Chapter 10: Empirical and Molecular Formulas

1. In each case below, the molecular formula for a compound is given. Determine the empirical formula for each compound.

   a) C_6H_6. This is the molecular formula for benzene, a liquid commonly used in industry as a starting material for many important products.

   b) $C_{12}H_4Cl_4O_2$. This is the molecular formula for a substance commonly called dioxin, a powerful poison that sometimes occurs as a by-product in the production of other chemicals.

   c) $C_6H_{16}N_2$. This is the molecular formula for one of the reactants used to produce nylon.

2. When a 0.3546 g sample of vanadium metal is heated in air, it reacts with oxygen to achieve a final mass of 0.6330 g. Calculate the empirical formula of vanadium oxide.

3. A sample of lead arsenate, an insecticide used against the potato beetle, contains 1.3813 g of lead, 9.00672 g of hydrogen, 0.4995 g of arsenic, and 0.4267 g of oxygen. Calculate the empirical formula for the lead arsenate.

4. Cisplatin, the common name for a platinum compound that is 'used to treat cancerous tumors, has the composition (mass percent) 65.02% platinum, 9.34% nitrogen, 2.02% hydrogen, and 23.63% chlorine. Calculate the empirical formula for cisplatin.

5. The most common form of nylon (Nylon-6) is 63.68% carbon, 12.38% nitrogen, 9.80% hydrogen, and 14.14% oxygen. Calculate the expirical formula for Nylon-6.

6. A white powder is analyzed and found to have the empirical formula of P_2O_5. The compound has a molar mass of 283.88 g. What is the compound's molecular formula?

7. A compound used as an additive for gasoline to help prevent engine knocks shows the following percentages: 71.65% Cl 24.27% C 4.07% H. The molar mass is known to be 98.96 g. Determine the empirical formula and the molecular formula for this compound.

8. A compound consists of 40.00% C, 6.713% H, and 53.28% O on a mass basis and has a molar mass of approximately 180 g. Determine the molecular formula of the compound.