

CHEM 101—General Chemistry

Exam #1

20 October 2004

Name _____

1. (10 points) Label the following elements as atomic or diatomic compounds.

Chromium (Cr)

Mercury (Hg)

Hydrogen (H)

Nitrogen (N)

Helium (He)

Sodium (Na)

Iodine (I)

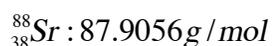
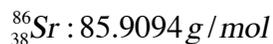
Oxygen (O)

Iron (Fe)

Selenium (Se)

2. (10 points) Give the correct molecular formula of a binary compound composed of nitrogen (N) and phosphorus (P).

3. (10 points) Strontium (Sr) has four naturally occurring isotopes with the following atomic masses:



The atomic weight listed in the Periodic Table is 87.62 g/mol. Which Sr isotope has the highest natural abundance?

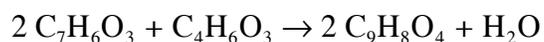
4. (20 points) A square piece of aluminum foil has a mass of 255 mg and is 3.000 inches long on each side. What is the thickness of the aluminum foil?

$$\rho_{\text{Al}} = 2.70 \text{ g/mL}$$

5. (20 points) What volume do 8.349×10^{11} molecules of water occupy at a temperature of $25\text{ }^\circ\text{C}$?

$$\rho_{\text{H}_2\text{O}}(25\text{ }^\circ\text{C}) = 0.99707\text{ g/mL}$$

6. (20 points) Aspirin (acetylsalicylic acid) is made by reacting salicylic acid with acetic anhydride:



If 1.826 g salicylic acid reacts with 0.675 g acetic anhydride to form 0.119 g water, how much aspirin is made in the reaction?

7. (20 points) A helium-filled balloon has a volume of 3.61 L. If 1.0000 mole of helium gas has a volume of 22.4, how many grams of helium are in the balloon? What is the mass of air displaced by the balloon?

$$\text{MW}_{\text{air}} = 28.8\text{ g/mol}$$

8. (20 points) The elemental composition of nicotine is 74.00% carbon, 8.65% hydrogen, and 17.35% nitrogen. Determine the empirical formula of nicotine.
9. (20 points) A compound of hydrazine dinitrate was determined to contain 2.508 g nitrogen, 0.271 g hydrogen, and 4.297 g oxygen. The molecular weight of the compound was measured to be 158.07 g/mol. Is the empirical formula of hydrazine dinitrate the same as the molecular formula? (You must show your work to support your answer.)