51. If \( \vec{A} \) and \( \vec{B} \) are two vectors such that \( |\vec{A} + \vec{B}| = |\vec{A} - \vec{B}| \) then \( \vec{A} \) and \( \vec{B} \) are __________ to each other.

\( |\vec{A} + \vec{B}| = |\vec{A} - \vec{B}| \) means they are \( \vec{B} \) from \( \vec{A} \) and vice versa.

(1) Parallel  
(2) Perpendicular  
(3) Antiparallel  
(4) Cannot be determined

52. A bread gives a boy 5000 Cal. How much height he can climb using this energy if his efficiency is 28\%.(Mass of the boy = 60 kg)?

\( \text{Mass} \times \text{Energy} = 5000 \text{ Cal} \times \text{Efficiency} \)

\( \text{Mass} \times \text{Distance} = 60 \text{ kg} \times \text{Height} \)

(\( \neq \) 10 m  
(\( \neq \) 20 m  
(\( \neq \) 5 m

53. The product of moment of inertia and angular acceleration is:

(1) Force  
(2) Torque  
(3) Linear momentum  
(4) Angular momentum

54. A particle moves in a potential energy field represented by \( U = U_0 - Px + Qx^2 \). The force constant will be:

\( U = U_0 - Px + Qx^2 \) is the potential energy function. \( x \) is the position.

(\( \neq \) 2Q  
(\( \neq \) Q - P  
(\( \neq \) Q  
(\( \neq \) P

[P.T.O.]
55. Which of the following is not correct under the action of central force?

(1) Work done in moving a particle depends on the path followed.
(2) Torque acting on the particle is zero.
(3) Angular momentum of the particle is constant.
(4) Areal velocity of the particle is zero.

56. The time period of a simple pendulum of infinite length is \( R \) \( (R \text{ radius of the Earth}) \):

(1) \( T = 2\pi \sqrt{\frac{2R}{g}} \)
(2) \( T = 2\pi \sqrt{\frac{R}{2g}} \)
(3) Infinity
(4) \( T = 2\pi \sqrt{\frac{R}{g}} \)

57. A particle is executing S.H.M. along a straight line with amplitude ‘A’. The potential energy is maximum when the displacement is:

(1) \( \pm A \)
(2) Zero
(3) \( \pm \frac{A}{2} \)
(4) \( \pm \frac{A}{\sqrt{2}} \)

58. The relaxation time \( (\tau) \) and the Quality factor \( (Q) \) of a damped oscillator are related by \( (\omega \text{ -angular velocity})

(1) \( Q = \frac{\omega}{\tau} \)
(2) \( Q = \frac{\omega}{\tau} \)
(3) \( Q = \frac{2\omega}{\tau} \)
(4) \( Q = \frac{\omega}{2\tau} \)
59. The velocity of a transverse wave in a wire under tension $T$ is ($\rho$ - mass per unit length)

\[ T \text{ kg/m} \text{ and } \text{mass per unit length} \ (\rho - \text{kg/m}) \]

\[
\begin{align*}
(1) & \quad \frac{\sqrt{T}}{\rho} \\
(2) & \quad \frac{T}{\sqrt{\rho}} \\
(3) & \quad \sqrt{T\rho} \\
(4) & \quad \frac{T}{\rho}
\end{align*}
\]

60. In a stationary wave, the separation between consecutive nodes is ($\lambda$ - wavelength):

\[ \lambda \text{ cm} \text{ and } \text{wavelength} \ (\lambda - \text{cm}) \]

\[
\begin{align*}
(1) & \quad \lambda \\
(2) & \quad \frac{\lambda}{4} \\
(3) & \quad \frac{\lambda}{2} \\
(4) & \quad 2\lambda
\end{align*}
\]

61. The ratio of rms velocity, mean velocity and most probable velocity of the molecules of a gas is:

\[ \text{rms velocity} : \text{mean velocity} : \text{most probable velocity} \]

\[
\begin{align*}
(1) & \quad \sqrt{2} : \sqrt{3} : \sqrt{\frac{8}{\pi}} \\
(2) & \quad \sqrt{2} : \sqrt{3} : \sqrt{\frac{8}{\pi}} \\
(3) & \quad \sqrt{3} : \sqrt{\frac{8}{\pi}} : \sqrt{2} \\
(4) & \quad \sqrt{3} : \sqrt{2} : \sqrt{\frac{8}{\pi}}
\end{align*}
\]

62. The viscosity of a gas is due to the transportation of:

\[ \text{mass} \text{ and } \text{transportation} \]

\[
\begin{align*}
(1) & \quad \text{mass} \\
(2) & \quad \text{energy} \\
(3) & \quad \text{linear momentum} \\
(4) & \quad \text{heat}
\end{align*}
\]

63. The area under the P-V curve and the volume axis gives:

\[ P-V \text{ curve and volume axis} \]

\[
\begin{align*}
(1) & \quad \text{Enthalpy of the system} \\
(2) & \quad \text{work done on or by the system} \\
(3) & \quad \text{Free energy of the system} \\
(4) & \quad \text{Entropy of the system}
\end{align*}
\]

[P.T.O.]
64. Which of the following represents Carnot's cycle:

Which of the following represents Carnot's cycle:

(1) \[ \begin{array}{c}
T \\
S 
\end{array} \]

(2) \[ \begin{array}{c}
T \\
S 
\end{array} \]

(3) \[ \begin{array}{c}
T \\
S 
\end{array} \]

(4) \[ \begin{array}{c}
P \\
V 
\end{array} \]

65. 10 g of ice at 0°C is converted into water at the same temperature. The change in entropy is:

(Latent heat of fusion of ice = 80 cal/g)

\[ \text{O}^\circ {\text{C}} \text{ र } 10 \text{ g जल} \text{ को} \text{ 0}^\circ {\text{C}} \text{ में परिवर्तित होता है। इसका अनुपात ध्वनि है:} \]

\[ \text{शीतकालीन ध्वनि के लिए} \]

(1) 2.93 cal/k  (2) 29.3 cal/k  (3) 3.93 cal/k  (4) 4.93 cal/k

66. The Clausius-Clapeyron equation is:

\[ \frac{dP}{dT} = \frac{LT}{(V_2 - V_1)} \]

(1) \[ \frac{dP}{dT} = \frac{LT}{(V_2 - V_1)} \]

(2) \[ \frac{dP}{dT} = \frac{L}{(V_2 - V_1)T} \]

(3) \[ \frac{dP}{dT} = \frac{(V_2 - V_1)}{LT} \]

(4) \[ \frac{dP}{dT} = \frac{1}{(V_2 - V_1)LT} \]

67. As the temperature of a black body increases, the wavelength corresponding to the maximum radiant energy:

(1) Shifts towards shorter wavelength

(2) Remains same

(3) Shifts towards longer wavelength

(4) Depends on the black body

68. According to Rayleigh-Jean's law, the radiant energy distribution is directly proportional to

(1) \( \lambda \)

(2) \( \lambda^2 \)

(3) \( \lambda^4 \)

(4) \( \lambda^4 \)
69. At a given temperature, \( T \) the total energy radiated by a black body is directly proportional to: 
\( T \)  \( T^2 \)  \( T^3 \)  \( T^4 \)

70. Maxwell-Boltzmann statistics is applicable to 
1. Molecules 
2. Electrons 
3. Photons 
4. Phonons

71. The minimum volume of a phase cell in Quantum mechanical system is (h-Planck's constant): 
\( h^{3/2} \)  \( \frac{h}{\pi} \)  \( h^3 \)  \( \frac{h^3}{\pi^3} \)

72. In Michelson interferometer, concentric circular fringes are produced when the angle between the real mirror and the image of second mirror is ———— radians.
\( \frac{\pi}{2} \)  \( \pi \)  \( 0 \)  \( \frac{\pi}{4} \)

73. If \( a_1 \) and \( a_2 \) are the amplitudes of interfering waves, then the maximum intensity at a point is: 
\( a_1 + a_2 \)  \( (a_1 + a_2)^2 \)  \( (a_1 + a_2)^{1/2} \)  \( (a_1 - a_2)^2 \)
74. A thin film of refractive index 1.375 is coated on a glass surface. Light of wavelength 550 nm gives no reflected light. Then the minimum thickness of the film is:

\[ \text{1.375} \] 1000 Å
\[ \text{1375} \] 1500 Å
\[ \text{1375} \] 750 Å
\[ \text{1375} \] 500 Å

75. In Fraunhofer diffraction pattern due to a circular aperture, as the diameter of the aperture increases, the radius of the Airy's disc:

\[ \text{1375} \] increases
\[ \text{1375} \] decreases
\[ \text{1375} \] remains same
\[ \text{1375} \] depends on the wavefront

76. If light incidents normally on a plane transmission grating having 5000 lines/cm, the longest wavelength of light whose spectrum can be seen is:

\[ \text{1375} \] \[ 2 \times 10^4 \] Å
\[ \text{1375} \] \[ 2 \times 10^5 \] Å
\[ \text{1375} \] \[ 2 \times 10^4 \] Å
\[ \text{1375} \] \[ 5 \times 10^5 \] Å

77. In plane transmission grating, the angle of diffraction is:

\[ \text{1375} \] directly proportional to wavelength
\[ \text{1375} \] inversely proportional to wavelength
\[ \text{1375} \] independent of wavelength
\[ \text{1375} \] directly proportional to grating element
78. In a negative crystal like calcite, the relation between refractive indices of extra ordinary ray \( (\mu_E) \) and ordinary ray \( (\mu_0) \) is:

\[ \mu_0 = \mu_E \] 
\[ \mu_0 > \mu_E \] 
\[ \mu_0 < \mu_E \] 
\[ \mu_0 \leq \mu_E \]

79. In a quarter-wave plate, the path difference between ordinary ray and extra ordinary ray is:

\[ \frac{\lambda}{2} \] 
\[ \frac{\lambda}{4} \] 
\[ \lambda \] 
\[ 2\lambda \]

80. In He-Ne laser, laser action takes place between:

(1) the energy levels of He only.
(2) the energy levels of Ne only.
(3) the energy levels of He and Ne.
(4) the mirrors of optical resonator.

81. The wavelength of light emitted by Ruby laser is:

(1) 6329 A° 
(2) 5461 A° 
(3) 5893 A° 
(4) 6943 A°

82. An electric dipole is placed in a uniform electric field. It’s potential energy will be minimum if the dipole moment makes an angle ———— radian with the field.

(1) 0°
(2) \( \pi \)
(3) \( \frac{\pi}{2} \)
(4) \( \frac{3\pi}{2} \)
83. A point charge \( q \) is placed at the centre of a cube of side \( L \) meters. The flux through one face of the cube is:

\[
\begin{align*}
(1) & \quad \frac{q}{\varepsilon_0} \\
(2) & \quad \frac{q}{6 \varepsilon_0} \\
(3) & \quad \frac{q}{L \varepsilon_0} \\
(4) & \quad \frac{q}{8 \varepsilon_0}
\end{align*}
\]

84. The maximum electric field that a dielectric can withstand without breakdown is called:

\begin{align*}
(1) & \quad \text{dielectric constant} \\
(2) & \quad \text{permeability} \\
(3) & \quad \text{permittivity} \\
(4) & \quad \text{dielectric strength}
\end{align*}

85. Gauss law is dielectrics is:

\[
\begin{align*}
(1) & \quad \oint \vec{E} \cdot d\vec{S} = \frac{q}{\varepsilon_0} \\
(2) & \quad \oint \vec{E} \cdot d\vec{S} = q \varepsilon_0 \\
(3) & \quad \oint \vec{E} \cdot d\vec{S} = \frac{Kq}{\varepsilon_0} \\
(4) & \quad \oint \vec{k} \vec{E} \cdot d\vec{S} = \frac{q}{\varepsilon_0}
\end{align*}
\]

86. Capacity of a parallel plate capacitor can be increased by:

\begin{align*}
(1) & \quad \text{increasing the distance between the plates.} \\
(2) & \quad \text{increasing the thickness of the plates.} \\
(3) & \quad \text{decreasing the thickness of the plates.} \\
(4) & \quad \text{decreasing the distance between the plates.}
\end{align*}
87. The work done in placing a charge $8 \times 10^{-18}$ C on a capacitor of 100 $\mu$F is:

1. $8 \times 10^{-10}$ J
2. $32 \times 10^{-32}$ J
3. $16 \times 10^{-32}$ J
4. $8 \times 10^{-26}$ J

88. The relation between magnetic susceptibility ($\chi_m$) and relative permeability ($\mu_r$) is:

1. $\mu_r - \chi_m = 1$
2. $\mu_r + \chi_m = 1$
3. $\mu_r - \chi_m = -1$
4. $\frac{\mu_r}{\chi_m} = 1$

89. The core of an electromagnet is made of soft iron because soft iron has:

1. low susceptibility and low retentivity
2. high susceptibility and low retentivity
3. high susceptibility and high retentivity
4. low susceptibility and high retentivity

90. The Hall voltage ($V_H$) and the concentration ($n$) of the charge carriers in a material are related by:

1. $V_H \alpha n$
2. $V_H \alpha \frac{1}{n}$
3. $V_H \alpha n^2$
4. $V_H \alpha \frac{1}{n^2}$

91. In a cyclotron, the time taken by the ion to travel in a semicircular path is:

1. $t = \frac{\lambda m}{B e}$
2. $t = \frac{B m}{\lambda e}$
3. $t = \frac{B e}{\lambda m}$
4. $t = \frac{B e m}{\lambda}$

[P.T.O.]
92. The mutual inductance between two coils of inductances $L_1$ and $L_2$ is $M$. Then

$M = L_1 + L_2$  \hspace{1cm} (1)

$M = \frac{1}{2} (L_1 + L_2)$  \hspace{1cm} (2)

$M = (L_1 + L_2)^2$  \hspace{1cm} (3)

$M = (L_1 L_2)^2$  \hspace{1cm} (4)

93. Lenz's law is the consequence of law of conservation of:

(1) charge  \hspace{1cm} (2) mass  \hspace{1cm} (3) momentum  \hspace{1cm} (4) energy

94. Betatron works on the same principle of:

(1) Generator  \hspace{1cm} (2) transformer  \hspace{1cm} (3) galvanometer  \hspace{1cm} (4) self inductor

95. In LCR series circuit, the capacitance is changed from $C$ to $4C$. To have same resonant frequency, the inductance should be changed from $L$ to ________.

$\text{LCR} = \frac{1}{2 \pi f^2}$  \hspace{1cm} $C = 4C$  \hspace{1cm} $f$  \hspace{1cm} $L = \frac{L}{4}$

(1) $2L$  \hspace{1cm} (2) $\frac{L}{2}$  \hspace{1cm} (3) $4L$  \hspace{1cm} (4) $\frac{L}{4}$

96. In an AC circuit, the reactance of a coil is $\sqrt{3}$ times its resistance. The phase difference between voltage across the coil and current in the coil is ________ radian.

$\text{AC} = \text{voltage} = \sqrt{3}$  \hspace{1cm} $\text{current} = \text{resistance}$  \hspace{1cm} $\pi$  \hspace{1cm} $\frac{\pi}{4}$  \hspace{1cm} $\frac{\pi}{6}$  \hspace{1cm} $\frac{\pi}{2}$

(1) $\frac{\pi}{3}$  \hspace{1cm} (2) $\frac{\pi}{4}$  \hspace{1cm} (3) $\frac{\pi}{6}$  \hspace{1cm} (4) $\frac{\pi}{2}$
97. In LR circuit, if the value of resistance is doubled then its time constant will be LR :
(1) doubled
(2) halved
(3) does not change
(4) becomes 4 times

98. Poynting theorem is:
(1) Work-energy theorem of Electrodynamics
(2) Work-force theorem of Electrodynamics
(3) Energy-force theorem of Electrodynamics
(4) Energy theorem of Electrodynamics

99. The velocity of an electromagnetic wave in a medium of refractive index 9 is:
(1) $2.7 \times 10^8$ m/s
(2) $3 \times 10^8$ m/s
(3) $3.33 \times 10^7$ m/s
(4) $0.33 \times 10^7$ m/s

100. Which of the following is not a Maxwell’s equation:
(1) $\nabla \cdot E = \frac{\rho}{\varepsilon}$
(2) $\nabla \cdot B = 0$
(3) $\nabla \times E = -\frac{\partial B}{\partial t}$
(4) $\nabla \times B = \mu_0 J$
CHEMISTRY

(Marks : 50)

101. The electronic configuration of an element with lowest ionization energy is:

(a) 1S^2 2S^2 2P^3
(b) 1S^2 2S^2 2P^6
(c) 1S^2 2S^2 2P^6 3S^2
(d) 1S^2 2S^2 2P^6 3S^1

102. The value of orbit angular momentum in third Bohr orbit is:

(1) \( \frac{9h}{2\pi} \)
(2) \( \frac{3h}{2\pi} \)
(3) \( \frac{27h}{2\pi} \)
(4) \( \frac{16h}{2\pi} \)

103. The hybridization of atomic orbitals of Nitrogen in NO_2, NO_3^-, and NH_4^+ respectively are:

(a) SP^2, SP^3 and SP
(b) SP, SP^2 and SP^3
(c) SP^2, SP and SP^3
(d) SP^2, SP^3 and SP^2

104. O_2^- is:

(a) Paramagnetic
(b) Diamagnetic
(c) Ferromagnetic
(d) Antiferromagnetic
105. The size of the atoms in a period from left to right:

- Decrease in size.
- Increase in size.
- First decrease and then increase
- First increase and then decrease

106. Which of the following pairs show the diagonal relation:

- Carbon and silicon.
- Boron and Aluminium.
- Beerylium and Aluminium
- Oxygen and Phosphorous.

107. Which of the following has the largest ionic radius:

- \( \text{Li}^+ \)
- \( \text{Na}^+ \)
- \( \text{Mg}^{2+} \)
- \( \text{Cs}^+ \)

108. The magnetic moment of a 3d transition metal ion is 5.9 Bohr magnetons. Its electronic configuration would be:

- \( 3d^4 \)
- \( 3d^5 \)
- \( 3d^6 \)
- \( 3d^3 \)

109. The crystal field stabilization energy for high spin \( d^4 \) octahedral complex ion is:

- 14 Dq.
- \( -6Dq \)
- \( -12Dq \)
- \( -2Dq \)

110. Which of the following compounds has the bond angle close to 90°:

- \( \text{NH}_3 \)
- \( \text{H}_2\text{S} \)
- \( \text{H}_2\text{O} \)
- \( \text{CH}_4 \)
111. The bond order of NO molecule is:

\[ \text{NO} \quad \text{bond order:} \quad \sqrt{2} \]

- (1) 1.5
- (2) 2
- (3) 2.5
- (4) 3

\( \square \)

112. The molecular formula for Barazole is:

\[ \text{(1) B}_2\text{H}_6 \quad \text{(2) B}_3\text{N}_3\text{H}_6 \quad \text{(3) B}_4\text{H}_{10} \quad \text{(4) B}_3\text{N}_3\text{H}_{12} \]

\( \square \)

113. BF\(_3\) is a more stable compound compared to BH\(_3\) because:

- (1) Bond dissociation energy of F\(_2\) is higher than that of H\(_2\)
- (2) Back donation of electrons from Fluorine to Boron
- (3) BF Bond length is higher than BH
- (4) Electronegativity of F is greater than that of H.

\( \square \)

114. Geometrical isomerism is exhibited by:

- (1) Pt (NH\(_3\))\(_2\)Cl\(_2\)
- (2) Pt (NH\(_3\))\(_3\)Cl
- (3) Zn (NH\(_3\))\(_2\)Cl\(_2\)
- (4) Cu (NH\(_3\))\(_3\)Cl

\( \square \)

115. Solid CO\(_2\) is an example of:

- (1) Ionic crystal
- (2) Covalent crystal
- (3) Metallic crystal
- (4) Molecular crystal

\( \square \)
116. According to HSAB theory, which among the following is a soft acid:

(1) \( F^- \)  
(2) \( Br^- \)  
(3) \( H^+ \)  
(4) \( NH_3 \)

117. Among the following the tetrahedral bond angle is lowest in:

(1) \( H_2O \)  
(2) \( CH_4 \)  
(3) \( BF_4^- \)  
(4) \( NH_3 \)

118. Geometrical isomerism is shown by:

(1) Glyceraldehyde  
(2) 1-Butene  
(3) Fumaric acid  
(4) 1,1-Dibromoethylene

119. The H – C – C bond angle in cyclohexane is close to:

(1) 60°  
(2) 109°28'  
(3) 120°  
(4) 180°

120. In the addition of HBr to a C – C double bond the Hydrogen goes to the carbon which has more hydrogens as is known as:

(1) Hofmann rule  
(2) Saytzeff rule  
(3) Markonikof rule  
(4) Hückel’s rule

[P.T.O.]
121. Arrange the following in the order of increasing acidity:

A. Cl – CH₂ – CH₂ – OH ;
B. CH₃ – CH₂ – OH
C. CH₃ – CH₂ – NH₂

(A) A > B > C
(2) A > C > B
(3) C > A > B
(4) B > A > C

122. Find out the product in the following reaction

Me
Me OH → 300° Cu
Me
Me

(1) Me
H
Me
Me
(2) Me
Me
Me
Me – C – OMe
(3) Me
Me
Me
Me
(4) CH₂ – CH₂ – CH₂ – CH₃

123. Predict the number of Chiral carbons present in sucrose:

(1) 6   (2) 7   (3) 9   (4) 8

124. The function of Anhydrous AlCl₃ in Friedel Crafts reaction is:

(1) To absorb water.
(2) To absorb HCl.
(3) To produce electrophile.
(4) To produce nucleophile.
125. Predict the stability order of (A) Ph–CH₂⁺; (B) ; (C) ; (D) CH₃⁺.

The stability order is:
(1) A > B > C > D
(2) D > C > B > A
(3) C > B > D > A
(4) C > A > B > D

126. Which of the following alkene gives acetone on ozonolysis?

(1) CH₂ = CH₂
(2) (CH₃)₂C = C(CH₃)₂
(3) CH₃ – CH = CH₂
(4) CH₃ – CH = CH – CH₃

127. Identify the major product in the following reaction.

(1) 
(2) 
(3) 
(4) 

128. Which of the following carbohydrates will not give red precipitate when heated with Benedict's solution?

(1) Maltose
(2) Lactose
(3) Glucose
(4) Fructose
129. Gabriel synthesis is carried out for the preparation of:

(1) Ethers
(2) Alcohols
(3) 1º Amines
(4) Carboxylic acids

130. Identify the basic amino acid in the following:

(1) Serine
(2) Alanine
(3) Tyrosine
(4) Glutamine

131. D-Glucose and D-mannose are:

(1) Anomers
(2) Epimers
(3) Enantiomers
(4) Isomers

132. Salicylaldehyde can be prepared from phenol by using:

(1) NaOH/CCl₄
(2) KOH/CHCl₃
(3) NaOH/CH₄CHO
(4) HCl/HCHO

133. Which of the following named reactions form cinnamic acid:

(1) Aldol condensation
(2) Cannizaro reaction
(3) Perkin Reaction
(4) Benzoin condensation
134. 2, 4 - DNP test is used to identify:

2, 4 - DNP సమస్య | అవసరమైన సమస్య
(1) Hydrocarbons (2) Phenols (3) Carbonyls (4) Amines

135. The acetyl derivatives of Glucose and fructose respectively are:

(1) Penta acetyl and Tetra acetyl
(2) Penta acetyl and penta acetyl
(3) Tetra acetyl and Tetra acetyl
(4) Tetra acetyl and Penta acetyl

136. Pyranose and furanose forms contain ———-, ———- membered rings respectively.

(1) 4, 5 (2) 5, 6 (3) 6, 5 (4) 5, 4

137. Isocyanide test is carried out by heating:

ఇసోసైయనైడ్ ప్రక్రియ | నిరూపణ
(1) CH₃ CO CH₃/Ca(OH)₂
(2) CHCl₃, HNO₃
(3) CHCl₃, Zn / H₂O
(4) CHCl₃, KOH, Ph-NH₂

138. The main component of the cell walls in the plant kingdom is:

(1) Glucose గ్లుక్స్
(2) Starch స్టార్చ్
(3) Glycogen గ్లిక్సేజన్
(4) Cellulose చెయల్స్లీస్

139. Identify the product in the following reaction:

\[
\text{苯} \xrightarrow{1. \cdot O_3} \xrightarrow{2. \cdot H_2O_2} ?
\]

(1) Isophthalaldehyde
(2) Teripthalaldehyde
(3) Phthalaldehyde
(4) Benzaldehyde

[P.T.O.]
140. If the rate of the reaction between A and B is \( \alpha[A] \) and \( \alpha \frac{1}{[B]} \). Then the order of the reaction is:

- (1) Zero
- (2) One
- (3) Two
- (4) Three

141. The vapour pressure of a solvent is 0.80 atmospheres. When a non-volatile substance is added, its vapour pressure decreases to 0.60 atmospheres. The mole fraction of the solute is:

- (1) 0.25
- (2) 0.50
- (3) 0.75
- (4) 0.90

142. An emulsifier is a substance which:

- (1) Helps dispersion of liquid in liquid.
- (2) Stabilizes the emulsion
- (3) Purifies the emulsion
- (4) Coagulates the emulsion

143. The minimum energy a molecule must possess to enter into a fruitful collision is known as:

- (1) Reaction energy
- (2) Collision energy
- (3) Activation energy
- (4) Threshold energy

144. The work done in the reversible isothermal expansion is:

- (1) Minimum
- (2) Zero
- (3) Maximum
- (4) Intermediate
145. Arrange $N_2$, $O_2$ and He liquids in the order of their boiling points:

$N_2$, $O_2$ and then He. The arrangement is as follows:

1. $N_2 > O_2 >$ He
2. $N_2 >$ He $> O_2$
3. $O_2 >$ N$_2$ > He
4. He $> O_2 > N_2$

146. In a solid lattice if a cation occupies an interstitial position rather than its lattice site, the defect is called:

1. Schottky defect
2. Frankel defect
3. Line defect
4. Surface defect

147. Which of the following exhibits highest ionic conductance:

1. $H^+$
2. $OH^-$
3. $Cl^-$
4. $Na^+$

148. Bragg equation is given by:

1. $E = h\gamma$
2. $n\lambda = 2d\sin\theta$
3. $\nu = \frac{k}{2\pi\sqrt{\mu}}$
4. $\Delta\nu = \frac{2h}{8\pi^2\mu}$

149. Doping of arsenic in silicon generates:

1. P-type semiconductor
2. n-p Junction
3. n-type semiconductor
4. compensated semiconductor

150. Liquid crystals do not exhibit:

1. Sharp melting point
2. Properties not common to either solid or liquid form.
3. Different orientation under external magnetic field
4. Different orientation under external electric field.

[P.T.O.]