M4 Practice Test

Empirical and molecular formulas:

Nicotine (molar mass 162.23 g/mol), an alkaloid in the nightshade family of plants that is mainly responsible for the addictive nature of cigarettes, contains 74.02% C, 8.710% H, and 17.27% N.

Determine the empirical and molecular formula for nicotine.

Determine the empirical and molecular formula for chrysotile asbestos. Chrysotile has the following percent composition: 28.03% Mg, 21.60% Si, 1.16% H, and 49.21% O. The molar mass for chrysotile is 520.8 g/mol.

A major textile dye manufacturer developed a new yellow dye. The dye has a percent composition of 75.95% C, 17.72% N, and 6.33% H by mass with a molar mass of about 240 g/mol. Determine the molecular formula of the dye.

Combustion Analysis:

Quinone, which is used in the dye industry and in photography, is an organic compound containing only C, H, and O. A 0.105g sample of the compound gives 0.257g of CO_2 and 0.0350g of H_2O when combusted; determine the empirical and molecular formula (molar mass 108g/mol).

A carbohydrate is a compound composed solely of carbon, hydrogen and oxygen. When 10.7695g of an unknown carbohydrate (Molar mass 128.2080 g/mol) was subjected to combustion analysis with excess oxygen, it produced 29.5747g CO_2 and 12.1068g H_2O. What is its molecular formula?

Ionic Equations:

Balance the following ionic equations:

___ MnO_4^- + ___H^+ + 5 H_2O_2 → 2 Mn^{2+} + ___H_2O + ___ O_2

___Fe^{2+} + ___MnO_4^- + ___H^+ → ___Fe^{3+} + ___Mn^{2+} + 4 H_2O

Determine the total and net ionic equations:

$$Na_2S_{(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + H_2S_{(g)}$$

Total:

Net:

$$K_3PO_{4(aq)} + CaCl_{2(aq)} \rightarrow KCl_{(aq)} + Ca_3(PO_4)_{2(s)}$$

Total:

Net:

Calculations from balanced equations:

85.4g of chlorine gas (Cl_2 molar mass 70.9g/mol) reacts with excess P_4 to produce 104g of PCl_3 (molar mass 137.3g/mol). Determine the percentage yield.

$$\_\_\_Cl_{2(g)} + \_\_\_P_{4(s)} \rightarrow \_\_\_PCl_{3(l)}$$

If the reaction of 91.3g of C_3H_6 (42.08g/mol) produces an 81.3% yield, how many grams of CO_2 (molar mass 44.01g/mol) would be produced?

$$\_\_\_C_3H_6 + \_\_\_O_2 \rightarrow \_\_\_CO_2 + \_\_\_H_2O$$

If the reaction of 77.0g of $Ca(CN)_2$ produces 27.1 grams of NH_3, what is the percentage yield?

$Ca(CN)_2$ molar mass: 92.11g/mol NH_3 molar mass: 17.03g/mol

$$\_\_\_Ca(CN)_2 + \_\_\_H_2O \rightarrow \_\_\_CaCO_3 + \_\_\_NH_3$$