

# Chapter 01

## Some Basic Concepts of Chemistry



### JEE RANKER'S STUFF



#### SINGLE CORRECT QUESTION

- Q.1** 4.0 g of caustic soda (molar mass = 40) contains same number of sodium ions as are present in-
- 10.6 g of  $\text{Na}_2\text{CO}_3$  (mol. mass 106)
  - 58.5 g of  $\text{NaCl}$  (Formula mass 58.5)
  - 7.1 g of  $\text{Na}_2\text{SO}_4$  (Formula mass 142)
  - 1 mol of  $\text{NaNO}_3$  (mol. mass 85)

- Q.2** A gaseous mixture contains  $\text{CO}_2(\text{g})$  and  $\text{N}_2\text{O}(\text{g})$  in 2 : 5 ratio by mass. The ratio of the number of molecules of  $\text{CO}_2(\text{g})$  and  $\text{N}_2\text{O}(\text{g})$  is :
- 5 : 2
  - 2 : 5
  - 1 : 2
  - 5 : 4

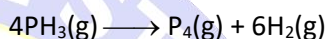
- Q.3** Weight of oxygen in  $\text{Fe}_2\text{O}_3$  and  $\text{FeO}$  is in the simple ratio for the same amount of iron is :
- 3 : 2
  - 1 : 2
  - 2 : 1
  - 3 : 1

- Q.4** The pair of species having same percentage (mass) of carbon is :
- $\text{CH}_3\text{COOH}$  and  $\text{C}_6\text{H}_{12}\text{O}_6$
  - $\text{CH}_3\text{COOH}$  and  $\text{C}_2\text{H}_5\text{OH}$
  - $\text{HCOOCH}_3$  and  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
  - $\text{C}_6\text{H}_{12}\text{O}_6$  and  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

- Q.5** Calculate the molecular formula of compound which contains 20% Ca and 80% Br (by wt.) if molecular weight of compound is 200. (Atomic wt. Ca = 40, Br = 80)
- $\text{Ca}_{1/2}\text{Br}$
  - $\text{CaBr}_2$
  - $\text{CaBr}$
  - $\text{Ca}_2\text{Br}$

- Q.6** The minimum quantity in gram of  $\text{H}_2\text{S}$  needed to precipitate 63.5 g of  $\text{Cu}^{+2}$  will be nearly
- $$\text{Cu}^{+2} + \text{H}_2\text{S} \longrightarrow \text{CuS} + 2\text{H}^+$$
- 63.5 g
  - 31.75 g
  - 34 g
  - 20 g

- Q.7** Phosphine ( $\text{PH}_3$ ) decomposes to produce vapours of phosphorus and  $\text{H}_2$  gas. What will be the change in volume when 100 mL of phosphine is decomposed ?

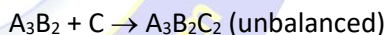


- + 50 mL
- 500 mL
- + 75 mL
- 500 mL

- Q.8** Calculate the amount of Ni needed in the Mond's process given below
- $$\text{Ni} + 4\text{CO} \longrightarrow \text{Ni}(\text{CO})_4$$
- If CO used in this process is obtained through a process, in which 6 g of carbon is mixed with 44 g  $\text{CO}_2$ .

- 14.675 g
- 29 g
- 58 g
- 28 g

- Q.9**  $\text{A} + \text{B} \rightarrow \text{A}_3\text{B}_2$  (unbalanced)



Above two reactions are carried out by taking 3 moles each of A and B and one mole of C. Then which option is/are correct ?

- 1 mole of  $\text{A}_3\text{B}_2\text{C}_2$  is formed
- 1/3 mole of  $\text{A}_3\text{B}_2\text{C}_2$  is formed
- 1/2 mole of  $\text{A}_3\text{B}_2$  is formed
- 1/2 mole of  $\text{A}_3\text{B}_2$  is left finally

- Q.10** What is the molarity of  $\text{H}_2\text{SO}_4$  solution that has a density of 1.84 g/cc and contains 98% by mass of  $\text{H}_2\text{SO}_4$ ? (Given atomic mass of S = 32)

- 4.18 M
- 8.14 M
- 18.4 M
- 18 M

- Q.11** 125 mL of 8% w/w NaOH solution (specific gravity 1) is added to 125 mL of 10% w/v HCl solution.

The nature of resultant solution would be \_\_\_\_\_.

- (1) Acidic (2) Basic  
(3) Neutral (4) None

**Q.12** An organic compound having molecular mass 60 is found to contain C = 20%, H = 6.67% and N = 46.67% while rest is oxygen. On heating it gives  $\text{NH}_3$  along with a solid residue. The solid residue give violet colour with alkaline copper sulphate solution. The compound is -

- (1)  $(\text{NH}_2)_2\text{CO}$  (2)  $\text{CH}_3\text{CH}_2\text{CONH}_2$   
(3)  $\text{CH}_3\text{NCO}$  (4)  $\text{CH}_3\text{CONH}_2$

**Q.13** The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is:

- (1) 2.05 M (2) 0.50 M (3) 1.78 M (4) 1.02 M

**Q.14** A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of  $\text{CO}_2$ . The empirical formula of the hydrocarbon is

- (1)  $\text{C}_2\text{H}_4$  (2)  $\text{C}_3\text{H}_4$  (3)  $\text{C}_6\text{H}_5$  (4)  $\text{C}_7\text{H}_8$

**Q.15** A certain alkaloid has 70.8% carbon, 6.2% hydrogen, 4.1% nitrogen and the rest oxygen. What is its empirical formula?

- (1)  $\text{C}_{20}\text{H}_{21}\text{NO}_4$  (2)  $\text{C}_{20}\text{H}_{20}\text{NO}_4$   
(3)  $\text{C}_{21}\text{H}_{20}\text{NO}_3$  (4)  $\text{C}_{20}\text{H}_{19}\text{NO}_3$

**Q.16**  $\text{CaCO}_3$  is 90% pure. Volume of  $\text{CO}_2$  collected at STP when 10 g of  $\text{CaCO}_3$  is decomposed is -

- (1) 2.016 litres (2) 1.008 litres  
(3) 10.08 litres (4) 20.16 litres

**Q.17** 50 g  $\text{CaCO}_3$  will react with ..... g of 20% HCl by weight.

- (1) 36.5 gm (2) 73 gm  
(3) 109.5 gm (4) 182.5 gm

**Q.18** 0.01 mole of iodoform ( $\text{CHI}_3$ ) reacts with Ag to produce a gas whose volume at NTP is

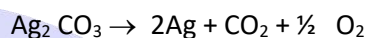
$$2\text{CHI}_3 + 6\text{Ag} \rightarrow \text{C}_2\text{H}_2 + 6\text{AgI(s)}$$

- (1) 224 ml (2) 112 ml  
(3) 336 ml (4) None of these

**Q.19** The minimum quantity in grams of  $\text{H}_2\text{S}$  needed to precipitate 63.5 g of  $\text{Cu}^{2+}$  will be nearly :  $\text{Cu}^{2+} + \text{H}_2\text{S} \rightarrow \text{CuS} + \text{H}_2$

- (1) 63.5 g (2) 31.75 g  
(3) 34 g (4) 20 g

**Q.20** 2.76 g of silver carbonate on being strongly heated yields a residue weighing



- (1) 2.16 g (2) 2.48 g  
(3) 2.32 g (4) 2.64 g

**Q.21** The volume of gas at NTP produced by 100 g of  $\text{CaC}_2$  with water:-



- (1) 70 litre (2) 35 litre  
(3) 17.5 litre (4) 22.4 litre

**Q.22** How many moles of magnesium phosphate,  $\text{Mg}_3(\text{PO}_4)_2$  will contain 0.25 mole of oxygen atoms?

- (1)  $2.5 \times 10^{-2}$  (2) 0.02  
(3)  $3.125 \times 10^{-2}$  (4)  $1.25 \times 10^{-2}$

**Q.23** A sample of ammonium phosphate  $(\text{NH}_4)_3\text{PO}_4$  contains 3.18 mol of H atoms. The number of mol of O atoms in the sample is :

- (1) 0.265 (2) 0.795  
(3) 1.06 (4) 3.18

**Q.24** 1 g of HCl and 1gm of  $\text{MnO}_2$  heated together the maximum weight of  $\text{Cl}_2$  gas evolved will be

$$[\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}]$$

- (1) 2g (2) 0.975 g  
(3) 0.486g (4) 0.972 g

**Q.25** Cortisone is a molecular substance containing 21 atoms of carbon per molecule. The mass percentage of carbon in cortisone is 69.98%. Its molar mass is :

- (1) 176.5 (2) 252.2  
(3) 287.6 (4) 360.1

## CHEMISTRY

**Q.26** The empirical formula of a compound of molecular mass 120 is  $\text{CH}_2\text{O}$ . The molecular formula of the compound is :

- (1)  $\text{C}_2\text{H}_4\text{O}_2$                       (2)  $\text{C}_4\text{H}_8\text{O}_4$   
(3)  $\text{C}_3\text{H}_6\text{O}_3$                       (4) all of these

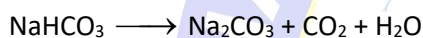
**Q.27** 1 litre of a hydrocarbon weights as much as one litre of  $\text{CO}_2$ . Then the molecular formula of the hydrocarbon is :

- (1)  $\text{C}_3\text{H}_8$     (2)  $\text{C}_2\text{H}_6$     (3)  $\text{C}_2\text{H}_4$     (4)  $\text{C}_3\text{H}_6$

**Q.28** The volume of oxygen required for complete combustion of 20 ml of ethene is

- (1) 30 ml    (2) 60 ml    (3) 40 ml    (4) 50 ml

**Q.29** When sodium bicarbonate is heated  $3.6 \times 10^{24}$  molecules of water are obtained. Find the moles of sodium bicarbonate heated.



- (1) 6            (2) 12            (3) 9            (4) 8

**Q.30** Equal moles of  $\text{H}_2\text{O}$  and  $\text{NaCl}$  are present in a solution. Hence, molality of  $\text{NaCl}$  solution is :

- (1) 0.55                      (2) 55.5  
(3) 1.00                      (4) 0.18

**Q.31** Decreasing order of mass of pure  $\text{NaOH}$  in each of the aqueous solution.

- (I) 50 g of 40% (W/W)  $\text{NaOH}$   
(II) 50 ml of 50% (W/V)  $\text{NaOH}$  ( $d_{\text{sol}} = 1.2 \text{ g/ml}$ ).  
(III) 50 g of 15 M  $\text{NaOH}$  ( $d_{\text{sol}} = 1 \text{ g/ml}$ ).

- (1) I, II, III                      (2) III, II, I  
(3) II, III, I                      (4) III = II = I.

**Q.32** The density (in  $\text{g mL}^{-1}$ ) of a 3.60 M sulphuric acid solution that is 29% ( $\text{H}_2\text{SO}_4$  molar mass = 98  $\text{g mol}^{-1}$ ) by mass will be :

- (1) 1.22    (2) 1.45    (3) 1.64    (4) 1.88

**Q.33** A 5.2 molal aqueous solution of methyl alcohol, ( $\text{CH}_3\text{OH}$ ), is supplied. What is the mole fraction of methyl alcohol in the solution?

- (1) 0.100                      (2) 0.190  
(3) 0.086                      (4) 0.050

## NUMERICAL VALUE TYPE QUESTIONS

**Q.34** What volume of a liquid (in L) will contain 10 mole ? If molar mass of liquid is 280 and its density is  $1.4 \text{ g/mL}$ .

**Q.35** Calculate the total moles of atoms of each element present in 122.5 g of  $\text{KClO}_3$ .

**Q.36** A sample of gaseous hydrocarbon occupying 1.12 litre at NTP. when completely burnt in air produced 2.2 g  $\text{CO}_2$  and 1.8 g  $\text{H}_2\text{O}$  Calculate the weight of hydrocarbon taken.

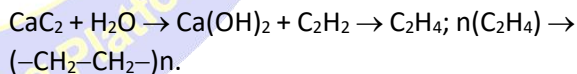
**Q.37** Chemical absorbers can be used to remove exhaled  $\text{CO}_2$  of space travellers in short space flights.  $\text{Li}_2\text{O}$  is one of the most efficient in terms of absorbing capacity pre unit weight. If the reaction is  $\text{Li}_2\text{O} + \text{CO}_2 \rightarrow \text{Li}_2\text{CO}_3$ . What is the absorption efficiency of pure  $\text{Li}_2\text{O}$  in litre  $\text{CO}_2$  (STP) per kg? [atomic weight of Li = 7]

**Q.38** What volume of water is required to make 0.20 N solution from 1600 mL of 0.2050 N solution?

**Q.39** Calculate normality of  $\text{NH}_4\text{OH}$  when 2 g is present in 800 mL solution.

**Q.40** Density of ozone relative to methane under the same temperature & pressure conditions is :

**Q.41** Formation of polyethene from calcium carbide takes place as follows :



The amount of polyethylene possibly obtainable from 64.0 kg  $\text{CaC}_2$  can be

**Q.42** 21.6 g of silver coin is dissolved in  $\text{HNO}_3$ . When  $\text{NaCl}$  is added to this solution, all silver is precipitated as  $\text{AgCl}$ . The weight of  $\text{AgCl}$  is found to be 14.35 g then % of silver in coin is :

**Q.43** The molality of a sulphuric acid solution is 0.2. Calculate the total weight of the solution having 1000 g of solvent.



## STATEMENT TYPE QUESTIONS

Each question contains STATEMENT-1 (Assertion) and STATEMENT-2 (Reason.)

Examine the statements carefully and mark the correct answer according to the instructions given below:

- (A) If both the statements are correct and STATEMENT-2 is the correct explanation of STATEMENT-1.  
 (B) If both the statements are correct but STATEMENT-2 is NOT the correct explanation of STATEMENT-1.  
 (C) If STATEMENT-1 is correct and STATEMENT-2 is incorrect.  
 (D) If STATEMENT-1 is incorrect and STATEMENT-2 is correct.

**Q.44** **STATEMENT-1:** Specific gravity is dimensionless.  
**STATEMENT-2:** Specific gravity is density of a substance measured w.r.t. density of water at 4°C  
 (1) A (2) B (3) C (4) D

**Q.45** **STATEMENT-1:** Gram molecular mass of  $O_2$  is 32g.  
**STATEMENT-2:** Relative atomic mass of oxygen is 32 a.m.u.  
 (1) A (2) B (3) C (4) D

**Q.46** **STATEMENT-1:** Molarity of pure water is 55.55 M at 298 K.  
**STATEMENT-2:** Molarity is temperature dependent.  
 (1) A (2) B (3) C (4) D

**Q.47** **STATEMENT-1:** The number of atoms in a given mass of dioxygen (oxygen) and trioxygen (ozone) gasses is same  
**STATEMENT-2:** The number of atoms depends on atomic mass, not on molecular mass.  
 (1) A (2) B (3) C (4) D

## MORE THAN ONE CORRECT TYPE QUESTIONS

**Q.48** Which of the following statement regarding the compound  $A_xB_y$  is/are correct

- (1) 1 mole of  $A_xB_y$  contains 1 mole of A and 1 mole B  
 (2) 1 equivalent of  $A_xB_y$  contains 1 equivalent of A and 1 equivalent of B  
 (3) 1 mole of  $A_xB_y$  contains x moles of A and y moles of B  
 (4) equivalent mass of  $A_xB_y$  = equivalent mass of A + equivalent mass of B

**Q.49** Solution containing 23 g HCOOH is /are :

- (1) 46 g of 70%  $\left(\frac{w}{v}\right)$  HCOOH ( $d_{\text{solution}} = 1.40$  g/mL)  
 (2) 50 g of 10 M HCOOH ( $d_{\text{solution}} = 1$  g/mL)  
 (3) 50 g of 25%  $\left(\frac{w}{w}\right)$  HCOOH  
 (4) 46 g of M HCOOH ( $d_{\text{solution}} = 1$  g/mL)

**Q.50** Which of the following statement(s) is/are correct for water?

- (1) H and O are in 2 : 1 atomic ratio  
 (2) H and O are in 2 : 1 mass ratio  
 (3) H and O are in 1 : 8 mass ratio  
 (4) Hydrogen and oxygen gases are combined in 2 : 1 volume ratio

**Q.51** The oxygen needed for complete combustion of 8g  $CH_4$  may be obtained from complete decomposition of

- (1)  $\frac{2}{3}$  mole  $KClO_3$   
 (2) 1 mole of  $H_2O_2$   
 (3) 2 mole of  $NaNO_3$  (up to 300°C)  
 (4) 2 mole of  $BaO_2$

**Q.52** When hydrocarbons are burnt completely in excess of oxygen gas, then

- (1) equal moles of  $CO_2$  and  $H_2O$  are formed form alkenes.  
 (2) more moles of  $H_2O$  than  $CO_2$  are formed from alkanes.

- (3) more moles of  $\text{CO}_2$  than  $\text{H}_2\text{O}$  are formed from alkynes
- (4) more moles of  $\text{CO}_2$  than  $\text{H}_2\text{O}$  are formed for any kind of hydrocarbon

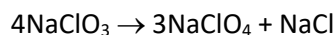
### COMPREHENSION TYPE QUESTIONS

**Q.53** Oleum is considered as a solution of  $\text{SO}_3$  in  $\text{H}_2\text{SO}_4$ . Which is obtained by passing  $\text{SO}_3$  in solution of  $\text{H}_2\text{SO}_4$ . When 100 g sample of oleum is diluted with desired mass of  $\text{H}_2\text{O}$  then the total mass of  $\text{H}_2\text{SO}_4$  obtained after dilution is known as % labelling in oleum.

For example, A oleum bottle labelled as '109%  $\text{H}_2\text{SO}_4$ ' means the 109 g total mass of pure  $\text{H}_2\text{SO}_4$  will be formed when 100 g of oleum is diluted by 9 g of  $\text{H}_2\text{O}$  which combines with all the free  $\text{SO}_3$  present in oleum to form  $\text{H}_2\text{SO}_4$  as  $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$ .

- (i) What is the % of free  $\text{SO}_3$  in an oleum that is labelled as '104.5%  $\text{H}_2\text{SO}_4$ '?  
 (1) 10 (2) 20 (3) 40 (4) None
- (ii) 9.0 g water is added into oleum into sample labelled as "112%"  $\text{H}_2\text{SO}_4$  then the amount of free  $\text{SO}_3$  remaining in the solution is : (STP = 1 atm and 273 K)  
 (1) 14.93 L at STP (2) 7.46 L at STP  
 (3) 3.73 L at STP (4) 11.2 L at STP
- (iii) If excess water is added into bottle sample labelled as "112%  $\text{H}_2\text{SO}_4$ " and is reacted with 5.3 &  $\text{Na}_2\text{CO}_3$ , then find the volume of  $\text{CO}_2$  evolved at 1 atm pressure and 300 K temperature after the completion of the reaction:  
 (1) 2.46 L (2) 24.6 L (3) 1.23 L (4) 12.3 L
- (iv) 1 g of oleum sample is diluted with water. The solution required 54 mL of 0.4 N NaOH for complete neutralization. The % of free  $\text{SO}_3$  in the sample is :  
 (1) 74 (2) 26  
 (3) 20 (4) None of these

**Q.54** Consider the following series of reactions



- (i) How much  $\text{Cl}_2$  is required prepare 122.5 g of  $\text{NaClO}_4$  by above sequential reaction?  
 (1) 284 g (2) 213 g (3) 142 g (4) 71 g
- (ii) How many moles of NaCl will be formed by using 1 mole  $\text{Cl}_2$  and other reagents in excess?  
 (1)  $\frac{1}{12}$  mole (2) 1.67 mole  
 (3) 1.75 mole (4) 0.75 mole
- (iii) How many moles of  $\text{NaClO}_3$  obtained after the completion of reaction by taking 1 mole  $\text{Cl}_2$  and other reagents in excess?  
 (1)  $\frac{1}{3}$  mole (2) Zero  
 (3)  $\frac{1}{4}$  mole (4) 1 mole

## MATCH THE COLUMN TYPE QUESTIONS

Q.55 Match the column.

Column-I	Column-II
(A) 44 g $\text{CO}_2$ gas	(P) 1 g molecule
(B) 35.2 g of $\text{CH}_4$	(Q) $N_A$ molecule
(C) 48 g of $\text{O}_3$ gas	(R) $22 N_A$ electrons
(D) 44 g of $\text{N}_2\text{O}$ gas	(S) 49.28 L at 1 atm and 273 K
	(T) $N_A$ atoms of oxygen

(1)  $A \rightarrow R, P, Q; B \rightarrow R, S; C \rightarrow P, Q; D \rightarrow P, Q, R, T$ (2)  $A \rightarrow P, Q, R; B \rightarrow R, S; C \rightarrow P, Q; D \rightarrow P, R, Q, T$ (3)  $A \rightarrow P, Q, R; B \rightarrow R, S; C \rightarrow P, Q; D \rightarrow P, Q, R, T$ (4)  $A \rightarrow P, Q, R; B \rightarrow S, R; C \rightarrow P, Q; D \rightarrow P, Q, R, T$ 

Q.56 Match the column.

Column-I	Column-II
(A) 0.5 mole of $\text{SO}_2$ (g)	(P) Occupy 11.2 L at 1 atm and 273 K
(B) 1 g of $\text{H}_2$ (g)	(Q) Weighs 24 g
(C) 0.5 mole of $\text{O}_3$ (g)	(R) Total no. of atoms = $1.5 \times N_A$
(D) 1 g molecule of $\text{O}_2$ (g)	(S) Weighs 32 g

(1)  $A \rightarrow P, R, S; B \rightarrow P; C \rightarrow Q, R, P; D \rightarrow S$ (2)  $A \rightarrow P, S, R; B \rightarrow P; C \rightarrow P, Q, R; D \rightarrow S$ (3)  $A \rightarrow S, R, P; B \rightarrow R; C \rightarrow P, R, Q; D \rightarrow P$ (4)  $A \rightarrow P, R, S; B \rightarrow P; C \rightarrow P, Q, R; D \rightarrow S$

# ANSWER KEY

## JEE RANKER'S STUFF

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	1	1	2	3	3	1	4	3	1	1	1	4	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	4	2	3	1	2	3	3	3	4	2	1	2	2	2
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	2	1	3	0.8	0	2	746.7	40	0.07	3	28	50	1020	1	3
Que.	46	47	48	49	50	51	52	53 (i)	53 (ii)	53 (iii)	53 (iv)	54 (i)	54 (ii)	54 (iii)	55
Ans.	2	1	2,3,4	1,2	1,3,4	1,3,4	1,2,3	2	3	3	2	1	3	2	3
Que.	56														
Ans.	4														

