cl₂ are mixed and allowed to react, how many grams of NaCl would be produced? Run Both and Choose Smallest Value \rightarrow just like 3a & 3b

$$128 \text{ g Na} \times \frac{1 \text{ mole Na}}{22.9898 \text{ g Na}} \times \frac{2 \text{ mole NaCl}}{2 \text{ mole Na}} \times \frac{58.4428 \text{ g NaCl}}{1 \text{ mole NaCl}} = 325.3912 \text{ g NaCl}$$

$$155 \text{ g Cl}_2 \times \frac{1 \text{ mole Cl}_2}{70.906 \text{ g Cl}_2} \times \frac{2 \text{ mole NaCl}}{1 \text{ mole Cl}_2} \times \frac{58.4428 \text{ g NaCl}}{1 \text{ mole NaCl}} = 255.5111 \text{ g NaCl} \times \text{smaller}$$

\neq Only 256g NaCl can be made before you run out of Cl₂

5.



- a) Calculate the number of kilojoules of energy released when 1.102×10^5 grams of oxygen react. $\text{g O}_2 \rightarrow \text{mole O}_2 \rightarrow \text{kJ}$

$$1.102 \times 10^5 \text{ g O}_2 \times \frac{1 \text{ mole O}_2}{31.9988 \text{ g O}_2} \times \frac{803 \text{ kJ}}{2 \text{ mole O}_2} = 1.382717 \times 10^6 \text{ kJ}$$

$$= \boxed{1.383 \times 10^6 \text{ kJ}}$$

- b) How many grams of water would be produced if the above reaction results in the release of 9.2×10^7 joules of energy? $\text{joules} \rightarrow \text{kJ} \rightarrow \text{mole H}_2\text{O} \rightarrow \text{g H}_2\text{O}$

$$9.2 \times 10^7 \text{ joules} \times \frac{1 \text{ kilojoule}}{1000 \text{ joules}} \times \frac{2 \text{ mole H}_2\text{O}}{803 \text{ kJ}} \times \frac{18.01528 \text{ g H}_2\text{O}}{1 \text{ mole H}_2\text{O}} = 4.12803 \times 10^3 \text{ g H}_2\text{O}$$

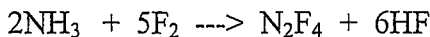
$$= \boxed{4.1 \times 10^3 \text{ g H}_2\text{O}}$$

- c) Calculate the number of calories released from the reaction of 605 grams of methane, CH_4 . $1 \text{ cal} = 4.184 \text{ joules}$ $\text{g CH}_4 \rightarrow \text{mole CH}_4 \rightarrow \text{kJ} \rightarrow \text{J} \rightarrow \text{cal}$

$$605 \text{ g CH}_4 \times \frac{1 \text{ mole CH}_4}{16.04276 \text{ g CH}_4} \times \frac{803 \text{ kJ}}{1 \text{ mole CH}_4} \times \frac{1000 \text{ J}}{1 \text{ kJ}} \times \frac{1 \text{ cal}}{4.184 \text{ J}} = 7.23769 \times 10^6 \text{ cal}$$

$$= \boxed{7.24 \times 10^6 \text{ cal}}$$

6.



- a) The reaction of 17.3 grams of F_2 in the above reaction resulted in the collection of 4.55 grams of N_2F_4 . What was the % yield in this reaction? $\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100$

$$\% \text{ Yield} = \frac{4.55 \text{ g N}_2\text{F}_4}{\left(17.3 \text{ g F}_2 \times \frac{1 \text{ mole F}_2}{37.9968 \text{ g F}_2} \times \frac{1 \text{ mole N}_2\text{F}_4}{5 \text{ mole F}_2} \times \frac{104.007}{1 \text{ mole N}_2\text{F}_4}\right)} \times 100 = 48.04185\%$$

$$= \boxed{48.0\%}$$

- b) If the above reaction runs in 63.8% yield, how many grams of HF could be collected from the reaction of 547 grams NH₃?

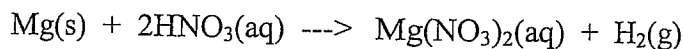
$$547 \text{ g NH}_3 \times \frac{1 \text{ mole NH}_3}{17.03052 \text{ g NH}_3} \times \frac{6 \text{ mole HF}}{2 \text{ mole NH}_3} \times \frac{20.00634 \text{ g HF}}{1 \text{ mole HF}} \times \frac{63.8 \text{ g HF actual}}{100 \text{ g HF Theoretical}} =$$

$$1229.8977 \text{ g HF}$$

$$= \boxed{1230 \text{ g HF}}$$

$$= \boxed{1.23 \times 10^3 \text{ g HF}}$$

7. Solution Stoichiometry.



- a) Calculate the number of mL of 4.23M HNO₃ needed to prepare 117 grams of Mg(NO₃)₂ from the above reaction.

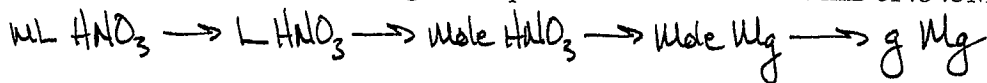
* We have not done conc. yet.
Hold on these last two.

$$117 \text{ g Mg(NO}_3)_2 \times \frac{1 \text{ mole Mg(NO}_3)_2}{148.3148 \text{ g Mg(NO}_3)_2} \times \frac{2 \text{ mole HNO}_3}{1 \text{ mole Mg(NO}_3)_2} \times \frac{1 \text{ L HNO}_3(\text{aq})}{4.23 \text{ mole HNO}_3} \times \frac{1000 \text{ mL HNO}_3(\text{aq})}{1 \text{ L HNO}_3(\text{aq})} =$$

$$372.98468 \text{ mL HNO}_3$$

$$= \boxed{373 \text{ mL HNO}_3(\text{aq})}$$

- b) How many grams of Mg are required to react with 28.4 mL of .645M HNO₃?



$$28.4 \text{ mL HNO}_3 \times \frac{1 \text{ L HNO}_3}{1000 \text{ mL HNO}_3} \times \frac{0.645 \text{ moles HNO}_3}{1 \text{ L HNO}_3} \times \frac{1 \text{ mole Mg}}{2 \text{ mole HNO}_3} \times \frac{24.3050 \text{ g Mg}}{1 \text{ mole Mg}} =$$

$$= 0.222609495 \text{ g Mg}$$

$$= \boxed{0.223 \text{ g Mg}}$$