

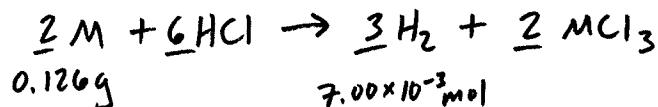
Name:

## WP Practice

### Exam 6: Stoichiometry

(Also review pretest packet for Unit 9: Stoichiometry)

1. 0.126 g of a metal, M, reacts with HCl (aq) to form hydrogen gas and MCl<sub>3</sub>. It is found that 7.00x10<sup>-3</sup> mole of hydrogen forms. Calculate the atomic mass (g/mol) of the metal and give the chemical symbol.



$$\text{atomic mass of } M = \frac{\text{g } M}{\text{mol } M}$$

← have  
← get from mol H<sub>2</sub>

$$7.00 \times 10^{-3} \text{ mol } H_2 \times \frac{2 \text{ mol } M}{3 \text{ mol } H_2} = 4.67 \times 10^{-3} \text{ mol } M$$

$$\frac{0.126 \text{ g } M}{4.67 \times 10^{-3} \text{ mol } M} = \boxed{27.0 \text{ g/mol}} \Rightarrow \boxed{Al}$$

find on p-table

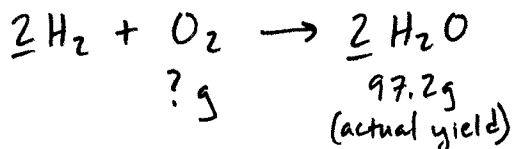
2. 0.303 g of a metal, M, reacts with H<sub>2</sub>SO<sub>4</sub> to form hydrogen gas and M<sub>2</sub>SO<sub>4</sub>. It is found that 0.0066 mole hydrogen forms. Calculate the atomic mass of the metal and give the chemical symbol.



$$0.0066 \text{ mol } H_2 \times \frac{2 \text{ mol } M}{1 \text{ mol } H_2} = 0.013 \text{ mol } M$$

$$\frac{0.303 \text{ g } M}{0.013 \text{ mol } M} = \boxed{23 \text{ g/mol}} \Rightarrow \boxed{Na}$$

3. Hydrogen combines with oxygen to produce water. If the yield for the reaction is 45.0%, how many grams of oxygen will have to be started in the reaction to yield 97.2 grams of water, assuming excess hydrogen? (Hint: use the formula for % yield and solve for theoretical yield)



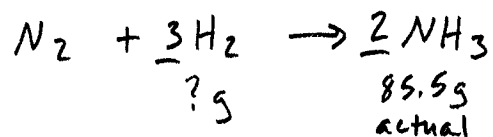
$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}}$$

$$\text{theoretical} = \frac{\text{actual}}{\% \text{ yield}}$$

$$\frac{97.2 \text{ g } H_2O}{0.450} = 216 \text{ g } H_2O \text{ (theoretical yield)}$$

$$216 \text{ g } H_2O \times \frac{1 \text{ mol } H_2O}{18.02 \text{ g } H_2O} \times \frac{1 \text{ mol } O_2}{2 \text{ mol } H_2O} \times \frac{32.00 \text{ g } O_2}{1 \text{ mol } O_2} = \boxed{192 \text{ g } O_2}$$

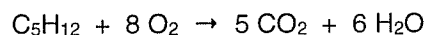
4. Nitrogen combines with hydrogen to produce  $\text{NH}_3$ . If the yield for the reaction is 28.6%, how many grams of hydrogen will have to be started in the reaction to yield 85.5g  $\text{NH}_3$ , assuming excess nitrogen? (Hint: use the formula for % yield and solve for theoretical yield)



$$\frac{85.5 \text{ g NH}_3}{0.286} = 299 \text{ g NH}_3 \text{ (theoretical)}$$

$$299 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.04 \text{ g NH}_3} \times \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} \times \frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2} = \boxed{53.2 \text{ g H}_2}$$

5. Pentane,  $\text{C}_5\text{H}_{12}$ , burns in oxygen to give carbon dioxide and water according to the following equation:



In one experiment, a mixture of 0.480 mol of pentane was burned in 0.995 mol of oxygen in a sealed steel vessel.

- a) Calculate the theoretical yield, in moles, of water.

$$0.480 \text{ mol C}_5\text{H}_{12} \times \frac{6 \text{ mol H}_2\text{O}}{1 \text{ mol C}_5\text{H}_{12}} = 2.88 \text{ mol H}_2\text{O}$$

$$0.995 \text{ mol O}_2 \times \frac{6 \text{ mol H}_2\text{O}}{8 \text{ mol O}_2} = \boxed{0.746 \text{ mol H}_2\text{O}}$$

- b) Find the limiting reactant, if any.

$\text{O}_2$  is limiting

- c) How many moles of the excess reactant are leftover from the reaction?

$$0.746 \text{ mol H}_2\text{O} \times \frac{1 \text{ mol C}_5\text{H}_{12}}{6 \text{ mol H}_2\text{O}} = 0.124 \text{ mol C}_5\text{H}_{12}$$

$$0.480 \text{ mol C}_5\text{H}_{12} - 0.124 \text{ mol C}_5\text{H}_{12} = \boxed{0.356 \text{ mol C}_5\text{H}_{12} \text{ in excess}}$$