MHT CET 2023 PCM May 9 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

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

General Instructions

(i) This **PCM** paper is from **MHT CET 2023**, 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. Light of wavelength 'λ' is incident on a slit of width 'd'. The resulting diffraction pattern is observed on a screen at a distance 'D'. The linear width of the principal maximum is then equal to the width of the slit if D equals

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

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

2. Two S.H.Ms. are represented by equations

$$y_1 = 0.1\sin\left(100\pi t + \frac{\pi}{3}\right)$$

and

$$y_2 = 0.1\cos(100\pi t)$$

The phase difference between the speeds of the two particles is

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

(C) $+\frac{\pi}{6}$ (D) $-\frac{\pi}{3}$

3. A film of soap solution is formed between two straight parallel wires of length 10 cm each separated by 0.5 cm. If their separation is increased by 1 mm while still maintaining their parallelism. How much work will have to be done?
(surface tension of solution

$$= 65 \times 10^{-2}\ \text{N/m}$$

)

(A) 7.22×10^{-6} J (B) 13.0×10^{-5} J

(C) 2.88×10^{-5} J (D) 5.76×10^{-5} J

4. An ideal gas in a container of volume 500 c.c. is at a pressure of $2 \times 10^{+5}$ N/m^2. The average kinetic energy of each molecule is 6×10^{-21} J. The number of gas molecules in the container is

(A) 5×10^{25} (B) 5×10^{23}

(C) 25×10^{23} (D) 2.5×10^{22}

5. A gas at N.T.P. is suddenly compressed to one-fourth of its original volume. If

$$\gamma = 1.5$$

, then the final pressure is

(A) 4 times (B) 1.5 times

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

6. A particle of mass 'm' moves along a circle of radius 'r' with constant tangential acceleration. If K.E. of the particle is 'E' by the end of third revolution after beginning of the motion, then magnitude of tangential acceleration is

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

(C) $\frac{E}{8\pi rm}$ (D) $\frac{E}{4\pi rm}$

7. An e.m.f.

$$E = 4\cos(1000t)$$

volt is applied to an LR circuit of inductance 3 mH and resistance 4 Ω. The maximum current in the circuit is

(A) $\frac{4}{\sqrt{7}}$ A (B) 1.0 A

(C) $\frac{4}{7}$ A (D) 0.8 A

8. In the reverse biasing of a p-n junction diode :

(A) the width of the depletion layer decreases.

(B) the width of the depletion layer increases.

(C) the number of minority charge carriers increase.

(D) the number of majority charge carriers increase.

9. When a charge of 3 C is placed in uniform electric field, it experiences a force of 3000 N. Within this field, potential difference between two points separated by a distance of 1 cm is

(A) 10 V (B) 90 V

(C) 1000 V (D) 3000 V

10. A soap bubble of radius 'R' is blown. After heating a solution, a second bubble of radius '2R' is blown. The work required to blow the 2nd bubble in comparison to that required for the 1st bubble is

(A) exactly double.

(B) slightly more than 4 times.

(C) slightly less than 4 times.

(D) slightly less than double.

11. In a transistor, in common emitter configuration, the ratio of power gain to voltage gain is

(A) α (B) $\frac{\beta}{\alpha}$

(C) $\beta\alpha$ (D) β

12. A galvanometer of resistance 20 Ω gives a deflection of 5 divisions when 1 mA current flows through it. The galvanometer scale has 50 divisions. To convert the galvanometer into a voltmeter of range 25 volt, we should connect a resistance of

(A) 1240 Ω in series. (B) 2480 Ω in series.
(C) 2480 Ω in parallel. (D) 20 Ω in parallel.

13. The equation of simple harmonic progressive wave is given by

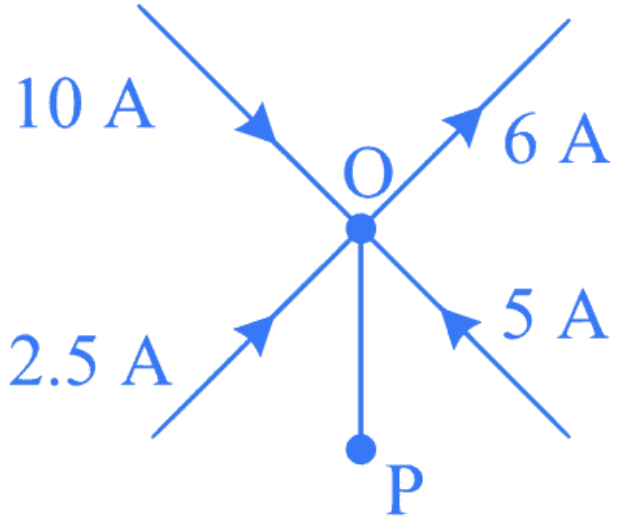
$$y = a\sin 2\pi(bt - cx)$$

. The maximum particle velocity will be half the wave velocity, if

c =

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

14. Five current carrying conductors meet at a point 'O' as shown in figure. The magnitude and direction of the current in conductor 'OP' is



(A) 6.5 A from O to P. (B) 9 A from P to O.
(C) 10.5 A from P to O. (D) 11.5 A from O to P.

15. An alternating voltage of frequency 'ω' is induced in electric circuit consisting of an inductance 'L' and capacitance 'C', connected in parallel. Then across the inductance coil

(A) current is maximum when $\omega^2 = \frac{1}{LC}$ (B) current is zero
(C) voltage is minimum when $\omega^2 = \frac{1}{LC}$ (D) voltage is maximum when $\omega^2 = \frac{1}{LC}$

16. A gas is compressed at a constant pressure of 50 N/m^2 from a volume of 10 m^3 to a volume of 4 m^3. Energy of 100 J is then added to the gas by heating. Its internal energy is

(A) increased by 400 J (B) increased by 200 J
(C) increased by 100 J (D) decreased by 200 J

17. The reactance of capacitor at 50 Hz is 5Ω. If the frequency is increased to 100 Hz, the new reactance is

(A) 5Ω (B) 10Ω
(C) 2.5Ω (D) 125Ω

18. Stationary waves can be produced in

(A) only solid and gaseous media (B) only liquid and gaseous media
(C) only solid and liquid media (D) solid, liquid and gaseous media

19. The pressure exerted by an ideal gas at a particular temperature is directly proportional to

(A) the mean speed of the gas molecules. (B) mean of the square of the speed of the gas molecules.
(C) the square of the mean speed of the gas molecules. (D) the root mean square speed of the gas molecules.

20. If a ray of light in denser medium strikes a rarer medium at angle of incidence i, the angles of reflection and refraction are r and r' respectively. If the reflected and refracted rays are at right angles to each other, the critical angle for the given pair of media is

(A) $\sin^{-1}(\tan r')$ (B) $\sin^{-1}(\tan r)$
(C) $\tan^{-1}(\sin i)$ (D) $\cot^{-1}(\tan i)$

21. A spring has a certain mass suspended from it and its period for vertical oscillations is 'T_1'. The spring is now cut in to two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillations is now 'T_2'. The ratio T_1/T_2 is

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

22. When photons of energies twice and thrice the work function of a metal are incident on the metal surface one after other, the maximum velocities of the photoelectrons emitted in the two cases are v_1 and v_2 respectively. The ratio $v_1 : v_2$ is

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

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

23. A simple pendulum of length 2 m is given a horizontal push through angular displacement of 60°. If the mass of bob is 200 gram, the angular velocity of the bob will be (Take Acceleration due to gravity $= 10\ m/s^2$) $(\sin 30^\circ = \cos 60^\circ = 0.5, \cos 30^\circ = \sin 60^\circ = \sqrt{3}/2)$

(A) $2\sqrt{2}$ rad/s (B) $3\sqrt{2}$ rad/s

(C) $2\sqrt{2.5}$ rad/s (D) $3\sqrt{2.5}$ rad/s

24. The force acting on the electron in hydrogen atom (Bohr' theory) is related to the principle quantum number 'n' as

(A) n^4 (B) n^{-4}

(C) n^2 (D) n^{-2}

25. If the frequency of the input voltage is 50 Hz, applied to a (a) half wave rectifier and (b) full wave rectifier. The output frequency in both cases is respectively

(A) 50 Hz, 50 Hz (B) 50 Hz, 100 Hz

(C) 100 Hz, 100 Hz (D) 100 Hz, 50 Hz

26. Periodic time of a satellite revolving above the earth's surface at a height equal to radius of the earth 'R' is [$g =$ acceleration due to gravity]

(A) $2\pi\sqrt{\frac{2R}{g}}$ (B) $4\pi\sqrt{\frac{2R}{g}}$

(C) $2\pi\sqrt{\frac{R}{g}}$ (D) $8\pi\sqrt{\frac{R}{g}}$

27. The wavelength of light for the least energetic photons emitted in the Lyman series of the hydrogen spectrum is nearly [Take $hc = 1240$ eV - nm, change in energy of the levels $= 10.2$ eV]

(A) 150 nm (B) 122 nm

(C) 102 nm (D) 82 nm

28. In Young's double slit experiment, the wavelength of light used is 'λ'. The intensity at a point is 'I' where path difference is $\left(\frac{\lambda}{4}\right)$. If I_0 denotes the maximum intensity, then the ratio $\left(\frac{I}{I_0}\right)$ is $\left(\sin\frac{\pi}{4} = \cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}\right)$

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

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

29. The side of a copper cube is 1 m at 0°C. What will be the change in its volume, when it is heated to 100°C ? $\left[\alpha_{copper} = 18 \times 10^{-6}/^\circ C\right]$

(A) $45 \times 10^{-4}\ m^3$ (B) $54 \times 10^{-4}\ m^3$

(C) $34 \times 10^{-4}\ m^3$ (D) $64 \times 10^{-4}\ m^3$

30. If current 'I' is flowing in the closed circuit with collective resistance 'R', the rate of production of heat energy in the loop as we pull it along with a constant speed 'V' is (L = length of conductor, B = magnetic field)

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

(C) $\frac{BLV}{R^2}$ (D) $\frac{B^2L^2V^2}{R}$

31. Two coils A and B have mutual inductance 0.008 H. The current changes in the coil A, according to the equation $I = I_m \sin \omega t$, where $I_m = 5$ A and $\omega = 200\pi$ rad s^{-1}. The maximum value of the e.m.f. induced in the coil B in volt is

(A) 4π (B) 8π

(C) 10π (D) 16π

32. A thin rod of length L has magnetic moment M when magnetised. If rod is bent in a semicircular arc what is magnetic moment in new shape?

(A) $\frac{M}{L}$ (B) $\frac{M}{\pi}$

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

33. A fluid of density 'ρ' and viscosity 'η' is flowing through a pipe of diameter 'd', with a velocity 'v'. Reynold number is

(A) $\frac{2\,d\rho v}{\eta}$ (B) $\frac{d\rho v}{\eta}$

(C) $\frac{d\rho v}{\eta^2}$ (D) $\frac{2\eta dv}{\rho}$

34. In Young's double slit experiment, the fringe width is 2 mm. The separation between the 13^{th} bright fringe and the 4^{th} dark fringe from the centre of the screen on same side will be

(A) 13 mm. (B) 17 mm.

(C) 19 mm. (D) 23 mm.

35. 10 A current is flowing in two straight parallel wires in the same direction. Force of attraction between them is 1×10^{-3} N. If the current is doubled in both the wires the force will be

(A) 1×10^{-3} N (B) 2×10^{-3} N

(C) 4×10^{-3} N (D) 0.25×10^{-3} N

36. Consider a planet whose density is same as that of the earth but whose radius is three times the radius 'R' of the earth. The acceleration due to gravity 'g_n' on the surface of planet is

$$g_n = x$$

. g where g is acceleration due to gravity on surface of earth. The value of 'x' is

(A) 9 (B) 3

(C) $\frac{1}{3}$ (D) $\frac{1}{9}$

37. When a certain metal surface is illuminated with light of frequency v, the stopping potential for photoelectric current is V_0. When the same surface is illuminated by light of frequency

$$\frac{v}{2}$$

, the stopping potential is

$$\frac{V_0}{4}$$

, the threshold frequency of photoelectric emission is

(A) $\frac{v}{6}$ (B) $\frac{v}{3}$

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

38. If the length of an open organ pipe is 33.3 cm , then the frequency of fifth overtone is [Neglect end correction, velocity of sound

$$= 333 \text{ m/s}$$

]

(A) 3500 Hz (B) 3000 Hz

(C) 2500 Hz (D) 2000 Hz

39. A transparent glass cube of length 24 cm has a small air bubble trapped inside. When seen normally through one surface from air outside, its apparent distance is 10 cm from the surface. When seen normally from opposite surface, its apparent distance is 6 cm. The distance of the air bubble from first surface is

(A) 15 cm (B) 14 cm

(C) 12 cm (D) 8 cm

40. The temperature of an ideal gas is increased from 27°C to 927°C. The r.m.s. speed of its molecules becomes

(A) twice (B) four times.

(C) half. (D) one-fourth.

41. A disc of radius R and thickness

$$\frac{R}{6}$$

has moment of inertia I about an axis passing through its centre and perpendicular to its plane. Dise is melted and recast into a solid sphere. The moment of inertia of a sphere about its diameter is

(A) $\frac{I}{5}$ (B) $\frac{I}{6}$

(C) $\frac{I}{32}$ (D) $\frac{I}{64}$

42. A charge 'q' moves with velocity 'v' through electric (E) as well as magnetic field (B). Then the force acting on it is

(A) $q(\vec{v} \times \vec{B})$ (B) $q(\vec{B} \times \vec{v})$

(C) $q(\vec{E} \times \vec{v})$ (D) $\vec{qE} + q(\vec{v} \times \vec{B})$

43. A parallel combination of two capacitors of capacities '2 C' and 'C' is connected across 5 V battery. When they are fully charged, the charges and energies stored in them be 'Q_1', 'Q_2' and 'E_1', 'E_2' respectively. Then

$$\frac{E_1 - E_2}{Q_1 - Q_2}$$

in J/C is (capacity is in Farad, charge in Coulomb and energy in J)

(A) $\frac{5}{4}$ (B) $\frac{4}{5}$

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

44. Consider the following statements A and B. Identify the correct choice in the given answers.
A. In an inelastic collision, there is no loss in kinetic energy during collision.
B. During a collision, the linear momentum of the entire system of particles is conserved if there is no external force acting on the system.

(A) Both A and B are wrong.
(B) Both A and B are correct.
(C) A is wrong and B is correct.
(D) A is correct and B is wrong.

45. The charges $2q, -q, -q$ are located at the vertices of an equilateral triangle. At the circumcentre of the triangle

(A) the field is zero but potential is not zero.
(B) the field is non-zero but the potential is zero.
(C) both, field and potential are zero.
(D) both. field and potential are non-zero.

46. The magnetic field at a point P situated at perpendicular distance 'R' from a long straight wire carrying a current of 12 A is 3×10^{-5} Wb/m^2. The value of 'R' in mm is

$$\left[\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}\right]$$

(A) 0.08
(B) 0.8
(C) 8
(D) 80

47. A particle at rest starts moving with constant angular acceleration 4 rad/s^2 in circular path. At what time the magnitudes of its tangential acceleration and centrifugal acceleration will be equal?

(A) 0.4 s
(B) 0.5 s
(C) 0.8 s
(D) 1.0 s

48. If the end correction of an open pipe is 0.8 cm, then the inner radius of that pipe is

(A) $\frac{1}{3}$ cm
(B) $\frac{2}{3}$ cm
(C) $\frac{3}{2}$ cm
(D) 0.2 cm

49. The mutual inductance (M) of the two coils is 3 H. The self inductances of the coils are 4 H and 9 H respectively. The coefficient of coupling between the coils is

(A) 0.3
(B) 0.4
(C) 0.5
(D) 0.6

50. A particle is vibrating in S.H.M. with an amplitude of 4 cm. At what displacement from the equilibrium position is its energy half potential and half kinetic?

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

51. Identify monodentate ligand from the following.

(A) Cyanide ion

(B) Ethylenediamine

(C) Oxalate ion

(D) Ethylendiaminetetraacetate

52. Identify linear polymer from the following.

(A) High density polythene

(B) Low density polythene

(C) Bakelite

(D) Melamine

53. What is the conductivity of 0.05 M $BaCl_2$ solution if its molar conductivity is 220 $\Omega^{-1}\ cm^2\ mol^{-1}$?

(A) 0.011 $\Omega^{-1}\ cm^{-1}$

(B) 0.022 $\Omega^{-1}\ cm^{-1}$

(C) 0.033 $\Omega^{-1}\ cm^{-1}$

(D) 0.044 $\Omega^{-1}\ cm^{-1}$

54. Which from following polymers is grouped in the category of elastomers?

(A) Nylon 6,6

(B) Buna-S

(C) Terylene

(D) Polythene

55. Which element from following exhibits diagonal relationship with beryllium?

(A) B

(B) Na

(C) Mg

(D) Al

56. What is the stock notation of Manganese dioxide?

(A) $Mn(I)O_2$

(B) $Mn(II)O_2$

(C) $Mn(III)O_2$

(D) $Mn(IV)O_2$

57. A reaction,

$$Ni_{(s)} + Cu^{+}_{((M))} \rightarrow Ni^{+}_{(IM)} + Cu_{(s)}$$

occurs in a cell. Calculate E°_{cell} if

$$E^{\circ}_{Cu} = 0.337\ V$$

and

$$E^{\circ}_{Ni} = -0.257\ V$$

(A) 0.594 V

(B) −0.594 V

(C) −0.08 V

(D) 0.08 V

58. What volume of ammonia is formed when 10 dm^3 dinitrogen reacts with 30 dm^3 dihydrogen at same temperature and pressure?

(A) 30 dm^3

(B) 20 dm^3

(C) 15 dm^3

(D) 10 dm^3

59. What is the number of moles of sp^2 hybrid carbon atoms present in n moles of isopentane?

(A) zero

(B) one

(C) two

(D) three

60. Find solubility of PbI_2 if its solubility product is 7.0×10^{-9}.

(A) 1.21×10^{-3} mol L^{-1}

(B) 3.228×10^{-3} mol L^{-1}

(C) 2.831×10^{-3} mol L^{-1}

(D) 1.811×10^{-3} mol L^{-1}

61. Identify the product formed when vapours of 2-methylpropan-2-ol are passed over hot copper.

(A) Propanone

(B) 2-Methylpropene

(C) 2-Methylpropanoic acid

(D) Propanal

62. Calculate the rate constant of first order reaction if the concentration of the reactant decreases by 90% in 30 minutes.

(A) 7.7×10^{-2} minute^{-1}

(B) 4.2×10^{-2} minute^{-1}

(C) 2.1×10^{-2} minute^{-1}

(D) 3.5×10^{-2} minute^{-1}

63. What different elements are found in baryte?

(A) Ca, S, O

(B) Zn, S, O

(C) Ba, S, O

(D) Mg, S, H, O

64. Identify the product '*B*' in the following reaction.

Cumene $\xrightarrow[\Delta]{KMnO_4\,.\,KOH}$ A $\xrightarrow{H_3O^+}$ B

(A) Phenol

(B) Potassium benzoate

(C) Benzoic acid

(D) Aniline

65. Which of the following on reaction with ammoniacal silver nitrate forms silver precipitate?

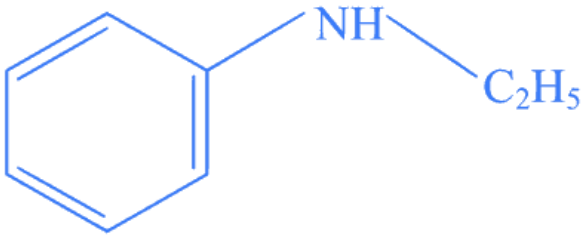
(A) Ethanol

(B) Ethanal

(C) Ethoxyethane

(D) Ethanoic acid

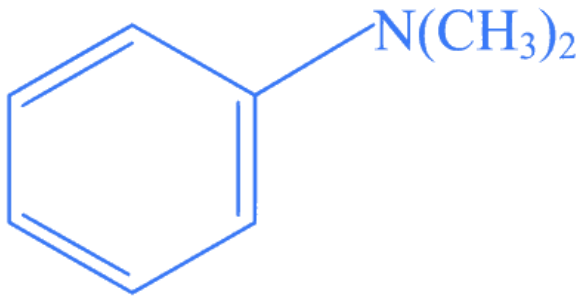
66. Identify an aromatic, mixed, 3° amine from following.



(A)

(B) $(C_2H_5)_3N$

(C) $(CH_3)_3C - NH_2$



(D)

67. For $NaCl_{(s)}$ enthalpy of solution is 4 kJ mol^{-1} and lattice enthalpy is 790 kJ mol^{-1}. What is hydration enthalpy of NaCl ?

(A) 786 kJ (B) 794 kJ

(C) −786 kJ (D) −794 kJ

68. Which from following statements regarding transition elements is NOT CORRECT?

(A) These exhibit properties between '*s*' and '*p*' block elements.

(B) These form cations with incomplete d-subshell.

(C) 5d series consists of all elements from lanthanum to mercury of periodic table.

(D) These are arranged in four different '*d*' series.

69. A solution of 8 g of certain organic compound in 2 dm^3 water develops osmotic pressure 0.6 atm at 300 K. Calculate the molar mass of compound. [R = 0.082 atm dm^3 K^{-1} mol^{-1}]

(A) 148 g mol^{-1} (B) 164 g mol^{-1}

(C) 172 g mol^{-1} (D) 180 g mol^{-1}

70. What is the value of $\Delta H - \Delta U$ for the following reaction?

$$2C_{(s)} + 3H_{2(g)} \rightarrow C_2H_{6(g)}$$

(A) 4RT (B) −5RT

(C) RT (D) −2RT

71. Which from the following compound solutions in water of equal concentration has electrical conductivity nearly same as distilled water?

(A) Urea (B) Sodium chloride

(C) Sodium hydroxide (D) Acetic acid

72. What is the pH of a solution containing 2.2×10^{-6}M hydrogen ions?

(A) 6.34 (B) 5.66

(C) 4.34 (D) 3.80

73. Which of the following statements is NOT true about Rutherford atomic model?

(A) Each atom consists of massive, +vely charged centre.

(B) The electrons are revolving continuously around the nucleus.

(C) This model does not describe the distribution of electrons around the nucleus.

(D) This model describes the energies of electrons.

74. What is IUPAC name of propylene glycerol?

(A) Propane-1,2-diol (B) Propane-1,3-diol

(C) Propane-1,2,3-triol (D) Propene-1,2,3-triol

75. Identify the CORRECT decreasing order of melting point of cluster of sodium atoms depending on size.

(A) Cluster of 10^3 atoms > cluster of 10^4 atoms > Bulk sodium

(B) Bulk sodium > cluster of 10^4 atoms > Cluster of 10^3 atoms

(C) Cluster of 10^4 atoms > Cluster of 10^3 atoms > Bulk sodium

(D) Bulk sodium > cluster of 10^3 atoms > Cluster of 10^4 atoms

76. Which from the following coordinate complexes contains anionic and neutral ligands in it?

(A) Potassium trioxalatoaluminate(III)

(B) Hexacyanoferrate (II)

(C) Pentaamminecarbonatocobalt (III) chloride

(D) Tetraamminecopper(II) ion

77. Which among the following is allylic halide?

(A) $CH_3 - CH_2 - CH_2 - X$

(B) $C_6H_5 - CH_2 - X$

(C) $CH_2 = CH - CH_2X$

(D) $CH_3 - CH = CH - X$

78. Which of the following compounds has the highest boiling point?

(A) Chloromethane (B) Fluoromethane

(C) Iodomethane (D) Bromomethane

79. A solution of nonvolatile solute is obtained by dissolving 1 g in 100 g solvent, decreases its freezing point by 0.3 K. Calculate cryoscopic constant of solvent if molar mass of solute is 60 g mol^{-1}.

(A) 1.0 K kg mol^{-1} (B) 1.4 K kg mol^{-1}

(C) 2.4 K kg mol^{-1} (D) 1.8 K kg mol^{-1}

80. What is the IUPAC name of allylamine?

(A) Propan-1-amine (B) Prop-2-en-1-amine

(C) Prop-1-en-2-amine (D) Propan-2-amine

81. What is the wave number of photon emitted during transition from orbit,

$n = 4$

to

$n = 2$

in hydrogen atom

$[R_H = 109677\ cm^{-1}]$

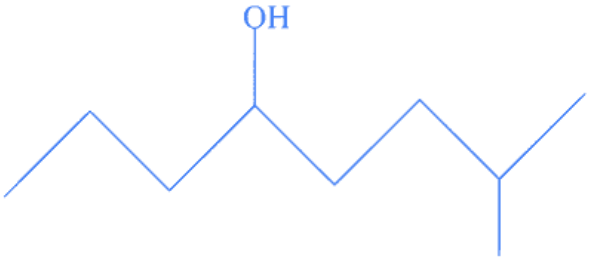
(A) 20564.44 cm^{-1} (B) 23032.17 cm^{-1}

(C) 15354.78 cm^{-1} (D) 25225.7 cm^{-1}

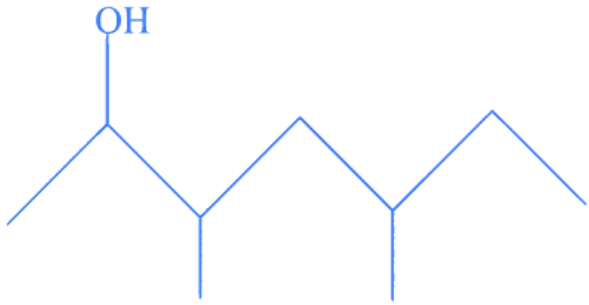
82. Which from following is a CORRECT bond line formula of

$HO(CH_2)_3CH(CH_3)CH(CH_3)_2$

(A)



(B)



(C)



(D)



83. Identify the carbon atoms of α-glucose and β-fructose forming glycosidic linkage in sucrose.

(A) C - 1 of β-fructose and C - 2 of α-glucose (B) C-1 of α-glucose and C – 2 of β-fructose

(C) C – 1 of α-glucose and C – 1 of β-fructose (D) C – 2 of α-glucose and C-2 of β-fructose

84. Calculate the molar mass of an element having density 21 g cm^{-3} that forms fcc unit cell

$[a^3 \cdot N_A = 36\ cm^3\ mol^{-1}]$

(A) 292.00 g mol^{-1} (B) 189.00 g mol^{-1}

(C) 140.00 g mol^{-1} (D) 108.00 g mol^{-1}

85. Which of the following is the SI unit of coefficient of viscosity?

(A) N s^{-1} m^{-2} (B) N s m^{-2}

(C) N s m^2 (D) N s^{-1} m^{-1}

86. Which from following metal has ccp crystal structure?

(A) Cu (B) Zn

(C) Mg (D) Po

87. Identify the reagent 'A' used in the following conversion.

Ethyl bromide $\xrightarrow{A}$ Ethylpropanoate

(A) Sodium propoxide (B) Ethoxy propane

(C) Silver propanoate (D) Silver ethanoate

88. What is the concentration of $[H_3O^+]$ ion in mol L^{-1} of 0.001 M acetic acid ($\alpha = 0.134$)

?

(A) 1.34×10^{-4} (B) 1.54×10^{-4}

(C) 1.80×10^{-4} (D) 1.70×10^{-4}

89. Which group elements from following are called as chalcogens?

(A) group 13 (B) group 15

(C) group 16 (D) group 17

90. What is the number of electrons around sulfur in H_2SO_4 molecule?

(A) 4 (B) 6

(C) 10 (D) 12

91. An ideal gas expands by 1.5 L against a constant external pressure of 2 atm at 298 K. Calculate the work done?

(A) -75 J (B) -303.9 J

(C) 13.3 J (D) -30 J

92. The rate law for the reaction A + B $\rightarrow$ product is given by rate $= k[A][B]$

Calculate $[A]$ if rate of reaction and rate constant are 0.25 moldm^{-3} s^{-1} and 6.25 mol^{-1}dm^3 s^{-1} respectively

$\left[[B] = 0.25 \text{ moldm}^{-3}\right]$

(A) 0.22 mol dm^3 (B) 0.16 mol dm^3

(C) 0.30 mol dm^3 (D) 0.25 mol dm^3

93. Which among the following has the lowest boiling point?

(A) Butyric acid (B) Valeric acid

(C) Acetic acid (D) Formic acid

94. Find the average rate of formation $O_{2(g)}$ in the following reaction.

$$2NO_{2(g)} \rightarrow 2NO_{(g)} + O_{2(g)}$$

$$\left[-\frac{\Delta[NO]}{\Delta t}\right] = x \text{ moldm}^{-3} \text{ s}^{-1}$$

(A) $\frac{x}{2}$ mol dm^{-3} s^{-1} (B) x mol dm^{-3} s^{-1}

(C) $2x$ mol dm^{-3} s^{-1} (D) $4x$ mol dm^{-3} s^{-1}

95. Which among the following reactions occurs by breaking of C $-$ O bond in alcohol?

(A) Reaction with propionic acid. (B) Reaction with acetic anhydride

(C) Reaction with phosphorus trichloride (D) Reaction with acetyl chloride

96. Which among the following gases exhibits very low solubility in water at room temperature?

(A) O_2 (B) CO_2

(C) NH_3 (D) HCl

97. Identify the trisaccharide from following.

(A) Maltose (B) Lactose

(C) Raffinose (D) Stachyose

98. Identify the element from following having six unpaired electrons in observed electronic configuration?

(A) Cu (B) Zn

(C) Cr (D) Ti

99. Find the radius of metal atom in simple cubic unit cell having edge length 334.7 pm?

(A) 167.35 pm (B) 334.70 pm

(C) 144.93 pm (D) 118.32 pm

100. Which of the following colloids is NOT a gel?

(A) Cheese (B) Milk

(C) Butter (D) Jellies

101. If the slope of one of the lines represented by
$$ax^2 + (2a+1)xy + 2y^2 = 0$$
is reciprocal of the slope of the other, then the sum of squares of slopes is

(A) $\frac{17}{4}$ (B) $\frac{82}{9}$
(C) $\frac{97}{36}$ (D) 2

102. In $\triangle PQR, \sin P, \sin Q$ and $\sin R$ are in A.P., then

(A) its altitudes are in A.P. (B) its altitudes are in H.P.
(C) its medians are in G.P. (D) its medians are in A.P.

103. The value of
$$\tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right), |x| < \frac{1}{2}, x \neq 0$$

(A) $\frac{\pi}{4} + \frac{1}{2}\cos^{-1}x^2$ (B) $\frac{\pi}{4} + \cos^{-1}x^2$
(C) $\frac{\pi}{4} - \frac{1}{2}\cos^{-1}x^2$ (D) $\frac{\pi}{4} - \cos^{-1}x^2$

104. If slope of a tangent to the curve
$$xy + ax + by = 0$$
at the point $(1,1)$ on it is 2, then a - b is

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

105. The equation of a line, whose perpendicular distance from the origin is 7 units and the angle, which the perpendicular to the line from the origin makes, is 120° with positive X-axis, is

(A) $x + \sqrt{3}y - 14 = 0$ (B) $x + \sqrt{3}y + 14 = 0$
(C) $x - \sqrt{3}y + 14 = 0$ (D) $x - \sqrt{3}y - 14 = 0$

106. Let a, b, c be the lengths of sides of triangle ABC such that
$$\frac{a+b}{7} = \frac{b+c}{8} = \frac{c+a}{9} = k$$
. Then
$$\frac{(\mathrm{A}(\triangle \mathrm{ABC}))^2}{\mathrm{k}^4} =$$

(A) 36 (B) 32
(C) 38 (D) 40

107. If the mean and S.D. of the data $3, 5, 7, a, b$ are 5 and 2 respectively, then a and b are the roots of the equation

(A) $x^2 - 10x + 18 = 0$ (B) $2x^2 - 20x + 19 = 0$
(C) $x^2 - 10x + 19 = 0$ (D) $x^2 - 20x + 18 = 0$

108. A man takes a step forward with probability 0.4 and backwards with probability 0.6 . The probability that at the end of eleven steps, he is one step away from the starting point is

(A) ${}^{11}C_6(0.24)^6$ (B) ${}^{11}C_6(0.24)^5$
(C) ${}^{11}C_6(0.4)^6(0.6)^5$ (D) ${}^{11}C_6(0.4)^5(0.6)^6$

109. If
$$f'(x) = x - \frac{5}{x^5}$$
and
$$f(1) = 4$$
, then $f(x)$ is

(A) $\frac{x^2}{2} + \frac{9}{4}\frac{1}{x^4} + \frac{5}{4}$ (B) $\frac{x^2}{2} - \frac{5}{4}\frac{1}{x^4} + \frac{9}{4}$
(C) $\frac{x^2}{2} + \frac{5}{4}\frac{1}{x^4} + \frac{9}{4}$ (D) $\frac{x^2}{2} - \frac{9}{4}\frac{1}{x^4} + \frac{5}{4}$

110. A linguistic club of a certain Institute consists of 6 girls and 4 boys. A team of 4 members to be selected from this group including the selection of a Captain (from among these 4 members) for the team. If the team has to include atmost one boy, the number of ways of selecting the team is

(A) 95 (B) 260
(C) 320 (D) 380

111. Negation of the statement
"The payment will be made if and only if the work is finished in time." Is

(A) The work is finished in time and the payment is not made. (B) The payment is made and the work is not finished in time.
(C) The work is finished in time and the payment is not made, or the payment is made and the work is finished in time. (D) Either the work is finished in time and the payment is not made, or the payment is made and the work is not finished in time.

112. The equation

$$x^3 + x - 1 = 0$$

has

(A) no real root.

(B) exactly two real roots.

(C) exactly one real root.

(D) all three real roots.

---

113. If a line L is the line of intersection of the planes

$$2x + 3y + z = 1$$

and

$$x + 3y + 2z = 2$$

. If line L makes an angle α with the positive X-axis, then the value of $\sec\alpha$ is

(A) $\sqrt{3}$

(B) 2

(C) 1

(D) $\sqrt{2}$

---

114. The range of values of x for which

$$f(x) = x^3 + 6x^2 - 36x + 7$$

is increasing in

(A) $(-\infty, -6) \cup (2, \infty)$

(B) $(-6, 2)$

(C) $(-\infty, -2) \cup (6, \infty)$

(D) $(-6, 2]$

---

115. The maximum value of the function

$$f(x) = 3x^3 - 18x^2 + 27x - 40$$

on the set

$$S = \{x \in \mathbb{R} / x^2 + 30 \leq 11x\}$$

is

(A) 122

(B) 132

(C) 112

(D) 222

---

116. Let p, q, r be three statements, then $[p \to (q \to r)] \leftrightarrow [(p \wedge q) \to r]$ is

(A) equivalent to $p \leftrightarrow q$.

(B) contingency.

(C) tautology.

(D) contradiction.

117.

$$\int_1^2 \frac{dx}{(x^2 - 2x + 4)^{\frac{3}{2}}} = \frac{k}{k+5}$$, then k has the value

(A) 1

(B) 2

(C) -1

(D) -2

---

118. The sides of a rectangle are given by the equations

$$x = -2, x = 4, y = -2$$

and

$$y = 5$$

Then the equation of the circle, whose centre is the point of intersection of the diagonals, lying within the rectangle and touching only two opposite sides, is

(A) $x^2 + y^2 + 2x + 3y + 9 = 0$

(B) $x^2 + y^2 - 2x + 3y + 9 = 0$

(C) $x^2 + y^2 + 2x - 3y - 9 = 0$

(D) $x^2 + y^2 - 2x - 3y - 9 = 0$

119.

$$\mathrm{a} = \hat{\mathrm{i}} + \hat{\mathrm{j}} + \hat{\mathrm{k}}, \mathrm{b} = \hat{\mathrm{j}} - \hat{\mathrm{k}}$$

, then vector $\bar{\mathrm{r}}$ satisfying

$$\mathrm{a} \times \mathrm{r} = \mathrm{b}$$

and

$$\mathrm{a} \cdot \mathrm{r} = 3$$

is

(A) $\frac{5}{3}\hat{\mathrm{i}} + \frac{2}{3}\hat{\mathrm{j}} + \frac{2}{3}\hat{\mathrm{k}}$

(B) $-\frac{5}{3}\hat{\mathrm{i}} + \frac{2}{3}\hat{\mathrm{j}} + \frac{2}{3}\hat{\mathrm{k}}$

(C) $\frac{5}{3}\hat{\mathrm{i}} - \frac{2}{3}\hat{\mathrm{j}} + \frac{2}{3}\hat{\mathrm{k}}$

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

---

120. The magnitude of the projection of the vector $2\hat{i} + \hat{j} + \hat{k}$ on the vector perpendicular to the plane containing the vectors $\hat{i} + \hat{j} + \hat{k}$ and $\hat{\mathrm{i}} + 2\hat{\mathrm{j}} + 3\hat{\mathrm{k}}$ is

(A) $\frac{2}{\sqrt{6}}$

(B) $\frac{1}{\sqrt{6}}$

(C) $\frac{5}{\sqrt{6}}$

(D) $\frac{7}{\sqrt{6}}$

---

121. The shortest distance between the lines

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$$

and

$$\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$$

is

(A) $\frac{1}{\sqrt{14}}$ units.

(B) $\frac{1}{\sqrt{5}}$ units.

(C) $\frac{1}{\sqrt{11}}$ units.

(D) $\frac{1}{\sqrt{6}}$ units.

---

122. If $\bar{a}, \bar{b}$ and $\bar{c}$ are any three non-zero vectors, then

$$(\bar{a} + 2\bar{b} + \bar{c}) \cdot [(\bar{a} - \bar{b}) \times (\bar{a} - \bar{b} - \bar{c})] =$$

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

(B) $2[\ \bar{\mathrm{a}}\ \ \bar{\mathrm{b}}\ \ \bar{\mathrm{c}}\ ]$

(C) $3[\ \bar{a}\ \ \bar{b}\ \ \bar{c}\ ]$

(D) $4[\ \bar{\mathrm{a}}\ \ \bar{\mathrm{b}}\ \ \bar{\mathrm{c}}\ ]$

---

123. In $\triangle ABC$, with usual notations,

$$m\angle C = \frac{\pi}{2}$$

, if

$$\tan\left(\frac{A}{2}\right)$$

and

$$\tan\left(\frac{B}{2}\right)$$

are the roots of the equation

$$a_1x^2 + b_1x + c_1 = 0\left(a_1 \neq 0\right)$$

, then

(A) $a_1 + b_1 = c_1$ (B) $b_1 + c_1 = a_1$

(C) $a_1 + c_1 = b_1$ (D) $b_1 = c_1$

---

124. If

$$\int \frac{\sin x}{3 + 4\cos^2 x}\,dx = A\tan^{-1}(B\cos x) + c$$

, (where c is a constant of integration), then the value of A + B is

(A) $\frac{5}{2\sqrt{3}}$ (B) $\frac{-1}{2\sqrt{3}}$

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

---

125. Vectors $\overline{a}$ and $\overline{b}$ are such that

$$|a| = 1; |b| = 4$$

and

$$\overline{a}\cdot\overline{b} = 2$$

. If

$$\overline{c} = 2\overline{a} \times \overline{b} - 3\overline{b}$$

, then the angle between $\overline{b}$ and $\overline{c}$ is

(A) $\frac{\pi}{6}$ (B) $\frac{5\pi}{6}$

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

---

126. If y is a function of x and

$$\log(x + y) = 2xy$$

, then the value of $y'(0)$ is

(A) 1 (B) -1

(C) 2 (D) 0

---

127. If

$$\cos 2B = \frac{\cos(A + C)}{\cos(A - C)}$$

. Then $\tan A, \tan B, \tan C$ are in

(A) Geometric Progression. (B) Arithmetic Progression.

(C) Harmonic Progression. (D) Arithmetico-Geometric Progression.

---

128. If

$$\log_2 x + \log_4 x + \log_8 x + \log_{16} x = \frac{25}{36}$$

and

$$x = 2^k$$

then k is

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

(C) $\frac{1}{3}$ (D) $\frac{1}{8}$

---

129. If

$$\begin{vmatrix} \cos(A+B) & -\sin(A+B) & \cos(2B) \\ \sin A & \cos A & \sin B \\ -\cos A & \sin A & \cos B \end{vmatrix} = 0$$

, then the value of B is

(A) $n\pi, n \in \mathbb{Z}$ (B) $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$

(C) $(2n+1)\frac{\pi}{4}, n \in \mathbb{Z}$ (D) $2n\frac{\pi}{3}, n \in \mathbb{Z}$

---

130. General solution of the differential equation

$$\log\left(\frac{dy}{dx}\right) = ax + by$$

is

(A) $ae^{by} + be^{ax} = c_1$, where c_1 is a constant.

(B) $ae^{-by} + b^{-ax} = c_1$, where c_1 is a constant.

(C) $ae^{-by} + be^{ax} = c_1$, where c_1 is a constant.

(D) $ae^{by} + be^{-ax} = c_1$, where c_1 is a constant.

131.

$$\int (\sqrt{\tan x} + \sqrt{\cot x})dx =$$

(A) $\sqrt{2}\ \sin^{-1}(\sin x - \cos x) + c$, where c is a constant of integration.

(B) $\frac{1}{\sqrt{2}}\sin^{-1}(\sin x - \cos x) + c$, where c is a constant of integration.

(C) $\sin^{-1}(\sin x - \cos x) + c$, where c is a constant of integration.

(D) $2\sin^{-1}(\sin x - \cos x) + c$, where c is a constant of integration.

---

132. If

$$Z_1 = 2 + i$$

and

$$Z_2 = 3 - 4i$$

and

$$\frac{Z_1}{Z_2} = a + bi$$

, then the value of $-7a + b$ is (where

$$i = \sqrt{-1}$$

and $a, b \in R$)

(A) 1 (B) -1

(C) $\frac{-3}{25}$ (D) $\frac{-9}{25}$

133. Let

$$\alpha \in \left(0, \frac{\pi}{2}\right)$$

be fixed. If the integral

$$\int \frac{\tan x + \tan \alpha}{\tan x - \tan \alpha} dx = A(x)\cos 2\alpha + B(x)\sin 2\alpha + c,$$

(where c is a constant of integration), then functions $A(x)$ and $B(x)$ are respectively

(A) $x + \alpha$ and $\log|\sin(x + \alpha)|$.

(B) $x - \alpha$ and $\log|\sin(x - \alpha)|$.

(C) $x - \alpha$ and $\log|\cos(x - \alpha)|$.

(D) $x + \alpha$ and $\log|\sin(x - \alpha)|$.

134. Two adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$, then the unit vector parallel to its diagonal is

(A) $\frac{3}{7}\hat{i} - \frac{6}{7}\hat{j} + \frac{2}{7}\hat{k}$ (B) $\frac{2}{7}\hat{i} - \frac{6}{7}\hat{j} + \frac{3}{7}\hat{k}$

(C) $\frac{6}{7}\hat{i} - \frac{2}{7}\hat{j} + \frac{3}{7}\hat{k}$ (D) $\frac{1}{7}\hat{i} + \frac{1}{7}\hat{j} - \frac{3}{7}\hat{k}$

135. A water tank has a shape of inverted right circular cone whose semi-vertical angle is

$$\tan^{-1}\left(\frac{1}{2}\right)$$

. Water is poured into it at constant rate of 5 cubic meter/minute. The rate in meter/ minute at which level of water is rising, at the instant when depth of water in the tank is 10 m is

(A) $\frac{1}{5\pi}$ (B) $\frac{1}{15\pi}$

(C) $\frac{2}{\pi}$ (D) $\frac{1}{10\pi}$

136. The differential equation of all circles which pass through the origin and whose centres lie on Y-axis is

(A) $(x^2 - y^2)\frac{dy}{dx} - 2xy = 0$

(B) $(x^2 - y^2)\frac{dy}{dx} + 2xy = 0$

(C) $(x^2 - y^2)\frac{dy}{dx} + xy = 0$

(D) $(x^2 - y^2)\frac{dy}{dx} - xy = 0$

137. If

$$x^k + y^k = a^k (a, k > 0)$$

and

$$\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$$

, then k has the value

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

(C) $\frac{1}{4}$ (D) $\frac{2}{7}$

138. The area (in sq. units) bounded by the curve

$$y = x|x|, X$$

-axis and the lines

$$x = -1$$

and

$$x = 1$$

is

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

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

139. The co-ordinates of the point, where the line

$$\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z+5}{4}$$

meets the plane

$$2x + 4y - z = 3$$

, are

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

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

140.

$$\lim_{x \to 0} \frac{(1 - \cos 2x) \cdot \sin 5x}{x^2 \sin 3x}$$

is

(A) $\frac{10}{3}$ (B) $\frac{5}{3}$

(C) $\frac{5}{6}$ (D) $\frac{2}{3}$

141. If g is the inverse of f and

$$f'(x) = \frac{1}{1 + x^3}$$

, then $g'(x)$ is

(A) $\frac{1}{1+(g(x))^3}$ (B) $1 + (g(x))^3$

(C) $\frac{g(x)}{1+(g(x))^3}$ (D) $\frac{(g(x))^3}{1+(g(x))^3}$

142. A problem in statistics is given to three students A, B and C. Their probabilities of solving the problem are

$$\frac{1}{2}, \frac{1}{3}$$

and

$$\frac{1}{4}$$

respectively. If all of them try independently, then the probability, that problem is solved, is

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

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

---

143. Let

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}, B = \begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$$

and

$$X = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

, if

$$\mathrm{AX} = \mathrm{B}$$

, then the value of $2\mathrm{a} + \mathrm{b} + 2\mathrm{c}$ is

(A) 10 (B) 8

(C) 6 (D) 12

144.

$$f(x) = \begin{cases} \frac{1-\cos kx}{x^2}, & \text{if } x \le 0 \\ \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}, & \text{if } x > 0 \end{cases}$$

is continuous at

$$x = 0$$

, then the value of k is

(A) 4 (B) 2

(C) -1 (D) -3

---

145. If D, E and F are the mid-points of the sides BC, CA and AB of triangle ABC respectively, then

$$\mathrm{AD} + \frac{2}{3}\mathrm{BE} + \frac{1}{3}\mathrm{CF} =$$

(A) $\frac{1}{2}\bar{\mathrm{AB}}$ (B) $\frac{1}{2}\bar{\mathrm{AC}}$

(C) $\frac{1}{2}\bar{\mathrm{BC}}$ (D) $\frac{2}{3}\bar{\mathrm{AC}}$

---

146. Two cards are drawn successively with replacement from a well shuffled pack of 52 cards, then mean of number of queens is

(A) $\frac{1}{13}$ (B) $\frac{1}{169}$

(C) $\frac{2}{13}$ (D) $\frac{4}{169}$

---

147. The equation of a plane, containing the line of intersection of the planes

$$2x - y - 4 = 0$$

and

$$y + 2z - 4 = 0$$

and passing through the point $(2, 1, 0)$, is

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

(C) $3x - 2y - z = 4$ (D) $3x + 2y - z = -4$

---

148. A random variable X assumes values 1, 2, 3, ..., n with equal probabilities, if

$$\mathrm{var}(X) = E(X)$$

, then n is

(A) 4 (B) 5

(C) 7 (D) 9

---

149. The graphical solution set for the system of inequations

$x - 2y \le 2, 5x + 2y \ge 10, 4x + 5y \le 20, x \ge 0,$
$y \ge 0$

is given by

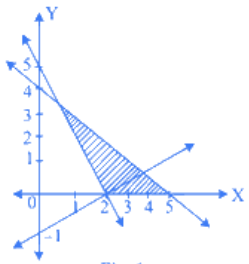


Fig. 1

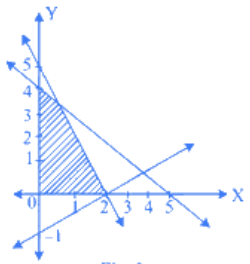


Fig. 2

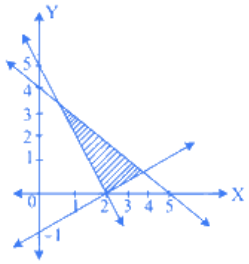


Fig. 3

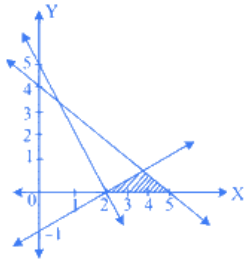


Fig. 4

(A) Fig. 2 (B) Fig. 4

(C) Fig. 1 (D) Fig. 3

150. Let

$$f(0) = -3$$

and $f'(x) \leq 5$ for all real values of x. The $f(2)$ can have possible maximum value as

(A) 10 (B) 5

(C) 7 (D) 13

- End of Question Paper -