MHT CET 2026 PCM May 12 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. A quantity Q is formulated $X^{-2}Y^{+\frac{3}{2}}Z^{-\frac{2}{5}}$. X, Y and Z are independent parameters which have fractional errors of 0.1, 0.2 and 0.5 respectively in measurement. The maximum fractional error of Q is

(A) 0.6 (B) 0.7

(C) 0.8 (D) 0.1

2. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is $\vec{C}$. If the magnitude of $\vec{B}$ is doubled, the new resultant vector becomes perpendicular to $\vec{A}$. Then the magnitude of $\vec{C}$ is

(A) B (B) $2B$

(C) $3B$ (D) $4B$

3. A block of mass 1 kg is kept on ice surface. When velocity of 4 m/s is given to it, it stops by friction in 5 second. The coefficient of friction is (acceleration due to gravity, $g = 10$ m/s^2)

(A) 0.02 (B) 0.04

(C) 0.08 (D) 0.09

4. Two bodies rotate with kinetic energies E_1 and E_2, moment of inertia about their axes of rotation is I_1 and I_2. If $3I_1 = I_2$ and $E_1 = 27E_2$ then the ratio of the angular momenta L_1 to L_2 is

(A) 9 : 1 (B) 3 : 1

(C) 27 : 1 (D) 1 : 1

5. A disc of mass 100 kg and radius 1m is rotating at 300 r.p.m. The torque required to rotate the disc in opposite direction with same speed in time 50 second is

(A) $5\pi Nm$ (B) $10\pi Nm$

(C) $20\pi Nm$ (D) $40\pi Nm$

6. Two loops A and B of radii R_1 and R_2 are made from uniform wire. If moment of inertia of loops A and B is I_A and I_B respectively then $\frac{R_1}{R_2}$ is (Given: $\frac{I_A}{I_B} = 27$)

(A) 9 : 1 (B) 27 : 1

(C) 81 : 1 (D) 3 : 1

7. A body is projected vertically upwards from earth's surface. If its kinetic energy of projection is equal to half of its minimum value required to escape from the gravitational influence then the height up to which it rises is (R = radius of earth)

(A) $4R$ (B) $3R$

(C) R (D) $2R$

8. The height of the liquid column raised in a capillary tube of certain radius when dipped in liquid A vertically is 5 cm. If the same tube is dipped in similar way in another liquid B of surface tension and density double the values of liquid A, the height of liquid column raised in liquid B is (Assume that angle of contact for both the liquids is almost same)

(A) 0.20 m (B) 0.10 m

(C) 0.05 m (D) 0.50 m

9. A water tank of height $'h'$ has a hole at the bottom. It is completely filled with water. The total pressure at the bottom is $4H$ and atmospheric pressure is H. The velocity of water flowing out of the hole is (ρ = density of water)

(A) $\left(\frac{6H}{\rho}\right)^{\frac{1}{2}}$ (B) $\left(\frac{H}{\rho}\right)^{\frac{1}{2}}$

(C) $\left(\frac{3H}{\rho}\right)^{\frac{1}{2}}$ (D) $\left(\frac{5H}{\rho}\right)^{\frac{1}{2}}$

10. $'n'$ small drops of water having same size fall through air with constant velocity 4 cm/s. They coalesce to form a big drop. The terminal velocity of the big drop is

(A) $2n^{2/3}cm/s$ (B) $12n^{2/3}cm/s$

(C) $4n^{2/3}cm/s$ (D) $8n^{2/3}cm/s$

11. What is the change in volume of an iron sphere of volume 400 cm^3, when it is heated from $0^\circ C$ to $50^\circ C$? ($\alpha_{iron} = 12 \times 10^{-6}/^\circ C$)

(A) $0.36cm^3$ (B) $0.18cm^3$

(C) $0.72cm^3$ (D) $0.54cm^3$

12. A rectangular black body of temperature $27^{\circ}C$ has surface area 6 cm $\times 3$ cm and rate of radiation E. If its temperature is increased by $300^{\circ}C$ and its linear dimensions are reduced to $\left(\frac{1}{3}\right)^{rd}$ of their initial value then the rate of radiation is

(A) $\frac{8}{9}E$ (B) $\frac{16}{9}E$

(C) $\frac{4}{9}E$ (D) $\frac{32}{9}E$

13. An ideal gas heat engine operate in Carnot cycle between $327^{\circ}C$ and $227^{\circ}C$. It absorbs 6×10^4 cal of heat at higher temperature. How much is the amount of heat converted in to work?

(A) $2 \times 10^4 cal$ (B) $1 \times 10^4 cal$

(C) $4 \times 10^4 cal$ (D) $3 \times 10^4 cal$

14. A monoatomic gas undergoes adiabatic change. Its pressure P and temperature T are related as $P \propto T^x$ where x is

(A) 3.5 (B) 2.5

(C) 4.5 (D) 1.5

15. At $27^{\circ}C$ temperature, the mean kinetic energy of the atoms of an ideal gas is E_1. If the temperature is increased by $300^{\circ}C$ then the mean kinetic energy of the atoms will be

(A) $\frac{E_1}{\sqrt{2}}$ (B) $\sqrt{2}E_1$

(C) $2E_1$ (D) $\frac{E_1}{2}$

16. The ratio of C_p to C_v for a non-rigid diatomic gas is

(A) $\frac{5}{3}$ (B) $\frac{7}{5}$

(C) $\frac{4}{3}$ (D) $\frac{9}{7}$

17. A ball released from height (h) which makes perfectly elastic collision with ground. The frequency of periodic vibratory motion is (g = acceleration due to gravity)

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

(C) $\frac{1}{2}\sqrt{\frac{2h}{g}}$ (D) $\frac{1}{2\pi}\sqrt{\frac{g}{2h}}$

18. A spring produces extension $'x'$ by applying a force $'F'$ N. A body of mass $'m'$ suspended from spring oscillates vertically with period $'T'$. The mass of the suspended body is (Neglect mass of spring)

(A) $\frac{T^2F}{4\pi^2x}$ (B) $\frac{TF}{4\pi x}$

(C) $\frac{TF^2}{4\pi^2x}$ (D) $\frac{T^2F}{4\pi x}$

19. If length of oscillating simple pendulum is made $\left(\frac{1}{3}\right)$ times at a place keeping amplitude same then its total energy will be

(A) 2 times (B) 3 times

(C) 6 times (D) 4 times

20. A simple pendulum of length $'L'$ and mass of the bob $'m'$ is oscillating with amplitude $'A'$. The maximum tension in the string is (g = acceleration due to gravity)

(A) $\left[mg - \left(\frac{A}{L}\right)^2\right]$ (B) $\left[mg + \left(\frac{A}{L}\right)^2\right]$

(C) $mg\left[1 + \left(\frac{A}{L}\right)^2\right]$ (D) $mg\left[1 - \left(\frac{A}{L}\right)^2\right]$

21. The equation of a wave travelling on a string is $Y = \sin(20\pi x + 10\pi t)$, where x and t are distance and time in SI units. The minimum distance between two points having the same oscillating speed is

(A) 2.5 cm (B) 5 cm

(C) 20 cm (D) 10 cm

22. In sonometer experiment, the string of length $'L'$ under tension vibrates in second overtone between the two bridges. The amplitude of vibration is maximum at length

(A) $\frac{L}{2}, \frac{L}{4}, \frac{L}{6}$ (B) $\frac{L}{6}, \frac{L}{2}, \frac{5L}{6}$

(C) $\frac{L}{3}, \frac{2L}{3}, \frac{5L}{6}$ (D) $\frac{L}{8}, \frac{L}{4}, \frac{L}{2}$

23. The third overtone of a closed organ pipe is in unison with 3^{rd} overtone of an open pipe. The ratio of length of closed to open pipe is

(A) $\frac{6}{5}$ (B) $\frac{7}{9}$

(C) $\frac{4}{3}$ (D) $\frac{7}{8}$

24. A sonometer wire resonates with a given tuning fork forming standing wave with 5 antinodes between two bridges when mass of 9 kg is suspended from the wire. When mass M is suspended from the wire with same fork and same length between two bridges, 3 antinodes are formed. Mass M is

(A) 5 kg (B) 14 kg

(C) 18 kg (D) 25 kg

25. A spherical conductor of diameter 3 mm is kept in a uniform electric field of intensity 4×10^7 N/C. The maximum charge on the conductor is $\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 SI units\right)$

(A) $2 \times 10^{-8} C$ (B) $10^{-8} C$

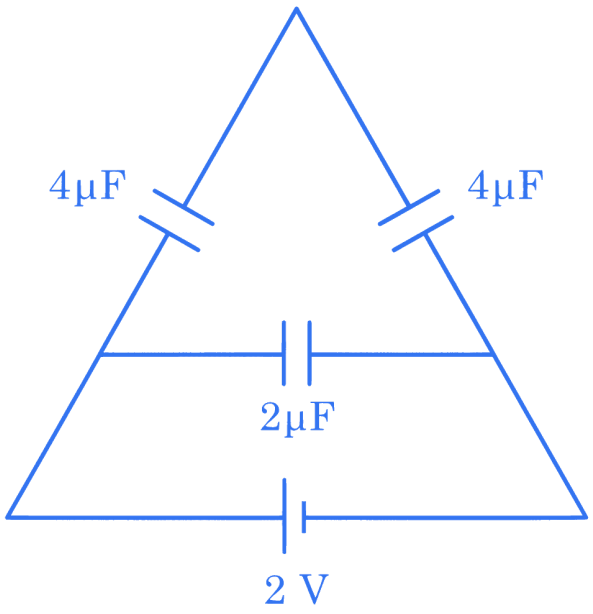
(C) $4 \times 10^{-8} C$ (D) $3 \times 10^{-8} C$

26. A capacitor of capacity $5\mu F$ is charged by a battery of e.m.f. 10 V. At an instant, the potential difference across the capacitor is 4 V and the time rate of change of potential difference across the capacitor is 0.6 V/s. Then the time rate at which energy is stored in the capacitor at that instant is

(A) $12 \times 10^{-6} J/s$ (B) $3 \times 10^{-6} J/s$

(C) $zero J/s$ (D) $30 \times 10^{-6} J/s$

27. What will be the charge on any one of the $4\mu F$ capacitors and $2\mu F$ capacitor in μC ?



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

(C) $3, 3$ (D) $4, 4$

28. A capacitor of unknown capacitance is connected across a battery of $'V'$ volt. The charge stored in it is $'Q'$ C. When potential across the capacitor is reduced by $'V_1'$ volt, the charge stored in it becomes $'Q_1'$ C. The potential $'V'$ is

(A) $\frac{QV_1}{Q-Q_1}$ (B) $\frac{Q}{(Q-Q_1)}$

(C) $\frac{V_1}{(Q_1-Q)}$ (D) $\frac{(Q-Q_1)}{V_1}$

29. When current I is passed through galvanometer coil, it is deflected through 16°. But when it is shunted by a resistance of 8Ω, the same current produces a deflection of 4°. The resistance of the galvanometer is

(A) 48Ω (B) 16Ω

(C) 24Ω (D) 12Ω

30. To determine the internal resistance of a cell by using a potentiometer, the null point is obtained at 1m when cell is shunted by 3Ω resistance and at 1.5m length when cell is shunted by 6Ω resistance. The internal resistance of the cell is

(A) 2Ω (B) 4Ω

(C) 6Ω (D) 8Ω

31. Two parallel wires of equal lengths are separated by a distance of 3 m from each other. The currents flowing through first and second wire is 3A and 4.5A respectively in opposite directions. The resultant magnetic field at mid point of both the wires is (μ_0 = permeability of free space)

(A) $\frac{5\mu_0}{2\pi}$ (B) $\frac{3\mu_0}{4\pi}$

(C) $\frac{2\mu_0}{\pi}$ (D) $\frac{5\mu_0}{6\pi}$

32. Choose the WRONG Statement from the following statements.

(A) A toroid is a solenoid bent in the form of a closed ring.

(B) The magnetic field lines of solenoid are straight lines parallel to the axis inside the solenoid.

(C) The magnetic field lines of toroid are circular having common centre.

(D) Inside a solenoid, magnetic field may be made strong by passing small current and using laminated coil of soft iron.

(A) D (B) C

(C) B (D) A

33. The relation between total magnetic field (B), magnetic intensity (H), permeability of free space (μ_0) and susceptibility (χ) is

(A) $\frac{B}{H} = \mu_0(1+\chi)$ (B) $BH = \mu_0(1+\chi)$

(C) $\frac{H}{B} = \mu_0(1-\chi)$ (D) $\frac{H}{B} = \mu_0(1+\chi)$

34. A closed coil consists of 500 turns on a rectangular frame of area 4.0 cm^2 and has a resistance of 50Ω. The coil is kept with its plane perpendicular to a uniform magnetic field of 0.2 T. The amount of charge flowing through the coil if it is turned through 180° will be 1.6×10^{-x} C. The Value of x is

(A) 19 (B) 9

(C) 3 (D) 2

35. An induced current of 2A flows through a coil. The resistance of the coil is 10Ω. What is the change in magnetic flux associated with a coil in 1 ms ?

(A) $2 \times 10^{-3} wb$ (B) $2 \times 10^{-2} wb$

(C) $22 \times 10^{-2} wb$ (D) $22 \times 10^{-4} wb$

36. The coil of area 0.1 m^2 has 1000 turns. It is placed in a magnetic field of strength 5×10^{-4} T. The average e.m.f. induced in the coil, if rotated through 180^0 in 0.1 s is ($\cos 0° = 1$, $\cos 180° = -1$)

(A) 0 V (B) 2.5 V

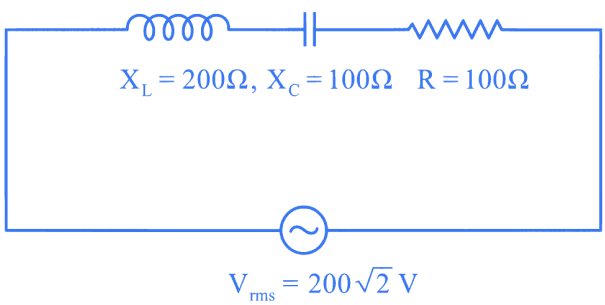
(C) 1 V (D) 5 V

37. An inductor of self inductance 1H connected in series with a resistor of 100πΩ and an a.c. supply of 100πV, 50 Hz. Maximum current flowing in the circuit in ampere is

(A) 0.5 (B) 1

(C) 1.5 (D) 2

38. In the given circuit, r.m.s. value of current through the resistor R is



(A) 20 A (B) 2 A

(C) 0.5 A (D) $2\sqrt{2}$ A

39. A capacitor of $10\mu F$ has reactance $2 \times 10^{-3}\Omega$. The corresponding frequency is

(A) $\frac{25}{\pi} MHz$ (B) $\frac{25}{\pi} Hz$

(C) 2.5 MHz (D) $\frac{2.5}{\pi} MHz$

40. A convex lens of focal length F produces a real image $'n'$ times the size of the object. The image distance is

(A) $\frac{F}{(n+1)}$ (B) $\frac{F}{(n-1)}$

(C) $F(n-1)$ (D) $F(n+1)$

41. Two plane polarised light waves combine at a certain point whose electric field components are $E_1 = E_0 \sin \omega t$ and $E_2 = E_0 \sin(\omega t + \pi/3)$. The amplitude of the resultant wave is ($\cos 60° = 0.5$)

(A) $3E_0$ (B) $\sqrt{3}E_0$

(C) E_0 (D) $E_0/\sqrt{3}$

42. A Parallel beam of monochromatic light is incident on a plane reflecting surface. If width of the plane incident and reflected plane wavefront is represented by AB and CD respectively then

(A) $AB > CD$ (B) $AB < CD$

(C) $AB = CD$ (D) $AB >> CD$

43. A double slit experiment is immersed in water of refractive index 1.33. The slit separation is 1 mm, distance between slit and screen is 1.33 m. The slits are illuminated by a light of wavelength 6300Å. The fringewidth is $x \times 10^{-4} m$. The value of $'x'$ is

(A) 5.8 (B) 8.6

(C) 4.9 (D) 6.3

44. The ratio of de-Broglie wavelengths of molecules of hydrogen and helium which are at temperatures $27°C$ and $127°C$ respectively is ($m_{He} = 2m_{H_2}$)

(A) $\sqrt{\frac{2}{1}}$ (B) $\sqrt{\frac{8}{3}}$

(C) $\sqrt{\frac{2}{3}}$ (D) $\sqrt{\frac{6}{7}}$

45. An electromagnetic wave of wavelength λ is incident on a photosensitive surface of negligible work function. If the photoelectrons emitted from this surface have de-Broglie wavelength λ_1, then

(A) $\lambda \propto \lambda_1$ (B) $\lambda \propto \lambda_1^2$

(C) $\lambda \propto \lambda_1^4$ (D) $\lambda \propto \lambda_1^6$

46. In Bohr's theory of hydrogen atom, in any series of spectral lines, wavelength of first line and corresponding series limit is respectively

(A) longest and shortest (B) shortest and shortest

(C) longest and longest (D) shortest and longest

47. Assuming the atom is in the ground state, the expression for the magnetic field at a point nucleus in hydrogen atom due to circular motion of electron is (μ_0 = permeability of free space, ϵ_0 = permittivity of free space, m = mass of electron, e = electronic charge)

(A) $\frac{\mu_0 e^2 m^2}{8\epsilon_0 h^2}$ (B) $\frac{\mu_0 e^7 \pi m^2}{8\epsilon_0^3 h^5}$

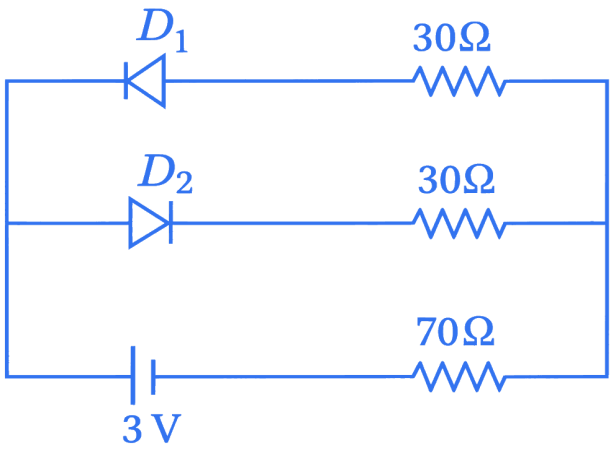
(C) $\frac{\mu_0 e^5 \pi m}{6\epsilon_0^2 h^2}$ (D) $\frac{\mu_0 e^2 \pi m^2}{8\epsilon_0 h^2}$

48. Pure silicon crystal at 300K has equal electron and hole concentration 2×10^{16} per m^3. Doping by indium increases hole concentration to 4×10^{22} per m^3. Electron concentration in doped silicon is

(A) $5 \times 10^9/m^3$ (B) $10^{10}/m^3$

(C) $8 \times 10^{10}/m^3$ (D) $10^9/m^3$

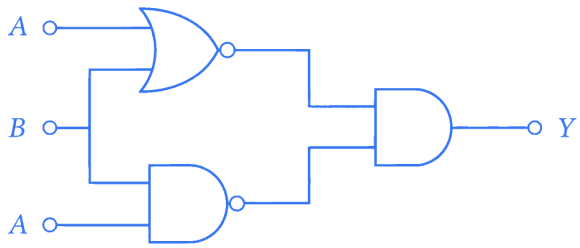
49. The circuit shown contains two ideal diodes D_1 and D_2. If a cell of e.m.f. 3V and negligible internal resistance is connected, then the current through 70Ω resistance in ampere is



(A) 0.01 (B) 0.02

(C) 0.03 (D) 0

50. The output Y of the given logic circuit is similar to the output of



(A) AND gate (B) NAND gate

(C) OR gate (D) NOR gate

51. Identify the quantity of water (expressed in different terms) that contains highest number of water molecules in it.

(A) 18 mL of water
(B) 10^{-3} mol of water
(C) 0.18 g of water
(D) 0.00224 L of water vapour at 1 atmp. and 273K

52. Identify the orbital having quantum numbers, $n = 4$ and $l = 2$ from following.

(A) $4d$
(B) $4p$
(C) $4f$
(D) $2d$

53. Which element in group 17 has the highest electronegativity?

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

54. Identify the false statement regarding PCl_5 by following.

(A) PCl_5 possesses two different Cl-P-Cl bond angles
(B) All five P-Cl bonds are identical in length
(C) PCl_5 exhibits sp^3d hybridisation
(D) PCl_5 consists of five P-Cl (sigma) bonds

55. Which among the following gases is difficult to liquefy ?

(A) Chlorine gas
(B) Nitrogen gas
(C) Ammonia gas
(D) Sulphur dioxide gas

56. Calculate the work done, when three moles of an ideal gas expand isothermally from $16dm^3$ to $20dm^3$, at a constant external pressure of 1.5 bar.

(A) 600 J
(B) -600 J
(C) -400 J
(D) 400 J

57. Which of the following statements is NOT true regarding the isothermal process?

(A) Heat is either added or removed from the system.
(B) The temperature of the system remains constant.
(C) The internal energy of the system remains constant.
(D) No heat enters or leaves the system.

58. The solubility of sparingly soluble salt BA in water is 1.2×10^{-5} mol dm^{-3}. Find its solubility product.

(A) 1.22×10^{-10}
(B) 1.44×10^{-10}
(C) 1.88×10^{-10}
(D) 2.08×10^{-10}

59. A weak monobasic acid is 0.08% dissociated in 0.02M solution. Calculate the dissociation constant of weak acid.

(A) 1.28×10^{-8}
(B) 1.50×10^{-8}
(C) 1.1×10^{-8}
(D) 1.60×10^{-8}

60. Identify the conjugate acid of NH_3 from following.

(A) NH_4^+
(B) NH_2^-
(C) H_3O^+
(D) NH_4OH

61. Find the number of moles of electrons required for reduction of $3n$ moles of Zn^{2+} to Zn

(A) $6n$
(B) $4n$
(C) $3n$
(D) $2n$

62. Which of the following properties is exhibited by reducing agent?

(A) Undergoes oxidation
(B) Brings about oxidation of other species
(C) Is electron acceptor
(D) Undergoes reduction

63. Which of the following elements is used as a moderator in nuclear reactors ?

(A) Mg
(B) Be
(C) Ba
(D) Sr

64. Which of the following compounds does NOT have a stereocenter?

(A) Propan-2-ol
(B) Butan-2-ol
(C) 2-Bromo-1-chlorobutane
(D) 2-Bromopentane

65. Which of the following statements regarding different electronic effects in organic reactions is TRUE ?

(A) Hyperconjugation is a temporary electronic effect.
(B) -CN group show positive resonance effect.
(C) The effect of hyperconjugation is usually stronger than the inductive effect.
(D) The resonance hybrid is less stable than any of the resonance structures.

66. Identify the product obtained when toluene is brominated in the presence of iron in dark.

(A) Mixture of o-Bromotoluene and p-Bromotoluene
(B) o-Bromotoluene
(C) p-Bromotoluene
(D) Benzyl bromide

67. Identify the product obtained when n-Hexane is heated at 773 K under 10 to 20 atm in presence of V_2O_5 ?

(A) $C_6H_{12} + H_2$
(B) $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_3 + H_2C{=}CH_2$
(C) $C_6H_6 + 4H_2$
(D) $CH_3\text{-}CH_3 + CH_3\text{-}CH_2\text{-}CH{=}CH_2$

68. E.coli bacteria from water can be effectively removed by using-

(A) Au-Nps
(B) Pt-Nps
(C) Ag-Nps
(D) Si-Nps

69. Calculate the volume of fcc unit cell having radius of particle 180 pm.

(A) $1.32 \times 10^{-22} cm^3$
(B) $4.67 \times 10^{-22} cm^3$
(C) $7.20 \times 10^{-22} cm^3$
(D) $2.46 \times 10^{-22} cm^3$

70. Sodium crystallizes in the bcc structure. If the edge length of a unit cell is 4.3×10^{-8} cm, calculate the radius of an atom.

(A) 1.86×10^{-8} cm
(B) 1.52×10^{-8} cm
(C) 2.15×10^{-8} cm
(D) 4.3×10^{-8} cm

71. What is the number of unit cells present in tetragonal crystal systems?

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

72. A 0.1 M solution of a solute A is Isotonic with a solution of B containing 1.5 gm of it per 100 cm^3. What is the molar mass of B?

(A) $150 gmol^{-1}$
(B) $115 gmol^{-1}$
(C) $75 gmol^{-1}$
(D) $750 gmol^{-1}$

73. Calculate the boiling point of solution prepared by adding 2.93 g of solute to 0.059 kg of solvent, if the boiling point of pure solvent $= 61.2^{\circ}C$, $K_b = 3.85^{\circ}C$ Kg mol^{-1} and molar mass of solute $= 32$ g/mol)

(A) 64.13^0C
(B) 58.27^0C
(C) 67.17^0C
(D) 63.45^0C

74. Calculate the freezing point of a 0.05 m aqueous solution of a non-electrolyte at 298 K. ($K_f = 1.86$ K kg mol^{-1})

(A) $-1.86^{\circ}C$
(B) $-0.93^{\circ}C$
(C) $-0.093^{\circ}C$
(D) $0.093^{\circ}C$

75. When 4 A current was passed through a salt solution for 45 minutes, 2.977 g metal was deposited. Calculate the charge on metal ion having molar mass 106.4 g mol^{-1}.

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

76. When same quantity of electricity is passed through two different cells containing copper sulfate and silver nitrate, if 0.99 g Ag and 0.29 g Cu are deposited, calculate the molar mass of Ag (Molar mass of Cu = 63.2 g/mol)

(A) 63.5 g/mol
(B) 10.78 g/mol
(C) 107.8 g/mol
(D) 31.6 g/mol

77. Rate constant for first order reaction is $40 s^{-1}$. Calculate the time required to reduce the concentration to 1/20 th of its initial value.

(A) 3.50×10^{-2} s
(B) 5.12×10^{-2} s
(C) 4.50×10^{-2} s
(D) 7.48×10^{-2} s

78. Consider the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$. In this reaction, NO_2 is being formed at the rate of 0.025 mol $L^{-1}s^{-1}$. What would be the rate of reaction?

(A) $0.625 \times 10^{-3} mol L^{-1} S^{-1}$
(B) $0.0625 \times 10^{-3} mol L^{-1} S^{-1}$
(C) $6.25 \times 10^{-3} mol L^{-1} S^{-1}$
(D) $6.25 \times 10^{-2} mol L^{-1} S^{-1}$

79. Which of the following is a pseudo-first order reaction?

(A) Decomposition of ammonia on platinum metal
(B) Decomposition of $H_2O_2(l)$
(C) Decomposition of $N_2O_5(g)$
(D) Hydrolysis of methyl acetate

80. Calculate the time required to reduce the radioactive substance to 20% if the half life period is 10 minutes.

(A) 23.23 minute
(B) 14.41 minute
(C) 18.52 minute
(D) 34.4 minute

81. What type of collodial system is milk?

(A) Sol
(B) Emulsion
(C) Gel
(D) Aerosol

82. Which from following properties is exhibited by cast iron ?

(A) It is very soft and contains 4% C.
(B) It is very soft and contains 2% C
(C) It is hard, brittle and contains 4% C.
(D) It is hard and contains less than 0.2% C.

83. Which of the following molecular formulae represents peroxy disulfuric acid?

(A) $H_2S_2O_7$
(B) $H_2S_2O_8$
(C) $H_2S_2O_6$
(D) H_2SO_5

84. Which of the following statements regarding transition elements is NOT true ?

(A) Zinc has completely filled $(n-1)$ d orbital in ground state.
(B) Zn is not regarded as transition elements.
(C) On the same ground like Zn, Cu is also not considered as transition element.
(D) General electronic configuration of $4d$ series is [Kr] $4d^{1-10}5s^{0-2}$

85. Which of the following compounds does NOT obey EAN rule?

(A) $[Cr(CO)_6]$
(B) $[Fe(CN)_6]^{4-}$
(C) $[Co(NH_3)_6]^{3+}$
(D) $[Fe(CN)_6]^{3-}$

86. Identify the geometry of $[Ni(CN)_4]^{2-}$ complex.

(A) Octahedral
(B) Tetrahedral
(C) Square planar
(D) Hexagonal

87. Why are tertiary alkyl halides inert towards SN^2 mechanism?

(A) Due to insolubility.
(B) Due to instability.
(C) Due to inductive effect.
(D) Due to steric hindrance.

88. Which of the following reagents, when reacted with aldehydes other than formaldehyde, forms secondary alcohols?

(A) Tollen's reagent
(B) Grignard reagent
(C) Fehling's reagent
(D) Schiff's reagent

89. Which of the following compounds is obtained when phenol reacts with concentrated nitric acid in the presence of conc. H_2SO_4 ?

(A) Benzoic acid
(B) Salicylic acid
(C) o- and p-nitrophenol
(D) Picric acid

90. Identify the product formed when aryl-alkyl ether reacts with cold HI.

(A) alkyl iodide and water
(B) aryl iodide and water
(C) alkyl iodide, aryl iodide and water
(D) phenol and alkyl iodide

91. Identify the product obtained when tert-Butyl methyl ether is heated with hot HI.

(A) $CH_3I + (CH_3)_3COH$
(B) $CH_3OH + (CH_3)_3C\text{-}I$
(C) $CH_3OH + (CH_3)_3C\text{-}OH$
(D) $CH_3I + (CH_3)_3C\text{-}I$

92. Identify the product obtained when acetonitrile reacts with methyl magnesium chloride in dry ether followed by acid hydrolysis.

(A) Propion aldehyde.
(B) Ethyl methyl Ketone.
(C) Acetone.
(D) Acetaldehyde.

93. Which of the following tests is used to identify ketones ?

(A) Sodium nitroprusside test
(B) Tollen's test
(C) Schiff test
(D) Felhing test

94. Which of the following conversion is carried out using the Mendius reaction?

(A) Amide to amine
(B) Alkyl halide to amine
(C) Nitroalkane to amine
(D) Alkyl cyanide to amine

95. Identify the type of reaction that Converts acetamide to methanamine by using aqueous KOH and Br_2.

(A) Gabriel phthalimide reaction
(B) Hofmann elimination reaction
(C) Hofmann exhaustive alkylation reaction
(D) Hofmann degradation reaction

96. Which of the following is a false statement regarding oligosaccharide ?

(A) Lactose on hydrolysis gives one glucose unit and one galactose unit.
(B) Maltose on hydrolysis gives one glucose unit and one fructose unit.
(C) Sucrose on hydrolysis gives one glucose unit and one fructose unit.
(D) Raffinose on hydrolysis gives one glucose unit, one fructose unit and one galactose unit.

97. Which of the following glycosidic linkage is present in lactose ?

(A) C-1 of α-D-glucose and C-4 of β-D-galactose.
(B) C-1 of β-D-galactose and C-4 of α-D-glucose.
(C) C-1 of β-D-galactose and C-5 of α-D-glucose.
(D) C-1 of α-D-glucose and C-5 of β-D-galactose.

98. Match **List I** with **List II**

List I **Polymer**	**List II** **Application**
(A). Glyptal	(i). Electrophoresis
(B). Buna N	(ii). LCD screen
(C). Perspex	(iii). Paints
(D). Polyacrylamide	(iv). Adhesive

Choose the **correct** answer from the options given below:

(A) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv)
(B) (A)-(iii), (B)-(ii), (C)-(iv), (D)-(i)
(C) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)
(D) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

99. Identify the polymer obtained from acrylonitrile and 1,3-butadiene.

(A) polystyrene
(B) Buna-S
(C) Neoprene
(D) Buna-N

100. Identify the synthetic antioxidant from following.

(A) Vitamin E
(B) Thymol
(C) BHT
(D) Chloroxylenol

101. Given $\log_{10} 2 = 0.3010$. Then the number of digits in the number 20^{10} is...

(A) 11 (B) 12

(C) 13 (D) 14

102. If $\sin^4\theta + \cos^4\theta = \frac{5}{8}, 0 < \theta < \frac{\pi}{2}$, then $\sin 2\theta = ...$

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

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

103. If $f(x) = \sin x + \cos x$, then which of the following is true?

(A) $f(130^\circ) < 0$ (B) $f(220^\circ) > f(320^\circ)$

(C) $f(140^\circ) = f(310^\circ)$ (D) $f(310^\circ) > 0$

104. If $\sin x, 1, \cos 2x$ are in G.P., then the general solution for x is ...

(A) $n\pi + (-1)^n\left(\frac{\pi}{3}\right), n \in \mathbb{Z}$

(B) $2n\pi + (-1)^n\left(\frac{\pi}{2}\right), n \in \mathbb{Z}$

(C) $n\pi + (-1)^{n+1}\left(\frac{\pi}{2}\right), n \in \mathbb{Z}$

(D) $2n\pi + (-1)^n + \left(\frac{\pi}{4}\right), n \in \mathbb{Z}$

105. In $\triangle ABC$, if $l(AB) = 8, l(BC) = 5, l(AC) = 7$, then $\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2}$ is equal to.....

(A) $\frac{10}{\sqrt{3}}$ (B) $\frac{10}{3}$

(C) $\frac{5}{\sqrt{3}}$ (D) $\frac{\sqrt{3}}{10}$

106. The modulus and argument of $(1 + i\sqrt{3})^8$ are respectively...

(A) 2 and $2\pi/3$ (B) 256 and $7\pi/3$

(C) 256 and $2\pi/3$ (D) 64 and $4\pi/3$

107. How many different five digit numbers which are divisible by 4 can be formed using the digits in the number 22457 ?

(A) 60 (B) 12

(C) 54 (D) 18

108. If $(2, 8)$ is one vertex and $x - y + 3 = 0$ is one diagonal of a square, then the equation of the other diagonal is

(A) $x + y - 10 = 0$ (B) $x + y + 10 = 0$

(C) $x - y + 10 = 0$ (D) $x - y - 10 = 0$

109. The product of the lengths of the perpendiculars drawn from the point $(3, 4)$ to the lines represented by $3x^2 - 5xy + 2y^2 = 0$ is...

(A) $\frac{1}{\sqrt{26}}$ (B) $\frac{1}{26}$

(C) $\sqrt{26}$ (D) 26

110. The length of the tangent segment drawn from point P to the circle, $x^2 + y^2 - 2x - 2y - 2 = 0$ is $4\sqrt{2}$ units. If λ_{max} and λ_{min} are the maximum and minimum distances of point P from the circle, then $\lambda_{max} + \lambda_{min}$ is equal to....

(A) 6 (B) 8

(C) 12 (D) 16

111. The equation $16x^2 - 3y^2 - 32x + 12y - 44 = 0$ represents a hyperbola whose...

(A) centre is $(-1, 2)$ (B) eccentricity is $\sqrt{\frac{19}{3}}$

(C) length of its transverse axis is $4\sqrt{3}$ (D) length of its conjugate axis is 4

112. Consider the function:

$$f(x) = \begin{cases} x^2 + 1 & \text{if } x < 2 \\ 5 & \text{if } x = 2 \\ 3x - 1 & \text{if } x > 2 \end{cases}$$

Which of the following statements is correct ?

(A) $\lim_{x\to 2} f(x)$ exists and is equal to 5 (B) $\lim_{x\to 2} f(x)$ exists but is not equal to 5

(C) $\lim_{x\to 2} f(x)$ does not exist because $f(2)$ is defined (D) $\lim_{x\to 2} f(x)$ does not exist because left-hand and right-hand limits are not equal

113. The switching circuit for the logical expression $(p \wedge q) \vee \sim (p \wedge q)$ is simplified and found to be equivalent to a circuit with:

(A) Two switches in series (B) Two switches in parallel

(C) A single switch (D) The lamp always glows

114. The negation of the statement "She will earn money if she works" is...

(A) She works and she will earn money
(B) She works and she will not earn money
(C) She will earn money and she works.
(D) She will earn money and she does not work.

115. The inverse of a statement $(p \vee q) \rightarrow r$ is

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

116. If $\cot^{-1} 2$ and $\cot^{-1} 3$ are the angles of a triangle, then the third angle is ...

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

117. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ and $A^{-1} = xA + yI$, then the values of x and y are...

(A) $x = \frac{1}{5}, y = \frac{-4}{5}$
(B) $x = \frac{-1}{5}, y = \frac{4}{5}$
(C) $x = \frac{1}{5}, y = \frac{4}{5}$
(D) $x = 1, y = -4$

118. If the matrix $A = \begin{bmatrix} 3 & -5 \\ 4 & -7 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 7 & -5 \\ 4 & a \end{bmatrix}$, then the value of a is...

(A) -3
(B) 3
(C) 5
(D) -5

119. If $f(x) = \begin{vmatrix} x^2 & \sin x & e^x \\ 2 & 1 & -1 \\ p & p^2 & 1 \end{vmatrix}$ then $f''(0) =$

(A) $2p^2 - p + 1$
(B) $4p^2 - p + 1$
(C) $4p^2 - p + 2$
(D) $2p^2 - p + 2$

120. If $f(x) = \begin{cases} \frac{\tan x - \cot x}{x - \frac{\pi}{4}}, & x \neq \frac{\pi}{4} \\ a, & x = \frac{\pi}{4} \end{cases}$, then the value of $'a'$ so that $f(x)$ is continuous at $x = \pi/4$ is...

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

121. The second derivative of $a \sin^3 t$ with respect to $a \cos^3 t$ at $t = \frac{\pi}{4}$ is...

(A) $\frac{4\sqrt{2}}{3a}$
(B) $\frac{3a}{4\sqrt{2}}$
(C) $\frac{4a}{3\sqrt{2}}$
(D) $\frac{3\sqrt{2}}{4a}$

122. If $\frac{d}{dx}\left(\frac{1+x^4+x^8}{1+x^2+x^4}\right) = ax^3 + bx$, then the values of a and b are respectively...

(A) $a = 4, b = 2$
(B) $a = 4, b = -2$
(C) $a = -2, b = 4$
(D) $a = -4, b = 2$

123. If $y = \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$ and $\frac{dy}{dx} = \frac{3}{4}$, then the value of x is...

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

124. If Rolle's theorem holds for the function $f(x) = x^3 + px^2 + qx + 5, x \in [1, 3]$ with $c = 2 + \frac{1}{\sqrt{3}}$, then the values of p and q are respectively...

(A) $6, -11$
(B) $6, 11$
(C) $-6, 11$
(D) $-6, -11$

125. A tangent is drawn from the origin $(0, 0)$ to the curve $y = \sin x$. If (x, y) is the point of contact and $x \neq 0$, then which of the following relations is true?

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

126. The sum of the abscissae of the points on the curve $y = x^3 - 6x^2 + x + 3$ whose normal is parallel to the line $x + y = 1975$ is...

(A) 4
(B) -22
(C) 7
(D) 0

127. If $\int x^7 e^x dx = e^x f(x) + c$, then $f(x)$ is equal to...

(A) $\sum_{r=0}^{7} (-1)^r x^{7-r} \cdot {}^7P_r$
(B) $\sum_{r=0}^{7} x^{7-r} \cdot {}^7P_r$
(C) $\sum_{r=0}^{7} (-1)^r x^{7-r} \cdot {}^7C_r$
(D) $\sum_{r=0}^{7} x^{7-r} \cdot {}^7C_r$

128. The value of the integral $\int \frac{1}{\cos x \cdot \log\left(\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)\right)} dx$ is....

(A) $\csc\left(\frac{x}{2}\right) + \cot\left(\frac{x}{2}\right) + c$
(B) $\sec^2(2x) + \log x + c$
(C) $\log|\log|\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)|| + c$
(D) $\tan\left[\log|\sec\left(\frac{\pi}{4} + \frac{x}{2}\right)|\right] + c$

129. The value of the integral $\int \frac{1}{\sin x - \sqrt{3}\cos x} dx$ is....

(A) $\frac{1}{2}\log\left|\csc\left(x-\frac{\pi}{3}\right)+\cot\left(x-\frac{\pi}{3}\right)\right|+c$

(B) $\frac{1}{2}\log\left|\csc\left(x-\frac{\pi}{3}\right)-\cot\left(x-\frac{\pi}{3}\right)\right|+c$

(C) $\frac{1}{2}\log\left|\csc\left(x+\frac{\pi}{3}\right)-\cot\left(x-\frac{\pi}{3}\right)\right|+c$

(D) $\frac{1}{2}\log\left|\csc\left(x+\frac{\pi}{3}\right)-\cot\left(x+\frac{\pi}{3}\right)\right|+c$

130. If $\int \sin^3 x \cdot \cos^3 x dx = \frac{1}{32}\left[\frac{3}{2}f(x)+\frac{1}{6}g(x)\right]+C$, then $f(x)$ and $g(x)$ are respectively...

(A) $-\sin 2x, \sin 6x$ (B) $-\cos 2x, \cos 6x$

(C) $\cos 6x, -\cos 2x$ (D) $\sin 2x, \sin 6x$

131. The value of the integral $\int_8^{15} \frac{dx}{(x-3)\sqrt{x+1}}$ is....

(A) $\frac{1}{2}\log\frac{5}{3}$ (B) $\frac{1}{3}\log\frac{5}{3}$

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

132. The value of the integral $\int_{-1}^{1} \frac{1}{(1+e^x)(1+x^2)} dx$ is....

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

(C) π (D) 0

133. If $f(x) = \begin{cases} \frac{[x]\cdot|x|}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$, where $[x]$ and $|x|$ denote the greatest integer function and the modulus function respectively, then $\int_{-2}^{1} f(x)dx = ...$

(A) 0 (B) 1

(C) 3 (D) 7

134. The area of the region bounded by the parabola $y^2 = 4x - 2$ and the line $y = 2x - 1$ is...(in sq. units)

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

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

135. If $\frac{dy}{dx} = y + 3$, where $y + 3 > 0$ and $y(0) = 2$, then $y(\log 2)$ is equal to...

(A) 5 (B) 7

(C) 10 (D) -5

136. If $g(x)$ denotes the integrating factor of the differential equation $x \log x \frac{dy}{dx} + y = 2\log x$ and $\int g(x)dx = h(x)[g(x) - 1] + c$, then $h(x) =$.....

(A) 1 (B) x

(C) $\log x$ (D) x^2

137. The differential equation of the family of lines perpendicular to the line passing through the point $(3, -5)$ with inclination $\frac{\pi}{3}$ is...

(A) $\frac{dy}{dx} + \sqrt{3} = 0$ (B) $\frac{dy}{dx} + 1 = 0$

(C) $dx + \sqrt{3}dy = 0$ (D) $\frac{dy}{dx} = 0$

138. If $\bar{a}, \bar{b}$ are unit vectors and $\bar{a} \cdot \bar{b} = 0$, then $(\bar{a} - 2\bar{b}) \cdot \{(2\bar{a} + \bar{b}) \times (\bar{a} \times \bar{b})\} = ...$

(A) 5 (B) 6

(C) 8 (D) 10

139. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} \cdot (\vec{b} + \vec{c}) + \vec{b} \cdot (\vec{c} + \vec{a}) + \vec{c} \cdot (\vec{a} + \vec{b}) = 0$ and $|\vec{a}| = 8, |\vec{b}| = 1, |\vec{c}| = 4$, then $|\vec{a} + \vec{b} + \vec{c}| = ...$

(A) 5 (B) 9

(C) 13 (D) 18

140. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is...

(A) $\sqrt{2}$ (B) 0

(C) $\sqrt{5}$ (D) $\sqrt{3}$

141. If $|\vec{u}| = 5, |\vec{v}| = 13, |\vec{u} \times \vec{v}| = 25$, then $\vec{u} \cdot \vec{v} = ...$

(A) 15 (B) $\pm\frac{5}{13}$

(C) ± 60 (D) ± 65

142. The length of the perpendicular from the point $(3, 2, 1)$ to the line $\frac{x-7}{-2} = \frac{y-7}{2} = \frac{z-6}{3}$ is k units. then the value of k....

(A) 3 (B) 5

(C) 7 (D) 9

143. The vector equation of the line passing through the point $(1, 2, -4)$ and perpendicular to the two the lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-5}{3} = \frac{y-33}{8} = \frac{5-z}{5}$ is...

(A) $\bar{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(5\hat{i} + 4\hat{j} + 7\hat{k})$

(B) $\bar{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$

(C) $\bar{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(3\hat{i} + 7\hat{j} + 13\hat{k})$

(D) $\bar{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(4\hat{i} + 10\hat{j} + 9\hat{k})$

144. The volume of the tetrahedron formed by the plane $6x + 4y - 5z - 60 = 0$ and the coordinate planes is ..... cubic units

(A) 300 (B) 30

(C) 360 (D) 400

145. If the line $\frac{x-2}{3} = \frac{y-1}{5} = \frac{z+2}{2}$ lies in the plane $x + 3y - pz + q = 0$, then the value of $p - q =$ .....

(A) 10 (B) 9

(C) 22 (D) 32

146. The ratio in which the point $\hat{i} + 2\hat{j} + 3\hat{k}$ divides the line segment joining $-2\hat{i} + 3\hat{j} + 5\hat{k}$ and $7\hat{i} - \hat{k}$ is....

(A) 1 : 2 (B) 2 : 3

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

147. The minimum and maximum values of the objective function $Z = 3x + 9y$, subject to $x + 3y \leq 60, x + y \geq 10, x \leq y, x \geq 0, y \geq 0$ are respectively...

(A) 90 and 190 (B) 60 and 180

(C) 30 and 120 (D) 40 and 220

148. A coin whose faces are marked as 5 and 3 is tossed 4 times. The probability that the sum of the numbers on the coin is greater than 17 is ___

(A) $\frac{5}{8}$ (B) $\frac{1}{16}$

(C) $\frac{5}{16}$ (D) $\frac{11}{16}$

149. The probability mass function (p.m.f) of a random variable X is $p(x) = \frac{x+3}{k}, x = -2, -1, 0, 1$ and $p(x) = 0$ otherwise, then the value of $E(x) = ...$

(A) 0 (B) 1

(C) 2 (D) -1

150. A man is known to speak the truth in 75% of cases. If he throws an unbiased die and tells his friend that it is a six. Assuming that when he tells a lie, he specifically reports the result as a six, the probability that it is actually a six is...

(A) $\frac{2}{3}$ (B) $\frac{5}{9}$

(C) $\frac{3}{8}$ (D) $\frac{8}{11}$

- End of Question Paper -