MHT CET 2020 PCM Oct 13 Shift 1 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

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

General Instructions

(i) This **PCM** paper is from **MHT CET 2020**, 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. $\vec{A}$ and $\vec{B}$ are two non-zero vectors inclined at an angle ' θ'. $\hat{a}$ and $\hat{b}$ are unit vectors along $\vec{A}$ and $\vec{B}$ respectively. The component of $\vec{A}$ in the direction of $\vec{B}$ is

(A) $\frac{\vec{A}\cdot\vec{B}}{B}$ (B) $\frac{\vec{A}\times\vec{B}}{A}$

(C) $\hat{a}\cdot\vec{B}$ (D) $\vec{A}\cdot\hat{b}$

2. If $\vec{A}=3\hat{i}-2\hat{j}+\hat{k}, \vec{B}=\hat{i}-3\hat{j}+5\hat{k}$ and $\vec{C}=2\hat{i}+\hat{j}-4\hat{k}$ form a right angled triangle then out of the following which one is satisfied?

(A) $\vec{B}=\vec{A}+\vec{C}, B^2=A^2+C^2$

(B) $\vec{A}=\vec{B}+\vec{C}, B^2=A^2-C^2$

(C) $\vec{C}=\vec{A}+\vec{B}, C^2=A^2+B^2$

(D) $\vec{A}=\vec{B}+\vec{C}, B^2=A^2+C^2$

3. The dimensions of Planck's constant are same as the product of

(A) time and displacement. (B) force and time.

(C) force, displacement and time. (D) force and displacement.

4. If 'E', 'M', 'L' and 'G' denote energy, mass, angular momentum and constant of gravitaion respectively then $\left(\frac{EL^2}{G^2M^5}\right)$ has dimensions of

(A) angle (B) acceleration

(C) velocity (D) time

5. A body of mass 'M' moving with velocity 'V' explodes into two equal parts. If one part comes to rest and the other part moves with velocity ' v_0 ', what would be the value of $'V_0$ '?

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

(C) 2 V (D) 4 V

6. A particle performing U.C.M. of radius $\frac{\pi}{2}$ m makes ' x ' revolutions in time ' t'. Its tangential velocity is

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

(C) $\frac{\pi X}{t^2}$ (D) $\frac{\pi^2 x}{t}$

7. Earth revolves round the sun in a circular orbit of radius 'R'. The angular momentum of the revolving earth is directly proportional to

(A) R^2 (B) R^3

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

8. A mass 'm' is tied to one end of a spring and whirled in a horizontal circle with constant angular velocity. The elongation in the spring is 1 cm. If the angular speed is doubled, the elongation in the spring is 6 cm. The original length of the spring is

(A) 1. 3 Cm (B) 9 Cm

(C) 6 Cn (D) 12Cm

9. Two springs of spring constants ' K' and ' 2 K' are stretched by same force. If ' $w_1{}^\circ$ and ' w_2 ' are the energies stored in them respectively then

(A) $w_1=2w_2$ (B) $w_1=\frac{w_2}{4}$

(C) $w_2=2w_1$ (D) $w_1=w_2$

10. In a system of two particles of masses ' m_1 ' and ' m_2 ', the second particle is moved by a distance 'd' towards the centre of mass. To keep the centre of mass unchanged, the first particle will have to be moved by a distance

(A) $\frac{m_1}{m_2}$ d, towards the centre of mass. (B) $\frac{m_2}{m}$ d, away from the the centre of mass. m

(C) $\frac{m_2}{m_1}$ d, towards the centre of mass. (D) $\frac{m_1}{m_2}$ d, away from the centre of mass.

11. Two bodies have their moments of inertia I and 2I respectively about their axes of rotation. If their kinetic energies of rotation are equal, their angular momenta will be in the ratio

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

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

12. A ring and a disc have same mass and same radius. The ratio of moment of inertia of a ring about a tangent in its plane to that of the disc about its diameter is

(A) 6 : 1 (B) 4 : 1

(C) 2 : 1 (D) 8 : 1

13. From a uniform circular thin disc of mass 9M and radius R, a small disc of radius $\frac{R}{3}$ is removed. The centre of the small disc is at a distance $\frac{2R}{3}$ from the centre of original disc. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through the centre of the disc of radius R is

(A) $4MR^2$ (B) $3MR^2$

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

14. Binding energy of a revolving satellite at height h is 3.5×10^8 J. Its potential energy is

(A) $7 \cdot 0 \times 10^8$ J (B) $-7 \cdot 0 \times 10^8$ J

(C) $-3 \cdot 5 \times 10^8$ J (D) 3.5×10^8 J

15. One end of thick horizontal copper wire of length '2L' and radius '2R' is welded to an end of another thin horizontal copper wire of length 'L' and radius 'R'. When they are stretched by applying same force at two ends, the ratio of the elongation in the thick wire to that in thin wire is

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

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

16. Water rises to a height of 15 mm in a capillary tube having cross-sectional area 'A'. If cross-sectional area of the tube is made ' $\frac{A'}{3}$ then the water will rise to a height of

(A) $15\sqrt{3} \times 10^{-3}$ m (B) $20\sqrt{3} \times 10^{-3}$ m

(C) $5\sqrt{3} \times 10^{-3}$ m (D) $10\sqrt{3} \times 10^{-3}$ m

17. Water rises upto a height ' h ' in a capillary tube on the surface of the earth. The value of 'h' increases, if the capillary tube apparatus is kept

(A) in a lift going upward with acceleration.

(B) on the sun.

(C) on the poles.

(D) in a lift going downward with acceleration (a) where a < g (acceleration due to gravity)

18. Water flows through a horizontal pipe at a speed 'V'. Internal diameter of the pipe is 'd'. If the water is emerging at a speed ' V_1 ' then the diameter of the nozzle is

(A) $\frac{V}{V_1}$ (B) $d\sqrt{\frac{V_1}{V}}$

(C) $d\sqrt{\frac{V}{V_1}}$ (D) $\frac{dV_1}{V}$

19. A black body has maximum wavelength λ_m at temperature 2200 K. Its corresponding wavelength at temperature 3300 K will be

(A) $\frac{9}{4}\lambda_m$ (B) $\frac{3}{2}\lambda_m$

(C) $\frac{4}{9}\lambda_m$ (D) $\frac{2}{3}\lambda_m$

20. A metal rod of cross-sectional area 3×10^{-6} m^2 is suspended vertically from one end has a length $0 \cdot 4$ m at 100°C. Now the rod is cooled upto 0°C, but prevented from contracting by attaching a mass ' m ' at the lower end. The value of ' m ' is ($Y = 10^{11}$ N/m^2, coefficient of linear expansion $= 10^{-5}$/K, g = 10 m/s^2)

(A) 40 kg (B) 20 kg

(C) 30 kg (D) 10 kg

21. At what temperature is the R.M.S. velocity of Hydrogen molecule equal to that of an oxygen molecule at 47°C ? (Molecular weight of hydrogen = 2, Molecular weight of oxygen = 32)

(A) 80 K (B) 20 K

(C) 40 K (D) 60 K

22. A mass M attached to a horizontal spring executes S.H.M. of amplitude A_1. When the mass M passes through its mean position, then a smaller mass m is placed over it and both of them move together with amplitude A_2. The ratio of $\left(\frac{A_1}{A_2}\right)$ is

(A) $\frac{M+m}{M}$ (B) $\left(\frac{M}{M+m}\right)^{\frac{1}{2}}$

(C) $\left(\frac{M+m}{M}\right)^{\frac{1}{2}}$ (D) $\frac{M}{M+m}$

23. A particle performs S.H.M. with amplitude 'A'. Its speed is tripled at the instant when it is at a distance of $\frac{2A}{3}$ from the mean position. The new amplitude of the motion is

(A) $\frac{5A}{3}$ (B) $\frac{7A}{3}$

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

24. A closed organ pipe and an open organ pipe have their first overtones identical in frequency. Their lengths are in the ratio

(A) 3 : 4 (B) 2 : 3

(C) 4 : 5 (D) 1 : 2

25. Two identical progressive waves moving in opposite direction superimpose to produce a stationary wave. The wavelength of each progressive wave is λ'. The wavelength of the stationary wave is

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

(C) λ (D) 2λ

26. In melde's experiment, when the tension decreases by 0.009 kg-wt, the number of loops changes from 4 to 5. The initial tension is

(A) 0.036 kg-wt. (B) $0 \cdot 009$ kg -wt.

(C) $0 \cdot 018$ kg-wt. (D) 0.025 kg-wt.

27. With what velocity an observer should move relative to a stationary source so that a sound of double the frequency of source is heard by an observer?

(A) Half the velocity of sound towards the source. (B) Same as velocity of sound away from the source.

(C) Twice the velocity of sound towards the source. (D) Same as velocity of sound towards the source.

28. Four capacitors of equal capacity have an equivalent capacitance C_1 when connected in series and an equivalent capacitance C_2 when connected in parallel. The ratio $\frac{C_2}{C_1}$, is

(A) 4 (B) 12

(C) 16 (D) 8

29. Three condensers of capacities C_1, C_2, C_3 are connected in series with a source of e.m.f. V. The potentials across the three condensers are in the ratio of

(A) $C_1 : C_2 : C_3$ (B) $C_1^2 : C_2^2 : C_3^2$

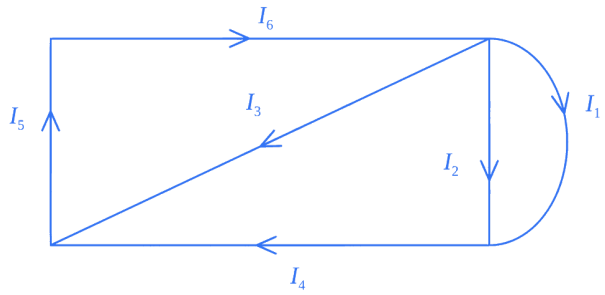
(C) $1 : 1 : 1$ (D) $\frac{1}{C_1} : \frac{1}{C_2} : \frac{1}{C_3}$

30. A galvanometer of resistance 100Ω requires 10μ A current for full scale deflection. Now a resistance of 1Ω is connected to convert it into an ammeter. The minimum current required to obtain full scale deflection is

(A) 101 mA (B) $1 \cdot 01$ mA

(C) $11 \cdot 0$ mA (D) $10 \cdot 1$ mA

31. In the following network, $I_1 = -0 \cdot 4$ A, $I_4 = 1$ A and $I_5 = 0 \cdot 4$ A. The values of I_2, I_3 and I_6 respectively are



(A) $0 \cdot 4$ A, $-0 \cdot 6$ A, $1 \cdot 4$ A

(B) $-0 \cdot 6$ A, $1 \cdot 4$ A, $0 \cdot 4$ A

(C) $1 \cdot 4$ A, $0 \cdot 4$ A, $-0 \cdot 6$ A

(D) $1 \cdot 4$ A, $-0 \cdot 6$ A, $0 \cdot 4$ A

32. The length of a potentiometer wire is 'L'. A cell of e.m.f. 'E' is balanced at a length $\frac{L'}{5}$ from the positive end of the wire. If the length of the wire is increased by $\frac{L}{2}$, at what distance will the same cell give a balance point? '

(A) $\frac{5L}{12}$ (B) $\frac{2L}{15}$

(C) $\frac{4L}{15}$ (D) $\frac{3L}{10}$

33. A bar magnet of magnetic moment $5Am^2$ is placed in a uniform magnetic induction 3×10^{-5} T. If each pole of a magnet experiences a force of $2 \cdot 5 \times 10^{-4}$ N then the magnetic length of the magnet is

(A) 0.8 m (B) $0 \cdot 2$ m

(C) 0.6 m (D) $0 \cdot 4$ m

34. A circular coil of radius 'R' carries an electric current 'I'. The magnetic field due to the coil at a point on the axis of the coil located at a distance ' r' from the centre of the coil, such that $r \gg R$, the magnetic field at that point is proportional to

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

(C) $\frac{1}{r^4}$ (D) $\frac{1}{r^2}$

35. An electron accelerated through potential difference ' V ' passes through a uniform transverse magnetic field and experiences a force ' F'. If the accelerating potential is increased to '2V', the electron in the same magnetic field will experience a force

(A) 3 F (B) F

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

36. Inside a bar magnet, the magnetic lines of force

(A) are from S-pole to N -pole of the magnet.
(B) do not exist
(C) depend upon area of cross-section of bar magnet.
(D) are from N -pole to S -pole of the magnet.

37. Magnetization of the sample is

(A) net magnetic dipole moment per unit volume.
(B) volume of the sample per unit magnetic dipole moment.
(C) ratio of magnetic dipole moment and pole strength.
(D) ratio of pole strength to magnetic dipole moment.

38. If 'N' is the number of turns in a circular coil, the value of its self inductance varies as

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

39. A toroidal solenoid with air core has an average radius ' R′, number of turns ' N′ and area of cross-section 'A'. The self-inductance of the solenoid is (Neglect the field variation across the cross-section of the toroid)

(A) $\frac{\mu_0 N^2 A}{R}$
(B) $\frac{\mu_0 N^2 A}{2\pi R}$
(C) $\frac{\mu_0 NA}{2\pi R}$
(D) $\frac{\mu_0 NA}{R}$

40. The refractive index of glass is $\frac{3}{2}$ and that of water is $\frac{4}{3}$. The critical angle for a ray of light going from glass to water is

(A) $\sin^{-1}\left(\frac{4}{7}\right)$
(B) $\sin^{-1}\left(\frac{5}{8}\right)$
(C) $\sin^{-1}\left(\frac{2}{3}\right)$
(D) $\sin^{-1}\left(\frac{8}{9}\right)$

41. A biconvex lens ($R_1 = R_2 = 20$ cm) has focal length equal to focal length of concave mirror. The radius of curvature of concave mirror is [R.I. of glass lens $= 1 \cdot 5$]

(A) -40 cm
(B) -20 cm
(C) 40 cm
(D) 20 cm

42. In Young's double slit experiment, the 6^{th} maximum with wavelength 'λ_1' is at a distance 'd_1' from the central maximum and the 4^{th} maximum with wavelength λ_2 is at distance d_2. Then $\frac{d_1}{d_2}$ is

(A) $\frac{2}{3}\frac{\lambda_1}{\lambda_2}$
(B) $\frac{3}{2}\frac{\lambda_1}{\lambda_2}$
(C) $\frac{2}{3}\frac{\lambda_2}{\lambda_1}$
(D) $\frac{3}{2}\frac{\lambda_2}{\lambda_1}$

43. A glass slab of thickness 4 cm contains the same number of waves as in 'x' cm of water column when both are transversed by the same monochromatic light. If the refractive indices of glass and water for that light are $\frac{5}{3}$ and $\frac{4}{3}$ respectively, the value of x will be

(A) $\frac{9}{20}$ cm
(B) $\frac{5}{4}$ cm
(C) 5 cm
(D) $\frac{20}{9}$ cm

44. A Fraunhofer diffraction pattern due to a single slit of width $0 \cdot 3$ mm is obtained on a screen placed at a distance of 3 m from the slit. The first minima lie at $5 \cdot 5$ mm on either side of the central maximum on the screen. The wavelength of light used is

(A) 6000Å
(B) 5500Å
(C) 4500Å
(D) 5000Å

45. If the kinetic energy of a particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is

(A) 75
(B) 25
(C) 50
(D) 5

46. Threshold frequency for a metal is 15×10^{14} Hz. The light of wavelength 6000Å falls on the metal surface. Which one of the following statements is correct? [velocity of light, $c = 3 \times 10^8$ m/s]

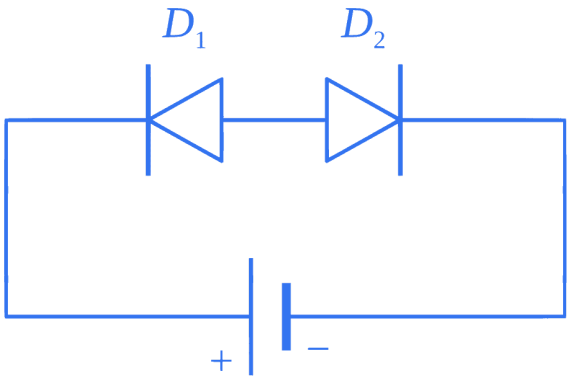
(A) photoelectrons are emitted with velocity c.
(B) photoelectrons come out with velocity 3×10^6 m/s
(C) photoelectrons come out with zero velocity.
(D) photoelectrons will not be emitted.

47. When an electron in a hydrogen atom jumps from the third orbit to the second orbit, it emits a photon of wavelength $\lambda\lambda'$. When it jumps from the fourth orbit to third orbit, the wavelength emitted by the photon will be

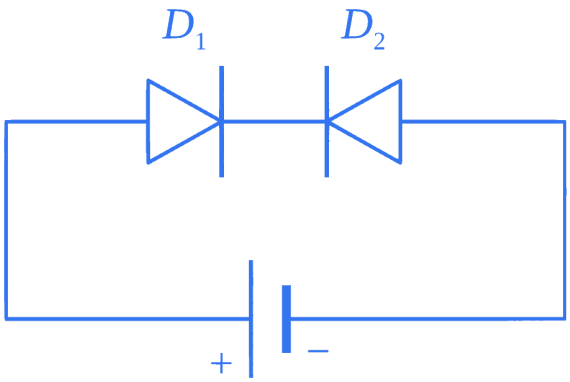
(A) $\frac{20}{13}\lambda$ (B) $\frac{16}{25}\lambda$

(C) $\frac{9}{16}\lambda$ (D) $\frac{20}{7}\lambda$

48. The non-zero potential difference across diode D_1 and that across diode D_2 are equal in the circuit shown in the figure (both the diodes are identical in characteristics)

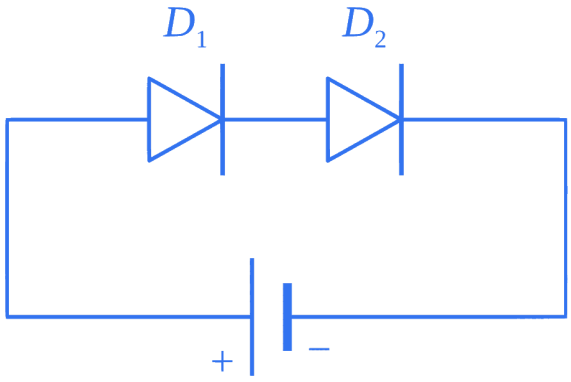


(A)

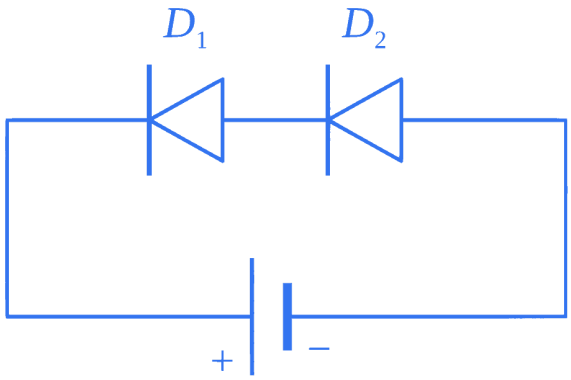


(B)

48. (continued)



(C)



(D)

(A) (A) (B) (B)

(C) (C) (D) (D)

49. A donor impurity results in

(A) conduction band just above the filled valence band.

(B) holes as majority carriers and electrons as minority carriers.

(C) production of n - type semiconductor.

(D) production of p - type semiconductor.

50. A signal of frequency 3kHz is amplitude modulated on a carrier wave of frequency $2 \cdot 5$MHz. The upper and lower sideband frequencies in the resultant signal are

(A) 2500kHz, 2503kHz (B) 2503kHz, 2497kHz

(C) $2 \cdot 5$MHz, 3kHz (D) $5 \cdot 5$MHz, $0 \cdot 5$MHz

51. Which of the following factors affect molarity of solution?

(A) Nature of solute dissolved
(B) Temperature
(C) Mass of solvent
(D) Molar mass of solvent

52. The units nanometer and picometer are related as,

(A) $1\ \text{nm} = 10^{3}\text{pm}$
(B) $1\ \text{nm} = 10^{-9}\text{pm}$
(C) $1\ \text{nm} = 10^{-12}\text{pm}$
(D) $1\ \text{nm} = 10^{-3}\text{pm}$

53. 3.42×10^{-2} kg Sugar (molar mass 342) is dissolved in water to produce 234.2 g of sugar syrup, what is the molality of sugar syrup?

(A) $0 \cdot 50\ \text{mol kg}^{-1}$
(B) $0 \cdot 76\ \text{mol kg}^{-1}$
(C) $0.67\ \text{mol kg}^{-1}$
(D) $0 \cdot 85\ \text{mol kg}^{-1}$

54. Which among the following is NOT a polar molecular solid?

(A) CH_4
(B) SO_2
(C) HCl
(D) H_2 S

55. If 'Q' is the magnitude of charge and 'r' is the distance between the centres of positive and negative charges then dipole moment (μ) is given by

(A) $\mu = \text{Q} + \text{r}$
(B) $\mu = Q \times r$
(C) $\mu = \frac{\text{Q}}{\text{r}}$
(D) $\mu = Q - r$

56. A certain sample of gas has a volume of 0.2 L at one atmosphere pressure and 273.15 K. What is the volume of gas at 273.15°C at same pressure?

(A) 2.703 L
(B) 0.2 L
(C) 0.4 L
(D) 5.406 L

57. Which of the following is NOT an intensive property?

(A) Surface tension
(B) Density
(C) Refractive index
(D) Heat capacity

58. Average bond enthalpy of water is $464 \cdot 5\ \text{kJ mol}^{-1}$. If the energy required to break first $0 - \text{H}$ bond is $502\ \text{kJ mol}^{-1}$, how much energy per mol is required to break second 0 -H bond?

(A) 929 kJ
(B) 251 kJ
(C) 427 kJ
(D) 678 kJ

59. For a reaction $\Delta\text{H} = -30\ \text{kJ}$ and $\Delta\text{S} = -45\ \text{J K}^{-1}$, at what temperature reaction changes from spontaneous to non spontaneous?

(A) $777 \cdot 0\ \text{K}$
(B) $675 \cdot 0\ \text{K}$
(C) $666 \cdot 6\ \text{K}$
(D) $375 \cdot 0\ \text{K}$

60. Which among the following pair of elements show highest oxidation state +7 in their different compounds? (Atomic no. $\text{Cr} = 24,\ \text{V} = 23,\ \text{Mn} = 25,\ \text{Cl} = 17,\ \text{S} = 16$)

(A) Mn, Cl
(B) Cr, Mn
(C) V, Mn
(D) S, Cl

61. Which of the following properties of hydrogen is similar to halogen family?

(A) Ionisation enthalpy
(B) Formation of unipositive ion
(C) Electronic configuration
(D) Electron gain enthalpy

62. Which of the following compounds is NOT present in it's standard state at 25°C and 1 atmosphere pressure?

(A) $CO_{2(\text{g})}$
(B) $CaCO_{3(\text{s})}$
(C) $C_2H_5OH_{(\text{l})}$
(D) $H_2O_{(\text{g})}$

63. Which among the following alkali metal chloride crystallises in form of hydrate?

(A) LiCl
(B) KCl
(C) CsCl
(D) NaCl

64. The number of possible monohalogen derivatives for the alkyl halide having molecular formula C_4H_9X is

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

65. Which one of the following compounds is optically active?

(A) 2-Chloropentane
(B) 3-Chloropentane
(C) 2-Chloropropane
(D) 2-Chloro-2 methyl butane

66. Number of primary carbon atoms present in 3 -Ethyl-2,4-dimethyl heptane is?

(A) 5
(B) 3
(C) 4
(D) 7

67. Which of the following processes for refining of metals involves a principle of selective adsorption of the components from a mixture.

(A) Electrolytic refining (B) Chromatography
(C) polling (D) Zone refining

68. Which of the following compounds is obtained by dry distillation of calcium propionate?

(A) Pentan-3-one (B) Pentan-2-one
(C) Propanone (D) Butan-2-one

69. The IUPAC name of $CH_3 - CH_2 - O - CH_2 - CH(CH_3)_2$ is

(A) 3-Ethoxy-2-methylpropane (B) 1-Ethoxy butane
(C) 1-Ethoxy-2-methylpropane (D) 1-Ethoxy isobutane

70. How many methyl groups are present in n -hexadecyl trimethyl ammonium chloride?

(A) 3 (B) 4
(C) 14 (D) 6

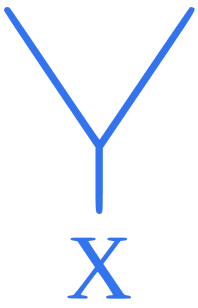
71. Compound A on reaction with chlorine in presence of u.v. light gives B; which when reacted with $NaNO_2$ in the solvent N, N -dimethyl formamide, gives 2 -Nitrobutane. The compound A is



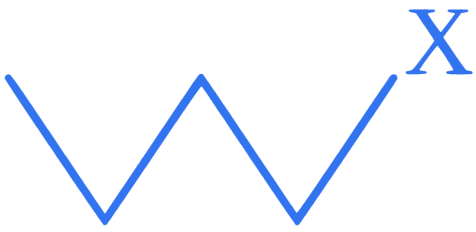
(A)



(B)



(C)



(D)

72. Identify the product X obtained in following reaction $CH_3-(CH_2)_4-CH_3 \xrightarrow[773\ K, 10-20\ atm]{Cr_2O_3} X$

(A) $CH_3-CH=CH-CH_3+CH_2=CH_2+H_2$

(B) $2CH_3-CH=CH_2+H_2$

(C) $C_6H_6+4H_2$

(D) $CH_3-(CH_2)_3-CH=CH_2+H_2$

73. What is the packing efficiency of fcc crystal structure?

(A) 74.0 %

(B) 68.04%

(C) $52 \cdot 4\%$

(D) $47 \cdot 6\%$

74. How many number of unit cells are present in 100 g of an element with fcc crystal having density 10 g/cm^3 and edge length 100pm ?

(A) 3×10^{25}

(B) 2×10^{25}

(C) 4×10^{25}

(D) 1×10^{25}

75. $38 \cdot 4$ g of unknown substance (molar mass 384 g mol^{-1}) and 116 g of acetone is used to prepare a solution at 313 K. If vapour pressure of pure acetone (molar mass 58 g mol^{-1}) is 0.842 atmosphere, what is the vapour pressure of solution?

(A) 0.650 atm

(B) 0.880 atm.

(C) 0.7999 atm.

(D) 0.958 atm

76. What is the standard potential of cell $Ni|Ni^{2+}{}_{(1M)}||Cu^{2+}{}_{(1M)}|Cu$ If $E^{\circ}Cu = 0 \cdot 337$ V and $E^{\circ}Ni = -0 \cdot 236$ V

(A) $0 \cdot 101$ V

(B) $-0 \cdot 136$ V

(C) 0.573 V

(D) -0.753 V

77. During the electrolysis of aqueous sodium chloride the product obtained at anode is

(A) $H_{2(g)}$

(B) $Cl_{2(g)}$

(C) $Na_{(s)}$

(D) O_2

78. The highest peak in energy profile diagram for mechanism of alkaline hydrolysis of tertiary butyl bromide represents

(A) transition state of 1^{st} step

(B) formation of carbocation

(C) transition state of 2^{nd} step

(D) products

79. In a first order reaction 87.5% of reactant is converted in to product in 15 minutes. The rate constant for the reaction is given by

(A) $\frac{0.693}{5}\ min^{-1}$

(B) $\frac{0.693}{15}\ min^{-1}$

(C) $\frac{5}{0.693}\ min^{-1}$

(D) $0.693 \times 5\ min^{-1}$

80. The rate law for the reaction $2NO_{(g)}+O_{2(g)} \longrightarrow 2NO_{2(g)}$ is rate $= k[NO]^2[O_2]$, then which among the following statement is correct?

(A) The reaction is first order in O_2, first order in NO and second order overall.

(B) The reaction is second order in NO, zero order in O_2 and second order overall.

(C) The reaction is second order in NO , first order in O_2 and third order overall.

(D) The reaction is zero order overall.

81. Freundlich's equation for adsorption of gas on solid is represented as

(A) $\frac{m}{x} = kP^n$

(B) $\frac{x}{m} = kP^n$

(C) $\frac{m}{x} = kP^{\frac{1}{n}}$

(D) $\frac{x}{m} = kP^{\frac{1}{n}}$

82. Which among following processes occurs at 1500 K in blast furnace for extraction of iron?

(A) Reduction of ore

(B) Ore loses moisture

(C) Combustion of coke

(D) Slag formation

83. Which among the following gases is used in treatment of cancer?

(A) He

(B) Ar

(C) Ne

(D) Rn

84. Which among the following oxides of nitrogen is brown coloured gas?

(A) N_2O_5

(B) N_2O_3

(C) NO_2

(D) N_2O_4

85. Which of the following oxyacid of chlorine has highest thermal stability?

(A) $HClO_4$

(B) HClO

(C) $HClO_3$

(D) $HClO_2$

86. Identify the formula of compound (B) formed in following reaction. (i) Lanthanoids (Ln) burnt in oxygen forming compound (A) (ii) Compound (A) reacts with CO_2 in excess to form compound (B)

(A) LnO_2 (B) Ln_2CO_3

(C) $Ln_3(CO_3)_2$ (D) $Ln_2(CO_3)_3$

87. Which of the following types of valences, according to Werner's theory is also called as primary valence?

(A) Ionisable valence (B) Auxiliary valence

(C) Residual valence (D) Subsidiary valence

88. Which among the following is a correct formula of Pentammine aqua cobalt (III) iodide?

(A) $[Co(NH_3)_5(H_2O)]I_3$ (B) $[Co(H_2O)(NH_3)_5I]$

(C) $[Co(NH_3)_5I]H_2O$ (D) $[Co(H_2O)(NH_3)_5]I$

89. Which element from following forms colourless compounds in $+2$ oxidation state?

(A) $Co(Z = 27)$ (B) $Zn(Z = 30)$

(C) $Cu(Z = 29)$ (D) $Mn(Z = 25)$

90. Which of the following compounds does NOT react with sodium metal?

(A) $CH_3 - CH_2 - OH$ (B) C_6H_5OH

(C) $CH_3 - O - CH_3$ (D) $CH_3 - COOH$

91. Which of the following is obtained by hydrogenation of benzoyl chloride in presence of Pd on $BaSO_4$?

(A) Benzene (B) Benzoic acid

(C) Benzyl alcohol (D) Benzaldehyde

92. Which of the following acids, does NOT undergo Hell-Vohlard-Zelinsky reaction?

(A) Butanoic acid (B) Propanoic acid

(C) Ethanoic acid (D) Methanoic acid

93. Which of the following is a Gattermann reaction?

(A) $ArN_2^+X^- \xrightarrow{CuCl/HCl} ArCl + N_2 \uparrow$

(B) $ArN_2^+X^- \xrightarrow{HBF_4} ArN_2^+BF_4^- \longrightarrow ArF + N_2 \uparrow + BF_3$

(C) $ArN_2^+X^- \xrightarrow{Cu/HBr} ArBr + N_2 \uparrow$

(D) $ArN_2^+X^- \xrightarrow[\triangle]{KI} ArI + N_2 \uparrow + KX$

94. Which among the following decreasing order of boiling points is correct for amines?

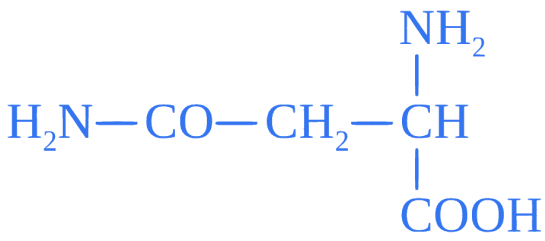
(A) Ethyl dimethylamine > Diethylamine > n-Butylamine (B) Diethylamine > Ethyl dimethylamine > n-Butylamine

(C) n-Butylamine > Ethyl dimethylamine > Diethylamine (D) n-Butylamine > Diethylamine > Ethyl dimethylamine

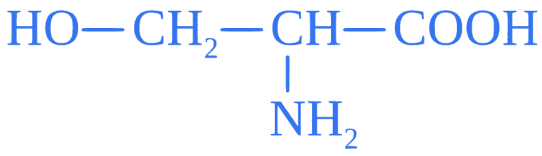
95. Which among the following formulae represents the ω - amino caproic acid?

(A) $H_2N - (CH_2)_5 - COOH$

(B) $H_2N - CH_2 - COOH$



(C)



(D)

96. Which among the following is a product of hydrolysis of one mole raffinose?

(A) 1 mole Glucose +1 mole Fructose +1 mole Galactose (B) 1 mole Fructose +2 moles Glucose

(C) 2 moles of Glucose (D) 2 moles flucose +1 mole Fructose +1 mole Galactose

97. Which among the following vitamins belongs to aromatic series?

(A) Vitamin A (B) Vitamin C

(C) Vitamin B complex (D) VitaminK

98. Which of the following polymers is prepared by using phenol?

(A) Bakelite (B) Melamine

(C) Teflon (D) Neoprene

99. Which among the following is a linear polymer?

(A) Melamine
(B) Vulcanised rubber
(C) Polyvinylchloride
(D) Polypropylene

100. Which of the following is used as disinfectant?

(A) Bithional
(B) Novestrol
(C) Sulphur dioxide
(D) Cloroxylenol

101. If f : R → R, such that $f(x) = \frac{e^x + e^{-x}}{e^x - e^{-x}}$, then f is

(A) a periodic function (B) an even function
(C) an odd function (D) a neither even nor odd function

102. If $f : R \to R$, $g : R \to R$ are two functions defined by $f(x) = 2x - 3$, $g(x) = x^3 + 5$ then $(fog)^{-1}(x) =$

(A) $\left(\frac{2x+3}{2}\right)^{\frac{1}{2}}$ (B) $\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$
(C) $\left(\frac{x-7}{2}\right)^{\frac{1}{2}}$ (D) $\left(\frac{x+7}{2}\right)^{\frac{1}{3}}$

103. If $\sec\theta = \frac{13}{12}, \theta$ lies in 4^{th} quadrant, then $\tan\theta \times \operatorname{cosec}\theta \times \sin\theta \times \cos\theta =$

(A) $\frac{-5}{13}$ (B) $\frac{144}{169}$
(C) $\frac{25}{169}$ (D) $\frac{5}{13}$

104. If $\tan\theta = \frac{1}{3}$, then $\cos 2\theta =$

(A) $\frac{1}{4}$ (B) $\frac{1}{10}$
(C) $\frac{1}{5}$ (D) $\frac{4}{5}$

105. $\cos x \cdot \cos 7x - \cos 5x \cdot \cos 13x =$

(A) $2\cos^2 6x \cdot \cos 12x$ (B) $2\sin^2 6x \cdot \cos 6x$
(C) $2\sin 6x \cdot \sin 12x$ (D) $2\sin 6x \cdot \cos 12x$

106. With usual notations, in ΔABC, if $b\cos^2\frac{C}{2} + c\cos^2\frac{B}{2} = \frac{3a}{2}$, then

(A) b, a, c are in A.P. (B) b, a, c are in G.P.
(C) a, b, c are in G.P. (D) a, b, c are in A.P.

107. In ΔABC with usual notations $a = 4$, $b = 3, \angle A = 60^\circ$, then c is a root of the equation

(A) $c^2 - 3c - 7 = 0$ (B) $c^2 - 3c + 7 = 0$
(C) $c^2 + 3c - 7 = 0$ (D) $c^2 + 3c + 7 = 0$

108. For a sequence if $S_n = \frac{5^n - 2^n}{2^n}$, then its fourth term is

(A) $\frac{375}{16}$ (B) $\frac{375}{8}$
(C) $\frac{251}{8}$ (D) $\frac{251}{16}$

109. The acute angle included between the lines $x\sin\theta - y\cos\theta = 5$ and $x\sin\alpha - y\cos\alpha + 11 = 0$ is

(A) $|\theta - \alpha|$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$ (D) $\theta + \alpha$

110. If one of the lines given by the equation $x^2 + kxy + 2y^2 = 0$ is $x + 2y = 0$, then k =

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

111. The joint equation of pair of lines passing through point of intersection of lines $2x^2 - xy - 15y^2 - 7x + 32y - 9 = 0$ and parallel to co-ordinate axes is

(A) $xy - x - 2y + 2 = 0$
(B) $xy + x + 2y - 2 = 0$
(C) $xy + x + 2y + 2 = 0$
(D) $xy - x - 2y - 2 = 0$

112. The length of latus rectum of the parabola whose focus is at $(1, -2)$ and directrix is the line $x + y + 3 = 0$ is

(A) $8\sqrt{2}$ units (B) $2\sqrt{2}$ units
(C) $\sqrt{2}$ units (D) $4\sqrt{2}$ units

113. The co-ordinates of foci of the ellipse $16x^2 + 9y^2 = 144$ are

(A) $(\pm 7, 0)$ (B) $(0, \pm\sqrt{7})$
(C) $(\pm\sqrt{7}, 0)$ (D) $(0, \pm 7)$

114. Which of the following statement pattern is a tautology?

$S_1 \equiv (\sim q \wedge p) \wedge q$
$S_2 \equiv [p \wedge (p \to q)] \to q$
$S_3 \equiv (p \wedge q) \wedge (\sim p \vee \sim q)$
$S_4 \equiv (p \wedge q) \to r$

(A) S_4 (B) S_3
(C) S_1 (D) S_2

115. The dual of the statement pattern $\sim p \wedge (q \vee t)$ is (where t is a tautology and c is a contradiction)

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

116. If $\tan^{-1}\left(\frac{1-x}{1+x}\right) - \frac{1}{2}\tan^{-1}x = 0$, for $x > 0$, then $x =$

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

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

117. If $A = \begin{bmatrix} 1 & 2 & i \\ 1 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, then $[\text{adj}(\text{adj}A)]^{-1} =$

(A) A^2 (B) 2 A

(C) A^{-1} (D) I

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

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

(C) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

119. If the function $f(x) = \frac{1-\sin 2x+\cos 2x}{1+\sin 2x+\cos 2x}$ if $x \neq \frac{\pi}{2}$ $=$ k if $x = \frac{\pi}{2}$ is continuous at $x = \frac{\pi}{2}$, then k $=$

(A) 2 (B) 1

(C) 0 (D) -1

120. If $x^2 + y^2 = 1$, then $\frac{d^2x}{dy^2} =$

(A) x^3 (B) y^3

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

121. If $\log_{10}\left(\frac{x^3-y^3}{x^3+y^3}\right) = 2$ then $\frac{dx}{dy} =$

(A) $\left(-\frac{99}{101}\right)\frac{x^2}{y^2}$ (B) $\left(-\frac{101}{99}\right)\frac{x^2}{y^2}$

(C) $\left(-\frac{101}{99}\right)\frac{y^2}{x^2}$ (D) $\left(-\frac{99}{101}\right)\frac{y^2}{x^2}$

122. If $y = e^{4x}\cos 5x$, then $\frac{d^2y}{dx^2}$ at $x = 0$ is

(A) -9 (B) 9

(C) 8 (D) -8

123. The equation of a normal to the curve $x = 4\sec\theta$ and $y = 4\tan^2\theta$ at $\theta = \frac{\pi}{4}$ is

(A) $x + y\sqrt{2} = 7\sqrt{2}$ (B) $2\sqrt{2}x + y = 8\sqrt{2}$

(C) $\sqrt{2}x + y = 7\sqrt{2}$ (D) $x + 2\sqrt{2}y = 12\sqrt{2}$

124. The radius of a circle is increasing at the rate 2 cm/ sec. The rate at which its area is increasing when the radius of the circle is 5 decimeters is

(A) $100\pi\text{cm}^2/\text{sec}$ (B) $200\pi\text{cm}^2/\text{sec}$

(C) $2000\pi\text{cm}^2/\text{sec}$ (D) $20\pi\text{cm}^2/\text{sec}$

125. A tangent to the curve $x = at^2, y = 2at$ is perpendicular to X axis, then the point of contact is

(A) $(0, -a)$ (B) $(0, 0)$

(C) $(0, 2a)$ (D) $(0, a)$

126. $\int \frac{x^2+1}{x^4+x^2+1}dx =$

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

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

127. $\int \frac{\sin 2x}{\sin^2 x\cos^2 x}dx =$

(A) $\log|\tan^2 x| + c$ (B) $\log|\sec^2 x| + c$

(C) $\log|\tan x| + c$ (D) $\log|\sec x| + c$

128. $\int \frac{\sec x}{\sqrt{\log(\sec x+\tan x)}}dx =$

(A) $\sqrt{\log(\sec x + \tan x)} + c$

(B) $\sqrt{\sec x + \tan x)} + c$

(C) $2\sqrt{\sec x + \tan x} + c$

(D) $2\sqrt{\log(\sec x + \tan x)} + c$

129. $\int_0^1 \tan^{-1}\left[\frac{2x-1}{1+x-x^2}\right]dx =$

(A) 0 (B) $\frac{\pi}{6}$

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

130. $\int_0^{\frac{\pi}{2}} \frac{\sin^{\frac{2}{3}}x}{\sin^{\frac{2}{3}}x+\cos^{\frac{2}{3}}x}dx =$

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

(C) $\frac{\pi}{2}$ (D) π

131. $\int_{-a}^{a} x^2\left(\frac{e^{x^3}-e^{-x^3}}{e^{x^3}+e^{-x^3}}\right)dx =$

(A) a^2

(B) 0

(C) a

(D) $2\int_0^a x^2\left(\frac{e^{x^3}-e^{-x^3}}{e^{x^3}+e^{-x^3}}\right)dx$

132. The area bounded by the parabola $x^2 = 4y$ and the lines $y = 2, y = 4$ and Y -axis is

(A) $\frac{4}{3}(8 - 2\sqrt{2})$ sq. units (B) $\frac{8}{3}(8 - 2\sqrt{2})$ sq. units

(C) $\frac{8}{3}(8 + 2\sqrt{2})$ sq. units (D) $(8 - 2\sqrt{2})$ sq. units

133. The equation of the curve which passes through point $(1, 0)$ and has tangent with slope $1 + \frac{y}{x} + \left(\frac{y}{x}\right)^2$ is

(A) $\tan^{-1}\left(\frac{x}{y}\right) = \log|x|$ (B) $\tan^{-1}\left(\frac{x}{y}\right) = \log|y|$

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

134. Water at 100°C cools in 15 minutes to 75°C in a room temperature of 25°C. Then the temperature of water after 30 minutes is

(A) $\left(\frac{400}{9}\right)^\circ$ C (B) $\left(\frac{526}{9}\right)^\circ$ C

(C) $\left(\frac{335}{9}\right)^\circ$ C (D) $\left(\frac{175}{3}\right)^\circ$ C

135. The general solution of the differential equation $\sec^2 x \tan y\, dx + \sec^2 y \tan x dy = 0$ is

(A) $\tan x \tan y = c$ (B) $\sec x \tan y = c$

(C) $\sec x \sec y = c$ (D) $\tan x \sec y = c$

136. The integrating factor of the differential equation $\frac{dy}{dx} + \frac{1}{x}y = x^3 - 3$ is

(A) $-y$ (B) y

(C) x (D) $-x$

137. In a certain culture of bacteria, the rate of increase is proportional to the number present. It is found that the number doubles in 4 hours. Then the number of times the bacteria are increased in 12 hours is

(A) 6 (B) 8

(C) 12 (D) 4

138. If $\overline{AB} = 3\hat{\imath} + 5\hat{\jmath} + 4\hat{k}, \overline{AC} = 5\hat{\imath} - 5\hat{\jmath} + 2\hat{k}$ represent the sides of triangle ABC, then the length of median through A is

(A) $\sqrt{6}$ units (B) 5 units

(C) $\sqrt{5}$ units (D) 6 units

139. If a, b, c are lengths of the sides BC, CA, AB respectively of $\triangle$ABC and H is any point in the plane of ΔABC such that $a\overline{AH} + b\overline{BH} + c\overline{CH} = \bar{0}$, then H is the

(A) Circumcentre of ΔABC (B) Incentre of ΔABC

(C) Centroid of ΔABC (D) Orthocentre of ΔABC

140. If the vectors $\bar{a} = \hat{\imath} - 2\hat{\jmath} + \hat{k}, \bar{b} = 2\hat{\imath} - 5\hat{\jmath} + p\hat{k}$ and $\bar{c} = 5\hat{\imath} - 9\hat{\jmath} + 4\hat{k}$ are coplanar, then the value of p is

(A) -3 (B) 3

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

141. The distance of the point $(3, 4, 5)$ from the point of intersection of the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ and plane $x + y + z = 2$ is

(A) 6 units (B) 13 units

(C) 10 units (D) 7 units

142. f a line in octant OXYZ makes equal angles with co-ordinate axes, then

(A) $l = m = n = \frac{1}{3}$ (B) $l = m = n = -\frac{1}{3}$

(C) $l = m = n = \frac{1}{\sqrt{3}}$ (D) $l = m = n = -\frac{1}{\sqrt{3}}$

143. A plane E_1 makes intercepts $1, -3, 4$ on the co-ordinate axes. The equation of a plane parallel to plane E_1 and passing through $(2, 6, -8)$ is

(A) $\frac{x}{2} - \frac{y}{3} + \frac{z}{4} + 3 = 0$

(B) $\frac{x}{1} - \frac{y}{3} + \frac{z}{4} + 12 = 0$

(C) $\frac{x}{1} - \frac{y}{3} + \frac{z}{4} + 2 = 0$

(D) $\frac{x}{3} - \frac{y}{6} + \frac{z}{2} + \frac{13}{3} = 0$

144. The equation of the line passing through the point $(2, 3, -4)$ and perpendicular to XOZ plane is

(A) $x = -2; y = 3 + \lambda; z = 4$

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

(C) $x = -2; y = -3 + \lambda; z = 4$

(D) $x = 2; y = 3 + \lambda; z = -4$

145. The shortest distance between the lines $\bar{r} = (1 - t)\hat{\imath} + (t - 2)\hat{\jmath} + (3 - 2t)\hat{k}$ and $\bar{r} = (p + 1)\hat{\imath} + (2p - 1)\hat{\jmath} + (2p + 1)\hat{k}$ is

(A) $\frac{8}{\sqrt{29}}$ units (B) $\frac{4}{\sqrt{29}}$ units

(C) $\frac{2}{\sqrt{5}}$ units (D) $\frac{4}{\sqrt{19}}$ units

146. The L.P.P. to maximize $z = x + y$, subject to $x + y \leq 30, x \leq 15, y \leq 20, x + y \geq 15, \quad x, y \geq 0$ has

(A) no solution. (B) a unique solution.

(C) infinite solutions. (D) unbounded solutions.

147. If $P(A') = 0 \cdot 6, P(B) = 0 \cdot 8$ and $P(B/A) = 0 \cdot 3$, then $P(A/B) =$

(A) $\frac{7}{20}$ (B) $\frac{3}{20}$

(C) $\frac{3}{4}$ (D) $\frac{9}{20}$

148. Given below is the probability distribution of discrete r.v. X

$X = x$	1	2	3	4	5	6
$P[X = x]$	k	0	2k	5k	k	3k

Then $P[X \geq 4] =$

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

(C) $\frac{1}{2}$ (D) $\frac{3}{4}$

149. If the function f defined by $f(x) = K\left(x - x^2\right)$ if $0 < x < 1 = 0$, other wise is the p.d.f. of a r. v. X, then the value of $P\left(X < \frac{1}{2}\right)$ is

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

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

150. The probability that the person who undergoes certain operation will survive is $0 \cdot 2$. If 5 patients undergo similar operations, then the probability that exactly four will survive is

(A) 0.0042 (B) 0.0084

(C) $0 \cdot 0032$ (D) $0 \cdot 0064$

- End of Question Paper -

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