Chapter 3 in-Class Problems

1. A certain element X forms a compound with oxygen in which there are two atoms of X for every three atoms of O. In this compound, 3.998 g of X is combined with 1.000 g of oxygen. Identify the element X.
2. Aspartame, C14H18N2O5, is an artificial sweetener sold as NutraSweet
   1. What is the molar mass of aspartame?
   2. How many grams of oxygen are in 23.2 g aspartame?
   3. How many milligrams of aspartame are present in 3.8 x 1018 molecules of aspartame?
3. Arcylonitrile, C3H3N, is the starting material for the production of a kind of synthetic fiber acrylics) and can be made from propylene, C3H6, by reaction with nitric oxide, NO, as follows (Use ICE method):

4 C3H6 (g) + 6 NO (g) → 4 C3H3N (s) + 6 H2O (l) + N2 (g)

What mass of C3H3N can be made when 21.6 g of C3H6 react with 21.6 g of nitric oxide?

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1. What mass of C3H3N can be made when 21.6 g of C3H6 react with 21.6 g of nitric oxide?
2. What is and how much excess reactant is present at the end of the reaction in grams
3. If the reaction above only goes to 92.4% completion how much Arcylonitrile, C3H3N was actually produced
4. Hexazole is a fungicide used to prevent mildew in rice and other crops. It is composed of 66.99% C, 9.56% H, and 23.44% N
   1. Determine the empirical formula of hexazole
5. 0.658 g of a compound containing only carbon, hydrogen, and oxygen is burned in excess O2. CO2 (1.285 g) and H2O (0.658g) are produced. The molar mass of the compound is determined by mass spectrometry to be 90 g/mole. Determine the empirical and molecular formulas.
6. Serotonin is a biomolecule composed of C, H, N, and O which is partially responsible for signaling the brain that we have had enough to eat. A 0.500 g sample of serotonin was subjected to combustion analysis forming 1.25 g of CO2 and 0.307 g of H2O. A second 0.350 g sample was reduced to convert all of the nitrogen to ammonia, forming 0.0677 g NH3. Determine the empirical formula of serotonin.