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) $n \times$Av. No. $\times$ 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 $^{12}_{6}C$ 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 ($C_{12}H_{22}O_{11}$) 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 persent in 1 mL of 0.1 M barium nitrate $Ba(NO_3)_2$ 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 & MOLECUALR 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 emperical 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) C_2H_5CN (4) $CH_2(NH)_2$

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 emperial 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 O_2 (2) 8 g O_2 (3) 9 g O_2 (4) 4 g O_2

21. 26 cc of CO_2 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 $BaCl_2$ is mixed with 0.2 mol of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ 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 SO_2 and 1.5×10^{22} molecules of H_2S 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 'H_2O' remain in the reaction vessel.

(2) 'H_2S' will remain in excess

(3) 'SO_2' will remain in excess

(4) None

24. 12 L of H_2 and 11.2 L of Cl_2 are mixed and exploded. The composition by volume of mixture is -

(1) 24 L of HCl (g)

(2) 0.8 L Cl_2 and 20.8 L HCl (g)

(3) 0.8 L H_2 and 22.4 L HCl (g)

(4) 22.4 L HCl (g)

25. 10 mL of gaseous hydrocarbon on combustion give 40 mL of CO_2(g) and 50 mL of H_2O (vap.). The hydrocarbon is -

(1) C_4H_5 (2) C_8H_{10} (3) C_4H_8 (4) C_4H_{10}

26. 500 mL of a gaseous hydrocarbon when burnt in excess of O_2 gave 2.5 L of CO_2 and 3.0 L of water vapours under same conditions. Molecular formula of the hydrocarbon is -

(1) C_4H_8 (2) C_4H_{10} (3) C_5H_{10} (4) C_5H_{12}

QUESTIONS BASED ON EQUIIVALENT WEIGHTS

27. Sulphur forms two chlorides S_2Cl_2 and SCl_2. The equivalent mass of sulphur in SCl_2 is 16. The equivalent weight of sulphur in S_2Cl_2 is -

(1) 8 (2) 16 (3) 32 (4) 64

28. If equivalent weight of S in SO_2 is 8 then equivalent weight of S in SO_3 is -

(1) $\frac{8\times2}{3}$ (2) $\frac{8\times3}{2}$

(3) $8\times2\times3$ (4) $\frac{2\times3}{8}$

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. H_3PO_4 is a tribasic acid and one of its salt is NaH_2PO_4. What volume of 1M NaOH solution should be added to 12 g NaH_2PO_4 to convert it into Na_3PO_4 ? (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 X_2O

(3) The element X could have an atomic weight of 7 and its oxide is X_2O

(4) The element X could have an atomic weight of 14 and its oxide is XO_2

QUESTIONS BASED ON CALCULATION OF ATOMIC WEIGHTS AND MOLECULAR WEIGHTS

34. Specific heat of a solid element is 0.1 Cal g^{-1} °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 $MgSO_4.7H_2O$. 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 it's 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 Mayer'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 possess 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. $n(O_2) = \frac{5.6}{22.4} = \frac{1}{4}$ moles

$N(O_2) = \frac{1}{4} \times NA$

$N(O) = 2 \times \frac{1}{4} \times 6.02 \times 10^{23}$

$= 3.01 \times 10^{23}$ atoms

2. No. of molecules = $n \times N_A$

No. of atoms = $n \times N_A \times$ atomicity

3. 12 gm $_6^{12}C$ means one mole $_6^{12}C$

$n(C) = 1$

$N(C) = N_A$

$N(P) = 6N_A$

$N(e^-) = 6\ N_A$

$N(n) = (12 - 6)N_A = 6N_A$

$N(p+e+n) = 18\ N_A = 18 \times 6.022 \times 10^{23}$

$= 1.084 \times 10^{25}$

4. Least no. of molecules means least moles.

So 3.2 gm SO_2 = 0.05 moles is least among all.

5. $n \times M\omega t = \omega t$

$0.05 \times (2M_B + 3M_A) = 9$

$2M_B + 3M_A = 180$ ....(1)

$0.1 \times (2M_B + M_A) = 10$

$2M_B + M_A = 100$ ....(2)

(1) & (2) $M_A = 40$ & $M_B = 30$

6. $n = \frac{4.4}{Mwt} = \frac{2.24L}{22.4L} \Rightarrow Mwt = 44$

So gas may be N_2O, CO_2

7. $n = \frac{W}{M\omega t} = \frac{Vml}{22400}$

$\Rightarrow M\omega t = \frac{W}{V} \times 22400$

8. $n_{H_2SO_4}(\text{initial}) = \frac{98mg}{98} = 10^{-3}$

$n_{H_2SO_4}(\text{removed}) = \frac{3.01 \times 10^{20}}{6.02 \times 10^{23}} = 0.5 \times 10^{-3}$

$n_{H_2SO_4}(\text{left}) = 10^{-3} - 0.5 \times 10^{-3}$

$= 0.5 \times 10^{-3}$

9. $n(C_{12}H_{22}O_{11}) = \frac{1.71}{342} = 5 \times 10^{-3}$

$n(C) = 12 \times 5 \times 10^{-3}$ moles

$N(C) = 12 \times 5 \times 10^{-3} \times N_A$

$= 3.6 \times 10^{22}$

10. $n = M \times V_{lit} = 0.1 \times 1 \times 10^{-3}$

$n = 10^{-4}$ 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 O_2 = no of moles of O_2

$= \frac{n(CO)}{2} = \frac{1}{2} \times \frac{6.02 \times 10^{24}}{6.02 \times 10^{23}} = \frac{10}{2} = 5$

12. Let compound is $X_p\ Y_q$

given $P \times 30 = q \times 20$

$\frac{p}{q} = \frac{2}{3}$

so formulla 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. $n(c) = \frac{38.8}{12}$; $n(H) = \frac{16.0}{1}$; $n(N) = \frac{45.2}{14}$

$= 3.23$ $=16$ $= 3.23$

C : H : N = 1 : 5 : 1

So formulla may be CH_3NH_2

15. $n(N) = \frac{2.34}{14}$; $n(O) = \frac{5.34}{16}$

$= 0.167$ $= 0.337$

N : O = 1 : 2

So simptest formulla 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. $$\%S = \frac{1\times 32}{M_{\omega t(\text{min imum})}}\times 100 = 3.4$$

$M_{\omega t(minimum)}$ = 941.176

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

Mwt(minimum) = 23600

19. For gases reaction

a.A + b.B → c.C + d.D

It is worng to say

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

20. $$\frac{n(Al)}{2} = \frac{n(O_2)}{3/2} \Rightarrow \frac{9/27}{2} = \frac{n(O_2)}{3/2}$$

$$n(O_2) = \frac{1}{4}$$

$$\omega t(O_2) = \frac{1}{4}\times 32 = 8 \text{ gm}$$

21. $CO_{2(g)}$ + C(s) → 2CO(g)

26ml : 2 × 26 ml

V_{CO} = 52 ml.

22. $3BaCl_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaCl$

0.5 moles 0.2 moles

Here Na_3PO_4 is L.R.

So completelly consumed

$$n_{Na_3(PO_4)} \text{ obtained} = \frac{1}{2}\times 0.2 = 0.1$$

23. $2H_2S + SO_2 \rightarrow 3S + 2H_2O$

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

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

So H_2S is L.R. consumed completely

SO_2 remain in exess

24. $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

12 L 11.2L –

0.8L 0 2×11.2L

0.8L H_2 and 22.4L HCl

25. $$C_xH_y + \left(x+\frac{y}{4}\right)O_2 \rightarrow x.CO_2 + \frac{y}{2}H_2O$$

10ml 40ml 50ml

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

x : y = 4 : 10

So Hydrocarbon is C_4H_{10}

26. $$C_xH_y + \left(x+\frac{y}{4}\right)O_2 \rightarrow x\ CO_2 + \frac{y}{2}H_2O$$

500 ml 2.5L 3.0L

1 L 5L 6L

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

So hydrocarbon is C_5H_{12}

27. $$E(S)_{S_2Cl_2} = \frac{2\times 32}{2\times 35.5}\times 35.5$$

= 32

28. $$E(S)_{SO_3} = \frac{1\times 32}{3\times 16}\times 8$$

$$= \frac{8\times 2}{3}$$

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.

$$\left(\frac{\omega t}{E}\right) = N\times V_{lit}$$

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

E = 63

31. equivalent of (NaH_2PO_4 to Na_3PO_4)
=equivalent of NaOH

$$n \times n_{f(NaH_2PO_4)} = M \times 1 \times V_{lit}$$

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

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

32. w(metal oxide) = 3.15 gm
w(metal) = 1.05 gm
w(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. $E(X) = \frac{14}{16} \times 8 = 7 = \frac{M_{\omega t}}{n_f}$

If nf = 1 Mωt = 7
oxide will be X_2O

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

Atomic $\omega t_{\text{experimental}} = \frac{6.4}{0.1} \simeq 64$

$$n_f = \frac{\text{Atomic } \omega t}{\text{Equivalent } \omega t} = \frac{64}{31.8} \simeq 2$$

So Atomic ωt exact = Equivalent $\times$ n_f
= 31.8 × 2
= 63.8

35. $MSO_4.7H_2O$ is isomorphous with $MgSO_4.7H_2O$
So $n_f(M) = 2$

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

Atomic ωt(M) = E (M) × nf

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

= 65.38

36. Mωt(metal chloride) = 2 × VD = 2 × 50 = 100
ωt (metal) = 29% of 100
= 29
= Mωt of metal

37. Atomic.$\omega t_{(\text{experimental})} \times 0.25 \simeq 6.4$

$$\text{Atomic } \omega t \simeq \frac{640}{25}$$

$$n_f = \frac{\text{Atomic } \omega t}{\text{Equivalent } \omega t} = \frac{640/25}{12} \simeq 2$$

Atomic ωt exact = Equivalent ωt × nf
= 12 × 2
= 24

38. $n = \frac{0.39}{M\omega t} = \frac{112\,\text{ml}}{22400\,\text{ml}}$

Mωt = 78

39. $n = \frac{0.2}{M\omega t} = \frac{56\text{ml}}{22400\text{ml}} \Rightarrow M\omega t = 80$

40. $n = \frac{1.16}{M\omega t} = \frac{1}{22.4} \Rightarrow$ Mωt = 26 so gas is C_2H_2

41. $E(M \text{ in } M_2O_3) = \frac{2 \times \text{Atomic wt M}}{3 \times 16} \times 8 = 9$

Atomic wt (M) = 27