

EMPIRICAL AND MOLECULAR FORMULAS

Empirical or simplest formula merely represents the mole ratios of the elements in the compound.

Molecular formula, which represents the actual compound, may be the same as the empirical formula or may be any whole number multiple of it containing the same elements in the same relative proportions.

1. A compound with molecular mass of 216 contains 33.3 % carbon, 0.93 % hydrogen, and 65.7 % chlorine. Calculate the simplest formula and the molecular formula of the compound. (C_3HCl_2 , $C_6H_2Cl_4$)
2. When 5.00 g of phosphorous, P, is burned in air, 11.40 g of the oxide is produced. Calculate the simplest formula of the oxide of phosphorous. (P_2O_5)
3. A sample of the oxide of tin of mass 3.014 g is heated at a low temperature; part of the oxygen is driven off to form another oxide of mass 2.694 g. Further heating with $H_2(g)$ removes the rest of the oxygen to give 2.374 g of Sn. What are the simplest formulas of the oxides? (SnO , SnO_2)
4. When 3.46 g of the hydrate of sodium carbonate is heated to drive off the water of hydration, the anhydrous residue weighs 1.28 g. What is the formula of the hydrate? ($Na_2CO_3 \cdot 10H_2O$)
5. Vitamin C (MM=176) contains C, H, and O. 4.00 g of vitamin C on combustion gives 6.00 g CO_2 and 1.632 g H_2O . What are the empirical and molecular formulas? ($C_3H_4O_3$, $C_6H_8O_6$)
6. A sample of white powder seized by the police was suspected of being cocaine. Combustion analysis of a 0.01832 sample gave 0.04804 g CO_2 and 0.01099 g of H_2O . The molecular formula of cocaine is $C_{17}H_{21}NO_4$. Can this white powder be the cocaine? Explain your reasoning.
7. When heated in air an element, E, burns to form an oxide with the empirical formula E_2O_3 . A 0.5386 g sample of the element gave 0.7111 g of oxide. What is the atomic mass of E and name the oxide.
8. 0.2533 g sample of a compound of iron and sulfur was reacted with oxygen gas to produce 0.1945 g of Fe_2O_3 and 0.2344 g of SO_2 . What is the empirical formula of the compound of iron and sulfur?