MHT CET 2026 PCM Apr 13 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. The period of oscillation of a simple pendulum is $T = 2\pi(L/g)^{1/2}$. Measured value of 'L' is 10 cm known to 1 mm accuracy and time for 100 oscillations is 50 second, using a watch of 1 second resolution. The percentage error in the measurement of 'g' is

(A) 2%
(B) 4%
(C) 5%
(D) 8%

2. The vector sum of the two forces $\vec{A}$ and $\vec{B}$ is perpendicular to their vector difference. Hence forces $\vec{A}$ and $\vec{B}$ are

(A) perpendicular to each other
(B) unequal in magnitude
(C) parallel to each other
(D) equal in magnitude

3. According to Boyle's law, the product PV remains constant. The SI unit of PV is same as that of

(A) momentum
(B) energy
(C) force
(D) impulse

4. A string of length 'L' fixed at one end carries a mass 'm' at the other end. The string makes $\frac{3}{\pi}$ r.p.s. around the vertical axis through fixed end. The tension in the string is

(A) $72mL$
(B) $36mL$
(C) $18mL$
(D) $9mL$

5. A stationary body explodes into two parts of masses M_1 and M_2. They move in opposite directions with velocities V_1 and V_2. The ratio of their kinetic energies is

(A) $\frac{M_1}{M_2}$
(B) $\frac{M_2}{M_1}$
(C) $\frac{M_1^2}{M_2^2}$
(D) $\frac{M_2^2}{M_1^2}$

6. A body slides down a smooth inclined plane of inclination θ and reaches the bottom with velocity 'V'. If the same body is a ring which rolls down the same inclined plane then linear velocity at the bottom of the plane is

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

7. The relative angular speed of hour hand and minute hand of clock is

(A) $\frac{2\pi}{60}$
(B) $\frac{11\pi}{360}$
(C) $\frac{11\pi}{21600}$
(D) $\frac{2\pi}{3600}$

8. A disc of radius 0.4 m and mass 1 kg rotates about an axis passing through its centre and perpendicular to its plane. The angular acceleration is 10 rad/s^2. The tangential force applied to the rim of the disc is

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

9. A body is projected vertically from earth's surface of radius R with velocity equal to half the escape velocity. The maximum height reached by the body is

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

10. Two small drops of liquid of same radius coalesce to form a big drop. The ratio of the total surface energies after and before the change is

(A) 2 : 1
(B) $\sqrt{2}$: 1
(C) $2^{-1/3}$: 1
(D) 1 : 2

11. Three liquids have same surface tension and have densities ρ_1, ρ_2 and ρ_3 $(\rho_1 > \rho_2 > \rho_3)$. In three identical capillaries rise of liquid is same. The corresponding angles of contact θ_1, θ_2 and θ_3 are related as

(A) $\theta_1 > \theta_2 > \theta_3$
(B) $\theta_1 < \theta_2 < \theta_3$
(C) $\theta_1 = \theta_2 = \theta_3$
(D) $\theta_1 > \theta_2 < \theta_3$

12. The work done in splitting a water drop of radius 'R' into 64 droplets is (T is the surface tension of water)

(A) $8\pi R^2T$
(B) $12\pi R^2T$
(C) $4\pi R^2T$
(D) $16\pi R^2T$

13. A celsius and a Fahrenheit thermometer are dipped in boiling water. The temperature of water is lowered until the Farenheit thermometer shows 140°. What is the fall in temperature on the Celsius thermometer?

(A) 60° C (B) 40° C
(C) 50° C (D) 80° C

14. Rate of radiation by a black body is 'R' at temperature 'T'. Another body has same area but emissivity is 0.2 and temperature 3T. Its rate of radiation is

(A) R (B) $2R$
(C) $16.2R$ (D) $0.2R$

15. A black rectangular surface of area A emits energy E per unit time at 27° C. If length and breadth is reduced to $\left(\frac{1}{4}\right)^{th}$ of initial value and temperature is raised to 327° C, then energy emitted per unit time becomes

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

16. The change in internal energy of the mass of gas, when the volume changes from V to 2V at constant pressure P is (γ is the ratio of specific heat at constant pressure to that of volume) ($\gamma = \frac{C_p}{C_v}$)

(A) $\frac{PV}{\gamma - 1}$ (B) $\frac{PV}{\gamma + 1}$
(C) $\frac{(\gamma - 1)}{PV}$ (D) $\frac{(\gamma + 1)}{PV}$

17. An ideal gas expands adiabatically ($\gamma = 1.5$). To reduce the r.m.s. velocity of the molecules 3 times the gas has to be expanded

(A) 9 times (B) 81 times
(C) 3 times (D) 27 times

18. A simple pendulum oscillates with an angular amplitude θ. If the maximum tension in the string is twice the minimum tension then θ is

(A) $\cos^{-1}(0.75)$ (B) $\cos^{-1}(0.5)$
(C) $\sin^{-1}(0.5)$ (D) $\sin^{-1}(0.75)$

19. A spring executes S.H.M. with mass 10 kg attached to it. The force constant of spring is 10 N/m. If at any instant its velocity is 40 cm/s, the displacement at that instant is
(Amplitude of S.H.M. is 0.5 m)

(A) 0.1 m (B) 0.3 m
(C) 0.5 m (D) 0.6 m

20. Waves having a velocity 10m/s, strike a stationary boat near the sea shore. The distance between two consecutive crests of the waves is 40m. After how many second, the consecutive waves strike the boat?

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

21. A musical instrument P produces sound waves of frequency 'n' and amplitude 'A'. Another musical instrument Q produces sound waves of frequency n/4. The waves produced by P and Q have equal energies. The amplitude of waves produced by Q will be

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

22. In a stationary wave, all the particles

(A) except at node vibrate in S.H.M. of same period but of different amplitudes
(B) vibrate in S.H.M. of same period and amplitude
(C) except at nodes vibrate in S.H.M. of same period and same amplitude
(D) vibrate in S.H.M. of different periods and different amplitudes

23. In fundamental mode, the time required for the sound wave to reach upto the closed end of a pipe filled with air is t second. The frequency of vibration of air column is
(λ = wavelength of the wave)

(A) $\frac{1}{t}$ (B) $\frac{0.25}{t}$
(C) $\frac{\lambda}{4t}$ (D) t

24. A sonometer wire is vibrating in third overtone. There are

(A) 5 nodes and 4 antinodes
(B) 4 nodes and 5 antinodes
(C) 4 nodes and 4 antinodes
(D) 5 nodes and 5 antinodes

25. A charge 'Q' C is placed at the centre of a cube. The electric flux through two opposite faces of the cube is
(ϵ_0 = permittivity of free space)

(A) $\frac{Q}{6\epsilon_0}$ (B) $\frac{Q}{3\epsilon_0}$
(C) $\frac{Q}{\epsilon_0}$ (D) $\frac{Q}{2\epsilon_0}$

26. The capacitance of a capacitor becomes $\frac{7}{6}$ times the original value if dielectric slab of thickness $t = \frac{2d}{3}$ is introduced between the plates, where 'd' is the distance of separation between the plates. The dielectric constant of the slab is

(A) $\frac{9}{11}$ (B) $\frac{14}{11}$
(C) $\frac{8}{11}$ (D) $\frac{12}{11}$

27. Two identical parallel plate air capacitors are connected in series to a battery of e.m.f. 'V'. If one of the capacitor is inserted in liquid of dielectric constant 'K' then potential difference of the other capacitor will become

(A) $\frac{KV}{K+1}$ (B) $\frac{KV}{K-1}$
(C) $\frac{K+1}{KV}$ (D) $\frac{K-1}{KV}$

28. A condenser of capacity C_1 is charged to potential V_1 and then disconnected. Uncharged capacitor of capacity C_2 is connected in parallel with C_1. The resultant potential V_2 is

(A) $\frac{C_1V_1}{C_2}$ (B) $\frac{C_1V_1}{C_1+C_2}$
(C) $\frac{C_2V_1}{C_1}$ (D) $\frac{C_2V_1}{C_1+C_2}$

29. A potentiometer wire is 4 m long and potential difference of 3V is maintained between the ends. The e.m.f. of the cell which balances against a length of 100 cm of the poteniometer wire is

(A) 0.25 V (B) 0.50 V
(C) 0.75 V (D) 1.0 V

30. Two wires A and B of equal lengths are connected in left and right gap respectively of a metre bridge, null point is obtained at 40 cm from left end. Diameters of the wires A and B are in the ratio 3:1 respectively, the ratio of specific resistance of A to that of B is

(A) 2 : 1 (B) 3 : 1
(C) 6 : 1 (D) 12 : 1

31. An iron rod is placed parallel to magnetic field intensity 2000 A/m. The magnetic flux through rod is 6×10^{-4} wb and its cross sectional area is 3 cm^2. The magnetic permeability of the rod in wb/A-m is

(A) 10^{-1} (B) 10^{-2}
(C) 10^{-3} (D) 10^{-4}

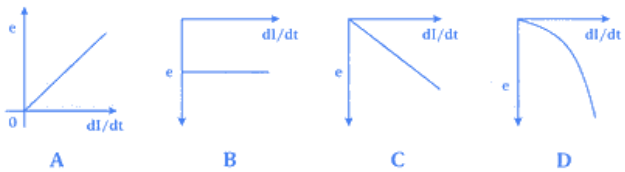
32. The magnetic flux near the axis and inside the air core solenoid of length 60 cm carrying current I is $\frac{\pi}{2} \times 10^{-6}$ Wb. Its magnetic moment will be (cross-sectional area is very small as compared to length of solenoid, μ_0 = Permeability of free space = $4\pi \times 10^{-7}$ SI unit)

(A) 0.75 Am^2 (B) 0.25 Am^2
(C) 0.50 Am^2 (D) 1.0 Am^2

33. If the number of turns in the coil of a moving coil galvanometer decreases, the resistance of the galvanometer,

(A) decreases (B) increases
(C) remains the same (D) may increase or decrease

34. The current flowing through the inductor of self inductance 'L' is continuously increasing at constant rate. The variation of induced e.m.f. (e) versus $\frac{dI}{dt}$ is shown graphically by figure



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

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35. Two coils P and Q have mutual inductance 'M' H. If the current in the coil P is $I = I_0 \sin \omega t$, then the maximum value of e.m.f. induced in coil Q is

(A) $\frac{\omega}{MI_0}$ (B) $\frac{M\omega}{I_0}$

(C) $M\omega I_0$ (D) $\frac{MI_0}{\omega}$

36. In series LCR circuit C = 2 uF, L=1 mH and R= 10 Ω. What is the ratio of energies stored in the capacitor and inductor when maximum current flows through circuit?

(A) 0.1 : 1 (B) 0.4 : 1

(C) 0.2 : 1 (D) 0.8 : 1

37. In series LCR resonant circuit, R=800 Ω, C = 2 μF and voltage across resistance is 200 V. The angular frequency is 250 rad/s. At resonance the voltage across the capacitance is

(A) 250 V (B) 500 V

(C) 1000 V (D) 750 V

38. An alternating e.m.f. is given by $e = e_0 \sin \omega t$. In what time the e.m.f. will have half its maximum value, if 'e' starts from zero? ($\sin 30^\circ = 0.5$)

(A) $\frac{T}{4}$ (B) $\frac{T}{8}$

(C) $\frac{T}{12}$ (D) $\frac{T}{16}$

39. A resistor of 100 Ω, inductor of self inductance $\left(\frac{4}{\pi^2}\right)$ H and a capacitor of unknown capacity are connected in series to an a.c. source of 200 V and 50 Hz. When the current and voltage are in phase, the value of capacity is

(A) 40 μF (B) 50 μF

(C) 20 μF (D) 25 μF

40. If a parallel beam of light is incident on spherical mirrors then after reflection they pass through focal point. If F is the focal length and R is the radius of curvature of mirror then

(A) $R = F$ (B) $R = 2F$

(C) $R = F/2$ (D) $R = F/4$

41. Choose the correct statement from the following.
Brewster's angle for a transparent medium is

(A) different for light of different colours (B) same for lights of different colours

(C) independent of refractive index of the medium (D) different for lights of same colour

42. In Young's double slit experiment, the angular width of a fringe is found to be 0.2° on a screen placed 1m away. The wavelength of light used in 600 nm. If the entire apparatus is immersed in water of refractive index 4/3. the angular width of the fringe will be

(A) 0.10° (B) 0.15°

(C) 0.20° (D) 0.25°

43. According to corpuscular theory of light, Which is NOT the property of light?

(A) The velocity of light does not change after reflection (B) Light travels in a straight line

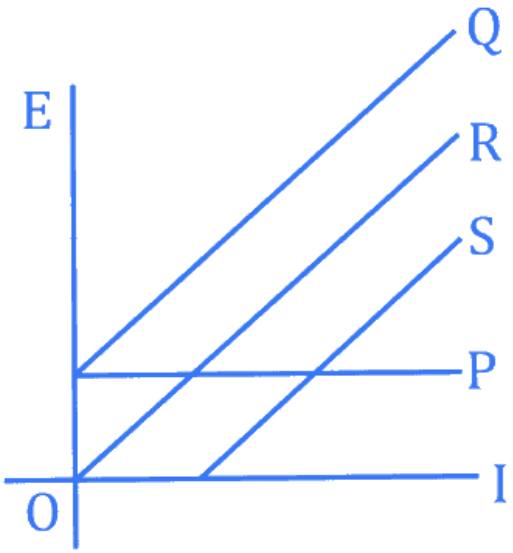
(C) The velocity of light in air is greater than in glass (D) The velocity of light changes after refraction

44. Energy of the incident photons on the photosensitive metal surface is 3W and then 5W where 'W' is the work function of that metal. The ratio of velocities of the emitted photoelectrons is

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

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

45. Which one of the four graphs showing lines P, Q, R and S between maximum kinetic energy (E) and intensity of incident radiation (I) is correct?



(A) P (B) Q
(C) R (D) S

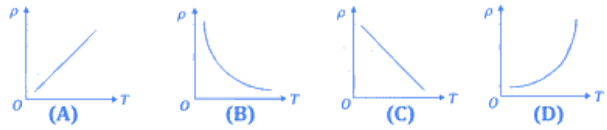
46. The ratio of centripetal acceleration for an electron revolving in 3rd and 5th Bohr orbit of hydrogen atom is

(A) 25 : 9 (B) 125 : 27
(C) 625 : 81 (D) 5 : 3

47. An electron is revolving in a circular orbit of radius 'r' in hydrogen atom. Using Bohr's theory, the angular momentum of the electron is
(M = magnetic dipole moment, m = mass of electron)

(A) $\frac{mM}{e}$ (B) $\frac{e}{mM}$
(C) $\frac{2mM}{e}$ (D) $\frac{e}{2mM}$

48. Which of the following graph represents the temperature (T) dependence of resistivity (ρ) of a semiconductor?



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

49. In common emitter mode of transistor, the d.c. current gain is 20, the emitter current is 7 mA. The collector current is

(A) $\frac{20}{3}$ mA (B) $\frac{14}{5}$ mA
(C) $\frac{1}{3}$ mA (D) $\frac{8}{13}$ mA

50. In transistor amplifier, base emitter junction is forward biased and collector base junction is reversed biased. The current gain is

(A) $\frac{\Delta I_C}{\Delta I_B}$ (B) $\frac{\Delta I_B}{\Delta I_C}$
(C) $\frac{\Delta I_E}{\Delta I_B}$ (D) $\frac{\Delta I_B}{\Delta I_E}$

51. Which of the following contains maximum number of molecules?

(A) 0.4 g H_2 gas
(B) 3.2 g of O_2 gas
(C) 16.8 dm^3 of H_2 gas at STP
(D) 11.2 dm^3 of O_2 gas at STP

52. What is the atomic number of an element having ns^1 electronic configuration and belonging to 3d transition series?

(A) Only 24
(B) Only 25
(C) Only 29
(D) 24 and 29

53. The electronic configurations of elements are as-
$A = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
$B = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
Which of the following is formula of ionic compound that could be formed between these two elements A and B?

(A) A_2B
(B) AB_2
(C) AB_5
(D) A_5B_2

54. Which of the following pairs represents isobars?

(A) $^3He_2$ and $^4He_2$
(B) $^{24}Mg_{12}$ and $^{25}Mg_{12}$
(C) $^{40}K_{19}$ and $^{40}Ca_{20}$
(D) $^{40}K_{19}$ and $^{39}K_{19}$

55. Identify the type of hybridization of carbon that is attached to the OH group, in benzylic alcohol?

(A) sp
(B) sp^2
(C) sp^3
(D) $dsp2$

56. Calculate the temperature of 2 moles of gas occupying a volume of 5.0 liters at 24.6 atmospheres?
($R = 0.0821$ L atm K^{-1} mol^{-1})

(A) 476°C
(B) 480°C
(C) 440°C
(D) 450°C

57. For a certain reaction $\Delta H = -50$ kJ and $\Delta S = -100$ J/K find the temperature so that the reaction is spontaneous.

(A) 650 K
(B) 600 K
(C) 550 K
(D) 450 K

58. Calculate the enthalpy change of the reaction,
$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
if bond energies (kJ mol^{-1}):
Hâ_x0080__x0093_H = 436,
Clâ_x0080__x0093_Cl = 242,
Hâ_x0080__x0093_Cl = 431

(A) −184 kJ/mol
(B) −246 kJ/mol
(C) −242 kJ/mol
(D) −431 kJ/mol

59. A weak monobasic acid is 0.04 % dissociated in 0.25 M solution. What is pH of the solution?

(A) 2.5
(B) 4
(C) 5
(D) 10

60. What is the relationship between the degree of dissociation of a weak base and its concentration?

(A) The degree of dissociation of a weak base is directly proportional to square root of its concentration.
(B) The degree of dissociation of a weak base is inversely proportional to square root of its concentration.
(C) The degree of dissociation of a weak base doesn't depend on concentration.
(D) The degree of dissociation of a weak base is directly proportional to its concentration

61. Which of the following sentences is true for a basic solution?

(A) For basic solution, $[H_3O^+] = [OH^-]$
(B) In basic solution, the excess of OH^- ions are present.
(C) In the basic solution, there is excess of H_3O^+ ions.
(D) The pOH of a basic solution can be calculated by pOH $= -\log[H^+]$

62. Which of the following is NOT a redox reaction?

(A) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
(B) $Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$
(C) $Mg + 1/2O_2 \rightarrow Mg^{2+} + O^{2-}$
(D) $Fe_{(s)} + Cu^{2+}_{(aq)} \rightarrow Fe^{2+}_{(aq)} + Cu_{(s)}$

63. Identify the false statement regarding chirality from the following.

(A) SN^1 reaction yields 1:1 mixture of both enantiomers

(B) A recemic mixture shows zero dipole rotation

(C) Enantiomers are superimposable mirror images of each other

(D) The product obtained by SN^2 reaction of haloalkane having chirality at the reactive site shows inversion of configuration

64. Which of the following statements are TRUE?
(I) Inductive effect operates through the sigma bond
(II) Resonance effect operates through the pi bond
(III) Inductive effects operate through the pi bond
(IV) Resonance effect operates through the sigma bond

(A) (I) and (II)

(B) (II) and (III)

(C) (III) and (IV)

(D) (I) and (IV)

65. The cyclic π-molecular orbital formed by overlap of p-orbitals must contain,

(A) $(4n + 2)$ p electrons.

(B) $(2n + 2)$ p electrons.

(C) $(4n - 2)$ p electrons.

(D) $(2n - 2)$ p electrons.

66. Identify the reagent used in Etard reaction

(A) Acetic anhydride

(B) Anhydrous aluminum chloride

(C) DIBAL-H

(D) Chromyl chloride

67. An element with a molar mass 27g mol^{-1} forms a cubic unit cell. Calculate the number of atoms present in a unit cell if the density of metal is 2.7g cm^{-3}.
$[a^3 \times N_A = 40\ cm^3\ mol^{-1}]$

(A) 1

(B) 2

(C) 4

(D) 6

68. A compound formed by elements A and B crystallizes in a cubic structure where A atoms are at the corner of the cube and B atoms are at the center of the cube. What is the formula of the compound?

(A) AB

(B) A_2B

(C) AB_2

(D) A_2B_2

69. Which of the following dopant is NOT used in Ge to obtain n-type semiconductor?

(A) P

(B) As

(C) Sb

(D) B

70. 2 g nonelectrolyte solute when dissolved in 50 g water increases its boiling point by 0.13 K. Calculate the molar mass of solute if molal elevation constant of water is 0.52 K kg mol^{-1}

(A) 140 g/mol

(B) 150 g/mol

(C) 160 g/mol

(D) 170 g/mol

71. Which of the following aqueous solutions will show maximum vapour pressure at 300K?

(A) 1 M NaCl

(B) 1 M $CaCl_2$

(C) 1 M $AlCl_3$

(D) 1 M $C_{12}H_{22}O_{11}$

72. Identify a pair of gases from following that does not obey Henry's law.

(A) NH_3 and CO_2

(B) CO_2 and O_2

(C) NH_3 and N_2

(D) N_2 and CH_4

73. Calculate the molar conductivity of 0.2 M KCl solution at 298 K ($k = 0.0248\ \Omega^{-1}cm^{-1}$)

(A) 143 Ω^{-1} cm^2 mol^{-1}

(B) 98 Ω^{-1} cm^2 mol^{-1}

(C) 124 Ω^{-1} cm^2 mol^{-1}

(D) 87 Ω^{-1} cm^2 mol^{-1}

74. Identify from following cell reactions that is spontaneous under standard state of conditions.

(A) $Ca(s) + Cd^{2+}(aq) \rightarrow Ca^{2+}(aq) + Cd(s)$,
$[E^0_{Ca} = -2.866\ V\ \&\ E^0_{Cd} = -0.403\ V]$

(B) $2Br^-(s) + Sn^{2+}(aq) \rightarrow Br_2(l) + Sn(s)$,
$[E^0_{Br} = 1.08\ V\ \&\ E^0_{Sn} = -0.136\ V]$

(C) $2Ag(s) + Ni^{2+}(aq) \rightarrow 2Ag^+(aq) + Ni(s)$,
$[E^0_{Ag} = 0.799\ V\ \&\ E^0_{Ni} = -0.257\ V]$

(D) $2Au(s) + Zn^{2+}(aq) \rightarrow 2Au^+(aq) + Zn(s)$,
$[E^0_{Au} = 1.68\ V\ \&\ E^0_{Zn} = -0.763\ V]$

75. Identify the correct name of law.
"At infinite dilution each ion migrates independent of co-ion and contributes to total molar conductivity of an elctrolyte irrespective of the nature of other ion to which it is associated."

(A) Henry's law
(B) Raoult's law
(C) Nernst derivative law
(D) Kohlrausch's law of independent migration of ions

76. For the reaction, $A + B \rightarrow P$, the rate law is rate $= k[A][B]^2$. The rate of reaction is 0.25 Ms^{-1} when $[A] = 1$ M, $[B] = 0.2$ M at 25°C. Calculate the rate constant of the reaction at the same temperature.

(A) 6.25 $M^{-2}s^{-1}$
(B) 6.0 $M^{-2}s^{-1}$
(C) 6.5 $M^{-2}s^{-1}$
(D) 6.75 $M^{-2}s^{-1}$

77. In first order reaction, 20 % concentration remains after 10 min. What would be the rate constant of reaction if $\log_{10}(5) = 0.6989$?

(A) 1.609 min^{-1}
(B) 6.989 min^{-1}
(C) 16.09 min^{-1}
(D) 0.1609 min^{-1}

78. Identify a type of order of reaction that its unit of rate constant is mol $dm^{-3}s^{-1}$ from the following.

(A) Zero-order reaction
(B) First-order reaction
(C) Second-order reaction
(D) Third-order reaction

79. Identify the dimensional nature of nanoparticles by the following.

(A) one dimensional
(B) two dimensional
(C) four dimensional
(D) zero dimensional

80. Which of the following statements is correct for the spontaneous adsorption of a gas?

(A) ΔS is negative and, therefore ΔH should be highly positive
(B) ΔS is negative and therefore, ΔH should be highly negative.
(C) ΔS is positive and therefore, ΔH should be negative.
(D) ΔS is positive and therefore, ΔH should also be highly positive.

81. Identify the correct statement regarding lyophilic colloid from the following.

(A) It is irreversible.
(B) It is solvent hating colloid.
(C) It is formed only by special methods.
(D) It is solvent loving colloid.

82. In the Charring process, concentrated sulfuric acid reacts with sugar to give sugar charcoal. What is the role of conc. H_2SO_4 in this reaction?

(A) An oxidizing agent
(B) A sulfonating agent
(C) A dehydrating agent
(D) A decomposing agent

83. Which of the following is the correct decreasing order of oxidizing power of perhalate ions?

(A) $BrO_4^- < IO_4^- < ClO_4^-$
(B) $IO_4^- > BrO_4^- > ClO_4^-$
(C) $IO_4^- < BrO_4^- < ClO_4^-$
(D) $BrO_4^- > IO_4^- > ClO_4^-$

84. Which of the following elements is doped to a fiber amplifier in an optical fiber communication system?

(A) Tm
(B) Yb
(C) Er
(D) Nd

85. Which of the following comparisons is correct for Δ_0 of the following complexes?
I- $[Co(H_2O)_6]^{2+}$
II- $[Co(H_2O)_6]^{3+}$
III- $[Fe(H_2O)_6]^{3+}$
IV- $[Fe(CN)_6]^{3+}$

(A) I < II
(B) I < III
(C) IV < II
(D) II < I

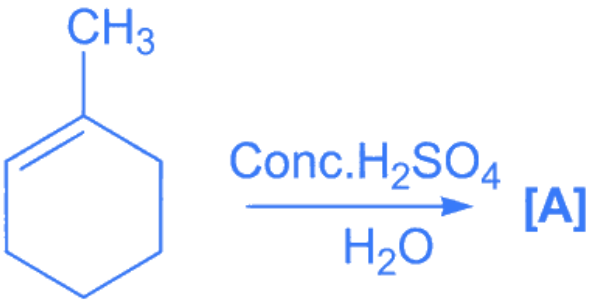
86. Among the given ligands, the negative ligand is

(A) Ammonia
(B) Methylamine
(C) Hydrazinium
(D) Nitrate

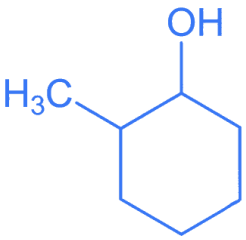
87. Which of the following compounds is obtained when Bromoethane is reacted with silver acetate?

(A) propanal
(B) acetic acid
(C) ethyl acetate
(D) methyl acetate

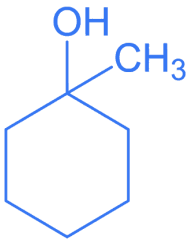
88. Find the structure of A in following reaction



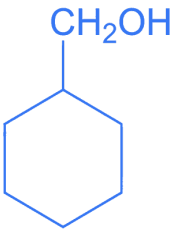
(A)



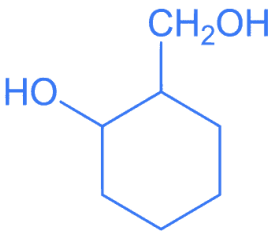
(B)



(C)



(D)



89. Identify the alcohol obtained when aldehyde other than formaldehyde is treated with Grignard's reagent followed by hydrolysis.

(A) Primary alcohol (B) Secondary alcohol
(C) Tertiary alcohol (D) Ketone

90. Identify the reagent used in the transformation of Ketone into semicarbazone.

(A) $NH_2 - OH$
(B) $NH_2 - NH_2$
(C) $NH_2 - NH - CONH_2$
(D) $NH_2 - NH - C_6H_5$

91. Identify the product obtained when ketone reacts with NH_2-NH_2.

(A) Aniline (B) Hydrazone
(C) Phenyl hydrazone (D) Anisole

92. Which of the following reagents is used to convert -CN group to -CH_2NH_2 group?

(A) CrO_3 (B) $Na + C_2H_5OH$
(C) H_3PO_4 (D) Al_2O_3

93. Which of the following reactions is exhibited only by primary amines?

(A) acetylation (B) alkylation
(C) reaction with nitrous acid (D) carbyl amine test

94. Which from following reagents is used to prepare alkyl isocyanides from RX?

(A) AgCN (alco) (B) NH_3 (alco)
(C) KNO_2 (D) $AgNO_2$

95. Which carbon atoms of glucose, numbered from 1 to 6 forms a hemiacetal structure between -CHO and -OH groups.?

(A) C-2 (B) C-3
(C) C-4 (D) C-5

96. Which one of the following is a globular protein?

(A) Insulin (B) Myosin
(C) Keratin in hair (D) Keratin in wool

97. Identify the cation present in chlorophyll in green plants.

(A) Mg^{2+} (B) Ca^{2+}
(C) Fr^{+} (D) Na^{+}

98. Identify the monomer used to prepare orlon.

(A) vinyl chloride (B) acrylonitrile
(C) styrene (D) tetrafluoroethylene

99. What type of polymer the natural rubber is?

(A) Fibre
(B) Elastomer
(C) Thermoplastic
(D) Thermosetting plastic

100. Identify the use of antipyretic drugs.

(A) To kill microorganism.
(B) To relieve pain.
(C) To reduce fever.
(D) To prevent pregnancy.

101. The polar form of the complex number $z = \frac{1}{1+i}$, (where $i = \sqrt{-1}$) is

(A) $\frac{1}{\sqrt{2}}\left(\cos\frac{7\pi}{4} + i\sin\frac{7\pi}{4}\right)$

(B) $\frac{1}{\sqrt{2}}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

(C) $\frac{1}{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

(D) $\frac{1}{2}\left(\cos\frac{7\pi}{4} + i\sin\frac{7\pi}{4}\right)$

102. The number of cubic equations that can be formed with the coefficients 0, 3, 2, 4, 5, 6 when repetition of coefficients is allowed, is....

(A) 720 (B) 1296

(C) 864 (D) 1080

103. $\tan 105^\circ =$ .....

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

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

104. The number of solutions in $\left[0, \frac{\pi}{2}\right)$ of the equation $\cos 3x \cdot \tan 5x = \sin 7x$ is

(A) 4 (B) 5

(C) 7 (D) 6

105. The area of the triangle formed by the co-ordinate axes and a line $px + qy = r$ (where p, q and r are positive real numbers) is $\frac{1}{54}$ sq.units, then ....

(A) p, 3r, q are in G.P. (B) $p^2 + q^2 = r^2$

(C) p, $3\sqrt{3}$ r, q are in G.P. (D) p, 27 r, q are in G.P.

106. The joint equation of the pair of lines through the origin and making an angle of $\frac{\pi}{4}$ with the line $3x + y - 6 = 0$ is

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

(B) $2x^2 + 3xy + 2y^2 = 0$

(C) $x^2 + 3xy - y^2 = 0$

(D) $x^2 - 3xy + y^2 = 0$

107. If a circle with center $(-1, 1)$ touches the line $x + 2y + 4 = 0$, then the co-ordinates of the point of contact are

(A) $(-2, -1)$ (B) $(8, -2)$

(C) $(2, -3)$ (D) $(4, -4)$

108. A point on the parabola $y^2 = \frac{36}{5}x$ at which the ordinate increases at thrice the rate of the abscissa is .....

(A) $\left(\frac{6}{5}, \frac{1}{5}\right)$ (B) $\left(\frac{1}{5}, \frac{6}{5}\right)$

(C) $(5, 6)$ (D) $\left(\frac{3}{5}, \frac{9}{5}\right)$

109. The area of the triangle formed by the lines joining the vertex of the parabola $x^2 = 48y$ to the ends of its latus rectum, is .....

(A) 144 sq. units (B) 288 sq. units

(C) 72 sq. units (D) 576 sq. units

110. $\lim\limits_{x\to 0}\left[\frac{\log|2+x| - \log|2-x|}{\tan x}\right] =$ .....

(A) 2 (B) 0

(C) -1 (D) 1

111. Consider the statement patterns

A. $(q \to p) \vee (p \to q)$

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

C. $[(p \vee q) \wedge \sim p] \wedge \sim q$

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

then statement patterns

(A) A and B are contradictions, C and D are tautologies.

(B) A and B are tautologies, C and D are contradictions.

(C) A, B, C, D all are tautologies.

(D) A, B, C, D all are contradictions.

112. The statement pattern $(p \wedge q) \to (r \vee \sim s)$ is false. Then the truth values of p, q, r and s are respectively

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

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

113. In a triangle ABC, with usual notations if $\frac{s-a}{11} = \frac{s-b}{12} = \frac{s-c}{13}$ and $\lambda \tan^2 \frac{A}{2} = 455$, then $\lambda =$

(A) 1155 (B) 1255

(C) 1355 (D) 1055

114. With usual notations, in $\triangle ABC$, if $2a^2 = b^2 + c^2$, then $\frac{\cos 3A}{\cos A} + 2 =$

(A) $\frac{b^2 - c^2}{2bc}$ (B) $\left(\frac{b^2 - c^2}{2bc}\right)^2$

(C) $\left(\frac{c^2 - b^2}{bc}\right)^2$ (D) $\frac{c^2 - b^2}{bc}$

115. With usual notations, in $\triangle ABC$, $(b-c)^2 \cos^2 \frac{A}{2} + (b+c)^2 \sin^2 \frac{A}{2} =$

(A) a^2 (B) $b^2 - c^2$

(C) $a^2 + b^2 + c^2$ (D) 0

116. Let $A = \begin{bmatrix} -5 & -3 \\ 2 & 1 \end{bmatrix}$. The Row transformation $R_1 \to R_1 + 3R_2$ will transform matrix A into

(A) an upper triangular matrix (B) a lower triangular matrix

(C) an identity matrix (D) a singular matrix

117. If $A = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}_{3\times 3}$, and $A^{-1} = \begin{bmatrix} \gamma & -1 & 1 \\ \alpha & 6 & -5 \\ \beta & -2 & 2 \end{bmatrix}_{3\times 3}$, then $|\alpha \cdot \beta \cdot \gamma| =$ _____ (where $|\cdot|$ denotes the absolute value)

(A) 125 (B) 220

(C) 225 (D) -225

118. If $y = \tan^{-1}\left\{\frac{\sqrt{1+x^2} - \sqrt{1-x^2}}{\sqrt{1+x^2} + \sqrt{1-x^2}}\right\}$, where $|x| < 1$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{-x}{\sqrt{1-x^4}}$ (B) $\frac{x}{\sqrt{1-x^4}}$

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

119. The value of $\tan^{-1}(\sqrt{3}) + \sec^{-1}(-2) - \sin^{-1}\left(-\frac{1}{2}\right)$ is

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

(C) $\frac{7\pi}{6}$ (D) $\frac{4\pi}{3}$

120. The domain of the function $f(x) = e^{\sqrt{5x-3-2x^2}}$ is

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

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

121. If $f(x) = \begin{cases} \frac{(8-2x)^{\frac{1}{3}} - 2}{3 - (243+5x)^{\frac{1}{5}}}, & \text{if } x \neq 0 \\ k, & \text{if } x = 0 \end{cases}$ is continuous at $x = 0$, then $k =$

(A) $\frac{5}{2}$ (B) $-\frac{5}{2}$

(C) $\frac{27}{2}$ (D) $\frac{-27}{2}$

122. If $y = x + e^x$, then $\frac{d^2x}{dy^2}$ is equal to

(A) $\frac{e^x}{(1+e^x)^2}$ (B) $\frac{-e^x}{(1+e^x)^2}$

(C) $\frac{e^x}{(1+e^x)^3}$ (D) $\frac{-e^x}{(1+e^x)^3}$

123. Let $f(x) = x - 5$.
If $g(x) = [f(4h(x) + 3)]^2$ and $h(1) = 4, h'(1) = -2$, then $g'(1) =$ .....

(A) -242 (B) -224

(C) -112 (D) -640

124. The equation of the normal to the curve $xy + 7 = 0$ is $Ax + By + C = 0$, then

(A) $A > 0, B > 0$ or $A < 0, B < 0$ (B) $A > 0, B < 0$

(C) $A < 0, B > 0$ (D) $C = 0$

125. A wire 40 metre in length is to be cut into two pieces. One piece is formed into a square and the other piece into a circle. The lengths of the two pieces so that the combined area of the square and the circle is minimum, are respectively

(A) $\frac{160}{\pi+4}, \frac{40\pi}{\pi+4}$ (B) $\frac{\pi+4}{160}, \frac{40\pi}{\pi+4}$

(C) $\frac{160}{\pi+4}, \frac{\pi+4}{40\pi}$ (D) 30, 10

126. If a spherical balloon has a variable diameter $3x + \frac{9}{2}$ units, then the rate of change of its volume with respect to x is

(A) $\frac{27\pi}{4}(2x+3)^2$ (B) $\frac{2\pi}{3}(2x+3)^2$

(C) $\frac{27\pi}{8}(2x+3)^2$ (D) $\frac{27\pi}{2}(2x+3)^2$

127. $\int \frac{30x^{14} + 15^x \log 225}{x^{15} + 15^x}\, dx =$

(A) $x^{15} + 15x^{14} + 30x^{13} + c$, where c is the constant of integration

(B) $\frac{\log(x^{15} + 15^x)}{2} + c$, where c is the constant of integration

(C) $\log(x^{15} + 15^x)^2 + c$, where c is the constant of integration

(D) $\log(x^{15} + 15^x) + c$, where c is the constant of integration

128. If $\int \frac{\sin 2x}{\sin^4 x + \cos^4 x}\, dx = f(x) + c$ where c is constant of integration, then the value of $\tan(f(x))$ is

(A) $\tan x$ (B) $\tan^2 x$

(C) $\tan^4 x$ (D) $\cot^4 x$

129. $\int e^{2x} \frac{2(\sin 2x \cos 2x - 1)}{2\sin^2 2x}\, dx = A\, e^{2x} \cot 2x + c$ (Where c is the constant of integration.), then $A^3 =$

(A) $\frac{1}{8}$ (B) 64

(C) 8 (D) $\frac{1}{64}$

130. If $\int_0^a \frac{dx}{1+4x^2} = \frac{\pi}{8}$, then $a =$

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

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

131. The value of the integral $\int_{-\sqrt{3}}^{\sqrt{3}} \frac{(2x^9 + 3x^8 - 5x^7 + 9x^6 + 4x^3 - x + 3)}{x^2 + 3}\, dx$ is

(A) $\frac{162}{7} + \sqrt{3}\frac{\pi}{4}$ (B) $\frac{162\sqrt{3}}{7} + \sqrt{3}\frac{\pi}{2}$

(C) $\frac{162\sqrt{3}}{7} + \frac{\pi}{2}$ (D) $\frac{162\sqrt{3}}{7} - \frac{\pi}{2}$

132. The area of the region (in sq.units) bounded by the curve $y = 2\sqrt{1-x^2}$ and the X-axis is

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

(C) π (D) $\frac{2\pi}{3}$

133. If $\frac{dy}{dx} = y + 5$ and $y(0) = 4$ then $y(\log 2)$ is equal to

(A) 2 (B) 5

(C) 7 (D) 13

134. The solution of the differential equation $\frac{dy}{dx} = \frac{x+y}{x-y}$ is

(A) $c(x^2+y^2)^{\frac{1}{2}} + e^{\tan^{-1}\left(\frac{y^2}{x}\right)} = 0$, where c is an arbitrary constant

(B) $c(x^2+y^2)^{\frac{1}{2}} = e^{\tan^{-1}\left(\frac{y}{x}\right)}$, where c is an arbitrary constant

(C) $c(x^2-y^2) = e^{\tan^{-1}\left(\frac{y}{x}\right)}$, where c is an arbitrary constant

(D) $c(x^2+y^2) = e^{\tan^{-1}\left(\frac{y}{x}\right)}$, where c is an arbitrary constant

135. A spherical balloon expands at a rate proportional to its surface area. Initially its radius is 2 cm and 5 minutes later it increases upto 7 cm, then surface area of spherical balloon after 12 minutes will be

(A) 2480 sq.cm. (B) 2460 sq.cm.

(C) 2464 sq.cm. (D) 2400 sq.cm.

136. Let $\bar{a}, \bar{b}, \bar{c}$ be three vectors having magnitudes 1, 1 and 2 respectively. If $\bar{a} \times (\bar{a} \times \bar{c}) + \bar{b} = \bar{0}$, then the acute angle between $\bar{a}$ and $\bar{c}$ is

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

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

137. The volume of a tetrahedron with vertices $5\hat{i} - \hat{j} + \hat{k}, 7\hat{i} - 4\hat{j} + p\hat{k}, \hat{i} - 6\hat{j} + 10\hat{k}$ and $-\hat{i} - 3\hat{j} + 7\hat{k}$ is 11 cubic units, then one of the values of p is

(A) 1 (B) 2

(C) 0 (D) 3

138. Let $\bar{a}, \bar{b}, \bar{c}$ be unit vectors such that $\bar{a}$ is perpendicular to the plane of $\bar{b}$ and $\bar{c}$. If the angle between $\bar{b}$ and $\bar{c}$ is $\frac{\pi}{3}$, then $|\bar{a}+\bar{b}+\bar{c}| =$

(A) 1 (B) 2

(C) 4 (D) 16

139. If a parallelogram is constructed on the vectors $\bar{a} = 3\bar{p} - \bar{q}, \bar{b} = \bar{p} + 3\bar{q}$ and $|\bar{p}| = 3, |\bar{q}| = 2$ and angle between $\bar{p}$ and $\bar{q}$ is $\frac{\pi}{3}$, then the ratio of the lengths of adjacent sides $\bar{a}$ and $\bar{b}$ of the parallelogram is

(A) $\sqrt{57} : \sqrt{54}$ (B) $\sqrt{67} : \sqrt{63}$

(C) $\sqrt{63} : \sqrt{47}$ (D) $\sqrt{57} : \sqrt{52}$

140. A vector $\bar{r}$ of magnitude $3\sqrt{2}$ units which makes angles of $\frac{\pi}{4}$ and $\frac{\pi}{2}$ respectively with Y and Z axes is

(A) $\bar{r} = \pm 3\hat{i} + 3\hat{j}$ (B) $\bar{r} = \hat{i} + \hat{j}$

(C) $\bar{r} = \pm 2\hat{i} + 3\hat{j}$ (D) $\bar{r} = \pm 5\hat{i} + \hat{j}$

141. The point having position vector $4\hat{i} - 11\hat{j} + 2\hat{k}$ lies on the line

(A) $\bar{r} = (6\hat{i} - 4\hat{j} + 5\hat{k}) + \lambda(\hat{i} + 7\hat{j} + 3\hat{k})$

(B) $\bar{r} = (6\hat{i} - 4\hat{j} + 5\hat{k}) + \lambda(2\hat{i} + \hat{j} + 3\hat{k})$

(C) $\bar{r} = (6\hat{i} - 4\hat{j} + 5\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + \hat{k})$

(D) $\bar{r} = (6\hat{i} - 4\hat{j} + 5\hat{k}) + \lambda(2\hat{i} + 7\hat{j} + 3\hat{k})$

142. The shortest distance between the lines, where the first line passes through $(0, 0, 0)$ and $(2, 0, 3)$ and the second line passes through $(2, 5, 0)$ and $(0, 4, 0)$ is

(A) $\frac{24}{7}$ units (B) $\frac{9}{7}$ units

(C) $\frac{1}{7}$ units (D) $\frac{36}{7}$ units

143. The co-ordinates of the foot of the perpendicular from the origin to the plane $2x - 3y - 6z = 49$ are...

(A) $(2, -3, -6)$ (B) $\left(\frac{2}{7}, \frac{-3}{7}, \frac{-6}{7}\right)$

(C) $(-2, 3, 6)$ (D) $\left(\frac{-2}{7}, \frac{3}{7}, \frac{6}{7}\right)$

144. Let a plane P pass through the point $(3, 7, -7)$ and contain the line $\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$. If the distance of the plane P from the origin is d, then d^2 is

(A) 2 (B) 3

(C) 4 (D) 6

145. The plane $\frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 1$ cuts the co-ordinate axes at the points A, B, C respectively. Then the area of triangle ABC is

(A) $\sqrt{61}$ sq. units (B) $\frac{\sqrt{61}}{2}$ sq. units

(C) $\frac{\sqrt{61}}{4}$ sq. units (D) $\frac{\sqrt{71}}{2}$ sq. units

146. In L.P.P., the corner points of the feasible region for the constraints $3x - y \geq 6, x \leq 3, y \leq 2, y \geq 0, x \geq 0$ are .....

(A) $(3, 2), (3, 0), (2, 0)$

(B) $\left(\frac{8}{3}, 2\right), (3, 2), (3, 0), (2, 0)$

(C) $(0, 0), (2, 0), \left(\frac{8}{3}, 2\right), (0, 2)$

(D) $(3, 2), (0, 3), (0, 2)$

147. The odds in favour of A winning a game of table tennis against B are 1:2. If 3 games are to be played, then the probability of A winning at least two games out of the three is.....

(A) $\frac{1}{27}$ (B) $\frac{2}{27}$

(C) $\frac{5}{27}$ (D) $\frac{7}{27}$

148. A random variable X has the following probability distribution

$X = x$	1	2	3	4	5	6	7	8
$P(X = x)$	0.15	0.23	0.10	0.12	0.20	0.08	0.07	0.05

For the events $E = \{X \text{ is a prime number}\}$, $F = \{X < 4\}$, $P(E \cup F)$ is

(A) 0.5 (B) 0.77

(C) 0.35 (D) 0.75

149. A random variable X takes the values 0, 1, 2, 3 and its mean is 1.3. If $P(X = 3) = 2P(X = 1)$ and $P(X = 2) = 0.3$, then $P(X = 0)$ is

(A) 0.3 (B) 0.4

(C) 0.2 (D) 0.5

150. Let $X \sim B\left(6, \frac{1}{2}\right)$. Then the maximum probability occurs at

(A) $X = 1$ (B) $X = 2$

(C) $X = 3$ (D) $X = 4$

- End of Question Paper -