MHT CET 2026 PCM May 14 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 2026**, 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. The resultant $\vec{R}$ of $\vec{P}$ and $\vec{Q}$ is perpendicular to $\vec{P}$. Also $|\vec{P}| = |\vec{R}|$. The angle between $\vec{P}$ and $\vec{Q}$ is
$(\tan 45^\circ = 1)$

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

2. If the initial velocity of projection be doubled, keeping the angle of projection same, the maximum height reached by it will

(A) remain the same (B) be doubled
(C) become four times (D) be halved

3. A particle of mass m is projected with velocity V making an angle of 45° with the horizontal. The magnitude of the angular momentum of the projectile about an axis of projection when the particle is at maximum height h is (g = acceleration due to gravity) $\left(\sin 45^\circ = \frac{1}{\sqrt{2}}\right)$ $\left(\cos 45^\circ = \frac{1}{\sqrt{2}}\right)$

(A) zero (B) $\frac{mV^3}{4\sqrt{2}g}$
(C) $\frac{mV^3}{\sqrt{2}g}$ (D) $m\sqrt{2gh^2}$

4. A stone of mass m is tied to a string and is moved in a vertical circle of radius r making 'n' r.p.m. The total tension in the string when the stone is at the lowest point is (g = acceleration due to gravity)

(A) mg (B) $m(g + \pi nr^2)$
(C) $m(g + nr)$ (D) $m\left[g + \frac{\pi^2 n^2 r}{900}\right]$

5. Three identical blocks A, B and C are placed on a horizontal frictionless surface. The blocks B and C are at rest. Block A is approaching towards B with a speed 10 m/s. The coefficient of restitution for all collisions is 0.5. The speed of block C just after collision is



(A) 5.6 m/s (B) 6 m/s
(C) 8 m/s (D) 10 m/s

6. A solid sphere is rotating about a diameter at an angular velocity ω. If it cools so that its radius reduces to $\left(\frac{1}{n}\right)^{\text{th}}$ of its original value, its angular velocity becomes

(A) $\frac{\omega}{n}$ (B) $\frac{\omega}{n^2}$
(C) $n\omega$ (D) $n^2\omega$

7. The magnitude of gravitational field at distances r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are I_1 and I_2 respectively. Given that $r_1 > R$ and $r_2 < R$, the ratio $\frac{I_1}{I_2}$ is

(A) $\frac{R^2}{r_1 r_2}$ (B) $\frac{R^3}{r_1 r_2^2}$
(C) $\frac{R^3}{r_1^2 r_2}$ (D) $\frac{R^4}{r_1^2 r_2^2}$

8. In air, a charged soap bubble of radius R breaks in to 27 small soap bubbles of equal radii r. Then the ratio of mechanical force acting per unit area of big soap bubble to that of a small soap bubble is

(A) $\frac{1}{81}$ (B) $\frac{3}{1}$
(C) $\frac{1}{3}$ (D) $\frac{9}{1}$

9. A frame made up of metallic wire enclosing a surface area A is covered with a soap film. If the area of the frame of metallic wire is reduced by 25% the energy of the soap film will be changed by

(A) 100% (B) 75%
(C) 50% (D) 25%

10. The excess pressure inside a spherical drop of water is four times that of another drop. Then, their respective mass ratio is

(A) 1 : 16 (B) 8 : 1
(C) 1 : 4 (D) 1 : 64

11. A metal rod (A) of length 20 cm expands by 0.075 cm when its temperature changes from 0°C to 100°C. Another metal rod (B) of different metal of same length expands by 0.045 cm for same temperature change. A third rod of same length is composed of 2 parts, one of metal A and another of metal B. For same temperature change, this rod expands by 0.060 cm. The portion made of metal A has the length

(A) 12 cm (B) 10 cm

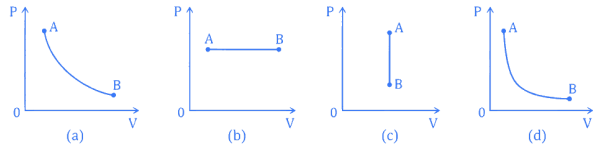
(C) 15 cm (D) 18 cm

12. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $\frac{3\lambda_0}{4}$, the power radiated by it becomes nP. The value of n is

(A) $\frac{256}{81}$ (B) $\frac{4}{3}$

(C) $\frac{3}{4}$ (D) $\frac{81}{256}$

13. Arrange the correct order of P-V diagrams in thermodynamics for an isothermal process, isobaric process, isochoric process and adiabatic process



(A) a,b,c,d (B) a,c,b,d

(C) d,c,b,a (D) d,b,c,a

14. If the ratio of molar heat capacities $\frac{C_p}{C_v} = \gamma$ then the ratio of $\frac{\Delta Q}{\Delta U}$ and $\frac{\Delta Q}{\Delta W}$ in an isobaric process is

(A) $2\gamma, \frac{\gamma}{2}$ (B) $\gamma, \frac{\gamma}{(\gamma-1)}$

(C) $\frac{\gamma}{(\gamma-1)}$ (D) $\frac{1}{\gamma}, (\gamma - 1)$

15. Heat required to raise the temperature of 2 mol of an ideal gas at constant pressure from 25° C to 35°C is 310 J. The amount of heat required to raise the temperature of the gas through the same range at constant volume is
($R = 8.3$ J/mol K)

(A) 384 J (B) 144 J

(C) 276 J (D) 452 J

16. At constant temperature, the volume of a gas is to be decreased by 4%. The pressure must be increased by

(A) 4% (B) 4.16%

(C) 8% (D) 3.86%

17. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$ where l is about 100 cm and has 1 mm accuracy. The period is about 2 s. The time of 100 oscillations is measured by a stopwatch of least count 0.1 s. The percentage error in 'g' is (gravitation acceleration)

(A) 0.1% (B) 1%

(C) 0.2% (D) 0.8%

18. A particle starts oscillating simple harmonically from its equilibrium position with time period T. The ratio of kinetic energy to potential energy of the particle at time $t = T/12$ is

(A) 1 : 4 (B) 2 : 1

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

19. The maximum velocity and maximum acceleration of a particle performing a linear S.H.M. are α and β respectively. Then, path length of the particle is

(A) $\frac{\alpha^2}{\beta}$ (B) $\frac{\beta}{2\alpha^2}$

(C) $\frac{2\alpha^2}{\beta}$ (D) $\frac{2\beta}{\alpha^2}$

20. A particle executes S.H.M. with time period 16 s. At time $t = 2$ s, the particle crosses the mean position while at $t = 4$ s, velocity is 4 m/s. The amplitude of motion (in m) is $\left(\sin 45^\circ = \frac{1}{\sqrt{2}}\right)$

(A) $\sqrt{2}\pi$ (B) $16\sqrt{2}\pi$

(C) $24\sqrt{2}\pi$ (D) $32\sqrt{2}/\pi$

21. The equation of a plane progressive wave is $Y = 0.025\ \sin(100t + 0.25x)$. The frequency of this wave would be

(A) $\frac{50}{\pi}$ Hz (B) $\frac{100}{\pi}$ Hz

(C) 100 Hz (D) 50 Hz

22. Two closed organ pipes A and B have the same length and A is wider than B. They resonate in the fundamental mode at frequencies n_A and n_B respectively, then

(A) $n_A = n_B$ (B) $n_A > n_B$

(C) $n_A < n_B$ (D) either (2) or (3) depending on the ratio of their diameters

23. The equation of a stationary wave along a stretched string is $y = 5 \sin \frac{\pi x}{3} \cos 40\pi t$ where x and y are in cm and t in second. The separation between two adjacent nodes is

(A) 6 cm (B) 4 cm

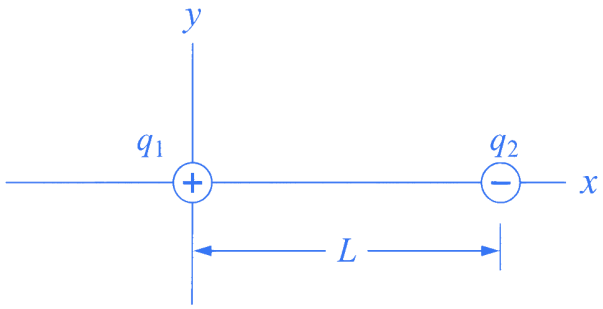
(C) 3 cm (D) 1.5 cm

24. A uniform rope of mass 0.1 kg and length 2.5 m hangs from ceiling. The speed of transverse wave in the rope at upper end and at a point 0.5 m distance from lower end will be ($g = 10$ m/s^2)

(A) 5 m/s, $\sqrt{5}$ m/s (B) 10 m/s, 3.2 m/s

(C) 7.5 m/s, 2.5 m/s (D) 2 m/s, 5 m/s

25. Two particles of charges $q_1 = 8q$ and $q_2 = -2q$ are placed as shown in figure. At what point away from q_2 on x-axis can a proton be placed placed so that it is in equilibrium?



(A) $x = 2L$ (B) $x = 2.5L$

(C) $x = 3L$ (D) $x = L$

26. The electric field intensity at a point near and outside the surface of a charged conductor of any shape is E_1. The electric field intensity due to a uniformly charged infinite thin plane sheet having the same surface charge density is E_2. The relation between E_1 and E_2 is

(A) $2E_1 = E_2$ (B) $E_1 = E_2$

(C) $E_1 = 2E_2$ (D) $E_1 = 4E_2$

27. An infinite line charge produces a field of 9×10^8 N/C at a distance of 2 cm. The linear charge density is

$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ SI unit}\right)$

(A) 10^{-3} C/m (B) 2×10^{-3} C/m

(C) 4×10^{-3} C/m (D) 10^{-2} C/m

28. A capacitor of 20 μF is charged up to 500 V is connected in parallel with another capacitor of 10 μF which is charged up to 200 V. Then, the common potential will be

(A) 400 V (B) 200 V

(C) 100 V (D) 50 V

29. A galvanometer of resistance 50 Ω is connected to a battery of 3V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. To reduce this deflection to 20 divisions, the resistance in series should be

(A) 5050 Ω (B) 5550 Ω

(C) 6050 Ω (D) 4450 Ω

30. In balanced meter bridge, the resistance of bridge wire is 0.1 Ω/cm. Unknown resistance X is connected in the left gap and 6 Ω in right gap. Null point divides the wire in the ratio 2 : 3. The current drawn from the battery of 5V having negligible resistance is

(A) 1 A (B) 1.6 A

(C) 2 A (D) 5 A

31. A particle carrying a charge equal to 100 times the charge of an electron is rotating one rotation per second in a circular path of radius 0.8 m. The value of magnetic field produced at the centre will be (μ_0 = permeability of free space)

(A) $10^{-7}/\mu_0$ (B) $\mu_0 10^{-17}$

(C) $\mu_0 10^{-6}$ (D) $\mu_0 10^{-7}$

32. Two parallel long wires carry currents i_1 and i_2 with $i_1 > i_2$. When the currents are in the same direction, the magnetic field at a point midway between the wires is 10 μT. If the direction of i_2 is reversed then the field becomes 30 μT. The ratio $\frac{i_1}{i_2}$

(A) 4 (B) 3

(C) 2 (D) 1

33. A paramagnetic substance in the form of a cube with sides 1 cm has a magnetic dipole moment 20×10^{-6} J/T when a magnetic intensity 60×10^{3} A/m is applied. Its magnetic susceptibility is

(A) 3.3×10^{-4} (B) 3.3×10^{-2}

(C) 4.3×10^{-2} (D) 2.3×10^{-2}

34. The self induced e.m.f. of a coil is 25 V. When the current in it is changed at uniform rate from 10 A to 25 A in 1 s, the change in the energy of the inductance is

(A) 437.5 J (B) 740 J

(C) 6375 J (D) 540 J

35. A square of side L metre lies in the XY plane in a region, where the magnetic field is $\vec{B} = B_0(2\hat{i} + 3\hat{j} + 4\hat{k})$, where B_0 constant. The magnitude of flux passing through the square is

(A) $2B_0L^2$ Wb (B) $3B_0L^2$ Wb

(C) $4B_0L^2$ Wb (D) $\sqrt{29}B_0L^2$ Wb

36. An arc lamp requires a direct current of 10 A at 90 V to function. If it is connected to 220 V (rms), 50 Hz a.c. supply, the series inductor needed for it to work is nearly

(A) $\frac{1}{\pi}$ H (B) $\frac{1}{5\pi}$ H

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

37. An alternating voltage is $E = 100 \sin\left(\omega t + \frac{\pi}{6}\right)$ V. The voltage will be maximum for the first time when t is $\left(\sin\frac{\pi}{2} = 1\right)$ (T = Periodic time)

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

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

38. A 10 μF capacitor is charged to 25 V of potential. The battery is then disconnected and a pure 100 mH coil is connected across the capacitor so that L-C oscillations are set up. The maximum current in the coil is

(A) 0.25 A (B) 0.01 A

(C) 2.5 A (D) 1.6 A

39. A current of 5 A is flowing at 220 V in the primary coil of a transformer. If the voltage produced in the secondary coil is 2200 V and 50% of power is lost, then the current in secondary will be

(A) 2.5 A (B) 5 A

(C) 0.25 A (D) 0.5 A

40. An equilateral prism deviates a ray through 45° for the two angles of incidence differing by 20°. One of the angle of incidence is

(A) 62.5° (B) 32.5°

(C) 52.5° (D) 22.5°

41. If Young's double slit experiment is performed in water

(A) the fringe width will decrease (B) the fringe width will increase

(C) the fringe width will remain unchanged (D) the fringe width first decreases and then increases

42. The distance of a point on the screen from two slits in biprism experiment is 1.8×10^{-5} m and 1.23×10^{-5} m. If wavelength of light used is 6000 Å the fringe number formed at that point is

(A) 10^{th} bright (B) 10^{th} dark

(C) 9^{th} bright (D) 9^{th} dark

43. Interference fringes are produced on a screen by using two light sources of intensities I and 9I. The phase difference between the beams is $\frac{\pi}{2}$, at point P and π at point Q on the screen. The difference between the resultant intensities at points P and Q is $\left(\cos\frac{\pi}{2} = 0, \cos\pi = -1\right)$

(A) $2I$ (B) $4I$

(C) $6I$ (D) $8I$

44. When photons of energy $h\nu$ fall on a metal plate of work function W_0, photoelectrons of maximum kinetic energy K are ejected. If the frequency of radiation is doubled, the maximum kinetic energy of ejected photoelectrons will be

(A) $K + W_0$ (B) $K + h\nu$

(C) K (D) $2K$

45. Energy of the incident photon on the metal surface is $3W$ and then $5W$, where W is the work function of that metal. The ratio of velocities of emitted photoelectrons is

(A) 1 : 4 (B) 1 : 2

(C) $1 : \sqrt{2}$ (D) 1 : 1

46. If λ_1 and λ_2 are the wavelengths of the first members of the Lyman and Paschen series respectively then $\lambda_1 : \lambda_2$ is

(A) 1 : 35 (B) 1 : 30

(C) 7 : 50 (D) 7 : 108

47. In hydrogen atom, an electron jumps from higher orbit to lower orbit so that radius of the lower orbit is $\left(\frac{1}{4}\right)^{\text{th}}$ of radius of higher orbit. If speed of electron in higher orbit was V, then speed in lower orbit is

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

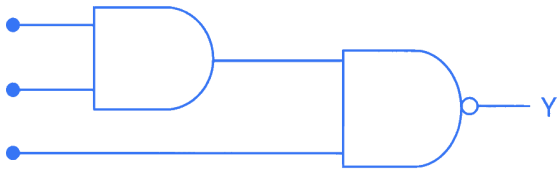
(C) V (D) $2V$

48. In an intrinsic semiconductor, at any ordinary temperature, the correct relation between the number of electrons per unit volume (n_e) and number of holes per unit volume (n_h) is

(A) $n_e = n_h$ (B) $n_e > n_h$

(C) $n_e < n_h$ (D) $n_e = n_h = 0$

49. The output Y, when all the three inputs are first high and then low, will respectively be



(A) $1, 0$ (B) $1, 1$

(C) $0, 0$ (D) $0, 1$

50. The current gain in the common emitter mode of a transistor is 10. The input impedance is 20 $k\Omega$ and load resistance 100 $k\Omega$. The power gain is

(A) 300 (B) 500

(C) 200 (D) 100

51. An element has two isotopes of mass numbers 65 and 67 with abundances of 25% and 75% respectively. Then the average atomic mass of the element is

(A) 65.5 (B) 67.5
(C) 66.5 (D) 66

52. What is the wavelength of the photon emitted during the transition from the orbit of $n = 4$ to that of $n = 2$ in hydrogen atom?

(A) 434 nm (B) 486 nm
(C) 656 nm (D) 410 nm

53. Find the number of sp^2 hybridized carbon atoms in cycloheptatriene?

(A) 1 (B) 6
(C) 5 (D) 7

54. Identify the set of molecules which have similar dipole moment from the following.

(A) H_2, CO_2, BF_3, CCl_4
(B) H_2, CO_2, NF_3, CH_4
(C) $H_2, CO_2, NH_3, CHCl_3$
(D) $HBr, CO_2, NF_3, CHCl_3$

55. Which of the following gases has the highest density under normal conditions?

(A) O_2 (B) SO_2
(C) CH_4 (D) N_2

56. Calculate the constant external pressure required to compress 4 moles of an ideal gas, from volume 30 dm^3 to 20 dm^3 when the work obtained is 4053 J.

(A) 4 atm. (B) 4.5 atm.
(C) 5 atm. (D) 3.5 atm.

57. Calculate the heat of formation of SO_2 from the following data,
i) $S + 3/2O_2(g) \rightarrow SO_3(g)$, $\Delta H = -5Y$ kJ
ii) $SO_2 + 1/2O_2(g) \rightarrow SO_3(g)$, $\Delta H = -3Y$ kJ

(A) $2Y$ kJ (B) $8Y$ kJ
(C) $-8Y$ kJ (D) $-2Y$ kJ

58. $CH_{4(g)} \rightarrow C_{(g)} + 4H_{(g)}$, $\Delta H = 1660$ kJ/mol. What type of enthalpy does the reaction represent?

(A) Enthalpy of decomposition (B) Enthalpy of atomization
(C) Enthalpy of ionization (D) Enthalpy of vaporization

59. Calculate the dissociation constant of weak monobasic acid if it dissociates to 0.04% in 0.2 M solution.

(A) 5.4×10^{-8} (B) 4.8×10^{-8}
(C) 3.9×10^{-8} (D) 3.2×10^{-8}

60. Calculate the amount of acetic acid in one liter of its solution if the degree of dissociation is 1.3% [$K_a = 1.8 \times 10^{-5}$]

(A) 1.6 g (B) 6.36 g
(C) 3.2 g (D) 9.8 g

61. Which of the following salts is made by weak acid and weak base?

(A) CH_3COOK (B) $NaNO_3$
(C) CH_3COONH_4 (D) NH_4Cl

62. What is the oxidation number of S in H_2SO_3 and $H_2S_2O_7$ respectively?

(A) +2 and +4 (B) +4 and +6
(C) +3 and +5 (D) +6 and +4

63. Which of the following compounds is used to prepare H_2O_2 by Merck process using aqueous H_2SO_4?

(A) $BaSO_4$ (B) 2-ethylanthraquinol
(C) $Na_2O_{2(aq)}$ (D) Na_2CO_3

64. What is the IUPAC name of o-tolualdehyde?

(A) 2-methyl benzaldehyde (B) 2-hydroxy benzaldehyde
(C) 2-methyle propanol (D) benzene carbaldehyde

65. Which of the following species exhibits $+I$ effect?

(A) $-COOR$ (B) $-CN$
(C) $-Cl$ (D) $-CH_3$

66. Which of the following statements is correct regarding aromatic ethers?

(A) These are ortho directing compounds towards electrophilic aromatic substitution.

(B) These are meta directing compounds towards electrophilic aromatic substitution.

(C) These are para directing compounds towards electrophilic aromatic substitution.

(D) These are ortho and para directing compounds towards electrophilic aromatic substitution.

67. Which of the following reagents is used to carry out aromatic electrophilic substitution reaction with iodine?

(A) HNO_3

(B) HI

(C) HCl

(D) H_3PO_4

68. The compound is formed of two different elements A and B. Atoms of B forms hcp structure and atoms of A occupy 2/3rd of octahedral voids. Calculate the formula of compound.

(A) AB

(B) AB_2

(C) A_2B

(D) A_2B_3

69. Find the type of unit cell if the density is 6.25 g/cm^3, edge length 400 pm and the atomic mass of an element is 120 g/mol.
(Consider $N_A = 6.02 \times 10^{23}$)

(A) Base centred

(B) bcc

(C) fcc

(D) sc

70. Identify anisotropic substance from following.

(A) Glass

(B) Ice

(C) Rubber

(D) Tar

71. The osmotic pressure of a particular solution is 8 atm at 298 K. What will be the osmotic pressure under similar conditions at 313 K?

(A) 7.60 atm

(B) 11.65 atm

(C) 8.40 atm

(D) 4.84 atm

72. A solution of 10.0 g of a nonvolatile, nonelectrolyte solute dissolved in 0.2 kg of benzene boils at 81.2°C. Calculate molar mass of the compound. (ebullioscopic constant for benzene = 2.53 K kg mol^{-1} and boiling point of pure benzene = 80.1° C)

(A) 215 gm/mol

(B) 115 gm/mol

(C) 225 gm/mol

(D) 155 gm/mol

73. What type of solution is gasoline?

(A) Gas in liquid

(B) Gas in solid

(C) Solid in Gas

(D) Liquid in liquid

74. Two solutions have concentration ratio 0.4 and conductivity ratio 0.2. What is the ratio of their molar conductivities?

(A) 0.1

(B) 0.2

(C) 0.5

(D) 0.4

75. Calculate the molar conductivity of 0.001 M $AgNO_3$ solution if the conductivity of 0.001 M $AgNO_3$ solution is 1.3×10^{-4} ohm^{-1} cm^{-1}.

(A) 130 ohm^{-1} cm^2 mol^{-1}

(B) 125 ohm^{-1} cm^2 mol^{-1}

(C) 140 ohm^{-1} cm^2 mol^{-1}

(D) 135 ohm^{-1} cm^2 mol^{-1}

76. What is the number of moles of electrons that are required for the reduction of 2 moles of Al^{+3} to Al?

(A) 3

(B) 4

(C) 6

(D) 1

77. A first order reaction has a half life period 69.3 seconds. Calculate the rate of reaction if the concentration of reactant is 0.1 M.

(A) 1.0×10^{-1} mol dm^{-3} s^{-1}

(B) 1.0×10^{-2} mol dm^{-3} s^{-1}

(C) 1.0×10^{-3} mol dm^{-3} s^{-1}

(D) 1.0×10^{-4} mol dm^{-3} s^{-1}

78. What is the slope for a first-order reaction plot of $\log[A]_0/[A]_t$ vs time (t)?

(A) slope $= k/2.303$

(B) slope $= -k/2.303$

(C) slope $= k$

(D) slope $= -k$

79. Which of the following is the correct relation for half life period of a zero order reaction?

(A) It is directly proportional to initial concentration of reactants
(B) It is inversely proportional concentrations of reactants
(C) It is directly proportional to the concentration of product.
(D) It is inversely proportional to the square of initial concentration of reactants

80. What type of colloid the cloud is?

(A) Solid sol
(B) Aerosol
(C) Emulsion
(D) Gel

81. Which of the following catalysts is used for Haber's process of manufacture of ammonia?

(A) Ni
(B) Pt
(C) Fe
(D) V_2O_5

82. Identify the correct order of bond dissociation enthalpy of halogens from following.

(A) I-I > Br-Br > Cl-Cl > F-F
(B) Cl-Cl > Br-Br > F-F > I-I
(C) I-I > Br-Br > Cl-Cl > F-F
(D) Br-Br > F-F > I-I > Cl-Cl

83. Which of the following inert gases is used in supersonic wind tunnels?

(A) Xenon
(B) Argon
(C) Neon
(D) Helium

84. Calculate the spin-only magnetic moment of divalent cation of a transition metal with atomic number 25.

(A) 2.84 BM
(B) 3.87 BM
(C) 4.90 BM
(D) 5.92 BM

85. Calculate magnetic moment for Fe^{3+}?

(A) 3.87 BM
(B) 2.83 BM
(C) 5.92 BM
(D) 1.73 BM

86. Identify a complex having four unpaired electrons in it

(A) $[CoF_6]^{3-}$
(B) $[Co(NH_3)_6]^{3+}$
(C) $[NiCl_4]^{2-}$
(D) $[Ni(CN)_4]^{2-}$

87. Identify the major product obtained when 2-Bromobutane is heated with alcoholic KOH.

(A) But-2-ene
(B) But-1-ene
(C) Propene and methane
(D) Ethene

88. Identify the product obtained in following reaction.

$C_3H_7 - O - C_3H_7 + HI_{\text{excess}} \xrightarrow[\text{Hot}]{\Delta} X + Y$

(A) C_3H_7OH and H_2O
(B) C_3H_7 and H_2O
(C) C_3H_7I and C_3H_7OH
(D) C_3H_7I and H_2O

89. Identify 'X' and 'Y' in the following reaction.

$C_3H_7 - O - C_3H_7 + HI$ (excess) $\xrightarrow[\text{Hot}]{\Delta} X + Y$

(A) C_3H_7OH and H_2O
(B) C_3H_7 and H_2O
(C) C_3H_7I and C_3H_7OH
(D) C_3H_7I and H_2O

90. Which of the following compounds, when reacted with ketones forms oxime?

(A) Hydrazine
(B) Semicarbazide
(C) Hydroxyl amine
(D) Phenyl hydrazine

91. Which of the following compounds undergoes Cannizzaro's reaction?

(A) Acetaldehyde
(B) Formaldehyde
(C) Propionaldehyde
(D) Butyraldehyde

92. Which of the following compounds is obtained in the saponification process?

(A) R-CHO
(B) R-COONa
(C) R-CO-R
(D) R-COCl

93. Which of the following compounds is obtained when N,N,N-triethylpropanammonium hydroxide is heated?

(A) Ethane and N,N-diethylpropylamine
(B) Ethene and N,N-diethylpropylamine
(C) Ethene and N-ethylpropylamine
(D) Ethene, ethane and N,ethylpropylamine

94. Identify secondary amines from the following list?
a) N,N-Dimethylethanamine
b) N-Methylmethanamine
c) 4-Bromobenzenamine
d) N-Methylbenzenamine
e) N-Methylethanamine

(A) b, d and e
(B) a and c
(C) Only a
(D) Only c

95. Which of the following nitrogen bases pairs with guanine of one strand of DNA?

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

96. Which of the following polymer is stored in the liver of animals?

(A) Amylose
(B) Amylopectin
(C) Cellulose
(D) Glycogen

97. Which of the following statements is NOT correct?

(A) Cisplatin is used in treatment of cancer.
(B) Haemoglobin contains iron.
(C) Na^{+} ions help in blood clotting.
(D) Chlorophyll in a plant is a complex of Mg^{2+} ions.

98. Identify the monomeric unit present in Orlon.

(A) Acrolein
(B) Glycol
(C) Vinyl cyanide
(D) isoprene

99. Which of the following polymers is NOT semisynthetic?

(A) Cellulose acetate rayon
(B) Cuprammonium rayon
(C) Teflon
(D) Cellulose nitrate

100. Which of the following compounds has antiseptic property?

(A) CHI_3
(B) CH_2Cl_2
(C) $CHCl_3$
(D) CCl_4

101. The domain of function $f(x) = \frac{1}{\sqrt{|x|-x}}$ is :

(A) $[0, \infty)$ (B) $(0, \infty)$

(C) $(-\infty, 0)$ (D) $(-\infty, 0]$

102. In ΔABC, $\angle C = \frac{2\pi}{3}$, then the value of $\cos^2 A + \cos^2 B - \cos A \cos B$ is

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

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

103. The number of solutions of $\cos 2x = \cos x$ in the interval $[0, 2\pi]$ is

(A) 2 (B) 3

(C) 4 (D) 6

104. The value of $\sum_{n=1}^{4}(i^n + i^{n+1})$ is

(A) 1 (B) i

(C) $-i$ (D) 0

105. A man has seven relatives, 4 of them are ladies and 3 gentlemen, his wife also has 7 relatives out of which 3 are ladies and 4 gentlemen. The number of ways in which they can invite a dinner party of 3 ladies and 3 gentlemen, so that there are 3 of the man's relatives and 3 of the wife's relatives, are

(A) 144 (B) 485

(C) 336 (D) 535

106. Four Rupee 5 coins, three rupee 2 coins and two rupee 1 coin are stacked together in a column at random. The probability that the coins of the same denomination are consecutive, is

(A) $\frac{13}{9!}$ (B) $\frac{1}{210}$

(C) $\frac{1}{35}$ (D) 0

107. Point C and D divide segment AB respectively internally and externally, in the ratio m:n then B divides CD internally in the ratio --------

(A) $(m+n) : m$ (B) $(m+n) : n$

(C) $(m-n) : (m+n)$ (D) $(m+n) : (m-n)$

108. If the polar coordinates of the point P are $\left(1, \frac{7\pi}{4}\right)$, then the sum of the squares of abscissa and ordinate of Cartesian coordinates of point P is

(A) 0 (B) 1

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

109. If $P(2, 7)$ is the mid-point of a line segment intercepted between the co-ordinate axes, then the equation of line is

(A) $2x + 7y = 28$ (B) $2x - 7y = 28$

(C) $7x + 2y = 28$ (D) $7x + 2y = 14$

110. If the sum of the cubes of slopes of two lines represented by the equation $ax^2 + 2hxy + by^2 = 0$ is 1, then

(A) $8h^3 - 6abh + b^3 = 0$

(B) $b^3 + 2h(4h^2 - ab) = 0$

(C) $3h^3 = 4ab^2$

(D) $a^2 + 2h^3 + 3b^2 = 1$

111. If the tangent to the curve $y^2 = 4x$ at $(4, 4)$ touches the circle $x^2 + y^2 - c = 0$ then the value of $5c$ is

(A) 64 (B) 16

(C) 4 (D) 8

112. Tangents are drawn from the point $P(3, 4)$ to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ touching the ellipse at points A and B. Then length of segment AB is

(A) $\frac{4\sqrt{2}}{5}$ (B) $\frac{16\sqrt{2}}{5}$

(C) $\frac{8\sqrt{10}}{5}$ (D) $\frac{9\sqrt{10}}{5}$

113. If $\lim_{x\to\infty}\left[\frac{x^3+1}{x^2+1} - (ax + b)\right] = 2$ then

(A) $a = 1,\ b = 1$ (B) $a = 1,\ b = -1$

(C) $a = 1,\ b = -2$ (D) $a = 1,\ b = 2$

114.

$[(p \wedge q) \vee (\sim r \vee \sim s \vee \sim t)] \wedge [(p \wedge q) \vee (r \wedge s \wedge t)] \equiv$

(A) $\sim p \wedge q$ (B) $p \vee q$

(C) $p \wedge q$ (D) $p \vee \sim q$

115. Let p, q, r be three logical statements. Consider the compound statements
$S_1 : [(p \to q) \wedge \sim q] \to r$ and
$S_2 : (p \vee q) \vee r$
Then which of the following is not true?

(A) If S_2 is True, then S_1 is True.
(B) If S_2 is False, then S_1 is False.
(C) If S_1 is False, then S_2 is False.
(D) If S_2 is False, then S_1 is True.

116. The negation of converse of "I can travel by train if I get my ticket reserved" is

(A) I get my ticket reserved and I cannot travel by train.
(B) I get my ticket not reserved and I can travel by train.
(C) I cannot travel by train and I get my ticket reserved.
(D) I can travel by train and I get my ticket not reserved

117. If $u = \tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ and $v = \tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ then $\frac{du}{dv} = \ldots$

(A) $\frac{\sqrt{1+x^2}}{4(1-x^2)}$
(B) $\frac{\sqrt{1-x^2}}{4(1+x^2)}$
(C) $\frac{\sqrt{1-x^2}}{2(1+x^2)}$
(D) $\frac{2\sqrt{1+x^2}}{(1-x^2)}$

118. If $-1 \le x \le -\frac{1}{\sqrt{2}}$ then $\sin^{-1}(2x\sqrt{1-x^2}) =$

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

119. If $\sin^{-1} x + \cos^{-1}\left(\frac{1}{\sqrt{5}}\right) = \frac{\pi}{4}$, then $x = \ldots$

(A) $\frac{-1}{\sqrt{10}}$
(B) $\frac{1}{\sqrt{10}}$
(C) $\frac{3}{\sqrt{10}}$
(D) $\frac{-3}{\sqrt{10}}$

120. The value of $\cot^{-1}\left(\frac{ab+1}{a-b}\right) + \tan^{-1}\left(\frac{b-c}{bc+1}\right) + \cot^{-1}\left(\frac{ac+1}{c-a}\right)$ is

(A) abc
(B) $ab + bc + ca$
(C) 0
(D) $1 - ab - bc - ac$

121. If the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{bmatrix}$ and its inverse is $A^{-1} = \begin{bmatrix} a & c & -7 \\ b & -1 & c \\ -2 & 0 & 1 \end{bmatrix}$, then ....

(A) $a = 13,\ b = -3,\ c = 0$
(B) $a = 13,\ b = 3,\ c = -2$
(C) $a = 13,\ b = -7,\ c = 2$
(D) $a = 13,\ b = -3,\ c = 2$

122. If $f(x) = \frac{1-\cos\left(\frac{px}{2}\right)}{x^2}$ is continuous at $x = 0$ and $f(0) = \frac{9\pi^2}{32}$, then the value of p is

(A) $p = \pm\frac{3}{2}$
(B) $p = \pm\frac{3}{4}$
(C) $p = \pm\frac{2}{3}$
(D) $p = \pm\frac{4}{3}$

123. If $x = \frac{1+\log t}{t^2}$ and $y = \frac{3+2\log t}{t}$, then the value of $\frac{dy}{dx}$ is

(A) t
(B) 1
(C) 0
(D) $\frac{y}{x}$

124. If $x^y y^x = 1$, then $\frac{dy}{dx}$ is equal to

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

125. If $3x^2 + 4xy + 5y^2 = 0$, then $\frac{dy}{dx} = \ldots$

(A) $\frac{x}{y}$
(B) $\frac{y}{x}$
(C) $\frac{2x}{y}$
(D) $\frac{x}{2y}$

126. A rectangular sheet of paper has its area 32 meters^2. The margins at the top and bottom are 50 cm each and at the sides 25 cm each. If the area of the printed space is maximum, then the dimensions of the paper are

(A) 16 meters and 2 meters
(B) 30 meters and 2 meters
(C) 8 meters and 4 meters
(D) 25 meters and 7 meters

127. A stone is dropped into a quiet lake and waves move in circles at the speed of 7 cm s^{-1}. At the instant when the radius of circular wave is 5 cm, the enclosed area is increasing at the rate ------ cm^2 s^{-1}

(A) 50π
(B) 60π
(C) 25π
(D) 70π

128. If Rolle's theorem holds for the function $f(x) = x^2 - px + 10,\ x \in [0, 4]$ with $c = 2$, then $p =$

(A) 4 (B) 2

(C) -4 (D) -2

129. The value of the integral $\int \frac{dx}{x^4+x^3}$ is

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

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

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

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

130. Evaluate $\int e^x(\sin x + 2\cos x)\sin x dx$

(A) $e^x \cos x + C$ (B) $e^x \sin x + C$

(C) $e^x \sin^2 x + C$ (D) $e^x \sin 2x + C$

131. If $\int \sqrt{1 + \sec x}dx = 2\sin^{-1}(f(x)) + c$, then

(A) $f(x) = \sqrt{2}\sin\left(\frac{x}{2}\right)$ (B) $f(x) = \sqrt{2}\cos\left(\frac{x}{2}\right)$

(C) $f(x) = \frac{1}{\sqrt{2}}\sin\left(\frac{x}{2}\right)$ (D) $f(x) = \frac{1}{\sqrt{2}}\cos\left(\frac{x}{2}\right)$

132. $\int \frac{x^3 \sin(\tan^{-1}(x^4))}{1+x^8}dx =$

(A) $\frac{1}{4}\cos(\tan^{-1}(x^4)) + c$

(B) $\frac{1}{4}\sin(\tan^{-1}(x^4)) + c$

(C) $\frac{1}{4}\sec(\tan^{-1}(x^4)) + c$

(D) $-\frac{1}{4}\cos(\tan^{-1}(x^4)) + c$

133. $\int_0^1 \frac{\sin^{-1}\sqrt{x(2-x)}}{\cos^{-1}x + \sin^{-1}\sqrt{x(2-x)}}dx = \ldots$

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

(C) $\frac{2}{3}$ (D) 0

134. $\int_0^{\pi/4} \log(1 + \tan x)dx = \ldots$

(A) $\frac{\pi}{4}\log(2)$ (B) $\frac{\pi}{2}\log(2)$

(C) $\frac{\pi}{8}\log(2)$ (D) $\log(2)$

135. The value of the integral $\int_0^{\pi/4} \frac{\cos x}{\sqrt{1-\sin^2 x}}dx$ is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{6}$

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

136. The area of the region bounded by the parabola $y^2 = 16x$ and the line $x = 4$ is

(A) $\frac{108}{3}$ sq. units (B) $\frac{118}{3}$ sq. units

(C) $\frac{128}{3}$ sq. units (D) $\frac{218}{3}$ sq. units

137. If the function $f(x)$ satisfying the equation $[f'(x)]^2 + 4f(x)f'(x) + f^2(x) = 0$, then $f(x) =$ (where c is constant of integration)

(A) $c \cdot e^{(2\pm\sqrt{3})x}$ (B) $c \cdot e^{(-3\pm\sqrt{2})x}$

(C) $c \cdot e^{(-2\pm\sqrt{3})x}$ (D) $c \cdot e^{(3\pm\sqrt{2})x}$

138. A person's assets start reducing in such a way that the rate of reduction of assets is proportional to the square root of the assets existing at that moment. If the assets at the beginning are ₹40 lakhs and they dwindle down to ₹40000 after 2 years. Then the person will be bankrupt in k years from the start. Then $k =$

(A) $2\frac{2}{9}$ (B) $2\frac{2}{7}$

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

139. The differential equation of the equation $x^2 + (y - b)^2 = 1$ is

(A) $x^2\left[\left(\frac{dy}{dx}\right)^2 + 1\right] = \left(\frac{dy}{dx}\right)^2$

(B) $x^2\left[\left(\frac{dy}{dx}\right)^2 + 1\right] = -\left(\frac{dy}{dx}\right)^2$

(C) $x^2\left[\left(\frac{dy}{dx}\right)^2 - 1\right] = -\left(\frac{dy}{dx}\right)^2$

(D) $x^2\left[\left(\frac{dy}{dx}\right)^2 - 1\right] = \left(\frac{dy}{dx}\right)^2$

140. If the volume of tetrahedron with its coterminous edges $\bar{a}, \bar{b}, \bar{c}$ is 6 cu. units then the volume of a tetrahedron with coterminous edges $(\bar{a} \times \bar{b}), (\bar{b} \times \bar{c}), (\bar{c} \times \bar{a})$ is

(A) 6 cu. units. (B) 36 cu. units.

(C) 216 cu. units. (D) 648 cu. units.

141. If $\bar{p}, \bar{q}, \bar{r}$ are unit vectors such that $\bar{p} \times (\bar{q} \times \bar{r}) = \frac{1}{7}\bar{q}$, then the angle between $\bar{p}$ and $\bar{r}$ is

(A) $\cos^{-1}(7)$ (B) $\sin^{-1}\left(\frac{4\sqrt{3}}{7}\right)$

(C) $\tan^{-1}\left(\frac{1}{7}\right)$ (D) $\frac{\pi}{2}$

142. The equation of the line passing through the point of intersection of the lines $\frac{x-3}{1} = \frac{y-5}{2} = \frac{z-1}{-1}$ & $\frac{x-4}{2} = \frac{y-2}{-1} = \frac{z-4}{2}$ and in the direction of $\hat{i} - 2\hat{j} + \hat{k}$ is

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

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

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

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

143. The distance of the point $(4, 5, 3)$ from the plane $x + y + z = 2$ measured parallel to the line $x = y = 2z$ is ..... units

(A) 6 (B) 9

(C) 12 (D) 3

144. The Cartesian equation of the line passing through $A(3, 2, 1)$ and $B(1, 3, 1)$ is:

(A) $\frac{x-3}{2} = \frac{y-2}{-1},\ z = 1$ (B) $\frac{x-3}{2} = \frac{y-2}{-1},\ z = -1$

(C) $\frac{x-3}{2} = \frac{y-2}{1},\ z = -1$ (D) $\frac{x-3}{2} = \frac{y-2}{1},\ z = -1$

145. If θ is the angle between the line $\bar{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$ and the plane $\bar{r} \cdot (\hat{i} - 2\hat{j} + 3\hat{k}) = 5$ then the value of $\cos^2\theta$ is

(A) $\frac{6}{21}$ (B) $\frac{36}{42}$

(C) $\frac{8}{21}$ (D) $\frac{3}{21}$

146. In $\triangle ABC$, mid-points of the sides AB, BC and CA are respectively $(l, 0, 0), (0, m, 0)$ and $(0, 0, n)$. Then $\frac{(AB)^2+(BC)^2+(CA)^2}{l^2+m^2+n^2} =$

(A) 2 (B) 16

(C) 1 (D) 8

147. If the points $A(1, p, 1), B(2, 5, -1), C(q, 11, r)$ are collinear. If the line passing through these points is perpendicular to the vector $4\hat{i} - 2\hat{j} + \hat{k}$, then the value of $p + q + r$ is

(A) -4 (B) 3

(C) 4 (D) -1

148. The point at which the maximum value of $3x + 2y$ subject to the constraints $x + y \leq 2, x \geq 0, y \geq 0$ is obtained is

(A) $(0, 0)$ (B) $(1.5, 1.5)$

(C) $(2, 0)$ (D) $(0, 2)$

149. A coin is tossed n times. The probability of getting a head at least once is greater than 0.8, then the least value of n is

(A) 2 (B) 3

(C) 4 (D) 5

150. Two numbers are selected at random without replacement from the first n natural numbers. Let X denote the larger of the two numbers obtained. If $E(X) = \frac{14}{3}$, then the value of n is

(A) 2 (B) 4

(C) 6 (D) 8

- End of Question Paper -