MHT CET 2026 PCM May 15 Shift 1 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. If $|\vec{A} \times \vec{B}| = \sqrt{3}(\vec{A} \cdot \vec{B})$ then the value of $|\vec{A} + \vec{B}|$ is ($\tan 60^\circ = \sqrt{3}$, $\cos 60^\circ = \frac{1}{2}$)

(A) $\left[A^2 + B^2 + \frac{AB}{\sqrt{3}}\right]^{\frac{1}{2}}$

(B) $A + B$

(C) $(A^2 + B^2 + \sqrt{3}\ AB)^{\frac{1}{2}}$

(D) $(A^2 + B^2 + AB)^{\frac{1}{2}}$

2. Angular velocity of hour hand of a watch is (in rad/s)

(A) $\frac{\pi}{43200}$ (B) $\frac{\pi}{30}$

(C) $\frac{\pi}{21600}$ (D) $\frac{\pi}{1800}$

3. The maximum and minimum tensions in the string whirling in a circle of radius 2.5 m are in the ratio 5 : 3 then its velocity is ($g = 10\ \text{m/s}^2$)

(A) 10 m/s (B) 100 m/s

(C) 1 m/s (D) 5 m/s

4. A block of mass m moving on a frictionless surface at speed V collides elastically with a block of same mass, initially at rest. Now, the first block moves at an angle θ with its initial direction and has speed V_1. The speed of the second block after collision is

(A) $\sqrt{V_1^2 - V^2}$ (B) $\sqrt{V^2 - V_1^2}$

(C) $\sqrt{V^2 + V_1^2}$ (D) $\sqrt{V - V_1}$

5. A square frame ABCD is formed by 4 identical rods each of mass m and length ℓ. This frame is in XY plane such that side AB coincides with x-axis and side AD along y-axis. The moment of inertia of the frame about x-axis is

(A) $\frac{5m\ell^2}{3}$ (B) $\frac{2m\ell^2}{3}$

(C) $\frac{4m\ell^2}{3}$ (D) $\frac{m\ell^2}{12}$

6. A thin uniform rod of length L and mass m is swinging freely about a horizontal axis passing through its end. Its maximum angular speed is ω. Its centre of mass rises to a maximum height of (g = acceleration due to gravity)

(A) $\frac{L^2\omega^2}{2g}$ (B) $\frac{L\omega}{6g}$

(C) $\frac{L\omega}{2g}$ (D) $\frac{L^2\omega^2}{6g}$

7. The kinetic energy of a revolving satellite (mass m) at a height equal to thrice the radius of the earth (R) is (g = acceleration due to gravity)

(A) $\frac{mgR}{8}$ (B) $\frac{mgR}{16}$

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

8. A 20 cm long capillary is dipped vertically in water. Water rises to 8 cm. If the arrangement is put in a freely falling elevator, the length of water column in capillary tube will be

(A) 8 cm (B) 10 cm

(C) 4 cm (D) 20 cm

9. If terminal speed of a sphere of gold (density = 19.5 kg/m^3) is 0.2 m/s in viscous liquid (density = 1.5 kg/m^3), find the terminal speed of a sphere of silver (density = 10.5 kg/m^3) of the same size in the same liquid.

(A) 0.4 m/s (B) 0.133 m/s

(C) 0.1 m/s (D) 0.2 m/s

10. A water drop is divided into 8 equal droplets. The pressure difference between the inner and outer side of the big drop will be

(A) same as for smaller droplet (B) half of that for smaller droplet

(C) $\left(\frac{1}{4}\right)^{th}$ of that for smaller droplet (D) twice that for smaller droplet

11. An iron tyre is to be fitted on to a wooden wheel 1.0 m in diameter. The diameter of the tyre is 6 mm smaller than that of the wheel. The tyre should be heated so that its temperature increases by a minimum of
(coefficient of volume expansion of iron = $3.6 \times 10^{-5}/^\circ\text{C}$)

(A) 167°C (B) 334°C

(C) 500°C (D) 1000°C

12. The temperature of a black body is increased by 50% then the percentage increase of radiation is nearly

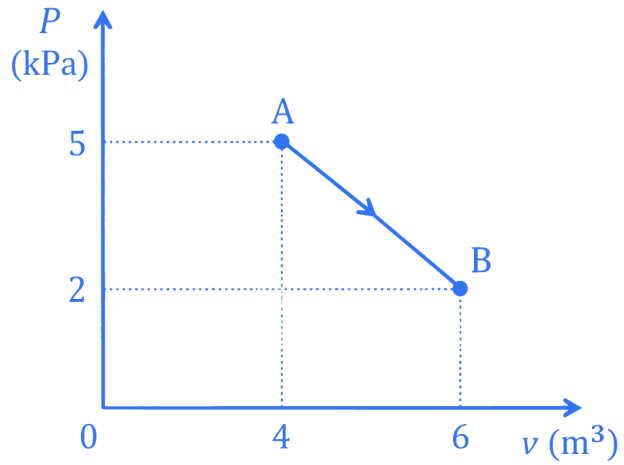
(A) 100% (B) 25%

(C) 400% (D) 500%

13. We consider a thermodynamic system. If ΔU is the increase in internal energy and W is the work done by the system, which one of the following statement is true?

(A) $\Delta U = -W$ in an adiabatic process
(B) $\Delta U = W$ in an isothermal process
(C) $\Delta U = -W$ in an isothermal process
(D) $\Delta U = W$ in an adiabatic process

14. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown. The change in internal energy of the gas during the transition is



(A) 20 kJ
(B) -20 kJ
(C) 20 J
(D) -12 kJ

15. How much heat energy in joule must be supplied to 14 g of nitrogen at room temperature to raise its temperature by 40°C at constant pressure?
(molecular wt. of nitrogen = 28 g, R = gas constant) (gas is diatomic)

(A) $50R$
(B) $60R$
(C) $70R$
(D) $80R$

16. The gas in a vessel is subjected to a pressure of 20 atm. at 27°C. Now half of the gas is released from the vessel and the temperature is raised by 50°C. The pressure of a gas in a vessel is nearly

(A) 8 atm.
(B) 11 atm.
(C) 12 atm.
(D) 17 atm.

17. A body of mass 64 g is made to oscillate turn by turn on two different springs A and B. Spring A and B has force constant 4 N/m and 16 N/m respectively. If T_1 and T_2 are the period of oscillations of springs A and B respectively, then $(T_1 + T_2)/(T_1 - T_2)$ will be

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

18. Two simple pendulums, A of mass M_1 and length L_1, and B of mass M_2 and length L_2. $M_1 = M_2$ and $L_1 = 2L_2$. If vibrational energies of both are same then which one of the following is correct?

(A) Amplitude of B greater than A
(B) Amplitude of B is smaller than A
(C) Amplitude of both is equal
(D) Amplitude of A is twice that of B

19. The period of S.H.M. of a particle is 12s. The phase difference between the positions at $t = 3$s and $t = 4$s will be

(A) $\frac{\pi}{4}$
(B) $\frac{3\pi}{5}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{2}$

20. The equation of a wave is $y = 0.07 \sin(12\pi x - 3000\pi t)$ where x is in metre and t is in second then

(A) $\lambda = \frac{1}{6}$ m, $v = 250 \frac{\text{m}}{\text{s}}$
(B) $a = 0.07$ m, $v = 500 \frac{\text{m}}{\text{s}}$
(C) $n = 1500$ Hz, $v = 200 \frac{\text{m}}{\text{s}}$
(D) $\lambda = \frac{1}{3}$ m, $v = 500 \frac{\text{m}}{\text{s}}$

21. A transverse wave is propagating on the string. The linear density of vibrating string is 10^{-3} kg/m. The equation of the wave is $Y = 0.05 \sin(x + 15t)$ where x and Y are in metre and time in second. The tension in the string is

(A) 0.2 N
(B) 0.25 N
(C) 0.225 N
(D) 0.325 N

22. A uniform wire of length L, diameter D and density ρ is stretched under tension T. The relation between its fundamental frequency f, length L and diameter D is

(A) $f \propto \frac{1}{LD}$
(B) $f \propto \frac{1}{\ell\sqrt{D}}$
(C) $f \propto \frac{1}{D^2}$
(D) $f \propto \frac{1}{\ell D^2}$

23. The speed of a wave on a string is 150 m/s when the tension is 120 N. The percentage increase in the tension to raise the wave speed by 20% is

(A) 44% (B) 40%

(C) 20% (D) 10%

24. A large insulated sphere of radius r, charged with Q C is placed in contact with a small insulated uncharged sphere of radius r_1 and is then separated. The charge on the smaller sphere will now be

(A) $Q(r + r_1)$ (B) $Q(r - r_1)$

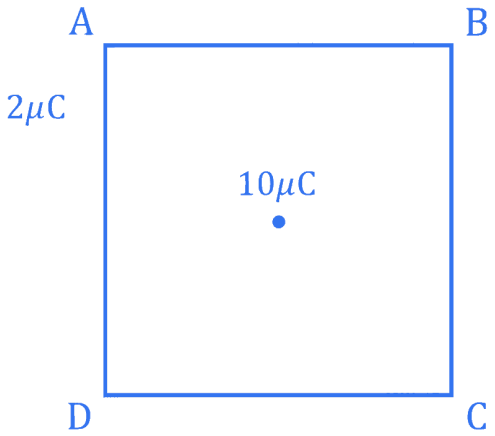
(C) $\frac{Q}{(r+r_1)}$ (D) $\frac{Qr_1}{(r+r_1)}$

25. Two charged identical metal spheres A and B repel each other with a force 3×10^{-5} N. Another identical uncharged sphere C is touched with A and then placed at the mid-point between A and B. Net force on C is $x \times 10^{-5}$ N. The value of x is

(A) 1 (B) 2

(C) 1.5 (D) 3

26. A charge $10\,\mu C$ exists at the centre of a square. The work done in moving a $2\,\mu C$ point charge from corner A to corner B of a square ABCD is



(A) zero (B) 5 J

(C) 2 J (D) 20 J

27. The electrostatic force (F) between the metal plates of an isolated parallel plate capacitor (C) having a charge Q and area A is (d = distance between the plates)

(A) $F \propto \sqrt{d}$ (B) $F \propto d$

(C) independent of d (D) $F \propto \frac{1}{d}$

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

(A) In series with 9 Ω (B) Parallel to x Ω

(C) In series with x Ω (D) Parallel to 9 Ω

29. Potentiometer wire of length 1m is connected in series with 490 Ω resistance and 2 V battery. If 0.2 mV/cm is the potential gradient then the resistance of the potentiometer wire is

(A) 4.9 Ω (B) 7.9 Ω

(C) 5.9 Ω (D) 6.9 Ω

30. A resistor of 6 Ω with a tolerance of 10% and another of 4 Ω with a tolerance of 10% are connected in series. The tolerance of combination is about

(A) 5% (B) 10%

(C) 12% (D) 15%

31. When an electron is kept in a strong magnetic field, then

(A) electron moves in opposite direction of applied magnetic field.

(B) electron moves in the direction of applied magnetic field.

(C) electron moves in the direction of perpendicular direction of magnetic field.

(D) electron remains stationary at the same position.

32. Two circular coils A and B are made from same wire but the radius of coil A is twice that of coil B. If the magnetic field at their centres is same then the ratio potential difference applied across them is

(A) 3 : 1 (B) 4 : 1

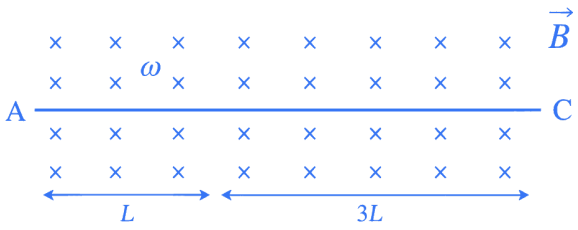
(C) 6 : 1 (D) 2 : 1

33. A magnetising field of 5000 A/m produces a magnetic flux of 4×10^{-5} Wb in an iron rod of cross-sectional area 0.4 cm^2. The permeability of the rod (in Wb/Am) is

(A) 4×10^{-6} (B) 1×10^{-3}

(C) 2×10^{-4} (D) 3×10^{-5}

34. A conducting rod AC of length $4L$ is rotated counter-clockwise about a point O in a uniform magnetic field B directed into the paper. If $AO = L$ and $OC = 3L$ then (ω = angular speed)



(A) $V_A - V_O = \frac{B\omega L^2}{2}$ (B) $V_O - V_C = \frac{7B\omega L^2}{2}$

(C) $V_A - V_C = 4B\omega L^2$ (D) $V_C - V_O = \frac{7B\omega L^2}{2}$

35. Two similar circular loops carry equal currents in the same direction. On moving coils further apart, the electric current will

(A) increase in both (B) decrease in both

(C) remain unchanged (D) increase in one coil and decrease in second coil

36. An alternating voltage $V = 200\sqrt{2}\sin(100t)$ volt is connected to 1 μF capacitor through a.c. ammeter. The reading of ammeter is

(A) 5 mA (B) 10 mA

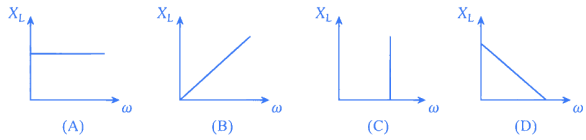
(C) 15 mA (D) 20 mA

37. The natural frequency of L-C circuit is 125000 Hz. Then the capacitor C is replaced by another capacitor with a dielectric medium of dielectric constant K. Now the frequency decreases by 25 KHz. The value of K is

(A) 3.0 (B) 2.1

(C) 1.56 (D) 1.7

38. Which one of the following graph represents the correct variation of inductive reactance (X_L) with angular frequency (ω)?



(A) A (B) B

(C) C (D) D

39. If a transformer of an amplifier has output impedance 8000 Ω and the speaker has input impedance of 8 Ω, the primary and secondary turns of this transformer connected between the output of amplifier and to loudspeaker should have the ratio

(A) 1000 : 1 (B) 100 : 1

(C) 1 : 32 (D) 32 : 1

40. An achromatic convergent doublet of two lenses in contact has a power of $+2D$. The convex lens has power $+5D$. What is the ratio of the dispersive powers of the convergent and divergent lenses?

(A) 2 : 5 (B) 3 : 5

(C) 5 : 2 (D) 5 : 3

41. In Young's experiment, one of the slit is covered with a transparent sheet of thickness 3.6×10^{-3} cm due to which position of central image shifts to a position originally occupied by 30^{th} bright fringe. The refractive index of the sheet is ($\lambda = 6000$ Å)

(A) 1.5 (B) 1.2

(C) 1.3 (D) 1.7

42. In double slit experiment, the angular width of the fringes is 0.20° for sodium light ($\lambda = 5890$ Å). To increase the angular width of the fringes by 10%, the necessary change in wavelength is

(A) zero (B) increase by 6479 Å

(C) decrease by 589 Å (D) increase by 589 Å

43. According to Huygens principle, a wave front propagates through a medium by

(A) pushing particles of the medium
(B) propagating through medium with speed of light
(C) carrying particles of same phase along with it
(D) creating secondary wavelets which forms a new wave front

44. An electron of mass m and charge e initially at rest gets accelerated by a constant electric field E. The rate of change of de-Broglie wavelength of the electron at time t is
(h = Planck's constant)

(A) $-\frac{h}{eEt^2}$
(B) $-\frac{eEt}{h}$
(C) $-\frac{mh}{eEt^2}$
(D) $-\frac{h}{eE}$

45. Light of wavelength λ strikes a photoelectric surface and electrons are ejected with an energy E. If E is to be increased to exactly twice its original value, the wavelength changes to λ_1 where

(A) $\lambda_1 < \frac{\lambda}{2}$
(B) $\lambda_1 > \lambda$
(C) $\lambda_1 > \frac{\lambda}{2} < \lambda$
(D) $\lambda_1 = \frac{\lambda}{2}$

46. An electron of stationary hydrogen atom jumps from 4th energy level to ground level. The recoil velocity of the atom as a result of electron transition will be
(h = Planck's constant, R = Rydberg's constant, m = mass of hydrogen atom)

(A) $\frac{9Rh}{16m}$
(B) $\frac{11Rh}{16m}$
(C) $\frac{13Rh}{16m}$
(D) $\frac{15Rh}{16m}$

47. A radioactive sample S_1 having activity A_1 has twice the number of nuclei as another sample of S_2 of activity A_2. If $A_2 = 2A_1$ then the ratio of half life of S_1 to the half life of S_2 is

(A) 4
(B) 2
(C) 0.25
(D) 0.75

48. In semiconductors, at room temperature the

(A) valance band is partially empty and the conduction band is partially filled.
(B) valance band is completely filled and the conduction band is partially filled.
(C) valance band is completely filled.
(D) conduction band is completely empty.

49. In an n-p-n transistor in common emitter configuration when V_{BE} is increased by small amount then

(A) I_B increases and I_C increases proportionally
(B) I_B increases and I_C remain constant
(C) I_B remain constant and I_C increases
(D) both I_B and I_C remain nearly constant

50. If an alternating voltage is applied across a diode in series with a load resistance then

(A) a d.c. voltage appears across load
(B) an a.c. voltage appears across load
(C) a pulsating voltage appears across load
(D) no voltage appears across load

51. Calculate the atomic mass in terms of u if the mass of an atom is 4.9817×10^{-23} g.
[1 amu $= 1.66056 \times 10^{-24}$ g]

(A) 12 u (B) 30 u
(C) 25.4 u (D) 8.35 u

52. Calculate the longest wavelength in the hydrogen emission spectrum of the Balmer series. [$\tilde{v} = 109677\ \text{cm}^{-1}$]

(A) 6.565×10^{-5} cm (B) 3.647×10^{-5} cm
(C) 4.377×10^{-5} cm (D) 1.824×10^{-5} cm

53. Which of the following pair of species has bond order one?

(A) N_2, CO (B) N_2, NO^+
(C) O_2^{2-}, F_2 (D) CO, NO^+

54. Which of the following gases exhibits positive deviation from ideal behavior at all pressures?

(A) H_2 (B) O_2
(C) CH_4 (D) CO_2

55. For the following reaction,
$C(s) + 2H_2(g) \rightarrow CH_4(g)$; $\Delta_r H^0 = -75$ kJ.
Calculate ΔG^0 if ΔS^0 is 185 JK^{-1}.

(A) -130.13 kJ (B) 130.13 kJ
(C) 19.87 kJ (D) -19.87 kJ

56. Calculate the work done in the following reaction
$NH_4NO_{3(s)} \rightarrow N_2O_{(g)} + 2H_2O_{(g)}$ at 300 K.
[$R = 8.314$ J K^{-1} mol^{-1}]

(A) -7.483 kJ mol^{-1} (B) -3.741 kJ mol^{-1}
(C) -11.224 kJ mol^{-1} (D) -14.966 kJ mol^{-1}

57. Which of the following processes uses the total heat absorbed by system to perform work on the surrounding?

(A) Adiabatic (B) Isothermal
(C) Isochoric (D) Isobaric

58. Calculate the $[CH_3COO^-]$ in 0.1M solution of acetic acid if K_a for acetic acid is 1.8×10^{-5}.

(A) 1.34×10^{-3} M (B) 1.68×10^{-3} M
(C) 2.12×10^{-3} M (D) 2.34×10^{-3} M

59. Calculate the pH of buffer solution containing 0.02 M weak acid and 0.04 M its salt with a strong base.
[$K_a = 7.2 \times 10^{-4}$]

(A) 3.14 (B) 3.44
(C) 3.76 (D) 3.96

60. If the dissociation constant of NH_4OH is 1.8×10^{-5}, calculate its degree of dissociation in 0.01 M.

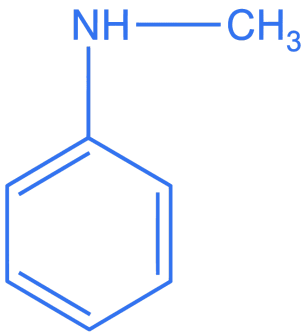
(A) 0.01215 (B) 0.0357
(C) 0.06132 (D) 0.04242

61. Identify the correct stock notation for manganese dioxide.

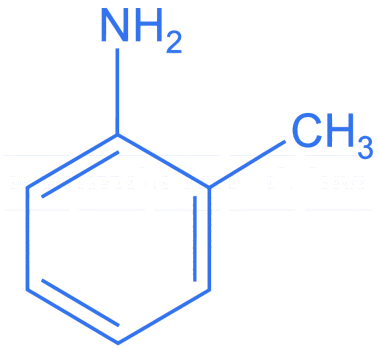
(A) $Mn(I)O_2$ (B) $Mn(II)O_2$
(C) $Mn(III)O_2$ (D) $Mn(IV)O_2$

62. Identify the structure of phenyl methanamine.

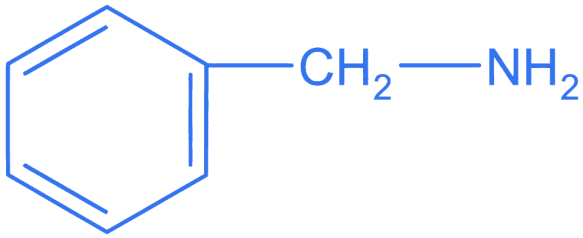
(A)



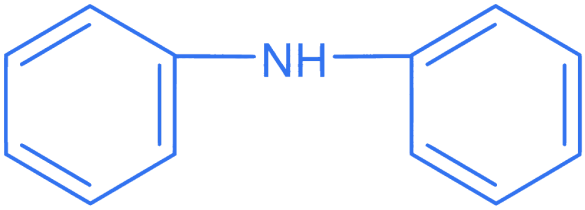
(B)



(C)



(D)



63. What type of compound the benzophenone is?

(A) aliphatic aldehyde (B) aliphatic ketone
(C) aromatic aldehyde (D) aromatic ketone

64. What is IUPAC name of CH_3CHO?

(A) Acetaldehyde (B) Methylaldehyde
(C) Ethanol (D) Ethanal

65. Which of the following hydrocarbons has most acidic H atom?

(A) Methane (B) Ethene
(C) Ethyne (D) Ethane

66. Identify a compound used as green solvent from following.

(A) CH_2Cl_2 (B) $CHCl_3$
(C) Super critical CO_2 (D) CCl_4

67. What is the mass of 5 unit cells of sodium element having bcc structure
(molar mass of Na $= 23$ g/mol)?

(A) 1.05×10^{-22} g (B) 4.123×10^{-23} g
(C) 7.638×10^{-23} g (D) 3.819×10^{-22} g

68. In a solid, oxide ions are arranged in ccp. Cation A occupies 1/8th of the tetrahedral voids and cation B occupies 1/4th of the octahedral voids. What is the formula of the compound?

(A) ABO_4 (B) AB_2O_3
(C) A_2BO_4 (D) AB_2O_4

69. What is the relationship between the radius of a particle (r) and edge length (a) for bcc unit cell?

(A) $r = a/2$ (B) $r = \sqrt{3}a/4$
(C) $r = \sqrt{2}a/4$ (D) $r = a/\sqrt{2}$

70. Calculate the percent of dissociation of 0.01 m aqueous solution of $K_3[Fe(CN)_6]$ that freezes at -0.062°C. [$K_f = 1.8$ K kg mol^{-1}]

(A) 81.47% (B) 83.51%
(C) 79.15% (D) 85.61%

71. A solution is prepared by dissolving 136.8 g sucrose in 1 kg of water. Find the vapor pressure of solution at 298 K. [Molar mass of sucrose = 342 g mol^{-1}, Vapour pressure of water = 18 mm Hg]

(A) 17.75 mm Hg (B) 17.79 mm Hg
(C) 17.95 mm Hg (D) 17.87 mm Hg

72. Which of following is the colligative property of a solution?

(A) Vapour pressure (B) Boiling point
(C) Osmotic pressure (D) Freezing point

73. Calculate the mass of cobalt deposited when 10 ampere current is passed for 109 minutes through cobalt chloride solution. (Molar mass of Co = 59 g/mol)

(A) 4.0 g (B) 20.0 g
(C) 40.0 g (D) 6.6 g

74. Identify the E_{red} value from following, if $CuSO_4$ solution dipped with Cu rod is diluted to 10 times.

(A) More by 0.02958 V, than E^0_{red}

(B) Less by 0.02958 V, than E^0_{red}

(C) More by 0.0592 V, than E^0_{red}

(D) Less by 0.0592 V, than E^0_{red}

75. Which of the following is the correct expression for molar conductivity of Na_2SO_4 at infinite dilution?

(A) $\Lambda_0(Na_2SO_4) = 2\lambda^0_{(Na^+)} + \lambda^0(SO_4^{2-})$

(B) $\Lambda_0(Na_2SO_4) = \lambda^0_{(Na^+)} + 2\lambda^0(SO_4^{2-})$

(C) $\Lambda_0(Na_2SO_4) = \lambda^0(Na^+) + \lambda^0(SO_4^{2-})$

(D) $\Lambda_0(Na_2SO_4) = (1/2)\lambda^0(Na^+) + \lambda^0(SO_4^{2-})$

76. For the first order reaction, the half life period is 10 minutes. What quantity of reactant remains after 30 minutes if the initial quantity of reactant taken is 1 g?

(A) 0.25 g

(B) 0.33 g

(C) 0.125 g

(D) 0.0625 g

77. If time required for 99% completion of a first order reaction is t minutes, find the time required for 99.9% completion.

(A) t minutes.

(B) $2t$ minutes.

(C) $3t/2$ minutes.

(D) $t/2$ minutes.

78. Identify the correct representation of Arrhenius equation from following.

(A) $k = A \cdot e^{E_a/T}$

(B) $k = A \cdot e^{E_a/RT}$

(C) $k = A \cdot e^{-E_a/R}$

(D) $k = A \cdot e^{-E_a/RT}$

79. Identify radioactive element from the following.

(A) Fr

(B) K

(C) Rb

(D) Li

80. Which of the following statements is NOT True with respect to physisorption?

(A) It is reversible

(B) It is multimolecular.

(C) $\Delta H < 0$

(D) $\Delta S > 0$

81. Which of the following molecules has highest bond dissociation enthalpy?

(A) Cl_2

(B) F_2

(C) Br_2

(D) I_2

82. Which of the following elements does not belong to Lanthanoids?

(A) Nd

(B) Lu

(C) Pa

(D) Pr

83. Identify the geometry of the $[CoF_6]^{3-}$ complex ion.

(A) Triagonal bipyramidal

(B) Tetrahedral

(C) Octahedral

(D) Square planar

84. Which of the following complexes is homoleptic?

(A) Diamminechloridonitrito-N-platinum (II)

(B) Pentaamminecarbonatocobalt (III) chloride

(C) Triamminetriaquachromium (III) chloride

(D) Potassium trioxalatoaluminate (III)

85. Cobalt chloride, when dissolved in water, forms a pink-colored solution. Identify the reason.

(A) The formation of $[Co(H_2O)_6]^{2+}$ complex that has octahedral geometry.

(B) The formation of $[Co(H_2O)_6]^{2+}$ complex that has tetrahedral geometry.

(C) The formation of $[Co(H_2O)_6]^{2-}$ complex that has tetrahedral geometry.

(D) The formation of $[Co(H_3O)_6]^{2+}$ complex that has octahedral geometry.

86. Which of the following compounds is obtained when alkyl halides reacted with silver nitrite?

(A) Nitroalkanes

(B) Alkyl nitrite

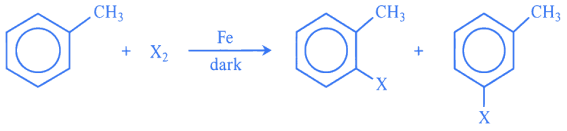
(C) Alkyl isocyanide

(D) Alkyl cyanide

87. Which of the following is an halogen exchange reaction?

(A) $RX + NaI \rightarrow RI + NaX$

(B) $R - OH + HX \xrightarrow{ZnCl_2} R - X + H_2O$



(C)

(D) $> C = C < + HX \rightarrow > C_| - C_| <$

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88. Identify the major product obtained when chlorobenzene is reacted with chlorine in the presence of anhydrous $FeCl_3$.

(A) 1,2-Dichlorobenzene
(B) Benzene hexachloride
(C) 1,4-Dichlorobenzene
(D) 2,4,6-Trichlorobenzene

89. Which of the following compounds cannot be prepared by Williamson's synthesis?

(A) $C_6H_5OCH_2CH_3$
(B) $CH_3CH_2O\ CH_2CH_3$
(C) $(CH_3)_3C\text{-}O\text{-}CH_2CH_3$
(D) $(CH_3)_3C\text{-}O\text{-}C(CH_3)_3$

90. Which of the following compounds is obtained when phenol is heated with Zn dust?

(A) Benzene
(B) Cyclohexanol
(C) Zinc phenoxide
(D) Benzoic acid

91. Identify the reagent used for preparation of p-Benzoquinone from phenol.

(A) Concentrated H_2SO_4
(B) Dilute H_2SO_4
(C) $Na_2Cr_2O_7/H_2SO_4$
(D) $Cu/573\ K$

92. Identify the type of compounds obtained when methanol is reacted with R-Mg-X.

(A) Alkane
(B) Alkene
(C) Ether
(D) Ester

93. Which of the following compounds is used to prepare aliphatic aldehydes by Rosenmund reduction?

(A) $R-COOH$
(B) $R-CN$
(C) $R-COCl$
(D) $R-O-R$

94. Which of the following reactions is used to prepare acid anhydride?

(A) By heating sodium salt of carboxylic acid with NaOH in the presence of CaO.
(B) By heating carboxylic acid in excess with P_2O_5.
(C) By reacting carboxylic acids with $LiAlH_4$.
(D) By heating Carboxylic acids with $SOCl_2$.

95. What type of amines exhibits diazotization reaction?

(A) Aliphatic primary amine
(B) Aromatic primary amine
(C) Aliphatic secondary amine
(D) Aromatic secondary amine

96. Which of the following nitrogen bases in nucleic acids contains two keto groups?

(A) Adenine
(B) Guanine
(C) Thymine
(D) Cytosine

97. Which of the following is non-reducing sugar?

(A) Lactose
(B) Fructose
(C) Sucrose
(D) Maltose

98. What type of polymer is the polystyrene?

(A) a thermoplastic polymer
(B) a thermosetting polymer
(C) an elastomer
(D) a cross-linked polymer

99. Find monomers of PHBV.

(A) β - hydroxy Butyric acid and β - hydroxy Valeric acid
(B) Glycine and ϵ amino caproic acid
(C) α - hydroxy Butyric acid and β - hydroxy Valeric acid
(D) β - hydroxy Butyric acid and caproic acid

100. Which of the following elements is not present in salvarsan?

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

101. Let $f : R \to R$ be defined by $f(x) = \frac{x^2+2x+3}{x^2+x+1}$. If the range of $f(x)$ is $[a, b]$, then $a + b = \ldots$

(A) 2 (B) 4

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

102. The value of the expression $\cos\left(\frac{\pi}{24}\right)\cos\left(\frac{\pi}{12}\right)\cos\left(\frac{\pi}{6}\right)\cos\left(\frac{\pi}{3}\right)$ is:

(A) $\frac{1}{16}\sin\left(\frac{\pi}{24}\right)$ (B) $\frac{\sqrt{3}}{32}\csc\left(\frac{\pi}{24}\right)$

(C) $\frac{\sqrt{3}}{16}$ (D) $\frac{1}{32}\sec\left(\frac{\pi}{12}\right)$

103. In $\triangle ABC$, if $b = \sqrt{3}+1$, $c = \sqrt{3}-1$ and $A = \frac{\pi}{3}$, then $B - C = \ldots$

(A) $\frac{\pi}{18}$ (B) $\frac{\pi}{12}$

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

104. If $n \in Z$, then the value of $\frac{2^n}{(1+i)^{2n}} + \frac{2^n}{(1-i)^{2n}} + \frac{(1+i)^{2n}+(1-i)^{2n}}{2^n}$ is equal to

(A) $4\cos\left(\frac{n\pi}{2}\right)$ (B) $2(n+1)\cos\left(\frac{n\pi}{2}\right)$

(C) $2[1+(-1)^n]$ (D) $2(n+2)$

105. How many numbers (without repetition) between 400 and 1000 can be made with the digits $2, 3, 4, 5, 6$, and 0?

(A) 120 (B) 720

(C) 60 (D) 24

106. The sum of the ordinates of the points on the line $4x + 3y = 10$ whose distance from the line $x + y - 4 = 0$ is $\sqrt{2}$ is equal to ...

(A) -4 (B) -10

(C) 12 (D) 18

107. If the equation $mx^2 - y^2 + 2y + n = 3$ represents a pair of perpendicular lines, then the values of m and n respectively are...

(A) $1, 3$ (B) $1, 2$

(C) $1, -3$ (D) $1, -2$

108. The equation of a circle whose center is at $(3, -4)$ and the line $12x - 5y - 17 = 0$ cuts the circle at A and B, where $l(AB) = 6$ is ...

(A) $x^2 + y^2 - 6x + 8y + 7 = 0$

(B) $x^2 + y^2 - 6x + 8y - 7 = 0$

(C) $x^2 + y^2 + 6x + 8y + 7 = 0$

(D) $x^2 + y^2 - 6x - 8y - 7 = 0$

109. The tangent to the parabola $x^2 = 2y$ at point P makes an angle of 45° with the X-axis, then the coordinates of P are:

(A) $\left(1, \frac{1}{2}\right)$ (B) $(2, 2)$

(C) $(-2, 2)$ (D) $\left(-1, \frac{1}{2}\right)$

110. One of the tangents at the end of the latus rectum of the parabola $y^2 = 12x$ is

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

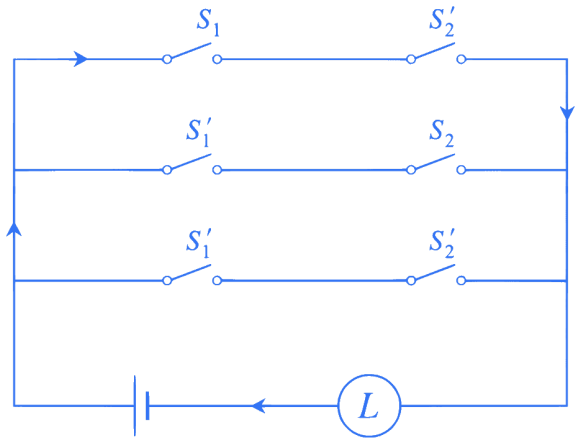
(C) $3x + y - 3 = 0$ (D) $x + 3y - 3 = 0$

111. $\lim_{h\to 0} \frac{\log_e(1+2h) - 2\log_e(1+h)}{h^2}$

(A) -1 (B) ∞

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

112. Let p: switch S_1 is closed, q: switch S_2 is closed.
Then, the equivalent symbolic form for the following circuit is:



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

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

113. If $p \to (\sim p \vee q)$ is false, then the truth values of p, q are:

(A) T, F (B) F, T

(C) F, F (D) T, T

114. The logical expression $[\sim (p \to q) \wedge (q \to p)] \vee \sim (p \leftrightarrow q)$ is equivalent to:

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

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

115. If $\sin^{-1}\left(\frac{y}{2}\right) = \tan^{-1}\left(\frac{x}{2}\right)$, $|y| < 2$, such that $\frac{dx}{dy} = k(4 + x^2)$, then $k = \ldots$

(A) $\frac{x}{2y}$ (B) $\frac{x}{4y}$

(C) $\frac{x}{y}$ (D) $\frac{y}{x}$

116. The solutions of the equation $\sin[2\cos^{-1}\{\cot(2\tan^{-1} x)\}] = 0$ are

(A) ± 3 (B) $1 \pm \sqrt{2}$

(C) $2 \pm \sqrt{2}$ (D) $\pm\sqrt{2}$

117. If $\tan^{-1}\left[\frac{\sqrt{5+2\sqrt{6}}}{1-\sqrt{6}}\right] = a + \tan^{-1}(\sqrt{2})$, then $\csc(a) = \ldots$

(A) 2 (B) -2

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

118. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$, then $xy + yz + zx$ is equal to

(A) 3 (B) -3

(C) 2 (D) -2

119. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{bmatrix}$, $B = \text{adj } A$ and $C = 5A$, then the value of $\frac{|\text{adj } B|}{|C|}$ is:

(A) 25 (B) 2

(C) 1 (D) 5

120. If $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 7 \\ 3 & 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 7 \\ 2 \end{bmatrix}$ then $\begin{bmatrix} x \\ y \\ z \end{bmatrix} =$

(A) $\begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

(C) $\begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$

121. Let $f(x) = \frac{12^x - 4^x - 3^x + 1}{1 - \cos 2x}$, for $x \neq 0$. If $f(x)$ is continuous at $x = 0$ and $f(0) = \frac{(\log a) \cdot (\log 3)}{4k}$, then the value of a in terms of k is:

(A) $a = 2^{4k}$ (B) $a = 2^{3k}$

(C) $a = 3^{4k}$ (D) $a = 4^{4k}$

122. If $f(x) = \sin(\tan^{-1} x)$, then $\int_0^1 x f''(x) dx$ is:

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

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

123. The derivative of $f(\cos x)$ with respect to $g(\tan x)$ at $x = \frac{\pi}{6}$, given that $f'\left(\frac{\sqrt{3}}{2}\right) = 4$ and $g'\left(\frac{1}{\sqrt{3}}\right) = 2$ is:

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

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

124. If $y = x^{x^{x \cdots \infty}}$, then $\frac{dy}{dx}$ is:

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

(C) $\frac{y}{x(1 + y \log x)}$ (D) yx^{y+1}

125. If $y = (\log x)^{\log x}$ and $\frac{dy}{dx} = \frac{y}{x} \times f(x)$ then $f(x) = \ldots$

(A) $(\log x)^x$ (B) $\log(\log x)$

(C) $x^{\log x}$ (D) $\log(\log x^e)$

126. A man of height 1.2 m is moving away from the lamp post at the rate 0.6 m/sec. If the height of the lamp post is 4.8 m, then the rate at which the shadow of the man is lengthening is:

(A) 0.02 m/s (B) 1.8 m/s

(C) 0.2 m/s (D) 2.0 m/s

127. The approximate surface area of a sphere of radius 2.01 cm is

(A) 16.16π cm^2 (B) 16.15π cm^2

(C) 16.14π cm^2 (D) 16.17π cm^2

128. $\int \frac{2x}{4 - 3x - x^2} dx = \ldots$

(A) $-\frac{8}{5}\log|4 - x| - \frac{2}{5}\log|1 + x| + c$

(B) $-\frac{2}{5}\log|4 + x| - \frac{8}{5}\log|1 - x| + c$

(C) $-\frac{2}{5}\log|4 - x| - \frac{8}{5}\log|1 + x| + c$

(D) $-\frac{8}{5}\log|4 + x| - \frac{2}{5}\log|1 - x| + c$

129. The integral $\int \frac{\csc x}{\cos^2[1+\log(\tan\frac{x}{2})]}\,dx$ is equal to:

(A) $\tan[1+\log(\tan\frac{x}{2})]+c$

(B) $\frac{1}{2}\tan[1+\log(\tan\frac{x}{2})]+c$

(C) $2\tan[1+\log(\tan\frac{x}{2})]+c$

(D) $\frac{1}{4}\tan[1+\log(\tan\frac{x}{2})]+c$

130. $\int e^x\left(\log(\sin x)+\sqrt{\frac{1+\cos 2x}{1-\cos 2x}}\right)dx=\ldots$

(A) $e^x\cot x+C$

(B) $e^x\log\sin x+C$

(C) $e^x\log\sin x+\tan x+C$

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

131. $\int \frac{x}{x^{5/2}+4x^{3/2}}\,dx=\ldots$

(A) $3\log|x^{5/2}+4x^{3/2}|+c$

(B) $\frac{1}{2}\log|x+4|+c$

(C) $4\sec(x^{3/2})+\log\left(\tan\left(\frac{x}{2}\right)\right)+c$

(D) $\tan^{-1}\left(\frac{\sqrt{x}}{2}\right)+c$

132. If $\int_{-1}^{4} f(x)dx=9$ and $\int_{2}^{4}(7-f(x))dx=10$, then $\int_{2}^{-1} f(x)dx=$

(A) 13 (B) 19

(C) -19 (D) -5

133. $\int_{\pi/6}^{\pi/3}\sin 2x\log(\tan x)\,dx=\ldots$

(A) 0 (B) $\frac{\sqrt{3}}{2}-1$

(C) $\frac{\sqrt{3}}{2}+\frac{1}{2}$ (D) $\left(\frac{\sqrt{3}-1}{2}\right)-\sqrt{3}$

134. The area of the region bounded by the line $4x+3y=12$, the X-axis, and the lines $x=-1$ and $x=2$ (in sq units) is:

(A) 10 (B) 12

(C) 30 (D) 15

135. An ice ball melts. The rate at which it melts is proportional to the amount of the ice at that time. If half quantity of ice melts in 20 minutes, then the time when $(1/8)^{th}$ part of original amount of the ice is left is:

(A) 60 minutes (B) 30 minutes

(C) 20 minutes (D) 40 minutes

136. The solution of the differential equation $\frac{dy}{dx}+1=e^{x+y}$ is

(A) $(x+y+C)e^{x+y}=0$

(B) $(x+C)e^{x+y}=0$

(C) $(x-C)e^{x+y}=0$

(D) $(x+C)e^{x+y}+1=0$

137. The order and degree of the differential equation $e^{\frac{dy}{dx}}+\frac{dy}{dx}=x$ is

(A) order = 1 and degree = 1

(B) order = 1 and degree = 2

(C) order = 1 and degree = not defined

(D) order = not defined and degree = 1

138. Let $\bar{a}=2\hat{i}+\hat{k}$, $\bar{b}=\hat{i}+\hat{j}+\hat{k}$, and $\bar{c}=4\hat{i}-3\hat{j}+7\hat{k}$. If $\bar{r}$ is a vector such that $\bar{r}\times\bar{b}=\bar{c}\times\bar{b}$ and $\bar{r}\cdot\bar{a}=0$, then the value of the scalar product $\bar{r}\cdot\hat{i}$ is:

(A) -1 (B) 2

(C) 0 (D) -3

139. If the scalar products of a vector $\bar{a}=x\hat{i}+y\hat{j}+z\hat{k}$ with $2\hat{i}+\hat{j}+\hat{k}$, $\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+2\hat{j}+3\hat{k}$ are $5, 3$, and 5 respectively, then $x+y+z=\ldots$

(A) 1 (B) 2

(C) 3 (D) 4

140. If $|\bar{a}|=24$, $|\bar{b}|=7$, $\bar{a}\cdot\bar{b}=0$, $\bar{a}+\bar{b}+\bar{c}=\bar{0}$, then $|\bar{c}|=\ldots$

(A) 31 (B) 17

(C) 40 (D) 25

141. If $\bar{a}=\hat{i}+2\hat{j}+2\hat{k}$, $\bar{b}=2\hat{i}-2\hat{j}+\hat{k}$ and $\bar{c}$ is a vector projection of $\bar{a}$ on the line of $\bar{b}$, then the value of $[2\bar{a}\ 3\bar{b}\ \sqrt{3}\bar{c}]$ is

(A) $6\sqrt{3}$ (B) 0

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

142. If the angle between the line $x=\frac{y-5}{2}=\frac{z+8}{k}$ and the plane $2x-3y+3z=9$ is $\cos^{-1}\left(\sqrt{\frac{13}{22}}\right)$, then $k=\ldots$

(A) $-\frac{24}{29}$ (B) $\frac{24}{29}$

(C) $-\frac{29}{24}$ (D) $\frac{29}{24}$

143. If the lines $\frac{1-x}{3} = \frac{3y-1}{2\lambda+1} = 4 - z$ and $\frac{x+2}{2\mu} = \frac{1-2y}{6} = \frac{5-z}{7}$ are perpendicular, then $3\mu + \lambda = \ldots$

(A) -4 (B) 3

(C) 8 (D) 6

144. Consider the lines
$L_1 : \frac{x}{2} = \frac{y}{2} = -z$,
$L_2 : \frac{x-1}{1} = \frac{y-1}{2} = \frac{z-3}{2}$.
The unit vector perpendicular to both L_1 and L_2 is:

(A) $\frac{-6\hat{i}-5\hat{j}+2\hat{k}}{\sqrt{65}}$ (B) $\frac{6\hat{i}-5\hat{j}+2\hat{k}}{\sqrt{65}}$

(C) $\frac{6\hat{i}+5\hat{j}+2\hat{k}}{\sqrt{65}}$ (D) $\frac{6\hat{i}-5\hat{j}-2\hat{k}}{\sqrt{65}}$

145. The coordinates of the foot of the perpendicular drawn from the point $P(-1, 3, 2)$ to the line formed by the intersection of the planes $x + y + z = 1$ and $2x - y + z = 2$ are:

(A) $\left(0, -\frac{1}{2}, \frac{3}{2}\right)$ (B) $(1, 0, 0)$

(C) $\left(-\frac{1}{2}, 0, \frac{3}{2}\right)$ (D) $\left(0, \frac{1}{2}, -\frac{3}{2}\right)$

146. The Incenter of the triangle whose vertices are $A(0, 3, 0)$, $B(0, 0, 4)$, and $C(0, 3, 4)$ is;

(A) $2\hat{i} + 3\hat{k}$ (B) $2\hat{i} - 3\hat{k}$

(C) $2\hat{j} - 3\hat{k}$ (D) $2\hat{j} + 3\hat{k}$

147. The L.P.P. Maximize $Z = 0.75x + 0.5y$ subject to $3x + 2y \leq 6$, $x + 4y \leq 4$, $x \geq 0$, $y \geq 0$ has

(A) unique solution (B) no solution

(C) two solutions (D) infinite solutions

148. If $X \sim B(10, 0.4)$, then the probability that X takes a value at least 2 is:

(A) $1 - 5(0.4)(0.6)^9$ (B) $1 - (0.6)^9(4.6)$

(C) $1 - (0.4)^{10}$ (D) 0.66

149. The probability mass function (p.m.f.) of a random variable X is as follows:

$P(X = 0) = 3k^3$, $P(X = 1) = 4k - 10k^2$,
$P(X = 2) = 5k - 1$, $P(X = x) = 0$

for any value of x, then the value of k is:

(A) $\frac{3}{4}$ (B) $\frac{3}{7}$

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

150. Two fair dice are tossed simultaneously. Let A be the event that the sum of the numbers is prime, and B be the event that at least one die shows a number 5. The odds against the occurrence of event B given that event A has already occurred is:

(A) 11 : 4 (B) 11 : 15

(C) 11 : 7 (D) 4 : 11

- End of Question Paper -