Calculations: Formulae of Organic Compounds

1. When a sample with a mass of 2.448g of a compound present in liquefied petroleum gas was analyzed, it was found to contain 2.003g of carbon and 0.448 g of hydrogen. What is its empirical formula? The molecular mass was determined to be 44gmol^{-1}, suggest a structural formula and a name for the compound.

2. A sample of a liquid consisting of only C, H, and O and having a mass of 0.5438g was burned in pure oxygen and 1.039g of CO_2 and 0.6369g of H_2O were obtained. What is the empirical formula of the compound? Determine all possible structural isomers for the compound and name them.

3. Isobutylene is a raw material for making synthetic rubber. A sample with a mass of 0.6481g was found to contain 0.5555g of carbon; the rest was hydrogen. Its molecular mass was determined to be 57 gmol^{-1}. What are the empirical and molecular formulas of isobutylene?

4. Cyanuric acid is used for such different purposes as making synthetic sponges and for killing weeds. A sample with a mass of 0.5627g was found to contain 0.1570g of carbon, 0.01317g of hydrogen, and 0.1832g of nitrogen, with the balance being oxygen. Its molecular mass was found to be 129gmol^{-1}. Calculate the empirical and molecular formulas of cyanuric acid.

5. 0.5g of an organic compound containing carbon, hydrogen and oxygen gave on combustion 0.6875g of CO_2 and 0.5625g of H_2O. Find the empirical formula of the substance. If its molecular formula is 32gmol^{-1}, suggest a structural formula for it.

6. 1.363g of an organic compound gave on combustion 1.100g of CO_2 and 0.563g of H_2O. Also 1.435g of the compound gave 2.507g of AgBr. The molecular mass of the compound is 110gmol^{-1}. Determine its molecular formula.

7. Several organic compounds have the following data when analyzed…
    0.64g of the compound on combustion gave 1.45g of CO_2 and 0.96g H_2O.
    0.147g of the compound gave 29.8cm^3 of nitrogen at 25°C and 101.3kPa.
    The molecular mass of the compound was determined to be 60gmol^{-1}.
    Determine the common molecular formula for these organic compounds and write the structural formula for all possible isomers.

8. Two organic compounds A and B containing carbon, hydrogen and oxygen have identical molecular formulae. 0.80g of A gave on combustion 1.76g CO_2 and 0.96g H_2O. The molecular mass of B was determined to be 60gmol^{-1}. Find the molecular formula and suggest structural formula for A and B with names.

9. An organic compound containing carbon, hydrogen, oxygen and sulphur was found to contain 31.4% carbon, 2.52% hydrogen. 0.70g of the compound gave 1.37g of $BaSO_4$. Find the empirical formula. If the molecular mass is 238gmol^{-1}, suggest a structural formula and a name for the compound.

10. One of the most deadly poisons, strychnine, has a molecular mass of 334gmol^{-1} and the composition 75.42% C, 6.63% H, 8.38% N; the rest is oxygen. Calculate the empirical and molecular formulas of strychnine.