CHAPTER 1

Some Basic Concepts of Chemistry

Section-A JEE Advanced/ IIT-JEE

A Fill in the Blanks

1. The modern atomic mass unit is based on ..... *(1980)*
2. The total number of electrons present in 18 ml of water is ..... *(1980)*
3. 3 g of a salt of molecular weight 30 is dissolved in 250 g of water. The molality of the solution is ..... . *(1983 - 1 Mark)*
4. The weight of 1×10^{22} molecules of $CuSO_4.5H_2O$ is ..... *(1991 - 1 Mark)*
5. The compound $YBa_2Cu_3O_7$, which shows superconductivity, has copper in oxidation state....., assume that the rare earth element yttrium is in its usual + 3 oxidation state. *(1994 - 1 Mark)*

C MCQs with One Correct Answer

1. 27 g of Al will react completely with how many grams of oxygen? *(1978)*
   (a) 8 g (b) 16 g
   (c) 32 g (d) 24 g
2. A compound was found to contain nitrogen and oxygen in the ratio 28 gm and 80 gm respectively. The formula of compound is *(1978)*
   (a) NO (b) N_2O_3
   (c) N_2O_5 (d) N_2O_4
3. The largest number of molecules is in *(1979)*
   (a) 36 g of water
   (b) 28 g of carbon monoxide
   (c) 46 g of ethyl alcohol
   (d) 54 g of nitrogen pentoxide
4. The total number of electrons in one molecule of carbon dioxide is *(1979)*
   (a) 22 (b) 44
   (c) 66 (d) 88
5. A gaseous mixture contains oxygen and nitrogen in the ratio of 1 : 4 by weight. Therefore the ratio of their number of molecules is *(1979)*
   (a) 1 : 4 (b) 1 : 8
   (c) 7 : 32 (d) 3 : 16
6. 2.76 g of silver carbonate on being strongly heated yields a residue weighing *(1979)*
   (a) 2.16 g (b) 2.48 g
   (c) 2.32 g (d) 2.64 g
7. M is molecular weight of $KMnO_4$. The equivalent weight of $KMnO_4$ when it is converted into K_2MnO_4 is *(1980)*
   (a) M (b) M/3
   (c) M/5 (d) M/7
8. If 0.50 mole of $BaCl_2$ is mixed with 0.20 mol of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is *(1981 - 1 Mark)*
   (a) 0.70 (b) 0.50
   (c) 0.20 (d) 0.10
9. One mole of N_2H_4 loses ten moles of electrons to form a new compound *Y*. Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in *Y*? (There is no change in the oxidation state of hydrogen). *(1981 - 1 Mark)*
   (a) –1 (b) –3
   (c) +3 (d) +5
10. The oxidation number of carbon in CH_2O is *(1982 - 1 Mark)*
    (a) – 2 (b) +2
    (c) 0 (d) +4
11. A molal solution is one that contains one mole of a solute in: *(1986 - 1 Mark)*
    (a) 1000 g of the solvent
    (b) one litre of the solvent
    (c) one litre of the solution
    (d) 22.4 litres of the solution
12. The brown ring complex compound is formulated as $[Fe(H_2O)_5(NO)]SO_4$. The oxidation state of iron is : *(1987 - 1 Mark)*
    (a) 1 (b) 2
    (c) 3 (d) 0
13. The equivalent weight of $MnSO_4$ is half of its molecular weight when it is converted to : *(1988 - 1 Mark)*
    (a) Mn_2O_3 (b) MnO_2
    (c) MnO_4^- (d) MnO_4^{2-}
14. In which mode of expression, the concentration of a solution remains independent of temperature? *(1988 - 1 Mark)*
    (a) Molarity (b) Normality
    (c) Formality (d) Molality

15. The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is : *(1990 - 1 Mark)*

(a) +3 (b) +2
(c) +1 (d) –1

16. The oxidation states of the most electronegative element in the products of the reaction, BaO_2 with dil. H_2SO_4 is *(1991 - 1 Mark)*

(a) 0 and –1 (b) –1 and –2
(c) –2 and 0 (d) –2 and –1

17. For the redox reaction : *(1992 - 1 Mark)*

$$MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$$

the correct coefficients of the reactants for the balanced reaction are *(1992 - 1 Mark)*

	MnO_4^-	$C_2O_4^{2-}$	H^+
(a)	2	5	16
(b)	16	5	2
(c)	5	16	2
(d)	2	16	5

18. The normality of 0.3 *M* phosphorous acid (H_3PO_3) is, *(1999 - 2 Marks)*

(a) 0.1 (b) 0.9
(c) 0.3 (d) 0.6

19. The oxidation number of sulphur in S_8, S_2F_2, H_2S respectively, are *(1999 - 2 Marks)*

(a) 0, +1 and –2 (b) +2, +1 and –2
(c) 0, +1 and +2 (d) –2, +1 and –2

20. Amongst the following identify the species with an atom in +6 oxidation state *(2000S)*

(a) MnO_4^- (b) $Cr(CN)_6^{3-}$
(c) NiF_6^{2-} (d) CrO_2Cl_2

21. The reaction, $3ClO^-(aq) \longrightarrow ClO_3^-(aq) + 2Cl^-(aq)$, is an example of *(2001S)*

(a) oxidation reaction
(b) reduction reaction
(c) disproportionation reaction
(d) decomposition reaction

22. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 ml. The volume of 0.1 N NaOH required to completely neutralize 10 ml of this solution is *(2001S)*

(a) 40 ml (b) 20 ml
(c) 10 ml (d) 4 ml

23. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is *(2001S)*

(a) (molecular weight)/2
(b) (molecular weight)/6
(c) (molecular weight)/3
(d) same as molecular weight

24. How many moles of electron weigh one kilogram? *(2002S)*

(a) 6.023×10^{23} (b) $\frac{1}{9.108} \times 10^{31}$
(c) $\frac{6.023}{9.108} \times 10^{54}$ (d) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

25. Which has maximum number of atoms? *(2003S)*

(a) 24g of C (12) (b) 56g of Fe (56)
(c) 27g of Al (27) (d) 108g of Ag (108)

26. Mixture X = 0.02 mol of $[Co(NH_3)_5SO_4]Br$ and 0.02 mol of $[Co(NH_3)_5Br]SO_4$ was prepared in 2 litre of solution. *(2003S)*

1 litre of mixture X + excess $AgNO_3 \longrightarrow Y$.

1 litre of mixture X + excess $BaCl_2 \longrightarrow Z$

No. of moles of Y and Z are

(a) 0.01, 0.01 (b) 0.02, 0.01
(c) 0.01, 0.02 (d) 0.02, 0.02

27. The pair of the compounds in which both the metals are in the highest possible oxidation state is *(2004S)*

(a) $[Fe(CN)_6]^{3-}, [Co(CN)_6]^{3-}$
(b) CrO_2Cl_2, MnO_4^-
(c) TiO_3, MnO_2
(d) $[Co(CN)_6]^{3-}, MnO_3$

28. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is *(2007)*

(a) 3 (b) 4
(c) 5 (d) 6

E Subjective Problems

1. What weight of AgCl will be precipitated when a solution containing 4.77 g of NaCl is added to a solution of 5.77 g of $AgNO_3$? *(1978)*

2. One gram of an alloy of aluminium and magnesium when treated with excess of dil. HCl forms magnesium chloride, aluminium chloride and hydrogen. The evolved hydrogen, collected over mercury at 0°C has a volume of 1.20 litres at 0.92 atm. pressure. Calculate the composition of the alloy. [H = 1, Mg = 24, Al = 27] *(1978)*

3. Igniting MnO_2 converts it quantitatively to Mn_3O_4. A sample of pyrolusite is of the following composition : MnO_2 80%, SiO_2 and other inert constituents 15%, rest being water. The sample is ignited in air to constant weight. What is the percentage of Mn in the ignited sample? *(1978)* [O = 16, Mn = 54.9]

4. 4.215 g of a metallic carbonate was heated in a hard glass tube and the CO_2 evolved was found to measure 1336 ml at 27°C and 700 mm pressure. What is the equivalent weight of the metal? *(1979)*

5. (a) 5.5 g of a mixture of $FeSO_4 \cdot 7H_2O$ and $Fe_2(SO_4)_3 \cdot 9H_2O$ requires 5.4 ml of 0.1 N $KMnO_4$ solution for complete oxidation. Calculate the number of gram mole of hydrated ferric sulphate in the mixture.

(b) The vapour density (hydrogen = 1) of a mixture consisting of NO_2 and N_2O_4 is 38.3 at 26.7°C. Calculate the number of moles of NO_2 in 100 g of the mixture.

(1979)

6. 5 ml of a gas containing only carbon and hydrogen were mixed with an excess of oxygen (30 ml) and the mixture exploded by means of an electric spark. After the explosion, the volume of the mixed gases remaining was 25 ml. On adding a concentrated solution of potassium hydroxide, the volume further diminished to 15 ml of the residual gas being pure oxygen. All volumes have been reduced to N.T.P. Calculate the molecular formula of the hydrocarbon gas.

(1979)

7. In the analysis of 0.500 g sample of feldspar, a mixture of chlorides of sodium and potassium is obtained which weighs 0.1180g. Subsequent treatment of mixed chlorides with silver nitrate gives 0.2451g of silver chloride. What is the percentage of sodium oxide and potassium oxide in feldspar. ***(1979)***

8. A compound contains 28 percent of nitrogen and 72 percent of metal by weight. 3 atoms of metal combine with 2 atoms of N. Find the atomic weight of metal. ***(1980)***

9. (i) A sample of $MnSO_4.4H_2O$ is strongly heated in air. The residue is Mn_3O_4.

(ii) The residue is dissolved in 100 ml of 0.1 N $FeSO_4$ containing dilute H_2SO_4.

(iii) The solution reacts completely with 50 ml of $KMnO_4$ solution.

(iv) 25 ml of the $KMnO_4$ solution used in step (iii) requires 30 ml of 0.1 N $FeSO_4$ solution for complete reaction.

Find the amount of $MnSO_4.4H_2O$ present in the sample.

(1980)

10. (a) One litre of a sample of hard water contains 1 mg of $CaCl_2$ and 1 mg of $MgCl_2$. Find the total hardness in terms of parts of $CaCO_3$ per 10^6 parts of water by weight.

(b) A sample of hard water contains 20 mg of Ca^{++} ions per litre. How many milli-equivalent of Na_2CO_3 would be required to soften 1 litre of the sample?

(c) 1 gm of Mg is burnt in a closed vessel which contains 0.5 gm of O_2.

(i) Which reactant is left in excess?

(ii) Find the weight of the excess reactants?

(iii) How may milliliters of 0.5 N H_2SO_4 will dissolve the residue in the vessel. ***(1980)***

11. A hydrocarbon contains 10.5g of carbon per gram of hydrogen. 1 litre of the vapour of the hydrocarbon at 127°C and 1 atmosphere pressure weighs 2.8g. Find the molecular formula. ***(1980)***

12. Find ***(1980)***

(i) The total number of neutrons and

(ii) The total mass of neutron in 7 mg of ^{14}C.

(Assume that mass of neutron = mass of hydrogen atom)

13. A mixture contains NaCl and unknown chloride MCl.

(i) 1 g of this is dissolved in water. Excess of acidified $AgNO_3$ solution is added to it. 2.567 g of white ppt. is formed.

(ii) 1 g of original mixture is heated to 300°C. Some vapours come out which are absorbed in acidified $AgNO_3$ solution, 1.341 g of white precipitate was obtained.

Find the molecular weight of unknown chloride. ***(1980)***

14. A 1.00 gm sample of H_2O_2 solution containing X per cent H_2O_2 by weight requires X ml of a $KMnO_4$ solution for complete oxidation under acidic conditions. Calculate the normality of the $KMnO_4$ solution. ***(1981 - 3 Marks)***

15. Balance the following equations.

(i) $Cu_2O + H^+ + NO_3^- \rightarrow Cu^{2+} + NO + H_2O$

(1981 - 1 Mark)

(ii) $K_4[Fe(CN)_6] + H_2SO_4 + H_2O \rightarrow K_2SO_4 + FeSO_4 + (NH_4)_2SO_4 + CO$

(1981 - 1 Mark)

(iii) $C_2H_5OH + I_2 + OH^- \rightarrow CHI_3 + HCO_3^- + I^- + H_2O$

(1981 - 1 Mark)

16. Hydroxylamine reduces iron (III) according to the equation:

$2NH_2OH + 4\,Fe^{3+} \rightarrow N_2O(g)\uparrow + H_2O + 4\,Fe^{2+} + 4H^+$

Iron (II) thus produced is estimated by titration with a standard permanganate solution. The reaction is :

$MnO_4^- + 5\,Fe^{2+} + 8H^+ \rightarrow \quad Mn^{2+} + 5\,Fe^{3+} + 4H_2O$

A 10 ml. sample of hydroxylamine solution was diluted to 1 litre. 50 ml. of this diluted solution was boiled with an excess of iron (III) solution. The resulting solution required 12 ml. of 0.02 M $KMnO_4$ solution for complete oxidation of iron (II). Calculate the weight of hydroxylamine in one litre of the original solution. (H = 1, N = 14, O = 16, K = 39, Mn = 55, Fe = 56) ***(1982 - 4 Marks)***

17. The density of a 3 M sodium thiosulphate solution ($Na_2S_2O_3$) is 1.25 g per ml. Calculate (i) the percentage by weight of sodium thiosulphate, (ii) the mole fraction of sodium thiosulphate and (iii) the molalities of Na^+ and $S_2O_3^{2-}$ ions. ***(1983 - 5 Marks)***

18. 4.08 g of a mixture of BaO and an unknown carbonate MCO_3 was heated strongly. The residue weighed 3.64 g. This was dissolved in 100 ml of 1 N HCl. The excess acid required 16 ml of 2.5 N NaOH solution for complete neutralization. Identify the metal M. ***(1983 - 4 Marks)***

(At. wt. H = 1, C = 12, O = 16, Cl = 35.5, Ba = 138)

19. Complete and balance the following reactions :

(i) $Zn + NO_3^- \rightarrow Zn^{2+} + NH_4^+$ ***(1983 - 1 Mark)***

(ii) $Cr_2O_7^{2-} + C_2H_4O \rightarrow C_2H_4O_2 + Cr^{3+}$ ***(1983 - 1 Mark)***

(iii) $HNO_3 + HCl \rightarrow NO + Cl_2$ ***(1983 - 1 Mark)***

(iv) $Ce^{3+} + S_2O_8^{2-} \rightarrow SO_4^{2-} + Ce^{4+}$ ***(1983 - 1 Mark)***

(v) $Cl_2 + OH^- \rightarrow Cl^- + ClO^-$ ***(1983 - 1 Mark)***

(vi) $Mn^{2+} + PbO_2 \rightarrow MnO_4^- + H_2O$ ***(1986 - 1 Mark)***

(vii) $S + OH^- \rightarrow S^{2-} + S_2O_3^{2-}$ ***(1986 - 1 Mark)***

(viii) $ClO_3^- + I^- + H_2SO_4 \rightarrow Cl^- + HSO_4^-$ ***(1986 - 1 Mark)***

(ix) $Ag^+ + AsH_3 \rightarrow H_3AsO_3 + H^+$ ***(1986 - 1 Mark)***

20. 2.68×10^{-3} moles of a solution containing an ion A^{n+} require 1.61×10^{-3} moles of MnO_4^- for the oxidation of A^{n+} to AO_3^- in acid medium. What is the value of n?

(1984 - 2 Marks)

21. Five ml of 8N nitric acid, 4.8 ml of 5N hydrochloric acid and a certain volume of 17M sulphuric acid are mixed together and made upto 2litre. Thirty ml. of this acid mixture exactly neutralise 42.9 ml of sodium carbonate solution containing one gram of $Na_2CO_3.10H_2O$ in 100 ml. of water. Calculate the amount in gram of the sulphate ions in solution.

(1985 - 4 Marks)

22. Arrange the following in increasing oxidation number of iodine. ***(1986 - 1 Mark)***

I_2, HI, HIO_4, ICl

23. (i) What is the weight of sodium bromate and molarity of solution necessary to prepare 85.5 ml of 0.672 N solution when the half-cell reaction is

$$BrO_3^- + 6H^+ + 6e^- \rightarrow Br^- + 3H_2O$$

(ii) What would be the weight as well as molarity if the half-cell reaction is :

$$2\,BrO_3^- + 12H^+ + 10e^- \rightarrow Br_2 + 6H_2O$$

(1987 - 5 Marks)

24. A sugar syrup of weight 214.2 g contains 34.2 g of sugar ($C_{12}H_{22}O_{11}$). Calculate : (i) molal concentration and (ii) mole fraction of sugar in the syrup. ***(1988 - 2 Marks)***

25. A sample of hydrazine sulphate ($N_2H_6SO_4$) was dissolved in 100 ml. of water, 10 ml of this solution was reacted with excess of ferric chloride solution and warmed to complete the reaction. Ferrous ion formed was estimated and it required 20 ml. of M/50 potassium permanganate solution. Estimate the amount of hydrazine sulphate in one litre of the solution. ***(1988 - 3 Marks)***

Reaction :

$$4Fe^{3+} + N_2H_4 \rightarrow N_2 + 4Fe^{2+} + 4H^+$$

$$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O.$$

26. An equal volume of a reducing agent is titrated separately with 1M $KMnO_4$ in acid neutral and alkaline media. The volumes of $KMnO_4$ required are 20 ml. in acid, 33.4 ml. neutral and 100 ml. in alkaline media. Find out the oxidation state of manganese in each reduction product. Give the balanced equations for all the three half reactions. Find out the volume of 1M $K_2Cr_2O_7$ consumed; if the same volume of the reducing agent is titrated in acid medium. ***(1989 - 5 Marks)***

27. A mixture of $H_2C_2O_4$ (oxalic acid) and $NaHC_2O_4$ weighing 2.02 g was dissolved in water and solution made upto one litre. Ten millilitres of the solution required 3.0 ml. of 0.1 N sodium hydroxide solution for complete neutralization. In another experiment, 10.0 ml. of the same solution, in hot dilute sulphuric acid medium. require 4.0 ml. of 0.1 N potassium permanganate solution for complete reaction. Calculate the amount of $H_2C_2O_4$ and $NaHC_2O_4$ in the mixture. ***(1990 - 5 Marks)***

28. A solid mixture (5.0 g) consisting of lead nitrate and sodium nitrate was heated below 600°C until the weight of the residue was constant. If the loss in weight is 28.0 per cent, find the amount of lead nitrate and sodium nitrate in the mixture.

(1990 - 4 Marks)

29. Calculate the molality of 1 litre solution of 93% H_2SO_4 (weight/volume). The density of the solution is 1.84 g/ml.

(1990 - 1 Marks)

30. A solution of 0.2 g of a compound containing Cu^{2+} and $C_2O_4^{2-}$ ions on titration with 0.02 M $KMnO_4$ in presence of H_2SO_4 consumes 22.6 ml. of the oxidant. The resultant solution is neutralized with Na_2CO_3, acidified with dil. acetic acid and treated with excess KI. The liberated iodine requires 11.3 ml of 0.05 M $Na_2S_2O_3$ solution for complete reduction.

Find out the molar ratio of Cu^{2+} to $C_2O_4^{2-}$ in the compound. Write down the balanced redox reactions involved in the above titrations. ***(1991 - 5 Marks)***

31. A 1.0 g sample of Fe_2O_3 solid of 55.2% purity is dissolved in acid and reduced by heating the solution with zinc dust. The resultant solution is cooled and made upto 100.0 ml. An aliquot of 25.0 ml of this solution requires 17.0 ml of 0.0167 M solution of an oxidant for titration. Calculate the number of electrons taken up by the oxidant in the reaction of the above titration. ***(1991 - 4 Marks)***

32. A 2.0 g sample of a mixture containing sodium carbonate, sodium bicarbonate and sodium sulphate is gently heated till the evolution of CO_2 ceases. The volume of CO_2 at 750 mm Hg pressure and at 298 K is measured to be 123.9 ml. A 1.5g of the same sample requires 150 ml. of (M/10) HCl for complete neutralisation. Calculate the % composition of the components of the mixture. ***(1992 - 5 Marks)***

33. One gram of commercial $AgNO_3$ is dissolved in 50 ml. of water. It is treated with 50 ml. of a KI solution. The silver iodide thus precipitated is filtered off. Excess of KI in the filterate is titrated with (M/10) KIO_3 solution in presence of 6M HCl till all I^- ions are converted into ICl. It requires 50 ml. of (M/10) KIO_3 solution. 20 ml. of the same stock solution of KI requires 30 ml. of (M/10)KIO_3 under similar conditions. Calculate the percentage of $AgNO_3$ in the sample.

(Reaction : $KIO_3 + 2KI + 6HCl \rightarrow 3ICl + 3KCl + 3H_2O$)

(1992 - 4 Marks)

34. Upon mixing 45.0 ml. of 0.25 M lead nitrate solution with 25.0 ml of 0.10 M chromic sulphate solution, precipitation of lead sulphate takes place. How many moles of lead sulphate are formed? Also, calculate the molar concentrations of the species left behind in the final solution. Assume that lead sulphate is completely insoluble. ***(1993 - 3 Marks)***

35. The composition of a sample of Wustite is $Fe_{0.93}O_{1.00}$. What percentage of the iron is present in the form of Fe (III)? ***(1994 - 2 Marks)***

36. 8.0575×10^{-2} kg of Glauber's salt is dissolved in water to obtain 1 dm^3 of a solution of density 1077.2 kg m^{-3}. Calculate the molarity, molality and mole fraction of Na_2SO_4 in the solution. ***(1994 - 3 Marks)***

37. A 3.00 g sample containing Fe_3O_4, Fe_2O_3 and an inert impure substance, is treated with excess of KI solution in presence of dilute H_2SO_4. The entire iron is converted into Fe^{2+} along with the liberation of iodine. The resulting solution is diluted to 100 ml. A 20 ml of the diluted solution requires 11.0 ml of 0.5 M $Na_2S_2O_3$ solution to reduce the iodine present. A 50 ml of the diluted solution, after complete extraction of the iodine requires 12.80 ml of 0.25 M $KMnO_4$ solution in dilute H_2SO_4 medium for the oxidation of Fe^{2+}. Calculate the percentages of Fe_2O_3 and Fe_3O_4 in the original sample.

(1996 - 5 Marks)

38. An aqueous solution containing 0.10 g KIO_3 (formula weight = 214.0) was treated with an excess of KI solution. The solution was acidified with HCl. The liberated I_2 consumed 45.0 mL of thiosulphate solution to decolourise the blue starch-iodine complex. Calculate the molarity of the sodium thiosulphate solution. ***(1998 - 5 Marks)***

39. How many millilitres of 0.5 M H_2SO_4 are needed to dissolve 0.5 g of copper(II) carbonate? ***(1999 - 3 Marks)***

40. A plant virus is found to consist of uniform cylindrical particles of 150 Å in diameter and 5000 Å long. The specific volume of the virus is 0.75 cm^3/g. If the virus is considered to be a single particle, find its molar mass. ***(1999 - 3 Marks)***

41. Hydrogen peroxide solution (20 ml) reacts quantitatively with a solution of $KMnO_4$ (20 ml) acidified with dilute H_2SO_4. The same volume of the $KMnO_4$ solution is just decolourised by 10 ml of $MnSO_4$ in neutral medium simultaneously forming a dark brown precipitate of hydrated MnO_2. The brown precipitate is dissolved in 10 ml of 0.2 M sodium oxalate under boiling condition in the presence of dilute H_2SO_4. Write the balanced equations involved in the reactions and calculate the molarity of H_2O_2.

(2001 - 5 Marks)

42. Calculate the molarity of water if its density is 1000 kg/m^3.

(2003 - 2 Marks)

H Assertion & Reason Type Questions

1. Read the following statement and explanation and answer as per the options given below :

STATEMENT(S) : In the titration of Na_2CO_3 with HCl using methyl orange indicator, the volume required at the equivalence point is twice that of the acid required using phenolphthalein indicator.

EXPLANATION(E) : Two moles of HCl are required for the complete neutralization of one mole of Na_2CO_3.

(1991 - 2 Marks)

(a) Both S and E are true, and E is the correct explanation of S.

(b) Both S and E are true, but E is not the correct explanation of S.

(c) S is true but E is false.

(d) S is false but E is true.

I Integer Value Correct Type

1. A student performs a titration with different burettes and finds titre values of 25.2 mL, 25.25 mL, and 25.0 mL. The number of significant figures in the average titre value is

(2010)

2. Silver (atomic weight = 108 g mol^{-1}) has a density of 10.5 g cm^{-3}. The number of silver atoms on a surface of area 10^{-12} m^2 can be expressed in scientific notation as $y \times 10^x$. The value of x is : ***(2010)***

3. The difference in the oxidation numbers of the two types of sulphur atoms in $Na_2S_4O_6$ is ***(2011)***

4. If the value of Avogadro number is 6.023×10^{23} mol^{-1} and the value of Boltzmann constant is 1.380×10^{-23} JK^{-1}, then the number of significant digits in the calculated value of the universal gas constant is ***(JEE Adv. 2014)***

Section-B JEE Main / AIEEE

1. In a compound C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular weight of compound is 108. Molecular formula of compound is **[2002]**
(a) $C_2H_6N_2$ (b) C_3H_4N (c) $C_6H_8N_2$ (d) $C_9H_{12}N_3$.

2. With increase of temperature, which of these changes? **[2002]**
(a) molality (b) weight fraction of solute
(c) molarity (d) mole fraction.

3. Number of atoms in 558.5 gram Fe (at. wt. of Fe = 55.85 g mol^{-1}) is
(a) twice that in 60 g carbon **[2002]**
(b) 6.023×10^{22}
(c) half that in 8 g He
(d) $558.5 \times 6.023 \times 10^{23}$

4. What volume of hydrogen gas, at 273 K and 1 atm. pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen ? **[2003]**
(a) 67.2 L (b) 44.8 L (c) 22.4 L (d) 89.6 L

5. 25ml of a solution of barium hydroxide on titration with a 0.1 molar solution of hydrochloric acid gave a litre value of 35ml. The molarity of barium hydroxide solution was **[2003]**
(a) 0.14 (b) 0.28 (c) 0.35 (d) 0.07

6. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of urea solution is **[2004]**
(a) 0.02 M (b) 0.01 M (c) 0.001 M (d) 0.1 M
(Avogadro constant, $N_A = 6.02 \times 10^{23}$ mol^{-1})

7. To neutralise completely 20 mL of 0.1 M aqueous solution of phosphorous acid (H_3PO_3), the value of 0.1 M aqueous KOH solution required is **[2004]**
(a) 40mL (b) 20mL (c) 10mL (d) 60mL

8. The ammonia evolved from the treatment of 0.30 g of an organic compound for the estimation of nitrogen was passed in 100 mL of 0.1 M sulphuric acid. The excess of acid required 20 mL of 0.5 M sodium hydroxide solution for complete neutralization. The organic compound is **[2004]**
(a) urea (b) benzamide
(c) acetamide (d) thiourea

9. Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M first solution + 520 ml of 1.2 M second solution. What is the molarity of the final mixture? **[2005]**
(a) 2.70 M (b) 1.344 M (c) 1.50 M (d) 1.20 M

10. If we consider that 1/6, in place of 1/12, mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of the substance will **[2005]**
(a) be a function of the molecular mass of the substance
(b) remain unchanged
(c) increase two fold
(d) decrease twice

11. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms? **[2006]**
(a) 1.25×10^{-2} (b) 2.5×10^{-2}
(c) 0.02 (d) 3.125×10^{-2}

12. Density of a 2.05M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is **[2006]**
(a) 2.28 mol kg^{-1} (b) 0.44 mol kg^{-1}
(c) 1.14 mol kg^{-1} (d) 3.28 mol kg^{-1}

13. The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (molar mass = 98 g mol^{-1}) by mass will be
(a) 1.45 (b) 1.64 **[2007]**
(c) 1.88 (d) 1.22

14. In the reaction, **[2007]**

$$2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$$

(a) 11.2 L $H_2(g)$ at STP is produced for every mole HCl(aq) consumed
(b) 6 L HCl(aq) is consumed for every 3 L $H_2(g)$ produced
(c) 33.6 L $H_2(g)$ is produced regardless of temperature and pressure for every mole A*l* that reacts
(d) 67.2 $H_2(g)$ at STP is produced for every mole A*l* that reacts.

15. Consider the following reaction :

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$$

The value's of x, y and z in the reaction are, respectively : **[JEE M 2013]**
(a) 5, 2 and 16
(b) 2, 5 and 8
(c) 2, 5 and 16
(d) 5, 2 and 8

16. A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of CO_2. The empirical formula of the hydrocarbon is : **[JEE M 2013]**
(a) C_2H_4 (b) C_3H_4 (c) C_6H_5 (d) C_7H_8

17. Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M, present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be : **[JEE M 2013]**
(a) 7.01% (b) 4.08% (c) 6.05% (d) 5.08%