Maximum : 100 marks

Time : 1 hour and 15 minutes

1. The total number of atoms in 6 grams of water is :

   (A) $6.02 \times 10^{23}$ (B) $12.04 \times 10^{23}$

   (C) $18.06 \times 10^{23}$ (D) $3.01 \times 10^{23}$

2. The percentage of an element M is 53 in its oxide of molecular formula $M_2O_3$. It's atomic mass is about :

   (A) 36 (B) 27

   (C) 18 (D) 23

3. The mass of oxygen required for the complete combustion of 2.5 grams of methane is :

   (A) 20 g (B) 15 g

   (C) 1.5 g (D) 10 g.

4. An organic compound with vapour density 28 on analysis gave 85.71% carbon and 14.29% hydrogen. Its molecular formula is :

   (A) $C_3H_8$ (B) $C_3H_6$

   (C) $C_4H_8$ (D) $C_4H_{10}$

5. The enthalpy change for the reaction $\frac{1}{2}X_2(g) \rightarrow X(g)$ is called :

   (A) enthalpy of transition (B) enthalpy of atomization

   (C) enthalpy of vaporization (D) enthalpy of formation

6. Lattice energy is the amount of energy released :

   (A) when one cation combines with one anion

   (B) when one mole cations combines with one mole anion

   (C) when one mole of ionic compound is formed from its cations and anions

   (D) all of the above

7. Energy required to dissociate 4 grams of gaseous hydrogen into free gaseous atoms is 208 kcal at 25°C. The H – H bond energy will be :

   (A) 104 kcal (B) 10.4 kcal

   (C) 1040 kcal (D) 1.04 kcal

8. The bond angles in molecules $BeF_2$, $SF_6$, $CCl_4$ and $NH_3$ are in the order :

(A) $SF_6 < CCl_4 < NH_3 < BeF_2$ (B) $SF_6 < NH_3 < CCl_4 < BeF_2$

(C) $NH_3 < SF_6 < CCl_4 < BeF_2$ (D) $NH_3 < CCl_4 < SF_6 < BeF_2$

9. The molarity of a solution obtained by mixing 50 ml of 0.40 M HCl and 50 ml of 0.20 M NaOH is :

(A) 0.20 M (B) 0.10 M

(C) 0.01 M (D) 0.02 M

10. In $XeF_6$ molecule, the hybridization of Xe atom is :

(A) $sp^3$ (B) $sp^3d$

(C) $sp^3d^3$ (D) $dsp^2$

11. Isopropyl bromide when treated with metallic sodium in ether gives :

(A) n-Hexane (B) 2, 2-Dimethyl propane

(C) 2-Methyl pentane (D) 2, 3-Dimethyl butane

12. The gas liberated at cathode during the electrolysis of sodium propionate is :

(A) Hydrogen (B) Carbon dioxide

(C) Ethane (D) n-Butane

13. But-1-ene and 2 – Methyl propene illustrate :

(A) Chain isomerism (B) Position isomerism

(C) Metamerism (D) Functional isomerism

14. Ozonolysis of 2-Methyl-2-butene gives :

(A) Acetone (B) Acetaldehyde

(C) Glyoxal (D) Acetone and Acetaldehyde

15. The pair which can be distinguished by ammoniacal cuprous chloride solution is :

(A) But-1-yne and Ethyne (B) But-1-yne and But-2-yne

(C) Propyne and Ethyne (D) n-Butane and But-2-yne

16. The monomer of Orlon is :

(A) $CH_2 = CF_2$ (B) $CF_2 = CF_2$

(C) $CH_2 = CH - CN$ (D) $CH_2 = CH - Cl$

17. Benzene when treated with phosgene in presence of $AlCl_3$ gives :

(A) Benzaldehyde
(B) Benzyl chloride
(C) Benzophenone
(D) Benzal chloride

18. Hydroxylation of Alkenes can be effected by :

(A) Luca's Reagent
(B) Baeyer's Reagent
(C) Tollens Reagent
(D) Borsche Reagent

19. Which of the following acids has the lowest pKa value?

(A) Acetic acid
(B) $\alpha$-Chloro acetic acid
(C) $\alpha$-Nitro acetic acid
(D) $\alpha$-Cyano acetic acid

20. The conversion of carboxylic acid in to primary amine by reaction with hydrazoic acid in presence of concentrated sulphuric acid is called :

(A) Schmidt Reaction
(B) Dakin Reaction
(C) Perkin Reaction
(D) Etard Reaction

21. Pyrolysis of calcium acetate gives :

(A) Formaldehyde
(B) Acetaldehyde
(C) Acetone
(D) Acetic acid

22. Wolff-Kishner Reduction of acetophenone gives :

(A) Toluene
(B) Ethyl Benzene
(C) Xylene
(D) Cumene

23. Which of the following compounds can give Butan-2-ol with $CH_3MgBr$ ?

(A) $H - CHO$
(B) $CH_3 - CHO$
(C) $CH_3 - CH_2 - CHO$
(D) $CH_3 - CO - CH_3$

24. The product obtained when an aldoxime is treated with phosphorous pentoxide is :

(A) Alkane
(B) Primary amine
(C) Nitrile
(D) Amide

25. The number of bridging hydrogen atoms in Diborane is :

(A) 2
(B) 4
(C) 3
(D) 6

26. The half-life period of a radioactive element is 100 days. How long will it take for the decay of 15 g out of 16 g?

(A) 200 days (B) 600 days

(C) 300 days (D) 400 days

27. The pH of a solution obtained by mixing 50 ml of 0.40 N HCl and 50 ml of 0.20 N NaOH is :

(A) 3 (B) 2

(C) 1 (D) log 2

28. Quantity of electricity in coulombs required to liberate 112 ml of $H_2$ gas at N.T.P. is :

(A) 4825 C (B) 96500 C

(C) 1930 C (D) 965 C

29. If $x_1$ and $x_2$ are the molefractions of solvent and non-volatile solute and $P°$ and $P$ are the vapour pressures of solvent and solution, then according to Raoult's law :

(A) $P = P° (1 - x_2)$ (B) $P° = x_1.P$

(C) $P - P° = x_1 - x_2$ (D) $(P° - P) / P° = x_1 / x_2$

30. At extremely high pressure, the van der Waal's equation for 1 mole a real gas may be written as :

(A) $PV = RT - a/V$ (B) $PV = RT + P.b$

(C) $PV = RT - P.b$ (D) $(P + a)(V - b) = RT$

31. Potassium crystallizes with bcc lattice. The number of atoms in a unit cell is :

(A) 1 (B) 8

(C) 4 (D) 2

32. In the Borax bead test, the colour of metaborate beads of copper is :

(A) Blue (B) Green

(C) Pink (D) Red

33. The oxidation number of carbon in carbon suboxide is :

(A) + 2/3 (B) +4/3

(C) – 4/3 (D) – 2/3

34. Which of the following is not a bidentate ligand?

(A) Ethylene diammine
(B) 1, 10-Phenantroline
(C) Pyridine
(D) Glycinate ion

35. Which of the following isomeric alcohols has the highest boiling point?

(A) n-Butyl alcohol
(B) iso-Butyl alcohol
(C) sec-Butyl alcohol
(D) t-Butyl alcohol

36. The number of proton NMR signals for p-Nitro toluene is :

(A) 2
(B) 5
(C) 4
(D) 3

37. The carbon-carbon double bond stretching frequency will be highest in :

(A) Cyclohexene
(B) 1, 3-Cyclohexadiene
(C) Benzene
(D) Same in all

38. The reagent which can reduce Nitrobenzene into Azobenzene is :

(A) Zn/HCl
(B) Zn/NaOH (MeOH)
(C) $Zn/NH_4Cl$
(D) Zn/NaOH ($H_2O$)

39. Amines can be estimated using a standard solution of :

(A) Sodium hydroxide
(B) Potassium permanganate
(C) Hydrochloric acid
(D) Sodium carbonate

40. Which of the following shows Carbyl amine Test :

(A) iso-Propyl amine
(B) Aniline
(C) o-Toluidine
(D) All of the above

41. Picric acid is :

(A) Trinitro benzene
(B) Trinitro toluene
(C) Trinitro phenol
(D) Tribromo phenol

42. The thermosetting plastic obtained by the polymerization reaction between phenol and formaldehyde is called :

(A) Bakelite
(B) Teflon
(C) Melamine
(D) None of the above

43. The condensation product of Chloroform with Acetone is :

(A) Chloropicrin (B) Chloretone

(C) Chloroprene (D) Chloroquine

44. Freon-112 is :

(A) $C_2Cl_4F_2$ (B) $CCl_2F_2$

(C) $C_2Cl_2F_4$ (D) $CClF_3$

45. The enzyme which converts starch into maltose is :

(A) Zymase (B) Invertase

(C) Diastase (D) Maltase

46. Chlorination of benzene in presence of sunlight gives :

(A) Chloro benzene (B) Hexachloro benzene

(C) Benzyl chloride (D) Benzene hexachloride

47. The heat evolved when 0.50 mole HCl is mixed with 0.20 mole NaOH solution will be :

(A) 57.1 kJ (B) 14.3 kJ

(C) 11.42 kJ (D) 1.14 kJ

48. The heats of formation of $CO_{(g)}$ and $CO_{2(g)}$ are – 26.4 kcal/mole and – 94 kcal/mole respectively. The heat of combustion of CO will be :

(A) + 26.4 kcal (B) + 94 kcal

(C) – 67.6 kcal (D) – 120.4 kcal

49. The Henderson equation for the pH of an acidic buffer solution is :

(A) pH = pKa + log [(salt)/(acid)]

(B) pH = pKa + log [(acid)/(salt)]

(C) pH = pKa – log [(salt)/(acid)]

(D) pH = pKa – log [(acid)/(salt)]

50. In a process $\Delta H$ = 100 kJ and $\Delta S$ = 100 J/K/mol at 400K. Then the value of $\Delta G$ will be :

(A) zero (B) 100 kJ

(C) 50 kJ (D) 60 kJ

51. For a gaseous reaction $X_{(g)} + Y_{(g)} \rightarrow 4Z_{(g)}$, $\Delta E$ at 300° K is 20 k cal. $\Delta H$ for the reaction will be :

(A) 21.2 k.cal (B) 18.8 k.cal

(C) 19.4 k.cal (D) 20 k.cal

52. Which of the following conditions will always lead to a spontaneous change?

(A) $\Delta H$ = +ve and $\Delta S$ = +ve (B) $\Delta H$ = – ve and $\Delta S$ = +ve

(C) $\Delta H$ = +ve and $\Delta S$ = – ve (D) $\Delta H$ = –ve and $\Delta S$ = –ve

53. During $\alpha$-decay N/P ratio :

(A) Increases (B) Decreases

(C) Remains constant (D) May increase or decrease

54. A sample of rock contains equal number of Uranium and Lead ($t\frac{1}{2}$ for U = $4.5 \times 10^9$ years). Then the age of the rock would be :

(A) $4.5 \times 10^9$ years (B) $2.25 \times 10^9$ years

(C) $9 \times 10^9$ years (D) $13.5 \times 10^9$ years

55. The most abundant element on earth's crust is :

(A) Hydrogen (B) Silicon

(C) Nitrogen (D) Oxygen

56. According to Bragg's equation, to get maximum intensity for first order reflection the distance between the planes must be :

(A) $\lambda$ (B) $\lambda / 2$

(C) $2\lambda$ (D) $\lambda / 4$

57. Which of the following nucleus has magic number of protons and neutrons?

(A) $_2He^4$ (B) $_{20}Ca^{41}$

(C) $_{50}Sb^{186}$ (D) $_{82}Pb^{208}$

58. The number of particles emitted when $_{90}Th^{232}$ changes to $_{82}Pb^{208}$ is :

(A) $4\alpha, 6\beta$ (B) $6\alpha, 4\beta$

(C) $6\alpha, 2\beta$ (D) $8\alpha, 6\beta$

59. 87.5% of a decay process was completed in 36 minutes. When was 50% of the decay completed?

(A) 24 Minutes (B) 18 Minutes

(C) 9 Minutes (D) 12 Minutes

60. The amount of NaOH in grams required to prepare 1 liter of 0.01 M solution :

(A) 0.20 (B) 0.40

(C) 2 (D) 4

61. Which of the following species is not amphoteric?

(A) $HCO_{3^-}$ (B) $HSO_{3^-}$

(C) $HPO_{4^-}$ (D) $HPO_{3^-}$

62. The ratio of (Kp/Kc) for the hypothetical reaction, $2AB_{3(g)} \rightleftharpoons A_{2(g)} + 3B_{2(g)}$ is :

(A) RT (B) $(RT)^2$

(C) 1/RT (D) $(RT)^{1/2}$

63. 5 ampere current passed for 20 seconds deposit 0.0658 g of an ion whose atomic weight is 189. The valency of the ion is :

(A) 3 (B) 2

(C) 1 (D) 4

64. The Calomel electrode is :

(A) $Pt - Hg/Hg^{2+}$ (B) $Ag/Ag^{+}$

(C) $Pt - Hg/Hg_2Cl_2 - Cl^{-}$ (D) $Ag/AgCl_{(s)} - Cl^{-}$

65. For a cell reaction, $Zn(s) + Mg^{2+}(C = 0.10) \rightleftharpoons Zn^{2+}(C = 1) + Mg(s)$, the e.m.f has been found to be 0.2312 volts. Then the standard e.m.f of the cell is :

(A) 0.2903 volts (B) – 0.2312 volts

(C) 0.2607 volts (D) 0.02312

66. 1 g of pure calcium carbonate was found to require 50 ml dilute HCl solution for complete reaction. The concentration of HCl solution is :

(A) 4 N (B) 0.40 N

(C) 2 N (D) 0.20 N

67. Which of the following solution has osmotic pressure nearest to that of an equimolar solution of $K_4[Fe(CN)_6]$ ?

(A) $C_{12}H_{22}O_{11}$ (B) $Al_2(SO_4)_3$

(C) $Na_2SO_4$ (D) $BaCl_2$

68. The first order rate constant 'k' is related to temperature as $\log k = 15 - 10^6/T$. Which of the following pair of values is correct :

(A) $A = 10^{15}$ and $E = 1.9 \times 10^4$ kJ

(B) $A = 10^{15}$ and $E = 40$ kJ

(C) $A = 10^{-15}$ and $E = 40$ kJ

(D) $A = 10^{-15}$ and $E = 1.9 \times 10^4$ kJ

69. The volume of oxygen at N.T.P obtained from the decomposition of 1 liter 100 volume $H_2O_2$ is :

(A) 100 liter (B) 10 liter

(C) 1 liter (D) 200 liter

70. Permutit is the commercial name for :

(A) Sodium calcium silicate (B) Calcium aluminium silicate

(C) Sodium fluoro silicate (D) Sodium aluminium silicate

71. 0.10 mole of a carbohydrate with empirical formula $CH_2O$ contains 1 g. of hydrogen. Its molecular formula will be :

(A) $C_5H_{10}O_5$ (B) $C_6H_{12}O_6$

(C) $C_4H_8O_4$ (D) $C_3H_6O_3$

72. Super oxides contain :

(A) $O^{2-}$ ions (B) $O_2^{2-}$ ions

(C) $O_{2^-}$ ions (D) $O^-$ ions

73. The type of glass possessing low coefficient of thermal expansion is :

(A) Soda glass (B) Pyrex glass

(C) Flint glass (D) Hard glass

74. Identify the fat-soluble vitamin :

(A) Thiamine (B) Nicotinic acid

(C) Ascorbic acid (D) Calciferol

75. Xerophthalmia is caused by the deficiency of :

(A) Vitamin A
(B) Vitamin D
(C) Vitamin C
(D) Vitamin K

76. The number of degrees of freedom (F) for the system in which ammonium chloride is in equilibrium with ammonia and hydrogen chloride would be :

(A) Zero
(B) One
(C) Two
(D) Three

77. The temperature at which two crystalline forms are in equilibrium is called :

(A) Transition point
(B) Melting point
(C) Eutectic point
(D) Triple point

78. Which of the following pair forms an ideal solution?

(A) Pyridine – Water
(B) Ethyl alcohol – Water
(C) Benzene – Acetic acid
(D) Benzene – Tolune

79. An example for a partially miscible liquid system with lower Critical Solution Temperature (CST) is :

(A) Phenol-Water
(B) Aniline-Water
(C) Aniline-Hexane
(D) Diethyl amine-Water

80. The heterocyclic ring system present in the alkaloid Quinine is :

(A) Piperidine
(B) Pyrolidine-Pyridine
(C) Quinoline
(D) Isoquinoline

81. The reduction product of Citral with Na(Hg)/Alcohol is :

(A) p-Cymene
(B) Geraniol
(C) Geranic acid
(D) Levulinic acid

82. The principal constituent of Turpentine oil is :

(A) Camphor
(B) Menthol
(C) $\alpha$-Pinene
(D) Zingiberene

83. Which of the following is a purine base present in nucleic acid?

(A) Thymine
(B) Cytosine
(C) Uracil
(D) Guanine

84. Lactose is a disaccharide made up of :

(A) Glucose and Fructose
(B) Two glucose units
(C) Two galactose units
(D) Glucose and Galactose

85. Arrange the following nucleophiles in the decreasing order of their nucleophilicity

$NH_{2^-}$ , $NH_3$, $C_2H_5$-$NH_2$, $C_6H_5$-$NH_2$

(A) $NH_{2^-} > NH_3 > C_2H_5\text{-}NH_2 > C_6H_5\text{-}NH_2$

(B) $NH_{2^-} > C_2H_5\text{-}NH_2 > NH_3 > C_6H_5\text{-}NH_2$

(C) $NH_{2^-} > NH_3 > C_6H_5\text{-}NH_2 > C_2H_5\text{-}NH_2$

(D) $NH_{2^-} > C_2H_5\text{-}NH_2 > C_6H_5\text{-}NH_2 > NH_3$

86. $S_N1$ mechanism operates in the hydrolysis of :

(A) t-Butyl chloride
(B) methyl chloride
(C) ethyl chloride
(D) iso-Propyl chloride

87. Temporary hardness of water is due to the presence of :

(A) Chlorides of Ca and Mg
(B) Bicarbonates of Ca and Mg
(C) Sulphates of Ca and Mg
(D) Nitrates of Ca and Mg

88. A sulphide ore of Iron is :

(A) Magnetite
(B) Haematite
(C) Limonite
(D) Iron pyrites

89. The most covalent aluminium halide is :

(A) Aluminium chloride
(B) Aluminium bromide
(C) Aluminium fluoride
(D) Aluminium iodide

90. The crystal system defined by $a = b = c$ and $\alpha = \beta = y \neq 90^\circ$ is called :

(A) Rhombohedral
(B) Triclinic
(C) Orthorhombic
(D) Tetragonal

91. For the reaction A $\rightarrow$ Product(s) when the concentration of A is doubled, the rate becomes 8 times. The order of the reaction is :

(A) 4
(B) 1
(C) 3
(D) 2

92. The pH of a $1 \times 10^{-5}$ M solution of NaOH is :

(A) 5 (B) 9

(C) 7 (D) 12

93. Which of the following molecules has the largest RMS velocity?

(A) $H_2S$ (B) $NH_3$

(C) $CO_2$ (D) $SO_2$

94. Adsorption isobar is a plot of amount adsorbed against :

(A) Temperature (B) 1/Temperature

(C) Pressure (D) Volume

95. Smoke is a dispersion of :

(A) Solid in Gas (B) Liquid in Gas

(C) Gas in Gas (D) Gas in Solid

96. Iodoform cannot be prepared from :

(A) $CH_3CHO$ (B) $CH_3CH_2OH$

(C) $CH_3OH$ (D) $CH_3CH(OH)CH_3$

97. Steel is heated to red hot and is rapidly cooled by dipping in water. This treatment is called :

(A) Tempering (B) Anealing

(C) Quenching (D) Hardening

98. Pure gold is :

(A) 18 carat (B) 22 carat

(C) 26 carat (D) 24 carat

99. The flame colour of Lithium metal is :

(A) Yellow (B) Blue

(C) Violet (D) Red

100. Iodine oxidizes thiosulphate ion to :

(A) Sulphite (B) Dithionate

(C) Tetrathionate (D) Sulphate