

1.
 - a. What is the atomic mass helium? _____ amu or _____ g/mole.
 - b. Calculate the molar mass of sulfur trioxide.

2. Write out four possible conversion factors needed to convert between moles, grams, and molecules/atoms.

3. Sulfur trioxide is a pollutant produced from burning coal. (Coal is mostly carbon, but can contain sulfur as an impurity.) SO_3 leads to the formation of sulfuric acid rain, according to the reaction: $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$
You calculated the molar mass of SO_3 in 1b, above.
 - a. Convert 27.3 grams of sulfur trioxide into moles.

 - b. Convert 2.4×10^{23} molecules of SO_3 into grams.
(What is the mass 2.4×10^{23} molecules of SO_3 ?)

 - c. How many molecules are in a 14.6 gram sample of SO_3 ?

 - d. How many atoms are in 2.4×10^{23} molecules of SO_3 ?
(hint: start by thinking about how many atoms are in ONE molecule of SO_3)

4. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ is the formula for sucrose, and is often called “table sugar.”
 - a. How many molecules are in 1.00 gram of sucrose?

 - b. How many atoms in 1.00 gram of sucrose?
(this is similar to #3d. Start by thinking about how many atoms are in 1 molecule of sucrose... and then combine this with your answer to 4a.)

4c. 1 cup of sugar (sucrose) contains 3.96×10^{23} molecules. What mass of sugar is this?

5a. Find the mass of 1.28×10^{22} water molecules.

b. A recipe calls for 150 mL (or 150 grams!) of water. How many water molecules will you need?

c. Find the mass of 1 water molecule. (Set up similarly to part (a)).

d. How many water molecules are in 2.50 moles of water?

e. How many atoms are in 2.50 moles of water?

6. The formula of caffeine is $C_8H_{10}N_4O_2$.

a. Calculate the molar mass of caffeine.

b. A 16 oz coffee from Starbucks (Pike Place Roast) contains 310 mg of caffeine. (0.31 grams)
How many caffeine molecules is this?

c. A Dr Pepper (12 oz can) contains 0.00021 moles of caffeine. How many milligrams of caffeine is this?

d. A cup of black tea (8 fluid ounces) contains 1.5×10^{20} molecules of caffeine. How many moles is this?