MHT CET 2026 PCM Apr 17 Shift 1 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

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

General Instructions

(i) This **PCM** paper is from **MHT CET 2026**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

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

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

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

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

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

1. Resultant of two vectors $\vec{P}$ and $\vec{Q}$ is of magnitude A. If $\vec{Q}$ is reversed, then the resultant is of magnitude B. The value of $A^2 + B^2$ is

(A) $P^2 + Q^2$ (B) $P^2 - Q^2$

(C) $2(P^2 + Q^2)$ (D) $2(P^2 - Q^2)$

2. Mass and volume of a body are found to be (6.00 ± 0.03) kg and (2.00 ± 0.02) m^3 respectively. Then the density of a body is

(A) (3.00 ± 0.010) kg/m^3 (B) (3.00 ± 0.015) kg/m^3

(C) (3.00 ± 0.020) kg/m^3 (D) (3.00 ± 0.045) kg/m^3

3. Two balls A and B are projected at an angle of 45° and 60° respectively, so that the maximum heights reached are same for both. The ratio of initial velocity of projection of ball A to that for ball B is

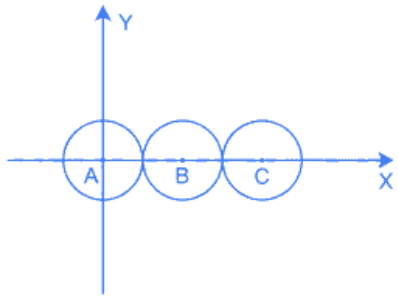
$(\sin 30^\circ = \cos 60^\circ = \frac{1}{2}, \sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}},$

$\sin 60^\circ = \cos 30^\circ = \frac{\sqrt{3}}{2})$

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

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

4. Three identical spheres, each of mass 'm' kg, are kept as shown in the figure, touching each other, with their centers on a straight line. If their centers are marked as A, B, C respectively, the distance of center of mass of the system from A is



(A) $\frac{AB + BC}{3}$ (B) $\frac{AB + AC}{3}$

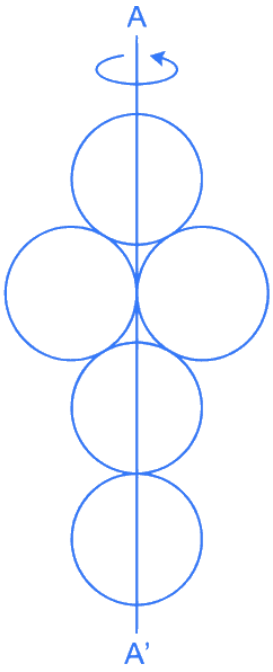
(C) $\frac{AC + BC}{2}$ (D) $\frac{AB + BC + AC}{3}$

5. Four point masses m, 2m, 3m and 4m are kept at the corners A, B, C and D respectively of a square ABCD of side 'b'. The moment of inertia of the system about an axis perpendicular to the plane of the square and passing through the point D is

(A) 12 mb^2 (B) 10 mb^2

(C) 8 mb^2 (D) 5 mb^2

6. A system of five solid spheres each of mass 'm' and radius 'r' are rotating about an axis AA' as shown in figure. Hence the moment of inertia of the system about the axis of rotation AA' is



(A) 6 mr^2 (B) 5 mr^2

(C) 4 mr^2 (D) 3 mr^2

7. Two bodies A and B have moment of inertia I_A and I_B, and angular momenta L_A and L_B respectively. Both of them have same kinetic energy of rotation. So the ratio L_A to L_B is

(A) $\frac{I_A}{I_B}$ (B) $\frac{I_A^2}{I_B^2}$

(C) $\sqrt{\frac{I_A}{I_B}}$ (D) $\sqrt{\frac{I_B}{I_A}}$

8. The speed with which the earth would have to rotate about its axis so that a person on the equator would weigh $\frac{3}{5}$th as much as at present is (g = gravitational acceleration, R = equatorial radius of the earth.)

(A) $\sqrt{\frac{3}{5}gR}$ (B) $\sqrt{\frac{2g}{5R}}$

(C) $\sqrt{\frac{3g}{5R}}$ (D) $\sqrt{\frac{5R}{2g}}$

9. The excess pressure inside a spherical water drop A is four times that of another water drop B. Then, the ratio of the mass of water drop A to that of drop B is

(A) 1 : 8 (B) 1 : 16

(C) 1 : 32 (D) 1 : 64

10. In a capillary tube of area of cross-section 'a' water rises to height 'h'. To what height will water rise in a capillary tube of area of cross-section $4a$?

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

(C) $2h$ (D) $4h$

11. A soap bubble of radius $\frac{1}{\sqrt{\pi}}$ cm is expanded to radius $\frac{3}{\sqrt{\pi}}$ cm. Surface tension of soap solution is 25 dyne/cm. The work done during expansion in erg is

(A) 800 (B) 1200

(C) 1600 (D) 2400

12. In an external environment of temperature (T) kelvin, a sphere at temperature ($3T$) kelvin has cooling rate R_1. When the temperature of that sphere falls to ($2T$) kelvin, the cooling rate R_2 of the sphere will become

(A) $\frac{15}{16}R_1$ (B) $\frac{11}{16}R_1$

(C) $\frac{7}{16}R_1$ (D) $\frac{3}{16}R_1$

13. 'x' joule of heat is incident on a body. Out of it, the total heat reflected and transmitted by it is 'y' joule. The absorption coefficient of the body is

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

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

14. Consider two rods 1 and 2 of same length. They have different specific heats (C_1, C_2), thermal conductivities (K_1, K_2) and area of cross-section (A_1, A_2) respectively. Both the rods have temperatures (T_1, T_2) at their ends. If their rate of loss of heat due to conduction is equal, then

(A) $A_1K_2 = A_2K_1$ (B) $A_1K_1 = A_2K_2$

(C) $\frac{A_1K_1}{C_1} = \frac{A_2K_2}{C_2}$ (D) $\frac{A_1K_2}{C_1} = \frac{A_2K_1}{C_2}$

15. A Carnot engine, whose efficiency is 40% takes heat from a source maintained at temperature 600K. To have an efficiency 60%, the intake temperature for the same exhaust temperature should be

(A) 1800 K (B) 900 K

(C) 720 K (D) 360 K

16. The heat energy that must be supplied to 14 g of nitrogen at room temperature to raise its temperature by 48 °C at constant pressure is (R = gas constant, Molecular weight of nitrogen (N_2) = 28)

(A) 72 R (B) 84 R

(C) 96 R (D) 108 R

17. The speeds of the seven molecules are 1, 3, 5, 7, 2, 4 and 6 km/s respectively. The ratio of their r.m.s. velocity and average velocity will be

(A) $2\sqrt{5} : 1$ (B) $\sqrt{5} : 1$

(C) $1 : 2\sqrt{5}$ (D) $\sqrt{5} : 2$

18. Two simple pendulums of lengths L_1 and L_2 have periodic time T_1 and T_2 respectively ($T_1 > T_2$). The time period of the pendulum of length ($L_1 - L_2$) is
[$(L_1 - L_2) > 60$ cm]

(A) $\sqrt{T_1^2 + T_2^2}$ (B) $\sqrt{T_1^2 - T_2^2}$

(C) $T_1 + T_2$ (D) $T_1 - T_2$

19. For a particle executing S.H.M., its potential energy is 8 times its kinetic energy at a certain displacement 'x' from the mean position. If 'A' is the amplitude of S.H.M., the value of 'x' is

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

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

20. A particle executing simple harmonic motion starts from mean position with amplitude 'A' and periodic time 'T'. At what displacement is its speed one-fourth of the maximum speed?

(A) $\frac{A}{\sqrt{15}}$ (B) $\frac{A}{4}$

(C) $\frac{4A}{\sqrt{15}}$ (D) $\frac{A\sqrt{15}}{4}$

21. A and B are two wires whose fundamental frequencies are 256 Hz and 382 Hz respectively. When third harmonic of A and the second harmonic of B are sounded together, the number of beats heard in two second will be

(A) 8 (B) 6

(C) 4 (D) 2

22. In case of stationary wave pattern, which of the following statement is CORRECT ?

(A) The distance between consecutive antinodes is equal to the wavelength.

(B) In a pipe open at both ends when an air column is vibrated, only even harmonics are present.

(C) When an air column is vibrated in a pipe closed at one end, all harmonics are present.

(D) In the case of a stretched string, when vibrated frequency of the first overtone is same as the second harmonic.

23. Out of the following musical instruments which is ' NOT ' a percussion instrument?

(A) Drum (B) Saxophone

(C) Daphali (D) Xylophone

24. The enclosed air inside a closed box of rigid walls has pressure P_1. The density of air inside this box is constant. On heating the gas, the pressure of the enclosed air is increased from P_1 to P_2 . Now it is observed that the sound travels 1.4 times faster than at pressure P_1. The ratio P_2 by P_1 is

(A) 2.25 (B) 1.96

(C) 1.5 (D) 1.4

25. Select the WRONG statement about polar molecules.

(A) Polar molecules have permanent dipole moment.

(B) A molecule in which centre of mass of positive charges does not coincide with the centre of mass of negative charges is a polar molecule.

(C) Polar molecules have symmetrical shape.

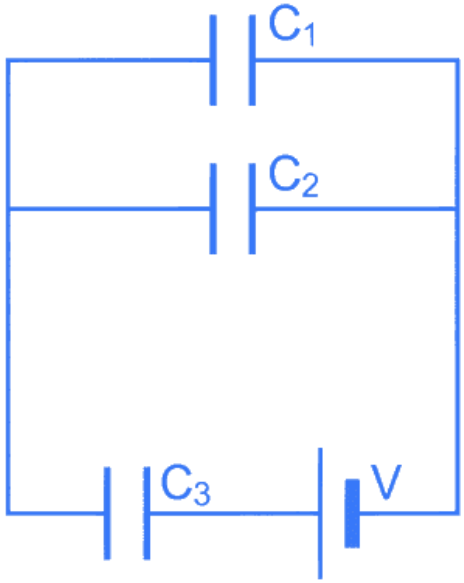
(D) Polar molecules act as tiny electric dipoles.

26. An electric dipole of length 3cm is placed with its axis making an angle of 60° with a uniform electric field of 5×10^4 N/C. It experiences a torque of $9\sqrt{3}$ Nm. The magnitude of charge on the dipole is $(\sin 60^\circ = \frac{\sqrt{3}}{2})$

(A) 0.6×10^{-2} C (B) 1.2×10^{-2} C

(C) 1.8×10^{-2} C (D) 2.4×10^{-2} C

27. Three capacitors C_1, C_2 and C_3 are connected to voltage source V as shown in figure. The voltage across C_3 will be



(A) $\frac{C_3V}{(C_1+C_2+C_3)}$ (B) $\frac{(C_1+C_2)V}{C_3}$

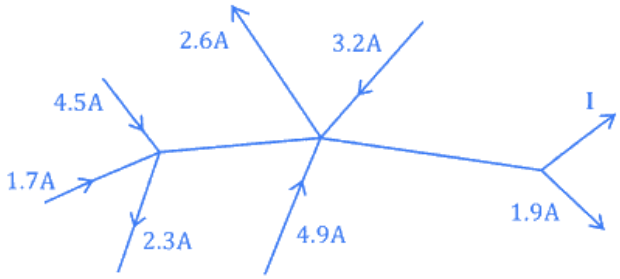
(C) $\frac{(C_2+C_3)V}{C_1+C_2}$ (D) $\frac{(C_1+C_2)V}{(C_1+C_2+C_3)}$

28. Two capacitors, C_1 and C_2 have their capacitances in the ratio 1:2. V_s and V_p are the potential differences applied across the series and parallel combination of C_1 and C_2 respectively, so that the energy stored in the two cases becomes same. The ratio V_s to V_p is

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

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

29. In the following figure, the current I is equal to



(A) 2.9 A (B) 3.9 A

(C) 6.2 A (D) 7.5 A

30. With a resistance 'X' connected in series with a galvanometer of resistance 100 Ω, it acts as a voltmeter of range 0 - 15 V. To double the range, a resistance of 1500 Ω is to be connected in series with 'X'. The value of 'X' in Ω is

(A) 1000 (B) 1200

(C) 1400 (D) 1600

31. The magnetic field at the center of circular coil carrying current 'I' for a single turn of a given length of wire is 'B'. The same wire is bent in a circular coil having two turns. When the same current passes through it, the value of magnetic field becomes

(A) $4B$ (B) $2B$

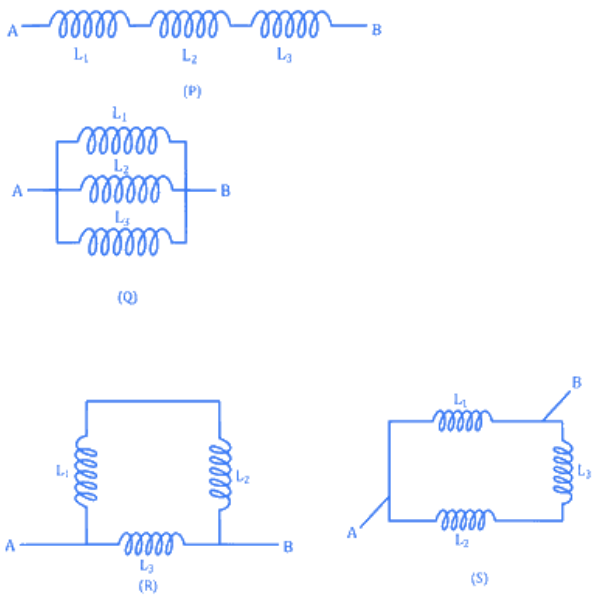
(C) $\frac{B}{2}$ (D) $\frac{B}{4}$

32. The magnetic field at perpendicular distance 'r' from a long wire carrying current 'I' is 'B'. The magnetic field at perpendicular distance '$2r$' from the same wire is

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

(C) $2B$ (D) $4B$

33. Three coils of inductance, $L_1 = 2$ H, $L_2 = 3$ H and $L_3 = 6$ H are connected so that they are separated from each other. To obtain the effective inductance of $\frac{18}{11}$ H between points A and B, out of the following figures, the correct one is



(A) P (B) S

(C) Q (D) R

34. Two coils have self inductance L_1 and L_2. The current through them is increasing at constant rate. If the power dissipated in both the coils is same, then the ratio of energy stored in the coil having inductance L_1 to that in L_2 is

(A) $\frac{L_1^2}{L_2^2}$ (B) $\frac{L_2^2}{L_1^2}$

(C) $\frac{L_1}{L_2}$ (D) $\frac{L_2}{L_1}$

35. The resistor 'R' inductance 'L' and capacitance 'C' are connected in series with an a.c. source. When 'L' is removed from the circuit, the phase difference between voltage and current in the circuit is $\frac{\pi}{3}$. If instead, C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is

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

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

36. The LC series resonant circuit produces a resonant frequency 'f'. If L is tripled and 'C' is increased by 3C, the resonant frequency will be

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

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

37. In LCR series circuit at resonance

(A) the current is minimum. (B) the impedance is maximum.

(C) the current leads the voltage by $\frac{\pi}{2}$ (D) the current and voltage are in phase.

38. A transformer has 120 turns in the primary coil and carries 5A current. Input power is one kilowatt. To have 560 V output, the number of turns in secondary coil will be

(A) 168 (B) 200

(C) 336 (D) 400

39. In telescopes for a given wavelength, the objectives with large aperture are used for

(A) greater resolution. (B) reducing lens aberration.

(C) greater magnification. (D) ease of manufacture.

40. A lens of refractive index 'μ' has focal length 'f'. When the lens is immersed in a liquid of refractive index 'μ_0', its focal length becomes 'f_0'. Then 'f_0' is given by

(A) $\frac{(\mu_0-\mu)f}{\mu(\mu_0-1)}$ (B) $\frac{\mu(\mu_0-1)f}{(\mu_0-\mu)}$

(C) $\frac{(\mu-\mu_0)f}{\mu_0(\mu-1)}$ (D) $\frac{\mu_0(\mu-1)f}{(\mu-\mu_0)}$

41. In Young's double slit experiment, width of the second slit is double the width of first slit, consequently the amplitude of the light from two slits. 'I_m' is the maximum intensity. The resultant intensity 'I' when they interfere with the phase difference of ϕ is given by

(A) $\frac{I_m}{9}\left(1+8\cos^2\frac{\phi}{2}\right)$ (B) $\frac{I_m}{7}\left(3+5\cos^2\frac{\phi}{2}\right)$

(C) $\frac{I_m}{5}\left(1+2\cos^2\frac{\phi}{2}\right)$ (D) $\frac{I_m}{3}\left(1+6\cos^2\frac{\phi}{2}\right)$

42. In a single slit diffraction experiment, for wavelength 'λ', half angular width of the principal maxima is 'θ'. Also for wavelength of light '$p\lambda$', the half angular width of the principal maxima is '$q\theta$'. The ratio of the half angular widths of the first secondary maxima in the first case to second case will be

(A) $p:1$ (B) $1:q$

(C) $p:q$ (D) $q:p$

43. Photoelectric emission is observed from a metallic surface for frequencies ν_1 and ν_2 of the incident light rays ($\nu_1 > \nu_2$). If the ratio of maximum value of kinetic energy of the photoelectron emitted in first case to that in second case 3 : K, then the threshold frequency of the metallic surface is

(A) $\frac{K\nu_1-\nu_2}{K-1}$ (B) $\frac{K-1}{K\nu_1-\nu_2}$

(C) $\frac{K-3}{K\nu_1-3\nu_2}$ (D) $\frac{K\nu_1-3\nu_2}{K-3}$

44. The kinetic energy of a free electron increases to 3 times the previous K.E. The ratio of new de-Broglie wavelength to previous de-Broglie wavelength is

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

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

45. For wavelength of visible radiation of Hydrogen spectrum, Balmer gave an equation as $\lambda = \frac{xm^2}{m^2-4}$, where m is the integer value. The value of x in terms of Rydberg's constant R is

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

(C) $2R$ (D) $4R$

46. The orbital magnetic moment (m_{orb}) of a revolving electron around the nucleus varies with the principal quantum number (n) as

(A) $m_{orb} \propto n^2$ (B) $m_{orb} \propto n$

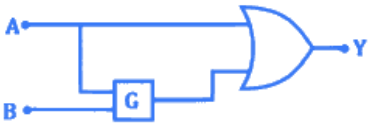
(C) $m_{orb} \propto \frac{1}{n^2}$ (D) $m_{orb} \propto \frac{1}{n}$

47. The half-life of the isotope ${}_{11}Na^{24}$ is 15 hr. How much time does it take for $\left(\frac{7}{8}\right)^{th}$ of a sample of this isotope to decay ?

(A) 45 hour (B) 60 hour

(C) 75 hour (D) 90 hour

48. To get the truth table shown from the following logic circuit, the gate G should be



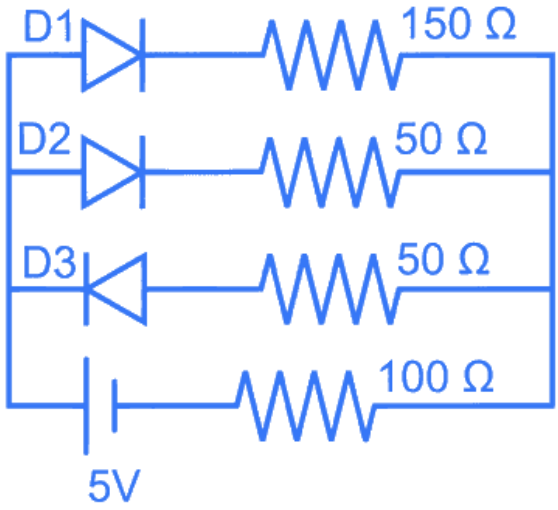
A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

(A) NAND gate.
(B) NOR gate.
(C) AND gate.
(D) OR gate.

49. When the Zener diode is used as a voltage regulator, it is connected in

(A) forward bias and in parallel with load.
(B) reverse bias and in series with load.
(C) forward bias and in series with load.
(D) reverse bias and in parallel with load.

50. In the circuit shown in figure all the three diodes D1, D2, D3 have forward resistance 50 Ω each and infinite backward resistance. If the battery voltage is 5V, the current through 100 Ω resistance is



(A) 60 mA
(B) 30 mA
(C) 20 mA
(D) 10 mA

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51. Calculate the number of molecules present in 2.24 dm^3 of carbon dioxide at STP ?

(A) 2.011×10^{22} (B) 3.011×10^{22}

(C) 6.022×10^{22} (D) 0.1×10^{23}

52. What is uncertainty in velocity of an electron if uncertainty in measurement of position is 50 pm ?

($m_e = 9.1 \times 10^{-31}$kg, $h = 6.63 \times 10^{-34}$Js, $\pi = 3.142$)

(A) 0.98×10^6 ms^{-1} (B) 1.16×10^6 ms^{-1}

(C) 2.61×10^6 ms^{-1} (D) 3.77×10^6 ms^{-1}

53. Which of the following elements belongs to group 2 and sixth period of periodic table?

(A) Rubidium (B) Strontium

(C) Caesium (D) Barium

54. Identify a molecule having highest dipole moment from following.

(A) NH_3 (B) H_2O

(C) $CHCl_3$ (D) BeF_2

55. V_0 and V_t are volumes of an ideal gas at 0 °C and t °C respectively, find ratio $\frac{V_t}{V_0}$

(A) $\frac{1}{273} \times t$ (B) $1 + 273 \times t$

(C) $1 + \frac{t}{273}$ (D) $\frac{1}{273 + t}$

56. Which of the following equations is used to obtain enthalpy change of a reaction?

(A) $\Delta H = \sum \Delta H_P - \sum \Delta H_R$

(B) $\Delta H = \sum \Delta H_R - \sum \Delta H_P$

(C) $\Delta H = \sum \Delta H_P + \sum \Delta H_R$

(D) $\Delta H = \frac{\sum \Delta H_P}{\sum \Delta H_R}$

57. A system is provided 50 J of heat and work done on the system is 10 J. What is change in internal energy ?

(A) 40 J (B) 60 J

(C) 30 J (D) 50 J

58. At 25 °C standard enthalpy of combustion of H_2, Cyclohexene and cyclohexane are -241, -3800 and -3920 kJ mol^{-1} respectively. What is the heat of hydrogenation of cyclohexene?

(A) -121 kJ (B) -242 kJ

(C) 121 kJ (D) 363 kJ

59. Calculate the solubility in mol dm^{-3} of sparingly soluble salt BA at 293 K if its solubility product is 8.56×10^{-5} at same temperature.

(A) 8.123×10^{-3} (B) 8.780×10^{-3}

(C) 9.252×10^{-3} (D) 7.756×10^{-3}

60. Which from following salts does not undergo hydrolysis ?

(A) Ammonium nitrate (B) Sodium acetate

(C) Ammonium cyanide (D) Sodium nitrate

61. Which of the following reactions is NOT an example of redox reaction?

(A) $Cl_2 + 2H_2O + SO_2 \longrightarrow 4H^+ + SO_4^{2-} + 2Cl^-$

(B) $Cu^{2+} + Zn \longrightarrow Cu + Zn^{2+}$

(C) $2H_2 + O_2 \longrightarrow 2H_2O$

(D) $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$

62. Which from the following is NOT polymorphic form of silica ?

(A) Cristobalite (B) α - quartz

(C) β - quartz (D) Aragonite

63. Which among the following is haloalkyne?

(A) Chloroethyne (B) 3 - Chloropropyne

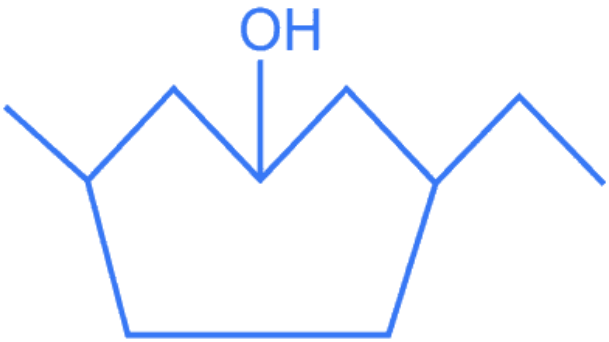
(C) 1 - Chloropent - 2 - yne (D) 4 - Chloropent - 2 - yne

64. Which from following statements is NOT true about homologous series?

(A) Each member of a series has same functional group. (B) Each member has same type of carbon skeleton.

(C) Each member differs by ethylene group from next member. (D) All members of series possess similar chemical properties.

65. What is IUPAC name of following compound?



(A) 3 - Methyl - 6 - ethyl cycloheptanol
(B) 3 - Ethylcyclooctanol
(C) 3 - Ethyl - 6 - methylcycloheptanol
(D) 1 - Ethyl - 5 - methylcycloheptan - 3 - ol

66. Which from following elements is NOT present in mustard gas?

(A) Cl (B) N
(C) S (D) C

67. When excess of chlorine is used in the chlorination of methane find the major product obtained.

(A) Chloromethane (B) Dichloromethane
(C) Trichloromethane (D) Tetrachloromethane

68. Alkenes on oxidation with $KMnO_4$ in dil H_2SO_4 forms

(A) Alkanol (B) Alkanal
(C) Alkanone (D) Alkanoic acid

69. Find the volume occupied by a particle in a simple cubic unit cell if the radius of a particle in it is 190 pm.

(A) 6.410×10^{-23} cm^3 (B) 3.625×10^{-23} cm^3
(C) 5.715×10^{-23} cm^3 (D) 2.873×10^{-23} cm^3

70. Calculate the number of unit cells in $1cm^3$ of metal if it forms simple cubic structure with unit cell edge length 500 pm.

(A) 4.0×10^{21} (B) 2.0×10^{21}
(C) 8.0×10^{21} (D) 3.0×10^{21}

71. Which of the following concentrations of solutions of urea in water exhibits minimum freezing point depression?

(A) 0.12 m (B) 0.18 m
(C) 0.08 m (D) 0.06 m

72. Calculate van't Hoff factor for aqueous solution of 0.02 m formic acid if it freezes at -0.045 °C.
[K_f = 1.86 K kg mol^{-1} and freezing point of water = 0 °C]

(A) 1.21 (B) 1.46
(C) 1.68 (D) 1.05

73. Calculate the molar mass of nonvolatile solute when 4 g of it is dissolved in 100 g solvent that boils at 319.4 K [K_b = 2.4 K kg mol^{-1}; B.P of pure solvent = 319 K]

(A) 220 $gmol^{-1}$ (B) 230 $gmol^{-1}$
(C) 240 $gmol^{-1}$ (D) 250 $gmol^{-1}$

74. If the emf of cell, $Cu_{(s)} \mid Cu^{2+}_{(1M)} \| Ag^{+}_{(1M)} \mid Ag$ is 0.463 V at 25 °C and standard potential of Cu electrode is 0.337 V. Find the standard potential of Ag electrode

(A) 0.128 V (B) −0.128 V
(C) 0.8 V (D) −0.8 V

75. Which of the following hot aqueous solutions is used to dip carbon rods of $H_2 - O_2$ fuel cell ?

(A) KCl (B) KOH
(C) H_2SO_4 (D) NH_4Cl

76. The conductivity of 0.02 M of KCl solution at 298 K is 0.0123 ohm^{-1} cm^{-1}. If the resistance of the cell containing this solution is 120 ohms, what is the value of the cell constant ?

(A) 1.050 cm^{-1} (B) 1.025 cm^{-1}
(C) 1.376 cm^{-1} (D) 1.476 cm^{-1}

77. Half life of zero order reaction is 1 hour. If initial concentration of reactant is 2.0 mol L^{-1}, find the time required to decrease concentration from 0.50 to 0.25 mol L^{-1}

(A) 0.25 hour (B) 0.50 hour
(C) 1.00 hour (D) 4.00 hour

78. What is the term used for the minimum kinetic energy required for the reactant molecules to undergo reaction?

(A) Potential energy (B) Bond energy
(C) Thermal energy (D) Activation energy

79. If time required for 90 % completion of a first order reaction is 't'. What is the time required for 99.9 % completion of reaction at same temperature?

(A) $3t$ (B) $2t$

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

80. Identify a nanomaterial having all three dimensions less than 100 nm?

(A) Fibers (B) Thin films

(C) Quantum dots (D) Nanotubes

81. Which from following is NOT an example of oil in water emulsion?

(A) Paint (B) Butter

(C) Vanishing cream (D) Milk

82. Which from following catalysts is used in contact process of industrial production of sulfuric acid using SO_2 and O_2 (air).

(A) Ni (finely divided) (B) Platinised asbestos

(C) Co-Th (D) Fe-Cr

83. Which from following compounds has lowest thermal stability?

(A) IBr (B) BrCl

(C) BrF (D) ClF

84. Why transition elements have more tendency to form interstitial compounds?

(A) Presence of interstitial sites (voids) in the crystal lattice (B) They have reducing property

(C) They have low ionization enthalpy (D) They have same atomic size.

85. What is EAN of Co in $[Co(NH_3)_6]^{3+}$?

(A) 24 (B) 27

(C) 36 (D) 30

86. Identify the total number of complexes from following list having monodentate ligands in them

(a) Tetracyanonickelate (II) ion
(b) Potassium hexafluoroaluminate (III)
(c) Tetraamminecopper(II) ion
(d) Potassium trioxalatoaluminate (III)

(A) 4 (B) 3

(C) 2 (D) 1

87. Which of the following reactions is used for the preparation of alkyl fluorides from alkyl chlorides?

(A) Sandmeyeres reaction (B) Fittig reaction

(C) Swartz reaction (D) Finkelstein reaction

88. Which among the following is allylic halide?

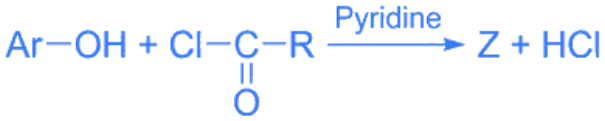
(A) $CH_3 - CH_2 - CH_2 - X$

(B) $C_6H_5 - CH_2 - X$

(C) $CH_2 = CH - CH_2 - X$

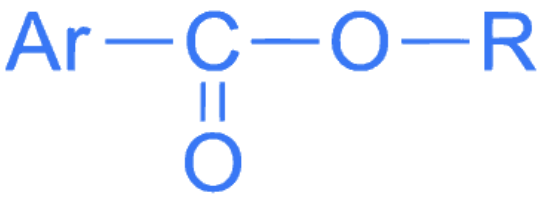
(D) $CH_3 - CH = CH - X$

89. Identify ' Z' in the following reaction.

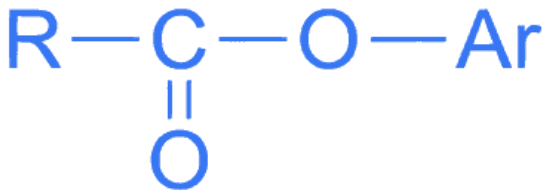


(A) $Ar - O - R$

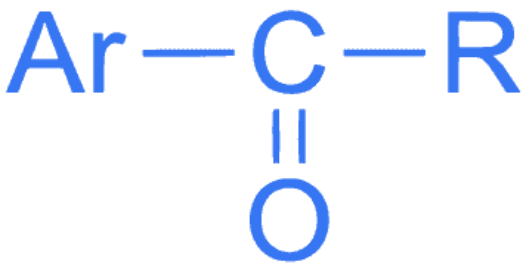
(B)



(C)



(D)



90. Identify trihydric phenol from following.

(A) Hydroquinone (B) Catechol

(C) O-Cresol (D) Pyrogallol

91. Which from the following is a correct decreasing order of boiling points for following organic compounds ?

(A) Aldehyde > Ketone > Alcohol > Carboxylic acid

(B) Carboxylic acid > Alcohol > Ketone > Aldehyde

(C) Ketone > Aldehyde > Carboxylic acid > Alcohol

(D) Alcohol > Aldehyde > Ketone > Carboxylic acid

92. When will be the acidic character of carboxylic acid higher in following cases ?

(A) Lower K_a and pK_a values

(B) Lower K_a value and higher pK_a value

(C) Higher K_a value and lower pK_a value

(D) Higher K_a and pK_a values

93. Identify the major product obtained when ethyl amine is reacted with excess of methyl iodide ?

(A) Tetramethylammonium iodide

(B) Ethyltrimethylammonium iodide

(C) Ethyldimethylamine

(D) Ethylmethylamine

94. Identify correct decreasing order of basic strength of amines

(A) $CH_3NH_2 > (CH_3)_2NH > C_6H_5NH_2 > NH_3$

(B) $(CH_3)_2NH > CH_3NH_2 > NH_3 > C_6H_5NH_2$

(C) $NH_3 > CH_3NH_2 > (CH_3)_2NH > C_6H_5NH_2$

(D) $C_6H_5NH_2 > (CH_3)_2NH > CH_3NH_2 > NH_3$

95. Which from following compounds is used to prepare adipic acid, enzymatically in Green technology developed by Darth and Frost?

(A) Sucrose

(B) Glucose

(C) Lactose

(D) Maltose

96. Which carbon atom (numbered from 1' to 5') of ribose lacks the oxygen to form deoxyribose ?

(A) 5'

(B) 3'

(C) 2'

(D) 1'

97. Which from following amino acids does NOT contain chiral carbon?

(A) Valine

(B) Alanine

(C) Glycine

(D) Isoleucine

98. Which from following oils is mainly a saturated fats?

(A) Coconut oil

(B) Olive oil

(C) Safflower oil

(D) Fish oil

99. Which from following is a homopolymer ?

(A) Polyacrylonitrile

(B) Buna - N

(C) Urea formaldehyde resin

(D) Polycarbonate

100. Which from following polymers is used to obtain articles like rain coats?

(A) $-[CH_2 - CH_2]-_n$

(B) $-\left[CH_2 - \underset{CN}{CH}\right]-_n$

(C) $-\left[CH_2 - \underset{Cl}{CH}\right]-_n$

(D) $-[CF_2 - CF_2]-_n$

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101. If α and β are the distinct roots of the equation $x^2 - x + 1 = 0$, then the value of $\alpha^{200} + \beta^{206} + 2$ is equal to

(A) 1 (B) -1

(C) 0 (D) 2

102. The number of arrangements of the letters in the word SOLAPUR, so that consonants and vowels are placed alternately is

(A) 100 (B) 129

(C) 144 (D) 121

103. If $\cos 43^\circ + \sin 43^\circ = k^3$, then $\cos 2^\circ = \ldots$

(A) $-\frac{k^3}{\sqrt{2}}$ (B) $\frac{k^3}{\sqrt{2}}$

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

104. If the equation $\sin 3\theta - \cos^2\theta = \frac{1}{4}$ and $\theta \in [0, \pi]$, then the number of solutions is...

(A) 0 (B) 2

(C) 4 (D) 6

105. If $A(2, -3)$ and $C(-6, 7)$ are opposite vertices of a rhombus ABCD, then the equation of diagonal BD is

(A) $5x - 4y + 2 = 0$ (B) $5x + 4y + 2 = 0$

(C) $4x - 5y + 18 = 0$ (D) $4x + 5y + 18 = 0$

106. The measure of the acute angle between the pair of lines $2x^2 + xy - y^2 - x + 2y - 1 = 0$ is:

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

(C) $\cos^{-1}\frac{1}{\sqrt{10}}$ (D) $\cos^{-1}\sqrt{10}$

107. The joint equation of a pair of lines passing through point $(1, 4)$, one of which is parallel to X-axis and the other makes an angle of 45° with the positive direction of X-axis, is

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

(B) $xy - y^2 - 4x + 7y - 12 = 0$

(C) $x^2 + 2xy - y^2 + 7 = 0$

(D) $xy - 2y^2 + 3x + 2y + 17 = 0$

108. If a circle passes through the points $(2, 3)$ and $(4, 5)$ and its center lies on the straight line $y - 4x + 3 = 0$, then its equation is.....

(A) $x^2 + y^2 - 4x - 10y + 25 = 0$

(B) $x^2 + y^2 - 4x - 10y - 25 = 0$

(C) $x^2 + y^2 - 4x + 10y - 25 = 0$

(D) $x^2 + y^2 + 25 = 0$

109. The equations of the tangents to the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ making an inclination of 30° with the major axis are

(A) $x + \sqrt{3}\ \ y \pm \sqrt{43}\ \ = 0$

(B) $x - \sqrt{3}y \pm \sqrt{43} = 0$

(C) $\sqrt{3}x - y \pm \sqrt{43} = 0$

(D) $x - \sqrt{3}y \pm \sqrt{3} = 0$

110. If $\lim\limits_{x \to 1} \frac{\sin(3x^2 - 4x + 1) - x^2 + 1}{2x^3 - 7x^2 + ax + b} = -2$, then the quadratic equation having roots a and b is

(A) $x^2 + 5x - 24 = 0$ (B) $x^2 - 5x + 24 = 0$

(C) $x^2 - 5x - 24 = 0$ (D) $x^2 + 5x + 24 = 0$

111. If the statements
p: If voltage increases then current decreases.
q : If voltage does not increases then current does not decreases.
r : If current decreases then voltage increases.
s : If current does not decreases then voltage does not increases.
then which of the following pairs of statements having same meaning

(A) p, q and r, s (B) p, r and q, s

(C) p, s and q, r (D) no pair having same meaning

112. If $p \to (q \vee \sim r)$ is false, then the truth values of $(p \leftrightarrow q) \wedge r$ and $\sim p \to \sim q$ are :

(A) T, T (B) T, F

(C) F, T (D) F, F

113. With usual notations, in $\triangle ABC$, if $\cos C = \dfrac{\sin A}{2\sin B}$, then which of the following is true ?

(A) $a = c$ (B) $a = b$

(C) $b = c$ (D) $a^2 = b^2 + c^2$

114. In $\triangle ABC$, if $a = 13, b = 14, c = 15$, then the value of $\sin A + \cos A$ is...

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

(C) $\dfrac{4}{5}$ (D) $\dfrac{12}{5}$

115. If the matrix $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ is expressed as the sum of a symmetric matrix B and a skew symmetric matrix C then which of the following relations is correct?

(A) $|A| = |B| \times |C|$ (B) $|A| = |B| + |C|$

(C) $|C| = 0$ (D) $|A| = |B|$

116. If A is a non-singular matrix and $A^2 - A + I = 0$, then $A^{-1} = \ldots$

(A) A (B) $A - I$

(C) $I - A$ (D) $A + I$

117. The value of $3\tan^{-1}\left(\dfrac{1}{2}\right) = \ldots$

(A) $\tan^{-1}\left(\dfrac{5}{2}\right)$ (B) $\tan^{-1}\left(\dfrac{2}{5}\right)$

(C) $\cot^{-1}\left(\dfrac{11}{2}\right)$ (D) $\tan^{-1}\left(\dfrac{11}{2}\right)$

118. If $f(x) = \dfrac{x+2}{x^2 - 3x + 1}$, then the values of x for which $f(x)$ is not defined are

(A) $x = \dfrac{3+\sqrt{5}}{2}, \; x = \dfrac{3-\sqrt{5}}{2}$

(B) $x = \dfrac{-3+\sqrt{5}}{2}, \; x = \dfrac{-3-\sqrt{5}}{2}$

(C) $x = \dfrac{3+\sqrt{3}}{2}, \; x = \dfrac{3-\sqrt{3}}{2}$

(D) $x = \dfrac{2+\sqrt{5}}{2}, \; x = \dfrac{2-\sqrt{5}}{2}$

119. If $f : R \to R$ and $g : R \to R$ are defined as $f(x) = 2x - |x|$ and $g(x) = 2x + |x|$, then

(A) $(fog)(2) + (gof)(2) = 0$

(B) $(fog)(2) - (gof)(-2) = 0$

(C) $(fog)(2) - (fog)(-2) = 0$

(D) $(gof)(2) + (gof)(-2) = 0$

120. Which of the following function is discontinuous at $x = 0$?

(A) $f(x) = (1+x)^{\frac{2}{x}}$, for $x \neq 0$
$= e^2$, for $x = 0$

(B) $f(x) = \sin x - \cos x$, for $x \neq 0$
$= -1$, for $x = 0$

(C) $f(x) = \dfrac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1}$, for $x \neq 0$
$= -1$, for $x = 0$

(D) $f(x) = \dfrac{e^{5x} - e^{2x}}{\sin 3x}$, for $x \neq 0$
$= 1$, for $x = 0$

121. If $y = x \cdot 7^x$, then the value of $\dfrac{dx}{dy}$ when $x = 1$ is

(A) $7(\log 7 + 1)$ (B) $\log 7 + 1$

(C) $\dfrac{1}{7(\log 7 + 1)}$ (D) $\dfrac{1}{\log 7 + 1}$

122. If $y = [(x+1)(2x+1)(3x+1)\ldots\ldots(nx+1)]^4$, where $n \in N$ and $\dfrac{dy}{dx}$ at $x = 0$ is $2k$, then the value of k is

(A) $\dfrac{n(n+1)}{2}$ (B) $n(n+1)$

(C) $2n(n+1)$ (D) $4n(n+1)$

123. If $f(x) = \cos x \cos 2x \cos 4x \cos 8x \cos 16x$, then $f'\left(\dfrac{\pi}{4}\right)$ is equal to

(A) 1 (B) 0

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

124. The derivative of the function $f(x) = \cos^4 x + \sin^4 x$, $0 \leq x \leq 2\pi$ is positive for

(A) $0 < x < \dfrac{\pi}{8}$ (B) $\dfrac{\pi}{4} < x < \dfrac{\pi}{2}$

(C) $\dfrac{\pi}{2} < x < \dfrac{5\pi}{8}$ (D) $\dfrac{5\pi}{8} < x < \dfrac{3\pi}{4}$

125. The tangent to the curve intersects the Y-axis at point P. A line drawn through point P is perpendicular to this tangent and passes through another point $(1, 0)$. The differential equation of the curve is...

(A) $y\frac{dy}{dx} - x\left(\frac{dy}{dx}\right)^2 = 1$

(B) $x\frac{dy}{dx} - y\left(\frac{dy}{dx}\right)^2 = 1$

(C) $y\frac{dy}{dx} + x = 1$

(D) $x\frac{dy}{dx} + y = 1$

126. The function $f(x) = \int \frac{x+3}{x^2 - 9x + 20}\,dx$, then $f(x)$ is

(A) increases on R

(B) decreases on R - (4, 5)

(C) decreases on $(-\infty, -3] \cup (4, 5)$

(D) increases on $(-3, \infty)$

127. If $f(x) = \log(1+x) - \frac{x}{1+x}$, then the values of x for which $f(x)$ is monotonically increasing and monotonically decreasing are respectively.....

(A) $(-\infty, 0), (0, \infty)$

(B) $(0, \infty), (-\infty, 0)$

(C) $(-1, 0), (0, \infty)$

(D) $(0, \infty), (-1, 0)$

128. The number 28 is divided into two positive parts such that the sum of the cube of one part and the square of the other part is minimum, then the absolute difference between the two parts is

(A) 24

(B) 12

(C) 8

(D) 20

129. The value of $\int \frac{\sin^3 x}{(\cos^4 x + 3\cos^2 x + 1)\tan^{-1}(\sec x + \cos x)}\,dx$ is

(A) $\log\left(\tan^{-1}(\sec x + \cos x)\right) + c$

(B) $2\log\left(\tan^{-1}(\sec x + \cos x)\right) + c$

(C) $\frac{\left(\tan^{-1}(\sec x + \cos x)\right)^2}{2} + c$

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

130. The value of $\int 2x^{\frac{1}{3}} \sin\sqrt[3]{x^2}\,dx$ is

(A) $\left(x^{\frac{2}{3}}\cos x^{\frac{2}{3}} + \sin x^{\frac{2}{3}}\right) + c$

(B) $3\left[x^{\frac{2}{3}}\cos x^{\frac{2}{3}} - \sin x^{\frac{2}{3}}\right] + c$

(C) $3\left[-x^{\frac{2}{3}}\cos x^{\frac{2}{3}} - \sin x^{\frac{2}{3}}\right] + c$

(D) $3\left[-x^{\frac{2}{3}}\cos x^{\frac{2}{3}} + \sin x^{\frac{2}{3}}\right] + c$

131. $\int x^3 \log x\,dx =$

(A) $\frac{x^4}{16}[4\log x - 1] + c$

(B) $\frac{x^4}{16}[4\log x + 1] + c$

(C) $\frac{x^4}{16}[-4\log x - 1] + c$

(D) $\frac{x^4}{16}[-4\log x + 1] + c$

132. If $f'(x) = \frac{(\sqrt{x}+1)e^{\sqrt{x}}}{\sqrt{x}}$ and $f(0) = e$ then $f(1) = \ldots\ldots\ldots\ldots$

(A) e

(B) $2e$

(C) $3e$

(D) $4e$

133. The value of $\int_0^{\pi} \frac{1}{1 + 2^{\cos x}}\,dx$ is _____

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

(B) π

(C) 2π

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

134. If $I_n = \int_1^e (\log_e x)^n\,dx$ where $n \in Z^+$ and $I_m + mI_{2026} = e$, then $m =$

(A) 2024

(B) 2025

(C) 2026

(D) 2027

135. The area of the region bounded by the lines $2x - y + 1 = 0$, $y = -1$, $y = 3$ and the y-axis is _____

(A) 2

(B) 5

(C) 3

(D) 4

136. Area enclosed by curve $y = 2x^2$ and lines $x \geq 1$, $y \leq 4$ is ..... sq. units

(A) $\frac{8\sqrt{2} - 10}{3}$

(B) $\frac{8(\sqrt{2} - 1)}{3}$

(C) $\frac{4\sqrt{2} - 5}{3}$

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

137. If $y = e^{-mx}$ is a solution of the differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = 0$, then the values of m are

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

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

138. For the differential equation $(x^2 + y^2)\,dy = xy\,dx$, it is given that $y(1) = 1$ and $y(x_0) = e$, then the value of x_0 is _____

(A) e (B) $\pm\sqrt{3}\,e$

(C) $3e^2$ (D) e^2

139. In $\triangle OAB$, $O(0, 0, 0)$, $A(6, 2, -3)$ and $B(4, 0, 3)$ are the vertices. Let $\vec{a}$ and $\vec{b}$ be position vectors of points A and B respectively and OM is the projection of $\vec{a}$ on $\vec{b}$ then $l(AM)$ is equal to...

(A) $\sqrt{10}$ *units* (B) $2\sqrt{10}$ *units*

(C) 10 *units* (D) 40 *units*

140. Let

$\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} + 2\hat{j} + 2\hat{k}$,

$\vec{c} = 4\hat{i} - 3\hat{j} + \hat{k}$

, then the vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ are

(A) Linearly dependent (B) Orthogonal

(C) Linearly independent (D) Coplanar

141. Let

$\bar{a} = (a_1\hat{i} + a_2\hat{j} + a_3\hat{k})$, $\bar{b} = (b_1\hat{i} + b_2\hat{j} + b_3\hat{k})$,

$\bar{c} = (c_1\hat{i} + c_2\hat{j} + c_3\hat{k})$

be three non-zero vectors such that $\bar{a}$ is a unit vector perpendicular to both $\bar{b}$ and $\bar{c}$. If the angle between $\bar{b}$ and $\bar{c}$ is $\frac{\pi}{3}$ then $\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}^2 =$

(A) $\frac{3}{4}|\bar{b}|^2|\bar{c}|^2$ (B) 1

(C) 0 (D) $\frac{1}{4}|\bar{b}|^2|\bar{c}|^2$

142. Two adjacent sides of a parallelogram ABCD are given by $\overline{AB} = 2\hat{i} + 10\hat{j} + 11\hat{k}$ and $\overline{AD} = -\hat{i} + 2\hat{j} + 2\hat{k}$. The side AD is rotated by an acute angle α in the plane of the parallelogram so that AD becomes AD'. If AD' makes a right angle with the side AB, then the cosine of the angle α is given by

(A) $\frac{8}{9}$ (B) $\frac{\sqrt{17}}{9}$

(C) $\frac{1}{9}$ (D) $\frac{4\sqrt{5}}{9}$

143. If θ is the angle between the lines $\frac{x-1}{2} = \frac{2y+3}{4}$; $z = -2$ and $x = 1$; $\frac{y-1}{2} = \frac{z+1}{2}$, then

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

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

144. If for some $m \in \mathbb{R}$ the lines $L_1 : \frac{x+1}{m} = \frac{y-m}{-1} = \frac{z-1}{1}$ and $L_2 : \frac{x+2}{-4} = \frac{y+1}{9} = \frac{z+1}{1}$ are coplanar, then line L_1 passes through the point

(A) $(-7, 2, -5)$ (B) $(7, -2, 5)$

(C) $(7, 2, 5)$ (D) $(7, -2, -5)$

145. If the lines $\vec{r} = \hat{i} + \hat{j} - \hat{k} + \lambda(q\hat{i} - 2\hat{j} + \hat{k})$ and $\vec{r} = p\hat{i} - 3\hat{j} + 2\hat{k} + \mu(\hat{i} - 2\hat{j} + 2\hat{k})$ intersect each other and $q\hat{i} - 2\hat{j} + \hat{k}$ is collinear to $4\hat{i} - 4\hat{j} + 2\hat{k}$, then the values of p and q are

(A) $p = 4,\ q = 3$ (B) $p = 2,\ q = 3$

(C) $p = 4,\ q = 2$ (D) $p = 4,\ q = 1$

146. The angle between a diagonal and one of its edges of a cube is .....

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

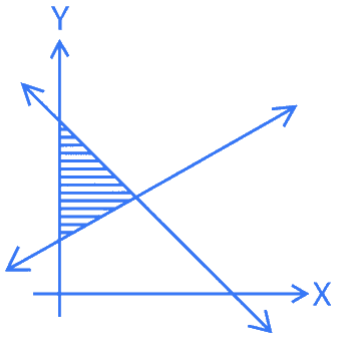
(C) $\cos^{-1}\left(\frac{1}{2\sqrt{2}}\right)$ (D) $\tan^{-1}\left(\sqrt{2}\right)$

147. For the linear programming problem, $x + 2y \leq 10$, $3x + y \leq 12$, $x, y \geq 0$, the maximum value of $z = 5x + 10y$ occurs at every point on the line segment joining the points..

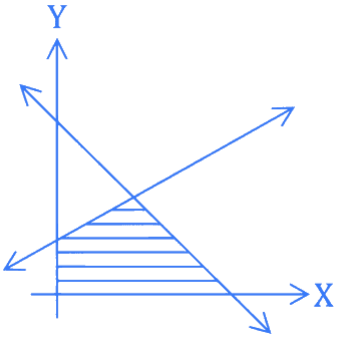
(A) $(0, 0)$ and $(4, 0)$ (B) $(0, 0)$ and $(0, 5)$

(C) $(4, 0)$ and $\left(\frac{14}{5}, \frac{18}{5}\right)$ (D) $(0, 5)$ and $\left(\frac{14}{5}, \frac{18}{5}\right)$

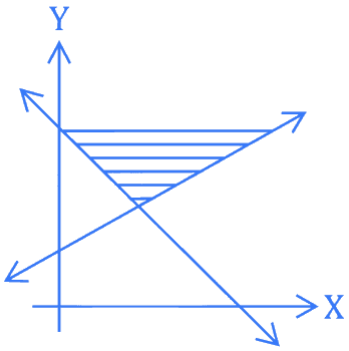
148. The region satisfying the inequalities $y - x \geq 2,\ x + y \leq 5,\ x \geq 0$ and $y \geq 0$ is



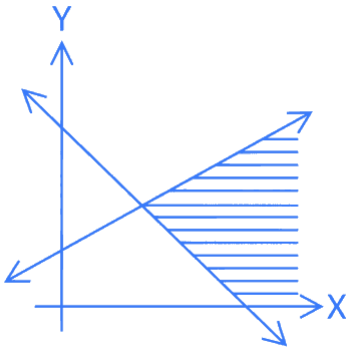
(A)



(B)



(C)



(D)

149. If the mean and the variance of a binomial variate X are 1 and 0.75 respectively, then which of the following is true?

(A) $P(X = 0) = 3P(X = 4)$

(B) $P(X = 1) = 2P(X = 2)$

(C) $P(X = 3) = 3P(X = 4)$

(D) $3P(X = 0) = 4P(X = 1)$

150. A box contains 8 red and N green balls. Two balls are drawn at random from it. If X is the random variable representing the number of green balls drawn and $E(X) = 1.2$, then $N = \ldots$

(A) 4 (B) 8

(C) 12 (D) 16

- End of Question Paper -