

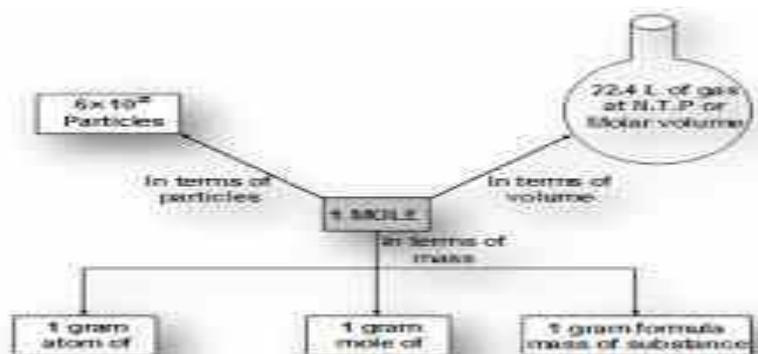
Class: IX	Topic: Atom and Molecule
Subject: Chemistry	Date 15/12/2021

Mole Concept and Molar Masses

- Atoms and molecules are extremely small in size but their numbers are very large even in a small amount of any substance.
- In order to handle such large numbers, a unit of similar magnitude is required.
- We use unit dozen to denote 12 items; score for 20 items and so on. To count the entities at microscopic level mole concept was introduced.
- In SI system, mole was introduced as seventh base quantity for the amount of a substance. It is denoted by (n)
- One mole is the amount of a substance that contains as many particles or entities as there are atoms in exactly 12 g (or 0.012 kg) of the ^{12}C isotope. One mole of any substance always contains the amount equal to its gram molecular mass also called molar mass.
- 1 mole water = gram molecular mass = 18g
- 1 mole carbon dioxide = gram molecular mass = 44 g
- This number of entities in 1 mole is so important that it is given a separate name and symbol.
- It is known as 'Avogadro constant', denoted by N_A in honour of Amedeo Avogadro.
- If a number is written without using the powers of ten 602213670000000000000000, so many entities (atoms, molecules or any other particle) constitute one mole of a particular substance.
-

Molar mass

- The mass of one mole of a substance in grams is called its molar mass.
- The molar mass in grams is numerically equal to atomic /molecular/formula mass in u.
- Molar mass of oxygen (O) = 16.02g.
- Molar mass of water (H_2O) = 18.02g.
- Molar mass of carbon (C) = 12g.
- Molar mass of sodium chloride (NaCl) = 58



1. How many molecules of water are there in 54 g of H₂O ?

Solution

Molar Mass of H₂O = 2 + 16 = 18 g/moles

So, number of moles of H₂O = Given Mass / Molar Mass = 54/18 = 3 moles

Now 1 moles = 6.022 × 10²³ molecule

So 3 moles will have 18.066 × 10²³ molecule

2. How many atoms of hydrogen are there in 36 g of NH₄⁺?

Solution

Molar mass (Molecular mass in gram) of NH₄⁺ = 14 + 4 = 18 g

No. of moles of NH₄⁺

= 36/18 = 2 moles

Now Total Moles of Hydrogen Atoms

= 8 moles

= 8 × 6.022 × 10²³ = 48.176 × 10²³

3. Calculate the number of Cu atoms in 0.3175 g of Cu.

Solution.

No. of moles of Cu

= Mass of Cu / Atomic mass

= 0.3175/63.5

= 0.005 mole

No. of Cu atoms

= No. of moles × Avogadro constant

= 0.005 × 6.022 × 10²³ = 0.005 × 6.022 × 10²³

= 30.11 × 10²⁰ Cu atoms.

4. What is the mass of:

(a) 1 mole of nitrogen atoms ?

(b) 4 moles of aluminium atoms (Atomic mass of aluminium = 27)

(c) 10 moles of sodium sulphite (Na₂SO₃) ?

Answer. (a) 1 mole of nitrogen atoms

= 1 × gram atomic mass of nitrogen atom

$$= 1 \times 14 \text{ g} = 14 \text{ g}$$

(b) 4 moles of aluminium atoms

$$= 4 \times \text{gram atomic mass of aluminium atoms}$$

$$= 4 \times 27 \text{ g} = 108 \text{ g}$$

(c) 10 moles of sodium sulphite (Na_2SO_3)

= 10 (2 x gram atomic mass of Na + 1 x gram atomic mass of sulphur + 3 x- gram atomic mass of oxygen)

$$= 10(2 \times 23 \text{g} + 1 \times 32 \text{g} + 3 \times 16 \text{g})$$

$$= 10 (46 \text{ g} + 32 \text{ g} + 48 \text{ g})$$

$$= 10 \times 126 \text{ g} = 1260 \text{ g}$$

5. (a) Give one point of difference between an atom and an ion.

(b) Give one example each of a polyatomic cation and an anion.

(c) Identify the correct chemical name of FeSO_3 : Ferrous sulphate, Ferrous sulphide, Ferrous sulphite.

(d) Write the chemical formula for the chloride of magnesium.

Answer.

(a) An atom is electrically neutral while an ion is electrically charged particle.

(b) Polyatomic cation — $(\text{NH}_4)^+$

Polyatomic anion — $(\text{SO}_4)^{2-}$

(c) Ferrous sulphite

(d) MgCl_2 (Magnesium chloride)

Note-The above content has been absolutely prepared from home