MHT CET 2026 PCM May 19 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 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. A vector $\vec{A}$ of magnitude $7\sqrt{2}$ unit, another vector $\vec{B}$ of magnitude 14 unit are inclined at an angle of 60°. The magnitude of the scalar product $(\vec{A}\cdot\vec{B})$ is $\left[\cos(60)^\circ = \frac{1}{2}\right]$

(A) $49\sqrt{2}$ (B) $7\sqrt{2}$

(C) $14\sqrt{2}$ (D) $9\sqrt{2}$

2. A wire has mass (0.4 ± 0.002) g, radius (0.6 ± 0.006) mm and length (8 ± 0.04) cm. The percentage error in the measurement of its density is

(A) 2% (B) 2.55%

(C) 3% (D) 3.55%

3. The minute hand of a wall-clock is 10 cm long. The average velocity of the tip of the minute hand between 6.00 am to 7.30 am is

(A) zero (B) $\frac{1}{270}$ cm/s

(C) $\frac{1}{180}$ cm/s (D) $\frac{1}{90}$ cm/s

4. A lead bullet moving with velocity 'v' strikes a wall and stops. 75% of its energy is converted into heat. If the increase in the temperature is $\frac{v^2}{nJs}$, then the value of n is

$\{s =$ specific heat of lead, $J =$ mechanical equivalent of heat$\}$

(A) $\frac{8}{3}$ (B) $\frac{4}{3}$

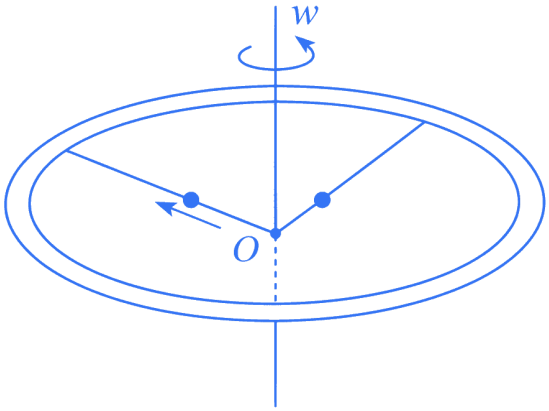
(C) $\frac{3}{8}$ (D) $\frac{3}{4}$

5. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

(A) $t^{1/2}$ (B) $t^{3/4}$

(C) $t^{3/2}$ (D) t^2

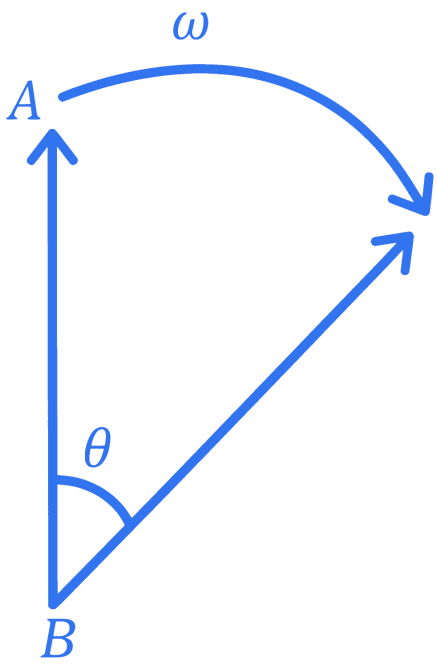
6. A ring of mass M and radius R is rotating with angular speed ω about a fixed vertical axis passing through its centre O with two point masses each of mass $\frac{M}{8}$ at rest at O. These masses can move radially outwards along two mass-less rods fixed on the ring as shown in figure. At some instant the angular speed of the system is $\frac{8\omega}{9}$ and one of the masses is at a distance of $\frac{3}{5}R$ from point O. At this instant, the distance of the other mass from point O is



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

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

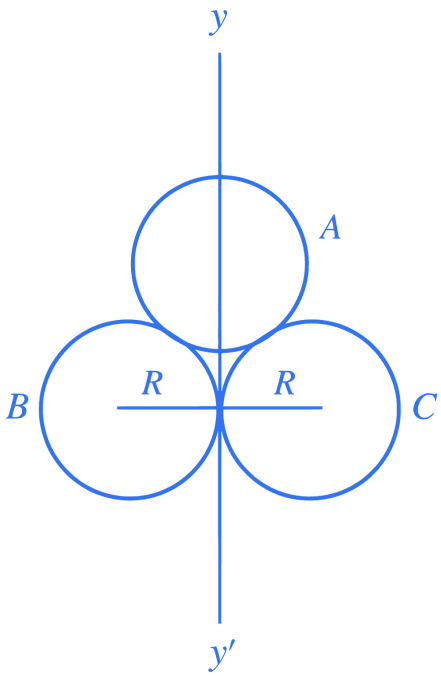
7. A uniform rod of length l is free to rotate in a vertical plane about a fixed horizontal axis through point B. The rod begins rotating from rest, from its unstable equilibrium position. The angular velocity ω, when it has turned through an angle θ, is



(A) $\sqrt{\frac{6g}{l}}\cos\frac{\theta}{2}$ (B) $\sqrt{\frac{6g}{l}}\sin\theta$

(C) $\sqrt{\frac{6g}{l}}\sin\frac{\theta}{2}$ (D) $\sqrt{\frac{6g}{l}}\cos\theta$

8. Three rings each of mass M and radius R are arranged as shown in the figure. The moment of inertia of a system about axis YY' will be



(A) $\frac{3MR^2}{2}$ (B) $3MR^2$

(C) $\frac{7MR^2}{2}$ (D) $5MR^2$

9. The minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of $3R$ is $\{G = \text{gravitational constant}\}$

(A) $\frac{3GMm}{8R}$ (B) $\frac{5GMm}{4R}$

(C) $\frac{3GMm}{4R}$ (D) $\frac{7GMm}{8R}$

10. A tiny water droplet falls through the air at a uniform terminal speed of 1 cm/s. If 27 such identical droplets coalesce to form a single larger drop, what will be the new terminal velocity of the resulting drop, assuming the air remains the same?

(A) 3 cm/s (B) 27 cm/s

(C) 81 cm/s (D) 9 cm/s

11. Which of the following is NOT TRUE?
a. When soluble substance is dissolved in water, the surface tension of water increases.
b. When sparingly soluble substance is mixed with water, surface tension of water increases.
c. When insoluble impurity is added into the water, surface tension of water decreases.
d. In case of molten copper or molten cadmium, the surface tension increases with increase in its temperature.

(A) b (B) c
(C) a (D) d

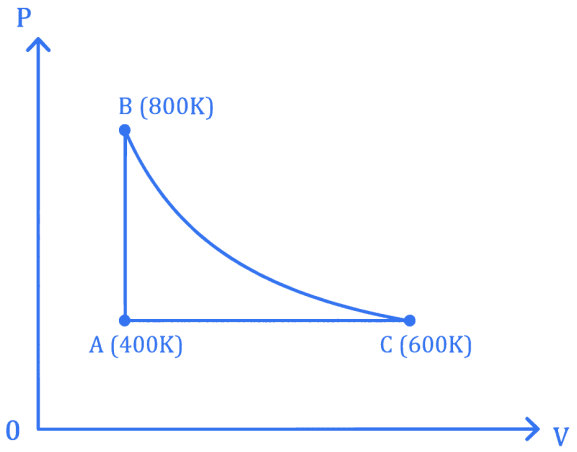
12. In a hydraulic press, the piston in the small cylinder has a diameter of d_1 cm, while the larger piston has a diameter of d_2 cm. If a force F_1 is applied to the small piston, then the force F_2 on the large piston is given by

(A) $F_2 = \frac{d_2^2}{d_1^2}F_1$ (B) $F_2 = \frac{d_1^2}{d_2^2}F_1$
(C) $F_2 = \frac{d_2^2}{d_1^2}\frac{1}{F_1}$ (D) $F_2 = \frac{d_1^2}{d_2^2}\frac{1}{F_1}$

13. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_o. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $0.75\lambda_o$, the power radiated by it becomes nP. The value n is

(A) $4/3$ (B) $256/81$
(C) $81/256$ (D) $3/4$

14. One mole of diatomic ideal gas undergoes a cyclic process ABC as shown in the figure. The process BC is adiabatic. The temperatures at A, B and C are 400 K, 800 K and 600 K, respectively. The correct statement is



(A) The change in internal energy in whole cyclic process is $250R$
(B) The change in internal energy in the process CA is $700R$
(C) The change in internal energy in the process AB is $-350R$
(D) The change in internal energy in the process BC is $-500R$

15. A Carnot engine has an efficiency of 30%. The energy is supplied to the engine at the rate of 3 kW. The output power of the engine is

(A) 100 W (B) 300 W
(C) 900 W (D) 1200 W

16. Heat is supplied to a rigid diatomic gas at constant pressure. The ratio of $\Delta Q : \Delta U : \Delta W$ is
{ΔQ = heat supplied, ΔU = change in internal energy, ΔW = work done during expansion}

(A) 5 : 3 : 2 (B) 2 : 3 : 5
(C) 7 : 5 : 2 (D) 2 : 5 : 7

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17. Two identical containers A and B with friction-less pistons contain the same ideal gas at the same temperature and the same volume, V. The mass of gas in A is m_A and that in B is m_B. The gas in each cylinder is now allowed to expand isothermally to the same final volume $2V$. The changes in pressure in A and B are found to be Δp and $3\Delta p$ respectively. Then

(A) $m_A = m_B$ (B) $3m_A = 2m_B$

(C) $3m_A = m_B$ (D) $3m_A = 4m_B$

18. A simple pendulum consists of a hollow sphere filled with mercury. As the mercury begins to leak out slowly through a small hole at the bottom, the time period of the pendulum will

(A) decrease continuously until the sphere is empty. (B) first increase and then decrease to the original value.

(C) remain constant throughout. (D) increase continuously until the sphere is empty.

19. The total energy of a particle executing SHM is E. If the amplitude is doubled and the frequency is halved, the new total energy will be

(A) $E/4$ (B) E

(C) $2E$ (D) $4E$

20. A linear harmonic oscillator of force constant 2×10^6 N/m has amplitude 0.01 m. Its

(A) maximum potential energy is 100 J. (B) maximum kinetic energy is 160 J.

(C) maximum potential energy is 160 J. (D) maximum potential energy is zero.

21. A set of 8 tuning forks is arranged in ascending order of frequencies. Each fork produces 4 beats with the next one and frequency of last fork is octave of first. The frequency of 5^{th} fork is

(A) 22 Hz (B) 33 Hz

(C) 44 Hz (D) 55 Hz

22. A sonometer wire resonates with a given tuning fork, forming standing waves with five antinodes between the two bridges, when a mass of 9 kg is suspended from the wire. When this mass is replaced by mass M, the wire resonates with the same tuning fork, forming three antinodes for the same positions of the bridges. The value of M (in kg) is

(A) $\frac{1}{25}$ (B) 5

(C) $\frac{25}{2}$ (D) 25

23. A pipe open at both ends has a frequency f in air. The pipe is dipped vertically in water, so that its $(1/3)$ part of its length is in water. The fundamental frequency of the air column is now xf, the value of x is

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

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

24. A man standing between two parallel cliffs fires a gun. He hear two echos one after 3 second and the other after 5 second. The separation between the two cliffs is 1360 m, the speed of sound is

(A) 320 m/s (B) 330 m/s

(C) 340 m/s (D) 350 m/s

25. A dipole of electric dipole moment $\vec{P}$ is placed in an electric field of strength $\vec{E}$. The angle between $\vec{P}$ and $\vec{E}$ for which the potential energy of the electric dipole is maximum, is

(A) $\cos^{-1}(1)$ (B) $\cos^{-1}(-1)$

(C) $\sin^{-1}(1)$ (D) $\sin^{-1}(-1)$

26. Two spheres A and B of radius a and b respectively are at the same electric potential. The ratio of the surface charge densities of A to that of B is

(A) $\frac{a^2}{b^2}$ (B) $\frac{b^2}{a^2}$

(C) $\frac{b}{a}$ (D) $\frac{a}{b}$

27. Three concentric metallic spherical shells of radii R, $3R$ and $9R$ are given charges Q_1, Q_2 and Q_3, respectively. It is found that surface charge densities on the outer surfaces of the shells are equal. Then the ratio of charges given to shells $Q_1 : Q_2 : Q_3$, is (Neglect the induction effects)

(A) 1 : 4 : 16 (B) 1 : 3 : 9

(C) $\frac{1}{3}$: 3 : 27 (D) 1 : $\frac{1}{3}$: 9

28. Four parallel plate capacitors are connected in parallel. Each capacitor has a plate area $\frac{A}{4}$ and the separation between the plates is d, $2d$, $3d$ and $4d$ respectively. The equivalent capacity of the combination is [ε_0 = permittivity of free space]

(A) $\frac{5A\varepsilon_0}{12d}$ (B) $\frac{7A\varepsilon_0}{24d}$

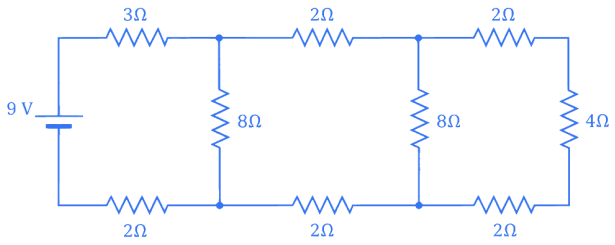
(C) $\frac{9A\varepsilon_0}{36d}$ (D) $\frac{25A\varepsilon_0}{48d}$

29. In a potentiometer circuit when two cells of emf 1.6 V and 1.3 V are connected to assist each other, the balancing length is 290 cm. What will be the balancing length in cm when these two cells are connected in opposition?

(A) 70 (B) 80

(C) 65 (D) 30

30. In the circuit shown in the figure, the current through



(A) the 3Ω resistance is 0.50 A. (B) the 3Ω resistance is 0.25 A.

(C) the 4Ω resistance is 0.50 A. (D) the 4Ω resistance is 0.25 A.

31. The currents through two thin long parallel wires, A and B carrying I and $\frac{I}{3}$ respectively, in the same direction. The distance between two wires is 'd'. The magnitude of force per unit length exerted by wire A on wire B is

(A) $\frac{\mu_0 I^2}{6\pi d}$ (B) $\frac{\mu_0 I^2}{3\pi d}$

(C) $\frac{\mu_0 I}{3\pi d}$ (D) $\frac{\mu_0 I}{6\pi d}$

32. Consider a circular loop (radius R) carrying current I, the magnetic field produced by it at a point on the axis at a distance z from the centre of the loop is $\frac{xR^2}{(z^2+R^2)^{3/2}}$. The value of x is

(A) $\mu_0 I$ (B) $\frac{\mu_0 I}{4}$

(C) $\frac{\mu_0 I}{2}$ (D) $\frac{\mu_0 I}{6}$

33. Soft iron is used in making an electromagnet because

(A) It has low permeability (B) It has high coercivity

(C) It has high retentivity (D) It has low retentivity

34. Two coils of self inductance, 2 mH and 8 mH are placed so closed together that the effective flux in one coil is completely linked with the other. The mutual inductance between these coils is,

(A) 16 mH (B) 10 mH

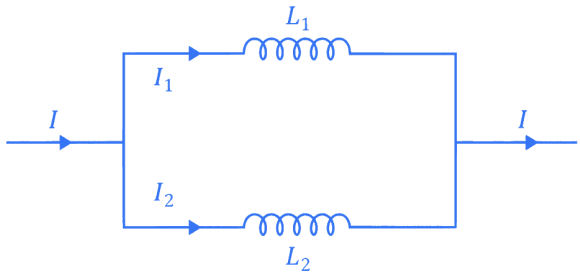
(C) 6 mH (D) 4 mH

35. Two conducting circular loops of radii r_1 and r_2 are placed in the same plane with their centres coinciding. If $r_1 >> r_2$, then the mutual inductance M between them is proportional to [I_1 = current flowing through coil 1 and I_2 = current flowing through coil 2]

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

(C) $\frac{r_2^2}{r_1}$ (D) $\frac{r_2}{r_1}$

36. Two inductors, L_1 and L_2 are connected in parallel and a time varying current flows as shown in the figure. The ratio of currents $\frac{I_2}{I_1}$ at any time, it is



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

(C) $\frac{L_1}{(L_1+L_2)^2}$ (D) $\frac{L_2}{(L_1+L_2)^2}$

37. A 40 μF capacitor is charged to 10 volts of potential. The battery is disconnected, and a pure 100 mH coil is connected across the capacitor so that LC oscillations are set up. Then, the maximum current in the coil is:

(A) 0.25 A (B) 0.10 A

(C) 0.30 A (D) 0.20 A

38. To reduce the resonant frequency in an L-C-R series circuit with a generator,

(A) the iron core of the inductor should be removed and the value of the capacitor is kept constant.

(B) the dielectric in the capacitor should be removed and the value of the inductor is kept constant.

(C) the generator frequency should be reduced.

(D) another capacitor should be added in parallel to the first capacitor and the value of the inductor is kept constant.

39. The output of step-down transformer is measured to be 36 V when connected to 6 W light bulb. The value of peak current is

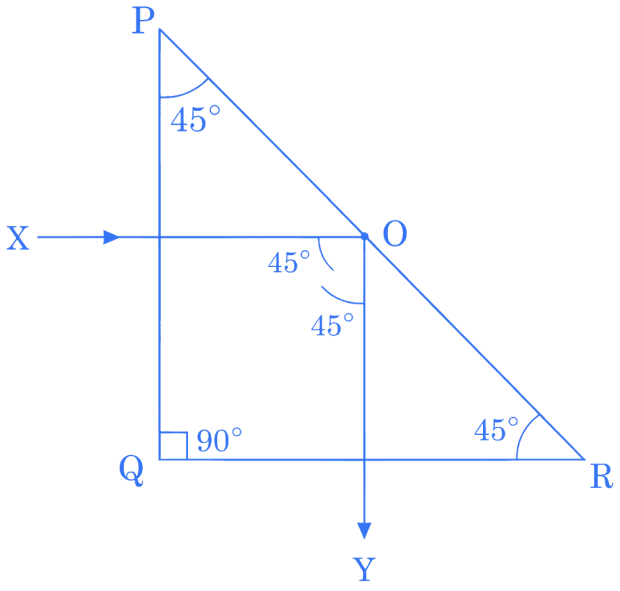
(A) $\frac{1}{\sqrt{2}}A$

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

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

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

40. The minimum refractive index of the material of a right-angled isosceles prism as shown in the following figure is



(A) 1

(B) $\sqrt{2}$

(C) $\sqrt{3}$

(D) 1.5

41. An observer looks at a distant tree of height 10 m with a telescope of magnifying power of 20. To the observer, the tree appears

(A) 10 times taller.

(B) 10 times nearer.

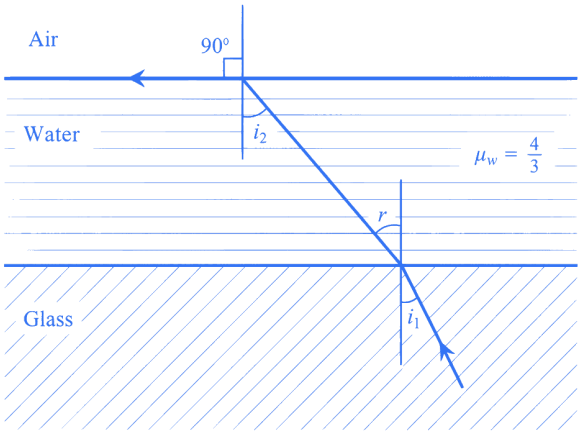
(C) 20 times nearer.

(D) 20 times taller.

42. A ray of light is incident at a glass-water interface at an angle (i_1), it emerges finally parallel to the surface of water, then the value of the refractive index of glass (μ_g) is

$\{\mu_w$ = refractive index of water = 4/3,

$\sin(90)^\circ = 1,\ \cos(90)^\circ = 0\}$



(A) 1

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

(C) $\frac{1}{\sin(i)}$

(D) $\frac{4\sin(i)}{3}$

43. In Young's double slit experiment, the separation between the slits is decreased to $\left(\frac{1}{3}\right)^{th}$ of its original distance and the distance between the slits and the screen is doubled. The fringe width

(A) remains unchanged.

(B) becomes 2 times the original.

(C) becomes 3 times the original.

(D) becomes 6 times the original.

44. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the surface is now illuminated with a radiation of wavelength 4λ, the stopping potential $\left(\frac{V}{8}\right)$. The threshold wavelength for the surface is

(A) λ

(B) 3λ

(C) 5λ

(D) 7λ

45. Radiation of wavelength λ, is incident on a photocell. The fastest emitted electron has speed v. If the wavelength is changed to $\frac{3\lambda}{4}$, the speed of the fastest electron will be

(A) greater than $v\left(\frac{4}{3}\right)^{1/2}$

(B) less than $v\left(\frac{4}{3}\right)^{1/2}$

(C) equal to $v\left(\frac{4}{3}\right)^{1/2}$

(D) equal to $v\left(\frac{3}{4}\right)^{1/2}$

46. In an alpha decay, the daughter nucleus produced is itself unstable and undergoes further decay. If the number of parent and daughter nuclei at time t are N_p and N_d respectively and their decay constants are λ_p and λ_d respectively. What condition needs to be satisfied in order for N_d to remain constant?

(A) $N_p N_d = \lambda_d \lambda_p$

(B) $(N_p)/(N_d) = (\lambda_p)/(\lambda_d)$

(C) $2N_p\lambda_d = 3N_d\lambda_p$

(D) $N_p\lambda_p = N_d\lambda_d$

47. A radioactive nucleus X with a half-life T, decays into a nucleus Y. At $t = 0$, there is no nucleus Y. After some time 't', the ratio of the number of Y to that of X is 0.4. Then, 't' is

(A) $T\log(1.4)$

(B) $\frac{T\log(1.4)}{\log(2)}$

(C) $\frac{T\log(2)}{2\log(1.4)}$

(D) $\frac{T}{\log(2)}$

48. In the energy band diagram of a p-type semiconductor, the "Acceptor Energy Level" is located

(A) exactly in the middle of the forbidden gap

(B) inside the conduction band

(C) just below the conduction band

(D) just above the valence band

49. To use Zener diode of maximum power rating 1.0 W as a 4.0 V stabilized power supply, the maximum current flowing through Zener diode will

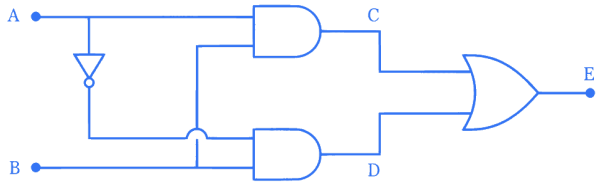
(A) 0.25 mA

(B) 25 mA

(C) 250 mA

(D) 2500 mA

50. For the logic circuit given below, for
a) input $A = 0$ and input $B = 1$, and
b) input $A = 1$ and input $B = 1$, the output E is respectively



(A) zero and one.

(B) one and zero.

(C) zero and zero.

(D) one and one.

51. The number of protons, electrons and neutrons in P^{3-} ion are, respectively

(A) 15, 15 and 16.
(B) 16, 15 and 15.
(C) 15, 18 and 16.
(D) 16, 15 and 18.

52. Calculate the total number of protons, neutrons and electrons in 1 mole of ^{20}Ne

(A) 6.022×10^{23}
(B) 1.8066×10^{25}
(C) 6.022×10^{24}
(D) 1.2044×10^{25}

53. Which is the correct decreasing order for ionic character of halides, where M is a monovalent metal?

(A) MF > MCl > MBr > MI
(B) MI > MBr > MCl > MF
(C) MI > MCl > MBr > MF
(D) MF > MBr > MCl > MI

54. What is the shape of a molecule if it has two lone pairs and three bonding pairs of electrons?

(A) trigonal planar
(B) tetrahedral
(C) bent
(D) T-shape

55. What is the value of critical temperature of CO_2 in °C?

(A) 33.2°C
(B) 30.98°C
(C) 154.3°C
(D) 126.0°C

56. Calulate $\Delta S_{(total)}$ for following reaction.
$CH_3OH_{(l)} + 3/2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$,
$\Delta H = -726$ kJ mol^{-1}, $\Delta S_{(system)} = 42$ JK^{-1}
(both at 298 K)

(A) 2.478 kJ K^{-1}
(B) -2.378 kJ K^{-1}
(C) 39.58 kJ K^{-1}
(D) 44.42 kJ K^{-1}

57. Evaluate the standard enthalpy of formation of C_2H_4 in kJ/mol from the following data,
$C_2H_{4(g)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(l)}$
$\Delta_r H^0 = -1411$ kJ/mol
$\Delta_f H^0(CO_2) = -393$ kJ/mol
$\Delta_f H^0(H_2O) = -285$ kJ/mol

(A) 1195 kJ/mol
(B) -1195 kJ/mol
(C) 55 kJ/mol
(D) -52 kJ/mol

58. Find the value of $\Delta_{(sub)}H$ for water if, enthalpy of fusion of water is 6.0 kJ mol^{-1} and enthalpy of vapourisation is 45.0 kJ mol^{-1}

(A) -51.0 kJ
(B) -41.0 kJ
(C) 41.0 kJ
(D) 51.0 kJ

59. What is the pH of a mixture of 40 ml of 0.1 M $Ba(HCOO)_2$ and 20 ml of 0.1 M HCOOH solution?
(pK_a for formic acid = 5)

(A) 2.8
(B) 5.6
(C) 8.4
(D) 11.2

60. The solubility product of a sparingly soluble salt BA_2 is 1.08×10^{-10}. Calculate its solubility in g dm^{-3} if the molar mass of salt is 175 g mol^{-1}.

(A) 5.25×10^{-2} g dm^{-3}.
(B) 1.75×10^{-2} g dm^{-3}
(C) 3.50×10^{-2} g dm^{-3}.
(D) 7.00×10^{-3} g dm^{-3}.

61. Which of the following aqueous solutions turns blue litmus red?

(A) Aqueous NaCl
(B) Aqueous KCl
(C) Aqueous solution of CO_2
(D) Aqueous NaOH

62. What is oxidation number of oxygen in super oxide of a monovalent metal?

(A) -2
(B) $-1/2$
(C) -1
(D) -1.5

63. Which of the following is an amphoteric hydroxide?

(A) $Mg(OH)_2$
(B) $Be(OH)_2$
(C) $Sr(OH)_2$
(D) $Ca(OH)_2$

64. What is the IUPAC name of CH_3-O-CH_2-CH_2-CH_3?

(A) 1-Methoxy propane
(B) 3-Propoxy methane
(C) 2-Propoxy methane
(D) 3-Methoxy propane

65. Identify the property of a racemic mixture by the following.

(A) Optically active.
(B) Optically inactive.
(C) Dextrorotatory
(D) Laevorotatory

66. Which of the following is the most stable cation?

(A) CH_3^+ (B) CF_3^+

(C) $(CH_3)_2CH^+$ (D) CF_3-CH_2^+

67. Which of the following reagents is used for acetylation of benzene?

(A) $(CH_3CO)_2O$

(B) H_2/Pt

(C) CO/Ni

(D) CH_3COCl

Choose the CORRECT option from the following.

(A) (A), (B) and (D) only. (B) (A), (B) and (C) only.

(C) (A) and (D) only. (D) (B), (C) and (D) only.

68. Which of the following is NOT a role of green chemistry?

(A) To promote innovative chemical technologies not having pollution. (B) To eliminate the use of hazardous chemicals.

(C) To protect the ozone layer. (D) Use of volatile solvents like CCl_4.

69. Which of the following salts does NOT exhibit Frenkel defect?

(A) NaCl (B) AgCl

(C) CaF_2 (D) ZnS

70. The unit cell of metal is fcc. Calculate the void volume unit cell if the radius of metal atom is 127.3 pm.

(A) 1.2142×10^{-23} cm^3 (B) 3.4558×10^{-23} cm^3

(C) 2.0221×10^{-23} cm^3 (D) 2.4284×10^{-23} cm^3

71. Which of the following is an example of ferromagnetic substance?

(A) NaCl. (B) C_6H_6.

(C) O_2. (D) Gd.

72. One litre of glucose solution have osmotic pressure 1.5 atmosphere is mixed with other 2 litre glucose solution of osmotic pressure 2.5 atmosphere. Then find resultant osmotic pressure of the solution.

(A) 0.217 atm (B) 2.17 atm

(C) 21.0 atm (D) 216 atm

73. Addition of 0.643 g of compound to 50 ml of benzene (density of benzene = 0.879 g/ml) lowers the freezing point from 5.51°C to 5.03°C. If K_f for benzene is 5.12 K kg/mol. Calculate the molecular weight of a compound in gram?

(A) 165 (B) 156

(C) 137 (D) 173

74. Find the solubility of organic compound R-X in water at 25°C and at 130 mmHg, if Henry's law constant for that organic compound is 0.160 mol L^{-1} bar^{-1} at that temperature.

(A) .0152 M (B) 0.0276 M

(C) 0.196 M (D) 0.118 M

75. What is the molar conductivity of a 0.5 mol/dm^3 $AgNO_3$ solution if electrolytic conductivity of it is 5.76×10^{-3} S cm^{-1} at 298 K?

(A) 2.88 S cm^2 mol^{-1} (B) 11.52 S cm^2 mol^{-1}

(C) 0.086 S cm^2 mol^{-1} (D) 28.8 S cm^2 mol^{-1}

76. For the cell $Ni_{(s)}|Ni^{++}_{(1M)}||Cu^{++}_{(1M)}|Cu_{(s)}$, if the concentration of an ion in the anode compartment is doubled, then the emf of cell will be

(A) increased by 2 V. (B) decreased by 2 V.

(C) increased by 0.00891 V. (D) decreased by 0.00891 V.

77. Identify the value of 1 S cm^2 mol^{-1} from following.

(A) 10^{-4} S m^2 mol^{-1} (B) 10^2 S m^2 mol^{-1}

(C) 10^{-2} S m^2 mol^{-1} (D) 10^4 S m^2 mol^{-1}

78. The rate constant for a first order reaction is 2.2×10^{-5} s^{-1} at 320°C. Calculate the time required for 15% completion?

(A) 639 S (B) 7391 S

(C) 3971 S (D) 9371 S

79. The rate constants for the first order reaction are x s^{-1} at 300 K and y s^{-1} at 320 K. Calculate the activation energy of the reaction.
[$R = 8.314$ J K^{-1} mol^{-1} and $y/x = 4$]

(A) 55.34 kJ. (B) 27.67 kJ.

(C) 83.1 kJ. (D) 110.68 kJ.

80. For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, the rate of reaction is equal to

(A) the rate of consumption of N_2.

(B) three times the rate of consumption of H_2.

(C) two times the rate of consumption of NH_3.

(D) two times the rate of consumption of N_2.

81. Which of the following statements is NOT true regarding oil in water emulsion?

(A) The oil is dispersed phase and water is dispersion medium.

(B) If water is added, it will be miscible with the emulsion.

(C) The addition of a small amount of an electrolyte has no effect on conducting power.

(D) Water is a continuous phase.

82. Which element from following exhibits anomalous behavior with remaining three members?

(A) F

(B) Cl

(C) Br

(D) I

83. Why is actinoid contraction more as compared to lanthanoide contraction?

(A) The shielding effect of electrons present in 4f and 5f orbitals is equal

(B) The azimuthal quantum numbers of 4f and 5f are same

(C) Poor shielding is offered by 5f electrons compared to 4f electrons in actinoids.

(D) 4f orbitals are more diffused as compared to 5f orbitals

84. Which of the following elements exhibits only one value of oxidation state?

(A) Mn

(B) Fe

(C) Zn

(D) W

85. Identify geometry of $[Ni(Cl)_4]^{2-}$.

(A) Square planar

(B) Tetrahedral

(C) Octahedral

(D) Trigonal bipyramidal

86. Which of the following coordination compounds exhibits linkage isomerism?

(A) $[Co(en)_3]Cl_3$

(B) $[Co(en)_2Cl_2]Cl$

(C) $[Co(en)_2NO_2Cl]Br$

(D) $[Co(NH_3)_5Cl]Br_2$

87. Identify the product obtained when chlorobenzene is treated with acetyl chloride in presence of anhy. $AlCl_3$.

(A) Mixture of 2-Chloroacetophenone and 4-chloroacetophenone.

(B) Mixture of 2-Chlorotoluene and 4-Chlorotoluene

(C) Mixture of 1, 2-Dichlorobenzene and 1, 4-Dichlorobenzene

(D) Acetophenon and Cl_2

88. What is the product of following reaction? $2CH_3I + 2Na \rightarrow P$

(A) CH_3-CH_3

(B) $CH_2 = CH_2$

(C) CH_4

(D) $CH \equiv CH$

89. Water solubility of alcohol, amines and alkanes of comparable molar mass are in order?

(A) Alcohol > alkane > amine

(B) Amine > Alcohol > alkane

(C) Alcohol > amines > alkanes

(D) Alkane > Alcohol > amine

90. Propene reacts with diborane in the presence of THF followed by H_2O_2 in alkaline medium to give compound A. Compound A reacts with phosphorous pentachloride to give compound B. Identify compound B.

(A) Propan-1-ol

(B) Propan-2-ol

(C) 1-chloropropane

(D) 2-chloropropane

91. Which of the following reactions is used to prepare diethyl ether from ethyl chloride?

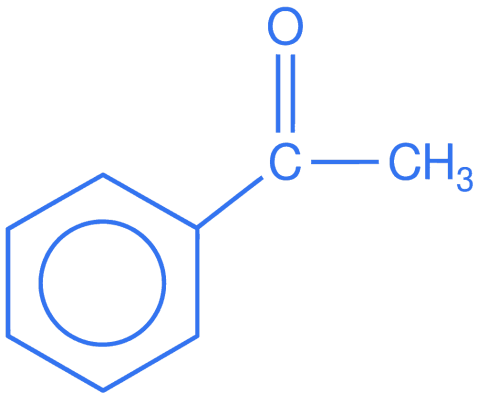
(A) Wurtz reaction

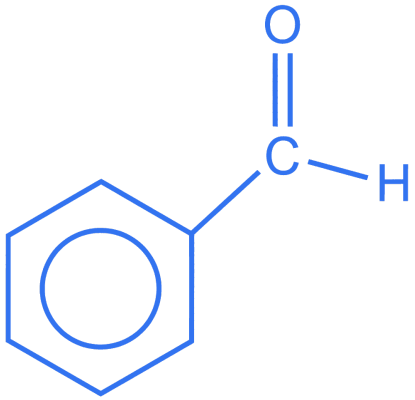
(B) Wurtz- fitting reaction

(C) Williamson's reaction

(D) Reimer- Tiemann reaction

92. Which of the following compounds is most reactive towards nucleophilic addition reaction?

(A) 

(B) 

(C) C_2H_5-CO-H

(D) C_2H_5-CO-C_2H_5

93. Identify the pair of ketone having both members as mixed ketones.

(A) Benzophenone, acetone

(B) Butanone, acetophenone

(C) Butanone, acetone

(D) Benzophenone, acetophenone

94. Which of the following compounds reacts with Grignard's reagent and hydrolyzes further to form carboxylic acid?

(A) ethanal

(B) methanal

(C) methyl cyanide

(D) carbon dioxide

95. Identify product P in following reaction.
$R\text{-}NH_2 + CHCl_3 + 3KOH\ (heat) \rightarrow P$

(A) CH_3-NH-R

(B) R-NC

(C) $(CH_3)_2$N-R

(D) R-Cl

96. Which of the following nitrogen bases is absent in RNA?

(A) Thymine

(B) Cytosine

(C) Uracil

(D) Adenine

97. Which from following reactions confirms presence of one carbonyl group in glucose?

(A) When glucose is heated with HI for longer time forms n-Hexane.

(B) When glucose is heated with hydroxyl amine forms glucose oxime.

(C) When glucose is heated with excess acetic Anhydride forms glucose pentaacetate.

(D) When glucose is treated with dilute nitric acid forms saccharic acid.

98. Which of the following is an Omega-3 fatty acid?

(A) 9, 12, 15 - octadecatrienoic acid

(B) Octadecanoic acid

(C) Hexadecanoic acid

(D) Octanoic acid

99. Which of the following polymers belongs elastomers?

(A) Polystyrene

(B) Polythene

(C) Polyvinyls

(D) Neoprene

100. What type of polymers the polycarbonates are?

(A) Polyester polymers

(B) Polyamide polymers

(C) Biodegradable polymers

(D) Cross-linked polymers

101. The domain of the function $f(x) = \frac{1}{\sqrt{|x|-x}}$ is

(A) $(0, \infty)$ (B) $(-\infty, 0)$
(C) $(-\infty, \infty) - \{0\}$ (D) $(-\infty, \infty)$

102. If $|z - 5i| = |z + 3|$, where z is a complex number, then the equation of the locus of z in Cartesian coordinates is ...

(A) $3x + 5y - 8 = 0$ (B) $3x - 5y - 8 = 0$
(C) $-3x + 5y - 8 = 0$ (D) $3x + 5y + 8 = 0$

103. The equation of the line $\sqrt{3}x - y + 4 = 0$ in the normal form is _____

(A) $x\cos\frac{\pi}{3} + y\sin\frac{\pi}{3} = 2$
(B) $x\cos\frac{5\pi}{6} + y\sin\frac{5\pi}{6} = 2$
(C) $x\cos\frac{\pi}{6} + y\sin\frac{\pi}{6} = 2$
(D) $x\cos\frac{\pi}{4} + y\sin\frac{\pi}{4} = 2$

104. If the slopes of the lines given by $ax^2 + 2hxy + by^2 = 0$ are in the ratio $2:3$, then $h^2 =$

(A) $\frac{2ab}{3}$ (B) $\frac{3ab}{2}$
(C) $\frac{24ab}{25}$ (D) $\frac{25ab}{24}$

105. The maximum number of points of intersection between 4 circles and 4 straight lines is:

(A) 66 (B) 50
(C) 32 (D) 18

106. The equation of the common tangent to the parabolas $y^2 = 4x$ and $x^2 = 32y$ is ...

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

107. The point on the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ which is equidistant from its foci can be

(A) $(0, 3)$ (B) $(5, 0)$
(C) $(3, 0)$ (D) $(0, 5)$

108. The value of $\lim_{x\to\frac{\pi}{4}}\left[\frac{4-(\cos x+\sin x)^4}{1-\sin 2x}\right]$ is equal to

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

109. The statement pattern $[p \wedge (q \vee r)] \vee [\sim r \wedge \sim q \wedge p]$ is equivalent to _____

(A) $q \vee r$ (B) $p \vee r$
(C) r (D) p

110. Consider the following statements -
(i) If a person is social, then he is happy.
(ii) If a person is not social, then he is not happy.
(iii) If a person is not happy, then he is not social.
(iv) If a person is happy, then he is social.
Which of the above statements are equivalent?

(A) (i) and (iv), (ii) and (iii) (B) (i) and (iii), (ii) and (iv)
(C) (i) and (ii), (iii) and (iv) (D) (i) and (iii), (i) and (iv)

111. The negation of the statement $(p \wedge \sim q) \rightarrow (\sim p \vee r)$ is equivalent to:

(A) $(p \wedge \sim q) \wedge (\sim r)$
(B) $(p \vee \sim q) \wedge (p \wedge \sim r)$
(C) $(\sim p \vee q) \vee (p \wedge \sim r)$
(D) $(p \wedge \sim q) \vee (p \wedge \sim r)$

112. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$, then $x^4 + y^4 + z^4 + 4x^2y^2z^2 =$

(A) $x^2y^2 + x^2z^2 + y^2z^2$
(B) $2(x^2y^2 + x^2z^2 + y^2z^2)$
(C) $3(x^2y^2 + x^2z^2 + y^2z^2)$
(D) $4(x^2y^2 + x^2z^2 + y^2z^2)$

113. If $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) = \frac{\pi}{4} - \tan^{-1}\left(\frac{1}{k}\right)$ then the value of k is

(A) 6 (B) 9
(C) 4 (D) 8

114. The value of $\cot\left(\text{cosec}^{-1}\frac{5}{3} + \tan^{-1}\frac{2}{3}\right)$ is ...

(A) $\frac{5}{17}$ (B) $\frac{3}{17}$
(C) $\frac{6}{17}$ (D) $\frac{4}{17}$

115. If a and b are respectively the minimum and maximum values of the expression $f(x) = (\sin^{-1} x + 2\cos^{-1} x)$, then $a + b$ is equal to...

(A) $\frac{\pi}{2}$ (B) π

(C) $\frac{3\pi}{2}$ (D) 2π

116. $\sin^{-1}(\cos(\sin^{-1} x)) + \cos^{-1}(\sin(\cos^{-1} x)) = \ldots$

(A) 0 (B) $\frac{\pi}{6}$

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

117. If $A + I = \begin{pmatrix} 3 & -2 \\ 1 & -1 \end{pmatrix}$, then the inverse of the matrix $(A - I)$ is:

(A) $\begin{pmatrix} 1 & -2 \\ 1 & -3 \end{pmatrix}$ (B) $\begin{pmatrix} 3 & -2 \\ 1 & -1 \end{pmatrix}$

(C) $\begin{pmatrix} -3 & 2 \\ -1 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} -3 & 2 \\ -1 & -1 \end{pmatrix}$

118. The sum of the matrix $\begin{bmatrix} 2 & -3 \\ 5 & -7 \end{bmatrix}$ and its multiplicative inverse is

(A) $\begin{bmatrix} 2 & -3 \\ 5 & -7 \end{bmatrix}$ (B) $\begin{bmatrix} -7 & 3 \\ -5 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} -5 & 0 \\ 0 & -5 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

119. If $f(x) = \begin{cases} \frac{x - e^x + \cos 2x}{x^2}, & \text{if } x \neq 0 \\ k, & \text{if } x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is...

(A) 2 (B) -2

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

120. If $\sqrt{1 - x^6} + \sqrt{1 - y^6} = a^3(x^3 - y^3)$, then $\frac{dy}{dx} = \ldots$

(A) $\frac{x^2}{y^2}\sqrt{\frac{1-x^6}{1-y^6}}$ (B) $\frac{y^2}{x^2}\sqrt{\frac{1-y^6}{1-x^6}}$

(C) $\frac{x^2}{y^2}\sqrt{\frac{1-y^6}{1-x^6}}$ (D) 0

121. If $f(x) = \sqrt{1 + \cos^2(x^2)}$, then $f'\left(\frac{\sqrt{\pi}}{2}\right) = \ldots$

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

(C) $-\sqrt{\frac{\pi}{6}}$ (D) $-\sqrt{\frac{\pi}{4}}$

122. If $f(x) = \log\left(\frac{1+x}{1-x}\right)$ and $g(x) = \left(\frac{3x + x^3}{1 + 3x^2}\right)$, then $\frac{d}{dx}(f(g(x))) =$

(A) $f'(x)$ (B) $g'(x)$

(C) $3g'(x)$ (D) $3f'(x)$

123. If $x = \frac{1-\sqrt{y}}{1+\sqrt{y}}$, then $\frac{dy}{dx} =$

(A) $\frac{4(x-1)}{(x+1)^3}$ (B) $\frac{4(x+1)}{(x-1)^3}$

(C) $\frac{(x-1)}{(x+1)^3}$ (D) $\frac{4(1-x)}{(x+1)^3}$

124. The maximum volume (in cubic units) of a right circular cylinder for which the sum of the square of its height and the square of its radius of base 48, is

(A) 48π (B) 64π

(C) 128π (D) 16π

125. If the slope of the tangent to the curve $2y^2 = ax^2 + b$ at $(1, -1)$ is -1, then ...

(A) $a = 2$ and $b = 0$ (B) $a = 2$ and $b = 1$

(C) $a = 0$ and $b = 1$ (D) $a = 1$ and $b = 2$

126. If $f(x)$ satisfy the condition of Rolle's Theorm in $[1, 2]$ and $f(x)$ is continuous in $[1, 2]$ then $\int_1^2 f'(x)dx$ is equal to _____

(A) 3 (B) 0

(C) 1 (D) 2

127. $\int \frac{dx}{(x+2)(x^2+1)}$ is equal to

(A) $\frac{1}{5}\log|x + 2| - \frac{1}{10}\log(x^2 + 1) + \frac{2}{5}\tan^{-1} x + C$

(B) $\log|x + 2| + \frac{1}{10}\log(x^2 + 1) + \frac{1}{5}\tan^{-1} x + C$

(C) $5\log|x + 2| + 10\log(x^2 + 1) + \tan^{-1} x + C$

(D) $\log|x + 2| + \frac{1}{10}\log(x^2 + 1) - \frac{1}{5}\tan^{-1} x + C$

128. $\int \sin^3 x \cos^3 x dx = \ldots$

(A) $-\frac{1}{192}[9\cos 2x - \cos 6x] + c$

(B) $\frac{1}{192}[9\cos 2x - \cos 6x] + c$

(C) $-\frac{1}{32}[\cos 2x - \cos 6x] + c$

(D) $\frac{1}{32}[\cos 2x - \cos 6x] + c$

129. $\int \frac{5x^{12} + 6x^{11}}{(x^6 + x + 1)^3} dx =$

(A) $-\frac{x^{12}}{2(x^6+x+1)^2} + c$ (B) $-\frac{1}{2(x^6+x+1)^2} + c$

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

130. If $\int \frac{1}{f(x)}dx = \log|f(x)|^2 + c$, then $f(x) = \ldots$

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

(C) $\frac{x^2}{2} + c$ (D) $x^2 + c$

131. If $\int_0^{\pi} \log(\sin x)dx = k$, then the value of $\int_0^{\frac{\pi}{4}} \log(1+\tan x)dx$ in terms of k is...

(A) $\frac{k}{8}$ (B) $-\frac{k}{2}$

(C) $-\frac{k}{8}$ (D) $\frac{k}{2}$

132. The value of $\int_1^2 \frac{1}{x(1+\log x)^2}dx$ is.....

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

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

133. $\int_0^{\frac{\pi}{2}} (1+\sin x)^3 dx =$

(A) 0 (B) 1

(C) $\frac{\pi}{2} - \frac{2}{3}$ (D) $\frac{5\pi}{4} + \frac{11}{3}$

134. The area bounded by the curve $y = x^2 + 4, x = y, x = 3$, and Y-axis is

(A) $\frac{51}{2}$ unit^2 (B) $\frac{33}{2}$ unit^2

(C) $\frac{27}{2}$ unit^2 (D) $\frac{21}{2}$ unit^2

135. The differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ determines a family of circles with

(A) variable radii and fixed center at $(0, 1)$

(B) fixed radius of 1 and variable centers on X-axis

(C) variable radii and fixed center at $(0, -1)$

(D) fixed radius of 1 and variable centers on Y-axis

136. If $y = c_1 \sin^2 x + c_2$, then its differential equation is:

(A) $\frac{d^2y}{dx^2} + 2\cot 2x\frac{dy}{dx} = 0$

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

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

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

137. The general solution of $e^{\frac{dy}{dx}} = x$ is

(A) $y = x\log x - x + c$

(B) $y = x\log x + c$

(C) $y = 1/x + c$

(D) $y = x.\log x + x + c$

138. Which of the following is not a correct pair of a linear differential equation and its integrating factor?

(A) Linear differential equation $\frac{dy}{dx} - y = 2x$, Integrating factor $= e^{-x}$

(B) Linear differential equation $\frac{dy}{dx} + y = e^x$, Integrating factor $= e^x$

(C) Linear differential equation $\frac{dy}{dx} = x + xy$, Integrating factor $= e^{\frac{x^2}{2}}$

(D) Linear differential equation $x\frac{dy}{dx} + 2y = x^2\log x$, Integrating factor $= x^2$

139. In a triangle PQR, L and M are the points on QR and PR respectively such that $QL = 2LR$ and $PM = 3MR$. Let S be the point of intersection of PL and QM; then S divides segment QM internally in the ratio ...

(A) 12 : 5 (B) 8 : 3

(C) 5 : 3 (D) 16 : 9

140. If

$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = 3\hat{i} + 4\hat{j} + 4\hat{k},$

$\vec{c} = 3\hat{i} + 2\hat{j} + 3\hat{k}$

are the position vectors of the vertices A, B and C respectively of $\triangle ABC$ and the bisector of $\angle A$ meets side BC at D where $B - D - C$, then $|\vec{AD}|$ is...

(A) $\frac{2\sqrt{30}}{5}$ (B) $\frac{2}{3}$

(C) $\frac{\sqrt{13}}{5}$ (D) 1

141. A parallelopiped is determined by vectors $\vec{a} = \hat{i} + 2\hat{k}, \vec{b} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} + 2\hat{j} + 3\hat{k}$. The length (in units) of its altitude drawn to the base determined by vectors $\vec{b}$ and $\vec{c}$ is

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

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

142. If three coterminous edges of a parallelopiped are represented by $\vec{a} - \vec{b}, \vec{b} - \vec{c}$ and $\vec{c} - \vec{a}$ then its volume is

(A) $[\vec{a}\ \vec{b}\ \vec{c}]$ (B) $[\vec{a}\ \vec{b}\ \vec{c}]^2$

(C) $2[\vec{a}\ \vec{b}\ \vec{c}]$ (D) 0

143. If $8\vec{AB} - 3\vec{AC} - 5\vec{AD} = \vec{0}$, then the point C divides BD in the ratio ...

(A) 8 : 5 internally (B) 3 : 4 externally

(C) 4 : 3 internally (D) 5 : 8 externally

144. If the lines $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{3}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z-5}{1}$ are intersect at the point P, then the distance (in units) of the point P from the origin $O(0, 0, 0)$ is ...

(A) $\sqrt{14}$ (B) $\sqrt{21}$

(C) $\sqrt{26}$ (D) $\sqrt{29}$

145. The foot of the perpendicular from the origin to the plane is $N = (4, 5, a), a > 0$ and $l(ON) = 7$, then vector equation of the plane is ...

(A) $\vec{r} \cdot (4\hat{i} + 5\hat{j} - 2\sqrt{2}\ \hat{k}) = 49$

(B) $\vec{r} \cdot (4\hat{i} + 5\hat{j} + 2\sqrt{2}\hat{k}) = 49$

(C) $\vec{r} \cdot (4\hat{i} - 5\hat{j} + 2\sqrt{2}\hat{k}) = 49$

(D) $\vec{r} \cdot (4\hat{i} + 5\hat{j} + 2\sqrt{2}\hat{k}) = 40$

146. The equation of a plane passing through the intersection of two planes $\vec{r} \cdot (\hat{i} - 2\hat{j} + 3\hat{k}) = 4$ and $\vec{r} \cdot (2\hat{i} + \hat{j} - 3\hat{k}) = 7$ and parallel to Y-axis is

(A) $\vec{r} \cdot (2\hat{i} - 2\hat{k}) = 11$ (B) $\vec{r} \cdot (\hat{i} + \hat{j} - 2\hat{k}) = 3$

(C) $\vec{r} \cdot (5\hat{i} - 3\hat{k}) = 18$ (D) $\vec{r} \cdot (4\hat{i} - 3\hat{k}) = 28$

147. The planes $5x - 2y + 3z = 9$ and $15x - 6y + 9z = -5$ are

(A) Perpendicular (B) Intersect each other

(C) Parallel (D) Pass through $(2, 2, 1)$

148. If X follows a Binomial distribution with parameters $n = 8$ and $p = \frac{1}{2}$ then $P(|X - 4| \leq 2)$

(A) $\frac{59}{64}$ (B) $\frac{119}{128}$

(C) $\frac{117}{128}$ (D) $\frac{29}{32}$

149. The variance of random variable X, for the following probability mass function (p. m. f.) is ...

$X = x$	1	2	3
$P(X = x)$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{2}{5}$

(A) $\frac{14}{25}$ (B) $\frac{11}{5}$

(C) $\frac{\sqrt{14}}{5}$ (D) $\frac{11}{25}$

150. Two fair dice are thrown. The probability that the sum of the scores is 7 such that the number on the second die is greater than that on the first die is ...

(A) $\frac{1}{6}$ (B) $\frac{1}{12}$

(C) $\frac{3}{4}$ (D) $\frac{1}{36}$

- End of Question Paper -