Name: _____
Hour: ____ Date: _____

Chemistry: *Supplemental Stoichiometry Problems*

Directions: *Solve each of the following problems. Assume excess of any reactant that isn't mentioned, unless otherwise specified. Show your work, including proper units, to earn full credit.*

1. Given the balanced equation, show what the following molar ratios (i.e., the conversion factors) should be. Include units in all terms. $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$

a. C_4H_{10} / O_2 b. O_2 / CO_2 c. O_2 / H_2O d. C_4H_{10} / CO_2 e. C_4H_{10} / H_2O

2. How many moles of oxygen are made if 12.0 moles of potassium chlorate react? $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

Q3 involves the reaction: *Copper(II) chloride reacts w/sodium nitrate to produce copper(II) nitrate and sodium chloride.*

3A. Write the balanced equation for the reaction.

3B. If 20.0 g of copper(II) chloride react with 20.0 g of sodium nitrate, what mass of sodium chloride is formed?

3C. What is the limiting reactant? _____

3D. How many moles of copper(II) nitrate are formed?

3E. What mass of excess reactant is left over?

ANSWERS: 2. 18.0 mol O_2 3B. 13.8 g NaCl 3C. $NaNO_3$ 3D. 0.118 mol $Cu(NO_3)_2$ 3E. 4.2 g $CuCl_2$

4A. How many grams of potassium chloride are produced from… $2\ K + Cl_2 \rightarrow 2\ KCl$

…2.50 g of potassium and excess chlorine?

4B. …1.00 g of chlorine and excess potassium?

5A. If 25.0 g of iron(III) phosphate react with excess sodium sulfate, how many grams of iron(III) sulfate can be made? $2\ FePO_4 + 3\ Na_2SO_4 \rightarrow Fe_2(SO_4)_3 + 2\ Na_3PO_4$

5B. If 18.5 grams of iron(III) sulfate are actually produced in Q5A, what is the percent yield?

5C. Now, a different trial of the reaction is done, starting with 15.0 grams of sodium sulfate and excess iron(III) phosphate. If that trial achieves a 65.0% yield, how many grams of sodium phosphate were made?

6A. What mass of sodium hydroxide is made from 1.20×10^2 g of sodium oxide? $Na_2O + H_2O \rightarrow 2\ NaOH$

6B. How many grams of sodium oxide are required to produce 1.60×10^2 grams of sodium hydroxide?

7. A human needs about 120. grams of glucose per day. How many grams of carbon dioxide are used by plants to produce this amount of glucose? $6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$

ANSWERS:

4A. 4.77 g KCl	5A. 33.1 g $Fe_2(SO_4)_3$	5C. 7.50 g Na_3PO_4	6B. 124 g Na_2O
4B. 2.10 g KCl	5B. 55.9%	6A. 155 g NaOH	7. 176 g CO_2

For Q8 and Q9: ***A. Which reactant is the limiting reactant?***
B. What number of moles of each product is formed?
C. What mass of excess reactant is left over after the reaction is complete?

8. Start with 30.0 grams of ammonium nitrate and 50.0 grams of sodium phosphate.

$3\ NH_4NO_3 + Na_3PO_4 \rightarrow (NH_4)_3PO_4 + 3\ NaNO_3$

9. Start with 100.0 grams of calcium carbonate and 45.0 grams of iron(III) phosphate.

$3\ CaCO_3 + 2\ FePO_4 \rightarrow Ca_3(PO_4)_2 + Fe_2(CO_3)_3$

ANSWERS:
8A. NH_4NO_3
8B. 0.125 mol $(NH_4)_3PO_4$, 0.375 mol $NaNO_3$
8C. 29.5 g Na_3PO_4
9A. $FePO_4$
9B. 0.149 mol $Ca_3(PO_4)_2$, 0.149 mol $Fe_2(CO_3)_3$
9C. 55.2 g $CaCO_3$

10. What quantity of energy is released when 540 g of cyclopentane are burned? $2\ C_5H_{10} + 15\ O_2 \rightarrow 10\ CO_2 + 10\ H_2O + 6{,}199\ kJ$

11A. What mass of iron is needed to react with 16.0 grams of sulfur? $8\ Fe + S_8 \rightarrow 8\ FeS$

11B. How many grams of iron(II) sulfide are produced?

12. A chemical company must produce 650 L of hydrogen at STP. The company has done this reaction many times before, and the percent yield is always about 84%. What mass of each reactant must they use in order to ensure that they produce 650 L of hydrogen? $Mg + 2\ HNO_3 \rightarrow Mg(NO_3)_2 + H_2$

13A. What volume of oxygen at STP is produced from 19.4 moles of sodium chlorate? $2\ NaClO_3 \rightarrow 2\ NaCl + 3\ O_2$

13B. How many molecules of oxygen are produced when 80.0 grams of sodium chloride are produced?

14A. How many moles of copper react with 3.50 moles of silver nitrate? $Cu + 2\ AgNO_3 \rightarrow Cu(NO_3)_2 + 2\ Ag$

14B. If 89.5 grams of silver were produced, how many grams of copper reacted?

15. What quantity of heat is produced if 32 g of cyclohexane react with 95 L of oxygen at STP? $C_6H_{12} + 9\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 3{,}690\ kJ$

ANSWERS:

10. 2.4×10^4 kJ
11A. 27.8 g Fe
11B. 43.8 g FeS
12. 840 g Mg, 4400 g HNO_3
13A. 652 L O_2
13B. 1.23×10^{24} m'c O_2
14A. 1.75 mol Cu
14B. 26.3 g Cu
15. 1400 kJ