MHT CET 2026 PCM May 19 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. In a vector $\vec{p}$, 'x' and 'y' components have magnitudes 2 units and 5 units respectively. A vector $\vec{q}$, along negative Y axis has magnitude of 3 units. Then $\vec{p} \cdot \vec{q}$ is

(A) -6 (B) -9

(C) -10 (D) -15

2. In a certain system, the quantities A and B are measured as 8 ± 0.08 and 6 ± 0.06 respectively. Let $x = AB$, $y = A + B$ and $z = A - B$. The correct order of % error in x, y and z is

(A) $x = y > z$ (B) $x < z < y$

(C) $z > x > y$ (D) $x > z > y$

3. A juggler throws balls into air. He throws one ball whenever the previous one is at its highest point. If he throws 4 balls in one second, the height from which each ball returns is nearly [acceleration due to gravity is $9.8\ \text{m/s}^2$]

(A) 30 cm (B) 40 cm

(C) 50 cm (D) 60 cm

4. A particle moves along a circular path of radius 'r' with uniform speed 'v'. The angle described by the particle in two seconds in radians is

(A) vr^2 (B) v/r

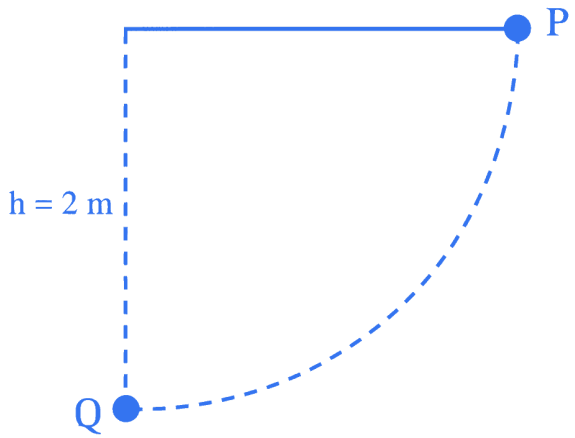
(C) $2v/r$ (D) $r/2v$

5. On a dry curved (banked) road, with banking angle of zero, the maximum safe speed for a moving vehicle is 'v'. After heavy rain, the maximum safe speed for the same road was reduced by 60%. The ratio of the coefficient of friction for the dry road to that of the wet road is

(A) 25 : 9 (B) 24 : 5

(C) 24 : 9 (D) 25 : 4

6. The bob of a simple pendulum of length 2m is kept at P. It is released and when it reaches Q, it losses 20% of its total energy due to air resistance. Its velocity at Q is [Take $g = 9.8\ \text{m/s}^2$]



(A) 4.4 m/s (B) 5.2 m/s

(C) 5.6 m/s (D) 6.2 m/s

7. A 6 kg mass and 1.5 kg mass are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is

(A) 4 : 1 (B) 2 : 1

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

8. A cricket ball of mass 120 g is moving with a velocity of 8 m/s and is hit by a bat so that the ball gets turned back with a velocity of 12 m/s. If the duration of contact between the ball and bat is 0.02 s, the impulse (in Ns) given to the ball by the bat is

(A) 0.48 (B) 1.2

(C) 2.4 (D) 3.6

9. A body of mass 'm' is raised to a height '$10R$' from the surface of the earth, where 'R' is the radius of the earth. Suppose it is released now. The speed with which it will strike the surface of the earth is nearly
[g = acceleration due to gravity]

(A) $\sqrt{\frac{20gR}{11}}$ (B) $\sqrt{\frac{10gR}{11}}$

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

10. A metal wire of length 'L' and density 'd' rests horizontally on the free surface of water. The maximum radius of the wire so that the wire does not sink in water is
[T = surface tension of water, g = gravitational acceleration]

(A) $\sqrt{\frac{2dg}{\pi T}}$ (B) $\sqrt{\frac{2T}{\pi dg}}$
(C) $\sqrt{\frac{\pi dg}{2T}}$ (D) $\sqrt{\frac{T}{\pi dg}}$

11. 'n' identical small drops of water are falling down vertically through a medium each with a terminal velocity 'v'. If they combine to form a single drop, then its terminal velocity is xv. The value of x is

(A) $n^{1/3}$ (B) $n^{2/3}$
(C) n^2 (D) n^3

12. Under isothermal conditions, a single drop of radius R is formed from two mercury drops of radii R_1 and R_2. After combination, the relation between R, R_1 and R_2 is

(A) $R = \frac{R_1+R_2}{2}$ (B) $R^3 = R_1^3 + R_2^3$
(C) $R^2 = R_1^2 + R_2^2$ (D) $R = R_1 + R_2$

13. A perfectly black body radiates power at temperature T_1K. If it is to radiate 16 times this power, its temperature should be increased by

(A) $(16T_1)K$ (B) $(4T_1)K$
(C) $(2T_1)K$ (D) $(T_1)K$

14. The length of mercury column in a mercury-in-glass thermometer is H_1 mm at the ice point and H_2 mm at the steam point. When the length is H mm, the temperature T is given in °C by ($H_1 < H_2$)

(A) $\frac{100(H-H_1)}{(H_2-H_1)}$ (B) $\frac{100(H_2-H)}{(H_2-H_1)}$
(C) $\frac{100(H_2-H_1)}{(H-H_1)}$ (D) $\frac{100(H_2-H)}{(H-H_1)}$

15. There is an expansion of a gas in a thermodynamic system. But this change cannot be plotted on a P-V diagram. Then it is

(A) an isothermal expansion. (B) a free expansion
(C) an adiabatic expansion (D) an isobaric expansion

16. When the temperature of 4 moles of a gas was increased from 70°C to 90°C, at constant volume, the change in internal energy was 60 J. The total heat capacity of the gas at constant volume is

(A) 0.5 J/K (B) 2 J/K
(C) 3 J/K (D) 4 J/K

17. The molar specific heat at constant pressure of an ideal gas is $\frac{7}{2}R$. The gas is made up of molecules which are

(A) polyatomic (B) non-rigid diatomic
(C) rigid diamotic (D) monoatomic

18. If 'm' represents the mass of each molecule of a gas and 'T' its absolute temperature respectively, then the root mean square velocity of the gaseous molecule is proportional to

(A) $m^{-1/2}T^{-1/2}$ (B) $m^{-1/2}T^{1/2}$
(C) $m^{1/2}T^{-1/2}$ (D) m^1T^1

19. Two simple harmonic motions are represented as $y_1 = 10\sin\omega t$ and $y_2 = 5\sin\omega t + 5\cos\omega t$, both in cm. The ratio of the amplitudes of y_2 (A_2) to that of y_1 (A_1), is

(A) 4 : 1 (B) $\sqrt{2}$: 1
(C) 1 : 1 (D) 1 : $\sqrt{2}$

20. The differential equation of a particle performing S.H.M. is $\frac{d^2x}{dt^2} + 64x = 0$, where x is in meter. The period of oscillation of the particle is (in second)

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{5}$ (D) $\frac{\pi}{8}$

21. A stretched string of length 'L' is fixed at both the ends, has 'n' nodes ($n > 2$). The length of the string in terms of n and wavelength λ is

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

22. Two simple harmonic sound waves travelling in the same direction are given by $y_1(x,t) = A\sin(0.5\pi x - 100\pi t)$ and $y_2(x,t) = A\sin(0.46\pi x - 92\pi t)$
The number of times, a stationary listener can hear sound of maximum intensity in one second is

(A) 3 (B) 4
(C) 6 (D) 8

23. For a stationary wave, $y = 10\cos(\pi x/15)\sin(48\pi t)$ cm, the distance between a node and the successive antinode is

(A) 30 cm (B) 22.5 cm

(C) 15 cm (D) 7.5 cm

24. The amplitude of a sound wave at a distance r from a point source is A. The amplitude at a distance $2r$ from the point source is

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

(C) A (D) $2A$

25. A semicircular arc of radius 'R' is charged uniformly and has charge per unit length as λ. The electric potential V at the centre of curvature is [ε_0 = permittivity of vacuum]

(A) $\frac{\lambda}{4\varepsilon_0}$ (B) $\frac{\lambda}{2\varepsilon_0}$

(C) $\frac{\lambda}{8\varepsilon_0}$ (D) $\frac{\lambda}{\varepsilon_0}$

26. Two charged particles each having a charge '$+q$' and mass 'm' are kept at a distance 'd'. If they are in equilibrium under the gravitational force and the electric force between them, then the ratio $\frac{q}{m}$ (specific charge) of each particle is (G-Universal gravitation constant, ε_0 = permittivity of free space)

(A) $G/4\pi\varepsilon_0$ (B) $4\pi\varepsilon_0 G$

(C) $\sqrt{4\pi\varepsilon_0 G}$ (D) $\sqrt{\frac{4\pi\varepsilon_0}{G}}$

27. Two parallel plate air capacitors of same capacity 'C' are connected in series to a battery of emf 'E'. Then one of the capacitors is completely filled with dielectric material of constant 'K'. The change in the effective capacity of the series combination is

(A) $\frac{C}{2}\left[\frac{K-1}{K+1}\right]^2$ (B) $\frac{C}{2}\left[\frac{K+1}{K-1}\right]^2$

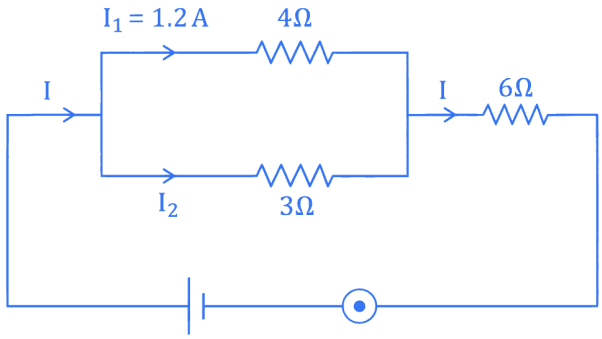
(C) $\frac{2}{C}\left[\frac{K-1}{K+1}\right]$ (D) $\frac{C}{2}\left[\frac{K-1}{K+1}\right]$

28. Consider the earth to be a sphere, having charge Q. Let R, V and A be its radius, volume and area respectively. The capacitance of the earth is [ε_0 = permittivity of free space]

(A) $4\pi\varepsilon_0\frac{V}{A}$ (B) $4\pi\varepsilon_0\frac{A}{V}$

(C) $12\pi\varepsilon_0\frac{A}{V}$ (D) $12\pi\varepsilon_0\frac{V}{A}$

29. In the following circuit, the current in the 4Ω resistance is 1.2 A. The total current (I) flowing in the circuit is



(A) 1.6 A (B) 2.4 A

(C) 2.8 A (D) 3.2 A

30. The potential gradient along the length of 1 metre wire of uniform cross section is 6 V/m. Let 'B' and 'C' be the two points at 40 cm and 60 cm marks respectively from one end. The potential difference between points B and C is

(A) 1.2 V (B) 2.4 V

(C) 3.5 V (D) 6.0 V

31. A magnetic dipole lying parallel to a magnetic field requires 'W' units of work to turn it through 30°. The torque required to keep this needle in this position is

$\left[\sin 30^\circ = \cos 60^\circ = 0.5,\ \sin 60^\circ = \cos 30^\circ = \frac{\sqrt{3}}{2},\ \sin 0^\circ = \cos 90^\circ = 1\right]$

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

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

32. Two particles X and Y of masses 'm_1' and 'm_2' respectively, having equal charges after being accelerated through the same potential difference enter a region of uniform magnetic field and describe circular paths of radii 'r_1' and 'r_2' respectively. The ratio of 'r_1' and 'r_2' is

(A) $\left(\frac{m_1}{m_2}\right)^2$ (B) $\frac{m_1}{m_2}$

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

33. A rectangular coil of effective area $0.04\ \text{m}^2$ is suspended freely in a radial magnetic field of $0.02\ \text{Wb/m}^2$. The torsional constant of the suspension fibre is $5 \times 10^{-9}\ \text{Nm/degree}$. If a current of $250\ \mu\text{A}$ is passed through it, then the angle through which it rotates is

(A) 30° (B) 40°

(C) 45° (D) 50°

34. The magnetic flux through a coil of resistance 'R' changes by an amount $\Delta\phi$ in the time Δt. The total quantity of induced current and charge is respectively

(A) $\frac{\Delta\phi}{\Delta t}$ and $\frac{\Delta\phi}{R}$ (B) $\frac{\Delta\phi}{\Delta t} \times R$ and $\frac{\Delta\phi}{\Delta t}$

(C) $\frac{\Delta\phi}{R\Delta t}$ and $\frac{\Delta\phi}{R}$ (D) $\frac{R\Delta t}{\Delta\phi}$ and $R\Delta\phi$

35. Whenever a magnet is moved either towards or away from a conducting coil, magnetic flux linked with the coil changes. This change is dependent on

(a) the strength of the magnetic field.
(b) the area of cross-section of the coil.
(c) the resistance of the coil.
(d) the number of turns in the coil.

(A) (a), (b), (c) (B) (a), (c), (d)

(C) (a), (b), (d) (D) (b), (c), (d)

36. In a discharging series L-C-R circuit, $C = 2\ \mu\text{F}$, $L = 1\ \text{mH}$ and $R = 10\ \Omega$. The ratio of the energies stored in the inductor and in the capacitor, when the maximum current flows in the circuit, is

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

(C) 3 : 2 (D) 5 : 1

37. An inductor of inductance L and a resistor of resistance R are joined in series and connected to an a.c. source of frequency ω. The power dissipated in the circuit is

(A) $\frac{(R^2+\omega^2L^2)}{V}$ (B) $\frac{V}{(R^2+\omega^2L^2)}$

(C) $\frac{V^2R}{(R^2+\omega^2L^2)}$ (D) $\sqrt{\frac{R^2+\omega^2L^2}{V^2}}$

38. An alternating voltage is given by $V = V_0 \sin\left(\omega t + \frac{\pi}{4}\right)$. The time when the voltage is maximum for the first time is

(T = periodic time of the alternating voltage, $\cos 0^\circ = \sin 90^\circ = 1$)

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

(C) $\frac{T}{8}$ (D) $\frac{T}{12}$

39. A transformer having an efficiency 80% is working on 200 V and 4 kW power supply. If the current in the secondary coil is 5 A, the voltage across the secondary coil and the current in the primary coil, respectively, are

(A) 10 A, 600 V (B) 20 A, 640 V

(C) 25 A, 680 V (D) 40 A, 700 V

40. A ray of light takes time 't' to travel a distance 'd' in air and it travels a distance '$4d$', in time 'T' in a certain medium. If $T = 8t$, the critical angle for the pair of media is

$\left[\sin\left(\frac{\pi}{6}\right) = 0.5,\ \sin\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}},\ \sin\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{2},\ \sin\left(\frac{\pi}{2}\right) = 1\right]$

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

(C) $\frac{\pi^c}{4}$ (D) $\frac{\pi^c}{6}$

41. The radii of curvature of both the surfaces of a convex lens are equal. One of the surfaces is made plane by grinding. The new focal length and power of the lens, respectively, are

(A) $\frac{f}{2}$ and $2P$ (B) $\sqrt{2}f$ and $\frac{P}{\sqrt{2}}$

(C) $2f$ and $\frac{P}{2}$ (D) f and P

42. In a biprism experiment, using a light of wavelength 4800 Å, a steady interference pattern was obtained on a screen 1 m away from the source. Now the source is replaced by another of wavelength 6400 Å and the screen is moved away from it by 20 cm. The fringewidth will

(A) decrease by 40%. (B) decrease by 60%.

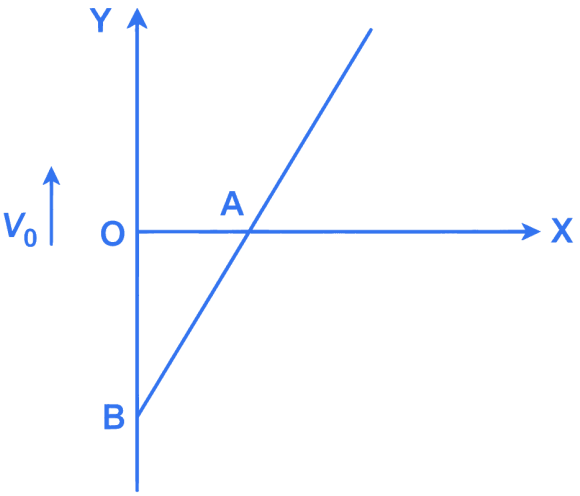
(C) increase by 60%. (D) increase by 40%.

43. In the diffraction pattern due to a single slit of width 'a' with incident light of wavelength 'λ', at an angle of diffraction 'θ', the condition for the second maximum is

(A) $a \sin\theta = 2\lambda$ (B) $2\lambda \sin\theta = 3a$

(C) $5\lambda \sin\theta = 3a$ (D) $2a \sin\theta = 5\lambda$

44. In an experiment on photoelectric effect, the stopping potential V_0 is plotted against the frequency ν of the incident light. Considering e as the electronic charge, the work function of the photoelectric surface is given by



(A) OA in eV
(B) OB in volt
(C) multiplication of (OB) and (e) in joules
(D) The slope of the line AB

45. The moment of inertia of the electron moving in the second Bohr orbit of a hydrogen atom is [m = mass of electron, h = Planck's constant, e = charge on electron, ε_0 = permittivity of free space]

(A) $\frac{\varepsilon_0^2 h^4}{8\pi^2 me^4}$
(B) $\frac{16\varepsilon_0^2 h^4}{\pi^2 me^4}$
(C) $\frac{2\varepsilon_0^2 h^4}{\pi^2 me^4}$
(D) $\frac{4\varepsilon_0^2 h^2 m}{\pi^2 e^4}$

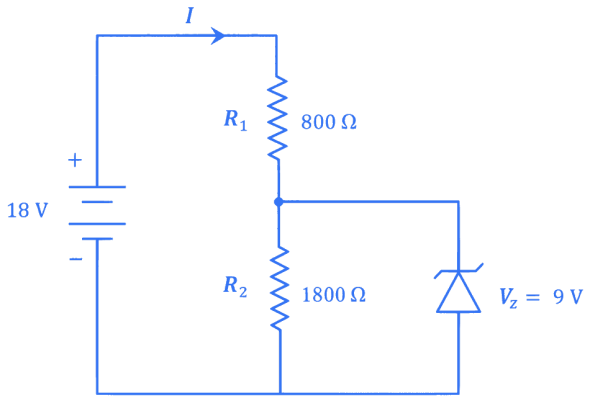
46. The de Broglie wavelength of an electron moving in the n^{th} Bohr orbit of radius 'r' is

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

47. Initially 8×10^{10} atoms are present in a radioactive sample. The half-life of the sample is 1 hour. The number of atoms that will decay in the time interval $t = 2$ hour to $t = 5$ hour, is

(A) 0.25×10^{10}
(B) 1.5×10^{10}
(C) 1.75×10^{10}
(D) 2×10^{10}

48. In the following circuit, the current through the Zener diode is

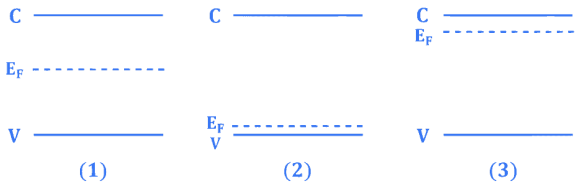


(A) 5.00 mA
(B) 6.25 mA
(C) 11.25 mA
(D) 16.25 mA

49. If two inputs of a NOR gate are shorted, the resulting gate is

(A) a NAND gate.
(B) an OR gate.
(C) an AND gate.
(D) a NOT gate.

50. The band diagrams of three semiconductors p, n and intrinsic are given in the figures (1), (2) and (3). C and V are the conduction and valence bands and E_F is the Fermi level. Figures, from (2),(1) and (3) respectively represent the type of semiconductors as



(A) intrinsic, n and p
(B) p, intrinsic and n
(C) intrinsic, p and n
(D) n, intrinsic and p

51. Calculate the volume occupied by 64 g dioxygen at STP.

(A) 22.4 L
(B) 44.8 L
(C) 11.2 L
(D) 33.6 L

52. What is the frequency of violet light if its wavelength is 400 nm?

(A) 4.0×10^{14} Hz
(B) 5.4×10^{14} Hz
(C) 7.5×10^{14} Hz
(D) 4.7×10^{14} Hz

53. Identify the compound having lowest boiling point.

(A) H_2O
(B) $CH_2(OH)$-$CH_2(OH)$
(C) $CH_3 - O - C_2H_5$
(D) $C_3H_7 - OH$

54. What types of intermolecular forces are present in N_2 molecules?

(A) London dispersion forces
(B) Dipole-dipole interactions
(C) Dipole-induced dipole interactions
(D) Hydrogen bonding

55. Which of the following is the correct order of lattice energy?

(A) $AlCl_3 > CaCl_2 > NaCl$
(B) $AlCl_3 > NaCl > CaCl_2$
(C) $CaCl_2 > AlCl_3 > NaCl$
(D) $NaCl > CaCl_2 > AlCl_3$

56. 2 moles of an ideal gas expand isothermally and reversibly from 10 L to 50 L at 298 K. Calculate the work done during this expansion. ($R = 8.314$ JK^{-1} mol^{-1})

(A) -79.756 J
(B) -7.9756 J
(C) -7975 kJ
(D) -7.975 kJ

57. A gas expands by 2500 cm^3 against constant external pressure 1.5 atm at constant temperature of 300 K. Calculate the work of expansion in kJ.

(A) -0.380
(B) -0.350
(C) -0.42
(D) -0.45

58. Which of the following is NOT the state function?

(A) Gibbs energy
(B) Temperature
(C) Heat
(D) Heat transfer at constant volume (Q_v)

59. If pK_b value for fluoride ion at 25°C is 10.83, calculate the ionisation constant of hydrofluoric acid in water at this temperature.

(A) 1.74×10^{-5}
(B) 3.52×10^{-3}
(C) 6.75×10^{-4}
(D) 5.38×10^{-2}

60. Phosphoric acid dissociates upto 80% in its 0.02 M solution at 25°C. Calculate the pH of the solution.

(A) 1.319
(B) 1.651
(C) 1.101
(D) 1.921

61. Which of the following salts does not undergo hydrolysis?

(A) Ammonium chloride .
(B) Sodium carbonate .
(C) Ammonium cyanide .
(D) Potassium nitrate .

62. Which of the following compounds has the lowest oxidation state of carbon?

(A) CH_4
(B) CCl_4
(C) CF_4
(D) CO_2

63. Identify unstable isotope of hydrogen from the following.

(A) Hydrogen
(B) Deuterium
(C) Tritium
(D) Deuterium and Tritium

64. What is IUPAC name of catechol?

(A) Benzene-1,3-diol
(B) 4-Methylphenol
(C) 4-Hydroxybenzaldehyde
(D) Benzene-1,2-diol

65. Identify the name of the isomerism in rapid equilibrium with each other in the following reaction.



(A) Geometrical isomerism
(B) Metamerism
(C) Tautomerism
(D) Functional isomerism

66. Which of the following compounds is obtained in the first step of Wolf - Kishner reduction when alkyl aryl ketones are reduced to alkyl benzene?

(A) Acids
(B) Alcohols
(C) Hydrazones
(D) Alkenes

67. Identify the reagent used in Etard reaction.

(A) $SnCl_2.HCl$
(B) CrO_3
(C) Pd-$BaSO_4$
(D) CrO_2Cl_2

68. Which reaction is used to synthesize straight-chain alkylbenzenes?

(A) Etard
(B) Rosenmund reduction
(C) Stephen's reaction
(D) Wolf kishner reduction

69. Identify the the major product of bromination of anisole in presence of acetic acid.

(A) o-bromoanisole
(B) p-bromoanisole
(C) m-bromoanisole
(D) di-orthobromoanisole

70. Which of the following reagents is used to convert benzene into glyoxal?

(A) O_3 followed by Fe and H_2O_2
(B) O_3 followed by Zn and H_2O
(C) H_2 with nickel at 473K
(D) $KMnO_4$

71. Which of the following processes is according to principles of green chemistry?

(A) Running reactions at high temperatures to maximize production
(B) Burning chemical waste for quick disposal
(C) Replacing hazardous solvents with water or ethanol in synthesis
(D) Increasing the use of petroleum-based feedstocks

72. Which of the following statements is correct regarding Frenkel defects?

(A) It arises due to an equal number of actions and anions are missing from their regular poisons in the crystal lattice.
(B) It arises when an ion of an ionic compound is missing from its regular site and occupies an interstitial position.
(C) After the defect density of substance decreases.
(D) In this, electrical neutrality of the compound is not maintained.

73. Calculate the radius of a particle present in fcc unit cell having edge length 200 pm.

(A) 7.07×10^{-9} cm
(B) 3.535×10^{-9} cm
(C) 1.4140×10^{-9} cm
(D) 8.71×10^{-9} cm

74. Which of the following metals has simple cubic structure?

(A) Potassium
(B) Polonium
(C) Calcium
(D) Magnesium

75. A solution containing 0.6 g nonelectrolyte solute in 30 g water freezes at $-0.6\,^{\circ}C$. Calculate the molar mass of solute if cryoscopic constant of water is 1.8 K kg mol^{-1}.

(A) 54 g mol^{-1}.
(B) 60 g mol^{-1}.
(C) 66 g mol^{-1}.
(D) 72 g mol^{-1}.

76. Calculate the osmotic pressure of a solution containing 3.42 g of fructose (molar mass = 180 g/mol) in 1 litre of water at 400 K.

(A) 0.624 atm
(B) 0.180 atm
(C) 0.340 atm
(D) 0.420 atm

77. Identify from following equimolar solutions that has maximum boiling point elevation. (Assuming complete dissociation)

(A) Potassium chloride (B) Lithium sulfate
(C) Aluminium sulphate . (D) Ammonium phosphate

78. A battery delivers a steady current of 3.00 ampere for 10.0 hours. Calculate the number of moles of electrons passed.

(A) 3.6 (B) 1.12
(C) 4.5 (D) 2.7

79. The molar conductivity of 0.01M acetic acid at 25°C is 16 S m^2 mol^{-1}. Find its percent dissociation in the 0.01M solution if molar conductivity of acetic acid at zero concentration is 390 S m^2 mol^{-1}.

(A) 1% (B) 2.2%
(C) 3% (D) 4.1%

80. What is the common unit of molar conductivity?

(A) S m^2 mol^{-1} (B) ohm^{-1} cm^2 mol^{-1}
(C) ohm cm^2 mol^{-1} (D) ohm^{-1} cm^2 mol

81. Identify the nature of the graph obtained when rate versus initial concentration is plotted for first order reaction.

(A) A straight line passing through the origine having -ve slope. (B) A straight line parallel to X axis.
(C) A straight line passing through the origine having +ve slope. (D) A straight line intercepting X and Y axes.

82. Calculate the activation energy when the rate of chemical reaction doubles with an increase of 10 K in absolute temperature from 298 K. ($R \times 2.303 = 19.15$ J K^{-1} mol^{-1}).

(A) 35.85 KJ mol^{-1} (B) 52.89 KJ mol^{-1}
(C) 42.36 KJ mol^{-1} (D) 26.14 KJ mol^{-1}

83. The rate law for a reaction is Rate $= k[A]^2[B]^0$. The overall order is

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

84. Identify a positively charged sol from the following.

(A) Antimony trisulfide (B) Eosin
(C) Gum (D) Hemoglobin

85. Which of following reactions occur at zone of reduction in blast furnace for extraction of iron?

(A) $C + \frac{1}{2}O_2 \rightarrow CO_{(g)}$

(B) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(C) $CaCO_3$ (heat) $\rightarrow CaO + CO_2$

(D) $CaO + SiO_2 \rightarrow CaSiO_3$

86. Which of the following factors is responsible for the anomalous behavior of oxygen?
(A). small atomic size.
(B). higher electronegativity.
(C). low O - O bond dissociation energy.
(D). absence of d - orbital
(E). presence of vaccant d - orbitals.
Choose the **correct** answer from the options given below:

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

87. Find the number of allotropic forms of Tellurium under normal conditions.

(A) 2 (B) 3
(C) 6 (D) 8

88. Identify the position of lanthanum in terms of the following blocks in the modern periodic table?

(A) f block (B) p block
(C) s block (D) d block

89. What is the effective atomic number of Cu in $[Cu(NH_3)_4]^{2+}$?

(A) 18 (B) 33
(C) 35 (D) 36

90. What type of isomerism is exhibited by the following coordinate complexes?
$[CO(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][CO(CN)_6]$

(A) Solvate isomerism. (B) Co-ordinate Isomerism.
(C) Ionisation Isomerism. (D) Linkage Isomerism.

91. Identify the products formed when benzenediazonium chloride reacts with CuCl / HCl
$C_6H_5N_2^+Cl^- + CuCl \rightarrow$

(A) $C_6H_5Cl + N_2$ (B) $C_6H_5Br + N_2$
(C) $C_6H_6 + N_2$ (D) C_6H_5OH

92. When R-X is treated with KCN (alcoholic, heat), find the type of attack found, when the major product is formed in this reaction?

(A) Attack occurs through nitrogen → Forming isocyanide.
(B) Attack occurs through carbon → Forming nitrile.
(C) Free radical substitution
(D) Elimination

93.
$CH_3\text{-}CH_2\text{-}Cl + NaI \xrightarrow{\text{acetone}} CH_3\text{-}CH_2\text{-}I + NaCl \downarrow$
The above reaction is known as:

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

94. Identify the product of reaction between alcoholic silver nitrite and ethyl bromide.

(A) Ethene (B) Ethane
(C) Ethane nitrile (D) Nitro ethane

95. Which of the following amines exhibits the Carbylamine test?

(A) Primary amine (B) Secondary amine
(C) Tertiary amine (D) Quaternary ammonium salt

96. What is the number of chiral carbon atoms in the open chain structure of glucose and fructose respectively?

(A) 4 carbon atoms in each (B) 3 carbon atoms in each
(C) 4 carbon atoms in glucose and 3 carbon atoms in fructose (D) 3 carbon atoms in glucose and 4 carbon atoms in fructose

97. Which of the following is NOT a disaccharide ?

(A) Cane sugar (B) Raffinose
(C) Lactose (D) Maltose

98. Which of the following statements is true regarding fats?

(A) These are polyesters of fatty acids and ethylene glycol.
(B) These are triesters of fatty acids and glycerols.
(C) These are esters of inorganic acids and bases.
(D) triester of unsaturated fatty acids and ethyl alcohol

99. Identify a monomer of natural rubber.

(A) Styrene (B) Butadiene
(C) Vinyl chloride (D) Isoprene

100. Identify a polymer containing nitrogen.

(A) Bakelite (B) Dacron
(C) Rubber (D) Nylon-6,6

101. If $f(x) = \{x\}$ represents the fractional part function, then for any $x \notin \mathbb{Z}$, the expression $f(x) + f(-x)$ is equal to...

(A) 0 (B) 1

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

102. If $\cos A = \frac{3}{4}$, then the value of $2 \sin \frac{A}{2} \cdot \sin \frac{5A}{2} = \ldots$

(A) $\frac{11}{16}$ (B) $\frac{\sqrt{11}}{16}$

(C) $-\frac{\sqrt{11}}{16}$ (D) $-\frac{11}{16}$

103. The general solution of the equation $4 \sin x \cos x + 2 \sin x + 2 \cos x + 1 = 0$, where $n \in Z$ is:

(A) $x = 2n\pi \pm \frac{2\pi}{3}$ or $n\pi + (-1)^n \frac{7\pi}{6}$ (B) $x = 2n\pi \pm \frac{\pi}{3}$ or $n\pi - (-1)^n \frac{5\pi}{6}$

(C) $x = 2n\pi + \frac{\pi}{3}$ or $n\pi + (-1)^n \frac{7\pi}{6}$ (D) $x = 2n\pi - \frac{\pi}{3}$ or $n\pi + (-1)^n \frac{7\pi}{6}$

104. If P and P' denote respectively the circumcenter and the orthocenter of $\triangle ABC$, then $\overline{PA} + \overline{PB} + \overline{PC} =$

(A) $\overline{PP'}$ (B) $\overline{P'P}$

(C) $2\overline{P'P}$ (D) $2\overline{PP'}$

105. The adjacent sides of a cyclic quadrilateral are 2 and 5, and the angle between them is 60°. If the area of the quadrilateral is $4\sqrt{3}$ sq. units then the perimeter of quadrilateral (in units) is:

(A) 14 (B) 13

(C) 12 (D) 10

106. In ΔABC, with the usual notations, if $\frac{a+b}{7} = \frac{b+c}{8} = \frac{c+a}{6} = 1$, then $\frac{\sin A}{\sin B} = \ldots$

(A) $\frac{7}{8}$ (B) $\frac{4}{3}$

(C) $\frac{5}{9}$ (D) $\frac{8}{7}$

107. If $w = -\frac{1}{2} + \frac{i\sqrt{3}}{2}$, then the value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1-w^2 & w^2 \\ 1 & w^2 & w^4 \end{vmatrix}$ is...

(A) $3w(w+1)$ (B) $3w(w-1)$

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

108. Everyone in the room handshakes with everyone else. If the total number of handshakes is 66, then the number of persons in the room is...

(A) 10 (B) 6

(C) 11 (D) 12

109. There are 4 boys and 6 girls to be seated in a circle for a photograph. The probability that no two boys are sitting together is...

(A) $\frac{5}{42}$ (B) $\frac{1}{6}$

(C) $\frac{5}{14}$ (D) $\frac{1}{210}$

110. The equation of the line which passes through the point of intersection of lines $x + 2y + 6 = 0$, $2x - y = 2$ and which makes intercept 5 on Y - axis is

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

(C) $39x + 2y - 10 = 0$ (D) $39x - 2y - 10 = 0$

111. If one of the lines given by $6x^2 - xy + 4ky^2 = 0$ is $3x + 4y = 0$, then k lies in the interval:

(A) $(-3, 0)$ (B) $[0, 1]$

(C) $[-1, 1]$ (D) $[-3, 0)$

112. The equation of the director circle of the circle $x^2 + y^2 + 3x - 8y - 3 = 0$ is:

(A) $4x^2 + 4y^2 + 12x - 32y - 12 = 0$

(B) $4x^2 + 4y^2 + 12x - 32y - 97 = 0$

(C) $x^2 + y^2 + 12x - 32y - \frac{97}{4} = 0$

(D) $x^2 + y^2 + 3x - 8y - 12 = 0$

113. The area (in sq.units) of a triangle formed by joining the vertex and the endpoints of the latus rectum of the parabola $x^2 = -20y$ is...

(A) 100 (B) 200

(C) 50 (D) 10

114. $\lim_{x \to \frac{\pi}{2}} \frac{[1-\tan(\frac{x}{2})](1-\sin x)}{[1+\tan(\frac{x}{2})](\pi-2x)^3} =$

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

(C) $\frac{1}{8}$ (D) $\frac{1}{4}$

115. The statement pattern $p \to (q \to p) \equiv$

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

(C) $p \to (p \leftrightarrow q)$ (D) $p \to (p \vee q)$

116. The negation of the inverse of $\sim p \to q$ is equivalent to:

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

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

117. If $\alpha \leq 2\sin^{-1} x + \cos^{-1} x \leq \beta$, then the values of α and β are

(A) $\alpha = 0, \beta = 2\pi$ (B) $\alpha = \pi, \beta = 2\pi$

(C) $\alpha = 0, \beta = \pi$ (D) $\alpha = -\pi, \beta = \pi$

118. If $A = \begin{bmatrix} -\frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & -\frac{1}{2} \end{bmatrix}$, the value of $|\text{Adj}(A^{2026})|$ is equal to:

(A) 1 (B) -1

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

119. Let $A = \begin{bmatrix} 1 & 2 \\ -5 & 1 \end{bmatrix}$ and $A^{-1} = xA + yI$, then the pair $(x, y) = \cdots$

(A) $\left(\frac{1}{11}, \frac{2}{11}\right)$ (B) $\left(\frac{1}{11}, -\frac{2}{11}\right)$

(C) $\left(-\frac{1}{11}, -\frac{2}{11}\right)$ (D) $\left(-\frac{1}{11}, \frac{2}{11}\right)$

120. If $A = \begin{bmatrix} 2 & -3 \\ 5 & -7 \end{bmatrix}$, then $A - A^{-1} =$

(A) $\begin{bmatrix} -9 & 6 \\ -10 & 9 \end{bmatrix}$ (B) $\begin{bmatrix} 9 & -6 \\ 10 & -9 \end{bmatrix}$

(C) $\begin{bmatrix} -9 & 10 \\ -6 & 9 \end{bmatrix}$ (D) $\begin{bmatrix} 9 & -10 \\ 6 & -9 \end{bmatrix}$

121. If $f(x) = \begin{cases} \frac{1-\sin^5 x}{5\cos^2 x} & , x < \frac{\pi}{2} \\ a & , \text{at } x = \frac{\pi}{2} \\ \frac{b(1-\sin x)}{8(\pi-2x)^2} & , x > \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, then $\left(\frac{b}{a}\right)^{\frac{5}{3}} = \ldots$

(A) $(4)^4$ (B) $(64)^2$

(C) $(32)^2$ (D) $(16)^3$

122. Let $3f(x) - 2f\left(\frac{1}{x}\right) = x$ for $x \neq 0$. Then the value of $f'(2)$ is:

(A) $\frac{2}{7}$ (B) $\frac{1}{2}$

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

123. If g is a differentiable function of x such that $g(x^5) = 3x^7$, for $x \neq 0$, $x \in \mathbb{R}$ then $g'(3125) = \ldots$

(A) 125 (B) 210

(C) 105 (D) 441

124. If $y = \sin^{-1}(y \cdot \cos 2x)$ such that $\frac{dy}{dx} = \frac{2y \cdot f(x)}{g(x) - \cos y}$ then $\{f(x)\}^2 - \{g(x)\}^2 =$

(A) $-\cos 4x$ (B) 1

(C) $\sin 4x$ (D) $\cos 4x$

125. Let $f(x)$ be a twice differentiable function such that $f''(x) = -f(x)$, and $f'(x) = g(x)$. Let $h(x) = \{f(x)\}^2 + \{g(x)\}^2$. If $h(2) = 7$, then $h(8)$ is equal to:

(A) 7 (B) 14

(C) 0 (D) not defined

126. The tangent to the curve $y = e^{2x}$ is drawn at the point $P(0, 1)$. If this tangent intersects the x-axis at point A and the y-axis at point B, then the area of $\triangle OAB$ (where O is the origin) in square units is:

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

(C) 1 (D) 2

127. The equation of the line tangent to the curve $y^2 = 4x$ with an inclination of 60° is:

(A) $3x - \sqrt{3}y - 1 = 0$ (B) $3x - \sqrt{3}y + 1 = 0$

(C) $3x + \sqrt{3}y + 1 = 0$ (D) $3x + \sqrt{3}y - 1 = 0$

128. A student learned 100 Math formulae for an examination. The number of formulae the student can remember in 't' days after learning is given by $f(t) = 100(1 - 0.1t)^2$. Then, the magnitude of the rate at which the student forgets the formula 3 days after learning is:

(A) -14 (B) 16

(C) 14 (D) 10

129. $\int \frac{x^3+x^2+2x+1}{x^2-x+1} dx = \ldots$

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

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

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

(D) $\frac{x^2}{2} - 2x - \frac{3}{2}\log|x^2 - x + 1| - \frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{2x-1}{\sqrt{3}}\right) + c$

130. $\int \tan^{-1}\sqrt{x}dx = \ldots$

(A) $x\tan^{-1}x - \frac{1}{2}\log(1+x^2) + c$

(B) $x\tan^{-1}x + \frac{1}{2}\log(1+x^2) + c$

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

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

131. If $\int[\sin(\log x) - \cos(\log x)]dx = xf(x) + c$, then the value of $f(x)$ is:

(A) $\sin(\log x)$ (B) $-\cos(\log x)$

(C) $-\sin(\log x)$ (D) $\cos(\log x)$

132. $\int \sec^2 2x \cdot \text{cosec}^2 2x dx = \ldots$

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

(B) $\cot 2x + \tan 2x + c$

(C) $\sec 2x + c$

(D) $\frac{1}{2}(\tan 2x - \cot 2x) + c$

133. Let $f(x)$ be odd and continuous on $[-a, a]$. Then the value of $\int_{-a}^{a} xf(x^2)dx$ is:

(A) 0 (B) $f(a)$

(C) $2f(a)$ (D) $2a$

134. The value of

$$\lim_{n\to\infty}\left(\frac{n}{(n+1)\sqrt{2n+1}} + \frac{n}{(n+2)\sqrt{2(2n+2)}} + \frac{n}{(n+3)\sqrt{3(2n+3)}} + \cdots + \frac{1}{2n\sqrt{3}}\right)$$

is:

(A) $\pi/3$ (B) $\pi/2$

(C) $\pi/4$ (D) 0

135. If $\int_0^{f(x)} dt = x\cos(\pi x)$ then $f'(4) = \ldots$

(A) -1 (B) 0

(C) 1 (D) 4π

136. The value of $\int_0^{\pi/2} \frac{\cos 3x+1}{2\cos x-1}dx$ is

(A) 2 (B) 1

(C) $\frac{1}{2}$ (D) 0

137. A body cools from 100°C to 80°C in 5 minutes in air at 20°C. The time taken to cool from 80°C to 60°C will be:

(A) Less than 5 minutes (B) Equal to 5 minutes

(C) Greater than 5 minutes (D) Cannot be determined

138. If the general solution of the differential equation $\frac{dy}{dx} = \cos(2x-3y) - \cos(2x+3y)$ is $\cos 2x = g(y) + c$, then $g(y) = \ldots$

(A) $\cos 2x + \cos 2y$

(B) $\sec y + \tan y$

(C) $-\frac{1}{3}\log|\tan\left(\frac{3y}{2}\right)|$

(D) $2\log|\text{cosec}3y - \cot 3y|$

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

(A) $y - x = \log\left(\frac{x}{y}\right) + c$

(B) $x - y = \log\left(\frac{x}{y}\right) + c$

(C) $y + x = \log\left(\frac{x}{y}\right) + c$

(D) $y + x = \log\left(\frac{y}{x}\right) + c$

140. The scalar triple product of the vectors $[2\bar{a}+3\bar{b}\ \ 3\bar{b}+\bar{c}\ \ \bar{c}+2\bar{a}]$ is equal to:

(A) $6[\bar{a}\ \bar{b}\ \bar{c}]$ (B) $12[\bar{a}\ \bar{b}\ \bar{c}]$

(C) $5[\bar{a}\ \bar{b}\ \bar{c}]$ (D) $24[\bar{a}\ \bar{b}\ \bar{c}]$

141. If the vector $\bar{r}$ is perpendicular to $\hat{i}-\hat{k}$ and $\bar{r}\times(\hat{i}+x\hat{j}-\hat{k}) = \hat{i}+2\hat{j}+3\hat{k}$, then the value of $\bar{r}\cdot(\hat{i}+x\hat{j}-\hat{k}) =$

(A) -2 (B) -1

(C) 1 (D) 2

142. $A(1,2)$, $B(1,0)$ and $C(0,2)$ are vertices of ΔABC. The position vector of the point in which the bisector of angle A cuts BC is .....

(A) $\frac{1}{3}\hat{i} + \frac{4}{3}\hat{j}$ (B) $\frac{2}{3}\hat{i} + \frac{4}{3}\hat{j}$

(C) $\frac{1}{3}\hat{i} + \frac{2}{3}\hat{j}$ (D) $\frac{2}{3}\hat{i} + \frac{5}{3}\hat{j}$

143. The equation of the plane that perpendicularly bisects the line segment joining the points $A(2,-1,3)$ and $B(3,1,0)$ is:

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

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

(C) $x - 3z + 2 = 0$

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

144. The angle between the line $\frac{x+1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ and the plane $3x + 4y + z + 5 = 0$ is:

(A) $\sin^{-1}\left(\frac{\sqrt{7}}{3}\right)$ (B) $\sin^{-1}\left(\frac{\sqrt{14}}{\sqrt{26}}\right)$

(C) $\sin^{-1}\left(\frac{\sqrt{21}}{14}\right)$ (D) $\sin^{-1}\left(\frac{\sqrt{28}}{21}\right)$

145. The equation of the plane containing the line $\frac{x+1}{4} = \frac{y-2}{-1} = \frac{z+5}{3}$ and parallel to the vector $\hat{i} + \hat{j} - \hat{k}$ is $ax + by + cz = 9$. Then, the value of $a + b - c$ is:

(A) 14 (B) -10

(C) -14 (D) 0

146. The distance of the point $(1, 1, 1)$ from the line passing through the point $(2, 3, 4)$ whose direction ratios are $2, -3, 6$ is:

(A) $\frac{\sqrt{290}}{7}$ (B) $\frac{\sqrt{390}}{7}$

(C) $\frac{\sqrt{490}}{7}$ (D) $\frac{\sqrt{590}}{7}$

147. The position vector of a point P, such that OP inclined to the X axis at 45° and to the Y axis at 60° and $|OP| = 12$ units is:

(A) $\vec{r} = 6\sqrt{2}\hat{i} - 6\hat{j} + 6\hat{k}$ (B) $\vec{r} = 6\sqrt{2}\hat{i} \pm 6\hat{j} \pm 6\hat{k}$

(C) $\vec{r} = 6\sqrt{2}\hat{i} + 6\hat{j} \pm 6\hat{k}$ (D) $\vec{r} = 6\sqrt{2}\hat{i} - 6\hat{j} - 6\hat{k}$

148. The minimum value of $Z = 4x + 6y$, subject to constraint $x + 2y \geq 80, 3x + y \geq 75, x \geq 0, y \geq 0$ is:

(A) 320 (B) 450

(C) 254 (D) 180

149. The sum and product of mean and variance of a binomial distribution are 3 and 2 respectively. Then, $P(X > 0) = \ldots$

(A) $\frac{15}{16}$ (B) $\frac{1}{16}$

(C) $\frac{1}{4}$ (D) $\frac{11}{16}$

150. 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) 0.2 (B) 0.1

(C) 0.3 (D) 0.4

- End of Question Paper -