Chem. 110 **Name**_____

Fall 2003 **EXAM 4** **(Last)** **(First)**

Activity series of metals and formula weights are presented on the last page

Part 1

1. **For each of the following reactants, predict the products and complete and balance the equations with formulas, symbols, and coefficients. Write the correct physical state (g), (l), (s), (aq). State the type of reaction. (25 points)**

   a. **Calcium is added to water**

      Equation:_____

      Type of reaction:_____

   b. **Metallic aluminum reacts with Fluorine gas**

      Equation:_____

      Type of reaction:_____

   c. **Hexane gas (C_6H_{14}) burns in oxygen**

      Equation:_____

      Type of reaction:_____

   d. **Barium oxide is added to water**

      Equation:_____

      Type of reaction:_____

   e. **Lithium carbonate is heated**

      Equation:_____

      Type of reaction:_____

/25 points

2. **Write the molecular equation, with physical states [(g), (l), (s), (aq)], total ionic and net ionic equations for each of the following reactions. All equations must be balanced (22 points)**

   a. **Solutions of ammonium acetate and calcium sulfate are mixed**

      Molecular:_____

      Total:_____
      _

      Net:_____

   b. **Barium sulfate solution is added to potassium hydroxide solution**

      Molecular:_____

      Total:_____
      _

      Net:_____

   c. **Aluminum is added to a nitric acid solution**

      Molecular:_____

      Total:_____
      _

      Net:_____

   d. **Solutions of sodium sulfite and nitric acid are mixed**

      Molecular:_____

      Total:_____
      _

      Net:_____

/20 points

Problems **For the following problems show all work, correct units (throughout the problem) and significant figures. Present your work in an organized fashion.** **(Use dimensional analysis)** **Balance the equation first.**

1. **Copper reacts with nitric acid in the following equation: (22 points)**
   ___$Ag_{(s)}$ + ___$HNO_{3\,(aq)}$ → ___ $AgNO_{3\,(aq)}$ + ___$NO_{(g)}$ + ___H_2O

   a. **How many grams of silver are needed to produce 168.26 moles of silver nitrate?**

Answer:_____

   b. **How many molecules of water are produced at the same time that 42.5 grams of silver nitrate are produced?**

Answer:_____

   c. **What is the molar concentration of nitric acid if it takes 450.0 mls of the acid to produce 3.44 X 10^{24} molecules of nitrogen monoxide?**

Answer:_____

/22 points

2. 35.02 ml of 4.0 M of Aluminum nitrate and 50.0 g of potassium carbonate react according to the following equation: (19 points) (Fill in the blank spaces in the equation first.)

___$Al(NO_3)_3$ + ___K_2CO_3 → ___KNO_3 (__) + ___$Al_2(CO_3)_3$ ( )

a What is the limiting reactant?

Answer:_____

b What is the maximum mass (in grams) of precipitate produced?

Answer:_____

c How many grams of aluminum nitrate remain after the reaction is complete?

Answer:_____

d How many grams of potassium carbonate remain after the reaction is complete?

Answer:_____
/19

2. Under appropriate reaction conditions PCl_3 and H_2O produce Phosphorous acid and Hydrochloric acid according to the equation

$$PCl_3 + 3\ H_2O \rightarrow H_3PO_3 + 3\ HCl$$

a) What is the theoretical yield (in grams) of phosphorous acid if 9.44×10^{24} molecules of water and 250.0 g of phosphorous trichloride are mixed? (16 points)

Answer:_____

b) If the percent yield of hydrochloric acid is 76.2%, what is the actual yield?

Answer:_____

/16points

Activity Series for common metals and hydrogen

K
Na
Ca
Mg
Al
Zn
Cr
Fe
Ni
Sn
Pb
H
Cu
Hg
Ag
Pt
Au

	Molar mass
HNO_3	63.02 g/mol
$Cu(NO_3)_2$	187.57g/mol
NO	30.01g/mol
H_2O	18.02g/mol
$Pb(NO_3)_2$	331.22 g/mol
$AlBr_3$	266.68 g/mol
$PbBr_2$	367.00 g/mol
$Al(NO_3)_3$	213.01g/mol
PCl_3	137.32 g/mol
H_3PO_3	82.01g/mol
HCl	36.46 g/mol
$AgNO_3$	169.8731 g/mol
K_2CO_3	138.2055 g/mol
KNO_3	101.1032 g/mol
$Al_2(CO_3)_3$	233.9898 g/mol