MHT CET 2026 PCM Apr 18 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. The angle made by vector $\vec{A} = 2\hat{i} + 3\hat{j}$ with x-axis and that with y-axis are respectively.

(A) $\tan^{-1} 2\sqrt{13}$, $\tan^{-1} 3\sqrt{13}$

(B) $\cos^{-1} \frac{2}{\sqrt{13}}$, $\cos^{-1} \frac{3}{\sqrt{13}}$

(C) $\cos^{-1} \frac{1}{\sqrt{2}}$, $\cos^{-1} \frac{1}{\sqrt{3}}$

(D) $\sin^{-1} \frac{1}{\sqrt{6}}$, $\sin^{-1} \frac{1}{2\sqrt{3}}$

2. If two resistors of resistances have values $R_1 = (350 \pm 3)\ \Omega$ and $R_2 = (140 \pm 4)\ \Omega$. The percentage error for the sum and difference of R_1 and R_2 are respectively

(A) 1.43% , 3.33%

(B) 7% , 1%

(C) 1% , 7%

(D) 3.33% , 1.43%

3. A body moves along a circular path of diameter 30 cm. It starts from one end of diameter, moves along the circular path and reaches the other end of diameter in 3 second. The angular speed of the body in radian per second is

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

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

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

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

4. A block of mass M is lying on a horizontal frictionless surface. One end of the uniform rope of half the mass of the block is fixed to the block which is pulled in the horizontal direction by applying a force F at the other end. The tension in the middle of the rope will be

(A) $\frac{F}{3}$

(B) $\frac{3F}{4}$

(C) $\frac{4F}{5}$

(D) $\frac{5F}{6}$

5. The angular momentum of a rotating body is 'L'. When the frequency of rotating body is tripled and its kinetic energy is made one-third, the new angular momentum becomes

(A) $9L$

(B) $6L$

(C) $\frac{L}{3}$

(D) $\frac{L}{9}$

6. A solid cylinder and a solid sphere having the same mass and radius roll down on the same smooth inclined plane. The ratio of the acceleration of the cylinder (a_c) to that of the sphere (a_s) is

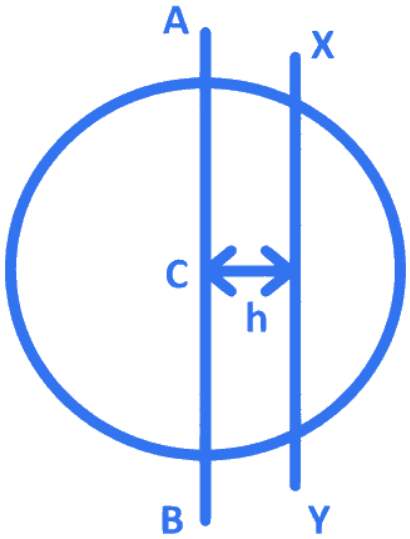
(A) $\frac{14}{15}$

(B) $\frac{15}{14}$

(C) $\frac{13}{14}$

(D) $\frac{11}{15}$

7. The radius of gyration K of a hollow sphere of mass M and radius R about an axis XY is equal to R as shown in figure. The distance of that axis from the center of the sphere is h. The value of h is



(A) $\frac{R}{\sqrt{3}}$

(B) $\frac{R}{2}$

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

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

8. The lengths of seconds pendulums on the surface of the earth and at an altitude 'h' from the surface of the earth are l_s and l_h respectively. The radius of the earth is

(A) $\frac{h\sqrt{l_h}}{\sqrt{l_s} - \sqrt{l_h}}$

(B) $\frac{h\sqrt{l_h}}{\sqrt{l_h} - \sqrt{l_s}}$

(C) $\frac{\sqrt{l_h}}{h(\sqrt{l_s} - \sqrt{l_h})}$

(D) $\frac{\sqrt{l_s}}{h(\sqrt{l_h} - \sqrt{l_s})}$

9. Time period of a simple pendulum is T_1 when on the earth's surface and T_2 when taken to a height '2R' above the earth's surface, where 'R' is the radius of the earth. The ratio $T_1 : T_2$ is

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

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

10. The pressure at half the depth of a lake is equal to two-third pressure at the bottom of the lake. So the depth 'h' of the lake is (ρ = density of water in the lake, g = acceleration due to gravity, P_0 = atmospheric pressure).

(A) $\frac{2P_0}{\rho g}$ (B) $\frac{P_0}{\rho g}$

(C) $\frac{2P_0}{3\rho g}$ (D) $\frac{P_0}{2\rho g}$

11. A spherical object is falling under gravity through a viscous fluid. The sphere attains the terminal velocity when

(A) viscous force is zero.

(B) buoyant force is equal to force due to gravity

(C) viscous force plus force of gravity becomes equal to buoyant force.

(D) buoyant force plus viscous force becomes equal to force due to gravity.

12. A piston of cross-sectional area 2.5×10^{-2} m^2 is used in a hydraulic lift to exert a force of 250 N on water. The cross-sectional area of the other piston which supports a car of mass 3000 kg is ($g = 9.8$ m/s^2)

(A) 1.96 m^2 (B) 2.94 m^2

(C) 3.92 m^2 (D) 5.88 m^2

13. Two spherical black bodies of radii R_1 and R_2 having surface temperature T_1 and T_2 respectively, radiate the same power. The ratio of R_1 to R_2 will be

(A) $\left(\frac{T_1}{T_2}\right)^2$ (B) $\left(\frac{T_1}{T_2}\right)^4$

(C) $\left(\frac{T_2}{T_1}\right)^2$ (D) $\left(\frac{T_2}{T_1}\right)^4$

14. The ratio of thermal conductivity of two rods of different materials is $4 : 3$. The two rods have same area of cross-section and same thermal resistance. The lengths of rods are in the ratio

(A) $5 : 4$ (B) $4 : 3$

(C) $1 : 5$ (D) $7 : 1$

15. In thermodynamic process for free expansion, select the '**WRONG**' statement out of the following options.

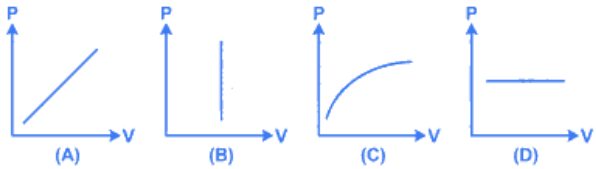
(A) Free expansions are adiabatic expansions and there is no exchange of heat between system and environment.

(B) A free expansion can be plotted on a p-V diagram.

(C) There is no work done on the system or by the system.

(D) It is an instantaneous change and the system is not in thermodynamic equilibrium.

16. Which of the following graphs between pressure and volume of a gas correctly shows isochoric process in thermodynamics?



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

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

17. The r.m.s. speed of hydrogen at S.T.P. is 'u' m/s. If the gas is heated at constant pressure till its volume becomes three times, the final temperature of the gas and the r.m.s. speed are respectively

(A) 1092 K , $3u$ m/s (B) 1092 K , $\frac{u}{3}$ m/s

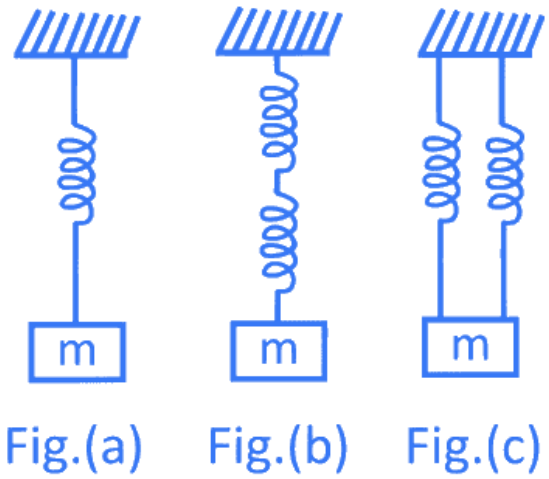
(C) 819 K , $\sqrt{3}\,u$ m/s (D) 819 K , $\frac{u}{\sqrt{3}}$ m/s

18. An ideal gas is heated from 27°C to 627°C at constant pressure. If initial volume of gas is 4 m^3, then the new volume of the gas will be

(A) 12 m^3 (B) 6 m^3

(C) 3 m^3 (D) 2 m^3

19.



All the springs in fig (a), (b) and (c) are identical, each one having force constant K. Mass m is attached to each system. If T_a, T_b and T_c are the periodic time of oscillations of the three systems in fig (a), (b) and (c) respectively, then

(A) $T_a = \sqrt{2}\,T_b$ (B) $T_b = 2T_a$

(C) $T_a = \dfrac{T_c}{\sqrt{2}}$ (D) $T_b = 2T_c$

20. A particle is performing simple harmonic motion about $x = 0$ with an amplitude 'a' and periodic time T. The speed of the particle at $x = \dfrac{a}{3}$ will be

(A) $\dfrac{2\pi a}{T}$ (B) $\dfrac{4\pi a}{3T}$

(C) $\dfrac{4\sqrt{2}\,\pi a}{3T}$ (D) $\dfrac{\sqrt{3}\,\pi^2 a}{2T}$

21. Two sources of sound are emitting progressive waves $y_1 = 4\sin 708\,\pi t$ and $y_2 = 3\sin 700\,\pi t$. The sources are placed close to each other. The number of beats heard per second and intensity ratio between waxing and wanning are respectively

(A) 4 , 16 : 9 (B) 8 , 16 : 9

(C) 8 , 49 : 1 (D) 4 , 49 : 1

22. Fifth overtone of an open pipe of length L_0 is in unison with the fifth overtone of the pipe closed at one end of length L_c.
The ratio L_0 to L_c is

(A) 11 : 6 (B) 11 : 12

(C) 6 : 11 (D) 12 : 11

23. The lengths of the two pipes open at both ends are L and $(L + L_1)$. If they are sounded together, the beat frequency will be
(v = velocity of sound in air)

(A) $\dfrac{vL_1}{L(L+L_1)}$ (B) $\dfrac{2vL_1}{L(L+L_1)}$

(C) $\dfrac{2L(L+L_1)}{vL_1}$ (D) $\dfrac{vL_1}{2L(L+L_1)}$

24. The number of waves counted by an observer on the sea-coast in one minute is 54. If the wavelength of the waves is 5 m then the velocity of the waves in m/s will be

(A) 4.5 (B) 5.4

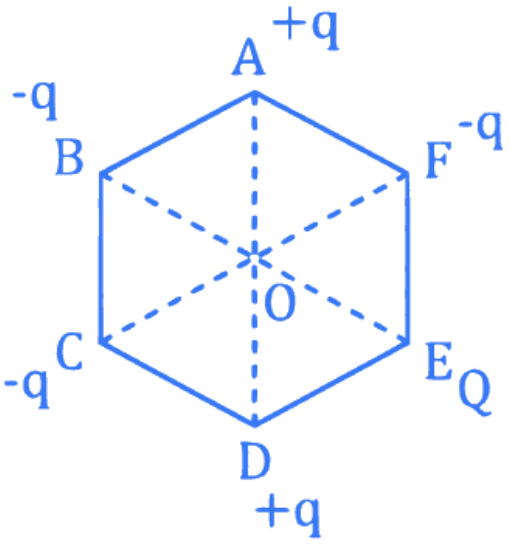
(C) 6.3 (D) 7.2

25. When a dipole placed parallel to electric field is rotating through π^c, the work done is W. The work done in rotating the dipole through $\left(\dfrac{\pi}{3}\right)^c$ is
($\cos 0^\circ = 1$, $\cos 60^\circ = \dfrac{1}{2}$, $\cos 180^\circ = -1$)

(A) $\dfrac{W}{4}$ (B) $\dfrac{W}{2}$

(C) W (D) $2W$

26. The point charges $+q$, $-q$, $-q$, $+q$, $+Q$ and $-q$ are placed at the vertices of a regular hexagon ABCDEF as shown in the figure.



The electric field at the centre of the hexagon 'O' due to the five charges at A, B, C, D and F is thrice the electric field at centre 'O' due to charge $+Q$ at E alone. The value of Q is

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

(C) $3q$ (D) $4q$

27. In an oscillating LC circuit, the maximum charge on the capacitor is Q. When the energy is stored equally between the electric and magnetic fields, the charge on the capacitor becomes

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

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

28. Two circular plates each of radius 'r' are kept parallel to each other distance 'd' apart. The capacitance of the capacitor formed is 'C_1'. If the radius of each of the plates is increased to $\sqrt{3}$ times the earlier radius and their distance of separation decreased to half the initial value, the capacitance now becomes 'C_2'. The ratio $C_1 : C_2$ is

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

(C) 1 : 6 (D) 6 : 1

29. A capacitor of capacitance C has charge Q and energy stored in it is W. If the charge is increased to 3Q, the energy stored in the capacitor W' will be

(A) $9W$ (B) $3W$

(C) $\frac{W}{3}$ (D) $\frac{W}{6}$

30. A potentiometer wire of length 4 m and resistance 5 Ω is connected in series with a resistance of 992 Ω and a cell of e.m.f. 4 V with internal resistance 3 Ω. The length of 0.75 m on potentiometer wire balances the e.m.f. of

(A) 2.50 mV (B) 3 mV

(C) 3.75 mV (D) 4 mV

31. By connecting a resistance of 980 Ω in series with a galvanometer, it is converted into a voltmeter of a certain range. When the resistance of 470 Ω is connected in series, the range is halved. The resistance of the galvanometer is

(A) 30 Ω (B) 40 Ω

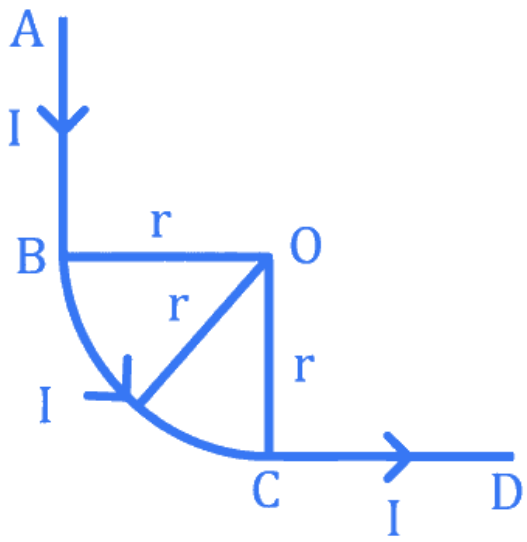
(C) 50 Ω (D) 60 Ω

32. The region inside a current carrying toroid is filled with a material (Niobium) having susceptibility $\chi = 2.6 \times 10^{-5}$. The percentage increase in the magnetic field in the presence of Niobium over that without it, is

(A) 2.6×10^{-5} (B) 2.6×10^{-4}

(C) 2.6×10^{-3} (D) 2.6×10^{2}

33. In the following figure, the magnitude of the magnetic field at point 'O' will be



(A) $\frac{\mu_0}{4\pi}\frac{I}{r}\left(\frac{2}{\pi}+2\right)$ (B) $\frac{\mu_0}{4\pi}\frac{I}{r}\left(\frac{2}{\pi}-2\right)$

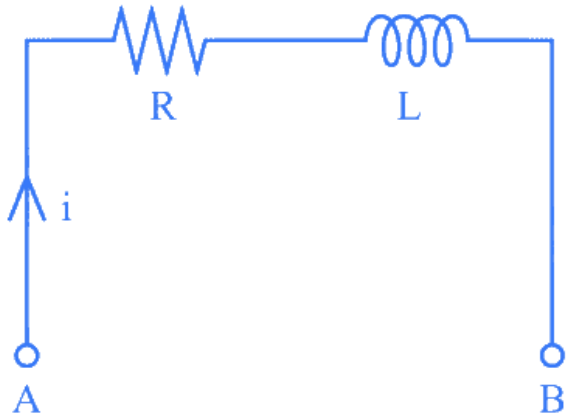
(C) $\frac{\mu_0}{4\pi}\frac{I}{r}\left(2+\frac{\pi}{2}\right)$ (D) $\frac{\mu_0}{4\pi}\frac{I}{r}\left(2-\frac{\pi}{2}\right)$

34. The ratio of magnetic field at the centre of the current carrying circular loop and its magnetic moment is 'x'. When both the current and radius are tripled, then the ratio will be

(A) $\frac{x}{27}$ (B) $\frac{x}{9}$

(C) $\frac{x}{3}$ (D) $3x$

35. In the circuit shown, when the current 'i' is 3A and increasing at the rate of 1A/s the measurement of the potential difference between A and B is 12 V. But when the same current 3A is decreasing at the rate of 1A/s, the measured potential difference V_{AB} between A and B is 6V. The value of 'R' in the circuit is



(A) 3 Ω (B) 4 Ω

(C) 6 Ω (D) 8 Ω

36. Two coils have a mutual inductance of 0.005 H. The current changes in the first coil according to equation $I = I_0 \sin\omega t$, where $I_0 = 10$ A and $\omega = 60\pi$ rad s^{-1}. The maximum values of e.m.f. in the second coil in volt will be

(A) 2π (B) 3π

(C) 4π (D) 6π

37. The magnetic potential energy stored in a certain inductor is 49 mJ when the current in the inductor is 70 mA. The inductance of the inductor is

(A) 0.20 H (B) 2.0 H

(C) 20 H (D) 200 H

38. An a.c. source is applied to a series LR circuit with $X_L = 3R$ and power factor is X_1. Now a capacitor with $X_c = R$ is added in series to LR circuit and power factor is X_2. The ratio X_1 to X_2 is

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

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

39. In an a.c. circuit, a resistance R is connected in series with an inductance 'L'. If phase angle between voltage and current is 45°, the value of inductive reactance will be

$(\sin 45^\circ = \frac{1}{\sqrt{2}} = \cos 45^\circ)$

(A) $2R$ (B) R

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

40. A simple microscope is a combination of two lenses in contact. Their powers are $+20$D and -4D. The distance of distinct vision is 25 cm. When seen through the microscope, the size of the image of an object 3 mm high is

(A) 1.8 cm (B) 1.5 cm

(C) 1.2 cm (D) 0.6 cm

41. When a glass plate of refractive index 1.44 is introduced in the path of one of the interfering beams, the fringes are displaced by a distance 'y'. If this plate is replaced by another plate of same thickness but of refractive index 1.66, the fringes will be displaced by a distance

(A) $\frac{2y}{3}$ (B) $\frac{4y}{5}$

(C) $\frac{5y}{4}$ (D) $\frac{3y}{2}$

42. In a certain region of the screen, number of fringes formed is observed to be 8 in Young's double slit experiment when light of wavelength 6600 Ã_x0085_ is used. If the light of wavelength 4400 Ã_x0085_ is used, the number of fringes observed in the same region of the screen will be

(A) 10 (B) 12

(C) 16 (D) 18

43. In a Fraunhofer diffraction of a single slit, when a slit is illuminated by a light of wavelength 6480 Ã_x0085_, angular width of central maximum is measured. When the slit is illuminated by light of another wavelength 'λ' the angular width decreases by 25%. The value of λ in Ã_x0085_ units is

(A) 4220 (B) 4530

(C) 4860 (D) 5230

44. If the kinetic energy of a particle is increased to 16 times, the percentage change in the de Broglie wavelength of a particle is

(A) 40 % (B) 60 %

(C) 75 % (D) 80 %

45. In case of photoelectric emission from certain metal, the cutoff frequency is ν. If the radiation of frequency 3ν is incident on the metal plate, the maximum possible velocity of the emitted electrons will be (m = mass of electron, h = Planck's constant)

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

(C) $2\left(\sqrt{\frac{h\nu}{m}}\right)$ (D) $\sqrt{\frac{2h\nu}{m}}$

46. The triply ionized beryllium (Be^{+++}) has the same electron orbital radius as that of the ground state of hydrogen. Hence, the energy state of triply ionized beryllium is (Given $Z = 4$ for beryllium)

(A) $n = 4$ (B) $n = 3$

(C) $n = 2$ (D) $n = 1$

47. The angular momentum of the electron in the third Bohr orbit of a hydrogen atom is 'l' so its angular momentum in the fourth Bohr orbit is

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

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

48. Which one of the following statements is 'WRONG' regarding LED?

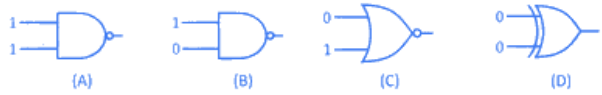
(A) LED's have long lifetime if properly manufactured.

(B) Colours produced by LED's do not fade out.

(C) LED's are energy efficient.

(D) Brightness of light emitted by LED cannot be controlled.

49. Which of the following logic gates will have an output of '1' (one) for the given inputs?



(A) D (B) B

(C) A (D) C

50. A diode and resistance are connected as shown in figures.

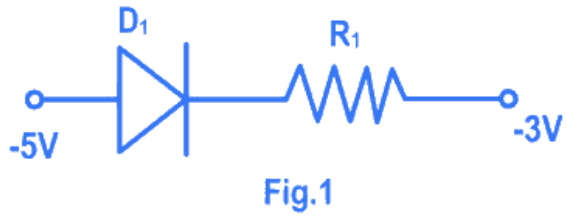


Fig.1



Fig.2

Out of the following statements, which one is true?
Diode in
A) fig (1) and fig (2) are both forward biased.
B) fig (1) and fig (2) are both reverse biased.
C) fig (1) is forward biased and in fig (2) is reverse biased.
D) fig (1) is reverse biased and in fig (2) is forward biased.

(A) D
(B) B
(C) A
(D) C

51. How many moles of potassium chlorate are heated to produce 22.4 lit of oxygen at STP ?

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

52. Which of the following colours of visible light has lowest energy?

(A) Violet (B) Blue
(C) Yellow (D) Red

53. What is formal charge on sulphur in sulphuric acid molecule?

(A) -2 (B) $+2$
(C) -1 (D) 0

54. Which of the following compound has square pyramidal structure?

(A) XeF_4 (B) XeF_6
(C) XeO_3 (D) $XeOF_4$

55. Which of the following metal halides have more covalent character?

(A) $SnCl_2$ (B) $PbCl_4$
(C) $SbCl_3$ (D) $PbCl_2$

56. What ratio by mass of 'Ne' and CH_4 should be mixed so that partial pressure exerted by each gas is same?

(A) 1 : 1 (B) 2 : 1
(C) 2 : 3 (D) 5 : 4

57. Calculate ΔH for the following reaction at 300 K
$2C_{(s)} + 3H_{2(g)} \longrightarrow C_2H_{6(g)}$ if ΔU for the reaction is -80 kJ ($R = 8.314\ JK^{-1}mol^{-1}$)

(A) -85.00 kJ (B) -43.00 kJ
(C) -128.00 kJ (D) -170.00 kJ

58. For a certain reaction, $\Delta H^\circ = 40$ kJ and $\Delta S^\circ = 80\ JK^{-1}$. Find the temperature so that $\Delta G^\circ = 0$

(A) 500 K (B) 400 K
(C) 300 K (D) 600 K

59. Which from following is correct expression of first law of thermodynamics for isothermal process?

(A) $W = -Q$
(B) $-\Delta U = -W$
(C) $\Delta U = Q_v$
(D) $Q_p = \Delta U + P_{ext}\Delta V$

60. Which of the following is Lewis acid?

(A) $BaCl_2$ (B) KCl
(C) $BeCl_2$ (D) LiCl

61. The solubility of a sparingly soluble a salt AB_2 is $1 \times 10^{-6}\ mol/dm^3$. Calculate its solubility product?

(A) 1×10^{-12} (B) 2×10^{-12}
(C) 3×10^{-12} (D) 4×10^{-18}

62. What is the molarity of H_2SO_4 solution having pH = 4 ?

(A) 4×10^{-1} M (B) 4×10^{-2} M
(C) 5×10^{-5} M (D) 1×10^{-4} M

63. Identify the conjugate bases of H_3PO_3 and H_2SO_4 respectively from following.

(A) HPO_3^{2-} and SO_4^{2-} (B) HPO_3^{2-} and HSO_4^-
(C) $H_2PO_3^-$ and HSO_4^- (D) PO_3^{3-} and SO_4^{2-}

64. What happens in the oxidation number of Mn during working of dry cell.

(A) Increases by 1 (B) decreases by 1
(C) Increases by 2 (D) decreases by 2

65. What is the formula of Tin (IV) oxide?

(A) Sn_2O_3 (B) SnO_2
(C) SnO_4 (D) SnO

66. Identify the name of second higher homologue of formic acid?

(A) Methanoic acid (B) Ethanoic acid
(C) Propanoic acid (D) Butanoic acidaa

67. What is the of number of chiral carbon atoms present in 2-Bromo-3,4,5-trimethylhexane ?

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

68. Which of the following alkyl chlorides on Wurtz reaction gives 2, 2, 5, 5- tetramethylhexane ?

(A) $(CH_3)_2CH - CH_2 - Cl$

(B) $(CH_3)_3C - CH_2 - Cl$

(C) $(CH_3)_2CH - \underset{\displaystyle CH_3}{\underset{|}{CH}} - Cl$

(D) $CH_3 - CH_2 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_3$

69. Calculate the number of atoms present in 1 g metal that forms simple unit cell structure if product of density and volume of unit cell is 66.5×10^{-24} g

(A) 1.504×10^{22} (B) 3.419×10^{22}

(C) 2.516×10^{22} (D) 2.018×10^{22}

70. Calculate the void volume in fcc unit cell if total volume of a unit cell is 6.4×10^{-23} cm^3 ?

(A) 3.172×10^{-23} cm^3 (B) 3.911×10^{-23} cm^3

(C) 1.664×10^{-23} cm^3 (D) 2.051×10^{-23} cm^3

71. What is the total number of Bravais lattices in orthorhombic crystal system?

(A) 3 (B) 2

(C) 1 (D) 4

72. 40 gram nonelectrolyte solute having molar mass 180 g mol^{-1} dissolved in water has osmotic pressure 2 atm at 300 K. Calculate the volume of solution. ($R = 0.0821$ atm $mol^{-1}K^{-1}$)

(A) 2.10 dm^3 (B) 2.34 dm^3

(C) 2.74 dm^3 (D) 3.40 dm^3

73. Calculate the molality of solution of non-volatile solute if boiling point of solution, molal elevation constant for solvent are 319.8 K and 2.5 K kg mol^{-1} respectively [Boiling point of solvent = 319.5 K]

(A) 0.12 mol kg^{-1} (B) 0.14 mol kg^{-1}

(C) 0.17 mol kg^{-1} (D) 0.21 mol kg^{-1}

74. Identify correct statements from following regarding 0.2 M urea and 0.2 M sucrose solutions.

(A) The urea solution is hypertonic to sucrose solution.

(B) The osmotic pressure of urea solution is higher than that of sucrose solution.

(C) These solutions exhibit same osmotic pressure.

(D) The sucrose solution is hypotonic to urea solution.

75. For a certain redox reaction in galvanic cell $X_{(s)} + Y^{2+}_{(aq)} \longrightarrow X^{2+}_{(aq)} + Y_{(s)}$, E° cell is 0.0296 V at 298 K. What is equilibrium constant of reaction?

(A) 1 (B) 10

(C) 100 (D) 1000

76. Which of the following net cell reactions occurs in a galvanic cell containing cadmium electrode and standard hydrogen electrode?
$E^\circ_{(Cd^{2+}_{(aq)}|Cd_{(s)})} = -0.403$ V.

(A) $H_{2(g)} + Cd^{2+}_{(aq)} \longrightarrow 2H^+_{(aq)} + Cd_{(s)}$

(B) $Cd_{(s)} + 2H^+_{(aq)} \longrightarrow Cd^{2+}_{(aq)} + H_{2(g)}$

(C) $2H_{2(g)} + Cd^{2+}_{(aq)} \longrightarrow 4H^+_{(aq)} + Cd_{(s)}$

(D) $2Cd_{(s)} + 2H^+_{(aq)} \longrightarrow 2Cd^{2+}_{(aq)} + H_{2(g)}$

77. In a first order reaction 20 millimole of reactant is lowered to 10 millimole in 0.3010 minute. Find rate constant of the reaction?

(A) 3.010 $minute^{-1}$ (B) 0.602 $minute^{-1}$

(C) 2.303 $minute^{-1}$ (D) 0.301 $minute^{-1}$

78. For the reaction $2NOBr_{(g)} \longrightarrow 2NO_{(g)} + Br_{2(g)}$, rate law is $r = k[NOBr]^2$. Rate constant is 1.62 M s^{-1} and concentration of NOBr is 5×10^{-3} M,
What is rate of reaction?

(A) 4.05×10^{-5} M s^{-1} (B) 6.48×10^{-6} M s^{-1}

(C) 2.12×10^{-5} M s^{-1} (D) 8.63×10^{-6} M s^{-1}

79. Which of the following reactions has of overall order 1.5 ?

(A) $2H_2O_{2(g)} \longrightarrow 2H_2O_{(\ell)} + O_{2(g)}$

(B) $H_{2(g)} + I_{2(g)} \longrightarrow 2HI_{(g)}$

(C) $CH_3CHO_{(g)} \longrightarrow CH_{4(g)} + CO_{(g)}$

(D) $2NO_{(g)} + 2H_{2(g)} \longrightarrow N_{2(g)} + 2H_2O_{(\ell)}$

80. Which from following anions has greater power for coagulation of positive sol?

(A) Cl^- (B) $[Fe(CN)_6]^{4-}$

(C) PO_4^{2-} (D) SO_4^{2-}

81. Which actinoid from following has smallest ionic size in $+3$ state?

(A) Pa (B) Cm

(C) Fm (D) Lr

82. What is the total number of transition series of d-block elements?

(A) 3 (B) 4

(C) 10 (D) 12

83. Identify a ligand with highest field strength among the following.

(A) H_2O (B) NH_3

(C) S^{2-} (D) NCS^-

84. Find EAN of Fe in $Fe(CO)_5$

(A) 35 (B) 36

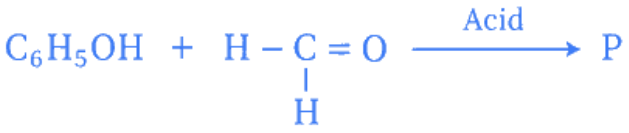
(C) 26 (D) 30

85. The reaction of aryl halide with sodium metal in dry ether to give biphenyl is known as

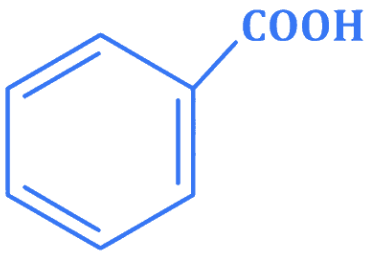
(A) Swartz reaction (B) Wurtz reaction

(C) Fittig reaction (D) Wrutz-fittig reaction

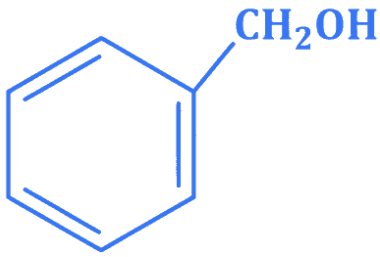
86. Identify the product P obtained in following reaction



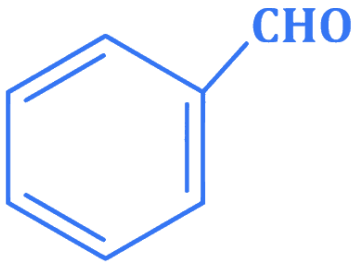
(A)



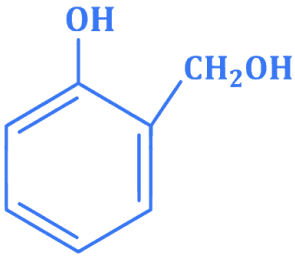
(B)



(C)



(D)



87. Which among the following has lowest boiling point?

(A) n - Butyl alcohol (B) Isobutyl alcohol

(C) sec-Butyl alcohol (D) tert-Butyl alcohol

88. Which from following is obtained by hydroboration - oxidation of propene?

(A) Propanal (B) Propanone

(C) Propan-1-ol (D) Propan-2-ol

89. Identify the reagent 'R' used in the following reaction

$C_6H_5COCl \xrightarrow{R} C_6H_5CHO + HCl$

(A) CO, HCl (B) $H_2, Pd - BaSO_4$

(C) $DIBAl - H$ (D) H_2O

90. Identify the product 'B' in the following reaction

Isopropyl cyanide $\xrightarrow{SnCl_2, HCl}$ A $\xrightarrow{H_3O^+}$ B + NH_4Cl

(A) Propanal (B) Propanone

(C) 2-Methylpropanal (D) 2-Methylpropanoic acid

91. Benzonitrile on reaction with a reagent in dry ether followed by hydrolysis forms benzophenone along with ammonia and hydroxymagnesium bromide. Identify the reagent used in above transformation.

(A) C_6H_5MgCl (B) C_2H_5MgBr

(C) C_6H_5MgI (D) C_6H_5MgBr

92. Propyne on reaction with water in presence of 40% sulphuric acid and 1% mercuric sulphate forms

(A) Propan-1-ol (B) Propan-2-ol

(C) Propanone (D) Propanal

93. Identify final products in the following sequence of reactions

RCOOH + R'OH $\xrightarrow{H^+}$ intermediate $\xrightarrow[Ni, \Delta]{H_2}$ Products

(A) R'COOH + RCH_2OH

(B) $RCH_2OH + R' - OH$

(C) $R'CH_2OH + R - OH$

(D) $R - OH + R' - OH$

94. Which from following amines does NOT form alkyl isocyanide when heated with alc. KOH and chloroform

(A) Methanamine (B) Propan-2-amine

(C) N, N-Diethylethanamine (D) Ethanamine

95. Which from following statements is NOT correct regarding Hofmann's exhaustive alkylation?

(A) In this quaternary ammmonium salts are obtained.

(B) Two moles of alkylhalide when heated with one mole primary amine forms tetraalkyl ammonium halide.

(C) Depending on the quantity of alkyl halides treated with primary amine, the mixture of secondary and tertiary amines obtained.

(D) The reaction is carried out in presence of $NaHCO_3$

96. Which from following is NOT a globular protein?

(A) Serum albumin (B) Insulin

(C) Egg albumin (D) Keratin

97. Which of the following has largest size?

(A) Antibody (B) Virus

(C) Bacteria (D) Cancer cell

98. What is the total mass of products obtained when one gram mole of sucrose is hydrolysed?

(A) 180 g (B) 342 g

(C) 170 g (D) 360 g

99. Which from following polymers is NOT obtained by addition polymerisation method?

(A) Teflon (B) Polyacrolonitrile

(C) LDP (D) PHBV

100. Which medicinal property is exhibited by methylsalicylate?

(A) Analgesic (B) Antioxident

(C) Antiseptic (D) Antimicrobial

101. The value of $\left(\frac{-1+i\sqrt{3}}{2}\right)^{18}+\left(\frac{-1-i\sqrt{3}}{2}\right)^{18}$ is

(A) 2 (B) 35

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

102. 11 players of the Indian cricket team are sitting at a circular table. The number of ways they can sit so that two players, the wicket keeper and the captain never sit together is ___

(A) 10! (B) $2\times 9!$

(C) $8\times 9!$ (D) $9\times 9!$

103. In $\triangle ABC$, if $\angle C=\frac{\pi}{3}$, then the value of $\cos^2 A+\cos^2 B+\cos A\cos B$ is...

(A) $\frac{3}{4}$ (B) $\frac{5}{4}$

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

104. The line L_1 given by $\frac{x}{p}+\frac{y}{2}=1$ passes through the point $(5,0)$. The line L_2 given by $\frac{x}{10}+\frac{y}{q}=1$ is parallel to L_1. Then the distance between the lines L_1 and L_2 is...

(A) $\frac{10}{\sqrt{29}}$ (B) $\frac{19}{2\sqrt{29}}$

(C) $\frac{5}{\sqrt{41}}$ (D) $\frac{10}{\sqrt{41}}$

105. Two lines are given by $x^2-4xy+4y^2+kx-2ky=0$, then the value of k so that the distance between them is 3 is

(A) $\sqrt{5}$ (B) $3\sqrt{3}$

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

106. The area of the region (in sq. unit) bounded by x-axis, the tangent and normal to the circle $x^2+y^2=4$, drawn at a point $(1,\sqrt{3})$ is

(A) 5 (B) $\sqrt{3}$

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

107. The tangent to the circle $x^2+y^2=10$ at the point $(3,1)$ touches the circle $x^2+y^2-2\sqrt{10}x-20y+k=0$, then the value of k is...

(A) -109 (B) 109

(C) -101 (D) 101

108. If the eccentricity of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1,(a>b)$ is $\frac{2}{3}$ and its focal chord is $3x+2y-6=0$, then the value of a^2+b^2 is...

(A) 11 (B) 12

(C) 13 (D) 14

109. If $\lim\limits_{x\to\infty}\left[\frac{x^2+x+1}{x+1}-ax-b\right]=3$, then $a-b=$...

(A) 2 (B) 3

(C) -2 (D) 4

110. The correct logical equivalence from the following is /are ___

(I) $p\to(q\to r)\equiv(p\wedge q)\to r$

(II) $(p\to q)\to r\equiv p\to(q\vee r)$

(III) $(p\to q)\to r\equiv(p\to r)\wedge(\sim q\to r)$

(IV) $p\to(q\to r)\equiv q\to(p\to r)$

(A) only (I) and (II) (B) only (III) and (IV)

(C) only (II) and (IV) (D) only (I) and (IV)

111. The contrapositive of the statement pattern $[p\vee(p\to q)]\to(p\wedge\sim q)$ is

(A) $(p\wedge\sim q)\to[p\wedge(p\to q)]$

(B) $(\sim p\wedge\sim q)\to[\sim p\wedge(p\to\sim q)]$

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

(D) $(\sim p\vee q)\to[\sim p\wedge(p\wedge\sim q)]$

112. The negation of the converse of $p\vee q$ is

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

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

113. In triangle ABC, with usual notations, if $(a+b+c)(a+b-c)=ab$, then the measure of angle C is...

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

(C) $\frac{5\pi}{6}$ (D) $\frac{3\pi}{4}$

114. In $\triangle ABC$, with usual notation, if $a = 13, b = 14, c = 15$, then the sum of the values of $\sin\left(\frac{A}{2}\right)$ and $\sin A$ is....

(A) $\frac{14}{5\sqrt{5}}$ (B) $\frac{\sqrt{5}+4}{5}$

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

115. Let $A = \begin{bmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$. If $B = \text{adj}\, A$, then the matrix B^{-1} is equal to...

(A) I (B) A^{-1}

(C) $-A$ (D) A

116. Let $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & -13 \\ 5 & -10 \end{bmatrix}$ be two matrices. If the variables x and y satisfy the matrix equation $((A^{-1})^2 + B)\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, then the ordered pair $(x, y) =$

(A) $(3, 5)$ (B) $(10, 7)$

(C) $(4, 6)$ (D) $(5, 3)$

117. If $0 \le x \le 1$, $I_1 = \int \sin^{-1}\sqrt{1-x^2}\,dx$ and $I_2 = \int \sin^{-1} x\,dx$, then which of the following is true?

(A) $I_1 = I_2$ (B) $I_1 = \frac{\pi}{2}I_2$

(C) $I_1 + I_2 = \frac{\pi}{2}x$ (D) $I_1 + I_2 = \frac{\pi}{2}$

118. Let $t \in (0,1)$ and $\alpha \in \left(0, \frac{\pi}{4}\right)$. If $x = \text{cosec}^{-1}\left(\frac{1+t^2}{2t}\right)$, $y = \cot^{-1}\left(\frac{\sqrt{1-t^2}}{t}\right)$ and $\frac{dy}{dx} = f(t)$, then the value of $f(\tan\alpha)$ is

(A) $\frac{\sec\alpha}{\sqrt{\cos 2\alpha}}$ (B) $\frac{\sec\alpha}{2\sqrt{\cos 2\alpha}}$

(C) $\frac{\cos\alpha}{2\sqrt{\cos 2\alpha}}$ (D) $\frac{\cos\alpha}{\sqrt{\cos 2\alpha}}$

119. If $y = \tan^{-1}\left(\frac{\log\left(\frac{e}{x^3}\right)}{\log ex^3}\right) + \tan^{-1}\left(\frac{\log(e^4x^3)}{\log\left(\frac{e}{x^{12}}\right)}\right)$, $x \in \left(e^{-\frac{1}{3}}, e^{\frac{1}{12}}\right)$ then $\frac{dy}{dx}$ is equal to...

(A) 1 (B) 0

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

120. If $0 \le x \le 1$ and $(\sin^{-1}x)^3 + (\cos^{-1}x)^3 = a\pi^3$ then

(A) $a \ge \frac{1}{32}$ (B) $a \ge \frac{1}{16}$

(C) $a \le \frac{1}{32}$ (D) $a \le \frac{1}{16}$

121. If $\sum_{n=1}^{2026} \tan^{-1}\left(\frac{1}{n^2+n+1}\right) = \tan^{-1}\left(1 - \frac{1}{x}\right)$, where $x \ne 0$, then $x =$

(A) 2028 (B) 2026

(C) 1014 (D) 1013

122. Let $f(x) = ax + b$ and $g(x) = cx + d$. The condition $f(g(x)) = g(f(x))$ holds for all x if and only if ...

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

(C) $f(d) = g(b)$ (D) $f(c) = g(a)$

123. The number of point / points where the function $f(x) = \frac{1}{x^2 - 5|x| + 6}$ is discontinuous is.....

(A) 0 (B) 1

(C) 2 (D) 4

124. If $x\,e^{xy} = y + \sin^2 x$, then the value of $\frac{dy}{dx}$ at $x = 0$ is equal to

(A) -1 (B) 1

(C) -2 (D) 2

125. If $g(x) = (x^2 + 2x + 1)\cdot f(x)$ such that $f(0) = 5$ and $\lim_{x\to 0}\frac{f(x)-5}{x} = 4$ then $g'(0) =$

(A) 20 (B) 12

(C) 18 (D) 14

126. If the line $x + By + C = 0$ is the normal to the curve given by $x = a\sin^3 t$, $y = b\cos^3 t$, (where $a, b \ne 0$) at a point $t = \frac{\pi}{2}$, then $B - C =$

(A) a (B) $2a$

(C) $-a$ (D) 0

127. If the tangent to the curve $xy + ax + by = 0$ at $(1, 1)$ makes an angle of $\tan^{-1}2$ with positive direction of the x-axis, then the value of $\frac{ab}{a+b}$ is...

(A) 1 (B) -1

(C) 2 (D) -2

128. If the side of an equilateral triangle increases at the rate of $\sqrt{3}$ cm/sec, then the rate of change of increase of its area when the side is 12 cm is ____

(A) 18 cm^2/sec (B) 10 cm^2/sec

(C) 12 cm^2/sec (D) $3\sqrt{3}$ cm^2/sec

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

(A) $\frac{x}{2}[\sin(\log x) - \cos(\log x)] + c$

(B) $\frac{x}{2}[\sin(\log x) + \cos(\log x)] + c$

(C) $\frac{x}{2}[\cos(\log x) - \sin(\log x)] + c$

(D) $\frac{x}{4}[\cos(\log x) - \sin(\log x)] + c$

130. The value of $\int \frac{n\sqrt{\text{cosec}^2 x^n - 1}}{x^{(1-n)}}\,dx$ is ...

(A) $\log(\sin x) + c$ (B) $\log(\sin x^n) + c$

(C) $\log(\cot x^n) + c$ (D) $\log(\cos x^n) + c$

131. $\int \frac{(x+1)\,dx}{x(1+xe^x)} = \ldots\ldots$

(A) $\log\left|\frac{xe^x}{1+xe^x}\right| + c$ (B) $\log\left|\frac{1+xe^x}{xe^x}\right| + c$

(C) $\log\left|\frac{(x+1)e^x}{xe^x}\right| + c$ (D) $\log\left|\frac{(x+1)e^x}{1+xe^x}\right| + c$

132. The value of the definite integral $\int_0^{\log_e 5} \frac{e^x\sqrt{e^x-1}}{e^x+3}\,dx$ is equal to...

(A) $5+\pi$ (B) $5-\pi$

(C) $4+\pi$ (D) $4-\pi$

133. If $[\cdot]$ denotes the greatest integer function, then $\int_0^{\pi/3}[\tan x]\,dx =$

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{6}$

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

134. The area (in square units) bounded by the line $y = x$, the X-axis and the lines $x = -2$ and $x = 4$ is...

(A) 6 (B) $\frac{15}{2}$

(C) $\frac{17}{2}$ (D) 10

135. The equation of the curve whose slope is $\frac{y-1}{x^2+x}$ and which passes through the point $(1, 0)$ is

(A) $xy - x - y - 1 = 0$

(B) $(y-1)(x+1) = 2x$

(C) $xy + x + y - 1 = 0$

(D) $y(x+1) - x + 1 = 0$

136. A body cools from 100°C to 60°C in 20 minutes, the temperature of the surroundings being 20°C. The total time taken (in minutes) for the body to cool down to 40°C is ...

(A) 60 (B) 40

(C) 50 (D) 30

137. The general solution of the differential equation $x\sin x\frac{dy}{dx} + (x\cos x + \sin x)y = \sin x$ is

(A) $x\sin x + y\cos x = c$ (B) $y\sin x + x\cos x = c$

(C) $xy\sin x - \cos x = c$ (D) $xy\sin x + \cos x = c$

138. If $\bar{a} = \hat{i} - \hat{k}$, $\bar{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}$ and $\bar{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$ then $[\bar{a}\,\bar{b}\,\bar{c}]$ depends on

(A) only x (B) neither x nor y

(C) either x or y (D) only y

139. Let $\bar{u}, \bar{v}, \bar{w}$ be three vectors such that $|\bar{u}| = 1, |\bar{v}| = 2, |\bar{w}| = 3$. If the projection of $\bar{v}$ along $\bar{u}$ is equal to the projection of $\bar{w}$ along $\bar{u}$ and $\bar{v}, \bar{w}$ are perpendicular to each other, then $|\bar{u} - \bar{v} + \bar{w}| =$...

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

(C) 2 (D) $\sqrt{14}$

140. Let $\bar{a}, \bar{b}, \bar{c}$ be three vectors of equal magnitude such that the angle between $\bar{a}$ and $\bar{b}$ is α, $\bar{b}$ and $\bar{c}$ is β, $\bar{c}$ and $\bar{a}$ is γ.
Then the minimum value of $\cos\alpha + \cos\beta + \cos\gamma$ is ...

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

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

141. A vector which is orthogonal to the vector $\bar{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and coplanar with the vectors $\bar{b} = 3\hat{i} + 2\hat{j}$ and $\bar{c} = 2\hat{i} + \hat{j} + 3\hat{k}$ is

(A) $25\hat{i} + 19\hat{j} - 21\hat{k}$ (B) $-25\hat{i} + 19\hat{j} - 21\hat{k}$

(C) $-25\hat{i} + 19\hat{j} + 21\hat{k}$ (D) $25\hat{i} + 19\hat{j} + 21\hat{k}$

142. The line ℓ passes through the point $(2,1,1)$ and is parallel to the plane $x+y+2z=18$. If line ℓ intersects the line $\frac{x+2}{3}=\frac{y+1}{-1}=\frac{z-2}{1}$, then equation of the line ℓ is...

(A) $\frac{x-2}{3}=\frac{y-1}{1}=\frac{z-1}{-2}$

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

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

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

143. The acute angle θ between the xy-plane and the plane passing through the point $(1,2,4)$ and parallel to the vectors with direction ratios $3,2,-1$ and $1,-2,-2$ is...

(A) $\cos^{-1}\left(\frac{8}{5\sqrt{5}}\right)$ (B) $\cos^{-1}\left(\frac{5}{8\sqrt{5}}\right)$

(C) $\sin^{-1}\left(\frac{8}{5\sqrt{5}}\right)$ (D) $\frac{\pi}{4}$

144. If the plane $\bar{r}=(\lambda+\mu)\hat{i}+(2+\mu)\hat{j}+(3\lambda+2\mu)\hat{k}$, where λ and μ are parameters, intersects coordinate axes at points $(a,0,0)$, $(0,b,0)$ and $(0,0,c)$ then $a+b+c=$...

(A) $\frac{7}{2}$ (B) 5

(C) $\frac{8}{3}$ (D) $\frac{10}{3}$

145. The coordinates of the point of intersection of the lines $\frac{x-3}{1}=\frac{y-5}{2}=\frac{z-1}{-1}$ and $\frac{x-4}{2}=\frac{y-2}{-1}=\frac{z-4}{2}$ are...

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

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

146. If the plane $2x+3y+z=6$ cuts coordinate axes at A, B and C, then the volume of tetrahedron OABC (where O is the origin) is .....cubic units.

(A) 30 (B) 6

(C) 36 (D) 180

147. The maximum value of $Z=4x+5y$, subject to the constraints $3x+y\leq 15, 3x+4y\leq 24, x\geq 0, y\geq 0$ is

(A) 31 (B) 30

(C) 42 (D) 47

148. A fair coin is tossed 9 times. On each toss, a man predicts that the outcome will be heads. The probability that the number of successful predictions is strictly greater than the number of unsuccessful predictions is...

(A) $\frac{3}{4}$ (B) $\frac{1}{6}$

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

149. Let $F(x)$ be the cumulative distribution function (c.d.f.) of a continuous random variable X. If $F(b)=0.7$ and $P(X>a)=0.4$, then the value of $P(a<X<b)$ is ...

(A) 0.1 (B) 0.2

(C) 0.3 (D) 0.5

150. If the probabilities of a student succeeding in the entrance tests for institutes A, B and C are 0.6, 0.5 and 0.4 respectively, while the probability of succeeding in both A and B is 0.3, in both B and C is 0.2, in both A and C is 0.2, and in all three is 0.1, then the probability that the student succeeds in exactly one of these tests is.....

(A) 0.3 (B) 0.4

(C) 0.5 (D) 0.6

- End of Question Paper -