

CHEM 103

R&R 2

31 May 2024

Adapted from a 25 May 2016 document

1. Label each substance as pure (P) or as a mixture (M):

- a.  $\text{H}_2\text{O}$  \_\_\_\_
- b. Orange juice (with pulp) \_\_\_\_
- c. Blood \_\_\_\_
- d. Iron \_\_\_\_
- e. Sucrose \_\_\_\_

2. Label each substance as heterogeneous (Het) or homogeneous (Hom):

- a. Air \_\_\_\_
- b. Sand on the beach \_\_\_\_
- c. A cup of black coffee \_\_\_\_
- d. Rainwater \_\_\_\_
- e. Maple syrup \_\_\_\_

3. Label each property as extensive (E) or intensive (I):

- a. Volume \_\_\_\_
- b. Density \_\_\_\_
- c. Mass \_\_\_\_
- d. Melting point \_\_\_\_
- e. Boiling point \_\_\_\_
- f. Solubility \_\_\_\_

4. Does the following description of a compound or element refer to its physical properties (phys) or chemical properties (chem)?

- a. The atomic weight of carbon is 12 amu \_\_\_\_
- b. Magnesium burns in air to produce a white solid \_\_\_\_
- c. The melting point of gold is 1062 °C \_\_\_\_
- d. The density of uranium is 18.70 g·cm<sup>-3</sup> \_\_\_\_
- e. Zinc reacts with hydrochloric acid to produce hydrogen gas \_\_\_\_

5. Label each as kinetic (K) or potential (P) energy:

- a. Wheel spinning \_\_\_\_
- b. Skier at the top of a mountain \_\_\_\_
- c. Fuel before it is burned \_\_\_\_
- d. Current in a wire \_\_\_\_
- e. Vibrations of water molecules in an ice cube \_\_\_\_

6. For each of the following elements, give both the name and the chemical formula of its ion.  
(Feel free to use the periodic table.)

Ex: Sodium:  $\text{Na}^+$ , sodium cation

- a. Calcium:
- b. Silver:
- c. Sulfur:
- d. Copper (two answers!):
- e. Iodine:
- f. Hydrogen (two answers!):

7. The element copper has two stable isotopes. Isotope A has an atomic mass of 62.9296 u, while Isotope B has an atomic mass of 64.9278 u. According to the periodic table, copper has an atomic mass of 63.5463. Assuming that copper exists only as isotopes A and B, determine the percentage occurrence of each isotope.

8. Theobromine,  $\text{C}_7\text{H}_8\text{N}_4\text{O}_2$ , is found in chocolate and has been shown to have properties that stimulate the heart, dilate blood vessels, and increase fluid loss in the urine.

a. What is the molar mass of theobromine?

b. What is the percent composition by moles of each of the elements in theobromine?

c. What is the percent composition by mass of each of the elements in theobromine?

9. I poured 1.50 mL of 100% isopropyl alcohol,  $\text{CH}_3\text{CHOHCH}_3$  (density 0.786 g/mL at room temperature), on a paper cut to clean it. How many carbon atoms did I just pour on my finger?

10. Gypsum,  $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$ , is a common material used to make drywall. A *dihydrate* of calcium sulfate, there are two molecules of water for every molecule of calcium sulfate; moreover, these water molecules are incorporated into the crystal structure.

- What is the molar mass of gypsum?
- What is the percent composition by moles of each element in gypsum?
- Suppose I heat 175 g of gypsum to obtain anhydrous calcium sulfate. How much mass is lost as water vapor?