Name Answer Key Hour _____

Chapter 12 Review Problems

(Honors Chemistry)

1. How many grams of aluminum chloride are produced when an excess of aluminum reacts with 3.34×10^6 grams of hydrochloric acid in a single replacement reaction? $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

3.34×10^6 g HCl | 1 mol HCl / 36.5 g HCl | 2 mol $AlCl_3$ / 6 mol HCl | 133.5-g $AlCl_3$ / 1 mol $AlCl_3$

4.07×10^6 -g $AlCl_3$

2. In a double replacement reaction, 200.0-g of aqueous silver nitrate reacts with 200.0-g of sodium phosphate. How many representative particles of silver phosphate are produced? $3AgNO_3 + Na_3PO_4 \rightarrow Ag_3PO_4 + 3NaNO_3$

200.0 g $AgNO_3$ | 1 mol $AgNO_3$ / 170-g $AgNO_3$ | 1 mol Na_3PO_4 / 3 mol $AgNO_3$ | 164-g / 1 mol Na_3PO_4 → 64.3 g Na_3PO_4

LR = $AgNO_3$

200.0 g Na_3PO_4 | 1 mol Na_3PO_4 / 164-g | 3 mol $AgNO_3$ / 1 mol Na_3PO_4 | 170 -g / 1 mol $AgNO_3$ → 622 g $AgNO_3$

200.0-g $AgNO_3$ | 1 mol $AgNO_3$ / 170-g | 1 mol Ag_3PO_4 / 3 mol $AgNO_3$ | 6.02×10^{23} FU / 1 mol Ag_3PO_4

2.36×10^{23} FU Ag_3PO_4

3. The percent yield of water was 87.6% after the combustion of 5.93×10^{13} grams of tricarbon octahydride. What was the actual yield of water? $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

Theoretical Yield

5.93×10^{13} | 1 mol C_3H_8 / 44-g | 4 mol H_2O / 1 mol C_3H_8 | 18-g / 1 mol H_2O

9.70×10^{13} g H_2O

9.70×10^{13} -g x .876 (87.6%) = 8.50×10^{13} g H_2O

4. In a synthesis reaction @ STP, 3.51×10^{29} atoms of potassium reacts with 4.67×10^5 grams of chlorine gas. How much product, in grams, will be produced? $2K + Cl_2 \rightarrow 2KCl$

3.51×10^{29} atoms K | 1 mol K / 6.02×10^{23} atoms | 1 mol Cl_2 / 2 mol K | 71-g Cl_2 / 1 mol Cl_2 → 2.07×10^7 g Cl_2

LR = Cl_2

4.67×10^5 g Cl_2 | 1 mol Cl_2 / 71-g | 2 mol K / 1 mol Cl_2 | 6.02×10^{23} atoms / 1 mol K → 7.92×10^{27} atoms K

4.67×10^5 g Cl_2 | 1 mol Cl_2 / 71-g | 2 mol KCl / 1 mol Cl_2 | 74.5-g / 1 mol KCl

9.80×10^5 g KCl

5. Identify the excess reagent and how much excess reagent exists when 4.68×10^7 grams of chlorine gas reacts in a single replacement reaction with 7.53×10^5 grams of sodium iodide. $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$

4.68×10^7 g Cl_2 | 1 mol Cl_2 / 71-g | 2 mol NaI / 1 mol Cl_2 | 150-g / 1 mol NaI = 1.98×10^8 g NaI

7.53×10^5 g NaI | 1 mol NaI / 150 g | 1 mol Cl_2 / 2 mol NaI | 71-g / 1 mol Cl_2 = 1.78×10^5 g Cl_2

Excess Reagent = Cl_2 $\quad 4.68 \times 10^7 - 1.78 \times 10^5 =$ **4.66×10^7 g excess**

6. After a synthesis reaction @ STP, 7.54×10^4 grams of product was produced from the reaction of 5.62×10^5 grams of potassium oxide and an excess of water. What was the percent yield of product formed? $K_2O + H_2O \rightarrow 2KOH$

5.62×10^5 g K_2O | 1 mol K_2O / 94-g | 2 mol KOH / 1 mol K_2O | 56-g / 1 mol KOH = 6.70×10^5 g KOH

$$\frac{7.54 \times 10^4 \text{ g}}{6.70 \times 10^5 \text{ g}} \times 100 = \boxed{11.3\%}$$

7. How many atoms of calcium are produced when 4.78×10^9 grams of lithium reacts with an excess of calcium sulfate in a single replacement reaction? $2Li + CaSO_4 \rightarrow Ca + Li_2SO_4$

4.78×10^9 g Li | 1 mol Li / 7-g | 1 mol Ca / 2 mol Li | 6.02×10^{23} atoms / 1 mol Ca

2.06×10^{32} atoms Ca

8. Identify the excess reagent and how much excess reagent exists when 285.0 grams of carbon tetrahydride reacts in a combustion reaction with 3.47×10^4 grams of oxygen gas? $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

285.0 g CH_4 | 1 mol CH_4 / 16-g | 2 mol O_2 / 1 mol CH_4 | 32-g / 1 mol O_2 = 1.14×10^3 g O_2

3.47×10^4 g O_2 | 1 mol O_2 / 32-g | 1 mol CH_4 / 2 mol O_2 | 16 g / 1 mol CH_4 = 8675 g CH_4

Excess Reagent = O_2 $\quad 3.47 \times 10^4 - 1.14 \times 10^3 =$ **3.36×10^4 g Excess**

9. What volume of hydrogen gas, at STP, is produced when of 50.0 g of Mg reacts with 75.0 g of hydrochloric acid in a single replacement reaction? $Mg + 2HCl \rightarrow MgCl_2 + H_2$

50-g Mg | 1 mol Mg / 24-g | 2 mol HCl / 1 mol Mg | 36.5-g / 1 mol HCl = 152 g HCl

LR = HCl

75-g HCl | 1 mol HCl / 36.5-g | 1 mol Mg / 2 mol HCl | 24-g / 1 mol Mg = 24.7 g Mg

75.0 g HCl | 1 mol HCl / 36.5-g | 1 mol H_2 / 2 mol HCl | 22.4-L / 1 mol H_2 = **2.30×10^1 L H_2**