Review of notes on Balancing Chemical Equations

When doing a chemical reaction, it is very important that exact **numbers of particles** be mixed so that the reaction takes place as expected.

      1 mole = 6.02×10^{23} (representative particles*)

This measurement is based on the number of particles in 12.000 grams of Carbon-12.

*Representative particles may be atoms, molecules, ions, formula units, so the following equalities are true:

                                      Write 2 conversion factors:

      1 mole = 6.02×10^{23} atoms

      1 mole = 6.02×10^{23} molecules

      1 mole = 6.02×10^{23} ions

      1 mole = 6.02×10^{23} formula units

Make *conversion factors* (see above) for each problem below.   Use them to solve problems about *moles and particles*.

Example:

How many atoms are in 2.00 moles of carbon?

Solution:

Your know that 1 mole C = 6.02×10^{23} atoms C, so the conversion factor is

      $\dfrac{6.02 \times 10^{23} \text{ atoms C}}{1 \text{ mole C}}$

Start with the given amount. Then use the conversion factor to convert the units.

2.00 moles C   X $\dfrac{6.02 \times 10^{23} \text{ atoms C}}{1 \text{ mole C}}$ = 1.2×10^{24} atoms C

You do these:

1. How many atoms are in 1.25 moles of iron?

2. How many atoms are in 4.75 moles of aluminum?

3. How many atoms are in 2.30 moles of calcium?

4. How many atoms are in 8.20 moles of CO_2?

This can also work in the other direction. How will you change the conversion factor? Why?

5. 3.01×10^{23} atoms of zinc is how many moles of zinc?

6. 1.20×10^{24} molecules of $C_6H_{12}O_6$ is how many moles?

In lab, you need a way to actually measure these quantities. Since you do not want to count the particles, and you have no way to measure 1 mole, you need a way to relate grams to moles. Remember carbon? If you need, for example, 3.00 moles of carbon for a chemical reaction, you can use the periodic table to find out that **1 mole carbon = 12.011 grams carbon**. You can make a conversion factor out of these equalities, and solve the problem:

3.00 moles C x 12.011 grams C   = 36.033 grams C
                        1 mole C

If you had, for example, 4.24 grams of carbon and wanted to know how many moles you had:

4.24 grams C x 1 mole C   =
                      12.011 g C

You have a resource for use in finding the number of grams in one mole of any atom. What is that resource?

_____

Definition: The mass of 1 mole of any substance is called its *molar mass*.

You try:

7. What is the mass in grams of 10.0 moles of Al?

8. What is the mass in grams of 5.00 moles of iron?

9. How many moles are equal to 20. grams of calcium?

Calculating molar mass

Now, let's try calculations involving compounds. You will first need to find the molar mass of the compound. You will need a periodic table and calculator.
To find molar mass, use this setup. It is important to write down your work because some compounds have several elements in them. Also, you can more easily check for errors if you have shown all your work.

Find the molar mass of aluminum carbonate:

Formula: $Al_2(CO_3)_3$ Al: 2 moles x
                                 C: 3 moles x 12.0111 g
                                 O: 9 moles x 15.9994 g
                                                 G

10. How many moles are equal to 10.0 grams of water? HINT: first, find the molar mass.

        Water is H_2O, so there are: H   2 x 1.00797 =   g
                                         O   1 x 15.9997 = _____ g
                                                                        g

11. What is the mass of 3.00 moles of glucose, $C_6H_{12}O_6$?

12. What is the mass in grams of 3.50 moles of NaCl (table salt?)

Gram-mole and Molar Mass Practice

1. How many moles are equal to 4.250 grams of water?

2. How many grams are equal to 1.30 moles magnesium chloride?

3. What is the mass in grams of 3.55 moles of sodium nitrate?

4, 22.50 grams of calcium carbonate are equivalent to what number of moles?

5. 10.0 grams of calcium nitrate are equal to how many moles of calcium nitrate?