Chemistry 1140 Exam Three   Name _____

R = 0.08206 L·atm/K·mol   **N = 6.022 x 10^{23} /mol**

All work must be shown to get full credit. Five points will be deducted if a pen is used.

1. (18 points) Balance *and* classify the following reactions. Use the smallest integer values possible for coefficients. Use the spaces provided for coefficients.

$P(s) +$ _____ $Cl_2(g) \rightarrow$ _____ $PCl_5(s)$

$Na(s) +$ _____ $NH_3(l) \rightarrow$ _____ $NaNH_2(s) +$ _____ $H_2(g)$

$Mg_3N_2(s) +$ _____ $H_2O(l) \rightarrow$ _____ $Mg(OH)_2(s) +$ _____ $NH_3(g)$

$BCl_3(g) +$ _____ $H_2O(l) \rightarrow$ _____ $H_3BO_3(aq) +$ _____ $HCl(aq)$

$CH_3OH(l) +$ _____ $O_2(g) \rightarrow$ _____ $H_2O(l) +$ _____ $CO_2(g)$

$NaN_3(s) \rightarrow$ _____ $Na(s) +$ _____ $N_2(g)$
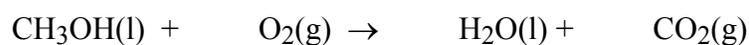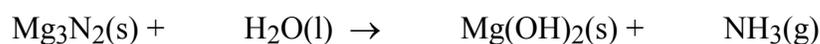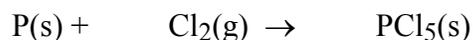
2. (12 points) For each metathesis reaction shown, a) write the products, b) balance the equation, and c) indicate the phase (solid or aqueous) for each product.

$Ca(NO_3)_2(aq) +$ _____ $K_2CO_3(aq) \rightarrow$

$FeCl_3(aq) +$ _____ $Na_3PO_4(aq) \rightarrow$

3. (6 points) Circle the substances that dissolve in water.

$AgCl$ $NaCl$ $Mg(NO_3)_2$ $Fe(OH)_3$ $CoCO_3$ $(NH_4)_2SO_4$

4. (10 points) Consider the following reaction:

$$3 \text{ Mg(s)} + \text{N}_2(\text{g}) \rightarrow \text{Mg}_3\text{N}_2(\text{s})$$
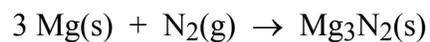
How many grams of magnesium are required to make 8.50 g of product?

5. (16 points) Consider the following reaction:

$$\text{K}_2\text{CO}_3(\text{aq}) + 2 \text{ AgNO}_3(\text{aq}) \rightarrow \text{Ag}_2\text{CO}_3(\text{s}) + 2 \text{ KNO}_3(\text{aq})$$
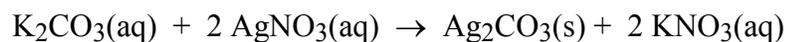
How many grams of Ag_2CO_3 are produced from 25.0 g of K_2CO_3 and 45.0 g of AgNO_3? (Hint: this is a limiting reagent problem.)

6. (8 points) How many water molecules are there in a water droplet with a mass of 3.0 µg?

7. (8 points) How many grams of Ne are contained in a large neon light if the volume is 3.50 L, the pressure is 1.15 atm, and the temperature is 23 ºC?

8. (8 points) Under identical conditions of pressure and temperature, which is more dense, moist air or dry air? Briefly explain why.

9. (14 points) Consider the production of lithium nitride from its elements:

$$6 \text{ Li(s) } + \text{ N}_2(g) \rightarrow 2 \text{ Li}_3\text{N(s)}$$
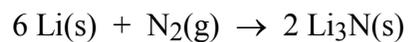
Calculate the percent yield if 3.456 g of lithium produces 4.980 g of product in excess N_2.

Extra Credit (no more than 10 points) Consider the decomposition of sodium azide (NaN_3):

$$2 \text{ NaN}_3(s) \rightarrow 2 \text{ Na(s) } + 3 \text{ N}_2(g)$$

How many grams of sodium azide are required to produce 8.36 L of N_2 gas at 22.5 °C and 0.976 atm?