**CHE1031 Lecture 2 HW**

Problems must be solved, or written out, in their entirety with all work shown on engineering graph paper. You must label each set in the upper left hand corner with your name, the date and the chapter. Problems must be identified by number and all work must be shown with answers boxed. Be sure your handwriting is legible. An example is posted in the ‘course basics’ section of our Moodle page.

**Dalton’s atomic theory**

1. Hydrogen sulfide is composed of two elements: hydrogen & sulfur. In an experiment, 6.500 g of hydrogen sulfide is fully decomposed into its elements.  
   a. If 0.384 g of hydrogen is isolated, how many grams of sulfur are isolated?

b. What fundamental law does this experiment demonstrate?

c. How does this law relate to Dalton’s atomic theory?

**Molecules & formulas**

2. What information does the empirical formula give us about a compound? What information does the molecular formula add? What does the structural formula tell us?

3. Determine the molecular and empirical formulas of the following:

a. the organic solvent, benzene, which has 6 carbons and 6 hydrogens

b. the compound silicon tetrachloride, with one silicon atom and four chlorine atoms, used in making computer chips

c. the reactive substance, diborane, with two boron atoms and six hydrogen atoms

d. the sugar, glucose, with six carbon atoms, twelve hydrogen atoms and six oxygen atoms

4. How many hydrogen atoms are there in each of these molecules?

a. C2H5OH

b. Ca(CH3COO)2

c. (NH3)3PO4

**Discovery of atomic structure**

5. How did Rutherford interpret the following observations made during his group’s particle scattering experiments?

a. Most α-particles were not deflected as they passed through the gold foil?

b. A few α-particles were deflected.

c. What differences would you expect if gold foil were replaced with beryllium foil?

6. An atom of rhodium (Rh) has a diameter of 2.7 x 10-8 cm.

a. How many Rh atoms would you place next to one another to span a distance of 6 μm?

b. If Rh atoms are spheres, what is the volume of a single atom (m3)?

7. Label each of these statements as **true** or **false**?

a. The nucleus of an atom contains most of the atom’s mass and takes up most of the atom’s volume.

b. Every atom of an element has the same number of protons.

c. The number of electrons in an atom is equal to the number of neutrons in that atom.

d. The protons of a helium atom are held together by a force called the strong nuclear force.

**Sub-atomic particles & the periodic table**

8. How many protons, neutrons & electrons are there in the following atoms:

a. 40Ar

b. 65Zn

c. 70Ga

9. Each of these isotopes is used in medicine. How many protons & neutrons are there in each isoptope?

a. phosphorous-32

b. chromium-51

c. cobalt-60

**Atomic weights**

10. Rubidium has two naturally occurring isotopes, rubidium-85 (mass 84.9118 amu, abundance 72.15%) and rubidium-87 (mass 86.9092 amu, abundance 27.85%). Calculate is the average atomic mass of rubidium.

11. Mass spectroscopy is a great technique for identifying molecular and atomic substances and samples. The spectrum of H2 gas can be measured under conditions that do not cause the molecule to break down into H atoms. The two naturally occurring isotopes of hydrogen are 1H (1.00783 amu; 99.9885%) and 2H (2.01410 amu; 0.0115%).

a. How many peaks with the mass spectrum of H2 have?

b. What is the approximate molecular masses of the types of H2 at each of these peaks?

c. Which type of H2 is most abundant (highest spectral peak) and which is least abundant (lowest spectral peak)?

**Periodic table**

12. For each of these elements record the name, atomic number and identify it as a metal, metalloid or nonmetal:

a. Li

b. Sc

c. Ge

**Ions & ionic compounds**

13. Use the periodic table to predict the charges of the following elements when they become ions:

a. Sr

b. As

c. Br

d. Se

14. Predict the formulas of the ionic compounds formed by these pairs of ions:

a. Cr+3 and Br-1

b. Fe+3 and O-2

c. Hg2+2 and CO3-2

15. Are these compounds ionic or molecular?

a. PF5

b. NaI

c. SCl2

d. Ca(NO3)2

**Naming chemical compounds**

Ionic compounds

16. Selenium, an element that is required in trace amounts for good nutrition, forms compounds in a manner similar to sulfur. Name these ions:

a. SeO4-2

b. Se-2

c. HSe-

17. Give the charges of the cation and anion of each of these compounds:

a. CuS

b. Ag2(SO4)

c. Al(ClO3)3

18. Name these ionic compounds:

a. K(CN)

b. CoS

c. Sr(OH)2

19. Write the formulas for these ionic compounds:

a. sodium phosphate

b. zinc nitrate

c. mercury (II) bromide

Molecular compounds

20. Name each of these molecular compounds:

a. N2O

b. NO

c. N2O5

Acids

21. Give the name or formula of each acid as appropriate:

a. hydroiodic acid

b. H2CO3

c. chloric acid