Chemistry Study Materials for Class 9

(NCERT based Revision of Atoms and molecules)

Ganesh Kumar **Date:- 13/07/2020**

Numerical problems based On Mole Concept

Question1. Calculate the mass of 6.022×10^{23} molecule of Calcium carbonate ($CaCO_3$).

Solution1. Molar mass (Molecular mass in gram) of $CaCO_3$ = 40+12+3×16 = 100 g

No. of moles of CaCO3 = No. of molecules/Avogadro constant

$= 6.022 \times 10^{23} / 6.022 \times 10^{23}$

= 1 mole

Mass of $CaCO_3$ = No. of moles × molar mass

= 1 × 100 g

= **100 g**.

Question2. Calculate the mass of 12.044×10^{23} carbon atoms.

Solution2. No. of moles of Carbon atoms = No. of atoms/Avogadro constant

$= 12.044 \times 10^{23}/6.022 \times 10^{23}$

= 2 mole

Mass of carbon atoms= No. of moles × atomic mass

= 2 × 12

= **24 g**.

Question3. Calculate the number of oxygen atoms in 1 mole of O_2.

Solution3. 1 molecule of O_2 = 2 oxygen atoms

So, 1 mole of O_2 = 2 mole oxygen atoms

$= 2 \times 6.022 \times 10^{23}$

= **12.044×10^{23} oxygen atoms.**

Question4. Calculate the number of Cu atoms in 0.635g of Cu.

Solution4. No. of moles of Cu = Mass of Cu/Atomic mass

= 0.635/63.5

=0.01 mole

No. of Cu atoms = No. of moles × Avogadro constant

= $0.01 \times 6.022 \times 10^{23}$

= **6.022×10^{23} Cu atoms**.

Question5. Calculate the number of molecules in 11.2 liters of SO_2 gas at NTP.

Solution5. 1 mole of SO_2 = 22.4 L (at NTP)

=> 11.4 L of SO_2 = 0.5 mole SO_2

= $0.5\times 6.022\times10^{23}$

= **3.011×10^{23} SO_2 molecules**.

Question6. An atom of some element X weighs 6.644×10^{-23} g. Calculate the number of gram-atoms in 40 kg of it.

Solution6. Mass of 1 mole X atoms = mass of 1 atom × Avogadro constant

= $6.644 \times 10^{-23} \times 6.022\times10^{23}$

= 40 g

So, the atomic mass of X = 40

No. of gram-atoms (or moles) of X = mass of X / atomic mass

= 40 × 1000/40

= **1000.**

Question7. An atom of some element X weighs 6.644×10^{-23} g. Calculate the number of gram-atoms in 40 kg of it.

Solution7. Molecular mass of CO_2 = 12 + 2 × 16 = 44

Total no. of moles in 200mg CO_2 = Mass of CO_2/Molecular mass

= 200×10^{-3} g/44

= 0.00454

No. of moles removed = $10^{21}/6.022\times10^{23}$

= 0.00166

No. of moles of CO_2 left = 0.00454 – 0.00166

= **0.00288**.

Question8. Calculate the volume occupied by 1 mole atom of

(i) Monoatomic gas, and (ii) Diatomic gas at NTP.

Solution8. 1 mole atom of monoatomic gas occupies 22.4 L at NTP, and
1 mole of diatomic gas (contains 2 atoms) occupies 11.4 L at NTP.

Question9. Calculate the volume of 20g H_2 at NTP.

Solution9. No. of moles of H_2 = 20/2 =10

Volume of any ideal gas at NTP = No. of moles × 22.4 L
= 10 × 22.4
= **224 L**.

Question10. What is the volume occupied by 6.022×10^{23} molecules of any gas at NTP?

Solution10. 6.022×10^{23} molecules = 1 mole molecules, and
1 mole molecules of any ideal gas occupies 22.4 L at NTP.

Question11. Calculate the number of atoms in 5.6 liters of a

(i) Monoatomic, and (ii) diatomic gas at NTP.

Solution11. No. of moles in 5.6 L gas at NTP = 5.6/22.4 = 0.25

No. of molecules in 5.6 L gas = $0.25 \times 6.022 \times 10^{23}$
= 1.5×10^{23} molecules

(i) In monoatomic gases, No. of atoms = No. of molecules

= $\mathbf{1.5 \times 10^{23}}$.

(ii)In diatomic gases, No. of atoms = 2 × No. of molecules

= $2 \times 1.5 \times 10^{23}$

= $\mathbf{3.0 \times 10^{23}}$.

****