MHT CET 2026 PCM Apr 20 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2026**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. A physical quantity x is related as $x = \sqrt{a}\, b^2 c^3 d^{-4}$. Relative errors in the quantities a , b, c and d are 2%, 1%, 3% and 4% respectively. Relative error in x will be

(A) 30% (B) 28%
(C) 24% (D) 18%

2. If two vectors $\vec{A} = 4\hat{i} + n\hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} + 2\hat{j} - \hat{k}$ are mutually perpendicular to each other then value of 'n' is

(A) $+3$ (B) $+1$
(C) -3 (D) -1

3. A particle completes 2 revolutions in a circular path of radius 3 cm. The angular displacement of the particle will be (in radian)

(A) π (B) 2π
(C) 3π (D) 4π

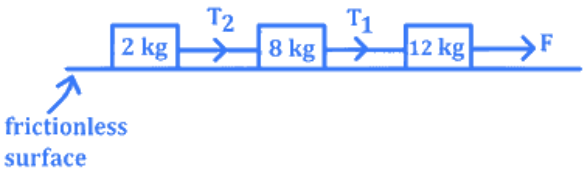
4. A car is travelling at 40 m/s on a circular path of radius 40 m. It is increasing its speed at the rate of $2\ \text{m/s}^2$. Its net acceleration is (in m/s^2) nearly

(A) $4\ \text{m/s}^2$ (B) $8\ \text{m/s}^2$
(C) $16\ \text{m/s}^2$ (D) $40\ \text{m/s}^2$

5. Two spheres are projected at angles 30° and 45° with the horizontal. The maximum height reached by both is same. The ratio of their initial velocities is, $\left(\sin 45^\circ = \frac{1}{\sqrt{2}}, \sin 30^\circ = 0.5\right)$

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

6. Three blocks of different masses connected with inextensible string are pulled by a force F on a frictionless surface as shown in the figure. The ratio of tensions T_1 to T_2 is



(A) 1 : 5 (B) 5 : 1
(C) 10 : 1 (D) 1 : 10

7. A solid sphere of mass 5 kg and a disc of mass 4 kg have the same radius. The ratio of moment of inertia of the sphere about its tangent to the moment of inertia of the disc about a tangent in its plane will be $x : y$. The value of x and y respectively is

(A) $5, 8$ (B) $6, 7$
(C) $7, 5$ (D) $4, 3$

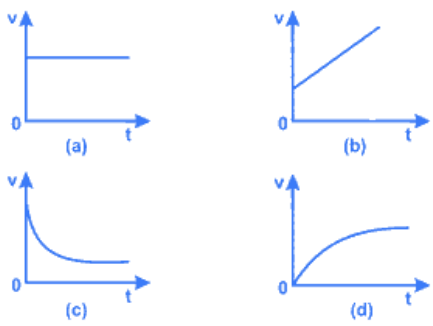
8. Select the correct statement out of the following

(A) Acceleration due to gravity decreases as we go up or down from earth's surface.
(B) Acceleration due to gravity is same at a height 'h' and depth 'd' from earth's surface, if $h = d$.
(C) Acceleration due to gravity at 640 km above the earth surface decreases by 10% of its value at earth's surface (earth's radius is 6400 km)
(D) There is reduction in acceleration due to gravity at poles due to rotation of earth as the poles are lying on the axis of rotation and do not revolve.

9. If we dip capillary tubes of different radii r_n in water and the water rises to different heights h_n in them, then $(n = 1, 2, 3 \ldots\ldots)$

(A) $\frac{h_n}{r_n^2} = \text{constant}$ (B) $\frac{h_n}{r_n} = \text{constant}$
(C) $h_n r_n^2 = \text{constant}$ (D) $h_n r_n = \text{constant}$

10. A small metal sphere is falling through a viscous liquid. The variation of velocity (V) with time (t) is shown correctly in graph



(A) b (B) a
(C) d (D) c

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11. On opposite sides of a wide vertical vessel filled with water (density ρ), two identical holes are drilled, each having cross-section area A. The height difference between holes is x. The resultant force of reaction of water flowing out of vessel is (g = acceleration due to gravity)

(A) ρAgx (B) $2\rho Agx$

(C) $3\rho Agx$ (D) $4\rho Agx$

12. Two stars A and B radiate maximum energy at wavelength 3.9×10^{-7} m and 5.2×10^{-7} m respectively. The ratio of the temperature of star A to that of star B will be

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

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

13. A piece of metal of 850 K is dropped into 1 kg of water at 300 K. If equilibrium temperature of water is 350 K then the heat capacity of the metal expressed in $\frac{J}{K}$ is $\left(\text{Sp. heat of water} = 1\ \frac{\text{cal}}{\text{g}^\circ\text{C}}\right)$

(A) 420 (B) 240

(C) 100 (D) 24

14. A sphere having temperature 600 K is losing heat due to radiation. At this temperature its rate of cooling is R. The rate of cooling of this sphere at 400 K is $\frac{x}{243}$. The value of x is (Temperature of surrounding is 300 K)

(A) $50R$ (B) $45R$

(C) $40R$ (D) $35R$

15. A black body is at temperature of 5780 K. The energy of radiation emitted by the body at wavelength 300 nm is U_1, at wavelength 500 nm is U_2 and that at 900 nm is U_3 respectively. Wien's constant $b = 2.89 \times 10^6$ nmK. This shows that

(A) $U_1 < U_2 < U_3$ (B) $U_1 > U_2 > U_3$

(C) $U_1 < U_2 > U_3$ (D) $U_1 > U_2 < U_3$

16. The efficiency of Carnot engine which operates between the two temperatures $T_1 = 500$ K and $T_2 = 300$ K is

(A) 75 % (B) 50 %

(C) 25 % (D) 40 %

17. An ideal gas having pressure P, volume V and temperature T is expanded isothermally, to a volume $3V$ and final pressure P_I. The same gas is expanded adiabatically to a volume $3V$, the final pressure being P_A. The ratio $\frac{P_A}{P_I}$ is $\left(\frac{C_P}{C_V} = \gamma\right)$

(A) 3γ (B) 3^γ

(C) $3^{(1-\gamma)}$ (D) $3^{(\gamma-1)}$

18. The displacement of a particle varies with time according to the relation
$x = a\sin\omega t + b\cos\omega t$

(A) The motion is simple harmonic motion with an amplitude $\sqrt[3]{a^2+b^2}$

(B) The motion is simple harmonic motion with an amplitude $\sqrt{a^2+b^2}$

(C) The motion is periodic but not simple harmonic motion

(D) The motion is simple harmonic with an amplitude (a^2+b^2)

19. For a particle executing S.H.M., the potential energy is n times the kinetic energy when its displacement from mean position is $\left(\frac{2\sqrt{2}}{3}\right)A$, where A is the amplitude of S.H.M. The value of n is

(A) 2 (B) 4

(C) 6 (D) 8

20. A particle is performing S.H.M. about $x = 0$, with an amplitude a and time period T. The speed of the particle at $x = \frac{a}{3}$ will be

(A) $\frac{2\pi a}{T}$ (B) $\frac{4\pi a}{3T}$

(C) $\frac{\sqrt{3}\,\pi^2 a}{2T}$ (D) $\frac{4\sqrt{2}\,\pi a}{3T}$

21. Two sound waves each of wavelength λ and same amplitude A interfere at point Q. If the path difference is $\frac{\lambda}{4}$, the amplitude of the resultant wave at point Q is $\left[\sin\frac{\pi}{2} = 1, \cos\frac{\pi}{2} = 0\right]$

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

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

22. Two monoatomic ideal gases '1' and '2' of molecular masses m_1 and m_2 respectively are enclosed in separate containers kept at the same temperature. The ratio of the speed of sound in gas '1' to that in gas '2' is

(A) $\sqrt{\frac{m_1}{m_2}}$ (B) $\sqrt{\frac{m_2}{m_1}}$

(C) $\frac{m_1}{m_2}$ (D) $\frac{m_2}{m_1}$

23. Two waves are represented as $y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and $y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \frac{\pi}{6}\right)$ The path difference between two waves is

(A) $\frac{\lambda}{5}$ (B) $\frac{\lambda}{4}$

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

24. The equation of a wave on a string of linear mass density $0.02\ \text{kg m}^{-1}$ is $Y = 0.01 \sin\left[2\pi\left(\frac{t}{0.02} - \frac{x}{0.50}\right)\right]$ m. The tension in the string is

(A) 12.50 N (B) 6.25 N

(C) 25 N (D) 50 N

25. If charge $+q$ is taken from one point to another over an equipotential surface, then

(A) work done on the charge continuously increases. (B) work is done by the charge.

(C) work done on the charge is constant. (D) no work is done.

26. A charge Q is placed at each corner of a cube of side r. The potential at the centre of the cube is (ϵ_0 = permittivity of free space)

(A) $\frac{4Q}{\pi\epsilon_0 r\sqrt{3}}$ (B) $\frac{8Q}{\pi\epsilon_0 r\sqrt{3}}$

(C) $\frac{16Q}{3\pi\epsilon_0 r}$ (D) $\frac{32Q}{\pi\epsilon_0 r\sqrt{3}}$

27. Select the 'WRONG' statement about polar molecules.

(A) A molecule in which centre of mass of positive charges does not coincide with the centre of mass of negative charges is a polar molecule. (B) They have permanent dipole moment.

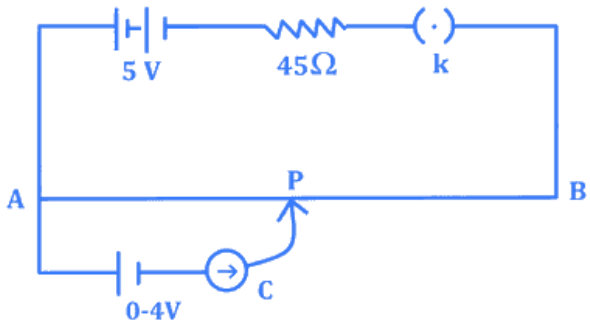
(C) They act as tiny electric dipoles. (D) They have symmetrical shape.

28. Two point charges placed in air separated by distance R exert a force F on each other. Now the space between those charges is filled with dielectric constant K. At distance R_1 between the charges, the same force is exerted as F. Then

(A) $R_1 = \sqrt{K}R$ (B) $R_1 = R$

(C) $R_1 = \frac{R}{K}$ (D) $R_1 = \frac{R}{\sqrt{K}}$

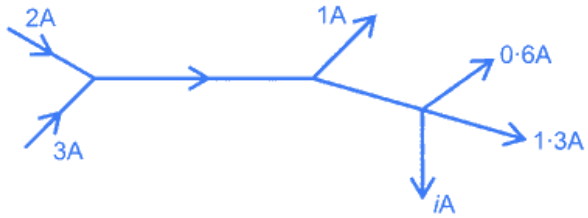
29. Figure shows a potentiometer wire AB having resistance of 5 Ω and length 10 m. An e.m.f. is 0.4 V of battery, the balancing length AP is (internal resistance is negligible)



(A) 8 m (B) 10 m

(C) 6 m (D) 4 m

30. The currents in different parts of the electric circuit are shown in following figure. The value of current i is



(A) 0.7 A (B) 1.4 A

(C) 2.1 A (D) 2.8 A

31. An electron is moving with initial velocity $\vec{v} = V_0\hat{j}$ in a magnetic field $\vec{B} = B_0\hat{i}$. Its de-Broglie wavelength will

(A) decrease with time.
(B) increase and decrease periodically.
(C) remains constant.
(D) increase with time.

32. A thin circular wire carrying current I has magnetic moment M. The shape of the wire is changed to a square and it carries the same current. It will have magnetic moment M_1. The ratio M to M_1 is

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

33. A circular arc of wire of radius of curvature r subtends an angle of $\frac{\pi}{5}$ radian at its centre. If current i is flowing in it then the magnetic induction at its centre is (μ_0 = permeability of free space)

(A) $\frac{\mu_0 i}{4r}$
(B) $\frac{\mu_0 i}{8r}$
(C) $\frac{\mu_0 i}{16r}$
(D) $\frac{\mu_0 i}{20r}$

34. A solenoid of 1000 turns is wound uniformly on a glass tube 4 m long and 0.3 m in diameter. The magnetic intensity at the centre of the solenoid when a current of 4 A flows through it is

(A) $2 \times 10^{+3}$ A/m
(B) $16 \times 10^{+3}$ A/m
(C) $4 \times 10^{+3}$ A/m
(D) 10^{+3} A/m

35. A circular disc of radius 20 cm is placed in uniform magnetic field of induction $\frac{7}{22}$ Wb/m^2 in such a way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is ($\cos 60^\circ = 0.5$)

(A) 0.01 Wb
(B) 0.02 Wb
(C) 0.06 Wb
(D) 0.08 Wb

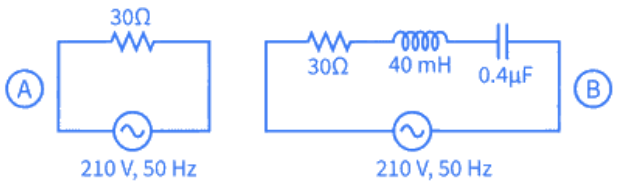
36. An aeroplane having a wing span of 30 m flies due north with the speed of 170 m/s. Magnetic field $B = 3.6 \times 10^{-5}$ T. The potential difference between the tips of the wings will be

(A) 136.4 mV
(B) 183.6 mV
(C) 272.8 mV
(D) 367.2 mV

37. In an LCR series circuit an alternating voltage source of frequency F is connected. The current leads the voltage by 45°. The value of L is

(A) $\frac{1+2\pi FCR}{2\pi FC}$
(B) $\frac{1+2\pi FCR}{4\pi^2F^2C}$
(C) $\frac{1-2\pi FCR}{4\pi^2F^2C}$
(D) $\frac{1+2\pi FR}{4\pi^2F^2C}$

38. Given below are the two circuits, choose the correct option.



(A) At resonance, current in (B) is less than that in (A)
(B) The r.m.s. current in (B) can be larger than that in (A)
(C) The r.m.s. current in (A) is always equal to that in (B)
(D) The r.m.s. current in (B) can never be larger than that in (A)

39. In a L-R circuit of 4 mH inductance and 3 Ω resistance, e.m.f. $E = \cos(1000t)$ V is applied. The amplitude of current is

(A) 1.6 A
(B) 1 A
(C) 0.2 A
(D) 0.4 A

40. A current of 4 A is flowing at 230 V in the primary coil of a transformer. If the voltage produced in the secondary coil is 2300 V and 40 % of power is lost, then the current in the secondary will be

(A) 0.24 A
(B) 0.2 A
(C) 0.12 A
(D) 0.4 A

41. A thin glass prism has refractive index 1.5. The correct relation between the angle of minimum deviation (δm) and angle of refraction (r) is

(A) $\delta m = \frac{r}{2}$
(B) $\delta m = 2r$
(C) $\delta m = r$
(D) $\delta m = \frac{3r}{2}$

42. In diffraction experiment from single slit, the angular width of the central maxima does NOT depend upon

(A) width of the slit
(B) wavelength of light used.
(C) ratio of wavelength and slit width.
(D) distance of the slit from the screen.

43. To improve the resolving power of a compound microscope we should

(A) decrease the diameter of the objective lens.
(B) decrease the focal length of the eye-piece.
(C) increase the refractive index of the medium between the object and objective lens.
(D) increase the wavelength of light.

44. In the diffraction pattern, the first maximum is at 30°, when a monochromatic light of wavelength λ is incident on a slit of width a. For the same wavelength, if the slit width is changed, so that first maximum is at 45°. The slit width is changed by $\left(\sin 30^\circ = \frac{1}{2}, \sin 45^\circ = \frac{1}{\sqrt{2}}\right)$

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

45. The ratio of de-Broglie wavelength of an α-particle and proton accelerated from rest by the same potential is $\frac{1}{\sqrt{m}}$. The value of m is

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

46. The kinetic energy of the electron in an orbit of radius r in hydrogen atom is proportional to (e = electronic charge)

(A) $\frac{e^2}{2r^2}$
(B) $\frac{e^2}{r^2}$
(C) $\frac{e^2}{2r}$
(D) $\frac{e^2}{4r}$

47. Which of the following is an integral multiple of $\frac{h}{2\pi}$ in Bohr's model of an hydrogen atom?

(A) Radius of an atom
(B) Kinetic energy
(C) Potential energy
(D) Angular momentum

48. Activity of a radioactive sample decreases to $\left(\frac{1}{4}\right)^{th}$ of its original value in 4 days. Then in 16 days its activity will become x times the original value. The value of x is

(A) $\frac{1}{16}$
(B) $\frac{1}{32}$
(C) $\frac{1}{256}$
(D) $\frac{1}{128}$

49. In Boolean expression $A + B = Y$ implies that

(A) Y exists when A or B exists but not when both A and B exist.
(B) Y exists only when A and B both exist.
(C) Y exists when both A and B do not exist.
(D) Y exists when A exists or B exists or both A and B exist

50. The depletion region of p-n junction

(A) increases if reverse biased.
(B) increases if forward biased.
(C) decreases if reverse biased.
(D) remains same in reverse and forward biasing.

51. What is the number of molecules in 2.125 g of ammonia?

(A) 6.022×10^{23} (B) 3.011×10^{23}

(C) 1.505×10^{22} (D) 7.527×10^{22}

52. Identify pair of orbitals having similar $(n + l)$ values from the following.

(A) 3s and 3p (B) 2p and 4s

(C) 3d and 4p (D) 2p and 3p

53. What is the proportionality between (I) Bond length and size of atom (II) Bond length and multiplicity of bond respectively?

(A) (I)- direct (II)-inverse (B) (I)- direct (II)-direct

(C) (I)-inverse (II)-direct (D) (I)-inverse (II)-inverse

54. A mixture of 0.5 mol N_2 gas, 1.0 mol O_2 gas and 1.5 mol H_2 gas exerts a total pressure of 18 bar. Find the partial pressure of $O_{2(g)}$.

(A) 4.0 bar (B) 6.0 bar

(C) 8.0 bar (D) 10.0 bar

55. The enthalpy of combustion of C, H_2, and CH_4 are -390, -285 and -890 kJ/mol. Find the enthalpy of formation of methane.

(A) -70 kJ (B) -111 kJ

(C) -170 kJ (D) -85 kJ

56. Calculate the change in internal energy if an ideal gas expands from 0.5 dm^3 to 3.5 dm^3 at constant pressure 2 bar by absorbing 1800 J heat energy.

(A) 1200 J. (B) -1200 J.

(C) 2400 J. (D) -2400 J.

57. Which of the following processes exhibits the decrease in internal energy of a system?

(A) Isothermal expansion of an ideal gas. (B) Isothrmal compression of an ideal gas.

(C) Adiabatic expansion of an ideal gas. (D) Adiabatic compression of an ideal gas

58. There are two different solutions, A and B. The pH of solution A is 4. Find the pH of solution B having $[H^+]$ three times that of solution A.

(A) 3.5229 (B) 4.229

(C) 3.229 (D) 3.5223

59. Calculate the pH of buffer solution containing 0.1M CH_3COOH and 0.1 M CH_3COONa $[K_a = 1.8 \times 10^{-5}]$

(A) 4.745 (B) 5.741

(C) 2.876 (D) 7.001

60. What is the pH of 1 molar HCl solution? (assume complete dissociation)

(A) 1 (B) 2

(C) Zero (D) 7

61. What is the oxidation state of Xe in $XeOF_4$?

(A) $+4$ (B) -4

(C) -6 (D) $+6$

62. What is the oxidation number of Cl in $HOClO_2$?

(A) $+7$ (B) $+5$

(C) $+3$ (D) $+1$

63. What is the number of electrons gained by Cl atom when n mole of ClO_4^- is transformed into n mole of ClO_2^- ion?

(A) $3n$ (B) $4n$

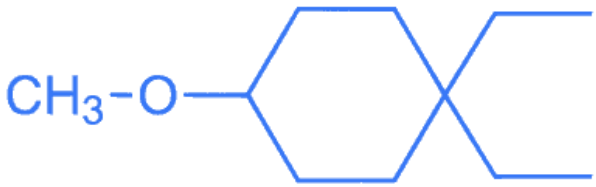
(C) n (D) $2n$

64. Choose a false statement regarding the properties of sodium hydroxide.

(A) It is highly water soluble. (B) It absorbs atmospheric CO_2 to form Na_2CO_3.

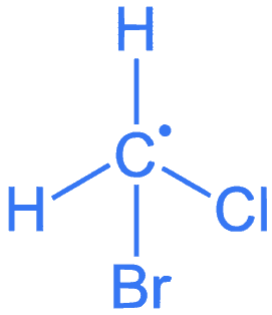
(C) the solution of NaOH turns blue litmus red. (D) NaOH is a white deliquescent solid.

65. The IUPAC name of the following compound is,

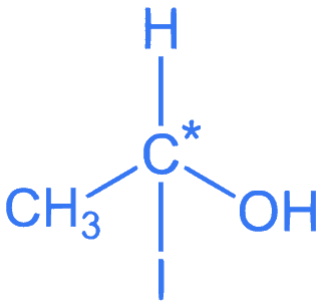


(A) 1, 1 - diethyl - 4 - methoxycyclohexane
(B) 1, 1 - dimethyl - 4 - methoxycyclohexane
(C) 4, 4 - dimethyl - 1 - methoxycyclohexane
(D) 4, 4 - Diethyl - 1 - methoxycyclohexane

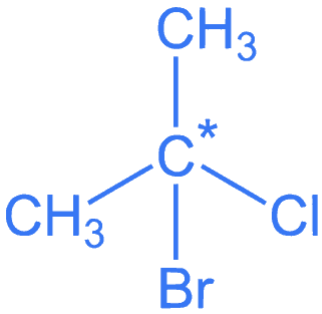
66. Which of the following molecule has Chiral Carbon?



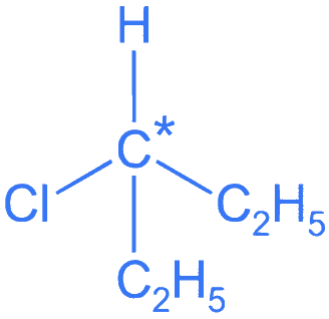
(A)



(B)



(C)



(D)

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67. Which one of the following series contains *only* electrophiles?

(A) R-OH, Cl^+, NH_3

(B) H_2O, R_2N^-, H_3O^+

(C) BF_3, SO_3, NO^+

(D) $AlCl_3$, R-NH_2, PCl_3

68. Which of the following reaction steps is known as propagation step

(A) Cl-Cl $\rightarrow Cl^{\bullet} + Cl^{\bullet}$

(B) $CH_3 + Cl_2 \rightarrow CH_3$-Cl + $Cl^{\bullet}$

(C) $CH_3^{\bullet} + Cl^{\bullet} \rightarrow CH_3$-Cl

(D) $CH_3^{\bullet} + CH_3^{\bullet} \rightarrow CH_3$-$CH_3$

69. A metal crystallizes in a bcc unit cell having unit cell volume 2.5×10^{-23} cm^3. Find the number of unit cells in 18 g metal if the density of metal is 7.2 g cm^{-3}.

(A) 1.0×10^{23} (B) 2.0×10^{23}

(C) 0.5×10^{23} (D) 1.5×10^{23}

70. A metal has a fcc structure if the edge length of unit cell is 200 pm, calculate the volume occupied by particles in a unit cell.

(A) 2.08×10^{-24} cm^3 (B) 5.92×10^{-24} cm^3

(C) 8×10^{-24} cm^3 (D) 3.14×10^{-24} cm^3

71. Which of the following defects is observed in steel?

(A) Substitutional impurity defect (B) Interstitial impurity defect

(C) Vacancy defect (D) Schottky defect

72. When the bottle of soft drink is opened, what would take place from the following?
(A) Solubility of dissolved gas decreases.
(B) bottle released internal pressure.
(C) effervences evolved from the bottle.
(D) increase in external pressure.
Identify the correct choice.

(A) (A), (B) and (C) only. (B) (A), (B) and (D) only.

(C) (A), (B), (C) and (D). (D) (B), (C) and (D) only.

73. Find the osmotic pressure of 0.01 M solution at 25 Â°C ($R = 0.0821$ L atm $mol^{-1}K^{-1}$)

(A) 0.201 atm (B) 0.245 atm

(C) 0.082 atm (D) 0.41 atm

74. Identify the colligative property from the followings?

(A) Vapour pressure of solution. (B) Osmotic pressure of solution.

(C) Boiling point of solution. (D) Freezing point of solution.

75. Determine the electrode potential of $Sn^{2+}(0.01M)$ | Sn(s) at 25°C if E°_{Sn} is -0.136 V.

(A) 0.186 V (B) -0.186 V

(C) -0.195 V (D) 0.195 V

76. If molar conductance at infinite dilution for CH_3COO^- and H^+ ions are 50 S cm^2 mol^{-1} and 350 S cm^2 mol^{-1} respectively, molar conductivity of 5×10^{-2} M CH_3COOH is 20 S $cm^2 mol^{-1}$. What is the hydrogen ion concentration in mol/dm^3 of CH_3COOH?

(A) 5×10^{-2} (B) 5×10^{-3}

(C) 2.5×10^{-3} (D) 2.5×10^{-4}

77. Which of the following expressions indicates the correct relationship between molar conductivity of strong electrolyte and its concentration?

(A) $\Lambda = \Lambda_0 + \sqrt{c}$ (B) $\Lambda = \Lambda_0 - a\sqrt{c}$

(C) $\Lambda = \Lambda_0 + a\sqrt{c}$ (D) $\Lambda = \Lambda_0 - \sqrt{c}$

78. What is the role of catalyst in reaction?

(A) To increase activation energy of a reaction (B) To decrease the equilibrium constant of the reaction

(C) To supply energy to the reactants (D) To decrease activation energy of a reaction

79. Calculate the rate constant of first order reaction A $\rightarrow$ B having rate 5.4×10^{-6} mol $dm^{-3}s^{-1}$ and $[A] = 0.3$ M.

(A) 1.52×10^{-5} s^{-1} (B) 1.68×10^{-5} s^{-1}

(C) 1.72×10^{-5} s^{-1} (D) 1.80×10^{-5} s^{-1}

80. What is the order and molecularity of the following elementary reaction?
$2NO_{2(g)} \rightarrow 2NO_{(g)} + O_{2(g)}$, rate $= k \times [NO_2]^2$

(A) The reaction is second order and biomolecular. (B) The reaction is first order and bimolecular.

(C) The reaction is second order and unimolecular. (D) The reaction is zero order and unimolecular.

81. Which of the following nanomaterials has one dimension < 100 nm?

(A) Quantum dots (B) Nanorings
(C) Thin films (D) Nanowires

82. In Haber process of production of ammonia Al_2O_3 is used as

(A) Adsorbate (B) Inhibitor
(C) Catalyst (D) Promoter

83. Which of the following pairs of elements does NOT include transition elements?

(A) Mn and Ag (B) Zr and Au
(C) Mo and Pt (D) Sn and Pm

84. Which of the following prediction is correct when the transition metal ion is colourless?

(A) it contains 0 unpaired electrons (B) it contains 1 unpaired electrons
(C) it contains 2 unpaired electrons (D) it contains 3 unpaired electrons

85. Which of the following complex is neutral?

(A) $K_3[Fe(CN)_5NO]$ (B) $[Zn(NH_3)_4]^{2+}$
(C) $[Co(NH_3)_5Cl]^{2+}$ (D) $[Ni(CO)_4]$

86. Which of the following coordinate complexes is heteroleptic?

(A) Pentacarbonyliron(0)
(B) Triamminetrinitrocobalt(III)
(C) Tetraamminecopper(II) ion
(D) Tetracyanonickelate(II) ion

87. What is the major product formed when 2-bromopentane reacts with alcoholic KOH?

(A) Pent-1-ene (B) Pent-2-ene
(C) Pentane (D) Pentan-2-ol

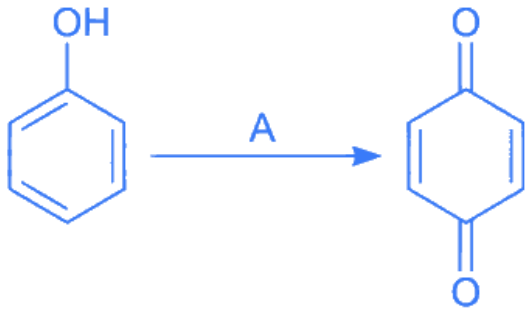
88. In Finkelstein reaction, which one of the following reagents is used?

(A) HI in dry acetone (B) NaI in dry acetone
(C) NaOI in dry acetone (D) NaI in dry ether

89. Which of the following alcohols contains the hydroxy group, at the side chain of the aromatic ring?

(A) allylic alcohol (B) vinylic alcohol
(C) aromatic alcohols (D) aliphatic alcohol

90. In the following reaction, condition 'A' is -



(A) Reduction with Zinc dust (B) Dehydration with H_2SO_4 / 443 K
(C) Treatment with CS_2 / low temperture (D) Oxidation with CrO_3

91. Which of the following compounds exhibits Schiff test?

(A) Ketones (B) Carboxylic acids
(C) Aldehydes (D) Ethers

92. Which of the following reactions is preferentially used to prepare the corresponding paraffins from alkanone?

(A) Clemmensen reduction (B) Etard reaction
(C) Rosenmund reduction (D) Haloform reaction

93. Identify the reason for the highest boiling point of R-COOH as compared to alkanes, ethers, alcohols and aldehydes.

(A) Formation of carboxylate ion (B) Van der waals force of attraction
(C) Formation of intramolecular hydrogen bonding (D) Formation of intermolecular hydrogen bonding

94. Aniline on treatment with $NaNO_2$ / HCl at about $0^\circ C$ gives a compound A, which on further treatment with CuCN / KCN gives a compound B, which when reacts with H_2 / Ni gives a compound C. The compound C on reaction with HNO_2 gives a compound D. The structure of D is:

(A) C_6H_5-CH_2-OH
(B) C_6H_5-NH-CH_2-CH_3
(C) C_6H_5-NH-OH
(D) C_6H_5-CH_2-NH_2

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95. Identify the reagent used to distinguish primary and secondary amines by Hinsberg test.

(A) $NaNO_2$ and HCl
(B) $FeCl_3$ (alc)
(C) $C_6H_5SO_2Cl$
(D) $CHCl_3$ and KOH (alc)

96. Identify the product when glucose reacts with bromine water.

(A) Saccharic acid
(B) Cyanohydrin
(C) Gluconic acid
(D) Nucleic acid

97. What type of compound the Legumelin is?

(A) Carbohydrate
(B) Globular protein
(C) Fibrous protein
(D) Enzyme

98. Which of the following is fully Fluorinated polymer?

(A) PVC
(B) Teflon
(C) neoprene
(D) Buna-S

99. Which of the following is a cross-linked, thermosetting polymer?

(A) Bakelite
(B) PVC
(C) Polystyrene
(D) PTFE (Teflon)

100. What is the chemical name of Aspirin?

(A) salicylic acid
(B) acetyl salicylic acid
(C) chloroxylenol
(D) thymol

101. The statement having truth value 'T' from the following is

(A) $\sin(x)$ is an even function.
(B) Every square matrix is non-singular.
(C) The product of complex number and its conjugate is purely imaginary.
(D) A square of any real number is non-negative.

102. If $i = \sqrt{-1}$ then $\left[i^{18} + \left(\frac{1}{i}\right)^{25}\right]^3 =$

(A) $4 + 4i$
(B) $2 + 2i$
(C) $4 - 4i$
(D) $2 - 2i$

103. The number of permutations of the letters of the word INSTITUTION are .....

(A) 6652800
(B) 221760
(C) 1108800
(D) 554400

104. If $x + y = \frac{\pi}{4}$, then $(1 + \tan x)(1 + \tan y) =$

(A) 1
(B) 2
(C) 3
(D) 0

105. A straight line makes equal negative intercepts on the coordinate axes. If the perpendicular distance from the origin to the line is 4 units, then the equation of the line is .....

(A) $x + y + 4 = 0$
(B) $x + y + 4\sqrt{2} = 0$
(C) $x - y + 4 = 0$
(D) $x - y + 4\sqrt{2} = 0$

106. If the angle made by the lines represented by the equation $ax^2 + 2hxy + by^2 = 0$ with X-axis are α and β, then $\tan(\alpha + \beta)$ is

(A) $\frac{h}{a+b}$
(B) $\frac{2h}{a-b}$
(C) $\frac{2h}{a+b}$
(D) $\frac{h}{a-b}$

107. The equation of a circle whose center lies on $x + 2y = 0$ and touching the lines $3x - 4y + 8 = 0$ and $3x - 4y - 28 = 0$ is

(A) $(x-2)^2 + (y+1)^2 = 324$
(B) $(x-2)^2 + (y-1)^2 = 324$
(C) $5(x-2)^2 + 5(y+1)^2 = 324$
(D) $25(x-2)^2 + 25(y+1)^2 = 324$

108. If P be any point on the ellipse $16x^2 + 25y^2 = 400$ with foci S and S' and area of $\triangle PSS'$ is 9 square units, then the abscissa of point P is.....

(A) $\frac{7\sqrt{5}}{4}$
(B) $\frac{4\sqrt{7}}{5}$
(C) $\frac{5\sqrt{7}}{4}$
(D) $\frac{10}{7}$

109. The value of $\lim_{n\to\infty}\left[\frac{1}{1-n^2} + \frac{2}{1-n^2} + \ldots + \frac{n}{1-n^2}\right]^3$ is

(A) 8
(B) -8
(C) $\frac{1}{8}$
(D) $\frac{-1}{8}$

110. If $\sim p \vee q$ is false then which of the following is correct?

(A) $p \leftrightarrow q$ is T
(B) $p \to q$ is T
(C) $q \to p$ is T
(D) $q \to p$ is F

111. The contrapositive of $\sim q \to p$ is equivalent to

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

112. The angles of $\triangle ABC$ are in A.P. and $b : c = \sqrt{3} : \sqrt{2}$ then $\angle A =$

(A) 30°
(B) 90°
(C) 105°
(D) 75°

113. With the usual notations, if the lengths of the sides of the triangle are 3 units, 5 units and 7 units, then the largest angle of the triangle is

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

114. If $A = \begin{bmatrix} 1 & -5 \\ -2 & 4 \end{bmatrix}$, then $A^{-1} =$

(A) $-\frac{1}{6}\begin{bmatrix} -4 & 5 \\ 2 & -1 \end{bmatrix}$
(B) $\frac{1}{14}\begin{bmatrix} -1 & 5 \\ 2 & -4 \end{bmatrix}$
(C) $\frac{1}{14}\begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$
(D) $-\frac{1}{6}\begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$

115. Let $A = \begin{bmatrix} 3 & 1 & 2 \\ 1 & 2 & 0 \\ 1 & 1 & 4 \end{bmatrix}$ and $pC_{11} + 4C_{21} - 5C_{32} = -2$, where C_{ij} denotes the cofactor of an element a_{ij} of matrix A, then the value of p is :

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

116. If

$$3\sin^{-1}\left(\frac{2x}{1+x^2}\right) - 4\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) + 2\tan^{-1}\left(\frac{2x}{1-x^2}\right) = \frac{\pi}{3}$$

then x =?

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

117. If $2\sin^{-1}x - 3\cos^{-1}x = 4$, then $2\sin^{-1}x + 3\cos^{-1}x =$

(A) $\frac{6\pi - 4}{5}$ (B) $\frac{6\pi + 4}{5}$
(C) $\frac{5\pi - 4}{6}$ (D) $\frac{5\pi + 4}{6}$

118. If $f(x) = \frac{2x-1}{x+5}$, $x \neq -5$ then $f^{-1}(x)$ is equal to

(A) $\frac{x+5}{2x-1}, x \neq \frac{1}{2}$ (B) $\frac{5x+1}{2-x}, x \neq 2$
(C) $\frac{5x-1}{2-x}, x \neq 2$ (D) $\frac{x-5}{2x+1}, x \neq -\frac{1}{2}$

119. If the function $f(x)$ defined by $f(x) = \begin{cases} ax+1 & \text{if } x \leq 3 \\ bx+3 & \text{if } x > 3 \end{cases}$ is continuous at $x = 3$, then $(a-b) =$ .....

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

120. If $f(x), g(x)$ be twice differentiable functions, satisfying $f''(x) = g''(x), f'(1) = 2g'(1) = 4$ and $f(2) = 3g(2) = 9$ then $f(x) - g(x)$ at $x = 4$ is equal to

(A) 0 (B) 10
(C) 8 (D) 2

121. If $y = \cos^2\left[\cot^{-1}\left(\sqrt{\frac{1-x}{1+x}}\right)\right]$ then $\frac{dy}{dx} =$ .....

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

122. If $\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = 6$, then $\frac{dy}{dx} =$

(A) $\frac{x+17y}{17x-y}$ (B) $\frac{x-17y}{17x-y}$
(C) $\frac{x-17y}{17x+y}$ (D) $\frac{x+17y}{17x+y}$

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

(A) 1 (B) 2
(C) 6 (D) 5

124. If $x = a\sin^3 t$ and $y = a\cos^3 t$, then the value of $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{3}$ is equal to

(A) $\frac{-32}{27a}$ (B) $\frac{-32}{3\sqrt{3}a}$
(C) $\frac{32}{27a}$ (D) $\frac{-32}{9a}$

125. An aeroplane at an altitude of 1 km is flying horizontally at 600 km / hr, passes directly over an observer. Then the rate at which it is approaching the observer when it is 1250 meters away from him is.....

(A) 360 km/hr (B) 430 km/hr
(C) 600 km/hr (D) 250 km/hr

126. The line $x + y = 0$ touches the curve $y^2 = ax^3 + b$ at $(1, -1)$ then values of a and b respectively are .....

(A) $\frac{1}{2}, \frac{2}{5}$ (B) $\frac{1}{3}, \frac{2}{3}$
(C) $\frac{2}{3}, \frac{1}{3}$ (D) $\frac{2}{5}, \frac{1}{2}$

127. The function $f(x) = x(x+3)e^{-\left(\frac{1}{2}\right)x}$ satisfies all the conditions of Rolle's theorem in $[-3, 0]$, then $c =$

(A) -3 (B) -2
(C) -1 (D) 0

128. If $\int f(x)dx = g(x) + c$ then $\int f^{-1}(x)dx =$

(A) $xf^{-1}(x) + c$

(B) $f(g^{-1}(x)) + c$

(C) $xf^{-1}(x) - g(f^{-1}(x)) + c$

(D) $g^{-1}(x) + c$

129. $\int \frac{\log x}{(1+\log x)^2}dx =$

(A) $\frac{1}{1+\log x} + c$ (B) $-\frac{1}{1+\log x} + c$

(C) $\frac{x}{1+\log x} + c$ (D) $-\frac{x}{1+\log x} + c$

130. $\int \frac{1}{\sqrt{2x-x^2}}dx =$

(A) $\sin^{-1}(x-1) + c$ (B) $\cos^{-1}(x-1) + c$

(C) $\tan^{-1}(x-1) + c$ (D) $\sin^{-1} x + c$

131. $\int (x^{21} + x^6 + x^3)(2x^{18} + 7x^3 + 14)^{\frac{1}{3}}\, dx =$

(A) $\frac{1}{56}(2x^{18} + 7x^3 + 14)^{\frac{4}{3}} + c$

(B) $(2x^{18} + 7x^3 + 14)^{\frac{4}{3}} + c$

(C) $(2x^{21} + 7x^6 + 14x^3)^{\frac{4}{3}} + c$

(D) $\frac{1}{56}(2x^{21} + 7x^6 + 14x^3)^{\frac{4}{3}} + c$

132. The value of the integral $\int_{1/e}^{e} \frac{|\log x|}{x^2}dx$ is

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

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

133. If $\int_{-\pi/2}^{\pi/2} (\sin^2 x + \sin^3 x)dx = k$, then the value of k

(A) 0 (B) 1

(C) π (D) $\frac{\pi}{2}$

134. If $I_n = \int_0^{\pi/4} \tan^n x\, dx, n \in N$ then $I_{n+2} + I_n$ is equal to

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

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

135. The area in square units of the region bounded by the curve $y = \sqrt{16-x^2}$ and lines $x = 0, x = 4$ above the X-axis is

(A) 16π (B) 12π

(C) 8π (D) 4π

136. The general solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = x^2 + 5$ is ....

(A) $\frac{x^4}{4} + \frac{5x^2}{2} - xy = c$ (B) $\frac{x^4}{4} - \frac{5x^2}{2} - xy = c$

(C) $\frac{x^4}{4} - \frac{5x^2}{2} + xy = c$ (D) $\frac{x^4}{4} + \frac{5x^2}{2} + xy = c$

137. The order and degree of the differential equation $\sqrt{1 + \frac{1}{\left(\frac{dy}{dx}\right)^2}} = \left(\frac{d^2y}{dx^2}\right)^{\frac{3}{2}}$, respectively are

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

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

138. Let $\vec{a} = 2\hat{i} + \hat{k}, \vec{b} = \hat{i} + \hat{j} + \hat{k}$, and $\vec{c} = 4\hat{i} - 3\hat{j} + 7\hat{k}$. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{r} \cdot \vec{a} = 0$, Then $\vec{r} \cdot \vec{c} =$

(A) -14 (B) 34

(C) -7 (D) 20

139. If $\vec{u} = \hat{i} + 2\hat{j} - 2\hat{k}, \vec{v} = 2\hat{i} + \hat{k}$ and $\vec{w}$ is unit vector then the maximum value of scalar triple product $[\vec{u}\ \vec{v}\ \vec{w}]$ is

(A) $-3\sqrt{5}$ (B) 0

(C) $3\sqrt{5}$ (D) $\sqrt{54}$

140. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors and $\vec{p}, \vec{q}, \vec{r}$ are defined as $\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a}\ \vec{b}\ \vec{c}]}, \vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{a}\ \vec{b}\ \vec{c}]}, \vec{r} = \frac{\vec{a} \times \vec{b}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, then $[(\vec{a} + \vec{b}) \cdot \vec{p} + (\vec{b} + \vec{c}) \cdot \vec{q} + (\vec{c} + \vec{a}) \cdot \vec{r}]$ is equal to

(A) 0 (B) 1

(C) 2 (D) 3

141. The volume of the parallelopiped whose coterminous edges are $2\hat{i} + \hat{j} - \hat{k}, 3\hat{i} - \hat{j} - \hat{k}, \hat{j} + 3\hat{k}$ is

(A) 16 cu. units (B) 6 cu. units

(C) 2 cu. units (D) 12 cu. units

142. Given the following expression

A) $(\vec{a} \times \vec{b}) \cdot \vec{c}$

B) $\vec{a} \times (\vec{b} \cdot \vec{c})$

C) $\vec{a} \cdot (\vec{b} \cdot \vec{c})$

D) $|\vec{a}|(\vec{b} \cdot \vec{c})$

E) $(\vec{a} \cdot \vec{b}) \times (\vec{b} \cdot \vec{c})$

Then which of the following is not correct

(A) B and E are meaningful

(B) A and D are meaningful

(C) B, C and E are meaningless

(D) A is meaningful but B is meaningless

143. If the perpendicular distance of the plane passing through the point $Q(1, 0, -1)$ and containing the line $\vec{r} = (\hat{i} - 3\hat{j} + \hat{k}) + \lambda(2\hat{i} - 2\hat{j} + \hat{k})$ from origin is $\frac{p}{\sqrt{53}}$ then $p = ...$

(A) 4

(B) 1

(C) 5

(D) 9

144. If the line joining points $(2, 1, 4)$ and $(a - 1, 4, -1)$ is parallel to the line joining points $(0, 2, b - 1)$ and $(5, 3, -2)$ then the values of b and a are respectively

(A) $18, \frac{2}{3}$

(B) $\frac{3}{2}, 18$

(C) $\frac{2}{3}, 18$

(D) $-\frac{2}{3}, 18$

145. Lines $\vec{r} = \vec{a} + \lambda\vec{b}$ and $\vec{r} = \vec{b} + \mu\vec{a}$ intersect at point $(2, 4, -4)$. If $|\vec{a} - \vec{b}| = 4$, then $\vec{a} \cdot \vec{b} =$

(A) 5

(B) 10

(C) -5

(D) -10

146. The Cartesian equations of the line passing through $A(0, 1, 1)$ and parallel to the X-axis are ....

(A) $y = 1, z = 1$

(B) $x = 0$

(C) $x + y + z = 2$

(D) $y = z$

147. The LPP maximize $z = 2x + 5y$ subject to $x + 3y \leq 6$, $2x + 6y \leq 18$, $x \geq 0$, $y \geq 0$ has

(A) Unique solution

(B) Infinite solutions

(C) No solution

(D) Unbounded feasible region

148. Four cards are drawn successively with replacement from well shuffled deck of 52 cards, then the probability that only two cards are club cards is .....

(A) $\frac{26}{128}$

(B) $\frac{24}{128}$

(C) $\frac{27}{128}$

(D) $\frac{28}{128}$

149. For the following probability distribution of a random variable X, the Expected value and Variance of X are respectively

$X = x$	1	2	3
$P(X = x)$	1/5	2/5	2/5

(A) $\frac{27}{5}, \frac{27}{25}$

(B) $\frac{11}{5}, \frac{14}{25}$

(C) $\frac{4}{5}, \frac{14}{25}$

(D) $\frac{7}{5}, \frac{11}{25}$

150. A fair die is rolled indefinitely. Player A wins if two consecutive rolls show 3 or 5, and player B wins if two consecutive rolls show 1 or 2 or 4 or 6. The probability that player A wins in the long run is

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

(B) $\frac{5}{21}$

(C) $\frac{1}{7}$

(D) $\frac{2}{21}$

- End of Question Paper -