Chem. 111
Spring 07
100 Points

Name _____
(Last)   (First)

EXAM 1

All significant figures and set-ups must be shown in an organized way. All units must be shown throughout the problems. Use the following table for molar masses.

Compound	Molar Mass g/mole	Compound	Molar Mass g/mole
H_2SO_4	98.0795	K_3PO_4	212.2663
$PbCO_3$	267.2092	K_3PO_3	196.2669
$Al_2(CO_3)_3$	233.9907	$NiSO_4$	154.7570
CO_2	44.01	$Ni_2(SO_4)_3$	405.5776
H_2O	18.0153	NH_3	17.031
$PbSO_4$	303.2636	SO_2	64.0648
$Al_2(SO_4)_3$	342.1539		

1. (10 points) When heated in air, an element, E, burns to form a oxide with the molecular formula E_2O_5. A 0.6251 g sample of the element produced 1.432 g of the compound.

    a. What is the molar mass of element E?

    Answer _____

    b. What is the symbol of element E?   Answer _____

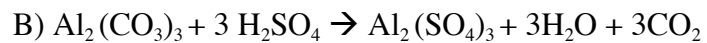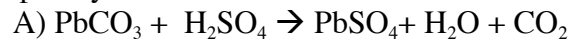   c. What is the name of the compound?   Answer _____
    /10 points

1

2. The molecule Caffeine has the formula $C_8H_xO_2N_4$. The compound contains 28.85% N by mass. What is the value of the integer X? (15 points)

What is the correct empirical formula for caffeine?

Answer _____

/15 points

2

3.Excess amount of H_2SO_4 is added to a mixture of $PbCO_3$ and $Al_2(CO_3)_3$. The mixture reacted completely.

    A) $PbCO_3 + H_2SO_4 \rightarrow PbSO_4 + H_2O + CO_2$

    B) $Al_2(CO_3)_3 + 3\ H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2O + 3CO_2$

    2.13g H_2O and 8.46 g $PbSO_4$ are produced along with $Al_2(SO_4)_3$ and CO_2. What is the mass of the original mixture? (15 points)

Answer _____

/15 points

3

4. Upon chemical treatment all of the phosphorous in a 125.21 g sample of a compound is converted to 158.8 g of potassium phosphate. (14 points)
   a. What is the mass percent of phosphorous in the compound

Answer _____

   b. Calculate the molar mass of the compound if there are 3 phosphorous atoms in each molecule of the compound.

/15 points   Answer _____

4

5. Treatment of 36.44 g of X_2O_3 with excess oxygen produces 40.44 g X_2O_5. Write the balanced equation. What is the molar mass of X. (12 points)

/12points   Answer _____

5

6.A mixture contains 22.21% nickelic sulfate, 24.88% nickelous sulfate, and the rest is sodium oxide. What is the number of sulfate ions in 146.91 grams of the mixture? (10 points)

Answer _____

7. Suppose 25.11 g of the metal nitride M_3N_2 reacts with H_2O to produce a metal oxide, MO, and 8.46 g of ammonia. Write the balanced equation. What is the molar mass of the metal? (15 points)

Answer _____

8. Quinine, a molecule that is active against the disease malaria contains only carbon, hydrogen, oxygen and nitrogen. It contains 8.63 % nitrogen by mass. It is found to contain 2 nitrogen atoms in every molecule of the compound. What is the molar mass of the quinine molecule? (10 points)

Answer _____

/10 points

8

9. In an effusion experiment, it was determined that nitrogen gas, N_2, effused through a small hole at a rate of 28.85 ml in .658 hrs. What would be the effusion rate of sulfur hexafluoride in liters per second if it effused under the same conditions? (10 points)
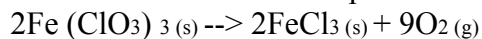
Answer_____

10. A 1,295 ml flask contains pure helium at a pressure of 745mmHg . A second flask with a volume of 485ml contains pure argon at a pressure of .825 atm .
If the two flasks are connected through a stopcock and the stopcock is opened, what is the partial pressure of argon? If the temperature is 45.4 $_0$C, how many moles of helium are present in the flask? (12 points)

Answer_____atm. Ar_____mol He

/22 pints

9

11. A 11.34 g mixture of potassium chloride and ferric chlorate are heated in an evacuated (no pressure) 3.0 L flask at $978^{\circ}C$. The potassium chloride does not react but the ferric chlorate decomposes.

$2Fe(ClO_3)_{3\ (s)} \rightarrow 2FeCl_{3\ (s)} + 9O_{2\ (g)}$

After the reaction goes to completion, the pressure is 4.00 atm? What is the percentage of KCl in the original mixture? (12 points)

Answer_____

12. Does the ideal gas law predict higher or lower gas pressure than what actually occurs in real gases? Describe under what conditions the pressure of real gases most deviate from ideal gases and what the molecules do in reality that causes this deviation from predicted pressure. Explain clearly. Write in complete sentences in a paragraph. Have a topic sentence with supporting sentences and a concluding sentence. (10 points)

/22 points

10