1. SOME BASIC CONCEPTS OF CHEMISTRY

Single Correct Answer Type

1. In which of the following pairs do the two species resemble each other most closely in chemical properties?
a) ${}_1^1H$ and ${}_1^2H$ b) ${}_8^{16}O$ and ${}_8^{16}O^{2-}$ c) ${}_{12}^{24}Mg$ and ${}_{12}^{24}Mg^{2+}$ d) ${}_7^{14}N$ and ${}_7^{14}N^{3-}$
2. Number of moles of $K_2Cr_2O_7$ reduced by 1 mol of Sn^{2+} is
a) $\frac{1}{3}$ b) $\frac{1}{6}$ c) $\frac{2}{3}$ d) 1
3. A mixed solution of potassium hydroxide and sodium carbonate required 15 mL of an N/20 HCl solution when titrated with phenolphthalein as an indicator. But the same amount of the solution when titrated with methyl orange as indicator required 25 mL of the same acid. the amount of KOH present in the solution is
a) 0.014 g b) 0.14 g c) 0.028 g d) 1.4 g
4. The volume strength of 1.5 N H_2O_2 solution is
a) 4.8 b) 8.4 c) 3.0 d) 8.0
5. A solution of 200 ppt is
a) 2×10^5 ppm b) 2×10^8 ppb c) Both (a) & (b) d) None of these
6. Which gives ppt with K_2CrO_4?
a) $Hg_2^{2+}, Pb^{2+}, Ag^+, Ba^{2+}$ b) Pb^{2+}, Ag^+, Ba^{2+} c) Ag^+, Ba^{2+} d) Pb^{2+}, Ba^{2+}
7. Mass of one atom of the element A is 3.9854×10^{-23}g. How many atoms are contained in 1 g of the element A?
a) 2.5092×10^{22} b) 6.022×10^{23} c) 3.9854×10^{23} d) 1.66×10^{-23}
8. 1.056 g of the Sn was treated with 1.947 g of I_2. After reaction was over, 0.601 g of Sn was recovered. Thus, empirical formula of the compound formed is $(Sn = 119, I = 127)$
a) SnI_2 b) SnI c) SnI_3 d) SnI_4
9. 0.4 mole of HCl and 0.2 mole of $CaCl_2$ were dissolved in water to have 500 mL of solution, the molarity of Cl^-ion is
a) 0.8 M b) 1.6 M c) 1.2 M d) 10.0 M
10. Match the substances given in B based on reactions given in A select correct answer from the alternate

	A(Reaction)		***B***(Substances)
I	A white, waxy solid, normality stored under water because it spontaneously inflames in air	*P*	HNO_3
II	A viscous liquid that reacts with table sugar, giving a charred mass	*Q*	Cl_2
III	An acid that reacts with copper metal,	*R*	P

	releasing brown fumes		
IV	A pale greenish yellow gas that dissolves in aqueous NaOH to give a solution used as a bleach	S	H_2SO_4

Codes

I II III IV

a) R Q R S

b) S R Q P

c) R S P Q

d) S R P Q

11. A mixture contains Cu^{2+}, Al^{3+} and Ni^{2+}. Following steps have been adopted but written in disorder
I: Filter, boil of H_2S gas and add NH_4Cl, heat and add NH_4OH
II: Filter, add NH_4OH and pass H_2S gas
III: Pass H_2S gas into acidified solution of mixture
Steps will be used in the following order
a) I, II, III b) III, I, II c) III, II, I d) I, III, II
12. The reaction between yttrium metal and dilute HCl produces $H_2(g)$ and Y^{3+} ions. The molar ratio of yttrium to that hydrogen produced is
a) 2:3 b) 3:2 c) 1:2 d) 2:1
13. A 500 g toothpaste contains 0.2 g fluoride. The concentration of fluoride in terms of ppm is
a) 100 b) 250 c) 400 d) 450
14. 44.8 L of CO_2 at NTP is obtained by heating x g of pure $CaCO_3$. x is
a) 100 g b) 200 g c) 50 g d) 44.8 g
15. A hydrate of Na_2SO_3 has 50% water by mass. It is
a) $Na_2SO_3 \cdot 5H_2O$ b) $Na_2SO_3 \cdot 6H_2O$ c) $Na_2SO_3 \cdot 7H_2O$ d) $Na_2SO_3 \cdot 2H_2O$
16. Potassium selenate is isomorphous with potassium sulphate and contains 50.0% of Se. Find the atomic weight of Se
a) 142 b) 71 c) 47.33 d) 284
17. Oxalic acid ($H_2C_2O_4$)forms two series of salt $HC_2O_4^-$ and $C_2O_4^{2-}$.If 0.9 g of oxalic acid is in 100 mL solution, $HC_2O_4^{2-}$ and $C_2O_4^{2-}$have normality respectively
a) 0.1 N, 0.1 N b) 0.1 N, 0.2 N c) 0.2 N, 0.2 N d) 0.2 N, 0.1 N
18. In basic medium, $CrO_4{}^{2-}$ reacts with $S_2O_3{}^{2-}$ resulting in the formation of $Cr(OH)_4{}^{\ominus}$and SO_4^{2-}. How many mL of 0.1 M Na_2CrO_4 is required to react with 40 mL of 0.25 M$Na_2S_2O_3$?
a) 240.2 mL b) 24.02 mL c) 266.67 mL d) 26.67 mL
19. Volume of $H_2C_2O_4 \cdot 2H_2O$ solution to prepare 0.10 M from 1.575 g of it is
a) 125 mL b) 250 mL c) 500 mL d) 1000 mL
20. A sodium salt of an unknown anion when treated with $MgCl_2$ gives white precipitate only boiling. The anion is
a) SO_4^{2-} b) HCO_3^- c) CO_3^{2-} d) NO_3^-
21. A (colourless salt) $\xrightarrow{\Delta} \underbrace{B + C}_{\text{gas}} + D;\ D \xrightarrow{H_2O} E$

Gas C turns solution E milky. B burns with blue flame. A also decolourlses MnO_4^-/H^+. Thus, A, B, C, D and E are

	A	B	C	D	E
a)	CaC_2O_4	CO	CO_2	CaO	$Ca(OH)_2$
b)	CaC_2O_4	CO_2	CO	CaO	$Ca(OH)_2$
c)	$CaCO_3$	CaO	CO	CO_2	$Ca(OH)_2$
d)	$CaOCl_2$	Cl_2	O_2	CaO	$Ca(OH)_2$

22. $Fe(OH)_3$ and $Cr(OH)_3$ can be separated using
    a) NaOH b) $NaOH + H_2O_2$ c) Both (a) and (b) d) None of these
23. Maximum number of moles of $PbSO_4$ that can be precipitated by mixing 20.00 mL of 0.1 M $Pb(NO_3)_2$ and 30.00 mL of 0.1 M Na_2SO_4 will be
    a) 0.002 b) 0.003 c) 0.005 d) 0.001
24. When 10 mL of ethyl alcohol (density $= 0.7893$ g mL^{-1}) is mixed with 20 mL of water (density 0.9971 g mL^{-1}) at 25°C, the final solution has a density of 0.9571 g mL^{-1}. The percentage change in total volume on mixing is
    a) 3.1% b) 2.4% c) 1% d) None of these
25. Which has maximum number of millimoles of Cl^- ion?
    a) 0.208 g $BaCl_2$ b) 100 mL of 0.1 M $BaCl_2$
    c) 0.745 g KCl d) Equal
26. For H_3PO_3, the correct choice is
    a) H_3PO_3 is dibasic and reducing b) H_3PO_3 is dibasic and non-reducing
    c) H_3PO_3 is tribasic and reducing d) H_3PO_3 is tribasic and non-reducing
27. A mixture of $Na_2C_2O_4$ and $KHC_2O_4 \cdot H_2C_2O_4$ required equal volumes of 0.2 M $KMnO_4$ and 0.2 M NaOH separately for complete titration. The mole ratio of $Na_2C_2O_4$ and $KHC_2O_4.H_2C_2O_4$ in the mixture is
    a) $\frac{2}{11}$ b) $\frac{11}{2}$ c) $\frac{5}{2}$ d) $\frac{7}{2}$
28. $NH_3 + OCl^{\ominus} \rightarrow N_2H_4 + Cl^{\ominus}$
    On balancing the above equation in basic solution, using integral coefficient, which of the following whole numbers will be the coefficient of N_2H_4?
    a) 1 b) 2 c) 3 d) 4
29. 0.05 g of a piece of metal in dilute acid gave 24.62 mL of H_2 at 27°C and 760 mm pressure. The Ew of metal is
    a) 25 b) 12.5 c) 50 d) 37.5
30. How many moles of O_2 will be liberated by one mole of CrO_5 is the following reaction:
    $CrO_5 + H_2SO_4 \rightarrow Cr_2(SO_4)_3 + H_2O + O_2$
    a) 4.5 b) 2.5 c) 1.25 d) None
31. A on reaction with dil. H_2SO_4 gives a colourless pungent gas that can turn $Cr_2O_7^{2-}/H^+$ green. Green colour is due to formation of
    a) CrO_4^{2-} b) Cr^{3+} c) CrO_3 d) CrO_2Cl_2
32. When 80 mL of 0.20 M HCl is mixed with 120 mL of 0.15 M KOH,the resultant solution is the same as a solution of
    a) 0.16 M KCl and 0.02 M HCl b) 0.08 M KCl
    c) 0.08 M KCl and 0.01 M KOH d) 0.08 M KCl and 0.01 M HCl
33. 5.6 g of a metal forms 12.7 g of metal chloride. Hence equivalent weight of the metal is
    a) 127 b) 254 c) 56 d) 28
34. Which of the following salts does not give positive test for nitrate ion?
    a) KNO_3 b) $NaNO_3$ c) $Pb(NO_3)_2$ d) $Mg(NO_3)_2$
35. 27 g of Al will react completely with …….. g of O_2
    a) 8 g b) 10 g c) 24 g d) 49 g

36. Test tube A contains $ZnCl_2$ aqueous solution while test tube B contains aq $CdCl_2$ solution. On passing H_2S gas
a) ZnS is precipitated
b) CdS is precipitated
c) Both (a) and (b) are precipitated
d) None of the above is precipitated

37. A solution of a metal ion when treated with KI gives a red precipitate which dissolves in excess KI to give a colourless solution. Moreover, the solution of metal ion on treatment with a solution of cobalt (III) thiocyanate gives rise to a deep blue crystalline precipitate. The metal ion is
a) Pb^{2+}
b) Hg^{2+}
c) Cu^{2+}
d) Co^{2+}

38. Mixture is initially orange in colour. When solution is prepared in dil. Acid, it changes to dark brown colour. Mixture contains
a) $HgI_2, Cr_2O_7^{2-}$
b) $I^-, Cr_2O_7^{2-}$
c) I^-, Cu^{2+}
d) I^-, SO_3^{2-}

39. When 100 mL of 0.1 M $Ba(OH)_2$ is neutralized with a mixture of x mL of 0.1 M HCl and y mL of 0.2 M H_2SO_3 using methyl orange indicator, what is value of x and y?
a) 200, 100
b) 100, 200
c) 300, 200
d) 200, 300

40. $A \rightarrow B$ (gas) used by dentist. Hence, A is
a) NH_4Cl
b) NH_4NO_2
c) NH_4NO_3
d) NH_4OH

41. Borax on heating strongly above its melting point melts to a liquid, which then solidifies to a transparent mass commonly known as borax-bead. The transparent glassy mass consist of
a) Sodium pyroborate
b) Boric anhydride
c) Sodium metaborate
d) Boric anhydride and sodium metaborate

42. Consider the ionisation of H_2SO_4 as follow:
$H_2SO_4 + 2H_2O \rightarrow 2H_3O^{\oplus} + SO_4^{2-}$
The total number of ions furnished by 100 mL of 0.1 M H_2SO_4 will be
a) 1.2×10^{23}
b) 0.12×10^{23}
c) 0.18×10^{23}
d) 1.8×10^{23}

43. White ppt of A on reaction with aq NH_3 are blackened. Select correct statement about A
a) A is also called calomel
b) A reacts with aq NH_3 forming $HgNH_2Cl$
c) A changes to grey on reaction with $SnCl_2$
d) All of the above are correct statements

44. What volume of 0.05 M $K_2Cr_2O_7$ in acidic medium is needed for complete oxidation of 200 mL of 0.06 M FeC_2O_4 solution?
a) 1.2 mL
b) 1.2 L
c) 120 mL
d) 800 mL

45. PbO_2 oxidises MnO_2 (black) to
a) MnO_4^{2-}
b) MnO_4^-
c) Mn^{2+}
d) Mn_2O_7

46. H_2S would separate the following at pH < 7
a) Zn^{2+}, Co^{2+}
b) Cu^{2+}, Cd^{2+}
c) Cu^{2+}, Cr^{3+}
d) Cu^{2+}, As^{3+}

47. 10 mL of H_2O_2solution (volume strength = x) required 10 mLof $\frac{N}{0.56}$ MnO_4^- solution in acidic medium. Hence, x is
a) 0.56
b) 5.6
c) 0.1
d) 10.0

48. Two substances I and II of carbon and oxygen have respectively 72.73% and 47.06% oxygen. Hence, they follow
a) Law of multiple proportion
b) Law of reciprocal proportion
c) Law of definite proportion
d) Law of conservation of mass

49. 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
a) 3
b) 4
c) 5
d) 6

50. A sample of copper sulphate pentahydrate contains 3.782 g of Cu. How many grams of oxygen are in the sample?
a) 0.952 g
b) 3.809 g
c) 4.761 g
d) 8.576 g

51. 4.4 g of CO_2 contains how many litres of CO_2 at STP?
a) 2.4 L b) 2.24 L c) 44 L d) 22.4 L
52. The equivalent weight of a certain trivalent element is 20. Molecular weight of its oxide is
a) 152 b) 56 c) 168 d) 68
53. 4.2 g of a metallic carbonate MCO_3 was heated in a hard glass tube and CO_2 evolved was found to have 1120 mL of volume at STP. The *Ew* of the metal is
a) 12 b) 24 c) 18 d) 15
54. Mass of one $^{14}_{7}N$ – atom is
a) 14 u b) 7 u c) 14 g d) 7 g
55. 5.3 g of M_2CO_3 is dissolved in 150 mL of 1 N HCl.Unused acid required 100 mL of 0.5 N NaOH.Hence, equivalent weight of *M* is
a) 23 b) 12 c) 24 d) 13
56. A mixture on heating gave a gas used as an anaesthetic, 1.1 g of gas occupies 0.56 L at NTP. Mixture contains
a) $NaNO_3 + NH_4Cl$
b) $NaNO_2 + NH_4Cl$
c) $CaCO_3 + MgCO_3$
d) $NH_4Cl + Na_2SO_4$
57. Which is temperature independent?
a) Mass per cent
b) Volume per cent
c) Mass/volume per cent
d) Molarity
58. In the flowing equation

$$CrO_4^{2-} + S_2O_3^{2-} + \overset{\ominus}{O}H \longrightarrow [Cr(OH)_4]^{-1} + SO_4^{2-}$$

What volume of 0.2 M Na_2CrO_4 solution is required just to react with 30 mL of 0.2 M $Na_2S_2O_3$ solution
a) 40 mL b) 80 mL c) 20 mL d) 60 mL
59. 0.3 g platinichloride of an organic diacidic base left 0.09 g of platinum on ignition. The molecular weight of the organic base is
a) 120 b) 240 c) 180 d) 60
60. Passing H_2S gas into a mixture of Mn^{2+}, Ni^{2+}, Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates
a) CuS and HgS b) MnS and CuS c) MnS and NiS d) NiS and HgS
61. Equivalent weight of H_3PO_2 (molecular weight= M) when it disproportionates into PH_3 and H_3PO_3 is
a) M b) $\frac{M}{2}$ c) $\frac{M}{4}$ d) $\frac{3M}{4}$
62. NaOH is formed according to reaction

$$2Na + \frac{1}{2}O_2 \rightarrow Na_2O$$

$$Na_2O + H_2O \rightarrow 2NaOH$$

To make 4g NaOH, Na required is
a) 4.6 g b) 4.0 g c) 2.3 g d) 0.23 g
63. 40 mL of 0.05 M solution of Cr^{3+} is oxidized to CrO_4^{2-} by 20 mL of H_2O_2 . H_2O_2 is
a) 0.15 M
b) 0.30 M
c) 0.10 M
d) 0.20 M
64. Mass of one atom of X is 6.66×10^{-23}g. Hence, number of moles of atom X in 40 kg is
a) 10^3 mol b) 10^{-3} mol c) $\frac{40 \times 10^3}{6.66 \times 10^{-23}}$ mol d) $\frac{40 \times 10^3}{6.022 \times 10^{23}}$ mol

65. 0.7 g sample of iron ore was dissolved in acid. Iron was reduced to +2 state and it required 50 ml of M/50 $KMnO_4$ solution for titration. The percentage of Fe and Fe_3O_4 in the ore is
a) 40 % Fe, 55.24%, Fe_3O_4 b) 55.24 % Fe, 40 %, Fe_3O_4
c) 8 % Fe, 11 %, Fe_3O_4 d) 11 % Fe, 8 %, Fe_3O_4

66. To prepare a solution that is 0.50 M KCl starting with 100 mL of 0.40 M KCl
a) Add 0.75 g KCl b) ADD 20 mL of water
c) Add 0.10 mol KCl d) Evaporate 10 mL water

67. How many moles of $MnO_4^{\ominus}$ ion will react with 1 mol of ferrous oxalate in acidic medium?
a) $\frac{1}{5}$ b) $\frac{2}{5}$ c) $\frac{3}{5}$ d) $\frac{5}{3}$

68. $K_4[Fe(CN)_6]$ can be used to detect one or more out of $Fe^{2+}, Fe^{3+}, Zn^{2+}, Cu^{2+}, Cd^{2+}$
a) Fe^{2+}, Fe^{3+} b) $Fe^{3+}, Zn^{2+}, Cu^{2+}$ c) All but Fe^{3+} d) All but Fe^{2+}

69. A mixture upon adding conc. H_2SO_4 gives orange red fumes. It may contain the anion pair
a) $CrO_4^{2-} + Cl^-$ b) $Br^- + Cl^-$ c) $NO_3^- + Cl^-$ d) $CrO_4^{2-} + NO_3^-$

70. 34 g of H_2O_2 is present in 1120 mL of solution. This solution is called
a) 10 vol solution b) 20 vol solution c) 34 vol solution d) 32 vol solution

71. $N_2 + 3H_2 \rightarrow 2NH_3$
Molecular weight of NH_3 and N_2 are x_1 are x_2, respectively. Their equivalent weights are y_1 and y_2, respectively. Then $(y_1 - y_2)$ is
a) $\left(\frac{2x_1 - x_2}{6}\right)$ b) $(x_1 - x_2)$ c) $(3x_1 - x_2)$ d) $(x_1 - 3x_2)$

72. In the mixture of $(NaHCO_3 + Na_2CO_3)$, volume of HCl required is x mL with phenolphthalein indicator and then y mL with methyl orange indicator in same titration. Hence, volume of HCl for complete reaction of Na_2CO_3 is:
a) $2x$ b) y c) $\frac{x}{2}$ d) $(y - x)$

73. HF attacks glass (Na_2SiO_3) forming
a) Na_2SiF_4 b) Na_2SiF_3 c) Na_2SiF_6 d) H_4SiO_4

74. When 2 g of gas A is introduced into an evacuated flask kept of 25°C, the pressure was found to be 1 atmosphere. If 3 g of another gas B is then added to the same flask, the pressure becomes 1.5 atm. Assuming ideal behavior, the ratio of molecular weights $(M_A : M_B)$ is
a) 1:3 b) 3:1 c) 2:3 d) 3:2

75. If equal volumes of 1 M $KMnO_4$ and 1 M $K_2Cr_2O_7$ solutions are allowed to oxidise Fe (II) to Fe (III) in acidic medium, then Fe (II) oxidized will be
a) More by $KMnO_4$ b) More by $K_2Cr_2O_7$ c) Equal in both cases d) Can't be determined

76. The simplest formula of a compound containing 50% of an element X (atomic weight 10) and 50% of element Y (atomic weight 20) is:
a) XY b) X_2Y c) XY_2 d) X_2Y_3

77. Number of millilitres of a 1.6% $BaCl_2$ (w/V) solution which required to precipitate the sulphur as $BaSO_4$ in a 0.60 g sample that contains 12% S is
a) 58.50 mL b) 14.63 mL c) 29.25 mL d) 21.00 mL

78. All the oxygen in a 0.5434 g sample of a pure oxide of iron is removed by reduction in a stream of H_2. The loss in weight is 0.1210 g. hence, formula of the iron oxide is (Fe = 56)
a) FeO b) Fe_2O_3 c) Fe_3O_4 d) FeO_2

79. A certain metal sulphide MS_2 is used extensively as a high temperature lubricant. If MS_2 is 40.00% by mass sulphur, atomic mass of M is
a) 60 b) 96 c) 100 d) 80

80. The weight of 1 L of ozonised oxygen at STP was found to be 1.5 g. When 100 mL of this mixture at STP was treated with turpentine oil, the volume was reduced to 90 mL. The molecular weight of ozone is
a) 49 b) 47 c) 46 d) 47.9

81. The empirical formula of a compound of carbon with hydrogen is CH_2 .1 L of this gaseous compound has mass equal to that of 1 L N_2 under standard state. Thus, molecular formula of the compound is
a) C_3H_6 b) C_2H_4 c) C_4H_8 d) C_5H_{10}

82. The concentration of 10% CH_3COOH in mol L^{-1} is
a) 10 b) 0.83 c) 1 d) 1.67

83. $KCl + \text{conc.}\, H_2SO_4 + K_2Cr_2O_7 \xrightarrow{\Delta} (X) \xrightarrow{\text{NaOH}} (Y)$. (X) is reddish brown coloured gas soluble in NaOH forming (Y), (X) and (Y) are
a) Cr_2OCl_2, Na_2CrO_3 b) $Cr_2O_2Cl_2, Na_2CrO_3$ c) CrO_2Cl, Na_2CrO_4 d) CrO_2Cl_2, Na_2CrO_4

84. In the titration of 100 mL of 0.01 M CH_3COOH with 0.01 M NaOH, $[H_3O^+] = K_a$ when
a) 100 mL of NaOH has been added b) 75 mL of NaOH has been added
c) 50 mL of NaOH has been added d) 25 mL of NaOH has been added

85. By H_2O_2/OH^-, $Cr(OH)_3$ changes to
a) CrO_3 b) $Cr_2O_7^{2-}$ c) CrO_4^{2-} d) $[Cr(OH)_4]^-$

86. 800 g of a 40% solution by weight was cooled. 100 g of solute precipitated. The percentage composition of remaining solution is
a) 31.4% b) 20.0% c) 23.0% d) 24%

87. The purity of H_2O_2 in a given sample is 85%. Calculate the weight of impure sample of H_2O_2 which requires 10 mL of M/5 $KMnO_4$ solution in a titration in acidic medium
a) 2 g b) 0.2 g c) 0.17 d) 0.15 g

88. *A* is a colourless substance. Aqueous solution of *A* gives reddish-orange ppt with KI; ppt dissolves in excess of KI forming a colourless solution. If NH_4Cl and NaOH solution is added to this colourless solution reddish brown ppt is formed. Substance *A* is
a) Epsom salt b) Mohr's saslt c) Calomel d) Corrosive sublimate

89. $K_4[Fe(CN)_6]$ can be used to detect some ions out of $Cd^{2+}, Cu^{2+}, Zn^{2+}, Fe^{3+}, Pb^{2+}$ and Bi^{3+}. Exclude ions are
a) $Fe^{3+}, Bi^{3+}, Pb^{2+}$ b) $Cu^{2+}, Zn^{2+}, Bi^{3+}$ c) Bi^{3+}, Pb^{2+} d) Fe^{3+}, Pb^{2+}

90. In the estimation of nitrogen by Kjeldahl's method, 2.8 g of an organic compound required 20 millimoles of H_2SO_4 for the complete neutralisation of NH_3 gas evolved. The percentage of nitrogen in the sample is
a) 20% b) 10% c) 40% d) 30%

91. Mixture of 1 mole of Na_2CO_3 and 2 moles of $NaHCO_3$ forms 1 mole of CO_2. Thus, per cent yield of CO_2 is
a) 25% b) 50% c) 75% d) 100%

92. NH_3 is formed in the following steps
I. $Ca + 2C \rightarrow CaC_2$ 50% yield
II. $CaC_2 + N_2 \rightarrow CaCN_2 + C$ 100% yield
III. $CaCN_2 + 3H_2O \rightarrow 2NH_3 + CaCO_3$ 50% yield
To obtain 2 moles NH_3, calcium required is
a) 1 mol b) 2 mol c) 3 mol d) 4 mol

93. When the same amount of zinc is treated separately with excess of sulphuric acid and excess of sodium hydroxide, the ratio of volume of hydrogen evolved is
a) 1:1 b) 1:2 c) 2:1 d) 9:4

94. Acidified MnO_4^- can be decolourised by
a) CaC_2O_4 b) H_2O_2 c) $FeSO_4$ d) All of these

95. An element A (atomic weight = 12) and B (atomic weight = 35.5) combines to form a compound X. If 4 mol of B combines with 1 mol of A to give 1 mol of X. The weight of 1 mol of X would be
a) 47.5 g b) 74.0 g c) 154.0 g d) 148.8 g

96. The density of 1 M solution of NaCl is 1.0585 g/mL.The molality of the solution is
    a) 1.0585 b) 1.00 c) 0.10 d) 0.0585
97. $KMnO_4$reacts with oxalic acid according to the equation
    $2MnO_4^- + 5C_2O_4^2 + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$
    Here 20 mL of 0.1 M $KMnO_4$is equivalent to
    a) 20 mL of 0.5 M $C_2H_2O_4$ b) 50 mL of 0.1 M $C_2H_2O_4$
    c) 50 mL of 0.5 M $C_2H_2O_4$ d) 20 mL of 0.1 M $C_2H_2O_4$
98. Which of the following substances contains greatest mass of chlorine?
    a) 5.0 g Cl_2 b) 0.5 mol Cl_2 c) 0.10 mol KCl d) 30.0 g $MgCl_2$
99. What mass of CO_2 could be formed by the reaction of 16 g $CH_4$with 48 g ofO_2?
    $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
    a) 44 g b) 33 g c) 16 g d) 24 g
100. At 100°C and 1 atm, if the density of the liquid water is 1.0 g cm^{-3} and that of water vapour is 0.00006 g cm^{-3}, then the volume occupied by water molecule in 1 L steam at this temperature is
    a) 6 cm^3 b) 60 cm^3 c) 0.6 cm^3 d) 0.06 cm^3
101. If 0.5 mole of $BaCl_2$ is mixed with 0.20 mole of Na_3PO_4, the maximum number of moles of $Ba_3(PO_4)_2$ then can be formed is
    a) 0.1 b) 0.2 c) 0.5 d) 0.7
102. Test of this anion is not performed in glass test tubes. This anion is
    a) F^- b) AsO_4^{3-} c) PO_4^{3-} d) BO_3^{3-}
103. A 0.13 g of a specimen containing MnO_2 is treated with iodide ions. If iodine liberated
    a) 75.3% b) 85.3% c) 95.3% d) None
104. One equivalent of magnesium oxide weighs 20 g then one equivalent of magnesium chloride weighs
    a) 29.75 g b) 47.5 g c) 95.0 g d) 20.0 g
105. 20 mL of x M HCl neutralisses completely 10 mL of 0.1 M $NaHCO_3$ solution and a further 5 mL of 0.2 M Na_2CO_3 solution to methyl orange end point. The value of x is
    a) 0.167 M b) 0.133 M c) 0.15 M d) 0.2 M
106. When 2.76 g of silver carbonate is strongly heated, it yields a residue weighting
    a) 2.16 g b) 2.48 g c) 2.32 g d) 2.64 g
107. If 20 mL of 0.1 M $K_2Cr_2O_7$ is required to titrate 10 mL of a liquid iron supplement, then the concentration of iron in the vitamin solution is
    a) 1.2 M b) 2.4 M c) 0.6 N d) 1.56 M
108. A metal displaced 16.8 mL of H_2 (in standard conditions) from an acid. Volume of N_2 needed to combine with this amount of H_2 into NH_3 is
    a) 11.2 mL b) 5.6 mL c) 8.4 mL d) 22.4 mL
109. 0.5 g of a mixture of K_2CO_3 and Li_2CO_3 requires 30 mL of 0.25 N − HCl solution for neutralisation. The percentage composition of the mixture is
    a) 96%K_2CO_3, 4% Li_2CO_3 b) 4%K_2CO_3, 96% Li_2CO_3
    c) 48%K_2CO_3, 52% Li_2CO_3 d) 52%K_2CO_3, 48% Li_2CO_3
110. The Mw of a oxide of an element is 44. The Ew of the element is 14. The atomic weight of the element is
    a) 14 b) 28 c) 42 d) 56
111. Which of the following are soluble in excess of NaOH
    (X): As_2S_3 ; (Y): CuS ; (Z): $AlCl_3$?
    a) X, Y, Z b) Y, Z c) X, Z d) X, Y
112. In the separation of Cu^{2+} and Cd^{2+} in 2nd group of qualitative analysis of cations tetrammine copper (II) sulphate and tetraammine cadmium (II) sulphate react with KCN to form the corresponding cyanide

complexes, which one of the following pairs of the complexes and their relative stabilities enables the separation of Cu^{2+} and Cd^{2+}?

a) $K_3[Cu(CN)_4]$: less stable and $K_2[Cd(CN)_4]$: more stable
b) $K_3[Cu(CN)_4]$: more stable and $K_2[Cd(CN)_4]$: less stable
c) $K_2[Cu(CN)_4]$: less stable and $K_2[Cd(CN)_4]$: more stable
d) $K_2[Cu(CN)_4]$: more stable and $K_2[Cd(CN)_4]$: less stable

113. Aqueous solution of a mixture contains Br^- and I^-. On passing Cl_2 gas and adding $CHCl_3$, then organic layer will be
a) Violet b) Reddish brown c) Colourlesss d) Blue

114. Ferric alum gives red colour with NH_4SCN due to formation of
a) $Al(SCN)_3$ b) $[Fe(SCN)_3]^-$ c) $Fe(SCN)_3$ d) $[Fe(SCN)]^{2+}$

115. Ag_2S is soluble in NaCN due to formation of
a) $Na[Ag(CN)_2]$ b) $Ag(CN)_2$ c) $Na_2[Ag(CN)_3]$ d) $Na_2[Ag(CN)_2]$

116. When 8.3 g copper sulphate (249.5) reacts with excess of potassium iodide then the amount of iodine liberated is
a) 42.3 g b) 24.3 g c) 4.23 g d) 2.43 g

117. CO, CO_2, C_2O_3 follow
a) Law of definite proportion
b) Law of multiple proportion
c) Law of conservation of mass
d) All of the above

118. 10 mLof $NaHC_2O_4$ is oxidised by 10 mL of 0.02 $MMnO_4^{\ominus}$. Hence, 10 mL of $NaHC_2O_4$ is neutralised by
a) 10 mL of 0.1 M NaOH
b) 10 mL of 0.02 M NaOH
c) 10 mL of 0.1 $Ca(OH)_2$
d) 10 mL of 0.05 N $Ba(OH)_2$

119. Aqueous solution of *A* gives yellow ppt with *aq* K_2CrO_4. *A* may contain
a) Pb^{2+} or Ag^+ or Ba^{2+}
b) Pb^{2+} or Ba^{2+}
c) Ag^+ or Ba^{2+}
d) Pb^{2+} or Ag^+

120. $Na_2SO_3 . xH_2O$ has 50% H_2O by mass. Hence, x is
a) 4 b) 5 c) 6 d) 7

121. A sample of ammonium phosphate $(NH_4)_3PO_4$ contains 3.18 moles of H-atoms. The number of moles of oxygen atoms in the sample is
a) 0.265 b) 0.795 c) 1.06 d) 3.18

122. Volume of 0.50 M NaOH solution required to react with 40.0 mL of 0.05 M H_2SO_4 solution is
a) 40.0 mL b) 80.0 mL c) 20.0 mL d) 8.0 mL

123. The weight of residue obtained by heating 2.76 g of silver carbonate is
a) 2.76 g b) 2.98 g c) 2.16 g d) 2.44 g

124. Some white colourless crystals are heated. A cracking sound is heard and brown fumes are given off. The residue is yellow-brown in colour. When a glowing splinter is held in the fumes, it is reglighted. The fumes consist of
a) O_2 b) NO_2 c) Cl_2 d) NO_2 and O_2

125. 12.5 mL of a solution containing 6.0 g of a dibasic acid in 1 L was found to be neutralized by 10 mL of a decinormal solution of NaOH. The molecular weight of the acid is
a) 150 b) 120 c) 110 d) 75

126. Sulphur forms the chlorides S_2Cl_2 and SCl_2. The equivalent mass of S in SCl_2 is 16 g mol^{-1}. Thus, equivalent mass of S in S_2Cl_2 is
a) 8 g b) 32 g c) 16 g d) 64 g

127. One isotope of a non-metallic element has mass number 127 and 74 neutrons in the nucleus. The anion derived from the isotope has 54 electrons. Hence, symbol for the anion is
a) ${}^{127}_{54}X^-$ b) ${}^{127}_{53}X^-$ c) ${}^{74}_{53}X^-$ d) ${}^{74}_{54}X^-$

128. $Fe(OH)_3$ and $Al(OH)_3$ can be separated using
 a) NaOH b) $KOH + Br_2$ water c) Both (a) and (b) d) None of these
129. The decompositon of $CaCO_3$ yielded 11.2 L ofCO_2. The mass of KOH required to combine with CO_2 to form carbonate is
 a) 56 g b) 112 g c) 28 g d) 11.2 g
130. The volume of 0.5 M H_3PO_4 that completely dissolves 3.1 g of copper carbonate is (molecular mass of copper carbonate = 124 g mol^{-1})
 a) 55.5 mL b) 45.5 mL c) 35.5 mL d) 33.3 mL
131. Two glucose solutions are mixed. One has a volume of 480 mL and a concentration of 1.50 M and the second has a volume of 520 mL and concentration 1.20 M. The molarity of final solution is
 a) 1.20 M b) 1.50 M c) 1.344 M d) 2.70 M
132. F_2 can be prepared by reacting hexfluoro mangante (IV) with antimony pentafluoride as:
 $K_2MnF_6 + SbF_5 \xrightarrow{150°C} KSbF_6 + MnF_3 + F_2$
 The number of equivalent of K_2MnF_6 required to react completely with one mol of SbF_5in the given reaction is
 a) 1.52 b) 5.0 c) 0.5 d) 4.0
133. $4I^{\ominus} + Hg^{2+} \rightarrow HgI_4{}^{2-}$
 1 mol each of Hg^{2+} and $I^{\ominus}$ will form $HgI_4{}^{2-}$
 a) 1 mol b) 0.5 mol c) 0.25 mol d) 2 mol
134. Ethyl alcohol is 46% by weight of solution. Hence, mole fraction of ethyl alcohol is
 a) 0.46 b) 0.54 c) 0.75 d) 0.25
135. In the following reaction,
 $3Ba(NO_3)_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaNO_3$
 2 moles each of $Ba(NO_3)_2$ and Na_3PO_4 form $Ba_3(PO_4)_2$
 a) 1 mol b) 1/3 mol c) 2/3 mol d) 4 mol
136. How many equivalents are there per mol of H_2S in its oxidation to SO_2?
 a) 2 b) 4 c) 6 d) 8
137. A mixture of two colourless substances was dissolved in water. When gaseous Cl_2 was passed through the solution, a deep brown colour developed. Addition of $BaCl_2$ or NaOH to the original solution give a white precipitate. The mixture contained
 a) $NaNO_3$ and $AlCl_3$ b) NaBr and KCl
 c) MgI_2 and $MgSO_4$ d) $BaSO_4$ and $PbCl_2$
138. 10 g mixture of $NaHCO_3$ and Na_2CO_3 has 1.68 g $NaHCO_3$. It is heated at 400 K. Weight of the residue will be
 a) 9.38 g b) 8.32 g c) 10.0 g d) 1.68 g
139. Mole fraction of ethanol in ethanol water mixture is 0.25. Hence, the percentage concentration of ethanol by weight of mixture is
 a) 25% b) 75% c) 46% d) 54%
140. 1 g CH_4 and 4 g of compound X have equal number of moles. Thus, molar mass of X is
 a) 16 g mol^{-1} b) 32 g mol^{-1} c) 4 g mol^{-1} d) 64 g mol^{-1}
141. 0.116 g of $C_4H_4O_4$ (A) is neutralised by 0.074 g of $Ca(OH)_2$. Hence, protonic hydrogen ($H^{\oplus}$) in (A) will be
 a) 1 b) 2 c) 3 d) 4
142. The molality of 1 L solution with x% H_2SO_4 is equal to 9. The weight of the solvent present in the solution is 910 g. The value of x is:
 a) 90 b) 80.3 c) 40.13 d) 9
143. 1 kg of NaOH solution contains 0.04 g of NaOH. The approximate concentration of solution is
 a) 0.04 ppm b) 0.004 ppm c) 40 ppm d) 400 ppm

144. Equal volumes of 0.200 M HCl and 0.400 M KOH are mixed. The concentration of the principal ions in the resulting solution are
a) $[K^+] = 0.400$ M, $[Cl^-] = 0.200$ M, $[H^+] = 0.200$ M
b) $[K^+] = 0.200$ M, $[Cl^-] = 0.200$ M, $[OH^-] = 0.100$ M
c) $[K^+] = 0.200$ M, $[Cl^-] = 0.100$ M, $[OH^-] = 0.100$ M
d) $[K^+] = 0.200$ M, $[Cl^-] = 0.100$ M, $[OH^-] = 0.200$ M
145. With MnO, colour of the bead in sodium carbonate-bead test is
a) Pink b) Black c) Yellow d) Green
146. 36.6 g of the crystal hydrate of barium chloride when roasted lose 5.4 g in mass. Thus, salt is
a) $BaCl_2 \cdot 5H_2O$ b) $BaCl_2 \cdot 4H_2O$ c) $BaCl_2 \cdot 3H_2O$ d) $BaCl_2 \cdot 2H_2O$
147. In the following reaction :
$NO_3^{\ominus} + As_2S_3 + H_2O \rightarrow AsO_4^{3-} + NO + SO_4^{2-} + H^{\oplus}$
The equivalent weight of As_2S_3 (with molecular weight M) is:
a) $\frac{3M}{28}$ b) $\frac{M}{4}$ c) $\frac{M}{24}$ d) $\frac{M}{28}$
148. 1.2 g of Mg is treated with 100 mL of 1 M H_2SO_4.Molar concentration of the H_2SO_4solution after complete reaction is
a) 0.5 M b) 0.005 M c) 0.10 M d) 0.20 M
149. $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$
100 mLof Xmolar H_2O_2 gives 3 L of O_2 gunder the condition when 1 mole occupies 24 L, value of X is
a) 2.5 b) 1.0 c) 0.5 d) 0.25
150. Mole fraction of a solute in an aqueous solution is 0.2. The molality of the solution will be
a) 13.88 b) 1.388 c) 0.138 d) 0.0138
151. The molarity of H_2SO_4 is 18 M. Its density is 1.8 g mL^{-1}. Hence, molality is:
a) 36 b) 200 c) 500 d) 18
152. 100 mL of $NaHC_2O_4$ required 50 mL of 0.1 M $KMnO_4$ solution in acidic medium. Volume of 0.1 M NaOH required by 100 mL of $NaHC_2O_4$ is
a) 50 mL b) 100 mL c) 125 mL d) 150 mL
153. For the reaction, $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$, the volume of carbon monoxide required at STP to reduce one mole of ferric oxide is
a) 22.4 dm^3 b) 44.8 dm^3 c) 67.2 dm^3 d) 11.2 dm^3
154. In sodium carbonate bead test, chromium salts (green) change to coloured bead
a) Yellow, $PbCrO_4$ b) Yellow, $BaCrO_4$ c) Yellow, Na_2CrO_4 d) Orange, $Na_2Cr_2O_7$
155. A salt which will turn dark on exposure to sunlight has the formula
a) $K_2C_2O_4$ b) $CaCl_2$ c) AgCl d) $Fe_4[Fe(CN)_6]$
156. The solution of sodium meta aluminate on boiling with ammonium chloride gives a white precipitate of
a) Al_2O_3 b) $AlCl_3$ c) $Al(OH)_3$ d) $NaAl(OH)_4$
157. In the mixture of $NaHCO_3$ and Na_2CO_3, the volume of a given HCl required is x mL with phenolphthaleiun indicator and further y mL required with methyl orange indicator. Hence, volume of HCl for complete reaction of $NaHCO_3$ is
a) $2x$ b) y c) $\frac{x}{2}$ d) $(y - x)$
158. A substance that will deliquesce in the normal laboratory atmosphere is
a) $CuSO_4$ b) NaOH c) SiO_2 d) All of these
159. What weight of a metal of equivalent weight 12 will give 0.475 g of its chloride?
a) 0.12 g b) 0.24 g c) 0.36 g d) 0.48 g
160. If 0.5 g of a mixture of two metals A and B with respective equivalent weights 12 and 9 displace 560 mL of H_2 at STP from an acid, the composition of the mixture is

a) 40% A, 60% B b) 60% A, 40% B c) 30% A, 70% B d) 70% A, 30% B

161. SiF_4 is hydrolysed by H_2O forming
a) H_2SiF_6, H_4SiO_4 b) H_2SiF_4, H_2SiF_6 c) H_2SiF_6, H_2SiO_3 d) H_2SiF_6, SiO_2

162. In the decomposition of 10 g of $MgCO_3$, 0.1 mole CO_2 and 4.0 g MgO are obtained. Hence, percentage purity of $MgCO_3$ is
a) 50% b) 60% c) 40% d) 84%

163. $2C + O_2 \rightarrow 2CO$. In this reaction the mass of carbon will be used up in forming 11.2 L of CO at NTP is
a) 0.6 g b) 6 g c) 12 g d) 24 g

164. The molarity of a solution obtained by mixing 750 mL of 0.5 (M) HCl with 250 mL of 2 (M)HClwill be
a) 0.875 M b) 1.00 M c) 1.75 M d) 0.0975 M

165. Equivalent weight of $MnO_4^{\ominus}$ in acidic, neutral and basic media are in ratio of:
a) 3:5:15 b) 5:3:1 c) 5:1:13 d) 3:15:5

166. A colourless gas is dissolved in water and the resulting solution turns red litmus blue, the gas may have been which one of the following?
a) HCl b) H_2S c) SO_2 d) NH_3

167. The volume of oxygen liberated at STP from 0.68 g of H_2O_2 is
$2H_2O_2 \rightarrow 2H_2O + O_2$
a) 112 mL b) 224 mL c) 56 mL d) 336 mL

168. An organic compound contains 4% sulphur. Its minimum molecular weight is
a) 200 b) 400 c) 800 d) 1600

169. Cu^{2+} and Ag^+ are both present in the same solution. To precipitate one of the ions and leave the other in solution, add
a) $H_2S(aq)$ b) $HCl(aq)$ c) HNO_3 d) $NH_4NO_3(aq)$

170. Which set does not contain amphoteric species?
a) $Al(OH)_3, Zn(OH)_2$ b) SnO_2, Al_2O_3 c) $Fe(OH)_3, Ni(OH)_2$ d) All of these

171. If an ore sample containing Mn is treated with 50 mL of 0.2750 M $Na_2C_2O_4$ aqnd the unreached $Na_2C_2O_4$ required 18.28 mL of 0.1232 M $KMnO_4$ in acidic medium, the number of moles of Mn in the ore is
a) 1.38×10^{-2} b) 1.49×10^{-3} c) 1.15×10^{-2} d) 8.12×10^{-3}

172. A mixture contains NO_2^- and SO_3^{2-}. On adding dilute H_2SO_4 and KI and then starch, blue colour appears. This is due to
a) NO_2^- b) SO_3^{2-} c) Both (a) and (b) d) None of these

173. 100 mL of 20.8% $BaCl_2$ solution and 50 mL of 9.8% H_2SO_4 solution will form $BaSO_4$
$(Ba = 137, Cl = 35.5, S = 32, H = 1, O = 16)$
$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$
a) 23.3 g b) 11.65 g c) 30.6 g d) None of these

174. In which case purity of the substance is 100%?
a) 1 mole of $CaCO_3$ gave 11.2 L CO_2 (at STP) b) 1 mole of $MgCO_3$ gave 40.0 g MgO
c) 1 mole of $NaHCO_3$ gave 4 g H_2O d) 1 mole of $Ca(HCO_3)_2$ gave 1 mole CO_2

175. Two samples of HCl of 1.0 M and 0.25 M are mixed. Find volumes of these samples taken in order to prepare 0.75 M HCl solution. Assume no water is added
(I) 20 mL, 10 mL (II) 100 mL, 50 mL
(III) 40 mL, 20 mL (IV) 50 mL, 25 mL
a) I, II, IV b) I, II c) II, III, IV d) I, II, III, IV

176. To increase the molar solubility of $CaCO_3(s)$ in a saturated aqueous solution add
a) More water b) Na_2CO_3 c) NaOH d) $NaHSO_4$

177. The molality of a H_2SO_4solution is 9. The weight of the solute in 1 kg H_2SO_4solution is
a) 900.0 g b) 469 g c) 882.0 g d) 9.0 g

178. A candle is burnt in a beaker until it extinguishes itself. A sample of gaseous mixture in the beaker contains and 6.08×10^{20} molecules of O_2, and 0.50×10^{20} molecules of CO_2. The total pressure is 734 mm of Hg. The partial pressure of O_2would be
a) 760.0 mm of Hg b) 76.0 mm of Hg c) 7.6 mm of Hg d) 0.76 mm of Hg
179. 10 mL of 1 M $BaCl_2$ solution and 5 mL 0.5 M K_2SO_4 are mixed together to precipitate out $BaSO_4$. The amount of $BaSO_4$ precipated will be
a) 0.005 mol b) 0.00025 mol c) 0.025 mol d) 0.0025 mol
180. Ethanol-water mixture has 46 g ethanol in 100 g mixture. By a suitable technique volatile component goes off. Thus
a) 3 moles of non-volatile component are left
b) 9 N_0 atoms of non-volatile component are left
c) 9 N_0 atoms of volatile component are separated
d) All the above statements are correct
181. 100 mL of 0.01 M $H_2SO_4$is neutralized by
a) 100 mL of 0.01 M NaOH b) 100 mL of 0.01 M $Ca(OH)_2$
c) 100 mL of 0.01 M $Al(OH)_3$ d) All the above are correct
182. When a substance A reacts with water it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produce gas B on reaction with dilute sulphuric acid at room temperature. A imparts a deep golden yellow colour to a smokeless flame of Bunsen burner. A, B, C and D, respectively are
a) $Na, H_2, NaOH, Zn$ b) K, H_2, KOH, Al
c) $CaH_2, Ca(OH)_2, Sn$ d) $CaC_2, C_2H_2, Ca(OH)_2, Fe$
183. The equivalent weight of phosphoric acid (H_3PO_4) in the reaction
$NaOH + H_3PO_4 \rightarrow NaH_2PO_4 + H_2O$ is
a) 59 b) 49 c) 25 d) 98
184. Upon mixing 50.0 mL of 0.1 M lead nitrate solution with 50 mL of 0.05 M chromic sulphate solution, precipitation of lead sulphate solution takes place. How many moles of lead sulphate are formed and what is the molar concentration of chromic sulphate left in the solution?
a) 0.005, 0.0084 b) 0.0084, 0.005 c) 0.005, 0.00084 d) 0.05, 0.00084
185. Which of the following reactions is not oxidation reduction?
a) $H^{\oplus} + OH^{\ominus} \rightarrow H_2O$ b) $\frac{1}{2}H_2 + \frac{1}{2}Cl_2 \rightarrow HCl$ c) $CaCO_3 \rightarrow CaO + CO_2$ d) (a)and (c)
186. Marsh test is used for detecting
a) As b) Zn c) Al d) CH_4
187. An iron sample contains 18% Fe_3O_4.What is the amount so that it is precipitated as Fe_2O_3 which weighs 0.40 g?
a) 2.15 g b) 1.075 g c) 4.30 g d) 2.01 g
188. Sodium fusion extract, obtained from aniline, on treatment with iron (II) sulphate and H_2SO_4, in presence of air gives a Prussian blue precipitate. The blue colour is due to the formation of
a) $Fe_4[Fe(CN)_6]_3$ b) $Fe_3[Fe(CN)_6]_2$ c) $Fe_4[Fe(CN)_6]_2$ d) $Fe[Fe(CN)_6]_3$
189. 10 mL of H_2O_2 solution (volume strength= x) required 10 mLof N/0.56 $MnO_4^{\ominus}$ solution in acidic medium. Hence, x is
a) 0.56 b) 5.6 c) 0.1 d) 10
190. The compound thioacetamide has been into analytical chemistry to replace which one of the following reagents?
a) H_2S b) DMG c) YAS d) $(NH_4)_2C_2O_4$
191. What maximum amount of $BaSO_4$ gets precipitated if 0.5 mol of $BaCl_2$ is mixed with 1 mole of H_2SO_4?
a) 0.5 mol b) 1.0 mol c) 1.5 mol d) 2.0 mol

192. Solution of (X) in dil. HCl + H_2O → white turbidity. $(X) \xrightarrow{H_2S/HCl}$ black ppt (Y). (Y) is soluble in
a) H_2SO_4 b) YAS c) HNO_3 d) HCl

193. 11.2 L of CO_2 is absorbed in 1 mole NaOH, Na_2CO_3 formed is
$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$
a) 5.6 mol b) 11.2 mol c) 0.5 mol d) 1.0 mol

194. $X^-, Y^{2-}$and Z^{3-} are isotonic and isoelectronic. Thus, increasing order of atomic number of X, Y and Z is
a) $X < Y < Z$ b) $Z < Y < X$ c) $X = Y = Z$ d) $Z < X < Y$

195. The ion most difficult to remove as a precipitate is
a) Ag^+ b) NH_4^+ c) Fe^{3+} d) Cu^{2+}

196. HNO_3 is 0.001 M. Hence, concentration in ppm is
a) 1×10^{-3} b) 100 c) 212 d) 63

197. 100 mLof 1 M $KMnO_4$oxidized 100 mLof H_2O_2 in acidic medium (when MnO_4^- is reduced to Mn^{2+}); volume of same $KMnO_4$required to oxidize 100 mLof H_2O_2in basic medium (when $MnO_4^-$is reduced to MnO_2) will be
a) $\frac{100}{3}$ mL b) $\frac{500}{3}$ mL c) $\frac{300}{5}$ mL d) 100 mL

198. If 100 mL of H_2SO_4 and 100 mL of H_2O are mixed, the mass percent of H_2SO_4 in the resulting solution is ($d_{H_2SO_4} = 0.09$ g mL^{-1}, $d_{H_2O} = 1.0$ g mL^{-1})
a) 90 b) 47.36 c) 50 d) 60

199. A salt contains cation A^{2+} and again B^{2-}. Both decolourise MnO_4^- in acidic medium. Salt is
a) Ferrous oxalate b) Ferric oxalate
c) Both (a) and (b) d) None of these

200. $K_2Cr_2O_7$ is obtained in the following steps:
$2FeCrO_4 + 2Na_2CO_3 + O \rightarrow Fe_2O_3 + 2Na_2CrO_4 + 2CO_2$
$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + H_2O + Na_2SO_4$
$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$
To get 0.25 mol of $K_2Cr_2O_7$, mol of 50% pure $FeCrO_4$ required
a) 1 mol b) 0.50 mol c) 0.25 mol d) 0.125 mol

201. The *Ew* of H_3PO_4 in the reaction is
$Ca(OH)_2 + H_3PO_4 \rightarrow CaHPO_4 + 2H_2O$
$(Ca = 40, P = 31, O = 16)$
a) 49 b) 98 c) 32.66 d) 147

202. Normality of a solution that contains 12.64 g of $KMnO_4$ in 500 mL of solution to be used in the reaction that produces K_2MnO_4ion as the reducing product is
a) 0.16 N b) 0.32 N c) 0.80 N d) 0.08 N

203. Of the following oxides, all are soluble, in NaOH(aq) except
a) ZnO b) Al_2O_3 c) Fe_2O_3 d) SnO_2

204. One litre of a sample of hard water contains 5.55 mg of $CaCl_2$ and 4.75 mg of $MgCl_2$. The total harness in terms of ppm of $CaCO_3$ is
a) 5 ppm b) 10 ppm c) 20 ppm d) None of these

205. In iodometric titration, hypo is oxidized to
a) $S_4O_6^{2-}$ b) SO_3^{2-} c) SO_4^{2-} d) SO_2

206. Mass of one atom of X is 2.66×10^{-23}g, then its 32 g is equal to
a) $32 \times 2.66 \times 10^{-23}$mol b) $\frac{32}{2.66 \times 10^{-23} \times 6.02 \times 10^{23}}$ mol
c) $\frac{32 \times 2.66 \times 10^{-23}}{6.02 \times 10^{23}}$mol d) None of the above

207. In a glass-tube, there are 18 g of glucose. 0.08 mole of glucose is taken. Glucose left in the glass-tube is
a) 0.10 g b) 17.92 g c) 3.60 mol d) 3.60 g
208. Stock phosphoric acid solution is 85% H_3PO_4 (by mass of solution) and has a specific gravity of 1.70. Hence, molarity of H_3PO_4solution is
a) 8.51 M b) 1.70 M c) 14.74 M d) 7.37 M
209. From the complete decomposition of 20 g $CaCO_3$ at STP, the volume of CO_2 obtained is
a) 2.24 L b) 4.48 L c) 20 L d) 22.4 L
210. Which element has maximum percentage in iron (III) sulphate (IV)?
a) Iron b) Sulphur c) Oxygen d) Equal
211. Consider the following laws of chemical combination with examples
1. Law of multiple proportion : N_2O, NO, NO_2
2. Law of reciprocal proportion : H_2O, SO_2, H_2S
Which is correct with examples?
a) I and II b) I only c) II only d) None of the above
212. Aqueous solution containing one mole borax reacts with two moles of acids. This is because of
a) Formation of 2 moles of $B(OH)_3$ only
b) Formation of 2 moles of $[B(OH)_4]^-$ only
c) Formation of mole each of $[B(OH)_3]$ and $[B(OH)_4]^-$
d) Formation of 2 mol each of $[B(OH)_4]^-$ and $B(OH)_3$, of which only $[B(OH)_4]^-$ reacts with acid
213. Mixture of 1 g each of Na_2CO_3 and $NaHCO_3$ is reacted with 0.1 N HCl.The mL of 0.1 N HCl required to react completely with the above mixture is
a) 15.78 mL b) 157.8 mL c) 198.4 mL d) 307.7 mL
214. 10 mL of $NaHC_2O_4$solution is neutralized by 10 mL of 0.1 M NaOH solution.10 mL of same $NaHC_2O_4$ solution is oxidized by 10 mL of $KMnO_4$solution in acidic medium. Hence, molarity of $KMnO_4$is
a) 0.1 M b) 0.2 M c) 0.04 M d) 0.02 M
215. In the following reaction,
$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$
2 moles MnO_2 react with 4 moles of HCl to form 11.2 L Cl_2 at STP. Thus, per cent yield of Cl_2 is
a) 25% b) 50% c) 100% d) 75%
216. An aqueous solution of glucose is 10%. The volume in which 1 g mol of it is dissolved will be
a) 0.9 L b) 9 L c) 1.8 L d) 18 L
217. 100 mLof solution of $CaCl_2$is evaporated to dryness; residue obtained is 0.111g Molarity of $CaCl_2$ solution is
a) 0.1 M b) 1.0 M c) 0.01 M d) 0.001 M
218. Colourless salt (A) + dil. H_2SO_4 + KI $\xrightarrow{\text{Starch}}$ blue colour. (A) can be
a) $K_2Cr_2O_7$ b) MnO_2 c) NH_4NO_2 d) NH_4Cl
219. The mass of 70% H_2SO_4 required for neutralization of one mole of NaOH is
a) 30 g b) 70 g c) 35 g d) 95 g
220. A gaseous mixture contains O_2 and N_2 in the ratio of 1:4 by wight. The ratio of their number of molecules is
a) 1:4 b) 1:8 c) 7:32 d) 3:16
221. A mineral consists of an equimolar mixture of the carbonates of two bivalent metals. One metal is present to the extent of 15.0% by weight, 3.0 g of the mineral on heating lost 1.10 g of CO_2. The percent by weight of other metal is
a) 65 b) 25 c) 75 d) 35
222. $[Na^+]$ in a solution prepared by mixing 30.00 mLof 0.12 M NaClwith 70 mLof 0.15 M Na_2SO_4 is
a) 0.135 M b) 0.141 M c) 0.210 M d) 0.246 M

223. A metal nitrate reacts with KI to give a black precipitate which on addition of excess of KI converts into orange colour solution. The cation of metal nitrate is
   a) Hg^{2+} b) Bi^{3+} c) Pb^{2+} d) Cu^{+}
224. Upon treatment with ammoniacal H_2S, the metal ion that precipitates as a sulphide is
   a) Fe (III) b) Al (III) c) Mg (II) d) Zn (II)
225. If two compounds have same empirical formula but different molecular formula, they must have
   a) Same viscosity b) Same vapour density (VD)
   c) Different molecular weight d) Different percentage composition
226. A gaseous mixture contains oxygen and nitrogen in the ratio 1:4 by weight. Therefore, the ratio of the number of molecules is:
   a) 1:4 b) 1:8 c) 7:32 d) 3:16
227. Analysis of chlorophyll shows that it contains 2.40 per cent magnesium. Thus, number of atoms in 1 g chlorophyll is
   a) 0.001 b) 1.00 c) 6.02×10^{20} d) 1.445×10^{19}
228. To make 0.01 mole which of the following has maximum mass?
   a) $NaHCO_3$ b) Na_2CO_3 c) Na_2SO_4 d) $Na_2C_2O_4$
229. Select the correct statement
   a) In iodometric titration, hypo is taken in burette
   b) In iodimetric titration, ---- I_2solution is taken in burette
   c) In iodometric titration ----- I_2formed exist as I_3^-
   d) All the above are correct statements
230. Precipitates of IIA and IIB can be separated by
   a) NaOH b) Yellow $(NH_4)_2S$ c) Both (a) and (b) d) None of these
231. What is the valency of an element of which the equivalent weight is 12 and the specific heat is 0.25?
   a) 1 b) 2 c) 3 d) 4
232. Ammonium salts can be decomposed by
   a) *aq* Na_2O b) *aq* CaO c) Both (a) and (b) d) None of these
233. In a titration H_2O_2 is oxidized to $O_2$by MnO_4^-. 24 mL of 0.1 M H_2O_2 of require 16 mL of 0.1 M MnO_4^- solution. Hence, MnO_4^-changes to
   a) MnO_4^{2-} b) MnO_2 c) MnO_4^{2-} d) Mn_2O_7
234. On adding KNO_2 and CH_3COOH solution to the neutral solution of $CoCl_2$, there is formation of yellowish orange precipitate of
   a) $K_3[Co(NO_2)_6]$ b) $K_4[Co(NO_2)_6]$ c) $K_3[Co(NO_2)_4(CH_3COO)$ d) $K_2[Co(NO_2)_4]$
235. M (molarity) and M'(molality) are related to each other by equation
   (m = molecular weight of solute, x = density g/mL)
   a) $M\left(\frac{m}{1000}+\frac{1}{M'}\right)=d$ b) $M'=\left(\frac{1000\,M}{1000\,d-Mm}\right)$
   c) Both (a) and (b) d) None of the above
236. On repeated sparking, 10 mL of a mixture of carbon monoxide and nitrogen required 7 mL of oxygen for combustion. What was the volume of nitrogen? (All volumes are measured under identical conditions)
   a) 7/2 mL b) 4 mL c) 7 mL d) 17/2 mL
237. The molar mass of a compound if 0.372 mole of it has a mass of 186 g, is
   a) 200 g b) 372 g c) 500 g d) 186 g
238. If 5.0 g of Al react with 4.45 g of O_2, empirical formula of aluminum oxide is
   a) Al_2O_3 b) AlO_2 c) Al_2O d) AlO_3
239. 1 mole of ferric oxalate is oxidized by x moles of MnO_4^-.Thus, x is
   a) 1.2 b) 2.1 c) 3.1 d) 1.3
240. NH_4SCN can be used to test one or more out of $Fe^{3+}, Co^{2+}, Cu^{2+}$

a) Fe^{3+} only b) Co^{2+}, Cu^{2+} c) Fe^{3+}, Cu^{2+} d) All of these

241. To increase significantly the concentration of free Zn^{2+} ion is a solution of the complex ion $[Zn(NH_3)_4]^{2+}$,
$Zn^{2+}(aq) + 4NH_3(aq) \rightleftharpoons [ZN(NH_3)_4]^{2+}(aq)$
add to the solution some
a) H_2O b) $HCl(aq)$ c) $NH_3(aq)$ d) $NH_4Cl(aq)$

242. The number of moles of oxygen obtained by the electrolytic decomposition of 90 g water is
a) 2.5 b) 5 c) 7.5 d) 10

243. Resultant molarity of H^+ion in a mixture of 100 mL of 0.1 M H_2SO_4 and 200 mL of 0.1 M H_3PO_3 is
a) 0.1 M b) 0.2 M c) 0.267 M d) 0.133 M

244. An isotope of Ge_{32}^{76} is
a) Ge_{32}^{77} b) As_{33}^{77} c) Se_{34}^{77} d) Se_{34}^{78}

245. An aqueous solution of a substance gives a white precipitate on treatment with dilute hydrochloric acid, which dissolves on heating. When hydrogen sulphide is passed through the hot acidic solution, a black precipitate is obtained. The substance is a
a) Hg^{2+} salt b) Cr^{2+} salt c) Ag^+ salt d) Pb^{2+} salt

246. O_3 oxidized I^- to I_2.Equivalent weight of O_3 is
a) 48 b) 32 c) 8 d) 4

247. At 100°C and 1 atm, if the density of the liquid water is 1.0 g cm^{-3} and that of water vapour is 0.0006 g cm^{-3}, then the volume occupied by water molecules in 1 L of steam at this temperature is
a) 6 cm^3 b) 60 cm^3 c) 0.6 cm^3 d) 0.06 cm^3

248. 1.0 g of a monobasic acid when completely acted upon Mg gave 1.301 g anhydrous Mg salt. Equivalent weight of acid is
a) 35.54 b) 36.54 c) 17.77 d) 18.27

249. 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
a) 176.5 b) 252.2 c) 287.6 d) 360.1

250. 100 mL of H_2O_2 is oxidised by 100 mL of 0.01 M $KMnO_4$ in acidic medium ($MnO_4^{\ominus}$reduced to Mn^{2+}). 100 mL of the same H_2O_2 is oxidised by V mL of 0.01 M $KMnO_4$ in basic medium ($MnO_4^{\ominus}$ reduced to MnO_2). Hence, V is
a) 500 b) 100 c) $\frac{100}{3}$ d) $\frac{500}{3}$

251. 1.6 g of pyrousite ore was ore was treated with 50 mL of 0.1 N oxalic acid and some sulphuric acid. the oxalic acid left in excess was raised to 250 mL in a flask. 25 mL of this solution, when titrated with 0.01 N$KMnO_4$, required 30 mL of the solution. The percentage of pure MnO_2 in the sample is
a) 10.86% b) 5.43% c) 1.086% d) None of these

252. How many moles of electrons weight one kilogram?
a) 6.023×10^{23}
b) $\frac{1}{9.108} \times 10^{31}$
c) $\frac{6.023}{9.108} \times 10^{54}$
d) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

253. Which of the following has maximum number of C-atoms?
a) 4.4 g CO_2 b) 3.0 g C_2H_6 c) 4.4 g C_3H_8 d) 1.3 g C_6H_6

254. Three test tubes A, B, C contain Pb^{2+}, Hg_2^{2+} and Ag^+ (but unknown). To each aqueous solution NaOH is added in excess. Following changes occur
A: Black ppt

B: Brown ppt
C: White ppt but dissolves in excess of NaOH
A, B and C contain respectively
a) Pb^{2+}, Hg_2^{2+} and Ag^+ b) Hg_2^{2+}, Ag^+, Pb^{2+} c) Ag^+, Pb^{2+}, Hg_2^{2+} d) Ag^+, Hg_2^{2+}, Pb^{2+}

255. Dimethyl glyoxime and $NaHSO_3/NH_4CNS$ are used to distinguish and separate Cu^{2+} and Ni^{2+}. These are used to order
a) HSO_3^-/CNS^- then DMG b) DMG then HSO_3^-/CNS^-
c) At random d) Given reagent are not suitable

256. $K_2Cr_2O_7 +$ conc. $H_2SO_4 + H_2O_2 +$ ether $\rightarrow$ blue perchromic anhydride (in ethereal layer). Blue colour is due to
a) CrO_3 b) H_2CrO_4 c) $H_2Cr_2O_3$ d) CrO_5

257. 1.2 g of Mg is treated with 100 mL of 1 M H_2SO_4.Molar concentration of the H_2SO_4 solution after complete reaction is
a) 0.5 M b) 0.005 M c) 0.10 M d) 0.20 M

258. Number of moles in 1.8 g H_2O is equal to the number of moles in
I : 1.8 g glucose
II : 6 g urea
III : 34.2 g sucrose
Select the correct group.
a) I, II, III b) I, II c) I, III d) II, III

259. Which is soluble in H_2O?
a) AgI b) AgBr c) AgCl d) AgF

260. K_2CrO_4oxidises KI in the presence of HCl to I_2. The equivalent weight of the K_2CrO_4 is
a) $\frac{Mw}{2}$ b) $Mw \times \frac{2}{3}$ c) $\frac{Mw}{3}$ d) $\frac{Mw}{6}$

261. Aqueous solution of salt
$$(A) + K_2CrO_4 \longrightarrow \underset{\text{(red ppt)}}{(B)} \xrightarrow{aq\ NH_3} \underset{\text{(black)}}{(C)}.\ A \text{ is}$$
a) $AgNO_3$ b) $Pb(NO_3)_2$ c) $Hg_2(NO_3)_2$ d) $Ca(NO_3)_2$

262. A sample of $CaCO_3$ is 50% pure. On heating 1.12 L of CO_2 (at STP) is obtained. Residue left (assuming non-volatile impurity) is
a) 7.8 g b) 3.8 g c) 2.8 g d) 8.9 g

263. 1 g of a sample of NaOH was dissolved in 50 mL of 0.33 M alkaline solution of $KMnO_4$ and refluxed till all the cyanide was converted into $OCN^{\ominus}$. The reaction mixture was cooled and its 5 mL portion was acidified by adding H_2SO_4 in excess and then titrated to end point against 19.0 mL of 0.1 M $FeSO_4$ solution. The percentage purity of NaCN sample is
a) 55.95 % b) 65.95 % c) 75.95 % d) 85.95 %

264. 1 mole of SO_2Cl_2 is dissolved in water and $Ca(OH)_2$ is added to neutralise acidic solution Moles of $Ca(OH)_2$ required are
a) 2 b) 3 c) 4 d) 5

265. If equal volumes of 1 M $KMnO_4$ and 1 M $K_2Cr_2O_7$ solutions are used to oxidise Fe^{2+}in acidic medium, then Fe^{2+} will be oxidised
a) More by $K_2Cr_2O_7$
b) More by $KMnO_4$
c) Equal in both the cases
d) The data is insufficient to predict the answer

266. Urea solution is one molal. Urea present in 1 kg solution is

a) 60 g b) 56.6 g c) 10.60 g d) 10.0 g

267. What volume of 0.2 M KOH will be required to neutralize 100 mL of 0.1 M H_3PO_4 using methyl red indicator (change of colour pink → yellow) and then bromothymol blue indicator is added
a) 50 mL b) 100 mL c) 150 mL d) 200 mL
268. When a soluble lead compound is added to a solution containing orange $K_2Cr_2O_7$ solution
a) $PbCr_2O_7$ is precipitated
b) $PbCrO_4$ is precipitated
c) $PbCrO_3$ is precipitated
d) None of the above is precipitated
269. Number of atoms in 20 g Ca is equal to number of atoms in
a) 20 g Mg b) 1.6 g CH_4 c) 1.8 g H_2O d) 1.7 g NH_3
270. If each O-atom has two equivalents, volume of one equivalent of O_2 gas at STP is
a) 22.4 L b) 11.2 L c) 5.6 L d) 44.8 L
271. The density of ammonia at 30°C and 5 atm pressure is
a) 3.42 g L^{-1} b) 2.42 g L^{-1} c) 1.71 g L^{-1} d) 3.84 g L^{-1}
272. 50 mL of H_2SO_4 require 10 g $CaCO_3$ for complete decomposition H_2SO_4 is
a) 9.8% b) 4.9% c) 19.6% d) 2.45%
273. Fe^{2+} does not give blue colour with $K_4[Fe(CN)_6]$ but on its reaction with (X), blue colour appears, (X) can be
a) MnO_4^-/H^+ b) H_2SO_4 c) NH_3 d) HCl
274. 20 mL of x M HCl neutralizes 5 mL of 0.2 M Na_2CO_3 solution to phenolphthalein end-point. The value of x is
a) 0.167 M b) 0.133 M c) 0.150 M d) 0.05 M
275. $NaNO_2 + A \rightarrow B \xrightarrow{\Delta} N_2$
$A + AgNO_3 \rightarrow$ White ppt soluble in C
$\xrightarrow{NaOH, \Delta} C$
Hence, A is
a) NaCl b) NH_4Cl c) NH_4NO_2 d) NH_4NO_3
276. $CuSO_4$ is decolourised on addition of KCN, the product is
a) $[Cu(CN)_4]^{2-}$ b) $[Cu(CN)_4]^{3-}$ c) $Cu(CN)_2$ d) CuCN
277. An excess of NaOH was added to 100 mL of a $FeCl_3$ solution which gives 2.14 of $Fe(OH)_3$. Calculate the normality of $FeCl_3$ solution
a) 0.2 N b) 0.3 N c) 0.6 N d) 1.8 N
278. A mixture is known to contain NO_3^- and NO_2^-. Before performing ring test for NO_3^-, the aqueous solution should be made free of NO_2^-. This is done by heating aqueous extract with
a) Conc. HNO_3 b) dil. HNO_3 c) Urea d) Zinc dust
279. If 0.50 mol 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
a) 0.70 b) 0.50 c) 0.20 d) 0.10
280. A bottle which contains 200 mL of 0.1 M NaOH solution, absorbs 1.00 millimol of CO_2 from the air. This solution is titrated with standard HCl solution using phenolphthalein indicator. Normality of resulting solution is found as
a) 0.190 N b) 0.380 N c) 0.095 N d) 0.0475 N
281. In the following final result is ...0.1 mole $CH_4 + 3.01 \times 10^{23}$ molecules $CH_4 - 9.6$ g $CH_4 =$ x mole H atoms
a) 0 mol H atom b) 0.2 mol H atom c) 0.3 mol H atom d) 0.4 mol H atom
282. The largest number of molecules is in
a) 36 g of water
b) 28 g of carbon monoxide
c) 46 g of ethyl alcohol
d) 54 g of nitrogen pentoxide
283. Disilane Si_2H_x is analysed and found to contain 90.28% by weight silicon. Value of x is (Si = 29)

a) 2 b) 3 c) 4 d) 6

284. Zinc pieces can added to acidified solution of SO_3^{2-}. Gas liberated can
a) Turn lead acetate paper black
b) Turn lime water milky
c) Give both of the above tests
d) Give none of the above tests

285. Ag_2CrO_4 ppt is soluble in
a) dil. HNO_3 b) aq NH_3 c) Both (a) and (b) d) None of these

286. 100 mL of a mixture of NaOH and $NaSO_4$ is neutralized by 10 mL of 0.5 M H_2SO_4.Hence, amount of NaOH in 100 mL mixture is
a) 0.2 g b) 0.4 g c) 0.6 g d) 1.0 g

287. 13.4 g of a sample of unstable hydrated salt $Na_2SO_4 \cdot XH_2O$ was found to contain 6.3 g of H_2O. The number of molecules of water of crystalisation is
a) 5 b) 7 c) 2 d) 10

288. Colourless salt $(X) \xrightarrow{\Delta} (Y) \xrightarrow{Cu^{2+},\Delta}$ colourless bead (Z), (X) can be
a) Borax b) Microcosmic salt c) Both (a) and (b) d) None of these

289. Molarity of Na_2CO_3 solution formed in the above question will be
a) 0.0244 M b) 0.0112 M c) 0.1500 M d) 0.1276 M

290. The volume strength of 1.5 N H_2O_2solution is
a) 8.4 b) 4.2 c) 16.8 d) 5.2

291. Concentrated hydrochloric acid contains 37% HCl (by mass). The density of this solution is 1.18 g/mL. The molarity (conc. in mol L^{-1}) of solution is
a) 10 M b) 12 M c) 13 M d) 14 M

292. 3.9 g of a mixture of aluminium and its oxide on reaction with aqueous solution of sodium hydroxide, gave 840 mL of a gas under standard conditions. Thus, aluminium content in the mixture is
a) 3.225 g b) 0.675 g c) 1.35 g d) 2.70 g

293. The normality and volume strength of a solution made by mixing 1.0 L each of 5.6 vol and 11.2 vol H_2O_2 solution are
a) 1 N, 5.6 vol b) 1.5 N, 5.6 vol c) 1.5 N, 8.4 vol d) 1 N, 8.4 vol

294. Select the correct statement
a) Prussian blue and Turnbull's blue are identical in structure
b) NH_4Cl decreases ionization of NH_4OH by common ion effect so as to precipitate only Al^{3+}, Cr^{3+} and Fe^{3+} as hydroxides
c) Both (a) and (b) are correct
d) None of the above is correct

295. 600 mL of ozonised oxygen at STP were found to weigh one gram. What is the volume of ozone in the ozonised oxygen?
a) 200 mL b) 150 mL c) 100 mL d) 50 mL

296. 1 g of X% H_2O_2required x mL of $KKMnO_4$ solution in acidic medium.Thus, molarity of $KMnO_4$ solution is
a) 0.12 M b) 0.60 M c) 0.024 M d) None of correct

297. The weight of 112 mL of oxygen at NTP is
a) 0.64 g b) 0.96 g c) 0.32 g d) 0.16 g

298. One mole of the salt $NaHC_2O_4.H_2C_2O_4$contains
a) 3 equivalents of H^+ and 4 equivalents of $C_2O_4^{2-}$
b) 1 equivalent each of $H^+$and $C_2O_4^{2-}$
c) 3 equivalents of $H^+$and 2 equivalents of $C_2O_4^{2-}$
d) None of the above is correct

299. A balloon blown up has a volume of 300 mL at 27°C. The balloon is distended to 5/6 of its maximum stretching capacity. The maximum temperature above which it will burst is
a) 77°C b) 67°C c) 57°C d) 87°C

300. Given, that the abundances of isotopes $_{54}Fe$, $_{56}Fe$ and $_{57}Fe$ are 5%, 90% and 5%, respectively, the atomic mass of Fe is
a) 55.85 b) 55.95 c) 55.75 d) 56.05
301. If 100 mL of acidified $2N - H_2O_2$ is allowed to react with $KMnO_4$ solution till there is a light tinge of purple colour, the volume of oxygen produced at STP is
a) 2.24 L b) 1.12 L c) 3.36 L d) 4.48 L
302. The nucleus of an atom consists of
a) Neutron b) Proton c) Electron d) Both (a) and (b)
303. 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
a) 40 mL b) 20 mL c) 10 mL d) 4 mL
304. Select the correct statement (s)
a) $[Cu(CN)_4]^{3-}$ is more stable than $[Cd(CN)_4]^{3-}$
b) If H_2S gas is passed into the aqueous solution of mixture of $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{3-}$, formation of yellow ppt indicates presence of Cd^{2+}
c) HgI_2 and BiI_3 both dissolve in excess of KI forming soluble HgI_4^{2-} and BiI_4^-
d) All of the above are correct statements
305. Iodate ion, IO_3^-, oxidizes SO_3^{2-} to SO_4^{2-} in acidic medium. If 100 mL sample of solution containing 2.14 g of KIO_3 reacts with 60 mL of 0.5 M Na_2SO_3 solution, then final oxidation state of iodine is
a) +5 b) +3 c) +1 d) −1
306. 0.5 mole of $BaCl_2$ is mixed with 0.2 mole of $(NH_4)_3PO_4$. Maximum number of moles of barium phosphate formed in this reaction is
a) 0.1 b) 0.2 c) 0.3 d) 0.5
307. Iodometric method can be used to estimate
a) $MnO_2, Cr_2O_7^{2-}, H_2O_2, CuSO_4$ b) $CaOCl_2, MnO_2, CuSO_4, Cl_2$
c) $Cr_2O_7^{2-}, CaOCl_2, H_2O_2$ d) All the above are correct sets
308. 1000 g $CaCO_3$ solution contains 10 g carbonate. The concentration of solution as carbonate is
a) 10 ppm b) 100 pm c) 1000 ppm d) 10000 ppm
309. Consider the following pairs,
I. CH_4, C_2H_6
II. CO, CO_2
III. NO, NO_2
IV. H_2O, H_2O_2
In which cases, law of multiple proportion is followed?
a) I, II b) I, II, III c) I, III, IV d) I, II, III, IV
310. $2KClO_3 \rightarrow 2KCl + 3O_2$. 5.0 g of $KClO_3$ gave 0.03 mole of O_2. Hence, percentage purity of $KClO_3$ is
a) 49% b) 50% c) 95% d) 98%
311. I^- reduces HNO_2 to
a) N_2 b) NO c) N_2O d) NO_2
312. Radius of water molecule is (assuming it spherical)
a) 19.27 nm b) 19.27 Å c) 192.7 pm d) 19.27 μm
313. When microcosmic salt is heated, transparent bead is of
a) $NaPO_3$ b) $Na(NH_4)HPO_4$ c) $NaBO_2$ d) B_2O_3
314. $BaCO_3 + CH_3COOH \rightarrow A \xrightarrow{Cr_2O_7^{2-} + OH^-} B$, B
a) $BaCr_2O_7$ b) $BaCrO_4$ c) $BaCrO_3$ d) $Ba_2Cr_2O_4$
315. Which pair has same percentage of carbon?
a) CH_3COOH and $C_6H_{12}O_6$ b) CH_3COOH and $C_{12}H_{22}O_{11}$

c) CH_3COOH and C_2H_5OH d) $C_6H_{12}O_6$ and $C_{12}H_{22}O_{11}$

316. Microcosmic salt and borax are used in the identification of cations by dry tests. They are respectively
a) $NaBO_2$ and $NaPO_3$ b) $NaNH_4HPO_4 \cdot 4H_2O$ and $Na_2B_4O_7 \cdot 10H_2O$
c) $NaPO_3$ and $NaBO_2$ d) $Na_2B_4O_7$ and $NaNH_4HPO_4$

317. Sodium combines with $^{35}_{17}Cl$ and $^{37}_{17}Cl$ to give two samples of sodium chloride. Their formation follows the law of
a) Gaseous diffusion b) Conservation of mass
c) Reciprocal proportion d) None of these

318. Silver metal reacts with chlorine (Cl_2) to yield silver chloride. If 2.00 g of Ag react with 0.657 g of Cl_2, empirical formula of silver chloride is
a) $AgCl_2$ b) Ag_2Cl c) $AgCl$ d) $AgCl_3$

319. After 20 ml of 0.1 M $Ba(OH)_2$ is mixed with 10 mL of 0.2 M $HClO_4$, the concentration of $\overset{\ominus}{OH}$ ions is
a) 2×10^{-3} M
b) 10^{-3}M
c) 0.066 M
d) $\overset{\ominus}{OH}$ ions are completely neutralized

320. In the standardization of Na_2SO_3 using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is
a) $\frac{Mw}{2}$ b) $\frac{Mw}{6}$
c) $\frac{Mw}{3}$ d) Same as the molecular weight

321. Water gas consisting of equal volumes of CO and H_2 is produced when water vapour is passed over red hot coal. Volume of water gas produced under standard state when 3.0 kg of coal is treated for water gas is
a) 5.6×10^2 L b) 11.2×10^3 L c) 2.8×10^2 L d) 22.4×10^3 L

322. If the equivalent weight of an element is 32, then the percentage of oxygen in its oxide is
a) 16 b) 40 c) 32 d) 20

323. KI reacts with H_2SO_4 producing I_2 and H_2S. The volume of 0.2 M H_2SO_4 required to produce 0.1 mol of H_2S is
a) 4 L b) 2.5 L c) 3.8 L d) 5 L

324. In which mode of expression, the concentration of a solution remains independent of temperature?
a) Molarity b) Normality c) Formality d) Molality

325. 25.0 g of $FeSO_4 \cdot 7H_2O$ was dissolved in water containing dilute H_2SO_4, and the volume was made up to 1.0 L. 25.0 mL of this solution required 20 mL of an N/10 $KMnO_4$ solution for complete oxidation. The percentage of $FeSO_4 \cdot 7H_2O$ in the acid solution is
a) 78% b) 98% c) 89% d) 79%

326. Water soluble mixture $\xrightarrow[\text{(ii) Filter}]{\text{(i) } BaCl_2}$ White ppt.
Filtrate + Br_2 water + $BaCl_2$ → White ppt. Mixture contains
a) SO_3^{2-} only b) SO_4^{2-} only c) Both (a) and (b) d) None of these

327. 10 g of MnO_2 on reaction with conc HCl liberated 0.1 equivalent of Cl_2 (Mn = 55). Hence, per cent purity of MnO_2 is
a) 87.0 b) 21.75 c) 50.0 d) 43.5

328. Assuming fully decomposed, the volume of CO_2 released at STP on heating 9.85 g of $BaCO_3$ (Atomic mass, Ba = 137) will be
a) 1.12 L b) 0.84 L c) 2.24 L d) 4.06 L

329. A gaseous mixture contains oxygen and nitrogen in the ratio of 1:4 by weight. Therefore, the ratio of their number of molecules is

a) 1:4 b) 1:8 c) 7:32 d) 3:16

330. An aqueous solution of 6.3 g oxalic acid dihydrate is made upto 250 mL.The volume of 0.1 N NaOH required to completely neutralize 10 mL of this solution is

a) 40 mL b) 20 mL c) 10 mL d) 50 mL

331. 100 mL of mixture of NaOH and Na_2SO_4 is neutralized by 10 mL of 0.5 M H_2SO_4. Hence, NaOH in 100 mL solution is

a) 0.2 g b) 0.4 g c) 0.6 g d) None

332. Mole fraction of glucose in aqueous solution is 0.5. Hence, molality of glucose solution is

a) 55.55 b) 1.0 c) 0.055 d) 90.0

333. 0.848 g aqueous solution of a mixture containing Na_2CO_3, NaOH, and an inert matter is titrated with M/2 HCl. The colour of phenolphthalein disappears when 20 mL of the acid has been added. Methyl orange is then added and 0.8 mL more of the acid is required to give a red colour to the solution. The percentage of Na_2CO_3 is

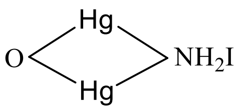
a) 25 b) 12.5 c) 75 d) 50

334. 10 L of hard water required 0.56 g of lime (CaO) for removing hardness. Hence, temporary hardness in ppm (part per million 10^6) of $CaCO_3$ is:

a) 100 b) 200 c) 10 d) 20

335. $HgCl_2$ + excess of KI → $(A) \xrightarrow{NH_3/NaOH} (B)$. (A) and (B) respectively are

a) K_2HgI_4 (Nesser's reagent),
(A)



(Iodide of Millon's base)
(B)

b) (B), (A)
c) Both (A)
d) Both (B)

336. 2.86 g of $Na_2CO_3.xH_2O$ in 100 mLsolution is 0.2 N. Hence, x is

a) 5 b) 10 c) 20 d) 2

337. $[X] + H_2SO_4 \rightarrow [Y]$ a colourless gas with irritating smell
$[Y] + K_2Cr_2O_7 + H_2SO_4 \rightarrow$ green solution $[X]$ and $[Y]$ aree

a) SO_3^{2-}, SO_2 b) Cl^-, HCl c) S^{2-}, H_2S d) CO_3^{2-}, CO_2

338. Titration of a 0.7439 g sample of impure $Na_2B_4O_7$ (borax) required 31.64 mL of 0.108 M HClfor reaction. In terms of B_2O_3percentage is
$B_4O_7^{2-} + 2H_3O^+ + 3H_2O \rightarrow 4H_3BO_3$

a) 46.39% b) 87.73% c) 32.15% d) 10.11%

339. A mixture of formic acid and oxalic acid is heated with cone H_2SO_4. The gas produced is collected and treated with KOH solution, whereby the volume decreases by 1/6th. The molar ratio of the two acids (formic acid/oxalic acid) is

a) 4:1 b) 1:4 c) 2:1 d) 1:2

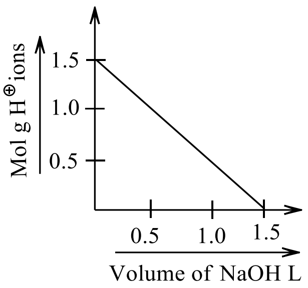
340. Sulphuryl chloride SO_2Cl_2 reacts with water to give a mixture of $H_2SO_4$and HCl. Moles of NaOHrequired to neutralize the solution formed by adding 1 mol of SO_2Cl_2 to excess water is are

a) 1 b) 2 c) 3 d) 4

341. The normality of 0.3 M phosphorous acid (H_3PO_3) is

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

342. A bivalent metal has 37.2 equivalent weight. The molecular weight of its chloride is
a) 216.6 b) 148.8 c) 145.4 d) 172.8
343. If CO_2 gas is passed into aq Na_2CrO_4 yellow solution
a) aq $Na_2Cr_2O_7$ (orange) solution is formed b) aq $Cr_2(CO_3)_2$ is formed
c) $Cr(OH)_3$ is precipitated d) No action
344. RH_2 (ion exchange resin) can replace Ca^{2+} in hard water
$RH_2 + Ca^{2+} \longrightarrow RCa + 2H^{\oplus}$
1 L of hard water after passing through RH_2 has pH=2. Hence, hardness in ppm of Ca^{2+} is
a) 200 b) 100 c) 50 d) 125
345. The percentage of chlorine in $KClO_2$ is
a) 15.5 b) 33.3 c) 17.7 d) 47.7
346. Fe^{3+} gives different colour with
a) CNS^- b) $[Fe(CN)_6]^{4-}$ c) CH_3COO^- d) All of these
347. A student performs a titration with different burettes and finds titre values of 25.2 mL, 25.25 mL, and 25.0mL. The number of significant figures in the average titre value is
a) 1 b) 2 c) 3 d) 4
348. In the reaction
$CrO_5 + H_2SO_4 \rightarrow Cr_2(SO_4)_3 + H_2O + O_2$
1 mol of CrO_5 will liberate how many moles of O_2?
a) $\frac{5}{2}$ b) $\frac{5}{4}$ c) $\frac{9}{2}$ d) None of these
349. Ammonia in 0.224 g of a compound $Zn(NH_3)_x Cl_2$ is neutralised by 30.7 mL of 0.20 M HCl. The value of x in the formula is
a) 4 b) 5 c) 6 d) 8
350. The decomposition of a certain mass of $CaCO_3$ gave 11.2 dm^3 of CO_2 gas as STP. The mass of KOH required to completely neutralise the gas is
a) 56 g b) 28 g c) 42 g d) 20 g
351. If we assume that $N_0 = 1.2 \times 10^{23} mol^{-1}$, then molar mass of O_2 will be taken as
a) 32 g mol^{-1} b) $\frac{32}{6} \text{ g mol}^{-1}$ c) $32 \times 10^{23} \text{ g mol}^{-1}$ d) $\frac{1 \times 10^{23}}{32} \text{ g mol}^{-1}$
352. The molarity (conc. In mol L^{-1}) of H_2SO_4 solution, which has a density 1.84 g/cc at 35°C and contains 98% by weight is
a) 1.84 M b) 18.4 M c) 20.6 M d) 24.5 M
353. The normality of solution obtained by mixing 10 mL of N/5 HCl and 30 mL of N/10 HClis
a) 0.067 N b) 0.2 N c) 0.133 N d) 0.125 N
354. What would you observe if you add with shaking excess dil. NaOH solution to $ZnCl_2$ solution?
a) A white ppt b) A white ppt which later dissolves
c) A green ppt d) A green ppt which later dissolves
355. Hardness of water is measured in terms of ppm (parts per million) of $CaCO_3$.It is the amount (in g) of $CaCO_3$ present in 10^6 g H_2O. In a sample of water, 10 L required 0.56 g of CaO to remove temporary hardness of $HCO_3^- Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$ Temporary hardness is
a) 200 ppm $CaCO_3$ b) 100 ppm $CaCO_3$ c) 50 ppm $CaCO_3$ d) 25 ppm $CaCO_3$
356. To 1 L of 1.0 M impure H_2SO_4 sample, 1.0 M NaOH solution was added and a plot was obtained as follows:



The % purity of H_2SO_4 and the slope of curve, respectively, are:

a) 75%, −1/2 b) 75%, −1 c) 50%, − 1/3 d) 50%, −1/2

357. The *Ew* of an element is 13. It forms an acidic oxide which with KOH forms a salt isomorphous with K_2SO_4. The atomic weight of element is

a) 13 b) 26 c) 52 d) 78

358. $NaHC_2O_4$ is 0.1 M when neutralized with NaOH.Hence, it is -------- when oxidized with MnO_4^-/H^+

a) 0.1 N b) 0.2 N c) 0.05 N d) 0.15 N

359. 0.106 g of Na_2CO_3 completely neutralizes 40.0 mL of H_2SO_4.Hence, normality of H_2SO_4solution is

a) 0.05 N b) 0.025 N c) 0.10 N d) 0.20 N

360. In diammonium phosphate $(NH_4)_2HPO_4$, the percentage of P_2O_5 is

a) 35.87 b) 46.44 c) 51.99 d) 53.78

361. When 1×10^{-3} mol of the chloride of an element Y was completely hydrolysed, it was found that the resulting solution required 20 mL of 0.1 M aqueous silver nitrate for complete precipitation of the chloride ion. Element Y could be

a) Aluminium b) Phosphorus c) Silicon d) Sulphur

362. The number of moles of oxygen present in one litre of air under STP conditions (it contains 21% oxygen) is

a) 0.246 mol b) 0.07438 mol c) 2.0078 mol d) 0.0094 mol

363. Number of atoms in increasing order in 1.6 g CH_4, 1.7 g NH_3 and 1.8 g H_2O is

a) $H_2O = NH_3 = CH_4$ b) $H_2O < NH_3 < CH_4$ c) $CH_4 < NH_3 < H_2O$ d) $CH_4 = NH_3 < H_2O$

364. The weight of 1×10^{22} molecules of $CuSO_4 \cdot 5H_2O$ is

a) 4.14 g b) 5.14 g c) 6.14 g d) 7.14 g

365. If 10 g of V_2O_5 is dissolved in acid and is reduced to V^{2+} by zinc metal, how many moles of I_2 could be reduced by the resulting solution if it is further oxidized to VO^{2+} ions? (Atomic mass of V is 51 g mol^{-1})

a) 0.11 mol of I_2 b) 0.22 mol of I_2 c) 0.055 mol of I_2 d) 0.44 mol of I_2

366. Percentage of nitrogen can be determined by volumetric technique and the method is called

a) Duma's method b) Kjeldahl's method c) Hofmann's method d) Victor's method

367. A 5.0 mL solution of H_2O_2 liberates 1.27 g of iodine from an acidified KI solution, the strength of H_2O_2 in terms of volume strength is

a) 11.2
b) 5.6
c) 1.7
d) 3.4

368. $Ag_2CrO_4 + H^+NO_3^- \rightarrow$ Soluble A, A is

a) Ag_2CrO_4 b) $AgNO_3$ c) $Ag_2Cr_2O_7$ d) Ag_2O

369. $Cu(OH)_2$ is highly soluble in all of the following except one. The exception is

a) H_2O b) $NH_3(aq)$ c) $HCl(aq)$ d) $HNO_3(aq)$

370. The hydrogen phosphate of certain metal has $MHPO_4$ formula. The formula of metal chloride is

a) MCl b) M_2Cl c) MCl_3 d) MCl_2

371. A mixture of $Na_2C_2O_4(A)$and $KHC_2O_4 . H_2C_2O_4(B)$ required equal volumes of 0.1 M $KMnO_4$ and 0.1 M NaOH separated. Molar ratio of A and B in the mixture is

a) 1 : 1 b) 1 : 5.5 c) 5.5 : 1 d) 3.1 : 1

372. SO_2 can

a) Decolourise MnO_4^-/H^+ solution
b) Turn $Cr_2O_7^{2-}/H^+$ solution green
c) Both (a) and (b) are correct
d) None of the above is correct

373. A 20.0 mL solution of Na_2CO_3required 30 mL of 0.01 M $K_2Cr_2O_7$ solution for the oxidation to Na_2SO_4.Hence, molarity of Na_2SO_3solution is

a) 0.015 M b) 0.045 M c) 0.030 M d) 0.0225 M

374. Four test tubes containing dil. HCl, $BaCl_2$, $CdCl_2$ and KNO_3 solution. Which of the following will identify $BaCl_2$?

a) Dil. H_2SO_4 b) K_2CrO_4 c) $FeSO_4/H_2SO_4$ d) $AgNO_3$

375. 5.3 g of M_2CO_3 is dissolved in 150 mL of 1 N HCl.Unused acid required 100 mL of 0.5 N NaOH.Hence, equivalent weight of M is

a) 23 b) 12 c) 24 d) 13

376. 0.45 g of an acid of molecular weight 90 was neutralized by 20 mL of a 0.5 N caustic potash. The basicity of an acid is

a) 1 b) 2 c) 3 d) 4

377. 10 mLof a blood sample (containing calcium oxalate) is dissolved in acid. It required 20 mLof 0.001 M $KMnO_4$(which oxidizes oxalate to carbon dioxide) hence, Ca^{2+} ion in 10 mLblood is

a) 0.200 g b) 0.02 g c) 2.00 g d) 0.002 g

378. Nine volumes of gaseous mixture consisting of gaseous organic compound A and just sufficient amount of oxygen required for complete combustion yielded on burning 4 volumes of CO_2, 6 volumes of water vapours, and 2 volumes of N_2, at all volumes measured at the same temperature and pressure. If the compounds contains C, H, and N only, the molecular formula of compound A is

a) $C_2H_3N_2$ b) $C_2H_6N_2$ c) $C_3H_6N_2$ d) C_3H_6N

379. 0.6 g NH_2CONH_2 is treated with NaOH and NH_3 formed is passed into 300 mL of 0.1 N H_2SO_4.Unused acid is

a) 50 mL b) 25 mL c) 100 mL d) 150 mL

380. The mass of $K_2Cr_2O_7$ required to produce 5.0 L CO_2 at 77°C and 0.82 atm pressure from excess of oxalic acid and volume of 0.1 N NaOH required to neutralize the CO_2 evolved, respectively, are

a) 7 g, 2.86 L b) 5 g, 1.86 L c) 4 g, 0.86 L d) None

381. In a gas S and O are 50% by mass, hence, their mole ratio is

a) 1 : 1 b) 1 : 2 c) 2 : 1 d) 3 : 1

382. A 4:1 molar mixture of He and CH_4 is contained in vessel at 20 bar pressure. Due to a hole in the vessel the gas mixture leakes out. What is the composition of mixture effusing out initially

a) 33.3% He, 66.7% CH_4 b) 66.7% He, 33.3% CH_4 c) 40% He, 60% CH_4 d) 60% He, 40% CH_4

383. ${}^{35}_{17}Cl$ and ${}^{37}_{17}Cl$ are two isotopes of chlorine. If average atomic mass is 35.5 then ration of these two isotopes is

a) 35 : 37 b) 1 : 3 c) 3 : 1 d) 2 : 1

384. 1 mole BaF_2 is treated with 2 moles of H_2SO_4.To make the resulting mixture neutral, NaOH is added. NaOH required in this process is

a) 4 mol NaOH b) 2 mol NaOH c) 3 mol NaOH d) 1 mol NaOH

385. A certain compound has the molecular formula X_4O_6. If 10 g of X_4O_6 has 5.72 g X, the atomic mass of X is

a) 32 amu b) 37 amu c) 42 amu d) 98 amu

386. Select the correct statement(s)

a) $Ag_2S_2O_3$ appears as white precipitate when $Na_2S_2O_3$ reacts with $AgNO_3$

b) $Ag_2S_2O_3$ is unstable turning black on standing due to formation of Ag_2S
c) $S_2O_3^{2-}$ can form soluble complex $[Ag(S_2O_3)_2]^{3-}$ with Ag^+
d) All of the above are correct statements

387. M^{2+} ion is isoelectronic of SO_2 and has $(Z + 2)$ neutrons (Z is atomic number of M) Thus, ionic mass of M^{2+} is
a) 70 b) 66 c) 68 d) 64

388. 10 g of $CaCO_3$ contains
a) 10 moles of $CaCO_3$
b) 0.1 g atom of Ca
c) 6×10^{23} atoms of Ca
d) 0.1 of equivalent of Ca

389. Turnbull's blue and Prussian's blue respectively are
I. $Fe^{II}[Fe^{II}(CN)_6]^{2-}$ II. $Fe^{III}[Fe^{III}(CN)_6]$
III. $Fe^{II}[Fe^{III}(CN)_6]^-$ IV. $Fe^{III}[Fe^{II}(CN)_6]^-$
a) I, II b) I, III c) III, IV d) IV, III

390. A compound with molecular mass 180 is acylated with CH_3COCl to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is
a) 2 b) 5 c) 4 d) 6

391. 0.31 g of N-containing compound on reaction with NaOH gave NH_3 which required 100 mL of 0.1 N HCl.Hence, % of N is
a) 45.16% b) 90.32% c) 22.58% d) 11.29%

392. An aqueous solution of NaCl is 5.85%. The volume in which 1 mole of it is dissolved will be
a) 1 L b) 10 L c) 5.85 L d) 58.5 L

393. How many moles of magnesium phosphate, $Mg_2(PO_4)_2$ will contain 0.25 mole of oxygen atoms?
a) 0.02 b) 3.125×10^{-2} c) 1.25×10^{-2} d) 2.5×10^{-2}

394. Which is the volatile compound burning with green flame?
a) $(C_2H_5)_3B$ b) $(C_2H_5)_3BO_3$ c) $Ba(NO_3)_2$ d) $BaCl_2$

395. In an experiment, 20 mL of 0.1 M solution of a metallic salt reacted exactly with 25 mL of 0.1 M solution of sodium sulphite. In the reaction, SO_3^{2-} is oxidised to SO_4^{2-}. If the original oxidation number of the metal in the salt was 3, what would be the new oxidation number of the metal?
a) 0 b) 1 c) 2 d) 4

396. A boy drinks 500 L of 9% glucose solution. The number of glucose molecules he has consumed is [mol. Wt. of glucose = 180]
a) 0.5×10^{23} b) 1.0×10^{23} c) 1.5×10^{23} d) 2.0×10^{23}

397. Atomic weight of barium is 137.34. The equivalent weight of barium in $BaCrO_4$ used as an oxidizing agent in acid medium is
a) 137.34 b) 45.78 c) 114.45 d) 68.67

398. A solution when diluted with H_2O and boiled, gives a white precipitate. On addition of excess NH_4Cl/NH_4OH, the volume of precipitate decreases leaving behind a white gelatinous precipitate. Identify the precipitate which dissolves in NH_4OH/NH_4Cl
a) $Zn(OH)_2$ b) $Al(OH)_3$ c) $Mg(OH)_2$ d) $Ca(OH)_2$

399. How many grams of phosphoric acid would be needed to neutralise 100 g of magnesium hydroxide? (The molecular weights are: $H_3PO_4 = 98$ and $Mg(OH)_2 = 58.3$)
a) 66.7 g b) 252 g c) 112 g d) 168 g

400. Dissolving 120 g of urea (60 g mol^{-1}) in 1000 g of water gave a solution of density 1.15 g/mL.The molarity of solution is
a) 1.78 M b) 2.00 M c) 2.05 M d) 2.22 M

401. $\underset{\text{orange}}{Cr_2O_7^{2-}} \underset{pH = y}{\overset{pH = x}{\rightleftharpoons}} \underset{\text{green}}{CrO_4^{2-}}$. This change is based on change in pH. Probable values of x and y can be

a) 8, 6 b) 8, 10
c) 4, 6 d) Change is independent of pH

402. 2 L of air formed 1915 mL of ozonised air when passed through Brodio's apparatus. The volume of ozone formed is

a) 85 mL b) 170 mL c) 225 mL d) 42.5 mL

403. Aqueous solution contains $ZnCl_2, CdCl_2$ and $CuCl_2$. On passing H_2S gas, there is precipitation of.... as sulphide

a) Zn^{2+}, Cd^{2+} b) Cu^{2+}, Cd^{2+} c) Zn^{2+}, Cu^{2+} d) $Zn^{2+}, Cu^{2+}, Cd^{2+}$

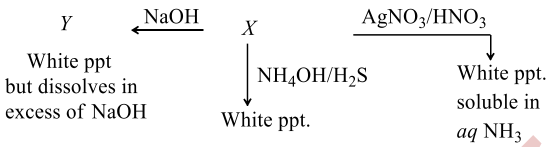
404. In a reaction, 4 mol of electrons are transferred to 1 mol of HNO_3.The possible product obtained due to reduction is

a) 0.5 mol of N_2 b) 0.5 mol of N_2O c) 1 mol of NO_2 d) 1 mol of NH_3

405. H_3PO_4 ($d = 1.8$ g/mL) is 18 M. Hence, mass percentage and molality are

a) 18, 32.4 b) 98, 32.4 c) 98, 500 d) 98, 18

406. 'X' is a colourless salt giving following reaction



a) $AlCl_3$ b) $ZnCl_2$ c) $Zn(CH_3COO)_2$ d) $ZnBr_2$

407. Which cation cannot be identified by flame test?

a) Na^+ b) K^+ c) Ba^{2+} d) Mg^{2+}

408. 4 mol of a solution containing A^{n+} requires 1.6 mol of $MnO_4^{\ominus}$ for the oxidation of A^{n+} to $AO_3^{\ominus}$is acidic medium. The value of$n$ is

a) 1 b) 2 c) 3 d) 4

409. A bag contains 0.32 g of oxygen. The same volume of an unknown gas A under similar conditions of temperature and pressure weight 0.26 g. The gas A is known to contain only C and H in 1:1 ratio. The molecular formula of the compound is

a) C_2H_2 b) C_4H_4 c) C_3H_4 d) CH

410. $Fe(OH)_3$ and $Cr(OH)_3$ ppt are separated by

a) *aq* NH_3 b) HCl
c) $NaOH/H_2O_2$ d) H_2SO_4

411. For complete reaction in
$3Ba(NO_3)_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaNO_3$
2 moles each of $Ba(NO_3)_2$ and Na_3PO_4 form $Ba_3(PO_4)_2$
which reactant is further required?

a) 1 mol $Ba(NO_3)_2$
b) 1 mol Na_3PO_4
c) 2 mol $Ba(NO_3)_2$
d) 2 mol Na_3PO_4

412. 10 L of hard water with temporary hardness [of $Ca(HCO_3)_2$] required 0.56 g of lime
$Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$
Temporary hardness in terms of ppm of $CaCO_3$ is

a) 56 b) 1/2 c) 100 d) 200

413. Atoms of the element X are spherical. Each atom of the element (atomic mass 23) is at the corner of the cube and is in contact along the edge length, then edge length is (density = 6.2 g cm^{-3})
a) 2.274 Å b) 1.137 Å c) 4.548 Å d) 1.183 Å
414. Which is not soluble in CH_3COOH?
a) CaC_2O_4 b) $Na_2C_2O_4$ c) $K_2C_2O_4$ d) $CaCO_3$
415. When 0.273 g of Mg is heated strongly in a nitrogen (N_2) atmosphere, 0.378 g of the compound is formed. Hence, compound formed is
a) Mg_3N_2 b) Mg_3N c) Mg_2N_3 d) MgN
416. In hot alkaline solution, Br_2 disproportionate to Br^- and BrO_3^-
$3Br_2 + 6OH^- \rightarrow 5Br^- + BrO_3^- + 3H_2O$
Hence, equivalent weight of Br_2 is (molecular weight = M)
a) $\frac{M}{6}$ b) $\frac{M}{5}$ c) $\frac{3M}{5}$ d) $\frac{5M}{3}$
417. When a mixture consisting of 10 moles of SO_2 and 15 moles of O_2 was passed over a catalyst, 8 moles of SO_3 were formed. Thus, percentage yield ofSO_3wrt SO_2 is
a) 80% b) 100% c) 50% d) 25%
418. Reactant present in excess (with extra number of moles of that reactant) in question (34) above is
a) $BaCl_2$, 0.3 mol b) $(NH_4)_3PO_4$, 0.2 mol
c) $(NH_4)_3PO_4$, 0.1 mol d) $BaCl_2$, 0.2 mol
419. Number of moles of $KMnO_4$ required to oxidize 1 L of 1 M iron (II) sulphate (IV) in acidic medium is
a) 1.0 b) 0.8 c) 0.2 d) 0.6
420. How many 'mL' of perhydrol is required to produce sufficient oxygen which can be used to completely convert 2 L of SO_2 gas to SO_3 gas?
a) 10 mL b) 5 mL c) 20 mL d) 30 mL
421. One mole of N_2H_4 losses 10 mol of electrons to form a new compound A. Assuming that all nitrogen appears in the new compound, what is the oxidation state of nitrogen in A? There is no change in the oxidation state of hydrogen
a) +1 b) −3 c) +3 d) +5
422. An orange colour mixture changes to green on acidification. Mixture may contain
a) HgI_2, CrO_4^{2-} b) $Fe^{2+}, Cr_2O_7^{2-}$ c) SO_3^{2-}, MnO_4^- d) Fe^{2+}, CrO_4^{2-}
423. Ionic mass of X^{3-} is 17. If it has 10 electrons, then number of neutrons are
a) 10 b) 13 c) 7 d) 17
424. A sample of ammonium dihydrogen phosphate (I) contains 3.18 moles of hydrogen atom. The number of moles of oxygen atoms in the sample is
a) 0.265 b) 0.795 c) 1.06 d) 3.18
425. 1.575 g of a dibasic acid is neutralized by 25 mL of 1 M NaOH solution. Hence, molar mass of dibasic acid is
a) 126 g mol^{-1} b) 63 g mol^{-1} c) 12.6 g mol^{-1} d) None of these
426. 0.6 g of urea (N_2H_4CO) on reaction with NaOH gave NH_3 which can be neutralized by
a) 100 mL of 0.1 N HCl b) 200 mL of 0.2 N HCl
c) 100 mL of 0.2 N HCl d) 100 mL of 0.1 N H_2SO_4
427. In the following reaction,
$2H_2S + SO_2 \rightarrow 2H_2O + 3S$
1 moles each of SO_2 and H_2S will give sulphur
a) 1 mol b) 3 mol c) 1.5 mol d) 2 mol
428. Moles of KHC_2O_4 (potassium acid oxalate) required to reduce 100 mL of 0.02 M $KMnO_4$ in acidic medium (to Mn^{2+}) is
a) 0.002 b) 0.005 c) 0.001 d) 0.007
429. Aqueous solution of $BaBr_2$ gives yellow ppt with

a) K_2CrO_4 b) $AgNO_3$ c) Both (a) and (b) d) None of these

430. When calomel reacts with NH_4OH, we get
a) $Hg(NH_2)Cl + Hg$ b) $NH_2 - Hg - Hg - Cl$
c) Hg_2O d) HgO

431. A 5.0 mL solution of H_2O_2 liberates 1.27 g of iodine from an acidified KI solution. The percentage strength of H_2O_2 is
a) 11.2 b) 5.6 c) 1.7 d) 3.4

432. A certain sample of phosphate rock contains 26.26% P_2O_5. A 0.5428 g sample is analysed by precipitating $MgNH_4PO_4 .6H_2O$ and igniting the precipitate to $Mg_2P_2O_7$ Thus, $Mg_2P_2O_7$ obtained is
a) 0.8486 g b) 0.1424 g c) 0.3648 g d) 0.2228 g

433. $CoCl_2$ gives blue colour with NH_4SCN in ethereal layer due to formation of
a) $(NH_4)_2[Co(SCN)_4]$ b) $(NH_4)_4[Co(SCN)_6]$
c) $(NH_4)_3[Co(SCN)_6]$ d) $(NH_4)[Co(SCN)_4]$

434. 1 g of the carbonate of a metal was dissolved in 25 mL of N-HCl. The resulting liquid required 5 mL of N-NaOH for neutralisation. The *Ew* of the metal carbonate is
a) 50 b) 30 c) 20 d) None

435. 5 g of CH_3COOH is dissolved in 1 L of ethanol. Suppose there is no reaction between them. If the density of ethanol is 0.789 g/mL then the molality of resulting solution is
a) 0.0256 b) 0.1056 c) 0.1288 d) 0.1476

436. What will be the volume of a 12 M solution if it is equivalent to 240 mL 18 M solution?
a) 6 L b) 600 L c) 400 L d) 0.36 L

437. Consider the following equilibrium
$AgCl \downarrow 2NH_3 \rightleftharpoons [Ag(NH_3)_2]^+ + Cl^-$
White ppt of AgCl appears on adding
a) NH_3 b) *aq* NaCl c) *aq* HNO_3 d) *aq* NH_4Cl

438. In an experiment, 6.67 g of $AlCl_3$ was produced and 0.54 g Al remained unreacted. How many g atoms of Al and Cl_2 were taken originally $(Al = 27, Cl = 35.5)$?
a) 0.07, 0.15 b) 0.07, 0.05 c) 0.02, 0.05 d) 0.02, 0.15

439. The density of 1 M solution of NaCl is 1.0585 g ml^{-1}. The molality of the solution is
a) 1.0585 b) 1.00 c) 0.10 d) 0.0585

440. 2 mol of N_2 and 3 mol H_2 gas are allowed to react in a 20 L flask at 400 K and after complete conversion of H_2 into NH_3, 10 L H_2O was added and temperature reduced to 300 K. pressure of the gas after reaction
$N_2 + 3H_2 \rightarrow 2NH_3$
a) $3R \times \frac{300}{20}$ b) $3R \times \frac{300}{10}$ c) $R \times \frac{300}{20}$ d) $R \times \frac{300}{10}$

441. Reagent that can detect presence of NH_3 is called
a) Fehling's solution b) Nessler's reagent
c) Benedict's solution d) Lucas reagent

442. Which of the following is the richest source of ammonia on a mass percentage basis?
a) NH_4NO_3 b) NH_2CONH_2 c) NH_4Cl d) $HNC(NH_2)_2$

443. Rest mass of an electron is 9.11×10^{-31}kg. Molar mass of the electron is
a) 1.50×10^{-31} kg mol^{-1} b) 9.11×10^{-31} kg mol^{-1}
c) 5.5×10^{-7} kg mol^{-1} d) 6.02×10^{23} kg mol^{-1}

444. Yellow coloured solution of $FeCl_3$ changes to light green when
a) $SnCl_2$ is added b) Zn is added c) H_2S gas is passed d) All true

445. NaOH can be prepared by two methods each with two steps having 100% extent
I. $2N + 2H_2O \rightarrow 2NaOH + H_2$
$2H_2 + O_2 \rightarrow 2H_2O$

II. $2Na + \frac{1}{2}O_2 \rightarrow Na_2O$

$Na_2O + H_2O \rightarrow 2NaOH$

Which gives the better yield?

a) Only I b) Only II c) Both equal d) None is suitable

446. What mass of ammonium phosphate $(NH_4)_3PO_4$ would contain 14.0 g of nitrogen?

a) 50.0 g b) 25.0 g c) 12.5 g d) 100.0 g

447. 2 moles of 50% pure $Ca(HCO_3)_2$ on heating form 1 mole of CO_2. Thus, per cent yield of CO_2 is

$Ca(HCO_3)_2 \xrightarrow{\Delta} CaO + H_2O + 2CO_2$

a) 50% b) 75% c) 80% d) 100%

448. How many moles of oxygen are contained in one litre of air if its volume content is 21% in standard conditions?

a) 0.21 mol b) 0.045 mol c) 0.067 mol d) 0.0094 mol

449. With Cr_2O_3, colour of the bead in sodium carbonate-bead test is

a) Red b) Blue c) Yellow d) Green

450. Consider the following reaction,

Nitrite + acetic acid + thiourea $\rightarrow N_2 + SCN^- + 2H_2O$

Formation of the product in the above reaction can be identified by

a) $FeCl_3$/dil. HCl when blood red coloour appears b) $FeCl_3$/dil. HCl when blue colour appears

c) $K_2Cr_2O_7$/HCl when green colour appears d) $KMnO_4$/HCl when colourless solution is formed

451. Consider the following reaction :

$M^{x+} + MnO_4^{\ominus} \rightarrow MO_3^{\ominus} + Mn^{2+}$

If 1 mol of $MnO_4^{\ominus}$ oxidises 1.67 mol of M^{x+} to $MO_3^{\ominus}$, then the value of x in the reaction is

a) 2 b) 3 c) 4 d) 5

452. What volume of 0.1 M $Ca(OH)_2$ will be required to neutralize 200 mL of 0.2 M H_2SO_3 using methyl orange indicator to change the colour from red (acidic medium) to yellow (basic medium)?

a) 200 mL b) 400 mL c) 20 mL d) 40 mL

453. Certain mol of HCN is oxidized completely by 25 mL of $KMnO_4$. The products are CO_2 and $NO_3^{\ominus}$ ion. When all CO_2 is passed through lime water, 1 g of $CaCO_3$ is obtained. The molarity of the $KMnO_4$ used is

a) 1.44 M b) 0.72 M c) 0.36 M d) None of these

454. Nitrite (NO_2^-) interferes in the 'ring-test' of nitrate (NO_3^-). Some of the following reagents can be used for the removal of nitrite

I: NH_4Cl

II: $(NH_2)_2CS$ (thiourea)

III: NH_2SO_3H (sulphamic acid)

IV: Sulphanilic acid

Correct choice is

a) I, II b) I, II, IV c) I, II, III d) I, III, IV

455. An organic compound contains C, H, and O. If C(%): H(%) = 6:1, what is the simplest formula of the compound, given that one mole of the compound contains half as much oxygen as would be required to burn all the C and H atoms in it to CO_2 and H_2O?

a) CH_2O b) $C_2H_4O_3$ c) C_3H_6O d) $C_3H_6O_2$

456. S^{2-} and SO_3^{2-} can be distinguished using

a) $(CH_3COO)_2Pb$ b) $Na_2[Fe(CN)_5NO]$

c) Both (a) and (b) d) None of the above

457. An unknown amino acid has 0.032% sulphur. If each molecule has one S-atom, then 1 g of this amino acid has molecules

a) 6.02×10^{18} b) 6.02×10^{19} c) 6.02×10^{21} d) 6.02×10^{23}

458. A colourless salt changes to yellow on heating. Salt is also soluble in NaOH as well as in dil. HCl. Salt can be
a) FeO b) PbO c) ZnO d) CdO

459. 3 mol of a mixture of $FeSO_4$ and $Fe_2(SO_4)_3$ required 100 mL of 2 M $KMnO_4$ solution in acidic medium. Hence, mole fraction of $FeSO_4$ in the mixture is
a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{2}{5}$ d) $\frac{3}{5}$

460. 25 mL samples of distilled water, tap water, and boiled water required, respectively. 1 mL, 13 mL and 5 mL of soap solution to form a permanent lather. The ratio of temporary to permanent hardness in the tap water is
a) 3:2 b) 2:3 c) 1:2 d) 2:1

461. A certain metal sulphide, MS_2, is used extensively as a high temperature lubricant. If MS_2 is 40.06% by mass sulphur, metal M has atomic mass
a) 160 u b) 64 u c) 40 u d) 96 u

462. $Ca(OH)_2 + H_3PO_4 \rightarrow CaHPO_4 + 2H_2O$
The equivalent weight of H_3PO_4 in the above reaction is
a) 21 b) 27 c) 38 d) 49

463. Ag_2CrO_4 (brick red ppt) is soluble in
a) dil. HNO_3 or $aq.NH_3$ b) dil. HCl or $aq.NH_3$
c) dil. HNO_3 or dil. HCl d) H_2O or dil. HNO_3

464. Mole fraction of $CaCO_3$ in hard water having hardness 200 ppm $CaCO_3$ is
a) 0.1 b) 3.6×10^{-5} c) 27.78×10^{-3} d) 0.035

465. Sodium nitroprusside turns purple when it is exposed in the atmosphere of
a) CO b) H_2S c) SO_2 d) CO_2

466. Cationic part of chromyl chloride is
a) Cr^{3+} b) CrO_2^{+} c) CrO_2^{2+} d) CrO^{2+}

467. 50 mL of $FeSO_4 .7H_2O$solution required 20 mL of 0.1 M $Cr_2O_7^{2-}$ solution in acidic medium. Hence, $FeSO_4 .7H_2O$ is
a) 0.24 M b) 0.24 N c) 66.72 g L^{-1} d) All correct

468. $H_2SO_4$is 98% by weight of solution. Hence, it is
a) 1 molal b) 10 molal c) 50 molal d) 500 molal

469. If 30 mL of H_2 and 20 mL of O_2 react to form water, what is left at the end of the reaction?
a) 10 mL of H_2 b) 5 mL of H_2 c) 10 mL of O_2 d) 5 mL of O_2

470. 0.4 g polybasic acid HnA (all the hydrogens are acidic) requires 0.5 g of NaOH for complete neutralization. The number of replaceable hydrogen atoms and the molecular weight of 'A' would be (Mw of acid=96)
a) 2, 94 b) 1, 95 c) 3, 93 d) 4, 92

471. CoS (black) obtained in group IV of salt analysis is dissolved in aqua regia, treated with an excess of $NaHCO_3$ and then Br_2 water is added. An apple green coloured stable complex is formed. It is
a) Sodium cobaltocarbonate b) Sodium cobaltibromide
c) Sodium cobalticarbonate d) Sodium cobaltobromide

472. n-Butane (C_4H_{10}) is produced by monobromination of C_2H_6 followed by Wurtz reaction. Calculate the volume of ethane at STP required to produce 55 g of n-butane. The bromination takes place with 90% yield and the Wurtz reaction with 85% yield
a) 27.75 L b) 55.5 L c) 111 L d) 5.55 L

473. Moles of KHC_2O_4 (potassium acid oxalate) required to reduce 100 mL of 0.02 M $KMnO_4$ in acidic medium (to Mn^{2+}) is
a) 0.002 b) 0.005 c) 0.001 d) 0.007

474. Number of molecules in 1 L of water is close to

a) $\frac{18 \times 10^{23}}{22.4}$ b) $55.5 \times 6.023 \times 10^{23}$ c) $\frac{6.023 \times 10^{23}}{23.4}$ d) $18 \times 6.023 \times 10^{23}$

475. For the formation of 5.00 moles of water, which reaction uses the most nitric acid?
a) $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$ b) $Al_2O_3 + 6HNO_3 \rightarrow 2Al(NO_3)_3 + 3H_2O$
c) $4Zn + 10HNO_3 \rightarrow 4Zn(NO_3)_2 + NH_4NO_3 + 3H_2O$ d) $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

476. 1.00 L of 0.15 N NaOHabsorbed 11.2 millimoles of CO_2 from air. Hence, new molarity of NaOH is
a) 0.1276 M b) 0.1500 M c) 0.0224 M d) 0.0112 M

477. For a given mixture of $NaHCO_3$ and Na_2CO_3,volume of a given HCl required is x mL with phenolphthalein indicator and furthery mL required with methyl orange indicator Hence, volume of HCl for complete reaction of $NaHCO_3$is
a) $2x$ b) $\frac{x}{2}$ c) y d) $(y - x)$

478. Hardness in water is 200 ppm $CaCO_3$.Molarity of $CaCO_3$ is
a) 2×10^{-3} M b) 1×10^{-3} M c) 2×10^{-2} M d) 2×10^{-4} M

479. 36 mL of 0.5 M Br_2 solution when made alkaline undergoes complete disproportionation into $Br^{\ominus}$and $BrO_3^{\ominus}$. The resulting solution requires 45 mL of As (III) solution to reduce $BrO_3^{\ominus}$to $Br^{\ominus}$. Given that As (III) is oxidised to As (V), what is the molarity of AS (III) solution?
a) 0.2 b) 0.1 c) 0.4 d) 0.5

480. One mole of potassium chlorate is thermally decomposed and excess of aluminium is burnt in the gaseous product. How many mole(s) of aluminium oxide are formed?
a) 1 b) 1.5 c) 2 d) 3

481. A colourless salt gives white ppt with $CaCl_2$ solution and can also decolourise MnO_4^-/H^+. Salt is decomposed by conc. H_2SO_4 forming gases
a) CO_2, SO_2 b) CO, CO_2 c) CO_2, SO_2 d) N_2, CO, CO_2

482. One litre of 0.15 M HCl and one litre of 0.3 M HCl is given. What is the maximum volume of 0.2 M HCl which one can make from these two solutions. No water is added
a) 1.2 L b) 1.5 L c) 1.3 L d) 1.4 L

483. 10 mL of a solution of H_2O_2 of 10 volume strength decolourises 100 mL of $KMnO_4$ solution acidified with dil H_2SO_4. The amount of $KMnO_4$ in the given solution is $(K = 39, Mn = 55)$
a) 0.282 g b) 0.564 g c) 1.128 g d) 0.155 g

484. The addition of $K_2CO_3(aq)$ to the following solutions is expected to produce a precipitate in every case but one. That one is
a) $BaCl_2(aq)$ b) $CaBr_2(aq)$ c) $Na_2SO_4(aq)$ d) $Pb(NO_3)_2(aq)$

485. A mixture of $CuSO_4$ and $CuSO_4.5H_2O$ has a mass of 1.245 g. After heating to drive off the water, the mass only 0.882 g. Thus, mass per cent of $CuSO_4$ is
a) 19.2% b) 80.8% c) 38.4% d) 71.6%

486. What mass of propane C_3H_8 contains the same mass of carbons as contained in 1.35 g of barium carbonate, $BaCO_3$?
a) 1.35 g b) 1.00 g c) 0.10 g d) 0.135 g

487. Molar ratio of Na_2SO_3andH_2O is 1 : 7 in $Na_2SO_3 \, . xH_2O$. Hence, their mass percentage is
a) 12.5 : 87.5 b) 87.5 : 12.5 c) 50 : 50 d) 75 : 25

488. Mixture containing 1 mole each of $NaHCO_3$, Li_2CO_3 and Na_2CO_3 is heated strongly. CO_2formed in this process will be
a) 3.0 mol b) 2.5 mol c) 1.0 mol d) 1.5 mol

489. What volume of 0.2 M $KMnO_4$ is required to react with 1.58 g of hypo solution ($Na_2S_2O_3$) In acidic medium?
a) 20 mL b) 10 mL c) 16.6 mL d) 50 mL

490. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (At. Wt. 78.4) then minimum molecular weight of peroxidase anhydrous enzyme is
a) 1.568×10^4 b) 1.568×10^3 c) 15.68 d) 2.168×10^4
491. RH_2 (ion exchange resin) can replace Ca^{2+} in hard water
$RH_2 + Ca^{2+} \rightarrow RCa + 2H^+$
1 L of hard water after passing through RH_2has pH 2.Hence, hardness in ppm of $Ca^{2+}$is
a) 200 b) 100 c) 50 d) 125
492. White ppt of AgCl and $PbCl_2$ can be separated using
a) *aq* NH_3 b) Hot water
c) Both (a) and (b) d) None of these
493. KI gives precipitate with all the cations given
a) Ag^+, Hg_2^{2+}, Pb^{2+} b) $Cu^{2+}, Zn^{2+}, Ni^{2+}$ c) Na^+, Ca^{2+}, Mg^{2+} d) Ag^+, Ca^{2+}, Sr^{2+}
494. If the dot under a question mark has a mass of 1×10^{-6}g, how many atoms are required to make such a dot?(of carbon)
a) 5×10^{16} b) 12×10^{-6} c) $\frac{10^{-6}}{12}$ d) $\frac{1 \times 10^{-6}}{N_0}$
495. Permanent hardness is due to SO_4^{2-} and Cl^- of Ca^{2+} and Mg^{2+} and is removed by the addition of Na_2CO_3
$CaSO_4 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$
$CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaCl$
If hardness is 100 ppm $CaCO_3$, amount of Na_2CO_3 required to soften 10 L of hard water is
a) 2.12 g b) 0.106 g c) 10.6 g d) 1.06 g
496. The weight of lime obtained by heating 200 kg of 95% pure lime stone is
a) 98.4 kg b) 106.4 kg c) 112.8 kg d) 122.6 kg
497. 100 mL solution of NaOH (containing 4 g NaOH per litre) and 50 mL of HCl (containing 7.3 g HCl per litre) react as
$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$ 0.5 g of NaCl is formed. Thus, unreacted NaOH is
a) 0.058 g b) 3.66 g c) 10.8 g d) 0.63 g
498. A hydrocarbon has 3 g carbon per gram of hydrogen, hence, simplest formula is
a) CH_4 b) C_6H_6 c) C_3H_8 d) CH_2
499. Aqueous solution of chloride of an element A containing 1×0^{-3}mol after complete hydrolysis required 30 mL of 0.1 M $AgNO_3$ solution to form AgCl.Element A is (Molar mass = 133.5 g mol^{-1})
a) Al b) P c) Si d) S
500. The normality of a solution that results from mixing 4 g of NaOH, 500 mL of 1 M HCl, and 10.0 mL of H_2O_4 (specific gravity 1.1, 49% H_2SO_4 by weight) is
a) 0.51 b) 0.71 c) 1.02 d) 0.45
501. A metal oxide has the formula Z_2O_3. It can be reduced by hydrogen to give free metal and water 0.2 g of the metal oxide requires 12 mg of hydrogen for complete reduction. The atomic weight of the metal is
a) 52 b) 104 c) 26 d) 78
502. 1 mol of $MnO_4{}^{2-}$ in neutral aqueous medium disproportionates to
a) $\frac{2}{3}$mol of $MnO_4{}^{\ominus}$ and $\frac{1}{3}$mol of MnO_2 b) $\frac{1}{3}$mol of $MnO_4{}^{\ominus}$ and $\frac{2}{3}$mol MnO_2
c) $\frac{1}{3}$mol of Mn_2O_7 and $\frac{2}{3}$ mol of MnO_2 d) $\frac{2}{3}$mol of Mn_2O_7 and $\frac{1}{3}$mol of MnO_2
503. A dark violet colour mixture in presence of dil. HCl changes to pale yellow solution. Mixture may contain
a) MnO_4^-, Fe^{2+} b) $MnO_4^-, C_2O_4^{2-}$ c) $I^-, Cr_2O_7^{2-}$ d) None of correct
504. Of the following solutions the one that is acidic is
a) $ZnSO_4(aq)$ b) $NaAl(OH)_4(aq)$ c) $NaHCO_3(aq)$ d) $KNO_3(aq)$
505. Eco-friendly reagent that can be used instead of H_2S is

a) Na_2S b) $(NH_4)_2CS_3$ c) $(NH_4)_2S_2$ d) S_8

506. 100 mLof ozone at STP were passed through 100 mL of 10 volume H_2O_2 solution. What is the volume strength of H_2O_2 after the reaction?
a) 9.5 b) 9.0 c) 4.75 d) 4.5

507. H_2S contains 94.11% sulphur; SO_2 contains 50% oxygen and H_2O contains 11.11% hydrogen. Thus,
a) Law of multiple proportion is followed
b) Law of reciprocal proportion is followed
c) Law of conservation of mass is followed
d) All of the above

508. The pH of 10^{-5} M HCl solution if 1 mL of it is diluted to 1000mL is
a) 5 b) 8 c) 7.02 d) 6.98

509. Number of moles of NH_3 formed when 0.535 g of NH_4Cl is completely decomposed by NaOH, is
$NH_4Cl + NaOH \rightarrow NH_3 + NaCl + H_2O$
a) 0.01 mol b) 5.35 mol c) 1.7 g d) 0.17 mol

510. A mixture of ethylene and excess of H_2 had a pressure of 600 mm Hg. The mixture was passed over nickel catalyst to convert ethylene to ethane. The pressure of the resultant mixture at the similar conditions of temperature and volume dropped to 400 mm Hg. The fraction of C_2H_4 by volume in the original mixture is
a) 1/3 rd of the total volume b) 1/4 th of the total volume
c) 2/3 rd of the total volume d) 1/2 of the total volume

511. $AgNO_3$ gives white ppt with hypo changing to black after sometime. Black ppt is of
a) $Ag_2S_2O_3$ b) Ag_2SO_4 c) $Ag_2S_4O_6$ d) Ag_2S

512. The calcium in a 0.8432 g sample is precipitated as CaC_2O_4. The precipitate is washed, ignited to $CaCO_3$ and found to weigh 0.3462 g. percentage of CaO in the sample is
a) 11.5% b) 23% c) 18% d) 46%

513. $CaCO_3$ is decomposed by HCl (density 1.825 g/cc)
$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
Volume of HCl required to decompose 10 g of 50% pure $CaCO_3$ is
a) 1.825 mL b) 3.65 mL c) 0.9125 mL d) 2 mL

514. A mixture contains 1 mol each of Fe^{2+} and Fe^{3+}ions. Volume of 1 M MnO_4^- required by the mixture in the oxidation of the given mixture is
a) 400 mL b) 200 mL c) 100 mL d) 1000 mL

515. In the following titrations indicators are
I. Fe^{2+} *vs* $Cr_2O_7^{2-}$
II. Cl^- *vs* Ag^+
III. Fe^{2+} *vs* MnO_4^-

	I	II	III
a)	Self MnO_4^-,	$[Fe(CN)_6]^{4-}$,	CrO_4^{2-}
b)	$[Fe(CN)_6]^{3-}$,	CrO_4^{2-},	CNS^-
c)	$[Fe(CN)_6]^{3-}$,	CrO_4^{2-},	Self MnO_4^-
d)	CNS^-,	CrO_4^{2-},	$[Fe(CN)_6]^{3-}$

516. 0.116 g of $C_4H_4O_4 (A)$ is neutralized by 0.074 g of $Ca(OH)_2$.Hence, protonic hydrogen (H^+) in (A)will be
a) 1 b) 2 c) 3 d) 4

517. SO_2 and CO_2 both turn lime water (A) milky, SO_2 also turns $K_2Cr_2O_7/H^+$ (B) green while O_2 is soluble in pyrogallol (C) turning it black. These gases are to be detected in order by using these reagents in a mixture. The order is
a) $(A), (B), (C)$ b) $(B), (C), (A)$ c) $(B), (A), (C)$ d) $(A), (C), (B)$

518. Mixture X = 0.02 mole of $[Co(NH_3)_5SO_4]Br$ and 0.02 mole of $[Co(NH_3)_5Br]SO_4$ was prepared in 2 L of solution.
1 L of mixture X + excess $AgNO_3 \rightarrow Y$

1 L of mixture X + excess $BaCl_2 \rightarrow Z$
Number 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

519. The expression relating mole fraction of solute (χ_2) and molarity (M) of the solution is: (where d is the density of the solution in g L^{-1} and Mw_1 and Mw_2 are the molar masses of solvent and solute, respectively)
a) $x_2 = \frac{M \times Mw_1}{M\,(Mw_1 - Mw_2) + 1000d}$ b) $x_2 = \frac{M \times Mw_1}{M(Mw_1 - Mw_2) + d}$
c) $x_2 = \frac{M \times Mw_1}{M(Mw_1 - Mw_2) - 1000d}$ d) $x_2 = \frac{M \times Mw_1}{M(Mw_1 - Mw_2) - d}$

520. A sample of $CuSO_4 \cdot 5H_2O$ contains 3.782 g of Cu. How many grams of oxygen are in this sample? (Cu = 63.5)
a) 0.952 g b) 3.80 g c) 4.761 g d) 8.576 g

521. 10 mL of H_2O_2 solution (volume strength = x) required 10 mL of N/0.56 $MnO_4^{\ominus}$ solution in acidic medium. Hence, x is:
a) 0.56 b) 5.6 c) 0.1 d) 10

522. In borax-bead test there is formation of transparent bead of
a) $NaPO_3$ and $NaBO_2$ b) $NaBO_2$ and $Na_2B_4O_7$
c) $NaBO_2$ and B_2O_3 d) $NaPO_3$ and B_2O_3

523. 1.70 g $AgNO_3(aq)$ reacts with 5.85 g NaCl (aq) to form AgCl (white ppt)
a) 14.35 g b) 0.1435 g c) 1.435 g d) 5.85 g

524. Number of mole of ${}^{12}_{6}C$ in 1 amu is
a) $\frac{1}{N_0}$ b) N_0 c) N_0^2 d) $\frac{1}{N_0 \times 12}$

525. According to Dalton's atomic theory, the smallest particle in which matter can exist, is called
a) An atom b) An ion c) An electron d) A molecule

526. Which has the maximum percentage of chlorine?
a) $C_6H_6Cl_6$ b) C_6H_5Cl c) CH_3Cl d) CCl_4

527. The number of moles of $KMnO_4$ that will be needed to react with 1 mol of sulphite ion in acidic solution is
a) $\frac{2}{5}$ b) $\frac{3}{5}$ c) $\frac{4}{5}$ d) 1

528. Calculate the number of oxygen atoms required to combine with 7.0 g of N_2 to form N_2O_3 if 80% of N_2 is converted into products
$N_2 + \frac{3}{2}O_2 \rightarrow N_2O_3$
a) 3.24×10^{23} b) 3.6×10^{23} c) 18×10^{23} d) 6.02×10^{23}

529. The amount of zinc (atomic weight = 65) necessary to produce 224 mL of H_2 by the reaction with an acid will be
a) 0.65 g b) 6.5 g c) 0.065 g d) 65 g

530. What volume of 0.1 M $Ba(OH)_2$ will be required to neutralise a mixture of 50 mL of 0.1 M HCl and 100 mL of 0.2 M H_3PO_4 using methyl red indicator?
a) 25 mL b) 50 mL c) 100 mL d) 125 mL

531. Suppose elements X and Y combine to form two compounds XY_2 and X_3Y_2 when 0.1 mole of former weigh 10 g while 0.05 mole of the latter weigh 9 g. What are the atomic weights of X and Y
a) 40, 30 b) 60, 40 c) 20, 30 d) 30, 20

532. 40 mL of 0.05 M solution of sodium sesquicarbonate($Na_2CO_3NaHCO_3; 2H_2O$) is titrated against 0.05 M HCl. x mL of HCl is used when phenolphthalein is the indicator and y mL of HCl is used when methyl orange is the indicator in two separate titrations. Hence e$(y - x)$ is
a) 80 mL b) 30 mL c) 120 mL d) None

533. A suspension containing insoluble substances ZnS, CuS, HgS, and FeS, is treated with 2N HCl. On filtering, the filtrate contained appreciable amounts of which one of the following groups?
a) Zinc and mercury b) Silver and iron
c) Copper and mercury d) Zinc, copper and iron

534. A sodium hydroxide solution has pH = 12. $\left(\text{pH} = \log\frac{1}{(\text{H}^+)}\right)$ 100 mL of this solution has NaOH
a) 0.4 g b) 0.04 g c) 0.004 g d) 4 g

535. The volume strength of 1.5 N H_2O_2 solution is
a) 4.8 b) 8.4 c) 3.0 d) 8.0

536. What volume of 0.1 M $KMnO_4$ is needed to oxidise 5 mg of ferrous oxalate in acidic medium (*Mw* of ferrous oxalate is 144)
a) 0.20 mL b) 0.1 mL c) 0.4 mL d) 2.08 mL

537. 5 mL of N-HCl, 20 mL of N/2 H_2SO_4 and 30 mL of N/3 HNO_3 are mixed together and the volume is made to 1 L. The normality of the resulting solution is
a) N/5 b) N/10 c) N/20 d) N/40

538. What volume of H_2 at 273 K and 1 atm will be consumed in obtaining 21.6 g of elemental boron (atomic mass of B = 10.8) from the reduction of BCl_3 with H_2
a) 89.6 L b) 67.2 L c) 44.8 L d) 22.4 L

539. By dissolving 1 mole each of the following acids in 1 L water, the acid which does not give a solution of 1 N strength is
a) H_3PO_4 b) $HClO_4$ c) HNO_3 d) HCl

540. To prepare a solution of concentration of 0.03 g/mL of $AgNO_3$, what amount of $AgNO_3$ should be added in 60 mL of solution?
a) 1.8 g b) 0.8 g c) 0.18 g d) None of these

541. 100 mL of 0.01 M $KMnO_4$ oxidised 100 mL H_2O_2 in acidic medium. Volume of the same $KMnO_4$ required in alkaline medium to oxidise 100 mL of the same H_2O_2 will be ($MnO_4^{\ominus}$ changes to Mn^{2+} in acidic medium and to MnO_2 in alkaline medium)
a) $\frac{100}{3}$ mL b) $\frac{500}{33}$ mL c) $\frac{300}{5}$ mL d) None

542. 10 mL of 0.2 N HCl and 30 mL of 0.1 N HCl together exactly neutralizes 40 mL of solution of NaOH, which is also exactly neutralised by a solution in water of 0.61 g of an organic acid. What is the equivalent weight of the organic acid?
a) 61 b) 91.5 c) 122 d) 183

543. The equivalent weight of $MnSO_4$ is half its molecular weight when it is converted to
a) Mn_2O_3 b) MnO_2 c) $MnO_4^{\ominus}$ d) MnO_4^{2-}

544. There is foul smell in presence of moisture with
a) $AlCl_3$ b) $Al_2(SO_4)_3$ c) FeS d) $FeSO_4$

545. The best way to ensure complete precipitation from saturated $H_2S(aq)$ of a metal ion M^{2+}, as its sulphide, $MS(s)$, is to
a) Add an acid b) Increase $[H_2S]$ in solution
c) Raise the pH d) Heat the solution

546. Sucrose solution is 1 molal. Mole fraction of sucrose in the aqueous solution is
a) 0.018 b) 0.015 c) 0.036 d) 0.009

547. $[Fe(H_2O)_5NO]^{2+}$ is formed as brown ring in NO_3^- test. Fe in this complex has….. unpaired electrons
a) One b) Two c) Three d) Four

548. Metal chloride *A* is soluble in hot water but insoluble in cold water. Select correct statement about *A*. Thus
a) *A* can give yellow ppt. with K_2CrO_4 b) *A* can give white ppt with K_2SO_4
c) *A* can give yellow ppt with KI d) All of the above are correct statements

549. When 10 g $CaCO_3$ reacts with 20 g $BaCl_2$
$BaCl_2 + CaCO_3 \rightarrow BaCO_3 + CaCl_2$ then limiting reactant is
a) $CaCO_3$ b) $BaCl_2$ c) $CaCl_2$ d) None of these

550. 36.5% HCl has density equal to 1.20 g mL^{-1}. The molarity (M) and molality (m), respectively, are
a) 15.7, 15.7 b) 12, 12 c) 15.7, 12 d) 12, 15.7

551. If 1 L of O_2 at 15°C and 750 mm pressure contains N molecules, the number of molecules in 2 liters of SO_2 under the same conditions of temperature and pressure will be
a) $N/2$ b) N c) 2 N d) 4 N

552. Al and $KClO_3$ react together to form Al_2O_3 according to
$2KClO_3 \rightarrow 2KCl + 3O_2$
$4Al + 3O_2 \rightarrow 2Al_2O_3$
4 moles of $KClO_3$(50% pure) on reaction with excess of Al form Al_2O_3
a) 2 mol b) 4 mol c) 6 mol d) 8 mol

553. 10 mL of a gaseous hydrocarbon is exploded with 100 mL of oxygen. The residual gas on cooling is found to measure 95 mL of which 20 mL is absorbed by caustic soda and the remainder by alkaline pyrogallol. The formula of the hydrocarbon is
a) CH_4 b) C_2H_6 c) C_2H_4 d) C_2H_2

554. A yellow solid known to be a single compound is completely insoluble in hot water but dissolves in hot dilute HCl to give an orange solution. When this solution is cooled, a white crystalline ppt is formed. This white ppt redissolves on heating the solution. The compound is
a) $Fe(OH)_3$ b) $PbCrO_4$ c) K_2CrO_4 d) $Co(OH)_2$

555. $BrO_3^{\ominus} + 5Br^{\ominus} \rightarrow Br_2 + 3H_2O$
If 50 mL 0.1 M $BrO_3^{\ominus}$ is mixed with 30 mL of 0.5 M $Br^{\ominus}$ solution that contains contains excess of $H^{\oplus}$ ions, the moles of Br_2 formed are
a) 6.0×10^{-4} b) 1.2×10^{-4} c) 9.0×10^{-3} d) 1.8×10^{-3}

556. Each drop of H_2O has 0.018 mL at room temperature Number of H_2O molecules in one drop is
a) 1×10^{-3} b) 6.02×10^{20} c) 22.4×10^{-3} d) $6.02 \times 3 \times 10^{2}$

557. Per cent yield of NH_3 in the following reaction is 80%
$NH_2CONH_2 + 2NaOH \xrightarrow{\Delta} Na_2CO_3 + 2NH_3$ 6 g NH_2CONH_2 reacts with 8 g NaOH to form NH_3
a) 3.4 g b) 2.72 g c) 4.25 g d) 11.2 g

558. The weight of MnO_2 and the volume of HCl of specific gravity 1.2 g mL^{-1} and 4% nature by weight, needed to produce 1.78 L of Cl_2 at STP. The reaction involved is:
$MnO_4 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$
a) 0.48 L b) 0.24 L c) 0.12 L d) 0.06 L

559. 0.1 g of metal combines with 46.6 mL of oxygen at STP. The equivalent weight of metal is
a) 12 b) 24 c) 6 d) 36

560. 3.4 g sample H_2O_2 solution containing x % $H_2O_2$by weight requires xmL of a $KMnO_4$ solution for complete oxidation under acidic condition. The normality of $KMnO_4$ solution is
a) 1 N b) 2 N c) 3 N d) 0.5 N

561. A spherical ball of radius 7 cm contains 56% iron. If density is 1.4 g/cm^3, number of moles of Fe present approximately is
a) 10 b) 15 c) 20 d) 25

562. Mass of one atom of an element is 6.64×10^{-23}g. This is equal to
a) 6.64×10^{-23} u b) 40.0 u c) $\frac{1}{40}$ u d) 6.64 u

563. The number of moles present in 2 L of 0.5 mol L^{-1} NaOH solution is
a) 0.5 b) 0.1 c) 1 d) 2

564. In an experiment, 50 mLof 0.1 M solution of a metallic salt reacted exactly with 25 mLof 0.1 M solution of sodium sulphite. In the reaction SO_3^{2-} is oxidized to SO_4^{2-}.If the original oxidation number of the metal in the salt was 3, what would be the new oxidation number of the metal?
a) 0 b) 1 c) 2 d) 4
565. Consider the following cases
I : 60 g CH_3COOH
II : 30 g HCHO
III : 60 g NH_2CONH_2
IV : 180 g $C_6H_{12}O_6$
Percentage of carbon is identical in
a) I, II b) I, III c) I, II, III d) I, II, IV
566. 10 g of a sample of a mixture of $CaCl_2$ and NaCl is treated to precipitate all the calcium as $CaCO_3$. This $CaCO_3$ is heated to convert all the Ca to CaO and the final mass of CaO is 1.62 g. The precent by mass of $CaCl_2$ in the original mixture is
a) 32.1 % b) 16.2 % c) 21.8 % d) 11.0%
567. The oxygen obtained from 72 kg of water is
a) 72 kg b) 46 kg c) 50 kg d) 64 kg
568. $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$
100 mL of X molar H_2O_2 gives 3 L of O_2 gas under the condition when 1 mol occupies 24 L. The value of X is
a) 2.5 b) 1.0 c) 0.5 d) 0.25
569. 100 mL of 1 M BaF_2solution is mixed with 100 mL of 2 M H_2SO_4.Resulting mixture contains
a) 0.1 mole of $BaSO_4$ b) 2 M H^+ c) Both are correct d) None is correct
570. Temporary hardness is due to HCO_3^- of Mg^{2+} andCa^{2+}. It is removed by addition of CaO
$Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$
Mass of CaO required to precipitate 2 g $CaCO_3$ is
a) 2.00 g b) 0.56 g c) 0.28 g d) 1.12 g
571. 1.06 g Na_2CO_3 is dissolved in 100 mL solution. 10 mL of this solution can be neutralized by
a) 10 mL of 0.1 N HCl b) 10 mL of 0.1 M H_3PO_4 c) 20 mL of 0.1 M H_2SO_4 d) 20 mL of 0.1 M HCl
572. Mg_2C_3(X) is decomposed by H_2O forming a gaseous hydrocarbon (Y). 8.4 g of$X$ gives ……… mol of Y
a) 0.1 b) 0.2 c) 0.3 d) 0.4
573. In the following reaction (B = 11)
$B_2H_6 + 2NaH \rightarrow 2NaBH_4$
6.75 g 8.55 g
Limiting reactant Excess reactant
a) B_2H_6 NaH = 1.80 g b) $NaHB_2H_6$ = 1.76 g c) B_2H_6NaH = 0.90 g d) Equal None
574. 10^{21} molecules are removed from 200 mg of CO_2. The moles of CO_2 left are
a) 2.88×10^{-3} b) 28.8×10^{-3} c) 288×10^{-3} d) 28.8×10^{3}
575. The vapour density of a chloride of an element is 39.5. The Ew of the elements is 3.82. The atomic weight of the element is
a) 15.28 b) 7.64 c) 3.82 d) 11.46
576. MnO_4^{2-} (1 mole) in neutral aqueous medium disproportionate to
a) $\frac{2}{3}$ mol of MnO_4^- and $\frac{1}{3}$ mol of MnO_2 b) $\frac{1}{3}$ mol of MnO_4^- and $\frac{2}{3}$ mol of MnO_2
c) $\frac{1}{3}$ mol of Mn_2O_7 and $\frac{1}{3}$ mol of MnO_2 d) $\frac{2}{3}$ mol of Mn_2O_7 and $\frac{1}{3}$ mol of MnO_2
577. A gas X is passed through water to form a saturated solution. The aqueous solution on treatment with silver nitrate gives a white precipitate. The saturated aqueous solution also dissolve magnesium ribbon with evolution of a colourless gas Y. Identify X and Y

a) $X = CO_2, Y = Cl_2$ b) $X = Cl_2, Y = CO_2$ c) $X = Cl_2, Y = H_2$ d) $X = H_2, Y = Cl_2$

578. 0.5 g of an organic substance containing phosphorus was heated with concHNO_3 in the carius tube. The phosphoric acid thus formed was precipitated with magnesia mixture ($MgNH_4PO_4$) which on ignition gave a residue of 1.0 g of magnesium pyrophosphate ($Mg_2P_2O_7$). The percentage of phosphorous in the organic compound is

a) 55.85 % b) 29.72 % c) 19.81 % d) 20.5 %

579. An aqueous solution of MCl_2 containing excess KCN, when treated with H_2S will precipitate MS only if 'M' is

a) Ni b) Co c) Cu d) Cd

580. Which of the following does not represent redox reaction?

a) $Cr_2O_7^{2-} + 2\overset{\ominus}{O}H \longrightarrow CrO_4^{2-} + H_2O$

b) $SO_5^{2-} + 2I^{\ominus} + 2H^{\oplus} \rightarrow I_2 + SO_4^{2-}$

c) $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(ClO)_2 + CaCl_2 + 2H_2O$

d) $PCl_5 \rightarrow PCl_3 + Cl_2$

581. 1 mol of ferric oxalate is oxidized by x mol of $MnO_4^{\ominus}$ in acidic medium. Hence, the value of x is

a) 1.2 b) 1.6 c) 1.8 d) 1.5

582. The mass of 70% H_2SO_4 required for neutralization of 1 mole of NaOH is

a) 70 g b) 35 g c) 30 g d) 95 g

583. Aluminium sulphate (X) is slightly insoluble in water. It is converted into soluble sodium sulphate by using Na_2CO_3 in the preparation of sodium carbonate extract. Moles of (Y), required for complete conversion of 1 mole of (X) into soluble sulphate, is

a) 1 b) 2 c) 3 d) 4

584. What volume of 0.1 M NaOH will be required to neutralize 100 mL of 0.1 M H_3PO_4 using methyl red indicator to change the colour form pink (acidic medium) to yellow (basic medium?)

a) 300 mL b) 200 mL c) 100 mL d) 30 mL

585. A molal solution is one that contains 1 mol of a solute in

a) 1000 g of solvent b) 1 L of solvent c) 1 L of solution d) 22.4 L of solution

586. Number of millimoles of Cl^- in 100 mL of 1 M $BaCl_2$ solution (assume 100% ionization) is

a) 100 b) 200 c) 300 d) 50

587. X^+, Y^{2+} and Z^- are isoelectronic of CO_2. Increasing order of protons in X^+, Y^{2+} and Z^- is

a) $X^+ = Y^{2+} = Z^-$ b) $X^+ < Y^{2+} < Z^-$ c) $Z^- < X^+ < Y^{2+}$ d) $Y^{2+} < X^+ < Z^-$

588. Which has maximum number of H-atoms per gram of the substance?

a) CH_4 b) $CuSO_4 .5H_2O$ c) H_2O_2 d) H_2O

589. Which is not true about H_3PO_2?

a) It is tribasic acid b) One mole is neutralized by 0.5 mol $Ca(OH)_2$

c) NaH_2PO_2 is normal salt d) It disproportionate to H_3PO_3 and PH_3 on heating

590. How many moles of ferric alum $(NH_4)_2SO_4Fe_2(SO_4)_3{\cdot}24H_2O$ can be made from the sample of Fe containing 0.0056 g of it?

a) 10^{-4} mol b) 0.5×10^{-4} mol c) 0.33×10^{-4} mol d) 2×10^{-4} mol

591. The total number of electrons in one molecular of carbon dioxide is

a) 22 b) 44 c) 66 d) 88

592. In the reaction,

$2Al(s) + 4HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^-(aq) + 3H_2(g)$

a) 6 L $HCl(aq)$ is consumed for every 3 L $H_2(g)$ produced

b) 33.6 L $H_2(g)$ is produced regardless of temperature and pressure for every mole Al that reacts

c) 67.2 L $H_2(g)$ at STP is produced for every mole Al that reacts

d) 11.2 L $H_2(g)$ at STP is produced fro every mole $HCl(aq)$ consumed

593. I_2 obtained from 0.1 mol of $CuSO_4$ required 100 mL of 1 M hypo solution, hence, mole percentage of pure $CuSO_4$ is

a) 100 b) 50 c) 25 d) 40

594. 100mL of 0.01 M $KMnO_4$ oxidised 100 mL H_2O_2 in acidic medium. The volume of same $KMnO_4$ required in strong alkaline medium to oxidise 100 mL of same H_2O_2 will be

a) $\frac{100}{3}$ mL b) $\frac{500}{3}$ mL c) $\frac{300}{5}$ mL d) None of these

595. $MnO_2 + 2KClO_3 \rightarrow K_2MnO_4 + Cl_2 + 2O_2$

$Cl_2 + K_2MnO_4 \rightarrow 2KCl + MnO_2 + O_2$

Each reaction takes place to the extent of 50%. 11.2 L of O_2 at STP is obtained from $KClO_3$ using

a) 0.67 mol b) 1.12 mol c) 1.33 mol d) 2.66 mol

596. The oxide of an element contains 67.67% of oxygen. Equivalent weight of the element is

a) 2.46 b) 3.82 c) 4.36 d) 4.96

597. If Avogadro's number would have been 1×10^{-10}, instead of 6.02×10^{23} then mass of one atom of H would be

a) 1 u b) 1×10^{10}u c) 6 u d) 6×10^{13} u

598. Which has maximum number of milliequivalents?

a) 100 mL of 0.01 N H_2SO_4 b) 100 mL of 0.01 N HCl
c) 100 mL of 0.01 N H_2PO_4 d) Equal

599. Aqueous solution of A can dissolve AgBr forming a soluble complex B, A also reacts with aqueous $AgNO_3$ solution giving white ppt. C changing to black ppt D, A, B, C and D are

	A	B	C	D
a)	$Na_2S_2O_3$	$Na_3[Ag(S_2O_3)_2]$	$Ag_2S_2O_3$	Ag_2S
b)	$Na_2S_3O_3$	$Ag_2S_2O_3$	Ag_2S	$Na_3[Ag(S_2O_3)_2]$
c)	NH_3	$[Ag(NH_3)_2]Br$	$Ag(OH)$	Ag_2O
d)	NH_3	$Na[Ag(OH)_2]$	Ag_2O	$[Ag(NH_3)_2]Br$

600. A 0.46 g sample of As_2O_3 required 25.0 mL of $KMnO_4$ solution for its titration. The molarity of $KMnO_4$ solution is

a) 0.016 b) 0.074 c) 0.032 d) 0.128

601. 3 moles of a mixture of $FeSO_4$ and $Fe_2(SO_4)_3$ required 100 mL of 2 M $KMnO_4$ solution in acidic medium. Hence, mole fraction of $FeSO_4$ in the mixture is

a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{2}{5}$ d) $\frac{3}{5}$

602. Equal weights of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is

a) $\frac{1}{3}$ b) $\frac{1}{2}$ c) $\frac{2}{3}$ d) $\frac{1}{3} \times \frac{273}{298}$

603. The mineral rutile is an oxide of titanium containing 39.95% oxygen and is isomorphous with cassiterite (SnO_2). The atomic weight of titanium is

a) 68.10 b) 58.10 c) 48.10 d) 38.10

Multiple Correct Answers Type

604. Which of the following statements is/are correct?

For the reaction:

$4Fe + 3O_2 \rightarrow 2FeO_3$

a) Fe is the limiting reagent
b) The mass O_2 left over at the end of the reaction is 1.2 g
c) The mass of Fe_2O_3 Produced is 12.0 g
d) O_2 is the limiting reagent

605. Which of the following statements is/are correct?
Commercial HCl is prepared by heating NaCl with H_2SO_4: $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$
a) 196.0 g of pure H_2SO_4 is required for the production of 245.0 g of conc HCl containing 40% HCl by weight
b) 245.0 g of 80% H_2SO_4 by weight is required for the production of 365.0 g of conc. HCl containing 40% HCl by weight
c) 2 mol of pure H_2SO_4 is required for the production of 365 g of 40% HCl
d) 2.5 mol of 80% H_2SO_4 is required for the production of 365.0 g of 40% HCl

606. A certain compound has the molecular formula X_4O_6 having 57.2% X. Thus,
a) Atomic mass of X is 32
b) X may contain five valence electrons
c) X is an electropositive metal
d) X can be a non-metal

607. Which of the statements are true about the law of chemical combination?
a) Potassium combines with two isotopes of chlorine (^{35}CI and ^{37}CI) to form two samples of KCl. Their formation follows the law of definite composition
b) Different proportions of oxygen in the varius oxidies of sulphur prove the law of multiple proportions
c) H_2O and H_2S contain 11.11% hydrogen and 5.88% hydrogen, respectively, whereas SO_2 contains 50% sulphur. The above data prove the law of reciprocal proportions
d) In the decomposition of NH_3, $\left(2NH_3 \xrightarrow{\Delta} N_2 + 3H_2\right)$, the ratio of volumes of NH_3, N_2, and H_2 is 2: 1: 3. The above data proves the Gay Lussac law

608. KCN is used in the
a) Separation of Cu^{2+} and Cd^{2+}
b) Metallurgical extraction of Ag^+ and Au^+
c) Identification of Fe^{3+}
d) Treatment of cancer

609. Isoelectronic species are represented by pairs
a) N^{3-}, O^{2-}
b) CO, CN^-
c) O_2^{2-}, F_2
d) O_2^-, CN^-

610. Which of the following statements are **wrong**?
a) 1.6 g of a hydrocarbon on combustion in excess of oxygen produces 1.2 of CO_2 and 0.4 of H_2O. The data illustrates the law of conservation of mass
b) The product of atomic mass and specific heat of any elements is a constant and is approximately 6.4. This is known as Dulong Petit's law
c) The atomic masses of the elements are usually fractional because they are mixtures of allotropes
d) The best standard of atomic mass is hydrogen-1.008

611. 2.0 g of a triatomic gaseous element was found to occupy a volume of 448 mL at 76 cm of Hg and 273 K. the mass of its atom is
a) 38.5 g
b) 33.3 u
c) 5.53×10^{-23}g
d) 38.5 u

612. An excellent solution for cleaning grease stains from cloth or leather consists of the following components: CCl_4 (80% by volume), ligroin (16%), and amyl alcohol (4%). How many mL of each should to taken to make up 80 mL of solution?
a) 64 mL CCl_4
b) 12.8 mL ligroin
c) 32 mL of amyl alcohol
d) 3.2 mL of amyl alcohol

613. Which of the following have equal mass of $Cl^{\ominus}$ ions in 1.0 L of each of the following solutions?
a) 5% NaCl (density = 1.07 g mL^{-1})
b) 5% KCl (d = 1.06 g mL^{-1})
c) 58.5 g NaCl
d) 55.5 g $BaCl_2$

614. Zinc oxalate can be tested by
a) NaOH when white precipitate is formed which dissolves in excess of NaOH
b) $KMnO_4$ which is decolourised
c) $CaCl_2$ which gives white precipitate
d) $K_4[Fe(CN)_6]$ which gives yellowish white precipitate

615. 100 g sample of clay (containing 19% H_2O, 40% silica, and inert impurities as rest) is partially dried so as to contain 10 % H_2O
Which of the following is/are correct statements(s)?
a) The percentage of silica in it is 44.4%
b) The mass of partially dried clay is 90.0 g
c) The percentage of inert impurity in it is 45.6%
d) The mass of water evaporated is 10.0 g

616. Which of the following pair of compounds illustrate the law of multiple proportions?
a) SO_2 and SO_3
b) NO_2 and N_2O
c) MgO and $Mg(OH)_2$
d) NO and N_2O_5

617. When a substance A reacts with water it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produces gas B on reaction with dilute sulphuric acid at room temperature. A imparts a deep golden yellow colour to a smokeless flame of Bunsen burner. A, B, C and D, respectively are
a) $Na, H_2, NaOH, Zn$
b) K, H_2, KOH, Al
c) $CaH_2, Ca(OH)_2, Sn$
d) $CaC_2, C_2H_2, Ca(OH)_2, Fe$

618. Which of the following statements about the following reaction is/are **NOT** correct?
$Cr_2O_7{}^{2-} + 3H_2O_2 + 8H^{\oplus} \rightarrow 2Cr^{3-} + 7H_2O + 3O_2$
a) H_2O_2 is oxidized to O_2
b) H_2O_2 is reduced to H_2O
c) The oxidation number of chromium atom changes by 3
d) Hydrogen ions are oxidized to H_2O

619. For the following balanced redox reaction
$2MnO_4{}^{\ominus} + 8H^{\oplus} + Br_2 \longrightarrow$
$2Mn^{2+} + 2BrO_3{}^{\ominus} + 2H_2O$
If the molecular weight of $MnO_4{}^{\ominus}$: Br_2 and Br_2 be M_1, M_2 respectively, then
a) Equivalent weight of $MnO_4{}^{\ominus}$ is $M_1/5$
b) Equivalent weight of Br_2 is $M_2/10$
c) The n-factor ratio of $MnO_4{}^{\ominus}: Br_2$ is 1: 1
d) None of these

620. The atomic number of an element is always equal to
a) Number of neutrons in the nucleus
b) Half of the atomic weight
c) Electrical charge of the nucleus
d) Number of protons

621. A compound contains atoms of three elements A, B and C. if the oxidation number of A is +2, B is +5, and C is −2, the possible formula of the compound is
a) $A(BC_3)_2$
b) $A_3(BC_4)_2$
c) $A_3(B_4C)_2$
d) ABC_2

622. 1 mole of H_3PO_3 reacts with NaOH in solution. Select the correct statements.
a) 1 mole of NaOH will replace NH^+ ion from H_3PO_3
b) 2 moles of NaoH will replace 2 N H^+ ions from H_3PO_3
c) 3 moles of NaOH will replace 3 N H^+ ions from H_3PO_3
d) On complete neutralisation of H_3PO_3, the equivalent weight of $H_3PO_3 = 41$

623. NaOH can dissolve
a) $Cr(OH)_3$
b) $Al(OH)_3$
c) $Zn(OH)_2$
d) $Fe(OH)_3$

624. 1 g equivalent of a substance is the weight of that amount of a substance which is equivalent to
a) 0.25 mol O_2
b) 8 g O_2
c) 16 g O_2
d) 0.50 mol O_2

625. Density of H_2O is 1 g mL^{-1}. If we have 1 mLH_2O then
a) It is 55.55 mol L^{-1}
b) It has $3.33 \times 10^{22} H_2O$ molecules
c) It has 3.33×10^{22} H-atoms
d) It has 6.66×10^{22} O-atoms

626. Which of the following statements is/are true if 1 mole of H_3PO_x is completely neutralized by 40 g of NaOH?
a) $x = 2$ and acid is monobasic
b) $x = 3$ and acid is dibasic
c) $x = 4$ and acid is tribasic
d) $x = 2$ and acid does not form acid salt

627. In the separation of Cu^{2+} and Cd^{2+} in 2nd group of qualitative analysis of cations tetrammine copper (II) sulphate and trammine cadmium (II) sulphate react with KCN to form the corresponding cyanide complexes, which one of the following pairs of the complexes and their relative stabilities enables the separation of Cu^{2+} and Cd^{2+}?
   a) $K_3[Cu(CN)_4]$: less stable and $K_2[Cd(CN)_4]$: more stable
   b) $K_3[Cu(CN)_4]$: more stable and $K_2[Cd(CN)_4]$: less stable
   c) $K_2[Cu(CN)_4]$: less stable and $K_2[Cd(CN)_4]$: more stable
   d) $K_2[Cu(CN)_4]$: more stable and $K_2[Cd(CN)_4]$: less stable
628. A bulb contains 1.6 g of O_2. It contains
   a) 0.05 mol of O_2
   b) 3.011×10^{22} molecules of O_2
   c) 1.12 L of O_2 at STP
   d) 1.22 L of O_2 at SATP
629. Choose the correct statement:
   a) 1 mol of $MnO_4^{\ominus}$ ion can oxidise 5 mol of Fe^{2+}ion in acidic medium
   b) 1 mol of $Cr_2O_7^{2-}$ion can oxidise 6 mol of Fe^{2+} ion in acidic medium
   c) 1 mol of Cu_2S can be oxidized by 1 mol of $Cr_2O_7^{2-}$ ion in acidic medium
   d) 1 mol of CuS can be oxidized by 1 mol of $Cr_2O_7^{2-}$ ion in acxidic medium
630. Which of the following is/are correct
   The following reaction occurs:
   $CS_2 + 3Cl_2 \xrightarrow{\Delta} CCl_4 + S_2Cl_2$
   1.0 g of CS_2 and 2.0 g of Cl_2 reacts
   a) 0.714 g CS_2 is used in the reaction
   b) 0.286 g CS_2 is in excess
   c) 1.45 g of CCl_4 is formed
   d) 0.8 g Cl_2 is in excess
631. Which of the following is isomorphous with magnesium sulphate ($MgSO_4 . 7H_2O$)?
   a) Green vitriol
   b) Potassium perchlorate
   c) Zinc sulphate hepta hydrate
   d) Blue vitriol
632. A colourless salt is precipitated as hydroxide on adding. aq. NaOH precipitate dissolves in excess aq. NaOH and precipitation occurs on adding aq. NH_3Cl. Colourless salt may be
   a) $AlCl_3$
   b) $ZnCrO_4$
   c) $ZnCl_2$
   d) $AlPO_4$
633. 2.84 g of P_4O_{10} is dissolved in 1 L aqueous solution. Thus,
   a) Resulting solution is 0.01
   b) It is neutralized to Na_3PO_4 by 400 mL of 0.3 M NaOH solution
   c) It is neutralized to $CaHPO_4$ by 400 mLof 0.1 M $Ca(OH)_2$ solution
   d) It cannot be neutralized by basic solution
634. Which of the following solution contains approximately equal hydrogen ion concentration?
   a) 100 mL of 0.1 M HCl + 50 mL H_2O
   b) 75 mL of 0.1 M HCl + 75 mL H_2O
   c) 50 mL of 0.1 M H_2SO_4 + 100 mL H_2O
   d) 100 mL of 0.1 N H_2SO_4 + 50 mL H_2O
635. Which of the statement are true?
   a) Law of constant composition is true for all types of compounds
   b) Molar volume of a gas at standard conditions is 22.4 L
   c) Vapour density of a gas is twice of its molecular mass
   d) Atomic masses of most elements are fractional
636. In one process giving below

$2NH_3(g) + CO_2(g) \rightarrow NH_2CONH_2(aq) + H_2O(l)$ 637.2 g of NH_3 are allowed to react with 1142 g of CO_2. In this

a) NH_3 is the limiting reactant and CO_2 is in excess
b) NH_3 is in excess and CO_2 is the limiting reactant
c) 1124 g of urea is formed
d) 319 g of CO_2 is left unreacted

637. 2 mole of a mixture of CO and CO_2 requires exactly 1 litre solution of 1 M NaOH for complete neutralisation. If CO present in mixture is now converted to CO_2 and again the mixture is treated with NaOH, then after this conversion.

a) Moles of CO_2 present initially in mixture =1
b) 2 litre NaOH solution of 1 M is more required for neutralisation
c) 2 litre solution of $\frac{1}{2} M$ NaOH is required more for neutralisation
d) 56 g KOH in aqueous solution is required more for neutralization

638. Which one are correct about the solution that contains 3.42 ppm $Al_2(SO_4)_3$ and 1.42 ppm Na_2SO_4?

a) $[Al^{3+}] = [Na^+]$
b) $[SO_4^{2-}] = [Na^+] = [Al^{3+}]$
c) $[SO_4^{2-}] = [Na^+] + [Al^{3+}]$
d) $[SO_4^{2-}] = [Na^+]$

639. Which of the following statements is/are correct?
A mixture containing 64.0 g H_2 and 64.0 g O_2 is ignited so that water is formed as follows:
$2H_2 + O_2 \rightarrow 2H_2O$

a) H_2 is the limiting reagent
b) O_2 is the limiting reagent
c) The reaction mixture contains 72.0 g of H_2O and 56.0 g of unreacted H_2
d) The reaction mixture contains 56.0 g of H_2O and 72.0 g unreacted H_2

640. Borax-bead test can be used to identify following ions

a) Ca^{2+} b) Cr^{3+} c) Mn^{2+} d) Cu^{2+}

641. If 100 mL of 1 M H_2SO_4 solution is mixed with 100 mL of 98% (W/W) of H_2SO_4 solution (d = 0.1 g mL^{-1}), then

a) Concentration of solution becomes half
b) Volume of solution becomes 200 mL
c) Mass of H_2SO_4 in the solution is 98 g
d) Mass of H_2SO_4 in the solution is 19.6 g

642. An inorganic mixture gives yellow precipitate on boiling with conc. HNO_3 and ammonium molybdate $(NH_4)_2MoO_4$). thus, inorganic mixture can be

a) $(NH_4)_3PO_4$ b) $(NH_4)_3AsO_4$ c) $Pb(NO_3)_2$ d) $(NH_4)_2C_2O_4$

643. A solution of $KHC_2O_4 . H_2C_2O_4 .2H_2O$ is 0.2 N as an acid. Then it is

a) 0.267 N as reducing agent
b) 0.6 M as an acid
c) 0.067 M as an acid
d) 0.067 M a reducing agent

644. Mass of KHC_2O_4 (potassium acid oxalate) required to reduce 100 mL of 0.02 M K $KMnO_4$ in acidic medium (to Mn^{2+}) is x g and to neutralize 100 mLof 0.05 M $Ca(OH)_2$ is y g, then

a) $x = y$ b) $2x = y$ c) $x = 2y$ d) None is correct

645. A sample of water has a hardness expressed as 77.5 ppm Ca^{2+}.This sample is passed through an ion exchange column and the $Ca^{2+}$is replaced by H^+. Select the correct statemet(s)

a) pH of the water after it has been so treated is 2.4
b) Every Ca^{2+}ion is replaced by one H^+ion
c) Every Ca^{2+}ion is replaced by two H^+ions
d) pHof the solution remains unchanged

646. X^- is isoelectronic of CO and has $(Z + 2)$ neutrons (Z = atomic number of X^-). Thus,

a) Ionic mass of X^- is 28
b) Ionic mass of X^- is 30
c) Atomic number of X^- is 13
d) Atomic number of X^- is 14

647. Which of the following has three significant figures?
    a) 3.70 b) 6.23×10^{25} c) 1.03 d) 0.052

648. Which of the following statements is/are correct?
    a) CaC_2 is made in an electric furnace by the reaction :
    $CaO + C \rightarrow CaC_2 + CO$
    16.0 g of CaC_2 is obtained from 9.0 g of C
    b) Polyethene can be produced form CaC_2as follows :
    $CaC_2 + H_2O \rightarrow CaO + HC \equiv CH$
    $HC \equiv CH + H_2 \rightarrow H_2C = CH_2$
    $n(CH_2{=}CH_2) \longrightarrow \text{−}\!\!\left(CH_2-CH_2\right)\!\!\text{−}_n$ (Polyethene)
    32.0 kg of CaC_2 produces 14.0 kg of polyethene
    c) 1.435 g of AgCl is obtained from 17.75 g of $[Ag(NH_3)_2]Cl$ by the following reaction :
    $[Ag\ (NH_3)_2]\ Cl + 2HNO_3 \rightarrow AgCl + 2NH_4NO_3$
    d) Commercial sodium 'hydrosulfite' is 50% pure $Na_2S_2O_4$. It is prepard as follows :
    i. $Zn\ +\ 2SO_2\ \rightarrow\ ZnS_2O_4$
    ii. $ZnS_2O_4 +\ Na_2CO_3 \rightarrow ZnCO_3 + Na_2S_2O_4$
    174.0 metric ton of commercial product ($Na_2S_2O_4$) can be made from 65.4 metric ton of Zn, with a sufficient supply of other reactants

649. Which of the following statements are correct?
    a) A sample of $CaCO_3$ contains Ca = 40%, C = 12 %, and O = 48%. If the law of constant compostion is true, then the mass of Ca in 10 g of $CaCO_3$ from another source is 4.0 g
    b) 12 g of carbon is heated in vacuum and there is no change in the mass, is the best example of the law of conservation of mass
    c) Air is heated at constant pressure and there is no change in mass but the volume increases, is the best example of the law of conservation of mass
    d) SO_2 gas was prepared by (i) heating Cu with conc H_2SO_4, (ii) burning sulphur in oxygen, (iii) reacting sodium sulphite (Na_2SO_3) with dilute H_2SO_4. It was observed that is each case, S and O combine in the ratio of 1:1. This data illustrates the law of constant composition

650. A g of a metal displaces V mL of H_2 at NTP. Eq. wt. of metal, E is/are:
    a) $E = \dfrac{A}{\text{wt. of } H_2 \text{displaced}} \times \text{eq. wt. of H}$
    b) $E = \dfrac{A \times 1.008 \times 22400}{\text{volume of } H_2 \text{displaced} \times 2}$
    c) $E = \dfrac{A \times 1.008 \times 22400}{\text{volume of } H_2 \text{displaced} \times 0.0000897}$
    d) None of the above

651. Volume of a gas at NTP is 1.12×10^{-7}cc. The number of molecules is thus equal to
    a) 3.01×10^{12} b) 3.01×10^{18} c) 3.01×10^{24} d) 3.01×10^{30}

652. 2 g of oleum is diluted with water. The solution was then neutralized by 432.5 mL of 0.1 N NaOH. Select the correct statements.
    a) % of oleum is 105.96
    b) % of free SO_3 is 26.5 in oleum
    c) Equivalent of H_2SO_4 are 0.03
    d) Equivalent of $SO_3 = 6.625 \times 10^{-3}$

653. Ag^+ and Pb^{2+} ions are precipitated together by addition of
    a) aq. NH_3 b) $K_2C_2O_4$ solution c) dil. HNO_3 d) KI solution

654. The melting point of a substance was quoted as 52.5°C, 52.57°C, 52.571°C, and 52.5713°C. Which of these values would be most acceptable and which will have maximum uncertainty?
 a) 52.5°C b) 52.57°C c) 52.571°C d) 52.5713°C
655. Which of the following statements is/are correct about the reaction
 $4\,CrO_5 + 6H_2SO_4 \rightarrow 2Cr_2(SO_4)_3 + 6H_2O + 7O_2$
 a) It is disproportionation reaction
 b) It is a an intramolecular redox reaction
 c) Cr acts as oxidant, whereas O acts as a reductant
 d) CrO_5 acts as oxidant and reductant both
656. A bivalent metal ion has equivalent mass of 12. Then
 a) Equivalent mass of its oxide is 28
 b) Molar mass of its oxide is 40
 c) Equivalent mass of its hydride is 13
 d) Molar mass of its hydride is 14
657. The following reaction takes place in basic medium :
 $$\underset{\text{(Chromate ion)}}{CrO_4^{2-}} + \underset{\text{(Stannite ion)}}{HSnO_2^{\ominus}} + H_2O \longrightarrow \underset{\text{(Stannate ion)}}{HSnO_3^{\ominus}} + \underset{\text{(Chromite ion)}}{CrO_2^{\ominus}} + \overset{\ominus}{O}H$$
 If 400 mL of M/5 chromate ion react with 500 mL of M/4 stannite ion, then which of the **following statements are correct?**
 a) Chromate ion, CrO_4^{2-}, is the limiting reagent
 b) Stannite ion, $HSnO_2^{\ominus}$, is the limiting reagent
 c) At the end of reaction, concentration of $CrO_2^{\ominus}$ ions $\approx$ 0.08 M
 d) At the end of reaction, concentration of $HSnO_3^{\ominus}$ $\approx$ 0.13 M
658. Select the correct statement(s)
 a) CdS and As_2S_3 can be separated using NaOH or yellow ammonium sulphide
 b) $FeCl_3$ gives blue precipitate with $K_4[Fe(CN)_6]$
 c) $FeCl_3$ gives blood red colour with KCNS
 d) Aq $FeCl_3$ is reduced to $FeCl_2$ when Zn pieces are added
659. An aqueous solution of glucose $C_6H_{12}O_6$) contains 1 mole of glucose in 1.8 L solution Thus,
 a) It is 10% aqueous solution
 b) Its density is 0.1 g mL^{-1}
 c) Solution contains 3.33×10^{20} glucose molecules per mL
 d) Solution contains 24 g atoms
660. When 0.273 g of Mg is heated strongly in a nitrogen (N_2) atmosphere, a chemical reaction occurs. The product of the reaction weighs 0.378 g. empirical formula of the compound is
 a) MgN b) Mg_3N_2 c) MgN_2 d) Mg_2N
661. Which of the statement are **false**?
 a) Physical quantity represented by volume is dm^3
 b) The length of pencil is 5 cms
 c) The work done by a system is 5 Joules
 d) Air sometimes is considered as a heterogeneous mixture due to the presence of dust particles which form a separate phase
662. Aqueous solution containing 1 mole of SO_2Cl_2 is neutralized by
 a) 2 moles of $Ca(OH)_2$ b) 1 mole of $Ca(OH)_2$ c) 2 moles of KOH d) 4 moles of KOH
663. Given that the abundance of isotopes $_{54}Fe$, $_{56}Fe$ and $_{57}Fe$ are 5%, 90% and 5% respectively, the atomic mass of Fe is

a) 55.85 b) 55.95 c) 55.75 d) 56.05

664. Which of the following statements is/are correct about the following reaction?

$Fe_3O_4 \xrightarrow{\Delta} Fe_2O_3$

a) The equivalent weight of Fe_3O_4 is M_1 (M_1 =Molecular weight of Fe_3O_4)
b) The equivalent weight of Fe_3O_4 is $M_1/3$
c) The equivalent weight of Fe_2O_3 is $3M_2/2$ (M_2 =Molecular weight of Fe_2O_3)
d) The equivalent weight of Fe_2O_3 is $M_2/2$

665. 100 mL of 0.06 M $Ca(NO_3)_2$ is added to 50 mL of 0.06 M $Na_2C_2O_4$. After the reaction is complete
a) 0.003 moles of calcium oxalate will get precipitated
b) 0.003 M of excess Ca^{2+} will remain in excess
c) $Na_2C_2O_4$ is the limiting reagent
d) $Ca(NO_3)_2$ is the excess reagent

666. Which of the following are isoelectronic of O^{2-}?
a) N^{3-} b) F^- c) Ti^+ d) Na^+

667. Which of the following statements is/are correct?
a) Chloropicrin ($CCl_3 \cdot NO_2$) can be made cheaply for use as an insecticide by the following reaction: $CH_3NO_2 + Cl_2 \rightarrow CCl_3 \cdot NO_2 + HCl$
b) In a rocket motor fueled with butane (C_4H_{10}), 0.1 mol of butane requires 14.56 L of O_2 at STP for complete combustion
c) A portable hydrogen generator utilises the reaction: ($CaH_2 + H_2O \rightarrow Ca(OH)_2 + H_2$). 2.1 g of CaH_2 would produce 2.24 L of H_2 at STP
d) In the Mond process for purifying nickel, the volatile nickel carbonyl [Ni $(CO)_4$] is produced by the reaction
$Ni + CO \rightarrow Ni\,(CO)_4$. 58.7 g of Ni utilises 89.6 L of CO at standard conditions

668. The molar mass of haemoglobin is about 65000 g/mol. Haemoglobin contains 0.35% Fe by mass. Thus, iron atoms present in haemoglobin molecule are
a) 1 b) 2 c) 3 d) 4

669. Acidified $K_4Cr_2O_7$ solution changes to green
a) When SO_2 gas is passed into it b) When $FeCl_3$ is added to it
c) When $FeSO_4$ is added to it d) When H_2O_2 is added to it

670. 25 mL of 0.2 M $AgNO_3$ is mixed with 50.0 mL of 0.08 M Na_2CO_3 solution. Resulting solution has
a) 0.02 M Na_2CO_3 b) 0.02 M $AgNO_3$ c) 0.0025 mol Ag_2NO_3 d) 0.69 g Ag_2CO_3

671. We have 1.6 g CH_4, 1.7 g NH_3 and 1.8 g H_2O select correct the alternate(s)
a) There are equal number of moles of each reactant
b) Total number of atoms in $CH_4 > NH_3 > H_2O$
c) Total number of H-atoms are in the ratio of 4 : 3 : 2
d) Total number of C-atoms in CH_4 < that of N-atoms in NH_3 < that of O-atoms in H_2O

672. 20 mL of H_2O_2 is reacted completely with acidified $K_2Cr_2O_7$ solution. 40 mL of $K_2Cr_2O_7$ solution was required to oxidise the H_2O_2 completely. Also, 2.0 mL of the same $K_2Cr_2O_7$ solution required 5.0 mL of a 1.0 $MH_2C_2O_4$ solution to reach
equivalence point. Which of the following statements is/are correct?
a) The H_2O_2 solution is 5 M
b) The volume strength of H_2O_2 is 56 V
c) The volume strength of H_2O_2 is 112 V
d) If 40 mL of 5 M/8 H_2O_2 is further added to the 10 mL of above H_2O_2 solution the volume strength of the resulting solution is changed to 16.8 V

673. 0.1 mol of $MnO_4^{\ominus}$ (in acidic medium) can

a) Oxidise 0.5 mol of Fe^{2+}
b) Oxidise 0.166 molof FeC_2O_4
c) Oxidise 0.25 mol of $C_2O_4{}^{2-}$
d) Oxidise 0.6 mol of $Cr_2O_7{}^{2-}$

674. Avogadro's number is the number of molecules present in
a) 32 g of oxygen
b) 1 g molecule of a substance
c) 22.4 L if a gas at NTP
d) None of the above

675. 100 mL of 0.2 M $KAl(OH)_2CO_3$ solution is completely neutralised by a standard solution of M/4 $H_2C_2O_4$ Which of the following is/are wrong?
a) The volume of $H_2C_2O_4$ required is 160 mL
b) The volume of $H_2C_2O_4$ required is 80 mL
c) The normality of $KAl(OH)_2CO_3$ is 0.4 N
d) It is a redox reaction

676. Which of the following statements is/are correct about the reaction?
$H_2SO_4 + Cu_3P + Cr_2O_7{}^{2-} \rightarrow CuSO_4 + H_3PO_4 + 2Cr^{3+}$
a) The number of moles of $Cr_2O_7^{2-}$ required to oxidise 6 mol of Cu_3P to $CuSO_4$ and H_3PO_4 is 11 mol
b) The number of moles of H_2SO_4 used in the reaction is 62
c) The number of moles of $Cr_2(SO_4)_3$ formed in the reaction is 11
d) The number of moles of K_2SO_4 formed in the reaction is 11

677. What volume of 0.1 M $KMnO_4$ in acidic medium required for complete oxidation of 100 mL of 0.1 M FeC_2O_4 and 100 mL of 0.1 M ferric oxalate separately
a) 60 mL of $KMnO_4$ with FeC_2O_4
b) 40 mL of $KMnO_4$ with FeC_2O_4
c) 40 mL of $KMnO_4$ with ferric oxalate
d) 120 mL of $KMnO_4$ with ferric oxalate

678. Three different solutions of oxidizing agents $K_2Cr_2O_7, I_2$, and $KMnO_4$ is titrated separately with 0.19 g of $K_2S_2O_3$. The molarity of each oxidising agent is 0.1 M and the reactions are:
i. $Cr_2O_7{}^{2-} + S_2O_3{}^{2-} \rightarrow Cr^{3+} + SO_4{}^{2-}$
ii. $I_2 + S_2O_3{}^{2-} \rightarrow I^{\ominus} + S_4O_6{}^{2-}$
iii. $MnO_4{}^{\ominus} + S_2O_3{}^{2-} \rightarrow MnO_2 + SO_4{}^{2-}$
(molecular weight of $K_2S_2O_3 = 190, K_2Cr_2O_7 = 294, KMnO_4 = 158$, and $I_2 = 254\ g\ mol^{-1}$)
Which of the following statements is/are correct?
a) All three oxidising agents can act as self-indicators
b) Volume of I_2 used is minimum
c) Volume of $K_2Cr_2O_7$ used is maximum
d) Weight of $KmnO_4$ used in the titration is maximum

679. Which of the statements are correct?
a) Physical quantity represented by work in joule is kg m^2s^{-2}
b) Physical quantity represented by force in newton is kg m s^{-2}
c) Physical quantity represented by work in joule is kg m s^{-2}
d) Physical quantity represented by force in newton is kg m^2s^{-2}

680. Nessler's reagent is used for the test of
a) CrO_4^{2-}
b) MnO_4^-
c) NH_4^+
d) PO_4^{3-}

681. Which of the following have same significant figures?
a) 0.070
b) 0.70
c) 7.0
d) 70

682. The molar mass of haemoglobin is about 65000 g mol^{-1}.Every haemoglobin contains 4 iron atoms. Thus,
a) Iron content in haemoglobin is 0.35% by mass
b) 1 mole of haemoglobin contains 56 g iron
c) 1 mole of haemoglobin contains 224 g iron
d) If iron content is increased to 0.56%, molar mass of haemoglobin would be higher than 65000 g mol^{-1}

683. A mixture of n_1 moles of $Na_2C_2O_4$ and $NaHC_2O_4$ is titrated separately with H_2O_2 and

KOH, to reach at equivalence point

Which of the following statements is/are correct

a) Moles of H_2O_2 andKOH are $n_1 + n_2$ and n_2

b) Moles of H_2O_2 and KOH is: $n_1 + \frac{n_2}{2}$ and n_1

c) n-factors of $NaHC_2O_4$ with KOH and H_2O_2 respectively, are 1 and 2

d) n-factors of $Na_2C_2O_4$ with H_2O_2 and KOH, respectively, are 2 and 1

684. 18 mL of 1.0 M Br_2 solution undergoes complete disproportionation in basic medium to $Br^{\ominus}$and $BrO_3^{\ominus}$. Then the resulting solution requires 45 mL of As^{3+}solution to reduce BrO_3 to Br. $As^{3-}$is oxidized to As^{5+}. Which statements are correct?

a) $Ew(Br_2) = \frac{M}{10}$

b) $Ew(Br_2) = \frac{5M}{3}$

c) Molarity of $As^{+3} = 0.4$ M

d) Molarity of $As^{3+} = 0.2$ M

685. Precipitation of cations a sulphide can be done by

a) H_2S

b) CdS

c) K_2CS_3

d) $(NH_4)_2S_2$

686. Which of the following relationships are wrong?

a) 1 atm =760 cm Hg

b) $1\ eV = 1.6021\times 10^{-19}\ cal$

c) $1\ u = 931.43\ eV$

d) $1\ dyne = 10^{-5}$ N

687. 100 mL of M/10 $Ca(MnO_4)_2$ in acidic medium can be oxidized completely with

a) 100 mLof 1 M $FeSO_4$ solution

b) $\frac{100}{3}$ mL of 1 M FeC_2O_4 solution

c) 25 mL of 1 M $K_2Cr_2O_7$ solution

d) 75 mL of 1 M $C_2O_4^{2-}$ solution

688. Which of the following relations are correct?

a) $1\ eV = 9.11 \times 10^{-4}$ J

b) $1\ L = 1\ dm^3$

c) 1 J = 1.98 cal

d) 1 atm = 1.01325 bar

689. Which of the following statements is/are correct?

i. 21.0 of lithium reacts with 32.0 g of O_2

$4Li + O_2 \rightarrow 2Li_2O$

ii. 3.9 g of K reacts with 4.26 g of CI_2

$2K + CI_2 \rightarrow 2KCl$

[Atomic weight of Li = 7 and K = 39 Mw of Li_2O = 30 and KCl = 74.5 g mol^{-1})

a) In reaction (i), O_2 is in excess

b) 45.0 g of Li_2O is formed is reaction (i)

c) In reaction (ii), Cl_2 is in excess

d) 7.45 g if KCl is formed is reaction (ii)

690. Which of the following statements is/are correct?

1.0 g mixture of $CaCO_3(s)$ and glass beads liberate 0.22 g of CO_2 upon treatment with excess of HCl. Glass does not react with HCl

$CaCO_3 + 2HCl \rightarrow CO_2 + H_2O + CaCl_2$

[Mw $CaCO_3$ = 100, Mw of CO_2 = 44, [Atomic weight of Ca = 40]

a) The weight of $CaCO_3$ in the original mixture is 0.5 g

b) The weight of calcium in the original mixture is 0.2 g

c) The weight of percent of calcium in the original mixture is 40% Ca

d) The weight percent of Ca in the original mixture is 20% Ca

691. If 0.80 mole of MnO_2 and 146 g of HCl react $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$ then,

a) 0.80 mole of Cl_2 is formed

b) 0.80 mole of HCl remains unreacted

c) MnO_2 is completely reacts

d) MnO_2 is the limiting reactant

692. Which of the following statements is/are correct in the following reaction

$As_2S_5 + NO_3^{\ominus} \rightarrow AsO_4^{3-} + NO_2 + SO_4^{2-}$

a) The equivalent weight of As_2S_5 is M/40 (M =molecular weight of As_2S_5)

b) The equivalent weight of $NO_3^{\ominus}$ is M/3

(M =molecular weight of $NO_3^{\ominus}$ion)

c) n-factor for the conversion of As_2S_5 to AsO_4^{3-} is zero

d) n-factor for the conversion of As_2S_5 to SO_4^{2-} is 30

693. In which of the following pairs, 10 g of each have an equal number of molecules?

a) N_2O and CO
b) N_2 and C_3O_2
c) N_2 and CO
d) N_2O and CO_2

694. 1 L sample of impure water containing sulphide ion is made ammoniacal and is titrated with 300 mL of 0.1 M $AgNO_3$ solution. Which of the following statements is/are correct about the above reaction?

a) The strength of H_2S in water is 0.51 g L^{-1}

b) The strength of H_2S in water is 5.1 g L^{-1}

c) The concentration of H_2S in water in ppm is 510

d) The concentration of H_2S in water in ppm is 51

695. Which of the following is/are correct?

100 mL of 3.0 M $HClO_3$ reacts with excess of $Ba(OH)_2$ according to the equation :

$Ba\,(OH)_2 + 2HClO_3 \rightarrow Ba(ClO_3)_2 + 2H_2O$

(Mw of $Ba(CIO_3)_2 = 304$ g mol^{-1})

a) 1.5 mol of $Ba(ClO_3)_2$ is formed
b) 3 mol of $Ba(ClO_3)_2$ is formed
c) 45.6 g of $Ba(CIO_3)_2$ is obtained
d) 4.56 g of $Ba(ClO_3)_2$ is obtained

696. x g of H_2O_2 requires 100 mL of M/5 $KMnO_4$ in a titration in a solution having pOH = 1.0

Which of following is/are correct?

a) The value of x is 1.7 g
b) The value of x is 0.34 g
c) $MnO_4^{\ominus}$ changes to MnO_4^{2-}
d) H_2O_2 changes to O_2

697. In which of the reactions, oxygen is an oxidant

a) $2F_2 + O_2 \rightarrow 2F_2O$
b) $C + O_2 \rightarrow CO_2$
c) $2C + O_2 \rightarrow 2CO$
d) $2N_2 + O_2 \rightarrow 2N_2O$

698. Which of the following statements are correct?

a) French chemist A. Lavoisier is called the father of chemistry and proposed the law of conservation of mass

b) French chemist Joseph Proust proposed the law of definite proportions

c) Dalton proposed the law of multiple proportions

d) Richter proposed the law of reciprocal proportions

699. A sample of metal contains 2.516×10^{23}atoms and has mass of 82.29 g. Select the correct statements for this case

a) Atomic mass of the metal is 197

b) Number of moles present in the given amount is 0.42

c) The probable metal is a coin metal

d) It is natural occurring metal

700. Which is/are correct about 4.25 g NH_3?

a) It contains 0.25 mole of NH_3

b) It contains 0.75 mole of H-atoms

c) It contains total of 1.0 mole of N and H atoms

d) It contains 1.5×10^{23} molecules of NH_3

701. Which quantity is/are independent of temperature?

a) Molarity
b) Mole fraction
c) % by weight
d) Molality

702. Permanent hardness is due to $Cl^{\ominus}$and $SO_4^{2-}$of $Mg^{+2}$and Ca^{2+} and is removed by adding Na_2CO_3

$CaSO_4 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$

$CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaCl$

Which of the following statements is/are correct?

a) If hardness is 100 ppm $CaCO_3$, the amount of Na_2CO_3 required to soften 10 L of hard water is 10.6 g

b) If hardness is 100 ppm $CaCO_3$, the amount of Na_2CO_3 required to soften 10 L of hard is 10.6 g
c) If hardness is 420 ppm $MgCO_3$, the amount of Na_2CO_3 required to soften 10 L of hard water is 53.0 g
d) If hardness is 420 ppm $MgCO_3$, the amount of Na_2CO_3 required to soften 10 L of hard water is 5.3 g

703. A solution is 2.00×10^{-4} M M in NaCl and 8.0×10^{-4} Min HCl, Thus
a) pH = 3.1 b) $p_{Cl^-} = 3.7$ c) $p_{Na^+} = 3.7$ d) $p_{Cl^-} = 3.0$

704. Which of the following statements is/are correct about 6.8 % strength of H_2O_2?
a) Its normality is 4 N b) Its molarity is 2 M
c) Its volume strength is 22.4 V d) Volume strength = 11.2 × M

705. Among the following groupings which represents the collection of isoelectronic species?
a) NO, CN^-, N_2, O_2^- b) $NO^+, C_2^{2-}, O_2^-, CO$ c) N_2, C_2^{2-}, CO, NO d) CO, NO^+, CN^-, C_2^{2-}

706. $KClO_4$ can be prepared by following reactions:
i. $Cl_2 + 2KOH \rightarrow KCl + KClO + H_2O$
ii. $3KClO \rightarrow 2KCl + KClO_3$
iii. $4KClO_3 \rightarrow 3KClO_4 + KCl$
(Atomic weight of K, Cl, and O are 39, 35.5 and 16)
a) The amount of Cl_2 required to prepare 277 g of $KClO_4$ by above series of $KClO_4$ by above series of reaction is 568 g
b) The volume of KOH in litres used by Cl_2, if KOH is 1.5 M, is 1.067 L
c) The amount of CI_2 required to prepare 200 g of $KClO_4$ by above series of reaction is 284 g
d) The volume of KOH in litres used by Cl_2, if KOH is 1.5 M, is 10.67 L

707. Which of the following may contain one proton and one neutron?
a) H_2^+ b) ${}_2^4He$ c) ${}_1^2D$ d) ${}_1^3T$

708. $H_2C_2O_4$ and $NaHC_2O_4$ behave as acids as well as reducing agents. Which are correct statements?
a) Equivalent weight of $H_2C_2O_4$and $NaHC_2O_4$are equal to their molecular weights when behaving as reducing agents
b) 100 mL of 1 M solution of each is neutralized by equal volumes of 1 M $Ca(OH)_2$
c) 100 mLof 1 N solution of each is neutralized by equal volumes of 1 N $Ca(OH)_2$
d) 100 mLof 1 M solution of each is oxidized by equal volumes of 1 M $KMnO_4$

709. Which of the following is/are correct?
The following reaction occurs :
$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$
106.0 g of Na_2CO_3 reacts with 109.5 g of HCl
a) The HCl is in excess
b) 117.0 g of NaCl is formed
c) The volume of CO_2 produced at 1 bar and 273 K is 22.7 L
d) The volume of CO_2 produced at 1 bar and 298 K is 24.7 L

710. Which of the following statements is/are correct?
a) 21.2 g sample of impure Na_2CO_3 is dissolved and reacted with a solution of $CaCl_2$, the weight of precipitate of $CaCO_3$ is 10.0 g. The % purity of Na_2CO_3 is 50%
b) The percentage purity of Na_2CO_3 is 60%
c) The number of moles of $Na_2CO_3 = CaCO_3 = 0.1$ mol
d) The number of moles of NaCl forms is 0.1 mol

711. Which of the statements are true?
Where Mw is the molecular weight of the respective compounds
a) The equivalent weight of $Ca_3(PO_4)_2$ is $Mw/6$
b) The equivalent weight of $Na_3PO_4 \cdot 12H_2O$ is $Mw/3$
c) The equivalent weight of K_2SO_4 is $Mw/2$

d) The equivalent weight of potash alum $K_2SO_4Al_2(SO_4)_3 \cdot 24H_2O$ is $Mw/8$

712. 2.0 g of an element is reacted with aqueous solution containing KOH and KNO_3 to yield K_2XO_2 and NH_3 · NH_3 thus liberated is absorbed in 200 mLof 0.05 MH_2SO_4. The excess acid required 10 mL of 1.5 M NaOH for complete neutralisation

Which of the following statements is/are correct?

a) The atomic weight of X is 100 g
b) The equivalent weight of X is 50 g
c) The equivalent weight of X is 25 g
d) The atomic weight of X is 200 g

713. Which of the following have same significant figures?

a) 6.02×10^{23}
b) 7.70×10^{-20}
c) 7.50
d) 0.75

714. Which of the following statements is/are **wrong**?

The following reactions occur:

i. $P_4 + 5O_2 \rightarrow P_4O_{10}$

ii. $P_4 + 3O_2 \rightarrow P_4O_6$

1.24 g of P_4 reacts with 8.0 g of O_2

a) P_4 is the limiting quantity
b) O_2 is the limiting quantity
c) Mass of P_4O_{10} obtained is 2.2 g
d) Mass of P_4O_6 obtained is 2.84 g

715. The simplest formula of a compound containing 50% of element X (atomic weight 10) and 50% of element Y (atomic weight 20) is

a) XY
b) X_2Y
c) XY_2
d) X_2Y_3

716. For the given aqueous reaction which of the statement (s) is (are) true?

$$\text{(Excess) KI} + K_3[Fe(CN)_6] \xrightarrow{\text{Dilute } H_2SO_4} \text{Brownish-yellow solution}$$

$$\downarrow ZnSO_4$$

$$\text{(White precipitate + Brownish-yellow filtrate)}$$

$$\downarrow Na_2S_2O_3$$

$$\text{Colourless solution}$$

a) The first reaction is a redox reaction
b) White precipitate is $Zn_3[Fe(CN)_6]_2$
c) Addition of filtrate to starch solution gives blue colour
d) White precipitate is solution in NaOH solution

717. ${}^{35}_{17}Cl$ and ${}^{35}_{17}Cl$ differ in

a) Atomic number
b) Number of neutrons
c) Number of electrons
d) Atomic mass

718. Two bulbs A and B contains 16 g O_2 and 16 g O_3, respectively. Which of the statements are true?

a) Both bulbs contain same number of atoms
b) Both bulbs contain different number of atoms
c) Both bulbs contain same number of molecules
d) Bulb A contains $N_A/2$ molecules while bulb B contains $N_A/3$ molecnles. (N_A = Avogadro's number)

719. Consider the following reactions:

$KClO_3(s) \xrightarrow{\Delta} KCl(s) + O_2(g)$, yield = 60%

$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$, yield = 50% (0.2 M)

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$, yield = 50%

What volume of 0.2 M H_2SO_4 solution is required to produce enough H_2 to completely react with O_2 liberated due to decomposition of 1.225 $KClO_3$

(Molecular weight of $KClO_3 = 39 + 35.5 + 3 \times 16$

$= 122.5 \text{ g mol}^{-1}$)

a) 150 mL b) 180 mL c) 360 mL d) 480 mL

720. 100 mLof 1.44% solution of pure FeC_2O_4 in dil. HCl is oxidized by 0.01 M $KMnO_4$.Then volume of $KMnO_4$required is

a) 120 mL b) 600 mL c) 200 mL d) 60 mL

721. 100 mL of 0.8 *M* NaOH are used to neutralised 100 mL solution obtained by passing 2.70 g SO_2Cl_2 in water. Select the correct statement.

a) The solution of SO_2Cl_2 has 0.2 *M* H_2SO_4 and 0.4 *M* HCl

b) The volume ratio of NaOH used for H_2SO_4 and HCl is 1 : 2

c) The volume ratio of NaOH used for H_2SO_4 and HCl is 1 : 1

d) Molarity of SO_2Cl_2 solution is 0.1 *M*

722. Which of the following reactions is/are not intermolecular redox reaction?

a) $PbO_2 + H_2O \rightarrow PbO + H_2O_2$

b) $2KClO_3 \rightarrow 2KCl + 3O_2$

c) $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$

d) $NH_4NO_2 \rightarrow N_2 + 2H_2O$

723. 10.78 g of H_3PO_4 in 550 mL solution is 0.40 N. Thus, this acid

a) Has been neutralized to HPO_4^{2-}

b) Has been neutralized to PO_4^{2-}

c) Has been neutralized to HPO_3^{2-}

d) Has been neutralized to $H_2PO_4^-$

724. Which of the following statements is/are correct?

The following reaction occurs:

$2Al + 3MnO \xrightarrow{\Delta} Al_2O_3 + 3Mn$

108.0 g of Al and 213.0 g of MnO was heated to initiate the reaction. (*Mw* of MnO = 71, atomic weight of Al = 13)

a) Al is present is excess b) MnO is present is excess

c) 54.0 g of Al is required d) 159.0 g of MnO is in excess

725. A solution of solute *X* contains 40% *X* by weight of solution. 800 g of this solution was cooled when 100 g of solute is precipitated. Thus, percentage composition of the remaining solution is

a) 31.4% b) 20.0% c) 23.0% d) 24.0%

726. $K_4[Fe(CN)_6]$ can be used to test

a) Fe^{3+} b) Fe^{2+} c) Zn^{2+} d) Cd^{2+}

727. Equal weights of X (atomic weight = 36) and Y (atomic weight = 24) are reacted to form the compound X_2Y_3, which of the following is/are correct?

a) X is the limiting reagent b) Y is the limiting reagent

c) No reactant is left over d) Mass of X_2Y_3 formed is double the mass of X taken

728. In diammonium hydrogen phosphate, $(NH_4)_2HPO_4$, percentage as

a) P_2O_5 is 53.78% b) NH_3 is 25.76% c) P is maximum d) N is maximum

729. When 100 mL of 0.1 M KNO_3 and 400 mL of 0.2 M HCl and 500 mL of 0.3 M H_2SO_4 are mixed, then in the resulting solution

a) The molarity of $K^{\oplus} =$ 0.01 M

b) The molarity of SO_4^{2-} = 0.15 M

c) The molarity of $H^{\oplus} =$ 0.38 M

d) The molarity of $NO_3^{\ominus}$ = 0.08 and $CI^{\ominus} =$ 0.01 M

730. Select the correct statements(s):

a) One mole of electrons weigh 0.55 mg

b) The number of atoms present in a molecule of gas is called atomicity
c) H_3BO_3 is monobasic acid
d) Na_3BO_3 is a salt

731. Which of the following statement is/are correct?
Excess of $H_2S(g)$ is bubbled into 1.0 L of 0.1 M $CuCl_2$ solution
$Cu^{2+} + H_2S(g) \rightarrow CuS(s) + 2H^{\oplus}$
a) 9.55 of CuS is produced
b) The concentration of $H^{\oplus}$ ions is 0.2 M
c) The concentration of $H^{\oplus}$ ions is 0.1 M
d) 95.5 g CuS is produced

732. Which of the following statements is/are correct?
The reaction:
a) $Bi + 4HNO_3 + 3H_2O \rightarrow Bi(NO_3)_3 \cdot 5H_2O + NO$
2.09 g of Bi in HNO_3 produces 48.5 g of bismuth nitrate
(Atomic weight Bi = 209 g, Mw of Bi $(NO_3)_3 \cdot 5H_2O = 485$ g)
b) 4.0 g of 63% HNO_3 by mass is required to react with 2.09 g of Bi
c) The volume of NO gas produced at STP (1 bar, 273 K) is 0.227 L
d) The volume of NO gas produced at SATP (1 bar, 298 K) is 0.247 L

733. Which of the following statements is/are correct?
20.0mL of 6.0 M HCl is mixed with 50.0 mL of 2.0 M $Ba(OH)_2$, and 30mL of water is added
a) The concentration of $\overset{\ominus}{O}H$ remaining in solution is 0.8 M
b) The concentration of $Cl^{\ominus}$ remaining in solution is 1.2 M
c) The concentration of Ba^{2+} remaining in solution is 1.0 M
d) 80 mmoles of $\overset{\ominus}{O}H$ is in excess

734. Mole fraction of ethanol $C_2H_5OH)$ in ethanol-water system is 0.25. Thus, it has
a) 25% ethanol by weight of solution
b) 75% water by weight of solution
c) 46% ethanol by weight of solution
d) 54% water by weight of solution

735. Which of the statements are true?
a) Brass is an element
b) Dry ice is a mixture
c) Aerated drink, e.g., coca cola, is a mixture
d) Diesel is a mixture

736. Which of the following statements is/are correct?
a) Mass of $Al_2(SO_4)_3 \cdot 18H_2O$ needed to make up 100 mL of an aqueous solution of concentration 27.0 mg of Al^{3+} per mL is 33.3 g
(Mw of $Al_2(SO_4)_3 \cdot 18H_2O = 666$ g mol^{-1}, atomic weight of Al = 27 g)
b) Mass of $CrCl_3 \cdot 6H_2O$ ($Mw = 266.5$ g) needed to prepare 1.0 L solution containing 26.0 g Cr^{3+} per litre is 133.25 g. (Atomic weight of Cr = 52 g)
c) Mass of NH_4Cl needed to prepare 100 mL of a solution containing 80 mg NH_4Cl per mL is 8.0 g
d) Mass of NH_3 per mL of solution needed for solution of NH_3 in water containing 20% NH_3 by weight (density = 0.8 g mL^{-1}) is 0.16 g mL^{-1}

737. A solution containing Cu^{2+} and $C_2O_4^2$ ions is titrated with 20 mL of M/4 $KMnO_4$ solution in acidic medium. The resulting solution is treated with excess of KI after neutralisation. The evolved I_2 is then absorbed is 25 mL of M/10 hypo solution
Which of the following statements are correct?
a) The difference of the number of m mol of $Cu^{2+}$and $C_2O_4^{2-}$ ions in the solution is 10 m mol
b) The difference of the number of m mol of Cu^{2+} and $C_2O_4^{2-}$ions in the solution is 22.5 m mol
c) The equivalent weight of Cu^{2+}ions in the titration with KI is equal to the atomic weight of Cu^{2+}
d) The equivalent weight of KI in the titration is M/2 (M=Molecular weight of KI)

738. The hardness of water due to $HCO_3^{\ominus}$ is 122 ppm. Select the correct statement (s)
   a) The hardness of water in terms of $CaCO_3$ is 200 ppm
   b) The hardness of water in terms of $CaCO_3$ is 100 ppm
   c) The hardness of water in terms of $CaCl_2$ is 222 ppm
   d) The hardness of water in terms of $MgCl_2$ is 95 ppm
739. Which one is not correct about
   $VO + Fe_2O_3 \longrightarrow FeO + V_2O_5$
   a) 2 mole of VO reacts completely with 5 mole of Fe_2O_3
   b) 1 mole of VO reacts completely with 1.5 mole of Fe_2O_3
   c) Eq. weight of $V_2O_5 = M/6$ and of Fe_2O_3 is $M/2$
   d) Eq. weight of $VO = M/3$ and FeO is M
740. A mixture containing one mole of BaF_2 and two mole of H_2SO_4 will be neutralised by:
   a) 1 mole KOH b) 2 mole $Ca(OH)_2$ c) 4 mole KOH d) 2 mole KOH
741. 11.2 g of mixture of MCl (volatile) and NaCl gave 28.7 g of white ppt with excess of $AgNO_3$ solution. 11.2 g of same mixture on heating gave a gas that on passing into $AgNO_3$ solution gave 14.35 g of white ppt. Hence,
   a) Ionic mass of M^+ is 18
   b) Mixture has equal mole fraction of MCl and NaCl
   c) MCl and NaCl are in the 1 : 2 molar ratio
   d) Ionic mass of M^+ is 10
742. $H_2C_2O_4$ and $NaHC_2O_4$ behave as acids as well as reducing agents. Which of the following are correct statements?
   a) Equivalent weights of $H_2C_2O_4$ and $NaHC_2O_4$ are equal to their molecular weights when acting as reducing agents
   b) Equivalent weights of $H_2C_2O_4$ and $NaHC_2O_4$ are equal to half their molecular weights when acting as reducing agents
   c) 100 mL of 1 M solution of each is neutralized by equal volumes of 1 N$Ca(OH)_2$
   d) 100 mL of 1 M solution of each is oxidized by equal volumes of 1 M $KMnO_4$
743. 56.0 g KOH, 138.0 g K_2CO_3 and 100.0 g $KHCO_3$ is dissolved in water and the solution is made 1 L. 10 mLof this stock solution is titrated with 2.0 M HCl. Which of the following statements is/are correct?
   a) When phenolphthalein is used as an indicator from the very beginning, the titre value of HCl will be 60 mL
   b) When phenolphthalein is used as an indicator from the very beginning, the titre value of HCl will be 40 mL
   c) When methyl orange is used as an indicator from the very beginning, the titre value of HCl will be 80 mL
   d) When methyl orange is used as an indicator after the first end point, the titre value of HCl will be 40 mL
744. Which of the following is/are correct about the redox reaction?
   $MnO_4^{\ominus} + S_2O_3^{2-} + H^{\oplus} \rightarrow Mn^{+2} + S_4O_6^{2-}$
   a) 1 mol of $S_2O_3^{2-}$ is oxidized by 8 mol of $MnO_4^{\ominus}$
   b) The above redox reaction with the change of pH from 4 to 10 will have an effect on the stoichiometry of the reaction
   c) Change of pH from 4 to 7 will change the nature of the product
   d) At pH $= 7, S_2O_3^{2-}$ ions are oxidised to $HSO_4^{\ominus}$
745. Which of the following solutions contains same molar concentration?
   a) 166 g. KI/L solution
   b) 33.0 g $(NH_4)_2SO_4$ in 200 mL solution
   c) 25.0 g $CuSO_4 \cdot 5H_2O$ in 100 mL solution
   d) 27.0 mg Al^{3+}per mL solution

: ANSWER KEY :

1)	a	2)	a	3)	a	4)	b	165)	a	166)	d	167)	b	168)	c
5)	c	6)	a	7)	a	8)	d	169)	b	170)	c	171)	d	172)	a
9)	b	10)	c	11)	b	12)	a	173)	b	174)	b	175)	d	176)	d
13)	c	14)	b	15)	c	16)	a	177)	b	178)	b	179)	d	180)	d
17)	b	18)	c	19)	a	20)	b	181)	b	182)	a	183)	d	184)	a
21)	a	22)	b	23)	a	24)	a	185)	d	186)	a	187)	a	188)	a
25)	b	26)	a	27)	b	28)	a	189)	d	190)	a	191)	a	192)	c
29)	a	30)	d	31)	b	32)	c	193)	c	194)	b	195)	b	196)	d
33)	d	34)	c	35)	c	36)	b	197)	b	198)	b	199)	a	200)	a
37)	b	38)	b	39)	a	40)	c	201)	a	202)	a	203)	c	204)	b
41)	d	42)	c	43)	d	44)	b	205)	a	206)	b	207)	d	208)	c
45)	b	46)	c	47)	d	48)	a	209)	b	210)	c	211)	a	212)	d
49)	d	50)	d	51)	b	52)	c	213)	d	214)	c	215)	b	216)	c
53)	a	54)	a	55)	a	56)	b	217)	c	218)	c	219)	b	220)	c
57)	a	58)	b	59)	b	60)	a	221)	d	222)	d	223)	b	224)	d
61)	d	62)	c	63)	a	64)	a	225)	c	226)	c	227)	c	228)	c
65)	a	66)	a	67)	c	68)	d	229)	d	230)	c	231)	b	232)	c
69)	a	70)	a	71)	a	72)	a	233)	b	234)	b	235)	c	236)	b
73)	c	74)	a	75)	b	76)	b	237)	c	238)	a	239)	a	240)	d
77)	c	78)	a	79)	b	80)	c	241)	b	242)	a	243)	b	244)	a
81)	b	82)	d	83)	d	84)	c	245)	d	246)	c	247)	d	248)	b
85)	c	86)	a	87)	b	88)	d	249)	d	250)	d	251)	b	252)	d
89)	c	90)	a	91)	d	92)	d	253)	c	254)	b	255)	a	256)	d
93)	a	94)	d	95)	c	96)	b	257)	a	258)	d	259)	d	260)	c
97)	b	98)	b	99)	b	100)	d	261)	c	262)	a	263)	c	264)	a
101)	a	102)	a	103)	a	104)	b	265)	a	266)	b	267)	b	268)	b
105)	c	106)	a	107)	a	108)	b	269)	b	270)	c	271)	a	272)	c
109)	a	110)	a	111)	c	112)	b	273)	a	274)	d	275)	b	276)	b
113)	a	114)	d	115)	a	116)	c	277)	c	278)	c	279)	d	280)	c
117)	b	118)	a	119)	b	120)	d	281)	a	282)	a	283)	d	284)	a
121)	c	122)	d	123)	c	124)	d	285)	c	286)	b	287)	b	288)	c
125)	a	126)	b	127)	b	128)	a	289)	b	290)	a	291)	b	292)	b
129)	a	130)	d	131)	c	132)	c	293)	c	294)	c	295)	a	296)	a
133)	c	134)	d	135)	c	136)	c	297)	d	298)	a	299)	d	300)	b
137)	c	138)	a	139)	c	140)	d	301)	a	302)	d	303)	a	304)	d
141)	b	142)	b	143)	c	144)	c	305)	d	306)	a	307)	d	308)	d
145)	d	146)	d	147)	d	148)	a	309)	d	310)	a	311)	b	312)	c
149)	a	150)	a	151)	c	152)	c	313)	a	314)	b	315)	a	316)	b
153)	c	154)	c	155)	c	156)	c	317)	d	318)	c	319)	c	320)	b
157)	d	158)	a	159)	a	160)	a	321)	b	322)	d	323)	b	324)	d
161)	a	162)	d	163)	b	164)	a	325)	c	326)	c	327)	d	328)	a

329)	c	330)	a	331)	b	332)	a	513)	d	514)	b	515)	c	516)	b
333)	d	334)	b	335)	a	336)	d	517)	c	518)	a	519)	b	520)	d
337)	a	338)	c	339)	a	340)	d	521)	d	522)	c	523)	c	524)	d
341)	d	342)	c	343)	a	344)	a	525)	a	526)	d	527)	a	528)	b
345)	b	346)	d	347)	c	348)	d	529)	a	530)	d	531)	a	532)	a
349)	c	350)	a	351)	a	352)	b	533)	d	534)	b	535)	b	536)	a
353)	d	354)	b	355)	a	356)	b	537)	d	538)	b	539)	a	540)	a
357)	d	358)	d	359)	a	360)	d	541)	b	542)	c	543)	b	544)	c
361)	d	362)	d	363)	b	364)	a	545)	c	546)	a	547)	c	548)	d
365)	a	366)	b	367)	a	368)	c	549)	b	550)	d	551)	c	552)	a
369)	a	370)	d	371)	c	372)	c	553)	d	554)	b	555)	c	556)	b
373)	b	374)	b	375)	a	376)	b	557)	b	558)	b	559)	a	560)	b
377)	d	378)	b	379)	c	380)	a	561)	c	562)	b	563)	c	564)	c
381)	b	382)	b	383)	c	384)	a	565)	d	566)	a	567)	d	568)	a
385)	a	386)	d	387)	a	388)	b	569)	c	570)	b	571)	d	572)	a
389)	c	390)	c	391)	a	392)	a	573)	b	574)	a	575)	b	576)	a
393)	b	394)	b	395)	c	396)	c	577)	c	578)	a	579)	d	580)	a
397)	b	398)	a	399)	c	400)	c	581)	a	582)	a	583)	c	584)	c
401)	a	402)	b	403)	b	404)	b	585)	a	586)	b	587)	c	588)	a
405)	c	406)	b	407)	d	408)	c	589)	a	590)	b	591)	a	592)	d
409)	a	410)	c	411)	a	412)	d	593)	a	594)	d	595)	a	596)	b
413)	a	414)	a	415)	a	416)	c	597)	a	598)	d	599)	a	600)	b
417)	a	418)	d	419)	d	420)	a	601)	a	602)	a	603)	c	1)	
421)	c	422)	b	423)	a	424)	c		a,b,c	2)	a,b,c,d	3)	a,b,d	4)	
425)	a	426)	c	427)	c	428)	b		b,c,d						
429)	c	430)	a	431)	d	432)	d	5)	a,b	6)	a,b,c	7)	c,d	8)	
433)	a	434)	a	435)	b	436)	d		b,c						
437)	c	438)	a	439)	b	440)	d	9)	a,b,d	10)	c,d	11)	a,b,c,d	12)	
441)	b	442)	d	443)	c	444)	d		a,c						
445)	c	446)	a	447)	a	448)	d	13)	a,b,d	14)	a	15)	b,d	16)	
449)	c	450)	a	451)	a	452)	a		a,b						
453)	d	454)	c	455)	b	456)	c	17)	c,d	18)	a,b	19)	a, b, d	20)	
457)	a	458)	c	459)	d	460)	d		b,c						
461)	d	462)	d	463)	a	464)	b	21)	a,b	22)	a,b	23)	a, d	24)	b
465)	b	466)	c	467)	c	468)	d	25)	a,b,c,d	26)	a,b,c,d	27)	a,b,c	28)	
469)	d	470)	d	471)	c	472)	b		a,c						
473)	b	474)	b	475)	c	476)	a	29)	a,c	30)	b,c	31)	c,d	32)	d
477)	d	478)	a	479)	c	480)	a	33)	a,c,d	34)	c, d	35)	a, c	36)	
481)	b	482)	b	483)	b	484)	c		b,c						
485)	a	486)	c	487)	c	488)	d	37)	b,c,d	38)	b,d	39)	a,b	40)	
489)	b	490)	a	491)	a	492)	c		a,c						
493)	a	494)	a	495)	d	496)	b	41)	b	42)	a,c	43)	a, c	44)	
497)	a	498)	a	499)	a	500)	a		a,b,c						
501)	c	502)	a	503)	a	504)	a	45)	a,b	46)	a,d	47)	a, b, c	48)	a
505)	b	506)	a	507)	b	508)	d	49)	a, b, c	50)	b,d	51)	a,b	52)	
509)	d	510)	a	511)	d	512)	b		b,c,d						

53)	b,c	54)	a,c,d	55)	a,b,c	56)	a,b,c,d
57)	b	58)	b,c	59)	a	60)	b
61)	a,c	62)	a,c,d	63)	a,b,d	64)	a,b,c
65)	d	66)	a,c,d	67)	a,c,d	68)	a,b,c
69)	a,b,d	70)	a,b,c	71)	a,b,c	72)	b,c,d
73)	a,b,c,d	74)	a,d	75)	a,b,d	76)	a,b
77)	c	78)	a,b,c,d	79)	a,c,d	80)	a,c
81)	b,c	82)	a,c	83)	a,b,c	84)	a,b
85)	a,b,c,d	86)	a,b,c,d	87)	a,b,d	88)	a,b,c,d
89)	a,b,c	90)	c,d	91)	a,c	92)	a,c
93)	b,c,d	94)	b,c,d	95)	a,b,c,d	96)	a,b,c,d

97)	a,b,c,d	98)	b, c, d	99)	a,d	100)	a,c,d
101)	a,b,c,d	102)	d	103)	a,d	104)	c
105)	a,c,d	106)	a,b,c,d	107)	a,c	108)	a,b,c,d
109)	a,b	110)	a,b,c	111)	b,c,d	112)	b
113)	a,c,d	114)	b,d	115)	a,d	116)	b
117)	b	118)	a, c	119)	b,c,d	120)	a,c
121)	a,c	122)	a	123)	a,c,d	124)	c,d
125)	a,b	126)	a,b,c	127)	a, b, c, d	128)	a,b
129)	b,c,d	130)	a,b,c,d	131)	c,d	132)	c,d
133)	a,b,c,d	134)	a,c	135)	b,d	136)	b, c, d
137)	b, c	138)	a,b	139)	b,d	140)	b,c,d
141)	b,c,d	142)	a,c,d				

: HINTS AND SOLUTIONS :

1 **(a)**

${}_1^1H$ and ${}_1^2H$ are isotopes. Thus, they resemble very closely in their chemical properties

2 **(a)**

$Cr_2O_7{}^{2-} = Sn^{2+}(Sn^{2+} \rightarrow Sn^{4+} + 2e^-)$

$(n = 6) \quad (n = 2)$

1 Eq = 1 Eq

$\frac{1}{6}\text{mol} = \frac{1}{2}\text{mol}$

$\therefore$ 1 mol of $Sn^{2+} = \frac{2}{6}$ mol of $Cr_2O_7{}^{2-}$

$= \frac{1}{3}$ mol of $Cr_2O_7{}^{2-}$

3 **(a)**

KOH + Na_2CO_3

(x mmol) (y mmol)

i. $(x \times 1) + (y \times 2) \times \frac{1}{2} = \frac{1}{20} \times 15$

ii. $(x \times 1) + (y \times 2) = \frac{1}{20} \times 25 \Rightarrow y = 0.5$ and $x = 0.25$

$\Rightarrow KOH = x \text{ mmoles} = 0.25 \times 10^{-3} \times 56 \text{ g} = 0.014 \text{ g}$

4 **(b)**

$2H_2O_2 \rightarrow 2H_2O + O_2$

68 g 22.4 L (at STP)

Mass of H_2O_2 in 1.5 N solution = Ew of $H_2O_2 \times 1.5$ N

$= 17 \times 1.5 = 25.5$ g

So, volume strength of 1.5 N H_2O_2 solution

$= \frac{22.4 \text{ L} \times 25.5 \text{ g}}{68.0} = 8.4 \text{ L}$

7 **(a)**

$3.9854 \times 10^{-23} \text{ g} = 1 \text{ atom}$

Thus, $1 \text{ g} = \frac{1}{3.9854 \times 10^{-23}}$ atoms

$= 2.5092 \times 10^{23}$ atoms

8 **(d)**

Sn taken = 1.056 g

Sn unreacted = 0.601 g

Sn reacted = 1.056 − 0.601 = 0.455

$= \frac{0.455}{119} \text{ mol} = 0.004 \text{ mol}$

I_2 reacted $= 1.947 \text{ g} = \frac{1.947}{254} \text{ mol} = 0.008 \text{ mol}$

Thus, Sn : I_2 = 0.004 : 0.008 = 1 : 2

Thus, empirical formula is $Sn(I_2)_2$ or SnI_4

9 **(b)**

0.4 mol HCl ≡ 0.4 mol Cl^-

0.2 mol $CaCl_2$ = 0.4 mol Cl^-

Total moles = 0.8 mol Cl^- in 0.5 L solution

Thus, molarity = 1.6 M

10 **(c)**

I. $P + O_2 \rightarrow P_2O_5$

II. $C_{12}H_{22}O_{11} + H_2SO_4 \rightarrow 12C + H_2SO_4 \cdot 11H_2O$
(conc.) (charred mass)

III. $Cu + HNO_3 \rightarrow NO_2$
(brown fumes)

IV. $Cl_2 + 2NaOH \rightarrow NaClO + NaCl + H_2O$
(NaClO: Bleaching agent)

12 **(a)**

$2Y \rightarrow 2Y^{3+} + 6e^-$ ($Y \rightarrow Y^{3+} + 3e^-$, ($n$ factor $= 3$)

$6H^{\oplus} + 6e^- \rightarrow 3H_2$ ($2H^{\oplus} + 2e^- \rightarrow H_2$, n factor $= 2$)

1 eq if Y = 1 eq of H_2

$(n = 3) \quad (n = 2)$

$\frac{1}{3}$ mol Y $= \frac{1}{2}$ mol H_2

$\therefore$ Y : H_2 = 2 : 3

13 **(c)**

$\frac{0.2 \times 10^6}{500} = 400$

14 **(b)**

$CaCO_3 \rightarrow CaO + CO_2$

100 g = 1 mol 22 4 L at NTP

200 g 44.8 L at NTP

15 **(c)**

$Na_2SO_3 : H_2O \equiv 50:50$ (Mw of $Na_2SO_3 = 126$)

Mole: $\frac{50}{126} : \frac{50}{18}$

Ratio: 1:7

16 **(a)**

K_2SO_4 and K_2SeO_4 are isomorphous

K_2SeO_4

$\Rightarrow 39 \times 2 + x + 64 = 142 + x$

$(142 + x)$g of $K_2SeO_4 \Rightarrow x$ g of Se

100 g of $K_2SeO_4 \Rightarrow \frac{x}{142 + x} \times 100$

$\therefore \frac{x}{142 + x} \times 100 = 50$

$\therefore x = 142$

17 **(b)**

$H_2C_2O_4 \rightleftharpoons H^+ + HC_2O_4^- \rightleftharpoons H^+ + C_2O_4^{2-}$

I II

Upto stage I-monobasic acid

II-dibasic acid

18 **(c)**

$S_2O_3^{2-} \rightarrow 2SO_4^{2-} + 8e^-$

$3e^- + CrO_4^{2-} \longrightarrow [Cr(OH)_4]^{\ominus}$

$CrO_4^{2-} \equiv S_2O_3^{2-}$

mEq = mEq

$V \times 0.1 \times 3 \equiv 40 \text{ mL} \times 0.25 \times 8$

$V = 266.67$ mL

19 **(a)**

$H_2C_2O_4 \cdot 2H_2O = 126 \text{ g mol}^{-1}$

$1.575 \text{ g } H_2C_2O_4.2H_2O = \frac{1.575}{126} = 0.0125 \text{ mol}$

Let the volume be = V L

$\therefore \frac{0.0125 \text{ mol}}{V\text{L}} = 0.10 \text{ M}$

$\therefore V = \frac{0.0125}{0.1} = 0.125 \text{ L}$

$= 125$ mL

20 **(b)**

$MgCl_2 + 2HCO_3^- \longrightarrow Mg(HCO_3)_2$

$Mg(HCO_3)_2 \xrightarrow{\Delta} MgCO_3 + H_2O + CO_2$

21 **(a)**

A decolourises MnO_4^-/H^+

Thus, A is CaC_2O_4

$\underset{A}{CaC_2O_4} \longrightarrow \underset{D}{CaO} + \underset{C}{CO_2} + \underset{B}{CO}$

B burns with blue flame

$CaO + H_2O \longrightarrow \underset{E}{Ca(OH)_2}$

$\underset{E}{Ca(OH)_2} \xrightarrow{C} \underset{\text{milk}}{CaCO_3}$

23 **(a)**

20.00 mL of 0.1 M $Pb^{2+} = 2 \times 10^{-3}$ mol Pb^{2+}

30.00 mL of 0. M $SO_4^{2-} = 3 \times 0^{-3}$ mol SO_4^{2-}

$Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4$

Pb^{2+} is in the limiting a quantity and every 1 mole of Pb^{2+} gives equal moles of $PbSO_4$ hence, $PbSO_4$ formed = 0.002 mol

24 **(a)**

Total weight of alcohol and water

$= 10 \times 0.7893 + 20 \times 0.9971$

Volume of mixture $= \frac{10 \times 0.7893 + 20 \times 0.9971}{0.9571}$

$= 29.08$ mL

Change in volume $= (20 + 10) - 29.08$

$= 0.92$ mL

% change in volume $= \frac{0.92 \times 100}{30} = 3.06\%$

$\approx 3.1\%$

25 **(b)**

(a) 0.208 g $BaCl_2 = \frac{0.208}{208}$ mole

$= 1 \times 10^{-3}$mole

= 1 millimole$BaCl_2$

= 2 millimolesCl^-

(b) 100 mL of 0.1 M $BaCl_2 = 100 \times 0.1$ millimoles$BaCl_2$

$= 100 \times 0.2$ millimoles Cl^-

$= 20$ millimoles

(c) 0.745 g KCl $= \frac{0.745}{74.5}$ mole KCl

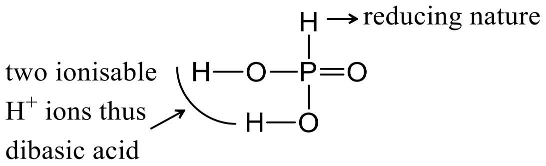
$= 0.01$ mole

$= 0.01 \times 1000$ millimoles

$= 10$ millimoles

26 **(a)**

H_3PO_3 has structure



27 **(b)**

$Na_2C_2O_4$; $KHC_2O_4 \cdot H_2C_2O_4$

x mmol $\quad y$ mmol

i. $x \times 0 + y \times 3 = 0.2 \times V$

ii. $x \times 2 + y \times 4 = (0.2 \times 5) \times V \Rightarrow \frac{x}{y} = \frac{11}{2}$

28 **(a)**

$2NH_3 + OCl^{\ominus} \rightarrow N_2H_4 + Cl^{\ominus} + H_2O$

29 **(a)**

Volume of H_2 at STP $= 24.62 \times \frac{273}{300} = 22.40$ mL

22400 mL of H_2 at STP $= 1$ mole $= 2$ Eq of H_2

22.4 mL of $H_2 = \frac{2}{22400} \times 22.4$

$= 0.002$ Eq of H_2

$= 0.002$ Eq of metal

$\therefore \frac{\text{Weight}}{Ew} = 0.002$

$\frac{0.05}{0.002} = Ew = 25$

30 **(d)**

Balance the equation :

$2CrO_5 + 3H_2SO_4 \rightarrow Cr_2(SO_4)_3 + 3H_2O + \frac{7}{2}O_2$

2 mol $CrO_5 \Rightarrow \frac{7}{2}$ mol of O_2

1 mol $CrO_5 \Rightarrow \frac{7}{4}$ mol of O_2

31 **(b)**

Cr^{3+} green

32 **(c)**

80 mL of 0.20 M HCl $= 80 \times 0.2$

$= 16$ millimol HCl

120 mL of 0.15 M KOH $= 120 \times 0.15$

$= 18$ millimol KOH

$M_1V_1(\text{HCl}) < M_2V_2(\text{KOH})$

Thus, resulting solution is basic containing KCl and unreacted KOH

$KOH + HCl \rightarrow KCl + H_2O$

$KOH = \frac{M_2V_2 - M_1V_1}{V_1 + V_2} = \frac{18 - 16}{200} = 0.01$ M

KCl formed = HCl used

$= 16$ millimoles

$= 16 \times 10^{-3}$ mol in 200 mL or 0.2 L solution

$[KCl] = \frac{16 \times 10^{-3}}{0.200 \text{ L}} = 0.08$ M

33 **(d)**

Weight of Cl reacted $= 12.7 - 5.6 - 7.1$ g

7.1 g Cl ≡ 5.6 g of metal

35.5 g Cl $= 28$ g of metal

35 **(c)**

$4Al + 3O_2 \rightarrow 2Al_2O_3$

4×27 g of Al $\Rightarrow 3 \times 32$ g of O_2

27 g of Al $\Rightarrow \frac{3 \times 32}{4 \times 27} \times 27 \Rightarrow 24$ g

36 **(b)**

$ZnCl_2 + H_2S \longrightarrow ZnS + 2HCl$

$CdCl_2 + H_2S \longrightarrow CdS + 2HCl$

ZnS is soluble in HCl hence not precipitated

37 **(b)**

$Hg^{2+} + 2I^- \longrightarrow HgI_2 \downarrow$ red ppt

$HgI_2 + 2I^- \longrightarrow HgI_4^{2-}$ Soluble

$Co(SCN)_3 + Hg^{2+} \longrightarrow$ deep blue crystalline ppt

38 **(b)**

$I^- + Cr_2O_7^{2-}$ (orange)

$I^- + Cr_2O_7^{2-} + H^+ \longrightarrow Cr^{3+} + I_2$

$I_2 + KI \longrightarrow KI_3$
dark brown

39 **(a)**

Methyl orange indicator indicates complete ionisation of HCl bit first steep ionization of $(H_3SO_3 \longrightarrow H^{\oplus} + HSO_3^{\ominus} (n = 1)\ (N = M \times 1)$

First case:

$Ba(OH)_2 \equiv HCl$
$N_1V_1 = N_2V_2$
$0.1 \times 2 \times 100 \equiv x \times 0.1 \times 1$
$x = 200$ mL

Second case:

$Ba(OH)_2 \equiv H_2SO_3$
$N_1V_1 = N_2V_2$
$(0.1 \times 2) \times 100 = 0.2 \times 1 \times y$
$x = 200$ mL $\quad y = 100$ mL

40 **(c)**

$NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$
laughing gas

41 **(d)**

$Na_2B_4O_7 \xrightarrow{\Delta} \underbrace{2NaBO_2 + B_2O_3}_{\text{bead}}$

42 **(c)**

$1 \text{ mol } H_2SO_4 \equiv 2 \text{ mol } H_3O^{\oplus} \equiv 1 \text{ mol } SO_4^{2-}$

$\left(\frac{100}{1000} \times 0.1 = 0.01\right) \equiv 2 \times 0.01 + 0.01$
$= 0.03$ mol

Total number of g ions $= 0.03 \times 6.02 \times 10^{23}$
$= 0.18069 \times 10^{23}$

44 **(b)**

$Cr_2O_7^{2-} + FeC_2O_4 \xrightarrow{H^{\oplus}}$
0.05 M $\quad$ 0.6 M/200mL

$Cr_2O_7^{2-} + 14H^{\oplus} + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$
$Fe^{2+} \rightarrow Fe^{+3} + e^-$
$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$
$FeC_2O_4 \rightarrow Fe^{3+} + 2CO_2 + 3e^-$
mEq of $K_2Cr_2O_7 \equiv FeC_2O_4$
$(0.05 \times 6) \times V = (0.6 \times 3) \times 200$
$\Rightarrow V = 1200 \text{ mL} = 1.2 \text{ L}$

45 **(b)**

$PbO_2 + MnO_2 + H^+ \longrightarrow MnO_4^-$
purple/violet

46 **(c)**

Zn^{2+}, Co^{2+} precipitated by $H_2S/NH_4OH, NH_4Cl$

$\begin{bmatrix} Cu^{2+}, & Cd^{2+} & \text{precipitated by } H_2S/HCl \\ Cu^{2+}, & As^{3+} & \text{only } Cu^{2+} \text{ is precipitated} \\ Cu^{2+}, & Cr^{3+} & \text{by } H_2S/HCl\ (pH < 7) \end{bmatrix}$

47 **(d)**

Normality of "x" volume $H_2O_2 = \frac{x}{5.6}$

$10 \times N_1(H_2O_2) = 10 \times \frac{1}{0.56}(MnO_4^-)$

$N_1 = \frac{1}{0.56} = \frac{x}{5.6}$

$\therefore x = 10$

48 **(a)**

	C	O
Substance I	27.27	72.73
Mole :	2.2725	4.5456
Ratio :	1 : 2	
Substance II	52.94	47.06
Mole :	4.11	2.94
Ratio :	1.5	1.0

3 : 1

49 **(d)**

$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+$
$\rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

$\overset{+6}{Cr_2O_7^{2-}} \rightarrow Cr^{3+}$

x-factor=6

Mohr's salt, $FeSO_4.(NH_4)_2SO_4.6H_2O$
oxidation; $Fe^{2+} \rightarrow Fe^{3+}$
x-factor=1

Mole ratio is reverse of x-factor ratio. Therefore, one mole of dichromate required=6 moles of Mohr's salt.

50 **(d)**

$CuSO_4 \cdot 5H_2O$

1 mol solute $\equiv$ 1 mol (Cu) $\equiv$ 10 mol (H)
$\equiv$ 9 mol (O)

63.5 g (Cu) $= 9 \times 16$ g(O)

Thus, 3.782 g (Cu) $= \frac{9 \times 16 \times 3.782}{63.5}$ g (O)

$= 8.5765$ g

51 **(b)**
4.4 g CO_2 =0.1 mol=2.24 L at STP

52 **(c)**
Atomic weight of element

$M =$ eq. wt.$\times$ valency $= 20 \times 3 = 60$

Molecular formula of its oxide $= M_2O_3$

Hence, molecular weight of oxide $= 2 \times 60 + 3 \times 16$

$= 120 + 48$

$= 168 \text{ g mol}^{-1}$

53 **(a)**
22400 mL = 1 mol of CO_2 = 2 Eq of CO_2
11200 mL = 1/2 mol of CO_2 = 1 Eq of CO_2
= Eq of CO_3^{2-}
Weight of metallic carbonate that would produce 1 g equivalent or 22 g or 11.2 L of CO_2 at STP would be its *Ew*

Ew of metallic carbonate $= \frac{4.2 \times 11200}{1120} = 42$ g

Ew of metal = *Ew* of MCO_3 − *Ew* of $CO_3^{\ 2-}$

$= 42 - 30 = 12$

$\left[\text{Ew of } CO_3^{\ 2-} = \frac{60}{2} = 30\right]$

Alternatively :
22400 mL = 1 mol of CO_2 = 2 Eq $CO_3^{\ 2-}$
11200 mL ⇒ 1 Eq of $CO_3^{\ 2-}$

$\therefore$ 1120 mL $\Rightarrow \frac{1}{11200} \times 1120 = 0.1$ Eq of $CO_3^{\ 2-}$

Eq of MCO_3 = Eq of $CO_3^{\ 2-}$

$\frac{\text{Weight}}{Ew} = \frac{\text{Weight}}{Ew} = 0.1$ Eq

$\therefore 0.1 = \frac{4.2}{Ew \text{ of } MCO_3}$

$\therefore$ Eq of $MCO_3 = 42$

$\therefore$ *Ew* of M = *Ew* of MCO_3 − *Ew* of $CO_3^{\ 2-}$

$= 42 - 30 = 12$

54 **(a)**
N_0 atoms = 14 g

1 atom $= \frac{14}{N_0} = 14$ amu

55 **(a)**
V mL of 1 N unused HCl = 100 mL of 0.5 N NaOH

$V = 50$ mL

Used 1 N HCl = 100 mL

100 mL of 1 N HCl = 0.1 equivalent HCl

= 0.1 equivalent HCl

= 0.11 equivalent of M_2CO_3

$\therefore$ equivalent mass of $M_2CO_3 = \frac{2M+60}{2} = (M + 30)$

$\therefore \frac{5.3}{M + 30} = 0.1$

$\therefore M = 23$

56 **(b)**
Gas is N_2O (laughing gas)
$NaNO_2 + NH_4Cl \rightarrow NH_4NO_2 + NaCl$
$NH_4NO_2 \rightarrow N_2O + 2H_2O$
Molar mass=44
0.56 L $N_2O \equiv 1.1$ g
22.4 L $N_2O \equiv 44$ g
Thus, gas is N_2O

57 **(a)**
Any factor that is volume independent, is temperature independent

58 **(b)**

i. $3e^- + CrO_4^{2-} \longrightarrow [Cr(OH)_4]^{\ominus}$
$x - 8 = -2$, $x = 6$; $x - 4 = -1$, $x = 3$

Ew of $CrO_4^{\ 2-} = \frac{Mw}{3}$

ii. $S_2O_3^{\ 2-} \rightarrow 2SO_4^{\ 2-} + 8e^-$
$2x - 6 = -22x - 6 = -4$
$2x = 42x = 12$

Ew of $S_2O_3^{\ 2-} = \frac{Mw}{8}$

$N_1V_1(CrO_4^{\ 2-}) = N_2V_2(S_2O_3^{\ 2-})$
i.e., m Eq of $CrO_4^{\ 2-}$ = mEq of $S_2O_3^{\ 2-}$
$V_1 \times 0.2 \times 3 = 30 \times 0.2 \times 8$

$V_1 = \frac{30 \times 0.2 \times 8}{0.2 \times 3} = 80$ mL

59 **(b)**

Let B is the original base

$2B + H_2PtCl_6 \rightarrow B_2H_2PtCl_2 \xrightarrow{\Delta} Pt$

Ew of $B_2H_2PtCl_2 = 2B + 2 + 195 + 6 \times 35.5$

$= 2B + 410$

$\frac{\text{Weight of chloroplatinate}}{\text{Weight of Pt}} = \frac{Ew \text{ of salt}}{Ew \text{ of Pt}}$

$\frac{0.3}{0.09} = \frac{2B + 410}{195}$

$B(Ew \text{ of base}) = 120$

Mw of base $= Ew \times$ Acidity

$= 120 \times 2 = 240$

60 **(a)**

Cu^{2+} and Hg^{2+} are precipitated in acidic medium

61 **(d)**

Refer concept application exercise 3.2 Q 3(a)

62 **(c)**

Final reaction is

$2Na + H_2O + \frac{1}{2}O_2 \rightarrow 2NaOH$

2 mol 2 mol

46 g 80 g

80 g NaOH is from = 46 g Na

4 g NaOH is from = 2.3 g Na

63 **(a)**

40 mL of 0.05 M Cr^{3+} = 40 mL of x M H_2O_2

$40 \times 0.05 \times 3$ N $Cr^{3+} = 40 \times 2$ XH_2O_2

x = 0.15 M

Cr^{3+} is oxidized to CrO_4^{2-} by H_2O_2 which is reduced to H_2O

64 **(a)**

Mass of one atom of $X = 6.66 \times 10^{-23}$g

If atomic mass= A

Then mass of one atom= $\frac{A}{N_0}$

$\therefore \frac{A}{N_0} = 6.66 \times 10^{-23}$g

$A = 6.66 \times 10^{-23} \times N_0$

$= 6.66 \times 10^{-23} \times 6.02 \times 10^{23}$

$= 40 \text{ g mol}^{-1}$

Hence, 40 kg X = 40000 gX $= \frac{40000}{40} = 1000$ mol

65 **(a)**

Ore of iron is Fe_3O_4 which is a mixture of FeO + Fe_2O_3. In Fe_2O_3, Fe is in +3 state which is reduced to +2 state

($Fe^{3+} + e^- \rightarrow Fe^{2+}$)

(In FeO, Fe is in +2 state)

Fe in +2 state (from FeO and Fe_2O_3) is equivalent of $MnO_4^{\ominus}$

$\therefore MnO_4^{\ominus} + 5Fe^{2+} + H^{\oplus} \longrightarrow Mn^{2+} + 5Fe^{3+} + H_2O$

mEq of $KMnO_4 = 50 \times \frac{1}{50} \times 5$

= 5 mEq

=5 mEq of Fe^{2+}

$= 5 \times 10^{-3} \times 56$ g of Fe^{2+}or Fe

= 0.280 g

% of Fe $= \frac{0.280}{0.7} \times 100 = 40\%$

Again 3Fe = Fe_3O_4

3×56 g $\equiv$ $(3 \times 56 + 64)$g of Fe_3O_4

168 g≡ 232 g of Fe_3O_4

% of $Fe_3O_4 = \frac{40 \times 323}{168} = 55.24\%$

66 **(a)**

Increase in molar concentration = 0.1 M

= 0.01 mol in 100 mL

= 0.745 g KCl in 100 mL

67 **(c)**

$FeC_2O_4 \rightleftharpoons Fe^{2+} + C_2O_4^{2-}$

$MnO_4^{\ominus}$ oxidises Fe^{2+} and $C_2O_4^{2-}$ both.

$Fe^{2+} + C_2O_4^{2-} \rightarrow Fe^{3+} + 2CO_2 + 3e^-$

$MnO_4^{\ominus} + 5e^- \longrightarrow Mn^{2+}$

$5FeC_2O_4 \equiv 3MnO_4^{\ominus}$

$1\ FeC_2O_4 \equiv \frac{3}{5} MnO_4^{\ominus}$

68 **(d)**

$Fe^{2+} + [Fe(CN)_6]^{4-} \rightarrow$ no colour
A

$Fe^{3+} + A \rightarrow Fe^{III}[Fe^{II}(CN)_6]^-$
Prussian blue

$Zn^{2+} + [Fe(CN)_6]^{4-} \rightarrow Zn_2[Fe(CN)_6] \downarrow$
bluish white ppt

$Cu^{2+} + [Fe(CN)_6]^{4-} \rightarrow Cu_2[Fe(CN)_6] \downarrow$
reddish brown

$Cd^{2+} + [Fe(CN)_6]^{4-} \rightarrow Cd_2[Fe(CN)_6] \downarrow$
bluish white

69 **(a)**

$2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$
from H_2SO_4

$Cr_2O_7^{2-} + H_2SO_4 \longrightarrow CrO_3$

$Cl^- + H_2SO_4 \longrightarrow HCl + HSO_4^-$

$CrO_3 + 2HCl \longrightarrow CrO_2Cl_2 + H_2O$
orange red fumes

70 **(a)**

$$N = \frac{W_2 \times 1000}{Ew_2 \times V_{mL}}$$

$$N = \frac{34 \times 1000}{17 \times 1120} = \frac{200}{112}$$

1N of H_2O_2 = 5.6 volume strength

$$\frac{200}{112} \text{N of } H_2O_2 = 5.6 \times \frac{200}{112} = 10\ V$$

71 **(a)**

$N_2 \equiv 2NH_3 \equiv 3H_2 \equiv 6H$

Ew of $N_2 = \frac{x_2}{6} = y_2$

Ew of $NH_3 = \frac{2x_1}{6} = y_1$

$$\therefore y_1 - y_2 = \left(\frac{2x_1}{6} - \frac{x_2}{6}\right) = \left(\frac{2x_1 - x_2}{6}\right)$$

72 **(a)**

1. With phenolphthalein indicator, $NaHCO_3$ does not react with HCl whereas with Na_2CO_3 is 50% reaction$V_{HCl} = x$ mL (Half titre value of Na_2CO_3)
2. With methyl orange indicator, $NaHCO_3$ reacts completely with HCl and with Na_2CO_3 is 100% reaction

But y mL of HCl is added after Na_2CO_3 has reacted upto $NaHCO_3$, i.e., half titre value of Na_2CO_3

V_{HCl} = Full litre value of $NaHCO_3$ + Half titre value of Na_2CO_3

y mL $= x' + x$ mL

∴ Volume of HCl required complete reaction of $Na_2CO_3 = x$ mL $+ x$ mL $= 2x$ mL

73 **(c)**

$6HF + Na_2SiO_3 \longrightarrow Na_2SiF_6 + 3H_2O$
glass

74 **(a)**

Moles ∝ Pressure

i. $\frac{2}{Mw_A} \propto 1$ atm

Pressure of B = 1.5 − 1 = 0.5 atm

ii. $\frac{3}{Mw_B} \propto 0.5$ atm

$$\frac{3}{Mw_B} \times \frac{Mw_A}{2} = \frac{0.5}{1}$$

$$\frac{Mw_A}{Mw_B} = 0.5 \times \frac{2}{3} = \frac{1}{3}$$

$\therefore Mw_A : Mw_B = 1:3$

76 **(b)**

X : 50% Y : 50%

X : Y = 5 : 2.5 = 2:1, hence X_2 Y

77 **(c)**

$S \rightarrow BaSO_4 \rightarrow BaCl_2$

32 208 g

0.60 × 0.12 = 0.072 g ?

$BaCl_2$ required by 0.072 g sulphur to be precipitated as

$$BaSO_4 = \frac{208}{32} \times 0.072 = 0.468 \text{ g}$$

Thus, volume of $BaCl_2$ solution $= \frac{0.468 \times 100}{1.6}$

= 29.25 mL

78 **(a)**

Iron oxide = 0.5434 g

Oxygen lost as H_2O = 0.1210 g

Iron = 0.5434 − 0.1210 = 0.4224 g

Element	Amount	%	Mole	Ratio
Iron (56)	0.4224 g	77.73	1.39	1
Oxygen (16)	0.1210 g	22.26	1.39	1

Thus, FeO

79 **(b)**

If atomic weight = M

Then % of $S = \left(\frac{64}{M+64}\right) \times 100 = 40$

$\therefore M = 96$

80 **(c)**

Volume of O_3 in 100 mL of ozonised O_2

$= 100 - 90 = 10$ mL (dissolved in turpentine)

Volume of O_3 in 1 L of ozonised O_2

$= \frac{10 \times 1000}{100} \times 100$ mL

Volume of O_2 in 1 L $= 1000 - 100 = 900$ mL

Weight of 900 mL of O_2 at STP $= \frac{900 \times 32}{22400} = 1.286$ g

Weight of 100 mL of O_3 at STP $= 1.5 - 1.286$

$= 0.214$ g

Now 100 mL of O_3 at STP weighs = 0.214 g

22400 mL of O_3 at STP weighs $= \frac{0.214 \times 22400}{100}$

$= 47.94$ g

Molecular weight of $O_3 = 47.94$ g

81 **(b)**

22.4 L $N_2 = 28$ g

1 L $N_2 = 1.25$ g

Thus, mass of 1 L compound = 1.25 g

22.4 L compound has mass = 28 g

Thus, molar mass = 28 g mol

Let molecular formula $= (CH_2)_x$

$\therefore 14x = 28$

$x = 2$

Thus, C_2H_4

82 **(d)**

10% acetic acid = 10 g in 100 mL

Conc. in mol $L^{-1} = \frac{10 \times 1000}{60 \times 100} = 1.67$

83 **(d)**

$KCl + H_2SO_4 \rightarrow KHSO_4 + HCl$
conc

$K_2Cr_2O_7 + 2H_2SO_4 \rightarrow 2KHSO_4 + 2CrO_3 + H_2O$

$CrO_3 + 2HCl \rightarrow CrO_2Cl_2 + H_2O$

$CrO_2Cl_2 + 2NaOH \rightarrow Na_2CrO_4 + HCl$
Yellow (Y)

84 **(c)**

This is a special case of buffer

$[H_3O^+] = K_a$

That is $pH = pK_a$

$$pH = pK_a + \log\frac{[CH_3COO^-]}{[CH_3COOH]}$$

thus, at this point

$[CH_3COO^-] = [CH_3COOH]$

It means 50% of CH_3COOH is converted into CH_3COO^-

Thus, NaOH required = 50 mL

85 **(c)**

$Cr(OH)_3 + H_2O_2 + OH^- \longrightarrow CrO_4^{2-}$
yellow

86 **(a)**

Solute present in 800 g solution $= 800 \times \frac{40}{100} =$ 320 g

Solute precipitated = 100 g

Solute left = 220 g

$\therefore$ Total weight of solution $= 800 - 100 = 700$ g

700 g solution has solute = 220 g

100 g solution has solute $= \frac{220}{700} \times 100 = 31.43\%$

87 **(b)**

mEq of $MnO_4^{\ominus} \equiv$ mEq of H_2O_2

$10 \times \frac{M}{5} \times 5 \equiv$ mEq of H_2O_2

$\Rightarrow 10$ mEq $\equiv$ mEq of H_2O_2

Weight of $H_2O_2 = 10 \times 10^{-3} \times \frac{34}{2} = 0.17$ g

Weight of impure $H_2O_2 = \frac{100}{85} \times 0.17 = 0.2$ g

90 **(a)**

% of N

$$= \frac{1.4 \times \text{mEq of } H_2SO_4 \text{used to neutralise } NH_3}{\text{Weight of compound}}$$

mmoles of $H_2SO_4 = 20$

mEq of $H_2SO_4 = 20 \times 2 = 40$ (n factor=2)

% of N $= \frac{1.4 \times 40}{2.8} = 20\%$

91 **(d)**

$NaCO_3 \xrightarrow{\Delta}$ no reaction

$2\ NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$

2 mol 1 mol

Given = 1 mol

Thus, 100% yield

92 **(d)**

From (III) 2 mol of NH_3 are formed from = 1 mol pure $CaCN_2$ or 2 mol $CaCN_2$ with 50% yield

From (II) CaC_2 required by 2 mol $CaCN_2$ = 2 mol

From (I) 2 mol CaC_2 are formed from = 2 mol Ca = 4 mol Ca if yield is 50%

93 **(a)**

In both cases, the same volume of hydrogen is evolved for the same amount of zinc reacted

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2 \uparrow$

$Zn + NaOH \rightarrow Na_2ZnO_2 + H_2 \uparrow$

95 **(c)**

4 B + A $\rightarrow$ X

4×35 12

Weight of X $= 4 \times 35.5 + 12 = 154$

96 **(b)**

$$M' = \frac{1000 \times 1}{[1000 \times 1.0585 - 58.5 \times 1]} = 1$$

97 **(b)**

Normality of oxalic acid $= 2 \times$ molarity

Normality of $KMnO_4 = 5 \times$ molarity

$\therefore$ 20 mL of 0.1 M $KMnO_4 \equiv$ 20 mL of 0.5 N $KMnO_4$

$\equiv$ 10 milliequivalent

(a) 20 mL of 0.5 M $H_2C_2O_4 \equiv 20 \times 0.5 \times 2N$

$\equiv$ 20 milliequivalents, thus false

(b) 50 mL of 0.1 M $H_2C_2O_4 \equiv 50 \times 0.1 \times 2$ N

$\equiv$ 10 milliequivalent

Thus, true

98 **(b)**

(a) 5.0 g Cl_2

(b) 0.5 mol $Cl_2 = 0.5 \times 71$ g $= 35.5$ g Cl_2

(c) 0.10 mol KCl = 0.1 mol Cl = 3.55 g Cl

(d) 30.0 g $MgCl_2 = \frac{30.0}{95}$ mol $= 0.2526$ mol

$= 17.49$ g Cl_2

99 **(b)**

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

1 mol 2 mol 44 g

16 g 64 g

Given 16 g 48 g = 1.5 mol?

Thus, O_2 is the limiting reactant

$\therefore$ 2 mol O_2give= 44 g CO_2

1.5 mol O_2 give $= \frac{44}{2} \times 1.5 = 33$ g CO_2

100 **(d)**

Mass of water in 1 L steam = 1000×0.00006 g $= 0.06$ g

Volume of 0.06 g water $= \frac{0.06\ g}{1 g\ cm^{-3}} = 0.06\ 6\ cm^3$

101 **(a)**

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

[3 mol 2 mol 6 mol 1mol]

Given $\Rightarrow$ 0.5 mol of $BaCl_2$ and 0.2 mol of Na_3PO_4

To find the limiting reagent

2 mol of $Na_3PO_4 \Rightarrow$ 3 mol of $BaCl_2$

0.2 mol of $Na_3PO_4 \Rightarrow 0.3$ mol of $BaCl_2$
$\therefore Na_3PO_4$ is the limiting reagent
$\therefore$ 2 mol of $Na_3PO_4 \Rightarrow 1$ mol of $Ba_3(PO_4)_2$
0.2 mol of $Na_3PO_4 \Rightarrow 0.1$ mol of $Ba_3(PO_4)_2$

102 **(a)**
F^- attacks glass

103 **(a)**

$$MnO_2 + I^{\ominus} \longrightarrow I_2 + Mn^{2+}$$

$I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2NaI$
[mEq $Na_2SO_3 = (1 \times 0.075) \times 30$]
mEq $Na_2S_2O_3$ = mEq I_2 = mEq MnO_2

$$\Rightarrow \frac{W_{MnO_2}}{87/2} \times 1000 = (1 \times 0.075) \times 30$$

$\Rightarrow$ % $MnO_2 = 75.3\%$

104 **(b)**
One equivalent magnesium oxide = 20 g

Since, equivalent mass of O = 8

Hence, equivalent mass of Mg = 20 − 8 = 12

Also, equivalent mass of chlorine = 35.5

Hence equivalent mass of magnesium chloride = 35.5 + 12

= 47.5

105 **(c)**
20 mL of x M HCl ≡ 10 mL of 0.1 M $NaHCO_3$ + 5 mL of 0.2 M Na_2CO_3
(methyl orange indicated 100% reaction of $NaHCO_3$ and Na_2CO_3)
0.2 M Na_2CO_3 = 0.4Na_2CO_3
$20x = 1 + 2 \Rightarrow x = 0.15$

106 **(a)**

$$Ag_2CO_3 \rightarrow 2Ag + CO_2 + \frac{1}{2}O_2$$

276 g Ag_2CO_3 gives $2 \times 108 = 216$ g residue
2.76 g Ag_2CO_3 gives 2.16 g residue (silver)

107 **(a)**
$Cr_2O_7^{2-} + Fe^{2+} \rightarrow 2Cr^{3+} + Fe^{3+}$
i. $6e^- + Cr_2O_7^{2-} \rightarrow 2Cr^{3+} (x = 6)$
ii. $Fe^{2+} \rightarrow Fe^{3+} + e^- (x = 1)$
mEq of $Cr_2O_7^{2-}$ = mEq of Fe^{2+}
$20 \times 0.1 \times 6$ mEq $= 10 \times N$
$N = 1.2$

$$M = \frac{N}{n\,'\text{factor}'} = \frac{1.2}{1} = 1.2 \text{ M}$$

108 **(b)**
$M + HCl \rightarrow H_2$

$N_2 + 3H_2 \rightarrow 2NH_3$

1 mol 3 mol 2 mol

1 volume 3 volume 2 volume

? 16.8 mL

3 mL H_2 combine with = 1 mL N_2

16.8 mL combine with = 5.6 mL N_2

109 **(a)**
Mw of $K_2CO_3 = 39 \times 2 + 12 + 48 = 138$ g mol^{-1}
Ew of $K_2CO_3 = \frac{138}{2} = 69$ g
Mw of $Li_2CO_3 = 7 \times 2 + 12 + 48 = 74$ g mol^{-1}
Ew of $Li_2CO_3 = \frac{74}{2} = 37$ g
Let x g of K_2CO_3 and $(0.5 - x)$g of Li_2CO_3
mEq K_2CO_3 + mEq of Li_2CO_3 = mEq of HCl

$$\left(\frac{x}{69} + \frac{0.5 - x}{37}\right) \times 1000 = 30 \times 0.25$$

$$\frac{37x + 69(0.5 - x)}{69 \times 37} = \frac{30 \times 0.25}{1000}$$

$$69 \times 0.5 - \frac{30 \times 0.25 \times 69 \times 37}{1000} = 32x$$

$34.5 - 19.14 = 32x$
$32x = 15.36$ and $x = 0.48$

$$\% \text{ of } K_2CO_3 = \frac{0.48 \times 100}{0.5} = 96\%$$

% of Li_2Co_3 = 4%

110 **(a)**
Let the formula of oxide = $M_2O_x = 44$
$2 \times M + x \times 16 = 44$
$2(E \times x) + x \times 16 = 44$
$2(14 \times x) + 16x = 44$
$\therefore x = 1$
Atomic weight = $14 \times 1 = 14$

111 **(c)**
$As_2S_3 + 6NaOH \rightarrow \underbrace{Na_3AsO_3 + Na_3AsS_3}_{\text{soluble}} + 3H_2O$
$AlCl_3 + 3NaOH \rightarrow Al(OH)_3 + 3NaCl$
$Al(OH)_3 + NaOH \rightarrow Na[Al(OH)_4]$
soluble

113 **(a)**

$2Br^- + Cl_2 \longrightarrow Br_2 + 2Cl^-$
$2I^- + Cl_2 \longrightarrow I_2 + 2Cl^-$
$2I^- + Br_2 \longrightarrow I_2 + 2Br^-$
Oxidising power is in order
$I_2 < Br_2 < Cl_2 < F_2$
Br_2 formed also oxidizes I^- to I_2

114 **(d)**
$Fe^{3+} + SCN^- \rightarrow [Fe(SCN)]^{2+}$

115 **(a)**
$Ag_2S + 2NaCN \rightarrow \underset{\text{soluble}}{2Na[Ag(CN)_2]} + Na_2S$

116 **(c)**
$2CuSO_4 + 4KI \rightarrow Cu_2I_2 + I_2 + 2K_2SO_4$

$2 \times 249.5 \text{ g } CaCO_3 \rightarrow 254 \text{ g } I_2$

$8.3 \text{ g } CuSO_4 \rightarrow \frac{254 \times 8.3}{499} \text{g} = 4.23 \text{ g } I_2$

117 **(b)**
$Co : CO_2 : C_2O_3 (CO_{1.5})$

$1 \text{ mol C} = 12 \text{ g C in CO} = 16 \text{ g O}$

$= 12 \text{ g C in } CO_2 = 32 \text{ g O}$

$= 12 \text{ g C in } C_2O_3 = 24 \text{ g O}$

Thus, ratio of O that combines with 12 g C = 2 : 4 : 3

118 **(a)**
In $NaHC_2O_4$, $C_2O_4^{2-}$ oxidised to CO_2 and $H^{\oplus}$ is nuetralised

$Ew_{NaHC_2O_4}(\text{as } C_2O_4^{2-}) = \frac{M}{2}$

$(\text{as } H^{\oplus}) = \frac{M}{1}$

$10 \times N_1(NaHC_2O_4) = 10 \times 0.1 \text{ NMnO}_4^{\ominus}$

$N_1 = 0.1 \text{ N}$

119 **(b)**
$PbCrO_4$, $BaCrO_4$ both are yellow

120 **(d)**

Mass	Moles	Ratio
$Na_2SO_3 = 50$	0.3968	1
$H_2O = 50$	2.7778	7

Thus, $x = 7$

121 **(c)**
x mol $(NH_4)_3PO_4 = 12x$ mol H atoms = 3.18 mol

$\therefore x = \frac{3.18}{12} = 0.265$ mol

Thus, O − atoms = $4x$ mol = $0.265 \times 4 =$ 1.06 mol

122 **(d)**
$\underset{\text{NaOH}}{V \times 0.5} = \underset{H_2SO_4}{40 \times 0.1\, N}$

$V = 8$ mL

123 **(c)**
$2\, Ag_2CO_3 \xrightarrow{\text{Heat}} 4Ag + 2CO_2 + O_2$

2×276 (g) $\quad 4 \times 108$(g)

$= 552 \quad = 432$

552 g silver carbonate give silver = 432 g

2.76 g of silver carbonate give silver = $\frac{432 \times 2.76}{552}$

= 2.16 g

125 **(a)**
Dibasic acid ≡ NaOH
12.5 mL $\quad 10 \text{ mL} \times 0.1 \text{ N} = 1 \text{ mFq}$
Strength of dibasic acid = 6 g L^{-1}
mEq of acid = mEq of NaOH
$12.5 \times N = 1$ mEq

$\frac{12.5 \times 6 \times 1000}{\frac{Mw}{2} \times 1000} = 1$

$\therefore Mw(\text{acid}) = 150$

126 **(b)**
$2Cl \equiv S$ in SCl_2

$1\text{ Cl} \equiv \frac{S}{2} = 10 \text{ g}$

Thus, atomic mass of S = 32 g

In S_2Cl_2

$2\text{ Cl} \equiv 2S = 64 \text{ g}$

1 Cl ≡ 32 g

127 **(b)**

$^{A}_{Z}X = {}^{A}_{A-N}X = {}^{127}_{127-74}X = {}^{127}_{53}X$

There are 54 electrons. Hence, ionic species is $^{127}_{53}X^{-}$

129 **(a)**

$CaCO_3 \rightarrow CaO + CO_2$

$2KOH + CO_2 \rightarrow K_2CO_3 + H_2O$

2 mol 1 mol

2 mol 22.4 L

1 mol 11.2 L

1 mol KOH = 56 g is required

130 **(d)**

$CuCO_3 \Rightarrow \frac{3.1}{123.5/2} \times 1000$

$\equiv$ mEq$CuCO_3 \equiv$ mEq $H_3PO_4 = (0.5 \times 3) \times V$

$\Rightarrow V_{mL} = 33.3$ mL

131 **(c)**

$M_1V_1 + M_2V_2 = M_3V_3$

$(V_3 = V_1 + V_2)$

$1.5 \times 480 + 1.2 \times 520 = M_3 \times 1000$

$M_3 = 1.344$ M

132 **(c)**

$K_2\overset{+4}{Mn}F_6 \rightleftharpoons \overset{+4}{Mn}F_4 + 2KF$ ...(i)

$2KF + 2SbF_5 \longrightarrow 2KSbF_6$ ...(ii)

$\overset{+4}{Mn}F_4 \rightleftharpoons MnF_3 + \frac{1}{2}F_2$ ...(iii)

Adding equations (i), (ii), and (iii), we get,

$K_2MnF_6 + 2SbF_5 \longrightarrow 2KSbF_6 + MnF_3 + \frac{1}{2}F_2$ ...(iv)

In equation (iii)

$e^- + \overset{+4}{Mn} \longrightarrow \overset{+3}{Mn}$ (n-factor = 1)

$F^{\ominus} \rightarrow \frac{1}{2}F_2 + e^-(n - \text{factor} = 1)$

Therefore, according to equation (iv)

2 mol of $SbF_5 \equiv$ 1mol of K_2MnF_6

$\equiv$ 1 Eq of K_2MnF_6

$\therefore$ 1 mol of $SbF_5 = \frac{1}{2}$ Eq $= 0.5$ Eq of K_2MnF_6

133 **(c)**

$I^{\ominus}$ is limiting reagent, so one mole $I^{\ominus}$ will give $\frac{1}{4}$ mol or 0.25 mole of HgI_4^{2-}

134 **(d)**

Ethanol $= 46\text{ g} = \frac{46}{46} = 1$ mol

Water $= 54\text{ g} = \frac{54}{16} = 3$ mol

Total moles = 1 + 3 = 4

$\therefore X_{ethanol} = \frac{1}{4} = 0.25$

135 **(c)**

$3Ba(NO_3)_2 + 2Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NaNO_3$

3 mol $Ba(NO_3)_2$ give = 1 mol $Ba_3(PO_4)_2$

2 mol $Ba(NO_3)_2$ give = $\frac{2}{3}$ mol $Ba_3(PO_4)_2$

2 mol Na_3PO_4 give = 1 mol $Ba_3(PO_4)_2$

136 **(c)**

$H_2S \rightarrow SO_2$

↑ ↑

−2 +4

Change in O.N. = 6 units

Thus, 1 mol H_2S = 6 equivalents H_2S

137 **(c)**

$MgI_2 + Cl_2 \longrightarrow MgCl_2 + I_2$
deep brown

$MgSO_4 + BaCl_2 \longrightarrow BaSO_4$
white ppt

138 **(a)**

Na_2CO_3 is not affected by heating

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$
Residue

139 **(c)**

$\chi_2 = \frac{n_2}{n_1 + n_2} = 0.25$ (ethanol)(solute)(Mw_2 = 46 g)

$\chi_1 = \frac{n_1}{n_1 + n_2} = 0.75$ (water)(solvent) (Mw_1 = 18 g)

$$\frac{\chi_1}{\chi_2}=\frac{n_1}{n_2}=\frac{3}{1}\Rightarrow\frac{W_1\times Mw_2}{Mw_1\times W_2}=\frac{3}{1}$$

$$\frac{W_1\times 46}{18\times W_2}=3$$

$$\frac{W_1}{W_2}=1.17$$

$$\therefore\frac{W_2}{W_1+W_2}=0.46$$

140 **(d)**

$$\frac{1\text{g}}{16}\text{CH}_4=\frac{4\text{g}X}{m}$$

$m=64\text{g mol}^{-1}$

141 **(b)**

$$\frac{0.116\text{ g of A}}{116\text{ g }(Mw\text{ A})}=\frac{0.074\text{ of Ca(OH)}_2}{W\ [\text{Ca(OH)}_2]}$$

$$W=74\text{ g}\equiv 1\text{ mol Ca(OH)}_2\equiv 2\text{ mol}\left(\overset{\ominus}{\text{OH}}\right)$$

$$\equiv 2\text{ mol }(\text{H}^{\oplus})$$

142 **(b)**

$$\text{Molality}=\frac{1000\times\text{Weight of solute}}{Mw\times\text{Weight of solvent}}$$

$$9=\frac{1000\times W}{98\times 910}$$

$W=802.6\text{ g L}^{-1}$

$=80.26$ g per 100 mL

144 **(c)**

K^+ and Cl^- remain unchanged but due to dilution (in equal volumes), molar concentration of each is halved

$[Cl^-]=0.1$ M

$[K^+]=0.2$ M

Also, $[OH^-]>[H^+]$, mixture is basic

$$[OH^-]_{\text{mix}}=\frac{0.4-0.2}{2}=0.1\text{ M}$$

146 **(d)**

Mass of water in salt $=5.4\text{ g}=\frac{5.4}{18}=0.3$ mol

Mass of anhydrous salt $(BaCl_2)=36.6-5.4=31.2$ g

$$=\frac{31.2}{208}=0.15\text{ mol}$$

Thus, $BaCl_2:H_2O=0.15:0.30=1:2$

Thus, salt is $BaCl_2.2H_2O$

147 **(d)**

$$NO_3^{\ominus}+As_2S_3\longrightarrow AsO_4^{3-}+NO+SO_4^{2-}$$

$$As_2S_3+20H_2O\longrightarrow 2AsO_4^{3-}+3SO_4^{2-}+40H^{\oplus}+28e^-$$

$E_{As_2S_3}=\frac{M}{28}$ ($n$factor $=28$) (electrons lost/mol)

148 **(a)**

$Mg+H_2SO_4\rightarrow MgSO_4+H_2$

24 g (98 g = 1 mol)

1.2 g Mg reacts with $=0.05$ mol H_2SO_4

H_2SO_4 taken $=100$ mL of 1 M H_2SO_4

$=0.1$ mol

$\therefore H_2SO_4$ left $=0.1-0.05$

$=0.05$ mol in 100 mL solution

$\therefore [H_2SO_4]=0.05\times 10=0.5$ M

149 **(a)**

$2H_2O(l)\rightarrow 2H_2O(l)+O_2(g)$

1. mol

1 mol = 24 L under given condition

24 L O_2 is from = 2 moles H_2O_2

3 L O_2 is from $=\frac{2\times 3}{24}=$

0.25 mole H_2O_2 in100 mL solution

Thus, molarity of $H_2O_2=\frac{0.25\times 1000}{100}=2.5\text{ mol L}^{-1}$

150 **(a)**

$\chi_B=0.2,\chi_A=0.1$

$$m=\frac{\chi_B\times 1000}{\chi_A\times Mw_A}=\frac{0.2\times 1000}{0.8\times 18}=13.88$$

151 **(c)**

Use formula

$$d=M\left(\frac{Mw_2}{1000}+\frac{1}{m}\right)\Rightarrow 1.8=18\left(\frac{98}{1000}+\frac{1}{m}\right)$$

Solve for m:

$\therefore m=500$

152 **(c)**

100 mL of $NaHC_2O_4 \equiv$ 50 mL of 0.1 M MnO_4^-

$100 \times N_1(C_2O_4^{2-}) \equiv 50 \times 0.5$ N MnO_4^-

$N_1 = 0.25$ N (as $C_2O_4^{2-}$)

$M_1(C_2O_4^{2-}) = 0.125$ (as $C_2O_4^{2-}$)

$\equiv 0.125$ N (as H^+)

$\therefore 100 \times 0.125$ M $(H^+) \equiv V \times 0.1$

$\therefore V = 125$ mL

153 **(c)**
$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

1 mol 3 mol

Volume of 1 mole carbon monoxide = 22.4 dm^3(= L)(at STP)

1 mole of ferric oxide is reduced by = 3 moles of CO

= 3×22.4 dm^3(= L) of CO

= 67.2 dm^3 of CO

155 **(c)**
AgCl is light sensitive

156 **(c)**
$NaAlO_2 + NH_4Cl + H_2O \longrightarrow NaCl + Al(OH)_3 \downarrow + NH_3$

157 **(d)**
1. With phenolphthalein indicator: $NaHCO_3$ does not react with HCl whereas Na_2CO_3 reacts upto $NaHCO_3$ stage (50% reaction)

$V_{HCl} = x$ mL

2. With methyl orange indicator: $NaHCO_3$ reacts completely with HCl and with Na_2CO_3 is 100% reaction. But y mL of HCl is added after Na_2CO_3 has reacted upto $NaHCO_3$. (i.e, half life value of Na_2CO_3)

V_{HCl} =Full titre value of $NaHCO_3$ +Half titre value of Na_2CO_3
y mL= Full titre value of $NaHCO_3 + x$ mL
Full titre value of$NaHCO_3 = (y - x)$ mL

159 **(a)**
Ew of metal chloride = Ew of M + Ew of Cl
= 12 + 35.5 = 47.5
47.5 g of metal chloride ⇒ Weight of metal ⇒ 12 g
0.475 g of metal chloride ⇒ $\frac{12 \times 0.475}{47.5}$
⇒ 0.12 g

160 **(a)**
1 mol of H_2 = 22400 mL = 2 Eq of H_2
1 Eq of H_2 = 11200 mL
Eq of $H_2 = \frac{560}{11200} = \frac{1}{20}$ Eq
[Let the weight of A be x g; weight of B = 0.5 – x]
Eq of A + Eq of B = Eq of H_2

$$\frac{x}{12} + \frac{0.5 - x}{9} = \frac{1}{20}$$

$\therefore x = 0.2$
% of A = $\frac{0.2 \times 100}{0.5}$ = 40%
% of B = 60%

161 **(a)**
$SiF_4 + 4H_2O \longrightarrow H_4SiO_4 + 4HF$
$2HF + SiF_4 \longrightarrow H_2SiF_6$

162 **(d)**
$MgCO_3(s) \xrightarrow{\Delta} MgO(s) + CO_2(g)$

1 mol = 84 g 40 g 1 mol

8.4 g (pure) 4.0 g 0.1 mol

in 10 g sample

Thus, % of pure $MgCO_3$ = 84%

163 **(b)**
C → CO

12 g 22.4 L

22.4 L CO from = 12 g C

11.2 L CO from = 6 g C

164 **(a)**

$$M \text{ (HCl) in mixture } = \frac{0.5 \times 750 + 2 \times 250}{750 + 250}$$

= 0.875 M

165 **(a)**

i. $MnO_4^{\ominus} \longrightarrow Mn^{2+}$ (acidic) $Ew = \frac{Mw}{5}$

ii. $MnO_4^{\ominus} \longrightarrow MnO_2$ (neutral) $Ew = \frac{Mw}{3}$

iii. $MnO_4^{\ominus} \longrightarrow MnO_4^{2-}$ (basic) $Ew = \frac{Mw}{1}$

Ratio is $\frac{1}{5}:\frac{1}{3}:\frac{1}{1} = 3:5:15$

166 **(d)**

Gas turns red litmus blue. It is basic in nature. Thus, NH_3

167 **(b)**

$2H_2O_2 \rightarrow 2H_2O + O_2$

2×34 22400 mL

2×34 g H_2O_2 liberates = 22400 mL of O_2 at STP

0.68 g H_2O_2 liberates $= \frac{0.68 \times 22400}{68} = 224$ mL

168 **(c)**

4 g sulphur is in 100 g compound, hence 32 g sulphur is in $= \left(\frac{100}{4} \times 32\right) = 800$ g compound

169 **(b)**

$Ag^+ + Cl^- \rightarrow AgCl \downarrow$
white ppt

$Cu^{2+} + Cl^- \rightarrow CuCl_2$
soluble

170 **(c)**

$Fe(OH)_3, Ni(OH)_2$ are not amphoteric

171 **(d)**

Ore of Mn is MnO_2 (pyrolusite)

$2e^- + MnO_2 \rightarrow Mn^{2+}$

$(x = 4) \rightarrow x = +2 (x = 4 - 2 = 2)$

Ew of $MnO_2 = \frac{Mw}{2}$

Excess of $C_2O_4^{2-} = 18.28 \times 0.1232 \times$ 5 mEq of MnO_4^-

Or= 11.26 mEq of $C_2O_4^{2-}$

Total $C_2O_4^{2-} = 50 \times 0.2750 \times 2$ mEq = 27.5 mEq

Reacted $C_2O_4^{2-} = 27.5 - 11.26 = 16.24$

= 16.24 mEq of $C_2O_4^{2-}$

or = 16.24 mEq of MnO_2

$= 16.24 \times 10^{-3}$ eq of MnO_2

Moles of $MnO_2 = \frac{16.24 \times 10^{-3}}{2}$

$= 8.12 \times 10^{-3}$ mol

172 **(a)**

NO_2^- oxidises I^- to I_2 which gives blue colour with starch

173 **(b)**

$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O$

208 g 98 g 233 g

100 mL of 20.8% $BaCl_2$ solution = 20.8 g $BaCl_2$

50 mL of 9.8% H_2SO_4 solution = 4.9 g H_2SO_4

Thus, H_2SO_4 is the limiting reagent

98 g H_2SO_4 gives = 233 g $BaSO_4$

4.9 g H_2SO_4 gives = 11.65 g $BaSO_4$

174 **(b)**

(a) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

1 mol 22.4 L

Actual = 11.2 L

Thus, 50%

(b) $MgCO_3 \xrightarrow{\Delta} MgO + CO_2$

1 mol 40 g

Thus, 100%

(c) $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$

2 mol 18 g

1 mol 9g

Actual = 4 g

Thus 44.4%

(d) $Ca(HCO_3)_2 \xrightarrow{\Delta} CaO + H_2O + 2CO_2$

1 mol 2 mol

Actual = 1 mol

Thus, 50%

175 **(d)**

$M_1 = 1.0$ M, $M_2 = 0.25$ M

Let V_1 and V_2 are volumes required
$(1.0 \times V_1 + 0.25 \times V_2) = 0.75\,(V_1 + V_2)$
$\Rightarrow 0.25\,V_1 = 0.5\,V_2 \Rightarrow V_1 : V_2 = 2 : 1$

177 **(b)**

9 molal $H_2SO_4 = 9 \times 98$ g H_2SO_4 in 1000 g H_2O

$= 882$ g H_2SO_4 in 1882 g H_2SO_4 solution

$= \frac{882}{1882} \times 1000$ g H_2SO_4 in 1 kg solution

$= 469$ g

178 **(b)**

$p_{O_2} = P_{\text{total}} \times \chi_{O_2} = (\text{moles fraction of } O_2)$

$$\chi_{O_2} = \frac{n_{O_2}}{n_{O_2} + n_{N_2} + n_{CO_2}}$$

$$\chi_{O_2} = \frac{0.76 \times 10^{20}}{(0.76 + 0.50 + 6.08) \times 10^{20}} = \frac{0.76}{7.34}$$

$$p_{O_2} = P_{\text{total}} \times \chi_{O_2} = 734 \times \frac{0.76}{7.34}$$

$= 76.0$ mm of Hg

179 **(d)**

$$\underset{\substack{10 \times 1 \\ = 10 \text{ mmol}}}{BaCl_2} + \underset{\substack{5 \times 0.5 \\ = 2.5 \text{ mmol}}}{K_2SO_4} \rightarrow BaSO_4 \downarrow + 2KCl$$

Here, K_2SO_4 is the limiting reagent
1 mmol $K_2SO_4 \equiv 1$ mmol $BaSO_4$
2.5 mmol $K_2SO_4 \equiv 2.5$ mmol $BaSO_4$

$$\equiv \frac{2.5}{1000} = 0.0025 \text{ mol } BaSO_4$$

180 **(d)**

Volatile component is $CH_3CH_2OH = 46$ g

$= \frac{46}{46} = 1$ mol

1 mole $= N_0$ molecules

$= 9N_0$ atoms thus, (c) is correct

Non − volatile component is $H_2O = 54\text{ g} = \frac{54}{18}$

$= 3$ moles

Thus, (a) is correct

$= 3N_0$ atoms

Thus, (b) is correct

181 **(b)**

100 mL of 0.01 M H_2SO_4 (dibasic acid)

Thus, neutralized by 100 mL of 0.01 M

$Ca(OH)_2$ (diacid base)

182 **(a)**

$$\underset{A}{2Na} + 2H_2O \longrightarrow \underset{(C)}{2NaOH} + \underset{(B)}{H_2}$$

$$\underset{D}{2Zn} + 2NaOH + 2H_2O \longrightarrow 2NaZnO_2 + 3H_2$$

$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

183 **(d)**

$NaOH + H_3PO_4 \rightarrow NaH_2PO_4 + H_2O$

40 g   98 g

1 g eq.   1 g eq.

Only 1 H is neutralized

Hence, eq. wt. = mol. wt. = 98

184 **(a)**

$$\underset{\substack{50 \times 0.1 \\ = 5 \text{ mmol}}}{\overset{3 \text{ mmol}}{3Pb(NO_3)_2}} + \underset{\substack{50 \times 0.05 \\ = 2.5 \text{ mmol}}}{\overset{1 \text{ mmol}}{Cr_2(SO_4)_3}} \rightarrow \overset{3 \text{ mmol}}{3PbSO_4} \downarrow + \overset{2 \text{ mmol}}{2Cr(NO_3)_3}$$

First find the limiting reagent
3 mmol of $Pb(NO_3)_2 \Rightarrow 1$ mmol of $Cr_2(SO_4)_3$
5 mmol of Pb $(NO_3)_2 \Rightarrow \frac{1}{3} \times 5$

$\Rightarrow \frac{5}{3} = 1.66$ mmol

So $Pb(NO_3)_2$ is the limiting reagent

i. 3 mmol of $Pb(NO_3)_2 \Rightarrow 3$ mmol of $PbSO_4$
5 mmol of $Pb(NO_3)_2 \Rightarrow 5$ mmol

$\Rightarrow \frac{5}{1000}$ mol $\Rightarrow 0.005$ mol

ii. Species left in the solution are $Cr_2(SO_4)_3$ and $Cr(NO_3)_3$

To calculate the concentration of $Cr_2(SO_4)_3$:

Intitial mmol $= 2.5$
Reacted mmol $= 1.65$
Left mmoles $= 2.5 - 1.66 = 0.84$ mmol
Total volume $= 50 + 50 = 100$ mL
Concentration $= \frac{0.84}{100} = 0.0084$ M

iii. To calculate the concentration of $Cr(NO_3)_3$:
3 mmol of $Pb(NO_3)_2 \Rightarrow 2$ mmol of $Cr(NO_3)_3$

5 mmol of $Pb(NO_3)_2 \Rightarrow \frac{2}{3} \times 5$

$\Rightarrow \frac{10}{3} = 3.33$ mmol

Concentration $= \frac{3.33}{100} = 0.033$ M

185 **(d)**

Reaction (a) is neutralization reaction and reaction (c) is decomposition reaction

187 **(a)**

$Fe_3O_4 \rightarrow 1.5\, Fe_2O_3$

1 mol   1.5 mol

232 g   240 g

?   0.40 g

Fe_3O_4 required by 0.40 g $Fe_2O_3 = \frac{232}{240} \times 0.4$

$= 0.3867$ g (pure)

$= 0.3867 \times \frac{100}{18}$ g

$= 2.15$ g impure Fe_3O_4

188 **(a)**

$[Fe(CN)_6]^{4-}$ is formed which forms Prussian blue with Fe^{3+}

$Fe^{3+} + [Fe(CN)_6]^{4-} \longrightarrow \underset{\text{Prussian blue}}{Fe_4[Fe(CN)_6]_3}$

189 **(d)**

mEq of $H_2O_2 \equiv$ mEq $MnO_4^{\ominus}$

$10\text{ mL} \times N = 10\text{ mL} \times \frac{1}{0.56}$

$N_{H_2O_2} = \frac{1}{0.56}$

$1\, N_{H_2O_2} \equiv 5.6$ 'V' (volume strength of H_2O_2)

$\frac{N}{0.56} H_2O_2 = 5.6 \times \frac{1}{0.56} = 10$ 'V'

190 **(a)**

$(NH_4)_2CS_3$ replaces H_2S

191 **(a)**

$BaCl_2 + H_2SO_4 \rightarrow BaSO_4$

1 mol   1 mol   1 mol

0.5 mol   1 mol   0.5 mol

192 **(c)**

X is $BiCl_3$

$BiCl_3 + H_2O \rightarrow \underbrace{BiOCl}_{\text{white turbidity}} + 2HCl$

$BiOCl + 2HCl \longrightarrow BiCl_3 + H_2O$

$\downarrow H_2S$

Bi_3S_3 (black ppt soluble in HNO_3)

193 **(c)**

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

2 mol   1 mol

22.4 L

1 mol   11.2 L   0.5 mol

194 **(b)**

Number of neutrons = number of electrons in X^-, Y^{2-} and Z^{3-}

Electrons*Z* (atomic number)

X^- E $(E-1)$

Y^{2-} E $(E-2)$

Z^{3-} E $(E-3)$

Thus, increasing order of atom number is

$Z < Y < X$

195 **(b)**

NH_4^+ salts are highly, soluble

196 **(d)**

$HNO_3 = 0.001\text{ M} = 0.001\text{ mol L}^{-1}$

$= 0.001 \times 63\text{ gL}^{-1}$

$= \frac{0.001 \times 63 \times 10^6}{10^3}$ g parts per million

$= 63$

197 **(b)**

(*b*) (I) $\left.\begin{matrix} H_2O_2 \longrightarrow O_2 \\ MnO_4^- \longrightarrow Mn^{2+} \end{matrix}\right\} \longleftarrow$ O.N. change = 5

(II) $\left.\begin{matrix} H_2O_2 \longrightarrow O_2 \\ MnO_4^- \longrightarrow MnO_2 \end{matrix}\right\} \longleftarrow$ O.N. change = 3

In I (acidic) $N_1V_1 = N_2V_2$

$H_2O_2MnO_4^-$

$2M_1 \times 100 = 0.5 \times 100$

$M_1((H_2O_2) = 2.5$ M

In II (basic)$N_1V_1 = N_2'V_2'$

$2M_1 \times 100 = 3 \times M_2 \times V_2'$

$2 \times 2.5 \times 100 = 3 \times 1 \times V_2'$

$V_2' = \frac{500}{3}$ mL

198 **(b)**

$X_{H_2SO_4} = \frac{100 \times 0.9}{100 \times 0.9 + 100 \times 1} = \frac{90}{190} = 0.4736$

% mass of $H_2SO_4 = 43.36$ %

199 **(a)**

$\left.\begin{array}{l} Fe^{2+} \\ C_2O_4^{2-} \end{array}\right]$ decolourise MnO_4^-/H^+

200 **(a)**

1mol $K_2Cr_2O_7$ is obtained from 2 mol of $FeCrO_4$
0.25 mol $K_2Cr_2O_7$ is obtained from
=0.50 mol of $FeCrO_4$ (100% pure)
=1.00 mol (if 50% pure)

201 **(a)**

Since two H-atoms are replaced

$\therefore Ew = \frac{Mw}{n} = \frac{98}{2} = 49$

202 **(a)**

$MnO_4^- \rightarrow MnO_4^{2-}$

+7 + 6

Change in O.N. = 1 unit

$\therefore$ Normality = Molarity

12.64 g $KMnO_4$ = 0.08 mol in 0.5 L

= 0.16 M = 0.16 N

203 **(c)**

$ZnO + 2NaOH \longrightarrow Na_2[ZnO_2] + H_2O$
$Al_2O_3 + 2NaOH \longrightarrow 2Na[AlO_2] + H_2O$
$SnO_2 + 2NaOH \longrightarrow Na_2[SnO_3] + H_2O$
$Fe_2O_3 + NaOH \longrightarrow$ insoluble

204 **(b)**

55.5 g $CaCl_2 \equiv 50$ g $CaCO_3$
55.5 mg $CaCl_2 \equiv 50 \times 10^{-3}$ g $CaCO_3$
47.5 g $MgCl_2 \equiv 50$ g $CaCO_3$
47.5 mg $MgCl_2 \equiv 50 \times 10^{-3}$ g $CaCO_3$
Total $CaCO_3 = (50 + 50) \times 10^{-3} = 10^{-2}$ g L^{-1}

ppm $= \frac{10^{-2}}{1000 \text{ mL}} \times 10^6$mL $= 10$

206 **(b)**

Mass of one atom $= 2.66 \times 10^{-23}$g

Mass of N_0 atoms $= 2.66 \times 10^{-23} \times 6.02 \times 10^{23}$g mol^{-1}

= atomic mass

Thus, number of moles in 32 g

$= \frac{32}{2.66 \times 10^{-23} \times 6.02 \times 10^{23}}$

207 **(d)**

18 g glucose = 0.10 mol glucose

Withdrawn = 0.08 mol

Left = $0.10 - 0.08 = 0.02$ mol $= 3.6$ g

208 **(c)**

100 g H_3PO_4 solution has = 85 g H_3PO_4

$\frac{100}{1.7}$ mL H_3PO_4 solution has = 85 g H_3PO_4

$= \frac{85}{98}$ mol

$\therefore$ Molarity $= \frac{85/98 \text{ mol}}{\left(\frac{100}{1.7 \times 1000} \text{L}\right)} = 14.74$ M

209 **(b)**

$CaCO_3 \rightarrow CaO + CO_2$

100 g 22.4

20 g $\frac{22.4}{5} = 4.48$ L

210 **(c)**

Iron (III) Sulphate (IV) is

$Fe^{3+}SO_3^{2-}$(oxidation of sulphur is = +4 in SO_3^{2-})

$Fe_2(SO_3)_3$

$Fe = 56 \times 2 = 112$ g

$S = 32 \times 3 = 96$ g

$O = 16 \times 9 = 144$ g

Thus, percentage of O is maximum out of total molar mass of $Fe_2(SO_3)_2 = 352$

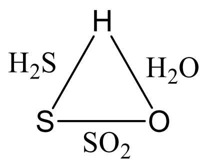
211 **(a)**

(a) I : $N_2O : NO : NO_2$

28gN/16g O : 14 gN/16g O : 14 gN/32g O

14 gN/8g O : 14 gN/16g O : 14 gN/32g O

4:2:1

II. 

Ratio of H and S in H_2S : 2 g H/32 g S

Ratio of H and O in H_2O : 2 g H/16 g O

Ratio of S and O in SO_2 : 32 g S/32 g O

Thus, law of reciprocal proportion is followed

Thus, I and II both

212 **(d)**

$[B_4O_5(OH)_4]^{2-} + 5H_2O$
$\rightarrow 2B(OH)_3 + 2[B(OH)_4]^-$

$2[B(OH)_4]^- + 2HCl \rightarrow B(OH)_3 + 2H_2O + 2Cl^-$

Each $[B(OH)_4]^-$ has one neutralisable OH^-

213 **(d)**

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

1 mol 2 mol

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

$Na_2CO_3 = 1\text{ g} = \frac{1}{106}$ mol $= \frac{2}{106}$ molH HCl

$NaHCO_3 = 1\text{ g} = \frac{1}{84}$ mol $\equiv \frac{1}{84}$ mol HCl

Total HCl required $= \left(\frac{1}{53} + \frac{1}{84}\right)$ mol HCl

Let volume of 0.1 N HCl = V mL

Then, moles $= \frac{0.1 \times V}{1000} = \frac{V}{10000}$

$\therefore \frac{V}{10000} = \left(\frac{1}{53} + \frac{1}{84}\right)$

$= 0.0308$ mol

$V = 0.0308 \times 10000$

$= 308$ mL

214 **(c)**

$NaHC_2O_4 \rightleftharpoons Na^+ + H^+ + C_2O_4^{2-}$

$H^+ \equiv OH^-$

and $C_2O_4^{2-} \equiv MnO_4^-$

$H^+ + OH^- \rightarrow H_2O$

$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+}$

10 mL of $NaHC_2O_4 \equiv$ 10 mL of 0.1 M NaOH

Thus, $10 \times M(NaHC_2O_4) = 10 \times 0.1$

$M = 0.1$ M $= 0.1$ N (since H^+ is neutralized)

$NaHC_2O_4 = 0.1$ N as an acid

$= 0.2$ N as $C_2O_4^{2-}$ oxidised by MnO_4^-

Let $MnO_4^- = x$ M $= 5x$ N

10 mL of 0.2 N $NaHC_2O_4 \equiv$ 10 mL of $5x$ N $KMnO_4$

$10 \times 0.2 = 10 \times 5x$

$\therefore x = \frac{0.2}{5} = 0.04$ M

215 **(b)**

$MnO_2 + 4HCl \rightarrow Cl_2$

2 mol 4 mol 1 mol = 22.4 L at STP

But Cl_2 formed = 11.2 L at STP

Thus, % yield $= \frac{11.2}{22.4} \times 100 = 50\%$

216 **(c)**

10 g glucose is in = 100 mL

$\therefore$ 180 g glucose is in $= \frac{100 \times 180}{10}$ mL = 1800 mL = 1.8 L

217 **(c)**

$CaCl_2$ (residue) = 0.111 g

$= \frac{0.111}{111 \text{ g mol}^{-1}}$

$= 1 \times 10^{-3}$ mole in 100 mL

$= \frac{1 \times 10^{-3} \times 1000}{100}$ mol in 1000 mL

= 0.01 M

218 **(c)**

$NH_4NO_2 + H^+ \longrightarrow HNO_2$

$HNO_2 \xrightarrow[\text{starch}]{\text{KI}}$ blue

219 **(b)**

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

220 **(c)**

Moles or molecules of $O_2 : N_2 = \frac{1}{32} : \frac{4}{28}$

$= \frac{1}{32} : \frac{1}{7} = \frac{7}{32} : 1 = 7 : 32$

221 **(d)**

$MCO_3 \rightarrow MO + CO_2 \uparrow$

$M'CO_3 \rightarrow M'O + CO_2 \uparrow$

Eq of CO_2 = Eq of carbonates of metals

1 mol of CO_2 = 1 mol of CO_3^{2-}

44 g of CO_2 = 60 g of CO_3^{2-}

1.10 g of $CO_2 = \frac{60}{44} \times 1.10 = 1.5$ g of CO_3^{2-}

% of $CO_3^{2-} = \frac{1.5 \times 100}{3} = 50\%$

% of one metal = 15%

% of another metal = 100 − 50 − 15 = 35%

222 **(d)**

$NaCl \rightleftharpoons Na^+ + Cl^-$

$Na_2SO_4 \rightleftharpoons 2Na^+ + SO_4^{2-}$

$[Na^+]_{mix} = \frac{30 \times 0.12 + 70 \times 0.15 \times 2}{30 + 70} = 0.246$ M

223 **(b)**

$Bi^{3+} + 3I^- \longrightarrow BiI_3 \downarrow$ black ppt

$BiI_3 + KI \longrightarrow K[BiI]_4$ orange solution

225 **(c)**

Same empirical formula, it means ratio of atoms is identical. Hence, they differ in molecular weight

226 **(c)**

Mol. ratio $O_2 : N_2$

$\frac{1}{32} : \frac{4}{28}$

Molecules $\frac{N_A}{32} : \frac{4N_A}{28} \Rightarrow 7 : 32$

227 **(c)**

Mg in 1 g chlorophyll $= \frac{1 \times 2.4}{100}$ g

$= \frac{1 \times 2.4}{100 \times 24}$ mol

$= \frac{1 \times 2.4 \times 6.02 \times 10^{23}}{100 \times 24}$ atoms

$= 6.02 \times 10^{20}$ atoms

228 **(c)**

Molar mass	**0.01 mol**
(a) $NaHCO_3$ = 84 g	0.84 g
(b) Na_2CO_3 = 106 g	1.06 g
(c) Na_2SO_4 = 142 g	1.42 g
(d) $Na_2C_2O_4$ = 134 g	1.34 g

229 **(d)**

(a) $CuSO_4 + 4KI \rightarrow Cu_2I_2 + 2K_2SO_4 + I_2$

$I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$

Liberated I_2 is estimated by $Na_2S_2O_3$(hypo) taken in burette

Thus, true

(b) I_2 (in burette) $+ 2N_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$

Thus, true

(c) $I_2 + KI \rightleftharpoons KI_3$

Thus, true

231 **(b)**
Specific heat × Atomic weight = 6.4
(Dulong and Petit law)
$\text{Atomic weight} = \frac{6.4}{\text{specific heat}} = \frac{6.4}{0.25}$
$\text{Atomic weight} = Ew \times \text{valency} = 25.6$
$\text{Valency} = \frac{\text{Atomic weight}}{Ew} = \frac{25.6}{12} = 2$
(Valency is always a whole number)

232 **(c)**
$NH_4^+ + OH^- \longrightarrow NH_3 + H_2O$

233 **(b)**
$H_2O_2 \rightarrow 2H^+ + O_2 + 2e^-$ $0.1\text{ M} = 0.2\text{ N}$

$MnO_4^- \rightarrow Mn^{x+}$ $0.1\text{ M} = 0.1(7-x)\text{N}$

$N_1V_2 = N_2V_2$

$0.2 \times 24 = 0.1(7-x)16$

$(7-x) = 3$

$x = 4$

Thus, change in oxidation number of MnO_4^- is 3.
Thus, MnO_4^- changes to MnO_2

234 **(b)**
$CH_3COOH + KNO_2 \longrightarrow CH_3COOK + HNO_2$
$CoCl_2 + 2KNO_2 \longrightarrow Co(NO_2)_2$
$3KNO_2 + Co^{II}(NO_2)_2 + 2HNO_2 \longrightarrow$
$K_3[Co^{III}(NO_2)_6] + H_2O + NO\uparrow$
potassium cobaltinitrite
(yellowish orange pH)

236 **(b)**
$CO = x\text{ mL}, N_2 = (10-x)\text{mL}$
$CO_2 + \frac{1}{2}O_2 \rightarrow CO_2,$
$N_2 + O_2 \rightarrow 2NO$
$O_2\text{required} = \frac{x}{2}\text{ mL}, O_2\text{required} = (10-x)\text{mL}$
$\frac{x}{2} + (10-x) = 7, x = 6\text{ mL}$
$N_2 = 10 - 6 = 4\text{ mL}$

237 **(c)**
$0.372\text{ mol} = 186\text{ g}$

$1\text{ mol} = \frac{186}{0.372} = 500\text{ g}$

238 **(a)**

		Mol	
Al	5 g	0.185	1.0
O_2	4.45 g	0.278	1.5

Thus, Al_2O_3

239 **(a)**
$Fe_2(C_2O_4)_3 \rightleftharpoons 2Fe^{3+} + 3C_2O_4^{2-}$

1 mol 3 mol

Only $C_2O_4^{2-}$ oxidised

$2MnO_4^- + 5C_2O_4^{2-} \rightarrow 10CO_2 + 2Mn^{2+}$

$5\text{ mol } C_2O_4^{2-} \equiv 2\text{ mol } MnO_4^-$

$\therefore 3\text{ mol } C_2O_4^{2-} = 1.2\text{ mol } MnO_4^-$

240 **(d)**
$Cu^{2+} + 2SCN^- \rightarrow \underset{\text{black}}{Cu(SCN)_2}\downarrow \xrightarrow{\Delta} \underset{\text{white}}{CuSCN}\downarrow + (SCN)_2$
$Fe^{3+} + SCN^- \rightarrow \underset{\text{red}}{[Fe(SCN)]^{2+}}$
$Co^{2+} + SCN^- \rightarrow \underset{\text{blue}}{[Co(SCN)_4]^{2-}}$

241 **(b)**
$[Zn(NH_3)_4]^{2+} + 4H^+ \rightarrow Zn^{2+} + 4NH_4^+$
Addition of H^+ shifts equilibrium in backward side releasing Zn^{2+} ions

243 **(b)**
H^+ (in H_2SO_4 – a dibasic acid) = 0.2 M

H^+ (in H_3PO_3 – a dibasic acid) = 0.2 M

$\text{Total } [H^+] = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$
$= \frac{100 \times 0.2 + 200 \times 0.2}{300} = 0.2\text{ M}$

244 **(a)**

Atoms of the same element having same atomic numbers but different mass numbers are called isotopes

246 **(c)**

$O_3 + 6I^- + 6H^+ \rightarrow 3H_2O + 3I_2$

$O_3 \equiv 3I_2 \equiv 6I$

$\therefore I \equiv \frac{O_3}{6}$

$\therefore$ Equivalent mass of $O_3 = \frac{48}{6} = 8$

247 **(d)**

For water vapours, $P = 0.0006 \text{ g cc}^{-1}$

$\therefore 0.0006 = \frac{\text{Mass}}{\text{Volume}} = \frac{\text{Mass}}{1000}$

$\text{Mass} = 1000 \times 0.0006 = 0.6 \text{ g}$

The density of liquid water is 1 g cc^{-1}

So, the volume occupied by water is

$\frac{\text{Mass}}{\text{density}} = \frac{0.6}{1} = 0.6 \text{ cc}$

248 **(b)**

$\frac{Ew \text{ of acid}}{Ew \text{ of salt of Mg}} = \frac{\text{Weight of acid}}{\text{Weight of salt}}$

$Mg + 2HCl$ (monobasic acid) $\rightarrow MgCl_2 + H_2$

Let Ew of acid $= Ew$ of H $+ Ew$ of acid redical

$\therefore$ Ew of salt of Mg $= Ew$ of Mg $+ Ew$ of acid radical

$\therefore \frac{Ew \text{ of acid}}{Ew \text{ of Mg salt}} = \frac{\text{Weight of acid}}{\text{Weight of Mg salt}}$

$\Rightarrow \frac{Ew \text{ of H} + Ew \text{ of acid radical } (E)}{Ew \text{ of Mg} + Ew \text{ of acid radical } (E)} = \frac{1.0}{1.301}$

$\Rightarrow \frac{1+E}{12+E} = \frac{1.0}{1.301}$

$\therefore E = 35.54$

$\therefore Ew$ of acid $= Ew$ of H $+ Ew$ of acid radical

$= 1 + 35.54 = 36.54$

249 **(d)**

If carbon content is 69.98 g then molar mass = 100 g

If carbon content is 21×12 g then molar mass is

$= \frac{100}{69.98} \times 21 \times 12$

$= 360.1 \text{ g mol}^{-1}$

250 **(d)**

$100 \times 5 \text{ N } (MnO_4^{\ominus}) \equiv V \times 3 \text{ N } (MnO_4^{\ominus})$

$V = \frac{500}{3} \text{ mL}$

251 **(b)**

$\underset{(1.6 \text{ g})}{MnO_2} + \underset{50 \text{ mL}/0.1 \text{ N}}{H_2C_2O_4} \longrightarrow Mn^{2+}$

excess $\rightarrow$ 25 mL $\equiv$ 0.01 N/30 mL of $KMnO_4$

mEq of $KMnO_4 \equiv$ mEq of $H_2C_2O_4]_{\text{excess in 25 mL}}$

$\Rightarrow$ Excess mEq of $H_2C_2O_4$ in 25 mL

$= 0.01 \times 30 = 0.30$

Excess mEq of $H_2C_2O_4$ in 250 mL = 3.0

mEq of $H_2C_2O_4$ used $= 5 - 3 = 2$

mEq of $MnO_4 = 2$

$\frac{\text{Weight}}{87/2} \times 1000 = 2 \Rightarrow \text{Weight} = 0.087 \text{ g}$

$\% \; MnO_2 = \frac{0.087}{1.6} \times 100 = 5.43\%$

252 **(d)**

$\because 9.108 \times 10^{-31}$ kg of electrons contain

$= \frac{1}{6.023 \times 10^{23}}$ mol

$\therefore$ 1 kg of electron will contain

$= \frac{1}{6.023 \times 10^{23} \times 9.108 \times 10^{-31}}$

$= \frac{1}{6.023 \times 9.108} \times 10^{8} \text{mol}$

253 **(c)**

(a) $4.4 \text{ g } CO_2 = \frac{4.4}{44} \text{ mol } CO_2 = 0.1 \text{ mol } CO_2$

=0.1 mol C

(b) $3.0 \text{ g } C_2H_6 = \frac{3.0}{30} \text{ mol } C_2H_6 = 0.1 \text{ mol } C_2H_6$

=0.2 mol C

(c)$4.4 \text{ g } C_3H_8 = \frac{4.4}{44} \text{ mol } C_3H_8 = 0.1 \text{ mol } C_3H_8$

=0.3 mol C

(d)$1.3 \text{ g } C_6H_6 = \frac{1.3}{78} \text{ mol } C_6H_6 = 0.017 \text{ mol } C_6H_6$

= 0.1 mol C

255 **(a)**

$Cu^{2+} \xrightarrow{NaHSO_3} Cu^{+}$

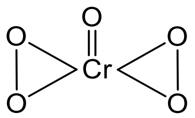
$Cu^{+} + CNS^{-} \longrightarrow CuCNS\downarrow$ white ppt

Filtrate contains Ni^{2+} and gives cherry red ppt with DMG

256 **(d)**

$K_2Cr_2O_7 + 2H_2SO_4 \rightarrow 2KHSO_4 + 2CrO_3 + H_2O$

$CrO_3 \xrightarrow{H_2O_2} CrO_5$



Blue in ethereal layer

257 **(a)**

$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

24 g 98 g

$1.2\text{ g} \frac{98 \times 1.2}{24} = 4.9\text{ g}$

100 mL of 1M $H_2SO_4 = 0.1\text{ mol} = 9.8\text{ g } H_2SO_4$

H_2SO_4 used $= 4.9$ g

H_2SO_4 left $= 9.8 - 4.9 = 4.9$ g in 100 mL

$= 49\text{ g L}^{-1}$

$= \frac{49}{98}\text{ mol L}^{-1}$

$= 0.5$ M

258 **(d)**

$1.8\text{ g } H_2O = \frac{1.8}{18} = 0.1\text{ mol}$

I : 1.8 g glucose $= \frac{1.8}{180} = 0.01$ mol

II : 6 g urea $= \frac{6}{60} = 0.1$ mol

III : 34.2 g sucrose $= \frac{34.2}{342} = 0.1$ mol

Thus, II, III

260 **(c)**

$3e^{-} + CrO_4^{2-} \longrightarrow [Cr(OH)_4]^{\ominus}$

$x = 6$ $x = 3$

$(x = 6 - 3 = 3)$

$\therefore Ew = \frac{Mw}{3}$

261 **(c)**

$Hg_2(NO_3)_2 \xrightarrow{K_2CrO_4} Hg_2CrO_4 \xrightarrow{NH_3}$ black (Hg)

red

262 **(a)**

$CaCO_3(s) \xrightarrow{\Delta} CaO(s)\downarrow + CO_2(g)\uparrow$

1mol = 100 g 1 mol = 56 g 22.4 L at STP

0.05 mol = 5 g pure 0.05 mol

= 2.8 g 1.12 L at STP

Impure $CaCO_3$ taken

= 10 g (5 g pure $CaCO_3$

+ 5 gimpurity)

CaO(s) left = 2.8 g

Impurity = 5.0 g

Total residue = 7.8 g

263 **(c)**

Assume medium to be dilute alkaline:

$\Rightarrow MnO_4^{\ominus} + 3e^{-} \longrightarrow MnO_2$ $(\because n \text{ factor} = 3)$

[Although it should have been mentioned clearly but if it as strongly alkaline, it is not possible to solve. Check yourself]

$\Rightarrow$ mEqNaCN $= (0.33 \times 3 \times 50) - (0.1 \times 1 \times 19)$

$\times \frac{50}{5} = 31$

Also, $CN^{\ominus} + H_2O \longrightarrow OCN^{\ominus} + 2H^{\oplus} + 2e^{-}$

$\Rightarrow$ mmol NaCN $= \frac{31}{2} = \frac{\text{Weight}}{49} \times 1000$

$\Rightarrow$ Weight $= \frac{31}{2} \times \frac{49}{1000} \Rightarrow$ NaCN purity =75.95%

264 **(a)**

$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

1 mol 1 mol 2 mol

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$

$2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$

Thus, total $Ca(OH)_2$ required = 2 mol

265 **(a)**

$Fe^{2+} \rightarrow Fe^{3+} + 1e^-$

$MnO_4^{\ominus} + 8H^{\oplus} + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

$Cr_2O_7^{2-} + 14H^{\oplus} + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$

Using mole concept

1 mol $MnO_4^{\ominus} \equiv$ 5 mol Fe^{2+}

and 1 mol $Cr_2O_7^{2-} \equiv$ 6 mol Fe^{2+}

so, $K_2Cr_2O_7$ will oxidise more Fe^{2+} to Fe^{3+}

266 **(b)**

One molal urea solution means 1 kg water has 60 g urea

Thus, total mass of one molal solution = 1060 g

1060 g solution has urea = 60 g

1000 g solution has urea $= \frac{60 \times 1000}{1060}$

= 56.6 g

267 **(b)**

Methyl red indicates the first step ionization of H_2PO_4. Bromothymol blue indicates the second step ionization of H_3PO_4. i.e.,

$H_2PO_4^{\ominus} \longrightarrow H^{\oplus} + HPO_4^{2-}$ $(n = 1)$ $(N = M \times 1)$

First case: When methyl red is added (change of

$H_3PO_4 \longrightarrow H_2PO_4^{\ominus} + H^{\oplus}$) $(n = 1)$ $(N = M \times 1)$

$KOH \equiv H_3PO_4$

$N_1V_1 \equiv N_2V_2$

$0.2 \times 1 \times V_1 = 0.1 \times 1 \times 100$

$V_1 = 50$ mL

Second case: When bromothymol blue is added

(change of $H_2PO_4^{\ominus} \longrightarrow H^{\oplus} + HPO_4^{2-}$)

$(n = 1)(N = M \times 1)$

$KOH \equiv H_2PO_4^{\ominus}$

$N_1V_1 \equiv N_2V_2$

$0.2 \times 1 \times V_1 = 0.1 \times 1 \times 100$

$V_1 = 50$ mL

Total volume = 50 + 50 = 100 mL

268 **(b)**

$Cr_2O_7^{2-} + H_2O \longrightarrow 2CrO_4^{2-} + 2H^+$

$Pb^{2+} + CrO_4^{2-} \longrightarrow PbCrO_4 \downarrow$

yellow

269 **(b)**

$20 \text{ g Ca} = \frac{20}{40} \text{ mol} = 0.5 \text{ mol Ca} = 0.5\ N_0 \text{atoms}$

(a) $20 \text{ g Mg} = \frac{20}{24} \text{ mol} = 0.833 \text{ mol Mg}$

$= 0.833\ N_0 \text{atoms}$

(b) $1.6 \text{ g } CH_4 = \frac{1.6}{16} \text{ mol} = 0.1 \text{ mol } CH_4$

$= 0.5\ N_0 \text{atoms}$

(c) $1.8 \text{ g } H_2O = \frac{1.8}{18} \text{ mol} = 0.1 \text{ mol } H_2O$

$= 0.3\ N_0 \text{atoms}$

(d) $1.7 \text{ g } NH_3 = \frac{1.7}{17} \text{ mol} = 0.1 \text{ mol } NH_3$

$= 0.4\ N_0 \text{atoms}$

270 **(c)**

1 mole O_2 = 2 O − atoms = 4 equivalents oxygen

Volume of 1 mole= 22.4 L at STP

Volume of 1 equivalent= 5.6 L at STP

271 **(a)**

$P = \frac{dRT}{M}$

$d = \frac{PM}{RT} = \frac{5 \times 17}{0.082 \times 300} = 3.42 \text{ g L}^{-1}$

272 **(c)**

$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

100 g   98 g

10 g   9.8 g

50 mL H_2SO_4has= 9.8 g

100 mL has = 19.6 g

273 **(a)**

Fe^{2+} is oxidized to Fe^{3+} by MnO_4^-/H^+

Fe^{3+} gives blue colour with $K_4[Fe(CN)_6]$

$Fe^{2+} + MnO_4^- + H^+ \rightarrow Fe^{3+} + Mn^{2+} + H_2O$

$Fe^{3+} + [Fe(CN)_6]^{4-} \rightarrow Fe[Fe(CN)_6]^-$

Prussian blue

274 **(d)**

Phenolphthalein end-point indicates 50% neutralization of Na_2CO_3 to $NaHCO_3$ stage

$Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl$

$\therefore$ 0.2 M Na_2CO_3 = 0.2 N Na_2CO_3

$\therefore N_1V_1 = N_2V_2$

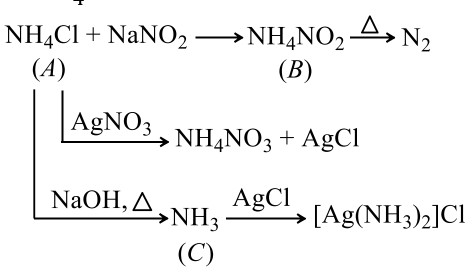
HCl $\quad Na_2CO_3$

$x \times 20 = 0.2 \times 5$

$x = 0.05$ N $= 0.05$ M HCl

275 **(b)**

A: NH_4Cl



276 **(b)**

$CuSO_4 + 2KCN \longrightarrow Cu(CN)_2 + K_2SO_4$

$2Cu(CN)_2 \longrightarrow 2CuCN + (CN)_2$

cyanogen

$CuCN + 3CN^- \longrightarrow [Cu(CN)_4]^{3-}$

277 **(c)**

$3NaOH + FeCl_3 \rightarrow Fe(OH)_3 + 3NaCl$

(excess) 100 mL

1 mmol $\equiv$ 1 mmol

$FeCl_3 \equiv Fe(OH)_3$

$M \times 100 \equiv \frac{2.14}{107} \times 1000$

$M_{FeCl_3} = 0.2$

$N_{FeCl_3} = 0.2 \times 3$ (valency factor = 3)

$= 0.6$ N

278 **(c)**

$2HNO_2 + NH_2CONH_2 \longrightarrow N_2 + CO_2 + 3H_2O$

279 **(d)**

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

[3 mol 2 mol 6 mol 1mol]

Given $\Rightarrow$ 0.5 mol of $BaCl_2$ and 0.2 mol of Na_3PO_4

To find the limiting reagent

2 mol of $Na_3PO_4 \Rightarrow$ 3 mol of $BaCl_2$

0.2 mol of $Na_3PO_4 \Rightarrow$ 0.3 mol of $BaCl_2$

$\therefore Na_3PO_4$ is the limiting reagent

$\therefore$ 2 mol of $Na_3PO_4 \Rightarrow$ 1 mol of $Ba_3(PO_4)_2$

0.2 mol of $Na_3PO_4 \Rightarrow$ 0.1 mol of $Ba_3(PO_4)_2$

280 **(c)**

Moles of NaOH intialy $= \frac{200 \times 0.100}{1000} = 0.02$ mol

CO_2 absorbed = 1 millimol = 0.001 mol

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

Thus, NaOH reacted $= 0.001 \times 2 = 0.002$ mol

Na_2CO_3 formed = 0.001 mol

NaOH unreacted $= 0.02 - 0.002 = 0.018$ mol

Thus, HCl required by NaOH for phenolphthalenin end-point

= 0.018 mol

Equivalent of Na_2CO_3 = 0.002 equivalents

$\therefore$ Moles of HCl required by 0.002 equivalents for phenolphthalein end-point $= \frac{0.002}{2} = 0.001$

(50% reaction is indicated upto $NaHCO_3$)

$\therefore$ Total HCl = (0.018 + 0.001)mol in 200 mL

$\equiv$ (unreacted NaOH + $NaHCO_3$ fromed)

$$\therefore N = \frac{(0.018 + 0.001)}{0.2} \text{ mol L}^{-1}$$

= 0.095 M = 0.095 N

281 **(a)**

I. 0.1 mol CH_4 = 0.4 mol H − atoms

II. $3.01 \times 10^{23} CH_4$ molecules = 0.5 mol CH_4
= 2.0 mol H − atoms

III. 9.6 g CH_4 = 0.6 mol CH_4 = 2.4 mol H − atoms

Thus, I + II − III = 0

282 **(a)**

The number of molecules in 36 g of water is

$\frac{36}{18}N = 2N$

The number of molecules in 28 g of CO is

$\frac{28}{28}N = N$

The number of molecules in 46 g of C_2H_5OH is

$\frac{46}{46} N = N$

The number of molecules in 54 g of N_2O_5 is

$\frac{54}{108} N = \frac{1}{2} N$

283 **(d)**

Element	%	Mole	Ratio
Si	90.28	3.11	1
H	9.72	9.72	3

SiH_3 thus Si_2H_6

284 **(a)**

$SO_3^{2-} + 2H^+ \longrightarrow SO_2 + H_2O$

$Zn + 2H^+ \longrightarrow Zn^{2+} + 2H$

$SO_2 + 4H \longrightarrow H_2S + 2H_2O$

$(CH_3COO)_2Pb + H_2S \longrightarrow \underset{\text{black}}{PbS \downarrow}$

286 **(b)**

$NaSO_4$ remains unreacted

$N_1V_1 = N_2V_2$

$N_1 \times 100 = (2 \times 0.5) \times 10$

$N_1(NaOH) = 0.1$

100 mL of 0.1 N NaOH = 0.01 mol NaOH

$= 0.01 \times 40 \text{ g} = 0.4 \text{ g}$

287 **(b)**

Weight of salt = 13.4 g

Weight of H_2O = 6.3 g

Weight of anhydrous salt = 13.4 − 6.3 = 7.1 g

Moles of anhydrous salt $= \frac{7.1}{842} = 0.05$

Moles of $H_2O = \frac{6.3}{18} = 0.35$ mol

0.05 mol of anhydrous salt ⇒ 0.35 mol of H_2O

1 mol of anhydrous salt ⇒ $\frac{0.35}{0.05} = 7$ mol

288 **(c)**

$\underset{\text{borax}}{Na_2B_4O_7} \xrightarrow{\Delta} NaBO_2 + \underbrace{B_2O_3}_{\text{transparent bead}}$

$B_2O_3 + CuO \rightarrow \underset{\text{Coloured bead}}{Cu(BO_2)_2}$

$Na(NH_4)HPO_4 \xrightarrow{\Delta} \underset{\text{Transparent bead}}{NaPO_3} + H_2O + NH_3$

$NaPO_3 + CuO \rightarrow \underset{\text{Coloured bead}}{Na[CuPO_4]}$

289 **(b)**

Na_2CO_3 formed = CO_2 absorbed

$= 0.0112 \text{ mol L}^{-1}$

$\therefore$ M (Na_2CO_3) = 0.0112 M

290 **(a)**

Normality of 'x' volume $H_2O_2 = \frac{x}{5.6}$

$\frac{x}{5.6} = 1.5$

$x = 1.5 \times 5.6$

= "8.4" volume

291 **(b)**

As in 78

$\frac{37 \times 1000 \times 1.18}{100 \times 36.5} = 12$ M

292 **(b)**

$Al + NaOH + H_2O \rightarrow NaAlO_2 + 1.5 H_2$

1 mol 1.5 mol

27 g 33.6 L at STP

33.6 L H_2 gas are from = 27 g Al

0.840 L H_2 gas are from $= \frac{27 \times 0.840}{33.6}$ g Al

= 0.675 g Al

293 **(c)**

1 N = 5.6 vol

⇒ Normalities of two solutions are 1 N and 2 N

Normality of mixture $= \frac{1\times1+1\times2}{1+1} = \frac{3}{2} = 1.5$ N

Volume strength $= \frac{3}{2} \times 5.6 = \frac{16.8}{2} = 8.4$ mol

295 **(a)**

Let the volume of $O_3 = x$ mL

Volume of O_2 present = $(600 - x)$ mL

22400 mL of O_3 and O_2 at STP will weight 48 g and 32 g respectively

The weight of x mL of $O_3 = \frac{x \times 48}{22400}$ g

The weight of $(600 - x)$ mL of $O_2 = \frac{(600-x)}{22400} \times 32$

Total weight of ozonised O_2(600 mL)

$$= \frac{48x}{22400} + \frac{(600 - x) \times 32}{22400} = 1.0$$

$\therefore\ x = 200$ mL

296 **(a)**

1 g H_2O_2(impure) $= 0.01X$ g pure H_2O_2

$H_2O_2 \rightarrow 2H^+ + O_2 + 2e^-$

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

$$1 \text{ mol } H_2O_2 = 2 \text{ equiv. } H_2O_2, E = \frac{\text{molar mass}}{2}$$

$$1 \text{ mol } MnO_4^- = 5 \text{ equiv. } MnO_4^- E = \frac{\text{molar mass}}{5}$$

$$0.01\,X \text{ g pure } H_2O_2 = \frac{0.01\text{ X}}{17} \text{ equiv. } H_2O_2$$

$$= \frac{0.01\text{ X}}{17} \text{ equiv. of } MnO_4^- \text{ in } X \text{ mL } MnO_4^- \text{ solution}$$

$$N(MnO_4^-) = \frac{0.01\,X\,1000}{17\,X}$$

$$= \frac{10}{17}$$

$$M(MnO_4^-) = \frac{10}{17 \times 5} = \frac{10}{85} = 0.12 \text{ M}$$

298 **(a)**

$NaHC_2O_4 . H_2C_2O_4 \rightleftharpoons Na^+ + 3H^+ + 2C_2O_4^{2-}$

1 mol 3 mol 2 mol

$3 \text{ mol } H^+ \equiv 3$ equivalents of H^+

$2 \text{ mol } C_2O_4^{3-} \equiv 4$ equivalents of $C_2O_4^{2-}$

299 **(d)**

Maximum capacity $= 300 \times \frac{6}{5} = 360$ mL

If volume is more than 360, it will burst

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{300}{300} = \frac{360}{T_2}$$

$T_2 = 360 \text{ K} = 360 - 273 = 87°\text{C}$

300 **(b)**

Average atomic weight

$$= \frac{54 \times 5 + 56 \times 90 + 57 \times 5}{100} = 55.95$$

301 **(a)**

Volume of O_2 at STP = 100 mL $\times$ 11.2 volume strength

= 1120 mL of O_2 at STP

(Since 1 N=5.6 volume strength; 2 N =11.2 volume strength of H_2O_2)

Volume of O_2 produced by H_2O_2 = 1120 mL

Same volume of O_2 will be peoduced by $KMnO_4$ = 1120 mL

Total volume of O_2 = 2240 mL = 2.24 L

302 **(d)**

Nucleus consists of proton and neutron and molar mass = neutron + proton

303 **(a)**

The normality of oxalic acid dehydrate is

$$\frac{6.3}{63} \times \frac{1}{250} \times 1000 = 0.4$$

[Ew for $(COOH)_2{\cdot}2H_2O$ is 63]

N_1V_1 (acid) $= N_2V_2$ (base)

or $0.4 \times 10 = 0.1 \times V_2$

or $V_2 = 40$ mL

305 **(d)**

Oxidation state of L in $KlO_3 = +5$

S in $SO_3^{2-} = +4$

S in $SO_4^{2-} = +6$

$IO_3^- + SO_3^{2-} \rightarrow SO_4^{2-} + I^x$

$+5 \quad +4 \quad +6 \quad x < 5$

Equivalent of $SO_3^{2-} = \frac{60 \times 0.5 \times 2}{1000} = 0.06$

Equivalent of $lO_3^- = (5 - x) \times \frac{2.14}{214} = (5 - x)0.01$

$(5 - x)0.01 = 0.06$

$5 - x = 6$

$x = -1$

306 **(a)**

$3BaCl_2 + 2(NH_4)_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6NH_4Cl$

3 mol 2 mol 1 mol

Given, 0.5 mol 0.2 mol 0.1 mol

Thus, $(NH_4)_3PO_4$ is the limiting reactant giving 0.1 mol $Ba_3(PO_4)_2$

307 **(d)**
Any oxidizing agent that can oxidize KI to I_2 which can be estimated by hypo, can be determined by iodometric titration

308 **(d)**

$$\text{ppm} = \frac{10 \times 10^6}{1000} = 10^4$$

309 **(d)**

$$\text{I} : \frac{\text{C : H mass ratio in } CH_4}{\text{C : H mass ratio in } C_2H_6} = \frac{3\text{ gc/gH}}{4\text{ gc/gH}} = 3:4$$

$$\text{II} : \frac{\text{C : O mass ratio in CO}}{\text{C : O mass ratio in } CO_2} = \frac{6\text{ g C/16g O}}{6\text{ g C/32g O}} = 2:1$$

$$\text{III} : \frac{\text{N : O mass ratio in NO}}{\text{N : O mass ratio in } NO_2} = \frac{14\text{ g N/10g O}}{14\text{ gN/32g O}} = 2:1$$

$$\text{IV} : \frac{\text{H : O mass ratio in } H_2O}{\text{H : O mass ratio in } H_2O_2} = \frac{2\text{ gH/10g O}}{2\text{gH/32g O}} = 2:1$$

Thus, in all cases law of multiple proportion is followed.

310 **(a)**
$2KClO_3 \rightarrow 2KCl + 3O_2$

2 mol 3 mol

(2×122.5)g give 3 mol O_2

0.03 mol O_2 is obtained from $= \frac{2 \times 122.5}{3} 0.03$

$= 2.45$ g pure $KClO_3$ in 5 g

Impure sample

Thus, % purity $= \frac{2.45}{5.00} \times 100 = 49\%$

311 **(b)**
$2I^- + 2NO_2^- + 4H^+ \rightarrow 2NO + I_2 + 2H_2O$

$-2 \quad +3 \quad \uparrow \quad 0$

$+2$

312 **(c)**
Density of water molecule = 1 g/mL

1 g = 1 mL

Thus, $\frac{1}{18}$ mol = 1mL

$\frac{1}{18} \times 6.02 \times 10^{23}$ molecules = 1 mL

Thus, volume of 1 molecule $= \frac{18}{6.02 \times 10^{23}}$

$= 3 \times 10^{-23}$mL

Volume of one spherical molecule$= \frac{4}{3}\pi r^3$

$\frac{4}{3}\pi r^3 = 3 \times 10^{-23}\text{cm}^3$

$\therefore r^3 = \frac{3 \times 3 \times 10^{-23}}{4\pi}\text{cm}^3$

$r^3 = 7.162 \times 10^{-23}\text{cm}^3$

$r = 1.927 \times 10^{-8}$cm

$= 1.927 \times 10^{-10}$m

$= 1.927$ Å

$= \frac{1.927 \times 10 \times 10^{-10}}{10}$m

$= 0.1927$ nm

$= \frac{1.927 \times 100 \times 10^{-10}}{100}$m

$= 192.7 \times 10^{-12}$m = 192.7 pm

313 **(a)**

$NaNH_4HPO_4 \xrightarrow{\Delta} NaPO_3 + H_2O + NH_3$
bead

314 **(b)**
$Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{2-} + H_2O$
$BaCO_3 + 2CH_3COOH \longrightarrow (CH_3COO)_2Ba$
soluble
$(CH_3COO)_2Ba + CrO_4^{2-} \longrightarrow BaCrO_4 \downarrow$

yellow ppt

315 **(a)**
Same empirical formulae

317 **(d)**
There are two types of NaCl formed. They differ in molar masses due to different isotopes of Cl

318 **(c)**

Element	%	Mole	Ratio
Ag	2.00	0.0185	1
Cl	0.657	0.0185	1

Thus, AgCl

319 **(c)**

mEq of $\overset{\ominus}{O}H = 20 \times 0.1 \times 2 = 4$ mEq

mEq of$HClO_4 (x = 1) = 10 \times 0.2 \times 1 = 2$mEq

mEq of $\overset{\ominus}{O}H$ left = 4 - 2 = 2 mEq

Concentration or N of $\overset{\ominus}{O}H = \frac{2 \text{ mEq}}{30 \text{ mL}}$

$= 0.066$ N of $\overset{\ominus}{O}H$

$= 0.066$ M of $\overset{\ominus}{O}H$

320 **(b)**

$6e^- + Cr_2O_7{}^{2-} \rightarrow 2Cr^{3+}$

$Ew = \frac{Mw}{6}$

321 **(b)**

$C + H_2O \rightarrow CO + H_2$

1 mol 1mol 1 mol
12 g 44.8 L

12 g

3.0 kg = 3000 g

12 g coal give = 44.8 L

3000 g coal give = 11200 L

$= 11.2 \times 10^3$L

322 **(d)**

Equivalent weight of element = 32 g

And that of oxygen = 8 g

Thus, one equivalent of oxide 40 g

Percentage of oxygen in oxide $= \frac{8}{40} \times 100$

= 20%

323 **(b)**

Since the n-factor of H_2S is not known, the problem is solved by mole concept by balancing the equation

$$2\,KI + H_2SO_4 \longrightarrow K_2SO_4 + I_2 + H_2S + H_2O$$

2(-) → 0 = +2

(+6 → -2) = 8

$$2I^{\ominus} \longrightarrow I_2 + \cancel{2e^-}\ ] \times 4$$

$$8H^{\oplus} + \cancel{8e^-} + SO_4{}^{2-} \longrightarrow S^{2-} + 4H_2O$$

$x = 6$ $x = -2$

$$8I^{\ominus} + 8H^{\oplus} + SO_4{}^{2-} \longrightarrow 4I_2 + S^{2-} + 4H_2O$$

Add other ions, i. e. $2H^{\oplus}$, $8K^{\oplus}$, and $4SO_4^{2-}$, to both sides to balance the equation. Net redox equation is

$$\underset{5\text{ mol}}{8KI + 5H_2SO_4} \longrightarrow 4K_2SO_4 + 4I_2 + \underset{1\text{ mol}}{H_2S} + 4H_2O$$

mol of $H_2S = \frac{3.4}{34} = 0.1$ mol

mol of $H_2SO_4 = 0.1 \times 5$ mol $= 0.5$ mol

$\therefore 0.2 \times V = 0.5$

V = 2.5 L

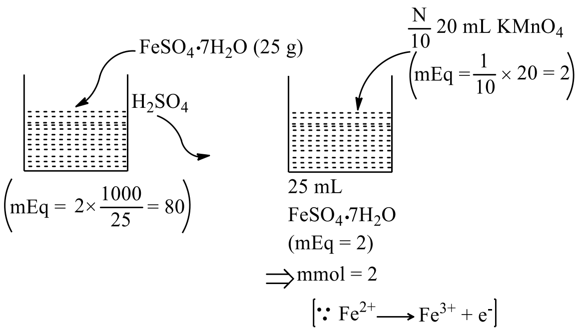
324 **(d)**

Molarity, normality, and formality are calculated against the volume of the solution. The volume of the solution changes with change in temperature; therefore, these quanities do not remain constant with temperature

Molality $(m) = \frac{\text{Moles of solute}}{\text{Mass of solvent in kg}}$

The molality of a solution remains independent of temperature because it involves only mass, which is independent of temperature

325 **(c)**



$$\Rightarrow \frac{(W_{FeSO_4 \cdot 7H_2O}) \times 1000}{278/1} = 80$$

$$\Rightarrow \quad W_{FeSO_4 \cdot 7H_2O} = 22.24$$

$$\Rightarrow \% \text{ of} FeSO_4 \cdot 7H_2O = \frac{22.24}{25} \times 100\% = 88.96\%$$

327 **(d)**

$MnO_2 + HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

0.1 equivalent $Cl_2 = \frac{0.1}{2}$ mol Cl_2^-

$= 0.05$ mol MnO_2

$= 4.35$ g MnO_2 in 10 g sample

Thus, 43.5% pure

328 **(a)**

On decomposition $BaCO_3$ liberates CO_2 as

$BaCO_3 \rightarrow BaO + CO_2 \uparrow$

22.4 L at STP

197 g of $BaCO_3$ give $= 22.4$ L of CO_2 at STP

9.85 g $BaCO_3$ will give $= \frac{22.4 \times 9.85}{197} = 1.12$ L

329 **(c)**

	O_2	N_2
Weight ratio	1	4
Moles ratio	$\frac{1}{32}$	$\frac{4}{28} = \frac{1}{7}$
Molecules ratio	$\frac{1}{32}N$	$\frac{1}{7}N$
Molecules ratio	7	32

331 **(b)**

Na_2SO_4 does not react

$N(NaOH) = 0.1 = 4 \text{ g L}^{-1}$

$= 0.4$ g per 100 mL

332 **(a)**

Mole fraction of glucose = 0.5

Hence, mole fraction of water = 0.5

Thus, moles of water = moles of glucose = x

Thus, water = 18 x g

$= \frac{18x}{1000}$ kg

$$\text{Molality} = \frac{\text{Moles of glucose}}{\text{kg of } H_2O}$$

$$= \frac{X}{\frac{18X}{1000}} = \frac{1000}{18}$$

$= 55.55 \text{ mol kg}^{-1}$

Direct Method

$$\text{Molality} = \frac{1000\, x_1(\text{glucose})}{(1 - x_1)m_2(\text{water})} = \frac{1000 \times 0.5}{0.5 \times 18} = 55.55$$

333 **(d)**

Let x and y are the mEq of NaOH and Na_2CO_3 respectively

Phenolphthalein as indicator:

mEq of NaOH $= \frac{1}{2}$ mEq of $Na_2CO_3 =$ mEq of HCl

$x + \frac{y}{2} = \frac{1}{2} \times 1 \times 20 = 10$ ...(i)

Methyl orange as indicator:

$\frac{\text{mEq } Na_2CO_3(\text{left})}{2} = \text{mEq of HCl}$

$\frac{y}{2} = \frac{1}{2} \times 8 = 4$ ...(ii)

$y = 8, x = 6$

Weight of $Na_2CO_3 = 8 \times 10^{-3} \times \frac{106}{2} = 0.424$ g

% of $Na_2CO_3 = \frac{0.424}{0.848} \times 100 = 5\%$

334 **(b)**

Temporary hardness is due to $HCO_3^{\ominus}$ of Ca^{2+} and Mg^{2+}

$$Ca(HCO_3)_2 + \underset{56\text{ g}}{CaO} \rightarrow \underset{(2 \times 100)\text{g}}{2\,CaCO_3} + H_2O$$

0.56 g CaO $\equiv 2$ g $CaCO_3$ in 10 L H_2O

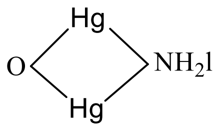
$= 2\text{ g } CaCO_3 \text{ in } 10^4 \text{mL } H_2O$

$= 200\text{ g } CaCO_3 \text{ in } 10^6 \text{mL } H_2O$

335 **(a)**

$$HgCl_2 + 2KI \rightarrow HgI_2 \xrightarrow[\text{excess}]{2KI} K_2HgI_4$$

(A)

$K_2HgI_4 + NH_3/NaOH \longrightarrow$ 

(B)

336 **(d)**

Molar mass of $Na_2CO_3 \, . xH_2O = (106 + 18x)$

$$2.86 \text{ g salt} = \left(\frac{2.86}{106 + 18x} \text{ mole in 100 mL}\right)$$

$$= \left(\frac{28.6}{106 + 18x}\right) \text{mole in 1000 mL}$$

$$\therefore \text{Molarity} = \left(\frac{28.6}{106 + 18x}\right)$$

Since, $CO_3^{2-} \equiv 2H^+$

Hence, normality $= 2 \times$ molarity $= 0.2$ N

$$\frac{2 \times 28.6}{106 + 18x} = 0.2$$

$x = 10$

337 **(a)**

$SO_3^{2-} + 2H^+ \longrightarrow SO_2$

(X) $\qquad (Y)$

$Cr_2O_7^{2-} + SO_2 + H^+ \longrightarrow Cr^{3+} + SO_4^{2-}$

green

338 **(c)**

$Na_2B_4O_7$ (borax) behaves like a weak base

Based on reaction :

$$\frac{\text{moles of } Na_2B_4O_7}{\text{moles of HCl}} = \frac{1}{2}$$

$$\text{Moles of HCl} = \frac{31.64 \times 0.108}{1000}$$

$= 3.417 \times 10^{-3}$mol

$\therefore$ Moles of $Na_2B_4O_7 = 1.7085 \times 10^{-3}$mol

Moles of $B_2O_3 = 2 \times$ moles of $Na_2B_4O_7$

$= 3.417 \times 10^{-3}$mol

$\therefore$ Amount $= 0.2392$ g

$$\% \text{ of } B_2O_3 = \frac{0.2392}{0.7439} \times 100 = 32.15\%$$

339 **(a)**

Let x mol of HCOOH and y mol of $(COOH)_2$

$HCOOH \xrightarrow{H_2SO_4} H_2O + CO$

$x \qquad\qquad x$

$(COOH)_2 \xrightarrow{H_2SO_4} H_2O + CO + CO_2$

$x \qquad\qquad x \quad y$

Total moles of $(CO + CO_2) = x + 2y$

Total moles of $CO_2 = y$

According to the question :

$$(x + 2y) \times \frac{1}{6} = y$$

$$\therefore \frac{x}{y} = 4:1$$

Alternatively :

Mole fraction of $CO_2 = \frac{y}{x+2y} = \frac{1}{6}$

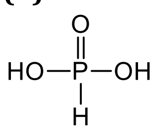
$$\therefore \frac{x}{y} = 4:1$$

340 **(d)**

$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

$\left.\begin{array}{r} H_2SO_4 \equiv 2NaOH \\ 2HCl \equiv 2NaOH \end{array}\right] = 4 \text{ NaOH}$

341 **(d)**



(H_3PO_3)

Only hydrogens attached to oxygen and contribute to basicity are replacable. From the structures it is clear that phosphours acid, H_3PO_3, is dibasic

Normality = Molarity × Basicity (for an acid)

$N = 0.3 \times 2 = 0.6$

342 **(c)**

Equivalent weight of $M^{2+} = 37.2$

Thus, molar mass of $M^{2+} = 37.2 \times 2 = 74.4$

Thus, molar mass of $MCl_2 = 74.4 + 71 = 145.4$

343 **(a)**

$CO_2 + H_2O \longrightarrow H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$

$2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$

orange

344 **(a)**

pH = 2, $[H^{\oplus}] = 10^{-2}$ M

$[Ca^{2+}] = \frac{10^{-2}}{2} = 0.5 \times 10^{-2} \times 40 \text{ g L}^{-1}$

$= \frac{0.5 \times 10^{-2} \times 40 \times 10^6}{10^3} \text{g}/10^6 \text{ mL} = 200 \text{ ppm}$

347 **(c)**

Average value $= \frac{25.2+25.25+25.0}{1} = \frac{75.45}{3}$

$= 25.15 = 25.2$ mL

Number of significant figure is 3.

348 **(d)**

Balance the reaction:

$2CrO_5 + 3H_2SO_4 \rightarrow Cr_2(SO_4)_3 + 2H_2O + \frac{7}{2}O_2$

$\Rightarrow$ 1 mol CrO_5liberates$\frac{7}{2}$ mol O_2

349 **(c)**

Mw of Zn $(NH_3)_x$ $Cl_2 = 65.30 + 17x + 35.5 \times 2$

$= 136.30 + 17x$

$(17x + 36.30)$ g of compound contains $= x$ mole of NH_3

0.224 g compound $= \frac{x}{17x+136.30} \times 0.224$

x mol of $NH_3 = x$ eq of NH_3

Eq of NH_3 = Eq of HCl

$\frac{0.224x}{17x + 136.30} = \frac{30.7 \times 0.2}{1000}$ eq of HCl

$x \approx 6.75 \approx 6$ (as the choice given)

350 **(a)**

Weight of 11.2 dm^3ofCO_2 gas at STP $= \frac{44}{2} = 22$ g

$2KOH + CO_2 \rightarrow K_2CO_3 + H_2O$

2×56 g44 g

KOH required for complete neutralization of 22 g of $CO_2 = \frac{2 \times 56}{44} \times 22 = 56$ g

352 **(b)**

100 g H_2SO_4 solution $= \frac{100}{1.84}$ mL H_2SO_4 solution has

$= 98$ g $H_2SO_4 = 1$ mol H_2SO_4

1000 mL H_2SO_4 solution has $= 18.4$ mol H_2SO_4

353 **(d)**

For mixing acidic solutions, resultant normality

$= \frac{N_1V_1 + N_2V_2}{V_1 + V_2} = \frac{10 \times 0.2 + 30 \times 0.1}{10 + 3} = 0.125$ N

354 **(b)**

$ZnCl_2 + 2NaOH \longrightarrow Zn(OH)_2 \downarrow \xrightarrow{NaOH} Na_2ZnO_2$

white ppt soluble

355 **(a)**

$Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$

56 g 200 g

0.56 g 2.00 g in 10 L water

10 L H_2O (= 10^4 mL) has $CaCO_3 = 2$ g

10^6 mL (ppm) has $CaCO_3 = 200$ g

Thus, 200 ppm $CaCO_3$

356 **(b)**

i. Moles of NaOH = 1.0 M × 1.5 L = 1.5 mol

Moles of H_2SO_4 = 1.0 M × 1L = 1.0 mol

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

2 mol 1 mol

Moles of H_2SO_4 reacted with NaOH

$= \frac{1}{2}$ mol of NaOH

$= \frac{1}{2} \times 1.5 = 0.75$ mol H_2SO_4

% purity of $H_2SO_4 = \frac{0.75 \text{ mol} \times 100}{1.0 \text{ mol}} = 75$ %

ii. For slope : $\frac{x}{a} + \frac{y}{b} = 1$

Slope $\left(\frac{y}{x}\right) = \frac{-b}{a} = -\frac{1.5}{1.5} = -1$

357 **(d)**

K_2MSO_4 and K_2SO_4 are isomorphous

Valency of S and M should be same = 6

Atomic weight = $Ew \times$ Valency = 13.00 × 6 = 78

358 **(d)**

$NaHC_2O_4 \rightleftharpoons Na^+ + H^+ + C_2O_4^{2-}$

NaOHneutralises H^+

MnO_4^-/H^+ oxidises $C_2O_4^{2-}$ to CO_2

Thus, 0.1 M = 0.2 N

359 **(a)**

$0.106\text{ g } Na_2CO_3 = \frac{0.106}{106}\text{ mol} = 2 \times 10^{-3}$ equivalent

$H_2SO_4 = \frac{40\text{ N}}{1000}$ equivalents

$$\frac{40\text{ N}}{1000} = 2 \times 10^{-3}$$

$\therefore \text{N} = 0.05\text{ N } H_2SO_4$

360 **(d)**

$2(NH_4)_2HPO_4 \equiv P_2O_5$

$2 \times 132\text{ g} \equiv 142\text{ g}$

Thus, % of $P_2O_5 = \frac{142}{264} \times 100 = 53.78$

361 **(d)**

$YCl_n + nH_2O \rightarrow nHCl + Y(OH)_n$

(n = valency of Y)

$nHCl + nAgNO_3 \rightarrow nAgCl$

$$\frac{1}{n} = \frac{1 \times 10^{-3}}{20 \times 0.1 \times 10^{-3}}$$

$$\left(\frac{\text{Molarity} \times \text{Volume}}{1000} = \text{Mol}\right)$$

$n = 2$ (others have $n > 2$)

362 **(d)**

Air contains 21% of O_2

Volume of oxygen $= \frac{21}{100} = 0.21$ L

Number of moles of oxygen present in 0.21 L at NTP

$$= \frac{0.21}{22.4} = 0.009375$$

363 **(b)**

Number of moles in		Molecules	Atoms
CH_4	0.1	$0.1N_0$	$0.5N_0$
NH_3	0.1	$0.1N_0$	$0.4N_0$
H_2O	0.1	$0.1N_0$	$0.3N_0$

364 **(a)**

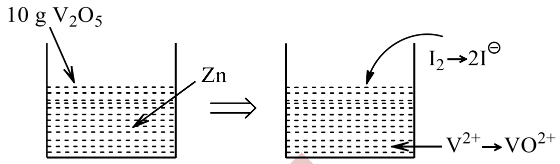
Weight of 6.023×10^{23} (Avogadro's number) = Mw of $CuSO_4 \cdot 5H_2O = 249$ g

= 1 mol of $CuSO_4 \cdot 5H_2O$

Weight of 1×10^{22} molecules of $CuSO_4 \cdot 5H_2O$

$$= \frac{249 \times 1 \times 10^{22}}{6.023 \times 10^{23}} = 4.14\text{ g}$$

365 **(a)**



i. $V_2O_5 + 10H^{\oplus} + 6e^{\ominus} \longrightarrow 2V^{2+} + 5H_2O$

$$\Rightarrow \text{mEq}V_2O_5 = \frac{10 \times 1000}{192/6}$$

$$\text{mmol }(V_2O_5) = \frac{10 \times 1000}{192}$$

$$\Rightarrow \text{ mmol } V^{2+} = \frac{10}{192} \times 1000 \times 2$$

$(V^{2+} \rightarrow VO^{2+} + 2e^- \quad \Rightarrow n - \text{factor} = 2)$

mEq V^{2+} (against I_2)$= \frac{20}{192} \times 1000 \times 2 = \text{mEq } I_2$

$$\Rightarrow \text{ mmol } I_2 = \frac{\left(\frac{20}{192} \times 1000 \times 2\right)}{2} = 104$$

$[\because I_2 + 2e^- \rightarrow 2I^{\ominus}]$

366 **(b)**

In Kjeldahl's method, N-containing compound is decomposed by NaOH and liberated NH_3 is estimated by acid by titration

367 **(a)**

$H_2O_2 \equiv KI \equiv I_2$

mEq of $H_2O_2 = 5 \times \text{N}$

mEq of $I_2 = \frac{\text{Weight}}{Ew} \times 1000$

$$= \frac{1.27}{127} \times 1000 = 10\text{ mEq}$$

$I_2 = Mw = 254$

$$Ew = \frac{Mw}{2} = \frac{254}{2} = 127$$

$\therefore$ mEq of H_2O_2 = mEq of I_2

$5 \times N = 10 \quad \therefore N = 2$

N of $H_2O_2 = 2$

$\therefore$ 1 N of H_2O_2 = 5.6 volume strength

2 N of H_2O_2 = 11.2 volume strength

368 **(c)**

$$2Ag_2CrO_4 + 2HNO_3 \longrightarrow \underset{\text{soluble}}{Ag_2Cr_2O_7} + 2AgNO_3 + H_2O$$

370 **(d)**

$MHPO_4 \rightleftharpoons M^{2+} + HPO_4^{2-}$

Thus, metal is divalent forming MCl_2

371 **(c)**

Let $Na_2C_2O_4(A)$ be $=$ x mol

And $KHC_2O_4 . H_2C_2O_4 =$ y mol

Let volume of each titre $= V$ mL

Moles of NaOH used $= \frac{V \times 0.1}{1000} = 10^{-4}V$

And equivalent moles of $KMnO_4$ used $= 10^{-4}$ V

$Na_2C_2O_4 \rightleftharpoons C_2O_4^{2-} + 2Na^+$

x x

$KHC_2O_4 \cdot H_2C_2O_4 \rightleftharpoons 2C_2O_4^{2-} + 3H^+ + K^+$

$2y$ $3y$

Thus, $[H^+]$ in mixture $= 3y =$ NaOH used $= 10^{-4}V$

And $[C_2O_4^{2-}]$ in mixture $= (x + 2y)$ moles

Equivalent of $[H^+] =$ Equivalent of NaOH

$3y = 10^{-4}$ V

Equivalent of $C_2O_4^{2-}$ which is oxidized to CO_2 = Equivalent of MnO_4^- which is reduced to Mn^{2+}

$2(x + 2y) = 5 \times 10^{-4}$ V

$\therefore \frac{(x + 2y)}{3y} = 5$

$\frac{x}{3y} + \frac{2}{3} = 2.5$

$\frac{x}{y} + 2 = 7.5$

$\frac{x}{y} = 7.5 - 2 = 5.5$

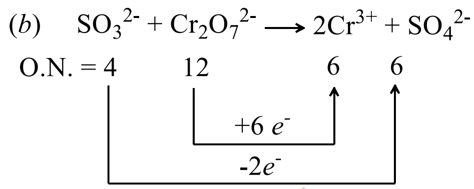
Thus, ratio is $= \frac{x}{y} = \frac{5.5}{1}$

372 **(c)**

$MnO_4^- + H^+ + SO_2 \longrightarrow Mn^{2+} + SO_4^{2-}$
colourless

$Cr_2O_7^{2-} + H^+ + SO_2 \longrightarrow Cr^{2+} + SO_4^{2-}$
green

373 **(b)**



$N_1V_1(SO_3^{2-}) = N_2V_2(Cr_2O_7^{2-})$

$2M_1 \times 20 = 6 \times 0.01 \times 30$

$M_1 = 0.045$ M

374 **(b)**

$BaCl_2 + K_2CrO_4 \longrightarrow BaCrO_4 \downarrow$
yellow ppt

375 **(a)**

$M_2CO_3 + 2HCl \rightarrow 2MCl + H_2O + CO_2$

M is a monovalent cation

Thus, equivalent weight of

$M_2CO_3 = \frac{\text{molar mass}}{2} = M + 30$

Let unused HCl be V mL

V mL of 1 N HCl $\equiv$ 100 ml of 0.5 N NaOH

$\therefore V = 50$ mL

1 N HCl used $= 150 - 50 = 100$ mL $= 0.1$ equiv

equiv. of $M_2CO_3 = \frac{5.3}{M + 30} = 0.1$

$M = 23$

376 **(b)**

Equivalents of KOH used $= \frac{20 \times 0.5}{1000} = 0.01$

Moles of acid $= \frac{0.45}{90} = 0.005$ mol

If basicity of acid $=$ x

Then equivalents of acid $= 0.005$ x

$\therefore 0.005$ x $= 0.01$

$\therefore x = 2$

377 **(d)**

10 mL Ca^{2+}(as CaC_2O_4)

$\equiv 20$ mL of 0.001 MMnO_4^-

$= 20 \times 0.005$ N MnO_4^-

$\therefore$ N $(C_2O_4^{2-}) = 2 \times 0.005$ N

$M(C_2O_4^{2-}) = 0.005$ M

M $(Ca^{2+}) = 0.005$ M

$[Ca^{2+}] = 0.005 \times 40$ g L^{-1}

$= \frac{0.005 \times 40}{100}$ g/10 mL

$= 0.002$ g

378 **(b)**

$2C_xH_yN_z + 7O_2 \rightarrow 4CO_2 + 6H_2O + 2N_2$

$2x = 4,$ $x = 2$

$2y = 12$ $y = 6$

$2z = 4,$ $z = 2$

Formula $= C_2H_6N_2$

379 **(c)**

$NH_2CONH_2 + 2NaOH \rightarrow Na_2CO_3 + 2NH_3$

0.6 g=0.01 mol 0.02 mol

$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

2 mol 1 mol

0.02 mol 0.01 mol

= 0.02 equiv.

1. N H_2SO_4 = 0.1 equivalent in = 1000 mL

0.02 equivalent in = 200 mL

H_2SO_4 unused = 100 mL

380 **(a)**

$H_2C_2O_4 \longrightarrow 2CO_2 + 2H^{\oplus} + 2e^-$

Moles $CO_2 = \frac{PV}{RT} = \frac{0.82 \times 5}{0.082 \times 350} = \frac{1}{7}$

$\Rightarrow$ $mEq_{CO_2} = \frac{1}{7} \times 1$ $mEq_{K_2Cr_2O_7}$

$\Rightarrow \frac{1}{7} = \frac{W_{K_2Cr_2O_7}}{294/6} \Rightarrow W_{K_2Cr_2O_7} = 7$ g

and $\frac{1}{7}$ mol $CO_2 \equiv \frac{1}{7}$ mol $H_2CO_3 \equiv 1 \times 2$ g Eq (acidic)

$= 0.1 \times V$

$= 2.86$ L

$V_{NaOH} = 2.86$ L

381 **(b)**

	Mass	Moles	Ratio
S	50 g	$\frac{50}{32} = 1.5625$	1
O	50 g	$\frac{50}{16} = 3.125$	2

382 **(b)**

$\frac{r_{He}}{r_{CH_4}} = \sqrt{\frac{M_{CH_4}}{M_{He}}} \times \frac{P_{He}}{P_{CH_4}}$

$P \propto$ moles

$\frac{r_{He}}{r_{CH_4}} = \sqrt{\frac{16}{4}} \times \frac{4}{1} = 2 \times 4 = 8:1$

Molar composition effusing = 8:1

Weight composition effusting $= 8 \times 4 : 1 \times 16 = 32 : 16$

% of He $= \frac{32}{48} \times 100 = 66.7\%$

% $CH_4 = 100 - 66.7 = 33.3\%$

383 **(c)**

Average atomic mass $\bar{A} = \frac{A_1X_1 + A_2X_2}{X_1 + X_2}$

$35.5 = \frac{35X_1 + 37X_2}{X_1 + X_2}$

On solving $\frac{X_1}{X_2} = \frac{3}{1}$

384 **(a)**

$BaF_2 + H_2SO_4 \rightarrow BaSO_4 + H_2F_2$

1 mol 1 mol 1 mol 1 mol

Given, 1 mol 2 mol

Thus, unreacted $H_2SO_4 = 1$ mol

H_2F_2 formed = 1 mol

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

1mol 2 mol

$H_2F_2 + 2NaOH \rightarrow Na_2F_2 + 2H_2O$

1 mol 2 mol

Thus, total NaOH required by 1mol H_2F_2 (formed) and 1 molH_2SO_4 (unreacted) = 4 mol

385 **(a)**

$$\frac{\text{Molecular weight of } X_4O_6}{\text{Atomic weight of 4 X}} = \frac{\text{Weight of } X_4O_6}{\text{Weight of X}}$$

$$\frac{4x + 96}{4x} = \frac{10}{5.72}$$

$x = 32$

386 **(d)**

$2AgNO_3 + Na_2S_2O_3 \longrightarrow Ag_2S_2O_3 + 2NaNO_3$

$Ag_2S_2O_3 + H_2O \longrightarrow H_2SO_4 + Ag_2S\downarrow$ (black)

$AgNO_3 + 2Na_2S_2O_3$ (excess) $\longrightarrow Na_3[Ag(S_2O_3)_2] + NaNO_3$

387 **(a)**

M^{2+} has electrons = 32 (isoelectronic of SO_2)

protons = 34 = Z

neutrons = 36

thus, ionic mass = 70

388 **(b)**

Mw_2 of $CaCO_3 = 40 + 12 + 48 = 100$

Moles of $CaCO_3$ in 10 g $= \frac{10}{100}$

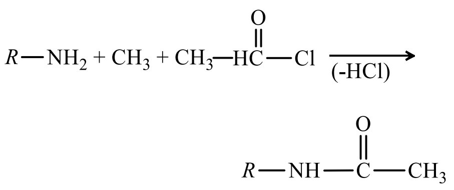
= 0.1 mol = 0.1 g atom

389 **(c)**

$Fe^{2+} + [Fe^{III}(CN)_6]^{3-} \rightarrow Fe^{II}[Fe^{III}(CN)_6]^-$ (Turnbull's blue)

$Fe^{3+} + [Fe^{II}(CN)_6]^{4-} \rightarrow Fe^{III}[Fe^{II}(CN)_6]^-$ (Prussian's blue)

390 **(c)**



Since each $-COCH_3$ group displace one H atom in the reaction of one mole of $CH_3-\overset{O}{\overset{\|}{C}}-Cl$ with one $-NH_2$ group, the molecular mass increases with 42 units.Since the mass increases by $(390 - 180) = 210$ hence the number of $-NH_2$ group 4 is $\frac{210}{42} = 5$

391 **(a)**

$$N_\% = \frac{1.4N_1V_1}{w}$$

Where, N_1 = normality of acid required to neutralize NH_3

V_1 = volume of acid

$$N_\% = \frac{1.4 \times 0.1 \times 100}{0.31} = 45.16\%$$

392 **(a)**

$$\frac{100 \times 58.5}{5.85} = 1000 \text{ mL} = 1\text{L}$$

393 **(b)**

$Mg_3(PO_4)_2$

8 moles of O-atom are contained in 1 mole $Mg_3(PO_4)_2$

Hence, 0.25 mole of O-atom $= \frac{1}{8} \times 0.25$ is contained in $= 3.125 \times 10^{-2}$

394 **(b)**

Ethyl borate formed in flame test of borate is volatile

395 **(c)**

$SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^{\oplus} + 2e^-$

mEq of salt = mEq of SO_3^{2-}

$\Rightarrow (0.1 \times n) \times 50 \equiv (0.1 \times 2) \times 25$

$\Rightarrow n = 1$

$M^{3+} + e^- \rightarrow M^{2+}$

396 **(c)**

Glucose in 500 mL solution

$$= \frac{9 \times 500}{100} = 45 \text{ g}$$

$$= \frac{45}{180} = 0.25 \text{ mol}$$

$= 0.25 \times 6.02 \times 10^{23}$ molecules

$= 1.5 \times 10^{23}$

397 **(b)**
CrO_4^{2-} (and not Ba^{2+}) is involved as an oxidizing agent and reduced to Cr^{3+}, hence, $Ew = \frac{Mw}{3}$

399 **(c)**
$3\,Mg(OH)_2 + 2H_3PO_4 \rightarrow Mg_3(PO_4)_2 + 3H_2O$
$\frac{3 \times 58.3}{2 \times 98} = \frac{100}{W}, \quad \therefore W = 112\text{ g}$

400 **(c)**
Total mass of solution = 1120 g

$\text{Volume} = \frac{1120}{1.15} = 973.91\text{ mL} = 0.97391\text{ L}$

$\text{Molarity} = \frac{\text{moles}}{\text{litres}} = \frac{120/60}{0.97391} = 2.05\text{ M}$

401 **(a)**
$Cr_2O_7^{2-} + 2OH^- \rightarrow 2CrO_4^{2-} + H_2O \quad pH > 7$
$2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O \quad pH < 7$

402 **(b)**
$3O_2 \rightleftharpoons 2O_3$
There is a reduction of 1 volume
When reduction in volume = 1, then volume of $O_3 = 2$
Volume of air = 2000 mL
Volume of ozonised air = 1915 mL
Reduction in volume = 2000 − 1915 = 85 mL
∴ when reduction is 1 volume ⇒ volume of $O_3 = 2$
∴ when reduction is 85 mL ⇒ 85 × 2 ⇒ 170 mL

403 **(b)**
$ZnCl_2 + 2H_2O \rightarrow Z(OH)_2 + 2HCl$
$CdCl_2 + 2H_2O \rightarrow Cd(OH)_2 + 2HCl$
$CuCl_2 + 2H_2O \rightarrow Cu(OH)_2 + 2HCl$
Cd^{2+} and Cu^{2+} ions are precipitated as CdS and CuS in acidic medium when H_2S gas is passed. This medium is provided by hydrolysis of their chlorides
Zn^{2+} as ZnS is not precipitated in HCl medium on passing H_2S gas

404 **(b)**

$HNO_3^{\ominus} + 4e^- \longrightarrow \frac{1}{2}\overset{+1\times 2\ -2}{N_2O}$ (Species with oxidation number = +1 is N_2O)
$1 + x - 6 = 0 \qquad a$
$(x = 5)$

Change in oxidation number $= 5 - a = 4 \Rightarrow a = 1$

405 **(c)**
Density = 1.8 g/mL

Molarity = 18 M = 18 mol H_3PO_4 in 1 L solution

1000 mL solution has H_3PO_4 = 18 mol = 18 × 98 g

1000 mL = (1800 g) solution has H_3PO_4 = 18 × 98 g

H_3PO_4 by mass % (by weight of solution) = $\frac{18 \times 98}{1800} \times 100 = 98\%$

Or (1800 − 18 × 98)g H_2O (solvent) H_3PO_4 = 18 × 98 g

2 g solvent has H_3PO_4 = 98 g = 1 mol H_3PO_4

1 kg = 1000 g solvent has H_3PO_4 = 500 molal

Thus, 98%, 500 molal

406 **(b)**

$\underset{X}{ZnCl_2} + NaOH \longrightarrow \underset{Y}{Zn(OH)_2} \xrightarrow{NaOH} Na_2ZnO_2$

$ZnCl_2 \xrightarrow{NH_4OH/H_2S}$ White ppt

$ZnCl_2 \xrightarrow{AgNO_3} \underset{\text{White ppt}}{AgCl\downarrow} \xrightarrow{NH_3} \underset{\text{soluble}}{[Ag(NH_3)_2]Cl}$

408 **(c)**
$A^{n+} \longrightarrow AO_3^-$ (undergoes oxidation)
$x = +n\; x - 6 = - \therefore x = 5$
∴ Number of e^- released in oxidation $= (5 - n)$
∴ Equivalents of $MnO_4^{\ominus} = 4 \times (5 - n)$
Equivalents of $MnO_4^{\ominus} = 1.6 \times 5$
$\therefore 4 \times (5 - n) = 1.6 \times 5$
$\therefore n = 3$

409 **(a)**
Moles of O_2 in bag A = 0.32/32 = 0.01 mol
Same volume of unknown gas = 0.01 mol
0.01 mol of unknown gas A = 0.26 g
1 mol of unknown gas A $= \frac{0.26}{0.01} = 26$ g
Mw of unknown gas A = 26 g
Empirical formula = CH

Empirical formula weight $= 12 + 1 = 13$ g

$$n = \frac{\text{Molecular formula weight}}{\text{Empirical formula weight}} = \frac{26}{13} = 2$$

Molecular formula $= (CH)_2 = C_2H_2$

410 **(c)**

$Cr(OH)_3$ is oxidized to CrO_4^{2-} (soluble) by $NaOH/H_2O_2$. $Fe(OH)_3$ is not affected

$Cr(OH)_3 + OH^- + H_2O_2 \rightarrow CrO_4^{2-}$

Soluble (yellow)

411 **(a)**

2 mol Na_3PO_4 require $= 3$ mol $Ba(NO_3)_2$

Thus, 1 mol $Ba(NO_3)_2$ is required further

412 **(d)**

$Ca(HCO_3)_2 + CaO \rightarrow 2CaCO_3 + H_2O$

56 g 2×100 g

0.56 g CaO $= 2$ g $CaCO_3$ in 10 L H_2O

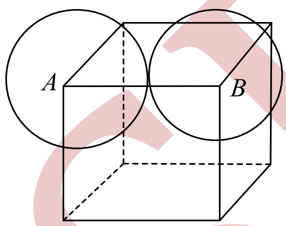
10 L ($= 10^4$ mL) hard water has $CaCO_3 = 2$ g

$\therefore 10^6$ mL hard water has $CaCO_3 = 200$ g

Thus, hardness part per million (in ppm) of $CaCO_3 = 200$

413 **(a)**

Edge length $= AB = 2r$



Volume of the spherical atom $= \frac{4}{3}\pi r^3$

$$\frac{\text{Mass}}{\text{Volume}} = \text{density}$$

$$\text{Volume} = \frac{\text{mass}}{\text{density}}$$

$$\text{Mass of one atom} = \frac{m}{N_0} = \frac{23}{6.02 \times 10^{23}}$$

$$\therefore \text{Volume} = \frac{23}{6.023 \times 10^{23} \times 6.20}$$

$$\frac{4}{3}\pi r^3 = \frac{23}{6.02 \times 10^{23} \times 6.2}$$

$$r^3 = \frac{3 \times 23}{4\pi \times 6.02 \times 10^{23} \times 6.2}$$

$$r^3 = 1.47 \times 10^{-24}\text{cm}^3$$

$$r = 1.137 \times 10^{-8}\text{ cm}$$

$$2r = 2.274 \times 10^{-8}\text{cm} = 2.274\text{ Å}$$

415 **(a)**

Mass of Mg $= 0.273$ g

Mass of magnesium and nitrogen compound $= 0.378$ g

Thus, nitrogen combined $= 0.105$ g

	Mass	Mole	Mole ratio
Mg	0.273 g	0.011375	1.51 = 3
N	0.105 g	0.0075	1.00 = 2

Thus, Mg_3N_2

416 **(c)**

	Change in O.N.	E
$\frac{1}{2}\underset{0}{Br_2} \longrightarrow \underset{-1}{Br^-}$	1	$= \frac{M/2}{1}$
$\frac{1}{2}\underset{0}{Br_2} \longrightarrow \underset{+5}{BrO_3^-}$	5	$= \frac{M/2}{5}$

Net equivalent weight $= E$ (in oxidn) + E (in redn)

$$= \frac{M/2}{5} + \frac{M/2}{1} = \frac{3M}{5}$$

417 **(a)**

$2SO_2 + O_2 \rightarrow 2SO_3$

2 mol 1 mol 2 mol

For SO_2 10 mol 5 mol 10 mol

For O_2 30 mol 15 mol 30 mol

If 10 mol SO_2 is taken, O_2 required is 5 mol, forming 10 mol SO_3

But SO_3 actual formed $= 8$ mol

Thus, percentage yield of SO_3wrt $SO_2 = \frac{8}{10} \times 100 = 80\%$

418 **(d)**

$BaCl_2$ required by 0.2 mol of $(NH_4)_3PO_4$ = 0.3 mol

Thus, $BaCl_2$ in excess $= 0.5 - 0.3 = 0.2$ mol

419 **(d)**

Iron (II) sulphate (IV) is

$(Fe^{2+})(SO_3^{2-})$

↑ ↑

+2 +4

Note In IUPAC nomenclature O.N. have been placed after element

Fe^{2+} is oxidized to $Fe^{3+}$and SO_3^{2-} is oxidized to SO_4^{2-} by MnO_4^- in acidic medium

1 L of 1 M $FeSO_3$ = 1 mole $FeSO_3$

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

$$5SO_3^{2-} + 2MnO_4^- + 6H^+ \rightarrow 5SO_4^{2-} + 2Mn^{2+} + 3H_2O$$

—

Thus, $5FeSO_3 \equiv 3MnO_4^-$

$1FeSO_3 \equiv \frac{3}{5}MnO_4^- = 0.6$ mole

420 **(a)**

Perhydrol means 30% solution of H_2O_2

H_2O_2 decomposes as

$2H_2O_2 \rightarrow 2H_2O + O_2$

Volume strength of 30% H_2O_2 solution is 100, that means 1 mL of this solution on decomposition gives 100 mL oxygen

$SO_2 + \frac{1}{2}O_2 \rightarrow SO_3$

1 L $\frac{1}{2}$ L 1 L

2 L 1 L 2 L

Since, 100 mL of oxygen is obtained by = 1 mL ofH_2O_2

∴ 1000 mL of oxygen will be obtained by

$= \frac{1}{100} \times 1000$ mL of H_2O_2

$= 10$ mL ofH_2O_2

421 **(c)**

$N_2H_4 \rightarrow 2N + 10e^-$
$2x + 4 = 0(2y)$
$2x = 4$
$\therefore 2y - (-4) = 10$
$y = 3$

422 **(b)**

$Fe^{2+} \longrightarrow Fe^{3+} + e^-$
$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$
green

423 **(a)**

X^{3-}, has 10 electrons

Thus, protons (= atomic number)in $X^{3-} = 7$

Neutron + proton = ionic mass = 17

Thus, neutrons $= 17 - 7 = 10$

424 **(c)**

Oxidation number of P in phosphate (I) = + 1

Thus, anion is : $H_2PO_2^-$

Thus, salt is $NH_4H_2PO_2$

(Ammonium hypophosphite)

6 mol H ≡ 1 mol $NH_4H_2PO_2$ = 2 mol (O)

Thus, 3.18 mol H $= \frac{2 \times 3.18}{6}$ mol (O) $= 1.06$ mol (O)

425 **(a)**

Milliequivalents of NaOH $= 25 \times 1$

$\therefore$ milliequivalent of dibasic acid

(equivalent weight E)

$= \dfrac{1.575 \times 1000}{E} \text{g}$

$\therefore E = \dfrac{1.575 \times 1000}{25} = 63$

$\therefore$ Molar mass $= E \times 2 = 126 \text{ g mol}^{-1}$

426 **(c)**
$N_2H_4CO + 2NaOH \rightarrow Na_2CO_3 + 2NH_3$

1 mol 2 mol

$0.6 \text{ g} = 0.01 \text{ mol}$

$2NH_3 + 2H^+ \rightarrow 2NH_4^+$

100 mL of 0.2 N HCl = 20 millimol = 0.02 mol

427 **(c)**
$2H_2S + SO_2 \rightarrow 2H_2O + 3S$

2 mol 1 mol 3 mol

Given 1 mol 1 mol ?

Thus, H_2S is the limiting reactant forming 1.5 mol S

428 **(b)**
$5C_2O_4^{2-} + 2MnO_4^- \rightarrow Mn^{2+} + 10CO_2$

2mol of $MnO_4^- \equiv$ 5 mol of $C_2O_4^{2-}(KHC_2O_4)$

$\dfrac{100 \times 0.02}{1000}$ mol MnO_4^- = 0.005 mol KHC_2O_4

430 **(a)**
$Hg_2Cl_2 + NH_3 \longrightarrow \underbrace{HgNH_2Cl + Hg}$

calomel

431 **(d)**
$H_2O_2 \equiv KI \equiv I_2$
mEq of $H_2O_2 = 5 \times N$
mEq of $I_2 = \dfrac{\text{Weight}}{Ew} \times 1000$
$= \dfrac{1.27}{127} \times 1000 = 10$ mEq
$I_2 = Mw = 254$

$Ew = \dfrac{Mw}{2} = \dfrac{254}{2} = 127$
$\therefore$ mEq of H_2O_2 = mEq of I_2
$5 \times N = 10 \quad \therefore N = 2$
1 N of H_2O_2 = 1.7% H_2O_2
2 N of H_2O_2 = 3.4 % H_2O_2

432 **(d)**
$P_2O_5 \rightarrow Mg_2P_2O_7$

1 mol 1 mol

142 g 222 g

P_2O_5 in the mineral $= 0.5428 \times \frac{26.26}{100} = 0.1425$ g

Thus, $Mg_2P_2O_7$ obtained = 0.2228 g

434 **(a)**
Total HCl $\Rightarrow 25 \times 1 = 25$ mEq
Excess HCl $\Rightarrow 5 \times 1 = 5$ mEq
HCl used $\Rightarrow 25 - 5 = 20$ mEq
$\therefore$ mEq of HCl = mEq of carbonate
$\frac{20}{1000}$ Eq $= \frac{\text{Weight}}{Ew}$ of carbonate$= \frac{1}{Ew}$
$\therefore Ew = \dfrac{1000}{20} = 50$

435 **(b)**
5 g $CH_3COOH = \dfrac{1}{12}$ mol

Volume of ethanol = 1 L = 1000 mL

Mass of ethanol = 1000×0.789 g

= 789 g = 0.789 kg

$\therefore$ Molality $= \dfrac{\text{moles of solute}}{\text{kg solvent}}$

$= \dfrac{1/12}{0.789} = 0.1056$ molal

436 **(d)**
$V \times 12\, M = 240 \times 18$

$V = \dfrac{240 \times 18}{12} = 360 \text{ mL} = 0.36 \text{ L}$

438 **(a)**
Moles of $AlCl_3$ produced $= \frac{6.67}{133.5} = 0.05$ mol

Excess of Al $= \frac{0.54}{27} = 0.02$ mole

g atom or moles of Al taken $= 0.05 + 0.02 = 0.07$
g atom or moles of Cl_2 taken $= 3 \times 0.05 = 0.15$

439 **(b)**
Use formula
$$d = M\left(\frac{Mw_2}{1000} + \frac{1}{m}\right) \Rightarrow 1.0585 = 1\left(\frac{58.5}{1000} + \frac{1}{m}\right)$$
Solve for m:
$\therefore m = 1$

440 **(d)**
N_2 left =1 mol
NH_3 formed = 2 mol but dissolved in H_2O; hence pressure is due to N_2 only. Hence, volume of the flask is 10 L since 10 L H_2O is added
$$\therefore P = \frac{n}{V}RT = \frac{300R}{10}$$

442 **(d)**
(a)NH_3 in $NH_4NO_3 = \frac{17}{80} = 0.2125$

(b)NH_3 is $NH_2CONH_2 = \frac{34}{62} = 0.5484$

(c)NH_3 in $NH_4Cl = \frac{17}{53.5} = 0.3178$

(d)NH_3 in $HNC(NH_2)_2 = \frac{51}{59+4} = 0.8095$

$(NH_2CONH_2 = 2NH_3 - 2H)$

$\therefore\ NH_2CONH_2 + 2H = 2NH_3$

Similarly, $NHC(NH_2)_2 = 3NH_3 - 4H$

$\therefore\ NHC(NH_2)_2 + 4H \equiv 3NH_3$

443 **(c)**
Rest mass of electron= 9.11×10^{-31} kg

mass of one mole of electrons= $9.11 \times 10^{-31} \times 6.02 \times 10^{23}$

$= 5.48 \times 10^{-7}$ kg mol^{-1}

444 **(d)**
(a) $2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$
Light green
(b) $FeCl_3$ solution is acidic due to hydrolysis
$FeCl_3 + 3H_2O \rightarrow Fe(OH)_3 + 3HCl$
Zinc pieces added liberate H (nascent) in situ and reduces $FeCl_3$ to $FeCl_2$
$FeCl_3 + 2H \rightarrow FeCl_2 + HCl$
(c) $2FeCl_3 + H_2S \rightarrow 2FeCl_2 + 2HCl + S$

445 **(c)**
Both represent same net reaction,

Thus, equal yield in both

446 **(a)**
$3N \equiv 1(NH_4)_3PO_4$

42 g N is in = 1 mol $(NH_4)_3PO_4$

14 g N is in $= \frac{14}{42}$ mol $(NH_4)_3PO_4$

$= \frac{1}{3}$ mol

$= \frac{1}{3} \times 149$ g $(NH_4)_3PO_4$

$= 49.67$ g ≈ 50.0 g

447 **(a)**
$Ca(hco_3)_2 \xrightarrow{\Delta} CaO + H_2O + 2CO_2$

1 mol 2 mol

Given, 2 mol of 50% pure = 1 mol

Instead of 2 mol CO_2, we get only 1 mol,

Thus, % yield is 50%

448 **(d)**
Oxygen content in 1 L at STP $= \frac{1\times21}{100} = 0.21$ L

22.4 L at STP = 1 mol

hence 0.21 L at STP $= \frac{1 \times 0.21}{22.4} = 0.009375$ mol

450 **(a)**
$SCN^- + FeCl_3 \longrightarrow [Fe(SCN)]Cl_2 + Cl^-$
blood red

451 **(a)**
$$M^{x+} + MnO_4^{\ominus} \longrightarrow MO_3^{\ominus} + Mn^{2+}$$
$$MnO_4^{\ominus} + 8H^{\oplus} + 5e^- \longrightarrow Mn^{2+} + 4H_2O$$
$$M^{x+} + 3H_2O \longrightarrow MO_3^{\ominus} + 6H^{\oplus} + (5-x)e^-$$
mEq of $MnO_4^{2-} \equiv$ mEq of M^{x+}
$1 \times 5 \equiv [1.67 \times (5 - x) \Rightarrow 5 - x = 3 \Rightarrow x = 2$

452 **(a)**

Methyl orange indicator indicates the first step ionization of H_2SO_3

$$H_3SO_3 \rightleftharpoons H^{\oplus} + HSO_3^{\ominus}$$

$$(n = 1)\left(Ew = \frac{Mw}{1}\right)(N = M \times 1)$$

$Ca(OH) \equiv H_2SO_3$

$N_1 \times V_1 = N_2 \times V_2$

$0.1 \times 2 \times V_1 = 0.2 \times 1 \times 2$

$V_1 = 200$ mL

453 **(d)**

$$HCN + KMnO_4 \longrightarrow CO_2 + NO_3^{\ominus} + Mn^{2+}$$

$$CO_2 \downarrow CaCO_3$$

$$(1\ g) \equiv 0.01\ mol$$

mol of $CO_2 = 0.01$ mol

$$CN^{\ominus} + 5H_2O \longrightarrow CO_2 + NO_3^{\ominus} + 10H^{\oplus} + 10e^-$$

$$MnO_4^{\ominus} + 8H^{\oplus} + 5e^- \longrightarrow Mn^{2+} + 4H_2O$$

$$CN^{\ominus} + 2MnO_4^{\ominus} + 6H^{\oplus} \longrightarrow CO_2 + NO_3^{\ominus} + 2Mn^{2+} + 3H_2O$$

1 mol $CO_2 \equiv$ 2 mol $MnO_4^{\ominus}$

0.01 mol $CO_2 \equiv$ 0.02 mol $MnO_4^{\ominus}$

$$M_{KMnO_4} = \frac{0.02}{\frac{25}{1000}} = 0.8\ M$$

454 **(c)**

$NH_4Cl, (NH_2)_2CS, NH_2SO_3H$ decompose NO_2^- to N_2

455 **(b)**

Molar ratio of C: H $= \frac{6}{12} : \frac{1}{1} = 2:1$

Formula of compound, $C_xH_{2x}O_y$

$C_xH_{2x}O_y + O_2 \rightarrow xCO_2 + xH_2O$

From the question $\frac{3x}{2} = y$

$x : y = 2 : 3$

Formula: $C_2H_4O_3$

456 **(c)**

	S^{2-}	SO_3^{2-}
$(CH_3COO)_2Pb$	Black ppt	No ppt
$Na_2[Fe(CN)_5NO]$	Purple colour	No colour

457 **(a)**

If 0.032 g sulphur then molar mass= 100 g

If 32 g sulphur then molar mass $= \frac{10}{0.032} \times 32$

$= 10^5$ g

Thus, molar mass $= 10^5 g\ mol^{-1}$

1 g amino acid $= \frac{1}{10^5}$ mol amino acid

$= \frac{N_0}{10^5}$ molecules

$= 6.02 \times 10^{18}$ molecules

458 **(c)**

$ZnO + 2NaOH \longrightarrow Na_2ZnO_2 + H_2O$

$ZnO + 2HCl \longrightarrow ZnCl_2 + H_2O$

459 **(d)**

$$FeSO_4 + Fe_2(SO_4)_3 + KMnO_4 \xrightarrow{H^{\oplus}}$$

Only $FeSO_4$ will be oxidised by $KMnO_4$

mEq of $FeSO_4 \equiv$ mEq of $KMnO_4$

$= 2 \times 5 \times 100 = 1000$

mEq of $FeSO_4 = 1 =$ mol of $FeSO_4$

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

$\Rightarrow x_{FeSO_4} = \frac{1}{3}$

460 **(d)**

Distilled H_2O Tap H_2O Boiled H_2O

[No hardness] $\begin{bmatrix} \text{Temporary +} \\ \text{permanent} \\ \text{hardness} \end{bmatrix} \begin{bmatrix} \text{Only} \\ \text{permanent} \\ \text{hardness} \end{bmatrix}$

(Volume of soaps solution)

1 mL 13 mL 5 mL

Volume of soap solution used effectively in tap water

$= 13 - 1 = 12$ mL

$\therefore$ Temporary + Permanent hardness = 12 mL

Volume of soap solution used effectively in boiled water $= 5 - 1 = 4$ mL

Permanent hardness = 4 mL

$\therefore$ Temporary + Permanent hardness =12 mL

Permanent hardness = 4 mL

Temporary hardness = 8 mL

$$\therefore \frac{\text{Temporary hardness}}{\text{Permanent hardness}} = \frac{8}{4} = 2:1$$

461 **(d)**

$MS_2 = M + 32 \times 2$

$= M + 64$

$\% \text{ of sulphur} = \left(\frac{64}{M+64}\right) \times 100 = 40.06$

$\therefore M + 64 = \frac{6400}{40.06}$

$M + 64 = 160$

$M = 160 - 64 = 96$

462 **(d)**

$H_3PO_4 \equiv 2OH^-, \text{Eq. wt.} = \frac{H_3PO_4}{2} = 49$

464 **(b)**

$CaCO_3 = 200 \text{ g} = 2 \text{ mol}$

$H_2O = 10^6 \text{ g} = \frac{10^6}{18} \text{ mol}$

$\text{Mole fraction of } CaCO_3 = \frac{2}{2 + \frac{10^6}{18}} = 3.6 \times 10^{-5}$

465 **(b)**

$[Fe(CN)_5NO]^{2-} + H_2S \longrightarrow [Fe(CN)_5NOS]^{4-}$

nitroprusside purple

466 **(c)**

$CrO_2Cl_2 \rightleftharpoons CrO_2^{2+} + 2Cl^-$

cation

467 **(c)**

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

Molarity = normality

Equivalent weight = molar weight

$Cr_2O_7^{2-} + 6e^- \rightarrow 2Cr^{3+}$

Normality = 6 × molarity

$\text{equivalent weight} = \frac{\text{molecular weight}}{6}$

$20 \text{ mL of } 0.1 \text{ M } Cr_2O_7^{2-} = 20 \times 0.6 N Cr_2O_7^{2-}$

$50 \text{ mL of} N_1 Fe^{2+} = 20 \times 0.6 \text{ N } Cr_2O_7^{2-}$

$N_1 = \frac{20 \times\times 0.6}{50}$

$= 0.24 \text{ N } Fe^{2+}$

$= 0.24 \text{ M } Fe^{2+}$

$= 0.24 \times 278$

$= 66.72 \text{ gL}^{-1}$

$(FeSO_4 \cdot 7H_2O = 278 \text{ g mol}^{-1})$

468 **(d)**

98% by weight of solution means

$H_2SO_4 = 98 \text{ g} = 1 \text{ mol}$

$H_2SO_4 + H_2O \text{ (solution)} = 100 \text{ g}$

$\therefore H_2O = 2 \text{ g} = 0.002 \text{ kg}$

$\therefore \text{Molality} = \text{conc. in mol kg}^{-1}$

$= \frac{1}{0.002} = 500 \text{ molal}$

469 **(d)**

$2H_2 + O_2 \rightarrow 2H_2O$

2 mL 1 mL

30 mL 15 mL

Thus, O_2 left = 5 mL

470 **(d)**

mEq Acid=mEq Base

$\Rightarrow \frac{0.4}{Mw/n} \times 1000 = \frac{0.5}{40/1} \times 1000$

$\Rightarrow n = 3 \text{ and } H_nA \equiv 96 \Rightarrow A = 96 - 3 \times 1 = 93$

471 **(c)**

$Na_3[Co(CO_3)_3]$

472 **(b)**

$2C_2H_6 + Br_2 \longrightarrow 2C_2H_5Br + HBr$

$\downarrow 2Na$

C_4H_{10}

$12 \times 4 + 10 = 58 \text{ g}$

58 g of n-butane $\Rightarrow 2 \times 22.4 \text{ L of } C_2H_6$ at STP

$\Rightarrow 2 \times 22.4 \times \frac{100}{85} \times \frac{100}{90}$

58 g of n-butane = 58.56 L

55 g of n-butane = 55.5 L

474 **(b)**

$1\ LH_2O = 1000\ g\ H_2O = \frac{1000}{18}$ mol

475 **(c)**

C) Ratio of HNO_3 per mol of H_2O

A) $\frac{8}{4} = 2$

B) $\frac{6}{3} = 2$

C) $\frac{10}{3} = 3.33$

D) $\frac{4}{2} = 2$

476 **(a)**

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

1 L of 0.15 N

0.15 mol   0.0112 mol

NaOH required by 0.0112 mol CO_2 = 0.0224 mol

NaOH unreacted = 0.15 − 0.0224

= 0.1276 mol in 1 L

Thus, M (NaOH) = 0.1276 M

477 **(d)**

Methyl orange indicates complete neutralization of Na_2CO_3 and $NaHCO_3$ white phenolphthalein indicates only 50% reaction of Na_2CO_3 to $NaHCO_3$ stage only. Let volume of given HCl required for complete neutralization of

$NaHCO_3 = V_1$

And for $Na_2CO_3 = V_2$

For phenolphthalein indicator (50% Na_2CO_3) = $\frac{V_2}{2} = x$

For methyl orange (further titration) $= \frac{V_2}{2} + V_1 = y$

$= x + V_1 = y$

Volume for $NaHCO_3 V_1 = (y - x)$mL

478 **(a)**

$CaCO_3$ = 200 ppm = 200 parts per million

= 200 g per 10^6 mL

= 2 mol per 10^6mL

= 2×10^{-3}mol per L

= 2×10^{-3} M

479 **(c)**

$6Br_2 + 12\overset{\ominus}{O}H \longrightarrow 10Br^{\ominus} + 2BrO_3^{\ominus} + 6H_2O$

36 mL/As^{3+} → 45 mL As^{3+}

6 mmol $Br_2 \equiv$ 2 mmol $BrO_3^{\ominus}$

$(36 \times 0.5) = \frac{1}{3} \times 36 \times 0.5$ mmol $BrO_3^{\ominus}$

mmol $BrO_3^{\ominus}$ = 6.0

$BrO_3^{\ominus} + 3As^{3+} + 6H^{\oplus} \longrightarrow Br^{\ominus} + 3As^{5+} + 3H_2O$

1 mmol $BrO_3^{\ominus} \equiv$ 3 mmol As^{3+}

6.0 mmol $BrO_3^{\ominus} \equiv$ mmol As^{3+}

$\left(MAs^{3+} = \frac{18}{45} = 0.4\ M\right)$

480 **(a)**

$KClO_3 \rightarrow KCl + \frac{3}{2}O_2$

$2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3$

1 mol of $KClO_3 \equiv$ 1 mol of Al_2O_3

481 **(b)**

Salt contains $C_2O_4^{2-}$

$CaCl_2 + C_2O_4 \longrightarrow CaC_2O_4 \downarrow$
white ppt

$C_2O_4^{2-}$ decolourises $MnO_4^- + H^+$

$CaC_2O_4 \longrightarrow CaO + CO + CO_2$

482 **(b)**

Since no water added, so volume of solution cannot exceed 2 L. So, less concentrated solution should be taken in its total volume

Only the small portion of more concentrated solution is to be mixed, so that the total concentrated is less than (0.3 M HCl)

Let x L of 0.3 M solution is mixed

Total volume = $(x + 1)$L

$M_1V_1 + M_2V_2 = M_3V_3\ [V_3 = (1 + x)$L

$0.3 \times x\ L + 0.15 \times 1\ L = M_3\ (1 + x)$ L

Final molarity = 0.2 M

$0.3\ x + 0.15 = 0.2\ (1 + x)$

$x = 0.5$ L

Maximum volume $= 1 + 0.5 = 1.5$ L

483 **(b)**

Volume of O_2 at STP $= 10$ mL $\times$ 10 'V'=100 mL

224000 mL of O_2at STP $= 1$ mol $= 4$ Eq

100 mL ofO_2 at STP $= \frac{4}{22400} \times 100 = \frac{1}{56}$Eq

Eq of $KMnO_4$ = Eq ofO_2

$= \frac{1}{56}$ Eq of $KMnO_4$

$= \frac{1}{56} \times 31.5$ g of $KMnO_4$

$= 0.564$ g

(Ew of $KMnO_4$ in acidic medium $= \frac{Mw}{5} = 31.5$)

Alternate method:

N of '10 V' of H_2O_2:

5.6 'V' of H_2O_2 = 1N

10 'V' of $H_2O_2 = \frac{10}{5.6}$ N

mEq of $KMnO_4 = 100 \times$ N

$\therefore$ mEq of H_2O_2 = mEq of $KMnO_4$

$\frac{100}{5.6} = 100 \times \text{N} \Rightarrow \text{N} = \frac{1}{5.6}$

Strength of $KMnO_4 = N \times Ew = \frac{1}{5.6} \times 31.5$

$= 5.64$ g L^{-1}

5.64 g of $KMnO_4 \Rightarrow$ 1000 mL

$\therefore$ In 100 mL of $KMnO_4$, the amount of $KMnO_4$

$= 0.564$ g

484 **(c)**

$BaCO_3, CaCO_3, PbCO_3$ – insoluble

Na_2CO_3 – soluble

485 **(a)**

Mass loss is due to H_2O

Let $CuSO_4.5H_2O$ = x g

$CuSO_4 = (1.245 - x)$g

Water $= (1.245 - 0.882) = 0.363$

$CuSO_4.5H_2O = 5H_2O$

1 mol 5 mol

249.5 g 90 g

$\text{x g} = \frac{90\text{ x}}{249.5\text{ g}} H_2O$

$\frac{90\text{ x}}{249.5} = 0.363$

x = 1.006 g

$CuSO_4 = (1.245 - 1.006) = 0.239$ g

% of $CuSO_4 = \frac{0.239}{1.245} = 19.2\%$

486 **(c)**

1 mol $BaCO_3$ = 1 mol C

197 g $BaCO_3$ contains = 12 g C

1.35 g $BaCO_3$ contains $= \frac{12 \times 1.35}{197} = 0.0822$ g C

C_3H_8 = 3C

3×12 g carbon is in = 44 g C_3H_8

$\therefore$ 0.0822 g carbon is in $= \frac{44 \times 0.0822}{36} = 0.100$ g

487 **(c)**

$Na_2SO_3 : H_2O$

Moles 1 : 7

Mass 126 : 126

Per cent 50 : 50

488 **(d)**

$Li_2CO_3 \rightarrow CO_2$

1 mol 1 mol

$Na_2CO_3 \rightarrow$ X

$2NaHCO_3 \rightarrow CO_2$

2 mol 1 mol

1 mol 0.5 mol

Total CO_2 = 1.5 mol

489 **(b)**

Ew of$Na_2S_2O_3 = \frac{158}{n}$ $(n = 1)$

$2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2e^- \left(n = \frac{2}{2} = 1\right)$

$MnO_4^{\ominus} = S_2O_3^{2-}$
mEq = mEq

$0.2M \times 5(n - \text{factor}) \times V = \frac{1.58}{158} \times 10^3$

$V = 10$ mL

490 **(a)**

Suppose molecular weight of enzyme = x

0.5% by weight means in 100 g of enzyme wt. of Se = 0.5 g

In x g of enzyme wt.. of Se $= \frac{0.5 \times x}{100}$

Hence, $78.4 = \frac{0.5 \times x}{100}$

$x = 15680 = 1.5680 \times 10^4$

491 **(a)**

$RH_2 + Ca^{2+} \rightarrow RCa + 2H^+$

Every Ca^{2+} ion is replaced by two H^+ ions

pH = 2

$\therefore [H^+] = 10^{-2}$ M

$\therefore [Ca^{2+}] = \frac{10^{-2}}{2}\text{ M} = \frac{10^{-2} \times 40}{2}\text{ g L}^{-1}$

$\therefore$ ppm of $Ca^{2+} = \frac{10^{-2} \times 40 \times 10^6}{2 \times 10^3} Ca^{2+} = 200$

492 **(c)**

$AgCl \quad + \quad 2NH_3 \longrightarrow [Ag(NH_3)_2]Cl$
Insoluble in hot soluble
Water $PbCl_2$
Soluble in hot water

494 **(a)**

$\frac{1 \times 10^{-6}}{12} \times N_0 = 5 \times 10^{16}$ atoms

495 **(d)**

$Na_2CO_3 \equiv CaCO_3$

106 g 100 g

Hardness in 10^6 mL H_2O = 100 g $CaCO_3$

$\therefore$ Hardness in 10 L (10^4 mL = 10^4 g)H_2O = 1 g $CaCO_3$

100 g $CaCO_3$ required = 106 g Na_2CO_3

$\therefore$ 1 g $CaCO_3$ required = 1.06 g Na_2CO_3

496 **(b)**

$\frac{200 \times 95 \times 56}{100 \times 100} = 106.4$ kg

497 **(a)**

$NaOH + HCl \rightarrow NaCl + H_2O$

40 g 36.5 g 58.5 g

NaOH in 100 mL = 0.4 g

HCl in 50 mL = 0.3675 g

NaCl formed = 0.5 g

58.5 g NaCl is formed from = 40 g NaOH

0.5 g NaCl is formed from $= \frac{40}{58.5} \times$ 0.5=0.342 g NaOH

NaOH unreacted = 0.4 − 0.342 = 0.058 g

498 **(a)**

	Amount	Moles	Ratio
C	3g	$\frac{3}{12} = 0.25$	1
H	1g	$\frac{1}{1} = 1.0$	4

Thus, simplest formula is CH_4

499 **(a)**

$ACl_n + nH_2O \rightarrow A(OH)_n + nHCl$

$nHCl + nAgNO_3 \rightarrow nAgCl + nHNO_3$

$ACl_n \equiv mHCl \equiv nAgNO_3$
1 mol $\quad n$ mol $\quad n$ mol

1×10^{-3} mol $\quad 1 \times 10^{-3}\, n$ mol

1×10^{-3} mol $1 \times 10^{-3} n$ mol

But $AgNO_3$ required = 30 mL of 0.1 M

$= \frac{30 \times 0.1}{1000} = 3 \times 10^{-3}$ mol

Thus, $1 \times 10^{-3} n = 3 \times 10^{-3}$

$\therefore n = 3$

Thus, chloride is ACl_3

$A + 3 \times 35.5 = 133.5$

$A = 27$

Thus, A is Al

500 **(a)**

4 g of NaOH $= 4/40 = 0.1$ mole $= 100$ mmol $\equiv$ 100 mEq

HCl $= 500 \times 1 = 500$ mEq

N of $H_2SO_4 = \frac{W_2 \times 1000}{Ew_2 \times V_{sol}\text{ (in mL)}}$

or $= \frac{\%\text{ by weight} \times 10 \times d}{Ew_2}$

$= \frac{49 \times 10 \times 1.1}{49} = 11$ N

mEq of $H_2SO_4 = 11\text{N} \times 10.00$ mL $= 110$ mEq

Total acid $= 100 + 500 = 610$ mEq

NaOH $= 100$ mEq

Acid left $= 610 - 100 = 510$ mEq

Total volume $= 1000$ mL

Normality of solution $= \frac{\text{mEq}}{\text{mL}} = \frac{510}{1000} = 0.51$ N

501 **(c)**

$Z_2O_3 + 3H_2 \rightarrow 2Z + 3H_2O$

[2 g = 200 mg] $\frac{12 \text{ mg}}{2 \text{ mg}}$ $= 6$ mmol

Since H_2 used is 6 m mol, Z_2O_3 used should be 2 mmol

Mol of $Z_2O_3 = \frac{\text{Weight}}{Mw} = \frac{200 \text{ mg} \times 10^{-3}\text{g}}{Mw}$

$= 2 \times 10^{-3}$ moles

$\therefore Mw\ (Z_2O_3) = 100$

$\therefore 2Z + 16 \times 3 = 100$

$Z = \frac{100 - 48}{2} = 26$

502 **(a)**

Remember it as a fact; in neutral medium, K_2MnO_4 (potassium magnanate) disproportions as follows:

$K_2MnO_4 \rightarrow KMnO_4 + MnO_2$

On balancing, we get:

$3MnO_4^{2-} + 2H_2O \longrightarrow 2MnO_4^{\ominus} + 4\overset{\ominus}{O}H + MnO_2$

$1 \text{ mol } MnO_4^{2-} \equiv \frac{2}{3} \text{ mol } MnO_4^{\ominus} \equiv \frac{1}{3} \text{ mol } MnO_2$

503 **(a)**

MnO_4^- is reduced to Mn^{2+} by Fe^{2+} which is oxidized to Fe^{3+}

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

504 **(a)**

$ZnSO_4 + 2H_2O \longrightarrow Zn(OH)_2 \downarrow + \underset{\text{acidic}}{2H_2SO_4}$

506 **(a)**

$O_3 \longrightarrow O_2 + O$...(i)

$H_2O_2 \longrightarrow H_2O + O$ ...(ii)

$O + O \longrightarrow O_2$...(iii)

1/2 vol 1/2 vol 1 vol

From equations (i) and (ii), we inter that 100 mL of O_3 at STP will produce 100 mL of molecular O_2 as such and 100 mL of oxygen molecule after reaction with H_2O_2

This new volume of 100 mL of molecular oxygen after reaction with H_2O_2 is contributed equally by O_3 and H_2O_2. Thus, 50 mL of oxygen have been contributed by H_2O_2

Again, we know

Volume of $H_2O_2 \times$ Volume strength of H_2O_2 =Volume of O_2 at STP

$\therefore$ 100 mL of '10 V' $H_2O_2 \equiv 1000$ mL of O_2 at STP

After utilization of 50 mL of O_2, according to equation(iii), the balance $(1000 - 50) = 950$ mL of O_2at STP are still retainable by 100 mL of H_2O_2

Hence volume strength of H_2O_2 after reaction

$\frac{\text{Volume of } O_2 \text{ at STP}}{\text{Volume of } H_2O_2} = \frac{950}{100} = 9.5$ V

$\therefore$ Volume strength $= 9.5$

507 **(b)**

H_2S 5.89 g H combines with= 94.11 gS

Hence, 1 g H combines with = 16g S

SO_2 50 g O combine with= 50 g S

Hence, 1 g O combines with = 1 g S

H_2O 11.11 g H combines with= 88.89 g O

1 g H combine with = 8 g O

Thus, law of reciprocal proportion is followed

508 **(d)**

Concentration of $H^{\oplus}$ in 1 mL $= 10^{-5}$ M

Concentration of $H^{\oplus}$ in 1000 mL $= 10^{-8}$ M

(pH=6.98)

509 **(d)**

$NH_4Cl + NaOH \rightarrow NH_3 + NaCl + H_2O$

$53.2 \text{ g} = 1 \text{ mol} = 17 \text{ g } NH_3$

$0.535 \text{ g} = 0.17 \text{ g } NH_3$

510 **(a)**

Let n mol of $(C_2H_4 + H_2)$

x mol of C_2H_4

$H_2 = (n - x)$mole

$\underset{x}{C_2H_4} + \underset{x}{H_2} \rightarrow \underset{x \text{ mol}}{C_2H_6}$

After reaction $(\underset{x}{C_2H_6} + \underset{n-x-x=n-x}{H_2} \text{ left})$

[Total $H_2 = (n - x)$, H_2 reacted$= x$]

H_2 left $= (n - x - x)$

$n = 600; n - x = 400$

$\frac{n}{n-x} = \frac{600}{400}; x = \frac{n}{3}$ volume of C_2H_4

$= \frac{1}{3}$rd of total volume

511 **(d)**

$2AgNO_3 + Na_2S_2O_3 \rightarrow 2NaNO_3 + Ag_2S_2O_3$

$Ag_2S_2O_3 + H_2O \rightarrow \underset{\text{black}}{Ag_2S} + H_2SO_4$

512 **(b)**

$CaO \rightarrow CaC_2O_4 \rightarrow CaCO_3$

56 g 100 g

? 0.3462 g

Pure CaO in the mineral $= \frac{56}{100} \times 0.3462 =$ 0.1938 g

$\therefore$ % of pure CaO $= \frac{0.1938}{0.8432} \times 100 = 23\%$

513 **(d)**

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

100 g 73 g

10 g 7.3 g

(50% pure) 5 g $\frac{7.3}{2}$ g HCl

$\frac{\text{mass}}{\text{volume}} = \text{density}$

$\therefore$ Volume of HCl $= \frac{\text{mass of HCl}}{\text{density of HCl}} = \frac{7.3}{2 \times 1.825}$

$= 2$ mL

514 **(b)**

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

1 mol

$Fe^{3+} \rightarrow$ x

1 mol

Only Fe^{2+} requires MnO_4^-

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

5 mol 1 mol

1 mol $\frac{1}{5}$ mol

Let volume of $KMnO_4 = V$ mL

Then moles of $KMnO_4 = \frac{V \times 1}{1000} = \frac{V}{1000}$ mol

$\frac{1}{5} = \frac{V}{1000}$

$V = 200$ mL

515 **(c)**

I : $Fe^{2+} \rightarrow$ Fe^{3+}

↑ ↑

Blue colour no colour with

With $[Fe(CN)_6^{3-}][Fe(CN)_6]^{3-}$

(Oxidized by $Cr_2O_7^{2-}$)

Thus, when oxidation is complete, there is no blue colour with $[Fe(CN)_6]^{3-}$ used externally

II : $Ag^+ + Cl^- \rightarrow AgCl$

Every drop of Ag^+ is converted into white ppt of AgCl. Any additional drop of Ag^+ gives red ppt. with CrO_4^{2-}

III : $Fe^{2+} \rightarrow Fe^{3+}$

MnO_4^- oxidises $Fe^{2+}$to Fe^{3+} and itself reduced to Mn^{2+} (colourless); when oxidation is complete, any additional drop of MnO_4^- imparts its own colour (MnO_4^- is thus self-indicator)

Thus, I : $[Fe(CN)_6]^{3-}$

II : CrO_4^{2-}

III : MnO_4^-

516 **(b)**

$0.116\text{ g } C_4H_4O_4(A) = \frac{0.116}{116} = 0.001\text{ mol}$

$= 0.001\text{ x equivalent}$

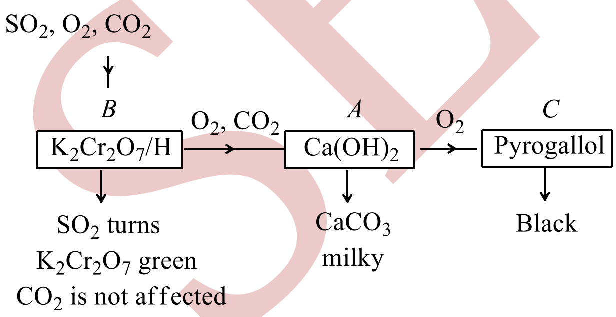
$0.074\text{ g } Ca(OH)_2 = \frac{0.074}{74} = 0.001\text{mol}$

$= 0.002\text{ equivalent}$

$\therefore 0.001x = 0.002$

$\therefore x = 2$

517 **(c)**



Thus, order is B, A, C

518 **(a)**

Mixture X contains 0.02 moles of $[Co(NH_3)_5SO_4]Br$ and 0.02 moles of $[Co(NH_3)_5Br]SO_4$ was prepared in 2L of solution. So, the concentration of $[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)_5Br]SO_4$ in solution are 0.01 mol/L and 0.01 mol/L respectively. During the reaction with $AgNO_3$(excess), AgBr is precipitated as follows

$[Co(NH_3)_5\,SO_4]Br + AgNO_3$
$\rightarrow [Co(NH_3)_5SO_4]NO_3 + AgBr\downarrow$
0.01 mol/L (excess) soluble (Y)
0.01 mol/L

Hence, number of moles of y=0.01

On addition of excess $BaCl_2$, $BaSO_4$ is precipitated as follows

$[Co(NH_3)_5Br]SO_4 + BaCl_2 \rightarrow BaSO_4$
$\downarrow + [Co(NH_3)_5Br]Cl_2$
0.01 mol/L (excess) 0.01 mol/L soluble
'Z'

Hence, number of moles of Z =0.01

Thus, the number of moles of Y and Z are 0.01 and 0.01 respectively.

519 **(b)**

Let the volume of solution = 1 L

Weight of solution $= 1 \times d = d$ g

Number of moles of solute (n_2) in 1 L solution = M

$\therefore \frac{W_2}{Mw_2} = M$

W_2 (weight of solute)$= M \times Mw_2$

W_1 (weight of solvent) = Weight of solution− Weight of solute

$= (d - M \times Mw_2)$

Number of moles of solvent (n_1)

$= \frac{W_1}{Mw_1} = \left(\frac{d - M \times Mw_2}{Mw_1}\right)$

$\therefore \chi_2 = \frac{n_2}{n_1 + n_2} = \frac{M}{\left(\frac{d - M \times Mw_2}{Mw_1}\right) + M}$

$= \frac{M \times Mw_1}{M\,(Mw_1 - Mw_2) + d}$

520 **(d)**

x mol $CuSO_4.5H_2O$

$= 249.5x$ g $CuSO_4.5H_2O$

$= 63.5$ x g Cu

$= 3.782$ g Cu

$\therefore 63.5\,x = 3.782$

$x = 0.05956$ mol

Every 1 mole of salt has = 9 moles O – atoms

$\therefore$ O – atoms = 0.05956 x 9 mol

$= 0.05956 \times 9 \times 16$ g

$= 8.576$ g O – atoms

521 **(d)**

$10 \times N_1 (H_2O_2) \equiv 10 \times \frac{N}{0.56} MnO_4^{\ominus}$

$N_1(H_2O_2) = \frac{1}{0.56}$

'x volume' H_2O_2 has normality $= \frac{x}{5.6}$

$\frac{x}{5.6} = \frac{1}{0.56}, \Rightarrow \quad x = 10$

522 **(c)**

$Na_2B_4O_7 \longrightarrow \underbrace{2NaBO_2 + B_2O_3}_{\text{bead}}$

523 **(c)**

$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

1 mol 1 mol 1 mol

170 g 58.5 g 143.5 g

1.70 g $AgNO_3$ gives 1.435 g AgCl

5.85 g NaCl gives 14.35 g AgCl

Thus, $AgNO_3$ is the limiting reactant

AgCl formed = 1.435 g

524 **(d)**

1 mol $^{12}_{6}C = 12$g

1 amu $= \frac{1}{N_0}$

Number of moles in amu $= \frac{1}{12N_0}$

525 **(a)**

By Dalton's theory, atom is the smallest particle

526 **(d)**

(a) Cl% $= \frac{35.5}{35.5 + 12 + 1} = \frac{35.5}{48.5} = \frac{x}{y}$

(b) $= \frac{35.5}{72 + 5 + 35.5} = \frac{35.5}{112.5}$

(c) $= \frac{35.5}{15 + 35.5} = \frac{35.5}{50.5}$

(d) $= \frac{35.5 \times 4}{12 + 35.5 \times 4} = \frac{35.5}{3 + 35.5} = \frac{35.5}{38.5}$

In all cases value of $X = 35.5$

Smaller the value of Y, larger the percentage of Cl

527 **(a)**

$5e^- + MnO_4^{\ominus} \longrightarrow Mn^{2+} \ (n = 5)$

$SO_3^{2-} \rightarrow SO_4^{2-} + 2e^- \ (n = 2)$

Eq of $MnO_4^{\ominus}$ = Eq of SO_3^{2-}

$\frac{1}{5}$mol $= \frac{1}{2}$mol

$\frac{2}{5}$mol = 1 mol

528 **(b)**

$2N_2 + 3O_2 \rightarrow 2N_2O_3$, (% yield = 80%)

Initial mol of $N_2 = \frac{7.0}{28} = 0.25$ mol

Moles of N_2 converted $= 0.25 \times \frac{80}{100} = 0.2$

2 mol N_2 = 3 mol O_2

0.2 mol N_2 = 0.3 mol O_2 (1 mol O_2 = 2 oxygen atom)

$= 2 \times 0.3$ mol O atom

$= 2 \times 0.3 \times 6.02 \times 10^{23} = 3.6 \times 10^{23}$

529 **(a)**

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

65 g 22400 mL

0.65 g 224 mL

530 **(d)**

Methyl red indicates complete ionisation of HCl ($n = 1$) and first step ionisation of $H_3PO_4 (n = 1)$

First case:

$Ba(OH)_2 \equiv HCl$

$N_1V_1 = N_2V_2$

$0.1 \times 2 \times V_1 = 0.1 \times 1 \times 50$

$V_1 = 25$ mL

Second case:

$(Ba(OH)_2 \equiv H_3PO_4 (n = 1)$

$0.1 \times 2 \times V_1 = 0.2 \times 1 \times 100$

Total volume $= 100 + 25 = 125$ mL

531 **(a)**

i. $X + 2Y \rightarrow XY_2$

0.1 mol of $XY_2 = 10$ g

1 mol of $XY_2 = 100$ g

ii. $3X + 2Y \rightarrow X_3Y_2$

0.05 mol of $X_3Y_2 = 9$g

1 mol of $X_3Y_2 = \frac{9}{0.05} = 180$g

$\left.\begin{matrix} \therefore X + 2Y = 10 \\ 3X + 2Y = 180 \end{matrix}\right] \begin{matrix} Mw\ XY_2 = 100 \\ Mw\ X_2Y_3 = 180 \end{matrix}$

Solve for X and Y

$X = 40$ g

$Y = 30$ g

532 **(a)**

0.05 M Na_2CO_3 = 1 N Na_2CO_3

0.05 M $NaHCO_3$ = 0.05 N $NaHCO_3$

40 L of 0.1 Na_2CO_3 = 40 mL of 0.1 N HCl

(For complete reaction)= 80 mL of 0.05 M HCl

For 50% reaction =40 mL of 0.05 M HCl

With phenolphthalein $= x = 40$ mL

40 mL of 0.05 $NaHCO_3$ = 40 mL of 0.05 M HCl

With methyl orange, $y = 80 + 40 = 120$ mL

$\therefore (y - x) = 80$ mL

533 **(d)**

On adding 2NHCl, AgCl and $HgCl_2$ are precipitated. Filtrate will contain Zn^{2+}, Cu^{2+} and Fe^{2+}

534 **(b)**

pH = 12

$\therefore [H^+] = 10^{-12}$ M

$[OH^-] = 10^{-2}$ M $= 10^{-2}$ mol L^{-1}

$= 10^{-3}$ mol per 100 mL

$= 10^{-3} \times 40$ g NaOH per 100 mL

$= 0.04$ g

535 **(b)**

$2H_2O_2 \rightarrow 2H_2O + O_2$

68 g　　22.4 L (at STP)

Mass of H_2O_2 in 1.5 N solution $= Ew$ of $H_2O_2 \times$ 1.5 N

$= 17 \times 1.5 = 25.5$ g

So, volume strength of 1.5 N H_2O_2 solution

$= \frac{22.4\ L \times 25.5\ g}{68.0} = 8.4$ L

536 **(a)**

mEq of $KMnO_4 = V \times 0.1 \times 5$

mEq of $Fe(C_2O_4)_2 = \frac{\text{Weight in g}}{Ew} \times 1000$

$\left[\begin{matrix} Fe^{+2} \rightarrow Fe^{+3} + e^- \\ C_2O_4^{2-} \rightarrow 2CO_2 + 2e^- \end{matrix}\right] (n = 3)$

Ew of $Fe(C_2O_4) = \frac{Mw}{3} = \frac{144}{3}$

$\therefore$ mEq of $Fe(C_2O_4) = \frac{5 \times 10^{-3}}{\frac{144}{3}} \times 10^3 = \frac{5 \times 3}{144}$

$\therefore$ mEq of $KMnO_4$ = mEq of $Fe(C_2O_4)$

$\therefore V \times 0.1 \times 5 = \frac{5 \times 3}{144}$

$\therefore V = 0.20$ mL

537 **(d)**

$N_1V_1 + N_2V_2 + N_3V_3 = N_4V_4$

$(V_4 = V_1 + V_2 + V_3 + V_4)$ or

V_4 = Final volume = 1L ≡ 1000 mL

$5 \times N + 20 \times \frac{N}{2} + 30 \times \frac{N}{3} = N_4 \times 1000$

$\therefore N_4 = \frac{N}{40}$

538 **(b)**

$2BCl_3 + 3H_2 \rightarrow 2B + 6HCl$

2×10.8 g B $\equiv 3 \times 22.4$ L of H_2

21.6 g B $\equiv \frac{3 \times 22.4 \times 21.6}{2 \times 10.8} = 67.2$ L of H_2

539 **(a)**

H_3PO_4 is a tribasic acid

540 **(a)**

Concentration in terms of g/mL is given as

$0.03 = \frac{\text{mass of } AgNO_3}{60}$

Mass of $AgNO_3 = 60 \times 0.03 = 1.8$ g

542 **(c)**

10 mL of 0.2 N HCl + 30 mL of 0.1 N HCl ≡ 40 mL of NaOH (≡ 0.61 g organic acid)

mEq of HCl ≡ mEq of NaOH ≡ mEq of organic acid

$10 \times 0.2 + 30 \times 0.1 \equiv \frac{0.61}{E} \times 1000$

$5 = \frac{0.61 \times 1000}{E}$

$E = \frac{610}{5} = 122$

543 **(b)**

$MnSO_4$

$x + 6 - 8 = 0, x = 2$

In (a) Mn_2O_3, $2x - 6 = 0, x = 3$

In (b) MnO_2, $x - 4 = 0, x = 4$

In (c) $MnO_4^{\ominus}$, $x - 8 = -1, x = 7$

In (d) MnO_4^{2-}, $x - 8 = -1, x = 6$

In (b), the change in oxidation number is $4 - 2 = 2$

Therefore, the answer is (b)

544 **(c)**

$FeS + 2H_2O \rightarrow Fe(OH)_2 + H_2S$
Foul smell

545 **(c)**

$H_2S \rightleftharpoons 2H^+ + S^{2-}$

On increasing pH, $[H^+]$ decreases, hence $[S^{2-}]$ increases making precipitation of M^{2+} as MS

546 **(a)**

Sucrose = 1 molal = 1 mol in 1000 g H_2O

Moles of water $= \frac{1000}{18}$

Mole of sucrose = 1

Total moles $= 1 + \frac{1000}{18}$

Mole fraction of sucrose $= \frac{1}{1 + \frac{1000}{18}} = \frac{18}{1018}$

$= 0.018$

547 **(c)**

Reaction and appearance of ring is due to charge transfer

$NO \longrightarrow NO^+ + e^-$

$Fe^{2+} + e^- \longrightarrow Fe^+$

⥮	1	1	1	1

⥮	⥮	1	1	1

Three unpaired electrons

$[Fe^+(H_2O)_5NO^+] \equiv [Fe(H_2O)_5NO]^{2+}$

Note Presence of three unpaired electrons is confirmed by magnetic moment of Fe which is $\sqrt{15}$ BM

548 **(d)**

$PbCl_2$ is soluble in hot water

$PbCl_2 \xrightarrow{K_2CrO_4} PbCrO_4 \downarrow$
yellow ppt

$PbCl_2 \xrightarrow{K_2SO_4} PbSO_4$
white ppt

$PbCl_2 \xrightarrow{KI} PbI_2 \downarrow$
yellow ppt

549 **(b)**

$BaCl_2 + CaCO_3 \rightarrow BaCO_3 + CaCl_2$

1 mol 1 mol

208 g 100 g

10 g $CaCO_3$ reacts with 20.8 g $BaCl_2$

But $BaCl_2$ taken = 20 g

Thus, $BaCl_2$ is the limiting reactant

550 **(d)**

$M = \frac{\text{\% by weight} \times 10 \times d}{Mw_2} = \frac{36.5 \times 10 \times 1.2}{36.5}$

$= 12$ M

$m = \frac{36.5 \times 1000}{36.5 \times (100 - 36.5)} = \frac{1000}{63.5} = 15.7\ m$

551 **(c)**

Under similar conditions of temperature and pressure, equal volume of gas contains equal number of molecules

$\therefore$ 1 L = N molecules

2 L = $2N$ molecules

552 **(a)**

From reaction stoichiometry

1 mol $KClO_3$ gives = 1 mol Al_2O_3

Thus, $4 \times \frac{50}{100} = 2$ mol pure $KClO_3$ give = 2 mol Al_2O_3

553 **(d)**

$C_xH_y + \left(x + \frac{y}{4}\right) O_2 \rightarrow xCO_2 + \frac{y}{2} H_2O$

1 mL $\left(x + \frac{y}{4}\right)$ mL x mL $\frac{y}{2}$ ml

10 mL $10\left(x + \frac{y}{4}\right)$ mL $10\ x$ mL

Volume absorbed by KOH = Volume of CO_2

Volume of CO_2 = 20 mL

$\therefore 10\ x = 20$

$x = 2$ mL = 2 mol

Volume absorbed by alkaline pyrogallol = volume of O_2

$= 95 - 20$

$= 75$ mL

Excess of $O_2 = 75$ mL

Total $O_2 = 100$ mL

Volume of O_2 reacted $= 100 - 75 = 25$ mL

$\therefore 10\left(x + \frac{y}{4}\right) = 25$ ml

$\therefore y = 2$

Formula of hydrocarbon $= C_2H_2$

554 **(b)**

$PbCrO_4 + HCl \longrightarrow PbCl_2 + H_2CrO_4$

$2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$

orange

555 **(c)**

Balance the equation :

$BrO_3^{\ominus} + 5Br^{\ominus} \longrightarrow 3Br_2 + 3H_2O$

1 mmol 5 mmol 1 mmol

Given : $50 \times 0.1 = 5$ mmol; $30 \times 0.5 = 15$ mmol

$Br^{\ominus}$ is the limiting reagent

5 mmol of $Br^{\ominus}$ gives $\Rightarrow$ 3 mmol of Br_2

15 mmol of $Br^{\ominus}$ gives $\Rightarrow \frac{3 \times 15}{5} = 9$ mmol

$= 9 \times 10^{-3}$ mol

556 **(b)**

0.018 mL $= 0.018$ g (density of water $= 1$g/mL)

$= \frac{0.018}{18} = 0.001$ mol

$= 6.02 \times 10^{20}$ molecules

557 **(b)**

$NH_2CONH_2 + 2NaOH \rightarrow 2NH_3$

60g 80 g $2 \times 17 = 34$ g

6 g 8 g 3.4 g

If yield is 100% NH_3 formed $= 3.4$ g

If yield is 80% NH_3 formed $= 3.4 \times \frac{80}{100} = 2.72$ g

558 **(b)**

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

Moles 0.08 $4 \times 0.8 \frac{1.78}{22.4} = 0.08$

$= 0.32$

$\Rightarrow W_{MnO_2} = 0.08 \times 87$ g $= 6.96$ g

$\left(\frac{10 \times 4 \times 1.2}{36.5}\right) \times V_L = 0.32 \Rightarrow V_L = 0.24$ L

559 **(a)**

1 mol of $O_2 = 4$ eq. of O

22400 mL of $O_2 = 4$ eq. of O

46.6 mL of $O_2 = \frac{4}{22400} \times 46.6$

$= 0.00832$ eq.

Equivalent of metal = Equivalent of O

$\frac{\text{Weight}}{Ew} = 0.00832$

$\frac{0.1}{E} = 0.00832$

$\therefore E = \frac{0.1}{0.00832} = 12.0$

560 **(b)**

100 g H_2O_2 sample solution contains x g of H_2O_2

3.4 g of solution contains $= \frac{x}{100} \times 3.4$

Weight of $H_2O_2 = \frac{3.4\,x}{100}$

Eq of $H_2O_2 = \frac{3.4\,x}{100} \times \frac{1}{17}$

mEq of $H_2O_2 = \frac{3.4\,x}{100 \times 17} \times 1000 = \frac{34x}{17} = 2x$

mEq of $KMnO_4 = x \times N$

$\therefore x \times N = 2x$

$N = 2$

561 **(c)**

$\frac{\text{Mass}}{\text{Volume}} = \text{Density}$

$\therefore$ Mass of spherical ball $= V \times d$

$= \frac{4}{3}\pi r^3 \times d$

$= \frac{4}{3} \times \frac{22}{7} \times (7)^3 \times 1.4$

$= 2012.27$ g

pure Fe content(56%) $= 2012.27 \times \frac{56}{100}$ g $= 1126.87$ g

Thus, moles of Fe $= 20.12$

562 **(b)**

Mass of one atom $= 6.64 \times 10^{-23}$g

Thus, atomic mass $= 6.64 \times 10^{-23} \times 6.02 \times 10^{23} = 40$

564 **(c)**

SO_3^{2-} is oxidized to SO_4^{2-} (change in O.N. = 2)

25 mL of 0.1 M SO_3^{2-} = 2.5 millimol

= 5.0 milliequivalents of SO_3^{2-}

= 5.0 milliequivalents of M^{3+}

50 mL of 0.1 M M^{3+} = 5 millimol (given)

Thus, decrease in O.N. of M^{3+} should be 1

So that 5 millimol = 5 milliequivalents

Thus, new O.N. of metal = 2

565 **(d)**

Percentage is irrespective of amount given

I. $CH_3COOH \equiv 2C$

60g 24 g

$$C_{\%} = \frac{24 \times 100}{60} = 40$$

II. $HCHO \equiv 1\,C$

30 g 12 g

$$C_{\%} = \frac{12 \times 100}{30} = 40$$

$NH_2CONH_2 \equiv 1\,C$

III. 60 g 12 C

$$C\% = \frac{12 \times 100}{60} = 20$$

IV. $C_6H_{12}O_6 \equiv 6\,C$

180 g 72 g

$$C_{\%} = \frac{72 \times 100}{180} = 40$$

Thus, I, II and IV

566 **(a)**

$CaCl_2 + NaCl = 10$ g

Let weight of $CaCl_2 = x$ g

$CaCl_2 \rightarrow CaCO_3 \rightarrow CaO$

1 mol 1 mol 1 mol

$\frac{x}{111}$ mol $\frac{x}{111}$ mol $\frac{x}{111}$ mol

Mol of CaO $= \frac{1.62}{56}$

$$\therefore \frac{x}{111} = \frac{1.62}{56}$$

$x = 3.21$ g

% of $CaCl_2 = \frac{3.21}{10} \times 100 = 32.1$ %

568 **(a)**

$2H_2O_2\,(l) \rightarrow 2H_2O\,(l) + O_2\,(g)$

24 L O_2 = 1 mol O_2

$$3\text{ L } O_2 = \frac{1}{8} \text{ mol } O_2 = \frac{1}{4} \text{mol } H_2O_2 \text{ in 100 mL}$$

$= 2.5$ mol $H_2O_2L^{-1}$

569 **(c)**

100 mL of 1 M BaF_2 = 100 millimoles

100 mL of 2 M H_2SO_4 = 200 millimoles

$BaF_2 + H_2SO_4 \rightarrow BaSO_4 + 2HF$

1 mol 1 mol 1 mol 2 mol

Initial 100 millimol 200 millimol

Final 0 100 millimol 100 millimol 200 milliomol

Thus, resulting solution has =
100 millimoles H_2SO_4 + 200 millimoles HF

= 200 millimoles of H^+ + 200 millimoles of H^+

= 400 millimoles H^+ in 200 mL solution

$$[H^+] = \frac{\frac{400}{1000} \text{ moles}}{\frac{200}{1000} \text{L}} = 2.0 \text{ M}$$

$[BaSO_4]$ = 100 millimoles $BaSO_4$ = 0.1 mol

Thus, (a), (b) true

570 **(b)**

200 g $CaCO_3$ = 56 g CaO

571 **(d)**

$1.06 \text{ g } Na_2CO_3 = \frac{1.06}{106} \text{ mol} = 0.01 \text{ mol in } 100 \text{ mL}$

$\therefore [Na_2CO_3] = \dfrac{0.01}{\frac{100}{1000 \text{ L}}} = 0.1 \text{ M}$

$= 0.2$ N (being diacid base)

10 mL of 0.2 N Na_2CO_3 = 2 milliequivalent

(a) 10×0.1 N HCl = 1 milliequivalent

(b) $10 \times 0.1 \text{ M}H_3PO_4 = 10 \times 0.3 \text{ N } H_3PO_4 =$ 3milliequivalent

(c) 20 mL of 0.1 M H_2SO_4 =
20 mL of 0.2 N H_2SO_4 = 4milliequivalent

(d) 20 mL of 0.1 M HCl = 20×0.1 N HCl = 2milliequivalent

572 **(a)**
$Mg_2C_3 + H_2O \rightarrow Mg(OH)_2 + CH_3C \equiv CH$

$(X)(Y)$

1mol propyne

8.4 g 1 mol

$\frac{8.4}{84} = 0.1$ mol 0.1 mol

575 **(b)**
Mw of metal chloride $(MCl_x) = M + x \times 35.5$
$= 2 \times VD = 2 \times 39.5$
$= 79.0$
$Mw = Ew \times x$
Valency of metal $= x$
Atomic weight of element $= Ew \times x$
$MCl_x = 3.82 \times x + x \times 35.5 = 79$
$x = \dfrac{79}{3.82 + 35.5} \approx 2$
Atomic weight $= Ew \times x = 3.82 \times 2 = 7.64$

576 **(a)**
$3MnO_4^{2-} + 2H_2O \rightarrow 2MnO_4^- + MnO_2 + 4OH^-$

$MnO_4^{2-} \rightarrow \frac{2}{3}MnO_4^- + \frac{1}{3}MnO_2$

577 **(c)**
$Cl_2 + H_2O \longrightarrow HCl + HClO$
(X)
$Mg + 2HCl \longrightarrow MgCl_2 + H_2$
(Y)

578 **(a)**
$P + HNO_3 \longrightarrow H_3PO_4 \xrightarrow[(NH_4Cl + MgCl_2)]{} MgNH_4(PO_4) \xrightarrow{\Delta} Mg_2P_2O_7$ (Magnesium pyrrophosphate)

Mw of $Mg_2P_2O_7 = (24 \times 21 + 31 \times 2 + 16 \times 7) = 222$

$\therefore$ % of P $= \dfrac{62}{222} \times \dfrac{\text{Weight of } Mg_2P_2O_7}{\text{Weight of compound}} \times 100$

$= \dfrac{62}{222} \times \dfrac{1.0}{0.5} \times 100 = 55.85\%$

580 **(a)**
In basic medium,$Cr_2O_7^{2-}$ changes to CrO_4^{2-}(no change in oxidation number)

581 **(a)**
$Fe_2(C_2O_4)_3 \equiv 3C_2O_4^{2-}$, Fe^{3+} is not affected
$2MnO_4^{\ominus} \equiv 5C_2O_4^{2-}, 3C_2O_4^{2-} \equiv 1.2\ MnO_4^{\ominus}$

582 **(a)**
$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

2 mol 1 mol

1 mol 0.5 mol $= 49 \text{ g } H_2SO_4$ (pure)

Thus, 70% H_2SO_4 required $= 49 \times \frac{100}{70} = 70$ g

583 **(c)**
$Al_2(SO_4)_3 + 3Na_2CO_3 \rightarrow 3Na_2SO_4 + Al_2(CO_3)_3$
Insoluble 1 : 3 soluble

584 **(c)**
Methyl red indicates first step ionization of H_3PO_4
$H_3PO_4 \rightleftharpoons H^{\oplus} + H_2PO_4^{\ominus}$

(n-factor=1) $\left(Ew = \frac{Mw}{1}\right)(N = M \times 1)$
$NaOH \equiv H_3PO_4$
$N_1 \times V_1 = N_2 \times V_2$
$0.1 \times 1 \times V_1 = 0.1 \times 1 \times 100$
$V_1 = 100$ mL

585 **(a)**
A molal solution is one that contains 1 mol of a solute in 1000 g or kg of the solvent.
Molality $(m) = \dfrac{\text{Moles of solute}}{\text{Mass of solvent in kg}}$

586 **(b)**

$BACl_2 \rightleftharpoons Ba^{2+} + 2Cl^-$

Millimoles of Cl^- $= 2 \times$millimoles of $BaCl_2$

$= 2 \times 100 \times 1$

$= 200$ millimoles

587 **(c)**

Number of electrons in $CO_2 = 6 + 16 = 22$

Electrons Electrons in neutral species = proton

X^+	22	23
Y^{2+}	22	24
Z^-	22	21

Thus, increasing order of proton is

$Z^- < X^+ < Y^{2+}$

588 **(a)**

H-atoms per gram

(a)$CH_4 \frac{4N_0}{16} = \frac{N_0}{4} = 0.25\ N_0$

(b)$CuSO_4 .5H_2O \quad \frac{10N_0}{249.5} = 0.04N_0$

(c)$H_2O_2 \frac{2N_0}{34} = 0.0588N_0$

(d)$H_2O \quad \frac{2N_0}{17} = 0.1176N_0$

589 **(a)**

H_3PO_2 is monobasic acid

$H_3PO_2 \rightleftharpoons H^+ + H_2PO_2^-$

590 **(b)**

Moles of Fe $= \frac{0.0056}{56} = 10^{-4}$ mol

1 mol of alum $=$ 2 mol of Fe

2 mol of Fe $=$ 1 mol of alum

10^{-4} mol of Fe $= \frac{1}{2} \times 10^{-4}$ mol

$= 0.5 \times 10^{-4}$ mol

591 **(a)**

In one molecule of CO_2, the number of electrons is $6 + 8 + 8 = 22$

592 **(d)**

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

6 mol 3 × 22.4 L

3×22.4 L $H_2(g)$ at STP are produced from 6 moles HCl

Hence, 11.2 L $H_2(g)$ at STP are produced from 1 mole HCl

593 **(a)**

$2CuSO_4 + 4KI \rightarrow Cu_2I_2 + I_2 + 2K_2SO_4$

$I_2 + 2Na_2S_2O_3 \rightarrow 2NaL + Na_2S_4O_6$

$2CuSO_4 = 2Na_2S_2O_3$

$CuSO_4 = Na_2S_2O_3$

100 mL of 1 M hypo $=$ 0.1 mol hypo

$=$ 0.1 mol pure $CuSO_4$

Hence, 100% pure

594 **(d)**

In acidic medium : mEq of $KMnO_4 \equiv$ meq of H_2O_2

$(0.01 \times 5) \times 100 \equiv N \times 100$ ...(i)

In basic medium: mEq of $KMnO_4 \equiv$ mEq of H_2O_2

$[MnO_4^{\ominus} \xrightarrow[\text{Strong}]{\overset{\ominus}{OH}} MnO_4^{2-}]$

$(0.01 \times 1) \times V = N \times 100$ ...(ii)

From equations (i) and (ii), we get

$(0.01 \times 1) \times V \equiv (0.01 \times 5) \times 100 \Rightarrow V = 500$ mL

595 **(a)**

Adding reactions,

$2KClO_3 \rightarrow 2KCl + 3O_2$

3 mol O_2 ($= 22.4 \times 3$ L at STP) are formed from $=$ 2 mol $KClO_3$

11.2 L O_2 are formed from $= \frac{2 \times 11.2}{3 \times 22.4}$ mol $KClO_3$

$= \frac{1}{3}$ if yield is 100%

$= \frac{2}{3}$ mol $KClO_3$ if yield is 50%

596 **(b)**

Oxygen = 67.67%

Metal = 32.33%

Thus, 67.67 g oxygen combine with = 32.33 g metal

Hence, 8 g oxygen combine with $= \frac{32.33 \times 8}{67.67} = 3.82$

597 **(a)**

A new Avogadro's number = X

Mass of one H − atom $= \frac{1}{x} = 1$ amu

598 **(d)**

Concentration have been taken in normality (g equivalent L^{-1})

Hence, 100 mL of 0.01 N H_2SO_4

= 100 mL of 0.01 N HCl

= 100 mL of 0.01 N H_3PO_4

599 **(a)**

$$\underset{(A)}{AgBr} + 2Na_2S_3O_2 \longrightarrow \underset{(B)}{Na_3[Ag(S_2O_3)_2]} + NaBr$$

$$2AgNO_3 + Na_2S_2O_3 \longrightarrow \underset{(C)}{Ag_2S_2O_3} + 2NaNO_3$$

$$Ag_2S_2O_3 \xrightarrow{H_2O} \underset{\text{black ppt}}{Ag_2S\downarrow}$$

600 **(b)**

$As_2O_3 \rightarrow 2AsO_4^{3-} + 4e^-$

$5e^- + MnO_4^{\ominus} \rightarrow Mn^{2+}$

$\left(Ew \text{ of } As_2O_3 = \frac{2 \times 75 + 3 \times 16}{4} = \frac{198}{4}\right)$

$As_2O_3 \equiv MnO_4^{\ominus}$

mEq ≡ mEq

$\left(\frac{0.46}{198/4}\right) \times 10^3 \equiv 25 \times N$

$N = 0.037$

$M_{KMnO_4} = \frac{N}{5} = \frac{0.037}{5} = 0.074$

601 **(a)**

Only $FeSO_4$ is oxidized

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

$MnO_4^- + 5e^- + BH^+ \rightarrow Mn^{2+} + 4H_2O$

100 mL of 2 M $MnO_4^- = 100 \times 10$ N MnO_4^-

$\equiv 1$ equiv. MnO_4^-

$\equiv 1$ equiv. Fe^{2+}

$\equiv 1$ mol Fe^{2+}

Thus, 1 mol $FeSO_4$ is in mixture of 3 mol of $FeSO_4$ and $Fe_2(SO_4)_3$

Mole fraction of $FeSO_4 = \frac{1}{3}$

602 **(a)**

Let 32 g of each be present

Moles of $O_2 = \frac{32}{32} = 1$

Moles of $CH_4 = \frac{32}{16} = 2$

Moles fraction of $O_2 = \frac{1}{1+2} = \frac{1}{3}$

Which is same as the fraction of pressure

603 **(c)**

$\begin{bmatrix} \text{Rutile} & & TiO_2 \\ \text{Cassiterite} & = & SnO_2 \end{bmatrix}$ Both are isomorphous

Mw of $TiO_2 = x + 32$

$(x + 32)$g of $TiO_2 \Rightarrow 32$ g of oxygen

100 g of $TiO_2 \Rightarrow \frac{32}{(32+x)} \times 100$

$\therefore \frac{32 \times 100}{(32 + x)} = 39.95$

$\therefore x = 48.10$

604 **(a,b,c)**

Moles of $O_2 = \frac{4.8}{32} = 0.15$ mol O_2

Moles of Fe required $= \frac{4 \text{ mol Fe}}{3 \text{ mol } O_2} \times 0.15 = 0.2$ mol

a. Given mol of Fe = 0.15. Hence Fe is the limiting reagent and no Fe will remain after the reaction

b. Weight of O_2required = (0.15 mol Fe)

$\left(\frac{3 \text{ mol } O_2}{4 \text{ mol Fe}}\right)\left(\frac{32 \text{ g } O_2}{\text{mol } O_2}\right)$

$= \frac{0.15 \times 3 \times 32}{4}$

$= 3.6 \text{ g } O_2$ required

Weight of O_2 in excess $= (4.8 \text{ g } O_2 \text{present}) - (3.6 \text{ g } O_2 \text{required})$

$= 1.2 \text{ g } O_2$ in excess

c. Weight of Fe_2O_3 produced $= (0.15 \text{ mol Fe}) \left(\frac{2 \text{ mol } Fe_2O_3}{4 \text{ mol Fe}}\right)\left(\frac{160 \text{ g } Fe_2O_3}{\text{mol } Fe_2O_3}\right)$

$= \frac{0.15 \times 2 \times 160}{4}$

$= 12.0 \text{ g } Fe_2O_3$ produced

d. O_2 is not the limiting reagent

605 **(a,b,c,d)**

a. Weight of 40% HCl $\equiv \frac{40}{100} \times 36.5 = 146$ g

2 mol HCl $(2 \times 36.5 = 73 \text{ g}) \equiv 1 \text{ mol } H_2SO_4$ (98g)

Weight of $H_2SO_4 = (146 \text{ g HCl}) \left(\frac{98 \text{ g } H_2SO_4}{73 \text{ g Cl}}\right)$

$= 196 \text{ g } H_2SO_4$

b. Weight of 80% H_2SO_4

$= \frac{196 \times 100}{80} = 245 \text{ g } H_2SO_4$

c. Mole of pure H_2SO_4

$= \frac{196}{98} = 2 \text{ mol } H_2SO_4$

d. Mole of 80% $H_2SO_4 = \frac{245}{98} = 2.5 \text{ mol } H_2SO_4$

607 **(b,c,d)**

Self explanatory

610 **(c,d)**

(c) $\Rightarrow$ isotopes

(d) $\Rightarrow$ C-12

611 **(b,c)**

Mass of 22400 mL of gas $= \frac{2 \times 22400}{448} = 100$

$\therefore$ Atomic mass $= \frac{100}{3} = 33.3$

Hence, mass of one atom $= \frac{33.3}{6.02 \times 10^{-23}} = 5.53 \times 10^{-23} g$

612 **(a,b,d)**

a. Volume of $CCl_4 = 80 \times \frac{80}{100} = 64$ mL

b. Volume of ligroin $= 80 \times \frac{16}{100} = 12.8$ mL

c. Wrong

d. Volume of amyl alcohol $= 80 \times \frac{4}{100} = 3.2$ mL

613 **(c,d)**

Use, $M = \frac{\% \text{ by weight} \times 10 \times d}{Mw_2}$

a. $M = \frac{5 \times 10 \times 1.07}{58.5} = 0.91 \text{ M } (Cl^{\ominus} = 0.91 \text{ M} = 0.91 \times 35.5 = 32.46 \text{ g})$

b. $M = \frac{5 \times 10 \times 1.06}{74.5} = 0.77 \text{ M } (Cl^{\ominus} = 0.77 \text{ M} = 0.77 \times 35.5 = 25.25 \text{ g})$

c. $M = \frac{W_2 \times 1000}{Mw_2 \times V_{sol} \text{ (in mL)}}$

$= \frac{58.5 \times 1000}{58.5 \times 1000} = 1 \text{ M}$

$(Cl^{\ominus} = 1 \text{ M} = 1 \times 35.5 = 35.5 \text{ g})$

d. $M = \frac{55.5 \times 1000}{111 \times 1000} = 0.5 \text{ M}$

$BaCl_2 \rightarrow Ba^{2+} + 2Cl^{\ominus}$

$\therefore Cl^{\ominus} = 2 \times \text{M} = 2 \times 0.5 = 1 \text{ M} = 1 \times 35.5$

$= 35.5$ g

615 **(a,c)**

	Silica	H_2O	Impurities
% in original clay] $\Rightarrow$	40	19	$100 - (40 + 19) = 41$
% after partial drying] $\Rightarrow a$		10	$100 - (a + 10) = 90 - a$

On heating, only water evaporates from clay, whereas silica and impurities are left as it is. Therefore, % ratio of silica and impurities remains unchanged, i.e.,

$\frac{40}{a} = \frac{41}{90 - a}, \therefore a = 44.4 \%$

% of impurities after partial drying $= (90 - a) = (90 - 44.4)$

$= 45.6 \%$

Mass of H_2O evaporated $= (19 - 10) = 9$ g

616 **(a,b,d)**

Self explanatory

618 **(b,d)**

Since$Cr_2O_7^{2-}$ is reduced to Cr^{3+}, so H_2O_2 must be oxidized to O_2

Oxidation number of Cr in $Cr_2O_7^{2-}$ is +6 and +3 in Cr^{3+}. So change in oxidation number=3. Hence statement (b)and (d)are wrong

621 **(a,b)**

The possible formula be $A_xB_yC_z$

As compound is neutral, so $x(+2) + y(+5) + z(-2) = 0$

$\Rightarrow \quad 2x + 5y - 2z = 0$

By hit and trial, we get: $x = 1, y = 2, z = 6$ and $x = 3, y = 2, z = 8$

So, compound is $A(BC_3)_2$or$A_3(BC_4)_2$

628 **(a,b,c,d)**

a. Moles of $O_2 = \frac{1.6}{32} = 0.05$

b. Molecules of $O_2 = 0.05 \times 6.023 \times 10^{23} = 3.011 \times 10^{22}$

c. Volume of O_2 at STP $= 0.05 \times 22.4 = 1.12$ L

d. V_{O2} at SATP $= 0.05 \times 24.4 = 1.22$ L

629 **(a,b,c,d)**

a. mEq of $Fe^{2+} = 1 \times 5 = 5$

mEq of $MnO_4^{\ominus} = 1 \times 5 = 5$

b. $Cr_2O_7^{2-} + 6Fe^{2+} + 14H^{\oplus} \longrightarrow 2Cr^{3+} + 7H_2O + 6Fe^{3+}$

1 mol $Cr_2O_7^{2-} \equiv$ 6 mol Fe^{2+}

c. Find n factor of Cu_2S

$Cu_2^{2+} \longrightarrow 2Cu^{2+} + 2e^-$

$S^{2-} \longrightarrow \overset{+4}{S}O_2 + 6e^-$

1 mol Cu_2S 8 mol e^-

$\Rightarrow$ mEq of $Cu_2S = 1 \times 8 = 8$

Now mEq of $MnO_4^{\ominus}$ (acidic) $= 5 \times 1.6 = 8$

d. $Cu^{2+} \rightarrow Cu^{2+}$ (not a redox reaction)

$S^{2-} \rightarrow SO_2 + 6e^-$

$\Rightarrow$ 1 mol CuS $\equiv$ 6 mol e^-

$\Rightarrow$ n-factor of Cus $= 6$

mEq of CuS $= 1 \times 6 = 6$

mEq of $Cr_2O_7^{2-} = 1 \times 6 = 6$

630 **(a,b,c)**

(Mw of $CS_2 = 76$, Mw of $Cl_2 = 71$, Mw of $CCl_4 = 154$ g mol^{-1})

Weight of Cl_2 needed

$= (1.0 g\ CS_2)\left(\frac{1\ mol\ CS_2}{76\ g\ CS_2}\right)\left(\frac{3\ mol\ CS_2}{mol\ CS_2}\right)\left(\frac{71\ g\ Cl_2}{mol\ Cl_2}\right)$

$= \frac{1\times3\times71}{76} = 2.8$ g Cl_2 needed

Since there is 2.0 g Cl_2 present, Cl_2 is the limiting quantity

a. Weight of Cs_2 used

$= (2.0\ g\ Cl_2)\left(\frac{1\ mol\ Cl_2}{71\ g\ Cl_2}\right)\left(\frac{1\ mol\ CS_2}{3\ mol\ Cl_2}\right)\left(\frac{76\ g\ CS_2}{mol\ CS_2}\right)$

$= \frac{2\times1\times1\times76}{71\times3} = 0.714$ g CS_2 used

b. Weight of CS_2 excess or formed

$=$ (1.0 g CS_2 present)$-$ (0.714 g used)

$= 0.286$ g CS_2 formed

c. Weight of CCl_4 formed

$= (2.0\ g\ Cl_2)\left(\frac{1\ mol\ Cl_2}{71\ g\ Cl_2}\right)\left(\frac{1\ mol\ CCl_4}{3\ mol\ Cl_2}\right)\left(\frac{154\ g\ CCl_4}{mol\ CCl_4}\right)$

$= \frac{2\times1\times154}{71\times3} = 1.45$ g CCl_4

d. Wrong

631 **(a,c)**

The substances which have same composition of atoms and similar crystal structures are called isomorphous to each other,

$\left.\begin{array}{l} Mg\ so_4.7H_2O(\text{epsom salt}) \\ Feso_4.7H_2o(\text{green vitriol}) \\ ZnSO_4.7H_2O(\text{white vitriol}) \end{array}\right\}$ All are isomorphous

634 **(c,d)**

a. $100 \times 0.1 = 10$ mmol $H^{\oplus}$/ 150 mL

b. $75 \times 0.1 = 7.5$ mmol $H^{\oplus}$/ 150 mL

c. $50 \times 0.1 \times 2$ (n factor) $= 10$ mmol/ 150 mL

d. $100 \times 0.1 = 10$ mmol/ 150 mL

635 **(d)**

a. Not applicable if the elements exists in different isotopes which may be involved in the formation of compound

b. At 1 atm, 25°C molor volume $= 22.7$ L

c. $Mw = 2 \times VD$,

d. Due to existence of isotopes

639 **(b,c)**

$n_{H_2} = \frac{64}{2} = 32$ mol

$n_{O_2} = \frac{64}{32} = 2$ mol

1 mol of O_2requires $= 2$ mol of H_2

2 mol of O_2 requires $= 4$ mol g H_2

Since H_2 is present in excess, therefore, O_2 is the limiting reagent

a. Wrong

b. So, O_2 is the limiting reagent

c. 2 mol of $O_2 = 4$ moles of $H_2O = 4 \times 18 = 72$ g H_2O moles of H_2 left $= 32 - 4 = 28$ mol $= 28 \times 2 = 56$ g H_2 Mixture contains $=$ (72 g $H_2O + 56$ g H_2)

d. Wrong

641 **(b,d)**

100 mL of 1 M H_2SO_4 + 100 mL (98%, $d = 0.1$) H_2SO_4

$\Rightarrow 100 \times 1\ M + 100\ mL \times \left(\frac{98 \times 10 \times 0.1}{98}\right)$

$\Rightarrow 100 \times 1\ M + 100 \times 1\ M$

$\therefore [H_2SO_4] = \frac{100 \times 1 + 100 \times 1}{200\ mL} = 1\ M$

$= 98$ g/1000 mL

Mass of $H_2SO_4 = \frac{98\ g \times 200\ mL}{1000\ mL} = 19.6$ g

Concentration of each component becomes half of the initial value

647 **(a,b,c)**

Leading zero or the zero placed to the left of the number are never significant. Thus, 0.052 has two significant figures.

648 **(a,b)**

a. $CaO + 3C \rightarrow CaC_2 + CO$
1 mole 3 mol (1 mol =64 g)

Moles of $CaC_2 = \frac{16}{64} = \frac{1}{4}$ mol

Weight of C $= 3 \times \frac{1}{4} \times 12 = 9.0$ g

b. Weight of $C_2H_4 = (32.0\text{ kg})\left(\frac{10^3\text{g}}{\text{kg}}\right)\left(\frac{1\text{ mol }CaC_2}{64\text{ g}}\right)$
$\left(\frac{1\text{ mol }C_2H_4}{\text{mol }CaC_2}\right)\left(\frac{28\text{ g }C_2H_4}{\text{mol }C_2H_4}\right)$
$= \frac{32 \times 10^3 \times 1 \times 1 \times 28}{64}$
$= 14 \times 10^3\text{g} = 14.0$ kg

c. $[Mw$ of $[Ag(NH_3)_2]Cl = 177.5, Mw$ of $AgCl = 143.5\text{ g mol}^{-1}]$
Weight of AgCl $= [17.75\text{ g Ag }(NH_3)_2\text{ Cl}]$
$\left(\frac{1\text{ mol Ag }(NH_3)_2Cl}{177.5\text{ g Ag }(NH_3)_2\text{ Cl}}\right)$
$\left(\frac{1\text{ mol AgCl}}{\text{mol Ag }(NH_3)_2\text{ Cl}}\right)\left(\frac{143.5\text{ g AgCl}}{\text{mol AgCl}}\right)$
$= \frac{17.75 \times 143.5}{177.5} = 14.35$ g
Hence, (c) is wrong

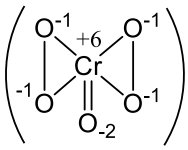
d. (Atomic weight of Zn = 65.4 g, Mw of $Na_2S_2O_4 = 174$)
Weight of pure $Na_2S_2O_4 = (65.4 \times 10^6\text{g Zn})$
$\left(\frac{1\text{ mol Zn}}{65.4\text{ g Zn}}\right)\left(\frac{1\text{ mol }Na_2S_2O_4}{\text{mol Zn}}\right)\left(\frac{174\text{ g }Na_2S_2O_4}{\text{mol }Na_2S_2O_4}\right)$
$= \frac{65.4 \times 10^6 \times 1 \times 1 \times 74}{65.4}$
$= 174 \times 10^6$g
= 174 metric ton
Weight of 50% pure $Na_2S_2O_4 = \frac{174 \times 100}{50}$
= 348 metric ton
Hence, (d) is wrong

649 **(a,d)**
Self explanatory

654 **(a,b)**
Acceptable value = 52.57°C
Maximum uncertainty = 52.5°C

655 **(b,c,d)**

Oxidation state of Cr in $CrO_5 = +6$



(Butterfly structure)

It changes to +3 in $Cr_2(SO_4)_3$
$3e^- + Cr^{6+} \rightarrow Cr^{3+}$ (reduction)(acts as oxidant)
Whereas O in CrO_5 changes to O_2
$2O^{\ominus} \rightarrow O_2 + 2e^-$ (oxidation) (acts of reductant)
So, CrO_5 acts as oxidant and reductant both and also it is intramolecular redox reaction since in CrO_5, both Cr and O undergoes oxidation and reduction reaction

657 **(a,c,d)**

$HSnO_2^{\ominus} \longrightarrow HSnO_3^{\ominus} + 2e^-] \times 3$
$x = 2$ $\quad x = 4$
$3e^- + CrO_4^{2-} \longrightarrow CrO_2^{\ominus}] \times 2$ [oxidation reducing agent]

$3HSnO_2^{\ominus} + 2CrO_4^{2-} \longrightarrow 3HSnO_3^{\ominus} + 2CrO_2^{\ominus}$
3 mmol 2 mmol 3 mmol 2 mmol

Given : $\begin{bmatrix} 500 \times \frac{2}{4} & 400 \times \frac{3}{5} \\ = 250\text{ mEq} & = 240\text{ mEq} \end{bmatrix}$

240 mEq of CrO_4^{2-} will react with 240 mEq of $HSnO_2^{\ominus}$

Therefore, CrO_4^{2-} is the limiting reagent.

i. $3HSnO_2^{\ominus} + 2CrO_4^{2-} \longrightarrow 3HSnO_3^{\ominus} + 2CrO_2^{\ominus}$

	$3HSnO_2^{\ominus}$	$2CrO_4^{2-}$	$3HSnO_3^{\ominus}$	$2CrO_2^{\ominus}$
Initial	⇒ 250 mEq	240 mEq	–	–
Reacted	⇒ 240 mEq	240 mEq	240 mEq	240 mEq
Left	⇒ 250 − 240 = 10 mEq	240 − 240 = 0	240 mEq	240 mEq

240 mEq or $\frac{240}{2} = 120$ mmol of $HSnO_2^{\ominus}$ will react to give mmol of $HSnO_3^{\ominus}$.

$\therefore [HSnO_3^{\ominus}] = \frac{\text{mmol}}{\text{Volume}} = \frac{120\text{ mmol}}{900\text{ mL}} = 0.13$ M
($V = 400 + 500 = 900$mL)

At the end of reaction, the concentration of $HSnO_3^{\ominus}$ = 0.13 M.

ii. 240 mEq or $\frac{240}{3} = 80$ mmol of CrO_4^{2-} will react to form 80 m mol. of $CrO_2^{\ominus}$.

$\therefore [CrO_2^{\ominus}] = \frac{\text{mmol}}{\text{Volume}} = \frac{80}{900} = 0.08$ M

So at the end of reaction, the concentration of $CrO_2^{\ominus}$ = 0.08 M.

661 **(b,c)**

b. $\Rightarrow$ 5 cm (not cms)

c. $\Rightarrow$ 5 joules (not Joules)

664 **(a,c)**

Fe_3O_4 $\quad\quad$ Fe_2O_3

$3x - 8 = 0, 3x = 8$ $\quad$ $2x - 6 = 0, 2x = 6$

$x = \frac{8}{3}$ $\quad\quad$ $x = 3$

$2\left(Fe^{\frac{8}{3}+}\right)_3 \longrightarrow 3(Fe^{3+})_2 + 2e^-$

$$\left[\begin{array}{c} x = \frac{8}{3} \times 2 \times 3 \\ x = 16 \\ n - \text{factor} = \frac{2}{2} = 1 \\ Ew_1 = \frac{M_1}{1} \end{array}\right] \left[\begin{array}{c} x = 18 \\ 3\text{ mol} = 2e^- \\ 1\text{ mol} = \frac{2}{3}e^- \\ n - \text{factor} = \frac{2}{3} \\ Ew_2 = \frac{M_2}{2/3} = \frac{3M_2}{2} \end{array}\right]$$

665 **(a,c,d)**

$Ca(NO_3)_2 + Na_2C_2O_4 \rightarrow CaC_2O_4 \downarrow + 2NaNO_3$

100×0.06 $\quad$ 50×0.06

$= 6$ mmol $\quad$ $= 3$ mmol $\quad$ 3 mmol $= 0.003$ mol

$Na_2C_2O_4$ is the limiting reagent

$\therefore$ 3 mmol $Na_2C_2O_4 \equiv$ 3 mmol $Ca(NO_3)_2$

$\equiv$ 3 mmol $CaC_2O_4 \equiv$ 6 mmol $NaNO_3$

mmol of $Ca(NO_3)_2$ left $= 6 - 3 = 3$ mmol $=$ 0.003 mol

$M_{Ca^{2+}}$ (left) $= \frac{3\text{ mmol}}{(100+50)\text{mL}} = \frac{3}{150} = 0.02$ M

Hence, option (b) is wrong

667 **(a,b,c)**

a. $CH_3NO_2 + 3Cl_2 \rightarrow CCl_3 \cdot NO_2 + 3HCl$

3 mol $\quad$ 1 mol

Volume of Cl_2 at STP $= 3 \times 0.54 \times 22.4 = 33.6$ L

b. $C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

1 mol $\quad$ 13/2 mol

Volume of O_2 at STP $= \frac{13}{2} \times 0.1 \times 22.4 = 14.56$ L

c. $CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$

(1 mol = 42 g) $\quad\quad$ 2 mol

Mol of $H_2 = \frac{2.1}{42} = \frac{1}{20}$

Volume of H_2 at STP $= 2 \times \frac{1}{20} \times 22.4 = 2.24$ L

d. $Ni + 4CO \rightarrow Ni\,(CO_4)$

1 mol $\quad$ 4 mol

$= 58.7$ g

Volume of CO at standard conditions $= 4 \times 24.4$ $= 97.6$ L

Hence, (d) is wrong

672 **(a,b,d)**

i. mEq $H_2O_2 \equiv$ mEq of $Cr_2O_7^{2-}$

$(n = 2)$ $\quad\quad$ $(n = 6)$

$20\text{ mL} \times N_1 = 40\text{ mL} \times N_2$ ...(i)

a. mEq of $Cr_2O_7^{2-} \equiv$ mEq of $C_2O_4^{2-}$

$(n = 2)$

$2.0 \times N_2 \equiv 5.0 \times 1.0 \times 2$

$N_2(Cr_2O_7^{2-}) = 5$ ...(ii)

Therefore, substituting the N_2 in equation (i)

$20\text{ mL} \times N_1 = 40\text{ mL} \times 5$

$N_1(H_2O_2) = 10$

$M_1(H_2O_2) = \frac{10}{2} = 5\,M$

b. 1 N $H_2O_2 = 5.6$ V

$\therefore$ 10 N $H_2O_2 = 56$ V

d. $N_1V_1 + N_2V_2 = N_3V_3$ ($V_3 = 10 + 40 = 50$ mL)

$10 \times 10 + 40 \times \frac{5}{8} \times 2 = N_3 \times 50$

N_3 (final) $H_2O_2 = 3$ N

The volume strength of $H_2O_2 = 5.6 \times 3 = 16.8$ V

673 **(a,b,c)**

$MnO_4^{\ominus} + 8H^{\oplus} + 5e^- \longrightarrow Mn^{2-} + 4H_2O$

(0.1 mol)

a. mEq of $MnO_4^{\ominus} = 0.1 \times 5 = 0.5$

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

(0.5 mol)

$\Rightarrow$ mEq of $Fe^{2+} = 0.5$

b. $FeC_2O_4 \rightarrow Fe^{3+} + 2CO_2 + 3e^-$

1. $\quad$ l)

$\Rightarrow$ mEq of $FeC_2O_4 = 0.166 \times 3 = 0.5$

c. $C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$

(0.25 mol)

$\Rightarrow$ mEq of $C_2O_4^{2-} = 0.25 \times 2 = 0.5$

d. $Cr_2O_7^{2-}$ being an oxidizing agent cannot be oxidized

674 **(a,b,c)**

According to Avogadro's hypopthesis,

32 g of oxygen contains 6.02×10^{23} molecules.

1 g molecule of a substance contains 6.02×10^{23} atoms

And 1 mole of any gas occupies 22.4 L or 22400 mL of

Volume at NTP or STP conditions.

675 **(b,c,d)**

n factor for $\overset{+1+3}{K}\overset{-2}{Al(OH)_2}\overset{-2}{CO_3}$ is the total positive or negative charge = 4

n factor for $H_2C_2O_4 = 2\ (2H^{\oplus}$ ions)

It is an acid-base titration

mEq of $KAl(OH)_2CO_3$ = mEq of $H_2C_2O_4$

$100\text{ mL} \times 0.2 \times 4 = \frac{1}{4} \times 2 \times V\text{ mL}$

$V_{H_2C_2O_4} = 160\text{ mL}$

$N_{KAl(OH)_2CO_3} = 0.2 \times 4 = 0.8\text{ N}$

676 **(a,b,c,d)**

i. In $\left(\overset{+1\times 3}{Cu_3}\ P^{-3}\right)$,

$Cu_3^{1+} \rightarrow 3Cu^{2+} + 3e^-$(oxidation)

$P^{3-} \rightarrow H_3PO_4 + 8e^-$(oxidation)

$x = -3 \quad 3 + x - 8 = 0$

$x = 5$

$4H_2O + Cu_3P \longrightarrow 3Cu^{2+} + H_3PO_4 + 11e^- + 5H^{\oplus}$ ..(i)

Reduction :

$Cr_2O_7^{2-} + 6e^- + 14H^{\oplus} \longrightarrow 2Cr^{3+} + 7H_2O$ ...(ii)

Multiply equation (i) by 6 and eqution (ii) by 11, net redox equation is:

$6Cu_3P + 11Cr_2O_7^{2-} + 124H^{\oplus} \longrightarrow 18Cu^{2+} + 6H_3PO_4 + 22Cr^{3+} + 53H_2O$

6 mol 11 mol

ii. Number of moles of H_2SO_4 used = $62H_2SO_4$

($= 124H^{\oplus} = 62SO_4^{2-}$)

Number of moles of $CuSO_4$ formed = $18\ CuSO_4 (= 18\ SO_4^{2-})$

Number of moles of $Cr_2(SO_4)_3$ formed= $11Cr_2(SO_4)_3 (= 33SO_4^{2-})$

Total number of SO_4^{2-} ion in reactant =62

Total number of SO_4^{2-} ion in product= $18 + 33 = 51$

Rest 11 mol of SO_4^{2-} ion in the reactant react with 11/ 2 mol of $K^{\oplus}$ion to give 11 mol of K_2SO_4

Net redox reaction is:

$6Cu_3P + 11K_2Cr_2O_7 + 62H_2SO_4$
$\rightarrow 18CuSO_4 + 6H_3PO_4 + 53H_2O + 11Cr_2(SO_4)_3 + 11K_2SO_4$

677 **(a,d)**

$\underset{(n=5)}{MnO_4^{\ominus}} \equiv \underset{(n=3)}{FeC_2O_4}$

$\left[\begin{array}{l} \overset{+2}{Fe} \longrightarrow \overset{+3}{Fe} + e^- \\ C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^- \end{array}\right] n = 3$

$V \times 0.1 \times 5 \equiv 100 \times 0.1 \times 3$

$V = 60\text{ mL}$

Case II: $\underset{(n=5)}{MnO_4^{\ominus}} \equiv \underset{(n=6)}{Fe_2(C_2O_4)_3}$ $\left[\begin{array}{l}\text{oxidation} \\ \text{reducing agent}\end{array}\right]$

$\left[\begin{array}{l} Fe^{3+} \text{ does not oxidise} \\ 3C_2O_4^{2-} \rightarrow 6CO_2 + 6e^- \end{array}\right]$

$V \times 0.1 \times 5 \equiv 100 \times 0.1 \times 6$

$V = 120\text{ mL}$

678 **(a,b,d)**

All three are self indicator s i.e., they do not need any indicator for titration

$K_2S_2O_3 = \frac{0.19}{190} = 10^{-3}\text{ mol} = 1\text{ mmol}$

i. mEq of $S_2O_3^{2-}(n = 8)$ = mEq of $Cr_2O_7^{2-}(n = 6)$

$1 \times 8 = 0.1 \times 6 \times V$

$\therefore V_{Cr_2O_7^{2-}} = \frac{80}{6}\text{ mL}$

ii. mEq of $S_2O_3^{2-}(n = 1)$ = mEq of$I_2(n = 2)$

$1 \times 1 = 0.1 \times 2 \times V$

$\therefore V_{I_2} = 5\text{ mL}$

iii. mEq of $S_2O_3^{2-}$ $(n = 8)$ = mEq of $MnO_4^{\ominus}(n = 3)$

$1 \times 8 = 0.1 \times 3 \times V$

$\therefore V_{MnO_4^{\ominus}} = \frac{80}{3}\text{ mL}$

Also,

Weight of $K_2Cr_2O_7 = 8 \times \frac{294}{6} \times 10^{-3} = 0.392\text{ g}$

Weight of $I_2 = 1 \times \frac{254}{2} \times 10^{-3} = 0.127\text{ g}$

Weight of $KMnO_4 = 8 \times \frac{158}{3} \times 10^{-3} = 1.264\text{ g}$

679 **(a,b)**

Self explanatory

683 **(a,c)**

$Na_2C_2O_4$and$NaHC_2O_4$ both reacts with H_2O_2 as reducing agent only. (n factor for both=2)

With H_2O_2:

Eq of H_2O_2 =Eq of $Na_2C_2O_4$ +Eq of $NaHC_2O_4$

2 ×moles of $H_2O_2 = n_1 \times 2 + n_2 \times 2$

Moles of $H_2O_2 = \frac{2(n_1+n_2)}{2} = (n_1 + n_2)$

With KOH: Only $NaHC_2O_4$ reacts with KOH as acid base titration, n factor=1 (one $H^{\oplus}$ ion)

Eq of KOH $=$ Eqof $NaHCO_3$

$1 \times$ moles of KOH $= n_2 \times 1$

Moles of KOH$= n_2$

$\therefore$ Moles of H_2O_2 and KOH are:$n_1 + n_2$) and n_2

n-factor of $NaHC_2O_4$ with KOH and $H_2O_2 = 1$ and 2

n-factor of $Na_2C_2O_4$ with H_2O_2 and KOH=2 and 2

684 **(b,c)**

$[2e^- + Br_2 \longrightarrow 2Br^{\ominus}] \times 5$

$Br_2 \longrightarrow 2BrO_3^{\ominus} + 10e^-$

$6\,Br_2 \longrightarrow 5\,Br^{\ominus} + 2BrO_3^{\ominus}$

Ew of $Br_2 = \dfrac{M}{2} + \dfrac{M}{10} = \dfrac{10M}{6} = \dfrac{5M}{3}$

mmoles of $Br_2 = 18 \times 1 = 18$

So mmoles of $BrO_3^{\ominus} = \dfrac{18}{6} \times 2 = 6$

mEq of $As^{+3} \longrightarrow$ mEq. of $BrO_3^{\ominus}$
$(n = 2)$ $(n = 6)$

$6e^- + BrO_3^{\ominus} \longrightarrow Br^{\ominus}$

mEq of $As^{3+} \equiv$ mEq of $BrO_3^{\ominus}$

$45 \times M \times 2(n \text{ factor}) \equiv 6 \times 6$

$\therefore M_{As^{3+}} = \dfrac{36}{90} = 0.4\,M$

686 **(a,b,c)**

$1\text{ atm} = 760\text{ torr} = 760\text{ mm Hg} = 76\text{ cm Hg}$
$= 1.013 \times 10^5\text{Pa.}$

$1\text{ eV} = 1.6021 \times 10^{-12}\text{erg} = 1.6021 \times 10^{-19}\text{ J}$
$= 3.827 \times 10^{-20}\text{cal} = 23.06\text{ kcal mol}^{-1}$

$1\text{ u} = 1.6605 \times 10^{-24}\text{g} = 1.6605 \times 10^{-27}\text{ kg}$
$= 1.492 \times 10^{-3}\text{erg} = 1.492 \times 10^{-10}\text{J}$
$= 9.310 \times 10^{8}\text{eV or } 931.48\text{ MeV}$

$1\text{ dyne} = 10^{-5}\text{N}$

687 **(a,b)**

$(10e^- + 2MnO_4^{\ominus} \longrightarrow 2Mn^{2+})\ (n = 10)$

a. $Fe^{2+} \rightarrow Fe^{3+} + e^-(n = 1)$

mEq of $Ca(MnO_4)_2 = 100 \times \frac{1}{10} \times 10 = 100$

mEq of $FeSO_4 = 100 \times 1 = 100$

b. mEq of $FeC_2O_4 (n = 3), \begin{bmatrix} Fe^{+2} \rightarrow Fe^{+3} + e^- \\ C_2O_4^{2-} \rightarrow 2CO_2 + 2e^- \end{bmatrix}$

$= \dfrac{100}{3} \times 3 \times 1$

$= 100 =$ mEq of $Ba(MnO_4)_2$

c. mEq of$K_2Cr_2O_7 (n = 6) = 25 \times 1 \times 6 = 150$

d. mEq of $C_2O_4^{2-} (n = 2) = 75 \times 2 \times 1 = 150$

688 **(a,b,c,d)**

All correct

689 **(a,b,c,d)**

Moles of Li $= \frac{21}{7} = 3.0$ mol

Moles of $O_2 = \frac{32}{32} = 3.0$ mol

a. Since (3.0 mol Li) $\left(\frac{1\text{ mol }O_2}{4\text{ mol Li}}\right) = \frac{3}{4} = 0.75$ mol of O_2 is required, therefore $(1.0 - 0.75) = 0.25$ mol of O_2 is in excess. Hence, Li is the limiting reagent

b. Weight of Li_2O formed

$= (3.0\text{ mol Li})\left(\dfrac{1\text{ mol }Li_2O}{2\text{ mol Li}}\right)\left(\dfrac{30\text{g }Li_2O}{\text{mol }Li_2O}\right)$

$= \dfrac{3 \times 1 \times 30}{2} = 45.0\text{ g }Li_2O$

c. Moles of K $= \frac{3.9}{39} = 0.1$ mol

Moles of $Cl_2 = \frac{4.26}{71} = 0.06$ mol

Since $\left(\frac{0.1}{2}\right) = 0.05$ mol of Cl_2 is required.

Therefore, $(0.06 - 0.05) =$ 0.01 mol of Cl_2 is in excess. Hence K is the limiting reagent

d. Weight of KCl formed

$= (0.1\text{ mol K})\left(\dfrac{1\text{ mol KCl}}{\text{mol K}}\right)\left(\dfrac{74.5\text{ g KCl}}{\text{mol KCl}}\right)$

$= 0.1 \times 1 \times 74.5 = 7.45$ g of KCl

690 **(a,b,d)**

a. Weight of $CaCO_3 = (0.22\text{ g }CO_2)$
$\left(\dfrac{1\text{ mol }CO_2}{44\text{ g }CO_2}\right)\left(\dfrac{1\text{ mol }CaCO_3}{\text{mol }CO_2}\right)$
$\left(\dfrac{100\text{ g }CaCO_3}{\text{mol }CaCO_3}\right)$

$= \dfrac{0.22 \times 100}{44} = 0.5\text{ g }CaCO_3$

b. Moles of $CaCO_3 =$ moles of Ca

$= \left(\dfrac{0.22}{44}\right) = 0.005$ mol

Weight of Ca $= 0.005 \times 40 = 0.2$ g Ca

d. % of Ca $= \frac{0.2}{1.0} \times 100 = 20\%$ Ca

Hence, (c) is wrong

692 **(a,b,c)**

I. In $\left(\overset{+5\times2}{As_2}\ \overset{-2\times5}{S_5}\right)$,

$$\left[\begin{array}{ccc} \overset{+5}{As_2} & \xrightarrow[\text{redox}]{\text{no}} & 2AsO_4^{3-} \\ 2x = 10 & & 2x - 16 = -6 \\ & & 2x = 10 \end{array}\right] \boxed{n = 0} \ldots\text{(i)}$$

$[S_5^{-2} \quad \rightarrow \quad 5SO_4^{2-} + 40e^-]$ ...(ii)

$5x = -10 \quad 5x - 40 = -10$

$5x = 30$

Add equations (i) and (ii), we get

$As_2S_5 \rightarrow 2AsO_4^{3-} + 5SO_4^{2-} + 40e^- (n = 40)$

$Ew = \dfrac{M}{40}$

II. Reduction:

$$\left[\begin{array}{ccc} 3e^- + NO_3^{\ominus} & \longrightarrow & NO_2 \\ x - 6 = -1 & & x - 4 = 2 \\ x = 5 & & x = 2 \end{array}\right] n = 3$$

693 **(c,d)**

Equal number of molecules are present when moles are same. For the same mass the molecular weight has to be same

Hence Mw of $N_2 = Mw$ of $CO = 28$ g

Mw of $N_2O = Mw$ of $CO_2 = 44$ g

694 **(a,c)**

mEq of H_2S = mEq of S^{2-} = mEq of $AgNO_3$

$\left[\dfrac{W}{34/2} \times 1000\right] = 300 \times 0.1 \ (n \text{ factor} = 1) = 30$

$\therefore \ W_{H_2S} = \dfrac{30 \times 17}{1000} = 0.51 \text{ g L}^{-1}$

ppm of $H_2S = \dfrac{0.51 \times 10^6}{10^3} = 510$

695 **(a,c)**

a. mmoles of $HClO_3 = 100 \times 3 = 300$ mmol

$= \frac{300}{2}$ mmol of Ba $(ClO_3)_2$

$= 150$ mmol $= 1.5$ mol

b. Wrong

c. Weight of Ba $(ClO_3)_2 = 150 \times 10^{-3} \times 304 =$ 45.6 g

d. Wrong

696 **(b,c,d)**

pOH = 1, strong basic medium

$\Rightarrow MnO_4^{\ominus} \longrightarrow MnO_4^{2-} (n\text{-factor} = 1)$

$2\overset{\ominus}{O}H + H_2O_2 \longrightarrow O_2 + 2H_2O + 2e^-$

mEq of H_2O_2 = mEq of $MnO_4^{\ominus}$

$\dfrac{x}{34/2} \times 1000 = 100 \times \left(\dfrac{1}{5} \times 1\right)$

$x = 0.34$ g

698 **(a,b,c,d)**

All correct

702 **(a,d)**

Mw of $CaCO_3 + 40 + 12 + 3 \times 16 = 100 \text{ g mol}^{-1}$

Mw of $Na_2CO_3 = 46 + 60 = 106 \text{ g mol}^{-1}$

i. $CaSO_4 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$...(i)

x mol $\quad x$ mol $\quad - \quad -$

$- \quad - \quad x$ mol $\quad -$

ii. $CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaCl$ ...(ii)

y mol $\quad y$ mol $\quad - \quad -$

$- \quad - \quad y$ mol

iii. 100 ppm$CaCO_3 \equiv 100$ g $CaCO_3$in10^6 mL

$= \dfrac{100}{100}$ mol in 10^6 mL

Moles of Na_2CO_3, required= Moles of $CaCO_3$

$= \dfrac{100}{100}$ mol in 10^6 mL

$\equiv 1$ mol in10^6 mL

$\equiv \dfrac{1}{10^6} \times 10 \times 10^3$ mL (10 L)

$= 1 \times 10^{-2}$ mol in 10 L

Therefore, moles of Na_2CO_3 required

$= 1 \times 10^{-2}$ mol in 10 L

$= 1 \times 10^{-2} \times 106$ g/10 L

$= 1.06$ g

Similarly, for 100 ppm $MgCO_3$: ($Mw$of $MgCO_3 = 24 + 60 = 84 \text{ g mol}^{-1}$)

iv. $MgSO_4 + Na_2CO_3 \rightarrow MgCO_3 + Na_2SO_4$ ...(i)

x mol $\quad x$ mol $\quad - \quad -$

$- \quad - \quad x$ moles

v. $MgCl_2 + Na_2CO_3 \rightarrow MgCO_3 + 2NaCl$ ...(ii)

y mol $\quad y$ mol $\quad - \quad -$

$- \quad - \quad y$ mol

vi. 420 ppm $MgCO_3 \equiv 420$ g $MgCO_3$in10^6 mL

$\equiv \dfrac{420}{84} = 5$ mol in 10^6 mL

Moles of Na_2CO_3 requied

$\equiv$ Moles of $MgCO_3$

$\equiv 5$ mol in10^6 mL

$\equiv \dfrac{5}{10^6} \times 10 \times 10^3$ mL (10 L)

$\equiv 5 \times 10^{-2}$ mol in 10 L

Moles of Na_2CO_3 required $\equiv 5 \times 10^{-2}$ mol $(10 \text{ L})^{-1}$

$\equiv 5 \times 10^{-2} \times 106\ g(10\ L)^{-1}$
$= 5.3\ g/10\ L$

704 **(a,b,c,d)**

a. $1.7\% = 1\ N$
$6.8\% = 4\ N$

b. $M = \frac{4N}{2} = 2\ M$

c. $1.7\% = 5.6$ 'V'
$6.8\% = 22.4$ 'V'

d. Volume strength$= 5.6 \times N = 5.6 \times 2 \times M = 11.2 \times M$

706 **(a,d)**

$1\ mol\ Cl_2 \equiv 2\ mol\ KOH \equiv 1\ mol\ KClO \equiv \frac{1}{3}\ mol\ KClO_3 \equiv \frac{1}{4}\ mol\ KClO_4$

Moles of $KClO_4 = \frac{277}{138.5} = 2$

$\begin{bmatrix} \text{Moles of } Cl_2 = 2 \times 4 = 8 \\ \text{mass of } Cl_2 = 8 \times 71 = 568\ g \end{bmatrix}$

Moles of $KOH = 2 \times 8 = 16$

$V_{KOH} = \frac{16}{1.5} = 10.67\ L$

709 **(a,b,c,d)**

(Mw of $Na_2CO_3 = 106$, Mw of $HCl = 36.5$, Mw of $NaCl = 58.5$)

Moles of $Na_2CO_3 = \frac{106}{106} = 1.0\ mol$

Moles of $HCl = \frac{109.5}{36.5} = 3.0\ mol$

a. Since for 1 mol of Na_2CO_3, 2 mol of HCl is required. So, HCl is in excess $(3 - 2) = 1.0$ mol
Therefore, Na_2CO_3 is the limiting quantity

b. Weight of NaCl formed

$= (1.0\ mol\ Na_2CO_3)\left(\frac{2\ mol\ NaCl}{mol\ Na_2CO_3}\right)\left(\frac{58.5\ g\ NaCl}{mol\ NaCl}\right)$

$= 1 \times 2 \times 58.5 = 117.0\ g\ NaCl$

c. 1 mol of $Na_2CO_3 = 1$ mol of $CO_2 = 22.7$ L at 1 bar, 273 K

d. 1 mol of $Na_2CO_3 = 1$ mol of $CO_2 = 24.7$ L at 1 bar, 298 K

710 **(a,c)**

Mw of $CaCO_3 = 100$, Mw of $Na_2CO_3 = 106$
Mw of $HNO_3 = 63\ g\ mol^{-1}$

$Na_2CO_3 + CaCl_3 \rightarrow CaCO_3 + 2NaCl$

a. moles of $CaCO_3 = \frac{10}{100} = 0.1\ mol$

moles of Na_2CO_3 = moles of $CaCO_3 \equiv 2 \times$ moles of NaCl

Weight of $Na_2CO_3 = 0.1 \times 106 = 10.6\ g$

% purity $Na_2CO_3 = \frac{10.6}{21.2} \times 100 = 50\%$

b. Wrong

c. Correct

d. moles of $NaCl = 2 \times 0.1 = 0.2$ mol

711 **(a,b,c,d)**

a. Valency factor $= 6 \begin{bmatrix} +2\times3 & -3\times2 \\ Ca_3 & (PO_4)_2 \end{bmatrix}$

b. Valency factor $= 3 \begin{bmatrix} +1\times3 & -3 \\ Na_3 & (PO_4) \end{bmatrix}$

c. Valency factor $= 2 \begin{bmatrix} +1\times2 & -2 \\ K_2 & SO_4 \end{bmatrix}$

d. valency factor = 8

$\begin{bmatrix} +1\times2 & -2 & +3\times2 & -2\times3 \\ K_2 & SO_4 & Al_2 & (SO_4)_3 \end{bmatrix}$

712 **(a,b)**

$[4\overset{\ominus}{O}H + 2H_2O + X \longrightarrow XO_2^{2-} + \cancel{2e^-} + 4H_2O] \times 4$

$x = 0 \qquad x - 4 = -2$
$x = 2$

$9H_2O + \cancel{8e^-} + NO_3 \longrightarrow NH_3 + 3H_2O + 9\overset{\oplus}{O}H$

$x - 6 = -1 \qquad x + 3 = 0$
$x = 5 \qquad x = -3$

$4X + 7\overset{\oplus}{O}H + NO_3^{\ominus} \longrightarrow 4XO_2^{2-} + NH_3\uparrow + 2H_2O$

or

$4X + 7KOH + KNO_3 \rightarrow 4K_2XO_2 + NH_3 \uparrow + 2H_2O$

mEq of H_2SO_4 (total)$= 200 \times 0.05 \times 2$ (n factor) $= 20$

mEq of $NaOH = 10 \times 1.5 \times 1$ (n factor)=15

mEq of reacted H_2SO_4 = mEq of NH_3
$20 - 15 = 5 \qquad 5$
$=$ mmoles of NH_3 (n factor=1)
5

Using mol concept: 1 mmol of $NH_3 = 4$ mmol of X
5 mmol of $NH_3 = 20$ mmol of X

mmol of $X = \frac{2.0}{Aw} \times 10^3 = 20$

Aw of $X = 100$

Since n factor for $X = 2$

$\therefore Ew$ of $X = \frac{100}{2} = 50$

713 **(a,b,c)**

Three

714 **(b,c,d)**

$n_{P_4} = \frac{1.24}{31 \times 4} = 0.01\ mol, n_{O_2} = \frac{8}{32} = 0.25$ moles

In reaction (i), moles of O_2 required

$= (0.01\ mol\ P_4)\left(\frac{5\ mol\ O_2}{mol\ P_4}\right)$

$= 0.01 \times 5 = 0.05$ mol

Since there is more O_2 present than required

a. Therefore, P_4 is the limiting quantity

b. Wrong

c. [Mw $P_4O_{10} = 284$]

0.01 mol of P_4 produces = 0.01 mol of P_4O_{10}

$= (0.01 \text{ mol } P_4)\left(\dfrac{1 \text{ mol } P_4O_{10}}{\text{mol } P_4O_{10}}\right)\left(\dfrac{284 \text{ g } P_4O_{10}}{\text{mol } P_4O_{10}}\right)$

$= 0.01 \times 284 = 2.84$ g

Hence, (c) is wrong

d. [Mw $P_4O_6 = 220$]

weight of P_4O_6 produced

$= (0.01 \text{ mol } P_4)\left(\dfrac{1 \text{ mol } P_4O_6}{\text{mol } P_4O_6}\right)\left(\dfrac{220 \text{ g } P_4O_6}{\text{mol } P_4O_6}\right)$

$= 0.01 \times 220 = 2.2$ g

Hence, (d) is wrong

718 **(a,d)**

a. Number of O_2 atoms $= \frac{16}{32} \times 2 \times N_A = 1 \times N_A$

b. Number of O_3 atoms $= \frac{16}{48} \times 3 \times N_A = 1 \times N_A$

c. i. Number of O_2 molecules $= \frac{16}{32} \times N_A = \frac{1}{2} N_A$

ii. Number of O_2 melecules $= \frac{16}{48} \times N_A = \frac{1}{3} N_A$

(d) is correct

719 **(b)**

i. $KClO_3(s) \xrightarrow{\Delta} KCl(s) + \frac{3}{2} O_2(g)$

Intial	$\frac{1.225}{1.225} \times 10^3$ = 10 mmol	—	—
Final	—	10 mmol	$10 \times \frac{3}{2}$ = 15 mmol (yield = 100%)
Final	—	6 mmol	$\frac{15 \times 60}{100}$ = 9 mmol (yield = 60%)

ii. $H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(l)$

[9 mmol $\frac{9}{2}$ mmol] (yield 100%)

18 mmol 9 mmol] (yield 50%)

iii. $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

$\begin{bmatrix} \text{18 mmol (yield = 100\%)} \\ \text{36 mmol (yield = 50\%)} \end{bmatrix}$ (18 mmol)

mmoles of H_2SO_4 required=36

$\therefore 0.2 \text{ M} \times V_{\text{mL}} = 36$

$V_{H_2SO_4} = 180$ mL

722 **(b,c,d)**

Self explanatory

724 **(a,c)**

Moles of Al $= \frac{108}{27} = 4.0$ mol

Moles of MnO $= \frac{213}{71} = 3.0$ mol

a. Since 2 mol of Al requires 3 mol of MnO, therefore Al is in excess

b. Wrong

c. Weight of Al required

$= (3.0 \text{ mol MnO})\left(\dfrac{2 \text{ mol Al}}{3 \text{ mol MnO}}\right)\left(\dfrac{27\text{g Al}}{\text{mol Al}}\right)$

$= \dfrac{3 \times 2 \times 27}{3} = 54.0$ g of Al

d. Weight of Al of excess = (108 − 54) = 54.0 g

727 **(c,d)**

(Let 'a' g of X and Y taken)

$2X + 3Y \rightarrow X_2Y_3$

Initial moles] ⇒ $\frac{a}{36}$ $\frac{a}{24}$

Final moles] ⇒ — — $\frac{a}{72}$

Since both X and Y are completely consumed, there is no liming reagent

Moles of $X_2Y_3 = \frac{a}{72}$

(Mw of $X_2Y_3 = 2 \times 36 + 24 \times 3 = 144$)

Weight of $X_2Y_3 = \frac{a}{72} \times 144 = 2a = 2 \times$ Weight of X

729 **(a,b,c)**

$KNO_3 + HCl + H_2SO_4$

$\begin{pmatrix} 100 \times 0.1 \\ = 10 \text{ mmol} \end{pmatrix} \begin{pmatrix} 400 \times 0.2 \\ = 80 \text{ mmol} \end{pmatrix} \begin{pmatrix} 500 \times 0.3 \\ = 150 \text{ mmol} \end{pmatrix}$

Total volume = 100 + 400 + 500 = 1000 mL

$M_{K^{\oplus}} = \dfrac{10}{1000} = 0.01$ M

$M_{SO_4^{-2}} = \dfrac{150}{1000} = 0.15$ M

$M_{H^{\oplus}} = \dfrac{80 + 2 \times 150}{1000} = 0.38$ M

$M_{NO_3^{\ominus}} = \dfrac{10}{1000} = 0.01$ M

$M_{Cl^{\ominus}} = \dfrac{80}{1000} = 0.08$ M

731 **(a,b)**

Mol of $Cu^{2+} = 1.0 \text{ L} \times 0.1 \text{ M} = 0.1$ mol Cu^{2+} = 0.1×2 mol $H^{\oplus}$

a. Weight of CuS = $0.1 \times 95.5 = 9.55$ g

b. Concentration of $H^{\oplus} = \frac{0.2 \text{ mol}}{1.0 \text{ L}} = 0.2$ M

(c) and (d) are wrong

732 **(b,c,d)**

a. Moles of Bi $= \frac{2.09}{209} = 0.01$ mol

Weight of bismuth nitrate = (0.01 mol Bi)

$\left(\frac{1\text{ mol Bi}(NO_3)_3\cdot 5H_2O}{\text{mol Bi}}\right)$
$\left(\frac{485\text{ g Bi}(NO_3)_3\cdot 5H_2O}{\text{mol Bi}(NO_3)_3\cdot 5H_2O}\right)$
$= 0.01 \times 484 = 4.85$ g

Hence, (a) is wrong

b. Weight of $HNO_3 = (0.01\text{ mol Bi})$
$\left(\frac{4\text{ mol }HNO_3}{\text{mol Bi}}\right)\left(\frac{63\text{ g }HNO_3}{\text{mol }HNO_3}\right)$
$\left(\frac{100\text{ g solution}}{63\text{ g }HNO_3}\right)$
$= \frac{0.01\times 4\times 63\times 100}{63} = 4\text{ g }HNO_3$

c. Molar volume of gas at STP (1 bar, 273 K)= 22.7 L

∴ Volume of NO gas = $0.01 \times 22.7 = 0.227$ L

d. Molar volume of gas at SATP (1 bar, 298 K) = 24.7 L

∴ Volume of NO gas = $0.01 \times 24.7 = 0.247$ L

733 **(a,b,c,d)**

mmoles of HCl ⇒ $20 \times 6 = 120$ ⇒ 120 mmol $H^{\oplus}$ + 120 mmol $Cl^{\ominus}$

mmoles of Ba $(OH)_2$ ⇒ $50 \times 2 = 100$ ⇒ 100 mmol Ba^{2+} + 200 mmol OH

$H^{\oplus} + \overset{\ominus}{O}H \longrightarrow H_2O$

Total volume = 20 + 50 + 30 = 100 mL

a. ∴ $[\overset{\ominus}{O}H] = \frac{(200-120)\text{mmol}}{100\text{ mL}} = 0.8$ M

b. $[Cl^{\ominus}] = \frac{120\text{ mmol}}{100\text{ mL}} = 1.2$ M

c. $[Ba^{2+}] = \frac{100\text{ mmol}}{100\text{ mL}} = 1.0$ M

d. mmoles of $\overset{\ominus}{O}H$ left = 200 − 120 = 80 mmol

735 **(c,d)**

(a) and (b) are compound. (c) and (d) are mixture

736 **(a,b,c,d)**

a. Weight g Al^{3+} in 100 mL of solution = 100 × 27 = 2700 mg = 2.7 g

2 mol Al^{3+} (27 × 2 g) ≡ 1 mol of $Al_2(SO_4)_3\cdot 18H_2O$ ≡ 666 g

2.7 g of $Al^{3+} = \frac{666\times 2.7}{54} = 33.3$ g

b. moles of $Cr^{3+} = \frac{26}{52} = 0.5$ mol

Weight of $CrCl_3\cdot 6H_2O = 0.5$ mol $Cr^{3+} \times 266.5$ g = 133.25 g

c. Weight of $NH_4Cl = (100\text{ mL})\left(\frac{80\text{ mg}}{\text{mL}}\right)\left(\frac{10^{-3}\text{ g}}{\text{mg}}\right) =$ 8.0 g

d. Weight of $NH_3 = \left(\frac{0.8\text{ g}}{\text{mL solution}}\right)\left(\frac{20\text{ g }NH_3}{100\text{ g solution}}\right)$
$= 0.16\text{ g mL}^{-1}$

737 **(a,c)**

i. Cu^{2+} does not react with $MnO_4^{\ominus}$ ion.

Only $C_2O_4^{2-}$ reacts with $MnO_4^{\ominus}$ ion.

$MnO_4^{\ominus} = C_2O_4^{2-}$
$(n = 5)\quad (n = 2)$

mEq ≡ mEq

$20 \times \frac{M}{4} \times 5 \equiv$ mEq

∴ mEq of $C_2O_4^{2-} = 25$

mmoles of $C_2O_4^{2-} = \frac{25}{2} = 12.5$

ii $Cu^{2+} = KI \equiv I_2 = S_2O_3^{2-}$ (hypo)

mEq ≡ mEq ≡ mEq ≡ mEq

$(n = 1)(n = 1)$

$(2Cu^{2+} + 2I^{\ominus} \longrightarrow Cu_2I_2)(2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2e^-)$

$(e + Cu^{2+} \rightarrow Cu^{1+})\left(n = \frac{2}{2} = 1\right)$

mEq of $S_2O_3^{2-} \equiv 25 \times \frac{M}{10} \times 1$
$= 2.5 =$ mEq of Cu^{2+}

mEq of $Cu^{2+} = 2.5$

mmoles of $Cu^{2+} = \frac{2.5}{1} = 2.5$

Difference in mmoles of $C_2O_4^{2-}$ and Cu^{2+} = 12.5 − 2.5
= 10

Ew of $Cu^{2+} = \frac{\text{Atomic weight of }Cu^{+2}}{1(n\text{ factor} = 1)}$

Ew of KI $= \frac{M}{n\text{ factor}} = \frac{M}{1} = M\left(\begin{matrix}2I^{\ominus} \longrightarrow I_2 + 2e^- \\ n = \frac{2}{2} = 1\end{matrix}\right)$

738 **(b,d)**

Since 2 mol of $HCO_3^{\ominus}$ is present. So there should be one mole each of $CaCO_3$, $CaCl_2$ and $MgCl_2$ to have equal hardness

∴ Mw of $HCO_3^{\ominus} = 61$,

ppm of $HCO_3^{\ominus} = 61 \times 2 = 122$ g in 10^6 mL H_2O

[Mw of $CaCO_3 = 100$, Mw of $CaCl_2 = 111$, Mw of $MgCl_2 = 95\text{ g mol}^{-1}$]

1 mol of $CaCO_3 \equiv 100$ ppm

1 mol of $CaCl_2 = 111$ ppm

1 mol of $MgCl_2 = 95$ ppm

Hence, answer is (b) and (d)

742 **(b,d)**

$H_2C_2O_4$: As acid, $n = 2$

As reducing agent, $n = 2$

$NaHC_2O_4$: As acid, $n = 1$

As reducing agent, $n = 2$

$E_{H_2C_2O_4}]_{\text{as reducing agent}} = \frac{M}{2}$;

$E_{NaHC_2O_4}]_{\text{as reducing agent}} = \frac{M}{2}$

On reaction with $KMnO_4$

$H_2C_2O_4$ and $NaHC_2O_4$:both are acting as reducing agents with same n factor of 2

mEq of$KMnO_4$ $\equiv$mEq of $H_2C_2O_4$

mEq of $KMnO_4 \equiv$ mEq of $NaHC_2O_4$

743 **(b,c,d)**

mEq of KOH/L$= \frac{56}{56/1} \times 10^3 = 1000 = 20/20$ mL solution

mEq of K_2CO_3/L $= \frac{138}{138/2} \times 10^3 = 2000 = 40/20$ mL solution

mEq of $KHCO_3$/L $= \frac{100}{100/1} \times 10^3 = 2000 = 20/20$ mL solution

b. With phenolphthalein:

mEq of KOH $+ \frac{1}{2}$mEq ofK_2CO_3 = mEq of HCl

$20 + \frac{40}{2} = V \times 1\text{ N } (n = 1)$

$V_{HCl} = 40$ mL

c. With methyl orange:

mEq of KOH + mEq of K_2CO_3 + mEq of $KHCO_3$ = mEq ofHCl

$20 + 40 + 20 = V \times 1N$

$V_{HCl} = 80$ mL

d. With methyl orange after the first end point:

$\frac{1}{2}$mEq of K_2CO_3 + mEq of $KHCO_3$ = mEq of HCl

$20 + 20 = V \times 1$ N

$V_{HCl} = 40$ mL

744 **(b,c,d)**

a. $5e^- + MnO_4^{\ominus} \longrightarrow Mn^{2+}\ (n = 5)$

$2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2e^- \left(n = \frac{2}{2} = 1\right)$

Eq of $MnO_4^{\ominus} \equiv$ Eq of $S_2O_3^{2-}$

$5 \times$ moles of $MnO_4^{\ominus} \equiv 1 \times$ moles of $S_2O_3^{2-}$

$\therefore$ 1 mol of $S_2O_3^{2-}$ = 5 mol of $MnO_4^{\ominus}$

b. pH changes from 4 to 10 (acidic to strongly basic)

$e^- + MnO_4^{\ominus} \longrightarrow MnO_4^{2-}\ (n = 1)$

$S_2O_3^{2-} \longrightarrow 2SO_4^{2-} + 8e^-\ (n = 8)$

Eq of $MnO_4^{\ominus}$ = Eq of $S_2O_3^{2-}$

$1 \times$ moles of $MnO_4^{\ominus} \equiv 8 \times$ moles of $S_2O_3^{2-}$

$\therefore$ 1 mol of $S_2O_3^{2-} = \frac{1}{8}$ mol of $MnO_4^{\ominus}$

Hence with change of pH from 4 to 10, will change the stoichiometry of reaction and also changes the product

c. pH changes from 4 to 7 (acidic to neutral medium)

$3e^- + MnO_4^{\ominus} \longrightarrow MnO_2\ (n = 3)$

$S_2O_3^{2-} \longrightarrow 2HSO_4^{\ominus} + 8e^-\ (n = 8)$

Hence it will also effect the stoichiometry of reaction and nature of product

d. At pH = 7, $S_2O_3^{2-}$ is oxidised to $HSO_4^{\ominus}$ ion.

745 **(a,c,d)**

[Mw of KI, $(NH_4)_2SO_4$, $CuSO_4 \cdot 5H_2O$ and Al^{3+}, respectively, are, 166, 132, 250, and 27 g mol^{-1}]

a. $M = \frac{166 \times 1000}{166 \times 1000} = 1.0$ M

b. $M = \frac{33 \times 1000}{132 \times 200} = 1.25$ M

c. $M = \frac{25 \times 1000}{250 \times 100} = 1.0$ M

d. $M = \frac{27 \times 10^{-3} \times 1000}{27 \times 1} = 1.0$ M