State and explain Avogadro's law.

Answer:

i. In the year 1811, Avogadro made a distinction between atoms and molecules and thereby proposed Avogadro's law.

ii. Avogadro proposed that, "Equal volumes of all gases at the same temperature and pressure contain equal number of molecules".

e.g. Hydrogen gas combines with oxygen gas to produce water vapour as follows:

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According to Avogadro's law, if 1 volume contains n molecules, then 2n molecules of hydrogen combine with n molecules of oxygen to give 2n molecules of water, i.e., 2 molecules of hydrogen gas combine with 1 molecule of oxygen to give 2 molecules of water vapour as represented

Point out the difference between 12 g of carbon and 12 u of carbon.

Answer:

12 g of carbon is the molar mass of carbon while 12 u of carbon is the mass of one carbon atom.

How many grams does an atom of hydrogen weigh ?

Answer:

The mass of a hydrogen atom is 1.6736 × 10-24 g.

Question D.

Calculate the molecular mass of the following in u.

a. NH_3

b. CH_3COOH

c. C_2H_5OH

Answer:

i. Molecular mass of NH_3 = (1 × Average atomic mass of N) + (3 × Average atomic mass of H)

= (1 × 14.0 u) +(3 × 1.0 u)

= 17 u

ii. Molecular mass of CH_3COOH = (2 × Average atomic mass of C) + (4 × Average atomic mass of H) + (2 × Average atomic mass of O)

= (2 × 12.0 u) + (4 × 1.0 u) + (2 × 16.0 u)

= 60 u

iii. Molecular mass of C_2H_5OH = (2 × Average atomic mass of C) + (6 × Average atomic mass of H) + (1 × Average atomic mass of O)

= (2 × 12.0 u) + (6 × 1.0 u) + (1 × 16.0 u)

= 46 u

Ans: i. The molecular mass of NH_3 = 17 u

ii. The molecular mass of CH_3COOH = 60 u

iii. The molecular mass of C_2H_5OH = 46 u

Question E.

How many particles are present in 1 mole of a substance ?

Answer:

The number of particles in one mole is 6.0221367 × 1023.

Question F.

What is the SI unit of amount of a substance ?

Answer:

The SI unit for the amount of a substance is mole (mol).

Question G.

What is meant by molar volume of a gas ?

Answer:

The volume occupied by one mole of a gas at standard temperature (0 °C) and pressure (1 atm) (STP) is called as molar volume of a gas. The molar volume of a gas at STP is 22.4 dm^3.

Question H.

State and explain the law of conservation of mass.

Answer:

Law of conservation of mass:

The law of conservation of mass states that, “Mass can neither be created nor destroyed” during chemical combination of matter.

Antoine Lavoisier who is often referred to as the father of modem chemistry performed careful experimental studies for various combustion reactions, namely burning of phosphorus and mercury in the presence of air.

Both his experiments resulted in increased weight of products.

After several experiments, in burning of phosphorus, he found that the weight gained by the phosphoms was exactly the same as the weight lost by the air. Hence, total mass of reactants = total mass of products.

When hydrogen gas bums and combines with oxygen to form water, the mass of the water formed is equal to the mass of the hydrogen and oxygen consumed. Thus, this is in accordance with the law of conservation of mass.

Question I.

State the law of multiple proportions.

Answer:

The law states that, “When two elements A and B form more than one compounds, the masses of element B that combine with a given mass of A are always in the ratio of small whole numbers”.