MHT CET 2022 PCM Aug 6 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 2022**, 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. 10^{23} molecules of a gas, each having a mass of 3×10^{-27} kg strike per second per sq.cm of a rigid wall at an angle of 60° with the normal and rebound with a velocity of 500 m/s. The pressure exerted by the gas molecules on the wall is

(A) 2000 $\mathrm{N/m^2}$ (B) 500 $\mathrm{N/m^2}$

(C) 1000 $\mathrm{N/m^2}$ (D) 1500 $\mathrm{N/m^2}$

2. Two masses m_1 and m_2 moving with velocities v_1 and v_2 in opposite directions collide elastically and after collision masses m_1 and m_2 move with velocity v_2 and v_1 respectively. The ratio $\left(\frac{m_2}{m_1}\right)$ is

(A) 0.75 (B) 1

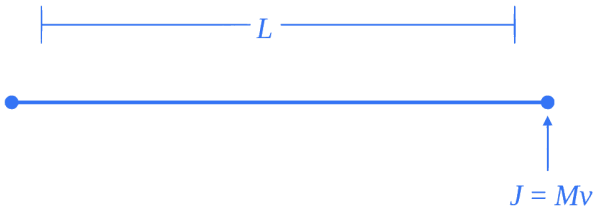
(C) 1.5 (D) 1.25

3. The angular velocity of the minute hand of a clock in degrees per second is

(A) 0.24 (B) 0.1

(C) 0.6 (D) 0.12

4. Consider a body shown in the figure, consisting of two identical balls, each of mass M connected by a light right rod. If an impulse $J = MV$ ($V =$ linear velocity of ball)is imparted to the body at one of its ends, what would be its angular velocity?



(A) $\frac{V}{3L}$ (B) $\frac{V}{4L}$

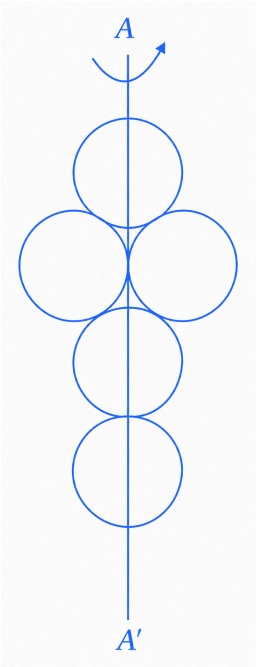
(C) $\frac{V}{L}$ (D) $\frac{2V}{L}$

5. Two circular loops P and Q of radii r and nr respectively are made from a uniform wire. Moment of inertia of Q about its axis is four times that of P about its axis. The value of n is

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

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

6. Five solid spheres each of mass m and radius r are rotating about an axis A as shown in figure. Hence the moment of inertia of the system about the axis of rotation A-A' as shown in figure. Hence the moment of inertia of the system about the axis of rotation A-A' is



(A) $6mr^2$ (B) $5mr^2$

(C) $3mr^2$ (D) $4mr^2$

7. The escape velocity of a body from the surface of the earth is 11.2 km/s. The escape velocity of a body from a planet having same mean density as the earth but twice the radius of earth is

(A) 5.5 km/s (B) 33.6 km/s

(C) 22.4 km/s (D) 11.2 km/s

8. The time period T of a satellite is related to the density (ρ) of the plane which is orbiting close around the planet as.

(A) $T \propto \rho^{1/2}$ (B) $T \propto \rho$

(C) $T \propto \rho^{-3/2}$ (D) $T \propto \rho^{-1/2}$

9. Two narrow tube of diameters d_1 and d_2 are joined together to form a Utube open at both ends. If U-tube contains water, the difference in water levels in the limbs is (T is the surface tension of water, angle of contact is zero and density of water is ρ, g is the acceleration due to gravity)

(A) $\frac{4T}{\rho g}\left[\frac{d_2-d_1}{d_1 d_2}\right]$ (B) $\frac{4T}{\rho g}\left[\frac{d_1 d_2}{d_1+d_2}\right]$

(C) $\frac{2T}{\rho g}\left[\frac{d_2-d_1}{d_1 d_2}\right]$ (D) $\frac{2T}{\rho g}\left[\frac{d_1+d_2}{d_1 d_2}\right]$

10. When a liquid flows through a tube, the Reynold's number is 900 , the flow of a liquid is

(A) turbulent.

(B) changes from turbulent flow to a streamline flow.

(C) streamline.

(D) changes from a streamline flow to a turbulent flow.

11. Eight identical small drops of water are falling down vertically through a medium, each with terminal velocity v. If they combine to form a single drop, then its terminal velocity will be

(A) $3v$ (B) $6v$

(C) $5v$ (D) $4v$

12. The radiation energy density per unit wavelength at temperature T is maximum at a wavelength λ_0. At temperature $2T$, it will have a maximum at a wavelength

(A) $\frac{\lambda_0}{4}$ (B) $2\lambda_0$

(C) $4\lambda_0$ (D) $\frac{\lambda_0}{2}$

13. An object is cooled from 75°C to 65°Cin2 min. The time, it takes to cool from 55°C to 45°Cis [The temperature of surrounding is 30°C]

(A) 9 min (B) 10 min

(C) 4 min (D) 8 min

14. If the temperature of back body is doubled, the frequency at which the spectral intensity becomes maximum, will be

(A) unchanged (B) four times

(C) doubled (D) halved

15. At thermodynamics process of uncontrolled change satisfying the equation $Q = W = 0$, is [Q = heat supplied, W = work done]

(A) Free expansion (B) Cyclic

(C) Isochoric (D) Isothermal

16. A monoatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston suddenly. If L_1 and L_2 are the lengths of the gas column before and after expansion respectively then $\frac{T_1}{T_2}$ is given by

(A) $\left(\frac{L_1}{L_2}\right)$ (B) $\left(\frac{L_2}{L_1}\right)^{2/3}$

(C) $\left(\frac{L_1}{L_2}\right)^{2/3}$ (D) $\left(\frac{L_2}{L_1}\right)$

17. Consider two SHMs along the same straight line $x_1 = A_1\sin(\omega t + \phi_1)$, $x_2 = A_2\sin(\omega t + \phi_2)$, where A_1 and A_2 are their amplitudes and ϕ_1 and ϕ_2 are their initial phase angle. If the two SHMs meet simultaneously and R is the resultant amplitude, match column I with column II.

Column-I	Column-II
$A.\ A_1 = A_2 = A, \delta = 0$	$I.\ A_1 + A_2$
$B.\ A_1 \neq A_2, \delta = 0$	$II.\ 0$
$C.\ A_1 = A_2 = A, \delta = 90°$	$III.\ 2A$
$D.\ A_1 = A_2 = A, \delta = 180°$	$IV.\ A\sqrt{2}$

(A) A - IV, B -III, C-II, D-I (B) A - III, B -I, C-IV, D-II

(C) A - I, B -III, C-II, D-IV (D) A - III, B -IV, C-I, D-II

18. A rectangular block of mas M and cross-sectional area A floats on a liquid of density ρ. It is given a small vertical displacement from equilibrium; it starts oscillating with frequency n then

(A) $n \propto \sqrt{A}$ (B) $n \propto A^3$

(C) $n \propto A$ (D) $n \propto A^2$

19. The equation of motion of a particle performing linear S.H.M is $x = 5\sin\left[4t - \frac{\pi}{6}\right]$, where x is its displacement in cm. The velocity of the particle when its displacement is 3 cm, is

(A) 8 cm/s (B) 6 cm/s

(C) 16 cm/s (D) 10 cm/s

20. A wave travelling along uniform string represented by $Y = A\sin(\omega t - kx)$ is superimposed on another wave travelling along the same string represented by $Y = A\sin(\omega t + kx)$. The resultant is

(A) A wave travelling along $+x$ direction.

(B) A standing wave having nodes at $x = \left(n + \frac{1}{2}\right)\frac{\lambda}{2}$, where $n = 0, 1, 2, 3 \ldots\ldots$

(C) A wave travelling along $-x$ direction

(D) A standing wave having nodes at $x = \frac{n\lambda}{2}$, where $n = 0, 1, 2, 3 \ldots\ldots$

21. If the ratio of the intensities of two waves producing interference is 49 : 16, then the ratio of the resultant maximum intensity to minimum intensity will be

(A) 11:3

(B) 121:9

(C) 7 : 4

(D) 49:16

22. A car sounding a horn of frequency 1000 Hz passes an observer. The ratio of frequencies of the both noted by the observer before and after passing of the car is 11:9. If the speed of sound is V, the speed of the car is

(A) V

(B) $\frac{V}{10}$

(C) $\frac{V}{100}$

(D) $\frac{V}{5}$

23. The optical path difference between two identical light waves arriving at a point is 31.5λ, where λ is the wavelength of light used. The point is [Given: Two light sources are coherent]

(A) alternative bright and dark.

(B) dark.

(C) bright.

(D) neither bright nor dark.

24. For a stationary wave, $Y = 10\sin\left(\frac{\pi x}{15}\right)\cos(48\pi t)$cm, the distance between a node and the successive antinode is

(A) 7.5 cm

(B) 30 cm

(C) 15 cm

(D) 60 cm

25. A pipe closed at one end length 0.8 m. At its open end a 0.5mlong uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of the pipe. If the tension in the wire in 50 N and the speed of sound is 320 m/s, the mass of the string used is

(A) 8 g

(B) 4 g

(C) 12 g

(D) 10 g

26. Identify the WRONG statement in the case of electric field lines.

(A) They do not intersect each other.

(B) They do not pass through a conductor.

(C) They start from a positive charge and end on a negative charge

(D) They do not pass through an insulator.

27. A parallel plate air filled capacitor of capacitance C has plate area A and the distance between the plates d. When a metal sheet of thickness $\left(\frac{d}{2}\right)$ and of the same area A is introduced between the plates, its capacitance becomes C_2. The ratio $C_2 : C_1$ is

(A) 4 : 1

(B) 2 : 1

(C) 3:1

(D) 3 : 2

28. An uncharged capacitor is connected to a battery. While charging the capacitor, how much is the energy lost, from the energy supplied by the battery?

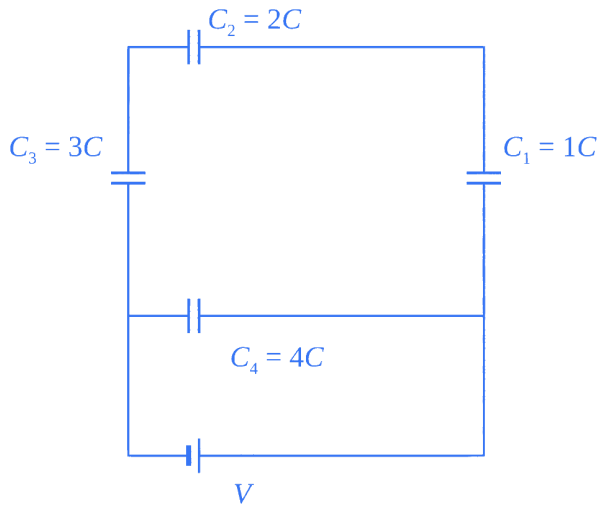
(A) 50%

(B) 75%

(C) 100%

(D) 25%

29. The network of four capacitors is connected to a battery as shown in the figure. The ratio of charges on capacitors C_2 and C_4 is



(A) $\frac{4}{17}$ (B) $\frac{5}{21}$
(C) $\frac{3}{22}$ (D) $\frac{1}{16}$

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

(A) 8Ω (B) 4Ω
(C) 6Ω (D) 3Ω

31. Let A be the cross-sectional area and ρ be the specific resistance of a potentiometer wire. If I is the current passing through the wire, then the potential gradient along the length of the wire is

(A) $\frac{I}{\rho A}$ (B) $\frac{IA}{\rho}$
(C) $IA\rho$ (D) $\frac{I\rho}{A}$

32. A proton moving in perpendicular magnetic field possess energy E. The strength of magnetic field is increases four times. But the proton is constrained to move in the path of same radius. The kinetic energy of proton will increase

(A) 4 times (B) 12 times
(C) 8 times (D) 16 times

33. A long solenoid has 200 turns per cm and carriers a currenti. The magnetic field at its centre is 6.28×10^{-2} Wb/m^2. Another long solenoid has 100 turns per cm and it carries a current $\frac{i}{3}$. The value of magnetic field at its centre is nearly

(A) 1.05×10^{-3} Wb/m^2
(B) 1.05×10^{-4} Wb/m^2
(C) 1.05×10^{-2} Wb/m^2
(D) 1.05×10^{-5} Wb/m^2

34. Two circular coils 1 and 2 are made from the same wire but the radius of the first coil is twice that of the second coil. What is the ratio of potential difference applied across them, so that the magnetic field at their centres is same?

(A) 2 : 3 (B) 6 : 4
(C) 3 : 2 (D) 4 : 1

35. Two coils A and B are placed in a circuit. When current in the coil A changes by 0.8 A the magnetic flux in coil B changes by 0.16 Wb. The mutual inductance between the coils is

(A) 2H (B) 20H
(C) 0.5H (D) 0.2H

36. The self-inductance L of a solenoid of length λ and area of crosssection A with a fixed number of turns N increases as

(A) λ increases and A decreases (B) λ decreases and A increases
(C) both λ and A increase (D) both λ and A decreases

37. An inductance coil has a resistance of 100Ω. When are a.c. signal of frequency 100Hzis applied to the coil, the voltage leads the current by 45°. The inductance of the coil in henry is $\left[\sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}}\right]$

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

38. A circuit of negligible resistance has an inductor of 0.16H and capacitor of 25μF connected in series with an alternating voltage source. The resonating frequency of the circuit is

(A) $\frac{150}{\pi}$ (B) $\frac{200}{\pi}$
(C) $\frac{250}{\pi}$ (D) $\frac{400}{\pi}$

39. A step-down transformer has N_S to N_p ratio of $20:1$. If 8 V are developed across 0.4Ω secondary, the primary current will be

(A) 1 A (B) 0.5 A

(C) 4 A (D) 2 A

40. The instantaneous values of current and voltage in an AC circuit are given by $I = 6\sin\left(100\pi t + \frac{\pi}{4}\right)$ and $V = 5\sin\left(100\pi t - \frac{\pi}{4}\right)$, then

(A) voltage leads the current by 45° (B) current leads the voltage by 45°

(C) voltage leads the current by 90° (D) current leads the voltage by 90°

41. The intermediate image formed by an objective lens of a compound microscope is

(A) virtual and diminished (B) real and magnified

(C) virtual and magnified (D) real and diminished

42. A glass convex lens is of refractive index 1.55 with both faces of same radius of curvature. What is the radius of curvature required if focal length is to be 20 cm ?

(A) 21 cm (B) 18 cm

(C) 20 cm (D) 22 cm

43. In Young's double slit experiment, the two slits are d distance apart. Interference pattern is observed on the screen at a distance D from the slits. Fist dark fringe is observed on the screen directly opposite to one of the slits. The wavelength of the light is.

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

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

44. The de-Broglie wavelength of an electron moving in the n^{th} Bohr orbit of radius r is

(A) $\frac{nr}{2\pi}$ (B) $\frac{2\pi r}{n}$

(C) $\frac{nr}{\pi}$ (D) $n\pi r$

45. In photoelectric experiment the stopping potential was measured to be V_1 and V_2 volt with incident light of wavelength λ and $\frac{\lambda}{2}$ respectively the value of V_2 is [(ϕ = work function, e = electronic charge]

(A) $V_1 + \frac{2\phi}{e}$ (B) $2V_1 + \frac{\phi}{e}$

(C) $2V_1 - \frac{\phi}{e}$ (D) $V_1 - \frac{2\phi}{e}$

46. For wavelength of visible radiation of hydrogen spectrum Balmer gave an equation as $\lambda = \frac{(\text{km}^2)}{(\text{m}^2 - 4)}$, where m is the integer value. The value of k in terms of Rydberg's constant R is

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

(C) R (D) $4R$

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

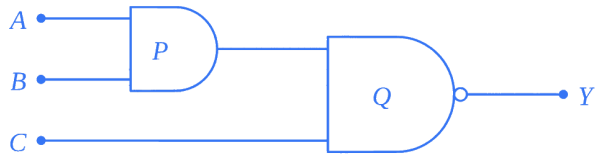
[$\mu_0 \rightarrow$ permeability of free space, $m \rightarrow$ mass of electron

$\varepsilon_0 \rightarrow$ permittivity of free space, $h \rightarrow$ Planck's constant]

(A) $\frac{\mu_0 e^3 \pi m^2}{8\varepsilon_0^2 h^4}$ (B) $\frac{\mu_0 e^2 \pi m^4}{6\varepsilon_0^3 h^4}$

(C) $\frac{\mu_0 e^7 \pi m^2}{8\varepsilon_0^3 h^5}$ (D) $\frac{\mu_0 e^3 \pi m^3}{6\varepsilon_0^3 h^3}$

48. What is the output Y in the following circuit, when all the three inputs A, B, C are firs 0 then 1 ?



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

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

49. In common emitter transistor amplifier, the output voltage and input voltage have a phase difference of

(A) π (B) $\frac{5\pi}{6}$

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

50. The majority charge carriers in p-type and n-type semiconductor are respectively

(A) holes and electrons (B) electrons and holes

(C) electrons and electrons (D) holes and holes

51. Find the formula weight of reactant if the formula weight of product is 54u and the percent atom economy is 75 .

(A) 72u (B) $24u$

(C) 30u (D) $80u$

52. What quantity of carbon dioxide is produced when 2 mole of carbon is burnt in 16 g of dioxygen?

(A) 44 g (B) 88 g

(C) 11 g (D) 22 g

53. Which among the following is group 16 element?

(A) Pb (B) Sb

(C) Po (D) As

54. Which among the following elements has only one electron in valence shell?

(A) Ca (B) Ra

(C) Rb (D) Ba

55. Match the following pairs.

Species	Number of electrons
(a) O^{2-}	(i) 18
(b) Li^{2+}	(ii) 2
(c) He	(iii) 10
(d) Ca^{++}	(iv) 1

(A) (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii) (B) (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)

(C) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i) (D) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

56. The decreasing order of bond angle in the following molecules is

(A) $NH_3 > CH_4 > H2O$

(B) $H_2O > NH_3 > CH_4$

(C) $CH_4 > H_2O > NH_3$

(D) $CH_4 > NH_3 > H_2O$

57. Which among the following molecules has lowest bond dissociation enthalpy?

(A) F_2 (B) Br_2

(C) Cl_2 (D) I_2

58. What is carbon-carbon bond length in benzene?

(A) 154 pm (B) 120pm

(C) 144pm (D) 138pm

59. Which among the following molecules is non polar?

(A) HCl (B) NH_3

(C) C_6H_6 (D) $I - Cl$

60. When 2.0 g sucrose is oxidised forming $CO_2(g)$ and $H_2O_{(\ell)}$ the internal energy changes by 24 kJ. Calculate the value of ΔH at 298 K in kJ/mol. (Molar mass of sucrose $= 342\ g\ mol^{-1}$)

(A) -140.3 J (B) 2014 J

(C) -5612 J (D) 8208 J

61. Which among the following properties is NOT a state function?

(A) Enthalpy (B) Volume

(C) Pressure (D) Work

62. A gas is allowed to expand in an insulated container against a constant external pressure of 2.5 bar from $4.5dm^3$ to $7 \times 10^{-3}\ m^3$. What is the change in internal energy of the gas?

(A) -625 J (B) -312.5 J

(C) -112.3 J (D) -3.25 J

63. An acid dissociated to 1.5% in its 0.1M solution. Calculate its dissociation constant.

(A) 1.2×10^{-5} (B) 2.25×10^{-5}

(C) 1.1×10^{-5} (D) 1.5×10^{-5}

64. What is the pH of one millimolar solution of NaOH ?

(A) 13 (B) 11

(C) 3 (D) 12

65. Identify weak acid weak base salt from following.

(A) Potassium bromide (B) Ammonium sulphate

(C) Ammonium acetate (D) Ammonium chloride

66. What is the oxidation state of oxygen in O_2^{2-} ion?

(A) $+2$ (B) $+1$

(C) -2 (D) -1

67. Which among the following is electron deficient compound?

(A) SiF_4 (B) BCl_3

(C) PCl_5 (D) CCl_4

68. Identify optically active substance from the following.

(A) $CH_3CH(Br)CH_2CH_3$

(B) $(CH_3)_2C(Br)CH_3$

(C) $CH_3(CH_2)_3CH_2Br$

(D) $(CH_3)_2CHCH(Br)CH(CH_3)_2$

69. Identify simple ether from the following.

(A) Methoxyethane (B) Anisole

(C) 1-propoxybenzene (D) Methoxymethane

70. Which among the following compounds is a primary alcohol?

(A) 2-methylpropan-2-ol (B) 2-methylpropan-1-ol

(C) Cyclobutanol (D) butan-2-ol

71. Identify tertiary alkyl halide from the following.

(A) $(CH_3)_2 - CH - CH_2 - Br$

(B) $(CH_3)_3 - C - Br$

(C) $CH_3 - (CH_2)_4 - CH_2 - Br$

(D) $(CH_3)_3 - C - CH_2 - Br$

72. How many π electrons are present in naphthalene to decide it's aromaticity?

(A) 6 (B) 8

(C) 7 (D) 10

73. Identify the product obtained when bromoethane is heated with excess of alcoholic ammonia under pressure.

(A) Ethanol (B) Nitro ethane

(C) Ethanamine (D) Ethene

74. Which among the following statement is NOT true about covalent network solid?

(A) In this solid the constituent particles are atoms. (B) Covalent solids have high melting points.

(C) The atoms in this solid are linked by covalent bonds. (D) These are soft in nature.

75. Which among the following statements is NOT true about Frenkel defect?

(A) It occurs in ionic compounds with sizes of cations and anions almost equal. (B) The density of solid crystal and its chemical properties remain unchanged as no ions are missing from the crystal lattice as a whole.

(C) The crystal as whole remains electrically neutral because equal number of cations and anions are present. (D) The ions of ionic compound must have low co-ordination number.

76. Calculate the number of unit cells in 3 grams metal that crystallises to simple cubic unit cell having edge length 336pm. (density of metal $= 9.4\ g\ cm^{-3}$)

(A) 8.41×10^{21} (B) 6.25×10^{21}

(C) 7.15×10^{21} (D) 5.82×10^{21}

77. Calculate the molality of a solution having freezing point depression 3.6 K and freezing point depression constant 4.8 K kg mol^{-1}.

(A) 0.3 mol kg^{-1} (B) 0.9 mol kg^{-1}

(C) 0.75 mol kg^{-1} (D) 0.5 mol kg^{-1}

78. Which among the following colligative properties is useful to determine molar masses of very expensive solutes?

(A) Vapour pressure lowering (B) Osmotic pressure

(C) Freezing point depression (D) Boiling point elevation

79. Calculate the molar mass of solute when 1.5 gram nonvolatile solute dissolved in 100 mL solvent having density 0.8 g mL^{-1} lowers its freezing point by 0.75 K. (Freezing point depression constant for solvent is 5 K kg mol^{-1})

(A) 125 g mol^{-1} (B) 110 g mol^{-1}

(C) 100 g mol^{-1} (D) 75 g mol^{-1}

80. Which among the following concentration of KCl solution is not used to determine cell constant of conductivity cell?

(A) Saturated KCl (B) 1.0MKCl

(C) 0.01MKCl (D) 0.1MKCl

81. Calculate mass of a divalent metal produced at cathode by passing 5amp current through its salt solution for 100 minutes. (Molar mas of metal $= x$)

(A) $\frac{193}{30}x$ (B) $\frac{193}{15}x$

(C) $\frac{15}{193}x$ (D) $\frac{30}{193}x$

82. The conductivity of 0.20MKCl solution at 300 K is $0.0248\Omega^{-1}$ cm^{-1}. What is its molar conductivity?

(A) $124\Omega^{-1}$ cm^2 mol^{-1} (B) $93\Omega^{-1}$ cm^2 mol^{-1}

(C) $62\Omega^{-1}$ cm^2 mol^{-1} (D) $186\Omega^{-1}$ cm^2 mol^{-1}

83. For the reaction $2\,A + B \rightarrow$ product, rate of the reaction is 15×10^{-2} $moldm^{-3}$ sec^{-1}. When $[A] = 0.3$ $moldm^{-3}$ and $[B] = 0.05$ $moldm^{-3}$. What is the value of rate constant if reaction is first order in both the reactants?

(A) 8 (B) 10

(C) 2 (D) 5

84. Which is the correct relation between rate constant and half-life of first order reaction?

(A) $k \times t_{1/2} = 0.693$ (B) $t_{1/2} = \frac{k}{0.693}$

(C) $k \times t_{1/2} = \frac{1}{0.639}$ (D) $k \times 0.693 = t_{1/2}$

85. What is half-life of a first order reaction if time required to decrease concentration of reactant from 0.8 $moldm^{-3}$ to 0.2 $moldm^{-3}$ is 12 hour?

(A) 6 hour (B) 3 hour

(C) 1.5 hour (D) 12 hour

86. Which among the following is an example of sorption?

(A) Oxygen gas is passed over finely divide nickel (B) Charcoal is added to methylene blue solution

(C) Chalk is dipped in ink (D) Hydrogen gas is passed over platinum

87. Which among the following lanthanoids forms most stable +2 oxidation state?

(A) Eu(Z = 63) (B) Ce(Z = 58)

(C) Pm(Z = 61) (D) Gd(Z = 64)

88. Which from following alloys is used for ultra-high speed flight?

(A) Cupra-nickel (B) Bronze

(C) Titanium alloy (D) Nichrome

89. Identify the type of isomerism exhibited by complex compounds. $[Cr(H_2O)_6]Cl_3$ and $\left[Cr(H_2O)_5Cl^2\right]$ Cl_2H_2O

(A) Linkage isomerism (B) Ionization isomerism

(C) Coordination isomerism (D) Solvate isomerism

90. Identify the formula of Bis (ethylenediamine) dithiocynatoplatinum (iv).

(A) $Pt[(en)_2\ S_2CN]^{4-}$ (B) $Pt[(en)(SCN)_2]^{4-}$

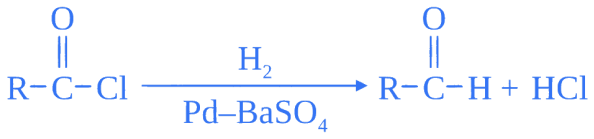
(C) $Pt[(en)_2\ S_2CN]^{4+}$ (D) $Pt[(en)_2(SCN)_2]^{2+}$

91. Which among the following is obtained as a product when phenol is treated with NaOH and CO_2 followed by acid hydrolysis?

(A) Phthalic acid (B) Benzoic acid

(C) Salicyalaldehyde (D) Salicylic acid

92. What is the name of following reaction?



(A) Stephen reaction (B) Aldol condensation

(C) Rosenmund reduction (D) Etard reaction

93. Identify the compound X in the following reaction.

$$+X \xrightarrow{\Delta} CHI_3 \downarrow + CH_3 - COONa + 2NaOH$$

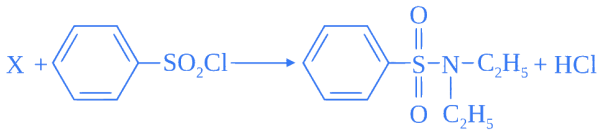
Acetone

(A) NaOI
(B) dil. NaOH
(C) $K_2Cr_2O_7$
(D) conc. KOH

94. Which among the following reactions forms acid anhydride?

(A) R – COOH treated with $NaHCO_{3(aq)}$
(B) R – COOH treated with PCl_5
(C) R – COOH (excess) heated in presence of P_2O_5
(D) R – COOH treated with $R' - OH$ and heated

95. Identify compound X in the following reaction.



(A) $(C_2H_5)_3 - N$
(B) $C_2H_5 - NH_2$
(C) $(C_2H_5)_2 - NH$
(D) $CH_3 - NH - C_2H_5$

96. Which among the following reagents is used to distinguish primary, secondary and tertiary amines according to solubility in alkaline medium?

(A) Benzene sulphonyl chloride
(B) Ethylene glycol
(C) Iodoform
(D) Acetyl chloride

97. Which carbon atom of glucose, numbered from C – 1 to C – 6 converts its function group to –COOH group when heated with Br_2 water?

(A) C-6
(B) C-1
(C) C-2
(D) C-4

98. Which of the following reagents converts $-CH_2OH$ group of glucose to –COOH group?

(A) Hydrogen cyanide
(B) dil. nitric acid
(C) Acetic anhydride
(D) Hydroxyl amine

99. Identify the monomers needed for synthesis of nylon 6,6 .

(A) Adipic acid and hexamethylenediamine
(B) Acrylonitrile and $\in$ caprolactam
(C) Ethylene glycol and $\in$ caprolactam
(D) Ethylene glycol and adipic acid

100. What is the molecular formula of a monomer used for preparation of teflon?

(A) C_2F_4
(B) C_2H_2
(C) C_2H_4
(D) C_2H_3CN

101. If the function $f(x) = x^3 - 3(a-2)x^2 + 3ax + 7$, for some $a \in R$ is increasing in $(0, 1]$ and decreasing in $[0, 5)$, then a root of the equation $\frac{f(x)-14}{(x-1)^2} = 0 (x \neq 1)$ is

(A) -7 (B) -14

(C) 7 (D) 14

102. If $[x]$ is greatest integer function and $2[2x-5] - 1 = 7$, then x lies in

(A) $[\frac{9}{2}, 5)$ (B) $[\frac{9}{2}, 5]$

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

103. If $\cot(A+B) = 0$, then $\sin(A+2B)$ is equal to

(A) $\sin 2A$ (B) $\cos A$

(C) $\sin A$ (D) $\cos 2A$

104. Let z be a complex number such that $|z| + z = 3 + i, i = \sqrt{-1}$, then $|z|$ is equal to

(A) $\frac{5}{4}$ (B) $\frac{\sqrt{41}}{4}$

(C) $\frac{\sqrt{34}}{3}$ (D) $\frac{5}{3}$

105. The polar co-ordinates of the point, whose Cartesian co-ordinates are $(-2\sqrt{3}, 2)$, are

(A) $(4, (\frac{11\pi}{12}))$ (B) $(4, (\frac{5\pi}{6}))$

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

106. If a question paper consists of 11 questions divided into two section I and II. Section I consist of 6 questions and section II consists of 5 question, then the number of different ways can student select 6 questions, taking at least 2 questions from each section, is

(A) 350 (B) 225

(C) 275 (D) 425

107. The joint equation of pair of lines through the origin and making an equilateral triangle with the line $y = 5$ is

(A) $3x^2 - y^2 = 0$ (B) $5x^2 - y^2 = 0$

(C) $x^2 - 3y^2 = 0$ (D) $\sqrt{3}x^2 - y^2 = 0$

108. If the line $3x - 4y - 7 = 0$ and $2x - 3y - 5 = 0$ pass through diameters of a circle of area 49π square units, then the equation of the circle is

(A) $x^2 + y^2 - 2x + 2y - 47 = 0$

(B) $x^2 + y^2 + 2x - 2y - 51 = 0$

(C) $x^2 + y^2 - 2x + 2y + 51 = 0$

(D) $x^2 + y^2 + 2x + 2y + 47 = 0$

109. If $\lim_{x\to 1} \frac{x^2-ax+b}{(x-1)} = 5$, then $(a+b)$ is equal to

(A) -3 (B) -4

(C) 7 (D) -7

110. The negation of the statement pattern $pv(q \rightarrow \sim r)$ is

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

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

111. If $p : \forall \in N, n^2 + n$ is an even number $q : \forall n \in N, n^2 - n$ is an odd number, then the truth values of $p \wedge q, p \wedge q$ and $p \rightarrow q$ are respectively

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

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

112. The negation of the statement "The payment will be made if and only if the work is finished in time" is

(A) The work is finished in time and the payment is not made

(B) Either the work finished in time and the payment is not made or the payment is made and the work is not finished in time

(C) The payment is made and the work is not finished in time

(D) The work is finished in time and the payment is not made or the payment is made and the work is finished in time

113. The variance and mean of 15 observations are respectively 6 and 10 . If each observation is increase by 8 then the new variance and new mean of resulting observations are respectively

(A) 14,10 (B) 14,18
(C) 6,18 (D) 6,10

114. If $\tan^{-1}\left(\frac{1-x}{1+x}\right)=\frac{1}{2}\tan^{-1}x$, then x has the value

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

115. The value of $\sin\left(2\sin^{-1}0.8\right)$ is equal to

(A) 0.48 (B) 0.16
(C) 0.96 (D) 0.12

116. The principal value of $\sin^{-1}\left(\sin\left(\frac{2\pi}{3}\right)\right)$ is

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

117. Given $\mathrm{A}=\begin{bmatrix}x & 3 & 2\\ 1 & y & 4\\ 2 & 2 & z\end{bmatrix}$, $xyz=60$ and $8x+4y+3z=20$, then $\mathrm{A}\cdot(\mathrm{adjA})$ is equal to

(A) $\begin{bmatrix}60 & 0 & 0\\ 0 & 60 & 0\\ 0 & 0 & 60\end{bmatrix}$ (B) $\begin{bmatrix}20 & 0 & 0\\ 0 & 20 & 0\\ 0 & 0 & 20\end{bmatrix}$
(C) $\begin{bmatrix}68 & 0 & 0\\ 0 & 68 & 0\\ 0 & 0 & 68\end{bmatrix}$ (D) $\begin{bmatrix}108 & 0 & 0\\ 0 & 108 & 0\\ 0 & 0 & 108\end{bmatrix}$

118. If $A=\begin{bmatrix}1 & 2 & 1\\ 3 & 1 & 3\end{bmatrix}$ and $B=\begin{bmatrix}2 & 3\\ 1 & 2\\ 1 & 2\end{bmatrix}$, then $(AB)^{-1}=$

(A) $\begin{bmatrix}\frac{-17}{5} & \frac{9}{5}\\ 2 & -1\end{bmatrix}$ (B) $\begin{bmatrix}\frac{17}{5} & \frac{9}{5}\\ 2 & 1\end{bmatrix}$
(C) $\begin{bmatrix}\frac{-17}{5} & 2\\ \frac{-9}{5} & -1\end{bmatrix}$ (D) $\begin{bmatrix}\frac{-17}{5} & 2\\ \frac{9}{5} & 1\end{bmatrix}$

119. If $f(x)=\begin{cases}ax^2+bx+1 & \text{if } |2x-3|\geq 2\\ 3x+2 & ;\text{ if } \frac{1}{2}<x<\frac{5}{2}\end{cases}$ is continuous on its domain, then $a+b$ has the value

(A) $\frac{23}{5}$ (B) $\frac{1}{5}$
(C) $\frac{13}{5}$ (D) $\frac{31}{5}$

120. If $y=\cos\left(\sin x^2\right)$, then $\frac{dy}{dx}atx=\sqrt{\frac{\pi}{2}}$ is

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

121. If $y=\sin\left(2\tan^{-1}\sqrt{\frac{1+x}{1-x}}\right)$, then $\frac{dy}{dx}$ is equal to

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

122. If $y=\log\sqrt{\frac{1+\sin x}{1-\sin x}}$, then $\frac{dy}{dx}$ at $x=\frac{\pi}{3}$ is

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

123. If $y^{\frac{1}{m}}+y^{\frac{-1}{m}}=2x, x^1 1$, then $\left(x^2-1\right)\left(\frac{dy}{dx}\right)^2$ is equal to

(A) m^2y (B) m^2y^2
(C) my^2 (D) $\frac{my^2}{2}$

124. If the normal to the curve $y=f(x)$ at the point $(3,4)$ makes and angle $\left(\frac{3\pi}{4}\right)^{\mathrm{C}}$ with positive X-axis, then $f'(3)$ is equal to

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

125. A spherical iron ball of 10 cm radius is coated with a layer of ice of uniform thickness that melts at the rate of $50\ \mathrm{cm}^3/\min$. If the thickness of ice is 5 cm, then the rate at which the thickness of ice decrease is

(A) $\frac{1}{18\pi}\mathrm{cm}/\min$ (B) $\frac{2}{9\pi}\mathrm{cm}/\min$
(C) $\frac{-1}{18\pi}\mathrm{cm}/\min$ (D) $\frac{1}{3\pi}\mathrm{cm}/\min$

126. A firm is manufacturing 2000 items. It is estimated that the rate of change of production P with respect to additional number of workers x is given by $\frac{dp}{dx}=100-12\sqrt{x}$. If the firm employs 25 more workers, then the new level of production of items is

(A) 2500 (B) 3000
(C) 3500 (D) 4500

127. If $\int e^{x^2}\cdot x^3dx=e^{x^2}f(x)+C$ (where C is a constant of integration) and $f(1)=0$, then value of $f(2)$ will be

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

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128. If $f(x) = \sqrt{\tan x}$ and $g(x) = \sin x \cdot \cos x$, then $\int \frac{f(x)}{g(x)} dx$ is equal to (where C is a constant of integration)

(A) $\sqrt{\tan x} + C$ (B) $\frac{1}{2}\sqrt{\tan x} + C$

(C) $\frac{3}{2}\sqrt{\tan x} + C$ (D) $2\sqrt{\tan x} + C$

129. $\int \frac{3x-2}{(x+1)(x-2)^2} dx =$ (where C is a constant of integration.)

(A) $\frac{-5}{9}\log(x+1) + \frac{5}{9}\log(x-2) - \frac{4}{3} \times \frac{1}{(x-2)} + C$

(B) $\frac{1}{9}\log(x+1) + \frac{5}{9}\log(x-2) - \frac{4}{3} \times \frac{1}{(x-2)} + C$

(C) $\frac{-5}{9}\log(x+1) + \frac{5}{9}\log(x-2) + \frac{4}{3} \times \frac{1}{x-2} + C$

(D) $\frac{-5}{9}\log(x+1) + \frac{1}{9}\log(x-2) + \frac{1}{x-2} + C$

130. $\int \frac{\sin\frac{5x}{2}}{\sin\frac{x}{2}} dx =$ (where C is a constant of integration.)

(A) $x + \sin x + 2\sin 2x + C$

(B) $x + 2\sin x + 2\sin 2x + C$

(C) $x + 2\sin x + \sin 2x + C$

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

131. $\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \frac{dx}{1+\cos x}$ is equal to

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

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

132. $\int_0^2 [x]dx + \int_0^2 |x-1|dx =$ (where $[x]$ denotes the greatest integer function.)

(A) 3 (B) 4

(C) 1 (D) 2

133. The value of the integral $\int_0^1 \sqrt{\frac{1-x}{1+x}} dx$ is

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

(C) $\left(\frac{\pi}{2}\right) + 1$ (D) 1

134. The area (in sq. units) of the region described by $A = \{(x,y)/x^2 + y^2 \leq 1$ and $y^2 \leq 1 - x\}$ is

(A) $\left(\frac{\pi}{2} - \frac{2}{3}\right)$ (B) $\left(\frac{\pi}{2} + \frac{4}{3}\right)$

(C) $\left(\frac{\pi}{2} - \frac{4}{3}\right)$ (D) $\left(\frac{\pi}{2} + \frac{2}{3}\right)$

135. The general solution of the differential equation $\frac{dy}{dx} = \frac{3x+y}{x-y}$ is (where C is a constant of integration.)

(A) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{y}{x\sqrt{3}}\right) - \log\left(\frac{y^2+3x^2}{x^2}\right)^{\frac{1}{2}} = \log(x) + C$

(B) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{y}{x\sqrt{3}}\right) + \log\left(\frac{y^2+3x^2}{x^2}\right)^{\frac{1}{2}} = \log(x) + C$

(C) $\tan^{-1}\left(\frac{y}{x}\right) + \log\left(\frac{y^2+3x^2}{x^2}\right) = \log(x) + C$

(D) $\tan^{-1}\left(\frac{x}{y}\right) + \log\left(\frac{y^2+3x^2}{x^2}\right) = \log(x) + C$

136. The differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ determines a family of circles with

(A) variable radii and a fixed centre at $(0,-1)$

(B) fixed radius of 1 unit and variable centres along the X-axis

(C) fixed radius of 1 unit and variable centres along the Y-axis

(D) variable radii and a fixed centre at $(0,1)$

137. Let $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ be two vectors. If $\vec{c}$ is a vector such that $\vec{b} \times \vec{c} = \vec{b} \times \vec{a}$ and $\vec{c} \cdot \vec{a}$ then $\vec{c} \cdot \vec{b}$ is equal to

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

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

138. If $\vec{a} = \hat{i} - \hat{k}, \vec{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}$ and $\vec{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$ then $[\vec{a}\vec{b}\vec{c}]$ depends on

(A) neither x nor y (B) only x

(C) only y (D) both x and y

139. $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, and $\vec{b} = \hat{i} - \hat{j} + \widehat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$ are three vectors then vector $\bar{r}$ in the plane of $\bar{a}$ and $\bar{b}$, whose projection on $\bar{c}$ is $\frac{1}{\sqrt{3}}$, is given by

(A) $(2\hat{i} - 1)\hat{i} - \hat{j} + (2t+1)\hat{k}, \forall t \in R$

(B) $(2t+1)\hat{i} - \hat{j} + (2t+1)\widehat{k}, \forall t \in R$

(C) $(2t-1)\hat{i} - \hat{j} + (2t-1)\widehat{k}, \forall t \in R$

(D) $(2t+1)\hat{i} - \hat{j} + (2t-1)\widehat{k}, \forall t \in R$

140. A line makes the same angle ' α ' with each of the x and y axes. If the angle ' θ ', which it makes with the z-axis, is such that $\sin^2\theta = 2\sin^2\alpha$, then the angle α is

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

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

141. The magnitude of the projection of the vector $2\hat{i}+3\hat{j}+\hat{k}$ on the vector perpendicular to the plane containing the vectors $\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}+3\hat{k}$ is

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

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

142. The equation of the lines passing through the point $(3,2)$ and making an acute angle of 45° with the lien $x-2y-3=0$ are

(A) $x+2y-7=0, 2x-y-4=0$

(B) $3x+y-11=0, x+3y-9=0$

(C) $3x-y-7=0, x+3y-9=0$

(D) $3x+y-11=0, x+3y+9=0$

143. The distance between parallel lines $\frac{x-1}{2}=\frac{y-2}{-2}=\frac{z-3}{1}$ and $\frac{x}{2}=\frac{y}{-2}=\frac{z}{1}$ is

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

(C) $\frac{\sqrt{5}}{3}$ units (D) $\frac{4\sqrt{5}}{3}$ units

144. A tetrahedron has vertices P$(1,2,1)$, Q$(2,1,3)$, R$(-1,1,2)$ and O$(0,0,0)$. Then the angle between the faces OPQ and PQR is

(A) $\cos^{-1}\left(\frac{17}{35}\right)$ (B) $\cos^{-1}\left(\frac{19}{31}\right)$

(C) $\cos^{-1}\left(\frac{19}{35}\right)$ (D) $\cos^{-1}\left(\frac{17}{31}\right)$

145. The equation of the plane passing through the points $(2,3,1)$, $(4,-5,3)$ and parallel to X-axis is

(A) $3y+4z=13$ (B) $y-4z=-1$

(C) $2y+4z=19$ (D) $y+4z=7$

146. The cartesian equation of a line passing through $(1,2,3)$ and parallel to planes $x-y+2z=5$ and $3x+y+z=6$ is

(A) $\frac{x-1}{-3}=\frac{y-2}{-5}=\frac{z-3}{4}$ (B) $\frac{x-1}{-3}=\frac{y-2}{5}=\frac{z-3}{4}$

(C) $\frac{x-1}{13}=\frac{y-2}{-1}=\frac{z-3}{1}$ (D) $\frac{x-1}{3}=\frac{y-2}{1}=\frac{z-3}{1}$

147. Maximum value of $Z=5x+2y$, subject to $2x-y\geq 2, x+2y\leq 8$ and $x,y\geq 0$ is

(A) 28 (B) 25.6

(C) 40 (D) 17.6

148. The incidence of occupational disease in an industry is such that the workmen have a 10% chance of suffering from it. The probability that out of 5 workmen, 3 or more will contract the disease is

(A) 0.0856 (B) 0.000856

(C) 0.00856 (D) 0.0000856

149. If $P(A\cup B)=0.7, P(A\cap B)=0.2$, then $P(A')+P(B')$ is

(A) 1.1 (B) 0.6

(C) 1.8 (D) 1.6

150. Two cards are drawn successively with replacement from a well shuffled pack of 52 cards. The mean of number of kings is

(A) $\frac{4}{169}$ (B) $\frac{1}{13}$

(C) $\frac{1}{169}$ (D) $\frac{2}{13}$

- End of Question Paper -