Mole

The mole (mol) is the amount of substance that contains exactly 6.022×10^{23} particles (atoms, molecules, or ions). This number is called Avogadro's number.

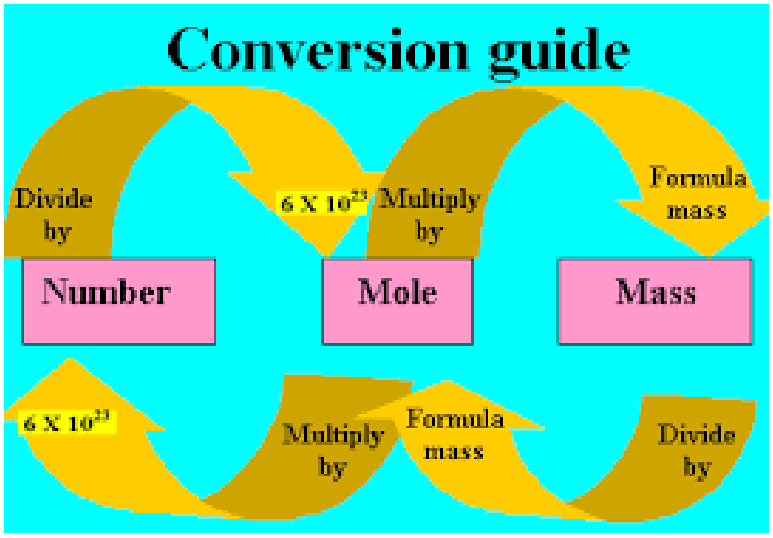

Figure 1 – a schematic to help you in your calculations

$$n = \frac{m}{M} \text{ (moles = mass ÷ molar mass)}$$

$$N = n \times N_A \ (N_A = \text{Avogadro's number})$$

$$m = n \times M \ (\text{Formula mass or atomic mass})$$

Figure 2 – the formulas you will need to complete the worksheet

Molar Mass (M)

The mass of **one mole** of a substance, measured in **grams per mole** (g mol^{-1})

How to find it:

Add the atomic masses from the periodic table.

Formula Mass (for ionic compounds)

The total mass of all atoms in the **formula** of an ionic compound

Formula Mass (for ionic compounds)

The total mass of all atoms in the **formula** of an ionic compound

Summary of steps to use in solving these problems

- Always start with $n = \frac{m}{M}$
- Use **ratios from the formula** for elements
- Convert to particles using **Avogadro's number**
- Convert back to mass with $m = nM$

1. Consider a mass of 18.0 grams of pure water.
    a. Find the amount of substance, in mol, present in 18.0 g of pure H_2O.

    b. Find the number of molecules present in this sample.

2. Consider a 4.40 g of dry ice (CO_2).
    a. Find the amount , in mol, of dry ice present in this sample.

    b. Find the amount, in mol, of oxygen atoms present in this sample.

    c. Find the mass of oxygen, in grams, present in this sample.

3. Calculate the number of atoms present in 4.20 g of sodium metal (Na).

4. Consider a 1.96 g sample of sulfuric acid (H_2SO_4).
    a. Calculate the amount, in mol, of H_2SO_4 molecules present in this sample.

    b. Calculate the amount of oxygen present in this sample in:
        i. mol.

        ii. grams

    c. Calculate the amount, of sulphur (S) atoms present in this sample in:
        i. mol.

        ii. grams.

5. Consider a sample containing 3.01 X 10^{24} HNO_3 molecules?

   a. What is the amount, in mol, of HNO_3 present?

   b. What is the mass, in grams, of this sample?

6. Consider a pure sample of SO_3. This sample contains 6.02 X 10^{22} molecules.

   a. What is the amount, in mol, of SO_3 present?

   b. What is the mass, in grams, of this sample?

7. A 3.00 gram sample of iron ore (Fe_2O_3) is analysed.
   a. What is the amount of pure Fe_2O_3 in the sample?

   b. What is the mass, in grams, of iron present in this sample?