## Part I: Chemical Formulae as Conversion Factors

By this point you should be comfortable converting grams ←→ moles←→ number of atoms or molecules for any element or compound. Next we will add chemical formulae as conversion factors to our toolbox. For example, if we wanted to convert between moles of $NH_3$ and moles of H atoms, we see that every 1mole of $NH_3$ has 3 moles of H atoms, which leads to the conversion factor.

$$\frac{3 \text{ mol H atoms}}{1 \text{ mol } NH_3} \text{ or } \frac{1 \text{ mol } NH_3}{3 \text{ mol H atoms}}$$

**1.** The following question refers to copper (II) sulfate. Show all your work with correct units and report your answer with correct significant figures and units.

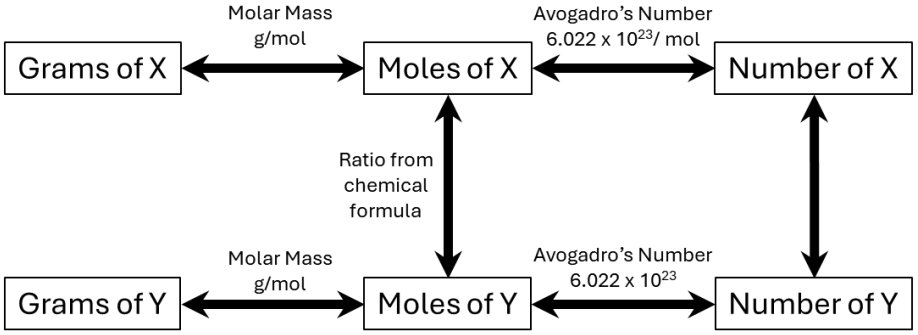
**a.** What is the formula for copper (II) sulfate?_____

**b.** Write a conversion factor that relates the moles of oxygen atoms to the moles of copper (II) sulfate.

**c.** Using the conversion factor from question 1b, determine how many moles of O atoms are present in 15.8 moles of copper (II) sulfate.

**d.** Using the conversion factor from question **1b**, determine how many moles of copper (II) sulfate you must have if you have a sample of a sample of copper (II) sulfate containing 2.50 moles of O atoms.

We can expand upon the flowchart used on the previous worksheet to now go between different molecules or elements in a chemical reaction. The conversion factor in the below chart is seen as the "ratio from chemical formula." This allows us to determine the relative quantity of one element or compound, *X*, to another, *Y*. Use the flowchart to answer question **2**.




**2.** Potassium permanganate is commonly used to treat a variety of skin conditions. How many iodine atoms are there in 2.8 grams of potassium permanganate? When using the above flowchart, replace *X* with potassium permanganate, and Y with Mn.

**a.** What is the formula for potassium permanganate?_____

**b.** Write a conversion factor that relates the moles of Mn atoms to the moles of potassium permanganate.

**c.** Using the flowchart as a guide, write out your plan for determining the number of Mn atoms in 2.8 grams of potassium permanganate. Be sure to write all the units in your flowchart. Units are more important than ever now that we are dealing with multiple atoms and molecules.

**d.** Finally, use the plan you just created in **2c** to calculate how man y Mn atoms are in 2.8 grams of potassium permanganate. Show all your work, including ALL units, for this calculation. Report your answer with the correct number of significant figures.

**3.** Now, let's use the flowchart as a guide for an entire chemical reaction. We will use this flowchart to determine how much silver sulfate can be made from 5.3 grams of lithium sulfate.

**a.** Balance the following reaction:

_____ $LiSO_{4\,(aq)}$ + _____ $AgClO_{3\,(aq)}$ → _____ $Ag_2SO_{4\,(s)}$ + _____ $LiClO_{3\,(aq)}$

**b.** Use your balanced chemical equation from above, determine the mole to mole ratio of lithium sulfate to silver sulfate.

**c.** Use the mole to mole ratio from **3b** to determine how many grams of silver sulfate can be made from 5.3 grams of lithium sulfate.