1 Some Basic Concepts of Chemistry

1.1 Introduction

1. How many chloride ions are there around sodium ion in sodium chloride crystal? **[PMT/ NEET-1988]**
a. 3 **b.** 8 **c.** 4 **d.** 6

2. The number of oxygen atoms in 4.4 g of CO_2 is approx.: **[PMT/NEET-1990]**
a. 1.2×10^{23} **b.** 6×10^{22} **c.** 6×10^{23} **d.** 12×10^{23}

3. Which one has the highest boiling point? **[PMT/NEET-1990]**
a. 0.1N Na_2SO_4 **b.** 0.1N $MgSO_4$
c. 0.1M $Al_2(SO_4)_3$ **d.** 0.1M $BaSO_4$

4. The total number of valence electrons in 4.2 gm of N_3^- ion is (N_A is the Avogadro's number): **[PMT/NEET-1995]**
a. $1.6N_A$ **b.** $3.2N_A$ **c.** $2.1N_A$ **d.** $4.2N_A$

5. If Avogadro number N_A is changed from 6.022×10^{23} $mole^{-1}$ to 6.022×10^{20} $mole^{-1}$, this would change: **[PMT/NEET-2015]**
a. The ratio of chemical species to each other in a balanced equation
b. The ratio of elements to each other in a compound
c. The definition of mass in units of grams
d. The mass of one mole of carbon

6. Which of the following is dependent on temperature? **[PMT/NEET-2017]**
a. Molarity **b.** Mole fraction
c. Weight percentage **d.** Molality

1.2 Units, Dimensions and Measurement

7. The dimensions of pressure are the same as that of: **[PMT/NEET-1995]**
a. Force per unit volume **b.** Energy per unit volume
c. Force energy **d.** Energy

8. Given the numbers: 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers is: **[PMT/NEET-1998]**
a. 3, 3 and 4 respectively **b.** 3, 4 and 4 respectively
c. 3, 4 and 5 respectively **d.** 3, 3 and 3 respectively

1.3 Laws of Chemical Combinations

9. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene? **[PMT/NEET-1989]**
a. 2.8 kg **b.** 6.4 kg **c.** 9.6 kg **d.** 96 kg

10. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. At 15° C and 150 mm Hg pressure, one liter of O_2 contains 'N' molecules. The number of molecules in two liters of SO_2 under the same conditions of temperature and pressure will be: **[PMT/NEET-1990]**
a. N/2 **b.** N **c.** 2N **d.** 4N

11. A sample of pure carbon dioxide, irrespective of its source contains 27.27% carbon and 72.73% oxygen. The data supports: **[PMT/NEET-1992]**
a. Law of constant composition
b. Law of conservation of mass
c. Law of reciprocal proportion
d. Law of multiple proportion

12. 0.24 g of a volatile gas, upon vaporization, gives 45 mL vapor at NTP. What will be the vapor density of the substance? (Density of H_2 = 0.089 g/L) **[PMT/NEET-1996]**
a. 95.93 **b.** 59.93 **c.** 95.39 **d.** 5.993

13. What volume of oxygen gas (O_2) measured at 0° C and 1 atm is needed to burn completely 1L of propane gas (C_3H_8) measured under the same conditions? **[PMT/NEET-2008]**
a. 5 L **b.** 10 L **c.** 7 L **d.** 6 L

14. Equal masses of H_2, O_2 and methane have been in a container of volume V at temperature 27° C in identical conditions. The ratio of the volumes of gases H_2: O_2: methane would be: **[PMT/NEET-2014]**
a. 8 : 16 : 1 **b.** 16 : 8 : 1 **c.** 16 : 1 : 2 **d.** 8 : 1 : 2

1.4 Atomic Mass, Molecular Masses and Equivalent Weight

15. When potassium permanganate is titrated against ferrous ammonium sulphate, the equivalent weight of potassium permanganate is: **[PMT/NEET-1988]**
a. Molecular weight / 10 **b.** Molecular weight / 5
c. Molecular weight / 2 **d.** Molecular weight

16. Elevation in boiling point was 0.52°C when 6gm of a compound X was dissolved in 100gm of water. Molecular weight of X is (K_b for water is 0.52 per 1000 gm of water): **[PMT/NEET-1989]**
a. 120 **b.** 60 **c.** 180 **d.** 600

17. Boron has two stable isotopes, ^{10}B(19%) and ^{11}B(81%). Calculate average at. wt. of boron in the periodic table. **[PMT/NEET-1990]**
a. 10.8 **b.** 10.2 **c.** 11.2 **d.** 10.0

18. The total number of gm-molecules of SO_2Cl_2 in 13.5g of sulphuryl chloride is: **[PMT/NEET-1992]**
a. 0.1 **b.** 0.2 **c.** 0.3 **d.** 0.4

19. 4.4 g of an unknown gas occupies 2.24 L of volume at standard temperature and pressure. The gas may be: **[PMT/NEET-1995]**
a. Carbon dioxide **b.** Carbon monoxide
c. Oxygen **d.** Sulphur dioxide

20. Assuming fully decomposed, the volume of CO_2 released at STP on heating 9.85 g of $BaCO_3$ (Atomic mass of Ba =137) will be: **[PMT/NEET-2000]**
a. 0.84 L **b.** 2.24 L **c.** 4.06 L **d.** 1.12 L

21. The weight of a molecule of the compound $C_{60}H_{122}$ is: **[PMT/NEET-2000]**

a. 1.4×10^{-21} g **b.** 1.09×10^{-21} g
c. 5.025×10^{23} g **d.** 16.023×10^{23} g

22. Boiling point of chloroform was raised by 0.323 K. When 0.5143 g of anthracene dissolved in 35 g of chloroform molecular mass of anthracene: (K_b for $CHCl_3$ = 3.9 kg mol^{-1}) **[PMT/NEET-2000]**

a. 79.42 g/mol **b.** 132.32 g/mol
c. 177.42 g/mol **d.** 242.32 g/mol

23. The percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (atomic weight=78.4). Then minimum molecular weight of peroxidase anhydrous enzyme is: **[PMT/NEET-2001]**

a. 1.568×10^{4} **b.** 1.568×10^{3}
c. 15.68 **d.** 3.136×10^{4}

24. The relative lowering of vapor pressure produced by dissolving 71.5 g of a substance in 1000 g of water is 0.00713. The molecular weight of the substance will be: **[PMT/NEET-2001]**

a. 18.0 **b.** 342
c. 60 **d.** 180

25. A compound possesses 8% sulphur by mass. The least molecular mass is: **[PMT/NEET-2002]**

a. 200 **b.** 400 **c.** 155 **d.** 355

26. $Ca(OH)_2 + H_3PO_4 \rightarrow CaHPO_4 + 2H_2O$. The equivalent weight of H_3PO_4 in the above reaction is: **[PMT/NEET-2004]**

a. 21 **b.** 27 **c.** 38 **d.** 49

27. On reduction with hydrogen, 3.6 g of an oxide of metal left 3.2 g of metal. If the vapor density of metal is 32, the simplest formula of the oxide would be**:** **[PMT/NEET-2004]**

a. MO **b.** M_2O_3 **c.** M_2O **d.** M_2O_5

28. An element, X has the following isotopic composition: $^{200}X:90\%$, $^{199}X:8.0\%$, $^{202}X:2.0\%$. The weighted average atomic mass of the naturally occurring element X is closest to: **[PMT/NEET-2007]**

a. 201 amu **b.** 202 amu **c.** 199 amu **d.** 200 amu

1.5 Mole Concept and Molar Masses

29. 1 cc N_2O at NTP contains **[PMT/NEET-1988]**

a. $\frac{1.8}{224}\times10^{22}$ atoms **b.** $\frac{6.02}{22400}\times10^{23}$ molecules
c. $\frac{1.32}{224}\times10^{23}$ electrons **d.** All of the above.

30. Ratio of C_p of C_v of a gas 'X' is 1.4. The number of atoms of the gas 'X' present in 11.2 liters of its at NTP will be: **[PMT/NEET-1989]**

a. 6.02×10^{23} **b.** 1.2×10^{23}
c. 3.01×10^{23} **d.** 2.01×10^{23}

31. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is: **[PMT/NEET-1990]**

a. 10 g molecules **b.** 5 g molecules
c. 1 g molecule **d.** 0.5 g molecules

32. The number of moles of SO_2Cl_2 in 13.5 gm is: **[PMT/NEET-1994]**

a. 0.1 **b.** 0.2 **c.** 0.3 **d.** 0.4

33. If 5.85 gms of NaCl are dissolved in 90 gms of water, the mole fraction of NaCl is : **[PMT/NEET-1994]**

a. 0.1 **b.** 0.2 **c.** 0.3 **d.** 0.0196

34. The number of moles of oxygen in one liter of air containing 21% oxygen by volume, under standard conditions, is: **[PMT/NEET-1995]**

a. 0.0093 mol **b.** 2.10 mol **c.** 0.186 mol **d.** 0.21 mol

35. If 0.50 mol of $CaCl_2$ is mixed with 0.20 mol of Na_3PO_4, the maximum number of moles of $Ca_3(PO_4)_2$ which can be formed, is**:** **[PMT/NEET-1998]**

a. 0.70 **b.** 0.50 **c.** 0.20 **d.** 0.10

36. Hemoglobin contains 0.334% of iron by weight. The molecular weight of hemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule of hemoglobin is: **[PMT/NEET-1998]**

a. 4 **b.** 6 **c.** 3 **d.** 2

37. The number of atoms in 4.25 g of NH_3 is approximately: **[PMT/NEET-1999]**

a. 4×10^{23} **b.** 2×10^{23} **c.** 1×10^{23} **d.** 6×10^{23}

38. When 1.80 gm glucose dissolve in 90 gm of H_2O, the mole fraction of glucose is: **[PMT/NEET-2000]**

a. 0.00399 **b.** 0.00199 **c.** 0.0199 **d.** 0.998

39. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/g whose radius and length are 7Å and 10Å, respectively. If $N_A = 6.02\times10^{23}$, find molecular weight of virus. **[PMT/NEET-2001]**

a. 15.4 kg/ mol **b.** 1.54×10^{4} kg/mol
c. 3.08×10^{4} kg/mol **d.** 3.08×10^{3} kg/mol

40. Which has maximum molecules? **[PMT/NEET-2002]**

a. 7g N_2 **b.** 2g H_2 **c.** 16g NO_2 **d.** 16 g O_2

41. How many atoms are contained in one mole of sucrose ($C_{12}H_{22}O_{11}$) ? **[PMT/NEET-2002]**

a. $45\times6.02\times10^{23}$ atoms/mole
b. $5\times6.62\times10^{23}$ atoms/mole
c. $5\times6.02\times10^{23}$ atoms/mole
d. None of these

42. How many moles of $K_2Cr_2O_7$ can be reduced by 1 mole of Sn^{2+} ? **[PMT/NEET-2003]**

a. 1/3 **b.** 1/6 **c.** 2/3 **d.** 1

43. MnO_4^{2-} (1 mole) in neutral aqueous medium is disproportionate to: **[PMT/NEET-2003]**

a. 2/3 mole of MnO_4^- and 1/3 mole of MnO_2
b. 1/3 mole of MnO_4^- and 2/3 mole of MnO_2
c. 1/3 mole of Mn_2O_7 and 1/3 mole of MnO_2
d. 2/3 mole of Mn_2O_7 and 1/3 mole of MnO_2

44. The maximum number of molecules is present in: **[PMT/NEET-2004]**

a. 15 L of H_2 gas at STP **b.** 5 L of N_2 gas at STP
c. 0.5 g of H_2 gas **d.** 10 g of O_2 gas

45. A sample of phosphorus trichloride (PCl_3) contains 1.4 moles of the substance. How many atoms are there in the sample? **[PMT/NEET-2004]**
a. 4 **b.** 5.6
c. 8.431×10^{23} **d.** 3.372×10^{24}

46. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl ? **[PMT/NEET-2008]**
a. 0.011 **b.** 0.029 **c.** 0.044 **d.** 0.333

47. The number of atoms in 0.1 mol of a triatomic gas is: ($N_A = 6.02 \times 10^{23}$ mol^{-1}) **[PMT/NEET-2010]**
a. 6.026×10^{22} **b.** 1.806×10^{23}
c. 3.600×10^{23} **d.** 1.800×10^{22}

48. Which has the maximum number of molecules among the following? **[PMT/NEET-2011]**
a. 44 g CO_2 **b.** 48 g O_3 **c.** 8 g H_2 **d.** 64g SO_2

49. The number of water molecules is maximum in: **[PMT/NEET-2015]**
a. 1.8 gram of water **b.** 18 gram of water
c. 18 moles of water **d.** 18 molecules of water

50. A mixture of gases contains H_2 and O_2 gases in the ratio of 1: 4 (w/w). What is the molar ratio of the two gases in the mixture? **[PMT/NEET-2015]**
a. 16:1 **b.** 2:1 **c.** 1:4 **d.** 4:1

51. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weights 10 g and 0.05 mole of X_3Y_2 weighs 9g, the atomic weights of X and Y are: **[PMT/NEET-2016]**
a. 40, 30 **b.** 60, 40 **c.** 20, 30 **d.** 30, 20

52. In which case is number of molecules of water maximum? **[PMT/NEET-2018]**
a. 18 mL of water **b.** 0.18 g of water
c. 0.00224 L of water vapors at 1 atm and 273K
d. 10^{-3} mol of water

53. Mixture of two metals having mass 2 g (A = 15, B = 30) are bivalent, dissolve in HCl and evolve 2.24 L H_2 at STP. What is mass of A present in the mixture? **[PMT/NEET-2018]**
a. 1 g **b.** 1.5 g **c.** 0.5 g **d.** 0.75 g

54. Which one of the following has maximum number of atoms? **[PMT/NEET-2020]**
a. 1 g of $Ag_{(s)}$ [Atomic mas of Ag = 108]
b. 1 g of $Mg_{(s)}$ [Atomic mas of Mg = 24]
c. 1 g of $O_{2(g)}$ [Atomic mas of O = 16]
d. 1 g of $Li_{(s)}$ [Atomic mas of Li = 7]

1.6 Percentage Composition

55. The percentage of P_2O_5 in diammonium hydrogen phosphate $(NH_4)_2HPO_4$ is: **[PMT/NEET-1992]**
a. 23.48 **b.** 46.96 **c.** 53.78 **d.** 71.00

56. Which of the following fertilizers has the highest nitrogen percentage? **[PMT/NEET-1993]**
a. Ammonium sulphate **b.** Calcium cyanamide
c. Urea **d.** Ammonium nitrate

57. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be: **[PMT/NEET-2008]**
a. CHO **b.** CH_4O **c.** CH_3O **d.** CH_2O

58. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample? (at. wt.: Mg = 24) **[PMT/NEET-015]**
a. 60 **b.** 84 **c.** 75 **d.** 96

59. An organic compound contains 78% (by wt.) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is: [Atomic wt. of C is 12, H is 1] **[PMT/NEET-2021]**
a. CH **b.** CH_2 **c.** CH_3 **d.** CH_4

1.7 Stoichiometric Calculations

60. At STP the density of CCl_4 vapor in g/L will be nearest to: **[PMT/NEET-1988]**
a. 6.87 **b.** 3.42 **c.** 10.26 **d.** 4.57

61. Normal boiling point of water is 373 K (at 760mm). Vapor pressure of water at 298 K is 23 mm. If the enthalpy of evaporation is 40.656 kJ/mole, the boiling point of water at 23 mm pressure will be: **[PMT/NEET-1995]**
a. 250 K **b.** 294 K **c.** 51.6 K **d.** 12.5 K

62. The amount of zinc required to produce 224 mL of H_2 at STP on treatment with dilute H_2SO_4 will be: **[PMT/NEET-1996]**
a. 65 g **b.** 0.065 g **c.** 0.65 g **d.** 6.5 g

63. In the reaction $4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(l)}$ when 1 mole of ammonia and 1 mole of O_2 are made to react to completion: **[PMT/NEET-1998]**
a. all the oxygen will be consumed
b. 1.0 mole of NO will be produced
c. 1.0 mole of H_2O is produced
d. all the ammonia will be consumed

64. Volume of CO_2 obtained by the complete decomposition of 9.85 g of $BaCO_3$ is: **[PMT/NEET-2000]**
a. 2.24 L **b.** 1.12 L **c.** 0.84 L **d.** 0.56 L

65. The molarity of a solution made by mixing 50ml of conc. H_2SO_4 (36 N) with 50 ml of water is: **[PMT/NEET-2001]**
a. 36 M **b.** 18 M **c.** 9 M **d.** 6 M

66. Molarity of liquid HCl, if density of solution is 1.17 g/cc is: **[PMT/NEET-2001]**
a. 36.5 **b.** 18.25 **c.** 32.05 **d.** 42.10

67. The mass of carbon anode consumed (giving only carbon dioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall's process is: **[PMT/NEET-2005]**
a. 270 kg **b.** 540 kg **c.** 90 kg **d.** 180 kg
(Atomic mass: Al = 27)

68. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be: **[PMT/NEET-2009]**
a. 3 mol **b.** 4 mol
c. 1 mol **d.** 2 mol

69. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, Na^+ and carbonate ions, CO_3^{2-} are respectively (Molar mass of Na_2CO_3 = 106 g mol^{-1}): **[PMT/NEET-2010]**

a. 0.477 M and 0.477 M **b.** 0.955 M and 1.910 M
c. 1.910 M and 0.955 M **d.** 1.90 M and 1.910 M

70. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of solution is: **[PMT/NEET-2013]**

a. 0.001 M **b.** 0.1 M
c. 0.02 M **d.** 0.01 M

71. In an experiment it showed that 10 mL of 0.05 M solution of chloride required 10 mL of 0.1 M solution of $AgNO_3$. Which of the following will be the formula of the chloride (X stands for the symbol of the element other than chlorine)? **[PMT/NEET-2013]**

a. X_2Cl_2 **b.** XCl_2
c. XCl_4 **d.** X_2Cl

72. When 22.4 liters of $H_{2(g)}$ is mixed with 11.2 liters of $Cl_{2(g)}$, each at STP, the moles of $HCl_{(g)}$ formed is equal to: **[PMT/NEET-2014]**

a. 1 mole of $HCl_{(g)}$ **b.** 2 mole of $HC_{l(g)}$
c. 0.5 mole of $HCl_{(g)}$ **d.** 1.5 mole of $HCl_{(g)}$

73. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much? (At. wt. Mg = 24, O = 16) **[PMT/NEET-2014]**

a. Mg, 0.16 g **b.** O_2, 0.16 g
c. Mg, 0.44 g **d.** O_2, 0.28 g

74. What is the mass of the precipitate formed when 50 mL of 6.9% solution of $AgNO_3$ is mixed with 50 mL of 5.8% NaCl solution? (Ag = 107.8, N =14, O = 16, Na = 23, Cl = 35.5) **[PMT/NEET-2015]**

a. 3.5 g **b.** 7 g **c.** 14 g **d.** 28 g

75. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP will be: **[PMT/NEET-2018]**

a. 1.4 **b.** 3.0 **c.** 2.8 **d.** 4.4

76. The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is: **[PMT/NEET-2019]**

a. 40 **b.** 10 **c.** 20 **d.** 30

77. The density of 2 M aqueous solution of NaOH is 1.28 g/cm^3. The molality of the solution is [Given that molecular mass of NaOH = 40 gol^{-1}]: **[PMT/NEET-2019]**

a. 1.20 m **b.** 1.56 m **c.** 1.67 m **d.** 1.32 m

1.8 Miscellaneous

78. Osmotic pressure of a solution containing 0.1 mole of solute per liter at 273K is: (in atm) **[PMT/NEET-1988]**

a. $\frac{0.1}{1} \times 0.08205 \times 273$ **b.** $0.1 \times 1 \times 0.08205 \times 273$
c. $\frac{1}{0.1} \times 0.08205 \times 273$ **d.** $\frac{0.1}{1} \times \frac{273}{0.08205}$

79. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene? **[PMT/NEET-1989]**

a. 2.8 kg **b.** 6.4 kg
c. 9.6 kg **d.** 96 kg

80. The latent heat of vaporization of water is 9700 Cal/mole and if the b.p. is 100°C, ebullioscopic constant of water is: **[PMT/NEET-1989]**

a. 0.513°C **b.** 1.026°C
c. 10.26°C **d.** 1.832°C

81. How many gm of H_2SO_4 is present in 0.25 gm mole of H_2SO_4 ? **[PMT/NEET-1990]**

a. 24.5 **b.** 2.45 **c.** 0.25 **d.** 0.245

82. H_2 evolved at S.T.P on complete reaction of 27 g of aluminium with excess of aqueous NaOH would be : **[PMT/NEET-1991]**

a. 22.4 **b.** 44.8 **c.** 67.2 **d.** 33.6 liters

83. The relationship between osmotic pressure at 273K when 10g glucose (P_1),10g urea (P_2) and 10g sucrose (P_3) are dissolved in 250ml of water is: **[PMT/NEET-1996]**

a. $P_1 > P_2 > P_3$ **b.** $P_3 > P_1 > P_2$
c. $P_2 > P_1 > P_3$ **d.** $P_2 > P_3 > P_1$

84. The ratio of the molar amounts of H_2S needed to precipitate the metal ions from 20mL each of 1M $Cd(NO_3)_2$ and 0.5M $CuSO_4$ is: **[PMT/NEET-1997]**

a. 1 : 1 **b.** 2 : 1 **c.** 1 : 2 **d.** Indefinite

85. Number of gm of oxygen in 32.2 g $Na_2SO_4.10H_2O$ is: **[PMT/NEET-2000]**

a. 20.8 **b.** 22.4 **c.** 2.24 **d.** 2.08

86. Vapor density of a gas is 22. What is its molecular mass? **[PMT/NEET-2000]**

a. 33 **b.** 22 **c.** 44 **d.** 11

87. 20 g of hydrogen is present in 5 liter vessel. The molar concentration of hydrogen is: **[PMT/NEET-2000]**

a. 4 **b.** 1 **c.** 3 **d.** 2

88. Which of the following has maximum number of molecules? **[PMT/NEET-2002]**

a. 16 gm of O_2 **b.** 16 gm of NO_2
c. 7 gm of N_2 **d.** 2 gm of H_2

89. The number of molecules in 4.25 g of ammonia is approximately: **[PMT/NEET-2002]**

a. 0.5×10^{23} **b.** 1.5×10^{23}
c. 3.5×10^{23} **d.** 2.5×10^{23}

90. Volume occupied by 1 molecule of water (density = 1g cm^{-3}) is: **[PMT/NEET-2008]**

a. $3.0 \times 10^{-23}\ cm^3$ **b.** $5.5 \times 10^{-23}\ cm^3$
c. $9.0 \times 10^{-23}\ cm^3$ **d.** $6.023 \times 10^{-23}\ cm^3$

91. What is the $[OH^-]$ in the final solution prepared by mixing 20.0 mL of 0.050 M HCl with 30.0 mL of 0.10 M $Ba(OH)_2$? **[PMT/NEET-2009]**

a. 0.12 M **b.** 0.10 M
c. 0.40 M **d.** 0.0050 M

92. Match Column I with Column II. **[NEET-2024]**

Column I (Conversion)	Column II (Number of Faraday required)
(A) 1mol of H_2O to O_2	**1.** 3F
(B) 1 mol of MnO_4^- to	**2.** 2F
(C) 1.5 mol of Ca from molten $CaCl_2$	**3.** 1F
(D) 1 mol of FeO to Fe_2O_3	**4.** 5F

Choose the correct answer from the option given below:
a. A →2, B →4, C →1, D →3
b. A →3, B →4, C →1, D →2
c. A →2, B →3, C →1, D →4
d. A →3, B →4, C →2, D →1

93. 1 gram of sodium hydroxide was treated with 25 mL of 0.75 M HCl solution, the mass of sodium hydroxide left unreacted is equal to: **[NEET-2024]**
a. 750 mg **b.** 250 mg **c.** Zero mg **d.** 200 mg

94. The highest number of helium atoms is in **[NEET-2024]**
a. 4mol of helium **b.** 4 u of helium
c. 4 g of helium
d. 2.271098 L of helium at STP

95. A compound X contains 32% of A, 20% of B and remaining percentage of C. Then, the empirical formula of X is : **[NEET-2024]**
(Given atomic masses of A = 64; B = 40; C = 32u)
a. A_2BC_2 **b.** ABC_3 **c.** AB_2C_2 **d.** ABC_4

96. Among the following choose the ones with equal number of atoms. **[NEET-2025]**
A. 212 g of $Na_2CO_3(s)$ [molar mass = 106 g]
B. 248 g of $Na_2O(s)$ [molar mass = 62 g]
C. 240 g of NaOH (s) [molar mass = 40 g]
D. 12 g of $H_2(g)$ [molar mass = 2 g]
E. 220 g of $CO_2(g)$ [molar mass = 44 g]
Choose the correct answer from the options given below:
a. B, D, and E only **b.** A, B, and C only
c. A, B, and D only **d.** B, C and D only

ANSWERS

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
d	a	c	a	d	a	b	d	c	c
11.	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
a	b	a	c	b	b	a	a	a	d
21.	**22.**	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
a	c	a	d	b	d	c	d	d	a
31.	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**
b	a	d	a	d	a	d	b	a	b
41.	**42.**	**43.**	**44.**	**45.**	**46.**	**47.**	**48.**	**49.**	**50.**
a	a	a	a	c	b	b	c	c	d
51.	**52.**	**53.**	**54.**	**55.**	**56.**	**57.**	**58.**	**59.**	**60.**
a	a	a	d	c	c	c	b	c	a
61.	**62.**	**63.**	**64.**	**65.**	**66.**	**67.**	**68.**	**69.**	**70.**
b	c	a	b	c	c	c	b	c	d
71.	**72.**	**73.**	**74.**	**75.**	**76.**	**77.**	**78.**	**79.**	**80.**
b	a	a	b	c	d	c	a	b	a

81.	82.	83.	84.	85.	86.	87.	88.	89.	90.
a	d	c	b	b	c	d	d	b	a
91.	**92.**	**93.**	**94.**	**95.**	**96.**				
b	a	b	a	b	c				

SOLUTIONS

1. **(d)** In NaCl crystal, every Na^+ ion is surrounded by $6Cl^-$ ion and every chloride ion is surrounded by $6Na^+$ ion.

2. **(a)** 44g of CO_2 has $2\times6\times10^{23}$ atoms of oxygen

4.4g of CO_2 has $=\frac{12\times10^{23}}{44}\times4.4=1.2\times10^{23}$ atoms.

3. **(c)** $Al_2(SO_4)_3$ gives maximum ions. Hence, it will show highest boiling point.

4. **(a)** 42g of N_3^- ions have $16N_A$ valence electrons 4.2g of N_3^- ion have $=\frac{16N_A}{42}\times4.2=1.6N_A$.

5. **(d)** Mass of 1 mole (6.022×10^{23} atoms) of carbon = 12g
If Avogadro Number (N_A) is changed then mass of 1 mole (6.022×10^{20} atoms) of carbon

$$=\frac{12\times6.022\times10^{20}}{6.022\times10^{23}}=12\times10^{-3}g$$

Therefore, the mass of 1 mole of carbon is changed

6. **(a)** Molarity depends on the volume of a solution which can be changed with change in temperature.

7. **(b)** Pressure $=\frac{\text{Force}}{\text{Area}}$

Therefore, dimensions of pressure $=\frac{MLT^{-2}}{L^2}=ML^{-1}T^{-2}$

and dimensions of energy per unit volume

$$=\frac{\text{Energy}}{\text{Volume}}=\frac{ML^2T^{-2}}{L^3}=ML^{-1}T^{-2}$$

8. **(d)** Zeros placed left to the number are never significant, therefore the no. of signification figures for the numbers 161 cm, 0.161 cm and 0.0161 cm are same, i.e., 3.

9. **(c)** $\underset{28g}{C_2H_4}+\underset{96g}{3O_2}\longrightarrow2CO_2+2H_2O$

For complete combustion.

2.8 kg of C_2H_4 requires $=\frac{96}{28}\times2.8\times10^3g$

$=9.6\times10^3g=9.6kg$ of O_2

10. **(c)** If 1 L of one gas contains N molecules, 2 L of any gas under the same conditions will contain 2N molecules.

11. **(a)** Law of constant composition.

12. **(b)** Weight of gas = 0.24g,
Volume of gas = 45
mL = 0.045 liter and density of H_2 = 0.089 g/L
Weight of 45 mL of H_2 = density × volume
$= 0.089\times0.045=4.005\times10^{-3}g$
Therefore, vapor density

$$=\frac{\text{Weight of certain volume of substance}}{\text{Weight of same volume of hydrogen}}$$

$$=\frac{0.24}{4.005\times10^{-3}}=59.93$$

13. **(a)** $\underset{1\text{vol.}}{C_3H_8}+\underset{5\text{vol,}}{5O_2}\longrightarrow\underset{3\text{vol.}}{3CO_2}+\underset{4\text{vol.}}{4H_2O}$

According to the above equation, 1 vol. or 1 liter of propane requires 5 vol. or 5 liters of O_2 to burn completely.

14. **(c)** According to Avogadro's hypothesis, ratio of the volumes of gases will be equal to the ratio of there no. of moles.

So, No. of moles $=\dfrac{\text{Mass}}{\text{Mol.mass}}$

$n_{H_2}=\dfrac{w}{2};n_{O_2}=\dfrac{w}{32};n_{CH_4}=\dfrac{w}{16}$

So, the ratio is $\dfrac{w}{2}:\dfrac{w}{32}:\dfrac{w}{16}$ or 16: 1: 2.

15. **(b)** Molecular weight / 5

16. **(b)** $\Delta T_b=\dfrac{100\times K_b\times w}{m\times W}$

$\therefore\quad 0.52=\dfrac{100\times5.2\times6}{m\times100}\quad m=\dfrac{100\times5.2\times6}{0.52\times100}=60.$

17. **(a)** Average atomic mass

$=\dfrac{19\times10+81\times11}{100}=10.81$

18. **(a)** Molecular weight of SO_2Cl_2

$=32+32+2\times35.5=135$ gm

$\because$ 135 gm of SO_2Cl_2 = 1 gm molecule

$\therefore$ 13.5gm of $SO_2Cl_2=\dfrac{1}{135}\times13.5=0.1$

19. **(a)** 2.24 L of gas has mass = 4.4 gm

$\therefore$ 22.4L of gas has mass $=\dfrac{4.4}{2.24}\times22.4=44$

So, given gas is CO_2 because CO_2 has molecular mass = 44.

20. **(d)** $BaCO_3\rightarrow BaO+CO_2\uparrow$

Molecular weight of $BaCO_3=137+12+3\times16=197$

$\because$ 197 gm produces 22.4L at S.T.P.

$\therefore$ 9.85 gm produces $\dfrac{22.4}{197}\times9.85=1.12$L at S.T.P.

21. **(a)** Molecular weight of $C_{60}H_{122}$

$=12\times60+122\times1=720+122=842$

$\because$ 6×10^{23} molecule $C_{60}H_{122}$ has mass = 842 gm

$\therefore$ 1 molecule $C_{60}H_{122}$ has mass $\dfrac{842}{6\times10^{23}}$

$=140.333\times10^{-23}$ gm

$=1.4\times10^{-21}$ gm.

22. **(c)** Here: $\Delta T_b=0.323K$

$w=0.5143g$ weight of anthracene.

$W=35g$ weight of chloroform

$K_b=$ Molal elevation constant $(3.9\ K-Kg/mol)$

$m=\dfrac{K_b\times w\times1000}{W\times\Delta T_b}=\dfrac{3.9\times0.5143\times1000}{0.323\times35}$

$=177.42g/mol$

23. **(a)** 0.5gm Se $\rightarrow$ 100gm peroxidase anhydrous enzyme

78.4gm Se $\rightarrow\dfrac{100\times78.4}{0.5}=1.568\times10^4$

Minimum m.w. $\rightarrow$ molecule at least contain one selenium.

24. **(d)** $\dfrac{P^0-P_s}{P^0}=\dfrac{\frac{w}{m}}{\frac{w}{m}+\frac{W}{M}}$

or $0.00713=\dfrac{71.5/m}{\frac{71.5}{m}+\frac{1000}{18}}\quad m=180$

25. **(b)** 8gm sulphur is present in 100gm of substance

$\therefore$ 32gm sulphur will present $=\dfrac{100}{8}\times32=400.$

26. **(d)** The equivalent weight of

$H_3PO_4=\dfrac{\text{molecular weight}}{2}$

$\because$ molecular wt. of $H_3PO_4=3+31+64=98\therefore\ \dfrac{98}{2}=49$

27. **(c)** As we know that

Equivalent weight $=\dfrac{\text{weight of metal}}{\text{weight of oxygen}}\times8$

$=\dfrac{32}{0.4}\times8=64$ Vapor density $=\dfrac{\text{mol. wt}}{2}$

Mol. wt $=2\times$ V.D $=2\times32=64$

As we know that $n=\dfrac{\text{mol.wt}}{\text{eq. wt}}=\dfrac{64}{64}=1$

Suppose, the formula of metal oxide be M_2O_n.

Hence the formula of metal oxide $=M_2O$.

28. **(d)** Average isotopic mass of X

$=\dfrac{200\times90+199\times8+202\times2}{90+8+2}$

$=\dfrac{18000+1592+404}{100}=199.96$ amu = 200 amu

29. **(d)** As we know, 22400 cc of N_2O contain 6.02×10^{23} molecules

$\therefore$ 1 cc of N_2O contain $\dfrac{6.02\times10^{23}}{22400}$ molecules

Since in N_2O molecule there are 3 atoms

$\therefore$ 1cc $N_2O=\dfrac{3\times6.02\times10^{23}}{22400}$ atoms $=\dfrac{1.8\times10^{22}}{224}$ atoms

No. of electrons in a molecule of

$N_2O=7+7+8=22$

Hence, no. of electrons in 1 cc of N_2O

$=\dfrac{6.02\times10^{23}}{22400}\times22$ electrons $=\dfrac{1.32}{244}\times10^{23}$ electrons.

30. **(a)** Here, $C_p/C_V=1.4$, which shows that the gas is diatomic.

22.4 L at NTP = 6.02×10^{23} molecules

$\therefore$ 11.2 L at NTP = 3.01×10^{23} molecules

Since gas is diatomic,

$\therefore$ 11.2 L at NTP = $2 \times 3.01 \times 10^{23}$ atoms= 6.02×10^{23} atom.

31. **(b)** Avogadro's no., $N_A = 6.02 \times 10^{23}$ molecules = 1 mole

$\therefore$ 6.02×10^{24} CO molecules = 10 moles CO

= 10 g atoms of O = 5 g molecules of O_2

32. **(a)** Gram molecule of SO_2Cl_2 = 135

$$n = \frac{w}{m} = \frac{13.5}{135} = 0.1.$$

33. **(d)** 5.85 g NaCl = $\frac{5.85}{58.5}$ mole = 0.1 mol

90 g $H_2O = \frac{90}{18}$ moles = 5 moles

mole fraction of NaCl = $\frac{0.1}{5+0.1} \approx 0.0196$.

34. **(a)** Volume of oxygen in one liter of air

$$= \frac{21}{100} \times 1000 = 210 \text{ mL}$$

Therefore, no. of moles $= \frac{210}{22400} = 0.0093$ mol.

35. **(d)** $3CaCl_2 + 2Na_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6NaCl$

$\therefore$ Mole of $Na_3PO_4 = 3$ mole of

$CaCl_2 = 1$ mole $Ca_3(PO_4)_2$

$\therefore$ 0.2 mole of $Na_3PO_4 = 0.3$ mole of $CaCl_2 = 0.1$ mole of $Ca_3(PO_4)_2$.

36. **(a)** Quantity of iron in one molecule

$$= \frac{67200}{100} \times 0.334 = 224.45 \text{ amu}$$

No. of iron atoms in one molecule of hemoglobin

$$= \frac{224.45}{56} = 4$$

37. **(d)** 17 g of $NH_3 = 4N_A$ atoms

4.25 g of $NH_3 = \frac{4N_A}{17} \times 4.25$ atoms

= N_A atoms = 6×10^{23} atoms.

38. **(b)** Mole fraction of glucose

$$= \frac{n}{n+N} = \frac{0.01}{0.01+5} = 0.00199$$

39. **(a)** Specific volume (vol. of 1 g) of cylindrical virus particle = 6.02×10^{-2} cc/g

Radius of virus, r = 7 Å = 7×10^{-8} cm

Volume of virus $= \pi r^2 \ell$

$$= \frac{22}{7} \times (7 \times 10^{-8})^2 \times 10 \times 10^{-8} = 154 \times 10^{-23} \text{ cc}$$

Wt. of one virus particle

$$= \frac{\text{Volume (cc)}}{\text{Specific volume (cc/g)}} = \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \text{ g}$$

$\therefore$ Molecular wt. virus = wt. of N_A particles

$$= \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \times 6.02 \times 10^{23} \text{ g/mol}$$

= 15400 g/ mol = 15.4 kg/mol.

40. **(b)** Number of molecules = moles $\times N_A$

Molecules of $N_2 = \frac{7}{14} N_A = 0.5N_A$

Molecules of $H_2 = N_A$

Molecules of $NO_2 = \frac{16}{46} N_A = 0.35N_A$

Molecules of $O_2 = \frac{16}{32} N_A = 0.5N_A$

$\therefore$ 2 g H_2 (1 mole H_2) contains maximum molecules.

41. **(a)** 1 mole of sucrose contains 6.023×10^{23} molecules

$\because$ 1 molecule of sucrose has 45 atoms

$\therefore$ 6.023×10^{23} molecule of sucrose has $45 \times 6.023 \times 10^{23}$ atoms/mole

42. **(a)** $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

$(Sn^{2+} \rightarrow Sn^{4+} + 2e^-) \times 3$

$Cr_2O_7^{2-} + 14H^+ + 3Sn^{2+} \rightarrow 3Sn^{4+} + 2Cr^{3+} + 7H_2O$

It is clear from this equation that 3 moles of Sn^{2+} reduce one mole of $Cr_2O_7^{2-}$, hence 1 mol. of Sn^{2+} will reduce $\frac{1}{3}$ moles of $Cr_2O_7^{2-}$.

43. **(a)** MnO_4^{2-} in neutral aqueous medium is disproportionate to $\frac{2}{3}$ mole of MnO_4^- and $\frac{1}{3}$ mole of MnO_2.

44. **(a)** At STP, 22.4 L = 6.023×10^{23} molecules

15 L $H_2 = \frac{6.023 \times 10^{23} \times 15}{22.4} = 4.033 \times 10^{23}$ molecules

5 L $N_2 = \frac{6.023 \times 10^{23} \times 5}{22.4} = 1.344 \times 10^{23}$ molecules

2g $H_2 = 6.023 \times 10^{23}$ molecules

0.5 g $H_2 = \frac{6.023 \times 10^{23} \times 0.5}{2} = 1.505 \times 10^{23}$ molecules

32 g $O_2 = 6.023 \times 10^{23}$ molecules

10 g $O_2 = \frac{6.023 \times 10^{23} \times 10}{32} = 1.882 \times 10^{23}$ molecules

45. **(c)** No. of atoms in one molecule

= no. of moles $\times 6.022 \times 10^{23}$

$= 1.4 \times 6.022 \times 10^{23} = 8.432 \times 10^{23}$

46. **(b)** $\underset{x \text{ mole}}{PbO} + \underset{2x \text{ moles}}{2HCl} \longrightarrow \underset{x \text{ mole}}{PbCl_2} + H_2O$

$\frac{6.5}{224}$ mole $\quad \frac{3.2}{36.5}$ mole = 0.029 mole = 0.087 mole

Thus, 0.029 mole of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl.

47. **(b)** No. of atoms = $N_A \times$ No. of moles $\times 3$

= $6.023 \times 10^{23} \times 0.1 \times 3 = 1.806 \times 10^{23}$

48. **(c)** 8 g H_2 has 4 moles while the other has 1 mole each.

49. **(c)** 1.8 gram of water $= \frac{6.023 \times 10^{23}}{18} \times 1.8$

$= 6.023 \times 10^{22}$ molecules

18 gram of water = 6.023×10^{23} molecules

18 moles of water = $18 \times 6.023 \times 10^{23}$ molecules

50. **(d)** Number of moles of $H_2 = 1/2$

Number of moles of $O_2 = \frac{4}{32}$

Hence, molar ratio $= \frac{1}{2} : \frac{4}{32} = 4:1$

51. **(a)** Let atomic weight of element X is x and that of element Y is y.

For $XY_2, n = \frac{w}{Mol.wt.}$

$$0.1 = \frac{10}{x+2y} \Rightarrow x + 2y = \frac{10}{0.1} = 100 \quad \ldots (i)$$

For $X_3Y_2, n = \frac{w}{Mol.wt.}$

$$0.05 = \frac{9}{3x+2y} \Rightarrow 3x + 2y = \frac{9}{0.05} = 180 \quad \ldots (ii)$$

On solving equations (i) and (ii), we get $x = 40$

$40 + 2y = 100 \Rightarrow 2y = 60 \Rightarrow y = 30$

52. **(a)** (a) Mass of water $= V \times d = 18 \times 1 = 18g$

Molecules of water = mole $\times N_A = \frac{18}{18} N_A = N_A$

(b) Molecules of water = mole $\times N_A = \frac{0.18}{18} N_A$

(c) Molecules of water $= \frac{0.00224}{22.4} = 10^{-4}$

Molecules of water = mole $\times N_A = 10^{-4} N_A$

(d) Molecules of water = mole $\times N_A = 10^{-3} N_A$

53. **(a)** $A + 2HCl \rightarrow ACl_2 + H_2$

Mole $= \frac{x}{15} \quad \frac{x}{15}$

$B + 2HCl \longrightarrow BCl_2 + H_2$

Mole $= \frac{2-x}{30} \quad \frac{2-x}{30}$

Mole of $H_2 = \frac{x}{15} + \frac{2-x}{30} = \frac{2.24}{22.4} = \frac{1}{10}$

$\frac{x}{15} - \frac{x}{30} = \frac{1}{10} - \frac{1}{15} \Rightarrow x = 1$ gm

54. **(d)** 1 mole of substance = N_A atoms

108 g of Ag = N_A atoms

$\Rightarrow$ 1 g of Ag $= \frac{N_A}{108}$ atoms 24 g of Mg = N_A atoms

$\Rightarrow$ 1 g of Mg $= \frac{N_A}{24}$ atoms

32 g of $O_2 = N_A$ molecules = 2 N_A atoms

$\Rightarrow$ 1 g of $O_2 = \frac{N_A}{16}$ atoms 7 g of Li = N_A atoms

$\Rightarrow$ 1 g of Li $= \frac{N_A}{7}$ atoms

Therefore, 1 g of $Li_{(s)}$, has maximum number of atoms.

55. **(c)** $\underset{2(36+1+31+64)=264}{2(NH_4)_2HPO_4} \equiv \underset{62+80=142}{P_2O_5}$

$$\% \text{ of } P_2O_5 = \frac{\text{wt. of } P_2O_5}{\text{wt of salt}} \times 100 = \frac{142}{264} \times 100 = 53.78\%.$$

56. **(c)** Urea (NH_2CONH_2), % of N $= \frac{28}{60} \times 100 = 46.66\%$

Similarly, % of N in other compounds are:

$(NH_4)_2SO_4 = 21.2\%$; $CaCN_2 = 35.0\%$ and

$NH_4NO_3 = 35.0\%$

57. **(c)** Atomic mass of C = 12, H = 1 and O = 16

Element	%composition	Mole ratio	Simple ratio
C	38.71	38.71/12	3.22/3.22
		= 3.22	= 1
H	9.67	9.67/1	9.67/3.22
		9.67	= 3
O	51.62	51.62/16	3.22/3.22
		= 3.22	= 1

58. **(b)** $MgCO_3(s) \longrightarrow MgO(s) + CO_2(g)$

Moles of $MgCO_3 = \frac{20}{30} = 0.238$ mol

From above equation

1 mole $MgCO_3$ gives 1 mole MgO

$\therefore$ 0.238 mole $MgCO_3$ will give 0.238 mole MgO

= 0.238 × 40 g = 9.523 g MgO

Practical yield of MgO = 8g MgO

$\therefore$ % purity $= \frac{8}{9.523} \times 10 = 84\%$

59. **(c)** Element % At. weight $\frac{\%}{\text{At. weight}}$ simplest ratio

C 78 12 6.5 1

H 22 1 22 = 3

Empirical formula of this compound is CH_3

60. **(a)** Weight of 1 mole of CCl_4 vapor

= 12 + 4 × 35.5 = 154 g

$\therefore$ Density of CCl_4 vapor $= \frac{154}{22.4} gL^{-1} = 6.875 gL^{-1}$

61. **(b)** Applying Clausius Clapeyron equation

$$\log \frac{P_2}{P_1} = \frac{\Delta H_V}{2.303R}\left[\frac{T_2 - T_1}{T_1 \times T_2}\right]$$

$$\log \frac{760}{23} = \frac{40656}{2.303 \times 8.314}\left[\frac{373 - T_1}{373T}\right]$$

This gives $T_1 = 294.4K$.

62. **(c)** $\underset{65g}{Zn} + H_2SO_4 \longrightarrow ZnSO_4 + \underset{22400mL}{H_2}$

Since 65g of zinc reacts to liberate 22400 mL of H_2 at STP, therefore, amount of zinc needed to produced 224 mL of H_2 at STP $= \frac{65}{22400} \times 224 = 0.65g.$

63. **(a)** $\underset{4 moles}{4NH_{3(g)}} + \underset{5 moles}{5O_{2(g)}} \longrightarrow \underset{4 moles}{4NO_{(g)}} + \underset{6 moles}{6H_2O_{(\ell)}}$

$\Rightarrow$ 1 mole of NH_3 requires = 5/4 = 1.25 moles of oxygen while 1 mole of O_2 requires = 4/5 = 0.8 mole of NH_3. Therefore, all oxygen will be consumed.

64. **(b)** $BaCO_3 \longrightarrow BaO + CO_2$

197.3 g 22.4 L at N.T.P.

9.85 g $\frac{22.4}{197.3} \times 9.85$

$\Rightarrow$ 9.85 g of $BaCO_3$ will produce 1.118 L of CO_2 at N.T.P. on the complete decomposition.

65. **(c)** $N_1V_1 = N_2V_2 \quad 36 \times 50 = N_2 \times 100$

$N_2 = \frac{36 \times 50}{100} = 18 \quad 18N\ H_2SO_4 = 9M\ H_2SO_4$.

66. **(c)** Density = 1.17 g/cc.

$\Rightarrow$ 1 cc. solution contains 1.17 g of HCl

$\therefore$ Molarity $= \frac{1.17 \times 1000}{36.5 \times 1} = 32.05$

67. **(c)** $\underset{\text{(From bauxite)}}{3C + 2Al_2O_3} \longrightarrow 4Al + 3CO_2$

4 moles of Al is produced by 3 moles of C.

1 moles of Al is produced by $\frac{3}{4}$ moles of C.

$\frac{270 \times 1000}{27} = 10^4$ moles of Al is produced by $\frac{3}{4} \times 10^4$ moles of C. Amount of carbon used $= \frac{3}{4} \times 10^4 \times 12g$

$= \frac{3}{4} \times 10 \times 12kg = 90kg$

68. **(b)** $H_2 + 1/2O_2 \longrightarrow H_2O$

2g 16 g 18g

1 mole 0.5 mole 1 mole

10 g of H_2 = 5 mole and 64 g of O_2 = 2 mole

$\therefore$ In this reaction, oxygen is the limiting reagent so amount of H_2O produced depends on the amount of O_2.

Since 0.5 mole of O_2 gives 1 mole of H_2O

$\therefore$ 2 mole of O_2 will gives 4 mole of H_2O.

69. **(c)** Molarity $= \frac{25.3 \times 1000}{106 \times 250} = 0.955M$

$Na_2CO_3 \rightarrow 2Na^+ + CO_3^{-2} \quad = 2$

0.955 0.955 M = 1.910 M

70. **(d)** Moles of urea $= \frac{6.02 \times 10^{20}}{6.02 \times 10^{23}} = 0.001$

Concentration of solution $= \frac{0.001}{100} \times 1000 = 0.01M$

71. **(b)** Millimoles of solution of chloride = 0.05 × 10 = 0.5

Millimoles of $AgNO_3$ solution = 10 × 0.1 = 1

So, the millimoles of $AgNO_3$ are double than the chloride solution.

$\therefore$ $XCl_2 + 2AgNO_3 \longrightarrow 2AgCl + X(NO_3)_2$

72. **(a)** 1 mole $\equiv$ 22.4 liters at STP.

$n_{H_2} = \frac{22.4}{22.4} = 1\,\text{mole}; \quad n_{Cl_2} = \frac{11.2}{22.4} = 0.5$ mole

Reaction is as, $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$

Initial	1 mole	0.5 mole	0
Final	(1 – 0.5)	(0.5 – 0.5)	2× 0.5
	= 0.5 mole	= 0 mole	1 mole

Here, Cl_2 is limiting reagent.

So, 1 mole of $HCl_{(g)}$ is formed.

73. **(a)** $n_{Mg} = \frac{1}{24} = 0.0416$ moles $n_{O_2} = \frac{0.56}{32} = 0.0175$ mole

The balanced equation is

$2Mg + O_2 \longrightarrow 2MgO$

Initial 0.0416 mole 0.0175 mole 0

Final (0.0416–2×0.0175)02×0.0175=0.0066 mole

Here, O_2 is limiting reagent,

$\therefore$ Mass of Mg left in excess = 0.0066 × 24 = 0.16 g

74. **(b)** 16.9 % solution of $AgNo_3$ means 16.9 g of $AgNO_3$ in 100 mL of solution.

= 8.45 g of $AgNO_3$ in 50 mL solution.

Similarly, 5.8 g of NaCl in 100 mL solution

$\equiv$ 2.9 g of NaCl in 50 mL solution.

The reaction can be represented as :

$AgNO_3 + NaCl \longrightarrow AgCl\downarrow + NaNO_3$

Initial	8.45/170	2.9/58.5	0	0
Mole	= 0.049	= 0.049		
Final moles	0	0	0.049	0.049

$\therefore$ Mass of AgCl precipitated = 0.049 × 143.3 = 7.02 $\approx$ 7g

75. **(c)** $HCOOH \xrightarrow[\text{conc.}H_2SO_4]{\text{Dehydrating agent}} CO + H_2O$

$n_i = \frac{2.3}{46} = \frac{1}{20}$ 0 0

$n_f = 0$ $\frac{1}{20}$ $\frac{1}{20}$

$H_2C_2O_4 \xrightarrow{\text{conc.}H_2SO_4} CO + CO_2 + H_2O$

$n_i = \frac{4.5}{90} = \frac{1}{20}$ 0 0 0

$n_f = 0$ $\frac{1}{20}$ $\frac{1}{20}$ $\frac{1}{20}$

H_2O gets absorbed by conc. H_2SO_4. Gaseous mixture (Containing CO and CO_2) when passed through KOH pellets, CO_2 gets absorbed.

Moles of CO left (unabsorbed) $= \frac{1}{20} + \frac{1}{20} = \frac{1}{10}$

Mass of CO = moles × molar mass $= \frac{1}{10} \times 28 = 2.8g$

76. **(d)** Haber's process, $N_2 + 3H_2 \longrightarrow 2NH_3$

2 moles of NH_3 are formed by 3 moles of H_2.

$\therefore$ 20 moles of NH_3 will be formed by 30 mole of H_2.

77. **(c)** Density = 1.28 g/cc, Conc. of solution = 2 M

Molar mass of NaOH = 40 g mole^{-1}

Volume of solution = 1 L = 1000 mL

Mass of solution = d × V = 1.28 × 1000 = 1280 g

Mass of solute = n × Molar mass = 2 × 40 = 80 g

Mass of solvent = (1280 – 80) g = 1200 g

Number of moles of solute $= \frac{80}{40} = 2$

$\therefore$ Molality $= \frac{2 \times 1000}{1200} = 1.67m$

78. **(a)** $\pi = \frac{w}{m} \times RT = \frac{0.1}{1} \times 0.0821 \times 273$

79. **(b)** $C_2H_4 + 2O_2 \rightarrow 2CO_2 + 2H_2O$

$\because$ 28gm C_2H_4 requires 64gm oxygen

$\therefore$ 2.8×10^3 gm C_2H_4 requires

$=\frac{64}{28}\times2.8\times10^3$ gm $=6.4\times10^3 gm = 6.4$kg.

80. **(a)** $K_b=\frac{M_1RT_0^2}{1000\ \Delta H_V}=\frac{18\times1.987\times(373)^2}{1000\times9700}=0.513^\circ C$

81. **(a)** $n=\frac{w}{m}; w=n\times m=0.25\times98=24.5$gm

82. **(d)** $H_2O+\underset{27gm}{Al}+NaOH\rightarrow NaAlO_2+\underset{\frac{3}{2}\times22.4=33.6L}{\frac{3}{2}H_2}$

83. **(c)** $P=\frac{w}{mv}R.T$ since wvT is constant thus

$P\propto\frac{1}{m}$ $P_2>P_1>P_3$.

84. **(b)** $Cd^{+2}+S^{2-}\rightarrow CdS$ $\quad 20\times1=20$

$Cu^{+2}+S^{2-}\rightarrow CuS$ $20\times0.5=10$ Ratio $=2:1$

85. **(b)** $Na_2SO_4.10H_2O=2\times23+32+4\times16+10\times18$

$=46+32+64+180=322$ gm

322gm $Na_2SO_4.10H_2O$ contains = 224 gm oxygen

32.2gm $Na_2SO_4.10H_2O$ contains

$=\frac{32.2\times224}{322}=22.4\ gm$

86. **(c)** $MW=2\times V.D.=2\times22=44$.

87. **(d)** Molar concentration $[H_2]=\frac{\text{Mole}}{\text{V in litre}}=\frac{20/2}{5}=2$.

88. **(d)** 2 gm. Hydrogen has maximum number of molecules than others

89. **(b)** 17gm NH_3 = 1 mole. (Molecules of)

$NH_3=\frac{6.02\times10^{23}\times4.25}{17}=1.5\times10^{23}$

90. **(a)** Weight of 6.023×10^{23} molecules of water = 18 g

As volume occupied by 6.023×10^{23} molecules of water (density = 1 g cm^{-3}) will be $=\frac{18\,g}{1\,g\,cm^{-3}}=18\ cm^3$ or mL

So, volume occupied by 1 molecule of water.

$=\frac{18}{6.023\times10^{23}}=2.988\times10^{-23}=3.0\times10^{-23}\ cm^3$

91. **(b)** 20 mL of 0.50 M HCl = 20×0.050 m mole

= 1.0 m mole = 1.0 meq. of HCl

30 mL of 0.10 M $Ba(OH)_2=30\times0.1$ m mol

= 3m mol = 3×2 meq= 6 meq $Ba(OH)_2$

1 meq of HCl will neutralize 1 meq of $Ba(OH)_2$

$Ba(OH)_2$ left = 5 meq. Total volume = 50 mL

$Ba(OH)_2$ conc. In final solution

$=\frac{5}{50}N=0.1N=0.05M$ $[OH^-]=2\times0.05M=0.10M$

Alternatively, $Ba(OH)_2+2HCl\rightarrow BaCl_2+2H_2O$

2 m mol of HCl neutralise 1 m mole of $Ba(OH)_2$

1 m mole of HCl neutralise 0.5 m mole of $Ba(OH)_2$

$Ba(OH)_2$ left = 3 – 0.5 m mole = 2.5 m mole

$[Ba(OH)_2]=\frac{2.5}{50}M=0.05M$

Or $[OH]^-=2\times0.05=0.1M$

92. **(a)** $4OH^-\rightarrow2H_2O+O_2+4e^-$

For 2 mole of H_2O = 4F charge is required

For 1 mole of $H_2O=\frac{4F}{2}$ =2 F required

$\overset{+7}{M}nO_4^-\rightarrow\overset{+2}{M}n^{2+}$

For 1 mole MnO_4^- 5 F charge is required

$Ca^{2+}\xrightarrow{+2e^-}Ca$

For 1 mole Ca^{2+} ion required = 2F

1.5 mole Ca^{2+} ion required $=\frac{2}{1}\times1.5=3F$

$\overset{+2}{Fe}O\rightarrow\overset{+3}{Fe_2}O_3$

For 1 mole FeO, 1 F charges is required

93. **(b)** $M=\frac{W\times1000}{M_2\times V(\text{in mL})}$

W= $M=\frac{M\times M_2\times V(\text{in mL})}{1000}=\frac{0.75\times36.5\times25}{1000}$

= 0.684 g (Mass of HCl)

$\underset{36.5g}{HCl}+\underset{40g}{NaOH}\longrightarrow HCl+NaOH$

36.5 g HCl reacts with NaOH = 40g

0.684 g HCl reacts with NaOH $=\frac{40}{36.5}\times0.684\cong0.750$ g

Amount of NaOH left = 1 g -0.750 g = 0.250 g = 250 mg

94. **(a)** (a) 4 mole of He = 4 N_A He atoms

(b) 4 u of He $=\frac{4u}{4u}$ =1 He atom

(c) 4 u of Helium $=\frac{4g}{4g}$ mole = 1 mole = N_A He atom

(d) 2.2710982 of He at STP $=\frac{2.271}{22.710982}$ mole

= 0.1 mole = 0.1 N_A He atom

95. **(b)**

Element	Mass percentage (%)	No. of Moles	No. of Moles/ Smallest number	Simplest whole number
A	32%	$\frac{32}{64}=\frac{1}{2}$	$\frac{1}{2}\times2$	= 1
B	20%	$\frac{20}{40}=\frac{1}{2}$	$\frac{1}{2}\times2$	= 1
C	48%	$\frac{48}{32}=\frac{3}{2}$	$\frac{3}{2}\times2$	= 3

So, empirical formula of X $\Rightarrow$ A:B:C::1:1:3

$\therefore$ The correct empirical formula of compound X is BC_3

96. **(c)** A, B, and D only

No. of atoms = Atomicity $\times$ mole $\times$ N_A

(A) No. of atoms $=6\times\frac{212}{106}\times N_A=12N_A$

(B) No. of atoms $=3\times\frac{248}{62}\times N_A=12N_A$

(C) No. of atoms $=3\times\frac{240}{40}\times N_A=18N_A$

(D) No. of atoms $=2\times\frac{12}{2}\times N_A=12N_A$

(E) No. of atoms $=3\times\frac{220}{44}\times N_A=15N_A$