

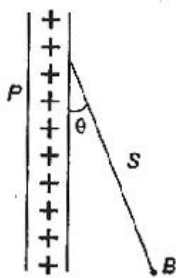
- (a) attract each other with a force of $\frac{\mu_0 q^2}{(2\pi d)}$
 (b) repel each other with a force of $\frac{\mu_0 q^2}{(2\pi d)}$
 (c) attract each other with a force of $\frac{\mu_0 q^2}{(2\pi d^2)}$
 (d) repel each other with a force of $\frac{\mu_0 q^2}{(2\pi d^2)}$

55. When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of the light which does not get transmitted is :

- (a) $\frac{1}{2} I_0$ (b) $\frac{1}{4} I_0$
 (c) zero (d) I_0

56. A charged ball B hangs from a silk thread S , which makes an angle θ with a large charged conducting sheet P , as shown in the figure. The surface charge density σ of the sheet is proportional to :

- (a) $\cos \theta$ (b) $\cot \theta$
 (c) $\sin \theta$ (d) $\tan \theta$



57. Two point charges $+8q$ and $-2q$ are located at $x=0$ and $x=L$ respectively. The location of a point on the x -axis at which the net electric field due to these two point charges is zero is :

- (a) $2L$ (b) $\frac{L}{4}$
 (c) $8L$ (d) $4L$

58. Two thin wire rings each having a radius R are placed at a distance d apart with their axes coinciding. The charges on the two rings are $+q$ and $-q$. The potential difference between the centres of the two rings is :

- (a) $\frac{qR}{4\pi\epsilon_0 d^2}$
 (b) $\frac{q}{2\pi\epsilon_0} \left[\frac{1}{R} - \frac{1}{\sqrt{R^2 + d^2}} \right]$
 (c) zero
 (d) $\frac{q}{4\pi\epsilon_0} \left[\frac{1}{R} - \frac{1}{\sqrt{R^2 + d^2}} \right]$

59. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C , then the resultant capacitance is :

- (a) $(n-1)C$ (b) $(n+1)C$
 (c) C (d) nC

60. When two tuning forks (fork 1 and fork 2) are sounded simultaneously, 4 beats per second are heard. Now, some tape is attached on the prong of the fork 2. When the tuning forks are sounded again, 6 beats per second are heard. If the frequency of fork 1 is 200 Hz, then what was the original frequency of fork 2 ?

- (a) 200 Hz (b) 202 Hz
 (c) 196 Hz (d) 204 Hz

61. If a simple harmonic motion is represented by $\frac{d^2x}{dt^2} + \alpha x = 0$, its time period is :

- (a) $\frac{2\pi}{\alpha}$ (b) $\frac{2\pi}{\sqrt{\alpha}}$
 (c) $2\pi\alpha$ (d) $2\pi\sqrt{\alpha}$

62. The bob of a simple pendulum is a spherical hollow ball filled with water. A plugged hole near the bottom of the oscillating bob gets suddenly unplugged. During observation, till water is coming out, the time period of oscillation would :

- (a) first increase and then decrease to the original value
 (b) first decrease and then increase to the original value
 (c) remain unchanged
 (d) increase towards a saturation value

63. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency ?

- (a) Zero (b) 0.5%
 (c) 5% (d) 20%

64. If I_0 is the intensity of the principal maximum in the single slit diffraction pattern, then what will be its intensity when the slit width is doubled ?

- (a) $2I_0$ (b) $4I_0$
 (c) I_0 (d) $\frac{I_0}{2}$

65. Two concentric coils each of radius equal to 2π cm are placed at right angles to each other. 3 A and 4 A are the currents flowing in each coil respectively. The magnetic induction in Wb/m^2 at the centre of the coils will be :

$$(\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am})$$

- (a) 12×10^{-5} (b) 10^{-5}
 (c) 5×10^{-5} (d) 7×10^{-5}

66. A coil of inductance 300 mH and resistance 2Ω is connected to a source of voltage 2V. The current reaches half of its steady state value in :
 (a) 0.05 s (b) 0.1 s
 (c) 0.15 s (d) 0.3 s
67. The self-inductance of the motor of an electric fan is 10 H. In order to impart maximum power at 50 Hz, it should be connected to a capacitance of :
 (a) $4\mu\text{F}$ (b) $8\mu\text{F}$
 (c) $1\mu\text{F}$ (d) $2\mu\text{F}$
68. An energy source will supply a constant current into the load, if its internal resistance is :
 (a) equal to the resistance of the load
 (b) very large as compared to the load resistance
 (c) zero
 (d) non-zero but less than the resistance of the load
69. A circuit has a resistance of 12Ω and an impedance of 15Ω . The power factor of the circuit will be :
 (a) 0.8 (b) 0.4
 (c) 1.25 (d) 0.125
70. The phase difference between the alternating current and emf is $\pi/2$. Which of the following cannot be the constituent of the circuit ?
 (a) C alone (b) R, L
 (c) L, C (d) L alone
71. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected along the direction of the fields with a certain velocity, then :
 (a) its velocity will decrease
 (b) its velocity will increase
 (c) it will turn towards right of direction of motion
 (d) it will turn towards left of direction of motion
72. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B . The time taken by the particle to complete one revolution is :
 (a) $\frac{2\pi mq}{B}$ (b) $\frac{2\pi q^2 B}{m}$
 (c) $\frac{2\pi qB}{m}$ (d) $\frac{2\pi m}{qB}$
73. In a potentiometer experiment the balancing with a cell is at length 240 cm. On shunting the cell with a resistance of 2Ω , the balancing length becomes 120 cm. The internal resistance of the cell is :
 (a) 1Ω (b) 0.5Ω
 (c) 4Ω (d) 2Ω
74. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 V lamp, when not in use ?
 (a) 40Ω (b) 20Ω
 (c) 400Ω (d) 200Ω
75. A magnetic needle is kept in a non-uniform magnetic field. It experiences :
 (a) a torque but not a force
 (b) neither a force nor a torque
 (c) a force and a torque
 (d) a force but not a torque

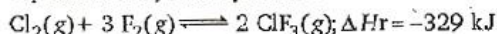
Chemistry

76. The oxidation state of Cr in $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]^+$ is :
 (a) 0 (b) +1
 (c) +2 (d) +3
77. Which one of the following types of drugs reduces fever ?
 (a) Tranquilliser (b) Antibiotic
 (c) Antipyretic (d) Analgesic
78. Which of the following oxides is amphoteric in character ?
 (a) SnO_2 (b) SiO_2
 (c) CO_2 (d) CaO
79. Which one of the following species is diamagnetic in nature ?
 (a) H_2 (b) H_2^+
 (c) H_2^- (d) He_2^+
80. If α is the degree of dissociation of Na_2SO_4 , the van't Hoff factor (i) used for calculating the molecular mass is :
 (a) $1 - 2\alpha$ (b) $1 + 2\alpha$
 (c) $1 - \alpha$ (d) $1 + \alpha$
81. Which of the following is a polyamide ?
 (a) Bakelite (b) Terylene
 (c) Nylon-66 (d) Teflon

82. Due to the presence of an unpaired electron, free radicals are :
- cations
 - anions
 - chemically inactive
 - chemically reactive
83. For a spontaneous reaction the ΔG , equilibrium constant (K) and E_{cell}° will be respectively :
- ve, > 1 , -ve
 - ve, < 1 , -ve
 - ve, > 1 , -ve
 - ve, > 1 , +ve
84. Hydrogen bomb is based on the principle of :
- artificial radioactivity
 - nuclear fusion
 - natural radioactivity
 - nuclear fission
85. An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions on the centres of the faces of the cube. The empirical formula for this compound would be :
- A_3B
 - AB_3
 - A_2B
 - AB
86. The highest electrical conductivity of the following aqueous solutions is of :
- 0.1 M difluoroacetic acid
 - 0.1 M fluoroacetic acid
 - 0.1 M chloroacetic acid
 - 0.1 M acetic acid
87. Lattice energy of an ionic compound depends upon :
- charge on the ion and size of the ion
 - packing of ions only
 - size of the ion only
 - charge on the ion only
88. Consider an endothermic reaction $X \rightarrow Y$ with the activation energies E_b and E_f for the backward and forward reactions respectively. In general :
- there is no definite relation between E_b and E_f
 - $E_b = E_f$
 - $E_b > E_f$
 - $E_b < E_f$
89. Aluminium oxide may be electrolysed at 1000°C to furnish aluminium metal (Atomic mass = 27 amu; 1 faraday = 96,500 Coulombs). The cathode reaction is
- $$\text{Al}^{3+} + 3e^{-} \rightarrow \text{Al}^0$$
- To prepare 5.12 kg of aluminium metal by this method would require :
- 5.49×10^1 C of electricity
 - 5.49×10^4 C of electricity
 - 1.83×10^7 C of electricity
 - 5.49×10^7 C of electricity
90. The volume of a colloidal particle, V_c as compared to the volume of a solute particle in a true solution V_s , could be :
- $\frac{V_c}{V_s} \approx 10^3$
 - $\frac{V_c}{V_s} \approx 10^{-1}$
 - $\frac{V_c}{V_s} \approx 10^{23}$
 - $\frac{V_c}{V_s} \approx 1$
91. Consider the reaction : $\text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3$ carried out at constant temperature and pressure. If ΔH and ΔU are the enthalpy and internal energy changes for the reaction, which of the following expressions is true ?
- $\Delta H > \Delta U$
 - $\Delta H < \Delta U$
 - $\Delta H = \Delta U$
 - $\Delta H = 0$
92. The solubility product of a salt having general formula MX_2 , in water is 4×10^{-12} . The concentration of M^{2+} ions in the aqueous solution of the salt is :
- 4.0×10^{-10} M
 - 1.6×10^{-4} M
 - 1.0×10^{-4} M
 - 2.0×10^{-6} M
93. Benzene and toluene form nearly ideal solutions. At 20°C , the vapour pressure of benzene is 75 torr and that of toluene is 22 torr. The partial vapour pressure of benzene at 20°C for a solution containing 78 g of benzene and 46 g of toluene in torr is :
- 53.5
 - 37.5
 - 25
 - 50
94. Which one of the following statements is not true about the effect of an increase in temperature on the distribution of molecular speeds in a gas ?
- The area under the distribution curve remains the same as under the lower temperature
 - The distribution becomes broader
 - The fraction of the molecules with the most probable speed increases
 - The most probable speed increases
95. For the reaction
- $$2\text{NO}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g}) + \text{O}_2(\text{g})$$
- ($K_c = 1.3 \times 10^{-6}$ at 184°C)
 ($R = 0.00831 \text{ kJ}/(\text{mol} \cdot \text{K})$)
 When K_p and K_c are compared at 184°C it is found that :

- (a) whether K_p is greater than, less than or equal to K_c depends upon the total gas pressure
 (b) $K_p = K_c$
 (c) K_p is less than K_c
 (d) K_p is greater than K_c

96. The exothermic formation of ClF_3 is represented by the equation :



Which of the following will increase the quantity of ClF_3 in an equilibrium mixture of Cl_2 , F_2 and ClF_3 ?

- (a) Adding F_2
 (b) Increasing the volume of the container
 (c) Removing Cl_2
 (d) Increasing the temperature
97. Hydrogen ion concentration in mol/L in a solution of pH = 5.4 will be :
- (a) 3.98×10^{-6} (b) 3.68×10^{-6}
 (c) 3.88×10^6 (d) 3.98×10^8

98. A reaction involving two different reactants can never be

- (a) bimolecular reaction
 (b) second order reaction
 (c) first order reaction
 (d) unimolecular reaction

99. Two solutions of a substance (non electrolyte) are mixed in the following manner.

480 mL of 1.5 M first solution + 520 mL of 1.2 M second solution.

What is the molarity of the final mixture ?

- (a) 2.70 M (b) 1.344 M
 (c) 1.50 M (d) 1.20 M
100. During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are :
- (a) Fe and Ni (b) Ag and Au
 (c) Pb and Zn (d) Se and Ag

Electrolyte	KCl	KNO_3	HCl	NaOAc	NaCl
$\Lambda^\infty (\text{S cm}^2 \text{ mol}^{-1})$	149.9	145.0	426.2	91.0	126.5

Calculate $\Lambda^\infty_{\text{HOAc}}$ using appropriate molar conductances of the electrolytes listed above at infinite dilution in H_2O at 25°C :

- (a) 217.5 (b) 390.7
 (c) 552.7 (d) 517.2
102. If we consider that 1/6, in place of 1/12, mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will :

- (a) be a function of the molecular mass of the substance
 (b) remain unchanged
 (c) increase two fold
 (d) decrease twice

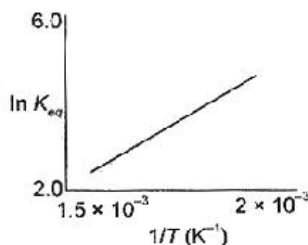
103. In a multi-electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric fields ?

- (A) $n = 1, l = 0, m = 0$
 (B) $n = 2, l = 0, m = 0$
 (C) $n = 2, l = 1, m = 1$
 (D) $n = 3, l = 2, m = 1$
 (E) $n = 3, l = 2, m = 0$
- (a) (D) and (E) (b) (C) and (D)
 (c) (B) and (C) (d) (A) and (B)

104. Based on lattice energy and other considerations which one of the following alkali metal chlorides is expected to have the highest melting point ?

- (a) RbCl (b) KCl
 (c) NaCl (d) LiCl

105. A schematic plot of $\ln K_{eq}$ versus inverse of temperature for a reaction is shown below :



The reaction must be :

- (a) highly spontaneous at ordinary temperature
 (b) one with negligible enthalpy change
 (c) endothermic
 (d) exothermic
106. Heating mixture of Cu_2O and Cu_2S will give
- (a) Cu_2SO_3 (b) $\text{CuO} + \text{CuS}$
 (c) $\text{Cu} + \text{SO}_3$ (d) $\text{Cu} + \text{SO}_2$
107. The molecular shapes of SF_6 , CF_4 and XeF_4 are :
- (a) different with 1, 0 and 2 lone pairs of electrons on the central atom, respectively
 (b) different with 0, 1 and 2 lone pairs of electrons on the central atom, respectively
 (c) the same with 1, 1 and 1 lone pair of electrons on the central atoms, respectively
 (d) the same with 2, 0 and 1 lone pairs of electrons on the central atom, respectively

108. The disperse phase in colloidal iron (III) hydroxide and colloidal gold is positively and negatively charged, respectively. Which of the following statements is not correct ?
- Coagulation in both sols can be brought about by electrophoresis
 - Mixing the sols has no effect
 - Sodium sulphate solution causes coagulation in both sols
 - Magnesium chloride solution coagulates, the gold sol more readily than the iron (III) hydroxide sol.
109. The number of hydrogen atom(s) attached to phosphorus atom in hypophosphorous acid is :
- three
 - one
 - two
 - zero
110. What is the conjugate base of OH^- ?
- O^{2-}
 - O^-
 - H_2O
 - O_2
111. Heating an aqueous solution of aluminium chloride to dryness will give :
- $\text{Al}(\text{OH})\text{Cl}_2$
 - Al_2O_3
 - Al_2Cl_6
 - AlCl_3
112. The correct order of the thermal stability of hydrogen halides ($\text{H}-\text{X}$) is :
- $\text{HI} > \text{HCl} < \text{HF} > \text{HBr}$
 - $\text{HCl} < \text{HF} > \text{HBr} < \text{HI}$
 - $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$
 - $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$
113. Calomel (Hg_2Cl_2) on reaction with ammonium hydroxide gives :
- HgO
 - Hg_2O
 - $\text{NH}_2-\text{Hg}-\text{Hg}-\text{Cl}$
 - HgNH_2Cl
114. The number and type of bonds between two carbon atoms in calcium carbide are :
- two sigma, two pi
 - two sigma, one pi
 - one sigma, two pi
 - one sigma, one pi
115. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is :
- +3
 - +2
 - +6
 - +4
116. In silicon dioxide :
- there are double bonds between silicon and oxygen atoms
 - silicon atom is bonded to two oxygen atoms
 - each silicon atom is surrounded by two oxygen atoms and each oxygen atom is bonded to two silicon atoms
 - each silicon atom is surrounded by four oxygen atoms and each oxygen atom is bonded to two silicon atoms
117. The lanthanide contraction is responsible for the fact that :
- Zr and Zr have the same oxidation state
 - Zr and Hf have about the same radius
 - Zr and Nb have similar oxidation state
 - Zr and Y have about the same radius
118. The IUPAC name of the co-ordination compound $\text{K}_3[\text{Fe}(\text{CN})_6]$ is :
- Tripotassium hexacyanoiron (II)
 - Potassium hexacyanoiron (II)
 - Potassium hexacyanoferrate (III)
 - Potassium hexacyanoferrate (II)
119. In which of the following arrangements the order is not according to the property indicated against it ?
- $\text{Li} < \text{Na} < \text{K} < \text{Rb}$: Increasing metallic radius
 - $\text{I} < \text{Br} < \text{F} < \text{Cl}$: Increasing electron gain enthalpy (with negative sign)
 - $\text{B} < \text{C} < \text{N} < \text{O}$: Increasing first ionisation enthalpy
 - $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$: Increasing ionic size
120. Of the following sets which one does not contain isoelectronic species ?
- BO_3^{3-} , CO_3^{2-} , NO_3^-
 - SO_3^{2-} , CO_3^{2-} , NO_3^-
 - CN^- , N_2 , C_2^{2-}
 - PO_4^{3-} , SO_4^{2-} , ClO_4^-
121. 2-methylbutane on reacting with bromine in the presence of sunlight gives mainly :
- 1-bromo-3-methylbutane
 - 2-bromo-3-methylbutane
 - 2-bromo-2-methylbutane
 - 1-bromo-2-methylbutane
122. Which of the following compounds shows optical isomerism ?
- $[\text{Co}(\text{CN})_6]^{3-}$
 - $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$
 - $[\text{ZnCl}_4]^{2-}$
 - $[\text{Cu}(\text{NH}_3)_4]^{2+}$
123. Which one of the following cyano complexes would exhibit the lowest value of paramagnetic behaviour ?

- (a) $[\text{Co}(\text{CN})_6]^{3-}$ (h) $[\text{Fe}(\text{CN})_6]^{3-}$
 (c) $[\text{Mn}(\text{CN})_6]^{3-}$ (d) $[\text{Cr}(\text{CN})_6]^{3-}$
 (Atomic no. Cr = 24, Mn = 25, Fe = 26, Co = 27)

124. The best reagent to convert pent-3-en-2-ol into pent-3-en-2-one is :

- (a) pyridinium chloro-chromate
 (b) chromic anhydride in glacial acetic acid
 (c) acidic dichromate
 (d) acidic permanganate

125. A photon of hard gamma radiation knocks a proton out of $^{24}_{12}\text{Mg}$ nucleus to form :

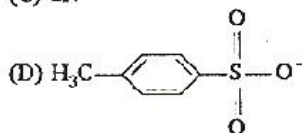
- (a) the isobar of $^{23}_{11}\text{Na}$
 (b) the nuclide $^{23}_{11}\text{Na}$
 (c) the isobar of parent nucleus
 (d) the isotope of parent nucleus

126. Reaction of one molecule of HBr with one molecule of 1, 3-butadiene at 40°C gives predominantly :

- (a) 1-bromo-2-butene under kinetically controlled conditions
 (b) 3-bromobutene under thermodynamically controlled conditions
 (c) 1-bromo-2-butene under thermodynamically controlled conditions
 (d) 3-bromobutene under kinetically controlled conditions

127. The decreasing order of nucleophilicity among the nucleophiles :

- (A) $\text{CH}_3\text{C}(\text{O})\text{O}^-$
 (B) CH_3O^-
 (C) CN^-



- (a) (C), (B), (A), (D)
 (b) (B), (C), (A), (D)
 (c) (D), (C), (B), (A)
 (d) (A), (B), (C), (D)

128. Tertiary alkyl halides are practically inert to substitution by $\text{S}_{\text{N}}2$ mechanism because of :

- (a) steric hindrance (b) inductive effect
 (c) instability (d) insolubility

129. In both DNA and RNA, heterocyclic base and phosphate ester linkages are at :

- (a) C'_5 and C'_1 respectively of the sugar molecule
 (b) C'_1 and C'_5 respectively of the sugar molecule
 (c) C'_2 and C'_5 respectively of the sugar molecule
 (d) C'_5 and C'_2 respectively of the sugar molecule

130. Among the following acids which has the lowest $\text{p}K_{\text{a}}$ value ?

- (a) $\text{CH}_3\text{CH}_2\text{COOH}$ (b) $(\text{CH}_3)_2\text{CH}-\text{COOH}$
 (c) HCOOH (d) CH_3COOH

131. Of the five isomeric hexanes, the isomer which can give two monochlorinated compounds is :

- (a) 2-methylpentane
 (b) 2, 2-dimethylbutane
 (c) 2, 3-dimethylbutane
 (d) n-hexane

132. Alkyl halides react with dialkyl copper reagents to give :

- (a) alkenyl halides
 (b) alkanes
 (c) alkyl copper halides
 (d) alkenes

133. Which one of the following methods is neither meant for the synthesis nor for separation of amines ?

- (a) Curtius reaction
 (b) Wurtz reaction
 (c) Hofmann method
 (d) Hinsberg method

134. Which types of isomerism is shown by 2, 3-dichlorobutane ?

- (a) Structural (b) Geometric
 (c) Optical (d) Diastereo

135. Amongst the following the most basic compound is :

- (a) p-nitroaniline (b) acetanilide
 (c) aniline (d) benzylamine

136. Acid catalyzed hydration of alkenes except ethene leads to the formation of :

- (a) mixture of secondary and tertiary alcohols
 (b) mixture of primary and secondary alcohols
 (c) secondary or tertiary alcohol
 (d) primary alcohol

137. Which of the following is fully fluorinated polymer ?

- (a) PVC (b) Thiokol
 (c) Teflon (d) Neoprene

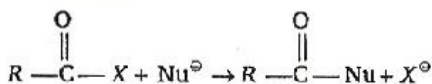
138. Elimination of bromine from 2-bromobutane results in the formation of :

- (a) predominantly 2-butene
- (b) predominantly 1-butene
- (c) predominantly 2-butene
- (d) equimolar mixture of 1 and 2-butene

139. Equimolar solutions in the same solvent have :

- (a) different boiling and different freezing points
- (b) same boiling and same freezing points
- (c) same freezing point but different boiling point
- (d) same boiling point but different freezing point

140. The reaction



is fastest when X is :

- (a) OCOR
- (b) OC_2H_5
- (c) NH_2
- (d) Cl

141. The structure of diborane (B_2H_6) contains :

- (a) four $2C-2e^-$ bonds and four $3C-2e^-$ bonds
- (b) two $2C-2e^-$ bonds and two $3C-3e^-$ bonds
- (c) two $2C-2e^-$ bonds and four $3C-2e^-$ bonds
- (d) four $2C-2e^-$ bonds and two $3C-2e^-$ bonds

142. Which of the following statements in relation to the hydrogen atom is correct ?

- (a) $3s$, $3p$ and $3d$ orbitals all have the same energy
- (b) $3s$ and $3p$ orbitals are of lower energy than $3d$ orbital
- (c) $3p$ orbital is lower in energy than $3d$ orbital
- (d) $3s$ orbital is lower in energy than $3p$ orbital

143. Which of the following factors may be regarded as the main cause of lanthanide contraction ?

- (a) Greater shielding of $5d$ electron by $4f$ electrons
- (b) Poorer shielding of $5d$ electron by $4f$ electrons
- (c) Effective shielding of one of $4f$ electrons by another in the sub-shell
- (d) Poor shielding of one of $4f$ electron by another in the sub-shell

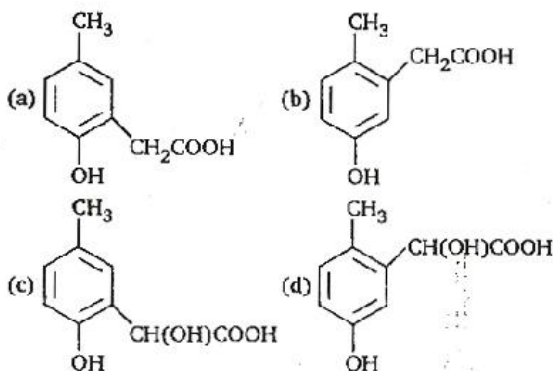
144. The value of the 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is :

- (a) d^5 (in strong ligand field)
- (b) d^3 (in weak as well as in strong fields)
- (c) d^4 (in weak ligand field)
- (d) d^4 (in strong ligand field)

145. Reaction of cyclohexanone with dimethylamine in the presence of catalytic amount of an acid forms a compound. Water during the reaction is continuously removed. The compound formed is generally known as :

- (a) an amine
- (b) an imine
- (c) an enamine
- (d) a Schiff's base

146. *p*-cresol reacts with chloroform in alkaline medium to give the compound A which adds hydrogen cyanide to form the compound B. The latter on acidic hydrolysis gives chiral carboxylic acid. The structure of the carboxylic acid is :



147. If the bond dissociation energies of XY , X_2 and Y_2 (all diatomic molecules) are in the ratio of 1 : 1 : 0.5 and ΔH_f for the formation of XY is -200 kJ mol^{-1} . The bond dissociation energy of X_2 will be :

- (a) 400 kJ mol^{-1}
- (b) 300 kJ mol^{-1}
- (c) 200 kJ mol^{-1}
- (d) none of these

148. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 0.50 atm pressure. Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask. When the decomposition reaction reaches equilibrium, the total pressure in the flask rises to 0.84 atm. The equilibrium constant for NH_4HS decomposition at this temperature is :

- (a) 0.11
- (b) 0.17
- (c) 0.18
- (d) 0.30

149. An organic compound having molecular mass 60 is found to contain C = 20%, H = 6.67% and N = 46.67% while rest is oxygen. On heating it gives NH_3 alongwith a solid residue. The solid residue give violet colour with alkaline copper sulphate solution. The compound is :

- (a) $\text{CH}_3\text{CH}_2\text{CONH}_2$ (b) $(\text{NH}_2)_2\text{CO}$
 (c) CH_3CONH_2 (d) CH_3NCO

150. $t_{1/4}$ can be taken as the time taken for the concentration of a reactant to drop to $\frac{3}{4}$ of its

initial value. If the rate constant for a first order reaction is k , the $t_{1/4}$ can be written as :

- (a) $0.75/k$ (b) $0.69/k$
 (c) $0.29/k$ (d) $0.10/k$

Mathematics

1. If C is the mid point of AB and P is any point outside AB , then :

(a) $\vec{PA} + \vec{PB} + \vec{PC} = \vec{0}$

(b) $\vec{PA} + \vec{PB} + 2\vec{PC} = \vec{0}$

(c) $\vec{PA} + \vec{PB} = \vec{PC}$

(d) $\vec{PA} + \vec{PB} = 2\vec{PC}$

2. Let P be the point $(1, 0)$ and Q a point on the locus $y^2 = 8x$. The locus of mid point of PQ is :

(a) $x^2 - 4y + 2 = 0$ (b) $x^2 + 4y + 2 = 0$

(c) $y^2 + 4x + 2 = 0$ (d) $y^2 - 4x + 2 = 0$

3. If in a frequency distribution, the Mean and Median are 21 and 22 respectively, then its Mode is approximately :

(a) 24.0 (b) 25.5

(c) 20.5 (d) 22.0

4. Let $R = \{(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$. The relation is :

(a) reflexive and symmetric only

(b) an equivalence relation

(c) reflexive only

(d) reflexive and transitive only

5. If $A^2 - A + I = 0$, then the inverse of A is :

(a) $I - A$ (b) $A - I$

(c) A (d) $A + I$

6. If the cube roots of unity are $1, \omega, \omega^2$, then the roots of the equation $(x - 1)^3 + 8 = 0$, are :

(a) $-1, 1 + 2\omega, 1 + 2\omega^2$

(b) $-1, 1 - 2\omega, 1 - 2\omega^2$

(c) $-1, -1, -1$

(d) $-1, -1 + 2\omega, -1 - 2\omega^2$

7. $\lim_{n \rightarrow \infty} \left[\frac{1}{n^2} \sec^2 \frac{1}{n^2} + \frac{2}{n^2} \sec^2 \frac{4}{n^2} + \dots + \frac{n}{n^2} \sec^2 1 \right]$

equals :

(a) $\frac{1}{2} \tan 1$ (b) $\tan 1$

(c) $\frac{1}{2} \operatorname{cosec} 1$ (d) $\frac{1}{2} \sec 1$

8. Area of the greatest rectangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is :

(a) $\frac{a}{b}$ (b) \sqrt{ab}

(c) ab (d) $2ab$

9. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where $c > 0$, is a parameter, is of order and degree as follows :

(a) order 2, degree 2

(b) order 1, degree 3

(c) order 1, degree 1

(d) order 1, degree 2

10. ABC is a triangle. Forces $\vec{P}, \vec{Q}, \vec{R}$ acting along IA, IB and IC respectively are in equilibrium, where I is the incentre of ΔABC . Then $\vec{P} : \vec{Q} : \vec{R}$ is :

(a) $\cos A : \cos B : \cos C$

(b) $\cos \frac{A}{2} : \cos \frac{B}{2} : \cos \frac{C}{2}$

(c) $\sin \frac{A}{2} : \sin \frac{B}{2} : \sin \frac{C}{2}$

(d) $\sin A : \sin B : \sin C$

11. If the coefficients of r th, $(r + 1)$ th and $(r + 2)$ th terms in the binomial expansion of $(1 + y)^m$ are in AP, then m and r satisfy the equation :

(a) $m^2 - m(4r - 1) + 4r^2 + 2 = 0$

(b) $m^2 - m(4r + 1) + 4r^2 - 2 = 0$

(c) $m^2 - m(4r + 1) + 4r^2 + 2 = 0$

(d) $m^2 - m(4r - 1) + 4r^2 - 2 = 0$

12. In a triangle PQR , $\angle R = \frac{\pi}{2}$. If $\tan \left(\frac{P}{2} \right)$ and $\tan \left(\frac{Q}{2} \right)$ are the roots of $ax^2 + bx + c = 0$, $a \neq 0$, then :

(a) $b = a + c$

(b) $b = c$

(c) $c = a + b$

(d) $a = b + c$