MHT CET 2022 PCM Aug 6 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 2022**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

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

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

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

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

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

1. A weightless string can support a tension up to 30 N. A stone of mass 0.5 kg is tied to its one end and is revolved in a circular path of radius 2 m in a vertical plane. Then the maximum angular velocity of the stone will be (acceleration due to gravity $g = 10\ \text{m/s}^2$)

(A) 10rad/s (B) $\sqrt{60}\text{rad/s}$

(C) $\sqrt{30}\text{rad/s}$ (D) 5rad/s

2. A ball of mass m moving with speed v collides elastically with an identical stationary ball which is initially at rest. After collision the first ball moves at an angle π to its initial direction and has speed $\left(\frac{v}{3}\right)$. The second ball moves in a straight line after the collision. Then speed of the second ball after collision is

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

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

3. A particle moves along a circular path of radius r with uniform speed v. The angle described by a particle in one second is

(A) vr^2 (B) $\frac{v^2}{r}$

(C) $\frac{r}{v}$ (D) $\frac{v}{r}$

4. The moment of inertia of a ring about an axis perpendicular to its plane and passing through its center is 4 kg m^2. Its moment of inertia about the tangent in the plane is

(A) 6 kg m^2 (B) 8 kg m^2

(C) 4 kg m^2 (D) 2 kg m^2

5. The relative angular speed of hour hand and minute hand of a clock is (in rad/s)

(A) $\frac{9\pi}{1860}$ (B) $\frac{11\pi}{21600}$

(C) $\frac{4\pi}{243}$ (D) $\frac{7\pi}{1480}$

6. Two spherical planets A and B have the same mass but their densities are in a ratio 8:1. For these planets, the ratio of acceleration due to gravity at the surface of A to its value at the surface of B is

(A) 8 : 1 (B) 4 : 1

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

7. A satellite of mass m is moving in a circular orbit of radius r around the earth. The angular momentum of the satellite about the center of orbitis ($M =$ mass of earth, $G =$ gravitational constant)

(A) $\left(GMm^2r^2\right)^{1/2}$ (B) $(GMmr)$

(C) $\left(GMm^2r\right)^{1/2}$ (D) $\left(GM^2mr\right)^{1/2}$

8. Two soap bubbles of radii r_1 and r_2 in vacuum coalesce under isothermal conditions. The resulting bubble has a radius equal to

(A) $\sqrt{r_1^2 + r_2^2}$ (B) $\frac{r_1+r_2}{2}$

(C) $r_1 + r_2$ (D) $\frac{r_1 r_2}{r_1+r_2}$

9. A small ball of mass M, radius R and density ρ moves with terminal velocity through a container filled with glycerine of density σ. The viscous force acting on the ball is ($g =$ gravitational acceleration)

(A) Mgрб (B) $Mg(\rho - \sigma)$

(C) $Mg\left[1 - \frac{\sigma}{\rho}\right]$ (D) $\frac{Mg\rho}{\sigma}$

10. If the excess pressure inside a soap bubble of radius 3 mm is equal to the pressure of a water column of height 0.8 cm, then the surface tension of the soap solution is ($\rho_{\text{water}} = 1000\ \text{kg/m}^3, g = 9.8\ \text{m/s}^2$)

(A) $0.588 \times 10^{-3}\ \text{N/m}$ (B) $588 \times 10^{-3}\ \text{N/m}$

(C) $58.8 \times 10^{-3}\ \text{N/m}$ (D) $5.88 \times 10^{-3}\ \text{N/m}$

11. The ratio of thermal conductivity of two rods A and B with the same area of cross-section is 3 : 2. If the thermal resistance of two rods is the same, then the ratio of length of rod A to length of rod B is

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

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

12. In an isochoric process if $t_1 = 27^\circ\text{C}$ and, $t_2 = 127^\circ\text{C}$ then $\frac{P_1}{P_2}$ will be equal to [P_1 and P_2 are the pressures at $t_1{}^\circ\text{C}$ and $t_2^\circ\text{C}$ respectively]

(A) $\frac{9}{59}$ (B) $\frac{4}{3}$

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

13. Out of the following statements, which one is 'NOT' correct in the case of a thermodynamic process?

(A) In an isothermal process, $\Delta T = 0$
(B) In an isobaric process, $\Delta P = 0$
(C) In an isochoric process, $W = 0$
(D) In an isothermal process, $Q = 0$

14. The r.m.s. speed of gas at temperature T is 2 times the r.m.s speed at 320 K. The value of the Temperature T is

(A) 1280 K
(B) 960 K
(C) 640 K
(D) 2560 K

15. The molar specific heat of an ideal gas at constant pressure and constant volume is C_p and C_v respectively. If R is the universal gas constant and the ratio of C_p to C_v is γ then. $C_v =$

(A) $\frac{y-1}{R}$
(B) $\frac{1-\gamma}{1+\gamma}$
(C) $\frac{1+\gamma}{1-\gamma}$
(D) $\frac{R}{\gamma-1}$

16. According to the kinetic theory of gases, when two molecules of gas collide with each other then

(A) Kinetic energy is conserved but momentum is not conserved.
(B) neither kinetic energy nor momentum is conserved.
(C) both kinetic energy and momentum are conserved.
(D) momentum is conserved but kinetic energy is not conserved.

17. A particle is suspended from a vertical spring which is executing S.H.M. of frequency 5 Hz. The spring is unstretched at the highest point of oscillation. Maximum speed of the particle is $\left(g = 10\ m/s^2\right)$

(A) $\frac{1}{\pi}$m/s
(B) $\frac{1}{4\pi}$m/s
(C) $\frac{1}{2\pi}$m/s
(D) πm/s

18. In S.H.M. a simple pendulum oscillates with frequency f. If the length of the pendulum is increased by three times its original length, then the frequency of oscillation of the pendulum will be

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

19. For a particle performing linear S.H.M., its average speed over one oscillation is ($A =$ amplitude of S.H.M., $n =$ frequency of oscillation)

(A) 4nA
(B) 8nA
(C) 2nA
(D) 6nA

20. The frequency of vibrating air column in a pipe, open at both ends is f_1. When $\left(\frac{3}{4}\right)^{\text{th}}$ of its length is immersed in water, the frequency of vibrating air column is f_2. The value of $\frac{f_1}{f_2}$ is

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

21. Two copper wires of radii r_1 and $r_2 (r_1 > r_2)$ are subjected to the same tension and are plucked. The transverse waves will

(A) not travel through both the wires
(B) travel with the same velocity in both the wires
(C) travel faster in the thinner wire
(D) travel faster in the thicker wire

22. In a pipe closed at one end, air column is vibrating in the fourth overtone, so the vibrating air column has

(A) 4 nodes and 5 antinodes.
(B) 5 nodes and 4 antinodes.
(C) 5 nodes and 5 antinodes.
(D) 4 nodes and 4 antinodes.

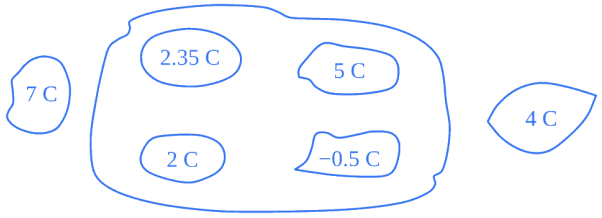
23. Two light rays having the same wavelength λ in vacuum are in phase initially. Then the first ray travels a path L_1 through a medium of refractive index μ_1, while the second ray travels a path of length L_2 through a medium of refractive index μ_2. The two waves are then combined to observe interference. The phase difference between the two waves is

(A) $\frac{2\pi}{\lambda}[\mu_2 L_1 - \mu_1 L_2]$
(B) $\frac{2\pi}{\lambda}\left[\frac{L_1}{\mu_1} - \frac{L_2}{\mu_2}\right]$
(C) $\frac{2\pi}{\lambda}[\mu_1 L_1 - \mu_2 L_2]$
(D) $\frac{2\pi}{\lambda}[L_2 - L_1]$

24. The displacement of a particle in a medium is $y = 10^{-4}\sin\left[100t + 20x + \frac{\pi}{3}\right]$ m, where t is in second and x is in metre. The speed of the wave is

(A) 5 m/s
(B) 10 m/s
(C) 15 m/s
(D) 20 m/s

25. The electric flux linked with the closed surface in $\mathrm{Nm^2C^{-1}}$ is $\left(\varepsilon_0 = 8.85 \times 10^{-12}\mathrm{C^2\ N^{-1}\ m^{-2}}\right)$



(A) 10^{12} (B) 8.85×10^{-13}
(C) 10^{10} (D) 10^{11}

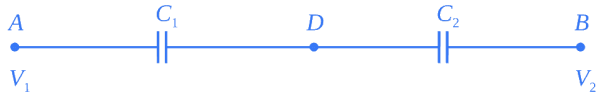
26. A charge QC is placed at the center of a cube. If ε_0 is the permittivity of vacuum then the flux through one face and two opposite faces of the cube is respectively

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

27. Four electric charges $+q, +q, -q$ and $-q$ are placed in order at the corners of a square of side $2r$. The electric potential at a point midway between the two negative charges is

(A) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{r}[1-\sqrt{5}]$ (B) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{r}\left[\frac{1}{\sqrt{5}}+1\right]$
(C) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{r}\left[\frac{1}{\sqrt{5}}-1\right]$ (D) Zero

28. Two condensers C_1 and C_2 in a circuit are joined as shown below. The potential of point A is V_1 and that of B is V_2. The potential of point D will be



(A) $\frac{C_1V_2+C_2V_1}{C_1+C_2}$ (B) $\frac{1}{2}(V_1+V_2)$
(C) $\frac{C_2V_1-C_1V_2}{C_1+C_2}$ (D) $\frac{C_2(V_1+V_2)}{C_1+C_2}$

29. When an additional resistance 1980Ω is connected in series with a voltmeter, each scale division has 100 times larger value. The resistance of the voltmeter is

(A) 60Ω (B) 20Ω
(C) 30Ω (D) 40Ω

30. The resistance in the left and right gaps of a meter bridge are 10Ω and 30Ω respectively. If the bridge is balanced, then the distance of the null point from the center of the wire is

(A) 20 cm (B) 30 cm
(C) 25 cm (D) 40 cm

31. Two identical long parallel wires carry currents I_1 and I_2 such that $I_1 > I_2$. When the currents are in the same direction, the magnetic field at a point midway between the wires is 6×10^{-6} T. If the direction of I_2 is reversed, the field becomes 3×10^{-5} T. The ratio $\left(\frac{I_1}{I_2}\right)$ is-

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

32. If M_0 and L_0 denote the magnetic moment and angular momentum of the electron due to its orbital motion respectively, then the gyromagnetic ratio is given by

(A) $\frac{M_0}{L_0}$ (B) L_0M_0
(C) $\sqrt{\frac{M_0}{L_0}}$ (D) $\frac{L_0}{L_0}$

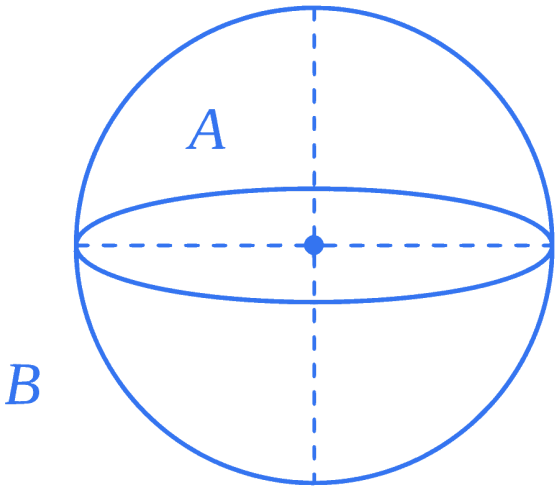
33. A wire of length L carries a current i. If the wire is turned into a circular coil and kept in a uniform magnetic field B, the maximum magnitude of torque in the given magnetic field will be

(A) $\frac{BL^2}{4\pi}$ (B) $\frac{BiL^2}{4\pi}$
(C) $\frac{B^2L^2}{2}$ (D) $\frac{BiL^2}{2}$

34. A long solenoid with 15 turns per cm has a small loop of area $2.0\,\mathrm{cm^2}$ placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 2.0 Ato 4.0 A in 0.1 s, the induced emf in the loop while the current is changing is nearly [Take $\pi = 3.14$]

(A) 9×10^{-6} V (B) 4.48×10^{-6} V
(C) 5.2×10^{-6} V (D) 7.54×10^{-6} V

35. Two coils of wire A and B are placed mutually perpendicular as shown in figure. When current is changed in any one coil



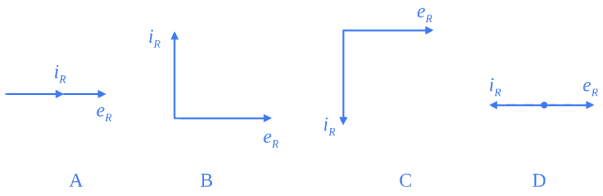
(A) magnetic flux linked with another coil is maximum.

(B) magnetic field will be perpendicular to the other plane of the coil.

(C) no current will be induced in another coil.

(D) current induced in another coil is maximum.

36. When a.c. source is connected across a pure resistor, the correct phase relation between current (i_R) and voltage (e_R) is shown in figure



(A) (B)

(B) (D)

(C) (A)

(D) (C)

37. In series LCR circuit, the voltage across L, C and R is 50 V, 20 V and 40 V respectively. The a.c. voltage applied across the combination of LCR is

(A) 10 V

(B) 110 V

(C) 70 V

(D) 50 V

38. An ideal transformer is used to set up an alternating e.m.f. of 220 V to 4.4kV to transmit 6.6 kW of power. The primary coil has 100 turns. What is current rating of secondary?

(A) 1.0 A

(B) 0.75 A

(C) 2.5 A

(D) 1.5 A

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

(A) 1 : 8

(B) 5 : 1

(C) 1 : 5

(D) 8 : 1

40. A compound microscope produces a magnification of 24 . The focal length of the eyepiece is 5 cm. The final image is formed at the least distance of distinct vision. The magnification produced by the objective is

(A) 4

(B) 5

(C) 6

(D) 7

41. The refracting angle of a glass prism is 30°. A ray is incident on one of the faces and is perpendicular to it. The angle of deviation δ between the incident ray and that leaves the prism is (Refractive index of glass $= 1.5)(\sin(30^\circ) = 0.5, \sin(48.6) = 0.75)$

(A) 17°

(B) 12.6°

(C) 16°

(D) 18.6°

42. A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first maximum of the diffraction pattern, the phase difference between the rays coming from the edges of the slit is

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

(B) π

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

(D) 3π

43. Two waves having amplitudes in the ratio 5:1 produce interference. The ratio of the maximum to minimum intensity is

(A) 6 : 4

(B) 25 : 1

(C) 3 : 2

(D) 9 : 4

44. When an electron in a hydrogen atom jumps from the third excited state to the ground state, the de-Broglie wavelength associated with the electron becomes

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

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

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

(D) $\frac{1}{16}$

45. In the case of photoelectric emission from a certain metal, the cutoff frequency is v. If radiation of frequency $2v$ is incident on the metal plate, the maximum possible velocity of the emitted electrons will be (m = mass of electron)

(A) $2\sqrt{\frac{hv}{m}}$ (B) $\sqrt{\frac{hv}{2m}}$

(C) $\sqrt{\frac{2hv}{m}}$ (D) $\sqrt{\frac{hv}{m}}$

46. The wave number of first line in Lyman series of hydrogen atom is (R is Rydberg's constant)

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

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

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

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

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

48. An n-type and a p-type silicon semiconductor can be obtained by doping pure silicon with

(A) Boron and arsenic respectively. (B) arsenic and boron respectively.

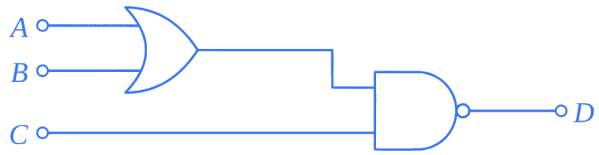
(C) sodium and magnesium respectively. (D) indium and sodium respectively.

49. Which one of the following logic gates is called as Universal gate?

(A) NOR (B) NOT

(C) Ex-OR (D) AND

50. For a given combination of logic gates, the inputs A, B and C are as follows. $A = B = C = 0$ and $A = B = 1, C = 0$ then the logic states of output D are respectively



(A) 0,0 (B) 0,1

(C) 1,0 (D) 1,1

51. Mass of one molecule of oxygen in amu and in gram respectively is

(A) $32u, 53.13 \times 10^{-24}$ g

(B) $16u, 6.0 \times 10^{-24}$ g

(C) $42u, 5.313 \times 10^{-24}$ g

(D) $53.13 \times 10^{-24}u, 32$ g

52. What is the position of copper in modern periodic table?

(A) Period- 5, Group-9

(B) Period-4, Group- 11

(C) Period-4, Group- 10

(D) Period- 3 , Group- 9

53. Identify the element having smallest atomic radius from following

(A) Ar

(B) P

(C) Si

(D) Cl

54. Identify non-benzenoid aromatic compound from the following

(A) Benzene

(B) Phenol

(C) Tropone

(D) Naphthalene

55. Which among the following concepts is NOT introduced by V. B. Theory?

(A) Delocalization of electron over the two nuclei.

(B) Shielding effect of electrons.

(C) Partial ionic character of a covalent bond.

(D) Number of lone pair and bonded pair of electrons decide the shape of the molecules.

56. The bond length of $C-F$ in CH_3-F molecule is

(A) 178pm

(B) 139 pm

(C) 214pm

(D) 193pm

57. The $H-C-H$ bond angle in CH_4 molecule is

(A) 120°

(B) $109^\circ 28'$

(C) 107°

(D) $104^\circ 28'$

58. Identify the correct decreasing order of bond dissociation enthalpy from following.

(A) $F-F > Cl-Cl > Br-Br > I-I$

(B) $Cl-Cl > F-F > Br-Br > I-I$

(C) $I-I > Br-Br > Cl-Cl > F-F$

(D) $Cl-Cl > Br-Br > F-F > I-I$

59. Calculate the pressure of 1.5 mole of gas having volume $3dm^3$ at 300 K $\left(R = 0.0821 dm^3 \text{ atm } K^{-1} \text{ mol}^{-1}\right)$

(A) 12.32 atm

(B) 14.6 atm

(C) 10.25 atm

(D) 15.3 atm

60. What is the work done at 300 K for the reaction? $SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(g)$? (Given $R = 8.314) K^{-1} \text{ mol}^{-1}$

(A) -1247.1 J

(B) -247 J

(C) 850.7 J

(D) 1247 J

61. The difference between enthalpy change and internal energy change for the combustion of one mole of ethyl alcohol is

(A) $-\frac{1}{2}$

(B) $-1.5RT$

(C) -RT

(D) $-2RT$

62. A certain system is exothermic by 260 kJ and does 10 kJ of work. What is the change in internal energy?

(A) -250 kJ

(B) -540 kJ

(C) -140 kJ

(D) -270 kJ

63. An organic weak monobasic acid is 0.001 percent dissociated in its 0.05M solution. What is its dissociation constant?

(A) 6×10^{-12}

(B) 5×10^{-12}

(C) 4×10^{-12}

(D) 1×10^{-12}

64. What is the pH at which $Mg(OH)_2$ starts to precipitate from a solution containing $0.1M Mg^{2+}$ ions? (Given Ksp for $Mg(OH)_2 = 1.0 \times 10^{-11}$)

(A) 7

(B) 4

(C) 6

(D) 9

65. Identify conjugate acid and conjugate base respectively in following reaction. $H_2O + HCl_{(aq)} \rightleftharpoons H_3O^+ + Cl^-_{(aq)}$

(A) H_2O and H_3O^+ (B) $H_3O^+$and H_2O

(C) $Cl^-$and HCl (D) HCl and H_3O^+

66. What is oxidation state of Mn in MnO_4^{-1} ?

(A) $+5$ (B) $+6$

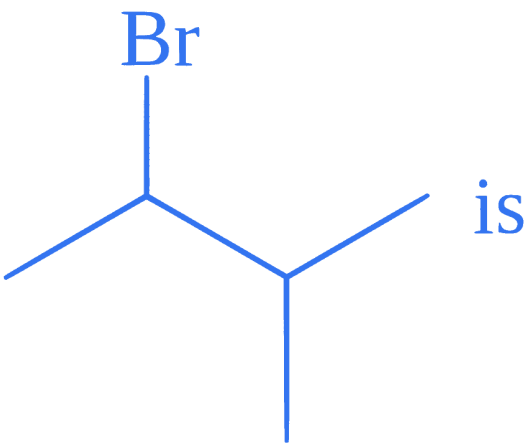
(C) $+4$ (D) $+7$

67. Which element from following forms a chlorophyll complex?

(A) Iron (B) Magnesium

(C) Calcium (D) Cobalt

68. IUPPAC name of the compound

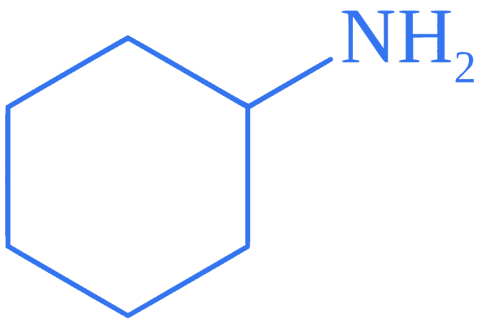


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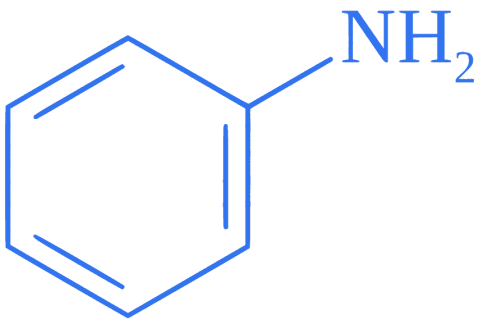
(A) 2 -Bromopentane (B) 3-Bromo-2-methylbutane

(C) 2-Bromo-3-methylbutane (D) 1-Bromo-3-methylbutane

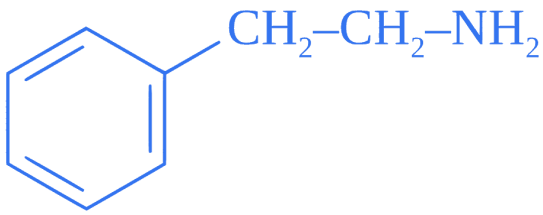
69. Which one of the following is an aromatic amine?



(A)



(B)

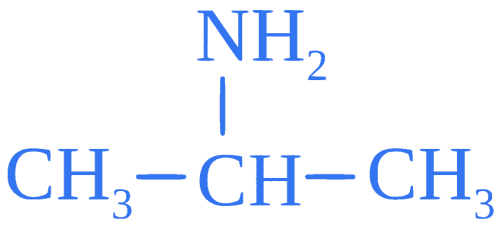


(C)

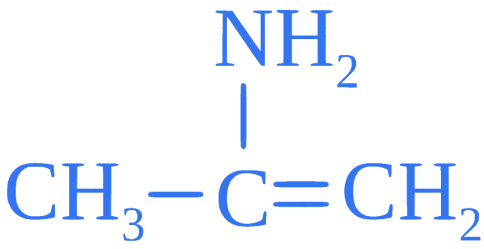
(D) $C_5H_9 - NH_2$

70. The correct structure of prop −2− en -1 - amine is

(A) $CH_3 - CH = CH - NH_2$



(B)



(C)

(D) $H_2C = CH - CH_2 - NH_2$

71. Which among the following compounds is vinylic halide?

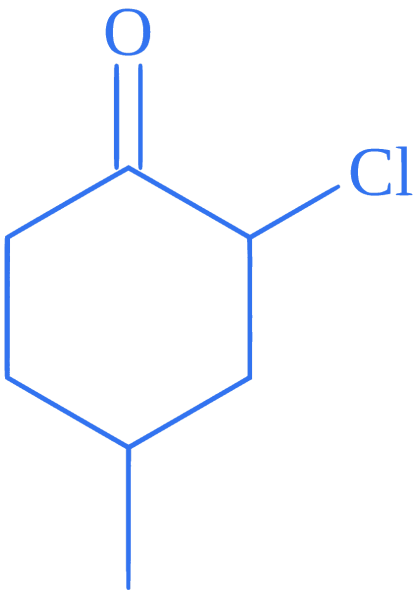
(A) 1 - chloroethene

(B) 2-Bromo-2-methylpropane

(C) 2 -chloropropane

(D) Bromoethane

72. What is the IUPC name of the compound?



(A) 4-methyl-6-chlorocyclohexanone

(B) 2-chloro-4-methylcyclohexanone

(C) 4-methyl-2-chlorocyclohexanone

(D) 6-chloro-4-methylcyclohexanone

73. Which among following statements is NOT a principle of green chemistry?

(A) Effluents of one industry can be used as coolant for thermal power stations.

(B) To develop technology for zero waste.

(C) To give priority for prevention of waste.

(D) It aims to dump waste product formed in one system instead to use as raw material for other system.

74. Which of the following is an example of ionic solid?

(A) Calcium fluoride

(B) ice

(C) silica

(D) sodium metal

75. Which of the following statements is NOT true about polymorphism?

(A) NaF and MgO are polymorphous compounds.
(B) Fullerene is a polymorphic form of carbon.
(C) Polymorphism occurring in elements is called allotropy.
(D) Single substance that exists in two or more forms is said to be polymorphous.

76. Calculate the density of metal which forms simple cubic structure with edge length of unit cell 336pm. (90 gram of meal contains 2.64×10^{23} atoms)

(A) 8.98 g cm^{-3}
(B) 10.8 g cm^{-3}
(C) 7.3 g cm^{-3}
(D) 9.46 g cm^{-3}

77. What is the molar mass of solute when 5 gram solute dissolved in 70 gran solvent lowers its freezing point by 2.5 K ? If $K_f = 3.5\ K - Kg/mol$.

(A) 100 g mol^{-1}
(B) 120 g mol^{-1}
(C) 160 g mol^{-1}
(D) 140 g mol^{-1}

78. Which of the following laws represents the quantitative relationship between the solubility of gas in liquid and its pressure?

(A) Charles's law
(B) Avogadro's law
(C) Raoult's law
(D) Henry's law

79. What is the unit of Henry's law constant?

(A) $moldm^{-3}$
(B) $moldm^3 bar^{-1}$
(C) $moldm^{-3} bar^{-1}$
(D) $moldm^{-3} bar$

80. What is the change in potential of following cell $Zn(s)\left|\begin{matrix}Znn^{2+}\\1M\end{matrix}\right|\left|\begin{matrix}Pb^{2+}\\1M\end{matrix}\right|Pb(s)$ if concentration of ions at anode is increased 10 times?

(A) Decreases by 0.0296 volt
(B) Increases by 10 volt
(C) Decreases by 10 volt
(D) Increase by 0.0296 volt

81. How many coulombs of electricity is required to produce 1 g Na metal from its ions? (Atomic mass Na = 23)

(A) 1516C
(B) 3132 C
(C) 2088 C
(D) 4196 C

82. What is the SI unit of molar conductivity?

(A) $Sdm^3\ mol^{-1}$
(B) $Sm^2\ mol^{-1}$
(C) $Scm^2\ mol^{-1}$
(D) Sm^2

83. Rate law equation for a reaction is $R = k[x][y]$, rate of reaction doubles when

(A) conc. of x is kept constant and conc. of y is halved
(B) conc. of both x and y is doubled
(C) conc. of x is doubled and conc. of y is kept constant
(D) conc. of y is doubled and conc. of x is halved

84. Rate of first order reaction A $\rightarrow$ product is 0.01 $moldm^{-3}\ s^{-1}$, calculate rate constant if concentration of reactant is 0.2M ?

(A) 0.05 sec^{-1}
(B) 0.1 sec^{-1}
(C) 0.5 sec^{-1}
(D) 0.01 sec^{-1}

85. Rate of reaction x + y $\rightarrow$ product is $5.4 \times 10^{-2}\ moldm^{-3}\ sec^{-1}$. When $[x] = 0.2\ moldm^{-3}$ and $[y] = 0.1\ moldm^{-3}$, calculate rate constant of reaction if it is first order in X and second order in Y

(A) 18 $mol^{-2} dm^6\ sec^{-1}$
(B) 27 $mol^{-2} dm^6\ sec^{-1}$
(C) 32 $mol^{-2} dm^6\ sec^{-1}$
(D) 12 $mol^{-2} dm^6\ sec^{-1}$

86. What is the range of particle size in colloidal state?

(A) 0.1 − 2 nm
(B) Greater than 1000 nm
(C) 2 − 500 nm
(D) Less than 0.1 nm

87. What is the number of unpaired electrons present in d orbitals of Cr(Z = 24) to have extra stability?

(A) 0
(B) 1
(C) 4
(D) 5

88. Identify the outer electronic configuration of first element of first transition series.

(A) $[Ar]3\ d^1 4\ s^1$
(B) $[Kr]4\ d^\circ 5\ s^2$
(C) $[Kr]4\ d^1 5\ s^2$
(D) $[Ar]3\ d^1 4\ s^2$

89. Identify the use of EDTA from following.

(A) Treatment of lead poisoning.
(B) Electroplating of noble metals.
(C) Treatment for cancer.
(D) Transmission of nerve signals.

90. Identify product A and B in following reaction. $R - COOR' \xrightarrow[\text{dry either}]{LiAlH_4} A + B$

(A) $A = R - CH_2OH$, $B = R^{'} - OH$

(B) $A = R - OH$, $B = R' - H$

(C) $A = R - COOH$, $B = R' - OH$

(D) $A = R - CH_3$, $B = R' - COOH$

91. What is the number of hydroxyl group present in propylene glycol?

(A) 3 (B) 4

(C) 1 (D) 2

92. The compound $CH_3 - CH = CH - CH_2 - OH$ is also called as

(A) Crotonyl alcohol (B) Benzenol

(C) Ethylene glycol (D) Propylene glycol

93. What is the product obtained when vapours of phenol is passed over heated zinc dust?

(A) Ethene (B) Benzene

(C) Benzoic acid (D) Cyclohexane

94. Identify the product formed in the reaction. Phenol + conc. $H_2SO_4 \xrightarrow{373\ K}$ product

(A) p - Phenol sulphonic acid (B) o-Phenol sulphonic acid

(C) m - Phenol sulphonic acid (D) Benzene sulphonic acid

95. What is the total number of carbon atoms present in n mole of citric acid?

(A) $2n$ (B) 3n

(C) 6n (D) $4n$

96. Identify product A in the following reaction. $2CH_3 - COOH \overset{\Delta, P_2O_5}{\rightleftharpoons} A + H_2O$

(A) Methyl acetate (B) Acetyl chloride

(C) Acetic anhydride (D) Ethane

97. Which among the following carbohydrate molecules is not further hydrolysed in to smaller units?

(A) Lactose (B) Stachyose

(C) Raffinose (D) Ribose

98. What is the quantity of water required to obtain one mole of glucose from one mole of sucrose by acid hydrolysis?

(A) 9.5 g (B) 18.0 g

(C) 15.0 g (D) 16.0 g

99. Identify branched chain polymer from following

(A) Melamine (B) Bakelite

(C) PVC (D) Low density polythene

100. Which among the following polymers is obtained by treatment on natural polymer?

(A) Terylene (B) Cuprammonium rayon

(C) Nylon 6 (D) Teflon

101. For a suitable chosen real constant a, let a function $f : R - [-a] \to R$ be defined by $f(x) = \frac{a-x}{a+x}$. Further, suppose that for any real number $x \neq -a$ and $f(x) \neq -a, (fof)(x) = x$. Then $f\left(\frac{-1}{2}\right)$ is equal to

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

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

102. If $\tan\theta = \frac{a}{b}$, then $b\cos 2\theta + a\sin 2\theta =$

(A) b (B) a

(C) 0 (D) 1

103. The value of θ, satisfying both the equation $\cos\theta = \frac{1}{\sqrt{2}}$ and $\tan\theta = -1$ in $[0, 2\pi]$, is

(A) $\left(\frac{\pi}{4}\right)$ (B) $\left(\frac{5\pi}{4}\right)$

(C) $\left(\frac{7\pi}{4}\right)$ (D) $\left(\frac{3\pi}{4}\right)$

104. If $(x+iy)^{1/3} = a+ib$ where $x, y, a, b \in R$ and $i = \sqrt{-1}$, then $\frac{x}{a} - \frac{y}{b} =$

(A) $-2\left(a^2+b^2\right)$ (B) $2\left(a^2-b^2\right)$

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

105. The number of different 9 digit number that can be formed, from the digits of the number 445577888 by rearranging its digits, so that the odd digits occupy even positions, are

(A) 120 (B) 60

(C) 180 (D) 36

106. If $A \equiv (x, 4, -1)$, $B \equiv (3, x, -5)$ and $C \equiv (2, -2, 3)$ are the vertices and $G \equiv (2, 1, -1)$ is the centroid of the triangle ABC, then the value of x is

(A) 3 (B) 1

(C) -2 (D) 2

107. The orthocenter of the triangle formed by the lines $x - 2y = 10$ and $6x^2 + xy - y^2 = 0$ is

(A) $(2, -4)$ (B) $(2, 4)$

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

108. The co-ordinates of the foot of the perpendicular from the point $(1, 2)$ on the line $x - 3y + 7 = 0$ are

(A) $\left(\frac{4}{5}, \frac{13}{5}\right)$ (B) $(-13, -2)$

(C) $\left(\frac{-13}{5}, \frac{-2}{5}\right)$ (D) $(2, 3)$

109. The equation of circle passing through the points $(1, -2)$ and $(4, -3)$ and whose centre lies on the line $3x + 2y = 7$ is

(A) $x^2 + y^2 + 6x - 2y - 5 = 0$

(B) $x^2 + y^2 - 6x - 2y + 5 = 0$

(C) $x^2 + y^2 + 6x + 2y - 5 = 0$

(D) $x^2 + y^2 - 6x + 2y + 5 = 0$

110. $\lim_{n\to\infty} n\left(\sqrt{n^2+9} - n\right) =$

(A) $\frac{9}{4}$ (B) 9

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

111. The contrapositive of $(\sim p \wedge q) \to (q \wedge \sim r)$ is

(A) $(p \vee \sim q) \to (\sim q \vee r)$

(B) $(\sim q \vee r) \to (\sim p \vee q)$

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

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

112. The statement $(p \to q) \to [(\sim p \to q) \to q]$ is

(A) equivalent to $\sim p \to q$ (B) a tautology

(C) a fallacy (D) equivalent to $p \to \sim q$

113. The stament pattern $p \to (q \to p)$ is equivalent to

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

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

114. In an experiment with 15 observations the results were available and $\sum X^2 = 2830, \sum X = 170$, one observation that was 20 , was found wrong and was replaced by the correct value 30 , then the corrected variance is

(A) 78.00 (B) 188.66

(C) 83.30 (D) 177.33

115. The value of $\text{cosec}^{-1}(\sqrt{2}) + \cos^{-1}\left(\frac{-1}{2}\right) - \sec^{-1}\left(\frac{2}{\sqrt{3}}\right)$ is equal to

(A) $\frac{3\pi}{4}$ (B) $\frac{\pi}{6}$

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

116. If $\tan^{-1} a + \tan^{-1} b + \tan^{-1} c = \pi$, then which of the following is true?

(A) $abc = 1$ (B) $a + b - c = \frac{ab}{c}$

(C) $a + b + c = abc$ (D) $a + b + c = 1$

117. If $A = \begin{bmatrix} 2 & -3 \\ -4 & 1 \end{bmatrix}$, then adj $\left(3A^2 + 12A\right)$ is equal to

(A) $\begin{bmatrix} 72 & -63 \\ -84 & 51 \end{bmatrix}$ (B) $\begin{bmatrix} 51 & 63 \\ 84 & 72 \end{bmatrix}$

(C) $\begin{bmatrix} 72 & -84 \\ -63 & 51 \end{bmatrix}$ (D) $\begin{bmatrix} 51 & 84 \\ 63 & 72 \end{bmatrix}$

118. If $A = \begin{bmatrix} 1 & a & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 13 & 2 & -7 \\ -3 & b & 2 \\ -2 & 0 & 1 \end{bmatrix}$, then the values of a and b are respectively

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

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

119. The function defined by $f(x) = \begin{cases} \frac{x-4}{|x-4|} + a & \text{if } x < 4 \\ a + b & \text{if } x = 4 \\ \frac{x-4}{|x-4|} + b & \text{if } x > 4 \end{cases}$ is continuous at $x = 4$, are

(A) $a = 0, b = 1$ (B) a = 1, b = 0

(C) a = 1, b = −1 (D) a = −1, b = 0

120. If $y = 3\cos(\log x) + 4\sin(\log x)$, then $x^2 y_2 + x y_1 =$

(A) xy (B) $-xy$

(C) $-y$ (D) y

121. If $y = \tan^{-1}(\sec x - \tan x)$, then $\frac{dy}{dx} =$

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

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

122. For $x > 1$, if $(2x)^{2y} = 4e^{2x-2y}$, then $(1 + \log 2x)^2 \frac{dy}{dx}$ is equal to

(A) $\frac{\log 2x + \log 2}{x}$ (B) $\frac{x \log 2x - \log 2}{x}$

(C) $\frac{x \log 2x + \log 2}{x}$ (D) $\frac{\log 2x - \log 2}{x}$

123. If

$$\sqrt{y - \sqrt{y - \sqrt{y - \ldots \ldots \ldots \infty}}} = \sqrt{x + \sqrt{x + \sqrt{x + \ldots \ldots \ldots \infty}}}$$

then $\frac{dy}{dx} =$

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

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

124. If $f'(x) = \tan^{-1}(\sec x \tan x)$, $\frac{-\pi}{2} < x < \frac{\pi}{2}$ and $f(0) = 0$, then $f(1) =$

(A) $\frac{1}{4}$ (B) $\frac{\pi-1}{4}$

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

125. If the tangent to the curve $y = \frac{x}{x^2-3}, x \in R, (x \neq \pm\sqrt{3})$ at a point $(\alpha, \beta) \neq (0, 0)$ on it, is parallel to the line $2x + 6y - 11 = 0$, then

(A) $|2\alpha + 6\beta| = 11$ (B) $|6\alpha + 2\beta| = 9$

(C) $|6\alpha + 2\beta| = 19$ (D) $|2\alpha + 6\beta| = 19$

126. The function $f(x) = \frac{\log(\pi+x)}{\log(e+x)}$ is

(A) decreasing on $\left(0, \frac{\pi}{e}\right)$, increasing on $\left(\frac{\pi}{e}, \infty\right)$

(B) increasing on $\left(0, \frac{\pi}{e}\right)$, decreasing on $\left(\frac{\pi}{e}, \infty\right)$

(C) increasing on $(0, \infty)$

(D) decreasing on $(0, \infty)$

127. Local maximum and local minimum values respectively of the function $f(x) = (x-1)(x+2)^2$ are

(A) $-4, 0$ (B) $0, -4$

(C) $-4, 4$ (D) $4, -4$

128. $\int \frac{1}{\cos x \sqrt{\cos 2x}} dx =$ (where C is a constant of integration.)

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

(B) $\log\left(\tan x + \sqrt{\tan^2 x + 1}\right) + C$

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

(D) $\log\left(\tan x + \sqrt{\tan^2 x - 1}\right) + C$

129. The integral $\int \frac{3x^{13} + 2x^{11}}{(2x^4 + 3x^2 + 1)^4} dx$ is equal to (where C is a constant of integration.)

(A) $\frac{x^{12}}{(2x^4+3x^2+1)^3} + C$ (B) $\frac{x^4}{(2x^4+3x^2+1)^3} + C$

(C) $\frac{x^4}{6(2x^4+3x^2+1)^3} + C$ (D) $\frac{x^{12}}{6(2x^4+3x^2+1)^3} + C$

130. If $f(x)=\int \frac{5x^8+7x^6}{(x^2+1+2x^7)^2}dx, x\geq 0$ and $f(0)=0$, then value of $f(1)$ is

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

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

131. If $f(x)=\frac{1}{\log x}$, $g(x)=\frac{1}{(\log x)^2}$, then $\int [f(x)-g(x)]\,dx=$ (Where C is a constant of integration.)

(A) $(\log x)^2+C$ (B) $x\log x+C$

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

132. If $\int_0^k \frac{dx}{2+8x^2}=\frac{\pi}{16}$, then value of k is

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

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

133. $\int_{\log\frac{1}{2}}^{\log 2}\sin\left(\frac{e^x-1}{e^x+1}\right)dx=$

(A) $2\log 2$ (B) $-2\log 2$

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

134. If $\int_0^{\frac{\pi}{2}}\frac{\cot x}{\cot x+\operatorname{cosec} x}dx=m(\pi+n)$, then (m.n) equals

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

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

135. The area of the region bounded by the curve $y^2=9x$ and the line $y=3x$ is

(A) $\frac{3}{2}$ sq.units (B) 1 sq.units

(C) $\frac{1}{2}$ sq.units (D) $\frac{1}{4}$ sq.units

136. The particular solution of $\log\left(\frac{dy}{dx}\right)=3x+4y$ at $x=y=0$ is

(A) $3e^{-4y}-4e^{3x}=7$ (B) $3e^{-4y}+4e^{3x}=7$

(C) $4e^{-4y}-3e^{3x}=7$ (D) $4e^{-4y}+3e^{3x}=7$

137. The assets of a person are increasing at a rate proportional to the square root of the assets at a given time. His assets increase from Rupees 9 crores to Rupees 16 crores in 2 years, then his assets at the end of 5 more years will be

(A) 46.25 cores (B) 42.25 crores

(C) 30.25 crores (D) 56.25 crores

138. The solution of the differential equation $(1+e^{-x})(1+y^2)\frac{dy}{dx}=y^2$ which passes through the point $(0,1)$ is

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

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

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

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

139. If $\bar{a},\bar{b},\bar{c}$ are the three unit vectors such that $|\bar{a}+\bar{b}+\bar{c}|=1$ and $\bar{b}$ is perpendicular to $\bar{c}$. If $\bar{a}$ makes angles α,β with $\bar{b}$ and $\bar{c}$ respectively, then $\cos\alpha+\cos\beta$ has the value

(A) -1 (B) -2

(C) 4 (D) 2

140. Let $\bar{a}=\hat{i}+\hat{j}+\hat{k},\bar{b}=\hat{i}-\hat{j}+\hat{k}$ and $\bar{c}=\hat{i}-\hat{j}-\hat{k}$ be three vectors. A vector $\overline{V}$ in the plane of $\bar{a}$ and $\overline{b}$, whose projection on $\bar{c}$ is $\frac{1}{\sqrt{3}}$ is given by

(A) $\hat{i}+3\hat{j}-3\hat{k}$ (B) $3\hat{i}-\hat{j}+3\hat{k}$

(C) $\hat{i}-3\hat{j}+3\hat{k}$ (D) $-3\hat{i}-3\hat{j}-\hat{k}$

141. The line joining points $(3,5,-7)$ and $(-2,1,8)$ meets yz-plane at point

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

(C) $\left(0,\frac{13}{5},-3\right)$ (D) $\left(0,\frac{-13}{5},2\right)$

142. The equation of the plane passing through the point $(2,2,1)$ and the intersection of the planes $x+2y-3z+1=0$ and $3x-2y+4z+3=0$ is

(A) $3x+26y+43z+3=0$

(B) $3x+26y-43z-3=0$

(C) $3x-26y-43z-3=0$

(D) $3x-26y+43z+3=0$

143. The Cartesian equation of the line passing through the point $(-3,0,1)$ and perpendicular to vectors $\hat{i}-2\hat{j}+\hat{k}$ and $2\hat{i}+\hat{j}-\hat{k}$ is

(A) $\frac{x+3}{1}=\frac{y}{3}=\frac{z-1}{-5}$ (B) $\frac{x+3}{-1}=\frac{y}{3}=\frac{z-1}{5}$

(C) $\frac{x+3}{1}=\frac{y}{3}=\frac{z-1}{5}$ (D) $\frac{x+3}{1}=\frac{y}{-3}=\frac{z-1}{5}$

144. A line makes angles $\frac{\alpha}{2}, \frac{\beta}{2}, \frac{\gamma}{2}$ with positive directions of the co-ordinate axes (x, y, z axes respectively), then $\cos\alpha + \cos\beta + \cos\gamma$ has the value

(A) 1 (B) 2

(C) 3 (D) -1

145. A vector $\bar{a}$ has components $2p$ and 1 with respect to a rectangular Cartesian system. This system is rotated though a certain angle about the origin in the counter clockwise sense. If, with respect to the new system, à has components $p+1$ and 1 , then

(A) $p = 0$ (B) p $= -1$ or p $= \frac{1}{3}$

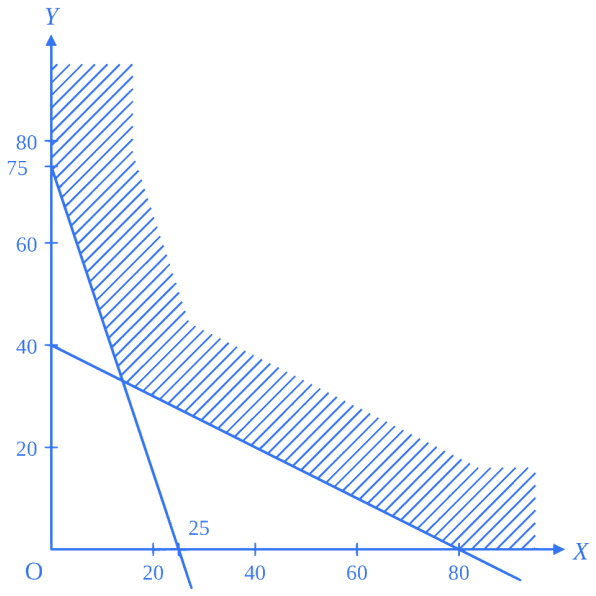
(C) p $= 1$ or p $= -\frac{1}{3}$ (D) p $= 1$ or p $= -1$

146. The co-ordinates of the foot of the perpendicular drawn form the origin to the plane $3x + 2y + 6z = 56$ is

(A) $\left(\frac{48}{7}, \frac{24}{7}, \frac{16}{7}\right)$ (B) $\left(\frac{24}{7}, \frac{48}{7}, \frac{16}{7}\right)$

(C) $\left(\frac{16}{7}, \frac{24}{7}, \frac{48}{7}\right)$ (D) $\left(\frac{24}{7}, \frac{16}{7}, \frac{48}{7}\right)$

147. Cost function Z given by Z $= 4x + 6y$ is to be minimized. The fessible region for this function Z is the shaded region represented in the following figure. Then the minimum value of Z is and occurs at the point



(A) $260, (20, 30)$ (B) $240, (0, 40)$

(C) $100, (25, 0)$ (D) $254, (14, 33)$

148. Let ω be a complex cube root of unity with $\omega \neq 1$. A fair die is thrown three times. If r_1, r_2 and r_3 are the numbers obtained on the die, then the probability that $\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$, is

(A) $\frac{1}{36}$ (B) $\frac{1}{8}$

(C) $\frac{1}{9}$ (D) $\frac{2}{9}$

149. An unbiased die is tossed 500 times. The standard deviation of getting sixes in these 500 tosses is

(A) $\frac{625}{9}$ (B) $\sqrt{\frac{250}{3}}$

(C) $\frac{25}{3}$ (D) $\frac{250}{3}$

150. A coin is tossed twice in succession. Let X represent the number of tails in two tosses, then the probability distribution of X is given by

(A)

$X = x_i$	0	1	2
P_i	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$

(B)

$X = x_i$	0	1	2
P_i	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$

(C)

$X = x_i$	0	1	2
P_i	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$

(D)

$X = x_i$	0	1	2
P_i	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

- End of Question Paper -