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Chem 4A Scholar Worksheet 1

Introduction to stoichiometry

Number of Moles:

Number of moles is a measure of the amount of chemicals. One mole of a certain species contains Avogadro's number($N_A = 6.022 \times 10^{23}$) of that species. For example, one mole of Potassium(K) contains 6.022×10^{23} Potassium atoms.

Molecular Formula:

Atom is the smallest division of an element. Molecules are composed of atoms. The molecules are expressed as $A_x B_y C_z \ldots$, where A,B,C,… represent the elements in the molecule, and x,y,z,… represent the numbers of atoms in the molecule.

For example:

A H_2 molecule contains 2 hydrogen atoms.

H_2SO_4 contains 2 hydrogen atoms, 1 sulfur atom and 4 oxygen atom.

Questions:

1. *How many moles of hydrogen atoms are there in 1 mole hydrogen molecule?*

2. *How many atoms does 0.5 mole of H_2O contain?*

Molecular Mass/Molar Mass:

Molecular mass is the sum of the atomic masses of the atoms in the molecule. Molar mass is the mass of 1 mole of molecules. The unit of molar mass is g/mol. Molar mass is often denoted as M.

e.g. The atomic mass of H is 1.008. What is the molar mass of hydrogen molecule?

$$M_{H_2} = 2M_H = 2 \times 1.008 = \underline{2.016} \text{ (g/mol)}$$

Question:

3. *What is the molar mass of MnO_2?*

Chemical Equations:

A chemical equation describes a chemical reaction. In a chemical reaction, participating molecules transform into other molecules. A molecule that is consumed in a reaction is called a reactant. A molecule that is formed in a reaction is called product. An arrow points from the reactant to the product, usually goes from left to right. The number in front of a molecule indicates the number of molecules involved in the reaction, for example:

$$CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$$

Reactants   Products
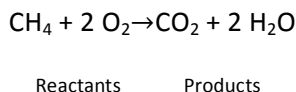
The above reaction means that for each CH_4 molecule that is consumed in the reaction, 2 O_2 molecules are consumed, 1 CO_2 and 2 H_2O molecules are formed.

Matters are conserved in chemical reaction. Atoms are not created nor destroyed in a reaction. The species and number of atoms on the left (reactant) side and right (product) side should be consistent. (with the exception of nuclear reactions, which will be addressed in Chem 4B).

The process of making the number of atoms on both sides equal is called balancing an equation. In chemistry, you will often encounter unbalanced equations. You should know how to balance them.

4. *Try balance the following equation:*

$$SnO_2 + H_2 \rightarrow Sn + H_2O$$