PHYS 0109 Name_____

To get the most out of this assignment, you should complete the assignment using only a calculator and the periodic table (not the list of elements) in the front of your book. However, you can use your book and your notes if you wish.

You cannot work on this assignment with a friend.

A couple of constants:

$N_A = 6.022 \times 10^{23}\ mol^{-1}$ 0 °C = 273.15 K
for H_2O at 20° d = 0.99823 g/cm^3

1. (2 pts. each) Provide names for the following compounds.

a. $CuCl_2$ copper(II) chloride b. $NaNO_2$ sodium nitrite

c. NH_4OH ammonium hydroxide d. P_2O_5 diphosphorous pentoxide

2. (2 pts. each) Provide formulas for the following compounds

a. cobalt(III) sulfate $Co_2(SO_4)_3$ b. dinitrogen tetroxide N_2O_4

c. potassium fluoride KF d. chloric acid $HClO_3$

3. (10 pts.) Determine the number of bromine atoms in 10.5 mL of bromoform (CBr_3H). The density of bromoform is 2.8899 g/mL.

$$10.5\ mL\ CHBr_3 \times \frac{2.8899\ g\ CBrr_3H}{1\ mL\ CBr_3H} \times \frac{1\ mol\ CBr_3H}{252.73\ g\ CBr_3H} \times \frac{3\ mol\ Br}{1\ mole\ CBr_3H} \times \frac{6.022 \times 10^{23}\ atoms\ Br}{1\ mol\ Br} =$$

$$= 2.1690 \times 10^{23}$$

$$= 2.17 \times 10^{23}\ atoms$$

4. (10 pts.) Determine the mass of fluorine required to make UF_6 from 3.977 g of uranium.

$$3.977\ g\ U \times \frac{1\ mol\ U}{238.029\ g\ U} \times \frac{6\ mol\ F}{1\ mol\ U} \times \frac{18.998\ g\ F}{1\ mol\ F} = 1.90451699582824$$

$$= 1.905\ g\ F$$

5. (12 pts) At 20 °C, 27.0852 g of a metal are added to student's picnometer. An additional 24.4487 g of water are required to completely fill the picnometer. In the absence of any added metal, the student's picnometer holds 26.4452 g of water.

a. Determine the volume of the picnometer.

$$26.4452 \text{ g } H_2O \times \frac{1 \text{ mL } H_2O}{0.99823 \text{ g } H_2O} = 26.49209 \text{ mL } H_2O$$

$$= 26.492 \text{ mL } H_2O$$

b. Determine the volume of the metal that was placed in the picnometer.

$$\text{vol metal} = \text{vol picnometer} - \text{vol of water added to metal}$$

$$\text{vol } H_2O \text{ added to metal to filll picnometer} = 24.4487 \text{ g } H_2O \times \frac{1 \text{ mL } H_2O}{0.99823 \text{ g } H_2O} = 24.49205 \text{ mL } H_2O$$

$$= 24.49205 \text{ mL } H_2O$$

$$\text{vol metal} = 26.49209 \text{ mL} - 24.49205 \text{ mL}$$

$$\text{vol metal} = 2.000 \text{ mL}$$

c. Determine the density of the metal that was placed in the picnometer.

$$d_{metal} = 27.0852 \text{ g}/2.000 \text{ mL}$$

$$d_{metal} = 13.54 \text{ g/mL}$$

6. (10) Determine the mass of a xenon atom in grams.

$$1 \text{ Xe atom} \times \frac{1 \text{ mol Xe atoms}}{6.022 \times 10^{23} \text{ Xe atoms}} \times \frac{131.29 \text{ g Xe}}{1 \text{ mol Xe atoms}} = 2.180 \times 10^{-22} \text{ g}$$

7. a. (5 pts) List the number of neutrons, protons, and electrons in a neutral carbon-10 atom.

$^1H^+ = 6$, $^0n = 4$, $e^- = 6$

b. (5 pts) List the number of neutrons, protons, and electrons in a potassium-39 ion.

$^1H^+ = 19$, $^0n = 20$, $e^- = 18$

8. (10 pts) Rutherford's alpha particle experiment (he shot alpha particles at thin metal foils) revealed what about the structure of the atom? (This answer only requires one sentence.)

The experiment revealed that an atom is mostly empty space, and that the mass of the atom is concentrated in the nucleus.