Name _____ AP Chemistry ___/___/___

Chapter 3 Practice Problems Homework

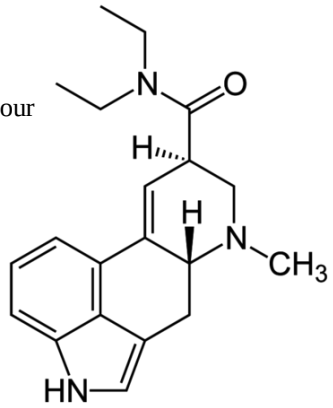
1. There are two naturally occurring isotopes of Gallium. One isotope, gallium-69, has a mass of 68.926 amu and an abundance of 60.108%.

a. A proton has a mass of 1.008 amu and the mass of a neutron is 1.009 amu. Explain why the mass of gallium-69 is less than 69 amu.

b. Calculate the **mass and name** of the other stable isotope of gallium.

2. D-lysergic acid diethylamide, (LSD) has a chemical formula of: $C_{20}H_{25}N_3O$.

a. Calculate the molar mass of LSD. Use the full atomic weight as it is listed on your periodic table.



b. Calculate the percent composition of the elements in LSD.

c. Determine the mass of each element in a 297 milligram sample of LSD.

d. In the 1960's a standard dose of LSD contained 270 micrograms of LSD. How many molecules of LSD are the in this size dose?

e. What is the mass of 1 molecule of LSD?

3. Caffeine is a popular stimulant used by people across the world. It is found in coffee, tea and colas.

a. Caffeine's percent composition is: 49.48% carbon, 5.15% hydrogen, 28.87% nitrogen and 16.49 % oxygen. Determine caffeine's empirical formula.

b. Caffeine has a molecular mass of 194.0 g/mol. Calculate caffeine's molecular formula.

4. A 2.00 gram sample of which of the following compounds contains the greatest mass of oxygen?

(A) sodium nitrate (B) sodium chlorate (C) sodium sulfite

(D) potassium chlorate (E) lithium nitrate

Explain:

5. A compound containing the elements C, H, N and O is analyzed. When a 2.1106 g sample is burned in excess oxygen, 3.2017 g of $CO_2(g)$ is formed. The combustion analysis also showed that the sample contained 0.1710 g of hydrogen.

(i) Determine the mass, in grams, of C in the 2.1106 g sample of the compound.

(ii) When the compound is analyzed for N content only, the mass percent of N is found to be 32.16%. Determine the mass, in grams of N in the original 2.1106 g sample of the compound.

(iii) Determine the mass, in grams, of oxygen in the original 2.1106 g sample of the compound.

(iv) Determine the empirical formula of the compound.

(v) The molecular mass of the compound is 174.2 g/mol. Determine the molecular formula of the compound.

6. Nitrogen gas reacts with hydrogen gas to form gaseous ammonia.

a. Write a balanced chemical equation for this reaction.

b. If 65.0 grams of nitrogen react with 10.0 grams of hydrogen gas, what is your limiting reactant. Justify your answer by showing your work or reasoning.

c. How many grams of the excess reagent will be left over once the reaction in part B has been carried out?

d. If in using the above amounts from part B, what is your theoretical yield?

e. If in using the above amounts from part B you produce 32.0 grams of ammonia, what is your percent yield?

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Chapter 3 Outline Review Problems

1. What isotope is used in determining the atomic mass of isotopes?

2. What is the mass ratio between carbon-12 and bromine-79. Bromine-79 has a mass of 78.918 amu?

3. There are two stable isotopes of bromine. Bromine-79 has a mass of 78.918 amu and an abundance of 50.69%. Bromine-81 has a mass of 80.916 amu and an abundance of 49.31%. Determine the average atomic mass of bromine.

4. Determine the molar mass and percent composition of the elements in potassium sulfate.

5. Determine the molar mass and the mass of each element in 69.96 grams of lithium chlorite.

6. Determine the number of molecules of sulfur hexafluoride there are in 150.0 grams of the substance.

7. Determine the volume of 1000. molecules of carbon dioxide at STP.

8. A compound that contains only nitrogen and oxygen is 30.4% N by mass; the molar mass of the compound is 92 g/mol. What is the empirical formula of the compound? What is the molecular formula of the compound?

9. Maleic acid is an organic compound composed of 41.39% C, 3.47% H, and the rest oxygen. If 0.129 mol of maleic acid has a mass of 15.0 g, what are the empirical and molecular formulas of maleic acid?

10. Answer the following questions that relate to the analysis of chemical compounds.
A compound containing the elements C, H, N, and O is analyzed. When a 1.2359 g sample is burned in excess oxygen, 2.241 g of $CO_2(g)$ is formed. The combustion analysis also showed that the sample contained 0.0648 g of H.

(i) Determine the mass, in grams, of C in the 1.2359 g sample of the compound.

(ii) When the compound is analyzed for N content only, the mass percent of N is found to be 28.84 percent. Determine the mass, in grams, of N in the original 1.2359 g sample of the compound.

(iii) Determine the mass, in grams, of O in the original 1.2359 g sample of the compound.

(iv) Determine the empirical formula of the compound.

(v) The molecular mass of the compound is 194.2 g/mol. Determine the molecular formula of the compound.

11. Aluminum powder is mixed with iron(II) oxide and the mixture is ignited. In one trial 44.06 grams of aluminum is reacted with 110.07 grams of iron(II) oxide.
(a) Write the balance chemical equation for the reaction that occurs. Identify the reactants and products.
(b) Identify the limiting reactant. Support your answer with calculations.
(c) How much of the excess reagent remains?
(d) Calculate the theoretical mass of iron metal produced.
(e) If 73.11 grams of iron are actually produced, what is the percent yield?