Class:-9

Stoichiometry

Mole Concept

Teaching Task

JEE Main Level Questions

Q1) Ans:- 3

Solution:-

1. Phosphorus (P_4):- Tetra atomic molecule.
2. Sulphur (S_8):- Octa-atomic molecule.
3. Ethane (C_2H_6):- 2 Carbons & 6 Hydrogens
   Hexa-atomic molecule.
4. Methane (CH_4):- Penta atomic molecule

Q2) Ans:- 3.

Solution:- Azide ion $= N_3^-$

No. of electrons in one mole of N_3^- ion $= 21+1$
$= 22.$

Q3) Ans:- 3.

Solution:- Hydrogen $_1H^1$

Atomic number (Z) $= 1$ Mass number (A) $= 1$

$$A = Z + n$$
$$n = A - Z = 1 - 1 = 0$$

No. of neutrons $= 0.$

Q4) Ans:- 4.

Solution:- One molecule of ammonium dichromate $(NH_4)_2Cr_2O_7$ contains 19 atoms.

1 mole of $(NH_4)_2Cr_2O_7$ Contains

$= 19 \times 6.02 \times 10^{23}$ atoms

$= 114 \times 10^{23}$ atoms.

Q5) Ans:- 2

Solution:- Molecular formula of Barium Carbonate is $BaCO_3$.

For 1 mole $BaCO_3 \rightarrow$ 3 oxygen atoms.

For 1.5 oxygen atoms, no. of moles of $BaCO_3$ = ?

$BaCO_3$	Oxygen atom.
1	3.
x	1.5

$3x = 1.5$

$x = \frac{1.5}{3} = 0.5$ moles

Q6) Ans:- 4

Solution:- Potash alum $\rightarrow K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$.

→ 2 moles of K^+, 2 moles of Al^{3+}, 4 moles of SO_4^{2-}, and 24 moles of H_2O.

→ 32 no. of moles of the Independent species present in one mole of potash alum.

Q6) Ans:- 1

Solution:- A mole corresponds to the mass of a substance that contain 6.023×10^{23} particles.

Glucose ($C_6H_{12}O_6$) → 1 molecule Contains 6 oxygen atom.

1 molecule → $6 \times 6.023 \times 10^{23}$.

0.25 mole of glucose contain $= 0.25 \times 6 \times 6.02 \times 10^{23}$

$= 9 \times 10^{23}$ atoms of oxygen.

Q7) Ans:- 1

Solution:- $C_{12}H_{22}O_{11}$ → Sucrose.

Total no. of atoms in one mole =

. Total no. of atoms in molecule x No. of atoms

$= 45 \times 6 \times 10^{23}$ atoms/mole

Q8) Ans:- 4.

Solution:- 1 Molecule of PCl_3 contains 4 atoms.

No. of atoms $= 4 \times$ (moles of PCl_3) $\times 6.02 \times 10^{23}$.

$= 4 \times 1.4 \times 6.02 \times 10^{23} = 3.372 \times 10^{24}$

Q9) Ans:- 2

Solution:- 1 mole of H_2 contains 6.023×10^{23} molecules & each molecule of H_2 contains 2 electrons.

∴ The total no. of electrons in one mole of H_2 are 12.046×10^{23}.

Q10) Ans:- 2

Solution:- Avogadro's Number(N) = 6.022×10^{23} rupees.

Spending rate = 10 lakh rupees per second

= 10^6 rupees per second.

$$\text{Time (seconds)} = \frac{\text{Total amount (rupees)}}{\text{Rate (rupees / second)}}$$

$$= \frac{6.022 \times 10^{23}}{10^6}$$

Time (seconds) = 6.022×10^{17} seconds

Convert seconds to years.

Time years = $6.022 \times 10^{17} \times 3.169 \times 10^{-8}$.

= 1.908×10^{10} years.

Q11) Ans:- 4.

Solution:-

1) 11.2 lit of SO_2 at STP.

No. of moles of SO_2 = $\frac{11.2}{22.4}$ = 0.5 moles.

No. of molecules = $0.5 \times 6.022 \times 10^{23}$.

Total atoms = $0.5 \times 6.022 \times 10^{23} \times 3 = 9.033 \times 10^{23}$.

2) 22.4L of Helium at STP.

Atoms = $1 \times 6.022 \times 10^{23} = 6.022 \times 10^{23}$

3) 22.4L of Hydrogen (H_2) at STP.

Total atoms = $1 \times 6.022 \times 10^{23} \times 2 = 1.2044 \times 10^{24}$.

4) 11.2L of Methane.

Total atoms = $0.5 \times 6.022 \times 10^{23} \times 5 = 1.5055 \times 10^{24}$

Methane has maximum atoms.

Advanced Level Questions

Q11) Ans:- 1, 3.

Solution:-

1) 1 mole of $H_2 = 1 \times 2 \times N_A = 2N_A$ ✓

2) 2 mole of $CO_2 = 2 \times 3 \times N_A = 6N_A$.

3) 2 moles of He $= 2 \times 1 \times N_A = 2N_A$ ✓

4) 0.5 moles of $O_3 = 0.5 \times 3 \times N_A = 1.5N_A$.

1 mole H_2 & 2 moles of He have same no. of atoms

Q12) Ans:- 1, 2, 3, 4.

Solution:- 0.5 moles of oxygen $= 0.5 \times N_A$ molecules.

1) 0.5 moles of $O_3 = 0.5 \times N_A$ molecules.

2) 0.5 mole of $SO_3 = 0.5 \times N_A$ molecules.

3) 0.5 mole of $SO_2 = 0.5 \times N_A$ molecules.

4) 0.5 mole of hydrogen $= 0.5 \times N_A$ molecules

Q13) Ans:- 1

Solution:- 1 Mole is equal to 6.022×10^{23} particles.

It is known as avagadro number (N_A).

Q14) Ans:- 4

Solution:- 1 mole of $O_3 \rightarrow 3 \times N_A$ atoms.

0.166 moles $\rightarrow x$

$x = 3 \times 0.166 \times N_A = 0.498N_A$

$= N_A/2$

Q15) Ans:- 4.

Solution:- 1 mole of Helium $\rightarrow 6.022 \times 10^{23}$.

0.25 moles of Helium $\rightarrow x$

$x = 0.25 \times 6 \times 10^{23}$.

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

Integer Type

Q16) Ans:- 4.5×10^{23}

Solution:- 1 mole of $CaCO_3$ Contains 3 'O' atoms.

1 mole $\rightarrow 3 \times 6.022 \times 10^{23}$ atoms.

0.25 mole $\rightarrow x$

$x = 3 \times 0.25 \times 6 \times 10^{23} = \frac{4.5}{18} \times 10^{23} = 4.5 \times 10^{23}$ atoms

Q17) Ans:- 2

Solution:- 1 mole H_2SO_4 Contains 2 moles of Hydrogen atoms.

Matrix Matching

Q18) Ans:- 1) C 2) A 3) D 4) B.

Solution:-

1) Nitric Oxide (NO) $\rightarrow$ C) $2 \times N_A = 2 \times 6.023 \times 10^{23} = 1.204 \times 10^{24}$.

2) Hydronium ion (H_3O^+) $\rightarrow$ A) $4 \times N_A = 4 \times 6.023 \times 10^{23} = 2.408 \times 10^{24}$.

3) Silver ion (Ag^+) $\rightarrow$ D) $1 \times N_A = 9.77 \times 10^{25}$ electrons.

4) Glucose ($C_6H_{12}O_6$) $\rightarrow$ B) $24 \times N_A = 1.445 \times 10^{25}$

Learner's Task

Conceptual Understanding Question

Q1) Ans:- 3.

Solution:- Atomicity is the number of atoms present in a molecule.

Q2) Ans:- B.

Solution:- Moleaule is the smallest particle of matter that exist independently.

Q3) Ans:- 4.

Solution:- 1 mole contains 6.022×10^{23} atoms or molecules or paticles.

'H' atom → 6.022×10^{23} atoms.

Zinc vapour → 6.022×10^{23} atoms.

Ammonia (NH_3) → 6.022×10^{23} molecules.

Q4) Ans:- 1

Solution:- No. of moles $= \frac{\text{No. of Particles}}{6.022 \times 10^{23}}$

Q5) Ans:- 2

Solution:- In one mole of H_2 gas, there are 2 moles of hydrogen atoms.

Q6) Ans:- 1

Solution:- Na (Z=11) → 11 electrons.

Sodium ion means Na^+ → loses 1 electron.

Na^+ = 10 electrons.

Sodium ion have 10 moles of electrons

Q7) Ans:- 4

Solution:- For H_2S → 2+1 atoms

= 3 atoms present

For 2 moles of H_2S → 2×3 = 6 atoms.

Total number of atoms in 2 moles =

$6 \times 6.022 \times 10^{23} = 36 \times 10^{23}$.

$= 3.6 \times 10^{24}$

Q8) Ans:- 3

Solution:- For 1 mole H atom → 1 electron and 1 proton present

Total subatomic particles = 1+1 = 2

2 moles of sub atomic particles present in 1 mole of hydrogen atoms.

Q9) Ans:- 2

Solution:- Revolving sub atomic particles means electrons.

He Contains '2' electrons.

Q10) Ans:- 4.

Solution:- 1 mole of NO_2 contain 6.022×10^{23} molecules.

If 10^{23} molecules removed, then

Remaining molecules $= 6.022 \times 10^{23} - 10^{23}$.

$= (6.022 - 1) \times 10^{23}$

$= 5.022 \times 10^{23}$.

JEE Main Level Questions

Q11) Ans:- a.

Solution:- One mole of CO_2 means

One mole of C = 6.02×10^{23} atoms of carbon.

One mole of CO_2 = 2 moles of oxygen atoms

$= 12.04 \times 10^{23}$ atoms of oxygen.

One mole of CO_2 = 6.02×10^{23} molecules of CO_2

Q12) Ans:- C

Solution:-

a) 2 moles of $S_8 \rightarrow 2 \times 8 \times N_A = 16\ N_A$ atoms.

b) 6 moles of $S \longrightarrow 6 \times N_A = 6\ N_A$ atoms.

c) 5.5 moles of $SO_2 \rightarrow 5.5 \times 3 \times N_A = 16.5\ N_A$ atoms

d) 4 moles of $CO \longrightarrow 4 \times 2 \times N_A = 8\ N_A$ atoms.

Q13) Ans:- 2, 3.

Solution:- 1 mole of $^{14}_{7}N^{-3}$ ion contains

protons = 7, electron = 10, neutrons = 7.

1 mole of $^{14}_{7}N^{-3}$ Contains

→ $7 \times 6.023 \times 10^{23}$ protons

→ $10 \times 6.023 \times 10^{23}$ electrons

→ $7 \times 6.023 \times 10^{23}$ neutrons

Q14) Ans:- 3.

Solution:- One mole of Sodium Contains

→ 6.022×10^{23} atoms of sodium &

→ 6.022×10^{23} molecules of sodium.

Q15) Ans:- 1, 3.

Solution:- The charge of one electron is

1.6025×10^{-19} C

Charge of one mole of electron =

$$= \frac{1.6025 \times 10^{-19} C}{1 \text{ atom}} \times \frac{6.023 \times 10^{23} \text{ atoms}}{1 \text{ mol}}$$

$$= 96,500 \text{ C/mol} \text{ & } 1 \text{ Faraday}.$$

Q16) Ans:- 1

Solution:- No. of molecules = No. of moles $\times N_A$.

0.25 moles of $CO_2 = 0.25\ N_A$.

Least moles have least no. of molecules.

Q17) Ans:- 1, 4.

Solution:-

1) 1mole of SO_2 = 16+16 = 32 electrons. ✓

2) 0.2 moles of NH_3 = 0.2[7+3] = 0.2×10 = 2electrons

3) 1.5 moles of oxygen = 1.5[16] = 24 electrons

4) 2 moles of sulphur = 2×16 = 32 electrons ✓

Q18) Ans:- 1

Solution:- Atomicity of $H_2S_2O_7$ = 2+2+7 = 11

Q19) Ans:- 4.

Solution:- 1 mole H_2SO_4 → 6.022×10^{23} molecules.

x moles of H_2SO_4 → 1.505×10^{23} molecules.

$$6.022 \times 10^{23} \times x = 1.505 \times 10^{23}.$$

$$x = \frac{1.505 \times 10^{23}}{6.022 \times 10^{23}} = 0.241 \text{ moles}$$

Q20) Ans:- 4.

Solution:- Carbon monoxide [CO] = 1 C + 1 Oxygen

1 mole → 6.022×10^{23} C atoms.

0.1 moles → x

$$x = 6.022 \times 10^{23} \times 0.1 = 6.022 \times 10^{23} \times 10^{-1}$$

$$= 6.022 \times 10^{22}$$

Advanced level Questions

Q21) Ans:- 1, 2, 4.

Solution:-

1) 1 mole of H_2 → $2 \times 6.022 \times 10^{23}$ atoms
$= 12.044 \times 10^{23}$ atoms

2) 2 moles of He → $2 \times 6.022 \times 10^{23}$ atoms
$= 12.044 \times 10^{23}$ atoms.

3) 0.25 moles of $CO_2 = 0.25 \times 3 \times 6.022 \times 10^{23}$.
$= 0.75 \times 6.022 \times 10^{23} = 4.5 \times 10^{23}$ atoms.

4) 1 mole of $N_2 = 1 \times 2 \times 6.022 \times 10^{23}$
$= 12.044 \times 10^{23}$ atoms

Q22) Ans:- A

Solution:- Magnesium ion (Mg^{+2}) = 10 moles of electrons
= 12 moles of protons
= 12 moles of neutrons.

1 mole = 6.022×10^{23} particles.

Integer Type

Q23) Ans:- 20.

Solution:- 2 moles of AL^{+3} = $2 \times 10 = 20$ moles of electrons

Q24) Ans:- 96,352

Solution:- The charge of 1mole of protons is approximately 96,352 Coulombs.

Matrix Matching

Q25) Ans:- A) 4. B) 3 C) 2 D) 1

Solution:-

	No. of Moles of Compound	No. of moles of oxygen atoms
A)	1.5 moles of $BaCO_3$	4) $1.5 \times 3 = 4.5$ oxygen atoms.
B)	2 moles of H_2SO_4	3) $2 \times 4 = 8$ oxygen atoms.
C)	2.5 moles of $ZnCO_3$	2) $2.5 \times 3 = 7.5$ oxygen atoms
D)	0.5 moles of glucose ($C_6H_{12}O_6$)	1) $0.5 \times 6 = 3$ oxygen atoms.