Stoichiometry Worksheet

1. Na_2SIO_3 (s) + 8 HF(aq) → H_2SiF_6 (aq) + 2 NaF(aq) + 3 H_2O (l)

a. How many moles of HF are needed to react with 0.300 mol of Na_2SiO_3?

b. How many grams of NaF form when 0.500 mol of HF reacts with excess Na_2SiO_3?

c. How many grams of Na_2SiO_3 can react with 0.800 g of HF?

2. $C_6H_{12}O_6$ (aq) → 2 C_2H_5OH (aq) + 2 CO_2 (g)

a. How many moles of CO_2 are produced when 0.400 mol of $C_6H_{12}O_6$ reacts in this fashion?

b. How many grams of $C_6H_{12}O_6$ are needed to form 7.50 g of C_2H_5OH?

c. How many grams of CO_2 form when 7.50 g of C_2H_5OH are produced?

3. Fe_2O_3 (s) + CO (g) → Fe(s) + CO_2 (g) (unbalanced!)

a. Calculate the number of grams of CO that can react with 0.150 kg of Fe_2O_3

b. Calculate the number of grams of Fe and the number of grams of CO_2 formed when 0.150 kg of Fe_2O_3 reacts

4. $2\ NaOH\ (s) + CO_2\ (g) \rightarrow Na_2CO_3\ (s) + H_2O\ (l)$

a. Which reagent is the limiting reactant when 1.85 mol NaOH and 1.00 mol CO_2 are allowed to react?

b. How many moles of Na_2CO_3 can be produced?

5. $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

a. What is the theoretical yield of C_6H_5Br in this reaction when 30.0 g of C_6H_6 reacts with 65.0 g or Br_2?

b. If the actual yield of C_6H_5Br was 56.7 g, what is the percent yield?

Mixed Stoichiometry Practice

Name _____

Date _____ Period _____

Write and/or balance the following equations (remember the diatomic elements and to criss-cross charges for ionic compounds!!!) Use the mole ratios from the balanced equations to solve the following stoichiometry problems. Use units and labels in all conversions, and round your answer to sig figs.

1. Potassium chlorate decomposes into potassium chloride and oxygen gas.

Balanced Equation:

2. How many moles of oxygen are produced when 3.0 moles of potassium chlorate decompose completely?

3. Butane (C_4H_{10}) undergoes complete combustion.

Balanced Equation:

4. How many grams of CO_2 are produced when 88 g of O_2 are reacted with an excess of butane?

5. Water decomposes into hydrogen gas and oxygen gas by electrolysis.

Balanced Equation:

6. How many grams of hydrogen will be produced when 6.0 moles of oxygen are produced?

7. How many grams of water are required to produce 9.00 grams of hydrogen?

8. Cobalt(II) chloride reacts with fluorine in a single replacement reaction to produce cobalt(II) fluoride and chlorine gas.

Balanced Equation:

9. How many grams of fluorine are required to produce 290.8 g of cobalt(II) fluoride?

10. Balance the following equation. Strontium chloride reacts with sulfuric acid to produce hydrochloric acid and strontium sulfate.

Balanced Equation:

What is the mass of strontium chloride that reacts with 300.0 g of sulfuric acid?

11. Solid iron(III) oxide reacts with hydrogen gas to form iron and water.

Balanced Equation:

12. How many grams of iron are produced when 450 grams of iron(III) oxide are reacted?

13. How many grams of water will be produced when 0.0155 moles of hydrogen gas react completely with iron(III) oxide?

(1) $Na_2SiO_{3(s)} + 8\,HF_{(aq)} \rightarrow \ldots$

see webpage for solutions.

(2) $C_6H_{12}O_{6(aq)} \rightarrow 2\,C_2H_5OH_{(aq)} + 2\,CO_{2(g)}$

(a) $0.400\,mol\ C_6H_{12}O_6 \rightarrow ?\ mol\ CO_2$

$$(0.400\,mol\ C_6H_{12}O_6)\left(\frac{2\,mol\ CO_2}{1\,mol\ C_6H_{12}O_6}\right) = 0.800\,mol\ CO_2\ produced$$

(b) $7.50\,g\ C_2H_5OH$, how much $C_6H_{12}O_6$ needed?

3 steps:

i. $$(7.50\,g\ C_2H_5OH)\left(\frac{1\,mol\ C_2H_5OH}{46\,g\ C_2H_5OH}\right) = 0.163\,mol\ C_2H_5OH$$

ii. $$(0.163\,mol\ C_2H_5OH)\left(\frac{1\,mol\ C_6H_{12}O_6}{2\,mol\ C_2H_5OH}\right) = 0.0815\,mol\ C_6H_{12}O_6$$

iii. $$(0.0815\,mol\ C_6H_{12}O_6)\left(\frac{180\,g\ C_6H_{12}O_6}{1\,mol\ C_6H_{12}O_6}\right) = 14.7\,g\ C_6H_{12}O_6$$

(3) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(a) 0.150 kg → ? g

150 g

g → mol $(150\,g\,Fe_2O_3)\left(\frac{1\,mol\,Fe_2O_3}{159.7\,g\,Fe_2O_3}\right) = 0.94\,mol\,Fe_2O_3$

mol → mol $(0.94\,mol\,Fe_2O_3)\left(\frac{3\,mol\,CO}{1\,mol\,Fe_2O_3}\right) = 2.82\,mol\,CO$

mol → g $(2.82\,mol\,CO)\left(\frac{28\,g\,CO}{1\,mol\,CO}\right) = 78.96\,g\,CO$

(b) $(0.94\,mol\,Fe_2O_3)\left(\frac{2\,mol\,Fe}{1\,mol\,Fe_2O_3}\right) = 1.88\,mol\,Fe$

$(1.88\,mol\,Fe)\left(\frac{55.85\,g\,Fe}{1\,mol\,Fe}\right) = 105\,g\,Fe$

$(0.94\,mol\,Fe_2O_3)\left(\frac{3\,mol\,CO_2}{1\,mol\,Fe_2O_3}\right) = 2.82\,mol\,CO_2$

$(2.82\,mol\,CO_2)\left(\frac{44\,g\,CO_2}{1\,mol\,CO_2}\right) = 124.1\,g\,CO_2$

(4) $2\ NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

$1.85\,mol \quad 1.0\,mol$

(a) $(1\,mol\,CO_2)\left(\frac{2\,mol\,NaOH}{1\,mol\,CO_2}\right) = 2\,mol\,NaOH$ (LR)

$(1.85\,mol\,NaOH)\left(\frac{1\,mol\,CO_2}{2\,mol\,NaOH}\right) = 0.925\,mol\,CO_2$ (XS)

(b) $(1.85\,mol\,NaOH)\left(\frac{1\,mol\,Na_2CO_3}{2\,mol\,NaOH}\right) = 0.925\,mol\,Na_2CO_3$

(5) $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

$30.0\,g \quad 65.0\,g$

(a) $(30.0\,g\,C_6H_6)\left(\frac{1\,mol\,C_6H_6}{78\,g\,C_6H_6}\right) = 0.385\,mol\,C_6H_6$ (LR)

$(65.0\,g\,Br_2)\left(\frac{1\,mol\,Br_2}{159.8\,g\,Br_2}\right) = 0.41\,mol\,Br_2$

$(0.385\,mol\,C_6H_5Br)\left(\frac{156.9\,g\,C_6H_5Br}{1\,mol\,C_6H_5Br}\right) = 60.4\,g\,C_6H_5Br$

(b) actual $= 56.7\,g$, $\% = \frac{56.7}{60.4} \times 100 = 93.9\%$ yield

(1) $2KClO_3 \rightarrow 2KCl + 3O_2$

(2) 3.0 mol ? mol

$$(3.0\ mol\ KClO_3)\left(\frac{3\ mol\ O_2}{2\ mol\ KClO_3}\right) = 4.5\ mol\ O_2$$

(3) $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

(4) XS 88 g O_2 ? g

i $(88\ g\ O_2)\left(\frac{1\ mol\ O_2}{32\ g\ O_2}\right) = 2.75\ mol\ O_2$

ii. $(2.75\ mol\ O_2)\left(\frac{8\ mol\ CO_2}{13\ mol\ O_2}\right) = 1.69\ mol\ CO_2$

iii. $(1.69\ mol\ CO_2)\left(\frac{44\ g\ CO_2}{1\ mol\ CO_2}\right) = 74.4\ g\ CO_2$

(5) $\underline{2}\,H_2O \rightarrow \underline{2}\,H_2 + \underline{1}\,O_2$

(6) g ? $\quad$ 6.0 mol

i. $(6.0\ mol\ O_2)\left(\frac{2\ mol\ H_2}{1\ mol\ O_2}\right) = 12.0\ mol\ H_2$

ii. $(12.0\ mol\ H_2)\left(\frac{2\ g\ H_2}{1\ mol\ H_2}\right) = 24.0\ g\ H_2$

(7) ? g $\quad$ 9.0 g H_2

i $(9.0\ g\ H_2)\left(\frac{1\ mol\ H_2}{2\ g\ H_2}\right) = 4.5\ mol\ H_2$

ii $(4.5\ mol\ H_2)\left(\frac{2\ mol\ H_2O}{2\ mol\ H_2}\right) = 4.5\ mol\ H_2O$

iii $(4.5\ mol\ H_2O)\left(\frac{18\ g\ H_2O}{1\ mol\ H_2O}\right) = 81\ g\ H_2O$

(8) $1CoCl_2 + 1F_2 \rightarrow 1COF_2 + 1Cl_2$

(9) ? g 290.8 g

$$(290.8\text{ g } COF_2)\left(\frac{1\text{ mol } COF_2}{96.9\text{ g } COF_2}\right) = 3.0\text{ mol } COF_2$$

$$(3.0\text{ mol } COF_2)\left(\frac{1\text{ mol } F_2}{1\text{ mol } COF_2}\right) = 3.0\text{ mol } F_2$$

$$(3.0\text{ mol } F_2)\left(\frac{38\text{ g } F_2}{1\text{ mol } F_2}\right) = 114.04\text{ g } F_2$$

(10) $\underline{1}\ SrCl_2 + \underline{1}\ H_2SO_4 \rightarrow \underline{2}\ HCl + \underline{1}\ SrSO_4$

(11) ?g 300g

$$(300g\ H_2SO_4)\left(\frac{1mol\ H_2SO_4}{98g\ H_2SO_4}\right) = 3.06mol\ H_2SO_4$$

$$(3.06mol\ H_2SO_4)\left(\frac{1mol\ SrCl_2}{1mol\ H_2SO_4}\right) = 3.06mol\ SrCl_2$$

$$(3.06mol\ SrCl_2)\left(\frac{158.5g\ SrCl_2}{1mol\ SrCl_2}\right) = 485g\ SrCl_2$$

(12) $Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$

(13) 450g ?g

$$(450g\ Fe_2O_3)\left(\frac{1mol\ Fe_2O_3}{159.7g\ Fe_2O_3}\right) = 2.82mol\ Fe_2O_3$$

$$(2.82mol\ Fe_2O_3)\left(\frac{2mol\ Fe}{1mol\ Fe_2O_3}\right) = 5.64mol\ Fe$$

$$(5.64mol\ Fe)\left(\frac{55.85g\ Fe}{1mol\ Fe}\right) = 315g\ Fe$$