Chapter 3 Atoms and Molecules Class 9 Important Questions NCERT Science

Q.1
Which of the following are tri-atomic and tetra-atomic molecules?
CH_3Cl, $CaCl_2$, NH_3, PCl_3, P_2O_5, H_2O, C_2H_5OH
Answer:
(i) Tri-atomic molecules are $CaCl_2$, H_2O.
(ii) Tetra-atomic molecules are NH_3, PCl_3.

Q.2
Differentiate between the actual mass of a molecule and gram molecular mass.
Answer:
Actual mass of a molecule is obtained by dividing the molar mass by Avogadro's number whereas gram molecular mass represents the molecular mass expressed in grams, i.e., it is the mass of 1 mole of molecules, i.e., Avogadro's number of molecules.

Q.3
Calculate the formula mass of sodium carbonate ($Na_2CO_3.10H_2O$).
Answer:
Formula mass of sodium carbonate
= (2 × atomic mass of Na) + (1 × atomic mass of C) + (3 × atomic mass of O) + 10 [(2 × atomic mass of H) + (1 × atomic mass of O)]
= 2 × 23 + 1 × 12 + 3 × 16 + 10 [(2 × 1) + (1 × 16)]
= 46 + 12 + 48 + 180 = 286 u

Q.4
Calculate the mass of one atom of hydrogen atom.
Answer:
1 mole of hydrogen atom = 1 g
or 6.022×10^{23} atoms of hydrogen weigh = 1 g
Mass of one atom = 16.022×1023g
= 1.66058×10^{-24}g

Q.5
How many moles are present in 4 g of sodium hydroxide?
Answer:
Gram molar mass of NaOH = 23 + 16 + 1 = 40 g
40 g of NaOH = 1 mol
∴ lg of NaOH = 140mol
∴ 4 g of NaOH = 140 × 4 mol = 0.1 mol

Q.**6**

A sample of ammonia weighs 3.00 g. What mass of sulphur trioxide contains the same number of molecules as are in 3.00 g ammonia?

Answer:

Number of moles of ammonia in 3.00 g = 3.0017 mol

= 0.1764 mol

Molecular mass of So_3 = 1 × 32u + 3 × 16u = 80u

1 mole of SO_3 weighs 80 g

∴ 0.1764 moles weigh = 80 × 0.1764 g

= 14.11 g

Q.7

How many (a) molecules (b) hydrogen atoms (c) oxygen atoms are there in 0.5 mol of water?

Answer:

(a) 1 mol of water contains 6.022×10^{23} molecules

∴ 0.5 mol of water contains 6.022×10232 molecules

= 3.011×10^{23} molecules

(b) 1 molecule of water contains 2 atoms of hydrogen

1 mol of water contains $2 \times 6.022 \times 10^{23}$ atoms of hydrogen

∴ 0.5 mol of water contains 2×6.022×10232 atoms of hydrogen

= 6.022×10^{23} atoms of hydrogen

(c) 1 molecule of water contains 1 atom of oxygen

1 mol of water contains 6.022×10^{23} atoms of oxygen

∴ 0.5 mol of water contains 6.022×10232 atoms of oxygen

= 3.011×10^{23} atoms of oxygen

Q.8

How many atoms would be present in a black dot marked on the paper with graphite pencil as a full stop at the end of a sentence. [Given mass of a dot = 10^{-18} g]

Answer:

1 mole of carbon atoms weigh = 12 g

Also, 1 mole of carbon atoms = 6.0 2 2 × 10^{23} atoms

Thus, 12 g of carbon atoms has 6.022×10^{23} atoms.

∴ 10^{-18} g of carbon will have 6.022×102312×10−18 × 10^{-18} carbon atoms

= 5.02×10^4 carbon atoms.

Q 9

Calculate the number of moles present in:

(i) 3.011×10^{23} number of oxygen atoms.

(it) 60 g of calcium

[Given that atomic mass of Ca = 40 u, Avogadro No. = 6.022×10^{23}]
Answer:
(i) 1 mole of oxygen contains 6.022×10^{23} atoms
$\therefore$ 6.022×10^{23} atoms of oxygen = 1 mol
1 atom of oxygen = 16.022×1023 mol
$\therefore$ 3.011×10^{23} atoms of oxygen = 1×3.011×10236.022×1023 mol
= 0.5 mol

(ii) Atomic mass of Ca = 40 u
40g of calcium = 1 mol
60g of calcium = 6040 mol =1.5 mol

Q 10
Calculate the mass per cent of each element of sodium chloride in one mole of it.
Answer:
Molecular mass of NaCl = (1 × 23 + 1 × 35.5) u = 58.5 u
Atomic mass of sodium = 23 u

$$\text{Mass per cent of Na} = \frac{\text{Atomic mass of Na}}{\text{Molecular mass of NaCl}} \times 100$$
$$= \frac{23}{58.5} \times 100 = \mathbf{39.32\%}$$

Mass % of Na = 39.32 %
Atomic mass of chlorine = 35.5 u

$$\text{Mass \% of Cl} = \frac{\text{Atomic mass of Cl}}{\text{Molecular mass of NaCl}} \times 100$$
$$= \frac{35.5}{58.5} \times 100 = \mathbf{60.68\ \%}$$