

EXTRA PROBLEMS – UNIT 2  
Chem 110

1. Indicate the position in the periodic table where each of the following occurs by giving the symbol of the element.
  - a. The  $4p$  subshell becomes completely filled.
  - b. The  $2s$  subshell becomes half-filled.
  - c. The fourth shell begins filling.
  - d. The fourth shell becomes completely filled.
2. Referring only to the periodic table, determine the element of lowest atomic number whose electronic configuration contains the following
  - a. Two completely filled orbitals.
  - b. Two completely filled subshells.
  - c. Two completely filled shells.
  - d. Two completely filled  $p$  subshells.
3. Calculate the number of nitrogen atoms in 5.25 g of a compound that contains 87.39% N and 12.61% H by mass.
4. A sample of a compound containing only C, H, and S was burned in oxygen, and 6.60 g of  $\text{CO}_2$ , 5.41 g of  $\text{H}_2\text{O}$ , and 9.61 g of  $\text{SO}_2$  were obtained. (Molar masses:  $\text{CO}_2 = 44.01 \text{ g/mole}$ ;  $\text{H}_2\text{O} = 18.02 \text{ g/mole}$ ;  $\text{SO}_2 = 64.06 \text{ g/mole}$ )
  - a. What is the empirical formula of the compound?
  - b. What was the mass, in grams, of the sample that was burned?
5. By analysis, a compound with the formula  $\text{KClO}_x$  is found to contain 28.9% chlorine by mass. What is the value of the interger  $x$ ?
6. A 7.503 g sample of a metal, M, is reacted with excess oxygen to yield 10.498 g of the oxide  $\text{MO}$ . Calculate the molar mass of the element M.
7. A certain compound contains only carbon, hydrogen, and oxygen. If it contains 47.4% carbon by mass, and if there is one oxygen atom present for every four hydrogen atoms, what is its empirical formula?
8. A mixture consists of 42.0%  $\text{NaCl}$  and 58.0%  $\text{CaCl}_2$  by mass. What is the total number of chloride ions ( $\text{Cl}^-$ ) present in 425 g of mixture? (Molar masses:  $\text{NaCl} = 58.44 \text{ g/mole}$ ;  $\text{CaCl}_2 = 110.98 \text{ g/mole}$ )
9. Methyl benzoate, a compound used in the manufacture of perfumes, has a molar mass of 136 g/mole, and its percent composition by mass is 70.57% C, 5.93% H, and 23.49% O. Determine the molecular formula of methyl benzoate.