Cosmo School

Chemistry

Class-9

Chapter-6

Concept of mole and chemical counting

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Lecture sheet with worksheet-7

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Unit-1:Stoichiometry

Stoichiometry measures the quantitative relationshipsbetween reactants and products in a chemical equation.It is used to determine the amount of products and reactants that are produced or needed in a given reaction. Describing the quantitative relationships among substances as they participate in chemical reactions is known as reaction stoichiometry.

The information that can be gathered regarding mole from a balanced chemical equation is the stoichiometry of that reaction. Using the concept of mole, we can convert anything from the level of atoms and molecules to the level of grams and kilograms.

Exercise-1:

1. Concept of mole is the main basis of stoichiometry-explain shortly.

Unit-2:Writing a chemical reaction as a chemical equation

Let's consider a simple chemical reaction—

Nitrogen gas reacts with hydrogen gas to produce ammonia gas.

$$N_2(g) \quad + \quad H_2(g) \quad \rightarrow \quad NH_3(g)$$

This reaction is written as an equation, in which the reactants combine on the left to yield the product on the right. During a reaction bonds are broken in reactant molecules and new bonds are formed in product. But the number of atoms of each element remains the same. That means the reaction follows the conservation of mass.

When writing a chemical reaction as an equation, the number of atoms of each element has to be exactly the same on the both sides of reaction. This is known as equation balancing.

Exercise-2.1:

1. Why balancing of chemical equation is important for stoichiometric analysis?

For stoichiometry balancing of chemical equation is very important. It is very useful for understanding the proportions of chemical substances as these react at a molecular level. But in practically we cannot deal with atoms and molecules.

But in a lab, or in industry, or in our lives, we have to work with measurable amounts of substances. We have to use chemicals by measuring with real scale(gram, kilogram scale etc,).

So, we have to need applying the stoichiometric concept to calculate specific masses of the reactants and products.

Exercise-2.2:

1. How can you analyze the significance of using stoichiometric concept?

Unit-3:Calculations considering mole concept in stoichiometry

Let's consider a simple chemical reaction—

Nitrogen gas reacts with hydrogen gas to produce ammonia gas.

$$N_2(g) \quad + \quad H_2(g) \quad \rightarrow \quad NH_3(g)$$

This equation is not balanced. So, we have to add necessary coefficients in front of molecules.

$$N_2(g) \quad + \quad 3\,H_2(g) \quad \rightarrow \quad 2NH_3(g)$$

Ratio: 1 : 3 : 2

And the coefficients can represent –

a) A specific amount of each substances
b) Ratio of reactants and products in the reaction

Coefficients tell us how many particles or molecules are reacting in the reaction and how many particles or molecules will be produced.

That means, in the above reaction 1 molecule of nitrogen reacts with 3 molecules of hydrogen to produce 2 molecules of ammonia. And the ratio of reactants and product is $N_2 : H_2 : NH_3 = 1:3:2$

So, for this reaction it will be always reacting in 1:3:2 ratio; no matter how many molecules of each reactants and products we have.

And coefficients are constant for any one particular chemical equation.

Exercise-3:

1. Find out the information for the followingtwo reactions that are called the stoichiometry of the reactions.
   a) $2Mg\,(s) + O_2(g) \rightarrow 2MgO(s)$
   b) $H_2\,(g) + Cl_2(g) \rightarrow 2\,HCl(g)$
2. How many moles of O_2 id necessary to produce 6 moles of water?
3. How much NH_3 in liter will be formed out of 4 liter N_2 at standard temperature and pressure?
4. How many grams of magnesium oxide will be produced if we put the necessary amount of oxygen with 2 gram magnesium metal?