

The number of moles present in the certain mass of a substance can be figured out using the following equation

Number of moles (n) = mass of substance/ molar mass

$n = m/M$

Molar mass numerically equal to molecular mass ( $M_r$ ), but Molar mass has its own units. The unit for M (molar mass) is g/mol or  $\text{g mol}^{-1}$

Mass of substance (m) must be in grams.

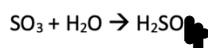
The units for moles is mol.

Consider sulfur, if  $A_r$  of S is 32.06

Molar mass of sulfur  $32.06 \text{ g mol}^{-1}$

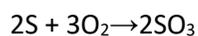
This means 32.06 g of S contains  $6.02 \times 10^{23}$  sulfur atoms or 1 mole of sulfur.

- An example of stoichiometry calculations  
Calculate how many grams of water and sulfur trioxide is needed to produce 100g of sulfuric acid according to the following chemical reaction:



	$\text{SO}_3$	$\text{H}_2\text{O}$	$\text{H}_2\text{SO}_4$
Molecular weight	80	18	98
Molar weight (g/mole)	80	18	98
Coefficients (moles reacting)	1	1	1
Known	?	?	100g
Number of moles to obtain the product and needed of reagents	1.02	1.02	$100/98 = 1.02$
Mass needed (g)	$1.02(\text{mole}) \times 80(\text{g/mole}) = 81.6(\text{g})$	$1.02(\text{mole}) \times 18(\text{g/mole}) = 18.36(\text{g})$	

- If the coefficients of the reactions were different from 1 you would have to calculate the number of moles of the reagents needed for the number of moles of the product using the reaction coefficients. For example, in the following reaction of S and  $\text{O}_2$  2 moles of S react with 3 moles of  $\text{O}_2$  to produce 2 moles of  $\text{SO}_3$ . In this case to obtain 1 mole of  $\text{SO}_3$  you would need 1 mole of S and  $3/2$  moles of  $\text{O}_2$ .



## Questions

1. Write down the total number of hydrogen atoms in each of the following
  - a) 1.00 mol H<sub>2</sub>
  - b) 0.200 mol CH<sub>4</sub>
  - c) 0.0500 mol NH<sub>3</sub>

2. How many moles of hydrogen gas are produced when 0.4 mol of sodium react with excess of water



3. How many moles of O<sub>2</sub> react with 0.01 mol C<sub>3</sub>H<sub>8</sub>?



4. Calculate the mass of arsenic(III) chloride produced when 0.15 g of arsenic reacts with excess chlorine

