NAME: **HONORS CHEMISTRY**

SECTION: Mixed Stoichiometry Problem Set

Answer the following questions. Show all your work; report your answer with appropriate units and the correct number of significant figures.

1. When elemental carbon is burned in the open atmosphere, with plenty of oxygen gas present, the product is carbon dioxide:

C(s) + O2(g) → CO2(g)

However, when the amount of oxygen present during the burning of the carbon is restricted, carbon monoxide is more likely to result:

2C(s) + O2(g) → 2CO (g)

What mass of each product is expected when a 5.00 g sample of pure carbon is burned under each of these conditions?

1. When zinc metal is added to an aqueous solution of silver nitrate, the following reaction occurs

\_\_Zn(s) + \_\_\_AgNO3(aq) → \_\_\_\_Ag(s) + \_\_Zn(NO3)2

Suppose a 2.00 g sample of zinc is added to a solution containing 2.50 g of silver nitrate.

Show which reactant is limiting and calculate the mass of silver metal formed.

Determine the mass of unreacted starting material which remains.

1. When iron and steam react at high temperatures, the following reaction takes place.

3 Fe(s) + 4 H2O(g) → Fe3O4(s) + 4 H2(g)

* What is the theoretical mass of Fe3O4 that should form when 100. g of iron is reacted with 100. g of water vapor?
* Determine the mass of unreacted starting material which remains.
* What is the percent yield if only 122 g of Fe3O4 is actually isolated?
1. Calculate the amount of heat (in kJ) released in the production of 17 g of Fe2O3 according to the following equation: 4 FeO + O2 → 2 Fe2O3 + 560.4 kJ
2. One way to determine the amount of chloride ion in a water sample is to titrate the sample with a solution of AgNO3 of known molarity to produce AgCl, as shown in the net ionic equation below:

Ag+(aq) + Cl-(aq) → AgCl(s)

If a 25.0 mL sample of water requires 27.2 mL of 0.104 M AgNO3, how many moles of AgCl will precipitate? What is the concentration of Cl- in the original sample?

1. Consider the following reaction, where X represents an unknown element:

6X(s) + 2 B2O3(s) → B4X3(s) + 3XO2(s)

If 165 g of X reacts completely with diboron trioxide to produce 2.29 mol of B4X3, what is the identify of X?

1. Ammonia reacts with oxygen to form nitrogen dioxide and water according to the following reaction:

4 NH3(g) + 7 O2(g) → 4 NO2(g) + 6 H2O(g)

You react ammonia and oxygen, and at the end of the experiment you find that you produced 23.0 g of water and have 8.52 g of ammonia left over. Determine the mass of oxygen that reacted.

Answers

1. 18.3 g CO2, 11.7 g CO
2. AgNO3 is LR, 1.59 g Ag, 1.52 g Zn
3. 138 g, 57 g XS reactant, 88.4% yield
4. -30. kJ
5. 0.002829 moles, 0.113 M
6. carbon
7. 47.7 g oxygen reacted