Tutorial Series No. 1

Exercise 1: Mole, Molar Mass

Which of the following samples contains the greatest amount of iron?

- 0.2 moles of $Fe_2(SO_4)_3$
- 20 g of iron
- 2.5×10^{23} atoms of iron

Data:

M(Fe) = 56 g/mol
M(S) = 32 g/mol
Avogadro's number, $N = 6.023 \times 10^{23}$

Exercise 2: Molar Volume

We have 10 g of carbon dioxide (CO_2) at 0°C and 1 atm pressure.

Data:

Molar mass of CO_2 = 44 g/mol

1. Calculate the number of moles of CO_2.
2. Assuming ideal gas behavior, calculate the volume occupied by CO_2 under these conditions.
   (Molar volume of an ideal gas at STP = 22.4 L/mol)

Exercise 3: Mass and Mole Fractions

A closed container contains a mixture of 5 g of dioxygen (O_2) and 3 g of dinitrogen (N_2).

Data:

Molar mass of O_2 = 32 g/mol
Molar mass of N_2 = 28 g/mol

1. Calculate the mass fraction of each gas in the mixture.
2. Calculate the mole fraction of each gas.

Exercise 4: Material Balance

20 g of magnesium (Mg) reacts with 40 g of dioxygen (O_2) to produce magnesium oxide (MgO).

The reaction is as follows:

$$2\ Mg + O_2 \rightarrow 2\ MgO$$

1. Determine the limiting reagent and the excess reagent.
2. Calculate the percentage of excess of the excess reagent.
3. If the mass of magnesium that actually reacts is 15 g, calculate the percentage conversion of magnesium.
4. Calculate the mass of magnesium oxide formed.

Data:

Molar mass of Mg = 24 g/mol
Molar mass of O_2 = 32 g/mol
Molar mass of MgO = 40 g/mol