Class: 9

IIT Foundation Plus

Stoichiometry

Atomic Weight, Molecular weight and GMW

Teaching Task.

Q1) Ans:- 2

Solution:- $CaCl_2$, 1 mole GMW = 40 + 71 = 111 gms.

For 222 gms $CaCl_2$ is 2 moles.

For 1 mole of $CaCl_2 \rightarrow Ca^{+2} \rightarrow N$.

For 2 moles of $CaCl_2 \rightarrow Ca^{+2} \rightarrow \underline{2N}$.

For 1 mole of $CaCl_2 \rightarrow 2Cl^- \rightarrow 2N$.

For 2 moles of $CaCl_2 \rightarrow \underline{4N}$.

Q2) Ans:- 1

Solution:- Equal no. of moles have Equal no. of molecules.

1) 16 gms of O_2 & 14 gms of N_2

'n' of $O_2 = \frac{16}{32} = \frac{1}{2}$ moles. 'n' of $N_2 = \frac{14}{28} \frac{1}{2}$ ✓

2) 8 gms of O_2 & 22 gms of CO_2

'n' of $O_2 = \frac{8}{32} \frac{1}{4}$ moles, 'n' of $CO_2 = \frac{22}{44} \frac{1}{2}$ moles

3) 28 gms of N_2 & 22 gms of CO_2

'n' of $N_2 = \frac{28}{28}$ 1 mole. 'n' of $CO_2 = \frac{22}{44} \frac{1}{2}$ moles.

4) 32 gms of O_2 & 32 gms of N_2

n of $O_2 = \frac{32}{32}$ 1 mole, n' of $N_2 = \frac{32}{28}$

Q3) Ans:- 1

Solution:- $SO_2Cl_2 = 32+32+71 = 135$ gms.

1 mole → 135 gms.

2 moles → 13.5 gms.

$135x = 13.5$

$x = \frac{13.5}{135}$ 0.1 moles.

Q4) Ans:- 1

Solution:- No. of atoms in $C_{12}H_{22}O_{11} = 12+22+11 = 45$

Total no. of atoms in one mole =

Total no. of atoms in Molecule $\times N$.

$= 45 \times 6.023 \times 10^{23}$ atoms/mole

Q5) Ans:- 4.

Solution:- For 1 mole of PCl_3, 4 atoms are present.

1 mole $= 4 \times 6.023 \times 10^{23}$ atoms.

1.4 moles $= x$

$x = 1.4 \times 6.023 \times 10^{23} \times 4 = 33.6 \times 10^{23}$.

$= 3.36 \times 10^{24}$ atoms

Q6) Ans:- 3.

Solution:- The molecular weight of H_2O_2 is 34 amu.

Weight of H_2O_2 is 34 gms

Q7) Ans:- 2

Solution:- No. of electrons $H_2 = 2e^-$

The no. of atoms present in 1mole of Hydrogen

mole $= 2 \times 6 \times 10^{23} = 12 \times 10^{23}$ electrons

Q8) Ans:- 1

Solution:- No. of moles $\propto$ No. of molecules.

1) 34gms of water

$$n = \frac{34}{18} = 1.88 \text{ moles.}$$ ✓

2) 28gms of CO_2

$$n = \frac{28}{44} = 0.636 \text{ moles}$$

3) 46 gms of CH_3OH

$$n = \frac{46}{32} = 1.43 \text{ moles.}$$

4) 54gms of N_2O_5

$N_2O_5 = 28 + 80 = 108.$

$$n = \frac{54}{108} \frac{1}{2} = 0.5 \text{ moles}$$

Maximum no. of molecules in 34gms of water

Q9) Ans:- 2

Solution:- For 1mole $Na_2O = (23 \times 2) + 16 = 46 + 16 = 62$ gms.

1 mole $\rightarrow$ 62g

x $\rightarrow$ 620gms $\Rightarrow$ $62x = 620$

$x = 10$ moles

Q10) Ans:- 4.

Solution:- For 1 mole CO_2 = 44 gms have 2N atoms of Oxygen.

$$44 \text{ gms} \rightarrow 2 \times 6 \times 10^{23}.$$
$$88 \text{ gms} \rightarrow x$$

$$44x = 88 \times 2 \times 6 \times 10^{23}.$$

$$x = \frac{88 \times 2 \times 6 \times 10^{23}}{44} = 24 \times 10^{23} \text{ atoms.}$$

For CO, 1 mole = 12 + 16 = 28 gms.

$$28 \text{ gms} \rightarrow 6 \times 10^{23} \text{ atoms of oxygen.}$$
$$x \rightarrow 24 \times 10^{23} \text{ atoms of oxygen.}$$

$$6 \times 10^{23} x = 28 \times 24 \times 10^{23}.$$

$$x = 112 \text{ gms of CO.}$$

Advanced Level Questions

Q11) Ans:- 2

Solution:- For Hydrogen $2 \text{ gms} \rightarrow 6 \times 10^{23} \times 2$ atoms.

$$x \rightarrow 1$$

$$12 \times 10^{23} x = 2 \text{ gms.}$$

$$x = \frac{2}{12 \times 10^{23}} = 0.16 \times 10^{-23} \text{ gms.}$$

For Helium, $4 \text{ gms} \rightarrow 6 \times 10^{23}$ atoms

$$x \rightarrow 1 \text{ atom}$$

$$6 \times 10^{23} x = 4$$

$$x = \frac{4}{6 \times 10^{23}} = 4 \times 0.166 \times 10^{-23}$$
$$= 4 \times 1.66 \times 10^{-24} \text{ gms.}$$

Q12) Ans:- C

Solution:- 1 mole $NH_3 = 14+3 = 17$ gms

1 mole = 17 gms → 6×10^{23} molecules of NH_3

x ⇒ 1 molecule

$6\times10^{23}\, x = 17$

$x = \frac{17}{6\times10^{23}}$.

$= 17\times0.166\times10^{-23}$

$= 17\times1.66\times10^{-24}$ gms.

Q13) Ans:- 1

Solution:- 1 a.m.u $= 1.67\times10^{-24}$ gms

amu is the smallest unit of mass used to measure the masses of atoms.

Q14) Ans:- 5

Solution:- CO_2, 1 mole = 44 gms

at STP, 44 gms → 22.4 litres. ✓

1 mole of a gas at STP occupies 22.4 litres, is called gram molecular volume.

A & R both are incorrect

Q15) Ans:- 3

Solution:- The no. of gram atoms of hydrogen present in 1 gram molecule of methane (CH_4) gas is 4.

Q16) Ans:- 4.

Solution:- $n \propto N$

1) SO_2, $n = \frac{100}{64} = 1.56$ moles

2) O_2, $n = \frac{100}{32} = 3.125$ moles.

3) He, $n = \frac{100}{4} 25 = 25$ moles

4) H_2, $n = \frac{100}{2} 50 = 50$ moles.

100 gms of H_2 have maximum No. of molecules.

Q17) Ans:- 1

Solution:- $SO_2 = 32+32$ gms $= 64$ gms.

64 gms $\rightarrow 6 \times 10^{23}$ molecules.

$x \rightarrow 1$ molecule

$6 \times 10^{23} x = 64.$

$x = \frac{64}{6 \times 10^{23}} = 10.66 \times 10^{-23}$ gms.

For methane molecule, $CH_4 = 12+4 = 16$ gms

16 gms $\rightarrow 6 \times 10^{23}$ molecules.

10.66×10^{-23} gms $\Rightarrow$ 'x' molecules

$16x = 10.66 \times 10^{-23} \times 6 \times 10^{23}$

$x = \frac{10.66 \times 6}{16} = 3.99$ molecules

Nearly 4 molecules of methane.

Integer Type.

Q18) Ans:- 5

Solution:- For 1 mole water = 18 gms

1 mole → 18 gms

x moles → 90 gms

$18x = 90$

$x = \frac{90}{18}$ 5 moles = 5 moles.

Q19) Ans:- 30

Solution:- At S.T.P 1 mole gas = 22.4 litres

1 mole → 22400 mL.

x moles → 200 mL.

$224\phi\phi x = 2\phi\phi$

$x = \frac{2}{224}$ moles.

The gas which has weight 0.268 gms for $\frac{2}{224}$ moles.

0.268 gms → $\frac{2}{224}$ moles

x → 1 mole

$\frac{2}{224} x = 0.268$

$x = \frac{0.268 \times 112}{2} = 30.016$ gms

Matrix Matching

Q20) Ans:- a) 3. b) 1 c) 4. d) 2

Solution :-

a) 2.3 gms of Na → 3) 1 mole Na = 23 gms.

x = 2.3 gms

$23x = 2.3$

$x = \frac{2.3}{23} = 0.1$ moles.

b). 3×10^{23} molecules of CO_2 → 1) 1 mole of $CO_2 \rightarrow 6 \times 10^{23}$ molecules

$x \rightarrow 3 \times 10^{23}$ molecules

$6 \times 10^{23} x = 3 \times 10^{23}$

$x = \frac{1}{2} = 0.5$ mole.

c) 1.12 lit of H_2 at STP → 4) 1 mole → 22.4 litres

x moles → 1.12 litres.

$22.4x = 1.12$

$x = \frac{1.12}{22.4} = 0.05$ moles

d) 8 grams of O_2 → 2) 1 mole of O_2 = 32 grams

x = 8 grams

$32x = 8$

$x = \frac{8}{32} = \frac{1}{4} = 0.25$ moles.

Learners Task.

Q1) Ans:- A

Solution:- 1 amu = $\frac{1}{12}$th of C-12 atom

Q2) Ans:- C

Solution:- He, 1 mole = 4 grams

4 grams = 6×10^{23} 'He' atoms

x = 1 'He' atom

$6 \times 10^{23}\, x = 4$

$x = \frac{4}{6 \times 10^{23}} = 0.666 \times 10^{-23}$

$= 6.66 \times 10^{-24}$ gms

Q3) Ans:- B.

Solution:- Molecules are the smallest particles of matter that can exist independently.

Q4) Ans:- A

Solution:- 1 mole of calcium atom weight = 40gms

Q5) Ans:- A

Solution:- 1 mole of any substance contain Avagadro no. of atoms / molecule

1 gram atom weight = 6.023×10^{23} atoms

Q6) Ans:- D

Solution:- For 1 mole NH_3, N = 14 gms.

1 mole → 14 gms.

0.5 moles → x

$x = 0.5 \times 14 = 7$ grams.

Q7) Ans:- B.

Solution:- Atomic mass of Zn = 65.5 gms.

Mass = Gram atoms × Atomic mass

$= 0.9 \times 65.5$

$= 58.95$ gms

Q8) Ans:- B.

Solution:- Atomic mass of C = 12 gms.

mass = Gram atoms × Atomic mass.

$= 0.4 \times 12$

$= 4.8$ gms

Q9) Ans:- D

Solution:- Atomic mass of S = 32 grams

mass = $32 \times 3 = 96$ gms.

Q10) Ans:- D.

Solution:- 1 mole of $CaCO_3 = 40 + 12 + 48 = 100$ gms

2.5 moles of $CaCO_3 = 2.5 \times 100 = 250$ gms

Q11) Ans:- B

Solution:- 1 mole $CaCO_3$ = 100 gms.

1 mole → 100 gms.

x → 20 gms

$100x = 20$

$x = \frac{20}{100} = \frac{1}{5} = 0.2$ moles.

JEE Main Level Questions

Q12) Ans:- A.

Solution:- For H atom = 1N atoms.

For H_2 molecule = 2N atoms.

H : H_2

1N : 2N = 1 : 2

Q13) Ans:- C

Solution:- For 1 mole $CaCO_3$ = 20 + 6 + 24

= 50 protons

For 100 gms of $CaCO_3$ = $50 \times 6 \times 10^{23}$ protons.

For 10 gms of $CaCO_3$ = x

$100x = 10 \times 50 \times 6 \times 10^{23}$.

$x = \frac{10 \times 50 \times 6 \times 10^{23}}{100} = 30 \times 10^{23}$

$= 3 \times 10^{24}$ protons

Q14) Ans:- A.

Solution:- For 1 mole of $C_6H_{12}O_6 = (6\times12)+12+6(16)$

$= 180$ gms.

1 mole $\rightarrow$ 180 gms

x moles $\rightarrow$ 5.4 gms

$180x = 5.4$

$x = \frac{5.4}{180} = 0.03$ moles.

Q15) Ans:- c.

Solution:- Atomic weight of He = 4 gms.

mass = Gram atoms x Atomic weight

Given mass = 8 gms.

Gram atoms $= \frac{8}{4} = 2$

Q16) Ans:- d.

Solution:- 16 grams of Oxygen is.

1) 1 gram atom of Oxygen.

2) 0.5 gram moles of oxygen molecule.

3) Equivalent weight $= \frac{16}{8} = 2$

So 16 grams means 2 gram equivalents

Q17) Ans:- C

Solution:- 1 mole $Na_2CO_3 = 46+12+48 = 106$ gms.

1 mole → 106 gms

x ⇒ 5.3 grams

$106x = 5.3$

$x = \frac{5.3}{106} = 0.05$ moles

Q18) Ans:- B.

Solution:- 1 mole $NaOH = 23+16+1 = 40$ grams

1 mole → 40 grams

x ⇒ 60 grams

$40x = 60$

$x = \frac{60}{40} = 1.5$ moles.

Q19) Ans:- A

Solution:- No. of moles $= \frac{\text{mass}}{\text{GMW.}}$

$= \frac{256}{32} = 8$ moles.

1 mole of O_2 have 2 gram atoms

8 moles of O_2 have 16 gram atoms

Q20) Ans:- D.

Solution:- $n = \frac{60}{12}$ 5 moles

1 mole of C have 1 gram atom.

5 moles of C have 5 gram atoms

Q21) Ans:- A

Solution:- 1 mole of HCl = 1+35.5 = 36.5 gms.

1 mole → 36.5 gms

x mole → 7.3 gms

$36.5x = 7.3$

$x = \frac{7.3}{36.5} = 0.2$ moles

Advanced Level Questions

Q22) Ans:- 1, 2, 3.

Solution:- At STP, any gas can occupy

22.4 litres = 22400 ml = 22.4 dm^3

= 22400 cm^3

Q23) Ans:- 1, 3.

Solution:- 1 mole of C-12 contains 6.02×10^{23} atoms.

Total no. of electrons = $6 \times 6.022 \times 10^{23}$

= $36 \times 10^{23} = 3.6 \times 10^{24}$ electrons

Total no. of sub atomic particles.

$e^- = 6$, $p = 6$, $n = 6$, Total = 18

Total no. of sub atomic particles = 18 N.

Q24) Ans:- 1

Solution:- Gram molecular weight = 1 mole =

6.023×10^{23} molecules.

Q25) Ans:- 3.

Solution:- $\frac{1}{12}$th of mass of C-12 $= 1.66 \times 10^{-24}$ gms

$= 1.66 \times 10^{-27}$ kg.

Atomic weight units 'amu'

Q26) Ans:- D.

Solution:- Atomic mass of Si = 28 amu.

100 'Si' atomic mass $= 28 \times 100$

$= 2800$ amu.

1 amu $= 1.66 \times 10^{-24}$ gms

100 'Si' atomic mass $= 2800 \times 1.66 \times 10^{-24}$.

$= 28 \times 1.66 \times 10^{-22}$ gms.

Q27) Ans:- C.

Solution:- Atomic weight of Oxygen = 100. (Given)

Molecular weight of water $= H_2O$

$= 2(1) + 16 = 18$ gms

For 16 gms Oxygen H_2 weight = 2 gms.

For 100 gms Oxygen H_2 weight = x gms

O H_2

16 → 2

100 → x

$\Rightarrow 16x = 200$

$x = \frac{200}{16} = 12.5$

Molecular weight of water $= 12.5 + 100$

$= 112.5$ gms

Integer Type

Q28) Ans:- 2240

Solution:- 1 mole CO_2 = 44 gms.

44 gms → 22400 cc

4.4 gms → x.

$44x = 22400 \times 4.4$

$x = \frac{22400 \times 4.4}{44}$

$= 2240$ cc

Q29) Ans:- 40.

Solution:- 1 mole of water = 18 gms.

1 → 18 gms

x moles → 720 grams

$18x = 720$

$x = \frac{720}{18}$ 40

= 40 moles.

Matrix Matching

(Q30) Ans: A) 4 B) 3 C) 2 D) 1

Solution:-

A) 1.008 g of H_2 → 4) 3.0115×10^{23} molecules

B) 245 of $KClO_3$ → 3) 2 moles of $KClO_3$ = 12.046×10^{23} molecules.

C) 71 grams of Cl_2 → 2) 22.4 litres at STP.

D) 10.8 grams of Silver → 1) 0.1 gram atoms