MORE PRACTICE

DIRECTIONS: Read each question carefully. For all calculations you must show your work and record your answers with the correct units and significant figures.

1. If the theoretical yield of Product A is 137 grams and you produce 132.5 grams in lab, what is your percent yield of Product A?

$$\frac{132.5\text{ g}}{137\text{ g}} \times 100\% = \boxed{96.7\%}$$

2. Magnesium reacts with copper (I) chloride in a single displacement reaction. If 10.00 grams of magnesium reacts with excess copper (I) chloride solution, how many grams of copper will be formed?

$$Mg + 2\,CuCl \rightarrow MgCl_2 + 2\,Cu$$

$$10.00\text{ g Mg} \left| \frac{1\text{ mol Mg}}{24.30\text{ g Mg}} \right| \frac{2\text{ mol Cu}}{1\text{ mol Mg}} \left| \frac{63.55\text{ g Cu}}{1\text{ mol Cu}} \right.$$

$$= \boxed{52.30\text{ g Cu}}$$

3. When 32.55 grams of heptane (C_7H_{16}) is burned, 93.40 grams of carbon dioxide is formed. What is the percent yield of carbon dioxide?

$$C_7H_{16} + 11\,O_2 \rightarrow 7\,CO_2 + 8\,H_2O$$

$$32.55\text{ g } C_7H_{16} \left| \frac{1\text{ mol } C_7H_{16}}{100.23\text{ g } C_7H_{16}} \right| \frac{7\text{ mol } CO_2}{1\text{ mol } C_7H_{16}} \left| \frac{44.01\text{ g } CO_2}{1\text{ mol } CO_2} \right.$$

$$= 100.0\text{ g } CO_2$$

$$\frac{93.40\text{ g}}{100.0\text{ g}} \times 100\% = \boxed{93.40\%\text{ yield}}$$

4. If 21.62 grams of pentane (C_5H_{12}) reacts with 70.15 grams of oxygen gas, which of the reactants is limiting? How many grams of each product can be formed? How many grams of the excess reactant remain?

$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

$21.62\text{ g } C_5H_{12} \left| \frac{1\text{ mol } C_5H_{12}}{72.17\text{ g } C_5H_{12}} \right| \frac{5\text{ mol } CO_2}{1\text{ mol } C_5H_{12}} \left| \frac{44.01\text{ g } CO_2}{1\text{ mol } CO_2} \right. = 65.92\text{ g } CO_2$

$21.62\text{ g } C_5H_{12} \left| \frac{1\text{ mol } C_5H_{12}}{72.17\text{ g } C_5H_{12}} \right| \frac{6\text{ mol } H_2O}{1\text{ mol } C_5H_{12}} \left| \frac{18.02\text{ g } H_2O}{1\text{ mol } H_2O} \right. = 32.39\text{ g } H_2O$

$70.15\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \right| \frac{5\text{ mol } CO_2}{8\text{ mol } O_2} \left| \frac{44.01\text{ g } CO_2}{1\text{ mol } CO_2} \right. = 60.30\text{ g } CO_2$

$70.15\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \right| \frac{6\text{ mol } H_2O}{8\text{ mol } O_2} \left| \frac{18.02\text{ g } H_2O}{1\text{ mol } H_2O} \right. = 29.63\text{ g } H_2O$

O_2 is limiting ∴ you can form 60.30 g CO_2 + 29.63 g H_2O

$70.15\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \right| \frac{1\text{ mol } C_5H_{12}}{8\text{ mol } O_2} \left| \frac{72.17\text{ g } C_5H_{12}}{1\text{ mol}} \right. = 19.78\text{ g needed}$ ∴ 1.84 g remain

5. If 9.04 grams of Tin (Tin is a transition metal) reacts with oxygen to form 11.48 grams of a certain tin oxide, what is the formula for the tin oxide? What is the charge on the tin ion?

$Sn + O_2 \rightarrow Sn_xO_y$

If 9.04 g Sn react w O_2 to form 11.48 g of a tin oxide this means 2.44 g Oxygen is used

$9.04\text{ g Sn} \left| \frac{1\text{ mol Sn}}{118.70\text{ g}} \right. = .0762\text{ mol Sn}$

$2.44\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g}} \right. = .0763\text{ mol } O_2$

∴ $Sn : O_2$ is 1 : 1

$Sn + O_2 \rightarrow SnO_2$

The charge on Tin is +4

6. What is the theoretical yield of aluminum oxide when 21.60 grams of aluminum reacts with 17.60 grams of oxygen gas? How may grams of the excess reactant will remain? $4\,Al + 3\,O_2 \rightarrow 2\,Al_2O_3$

$$21.60\text{ g Al} \left| \frac{1\text{ mol Al}}{26.98\text{ g Al}} \right| \frac{2\text{ mol } Al_2O_3}{4\text{ mol Al}} \left| \frac{101.96\text{ g } Al_2O_3}{1\text{ mol}} \right| = 40.81\text{ g } Al_2O_3$$

$$17.60\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \right| \frac{2\text{ mol } Al_2O_3}{3\text{ mol } O_2} \left| \frac{101.96\text{ g } Al_2O_3}{1\text{ mol}} \right|$$

O_2 is limiting – 37.39 g Al_2O_3 is theoretical yield = 37.39 g Al_2O_3

$$17.60\text{ g } O_2 \left| \frac{1\text{ mol } O_2}{32.00\text{ g}} \right| \frac{4\text{ mol Al}}{3\text{ mol } O_2} \left| \frac{26.98\text{ g}}{1\text{ mol}} \right| = 19.79\text{ g needed}$$

21.60 − 19.79 = 1.81 g A remain

7. How many grams of oxygen are needed to react with 17.40 grams of butane (C_4H_{10})? How many grams of carbon dioxide and water can be formed? Check your answers by comparing the total grams of reactants and the total grams of products.

$2\,C_4H_{10} + 13\,O_2 \rightarrow 8\,CO_2 + 10\,H_2O$

$$17.40\text{ g } C_4H_{10} \left| \frac{1\text{ mol } C_4H_{10}}{58.14\text{ g } C_4H_{10}} \right| \frac{13\text{ mol } O_2}{2\text{ mol } C_4H_{10}} \left| \frac{32.00\text{ g } O_2}{1\text{ mol}} \right| = 62.25\text{ g } O_2$$

$$17.40\text{ g } C_4H_{10} \left| \frac{1\text{ mol } C_4H_{10}}{58.14\text{ g } C_4H_{10}} \right| \frac{8\text{ mol } CO_2}{2\text{ mol } C_4H_{10}} \left| \frac{44.01\text{ g}}{1\text{ mol}} \right| = 52.68\text{ g } CO_2$$

$$17.40\text{ g } C_4H_{10} \left| \frac{1\text{ mol } C_4H_{10}}{58.14\text{ g } C_4H_{10}} \right| \frac{10\text{ mol } H_2O}{2\text{ mol } C_4H_{10}} \left| \frac{18.02\text{ g } H_2O}{1\text{ mol}} \right| = 26.96\text{ g } H_2O$$

$17.40\text{ g} + 62.25\text{ g} = 52.68\text{ g} + 26.96\text{ g}$

$79.65\text{ g} = 79.64\text{ g}$ close

8. How many grams of sodium chloride will be formed when 2.4 grams of sodium carbonate reacts with excess hydrochloric acid?

$Na_2CO_3 + 2\,HCl \rightarrow 2\,NaCl + H_2O + CO_2$

$$2.4\text{ g } Na_2CO_3 \left| \frac{1\text{ mol } Na_2CO_3}{105.99\text{ g } Na_2CO_3} \right| \frac{2\text{ mol NaCl}}{1\text{ mol } Na_2CO_3} \left| \frac{58.44\text{ g}}{1\text{ mol NaCl}} \right| = 2.6\text{ g NaCl}$$