Chemistry Study Materials for Class 11 (NCERT Based Questions with Answers)

Ganesh Kumar Date:- 03/09/2020

(Chapter -01)Some Basic Concept of Chemistry

Five Marks questions with answers

1. What is the difference between empirical and molecular formula? A compound contains 4.07 % hydrogen, 24.27 % carbon and 71.65 % chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulas?

Ans. An empirical formula represents the simplest whole number ration of various atoms present in a compound whereas the molecular formula shows the exact number of different types of atoms present in a molecule of a compound.

Name of element	Percentage of elements	Step-1Conversion of mass per cent to grams.	Step 2. number moles of each element	Step 3. Divide the mole value by the smallest number
C	24.27%	24.27g	24.27/12 = 2.0225	2.0225/2.018 = 1
H	4.07%	4.07g	4.07/1= 4.07	4.07/2.018 =2
Cl	71.65%	71.65g	71.65/35.5 = 2.018	2.018/2.018 = 1

The empirical formula of the above compound is CH_2Cl.

Empirical formula mass is 12 + (1x2) + 35.5 = 49.5

n= molecular mass/ empirical formula mass =98.96/49.5 = 2

Hence molecular formula is $C_2H_4Cl_2$

2. Dinitrogen and dihydrogen react with each other to produce ammonia according to the following chemical equation:

$$N_2(g) + H_2(g) \rightarrow 2NH_3(g)$$

(i) Calculate the mass of ammonia produced if 2.00×10^3 g dinitrogen reacts with 1.00×10^3 g of dihydrogen.

(ii) Will any of the two reactants remain unreacted?

(iii) If yes, which one and what would be its mass?

Ans. (i) Balancing the given chemical equation, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

From the equation, 1 mole (28 g) of dinitrogen reacts with 3 mole (6 g) of dihydrogen to give 2 mole (34 g) of ammonia.

$\Rightarrow 2.00 \times 10^3$ g of dinitrogen will react with $\frac{6\text{ g}}{28\text{ g}} \times 2.00 \times 10^3\text{ g}$ dihydrogen

i.e., 2.00×10^3 g of dinitrogen will react with 428.6 g of dihydrogen.

Given, Amount of dihydrogen = 1.00×10^3 g

Hence, N_2 is the limiting reagent.

28 g of N_2 produces 34 g of NH_3.

Hence, mass of ammonia produced by 2000 g of $N_2 = \frac{34\text{ g}}{28\text{ g}} \times 2000\text{ g}$

= 2428.57 g

(ii) N_2 is the limiting reagent and H_2 is the excess reagent.

Hence, H_2 will remain unreacted.

(iii) Mass of dihydrogen left unreacted = 1.00×10^3 g – 428.6 g

= 571.4 g

HOTS (Higher Order Thinking Skills)

1. What is the difference between 160 cm and 160.0 cm

Ans. 160 has three significant figures while 160.0 has four significant figures. Hence, 160.0 represent greater accuracy.

2. In the combustion of methane, what is the limiting reactant and why?

Ans. Methane is the limiting reactant because the other reactant is oxygen of the air which is always present in excess. Thus, the amounts of CO_2 and H_2O formed depend upon the amount of methane burnt.

3. A compound made up of two elements A and B has A= 70 %, B = 30 %. Their relative number of moles in the compound are 1.25 and 1.88. calculate

a. Atomic masses of the elements A and B

b. Molecular formula of the compound , if its molecular mass is found to be 160

Ans. Relative no. of moles of an element = $\frac{\%\text{ of the element}}{\text{Atomic mass}}$

Or atomic mass = $\frac{\%\text{ of the element}}{\text{Relative no. of moles}} = \frac{70}{1.25} = 56$

Atomic mass of B = 30/1.88 = 16

Calculation of Empirical formula

Element	Relative no. of moles	Simplest molar ratio	Simplest whole no. molar ratio
A	1.25	1.25/1.25 = 1	2
B	1.88	1.88/1.25 = 1.5	3

Empirical formula = A_2B_3

Calculation of molecular formula-

Empirical formula mass = 2 x 56 + 3x 16 = 160

n= molecular mass / Empirical formula mass = 160/160 = 1

Molecular formula = A_2B_3

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