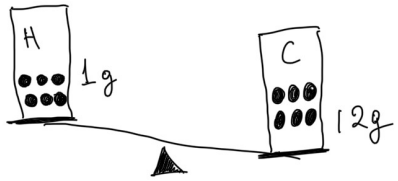
HW 16

The mole, M_r, M.

- To calculate masses of products and reactants using *balanced* chemical equations we use a unit called **mole**. One mole of a substance is the amount whose mass equals the molecular or atomic weight (in atomic mass units, amu) of the substance **expressed in grams**. This means that molecular weight of any substance in amu (from periodic table) is equal to molar weight (mass) in grams.

One mole is the amount of substance that contains the same number of particles (atoms, ions, molecules etc.) as there are carbon atoms in 12 g of carbon 12



1g of H – $6.02 \cdot 10^{23}$ atoms of H

12g of C – $6.02 \cdot 10^{23}$ atoms of C

- *A mole of anything has 6.022 x 10^{23} particles*. This is called Avogadro's number, after Amedeo Avogadro, who first suggested that equal volumes of gas have equal numbers of molecules.
- The number of moles present in the certain mass of a substance can be figured out using the following equation

  Number of moles = mass of substance/ molar mass

  n = m/M

  The unit for M (molar mass) is g/mol or $gmol^{-1}$

  Mass of substance (m) must be in grams.

  Consider sulfur, if A_r of S is 32.06

Molar mass of sulfur 32.06 $gmol^{-1}$

This means 32.06 g of S contains $6.02x10^{23}$ sulfur atoms or 1 mole of sulfur. 64.12 g of sulfur contains 2 moles of sulfur.

- Knowing A_r we can calculate relative molecular mass M_r of the molecules.

M_r is the sum of the relative atomic masses of the individual atoms making up a molecule.

What is relative molecular mass of methane?

CH_4

12.04 (A_r of C) + 4x1.01 (A_r of H) = 16.08

Questions:

1. Work out the relative molecular masses (M_r) of the following compounds:

C_2H_5OH
PCl_5
$Mg_{3(}PO_4)_2$
$Na_2S_2O_3$

2. Calculate the number of moles in 5 g of CO_2.
   Calculate the number of moles in 128 g of O_2.