MHT CET 2020 PCM Oct 16 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 2020**, 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 body slides down a smooth inclined plane having angle θ and reaches the bottom with velocity v. If a body is a sphere, then its linear velocity at the bottom of the plane is

(A) $\sqrt{\frac{9}{7}}v$ (B) $\sqrt{\frac{5}{7}}v$

(C) $\sqrt{\frac{2}{7}}v$ (D) $\sqrt{\frac{3}{7}}v$

2. A light wave of wavelength λ is incident on a slit of width d. The resulting diffraction pattern is observed on a screen at a distance D. If linear width of the principal maxima is equal to the width of the slit, then the distance D is

(A) $\frac{2\lambda}{d}$ (B) $\frac{d^2}{2\lambda}$

(C) $\frac{2\lambda^2}{d}$ (D) $\frac{d}{\lambda}$

3. The damping force of an oscillator is directly proportional to the velocity. The unit of constant of proportionality is

(A) kg ms^{-1} (B) kg s^{-1}

(C) kg ms^{-2} (D) kg-s

4. The magnetic susceptibility of a paramagnetic material at -73°C is 0.0075. Its value at -173°C will be

(A) 0.0150 (B) 0.0075

(C) 0.0030 (D) 0.0045

5. A particle performs simple harmonic motion with period of 3 s . The time taken by it to cover a distance equal to half the amplitude from mean position is [$\sin 30^\circ = 0.5$]

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

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

6. A sonometer wire under suitable tension having specific gravity ρ, vibrates with frequency n in air. If the load is completely immersed in water the frequency of vibration of wire will become

(A) $[\frac{\rho-1}{n\rho}]^{\frac{1}{2}}$ (B) $n[\frac{\rho-1}{\rho}]^{\frac{1}{2}}$

(C) $n[\frac{\rho}{\rho-1}]^{\frac{1}{2}}$ (D) $[\frac{n\rho}{\rho-1}]^{\frac{1}{2}}$

7. A radioactive nucleus emits 4α-particles and 7β-particles in succession. The ratio of number of neutrons of that of protons, is [$A =$ mass number, $Z =$ atomic number]

(A) $\frac{A-Z-13}{Z-2}$ (B) $\frac{A-Z-15}{Z-1}$

(C) $\frac{A-Z-13}{Z-1}$ (D) $\frac{A-Z-11}{Z-2}$

8. A thin uniform rod has mass M and length L The moment of inertia about an axis perpendicular to it and passing through the point at a distance $\frac{L}{3}$ from one of its ends, will be

(A) $\frac{ML^2}{12}$ (B) $\frac{7}{8}ML^2$

(C) $\frac{ML^2}{9}$ (D) $\frac{ML^2}{3}$

9. An obstacle is moving towards the source with velocity v. The sound is reflected from the obstacle. If c is the speed of sound and λ is the wavelength, then the wavelength of the reflected wave λ_r is

(A) $\lambda_r = (\frac{c-v}{c+v})\lambda$ (B) $\lambda_r = (\frac{c+v}{c-v})\lambda$

(C) $\lambda_r = (\frac{c-v}{c})\lambda$ (D) $\lambda_r = (\frac{c+v}{c})\lambda$

10. If the angle of dip at places A and B are 30° and 45° respectively, then the ratio of horizontal component of earth's magnetic field at A to that at B will be

$$\left[\sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}}, \sin\frac{\pi}{6} = \frac{1}{2}, \cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}\right]$$

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

(C) $\sqrt{3}:\sqrt{2}$ (D) $\sqrt{2}:\sqrt{3}$

11. The ratio of energy required to raise a satellite of mass m to a height h above the earth's surface of that required to put it into the orbit at same height is [$R =$ radius of the earth]

(A) $\frac{h}{R}$ (B) $\frac{3h}{R}$

(C) $\frac{4h}{R}$ (D) $\frac{2h}{R}$

12. A circular coil of radius R is carrying a current I_1 in anti-clockwise sense. A long straight wire is carrying current I_2 in the negative direction of X-axis. Both are placed in the same plane and the distance between centre of coil and straight wire is d. The magnetic field at the centre of coil will be zero for the value of d equal to

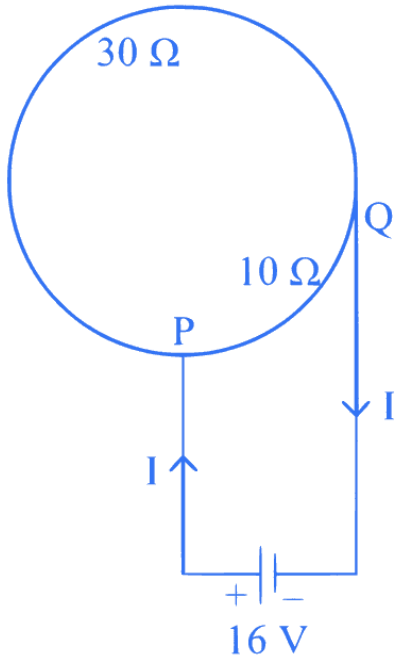
(A) $\frac{R}{\pi}(\frac{I_2}{I_1})$ (B) $\frac{\pi}{R}(\frac{I_2}{I_1})$

(C) $\frac{\pi}{R}(\frac{I_1}{I_2})$ (D) $\frac{R}{\pi}(\frac{I_1}{I_2})$

13. A circular coil of radius R has a resistance of 40Ω. Figure shows two points P and Q on the circumference separated by a distance

$$\frac{\pi R}{2}$$

which are connected to a 16 V battery with internal resistance of 0.5Ω. What is the value of current I flowing through the circuit?



(A) 3A (B) 2A

(C) 1A (D) 0.5A

14. An α-particle of energy 10 eV is moving in a circular path in uniform magnetic field. The energy of proton moving in the same path and same magnetic field will be [mass of α-particle $= 4$ times mass of proton]

(A) 8 eV (B) 16 eV

(C) 4 eV (D) 10 eV

15. In communication system, a repeater is used to extend the range to transmission. It is the combination of

(A) IF stage and amplifier (B) rectifier and detector

(C) receiver and transmitter (D) modulator and power amplifier

16. Two wires of different materials have same length L and same diameter d. The second wire is connected at the end of the first wire and forms one single wire of double the length. This wire is subjected to stretching force F to produce the elongation I. The two wires have

(A) different stress but same strain (B) different stress and different strain

(C) same stress but different strain (D) same stress and same strain

17. When wavelength of light used in optical instruments A and B are 4500 $\overset{o}{\text{A}}$ and 6000 $\overset{o}{\text{A}}$ respectively, the ratio of resolving power of A to B will be

(A) 9 : 16 (B) 16 : 9

(C) 7 : 1 (D) 4 : 3

18. The light of wavelength λ incident on the surface of metal having work function ϕ emits the electrons. The maximum velocity of electrons emitted is [$c =$ velocity of light, $h =$ Planck's constant, $m =$ mass of electron]

(A) $[\frac{2(h\nu-\varrho)\lambda}{mc}]$ (B) $[\frac{2(hc-\lambda\varrho)}{m\lambda}]^{1/2}$

(C) $[\frac{2(hc-\lambda)}{m\lambda}]^{1/2}$ (D) $[\frac{2(hc-\varrho)}{m\lambda}]$

19. A thin light weight rod of diamagnetic substance such as silver is suspended in uniform external magnetic field. It will align itself with its length

(A) parallel to magnetic field (B) perpendicular to magnetic field

(C) inclined at an angle 45° to magnetic field (D) inclined at an angle 120° to magnetic field

20. A batsman hits a ball of mass 0.2 kg straight towards the bowler without changing its initial speed of 6 m/s. What is the impulse imparted to the ball?

(A) 3.2 N-s (B) 1.6 N-s
(C) 4 N-s (D) 2.4 N-s

21. There are four convex lenses L_1, L_2, L_3 and L_4 of focal length $2, 4, 6$ and 8 cm, respectively. Two of these lenses from a telescope of length 10 cm and magnifying power 4. The objective and eye lenses are respectively

(A) L_1, L_2 (B) L_1, L_4
(C) L_2, L_3 (D) L_4, L_1

22. The ratio of radii of gyration of a ring to a disc (both circular) of same radii and mass, about a tangential axis perpendicular to the plane is

(A) $\frac{\sqrt{3}}{\sqrt{2}}$ (B) $\frac{2}{\sqrt{5}}$
(C) $\frac{\sqrt{2}}{1}$ (D) $\frac{2}{\sqrt{3}}$

23. An open organ pipe and a closed organ pipe have the frequency of their first overtone identical. The ratio of length of open pipe to that of closed pipe is

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

24. A particle starting from rest moves along the circumference of a circle of radius r with angular acceleration α. The magnitude of the average velocity, in the time it completes the small angular displacement θ is

(A) $r(\frac{2}{\alpha\theta})^2$ (B) $r(\frac{\alpha\theta}{2})^2$
(C) $\rho(\frac{\alpha\theta}{2})$ (D) $r(\frac{\alpha\theta}{2})^{\frac{1}{2}}$

25. Two spherical black bodies of radius r_1 and r_2 with surface temperature T_1 and T_2 respectively, radiate same power, then $r_1 : r_2$ is

(A) $(\frac{T_2}{T_1})^4$ (B) $(\frac{T_2}{T_1})^2$
(C) $(\frac{T_1}{T_2})^2$ (D) $(\frac{T_1}{T_2})^4$

26. Which of the following instruments is not a direct reading instrument?

(A) Electronic balance (B) Potentiometer
(C) Ammeter (D) Voltmeter

27. A block of mass m is moving on rough horizontal surface with momentum p. The coefficient of friction between the block and surface is μ. The distance covered by block before it stops is [$g =$ acceleration due to gravity]

(A) $\frac{2\mu M^2 g}{p^2}$ (B) $\frac{p}{2\mu M g}$
(C) $\frac{2\mu M g}{p}$ (D) $\frac{p^2}{2\mu M^2 g}$

28. A large open tank containing water has two holes to its wall. A square hole of side a is made at a depth y and a circular hole of radius r is made at a depth $16y$ from the surface of water. If equal amount of water comes out through both the holes per second, then the relation between r and a will be

(A) $r = \frac{a}{2\sqrt{\pi}}$ (B) $r = \frac{a}{2\pi}$
(C) $r = \frac{2a}{\pi}$ (D) $r = \frac{2a}{\sqrt{\pi}}$

29. Refractive index of the medium is μ and wavelength is λ, then which of the following proportionality relation is correct?

(A) $\mu \propto \lambda^2$ (B) $\mu \propto \frac{1}{\lambda}$
(C) $\mu \propto \lambda$ (D) $\mu \propto \frac{1}{\lambda^2}$

30. A transistor has a voltage gain A. If the amount βA of its output is applied to the input of the transistor, then the transistor becomes oscillator, when

(A) $\beta A = 0$ (B) $\beta A = 1$
(C) $\beta A = \infty$ (D) $\beta = 0$

31. A spherical rubber balloon carries a charge, uniformly distributed over the surface. As the balloon is blown up and increases in size, the total electric flux coming out of the surface

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

32. A diatomic gas undergoes adiabatic change. Its pressure p and temperature T are related as $p \propto T^x$, where x is

(A) 3.0 (B) 1.5
(C) 2.5 (D) 3.5

33. The ratio of energies of photons produced due to transition of electron of hydrogen atom from its (i) second to first energy level and (ii) highest energy level to second level is respectively

(A) 2.5 : 1 (B) 3 : 1

(C) 2 : 1 (D) 4 : 1

34. As we go from the equator of the earth to pole of the earth, the value of acceleration due to gravity

(A) decreases (B) decreases up to latitude of 45° and increases thereafter

(C) remains same (D) increases

35. Two wires A and B are stretched by the same load. The radius of wire A is double the radius of wire B. The stress on the wire B as compared to the stress on the wire A is

(A) half (B) equal

(C) twice (D) four times

36. When tension T is applied to a sonometer wire of length I, it vibrates with the fundamental frequency n. Keeping the experimental setup same, when the tension is increased by 8 N, the fundamental frequency becomes three times the earlier fundamental frequency n. The initial tension applied to the wire (in newton) was

(A) 2.0 (B) 2.5

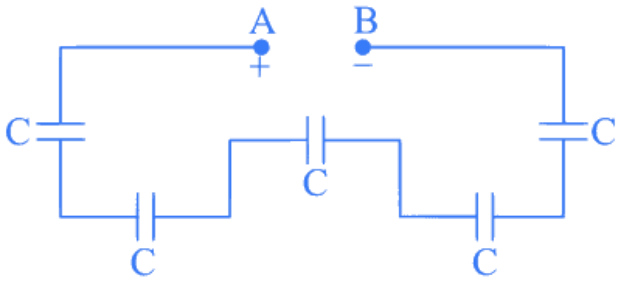
(C) 0.5 (D) 1.0

37. At absolute zero temperature, pure silicon behaves as

(A) non-metal (B) insulator

(C) metal (D) extrinsic semiconductor

38. Five capacitors each of capacity C are connected as shown in figure. If their resultant capacity is 2μF, then the capacity of each condenser is



(A) 5 μF (B) 2 μF

(C) 2.5 μF (D) 10 μF

39. The work done in blowing a soap bubble of radius R is W. The work done in blowing a bubble of radius $2R$ of the same soap solution is

(A) $\frac{W}{4}$ (B) $\frac{W}{2}$

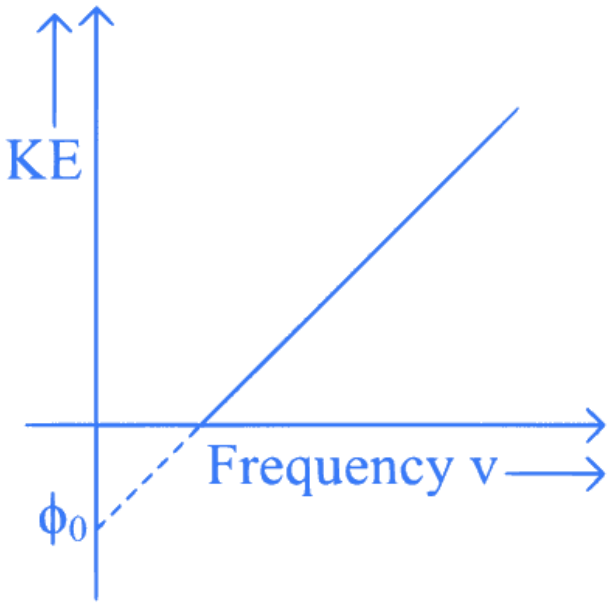
(C) $4W$ (D) $2W$

40. The x, y components of vector $\mathbf{P}$ have magnitudes 1 and 3 and x, y components of resultant of $\mathbf{P}$ and $\mathbf{Q}$ have magnitudes 5 and 6, respectively. What is the magnitude of $\mathbf{Q}$?

(A) 5 (B) 4

(C) 3 (D) 2

41. The graph of kinetic energy against the frequency v of incident light is as shown in the figure. The slope of the graph and intercept on X-axis respectively are



(A) maximum KE, threshold frequency
(B) Planck's constant, threshold frequency
(C) Planck's constant, work function
(D) work function, maximum KE

42. The length of solenoid is I whose windings are made of material of density D and resistivity ρ. The winding resistance is R. The inductance of solenoid is [$m =$ mass of winding wire, $\mu_0 =$ permeability of free space]

(A) $\frac{\mu_0}{4\pi I}(\frac{Rm}{\rho D})$
(B) $\frac{\mu_0}{2\pi I}(\frac{Rm}{\rho D})$
(C) $\frac{\mu_0}{2\pi I}(\frac{\rho D}{Rm})$
(D) $\frac{\mu_0}{4\pi/}(\frac{\rho D}{Rm})$

43. A step-up transformer has 300 turns of primary winding and 450 turns of secondary winding. A primary is connected to 150 V and the current flowing through it is 9A. The current and voltage in the secondary are

(A) 13.5 A, 100 V
(B) 13.5 A, 225 V
(C) 4.5 A, 100 V
(D) 6.0 A, 225 V

44. A simple pendulum of length I has a bob of mass m. It executes SHM of small amplitude A. The maximum tension in the string is ($g =$ acceleration due to gravity)

(A) mg
(B) $mg(\frac{A^2}{I^2}+1)$
(C) 2 mg
(D) $mg(\frac{A}{I}+1)$

45. A block of mass m attached to one end of the vertical spring produces extension x. If the block is pulled and released, the periodic time of oscillation is

(A) $2\pi\sqrt{\frac{x}{4g}}$
(B) $2\pi\sqrt{\frac{2x}{g}}$
(C) $2\pi\sqrt{\frac{x}{2g}}$
(D) $2\pi\sqrt{\frac{x}{g}}$

46. The resultant of two vector **A** and **B** is **C**. If the magnitude of **B** is doubled, the new resultant vector becomes perpendicular to A. Then, the magnitude of **C** is

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

47. A ray of light travelling through glass of refractive index $\sqrt{2}$ is incident on glass-air boundary at an angle of incidence 45°. If refractive index of air is 1 , then the angle of refraction will be

$$\left[\sin 45^\circ = \frac{1}{\sqrt{2}}, \sin 90^\circ = 1\right]$$

(A) 45°
(B) 30°
(C) 60°
(D) 90°

48. A particle of mass m is performing UCM along a circle of radius r. The relation between centripetal acceleration a and kinetic energy E is given by

(A) $a = \frac{2E}{mr}$
(B) $a = 2Em$
(C) $a = \frac{E}{mr}$
(D) $a = (\frac{2E}{mr})^2$

49. In conversion of moving coil galvanometer into an ammeter of required range, the resistance of ammeter, so formed is [$S =$ shunt and $G =$ resistance of galvanometer]

(A) $\frac{S+G}{SG}$
(B) $\frac{SG}{S+G}$
(C) $\frac{S-G}{SG}$
(D) $\frac{SG}{S-G}$

50. A square frame of each side L is dipped in a soap solution and taken out. The force acting on the film formed is ($T =$ surface tension of soap solution)

(A) $8TL$
(B) $2TL$
(C) $R = (R_1^3 + R_2^3)^{1/3}$
(D) 12 TL

51. Which of the following is obtained by catalytic oxidation of ammonia?

(A) N_2O (B) NO

(C) HNO_2 (D) NO_2

52. The volume of oxygen required for complete combustion of 0.25 mole of methane at STP is

(A) 22.4 dm^3 (B) 11.2 dm^3

(C) 7.46 dm^3 (D) 5.6 dm^3

53. A solution of $CuSO_4$ is electrolysed using a current of 1.5 amperes for 10 minutes. What mass of Cu is deposited at cathode? [Atomic mass of Cu = 63.7]

(A) 0.637 g (B) 0.297 g

(C) 0.150 g (D) 0.395 g

54. Which of the following reaction proves the chlorinating property of phosphorus pentachloride?

(A) $PCl_5 + H_2O \longrightarrow POCl_3 + 2HCl$

(B) $2PCl_5 + Sn \longrightarrow SnCl_4 + 2PCl_3$

(C) $PCl_5 \longrightarrow PCl_3 + Cl_2$

(D) $P_4 + 10Cl_2 \longrightarrow 4PCl_5$

55. Number of oxygen atoms present in salicylaldehyde are

(A) 1 (B) 3

(C) 4 (D) 2

56. Which polymer from following is used as synthetic leather?

(A) PVC (B) Bakelite

(C) Polythene (D) Polystyrene

57. Which among the following is used as an oxidising agent to bleach wood pulp into white paper?

(A) H_2O_2 (B) Cl_2

(C) $Mn(OH)_2$ (D) NaOCl

58. What is the number of $=N-OH$ groups present in dimethyl glyoximato?

(A) 4 (B) 1

(C) 2 (D) 3

59. Work done when 2 mole of an ideal gas is compressed from a volume of 5 m^3 to 2.5 m^3 at 300 K, under a pressure of 100 kpa is

(A) 49.75 kJ (B) 248.7 kJ

(C) 497.5 kJ (D) 99.50 kJ

60. Which of the following pairs of aryl halides cannot be prepared directly by electrophilic substitution?

(A) Aryl chloride and aryl bromide (B) Aryl fluoride and aryl chloride

(C) Aryl bromide and aryl iodide (D) Aryl iodide and aryl fluoride

61. Which of the following reaction of diazonium salt involves retention of diazonium group?

(A) Reaction with phosphinic acid (B) Reaction with dilute sulphuric acid

(C) Reaction with HCl and Cu powder (D) Reaction with phenol

62. The common name of 1-chloro-2, 2-dimethyl propane is

(A) isopentyl chloride (B) neo-pentyl chloride

(C) *n*-pentyl chloride (D) isopropyl chloride

63. Which of the following actinoids exhibits only +3 oxidation state?

(A) Lr (Z = 103) (B) U (Z = 92)

(C) Th (Z = 90) (D) Pa (Z = 91)

64. 60 g CH_3COOH dissolved in 1 dm^3 solvent, what is molality of solution? (density = 1.25 g/cm^3)

(A) 0.8 m (B) 0.4 m

(C) 0.2 m (D) 0.6 m

65. If resistivity of 0.8 M KCl solution is $2.5 \times 10^{-3} \Omega$ cm. Calculate molar conductivity solution?

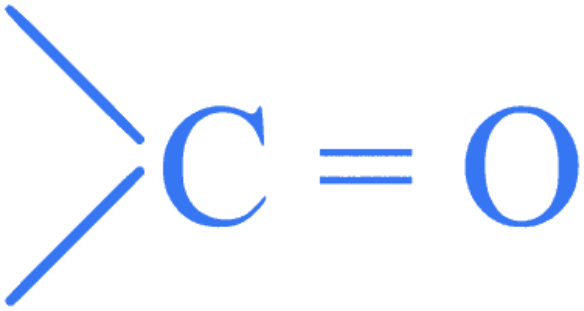
(A) $2 \times 10^5 \Omega^{-1}$ cm^2 mol^{-1}

(B) $5 \times 10^5 \Omega^{-1}$ cm^2 mol^{-1}

(C) $4 \times 10^5 \Omega^{-1}$ cm^2 mol^{-1}

(D) $3 \times 10^5 \Omega^{-1}$ cm^2 mol^{-1}

66. Which of the following compounds does not contain



group ?

(A) Ester (B) Amide

(C) Ether (D) Acyl halide

67. If, 2 moles of an ideal gas at 546 K has volume of 44.8 L, then what will be it's pressure? ($R = 0.082$)

(A) 3.129 atm (B) 1.098 atm

(C) 1.998 atm (D) 2.408 atm

68. In which of the following compounds intramolecular hydrogen bonding is present?

(A) Ammonia (B) Ethanol

(C) Water (D) o-nitrophenol

69. Which of the following is not a character of ideal drug?

(A) Should destroy harmful organisms (B) Is not localised to affected site

(C) Harmless to host (D) Should not disturb physiological process

70. Identify compound 'B' in following series of reactions?

$$\text{Acetonitrile} \xrightarrow{\text{Na/ alcohol}} A \xrightarrow{\text{NaNO}_2\text{/ dil. HCl}} B$$

(A) Ethyl amine (B) Nitroethane

(C) Ethyl alcohol (D) Ethyl chloride

71. Which among the following compounds is obtained when glucose react with hydrogen cyanide?

(A) Gluconic acid (B) Glucose cyanohydrin

(C) Saccharic acid (D) n-hexane

72. Which of the following formula represents lithium imide?

(A) $LiNH_2$ (B) Li_2NH

(C) Li_3N (D) LiNH

73. Identify the process of refining to obtain pig tin.

(A) Polling (B) van Arkel

(C) Liquation (D) Mond process

74. An acylchloride is hydrogenated over catalyst palladium on barium sulphate to form an aldehyde. This reaction is called as

(A) Wolff-Kishner reduction (B) Etard reaction

(C) Rosenmund reduction (D) Stephen reaction

75. A first order reaction has a rate constant 0.00813 min^{-1}. How long will it take for 60% completion?

(A) 56.35 min (B) 98.7 min

(C) 62.77 min (D) 112.7 min

76. Which of the following properties is of the thermosetting polymers?

(A) These can be remoulded (B) On heating these become soft

(C) These are cross-linked polymers (D) These can be recycled

77. Equilibrium constant for a reaction is 20. What is the value of ΔG° at 300 K ? $\left(R = 8 \times 10^{-3}\ \text{kJ}\right)$

(A) $-7.191\ \text{kJ mol}^{-1}$ (B) $-5.527\ \text{kJ mol}^{-1}$

(C) $-2.763\ \text{kJ mol}^{-1}$ (D) $-1.663\ \text{kJ mol}^{-1}$

78. If entropy of a solid is greater than zero, at $T = 0$, it is called

(A) formal entropy (B) standard entropy

(C) residual entropy (D) absolute entropy

79. Silver crystallises in fcc structure, if edge length of unit cell is 316.5 pm . What is the radius of silver atom?

(A) 121.91 pm (B) 111.91 pm

(C) 137.04 pm (D) 158.25 pm

80. Which is the product obtained, when Br_2 water reacts with glucose?

(A) 1,6-dibromo glucose
(B) Saccharic acid
(C) Gluconic acid
(D) Bromohexane

81. Propane nitrile on reaction with ethyl magnesium iodide in presence of dry ether gives complex. This imine complex on acid hydrolysis forms

(A) propanone
(B) 2-pentanone
(C) butanone
(D) 3-pentanone

82. Which of the following is not dihydric phenol?

(A) Hydroquinone
(B) α-naphthol
(C) Resorcinol
(D) Catechol

83. What is osmotic pressure of a semi molar solution at 27°C ?

$(R = 0.082)$

(A) 20.5 atm
(B) 4.96 atm
(C) 2.46 atm
(D) 12.3 atm

84. What is IUPAC name of hydroquinone?

(A) Benzene-1, 3, 5-triol
(B) Benzene-1, 2-diol
(C) Benzene-1, 4-diol
(D) Benzene-1, 2, 4-triol

85. In gas phase



bond angle in H_2O_2 is

(A) 94.8°
(B) 111.5°
(C) 98.4°
(D) 147.5°

86. Solutions A, B, C and D are respectively 0.2 M urea, 0.10 M NaCl, 0.05 M $BaCl_2$ and 0.05 M $AlCl_3$. All solutions are isotonic with each other except

(A) B
(B) A
(C) D
(D) C

87. Which among the following carbocation is most reactive?

(A) CH_3^+
(B) $CH_3 - CH_2^+$
(C) $(CH_3)_2CH^+$
(D) $(CH_3)_3C^+$

88. Which of the following metals is refined by vapour phase refining in Mond process?

(A) Zn
(B) Zr
(C) Si
(D) Ni

89. What is correct order of $C - X$ bond strength in $CH_3 - X$?

(A) $CH_3F > CH_3Cl > CH_3Br > CH_3I$
(B) $CH_3Cl > CH_3Br > CH_3l > CH_3\ F$
(C) $CH_3I > CH_3Br > CH_3Cl > CH_3\ F$
(D) $CH_3F > CH_3Br > CH_3Cl > CH_3I$

90. An element crystallises in a bcc lattice with cell edge of 500 pm. The density of the element is 7.5 g cm^{-3}. How many atoms are present in 300 g of metal?

(A) 6.4×10^{23} atoms
(B) 12.8×10^{23} atoms
(C) 3.2×10^{23} atoms
(D) 1.6×10^{23} atoms

91. Which among the following compound is not optically active?

(A) 3-chloro-2-methyl pentane
(B) 3-chloropentane
(C) 2-chloropentane
(D) 2-chloro-3-methyl pentane

92. Which of the following benzylic alcohol is tertiary alcohol?

(A) 1-phenyl ethanol
(B) 2-phenyl propan-2-ol
(C) Phenyl methanol
(D) 1-phenyl propan-2-ol

93. Identify the hydrocarbon compound from following containing carbon atoms in the range of C_6 to C_8 ?

(A) Petrol
(B) CNG
(C) Diesel
(D) Waxes

94. Which of the following is multimolecular colloid?

(A) Aqueous solution of protein
(B) Solution of rubber in organic solvent
(C) Silver solution
(D) Aqueous polyvinyl alcohol

95. An element has a bcc structure with cell edge of 288 pm . The density of element is 7.2 g cm^{-3}. What is the atomic mass of an element?

(A) 25.89 (B) 51.78
(C) 77.68 (D) 62.43

96. What is the secondary valence of Co^{3+} ion according to Werner's theory in $[Co(NH_3)_4Cl_2]^+$?

(A) 3 (B) 6
(C) 5 (D) 4

97. Which of the following elements belongs to first inner transition series?

(A) Pu (B) Pr
(C) Bk (D) Fm

98. How many numbers of $P-OH$ and $P-O-P$ bonds are present in pyrophosphoric acid respectively?

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

99. What is the value of rate constant of first order reaction, if it takes 15 minutes for consumption of 20% of reactants?

(A) 1.38×10^{-2} min^{-1} (B) 1.48×10^{-2} min^{-1}
(C) 1.07×10^{-2} min^{-1} (D) 1.84×10^{-2} min^{-1}

100. Which of the following molecule does not contain oxygen?

(A) Veronal (B) Phenelzine
(C) Serotonin (D) Iproniazid

101. If the equation
$$ax^2 + 2hxy + by^2 + 2gx + 2fy = 0$$
has one line as the bisector of the angle between co-ordinate axes, then

(A) $(a+b)^2 = 4(h^2+f^2)$

(B) $(a+b)^2 = 4(h^2+g^2+f^2)$

(C) $(a+b)^2 = 4h^2$

(D) $(a+b)^2 = 4(h^2+g^2)$

102.
$$\left[\sin\left(\tan^{-1}\frac{3}{4}\right)\right]^2 + \left[\sin\left(\tan^{-1}\frac{4}{3}\right)\right]^2 =$$

(A) 0 (B) 1

(C) 5 (D) -1

103. If the plane
$$2x + 3y + 5z = 1$$
intersects the co-ordinate axes at the points A, B, C, then the centroid of $\triangle ABC$ is

(A) $(2,3,5)$ (B) $(\frac{1}{6}, \frac{1}{9}, \frac{1}{15})$

(C) $(\frac{3}{2}, 1, \frac{3}{5})$ (D) $(\frac{1}{2}, \frac{1}{3}, \frac{1}{5})$

104. The eccentricity of the ellipse
$$y^2 + 4x^2 - 12x + 6y + 14 = 0$$
is

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

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

105. For
$$f(x) = [x]$$
, where $[x]$ is the greatest integer function, which of the following is true, for every $x \in \mathbf{R}$

(A) $[x]+1 = x$ (B) $[x]+1 < x$

(C) $[x]+1 \leq x$ (D) $[x]+1 > x$

106. The value of
$$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{8}\right)$$
is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{4}$ (D) $\frac{\pi}{12}$

107. The integrating factor of the differential equation
$$\sin y\left(\frac{dy}{dx}\right) = \cos y(1 - x\cos y)$$
is

(A) $e^{\sin y}$ (B) e^{-x}

(C) $e^{-\cos y}$ (D) e^{-y}

108. The direction co-sines of the line which bisects the angle between positive direction of Y and Z axes are

(A) $0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0$

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

109. The equation of normal to the curve
$$y = \sin\left(\frac{\pi x}{4}\right)$$
at the point $(2,5)$ is

(A) $x = 2$ (B) $x + y = 5$

(C) $x + y = 2$ (D) $y = 5$

110. The negation of the statement ' He is poor but happy' is

(A) He is poor but not happy (B) He is neither poor nor happy

(C) He is not poor and not happy (D) He is not poor or not happy

111. The matrix
$$A = \begin{bmatrix} a & -1 & 4 \\ -3 & 0 & 1 \\ -1 & 1 & 2 \end{bmatrix}$$
is not invertible only if $a =$

(A) 17 (B) -16

(C) -17 (D) 16

112. The maximum value of
$$Z = 3x + 5y$$
, subject to $3x + 2y \leq 18, x \leq 4, y \leq 6, x, y \geq 0$ is

(A) 30 (B) 32

(C) 27 (D) 36

113.
$$\int \left[-\frac{\log x - 1}{1 + (\log x)^2}\right]^2 dx =$$

(A) $\frac{x}{1+(\log x)^2} + c$ (B) $\frac{x}{(1+\log x)} + c$

(C) $\frac{x^2}{1+(\log x)^2} + c$ (D) $\frac{1}{1+(\log x)^2} + c$

114.

$$\int \frac{dx}{\cos 2x - \cos^2 x} =$$

(A) $-\tan x + c$ (B) $\cot x + c$

(C) $\tan x + c$ (D) $-\cot x + c$

---

115. The area included between the parabolas

$$y^2 = 5x$$

and

$$x^2 = 5y$$

is

(A) $\frac{25}{3}$ sq units (B) 25 sq units

(C) $\frac{25}{4}$ sq units (D) $\frac{25}{7}$ sq units

---

116. The straight lines represented by the equation

$$9x^2 - 12xy + 4y^2 = 0$$

are

(A) coincident (B) perpendicular

(C) intersect at 60° (D) parallel

---

117. The odds in favour of drawing a king from a pack of 52 playing cards is

(A) 1 : 4 (B) 4 : 1

(C) 12 : 1 (D) 1 : 12

118.

$$\int_{\frac{\pi}{5}}^{\frac{3\pi}{10}} \left[\frac{\tan x}{\tan x + \cot x}\right] dx =$$

(A) $\frac{3\pi}{10}$ (B) $\frac{\pi}{20}$

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

---

119. The angle between the lines

$$\frac{x-1}{4} = \frac{y-3}{1} = \frac{z}{8}$$

and

$$\frac{x-2}{2} = \frac{y+1}{2} = \frac{z-4}{1}$$

is

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

(C) $\cos^{-1}(\frac{3}{4})$ (D) $\cos^{-1}(\frac{1}{3})$

---

120. In a $\triangle ABC$ if

$$2\cos C = \sin B \cdot \operatorname{cosec} A$$

, then

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

(C) $a = b = c$ (D) $a = b$

---

121. The order and degree of the differential equation

$$\left[1 + \left[\frac{dy}{dx}\right]^3\right]^{\frac{7}{3}} = 7\frac{d^2y}{dx^2}$$

are respectively.

(A) 2, 1 (B) 1, 2

(C) 3, 2 (D) 2, 3

---

122. The rate at which the metal cools in moving air is proportional to the difference of temperatures between the metal and air. If the air temperature is 290 K and the metal temperature drops from 370 K to 330 K in 10 min , then the time required to drop the temperature upto 295 K is

(A) 30 min (B) 35 min

(C) 20 min (D) 40 min

---

123. If

$$A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$$

, then

$$B^{-1}A^{-1} =$$

(A) $\begin{bmatrix} -2 & -3 \\ -7 & 11 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -3 \\ -7 & 11 \end{bmatrix}$

(C) $\begin{bmatrix} 2 & 3 \\ 7 & 11 \end{bmatrix}$ (D) $\begin{bmatrix} -2 & -3 \\ -7 & -11 \end{bmatrix}$

---

124. The domain of the function

$$f(x) = \sqrt{x}$$

is

(A) R (B) $R^+ \cup \{0\}$

(C) $R - \{0\}$ (D) R^+

125.

If $\sin(x+y) + \cos(x+y) = \sin\left[\cos^{-1}\left(\frac{1}{3}\right)\right]$

, then $\frac{dy}{dx} =$

(A) 1 (B) -1

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

---

126. The micro-organisms double themselves in 3 h. Assuming that the quantity increases at a rate proportional to it self, then the number of times it multiplies themselves in 18 yr is

(A) 32 (B) 64

(C) 40 (D) 128

127. Out of 100 people selected at random, 10 have common cold. If five persons selected at random from the group, then the probability that at most one person will have common cold is

(A) 0.9851 (B) 0.9185

(C) 0.9245 (D) 0.9254

128. If the line

$$r = (\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}) + \lambda(2\hat{\mathbf{i}} + \hat{\mathbf{j}} + 2\hat{\mathbf{k}})$$

is parallel to the plane

$$r \cdot (3\hat{i} - 2\hat{\mathbf{j}} + m\hat{\mathbf{k}}) = 10$$

, then the value of m is

(A) -2 (B) 3

(C) 2 (D) -3

129. Let G be the centroid of a $\triangle ABC$ and O_{b_θ} other point in that plane, then

$$OA + OB + OC + CG =$$

(A) O (B) 4 OG

(C) 3 OG (D) 2 OG

130. The points $A(-a,-b), B(0,0), C(a,b)$ and $D\left(a^2, ab\right)$ are

(A) vertices of a square (B) vertices of a parallelogram

(C) collinear (D) vertices of a rectangle

131. The particular solution of the differential equation

$$y\left(\frac{dx}{dy}\right) = x\log x$$

at

$$x = e$$

and

$$y = 1$$

is

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

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

132.

$$\tan A + 2\tan 2A + 4\tan 4A + 8\cot 8A =$$

(A) tanA (B) tan2A

(C) cot2 A (D) cotA

133.

$$\cos(36^\circ - A)\cos(36^\circ + A) + \cos(54^\circ + A)\cos(54^\circ - A) =$$

(A) cos$A$ (B) cos2A

(C) sin$A$ (D) sin2A

134. The pdf of a continuous r.v. X is given by

$$f(x) = \frac{x}{8}, 0 < x < 4 = 0$$

, otherwise, then $P(X \leq 2)$ is

(A) $\frac{1}{4}$ (B) $\frac{5}{16}$

(C) $\frac{9}{16}$ (D) $\frac{7}{16}$

135. If

$$f(x) = \frac{|x|}{x}$$

, for $x \neq 0$

$$= 1$$

, for

$$x = 0$$

, then tre function is

(A) differentiable but not continuous at $x = 0$ (B) continuous and differentiable at $x = 0$

(C) neither continuous nor differentiable at $x = 0$ (D) continuous but not differentiable at $x = 0$

136. If p, q are true statement and r is false statement, then which of the following statements is a true statement.

(A) $(p \to r) \to q$ is false (B) $(p \leftrightarrow q) \to r$ is false

(C) $(p \wedge q) \to r$ is true (D) $(p \vee q) \vee r$ is false

137. The cosine of the angle included between the lines

$$\mathbf{r} = (2\hat{\mathbf{i}} + \hat{\mathbf{j}} - 2\hat{\mathbf{k}}) + \lambda(\hat{\mathbf{i}} - 2\hat{\mathbf{j}} - 2\hat{\mathbf{k}})$$

and

$$\mathbf{r} = (\hat{\mathbf{i}} + \hat{\mathbf{j}} + 3\hat{\mathbf{k}}) + \mu(3\hat{\mathbf{i}} + 2\hat{\mathbf{j}} - 6\hat{\mathbf{k}})$$

where $\lambda, \mu \in R$ is.

(A) $\frac{3}{21}$ (B) $\frac{17}{21}$

(C) $\frac{13}{21}$ (D) $\frac{11}{21}$

138.

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

(A) $x + \log(1 - 2e^{-x}) + c$

(B) $x + 2\log(1 - 2e^{-x}) + c$

(C) $\log(1 - 2e^{-x}) + c$

(D) $x - \log(1 - 2e^{-x}) + c$

139. If the volume of the parallelopiped whose conterminus edges are along the vectors $\mathbf{a}, \mathbf{b}, \mathbf{c}$ is 12, then the volume of the tetrahedron whose conterminus edges are $\mathbf{a} + \mathbf{b}, \mathbf{b} + \mathbf{c}$ and $c + a$ is

(A) 12 (units)^3 (B) 24 (units)^3

(C) 4 (units)^3 (D) 6 (units)^3

140. The function

$$f(x) = \frac{x+1}{9x+x^3}$$

is

(A) discontinuous at exactly two points
(B) discontinuous at exactly one point
(C) continuous for all real values of x
(D) discontinuous at exactly three points

141. For any non-zero vectors **a** and **b**,

(A) $a \times b$
(B) $|a \times b|^2$
(C) 0
(D) $|\mathbf{a} \times \mathbf{b}|$

142. If

$$f(x) = \sin^{-1}\left(\sqrt{\frac{1-x}{2}}\right)$$

, then

$$f'(x) =$$

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

143. The rational form of a number $1.\overline{41}$ is

(A) $\frac{140}{99}$
(B) $\frac{154}{99}$
(C) $\frac{41}{99}$
(D) $\frac{55}{99}$

144. The length of latus-rectum of the parabola

$$x^2 + 2y = 8x - 7$$

is

(A) 4
(B) 8
(C) 6
(D) 2

145. If

$$x + y = \frac{\pi}{2}$$

, then the maximum value of $\sin x \cdot \sin y$ is

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

146.

$$\int_0^1 \left(\frac{x^2-2}{x^2+1}\right)dx =$$

(A) $1 - \frac{\pi}{4}$
(B) $1 + \frac{\pi}{4}$
(C) $1 + \frac{3\pi}{4}$
(D) $1 - \frac{3\pi}{4}$

147. If

$$a = \sin 175^\circ + \cos 175^\circ$$

, then

(A) $a > 0$
(B) $a < 0$
(C) $a = 0$
(D) $a = 1$

148.

$$\int_{-5}^{5} \log\left(\frac{7-x}{7+x}\right)dx =$$

(A) 5
(B) -5
(C) 0
(D) 10

149. For every value of x, the function

$$f(x) = \frac{1}{a^x}, a >$$

0 is,

(A) neither increasing nor decreasing
(B) decreasing
(C) constant
(D) increasing

150. If a die is thrown at random, then the expectation of the number on it is

(A) 2.4
(B) 3.3
(C) 2.1
(D) 3.5

- End of Question Paper -