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AP Chemistry – Isn't the first quarter over yet? – 20

Name _____Per ___

1. Aluminum hydroxide reacts with sulfuric acid as follows:

$$2\ Al(OH)_{3\,(s)} + 3\ H_2SO_{4\,(aq)} \rightarrow Al_2(SO_4)_{3\,(aq)} + 6\ H_2O_{(l)}$$

(a) Which reactant is the limiting reactant when 0.450 moles of $Al(OH)_3$ and 0.550 moles of H_2SO_4 are allowed to react?

(b) How many moles of $Al_2(SO_4)_3$ can form under these conditions?

(c) How many moles of the excess reactant remain after the completion of the reaction?

2. Solutions of sulfuric acid and lead(II) acetate react to form solid lead(II) sulfate and aqueous acetic acid. If 7.50 g of sulfuric acid and 7.50 g of lead(II) acetate are mixed, calculate the mass of sulfuric acid, lead(II) acetate, lead(II) sulfate and acetic acid present in the mixture after the reaction is complete.

3. One molecule of the antibiotic penicillin G has a mass of 5.342×10^{-21} g. What is the molar mass of penicillin G?

4. Hemoglobin, the oxygen-carrying protein in red blood cells, has four iron atoms per molecule and contains 0.340% iron by mass. Calculate the molar mass of hemoglobin.

5. Serotonin is a compound that conducts nerve impulses in the brain. It contains 68.2 mass percent C, 6.84 mass percent H, 15.9 mass percent N and 9.06 mass percent O. Its molar mass is 176 g/mole. Determine its molecular formula.

6. An oxybromate compound, $KBrO_x$, where *x* is unknown, is analyzed and found to contain 52.92% Br. What is the value of *x*?

7. A mixture of $N_{2\,(g)}$ and $H_{2\,(g)}$ reacts in a closed container to form ammonia, $NH_{3\,(g)}$. The reaction ceases before either reactant has been totally consumed. At this stage 2.0 moles of N_2, 2.0 moles H_2, and 2.0 moles NH_3 are present. How many moles of N_2 and H_2 were present originally?

8. Balance the following chemical equations and indicate whether they are synthesis, decomposition or combustion reactions:

a) $C_3H_6 + O_2 \rightarrow CO_2 + H_2O$

b) $NH_4NO_3 \rightarrow N_2O + H_2O$

c) $C_5H_6O + O_2 \rightarrow CO_2 + H_2O$

d) $N_2 + H_2 \rightarrow NH_3$

e) $K_2O + H_2O \rightarrow KOH$

9. Calculate the percent carbon by mass in each of the following compounds:

a) CO_2

b) methanol

c) C_2H_6

d) CN_2H_4S

10. The molecular formula of aspartame, the artificial sweetener marketed as NutraSweet® is $C_{14}H_{18}N_2O_5$
a) What is the molar mass of aspartame?

b) How many moles of aspartame are present in 1.00 mg of aspartame?

c) How many molecules of aspartame are present in 1.00 mg of aspartame?

d) How many hydrogen atoms are present in 1.00 mg of aspartame?