MHT CET 2020 PCM Oct 20 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. The magnitude of the sum of the two vectors $\vec{A}$ and $\vec{B}$ is equal to the magnitude of the difference of two vectors $\vec{A}$ and $\vec{B}$. The angle between $\vec{A}$ and $\vec{B}$ is

(A) 30° (B) 45°

(C) 90° (D) 180°

2. Let $\vec{P} = \hat{i}\,P\sin\theta - \hat{j}\,P\cos\theta$, be any vector. Another vector $\vec{Q}$ which is perpendicular to $\vec{P}$ is

(A) $(\hat{i}\,Q\sin\theta + \hat{j}\,Q\cos\theta)$

(B) $(\hat{i}\,Q\cos\theta + \hat{j}\,Q\sin\theta)$

(C) $(\hat{i}\,Q\cos\theta - \hat{j}\,Q\sin\theta)$

(D) $(\hat{i}\,P\sin\theta + \hat{j}\,P\cos\theta)$

3. In the equation, pressure $P = \frac{c-t^2}{DS}$, S and t represent the distance and time respectively. The dimensions of $\left(\frac{D}{c}\right)$ are

(A) $\left[L^0M^{-1}\,T^2\right]$ (B) $\left[L^0M^1\,T^1\right]$

(C) $\left[L^1M^{-1}\,T^{-2}\right]$ (D) $\left[L^1M^1\,T^2\right]$

4. A particle of mass 'm' moves along a circle of radius 'r' with constant tangential acceleration. If kinetic energy 'E' of the particle becomes three times by the end of third revolution after beginning of the motion then the magnitude of tangential acceleration is

(A) $\frac{E}{12\pi rm}$ (B) $\frac{E}{3\pi rm}$

(C) $\frac{E}{6\pi rm}$ (D) $\frac{E}{24\pi rm}$

5. A rod of length 'L' is hung from its one end and a mass 'm' is attached to its free end. What tangential velocity must be imparted to 'm', so that it reaches the top of the vertical circle? (g = acceleration due to gravity)

(A) $4\sqrt{gL}$ (B) $2\sqrt{gL}$

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

6. A block of mass 'm' moving along a straight line with constant velocity $3\vec{V}$ collides with another block of same mass at rest. They stick together and move with common velocity. The common velocity is

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

(C) $\vec{3}\vec{V}$ (D) $\vec{V}$

7. A ball kept at 20 m height falls freely in downward direction vertically and hits the ground. The coefficient of restitution is 0.4. After the first rebound the upward velocity is $\left[g = 10\ m/s^2\right]$

(A) 8 m/s (B) 12 m/s

(C) 4 m/s (D) 16 m/s

8. Two circular rings 'A' and 'B' of radii 'nR' and 'R' are made from the same wire. The moment of inertia of 'A' about an axis passing through the centre and perpendicular to the plane of 'A' is 64 times that of the ring 'B'. The value of ' n ' is

(A) 8 (B) 3

(C) 6 (D) 4

9. Three point masses, each of mass 'm' are placed at the corners of an equilateral triangle of side 'ℓ'. The moment of inertia of the system about an axis along any one side of the triangle is

(A) $\frac{1}{3}\,m\ell^2$ (B) $\frac{3}{2}\,m\ell^2$

(C) $\frac{3}{4}\,m\ell^2$ (D) $m\ell^2$

10. Two discs having moment of inertia I_1 and I_2 are made from same material have same mass. Their thickness and radii are t_1, t_2 and R_1, R_2 respectively. The relation between moment of inertia of each disc about an axis passing through its centre and perpendicular to its plane and its thickness is

(A) $I_1t_1 = I_2t_2$ (B) $I_1t_2^2 = I_2t_1^2$

(C) $I_1t_2 = I_2t_1$ (D) $I_1t_1^2 = I_2t_2^2$

11. When the value of acceleration due to gravity ' g ' becomes $\left(\frac{g}{3}\right)$ above the earth's surface at height 'h' then relation between 'h' and 'R' is [R = radius of the earth]

(A) $h = R(\sqrt{3} - 1)$ (B) $h = R$

(C) $h = R(\sqrt{2} - 1)$ (D) $h = 2R$

12. If the radius of a planet is 'R' and density ' ϱ ', then the escape velocity 'Ve' of any body from its surface will be proportional to

(A) R (B) $\frac{\sqrt{\varrho}}{R}$

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

13. The ratio of length of two wires of same material is $1:2$ and the ratio of their radii is $1:\sqrt{2}$. If they are stretched by the same force, the ratio of increase in their lengths is

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

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

14. The compressibility of water is $6\times10^{-10}\ \mathrm{m^2/N}$. If one litre of water is subjected to a pressure of $4\times10^{7}\ \mathrm{N/m^2}$, then the decrease in its volume in millilitre will be

(A) 10 (B) 20

(C) 24 (D) 15

15. A metal sphere of radius 'R', density ' ϱ_1 ' moves with terminal velocity ' $\mathrm{v_1}$ ' through a liquid of density ' σ'. Another sphere of same radius but of density ' ϱ_2 ' moves through same liquid. Its terminal velocity will be

(A) $\left[\frac{\varrho_1-\varrho_2}{\sigma}\right]\mathrm{v_1}$ (B) $\left[\frac{\varrho_2+\sigma}{\varrho_1+\sigma}\right]\mathrm{v_1}$

(C) $\left[\frac{\varrho_1+\varrho_2}{\sigma}\right]\mathrm{v_1}$ (D) $\left[\frac{e_2-\sigma}{e_1-\sigma}\right]\mathrm{v_1}$

16. If ' T' is the surface tension of a soap solution, then the work done in blowing a soap bubble from diameter 'D' to diameter '2D' is

(A) $2\pi TD^2$ (B) $4\pi TD^2$

(C) $8\pi TD^2$ (D) $6\pi TD^2$

17. When a capillary tube is immersed in water vertically, water rises to a height ' h' inside the tube. If the radius of another capillary tube is $\frac{1}{3}$ that of the previous, the height to which water will rise in this tube, is

(A) h. (B) $h\sqrt{3}$

(C) $\frac{h}{3}$. (D) 3h.

18. Three black discs ' x', 'y','z' have radii $1\ \mathrm{m}, 2\ \mathrm{m}$ and $3\ \mathrm{m}$ respectively. The wavelengths corresponding to maximum intensity are 200,300 and $400\ \mathrm{nm}$ respectively. The relation between emissive powers 'Ex', 'Ey' and 'Ez' is

(A) $Ex > Ey < Ez$ (B) $Ex < Ey < Ez$

(C) $Ex = Ey = Ez$ (D) $Ex > Ey > Ez$

19. Two ideal gases A and B having the same temperature T, same pressure P and same volume V, are mixed together. If the temperature of mixture is kept constant and the volume occupied by the mixture is reduced to $\frac{V}{2}$, then the pressure of the mixture will become

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

(C) 4P (D) 2P

20. If length of oscillating simple pendulum is made $\frac{1}{3}$ times at a place keeping amplitude same, then its total energy (E) will be

(A) 6E (B) 4E

(C) 2E (D) 3E

21. A pendulum performs S.H.M. with period $\sqrt{3}$ second in a stationery lift. If lift moves up with acceleration $\frac{g}{3}$, the period of pendulum is [g = acceleration due to gravity]

(A) $2\cdot00$ second (B) $1\cdot5$ second

(C) $2\cdot5$ second (D) $1\cdot75$ second

22. A man of mass ' M' ' is standing on the platform. The platform is executing S.H.M. of frequency 'f'in vertical direction. The span of oscillation is 'L'. Then the acceleration of the platform at the top of the oscillation is

(A) $4\pi^2f^2\ \mathrm{L}$ (B) $\frac{2\pi^2f^2\ \mathrm{L}}{\mathrm{M}}$

(C) $\frac{4\pi^2f^2\ \mathrm{L}}{\mathrm{M}}$ (D) $2\pi^2f^2\ \mathrm{L}$

23. A source of sound is moving with constant velocity of $30\ \mathrm{m/s}$ emitting a note of frequency $256\ \mathrm{Hz}$. The ratio of frequencies observed by a stationary observer while the source is approaching him and after it crosses him is [speed of sound in air $= 330\ \mathrm{m/s}$]

(A) $8:9$ (B) $9:8$

(C) $5:6$ (D) $6:5$

24. A stretched uniform wire of length L under tension T is vibrating with frequency 'n'. A closed pipe of same length is also vibrating with same fundamental frequency 'n'. If T is increased by $16\ \mathrm{N}$, it is in resonance with 2^{nd} harmonic of same closed pipe. The initial tension in the wire is

(A) 1 N (B) 2 N

(C) $1\cdot5$ N (D) $0\cdot5$ N

25. If we add 3 kg load to the hanger of sonometer, the fundamental frequency becomes two times its initial value. The initial load must be

(A) 2 kg (B) $1 \cdot 5$ kg

(C) $2 \cdot 5$ kg (D) 1 kg

26. In resonance tube of length 0.8 m, air column vibrates with a source of frequency 375 Hz for a certain height of water from bottom of the tube. Water level corresponding to fundamental frequency is (Neglect end correction, speed of sound in air = 330 m/s)

(A) 0.45 m (B) 0.58 m

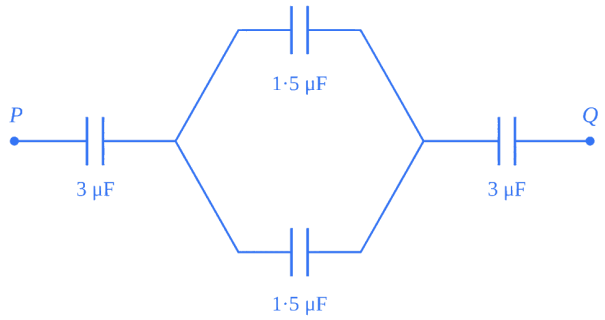
(C) 0.8 m (D) 0.65 m

27. A charge 'Q' μ C is placed at the centre of a cube. The flux through one face and two opposite faces of the cube is respectively

(A) $\frac{Q}{6\epsilon_0}\mu$Vm, $\frac{Q}{3\epsilon_0}\mu$Vm (B) $\frac{Q}{12\epsilon_0}\mu$Vm, $\frac{Q}{\epsilon_0}\mu$Vm

(C) $\frac{Q}{6\epsilon_0}\mu$Vm, $\frac{Q}{2\epsilon_0}\mu$Vm (D) $\frac{Q}{12\epsilon_0}\mu$Vm, $\frac{Q}{3\epsilon_0}\mu$Vm

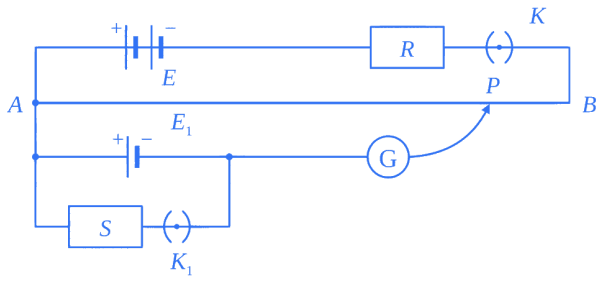
28. What is the capacitance between the points 'P' and 'Q' in the combination of capacitors shown in figure?



(A) 1μF (B) 9μF

(C) 2μF (D) 7μF

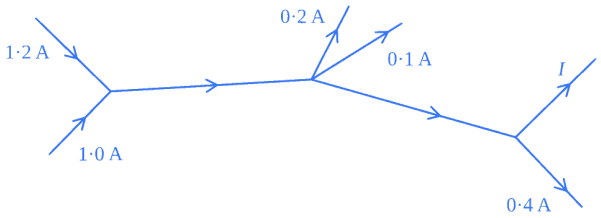
29. Two students X and Y perform potentiometer experiment separately and null point was obtained as shown in diagram. During the experiment, (i) X increases the value of R (resistance) (ii) Y decreases the value of S (resistance) without any other change The position of null point obtained by students X and Y respectively



(A) would shift towards A by both X and Y (B) would shift towards point A, would shift towards B

(C) would shift towards B by both X and Y (D) would shift towards point B, would shift towards A

30. The value of current 'I' in the given current distribution is



(A) $2 \cdot 2$ A (B) $1 \cdot 5$ A

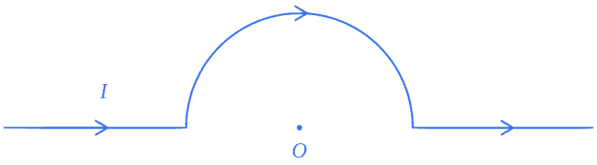
(C) $1 \cdot 9$ A (D) $0 \cdot 2$ A

31. The deflection in moving coil galvanometer of resistance 45Ω falls from 30 divisions to 3 divisions. The length of the shunt wire required to convert galvanometer to ammeter is [specific resistance of material of shunt wire $= 5 \times 10^{-7}\Omega$m and area of cross- section of wire $= 4 \times 10^{-7}$ m^2]

(A) 4 m (B) 6 m

(C) 8 m (D) 2 m

32. A straight wire carrying current 'I' is bent into a semi-circular arc of radius 'r', as shown. The magnitude of magnetic field at point '0' due to semi-circular arc is (μ_0 = Permeability of free space)



(A) $\frac{\mu_0 I}{4r}$ (B) $\frac{\mu_0 I}{2r}$
(C) $\frac{\mu_0 I}{r^2}$ (D) $\frac{\mu_0 I}{r}$

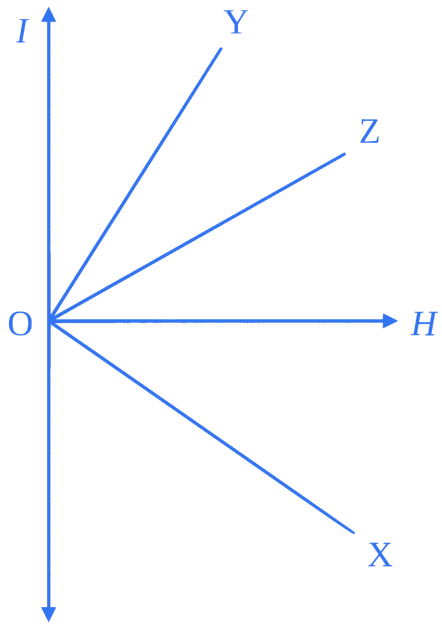
33. An electron at rest is accelerated by a potential ' V_1 ', in uniform magnetic field experiences a force 'F 1'. When potential is changed to 'V_2' ', the force experienced by the electron gets doubled. The ratio of V_1 to V_2 is

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

34. The magnetic property of magnetic substance is associated with

(A) spin motion of the nucleus. (B) orbital and spin motion of electrons.
(C) only orbital motion of electrons. (D) only spin motion of electrons.

35. The variation of intensity of magnetisation (I) and the applied magnetic field intensity (H) for three magnetic materials ' X', 'Y' and ' Z ' are shown in the graph as OX, OY and OZ respectivley. The materials ' X','Y' and ' Z ' respectively are



(A) paramagnetic, diamagnetic, ferromagnetic (B) diamagnetic, paramagnetic, ferromagnetic
(C) ferromagnetic, diamagnetic, paramagnetic (D) diamagnetic, ferromagnetic, paramagnetic

36. A torque of $1 \cdot 732 \times 10^{-5}$Nm is required to hold a magnet at 90° with the horizontal component of earth's magnetic field. The torque required to hold it at 60° will be $\left[\sin\frac{\pi}{2} = 1, \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}\right]$ $[\sqrt{3} = 1 \cdot 732]$

(A) $1 \cdot 5 \times 10^{-5}$Nm (B) 1×10^{-5}Nm
(C) $1 \cdot 732 \times 10^{-5}$Nm (D) $0 \cdot 5 \times 10^{-5}$Nm

37. A toroid is a long coil of wire wound over a circular core. If 'r' and 'R' are the radii of the coil and toroid respectively, the coefficient of self-induction of the toroid is (The magnetic field in it is uniform and R >> r) (N = number of turns of the coil and μ_0 = permeability of free space)

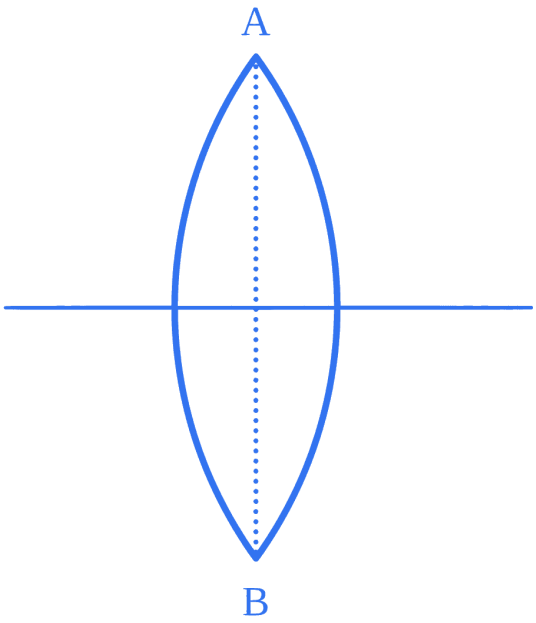
(A) $\frac{2\mu_0 r^2}{N^2 R}$ (B) $\frac{\mu_0 N^2 R^2}{2r}$
(C) $\frac{\mu_0 N^2 r^2}{2R}$ (D) $\frac{\mu_0 R}{2 N^2 r^2}$

38. An e.m.f. $E = E_0 \sin \omega t$ is applied to a circuit containing 'L' and 'R' in series. If $X_L = R$, then the power dissipated in the circuit is

(A) $\frac{E_0^2}{4R}$ (B) $\frac{E_0}{2R}$

(C) $\frac{E_0}{4R}$ (D) $\frac{E_0^2}{2R}$

39. The figure shows equiconvex lens of focal length ' f '. If the lens is cut along AB, the focal length of each half will be



(A) 2f (B) f

(C) 3f (D) 4f

40. A light of wavelength $'\lambda_1'$ and velocity C_1 travels from the first medium of refractive index ' μ_1 ' into the second medium of refractive index ' μ_2 '. The wavelength and velocity of light in the second medium is $'\lambda_2'$ and C_2 respectively. The refractive index of second medium with respect to first medium is given by

(A) $\frac{c_2}{c_1}$ (B) $\frac{\mu_2}{\mu_1}$

(C) $\frac{\mu_1}{\mu_2}$ (D) $\frac{\lambda_2}{\lambda_1}$

41. A light travels through water in the beaker. The height of water column is 'h'. Refractive index of water is ' μ_w'. If C is velocity of light in air, the time taken by light to travel through water will be

(A) $\frac{\mu_w h}{C}$ (B) $h\mu_w C$

(C) $\frac{hC}{\mu_w}$ (D) $\frac{h}{\mu_w C}$

42. In Young's double slit experiment, the distance between the slits is 3 mm and the slits are 2 m away from the screen. Two interference patterns can be obtained on the screen due to light of wavelength 480 nm and 600 nm respectively. The separation on the screen between the 5^{th} order bright fringes on the two interference patterns is

(A) 6×10^{-4} m (B) 8×10^{-4} m

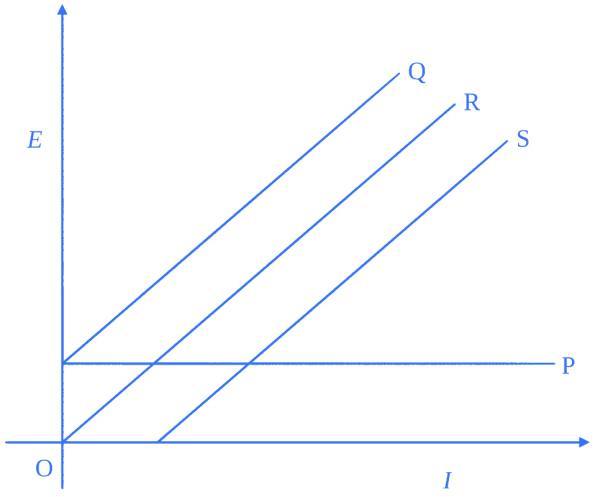
(C) 12×10^{-4} m (D) 4×10^{-4} m

43. The ratio of intensities of two waves producing interference is 9 : 4, then the ratio of the resultant maximum and minimum intensities will be $\left(\cos \frac{\pi}{3} = \frac{1}{2}\right)$

(A) 4 : 9 (B) 9 : 4

(C) 25 : 1 (D) 5 : 1

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



(A) S (B) R

(C) Q (D) P

45. A photon of wavelength 3315 Å falls on a photocathode and an electron of energy 3×10^{-19} J is ejected. The threshold wavelength of photon is [Planck's constant (h) $= 6.63 \times 10^{-34}$ J – s, velocity of light (c) $= 3 \times 10^8$ m/s]

(A) 6630Å (B) 3315Å

(C) 5000Å (D) 1130Å

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46. In hydrogen spectrum, the wavelengths of light emitted in a series of spectral lines is given by the equation, $\frac{1}{\lambda} = R\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$, where $n = 5, 6, 7 \ldots\ldots\ldots\ldots$ and 'R' is Rydberg's constant. Identify the series and wavelength region.

(A) Pfund, near infrared
(B) Brackett, infrared
(C) Pfund, far infrared
(D) Brackett, near infrared

47. Two different radioactive elements with half-lives ' T_1 ' and ' T_2 ' have undecayed atoms ' N_1' and 'N_2' respectively, present at a given instant. The ratio of their activities at this instant is

(A) $\frac{T_1\,T_2}{N_1\,N_2}$
(B) $\frac{N_1\,N_2}{T_1\,T_2}$
(C) $\frac{N_1\,T_1}{N_2\,T_2}$
(D) $\frac{N_1\,T_2}{N_2\,T_1}$

48. In light emitting diode (LED), light is given out due to

(A) drifting of electrons.
(B) diffusion of holes.
(C) recombination of holes and electrons.
(D) emission of holes and electrons.

49. In common emitter configuration of a transistor, current gain is more than 1 because [I_b, I_e and I_c are base, emitter and collector currents respectively

(A) $I_c < I_b$
(B) $I_b < I_e$
(C) $I_c < I_e$
(D) $I_c > I_b$

50. Modulation is a process of superposing

(A) low frequency radio signal on low frequency audio waves.
(B) high frequency audio signal on low frequency radio waves.
(C) low frequency audio signal on high frequency radio waves.
(D) high frequency radio signal on low frequency audio signal.

51. Pure samples of copper carbonate synthesised in laboratory and found naturally if both contains $51 \cdot 35\%$ copper, $38 \cdot 91\%$ carbon and $9 \cdot 74\%$ oxygen by weight. This is an accordance with

(A) Law of combining volumes
(B) Law of conservation of mass
(C) Law of multiple proportion
(D) Law of definite proportion

52. Identify the element if it's expected electronic configuration is $[Ar]3\ d^{10}4\ s^2$.

(A) Hg
(B) Co
(C) Cd
(D) Zn

53. Which of the following molecules has zero dipole moment?

(A) H_2O
(B) H_2S
(C) NF_3
(D) CO_2

54. Identify the molecule with linear geometry?

(A) ClF_3
(B) C_2H_4
(C) BeF_2
(D) SO_2

55. What is bond length of $C-C$ bond in alkane having all carbon atoms sp^3 hybrid?

(A) 154pm
(B) 133pm
(C) 112pm
(D) 120pm

56. Volume of a balloon at $25^\circ C$ and 1 bar pressure is $2 \cdot 27$ L. If the pressure of the gas in balloon is reduced to 0.227 bar, what is the rise in volume of a gas?

(A) 12.27 L
(B) $7 \cdot 73$ L
(C) 10 L
(D) $10 \cdot 227$ L

57. What is the work done when 2 mole of an ideal gas are expanded isothermally and reversibly from $5\ m^3$ to $10\ m^3$ at 300 K? $\left(R = 8 \cdot 314\ J\ K^{-1}\ mol^{-1}\right)$

(A) -34.58 kJ
(B) 3.458 kJ
(C) -1.728 kJ
(D) $-3 \cdot 458k$

58. When 1 mole of gas is heated at Constant volume and heat supplied is 500 J then which of the following is correct?

(A) $\Delta u = -0 \cdot 5J, q = -500]$
(B) $q = -500\ J, \Delta u = 0$
(C) $q = 500\ J,\ w = 0$
(D) $w = 500\ J, \Delta u = 0$

59. The heat of Combustion of acetaldehyde to carbon dioxide and water is $-1172\ kJ\ mol^{-1}$. Calculate amount of heat liberated when 66 g of acetaldehyde were completely oxidised ? (at. mass $C = 12$, $H = 1, 0 = 16$)

(A) 1758 kJ
(B) 2344 kJ
(C) 6600 kg
(D) 1172 kJ

60. Carbon is present in highest oxidation number in

(A) CO_3^{2-}
(B) $\cdot CaC_2$
(C) CO
(D) $C_2O_4^{2-}$

61. If n is the number of asymmetric carbon atoms, the number of optical isomers possible is given by formula

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

62. The number of optical isomers possible for 3,4 -dichloropentan-2-ol is

(A) Two
(B) Sixteen
(C) Eight
(D) Four

63. Which of the following groups does not show $(-R)$ effect?

(A) $-CHO$
(B) $-COOH$
(C) $-CN$
(D) $-OH$

64. Which of the following is a functional isomer of pentan-2-ol?

(A) Pentan-1-ol
(B) Pentan-2-one
(C) Ethoxypropane
(D) Pentan-3-ol

65. How many methyl groups are present in butylated hydroxytoluene?

(A) 6
(B) 10
(C) 4
(D) 7

66. Which of the following reactions yields propan-2-ol?

(A) $CH_3 - CO - CH_3 \xrightarrow[H_3O^+]{CH_3MgI/\text{ ether}}$

(B) $CH_3 - CH = CH_2 \xrightarrow[(ii)\ H_2O_2]{(i)\ B_2H_6}$

(C) $CH_3 - CH = CH_2 \xrightarrow[(ii)\ H_2O]{(i)\ \text{cold.conc } H_2SO_4}$

(D) $H - CH0 \xrightarrow[H_3O^+]{c_2H_5MgBr/\text{ether}}$

67. What is the mass of bcc type unit cell of sodium if mass of one atom of sodium is $3 \cdot 819 \times 10^{-23}$ g ?

(A) $7 \cdot 038 \times 10^{-23}$ g (B) $7 \cdot 638 \times 10^{-23}$ g

(C) $3 \cdot 819 \times 10^{-23}$ g (D) 1.5276×10^{-22} g

68. Which among the following is NOT an amorphous solid?

(A) Rubber (B) Butter

(C) Tar (D) Camphor

69. Which among the following is ferromagnetic in nature?

(A) Benzene (B) Oxygen

(C) Iron (D) Water

70. Which of the following formula correctly gives the value of ebuillioscopic constant?

(A) $\frac{W_1 \times 1000}{\Delta T_b \times W_2 \times M_2}$ (B) $\frac{W_2 \times 1000}{\Delta T_b \times W_1 \times M_2}$

(C) $\frac{M_2 \times \Delta T_b \times W_2}{W_1}$ (D) $\frac{\Delta T_b \times M_2 \times W_1}{W_2}$

71. What will be the molar mass of solute if vapour pressure of pure benzene is 450 mm Hg when $1 \cdot 5$ g of non volatile solute is added to 30 g of benzene? (Vapour pressure of solution = 400 mmHg, atomic mass C = 12, H = 1)

(A) $35 \cdot 1$ g mol^{-1} (B) $26 \cdot 1$ g mol^{-1}

(C) $28 \cdot 4$ g mol^{-1} (D) $30 \cdot 0$ g mol^{-1}

72. If van't Hoff factor of monofluoroacetic acid in water is $1 \cdot 076$. What is it's degree of dissociation?

(A) 0.76 (B) 0.076

(C) 0.924 (D) 0.538

73. During discharging the change taking place at cathode in lead accumulator is

(A) $Pb_{(s)}$ is oxidised to $Pb^{2+}_{(aq.\ .}$ (B) $Pb^{2+}_{(aq.)}$ is oxidised to $PbO_{2(\ s)}$

(C) $PbO_{2(\ s)}$ is reduced to $Pb^{2+}_{(aq.\ )}$ (D) $Pb^{2+}_{(aq.)}$ is reduced to $Pb_{(s)}$

74. Molar conductivity of 0.01 M HCl solution is $400 \cdot 0 \Omega^{-1}$ cm^2 mol^{-1}. Calculate the conductivity of HCl solution.

(A) $4 \cdot 0 \times 10^{-4} \Omega^{-1}$ cm^{-1}

(B) $8 \cdot 0 \times 10^{-2} \Omega^{-1}$ cm^{-1}

(C) $2 \cdot 5 \times 10^{-2} \Omega^{-1}$ cm^{-1}

(D) $4 \cdot 0 \times 10^{-3} \Omega^{-1}$ cm^{-1}

75. What is the molecularity and order of the following reaction if rate law is rate $= K[O_3][O]$ respectively? $O_{3(\ g)} + O_{(g)} \longrightarrow 2O_{2(\ g)}$

(A) 3 and 2 (B) 3 and 1

(C) 2 and 2 (D) 4 and 2

76. A first order reaction is 75% completed in 60 minutes, the time required for it's 50% completion is.

(A) 120 min (B) 60 min

(C) 40 min (D) 30 min

77. Which of the following is an emulsion?

(A) Butter (B) Jellies

(C) Milk (D) Mist

78. Which following compound acts as a flux in extraction of copper from copper pyrites

(A) $CaSiO_3$ (B) FeO

(C) $FeSiO_3$ (D) SiO_2

79. Identify the mineral from following containing aluminium

(A) Magnesite (B) Haematite

(C) Cryolite (D) Siderite

80. Noble gas used in miner's cap lamp is

(A) Ra (B) Kr

(C) Ar (D) He

81. When SO_2 is passed through acidified $K_2Cr_2O_7$ solution

(A) reduction of SO_2 takes place (B) the solution turns orange

(C) the solution turns blue (D) the solution turns green

82. What is the molecular formula of pyrophosphoric acid?

(A) $H_4P_2O_7$ (B) H_3PO_4

(C) $H_4P_2O_5$ (D) $H_2P_2O_5$

83. Which among the following elements is radioactive?

(A) Lu (B) Nd

(C) Eu (D) Pm

84. What is the total number of ligands present in $[COCl_2(NH_3)_4]Cl$

(A) 2 (B) 4

(C) 1 (D) 6

85. Which among the following is a monodentate ligand?

(A) Oxalato (B) Water

(C) Ethylenediamine (D) Dimethylgyoximato

86. Which among the following has highest boiling point?

(A) tert-butyl bromide (B) isobutyl bromide

(C) n-butyl bromide (D) sec-butyl bromide

87. Identify the product Y in the following series of reactions. 4-Nitrotoluene $\xrightarrow[273-278\ K]{(CH_3co)_2o/cros} X \xrightarrow[\Delta]{H_3O^+} Y$

(A) 4-nitrobenzaldehyde (B) Benzaldehyde

(C) 4-nitrobenzoic acid (D) Acetophenone

88. Which of the following reagents is used to convert phenol to benzene?

(A) Zn (dust) (B) Na

(C) $KMnO_4$ (acidified) (D) $LiAlH_4$

89. When aldoxime is treated with trifluoroperoxy acetic acid yields

(A) 2° amine (B) 1° amine

(C) 1° nitroalkanes (D) 2° nitroalkanes

90. Identify 'B' in the following reaction Benzonitrile $\xrightarrow[ether]{C_6H_5MgBr} A \xrightarrow{H_3O^+} BMg <^{Br}_{OH}$

(A) Benzophenone (B) Benzaldehyde

(C) Aniline (D) Diphenyl

91. Which of the following is used to convert olefins into aldehyde?

(A) H_2 and CO (B) H_2

(C) CO and alkyne (D) CO

92. Which of the following is Clemmensen reduction?

(A) $-CO- + 4[H] \xrightarrow[\Delta]{Zn-Hg/conc.HCl} -CH_2- + H_2O$

(B) $-CO-Cl \xrightarrow[Pd-BaSO_4]{H_2} -CHO + HCl$

(C) $-CH=O \xrightarrow[-H_2O]{H_2N-NH2} R-CH=N-NH_2 \xrightarrow[\Delta]{KOH/ethyleneglycol} -CH_3 + N_2$

(D) $-C \equiv N + 2[H] \xrightarrow[\text{dil HCl}]{Sn\,Cl_2} -CH=NH \cdot HCl \xrightarrow{H_3O^+} -C=O + NH_4Cl$

93. The reaction in which copper (I) salt is used to replace nitrogen in diazonium salt is called,

(A) Sandmeyer reaction (B) Hoffmann elimination

(C) Gattermann reaction (D) Balz - Schiemann reaction

94. Which of the following reagents is used in Mendius reduction reaction of alkyl cyanide?

(A) Sn/HCl (B) $LiAlH_4$/ Ether

(C) $Na-Hg/H_2O$ (D) Na/C_2H_5OH

95. The catalyst used to convert sodium to sodium amide is

(A) V_2O_5 (B) Pt

(C) $Fe(NO_3)_3$ (D) Fe

96. Which among the following sugars does not reduce Tollen's reagent?

(A) Ribose (B) Lactose

(C) Maltose (D) Sucrose

97. Which among the following is a natural biopolymer of monosaccharides?

(A) glycogen (B) Neoprene

(C) Silk (D) Isoprene

98. Identify thermoplastic polymer from following

(A) Bakelite (B) Nylon-6

(C) Polystyrene (D) Neoprene

99. Which among the following catalysts is used in the preparation dacron?

(A) Oxygen

(B) Titanium chloride and triethyl aluminium

(C) Zinc acetate and antimoney trioxide

(D) Peroxide

100. Which of the following drugs produce depression of central nervous system?

(A) Methyl salicylate

(B) Codeine

(C) ibuprofen

(D) Paracetamol

101. $f(x) = \frac{3x+2}{5x-3}, x \in R - \left\{\frac{3}{5}\right\}$, then

(A) $f^{-1}(x) = f(x)$

(B) $f^{-1}(x)$ does not exist.

(C) $f[f(x)] = -x$

(D) $f^{-1}(x) = -f(x)$

102. The domain and range of the relation R given by $R = \{(x, y)/y = x + \frac{6}{x}, x, y \in N \text{ and } x < 6\}$ are

(A) Domain $= \{2, 3\}$, Range $= \{5\}$.

(B) Domain $= \{1, 2\}$, Range $= \{5, 7\}$.

(C) Domain $= \{1, 2, 3, 4, 5\}$, Range $= \left\{7, 5, \frac{6}{4}, \frac{6}{5}\right\}$.

(D) Domain $= \{1, 2, 3\}$, Range $= \{5, 7\}$.

103. If $\tan\theta + \cot\theta = 4$, then $\tan^4\theta + \cot^4\theta =$

(A) 194

(B) 110

(C) 80

(D) 191

104. If A, B, C, D are the angles of a cyclic quadrilateral taken in order, then $\cos A + \cos B + \text{Cos}C + \text{Cos}D =$

(A) -1

(B) 1

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

(D) 0

105. If $\sin\theta = \sin 15^\circ + \sin 45^\circ$, where $0^\circ < \theta < 180^\circ$, then $\theta =$

(A) 75°

(B) 150°

(C) 45°

(D) 60°

106. The general solution of $\frac{1-\cos 2x}{1+\cos 2x} = 3$ is

(A) $x = 2n\pi \pm \frac{\pi}{3}, n \in Z$

(B) $x = n\pi \pm \frac{\pi}{6}, n \in Z$

(C) $x = 2\text{n}\pi \pm \frac{\pi}{6}, \text{n} \in \text{Z}$

(D) $x = \text{n}\pi \pm \frac{\pi}{3}, \text{n} \in \text{z}$

107. with usual notations, if triangle ABC is right angled at C, then $\left(\frac{a^2+b^2}{a^2-b^2}\right)\sin(\text{A} - \text{B}) =$

(A) 3

(B) 1

(C) 0

(D) -1

108. The sum to 10 terms of the series $1 \times 3^2 + 2 \times 5^2 + 3 \times 7^2 + \ldots\ldots\ldots\ldots$ is

(A) 13,495

(B) $\cdot 15,595$

(C) $13,000$

(D) 13,695

109. The distance between the lines given by $3x + 4\text{y} = 9$ and $6x + 8\text{y} = 15$ is

(A) 5 units

(B) \$ 3 units

(C) $0 \cdot 5$ units

(D) $0 \cdot 3$ units

110. The measure of the angle between the lines $x^2 + 2xy\,\text{cosec}\,\alpha + y^2 = 0$ is

(A) $\frac{\pi}{2} - \alpha$

(B) $\frac{\pi}{2} + \alpha$

(C) α

(D) $\pi - \alpha$

111. The joint equation of two lines through the origin each making an angle of 30° with the Y - axis is

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

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

(C) $x^2 - y^2 = 0$

(D) $\cdot 2x^2 - 3y^2 = 0$

112. The equation of the circle, the end-points of whose diameter are the centres of the circles $x^2 + y^2 - 2x + 3y - 3 = 0$ and $x^2 + y^2 + 6x - 12y - 5 = 0$ is

(A) $2x^2 + 2y^2 + 4x - 9y - 24 = 0$

(B) $2x^2 + 2y^2 + 4x + 9y - 24 = 0$

(C) $2x^2 + 2y^2 + 4x - 9y + 24 = 0$

(D) $2x^2 + 2y^2 - 4x - 9y - 24 = 0$

113. The centre of the hyperbola $9x^2 - 36x - 16y^2 + 96y - 252 = 0$ is

(A) $(-2, -3)$

(B) $(2, -3)$

(C) $(-2, 3)$

(D) $(2, 3)$

114. If $\text{f}(x) = \left(\frac{2^x-1}{1-3^x}\right)$, for $\text{x} \neq 0$ is continuous at $x = 0$, then $\text{f}(0) =$

(A) $\cdot \log 3$

(B) $\frac{-(\log 2)}{(\log 3)}$

(C) $\frac{(\log 2)}{(\log 3)}$

(D) $-\log 2$

115. The negation of the logical statement $(\text{p} \vee \sim \text{q}) \rightarrow (\text{p} \wedge \sim \text{q})$ is

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

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

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

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

116. If p : Seema is fat. q : She is happy, then the logical equivalent statement of 'If Seema is fat, then she is happy' is

(A) Seema is not fat or she is unhappy.
(B) Seema is not fat or she is happy.
(C) Seema is fat and she is happy.
(D) Seema is fat or she is happy.

117. $\int_{-1}^{3}\left[\tan^{-1}\left(\frac{x}{x^2+1}\right)+\tan^{-1}\left(\frac{x^2+1}{x}\right)\right]dx =$

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

118. If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$, then $x^{100}+y^{100}+z^{100}=$

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

119. If $A=\begin{bmatrix}1 & 2\\ -5 & 1\end{bmatrix}$ and $A^{-1}=xA+yI$, where I is unit matrix of order 2 , then the values of x and y are respectively

(A) $\frac{1}{11},\frac{2}{11}$
(B) $\frac{-1}{11},\frac{2}{11}$
(C) $\frac{1}{11},\frac{-2}{11}$
(D) $\frac{-1}{11},\frac{-2}{11}$

120. The element in the third row and first column of the inverse of the matrix $\begin{bmatrix}1 & -3 & 2\\ -3 & 3 & -1\\ 2 & -1 & 0\end{bmatrix}$ is

(A) -3
(B) $x=4$
(C) 3
(D) 2

121. If $x=e^{(y+e)^{(y+e)}(y+\ldots\ldots\infty)}$, then $\frac{dy}{dx}=$

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

122. If $y=\cos^2\left(\frac{5x}{2}\right)-\sin^2\left(\frac{5x}{2}\right)$, then $\left(\frac{d^2y}{dx^2}\right)=$

(A) $-5\sqrt{1-y^2}$
(B) $5\sqrt{1-y^2}$
(C) $25y$
(D) $-25y$

123. If $y=\sec\left(\tan^{-1}x\right)$, then $\frac{dy}{dx}$ at $x=1$ is

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

124. If the line $y=4x-5$ touches the curve $y^2=ax^3+b$ at the point $(2,3)$, then

(A) $a=-2,b=-7$
(B) $a=-2,b=7$
(C) $a=2,b=-7$
(D) $a=2,b=7$

125. The minimum value of $f(x)=a^2\cos^2x+b^2\sin^2x$ if $a^2>b^2$, is

(A) a^2-b^2
(B) b^2
(C) a^2+b^2
(D) a^2

126. The approximate value of $f(x)=3x^2+5x+3$ at $x=3\cdot02$ is

(A) $45\cdot36$
(B) $45\cdot46$
(C) $44\cdot76$
(D) $44\cdot46$

127. If $\int\frac{2x^2+3}{(x^2-1)(x^2+4)}dx=a\log\left|\frac{x-1}{x+1}\right|+b\tan^{-1}\left(\frac{x}{2}\right)+C$, then

(A) $a=\frac{1}{2},\ b=\frac{1}{2}$
(B) $a=-1,\ b=1$
(C) $a=\frac{1}{2},\ b=\frac{-1}{2}$
(D) $a=1,\ b=-1$

128. $\int\frac{x+1}{x^2+5x+6}dx=$

(A) $-\log|x+2|-2\log|x+3|+C$
(B) $-\log|x+2|+2\log|x+3|+C$
(C) $2\log|x+2|-2\log|x+3|+C$
(D) $\log|x+2|+2\log|x+3|+C$

129. $\int(1+x)\log x\,dx=$

(A) $\left(x+\frac{x^2}{2}\right)\log x+\left(x-\frac{x^2}{4}\right)+C$
(B) $\left(x+\frac{x^2}{2}\right)\log x-\left(x+\frac{x^2}{4}\right)+C$
(C) $\left(x+\frac{x^2}{2}\right)\log x-\left(x-\frac{x^2}{4}\right)+C$
(D) $\left(x+\frac{x^2}{2}\right)\log x+\left(x+\frac{x^2}{4}\right)+C$

130. $\int_0^{\pi}\frac{e^{\cos x}}{(e^{\cos x}+e^{-\cos x})}dx=$

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

131. $\int_1^{28}\frac{dx}{x(1+\log x)^2}=$

(A) $\cdot\log2$
(B) $1+\log2$
(C) $\frac{\log2}{(1+\log2)}$
(D) $\frac{1}{(1+\log2)}$

132. The area of the region included between the parabola $y^2=x$ and the line $x+y=2$ in the first quardrant is

(A) $\frac{1}{6}$ sq. units
(B) $\frac{7}{6}$ sq. units
(C) $\frac{1}{2}$sq. units
(D) $\frac{2}{3}$ sq. units

133. The integrating factor of the differential equation $\mathrm{y}\log_y\left(\frac{dx}{dy}\right)+x-\log \mathrm{y}=0$ is

(A) $\log(\log y)$ (B) $\log y$

(C) y (D) e^y

134. The solution of the differential equation $\sin^{-1}\left(\frac{dy}{dx}\right)=x+\mathrm{y}$ is

(A) $x=\tan(x+y)\cdot\sec(x+y)+c$

(B) $x=\tan(x+y)-\sec(x+y)+c$

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

(D) $x=\tan x\cdot\tan y+c$

135. The rate of increase of population of a country is proportional to the number present. If the population doubles in 50 years, then the time taken by it to become four times of it self is

(A) 300 years (B) 100 years

(C) 200 years (D) 400 years

136. The equation of the curve whose slope at any point is equal to $2xy$ and which passes through the point $(0,1)$ is

(A) $\cdot\log y=x^2$ (B) $\log y=\frac{1}{x}$

(C) $\frac{1}{y}=x$ (D) $\log y=x$

137. The order and degree of the differential equation $y=px+\sqrt{a^2\mathrm{p}^2+b^2}$, where $\mathrm{p}=\frac{dy}{dx}$ are respectively

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

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

138. If $\bar{\mathrm{a}}=2\hat{\imath}+3\hat{\jmath}+\hat{\mathrm{k}}, \overline{\mathrm{b}}=4\hat{\imath}+5\hat{\jmath}+3\hat{\mathrm{k}}$ and $\bar{\mathrm{c}}=6\hat{\imath}+\hat{\mathrm{j}}+5\hat{\mathrm{k}}$ are the position vectors of the vertices of a triangle ABC respectively, then the position vector of the intersection of the medians of the triangle ABC is

(A) $4\hat{\imath}+3\hat{\jmath}+3\hat{\mathrm{k}}$ (B) $2\hat{\imath}+3\hat{\jmath}+3\hat{\mathrm{k}}$

(C) $5\hat{\imath}+3\hat{\jmath}+3\hat{\mathrm{k}}$ (D) $3\hat{\imath}+3\hat{\jmath}+4\hat{\mathrm{k}}$

139. If the position vectors of the vertices A,B,C of a tringle ABC are $4\hat{\imath}+7j+8\hat{k}, 2\hat{\imath}+3\hat{\jmath}+4\hat{k}$ and $2\hat{\imath}+5\hat{\jmath}+7\hat{k}$ respectively, then the position vector of the point where bisector of angle A meets BC is

(A) $\frac{1}{3}(6\hat{\imath}+11\hat{\jmath}+15\hat{\mathrm{k}})$ (B) $\frac{1}{2}(4\hat{\imath}+8\hat{\jmath}+11\hat{\mathrm{k}})$

(C) $\frac{1}{4}(8\hat{\imath}+14\hat{\jmath}+19\hat{\mathrm{k}})$ (D) $\frac{1}{3}(6\hat{\imath}+13\hat{\mathbf{j}}+18\hat{\mathrm{k}})$

140. If $\bar{a},\bar{b},\bar{c}$ are non $-$ coplanar vectos and $(\bar{\mathrm{a}}+\overline{\mathrm{b}}+\bar{\mathrm{c}})\cdot(\bar{\mathrm{a}}\times\overline{\mathrm{b}}+\overline{\mathrm{b}}\times\bar{\mathrm{c}}+\bar{\mathrm{c}}\times\bar{\mathrm{a}})=\mathrm{k}[\bar{\mathrm{a}}\overline{\mathrm{b}}\bar{\mathrm{c}}]$, then value of k is

(A) 4 (B) 1

(C) 2 (D) 3

141. The angle between the line $\bar{\mathrm{r}}=(\hat{\imath}+2\hat{\jmath}-\hat{\mathrm{k}})+\lambda(\hat{\imath}-\hat{\jmath}+\hat{\mathrm{k}})$ and the plane $\bar{\mathrm{r}}\cdot(2\hat{\imath}-\hat{\jmath}+\hat{\mathrm{k}})=4$is

(A) $\sin^{-1}\left(\frac{2}{3}\right)$ (B) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

(C) $\sin^{-1}\left(\frac{2\sqrt{2}}{3}\right)$ (D) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$

142. The equation of a plane containing the point $(1,-1,1)$ and parallel to the plane $2x+3y-4z=17$ is

(A) $\bar{\mathrm{r}}\cdot(2\hat{\imath}-3\hat{\jmath}-4\hat{\mathrm{k}})=-1$

(B) $\bar{\mathrm{r}}\cdot(\hat{\imath}-\hat{\mathrm{j}}+\hat{\mathrm{k}})=3$

(C) $\bar{\mathrm{r}}\cdot(2\hat{\imath}+3\hat{\jmath}-4\hat{\mathrm{k}})=-5$

(D) $\bar{\mathrm{r}}\cdot(2\hat{\imath}+3\hat{\jmath}-4\hat{\mathrm{k}})=5$

143. If the lines $\frac{x-1}{2}=\frac{\mathrm{y}+1}{3}=\frac{\mathrm{z}-1}{4}$ and $\frac{x-3}{1}=\frac{\mathrm{y}-\mathrm{k}}{2}=\frac{\mathrm{z}}{1}$ intersect, then the value of the k is

(A) $\frac{-2}{9}$ (B) $\frac{9}{2}$

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

144. The parametric equation of the line passing throught the points $A(3,4,-7)$ and $B(1,-1,6)$ are

(A) $x=1+3\lambda, y=-1+4\lambda, z=6-7\lambda$

(B) $x=-2+3\lambda,\ \mathrm{y}=-5+4\lambda, \mathrm{z}=13-7\lambda$

(C) $x=3-2\lambda, y=4-5\lambda, \mathrm{z}=-7+13\lambda$

(D) $x=3+\lambda, \mathrm{y}=-1+4\lambda, \mathrm{z}=-7+6\lambda$

145. If a line makes angles of measure $\frac{\pi}{6}$ and $\frac{\pi}{3}$ with X and Y axes respectively, then the angle made by the line with Z axis is

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

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

146. The minimum value of the objective function $\mathrm{Z}=5x+8\mathrm{y}$, subject to $x+\mathrm{y}\geq 5$ $x\leq 4, y\leq 2, x\geq 0, y\geq 0$ occur at the point

(A) $(5,0)$ (B) $(0,5)$

(C) $(4,2)$ (D) $(4,1)$

147. If a discrete random variable X has probability distribution as follows

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

Then $\text{var}(X) =$

(A) $\frac{3}{4}$ (B) $\frac{22}{27}$

(C) $\frac{24}{27}$ (D) $\frac{23}{27}$

148. If $f(x) = \frac{x}{8}$, if $0 < x < 4 = 0$, otherwise is probability density function (p.d.f) of c.r.v. X and $F(x)$ is c.d.f. associated with $f(x)$, then $F(0 \cdot 5) =$

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

(C) $\frac{1}{32}$ (D) $\frac{1}{128}$

149. Suppose that 5% of men and 0.25% of women have gray hair. A gray hair person is selected at random. If there are equal number of males and females, then the probability that the person selected being men is

(A) $\frac{20}{21}$ (B) $\cdot\frac{10}{21}$

(C) $\frac{1}{21}$ (D) $\frac{11}{21}$

150. A die is thrown 100 times. If the success is in getting an even number, then the variance of number of successes is

(A) 1.10 (B) 25

(C) 50 (D) 100

- End of Question Paper -