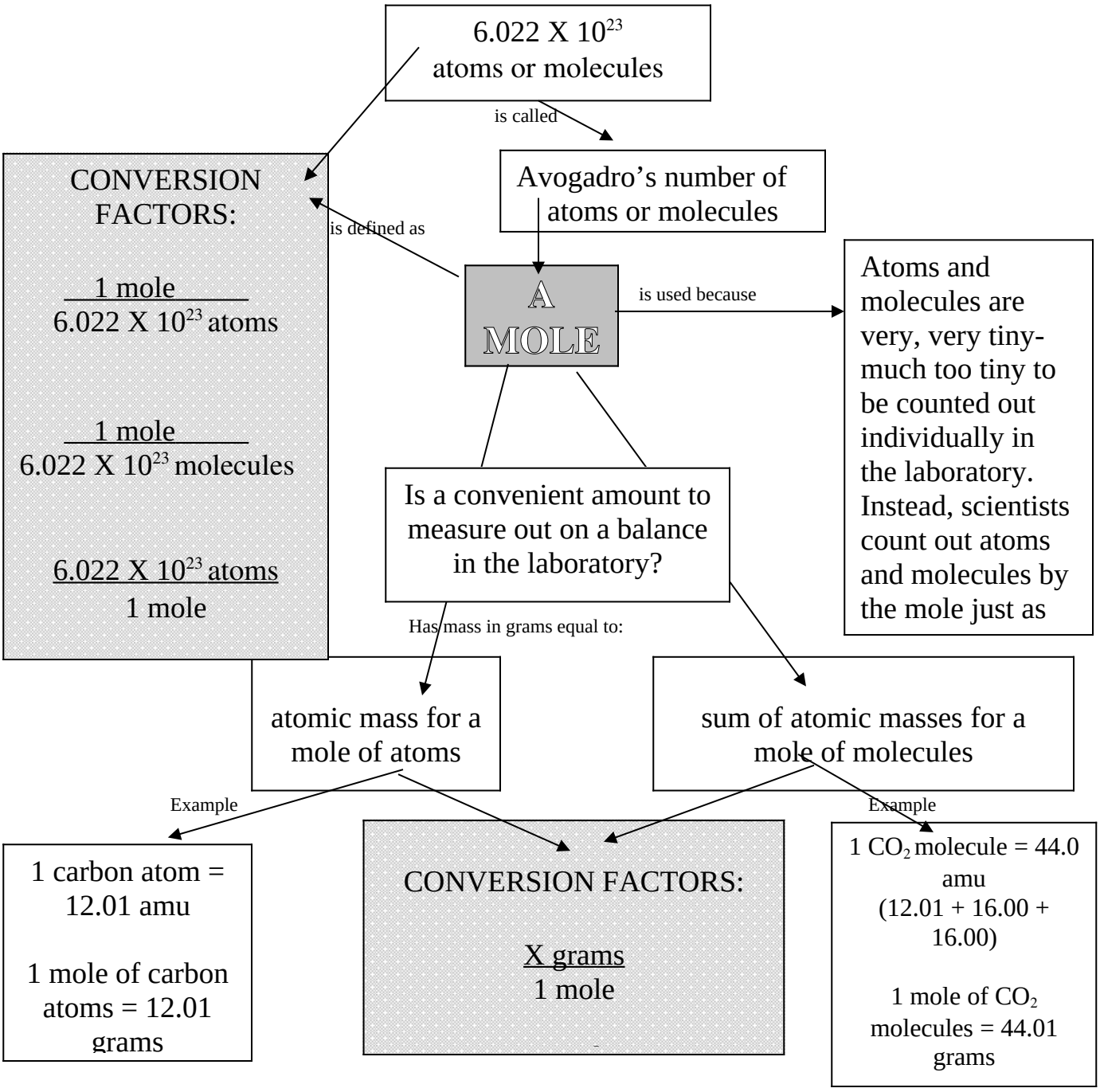

Conversions using the periodic table

Why was the number 6.02×10^{23} chosen for one mole?

Atoms and molecules are very, very tiny-much too tiny to be counted out individually in the laboratory. Instead, scientists count out atoms and molecules by the mole (just as eggs are counted out by the dozen and paper clips are counted out by the gross). The number of items in a mole (6.02×10^{23}) was carefully chosen so that:

1. It is a convenient amount to measure out on a balance in the laboratory. (i.e. what is the size of one mole of carbon?)

2. One mole of atoms of an element has a mass <u>in grams</u> equal to the atomic mass of the element in amu's.
    - What is the average relative mass or atomic mass in amu's of one atom of chlorine?

    - What is the mass in grams of one mole of chlorine atoms?

3. One mole of a substance has a mass <u>in grams</u> equal to the <u>sum</u> of the atomic masses for all atoms in the formula.
    - What is the mass in grams of one mole of NaCl?

Conversions using the periodic table and Avogadro's number

Use conversion factors to solve these problems. Your conversion factors will come from Avogadro's number or the periodic table.

1) Periodic Table

The periodic table tells you that for helium, 1 mole = 4.00g.
Therefore, there are two conversion factors you can use for helium:

$$\frac{1\text{ mole}}{4.00\text{g}} \quad \text{or} \quad \frac{4.00\text{g}}{1\text{ mole}}$$

The periodic table tells you that for H_2O, 1 mole = 18.00g.
Therefore, there are two conversion factors you can use for H_2O:

$$\frac{1\text{ mole}}{18.00\text{g}} \quad \text{or} \quad \frac{18.00\text{g}}{1\text{ mole}}$$

2) Avogadro's number

The definition of Avogadro's number is that 1 mole = 6.02×10^{23} atoms, Therefore there are two conversion factors you can use from this definition. Write them in the space below:

Avogadro's number also tells you that 1 mole = 6.02×10^{23} molecules, Therefore there are two conversion factors you can use from this definition. Write them in the space below:

Empirical Formulas

Experiments in the lab generate data that can be analyzed in order to determine the empirical formula of a compound. You did such experiments to determine the empirical formula of Magnesium oxide, MgO and Magnesium hydroxide, $Mg(OH)_2$.

How do you get from the data to the formula?

STEP 1: Change % to grams. [Skip this step if your data is already in grams.]

FREON If your data reveals that Freon-12 is 9.933% carbon, 58.63% chlorine and 31.44 % fluorine, how would you convert this to grams? Assume you have a 100 g sample. Then that sample has 9.933 g carbon, 58.63 g chlorine and 31.44 g fluorine.

ADVIL If your data reveals that the active ingredient in Advil contains 7.568 g of carbon, 0.881 g hydrogen and 1.551 g of oxygen, you can move on to step 2.

STEP 2: Convert the grams to moles using a conversion factor from the periodic table.

FREON Convert the above gram data for Freon-12 to moles.

9.933 g carbon X $\frac{1 \text{ mole}}{12.01 \text{ g}}$ = 58.63 g chlorine 31.44 g fluorine

ADVIL Convert the above gram data for Advil to moles.

7.568 g carbon 0.881 g hydrogen 1.551 g oxygen

STEP 3: Write the formulas using the moles you calculated. But change the moles to whole numbers.

FREON Freon-12 = $C_{0.8271}Cl_{1.664}F_{1.605}$
Divide all three numbers by 0.8271, the smallest number. Write the formula.

Are you close to whole numbers? Then round off to whole numbers for the formula.
Check your answer given in parentheses. (Ans CCl_2F_2)

ADVIL Advil = $C_{0.6301}H_{0.872}O_{0.09694}$
Divide all three of those numbers by 0.09694, the smallest number. Write the formula.

You can't really round off to whole numbers. So, multiply all of those by 2 (to get rid of the .5).
Check your answer given in parentheses. (Ans $C_{13}H_{18}O_2$)