MHT CET 2026 PCM Apr 15 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. Let $\vec{A}$ and $\vec{B}$ are two non-zero vectors of different magnitude. Which one of the following is the correct equation ?

(A) $\vec{A} \cdot \vec{B} = -\vec{B} \cdot \vec{A}$ (B) $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$

(C) $\vec{A} + \vec{B} = \vec{B} + \vec{A}$ (D) $\vec{A} - \vec{B} = \vec{B} - \vec{A}$

2. A wire has mass (0.3 ± 0.003) gram, radius (0.5 ± 0.005) mm and length (6 ± 0.06) cm. The maximum error in the measurement of density is

(A) 4% (B) 3%

(C) 2% (D) 5%

3. A batsman hits a ball with a velocity 'v', making an angle of 60° with the vertical. After some time direction of velocity is making an angle of 60° with the horizontal. The speed of the ball at this instant is

$\left[\cos(60^\circ) = \frac{1}{2}, \cos(30^\circ) = \frac{\sqrt{3}}{2}\right]$

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

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

4. A particle at rest starts moving with constant angular acceleration 'α' in a circular path of radius 'r'. At certain instant, the magnitude of centripetal acceleration is $\left(\frac{1}{3}\right)^{rd}$ the tangential acceleration. The relation between linear speed (V) and angular acceleration (α) is

(A) $V = \frac{r\alpha}{3}$ (B) $V = \alpha\sqrt{\frac{r}{2}}$

(C) $V = r\sqrt{\frac{\alpha}{3}}$ (D) $V = \sqrt{\frac{\alpha r}{3}}$

5. A car of mass m is crossing the convex bridge of radius of curvature R with speed V. At the highest point the thrust is (g = gravitational acceleration)

(A) mg (B) $\frac{mv^2}{R}$

(C) $mg - \frac{mv^2}{R}$ (D) $mg + \frac{mv^2}{R}$

6. A bucket containing water is revolved in vertical circle of radius r. To prevent the water from falling down, the period of revolution required is (g = gravitational acceleration)

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

(C) $2\pi\sqrt{rg}$ (D) $\frac{\sqrt{rg}}{2\pi}$

7. In case of perfectly elastic collision,

(A) the total kinetic energy before collision is equal to the total kinetic energy after collision.

(B) the total kinetic energy before collision is less than total kinetic energy after collision.

(C) the total kinetic energy before collision is greater than the total kinetic energy after collision.

(D) coefficient of restitution is equal to zero.

8. The distance of the two planets A and B from the sun are 'r_A' and 'r_B' respectively such that $r_B = 100\, r_A$. The ratio of the speed of planet A to that of planet B is (both the planets are revolving around the sun)

(A) $\frac{1}{\sqrt{10}}$ (B) $\sqrt{10}$

(C) 10 (D) $10\sqrt{10}$

9. A square frame of each side L is dipped in a soap solution and taken out, the force acting on the film formed is (T = surface tension of soap solution)

(A) $4TL$ (B) $8TL$

(C) $12TL$ (D) $16TL$

10. Three liquids have same surface tension and 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 angle 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) $\theta_1 > \theta_2 < \theta_3$

11. The excess pressure inside the first soap bubble of radius R_1 is three times that inside the second soap bubble of radius R_2. The ratio of volumes of the first to second bubble is

(A) 1 : 27 (B) 1 : 18

(C) 1 : 9 (D) 1 : 3

12. The ratio of the thermal conductivity of two rods of different materials is 6:5. The two rods of same area of cross section and same thermal resistance will have the length in the ratio

(A) 5 : 6 (B) 6 : 5

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

13. A black rectangular surface of area A emits energy E per second at 127°C. If length and breadth is reduced to half of initial value and temperature is raised to 527°C then energy emitted becomes

(A) E (B) $2E$

(C) $4E$ (D) $8E$

14. The energy spectrum of a black body exhibits a maximum around a wavelength λ. The temperature of a black body is now changed such that the energy is maximum at wavelength $2\lambda/3$. The power radiated by the black body will now increase by a factor of

(A) $\frac{256}{81}$ (B) $\frac{81}{16}$

(C) $\frac{162}{41}$ (D) $\frac{16}{81}$

15. In a cyclic process, work done by the system is

(A) zero. (B) equal to the heat given to system.

(C) more than the heat given to system. (D) independent of heat given to system.

16. The average translational kinetic energy of a molecule in a gas is E_1. The kinetic energy of the electron (e) accelerated from rest through potential difference 'V' volt is E_2. The temperature at which $E_1 = E_2$ possible is (N = number of molecules, R = gas constant)

(A) $\frac{eVN}{2R}$ (B) $\frac{2eVN}{3R}$

(C) $\frac{eVN}{R}$ (D) $\frac{3eVN}{4R}$

17. An ideal gas is expanded adiabatically. How many times has the gas to be expanded to reduce the r.m.s. speed of molecules 3 times ? ($\gamma = 1.5$)

(A) 32 times (B) 16 times

(C) 8 times (D) 81 times

18. A body of mass 0.4 kg performs simple harmonic motion. It experiences a restoring force of 0.4 N when its displacement from the mean position is 4 cm. The force constant and magnitude of acceleration respectively are

(A) $5\ \mathrm{N/_m}, 0.5\ \mathrm{m/_{s^2}}$ (B) $10\ \mathrm{N/_m}, 1\ \mathrm{m/_{s^2}}$

(C) $15\ \mathrm{N/_m}, 1.5\ \mathrm{m/_{s^2}}$ (D) $20\ \mathrm{N/_m}, 2\ \mathrm{m/_{s^2}}$

19. The minimum phase difference between two simple harmonic motions is

$x_1 = \frac{1}{\sqrt{2}}\sin\omega t + \frac{1}{\sqrt{2}}\cos\omega t$

$x_2 = \sin\omega t + \cos\omega t \quad \left[\sin\frac{\pi}{4} = \cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}\right]$

(A) zero (B) $\frac{\pi^C}{3}$

(C) $\frac{\pi^C}{4}$ (D) $\frac{\pi^C}{5}$

20. A pendulum clock is running slow, In order to correct it, we should

(A) reduce the amplitude of oscillation. (B) reduce the mass of the bob.

(C) reduce the length of pendulum. (D) increase the length of pendulum.

21. A simple harmonic progressive wave is represented by $y = A\sin(120\pi t + 3x)$. The distance between two points on the wave at a phase difference of $\frac{\pi}{3}$ radian is

(A) $\frac{\pi}{6}$ m (B) $\frac{\pi}{9}$ m

(C) $\frac{2\pi}{9}$ m (D) $\frac{\pi}{18}$ m

22. A pipe open at both ends has a fundamental frequency 'f' in air. The pipe is dipped in water, so that $\frac{2}{3}^{rd}$ length of pipe is in water, Now the fundamental frequency of the air column is

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

(C) $\frac{5}{2}f$ (D) $\frac{7}{2}f$

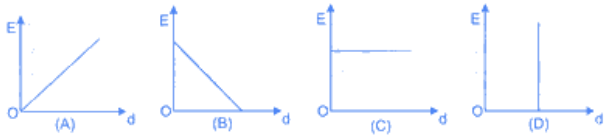
23. To increase the frequency of transverse oscillations of a stretched string by 40%, the tension must be increased by

(A) 100%
(B) 40%
(C) 96%
(D) 140%

24. When open pipe is closed from one end then second overtone of closed pipe is higher in frequency by 100 Hz than first overtone of open pipe. The fundamental frequency of open end pipe will be (Neglect end correction)

(A) 200 Hz
(B) 300 Hz
(C) 100 Hz
(D) 400 Hz

25. For a uniformly charged plane sheet, the variation of electric field (E) with distance (d) is correctly shown graphically in graph



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

26. A point charge 'Q' is placed at the centre of the line joining two equal charges '+q' and '+q'. The value of 'Q' when the system is in equilibrium is

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

27. Capacitors of capacities C_1 and C_2 are connected in series. If the combination is connected to a supply of V volt then the potential difference across capacitor C_2 is

(A) $\frac{C_1+C_2}{C_1V}$
(B) $\frac{C_1V}{C_1+C_2}$
(C) $\frac{C_1+C_2}{C_2V}$
(D) $\frac{C_2V}{C_1+C_2}$

28. Two parallel plate air capacitors are connected in parallel. Each capacitor has plate area $A/2$ and separation between the plates is d and $2d$ respectively. The equivalent capacity of the combination is
(ϵ_0 = absolute permittivity of free space)

(A) $\frac{A\epsilon_0}{d}$
(B) $\frac{3A\epsilon_0}{4d}$
(C) $\frac{2A\epsilon_0}{3d}$
(D) $\frac{A\epsilon_0}{4d}$

29. In metre bridge experiment, the resistance in the left gap is 15 Ω and in the right gap is 45 Ω. The bridge is balanced. The distance of the null point from the centre of the wire is

(A) 80 cm
(B) 60 cm
(C) 40 cm
(D) 25 cm

30. A potentiometer wire is 4m long and potential difference of 2V is maintained between the ends. The e.m.f. of the cell which balances against a length of 80 cm of the potentiometer wire is

(A) 0.25 V
(B) 0.30 V
(C) 0.40 V
(D) 0.80 V

31. An iron rod is placed parallel to magnetic field intensity 1000 A/m. The magnetic flux through the rod is 3×10^{-4} Wb and its cross-sectional area is 1.5 cm^2. The magnetic permeability of rod in $Wb/_{A\text{-}m}$ is

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

32. A charge moves in a circular path perpendicular to a magnetic field. The time period of revolution is independent of

(A) mass of the particle
(B) velocity of the particle
(C) magnetic field
(D) charge

33. A long wire is bent into a circular coil of one turn and then into a circular coil of smaller radius having n turns. If the same current is passed in both the cases, the ratio of magnetic field produced at the centre for one turn to that of n turns is

(A) $1 : n$
(B) $n : 1$
(C) $1 : n^2$
(D) $n^2 : 1$

34. A thin ring of radius 'R' metre has charge 'q' coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of 'f' revolution/s. The value of magnetic induction at the centre of the ring in Wb/m^2 is
(μ_0 = permeability of free space)

(A) $\frac{\mu_0 q}{2fR}$
(B) $\frac{\mu_0 q}{2\pi R}$
(C) $\frac{\mu_0 qf}{2R}$
(D) $\frac{\mu_0 q\pi}{2fR}$

35. Two concentric circular coils having radii r_1 and r_2 ($r_2 << r_1$) are placed co-axially with centres coinciding. The mutual inductance of the arrangement is (Both coils have single turn, μ_0 = permeability of free space)

(A) $\frac{\mu_0 \pi r_2}{2r_1}$ (B) $\frac{\mu_0 \pi r_1^2}{2r_2}$

(C) $\frac{\mu_0 \pi r_1}{2r_2}$ (D) $\frac{\mu_0 r_2^2 \pi}{2r_1}$

36. Two solenoids A and B of equal number of turns have their lengths and radii in the same ratio 1 : 3. The ratio of the self-inductance of solenoid A to that of B will be

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

(C) 1 : 9 (D) 3 : 1

37. An electric lamp connected in series with a capacitor and an a.c source is glowing with certain brightness. On reducing the frequency of source the brightness of the lamp

(A) is increased (B) is reduced

(C) remain the same (D) becomes zero

38. A series resonant circuit consists of an inductor 'L' and capacitor 'C' which produces resonant frequency 'f'. If 'L' is increased by '2L' and 'C' is changed to '9C' the resonant frequency will be

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

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

39. In an LCR series circuit, at resonance,

(A) the impedance is maximum (B) the current is minimum

(C) the current leads the voltage by $\frac{\pi}{2}$ (D) the current and voltage are in phase

40. The angle of minimum deviation produced by a thin prism in air is δ_1. What will be the minimum deviation (δ_2) if the prism is immersed in liquid ?

$\left[{}^a n_g = \frac{3}{2},\ {}^a n_\ell = \frac{1}{3}\right]$

(A) $\delta_2 = 3\,\delta_1$ (B) $\delta_2 = 5\,\delta_1$

(C) $\delta_2 = 7\,\delta_1$ (D) $\delta_2 = 9\,\delta_1$

41. In the phenomenon of refraction of light for the same angle of incidence

(A) angle of refraction is same for different colours. (B) angle of refraction is different for different colours.

(C) angle of refraction does not depend upon the colour of the light used. (D) angle of refraction depends on critical angle.

42. A double slit experiment is immersed in water of refractive index 1.33. The slit separation is 1 mm, distance between slit and screen is 1.33 m. The slits are illuminated by light of wavelength 6300 Å. The fringe width is

(A) 4.9×10^{-4} m (B) 6.3×10^{-4} m

(C) 8.6×10^{-4} m (D) 5.8×10^{-4} m

43. Light of wavelength λ is incident on a single slit of width 'a' and the distance between slit and screen is 'D'. In diffraction pattern, if slit width is equal to the width of the central maximum then 'D' is equal to

(A) $\frac{a}{\lambda}$ (B) $\frac{a^2}{\lambda}$

(C) $\frac{a}{2\lambda}$ (D) $\frac{a^2}{2\lambda}$

44. When a metallic surface is illuminated with a radiation of wavelength 'λ', the stopping potential is 'V'. If the same surface is illuminated with radiation of wavelength 6λ, the stopping potential is $\left(\frac{V}{12}\right)$. The threshold wavelength for the surface is

(A) 5λ (B) 10λ

(C) 11λ (D) 12λ

45. In photoelectric effect experiment, if the frequency of incident radiation (v) is increased, keeping all other factors constant, the stopping potential, ($v > v_0$) (v_0 = threshold frequency)

(A) decreases (B) remains the same

(C) increases (D) becomes zero

46. The electron in hydrogen atom is initially in the second excited state. When it finally moves to ground state, the maximum number of spectral lines emitted are

(A) 2 (B) 3

(C) 4 (D) 5

47. In the hydrogen atom, radii of the first four Bohr orbits are related as

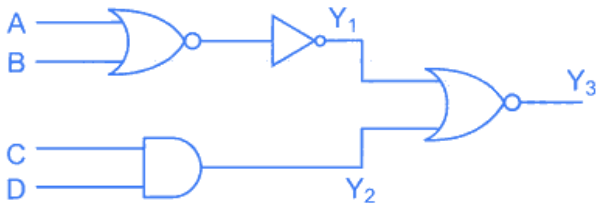
(A) $1 : 2 : 3 : 4$

(B) $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$

(C) $1 : 4 : 9 : 16$

(D) $\frac{1}{4} : \frac{1}{9} : \frac{1}{16}$

48. In the logic circuit diagram, when all the four inputs, A, B, C, D are 'one' the outputs Y_1, Y_2, Y_3 are respectively (1, 1, 0). When the inputs A and C are changed to zero and B and D are still 'one', then the outputs Y_1, Y_2, Y_3 are respectively change to



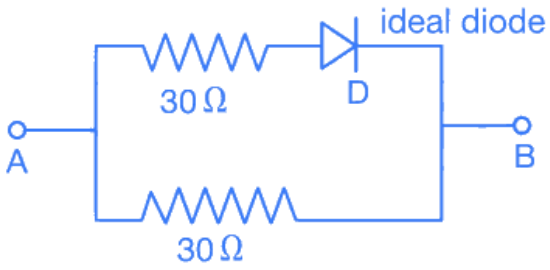
(A) $1, 1, 1$

(B) $1, 0, 0$

(C) $0, 1, 0$

(D) $0, 0, 1$

49. In the diagram shown, the resistance between points A and B is 'R_1' when an ideal diode D is forward biased and is 'R_2' when ideal diode D is reverse biased. The ratio R_1/R_2 is



(A) 2

(B) 1

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

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

50. In common emitter amplifier, a change of 0.2 mA in the base current causes a change of 5 mA in the collector current. If input resistance is 2 kΩ and voltage gain is 75, the load resistance used in the circuit is

(A) 2 kΩ

(B) 3 kΩ

(C) 4 kΩ

(D) 6 kΩ

51. Find the mass of sodium carbonate in grams to form 100 ml 0.1 M solution in water?
(Molar mass of Na_2CO_3 = 106 g/mol)

(A) 1.06 g
(B) 3.18 g
(C) 2.12 g
(D) 4.16 g

52. What is number of hydrogen molecules needed to synthesize 3.4 g of ammonia by reaction with nitrogen?

(A) 6.022×10^{23}
(B) 1.2044×10^{23}
(C) 1.8066×10^{23}
(D) 1.8044×10^{24}

53. If the velocity of the electron in Bohr's first orbit is 2.19×10^6 Ms^{-1}, Calculate the de Broglie wavelength associated with it.
[$h = 6.626 \times 10^{-34}$ J s & Mass of electrons $= 9.10938 \times 10^{-31}$ kg]

(A) 332 pm
(B) 313 pm
(C) 342 pm
(D) 323 pm

54. Identify the group of periodic table that contains element Astatine.

(A) 17
(B) 16
(C) 18
(D) 1

55. What type of bond and type of overlapping present in N_2 molecule ?

(A) Single bond and s−s overlap
(B) Double bond and s−p overlap
(C) Triple bond and p−p overlap
(D) Double bond and p−p overlap

56. Calculate the new pressure of the gas enclosed in a cylinder when it compressed from 5 L to 2 L at 1 atm and 300 K. The final temperature in this process is 500 K.

(A) 1.5 atm
(B) 3.12 atm
(C) 2.5 atm
(D) 4.16 atm

57. For a certain reaction, ΔH^0 is −345 kJ and ΔS^0 is -123 JK^{-1}. At what temperature the change over from spontaneous to nonspontaneous will occur?

(A) 1052 K
(B) 1956 K
(C) 2568 K
(D) 2805 K

58. For a reaction to be spontaneous at all temperatures, the values of enthalpy change and entropy change should be

(A) $\Delta H > 0$ and $\Delta S > 0$
(B) $\Delta H < 0$ and $\Delta S > 0$
(C) $\Delta H < 0$ and $\Delta S < 0$
(D) $\Delta H > 0$ and $\Delta S < 0$

59. Find Δn when 1 mol of each $NH_{3(g)}$ and $HCl_{(g)}$, reacts to form solid NH_4Cl.

(A) 1
(B) −2
(C) −1
(D) −3

60. What is the solubility product of binary sparingly soluble salt BA if 100 mL saturated solution of salt consist 10^{-4} moles at room temperature?

(A) 1×10^{-4}
(B) 1×10^{-6}
(C) 1×10^{-8}
(D) 1×10^{-10}

61. Calculate pOH of 0.001M HCl solution.

(A) 11
(B) 10
(C) 12
(D) 3

62. Identify from following the conjugate base of $[Zn(H_2O)_4]^{2+}$

(A) $[Zn(H_2O)_4]^{2-}$ NH_3
(B) $[Zn(H_2O)_3]^{2-}$
(C) $[Zn(H_2O)_3OH]^{+}$
(D) $[Zn(H_2O)H]^{3+}$

63. For the following redox reaction, find the correct statement.
$Sn^{2+} + 2Fe^{3+} \rightarrow Sn^{4+} + 2Fe^{2+}$

(A) Sn^{2+} is undergoing oxidation.
(B) Fe^{3+} is undergoing oxidation.
(C) It is not a redox reaction.
(D) Both Sn^{2+} and Fe^{3+} are oxidized.

64. Which of the following is the most abundant element in universe?

(A) H
(B) O
(C) Ne
(D) C

65. What is the correct IUPAC name for a molecule that has two amino groups in opposing (para) locations around a benzene ring?

(A) Benzenediamine
(B) Benzene-1,4-diamine
(C) p-Aminoaniline
(D) 4-Aminobenzenamine

66. What is IUPAC name of the compound $CH_3CH{=}CHCH{=}CHCOOH$?

(A) Hexanedioc acid
(B) Hexa-2,4-dienoic acid
(C) Penta-1,3-dienoic acid
(D) Pentenedioc acid

67. Match **List I** with **List II**

List I	List II
(A). Inductive effect	(I). Delocalization of π electrons
(B). Hyper-conjugation	(II). Displacement of π electrons
(C). Resonance effect	(III). Delocalization of σ electrons
	(IV). Displacement of σ electrons

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

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

68. What are the reactants involved in Friedal Crafts alkylation?

(A) $C_6H_6 + NH_3$
(B) $C_6H_6 + CH_3Cl$
(C) $C_6H_6 + CH_3COCl$
(D) $C_6H_6 + CH_4$

69. Identify the false statement regarding magnetic properties of substance.
(A) Paramagnetic substances are weakly attracted.
(B) Diamagnetic substances are weakly attracted.
(C) Ferromagnetic substances strongly attracted.
(D) Diamagnetic substance strongly attracted

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

70. Calculate the number of atoms present in 1.625 g metal if it forms bcc unit cell structure. $[\rho \times a^3 = 3.25 \times 10^{-22}\ g]$

(A) 2.0×10^{22}
(B) 1.5×10^{22}
(C) 2.5×10^{22}
(D) 1.0×10^{22}

71. Identify the covalent crystal from the following.

(A) Fe
(B) CH_4
(C) SiO_2
(D) KCl

72. If a 0.4 molal solution of a nonvolatile solute in organic solvent decreases its freezing point by 2.4 K., then the molal depression constant of solvent will be

(A) 3.0 K kg mol^{-1}
(B) 4.0 K kg mol^{-1}
(C) 5.0 K kg mol^{-1}
(D) 6.0 K kg mol^{-1}

73. Which of the following colligative properties is useful to determine the molar masses of proteins, polymers or colloids, with the greatest precision?

(A) Elevation in boiling point
(B) Depression in freezing point
(C) Osmotic pressure
(D) Relative lowering of vapour pressure

74. Calculate the concentration of silver nitrate solution if molar conductivity and conductivity of silver nitrate at 25°C are respectively 120 ohm^{-1} cm^2 mol^{-1} and 0.0024 ohm^{-1} cm^{-1}.

(A) 0.01 M
(B) 0.02 M
(C) 0.03 M
(D) 0.04 M

75. The E^0_{cell} of $Al_{(s)}|Al^{3+}(1M)||Pb^{2+}(1M)|Pb_{(s)}$ cell is 1.5 V if E^0_{Pb} is -0.14 V then E^0_{Al} will be

(A) 1.64 V
(B) -1.64 V
(C) 1.36 V
(D) -1.36 V

76. Which of the following is an electrolyte in dry cell ?

(A) Potassium hydroxide
(B) Sulphuric acid
(C) Ammonium chloride and zinc chloride
(D) Manganese dioxide

77. The rate of reaction $A + B \rightarrow P$ is 4×10^{-2} mol dm^{-3} s^{-1}
When $[A] = 0.2$ mole dm^{-3} and $[B] = 0.1$ mole dm^{-3}, What is the rate constant of reaction, if it is first order with respect to A and second order with respect to B ?

(A) 10 mol^{-2}dm^6 s^{-1} (B) 20 mol^{-2}dm^6 s^{-1}
(C) 25 mol^{-2}dm^6 s^{-1} (D) 40 mol^{-2}dm^6 s^{-1}

78. For the reaction $2A \longrightarrow 3C + D$, the rate of reaction is represented by

(A) $-d[A]/dt = -d[D]/dt$
(B) $-d[C]/dt = -2d[A]/dt$
(C) $-d[A]/dt = -d[D]/dt$
(D) $-\frac{1}{2}\frac{d[A]}{dt} = +\frac{1}{3}\frac{d[C]}{dt}$

79. Which of the following is applicable to thin film?

(A) One dimensional nanostructure (B) Zero dimensional nanostructure
(C) Two dimensional nanostructure (D) Three dimensional nanostructure

80. What is the role of catalyst in catalytic reaction ?

(A) It decreases the enthalpy of reaction. (B) It increases the enthalpy of reaction.
(C) It decreases the energy of activation of reaction. (D) It increases the energy of activation of reaction.

81. Which of the following exhibits the minimum coagulating power for precipitating of positively charged ferric oxide sol ?

(A) KNO_3 (B) K_2SO_4
(C) K_3PO_4 (D) $K_4Fe(CN)_6$

82. Identify weakest acid from following.

(A) Hypochlorous acid (B) Chlorous acid
(C) Chloric acid (D) Perchloric acid

83. Which of the following elements has completely filled 4 f orbital at the expected ground state configuration?

(A) La (B) Yb
(C) Eu (D) Gd

84. Which of the following elements in +3 oxidation state forms colourless compounds?

(A) Sc (B) Ni
(C) Cr (D) V

85. Identify the complex having the highest number of unpaired electrons from following.

(A) $[Co(NH_3)_6]^{3+}$ (B) $[CoF_6]^{3-}$
(C) $[NiCl_4]^{2-}$ (D) $[Ni(CN)_4]^{2-}$

86. Which of the following ligands splits d orbitals to maximum level?

(A) CN^- (B) H_2O
(C) Cl^- (D) NH_3

87. Which of the following is used as solvent for Grignard reagent?

(A) Alcohol (B) Ether
(C) Phenol (D) Ketone

88. Which of the following is a correct feature of the SN^2 mechanism?

(A) The SN^2 mechanism proceeds mainly with racemization. (B) The SN^2 mechanism includes a transition state with penta coordinating carbon.
(C) The SN^2 mechanism involves formation of planar carbocation intermediate in the first step. (D) The SN^2 mechanism involves formation of carbocation with SP^2 hybridized carbon.

89. In benzylic halides, the halogen atom is bonded to

(A) sp hybridized carbon atom. (B) sp^2 hybridized carbon atom.
(C) sp^3 hybridized carbon atom. (D) dsp^2 hybridized carbon atom.

90. Method of preparation of alkyl halide
$2R\text{-}Br + Hg_2F_2 \rightarrow 2R\text{-}F + Hg_2Br_2$
This reaction is known as

(A) Finkelstein reaction (B) Swartz reaction
(C) Sandmeyer reaction (D) Wurtz reaction

91. Which of following on oxidation forms propanone?

(A) 1-Propanol (B) 2-Propanol
(C) 2-Butanol (D) 2- methylbutan-1-ol

92. Identify the name of reaction when phenol reacts with chloroform in aqueous NaOH.

(A) Kolbe's reaction
(B) Reimer-Tiemann reaction
(C) Williamson synthesis
(D) Friedel-Crafts acylation

93. Which of the following compounds is obtained by Williamson synthesis ?

(A) only simple ethers
(B) only mixed ethers
(C) simple and mixed ethers.
(D) esters

94. Which of the following is the strongest carboxylic acid?

(A) CH_3COOH
(B) $HCOOH$
(C) CH_3CH_2-$COOH$
(D) $ClCH_2COOH$

95. Which of the following amines is not represented by formula C_3H_9N ?

(A) 1° amine
(B) 2° amine
(C) 3° amine
(D) quaternary ammonium salt

96. Which of the following statements are correct?
A) α - amino acids present in protein is L- amino acid.
B) Amino acids contain NH_2 as well as COOH group.
C) Number of amino group and carboxylic group are same in amino acids always.
D) Tryosine was firstly obtained from cheese.
Choose the correct alternatives from below:

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

97. During denaturation, which level of protein structure remains unchanged?

(A) primary
(B) secondary
(C) tertiary
(D) quaternary

98. Identify the natural source of ascorbic acid from following.

(A) Citrus fruits
(B) Cinnamon
(C) Turmeric
(D) Clove

99. Identify the monomers used to prepare bakelite from the following.

(A) phenol , chloroform
(B) formaldehyde , NaOH
(C) phenol , methanal
(D) aniline , urea

100. Which among the following is NOT a polyester polymer ?

(A) Glyptal
(B) Novolac
(C) PHBV
(D) Dacron

101. If x, y, z are the sides of a right angled triangle, where z is the largest side, then $\frac{1}{\log_{x+z} y} + \frac{1}{\log_{z-x} y} =$

(A) 1 (B) 2

(C) 3 (D) 4

102. If ω is a complex cube root of unity, then the value of $\sin\left[\pi(\omega^{10} + \omega^{23}) - \frac{\pi}{4}\right] =$

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

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

103. If 6 boys and 3 girls are to be seated in a row for a photograph, then the probability that the end seats are occupied by the girls and no two girls are side by side is

(A) $\frac{5}{12}$ (B) $\frac{1}{28}$

(C) $\frac{1}{84}$ (D) $\frac{5}{84}$

104. A bag contains 23 balls, of which 7 are identical. The number of ways of selecting 12 balls from the bag is....

(A) ${}^{18}C_6 + {}^{18}C_8$ (B) ${}^{18}C_7 + {}^{19}C_8$

(C) ${}^{16}C_8 + {}^{18}C_{15}$ (D) ${}^{16}C_8 + {}^{18}C_9$

105. The approximate value of $(0.007)^{\frac{1}{3}}$ is

(A) $\frac{21}{120}$ (B) $\frac{23}{120}$

(C) $\frac{29}{120}$ (D) $\frac{31}{120}$

106. If $33\theta = \pi$, then the value of $\cos\theta \cos 2\theta \cos 4\theta \cos 8\theta \cos 16\theta$ is

(A) $\frac{1}{16}$ (B) $\frac{1}{32}$

(C) $\frac{1}{64}$ (D) $\frac{-1}{32}$

107. If $\sec 4\theta - \sec 2\theta = 2$, then $\theta =$

(A) $n\pi + \frac{\pi}{8}, \frac{n\pi}{5} + \frac{\pi}{6}, n \in Z$

(B) $n\pi + \frac{\pi}{6}, \frac{n\pi}{5} + \frac{\pi}{8}, n \in Z$

(C) $n\pi + \frac{\pi}{2}, \frac{n\pi}{5} + \frac{\pi}{10}, n \in Z$

(D) $n\pi + \frac{\pi}{3}, n\pi + \frac{\pi}{10}, n \in Z$

108. The equation of the line passing through the point of intersection of the lines $x + 2y + 6 = 0$ and $2x - y = 2$ and making an intercept 5 on the y-axis is

(A) $39x + 2y - 10 = 0$ (B) $39x - 2y + 10 = 0$

(C) $x + 4y - 20 = 0$ (D) $x - 4y + 20 = 0$

109. The line $x + y = 3$ intersects the pair of straight lines $x^2 - 3xy + y^2 = 0$ at points A and B. Then the co-ordinates of the mid-point of AB are

(A) $\left(\frac{5}{2}, \frac{3}{2}\right)$ (B) $\left(\frac{1}{2}, \frac{1}{2}\right)$

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

110. The angle between the tangents drawn from the origin to the circle $(x-7)^2 + (y+1)^2 = 25$ is

(A) 45° (B) 90°

(C) 60° (D) 30°

111. The equation of the common tangent touching the circle $(x-3)^2 + y^2 = 9$ and the parabola $y^2 = 4x$ above the X-axis is

(A) $\sqrt{3}y = 3x + 1$ (B) $\sqrt{3}y = -(x + 3)$

(C) $\sqrt{3}y = x + 3$ (D) $\sqrt{3}y = -(3x + 1)$

112. If $\lim_{x\to\infty} \frac{(2x-1)^{19} \cdot (3x+2)^{11}}{(6x-5)^{30}} = 2^a \cdot 3^b$, then $a + b =$

(A) -30 (B) -11

(C) -19 (D) 30

113. The dual of the statement pattern $(p \wedge \sim q) \longrightarrow (q \wedge \sim p)$ is equivalent to

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

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

(C) $(\sim p \to q) \wedge (q \to p)$

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

114. Negation of the statement "If an integer is greater than 4 and less than 5, then it is a multiple of 3", is

(A) An integer is not greater than 4 but less than 5 and it is a multiple of 3.

(B) If an integer is not greater than 4 and less than 5 then it is not a multiple of 3.

(C) An integer is greater than 4 and less than 5 but it is not a multiple of 3.

(D) An integer is not greater than 4 and not less than 5 but it is not a multiple of 3.

115. In a triangle ABC, with the usual notations, $\angle B = \frac{\pi}{3}$, $\angle C = \frac{\pi}{4}$. If D divides BC internally in the ratio 1:3, then $\frac{\sin\angle BAD}{\sin\angle CAD} =$

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

(C) $\frac{1}{\sqrt{6}}$ (D) $\sqrt{\frac{2}{3}}$

116. Let P_1, P_2, P_3 be the altitudes of a triangle ABC from the vertices A, B, C respectively. If $\triangle$ denotes the area of the triangle and s is the semi-perimeter of the triangle, then $\frac{\cos A}{P_1} + \frac{\cos B}{P_2} + \frac{\cos C}{P_3} =$

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

(C) R^2 (D) $\frac{1}{R^2}$

117. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 7 & 3 \\ 0 & 6 \end{bmatrix}$ and $AB = C$, then the inverse of matrix B is

(A) $\frac{1}{42}\begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}$ (B) $\frac{1}{6}\begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}$

(C) $\frac{1}{42}\begin{bmatrix} 6 & 3 \\ -1 & 2 \end{bmatrix}$ (D) $\frac{1}{6}\begin{bmatrix} 7 & 3 \\ -1 & 3 \end{bmatrix}$

118. The element in the third row and the second column in the inverse matrix of a matrix $\begin{bmatrix} 1 & 3 & 3 \\ 3 & 1 & 3 \\ 3 & 3 & 4 \end{bmatrix}$ is

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

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

119. If $y = \tan^{-1}\sqrt{\frac{1+\sin 2x}{1-\sin 2x}}$, then $\frac{dy}{dx}$ at $x = \frac{\pi}{6}$ is

(A) 0 (B) 1

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

120. The value of $\tan^{-1}\left(\frac{\cos\left(\frac{19\pi}{4}\right)-1}{\sin\left(\frac{\pi}{4}\right)}\right)$ is equal to

(A) $-\frac{\pi}{4}$ (B) $-\frac{5\pi}{12}$

(C) $-\frac{3\pi}{8}$ (D) $-\frac{4\pi}{9}$

121. The value of f(0) so that the function $f(x) = \frac{(256-8x)^{\frac{1}{4}}-4}{16-4(64+3x)^{\frac{1}{3}}}$, $x \neq 0$ is continuous at $x = 0$, is

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

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

122. The derivative of $\sin\left(\log\left(\frac{x+3}{x}\right)\right)$ is

(A) $\frac{3}{x+3}\cos\left(\log\left(\frac{x+3}{x}\right)\right)$

(B) $\frac{3}{x(x+3)}\cos\left(\log\left(\frac{x+3}{x}\right)\right)$

(C) $\frac{-3}{x(x+3)}\cos\left(\log\left(\frac{x+3}{x}\right)\right)$

(D) $\frac{-1}{x(x+3)}\cos\left(\log\left(\frac{x+3}{x}\right)\right)$

123. If $e^y + xy = e$, then the ordered pair $\left(\frac{dy}{dx}, \frac{d^2y}{dx^2}\right)$ at $x = 0$ is equal to

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

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

124. The surface area of a spherical ball is increasing at the rate of 4π cm^2/second. The rate at which the radius is increasing when the surface area is 16π cm^2 is

(A) 0.5 cm/second (B) 0.25 cm/second

(C) 0.125 cm/second (D) 1 cm/second

125. The maximum value of $\left(\frac{1}{x}\right)^x$, $x > 0$ is

(A) e^e (B) e^{-e}

(C) $e^{1/e}$ (D) $\left(\frac{1}{e}\right)^{1/e}$

126. The point on the curve $9y^2 = x^3$ where the normal to the curve makes equal intercepts with the co-ordinate axes is

(A) $\left(-4, \frac{8}{3}\right)$ (B) $\left(4, \frac{8}{3}\right)$

(C) $\left(-4, \frac{-8}{3}\right)$ (D) $\left(-4, \frac{3}{8}\right)$

127. A spherical mothball has initial radius 3 cm. Due to evaporation, the radius of the ball reduces to 1 cm in 4 months. In how many months would the mothball evaporate completely if the volume is lost at a rate proportional to the surface area ?

(A) 6 months (B) 8 months

(C) 10 months (D) 12 months

128. $\int \frac{x^2\,dx}{(x^2+2)(x^2+5)} =$

(A) $-\left(\frac{\sqrt{2}}{3}\tan^{-1}\frac{x}{\sqrt{2}} + \frac{\sqrt{5}}{3}\tan^{-1}\frac{x}{\sqrt{5}}\right) + c$, where c is the constant of integration

(B) $\left(\frac{\sqrt{2}}{3}\tan^{-1}\frac{x}{\sqrt{2}} + \frac{\sqrt{5}}{3}\tan^{-1}\frac{x}{\sqrt{5}}\right) + c$, where c is the constant of integration

(C) $\frac{\sqrt{2}}{3}\tan^{-1}\left(\frac{x}{\sqrt{2}}\right) - \frac{\sqrt{5}}{3}\tan^{-1}\left(\frac{x}{\sqrt{5}}\right) + c$, where c is the constant of integration

(D) $-\frac{\sqrt{2}}{3}\tan^{-1}\left(\frac{x}{\sqrt{2}}\right) + \frac{\sqrt{5}}{3}\tan^{-1}\left(\frac{x}{\sqrt{5}}\right) + c$, where c is the constant of integration

129. The value of $\int \frac{\sin^6 x + \cos^6 x}{\sin^2 x \cdot \cos^2 x}\,dx$ is

(A) $\cot x + \cot^2 x + c$, where c is the constant of integration

(B) $\tan x - \cot x - 3x + c$, where c is the constant of integration

(C) $2\sin^5 x + 2\cos^5 x + c$, where c is the constant of integration

(D) $\sin^3 x + 2\cos^3 x + c$, where c is the constant of integration

130. $\int \text{cosec}^{-1}\left(\sqrt{\frac{a+x}{x}}\right)\,dx =$

(A) $a\theta\tan^2\theta - a\tan\theta - a\theta + c$ $\left(\text{where } \theta = \tan^{-1}\left(\sqrt{\frac{x}{a}}\right)\right)$ and c is the constant of integration

(B) $a\theta\tan^2\theta - a\tan\theta + a\theta + c$ $\left(\text{where } \theta = \tan^{-1}\left(\sqrt{\frac{x}{a}}\right)\right)$ and c is the constant of integration

(C) $a\theta\tan^2\theta + a\tan\theta - a\theta + c$ $\left(\text{where } \theta = \tan^{-1}\left(\sqrt{\frac{x}{a}}\right)\right)$ and c is the constant of integration

(D) $a\theta\tan^2\theta + a\tan\theta + a\theta + c$ $\left(\text{where } \theta = \tan^{-1}\left(\sqrt{\frac{x}{a}}\right)\right)$ and c is the constant of integration

131. $\int_0^{\pi} |\sin 2x|\,dx =$

(A) 0 (B) 1

(C) 2 (D) -1

132. If $f(x)$ is an even function, then $\int_{-2}^{2}(|x| + f(x)\sin x)\,dx$ is

(A) 2 (B) 4

(C) 6 (D) 8

133. The area of the region bounded by the curves $y = |x-4|$, $x = 3$ and $x = 5$, and the X-axis is

(A) 5 sq. units (B) 3 sq. units

(C) 6 sq. units (D) 1 sq. unit

134. The solution of $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$ is

(A) $\log\left[1 + \tan\left(\frac{x+y}{2}\right)\right] = y + c$, where c is the constant of integration

(B) $\log\left[1 - \tan\left(\frac{x+y}{2}\right)\right] = y + c$, where c is the constant of integration

(C) $\log\left[1 + \tan\left(\frac{x+y}{2}\right)\right] = x + c$, where c is the constant of integration

(D) $\log\left[1 - \tan\left(\frac{x+y}{2}\right)\right] = x + c$, where c is the constant of integration

135. The order and degree of the differential equation $3-\left(\frac{d^3y}{dx^3}\right)^{\frac{7}{3}}=\left(\frac{dy}{dx}\right)^5$ are respectively

(A) $3,7$ (B) $7,3$

(C) $5,7$ (D) $3,5$

136. The solution of the differential equation $e^{-x}(y+1)dy+(\cos^2 x-\sin 2x)y\,dx=0$, given that $y=1$ when $x=0$ is

(A) $\log y+\frac{1}{y}+e^x\cos^2 x=1$

(B) $\log y+y+e^x\cos^2 x=2$

(C) $(y+1)+e^x\cos^2 x=2$

(D) $\log\left(y+\frac{1}{y}\right)+e^x\cos^2 x=1$

137. A unit vector coplanar with $\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}+2\hat{j}+\hat{k}$ and perpendicular to $\hat{i}+\hat{j}+\hat{k}$ is

(A) $\pm\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$ (B) $\pm\frac{1}{\sqrt{3}}(\hat{i}-\hat{j}+\hat{k})$

(C) $\pm\frac{1}{\sqrt{2}}(\hat{j}-\hat{k})$ (D) $\pm\frac{1}{\sqrt{2}}(\hat{j}+\hat{k})$

138. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, $|\vec{a}|=|\vec{b}|=|\vec{c}|=3$ and θ is the angle between $\vec{b}$ and $\vec{c}$ then $\tan^2\theta+\cot^2\theta=$

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

(C) $\frac{8}{3}$ (D) $\frac{10}{3}$

139. The altitude of the parallelopiped, whose coterminous edges are the vectors $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=2\hat{i}+4\hat{j}-\hat{k}$, $\vec{c}=\hat{i}+\hat{j}+3\hat{k}$, where $\vec{a}$, $\vec{b}$ are the sides of the base of parallelopiped, is

(A) $\frac{2\sqrt{2}}{\sqrt{19}}$ units (B) $\frac{\sqrt{2}}{\sqrt{19}}$ units

(C) $\frac{\sqrt{19}}{\sqrt{2}}$ units (D) $\frac{\sqrt{19}}{2\sqrt{2}}$ units

140. Let ABCD be a quadrilateral with $\overline{AB}=\vec{a}$, $\overline{AD}=\vec{b}$ and $\overline{AC}=3\vec{a}+2\vec{b}$. If its area is α times the area of the parallelogram with AB, AD as adjacent sides, then the value of α is equal to

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

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

141. Let $\vec{a}=\hat{i}+2\hat{j}-2\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$. If $\vec{c}$ is a vector such that $\vec{a}\cdot\vec{c}=|\vec{c}|$, $|\vec{c}-\vec{a}|=2\sqrt{2}$ and the angle between $\vec{a}\times\vec{b}$ and $\vec{c}$ is 60°, then $|(\vec{a}\times\vec{b})\times\vec{c}|$ is equal to

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

(C) $3\sqrt{\frac{3}{2}}$ (D) $\frac{9\sqrt{3}}{2}$

142. The co-ordinates of the point where the line joining the points $(3,5,-7)$ and $(-2,1,8)$ is intersected by the YOZ plane are

(A) $\left(0,\frac{-13}{5},\frac{2}{5}\right)$ (B) $\left(0,\frac{13}{5},\frac{2}{5}\right)$

(C) $\left(0,\frac{13}{5},2\right)$ (D) $\left(0,\frac{-13}{5},-2\right)$

143. If the lines $\vec{r}=(\hat{i}+m\hat{j}+3\hat{k})+\lambda(2\hat{i}+3\hat{j}+4\hat{k})$ and $\vec{r}=(4\hat{i}+\hat{j})+\mu(5\hat{i}+m\hat{j}+\hat{k})$ intersect each other, then m =

(A) 1 (B) -1

(C) 2 (D) -2

144. If the lines $x=-1+s$, $y=3-\lambda s$, $z=1+\lambda s$ and $x=\frac{t}{2}$, $y=1+t$, $z=2-t$ with parameters s and t, are coplanar, then $\lambda=$

(A) 2 (B) 1

(C) -2 (D) -1

145. The equation of the plane passing through the point $(1,2,1)$ and perpendicular to the planes $x+2y+2z-7=0$ and $3x+3y+2z-5=0$ is

(A) $2x+y-2z-2=0$

(B) $2x-4y+3z+3=0$

(C) $2x+4y-5z-5=0$

(D) $x+4y-6z-3=0$

146. The distance of the point $(1,0,-3)$ from the plane $x-y-z=9$ measured parallel to the line $\frac{x-2}{2}=\frac{y+2}{3}=\frac{z-6}{-6}$ is

(A) 5 units (B) 7 units

(C) 6 units (D) 8 units

147. The difference between the maximum and minimum values of the objective function $Z = 3x + 5y$, subject to the constraints $x + 3y \leq 60$, $x + y \geq 10$, $x - y \leq 0$, $x, y \geq 0$ is

(A) 50 (B) 60

(C) 70 (D) 80

148. For the following probability distribution, the standard deviation of the random variable X is

X	2	3	4
p(X=x)	0.2	0.5	0.3

(A) 0.5 (B) 0.6

(C) 0.61 (D) 0.7

149. A random variable X has the following probability distribution

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

For the event E = { X is a prime number } and F = { X < 4 }, P(E∪F) =

(A) 0.87 (B) 0.77

(C) 0.35 (D) 0.50

150. The probability that event A happens in a trial is 0.4. If three independent trials are made, then the probability that A happens at least once is.....

(A) 0.216 (B) 0.926

(C) 0.064 (D) 0.784

- End of Question Paper -