MHT CET 2019 PCM May 2 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2019**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. A metal surface is illuminated by light of given intensity and frequency to cause photoemission. If the intensity of illumination is reduced to one fourth of its original value then the maximum KE of the emitted photoelectrons would be

(A) twice the original value
(B) four times the original value
(C) one fourth of the original value
(D) unchanged

2. Torque acting on a rectangular coil carrying current ' l ' situated parallel to magnetic field of induction ' B ', having number of turns ' n ' and area ' A ' is

(A) $ni(\hat{A}\cdot\hat{B})$
(B) $\frac{nBA}{i}$
(C) $ni(\mathbf{A}\times\mathbf{B})$
(D) $\frac{iBA}{n}$

3. A force $(F)=-5\hat{\mathbf{i}}-7\hat{\mathbf{j}}+3\hat{\mathbf{k}}$ acting on a particle causes a displacement $(s)=3\hat{\mathbf{i}}-2\hat{\mathbf{j}}+a\hat{\mathbf{k}}$ in its own direction. If the work done is 14 J , then the value of ' a ' is

(A) 0
(B) 5
(C) 15
(D) 1

4. When the electron in hydrogen atom jumps from fourth Bohr orbit to second Bohr orbit, one gets the

(A) second line of Balmer series
(B) first line of Balmer series
(C) first line of Pfund series
(D) second line of Paschen series

5. Light of wavelength ' λ ' is incident on a single slit of width ' a ' and the distance between slit and screen is ' D '. In diffraction pattern, if slit width is equal to the width of the central maximum then ' D ' is equal to

(A) $\frac{a}{2\lambda}$
(B) $\frac{a^2}{2\lambda}$
(C) $\frac{a}{\lambda}$
(D) $\frac{a^2}{\lambda}$

6. In U.C.M., when time interval $\delta t\to 0$, the angle between change in velocity ($\delta\mathbf{v}$) and linear velocity $(\boldsymbol{v})$ will be

(A) 0°
(B) 90°
(C) 180°
(D) 45°

7. A stretched string fixed at both ends has ' m ' nodes, then the length of the string will be

(A) $(m-1)\frac{\lambda}{2}$
(B) $\frac{(m+1)\lambda}{2}$
(C) $\frac{m\lambda}{2}$
(D) $(m-2)\frac{\lambda}{2}$

8. A particle is performing a linear simple harmonic motion of amplitude ' A '. When it is midway between its mean and extreme position, the magnitudes of its velocity and acceleration are equal. What is the periodic time of the motion?

(A) $\frac{2\pi}{\sqrt{3}}$ s
(B) $\frac{\sqrt{3}}{2\pi}s$
(C) $2\pi\sqrt{3}$ s
(D) $\frac{1}{2\pi\sqrt{3}}$ s

9. Three identical rods each of mass ' M ' and length ' L ' are joined to form a symbol ' H'. The moment of inertia of the system about one of the sides of ' H ' is

(A) $\frac{2ML^2}{3}$
(B) $\frac{ML^2}{2}$
(C) $\frac{ML^2}{6}$
(D) $\frac{4ML^2}{3}$

10. The luminous border that surrounds the profile of a mountain just before sun rises behind it, is an example of

(A) dispersion
(B) total internal reflection
(C) interference
(D) diffraction

11. A block of mass ' m ' moving on a frictionless surface at speed ' v ' collides elastically with a block of same mass, initially at rest. Now the first block moves at an angle ' θ ' with its initial direction and has speed ' v_1 '. The speed of the second block after collision is

(A) $\sqrt{v_1^2-v^2}$
(B) $\sqrt{v^2-v_1^2}$
(C) $\sqrt{v^2+v_1^2}$
(D) $\sqrt{v-v_1}$

12. Three point masses each of mass ' m ' are kept at the corners of an equilateral triangle of side. The system rotates about the center of the triangle without any change in the separation of masses during rotation. The period of rotation is directly proportional to $\left(\cos 30^\circ=\sin 60^\circ=\frac{\sqrt{3}}{2}\right)$

(A) $\sqrt{L}$
(B) $L^{3/2}$
(C) L
(D) L^{-2}

13. Two pendulums begin to swing simultaneously. The first pendulum makes nine full oscillations when the other makes seven. The ratio of the lengths of the two pendulums is

(A) $\frac{49}{81}$ (B) $\frac{64}{81}$
(C) $\frac{8}{9}$ (D) $\frac{7}{9}$

14. When light enters glass from vacuum, then the wavelength of light

(A) decreases (B) becomes zero
(C) remains same (D) increases

15. Which one of the following statement is correct?

(A) Surface energy is potential energy per unit length (B) Surface tension is work done per unit area
(C) Surface tension is work done per unit length (D) Surface energy is work done per unit force

16. What is the minimum energy required to launch a satellite of mass ' m ' from the surface of the earth of mass ' M ' and radius ' R ' at an altitude $2R$?

(A) $\frac{GMm}{2R}$ (B) $\frac{2GMm}{3R}$
(C) $\frac{GMm}{3R}$ (D) $\frac{5GMm}{6R}$

17. A wire of length ' L ' and area of cross section ' A ' is made of material of Young's modulus ' r. It is stretched by an amount ' x '. The work done in stretching the wire is

(A) $\frac{Yx^2A}{2L}$ (B) $\frac{2Yx^2A}{L}$
(C) $\frac{Y\times A}{2L}$ (D) $\frac{Yx^2A}{2}$

18. In a parallel plate air capacitor the distance between plates is reduced to one fourth and the space between them is filled with a dielectric medium of constant 2 . If the initial capacity of the capacitor is 4μ F. then its new capacity is

(A) 32μ F (B) 18μ F
(C) 8μ F (D) 44μ F

19. An aircraft is moving with uniform velocity 150 m/s in the space. If all the forces acting on it are balanced, then it will

(A) keep moving with same velocity (B) remain floating at its place
(C) escape in space (D) fall down on earth

20. In case of p-n junction diode, the width of depletion region is

(A) decreased with heavy doping (B) increased by reverse biasing
(C) decreased with light doping (D) increased by forward biasing

21. In the study of transistor as an amplifier, the ratio of collector current to emitter current is 0.98 then the ratio of collector current to base current will be

(A) 99 (B) 49
(C) 50 (D) 98

22. A stretched wire of length 260 cm is set into vibrations. It is divided into three segments whose frequencies are in the ratio 2 : 3 : 4. Their lengths must be

(A) 80 cm, 60 cm, 120 cm
(B) 120 cm, 80 cm, 60 cm
(C) 60 cm, 80 cm, 120 cm
(D) 120 cm, 60 cm, 80 cm

23. The force ' F ' acting on a body of density ' d ' are related by the relation $F=\frac{y}{\sqrt{d}}$. The dimensions of ' y ' are

(A) $[\mathrm{L}^{-\frac{1}{2}}\mathrm{M}^{\frac{3}{2}}\ \mathrm{T}^{-2}]$ (B) $[L^{-1}M^{\frac{1}{2}}T^{-2}]$
(C) $[L^{-1}M^{\frac{3}{2}}T^{-2}]$ (D) $[\mathrm{L}^{-\frac{1}{2}}\mathrm{M}^{\frac{1}{2}}\ \mathrm{T}^{-2}]$

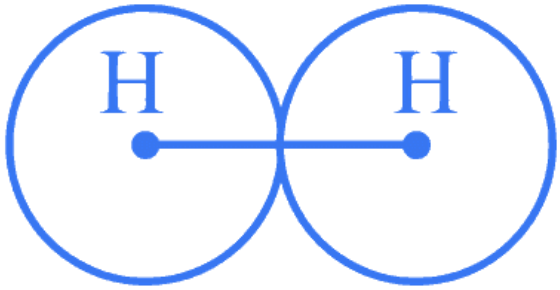
24. The magnetization of bar magnet of length 5 cm , cross sectional area 2 cm^2 and net magnetic moment $1\mathrm{Am}^2$ is

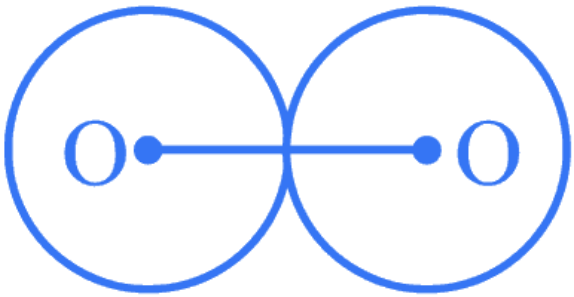
(A) 3×10^5 A/m (B) 4×10^5 A/m
(C) 2×10^5 A/m (D) 1×10^5 A/m

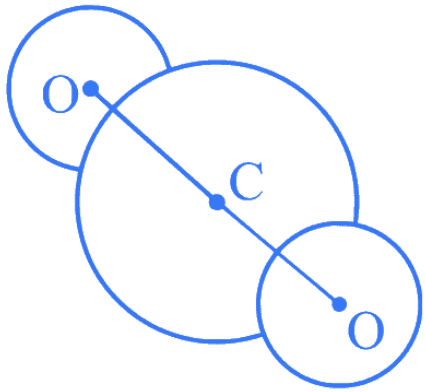
25. The dimensions of self or mutual inductance are given as

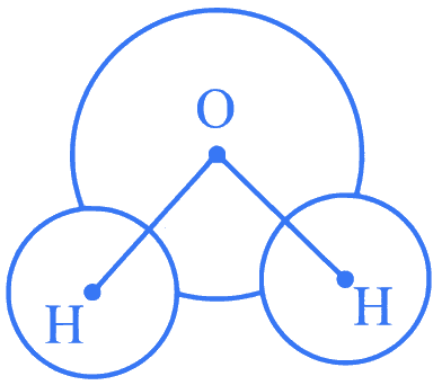
(A) $[L^{-2}M^1T^{-2}I^{-2}]$ (B) $[L^2M^2T^{-2}I^{-2}]$
(C) $[L^2M^1T^{-2}I^{-2}]$ (D) $[L^2M^2T^{-2}I^{-2}]$

26. Which of the following molecules is a polar molecule?

(A) 

(B) 

(C) 

(D) 

27. Magnetic susceptibility of a paramagnetic substance is

(A) large and positive (B) small and positive
(C) small and negative (D) large and negative

28. A circular coil of wire consisting of 100 turns each of radius 9 cm carries a current of 0.4 A . The magnitude of the magnetic field at the centre of coil is $\left[\mu_0 = 12.56 \times 10^{-7}\text{SI Unit}\right]$

(A) 2.4×10^{-11} T (B) 2.79×10^{-5} T
(C) 2.79×10^{-4} T (D) 2.79×10^{-3} T

29. A simple harmonic progressive wave is represented as $y = 0.03 \sin \pi(2t - 0.01x)$m. At a given instant of time, the phase difference between two particles 25 m apart is

(A) π rad (B) $\frac{\pi}{2}$ rad
(C) $\frac{\pi}{4}$ rad (D) $\frac{\pi}{8}$ rad

30. The equation of state for 2 g of oxygen at a pressure ' P ' and temperature ' T, when occupying a volume ' V ' will be

(A) $pV = 16RT$ (B) $pV = RT$
(C) $pV = \frac{1}{16}RT$ (D) $pV = 2RT$

31. The magnetic dipole moment of a short magnetic dipole at a distant point along the equator of magnet has a magnitude of ' X ' in SI units. If the distance between the point and the magnet is halved then the magnitude of dipole moment will be

(A) $2x$ (B) $\frac{1}{2}x$
(C) X (D) $\frac{1}{8}x$

32. The ratio of the dimensions of Planck's constant to that of moment of inertia is the dimensions of

(A) angular momentum (B) velocity
(C) frequency (D) time

33. If ' x ', v ' and ' a ' denote the displacement, velocity and acceleration of a particle respectively executing SHM of periodic time h then which one of the following does not change with time?

(A) $\frac{aT}{x}$ (B) $at + 2\pi v$
(C) $\frac{aT}{v}$ (D) $aT + 4\pi^2 v^2$

34. A particle is performing U.C.M. along the circumference of a circle of diameter 50 cm with frequency 2 Hz . The acceleration of the particle in m/s^2 is

(A) $2\pi^2$ (B) $8\pi^2$
(C) π^2 (D) $4\pi^2$

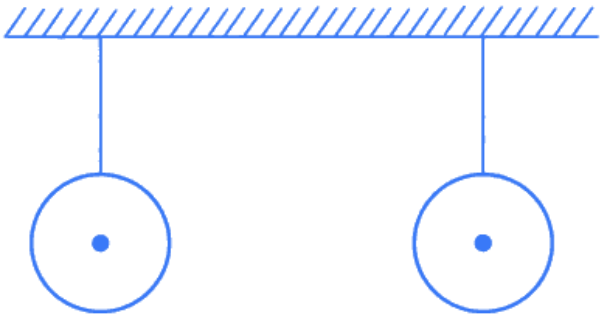
35. Find the wrong statement from the following about the equation of stationary wave given by $Y = 0.04\cos(\pi x)\sin(50\pi t)\text{m}$ where t is in second. Then for the stationary wave.

(A) Time period $= 0.02$ s
(B) Wavelength $= 2$ m
(C) Velocity $= 50$ m/s
(D) Amplitude $= 0.02$ m

36. A convex lens of focal length ' f ' is placed in contact with a concave lens of the same focal length. The equivalent focal length of the combination is

(A) f
(B) infinity
(C) $\frac{f}{2}$
(D) zero

37. Two light balls are suspended as shown in figure. When a stream of air passes through the space between them, the distance between the balls will



(A) remain same
(B) increase
(C) may increase or decrease, depending on speed of air
(D) decrease

38. The range of an ammeter of resistance ' G can be increased from ' I ' to ' nI ' by connecting

(A) a series resistance of $\frac{G}{n+1}\Omega$
(B) a shunt of $\frac{G}{n-1}\Omega$
(C) a shunt of $\frac{G}{n+1}\Omega$
(D) a series resistance of $\frac{G}{n-1}\Omega$

39. The critical angle for light going from medium ' x' to medium ' y ' is ' θ '. The speed of light in medium ' x ' is ' v_x '. The speed of light in medium ' y ' is

(A) $\frac{v_x}{\tan\theta}$
(B) $v_x\sin\theta$
(C) $v_x\tan\theta$
(D) $\frac{v_x}{\sin\theta}$

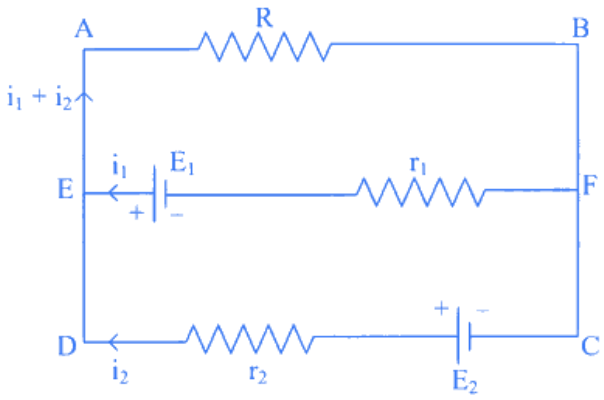
40. When a 12000 joule of work is done on a flywheel, its frequency of rotation increases from 10 Hz to 20 Hz . The moment of inertia of flywheel about its axis of rotation is $\left(\pi^2 = 10\right)$

(A) 1 kgm^2
(B) 2 kgm^2
(C) 1.688 kgm^2
(D) 1.5 kgm^2

41. A rigid body is rotating with angular velocity ' ω ' about an axis of rotation. Let v ' be the linear velocity of particle which is at perpendicular distance ' r ' from the axis of rotation. Then the relation $v = r\omega$ ' implies that

(A) ω does not depend on r
(B) $\omega \propto \frac{1}{r}$
(C) $\omega \propto r$
(D) $\omega = 0$

42. In the given electrical circuit, which one of the following equations is a correct equation?



(A) $E_2 - i_2r_2 - E_1 - i_1r_1 = 0$
(B) $E_1 - (i_1 + i_2)R + i_1r_1 = 0$
(C) $E_1 - (i_1 + i_2)R - i_1r_1 = 0$
(D) $-E_2 - (i_1 + i_2)R + i_2r_2 = 0$

43. The maximum wavelength of radiation emitted by a star is 289.8 nm . Then intensity of radiation for the star is (Given : Stefan's constant $= 5.67 \times 10^{-8}\text{Wm}^{-2}\,\text{K}^{-4}$, Wien's constant, $b = 2898\mu\text{mK}$)

(A) $5.67 \times 10^{-12}\text{Wm}^{-2}$
(B) $10.67 \times 10^{14}\text{Wm}^{-2}$
(C) $5.67 \times 10^{8}\text{Wm}^{-2}$
(D) $10.67 \times 10^{7}\text{Wm}^{-2}$

44. A lift is tied with thick iron ropes having mass ' M '. The maximum acceleration of the lift is ' a ' m/s^2 and maximum safe stress is ' S ' N/m^2. The minimum diameter of the rope is

(A) $\left[\frac{6M(g+a)}{\pi S}\right]^{\frac{1}{2}}$
(B) $\left[\frac{4M(g+a)}{\pi S}\right]^{\frac{1}{2}}$
(C) $\left[\frac{M(g+a)}{\pi S}\right]^{\frac{1}{2}}$
(D) $\left[\frac{M(g-a)}{\pi S}\right]^{\frac{1}{2}}$

45. In Balmer series, wavelength of first line is ' λ_1 ' and in Brackett series wavelength of first line is ' λ_2 ' then $\frac{\lambda_1}{\lambda_2}$ is

(A) 0.162 (B) 0.124

(C) 0.138 (D) 0.188

46. An alternating voltage is given by $E = 100 \sin\left(\omega + \frac{\pi}{6}\right)$ V. The voltage will be maximum for the first time when is [$T =$ periodic time)

(A) $\frac{T}{12}$ (B) $\frac{T}{2}$

(C) $\frac{T}{6}$ (D) $\frac{T}{3}$

47. In frequency modulated wave

(A) frequency varies with time

(B) both frequency and amplitude vary with time

(C) amplitude varies with time

(D) both frequency and amplitude are constant

48. With a resistance of ' X ' in the left gap and resistance of 9Ω in the right gap of a meter bridge, the balance point is obtained at 40 cm from the left end. In what way and to which resistance 3Ω resistance be connected to obtain the balance at 50 cm from the left end?

(A) In series with 9Ω (B) Parallel to $X\Omega$

(C) In series with $X\Omega$ (D) Parallel to 9Ω

49. The excess of pressure, due to surface tension, on a spherical liquid drop of radius ' R ' is proportional to

(A) R^{-1} (B) R

(C) R^{-2} (D) R^2

50. $\mathbf{P}$ and $\mathbf{Q}$ are two non-zero vectors inclined to each other at an angle ' θ '. ' p ' and ' q ' are unit vectors along $\mathbf{P}$ and $\mathbf{Q}$ respectively. The component of $\mathbf{Q}$ in the direction of $\mathbf{Q}$ will be

(A) $p \cdot Q$ (B) $\frac{P \times Q}{P}$

(C) $\frac{P \cdot Q}{Q}$ (D) $p \cdot q$

51. The number of σ and π-bonds in 2-formyl-benzoic acid are respectively

(A) 10, 3 (B) 14, 3
(C) 12, 5 (D) 17, 5

52. The volume of 1 mole of any pure gas at standard temperature and pressure is always equal to

(A) $0.022414\ m^3$ (B) $22.414\ m^3$
(C) $2.2414\ m^3$ (D) $0.22414\ m^3$

53. Veronal is used as a/an

(A) analgesic (B) antihistamine
(C) antibiotic (D) tranquilizer

54. Which of the following is also called as nitrogen sesquioxide?

(A) NO_2 (B) N_2O_3
(C) N_2O_4 (D) N_2O_5

55. The oxidation number of sulphur in S_8 molecule is

(A) 6 (B) 0
(C) 2 (D) 3

56. Which among the following is a set of nucleophiles ?

(A) H^+, NH_3, Cr^- (B) BF_3, H_2O, NH_3
(C) $AlCl_3, BF_3, NH_3$ (D) $CN^-, H_2O, R-OH$

57. Which of the following acts as oxidising agent in hydrogen-oxygen fuel cell ?

(A) H_2 (B) KOH
(C) O_2 (D) C

58. In ozone molecule the formal charge on the central oxygen atom is

(A) -1 (B) $+2$
(C) 0 (D) $+1$

59. According to Werner's theory the geometry of the complex is determined by

(A) only from the primary valence in space
(B) number and position of the primary valences in space
(C) number and position of the secondary valences in space
(D) only from the position of secondary valence in space

60. How many total constituent particles are present in simple cubic unit cell?

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

61. The correct representation of Nernst's equation for half-cell reaction $Cu^{2+}(aq) + e^- \longrightarrow Cu^+(aq)$ is

(A) $E^\circ_{Cu^+}, Cu^{2+} = E^\circ_{Cu^+}, Cu^{2+} - \frac{0.0592}{2}\log\frac{[Cu^+]}{[Cu^{2+}]}$

(B) $E_{Cu^+,Cu^{2+}} = E^\circ_{Cu^+,Cu^{2+}} - \frac{0.0592}{1}\log\frac{[Cu^+]}{[Cu^{2+}]}$

(C) $E_{Cu^+,Cu^{2+}} = E_{Cu^+,Cu^{2+}} - \frac{0.0592}{2}\log\frac{[Cu^+]}{[Cu^{2+}]}$

(D) $E_{Cu^+,Cu^{2+}} = E^\circ_{Cu^+}; Cu^{2+} - \frac{0.0592}{1}\log\frac{[Cu^+]}{[Cu^{2+}]}$

62. Which among the following is a neutral complex?

(A) $[Fe(H_2O)_6]Cl_3$ (B) $[Ni(NH_3)_6]Cl_2$
(C) $[Pt(NH_3)_2Cl_2]$ (D) $K[Ag(CN)_2]$

63. Identify the equation in which change in enthalpy is equal to change in internal energy

(A) $2H_2O_2(I) \longrightarrow 2H_2O(I) + O_2(g)$

(B) $C(s) + O_2(\ g) \longrightarrow CO_2(\ g)$

(C) $PCl_5(\ g) \longrightarrow PCl_3(\ g) + Cl_2(\ g)$

(D) $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

64. Limestone is used as a flux in the extraction of

(A) iron (B) aluminium
(C) zinc (D) copper

65. Which among the following does not form polyhalide ion?

(A) Chlorine (B) Bromine
(C) Iodine (D) Fluorine

66. How many isomers are possible for an alkane having molecular formula C_5H_{12} ?

(A) 5 (B) 3

(C) 4 (D) 2

67. Which of following elements does not form amide when reacted with ammonia?

(A) Li (B) Na

(C) K (D) Rb

68. Two moles of an ideal gas is expanded isothermally and reversibly at 300 K from 1 L to 10 L . The enthalpy change in kJ is

(A) 11.4 kJ (B) 4.8 kJ

(C) -11.4 kJ (D) zero kJ

69. α-chlorosodium acetate on boiling with aqueous sodium nitrite gives

(A) nitromethane (B) α-chloronitromethane

(C) nitroethane (D) acetyl chloride

70. The bond angle $H-O-O$ in H_2O_2 in gaseous phase is

(A) 90.2° (B) 111.5°

(C) 101.9° (D) 94.8°

71. How many metameric ethers are represented by the molecular formula $C_4H_{10}O$?

(A) 4 (B) 3

(C) 2 (D) 5

72. The activation energy of a reaction is zero. Its rate constant at 280 K is $1.6 \times 10^{-6}\ s^{-1}$, the rate constant at 300 K is

(A) $3.2 \times 10^{-6}\ s^{-1}$ (B) zero

(C) $1.6 \times 10^{-6}\ s^{-1}$ (D) $1.6 \times 10^{-5}\ s^{-1}$

73. Which of following metals occurs in native state?

(A) Magnesium (B) Platinum

(C) Potassium (D) Sodium

74. Which of the following is not a broad spectrum antibiotics ?

(A) Penicillin (B) Amoxicillin

(C) Chloramphenicol (D) Ampicillin

75. The oxidation state of sulphur in $H_2S_2O_7$ is

(A) +4 (B) +6

(C) +5 (D) +7

76. The reaction in which 2 molecules of chlorobenzene reacts with metallic sodium in presence of dry ether forming diphenyl is an example of,

(A) Wurtz-Fittig reaction (B) Wurtz reaction

(C) Rosenmund reaction (D) Balz-Schiemann reaction

77. The percentage of unoccupied volume in simple cubic cell is

(A) 52.40% (B) 32.00%

(C) 47.60% (D) 68.04%

78. Isobutylene on hydroboration followed by oxidation with hydrogen peroxide in presence of base yields

(A) n-butyl alcohol (B) sec-butyl alcohol

(C) tert-butyl alcohol (D) isobutyl alcohol

79. What is the density of water vapour at boiling point of water?

(A) $1 \times 10^{-4}\ g\ cm^{-3}$ (B) $1\ g\ cm^{-3}$

(C) $6 \times 10^{-4}\ g\ cm^{-3}$ (D) $4 \times 10^{-4}\ g\ cm^{-3}$

80. Which of the following molecules form a Zwitter ion?

(A) CH_3COOCH_3 (B) H_2NCH_2COOH

(C) $CH_3COC_2H_5$ (D) CH_3CH_2COOH

81. Which reaction is useful in exchange of halogen in alkyl chloride by iodide?

(A) Wurtz reaction (B) Finkelstein reaction

(C) Reimer-Tiemann reaction (D) Williamson synthesis

82. Propene when treated with cold conc. H_2SO_4 forms a compound which on heating with water gives

(A) propan-2-ol (B) butan-1-ol

(C) ethanol (D) propan-1-ol

83. Identify the amine formed when ethyltrimethyl ammonium iodide is treated with silver hydroxide and further heated strongly

(A) $C_2H_5N(CH_3)_2$ (B) $C_2H_5NH_2$

(C) $(CH_3)_3N$ (D) CH_3NH_2

84. For a chemical reaction rate law is, rate $= k[A]^2[B]$. If $[A]$ is doubled at constant $[B]$, the rate of reaction

(A) increases by a factor of 8
(B) increases by a factor of 4
(C) increases by a factor of 3
(D) increases by a factor of 2

85. Which of the following is a natural polymer?

(A) Nylon
(B) Teflon
(C) Linen
(D) Orlon

86. The monomers used in the preparation of dextron are

(A) glycine and ω - amino caproic acid
(B) 3 - hydroxy butanoic acid and 3-hydroxy pentanoic acid
(C) glycine and lactic acid
(D) lactic acid and glycolic acid

87. When a mixture of manganese dioxide, potassium hydroxide and potassium chlorate is fused, the product obtained is

(A) K_2SO_4
(B) K_2MnO_3
(C) K_2MnO_4
(D) $KMnO_4$

88. In which oxidation state, group 15 elements act as Lewis base?

(A) $+5$
(B) $+4$
(C) -3
(D) $+3$

89. Relationship between van't Hoff's factor (i) and degree of dissociation (α) is

(A) $i = \frac{\alpha-1}{n'-1}$
(B) $i = \frac{\alpha-1}{1-n'}$
(C) $\alpha = \frac{1-i}{n'-1}$
(D) $\alpha = \frac{i-1}{n'-1}$

90. Which of following elements does not react with hot concentrated sulphuric acid?

(A) Sb
(B) N
(C) P
(D) As

91. In the reaction, $H_2O_2(aq) \xrightarrow{I^-_{(aq)}} H_2O(I) + \frac{1}{2}O_2(g)$ iodide ion acts as

(A) homogenous catalyst
(B) acid catalyst
(C) heterogenous catalyst
(D) enzyme catalyst

92. The ionic charges of manganate and permanganate ion are respectively

(A) $-2, -2$
(B) $-1, -2$
(C) $-2, -1$
(D) $-1, -1$

93. How many gram of sodium (atomic mass $23u$) is required to prepare one mole of ethane from methyl chloride by Wurtz reaction?

(A) 2
(B) 23
(C) 11.5
(D) 46

94. The enzyme which converts maltose to glucose is

(A) maltase
(B) insulin
(C) lysine
(D) zymase

95.

$$\text{If } C(s) + O_2(g) \rightarrow CO_2(g), \Delta H = -X$$

$$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g), \Delta H = -Y$$

Calculate $\Delta_f H$ for $CO_{(g)}$ formation

(A) $-Y - X$
(B) $Y - X$
(C) $X + Y$
(D) $X - Y$

96. What is the atomicity of aluminium phosphate?

(A) 8
(B) 6
(C) 5
(D) 13

97. Which among the following compounds is obtained when ethane nitrile is acid hydrolysed?

(A) Formic acid
(B) Formamide
(C) Acetamide
(D) Acetic acid

98. Standard hydrogen electrode (SHE) is a

(A) primary reference electrode
(B) secondary reference electrode
(C) metal - sparingly soluble salt electrode
(D) metal - metal ion electrode

99. 9 gram anhydrous oxalic acid (mol. wt. $= 90$) was dissolved in 9.9 moles of water. If vapour pressure of pure water is p_1° the vapour pressure of solution is

(A) $0.99p_1^\circ$
(B) $0.1p_1^\circ$
(C) $0.99p_1^\circ$
(D) $1.1p_1^\circ$

100. Which of the following sets of solutions of urea (mol . mass 60 g mol^{-1}) and sucrose (mol . mass 342 g mol^{-1}) is isotonic?

(A) 9.1 gL^{-1} urea and 6.0 gL^{-1} sucrose

(B) 3.0 gL^{-1} urea and 3.0 gL^{-1} sucrose

(C) 6.0 gL^{-1} urea and 9.0 gL^{-1} sucrose

(D) 3.0 gL^{-1} urea and 17.1 gL^{-1} sucrose

101. In a bionomial distribution, mean is 18 and variance is 12 then $p =$ .....

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$

(C) $\frac{3}{4}$ (D) $\frac{1}{2}$

102. If lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-\lambda}{2} = \frac{z}{1}$ intersect each other, then $\lambda =$ .....

(A) $\frac{7}{2}$ (B) $\frac{3}{2}$

(C) $\frac{9}{2}$ (D) $\frac{5}{2}$

103. The particular solution of the differential equation $\log\left(\frac{dy}{dx}\right) = x$, when $x = 0, y = 1$ is .....

(A) $y = e^x + 2$ (B) $y = -e^x$

(C) $y = -e^x + 2$ (D) $y = e^x$

104. The p.d.f of a random variable x is given by

$$f(x) = \frac{1}{4a}, \quad 0 < x < 4a, (a > 0)$$
$$= 0, \text{otherwise}$$

and $P\left(x < \frac{3a}{2}\right) = kP\left(x > \frac{5a}{2}\right)$ then $k =$ .....

(A) 1 (B) $\frac{1}{4}$

(C) $\frac{1}{8}$ (D) $\frac{1}{2}$

105. If the function $f(x) = \frac{\left(e^{kx}-1\right)\tan kx}{4x^2}, x \neq 0$
$= 16 \quad x = 0$
is continuous at $x = 0$, then $k =$ .....

(A) $\pm\frac{1}{8}$ (B) ± 4

(C) ± 2 (D) ± 8

106. The solution of the differential equation $ydx - xdy = xydx$ is .....

(A) $x^2 = e^x y^2$ (B) $x = ye^x$

(C) $xy = e^x$ (D) $x^2y^2 = \log x$

107. The maximum value of $z = 6x + 8y$ subject to $x - y \geq 0, x + 3y \leq 12, x \geq 0, y \geq 0$ is .....

(A) 72 (B) 42

(C) 96 (D) 24

108. If $\sum_{r=1}^{n}(2r+1) = 440$, then $n =$ .....

(A) 20 (B) 22

(C) 21 (D) 19

109. If p and q are true and r and s are false statements, then which of the following is true?

(A) $(q \wedge r) \vee (\sim p \wedge s)$

(B) $(\sim p \rightarrow q) \leftrightarrow (r \wedge s)$

(C) $(p \rightarrow q) \vee (r \leftrightarrow s)$

(D) $(p \wedge \sim r) \wedge (\sim q \vee s)$

110. If the standard deviation of the random variable X is $\sqrt{3pq}$ and mean is $3p$ then $E\left(x^2\right) =$ .....

(A) $3pq + 3q^2$ (B) $3p(1 + 2p)$

(C) $3pq + 3p^2$ (D) $3q(1 + 2q)$

111. If $f(x) = [x]$, where $[x]$ is the greatest integer not greater than x, then $f'(1^+) =$ .....

(A) 1 (B) 2

(C) 0 (D) -1

112. If lines represented by

$$\left(1 + \sin^2\theta\right)x^2 + 2hxy + 2\sin\theta y^2 = 0,$$
$$\theta \in [0, 2\pi]$$

are perpendicular to each other then $\theta =$ .....

(A) $\frac{\pi}{2}$ (B) π

(C) $\frac{3\pi}{2}$ (D) $\frac{\pi}{6}$

113. If $A = \{x \mid x \in N, x \text{ is a prime number less than } 12\}$ and $B = \{x \mid x \in N, x \text{ is a factor of } 10\}$, then $A \cap B =$ .....

(A) $\{2\}$ (B) $\{2, 5\}$

(C) $\{2, 5, 10\}$ (D) $\{1, 2, 5, 10\}$

114. If R is the circum radius of $\triangle ABC$, then $A(\triangle ABC) =$ .....

(A) $\frac{abc}{R}$ (B) $\frac{abc}{4R}$

(C) $\frac{abc}{3R}$ (D) $\frac{abc}{2R}$

115. If A, B, C and D are $(3, 7, 4), (5, -2, -3), (-4, 5, 6)$ and $(1, 2, 3)$ respectively, then the volume of the parallelopiped with AB, AC and AD as the co-terminus edges, is ..... cubic units.

(A) 91 (B) 94

(C) 92 (D) 93

116. If $(-\sqrt{2}, \sqrt{2})$ are cartesian co-ordinates of the point, then its polar co-ordinates are .....

(A) $(1, \frac{4\pi}{3})$ (B) $(2, \frac{3\pi}{4})$

(C) $(3, \frac{7\pi}{4})$ (D) $(4, \frac{5\pi}{4})$

117. If

$$\int \frac{\cos x - \sin x}{8 - \sin 2x} dx = \frac{1}{p} \log \left[\frac{3 + \sin x + \cos x}{3 - \sin x - \cos x} \right] + c,$$

then $p =$ .....

(A) 6 (B) 1

(C) 3 (D) 12

118. If A is non-singular matrix and $(A + I)(A - I) = 0$ then $A + A^{-1} =$ .....

(A) 2A (B) 0

(C) I (D) 3I

119. Equations of planes parallel to the plane $x - 2y + 2z + 4 = 0$ which are at a distance of one unit from the point $(1, 2, 3)$ are .....

(A) $x + 2y + 2z = -6, x + 2y + 2z = 5$

(B) $x - 2y - 6 = 0, x - 2y + z = 6$

(C) $x + 2y + 2z = 6, x + 2y + 2z = 0$

(D) $x - 2y + 2z = 0, x - 2y + 2z - 6 = 0$

120. The y-intercept of the line passing through $A(6, 1)$ and perpendicular to the line $x - 2y = 4$ is .....

(A) 5 (B) 13

(C) -2 (D) 26

121. If function

$$\begin{aligned} f(x) &= x - \frac{|x|}{x}, x < 0 \\ &= x + \frac{|x|}{x}, x > 0 \\ &= 1, \quad x = 0, \text{ then} \end{aligned}$$

(A) $\lim_{x \to 0^-} f(x)$ does not exist

(B) $\lim_{x \to 0^+} f(x)$ does not exist

(C) $f(x)$ is continuous at $x = 0$

(D) $\lim_{x \to 0^-} f(x) \neq \lim_{x \to 0^+} f(x)$

122. In $\triangle ABC$, if $\tan A + \tan B + \tan C = 6$ and $\tan A \cdot \tan B = 2$ then $\tan C =$ .....

(A) 3 (B) 4

(C) 1 (D) 2

123. If $P(6, 10, 10), Q(1, 0, -5), R(6, -10, \lambda)$ are vertices of a triangle right angled at Q, then value of λ is .....

(A) 0 (B) 1

(C) 3 (D) 2

124. For L.P.P, maximize $z = 4x_1 + 2x_2$ subject to $3x_1 + 2x_2 \geq 9, x_1 - x_2 \leq 3, x_1 \geq 0, x_2 \geq 0$ has

(A) infinite number of optimal solutions (B) unbounded solution

(C) no solution (D) one optimal solution

125. The function $f(x) = x^3 - 3x$ is .....

(A) increasing in $(-\infty, -1) \cup (1, \infty)$ and decreasing in $(-1, 1)$ (B) increasing in $(0, \infty)$ and decreasing in $(-\infty, 0)$

(C) decreasing in $(0, \infty)$ and increasing in $(-\infty, 0)$ (D) decreasing in $(-\infty, -1) \cup (1, \infty)$ and increasing in $(-1, 1)$

126. If $x = \sin\theta, y = \sin^3\theta$ then $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$ is .....

(A) 3 (B) 6

(C) $\frac{1}{6}$ (D) $\frac{1}{3}$

127. The area of the region enclosed between pair of the lines $xy = 0$ and the lines $xy + 5x - 4y - 20 = 0$, is .....

(A) 20 square units (B) $\frac{4}{5}$ square units

(C) 10 square units (D) 6 square units

128. If three dices are thrown then the probability that the sum of the numbers on their uppermost faces to be atleast 5 is

(A) $\frac{1}{53}$ (B) $\frac{53}{54}$

(C) $\frac{1}{54}$ (D) $\frac{52}{53}$

129. If $f(x) = 3x + 6, g(x) = 4x + k$ and $f \circ g(x) = g \circ f(x)$ then $k =$

(A) -9 (B) 18

(C) $\frac{1}{9}$ (D) 9

130. If the sum of an infinite GP be 9 and sum of first two terms be 5 then their common ratio is .....

(A) $\frac{1}{3}$ (B) 3

(C) $\frac{2}{3}$ (D) $\frac{3}{2}$

131. The negation of " $\forall, n \in N, n+7>6$ " is .....

(A) $\exists n \in N$, such that $n+7 \leq 6$
(B) $\exists n \in N$, such that $n+7 \geq 6$
(C) $\forall n \in N, n+7 \leq 6$
(D) $\exists n \in N$, such that $n+7<6$

132. If the vectors $x\hat{\mathbf{i}}-3\hat{\mathbf{j}}+7\hat{\mathbf{k}}$ and $\hat{\mathbf{i}}+y\hat{\mathbf{j}}-z\hat{\mathbf{k}}$ are collinear then the value of $\frac{xy^2}{z}$ is equal

(A) $\frac{9}{7}$
(B) $\frac{-9}{7}$
(C) $\frac{-7}{9}$
(D) $\frac{7}{9}$

133.

$$\text{If } \int \tan(x-\alpha)\tan(x+\alpha)\cdot\tan 2x dx = p\log|\sec 2x| + q\log|\sec(x+\alpha)| + r\log|\sec(x-\alpha)| + c \text{ then } p+q+r = \ldots\ \ldots\ \ldots$$

(A) $\frac{-3}{2}$
(B) $\frac{-5}{2}$
(C) $\frac{5}{2}$
(D) $\frac{3}{2}$

134. Using differentiation, approximate value of $f(x)=x^2-2x+1$ at $x=2.99$ is .....

(A) 3.96
(B) 9.96
(C) 4.98
(D) 5.98

135. A particle moves so that $x=2+27t-t^3$. The direction of motion reverses after moving a distance of ..... units.

(A) 80
(B) 56
(C) 60
(D) 65

136. Which of the following is not equal to $\mathbf{w}\cdot(\mathbf{u}\times\mathbf{v})$?

(A) $\mathbf{u}\cdot(\mathbf{v}\times\mathbf{w})$
(B) $\mathbf{v}\cdot(\mathbf{w}\times\mathbf{u})$
(C) $(\mathbf{u}\times\mathbf{v})\cdot\mathbf{w}$
(D) $\mathbf{v}\cdot(\mathbf{u}\times\mathbf{w})$

137. The value of $\sin 18^\circ$ is

(A) $\frac{\sqrt{5}+1}{4}$
(B) $\frac{\sqrt{5}-1}{4}$
(C) $\frac{4}{\sqrt{5}+1}$
(D) $\frac{4}{\sqrt{5}-1}$

138. If the foot of the perpendicular drawn from the point $(0,0,0)$ to the plane is $(4,-2,-5)$ then the equation of the plane is .....

(A) $4x+2y+5z=-13$
(B) $4x-2y-5z=45$
(C) $4x+2y-5z=37$
(D) $4x-2y+5z=-5$

139.

$$\int \frac{x^2+1}{x^4-x^2+1}dx = \ldots\ \ldots$$

(A) $\tan^{-1}(\frac{x^2+1}{2})+c$
(B) $\tan^{-1}(x^2)+c$
(C) $\tan^{-1}(2x^2-1)+c$
(D) $\tan^{-1}(\frac{x^2-1}{x})+c$

140. If $x^y=e^{x-y}$, then $\frac{dy}{dx}$ at $x=1$ is .....

(A) e
(B) 1
(C) 0
(D) -1

141. If $A=\begin{bmatrix}1+2i & i\\ -i & 1-2i\end{bmatrix}$, where $i=\sqrt{-1}$, then $A(\text{adj } A)=\ldots$

(A) $-2I$
(B) $2I$
(C) $5I$
(D) $4I$

142. Which of the following statements is contingency?

(A) $(p\vee q)\vee\sim q$
(B) $(p\vee q)\wedge\sim q$
(C) $(p\vee q)\vee\sim p$
(D) $p\rightarrow(p\vee q)$

143.

$$\int_a^b \frac{\sqrt{x}}{\sqrt{x}+\sqrt{a+b-x}}dx = \ldots\ \ldots$$

(A) $a+b$
(B) $\frac{b-a}{2}$
(C) $a-b$
(D) $\frac{a-b}{2}$

144. The intercept on the line $y=x$ by the circle $x^2+y^2-2x=0$ is AB. The equation of the circle with AB as a diameter is .....

(A) $x^2+y^2+x+y=0$
(B) $x^2+y^2-x-y=0$
(C) $x^2+y^2-3x+y=0$
(D) $x^2+y^2+3x-y=0$

145. The equation of the circle concentric with the circle $x^2+y^2-6x-4y-12=0$ and touching the Y-axis is .....

(A) $x^2+y^2-6x-4y+4=0$
(B) $x^2+y^2-6x-4y+9=0$
(C) $x^2+y^2-6x-4y-4=0$
(D) $x^2+y^2-6x-4y-9=0$

146.

$$\int_0^1 x(1-x)^5 dx = \ \ldots \ \ldots$$

(A) $\frac{1}{5}$ (B) $\frac{1}{42}$

(C) $\frac{1}{13}$ (D) $\frac{13}{42}$

147. If $4\sin^{-1}x + 6\cos^{-1}x = 3\pi$ then $x =$ .....

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{2}$

(C) 0 (D) $-\frac{1}{2}$

148. If $\int_0^a \sqrt{\frac{a-x}{x}}dx = \frac{K}{2}$, then $K = \ldots..$

(A) $\frac{\pi a}{2}$ (B) $\frac{5\pi a}{2}$

(C) $\frac{3\pi a}{2}$ (D) πa

149. In $\triangle ABC$; with usual notations,

$$\frac{b\sin B - c\sin C}{\sin(B-C)} = \ \ldots \ \ldots$$

(A) b (B) $a+b+c$

(C) a (D) c

150. The solution of the differential equation $\frac{d\theta}{dt} = -k(\theta - \theta_0)$ where k is constant, is .....

(A) $\theta = \theta_0 + ae^{-kt}$ (B) $\theta = \theta_0 + ae^{kt}$

(C) $\theta = 2\theta_0 - ae^{kt}$ (D) $\theta = 2\theta_0 - ae^{-kt}$

- End of Question Paper -