PS3.9. An oxide of osmium is pale yellow in color. A 2.89 g sample of this oxide contains 2.16 g of osmium. Assuming the remainder is oxygen determine the empirical formula of the compound.

PS3.10a. Combustion analysis of an unknown organic compound showed the presence of carbon, hydrogen and chlorine. When a 0.01870 g sample of the compound is combusted 0.00967 g of carbon dioxide and 0.00397 g of water are formed. Determine the empirical formula of compound.

PS3.10b. Determine the simplest formula for gold chloride if a 0.303 g sample of gold chloride reacts with $AgNO_3$ to produce gold nitrate and 0.430 g of AgCl.

Water is added to 4.267 grams of UF_6. After the reaction occurs two compounds are formed. A solid product that has a mass of 3.730 grams that contains only uranium, oxygen and fluorine. The other product is a gas with a mass of 0.970 grams that is 95.0% fluorine, and the remainder is hydrogen.

(a) From these data, determine the empirical formula of the gas.

(b) What fraction of the fluorine of the original compound is in the solid and what fraction is in the gas after the reaction?

(c) What is the formula of the solid product?

(d) Write a balanced equation for the reaction between UF_6 and H_2O. Assume that the empirical formula of the solid and the gas represent the true formula for each substance.

Design an experiment to collect data that supports the claim that a 1.0 *M* NaCl solution is a ***homogeneous*** mixture. Describe the steps, the data you would collect, and how the data support the claim. Laboratory equipment for your experiment should be taken from the list below. (You may not need all of the equipment.)

50 – mL beakers	Drying oven
Volumetric pipets (5 mL, 10 mL and 25 mL	Hot plate
Stirring rod	balance
100 mL of 1.0 *M* NaCl	Fume hood

You want to determine the $\Delta H^{\circ}_{solution}$, for NH_4Cl, the enthalpy associated with solid ammonium chloride dissolving in water $NH_4Cl_{(s)} \rightarrow NH_4Cl_{(aq)}$. Design an experiment to determine the $\Delta H^{\circ}_{solution}$. Describe the steps, the data you would collect, and how the data is used to determine $\Delta H^{\circ}_{solution}$. Assume you already know the heat capacity of the calorimeter. Laboratory equipment for your experiment should be taken from the list below. (You may not need all of the equipment.)

thermometer	100 mL beaker
Styrofoam cup(s) with lid	balance
100 mL graduated cylinder	Hot plate
Distilled water	Ice cubes

A, B, C and D are four chemical substances that comprised a chemical reaction. Some are reactants and some are products. Describe a strategy to determine the balanced chemical equation.

Break up into groups of 4 to 5 and come up with a strategy.

If all four are mixed together…

Substance	Initial Amount	Final Amount
A	1	2
B	1	0
C	1	0.5
D	1	1.5

Method to determine the balanced chemical equation:

	C + 2B → 2A + D			
I	1	1	1	1
C	-.5	-1	+1	+.5
F	0.5	0	2	1.5

$0.430\ g\ AgCl\left(\frac{1\ mol\ AgCl}{143.5\ g}\right)\left(\frac{1\ mol\ Cl}{1\ mol\ AgCl}\right)\left(\frac{35.5\ g}{1\ mol\ Cl}\right) = 0.106\ g\ Cl$

Since we initially had 0.303 g of gold chloride, and 0.106 g of it is chloride, than 0.303 g - 0.106 g is 0.197 g is gold.

$0.197\ g\ Au\left(\frac{1\ mol\ Au}{197\ g}\right) = 0.00100\ mol\ Au$

$0.106\ g\ Cl\left(\frac{1\ mol\ Cl}{35.5\ g}\right) = 0.00299\ mol\ Cl$

$\frac{0.00100\ mol\ Au}{0.00100\ mol} : \frac{0.00299\ mol\ Cl}{0.00100\ mol}$ = 1 Au : 3 Cl therefore the formula is $AuCl_3$

5. A compound that contains only carbon, hydrogen and oxygen is 48.64% carbon, 8.16% hydrogen and the remainder is oxygen. Determine the empirical formula for the substance.

   A) C_6HO_5
   B) $C_4H_8O_3$
   C) CH_3O
   D) $C_3H_6O_2$
   E) C_3H_3O

7. A chloride of the metal titanium reacts with water to produce an oxide of titanium and hydrogen chloride gas. When a 0.500 g sample of the chloride of titanium, is reacted with water, 0.355 g of hydrogen chloride is formed. What is the formula for the chloride of titanium?

A) $TiCl$
B) $TiCl_2$
C) $TiCl_3$
D) $TiCl_4$
E) $TiCl_5$

IN a laboratory students are given a substance that could be pure Cu or a compound composed of copper and oxygen. They are told to measure our a sample of the compound and to heat it for 10 minutes using a Bunsen burner. They are told that after heating the original sample the compound in their crucible is CuO. Describe how students would determine whether the original substance they were given is pure copper or and oxide of copper. If the original sample is an oxide, what is the formula of the oxide of copper?