

SOME BASIC CONCEPT OF CHEMISTRY

QUESTIONS BASED ON MOLES

1. 5.6 L of oxygen at STP contains -
 (1) 6.02×10^{23} atoms (2) 3.01×10^{23} atoms
 (3) 1.505×10^{23} atoms (4) 0.7525×10^{23} atoms
2. The number of atoms in "n" mole of gas can be given by :-
 (1) $n \times \text{Av. No.} \times \text{atomicity}$ (2) $\frac{n \times \text{Av. No.}}{\text{Atomicity}}$
 (3) $\frac{\text{Av. No.} \times \text{Atomicity}}{n}$ (4) None
3. Sum of number of protons, electrons and neutrons in 12g of $^{12}_6\text{C}$ is :-
 (1) 1.8 (2) 12.044×10^{23}
 (3) 1.084×10^{25} (4) 10.84×10^{23}
4. Which of the following contains the least number of molecules ?
 (1) 4.4 g CO_2 (2) 3.4 g NH_3
 (3) 1.6 g CH_4 (4) 3.2 g SO_2
5. Elements A and B form two compounds B_2A_3 and B_2A . 0.05 moles of B_2A_3 weight 9.0 g and 0.10 mole of B_2A weight 10 g. Calculate the atomic weight of A and B :-
 (1) 20 and 30 (2) 30 and 40
 (3) 40 and 30 (4) 30 and 20
6. 4.4 g of an unknown gas occupies 2.24 L of volume at STP. The gas may be :-
 (1) N_2O (2) CO
 (3) CO_2 (4) 1 & 3 both
7. If V mL of the vapours of substance at NTP weight W g. Then molecular weight of substance is:-
 (1) $(W/V) \times 22400$ (2) $\frac{V}{W} \times 22.4$
 (3) $(W - V) \times 22400$ (4) $\frac{W \times 1}{V \times 22400}$
8. If 3.01×10^{20} molecules are removed from 98 mg of H_2SO_4 , then the number of moles of H_2SO_4 left are :-
 (1) 0.1×10^{-3} (2) 0.5×10^{-3}
 (3) 1.66×10^{-3} (4) 9.95×10^{-2}
9. A person adds 1.71 gram of sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) in order to sweeten his tea. The number of carbon atoms added are (mol. mass of sugar = 342)
 (1) 3.6×10^{22} (2) 7.2×10^{21}
 (3) 0.05 (4) 6.6×10^{22}

10. The total number of ions present in 1 mL of 0.1 M barium nitrate $\text{Ba}(\text{NO}_3)_2$ solution is -
 (1) 6.02×10^{18} (2) 6.02×10^{19}
 (3) $3.0 \times 6.02 \times 10^{19}$ (4) $3.0 \times 6.02 \times 10^{18}$
11. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is -
 (1) 10 g molecules (2) 5 g molecules
 (3) 1 g molecules (4) 0.5 g molecules

QUESTIONS BASED ON PERCENTAGE, EMPIRICAL FORMULA & MOLECULAR FORMULA

12. A compound of X and Y has equal mass of them. If their atomic weights are 30 and 20 respectively. Molecular formula of the compound is :-
 (1) X_2Y_2 (2) X_3Y_3
 (3) X_2Y_3 (4) X_3Y_2
13. An oxide of metal M has 40% by mass of oxygen. Metal M has atomic mass of 24. The empirical formula of the oxide is :-
 (1) M_2O (2) M_2O_3
 (3) MO (4) M_3O_4
14. A compound contains 38.8% C, 16.0% H and 45.2% N. The formula of the compound would be
 (1) CH_3NH_2 (2) CH_3CN
 (3) $\text{C}_2\text{H}_5\text{CN}$ (4) $\text{CH}_2(\text{NH})_2$
15. A gas is found to contain 2.34 g of Nitrogen and 5.34 g of oxygen. Simplest formula of the compound is -
 (1) N_2O (2) NO
 (3) N_2O_3 (4) NO_2
16. 2.2 g of a compound of phosphorous and sulphur has 1.24 g of 'P' in it. Its empirical formula is -
 (1) P_2S_3 (2) P_3S_2
 (3) P_3S_4 (4) P_4S_3
17. Insulin contains 3.4% sulphur ; the minimum molecular weight of insulin is :
 (1) 941.176 (2) 944
 (3) 945.27 (4) None
18. A giant molecule contains 0.25% of a metal whose atomic weight is 59. Its molecule contains one atom of that metal. Its minimum molecular weight is -
 (1) 5900 (2) 23600
 (3) 11800 (4) $\frac{100 \times 59}{0.4}$

QUESTIONS BASED ON STOICHIOMETRY

19. In a gaseous reaction of the type
 $aA + bB \longrightarrow cC + dD$,
which statement is wrong ?
(1) a litre of A combines with b litre of B to give c litre of C and d litre of D
(2) a mole of A combines with b moles of B to give c mole of C and d mole of D
(3) a gm of A combines with b gm of B to give c gm of C and d gm of D
(4) a molecules of A combines with b molecules of B to give c molecules of C and d molecules of D
20. In a given reaction, 9 g of Al will react with
$$2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3$$

(1) 6 g O₂ (2) 8 g O₂ (3) 9 g O₂ (4) 4 g O₂
21. 26 cc of CO₂ are passed over red hot coke. The volume of CO evolved is :-
(1) 15 cc (2) 10 cc (3) 32 cc (4) 52 cc
22. If 0.5 mol of BaCl₂ is mixed with 0.2 mol of Na₃PO₄, the maximum number of moles of Ba₃(PO₄)₂ that can be formed is
$$3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$$

(1) 0.7 (2) 0.5 (3) 0.3 (4) 0.1
23. If 1.6 g of SO₂ and 1.5 × 10²² molecules of H₂S are mixed and allowed to remain in contact in a closed vessel until the reaction
$$2H_2S + SO_2 \longrightarrow 3S + 2H_2O$$
,
proceeds to completion. Which of the following statement is true ?
(1) Only 'S' and 'H₂O' remain in the reaction vessel.
(2) 'H₂S' will remain in excess
(3) 'SO₂' will remain in excess
(4) None
24. 12L of H₂ and 11.2L of Cl₂ are mixed and exploded. The composition by volume of mixture is -
(1) 24 L of HCl (g)
(2) 0.8 L Cl₂ and 20.8 L HCl (g)
(3) 0.8 L H₂ and 22.4 L HCl (g)
(4) 22.4 L HCl (g)
25. 10 mL of gaseous hydrocarbon on combustion give 40 mL of CO₂(g) and 50 mL of H₂O (vap.). The hydrocarbon is -
(1) C₄H₅ (2) C₈H₁₀ (3) C₄H₈ (4) C₄H₁₀

26. 500 mL of a gaseous hydrocarbon when burnt in excess of O₂ gave 2.5 L of CO₂ and 3.0 L of water vapours under same conditions. Molecular formula of the hydrocarbon is -
(1) C₄H₈ (2) C₄H₁₀ (3) C₅H₁₀ (4) C₅H₁₂

QUESTIONS BASED ON EQUIVALENT WEIGHTS

27. Sulphur forms two chlorides S₂Cl₂ and SCl₂. The equivalent mass of sulphur in SCl₂ is 16. The equivalent weight of sulphur in S₂Cl₂ is -
(1) 8 (2) 16 (3) 32 (4) 64
28. If equivalent weight of S in SO₂ is 8 then equivalent weight of S in SO₃ is -
(1) $\frac{8 \times 2}{3}$ (2) $\frac{8 \times 3}{2}$
(3) 8 × 2 × 3 (4) $\frac{2 \times 3}{8}$
29. 0.45 g of acid (molecular wt. = 90) was exactly neutralised by 20 mL of 0.5 N NaOH. Basicity of the acid is -
(1) 1 (2) 2 (3) 3 (4) 4
30. 0.126 g of an acid requires 20 mL of 0.1 N NaOH for complete neutralisation. Equivalent weight of the acid is -
(1) 45 (2) 53 (3) 40 (4) 63
31. H₃PO₄ is a tribasic acid and one of its salt is NaH₂PO₄. What volume of 1M NaOH solution should be added to 12 g NaH₂PO₄ to convert it into Na₃PO₄ ? (at.wt of P=31)
(1) 100 mL (2) 200 mL (3) 80 mL (4) 300 mL
32. A metal oxide is reduced by heating it in a stream of hydrogen. It is found that after complete reduction 3.15 g of the oxide have yielded 1.05 g of the metal. We may conclude that.
(1) Atomic weight of the metal is 4
(2) Equivalent weight of the metal is 8
(3) Equivalent weight of the metal is 4
(4) Atomic weight of the metal is 8
33. 14 g of element X combines with 16 g of oxygen. On the basis of this information, which of the following is a correct statement:-
(1) The element X could have an atomic weight of 7 and its oxide is XO
(2) The element X could have an atomic weight of 14 and its oxide is X₂O
(3) The element X could have an atomic weight of 7 and its oxide is X₂O
(4) The element X could have an atomic weight of 14 and its oxide is XO₂

**QUESTIONS BASED ON CALCULATION
OF ATOMIC WEIGHTS AND
MOLECULAR WEIGHTS**

- 34.** Specific heat of a solid element is $0.1 \text{ Cal g}^{-1} \text{ }^\circ\text{C}$ and its equivalent weight is 31.8. Its exact atomic weight is -
(1) 31.8 (2) 63.6 (3) 318 (4) 95.4
- 35.** A metal M forms a sulphate which is isomorphous with $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$. If 0.6538 g of metals M displaced 2.16 g of silver from silver nitrate solution, then the atomic weight of the metal M is
(1) 32.61 (2) 56.82 (3) 65.38 (4) 74.58
- 36.** The chloride of a metal contains 71% chlorine by weight and the vapour density of it is 50, the atomic weight of the metal will be:-
(1) 29 (2) 58 (3) 35.5 (4) 71
- 37.** The specific heat of a metal M is 0.25. Its equivalent weight is 12. What is its correct atomic weight :-
(1) 25.6 (2) 36 (3) 24 (4) 12
- 38.** 0.39 g of a liquid on vapourisation gave 112 mL of vapour at STP. Its molecular weight is -
(1) 39 (2) 18.5 (3) 78 (4) 112
- 39.** In Victor Meyer's method 0.2 g of a volatile compound on volatilisation gave 56 mL of vapour at STP. Its molecular weight is -
(1) 40 (2) 60 (3) 80 (4) 120
- 40.** One litre of a certain gas weighs 1.16 g at STP. The gas may possibly be -
(1) C_2H_2 (2) CO (3) O_2 (4) NH_3
- 41.** The oxide of an element possesses the molecular formula M_2O_3 . If the equivalent mass of the metal is 9, the molecular mass of the oxide will be -
(1) 27 (2) 75 (3) 102 (4) 18

SOLUTION

SOME BASIC CONCEPT OF CHEMISTRY

1. $n(\text{O}_2) = \frac{5.6}{22.4} = \frac{1}{4}$ moles
 $N(\text{O}_2) = \frac{1}{4} \times N_A$
 $N(\text{O}) = 2 \times \frac{1}{4} \times 6.02 \times 10^{23}$
 $= 3.01 \times 10^{23}$ atoms
2. No. of molecules = $n \times N_A$
 No. of atoms = $n \times N_A \times \text{atomicity}$
3. 12 gm ^{12}C means one mole ^{12}C
 $n(\text{C}) = 1$
 $N(\text{C}) = N_A$
 $N(\text{P}) = 6N_A$
 $N(e^-) = 6 N_A$
 $N(n) = (12 - 6)N_A = 6N_A$
 $N(p+e+n) = 18 N_A = 18 \times 6.022 \times 10^{23}$
 $= 1.084 \times 10^{25}$
4. Least no. of molecules means least moles.
 So 3.2 gm $\text{SO}_2 = 0.05$ moles is least among all.
5. $n \times \text{Mwt} = wt$
 $0.05 \times (2M_B + 3M_A) = 9$
 $2M_B + 3M_A = 180 \quad \dots(1)$
 $0.1 \times (2M_B + M_A) = 10$
 $2M_B + M_A = 100 \quad \dots(2)$
 (1) & (2) $M_A = 40$ & $M_B = 30$
6. $n = \frac{4.4}{\text{Mwt}} = \frac{2.24\text{L}}{22.4\text{L}} \Rightarrow \text{Mwt} = 44$
 So gas may be N_2O , CO_2
7. $n = \frac{W}{\text{Mwt}} = \frac{V\text{ml}}{22400}$
 $\Rightarrow \text{Mwt} = \frac{W}{V} \times 22400$
8. $n_{\text{H}_2\text{SO}_4}(\text{initial}) = \frac{98\text{mg}}{98} = 10^{-3}$
 $n_{\text{H}_2\text{SO}_4}(\text{removed}) = \frac{3.01 \times 10^{20}}{6.02 \times 10^{23}} = 0.5 \times 10^{-3}$
 $n_{\text{H}_2\text{SO}_4}(\text{left}) = 10^{-3} - 0.5 \times 10^{-3}$
 $= 0.5 \times 10^{-3}$
9. $n(\text{C}_{12}\text{H}_{22}\text{O}_{11}) = \frac{1.71}{342} = 5 \times 10^{-3}$
 $n(\text{C}) = 12 \times 5 \times 10^{-3}$ moles
 $N(\text{C}) = 12 \times 5 \times 10^{-3} \times N_A$
 $= 3.6 \times 10^{22}$
10. $n = M \times V_{\text{lit}} = 0.1 \times 1 \times 10^{-3}$
 $n = 10^{-4}$ moles
 $n(\text{total ions}) = 3 \times 10^{-4}$
 $N(\text{total ions}) = 3 \times 10^{-4} \times 6.02 \times 10^{23}$
 $= 3 \times 6.02 \times 10^{19}$
11. No. of gm molecules of $\text{O}_2 = \text{no of moles of } \text{O}_2$
 $= \frac{n(\text{CO})}{2} = \frac{1}{2} \times \frac{6.02 \times 10^{24}}{6.02 \times 10^{23}} = \frac{10}{2} = 5$
12. Let compound is X_pY_q
 given $P \times 30 = q \times 20$
 $\frac{p}{q} = \frac{2}{3}$
 so formula is X_2Y_3
13. Let oxide is M_2O_x
 given $40 = \frac{x \times 16}{2 \times 24 + x \times 16} \times 100$
 $x = 2$
 So oxide is M_2O_2
 EF is MO
14. $n(\text{C}) = \frac{38.8}{12}$; $n(\text{H}) = \frac{16.0}{1}$; $n(\text{N}) = \frac{45.2}{14}$
 $= 3.23$; $= 16$; $= 3.23$
 $\text{C} : \text{H} : \text{N} = 1 : 5 : 1$
 So formula may be CH_5NH_2
15. $n(\text{N}) = \frac{2.34}{14}$; $n(\text{O}) = \frac{5.34}{16}$
 $= 0.167$; $= 0.337$
 $\text{N} : \text{O} = 1 : 2$
 So simplest formula is NO_2

16. Let compound is P_xS_y

$$\%P = \frac{1.24}{2.20} \times 100 = \frac{x \times 31}{(x \times 31) + (y \times 32)} \times 100$$

$$\frac{x}{y} = \frac{4}{3}$$

So formula is P_4S_3

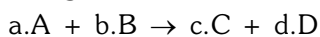
17. $\%S = \frac{1 \times 32}{M_{\text{ot(minimum)}}} \times 100 = 3.4$

$$M_{\text{ot(minimum)}} = 941.176$$

18. $\%Metal = \frac{1 \times 59}{Mwt(\text{minimum})} \times 100 = 0.25$

$$Mwt(\text{minimum}) = 23600$$

19. For gases reaction



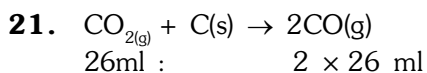
It is wrong to say

a gm of A combines with b gm of B to give C and D.

20. $\frac{n(\text{Al})}{2} = \frac{n(\text{O}_2)}{3/2} \Rightarrow \frac{9/27}{2} = \frac{n(\text{O}_2)}{3/2}$

$$n(\text{O}_2) = \frac{1}{4}$$

$$\text{wt}(\text{O}_2) = \frac{1}{4} \times 32 = 8 \text{ gm}$$



$$V_{\text{CO}} = 52 \text{ ml.}$$

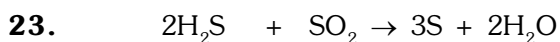


0.5 moles 0.2 moles

Here Na_3PO_4 is L.R.

So completely consumed

$$n_{\text{Na}_3(\text{PO}_4)} \text{ obtained} = \frac{1}{2} \times 0.2 = 0.1$$

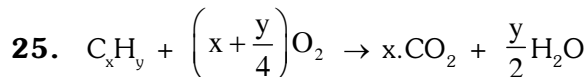
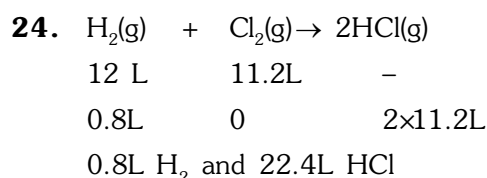


$$n = \frac{1.5 \times 10^{22}}{6 \times 10^{23}} \quad \frac{1.6}{64}$$

$$= \frac{1}{40} \quad = \frac{1}{40}$$

So H_2S is L.R. consumed completely

SO_2 remain in excess

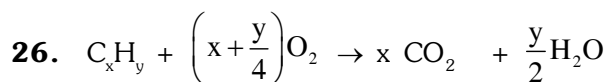


$$10\text{ml} \qquad \qquad \qquad 40\text{ml} \qquad 50\text{ml}$$

$$x : \frac{y}{2} = 4 : 5$$

$$x : y = 4 : 10$$

So Hydrocarbon is C_4H_{10}



$$500 \text{ ml} \qquad \qquad \qquad 2.5\text{L} \qquad 3.0\text{L}$$

$$1 \text{ L} \qquad \qquad \qquad 5\text{L} \qquad 6\text{L}$$

$$x : \frac{y}{2} = 5 : 6 \Rightarrow x : y = 5 : 12$$

So hydrocarbon is C_5H_{12}

27. $E(\text{S})_{\text{S}_2\text{Cl}_2} = \frac{2 \times 32}{2 \times 35.5} \times 35.5$
 $= 32$

28. $E(\text{S})_{\text{SO}_3} = \frac{1 \times 32}{3 \times 16} \times 8$
 $= \frac{8 \times 2}{3}$

29. equivalent of Acid = equivalent of NaOH

$$\left(\frac{0.45}{90}\right) \times n_f = 0.5 \times 20 \times 10^{-3}$$

$$n_f = 2$$

30. equivalent of Acid = equivalent of NaOH.

$$\left(\frac{\text{wt}}{E}\right) = N \times V_{\text{lit}}$$

$$\frac{0.126}{E} = 0.1 \times 20 \times 10^{-3}$$

$$E = 63$$

31. equivalent of $(\text{NaH}_2\text{PO}_4 \text{ to } \text{Na}_3\text{PO}_4)$
=equivalent of NaOH

$$n \times n_f(\text{NaH}_2\text{PO}_4) = M \times 1 \times V_{\text{lit}}$$

$$\frac{12}{120} \times 2 = 1 \times V_{\text{lit}}$$

$$V_{\text{lit}} = 200 \text{ ml}$$

32. $w(\text{metal oxide}) = 3.15 \text{ gm}$
 $w(\text{metal}) = 1.05 \text{ gm}$
 $w(\text{oxygen}) = 3.15 - 1.05 = 2.10$

$$E(\text{metal})_{\text{in metal oxide}} = \frac{\omega(\text{metal})}{\omega(\text{oxygen})} \times 8$$

$$= \frac{1.05}{2.10} \times 8 = 4$$

33. $E(X) = \frac{14}{16} \times 8 = 7 = \frac{M_{\text{ot}}}{n_f}$

If $nf = 1$ $M_{\text{ot}} = 7$
oxide will be X_2O

34. Atomic wt of metal \times Specific heat $\left(\frac{\text{Cal}}{\text{gm}^\circ\text{C}} \right) \approx 6.4$

$$\text{Atomic wt}_{\text{experimental}} = \frac{6.4}{0.1} \approx 64$$

$$n_f = \frac{\text{Atomic wt}}{\text{Equivalent wt}} = \frac{64}{31.8} \approx 2$$

$$\begin{aligned} \text{So Atomic wt exact} &= \text{Equivalent} \times n_f \\ &= 31.8 \times 2 \\ &= 63.8 \end{aligned}$$

35. $\text{MSO}_4 \cdot 7\text{H}_2\text{O}$ is isomorphous with $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
So $n_f(\text{M}) = 2$

$$E(\text{M}) = \frac{0.6538}{2.16} \times 108 = \frac{65.38}{2}$$

$$\text{Atomic wt}(\text{M}) = E(\text{M}) \times n_f$$

$$= \frac{65.38}{2} \times 2$$

$$= 65.38$$

36. $M_{\text{ot}}(\text{metal chloride}) = 2 \times \text{VD} = 2 \times 50 = 100$
 $\omega(\text{metal}) = 29\% \text{ of } 100$
 $= 29$

$$= M_{\text{ot}} \text{ of metal}$$

37. Atomic wt. $_{(\text{experimental})} \times 0.25 \approx 6.4$

$$\text{Atomic wt} \approx \frac{640}{25}$$

$$n_f = \frac{\text{Atomic wt}}{\text{Equivalent wt}} = \frac{640/25}{12} \approx 2$$

$$\begin{aligned} \text{Atomic wt exact} &= \text{Equivalent wt} \times n_f \\ &= 12 \times 2 \\ &= 24 \end{aligned}$$

38. $n = \frac{0.39}{M_{\text{ot}}} = \frac{112 \text{ ml}}{22400 \text{ ml}}$

$$M_{\text{ot}} = 78$$

39. $n = \frac{0.2}{M_{\text{ot}}} = \frac{56 \text{ ml}}{22400 \text{ ml}} \Rightarrow M_{\text{ot}} = 80$

40. $n = \frac{1.16}{M_{\text{ot}}} = \frac{1}{22.4} \Rightarrow M_{\text{ot}} = 26$ so gas is C_2H_2

41. $E(\text{M in } \text{M}_2\text{O}_3) = \frac{2 \times \text{Atomic wt M}}{3 \times 16} \times 8 = 9$

$$\text{Atomic wt (M)} = 27$$