

Problem Set #3

1. Tetraphosphorus decaoxide reacts with water to form phosphoric acid, a major industrial acid. In the laboratory, the oxide is used as a drying agent. What is the mass of 4.65×10^{22} molecules of tetraphosphorus decaoxide? How many P atoms are present in this sample?
2. An unknown metal M reacts with sulfur to form a compound with formula M_2S_3 . If 3.12 g M reacts with exactly 2.88 g S, what are the names of M and M_2S_3 ?
3. One of the most widespread environmental carcinogens (cancer causing agent) is benzo[a]pyrene ($M=252.30$ g/mol). It is found in coal dust, cigarette smoke and even charcoal-grilled meat. Analysis of this hydrocarbon shows 95.21% C and 4.79% H. What is the molecular formula of benzo[a]pyrene?
4. A dry-cleaning solvent ($M=146.99$ g/mol) that contains C, H and Cl is suspected as a cancer-causing agent. When a 0.250-g sample was studied by combustion analysis, 0.451 g CO_2 and 0.0617 g H_2O formed. Calculate the molecular formula.
5. Cortisone ($M=176$ g/mol) is a hormone formed in the adrenal gland that is used in the treatment of rheumatoid arthritis. It has the following elemental composition by mass: 70.0% C, 7.83% H and 22.2% O. What is the molecular formula?
6. Isobutylene is a hydrocarbon used in the manufacture of synthetic rubber. When 0.847 g of isobutylene was analyzed by combustion the 2.657 g of CO_2 and 1.089 g of H_2O were collected. What is the empirical formula of isobutylene?
7. Menthol ($M=156.3$ g/mol) a strong-smelling substance used in cough drops, is a compound of carbon, hydrogen, and oxygen. When 0.1595 g menthol was subjected to combustion analysis, it produced 0.449 g CO_2 and 0.184 g H_2O .
8. Serotonin ($M=176$ g/mol) is a compound that conducts nerve impulses in brain and muscle. It contains 68.2% C, 6.86 % H 15.9% N and 9.08 %O. What is the molecular formula?