MHT CET 2025 PCM Apr 25 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 2025**, 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 fundamental frequencies of vibrations of air column in pipe open at both ends and in pipe closed at one end are ' n_1 ' and ' n_2 ' respectively, then

(A) $n_1 = n_2$ (B) $n_1 = 2n_2$

(C) $2n_1 = n_2$ (D) $3n_1 = 4n_2$

2. A force F is applied on a square plate of side L . If the percentage error in determining F is 3% and that in L is 2%, then the percentage error in determining the pressure is

(A) 7% (B) 5%

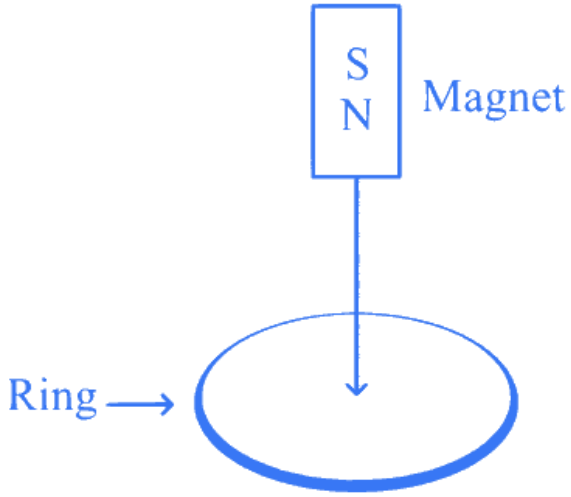
(C) 3% (D) 2%

3. A bob of mass ' m ' is tied by a massless string whose other end is wound on a flywheel (disc) of radius ' R ' and mass ' m '. When released from the rest, the bob starts falling vertically downwards. If the bob has covered a vertical distance ' h ', then angular speed of wheel will be (There is no slipping between string and wheel, g - acceleration due to gravity)

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

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

4. A copper ring having a cut such as not to form a complete loop is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring as shown in figure. The acceleration of the falling magnet is (g = acceleration due to gravity)



(A) g (B) less than g

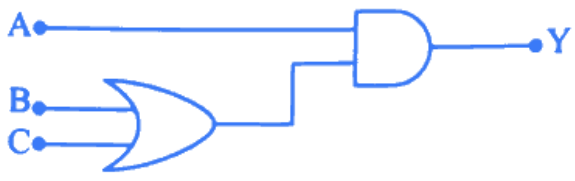
(C) more than g (D) zero

5. In Young's double slit experiment, at two points P and Q on screen, waves from slits S_1 and S_2 have a path difference of 0 and $\frac{\lambda}{4}$ respectively. The ratio of intensities at point P to that at Q will be $\left(\cos 0^\circ = 1, \cos 45^\circ = \frac{1}{\sqrt{2}}\right)$

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

(C) $\sqrt{2}$: 1 (D) 4 : 1

6. One of the following values of inputs A, B and C respectively gives output (Y) of the following combination of logic gates as ' 1 ' is



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

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

7. The initial average kinetic energy of the molecules was E , when a gas sample is at 27°C. When the gas is heated to 327°C, then the final average kinetic energy will be

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

(C) 300 E (D) 327 E

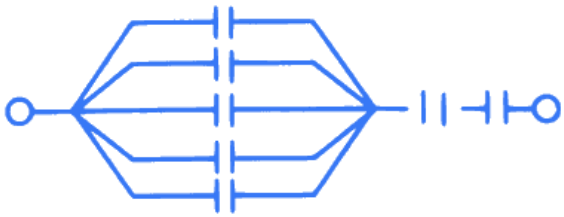
8. A piece of semiconductor is connected in series in an electric circuit. On increasing the temperature, the current in the circuit will

(A) decrease. (B) remain unchanged.

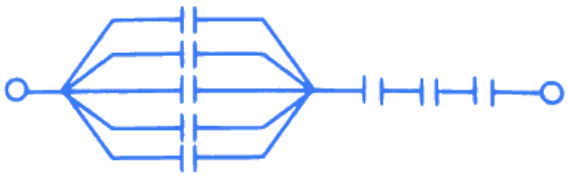
(C) increase. (D) stop flowing.

9. Seven capacitors each of capacitance 2μ F are to be connected in a configuration to obtain an effective capacitance $\left(\frac{10}{11}\right)$ μF. The combination is

(A)



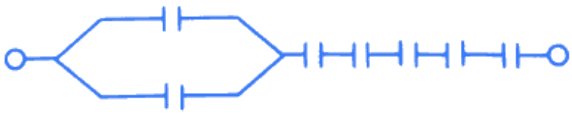
(B)



(C)



(D)



10. In an LR circuit, the value of L is $\left(\frac{0.3}{\pi}\right)$ henry and the value of R is 40Ω, If in the circuit, an alternating e.m.f of 230 V at 50 cycles per second is connected, the impedance of the circuit and current will be respectively

(A) 12.5Ω, 9.2 A (B) 46.4Ω, 6.4 A

(C) 23.2Ω, 5 A (D) 50Ω, 4.6 A

11. The depth at which the value of acceleration due to gravity becomes $\left(\frac{1}{n}\right)$ times the value at the surface of the earth is
(R = radius of the earth)

(A) $\frac{R(n-1)}{n}$ (B) $\frac{R(n+1)}{n}$

(C) $\frac{\mathrm{Rn}}{(\mathrm{n}-1)}$ (D) $\frac{R}{n}$

12. A horizontal pipeline carries water in a streamline flow. At a point along the pipe, where the cross-sectional area is 10 cm^2, the velocity of water is 1 m/s and pressure is 2000 Pa . The pressure of water at another point where the cross-sectional area 5 cm^2 is
[Given → density of water = 1000 $\mathrm{kg/m}^3$]

(A) 1000 Pa (B) 750 Pa

(C) 500 Pa (D) 250 Pa

13. Two simple pendulums have first (A) bob of mass ' M_1 ' and length ' L_1 ', second (B) of mass ' M_2 ' and length ' L_2 '. $M_1 = M_2$ and $L_1 = 2\,L_2$. If their total energies are same then the correct statement is

(A) amplitude of B is greater than amplitude of A. (B) amplitude of B is smaller than amplitude of A.

(C) amplitude of both will be same. (D) amplitude of B is twice that of A .

14. If the frequency of incident light in a photoelectric experiment is doubled, then stopping potential will

(A) be doubled. (B) be halved.

(C) become more than double. (D) become less than double.

15. A constant force $\vec{F} = 3\hat{i} - 2\hat{j} - \hat{k}$ newton has a displacement $\vec{r} = 2\hat{i} - 3\hat{j} - 3\hat{k}$ metre in 2 second. The work done and the power are respectively

(A) 20 joule, 10 watt (B) 15 joule, 7.5 watt

(C) 13 joule, 6.5 watt (D) 10 joule, 5 watt

16. In a common emitter amplifier configuration, the current gain is 62 . The collector resistance and input resistance are 5kΩ and 500Ω respectively. If the input voltage is 0.01 V , the output voltage will be

(A) 0.62 V (B) 6.2 V

(C) 62 V (D) 620 V

17. A thin uniform rod of length ' L ' and mass ' M ' is swinging freely about a horizontal axis passing through its end. Its maximum angular speed is ' ω '. Its centre of mass rises to a maximum height of
(g = acceleration due gravity)

(A) $\frac{L^2\omega^2}{2g}$ (B) $\frac{\mathrm{L}\omega}{6\,\mathrm{g}}$
(C) $\frac{\mathrm{L}\omega}{2\,\mathrm{g}}$ (D) $\frac{\mathrm{L}^2\omega^2}{6\,\mathrm{g}}$

18. In a biprism experiment a steady interference pattern is observed on the screen using a light of wavelength 5000 $\mathring{\mathrm{A}}$. Without disturbing the set up of the experiment, the source of light is replaced by a source of wavelength 6400 $\mathring{\mathrm{A}}$.
The fringe width will

(A) decrease by 48% (B) decrease by 28%
(C) increase by 48% (D) increase by 28%

19. Two girls are standing at the ends ' A ' and ' B ' of a ground where AB = b. The girl at ' B ' starts running in a direction perpendicular to ' AB ' with velocity ' V_1 '. The girl at ' A ' starts running simultaneously with velocity ' V_2 ' and in shortest distance meets the other girl in time ' t '. The value of ' t ' is

(A) $\frac{b}{\sqrt{V_1{}^2+V_2{}^2}}$ (B) $\frac{b}{V_1+V_2}$
(C) $\frac{b}{V_2-V_1}$ (D) $\frac{b}{\sqrt{V_2{}^2-V_1{}^2}}$

20. A coil of wire of radius ' r ' has 600 turns and a self-inductance of 108 mH . The self-inductance of a coil with same radius and 500 turns is

(A) 80 mH (B) 75 mH
(C) 108 mH (D) 90 mH

21. A sample of an ideal gas $\left(\gamma=\frac{5}{3}\right)$ is heated at constant pressure. If 100 J of heat is supplied to the gas, the work done by the gas is

(A) 150 J (B) 60 J
(C) 40 J (D) 250 J

22. Using Bohr's quantisation condition, what is the rotational energy in the second orbit for a diatomic molecule?
(I = moment of inertia of diatomic molecule and h = Planck's constant)

(A) $\frac{\mathrm{h}}{2\mathrm{I}\pi^2}$ (B) $\frac{h^2}{2I\pi^2}$
(C) $\frac{\mathrm{h}^2}{2\mathrm{I}^2\pi^2}$ (D) $\frac{\mathrm{h}}{2\mathrm{I}^2\pi}$

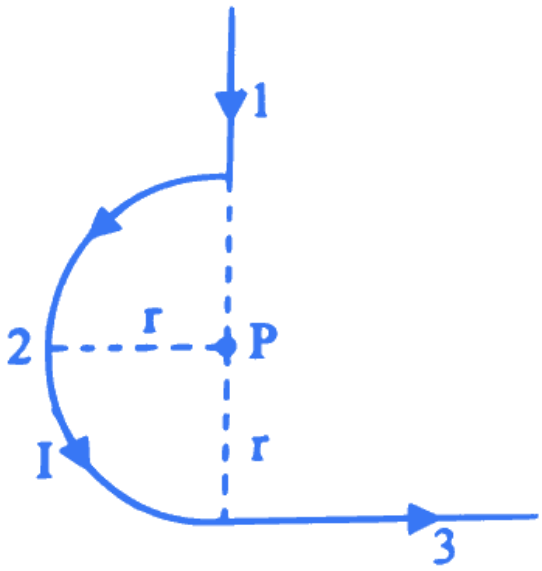
23. Assuming the drops to be spherical, 27 identical drops of mercury are charged simultaneously to the same potential of 20 volt. If all the charged drops are made to combine to form one big drop, then potential of big drop will be

(A) 90 V (B) 180 V
(C) 270 V (D) 360 V

24. An object of mass ' m ' moving with velocity ' u ' collides with another stationary object of mass ' M ' and stops just after the collision. The coefficient of restitution is

(A) $\frac{\mathrm{m}}{\mathrm{M}+\mathrm{m}}$ (B) $\frac{M-m}{M+m}$
(C) $\frac{\mathrm{m}}{\mathrm{M}}$ (D) 1

25. In the following figure magnitude of the magnetic field at the point p is

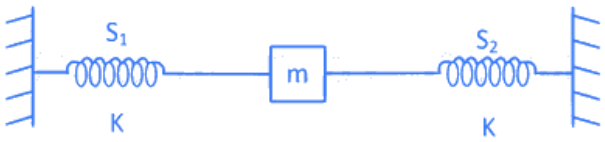


(A) $\frac{\mu_0 I}{4\pi r}+\frac{\mu_0 I}{r}$ (B) $\frac{\mu_0 I}{4\pi r}+\frac{\mu_0 I}{2r}$
(C) $\frac{\mu_0\mathrm{I}}{4\pi\mathrm{r}}+\frac{\mu_0\mathrm{I}}{4\mathrm{r}}$ (D) $\frac{\mu_0\mathrm{I}}{4\pi\mathrm{r}}-\frac{\mu_0\mathrm{I}}{4\mathrm{r}}$

26. A balloon is filled at 27°C and 1 atmospheric pressure by volume 500 m^3 helium gas. At −3°C and 0.5 atmospheric pressure, the volume of helium gas will be

(A) 500 m^3 (B) 700 m^3
(C) 900 m^3 (D) 1000 m^3

27. As shown in the figure, S_1 and S_2 are identical springs with spring constant K each. The oscillation frequency of the mass ' m ' is ' f '. If the spring S_2 is removed, the oscillation frequency will become



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

28. The volume of a metal sphere increases by 0.33% when its temperature is raised by 50°C. The coefficient of linear expansion of the metal is

(A) $2.2 \times 10^{-5}/°C$
(B) $6.6 \times 10^{-5}/°C$
(C) $13.2 \times 10^{-5}/°C$
(D) $19.8 \times 10^{-5}/°C$

29. The amount of work done in blowing a soap bubble such that its diameter increases from 'd' to ' D ' is (T = surface tension of solution)

(A) $\pi(D^2 - d^2)T$
(B) $2\pi(D^2 - d^2)T$
(C) $4\pi(D^2 - d^2)T$
(D) $8\pi(D^2 - d^2)T$

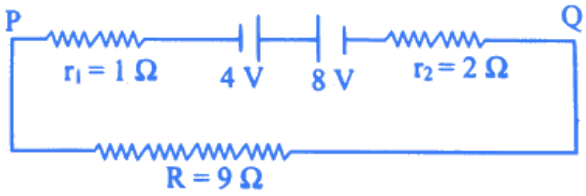
30. In an a.c. circuit, a resistance ' R ' is connected in series with an inductance ' L '. If phase angle between voltage and current is 45°, the value of inductive reactance will be $(\tan 45° = 1)$

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

31. In an open end organ pipe of length ' L ', if the velocity of sound is ' V ', then the fundamental frequency will be (Neglect end correction)

(A) $\frac{V}{2L}$ and all harmonics are present.
(B) $\frac{V}{4L}$ and all harmonics are present.
(C) $\frac{V}{2L}$ and even harmonics are present.
(D) $\frac{V}{4L}$ and even harmonics are present.

32. Two batteries of e.m.f 4 V and 8 V with internal resistance 1Ω and 2Ω respectively are connected in a circuit with a resistance of 9Ω as shown in the figure. The current and potential difference between the points ' P ' and ' Q ' is R = 9Ω



(A) $\frac{1}{3}$ A and 4 V
(B) $\frac{1}{3}$ A and 3 V
(C) $\frac{1}{2}$ A and 5 V
(D) $\frac{1}{6}$ A and 3 V

33. At what speed should a source of sound move so that the observer finds the apparent frequency equal to half the original frequency?

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

34. A particle starts oscillating simple harmonically from its mean position with time period ' T '. At time $t = \frac{T}{6}$, the ratio of the potential energy to kinetic energy of the particle is

$[\sin 30° = \cos 60° = 0 \cdot 5, \cos 30° = \sin 60° = \sqrt{3}/2]$

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

35. A coil of ' n ' turns and resistance $R\Omega$ is connected in series with a resistance $\frac{R}{2}$. The combination is moved for time ' t ' second through magnetic flux ϕ_1 to ϕ_2. The induced current in the circuit is

(A) $\frac{n(\varrho_1 - \varrho_2)}{3Rt}$
(B) $\frac{2n(\varrho_1 - \varrho_2)}{3Rt}$
(C) $\frac{2n(\varrho_1 - \varrho_2)}{Rt}$
(D) $\frac{n(\varrho_1 - \varrho_2)}{Rt}$

36. An electron of mass ' m ' and charge ' e ' initially at rest gets accelerated by a constant electric field ' E '. The rate of change of de-Broglie wavelength of the electron at time ' t ' is (Ignore relativistic effect)(h = Planck's constant)

(A) $-\frac{h}{eEt^2}$
(B) $-\frac{eEt}{h}$
(C) $\frac{-mh}{eEt^2}$
(D) $-\frac{h}{eE}$

37. The moment of inertia of a solid sphere of mass ' m ' and radius ' R ' about its diametric axis is ' I '. Its moment of inertia about a tangent in the plane is

(A) 2.5 I
(B) 3.0 I
(C) 3.5 I
(D) 4 I

38. A glass cube of length 21 cm has a small air bubble trapped inside. When viewed normally from one face, its apparent distance is 8 cm. When viewed normally from the opposite face, its apparent distance is 6 cm . The refractive index of glass and the actual distance of the air bubble from the first surface respectively are

(A) $1.5, 12$ cm
(B) $1.55, 14$ cm
(C) $1.6, 11$ cm
(D) $1.5, 9$ cm

39. Two identical metal plates are given charges q_1 and $q_2\,(q_2 < q_1)$ respectively. If they are now brought close together to form a parallel plate capacitor with capacitance ' C ', the potential difference ' V ' between the plates is

(A) $\frac{q_1-q_2}{c}$
(B) $\frac{q_1+q_2}{C}$
(C) $\frac{q_1-q_2}{2C}$
(D) $\frac{q_1+q_2}{2C}$

40. In hydrogen atom in its ground state, the first Bohr orbit has radius ' r_1 '. When the atom is raised to one of its excited states, the electrons orbital velocity becomes one-third. The radius of that orbit is

(A) $2r_1$
(B) $3r_1$
(C) $4r_1$
(D) $9r_1$

41. Heat supplied $dQ =$ increased in internal energy dU is true for

(A) isothermal process.
(B) adiabatic process.
(C) isobaric process.
(D) isochoric process.

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

(A) 900
(B) 1100
(C) 1400
(D) 1600

43. When one end of a capillary tube is dipped in water, the height of water column is ' h '. The upward force of 105 dyne due to surface tension is balanced by the force due to the weight of water column. The inner circumference of the capillary tube is
(Surface tension of water $= 7 \times 10^{-2}$ N/m)

(A) 1.5 cm
(B) 2 cm
(C) 2.5 cm
(D) 3 cm

44. A tuning fork gives 5 beats per second with 40 cm length of sonometer wire. If the length of the wire is shortened by 1 cm , the number of beats is still the same. The frequency of the fork is

(A) 390 Hz
(B) 395 Hz
(C) 400 Hz
(D) 405 Hz

45. A circular coil carrying current ' T ' has a radius ' r ' and ' n ' turns. The magnetic field along the axis of a coil at a distance ' $2\sqrt{2}r$ ', from its centre is ($\mu_0 =$ permeability of free space, n is very small)

(A) $\frac{\mu_0 \mathrm{nI}}{9\mathrm{r}}$
(B) $\frac{\mu_0 nI}{18r}$
(C) $\frac{\mu_0 \mathrm{nI}}{54\mathrm{r}}$
(D) $\frac{\mu_0 \mathrm{nI}}{27\mathrm{r}}$

46. Two equally charged small balls placed at a fixed distance experience a force ' F '. A similar uncharged ball after touching one of them is placed at the middle point between the two balls. the force experienced by this ball is

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

47. An a.c. source of frequency ' f ' is connected to a circuit containing an inductance ' L ' and resistance ' R ' in series. The impedance of this circuit is

(A) $\sqrt{\mathrm{R}^2 + 2\pi\mathrm{fL}^2}$
(B) $\sqrt{\mathrm{R}^2 + \mathrm{L}^2}$
(C) $\mathrm{R} + 2\pi\mathrm{fL}$
(D) $\sqrt{\mathrm{R}^2 + 4\pi^2\mathrm{f}^2\,\mathrm{L}^2}$

48. A black body emits radiation of maximum intensity at wavelength ' λ ' at temperature T K. Its corresponding wavelength at temperature 1.5 T K will be

(A) $\frac{2\lambda}{3}$
(B) $\frac{4\lambda}{3}$
(C) $\frac{16\lambda}{81}$
(D) $\frac{81\lambda}{16}$

49. In a single slit diffraction experiment, slit of width ' a ' is illuminated by light of wavelength ' λ ' and the width of the central maxima in diffraction pattern is measured as ' y '. When half of the slit is covered and illuminated by light of wavelength (1.5) λ, the width of the central maximum in diffraction pattern becomes

(A) $\frac{3}{2}y$

(B) $\frac{2}{3}y$

(C) $3y$

(D) $\frac{y}{3}$

50. To protect the instrument from magnetic field, it is completely surrounded by

(A) soft ferromagnetic substance.

(B) diamagnetic substance only.

(C) paramagnetic substance only.

(D) both diamagnetic and paramagnetic substances.

51. Which among the following salts forms basic solution when dissolved in water?

(A) $NaNO_3$ (B) CH_3COONH_4

(C) KCN (D) NH_4 F

52. Identify the product formed when 2-Bromobutane is heated with aqueous solution of sodium hydroxide.

(A) But-1-ene (B) But-2-ene

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

53. What is the charge required to convert 2 mol$KMnO_4$ to $MnSO_4$?

(A) 2 F (B) 4 F

(C) 5 F (D) 10 F

54. Find the volume of 56 g dinitrogen at STP

(A) 11.2 Lit. (B) 22.4 Lit.

(C) 44.8 Lit. (D) 67.2 Lit.

55. Calculate the work done in joule if 1 mole of an ideal gas compressed from volume $24dm^3$ to $13dm^3$ at constant external pressure 3 bar.

(A) 3300 J (B) 2250 J

(C) 4400 J (D) 4870 J

56. If Instantaneous rate of reaction is stated as $-\frac{1}{2}\frac{d[x]}{dt} = -\frac{d[y]}{dt} = \frac{1}{2}\frac{d[z]}{dt}$, identify the reaction.

(A) $x - 2y \longrightarrow 2z$ (B) $2x + y \longrightarrow 2z$

(C) $x + y \longrightarrow z$ (D) $2x - 2y \longrightarrow z$

57. Calculate the vapour pressure of solution if relative lowering of vapour pressure and vapour pressure of pure solvent are 0.018 and 18 mm Hg respectively at 300 K .

(A) 18.32 mm Hg (B) 17.08 mm Hg

(C) 17.68 mm Hg (D) 18.60 mm Hg

58. Which from following elements in respective oxidation state develops highest spin only magnetic moment?

(A) Mn^{2+} (B) Ti^{3+}

(C) Cu^{2+} (D) Ni^{2+}

59. Which from following polymers is used as wool substitute?

(A) Glyptal (B) Polyacrylonitrile

(C) Terylene (D) Neoprene

60. Which from following compounds does NOT contain nitrogen in it?

(A) Thiophene (B) Pyridine

(C) Pyrrole (D) Piperidine

61. A container contains 4 gH_2, 4 gHe and certain amount of 'Ne' at a certain temperature. What is the mass of 'Ne' required so that the partial pressure exerted by 'Ne' is equal to the partial pressure of He ?

(A) 4 g (B) 8 g

(C) 10 g (D) 20 g

62. Find the EAN of Zn in $[Zn(NH_3)_4]^{2+}$?

(A) 38 (B) 37

(C) 36 (D) 35

63. If standard reduction potential (E°) of $\left(Mg^{+2}_{(aq)} \mid Mg_{(s)}\right)$, $\left(Ag^{+}_{(aq)} \mid Ag_{(s)}\right)$, $\left(Zn^{+2}{}_{(aq)} \mid Zn_{(s)}\right)$ and $\left(Cu^{+2}{}_{(aq)} \mid Cu_{(s)}\right)$ are -2.37 V, $+0.79$ V, -0.76 V and $+0.34$ V respectively. Which of the following reaction is spontaneous?

(A) $Zn_{(s)} + Mg^{+2}_{(aq)} \longrightarrow Zn^{+2}_{(aq)} + Mg_{(s)}$

(B) $2Ag_{(s)} + Zn^{+2}_{(aq)} \longrightarrow 2Ag^{+}_{(aq)} + Zn_{(s)}$

(C) $Zn_{(s)} + Cu^{+2}_{(aq)} \longrightarrow Zn^{+2}_{(aq)} + Cu_{(s)}$

(D) $Cu_{(s)} + Mg^{+2}_{(aq)} \longrightarrow Cu^{+2}_{(aq)} + Mg_{(s)}$

64. Which from following statements is NOT true for phenol?

(A) Phenols are polar molecules.

(B) Pure phenol is odourless, nontoxic, high melting solid.

(C) Boiling points of phenols increases with increase in molecular mass.

(D) Phenols show appreciable solubility in water.

65. In carbinol system, sec-Butyl alcohol is named as

(A) Ethyl methyl carbinol
(B) sec-Butylcarbinol
(C) Isopropyl carbinol
(D) Diethylcarbinol

66. Calculate the number of unit cells in 1 cm^3 volume of metal if unit cell edge length is 1.25×10^{-8} cm.

(A) 1.40×10^{23}
(B) 3.35×10^{23}
(C) 5.12×10^{23}
(D) 2.25×10^{23}

67. Calculate the number of moles of nonvolatile solute dissolved in 0.5 kg solvent if molal elevation constant for solvent is 2 kg K mol^{-1} $[\Delta T_b = 0.8\ K]$

(A) 0.1
(B) 0.2
(C) 0.3
(D) 0.4

68. Which from following is an example of both intensive property and state function?

(A) Internal energy
(B) Volume
(C) Temperature
(D) Entropy

69. What is the number of moles of H atoms required for complete reduction of one mole acetonitrile?

(A) 2
(B) 4
(C) 6
(D) 1

70. Calculate the pH of centimolar solution of monoacidic weak base. Which is 10% dissociated in its aqueous solution?

(A) 9
(B) 10
(C) 11
(D) 12

71. Identify ' A ' in the following reaction.

A $\xrightarrow{\text{Lithium amide}}$ Ethynyl lithium $\xrightarrow{\text{Bromoethane}}$ But - 1 - yne

(A) Ethene
(B) Ethyne
(C) But-1-ene
(D) But-2-ene

72. What is molar conductivity at zero concentration in $\Omega^{-1}\ cm^2\ mol^{-1}$ for aluminium sulphate, if molar ionic conductivities at zero concentration of Al^{+3} and SO_4^{-2} are $189\Omega^{-1}\ cm^2\ mol^{-1}$ and $50.1\Omega^{-1}\ cm^2\ mol^{-1}$ respectively?

(A) 239.1
(B) 428.1
(C) 478.2
(D) 528.3

73. Which of the following compounds is an optically inactive compound?

(A) 3-chlorohexane
(B) 2-chloro-2-methylbutane
(C) 2-chloropentane
(D) 2-chloro-3-methylbutane

74. Which of the following reagents is used in the conversion of phenol into picric acid?

(A) dil. HNO_3
(B) dil. HNO_2
(C) conc. HNO_3+ conc. H_2SO_4
(D) conc. H_2SO_4

75. Which of the following is an example of second order reaction?

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

76. Calculate the total volume occupied by all particles in fcc unit cell if volume of unit cell is $6.4 \times 10^{-23}\ cm^3$

(A) $3.321 \times 10^{-23}\ cm^3$
(B) $4.350 \times 10^{-23}\ cm^3$
(C) $5.126 \times 10^{-23}\ cm^3$
(D) $4.736 \times 10^{-23}\ cm^3$

77. Identify the product formed in the following reaction. $(CH_3CO)_2O \xrightarrow{H_2O}$ Product

(A) CH_3COCH_3
(B) $CH_3 - CHO$
(C) $CH_3 - OH$
(D) CH_3COOH

78. What type of glycosidic linkages are present in amylose?

(A) $\alpha - 1,4$
(B) $\alpha - 1,6$
(C) $\alpha - 1,4$ and $\alpha - 1,6$
(D) $\beta - 1,4$ and $\alpha - 1,6$

79. Which of the following is more polar?

(A) H_2S
(B) NH_3
(C) NF_3
(D) $CHCl_3$

80. When 2-methylbut-2-ene is treated with hydrogen chloride, the major product formed is

(A) 3-chloro-2-methylbutane
(B) 2-chloro-2-methylbutane
(C) 2-chloro-3-methylbutane
(D) 2-chlorobutane

81. Which colour is developed to the solution when alkaline earth metals are dissolved in liquid ammonia?

(A) Crimson red
(B) Orange
(C) Deep blue black
(D) Faint green

82. Which of the following house hold plastic material is used to prepare drinking straws?

(A) PVC
(B) LDPE
(C) PS
(D) PP

83. What is the time required for 99% completion of a first order reaction if rate constant is $23.03\ min^{-1}$?

(A) 0.2 minute
(B) 0.4 minute
(C) 6.2 minute
(D) 8.1 minute

84. Identify the product formed in the following reaction. $C_6H_5 - CH_2 - CH_3 \xrightarrow[ii)\ H_3O^+]{i)\ alk.\ KMnO_4}$ Product

(A) $C_6H_5 - CH_2 - COOH$
(B) $C_6H_5CH_2 - CH_2 - COOH$
(C) $C_6H_5 - OH$
(D) $C_6H_5 - COOH$

85. Arrange the following equimolar solutions according to increasing order of osmotic pressure [Assume complete ionisation]
i) KCl
ii) $BaCl_2$
iii) $AlCl_3$
iv) $Al_2(SO_4)_3$

(A) $BaCl_2 < Al_2(SO_4)_3 < KCl < AlCl_3$
(B) $Al_2(SO_4)_3 < KCl < BaCl_2 < AlCl_3$
(C) $KCl < BaCl_2 < AlCl_3 < Al_2(SO_4)_3$
(D) $AlCl_3 < BaCl_2 < Al_2(SO_4)_3 < KCl$

86. Which from following is useful to extract analgesic and antimicrobial compounds?

(A) Turmeric
(B) Cinnamon
(C) Citrus fruit
(D) Clove

87. Which element from following has smallest ionic size in +3 state?

(A) Lu
(B) La
(C) Dy
(D) Nd

88. Identify the monomers used in preparation of Nylon 2- nylon 6

(A) Glycine and ϵ amino caproic acid
(B) β - hydroxy butyric acid and β - hydroxy valeric acid
(C) Ethylene glycol and phthalic acid
(D) Acrylamide and vinyl chloride

89. Identify the correct increasing order of field strength of ligands from following.

(A) $Cl^- < I^- < S^{2-} < OH^-$
(B) $I^- < Cl^- < S^{2-} < OH^-$
(C) $OH^- < Cl^- < I^- < S^{2-}$
(D) $S^{2-} < OH^- < I^- < Cl^-$

90. A monobasic weak acid dissociates 2% in its 0.002 M solution. Calculate the dissociation constant of weak acid.

(A) 2×10^{-9}
(B) 8×10^{-7}
(C) 6×10^{-7}
(D) 4×10^{-6}

91. Which of the following pair of compounds consists equal number of lone pair of electrons in the valence shell of central atom?

(A) BrF_5 and XeF_6
(B) ICl and H_2 S
(C) ClF_3 and XeF_2
(D) IF_7 and XeF_4

92. Which of the following is an acidic oxide?

(A) CO
(B) NO
(C) N_2O
(D) N_2O_5

93. What is oxidation number of sulphur in SO_3 ?

(A) +3
(B) +4
(C) +6
(D) -3

94. Which from following substances is classified as macromolecular colloid?

(A) Soap
(B) Detergent
(C) S_8 sulphur molecules
(D) Nylon

95. What is the total number of unit cells shared by each corner particle of bcc unit cell?

(A) 4
(B) 2
(C) 8
(D) 1

96. Which of the following is used as reagent in Etard reaction?

(A) Chromium chloride (B) Chromyl chloride

(C) Chromium oxide (D) Chromic acid

97. For a certain reaction, $\Delta H = -210\,kJ$ and $\Delta S = -150\,J\,K^{-1}$ Find the temperature so that $\Delta G = 0$.

(A) 1100 K (B) 1200 K

(C) 1400 K (D) 1300 K

98. Which of the following elements contains maximum number of unpaired electrons?

(A) Fluorine (B) Sodium

(C) Nitrogen (D) Oxygen

99. Which from following amines on heating with chloroform and ethanolic potassium hydroxide produces foul smell?

(A) $(CH_3)_3\,N$ (B) $(CH_3)_2NH$

(C) $(CH_3CH_2)_2NH$ (D) $CH_3CH_2NH_2$

100. What is the total number of carbon atoms present in a sugar molecule of RNA nucleotide?

(A) 6 (B) 5

(C) 4 (D) 12

101. If a circle with centre at $(-1, 1)$ touches the line $x + 2y + 4 = 0$ then the co-ordinates of the point of contact are

(A) $(-2, -1)$ (B) $(8, -6)$

(C) $(-10, 3)$ (D) $(-4, 0)$

102. A doctor assumes that patient has one of three diseases d1, d2 or d 3 . Before any test he assumes an equal probability for each disease. He carries out a test that will be positive with probability 0.7 if the patient has disease d1, 0.5 if the patient has disease d 2 and 0.8 if the patient has disease d3. Given that the outcome of the test was positive then probability that patient has disease d2 is

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

(C) $\frac{1}{5}$ (D) $\frac{1}{7}$

103. A particle P starts from the point $Z_0 = 1 + 2i$ where $i = \sqrt{-1}$. It moves first horizontally away from the origin by 5 units and then vertically upwards parallel to positive Y -axis by 3 units to reach a point Z_1. From Z_1 the particle moves $\sqrt{2}$ units in the direction of vector $\hat{i} + \hat{j}$ and then it moves through an angle $\frac{\pi}{2}$ in anticlockwise direction on a circle with centre at origin to reach at point Z_2, then $Z_2 =$

(A) $6 + 7i$ (B) $-7 + 6i$

(C) $-6 + 7i$ (D) $7 - 6i$

104.

$$\lim_{x \to 0} \frac{63^x - 9^x - 7^x + 1}{\sqrt{2} - \sqrt{1 + \cos x}} = \ldots \ldots$$

(A) $\frac{4\sqrt{2}}{\log 7 \cdot \log 9}$ (B) $4\sqrt{2}\log 7 \cdot \log 9$

(C) $4\sqrt{2}\log 63$ (D) $\frac{\log 7 \cdot \log 9}{4\sqrt{2}}$

105. Consider the following three statements
(A) If $3 + 2 = 7$ then $4 + 3 = 8$.
(B) If $5 + 2 = 7$ then earth is flat.
(C) If both (A) and (B) are true then $5 + 6 = 11$.
Which of the following statements is correct?

(A) (A) and (C) are true while (B) is false.

(B) (A) is true while (B) and (C) are false.

(C) (A) is false but (B) and (C) are true.

(D) (A) is false while (C) is true.

106. If $A = \begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$ and A .adj $A = AA^T$, then $5a + b =$

(A) 7 (B) 9

(C) 13 (D) 5

107. The common principal solution of the equations $\sin\theta = -\frac{1}{2}$ and $\tan\theta = \frac{1}{\sqrt{3}}$ is

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

(C) $\frac{7\pi}{6}$ (D) $\frac{11\pi}{6}$

108. The slopes of the lines represented by $6x^2 + 2hxy + y^2 = 0$ are in the ratio $2 : 3$, then $h =$

(A) $\pm\frac{7}{2}$ (B) $\pm\frac{1}{2}$

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

109. If θ is an obtuse angle between vectors $\bar{a}$ and $\bar{b}$ such that $|\bar{a}| = 5, |\bar{b}| = 3$ and $|\bar{a} \times \bar{b}| = 5\sqrt{5}$ then $\bar{a} \cdot \bar{b} =$

(A) 10 (B) -10

(C) 5 (D) -5

110. If the plane $\frac{x}{2} - \frac{y}{3} - \frac{z}{5} = 1$ cuts the co-ordinate axes in points A, B, C respectively, then the area of the triangle ABC is

(A) $\frac{17}{2}$ sq. units. (B) $\frac{19}{2}$ sq. units

(C) $\frac{11}{2}$ sq. units (D) $\frac{15}{2}$ sq. units

111. The rate of increase of the population of a city is proportional to the population present at that instant. In the period of 40 years the population increased from 30,000 to 40,000 . At any time t the population is $(a)(b)^{\frac{t}{40}}$. Then the values of a and b are respectively

(A) $30,000, \frac{2}{3}$ (B) $30,000, \frac{4}{3}$

(C) $40,000, \frac{2}{3}$ (D) $40,000, \frac{3}{4}$

112. The probability that a student is not a swimmer is $\frac{1}{5}$. The probability that out of 5 students selected at random 4 are swimmers is

(A) $(\frac{4}{5})^4$ (B) $(\frac{4}{5})^4(\frac{1}{5})$

(C) $(\frac{4}{5})^5 \times \frac{1}{5}$ (D) $(\frac{4}{5})^3 \times \frac{1}{5^2}$

113. A player tosses two coins. He wins ₹ 10 , if 2 heads appears, ₹ 5 , if one head appear and ₹ 2 if no head appears. Then variance of winning amount is

(A) 38.5 (B) 8.25

(C) 5.5 (D) 44.00

114. Consider the probability distribution

$X = x$	1	2	3	4	5
$P(X = x)$	K	2 K	K^2	2 K	$5 K^2$

Then the value of $P(X > 2)$ is

(A) $\frac{7}{12}$ (B) $\frac{1}{36}$

(C) $\frac{1}{2}$ (D) $\frac{23}{36}$

115. The equation of the curve passing through origin and satisfying $(1 + x^2)\frac{dy}{dx} + 2xy = 4x^2$ is

(A) $y(1 + x^2) = 4x^3$ (B) $4(1 + x^2) = 4 + y^2$

(C) $3y(1 + x^2) = 4x^3$ (D) $1 + y^2 = 4x^3 + 1$

116. If $y = \tan^{-1}\left(\frac{12x - 64x^3}{1 - 48x^2}\right)$, then $\frac{dy}{dx} =$

(A) $\frac{3}{1+16x^2}$ (B) $\frac{4}{1+16x^2}$

(C) $\frac{12}{1+16x^2}$ (D) $\frac{1}{1+16x^2}$

117. The order of the differential equation whose general solution is given by $y = (C_1 + C_2)\sin(x + C_3) - C_4 e^{x+C_5}$ is (where C_1, C_2, C_3, C_4, C_5 are arbitrary constants)

(A) 5 (B) 4

(C) 2 (D) 3

118. In L.P.P., the maximum value of objective function $Z = 6x + 3y$ subject to constraints $x + y \leq 5, x + 2y \geq 4, 4x + y \leq 12, x, y \geq 0$ is

(A) $\frac{132}{7}$ (B) 22

(C) 15 (D) $\frac{122}{7}$

119. If the lines $x = ay - 1 = z - 2$ and $x = 3y - 2 = bz - 2 (ab \neq 0)$ are coplanar, then

(A) $a = 1, b = \frac{1}{2}$ (B) $a = 2, b = 2$

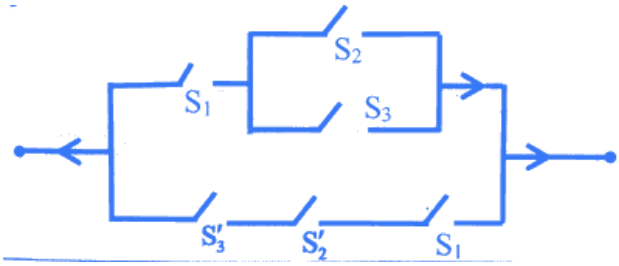
(C) $a = \frac{1}{2}, b = \frac{1}{2}$ (D) $b = 1, a \in \mathbb{R} - \{0\}$

120. If $\left(\tan^{-1} x\right)^2 + \left(\cot^{-1} x\right)^2 = \frac{5\pi^2}{8}$, then $x^2 + 1 =$

(A) -1 (B) 2

(C) 1 (D) -2

121. If $p \equiv$ The switch S_1 is closed, $q \equiv$ The switch S_2 is closed, $r \equiv$ switch S_3 is closed, then symbolic form of following switching circuit is equivalent to



(A) p (B) q

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

122. Let $f : \mathbb{R} \to \mathbb{R}$ is differentiable function having $f(3) = 3, f'(3) = \frac{1}{27}$ and $g(x) = \begin{cases} \int_3^{f(x)} \frac{3t^2}{x-3} dt, & \text{if } x \neq 3 \\ K, & \text{if } x = 3 \end{cases}$ is continuous at $x = 3$, then $K =$

(A) 1 (B) 3

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

123. The area bounded by the curve $y = 4x - x^2$ and X - axis in square units, is

(A) $\frac{32}{3}$ (B) 16

(C) 32 (D) $21\frac{1}{3}$

124. The Cartesian equation of the plane $\bar{r} = (2\hat{i} - 3\hat{j}) + \lambda(\hat{i} + 2\hat{j} - \hat{k}) + \mu(2\hat{i} + 3\hat{j} + \hat{k})$ is

(A) $5x - 4y + z = 22$ (B) $5x - 3y + z = 19$

(C) $5x - 3y - z = 19$ (D) $5x - 4y - z = 22$

125. If the line $\frac{x-3}{2} = \frac{y+5}{-1} = \frac{z+2}{2}$ lies in the plane $\alpha x + 3y - z + \beta = 0$, then values of α and β respectively are ....

(A) $\frac{3}{2}, \frac{13}{2}$ (B) $\frac{5}{2}, \frac{9}{2}$

(C) $-\frac{5}{2}, \frac{9}{2}$ (D) $\frac{5}{2}, \frac{11}{2}$

126.

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

(A) 0 (B) 1

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

127. If the vectors $\bar{a} = c(\log_7 x)\hat{i} + 2\hat{j} + 3\hat{k}$ and $\bar{b} = (\log_7 x)\hat{i} + 3c(\log_7 x)\hat{j} - 4\hat{k}$ make obtuse angle for any $x > 0$, then c belongs to

(A) $(0, \frac{3}{4})$ (B) $(\frac{-3}{4}, 0)$

(C) $(\frac{-4}{3}, 0)$ (D) $(0, \frac{4}{3})$

128.

$$\int_{\frac{-\pi}{4}}^{\frac{\pi}{4}} \sin^{-4} x dx =$$

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

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

129. The altitude through vertex A of $\triangle ABC$ with position vectors of points A, B, C as $\bar{a}, \bar{b}, \bar{c}$ respectively is

(A) $\frac{|\bar{b}\times\bar{c}|}{|\bar{c}-\bar{b}|}$ (B) $\frac{|\bar{a}\times\bar{b}+\bar{b}\times\bar{c}+\bar{c}\times\bar{a}|}{|\bar{c}-\bar{b}|}$

(C) $\frac{|\bar{a}\times\bar{b}+\bar{b}\times\bar{c}+\bar{c}\times\bar{a}|}{|\bar{c}\times\bar{b}|}$ (D) $\frac{|\bar{b}\times\bar{c}|}{|\bar{a}|}$

130.

$$\int \frac{dx}{(x+a)^{\frac{9}{7}}(x-b)^{\frac{5}{7}}} =$$

(A) $\frac{7}{a+b}(\frac{x-b}{x+a})^{\frac{9}{7}} + c$, where c is the constant of integration.

(B) $\frac{7}{a+b}(\frac{x-b}{x+a})^{\frac{5}{7}} + c$, where c is the constant of integration.

(C) $\frac{7}{2(a+b)}(\frac{x-b}{x+a})^{\frac{2}{7}} + c$, where c is the constant of integration.

(D) $\frac{7}{a+b}(\frac{x-b}{x+a})^{\frac{1}{7}} + c$, where c is the constant of integration.

131. The lines $\bar{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(3\hat{i} - \hat{j})$ and $\bar{r} = (4\hat{i} - \hat{k}) + \mu(2\hat{i} + 3\hat{k})$ are

(A) intersecting but not perpendicular (B) perpendicular

(C) parallel (D) skew lines

132. If $\bar{b}$ and $\bar{c}$ are unit vectors and $|\bar{a}| = 7$, $\bar{a} \times (\bar{b} \times \bar{c}) + \bar{b} \times (\bar{c} \times \bar{a}) = \frac{1}{2}\bar{a}$, then angle between the vectors $\bar{a}$ and $\bar{c}$ and angle between the vectors $\bar{b}$ and $\bar{c}$ are respectively

(A) $90°, 60°$ (B) $30°, 60°$

(C) $90°, 120°$ (D) $45°, 90°$

133. With usual notations in $\triangle ABC$, if $\angle B = \frac{\pi}{2}$, and $\tan\frac{A}{2}, \tan\frac{C}{2}$ are roots of equation $px^2 + qx + r = 0$, $p \neq 0$, then

(A) $p + q = r$ (B) $r + p = q$

(C) $r = p$ (D) $p = q$

134. $\int \frac{dx}{x(x^3+1)} =$

(A) $\log(\frac{x^3}{x^3+1}) + c$, where c is the constant of integration

(B) $\frac{1}{3}\log(\frac{x^3}{x^3+1}\sqrt{3}) + c$, where c is the constant of integration

(C) $\log(\frac{x^3}{x^3+1}\sqrt{3}) + c$, where c is the constant of integration

(D) $\frac{1}{3}\log(\frac{x^3+1}{x^3}) + c$, where c is the constant of integration

135. If $\tan^{-1}(x+1) + \tan^{-1}x + \tan^{-1}(x-1) = \tan^{-1}3$, then for $x < 0$ the value of $500x^4 + 270x^2 + 997 =$

(A) 6716 (B) 1767

(C) 1768 (D) 6717

136. Let $f : \mathbb{R} - \{2\} \to \mathbb{R} - \{1\}$ defined by $f(x) = \frac{x-3}{x-2}$ and $g : \mathbb{R} \to \mathbb{R}$ defined by $g(x) = 3x - 2$, then sum of all values of x for which $f^{-1}(x) + g^{-1}(x) = \frac{19}{6}$ is

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

(C) $\frac{9}{2}$ (D) $\frac{11}{2}$

137. There are 11 points in a plane of which 5 points are collinear. Then the total number of distinct quadrilaterals with vertices at these points is

(A) 265 (B) 330

(C) 250 (D) 325

138. $\int \frac{x^4\cos(\tan^{-1}x^5)}{1+x^{10}}dx$ equals

(A) $\frac{\sin(\tan^{-1}x^5)}{5} + c$, where c is the constant of integration

(B) $x^4\sin(\tan^{-1}x^5) + c$, where c is the constant of integration

(C) $\frac{\sin(\tan^{-1}x^5)}{4} + c$, where c is the constant of integration

(D) $\cos(\tan^{-1}x^5) + c$, where c is the constant of integration

139. The length of the perpendicular drawn from the origin on the normal to the curve $x^2 + 2xy - 3y^2 = 0$ at the point $(2, 2)$ is

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

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

140. If $f(x) = \log(1+x) - \frac{2x}{2+x}$ then $f(x)$ is increasing in

(A) $(-1, \infty)$ (B) $(-\infty, \infty)$

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

141. The angle θ, at which the curves $y = 3^x$ and $y = 7^x$ intersect, is given by

(A) $\tan\theta = \frac{\log(\frac{3}{7})}{1+(\log 3)(\log 7)}$ (B) $\tan\theta = \frac{\log(\frac{7}{3})}{1+(\log 3)(\log 7)}$

(C) $\tan\theta = \frac{\log(\frac{3}{7})}{1-(\log 3)(\log 7)}$ (D) $\tan\theta = \frac{\log(\frac{7}{3})}{1-(\log 3)(\log 7)}$

142. The function $f(x) = x^3 - 6x^2 + ax + b$ satisfies the conditions of Rolle's theorem in $[1, 3]$. Then the values of a and b are respectively

(A) $11, -6$ (B) $-6, 11$

(C) $-11, 6$ (D) $6, -11$

143. If

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

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

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

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

144. If $x = \sin t$ and $y = \sin pt$, then the value of

$$(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y =$$

(A) 0 (B) 1

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

145. Let $\bar{a} = \hat{i} + \hat{j} - \hat{k}$ and $\bar{c} = 5\hat{i} - 3\hat{j} + 2\hat{k}$ and if $\overline{b} \times \overline{c} = \overline{a}$ then $|\overline{b}| =$

(A) $\sqrt{113}$ (B) $\sqrt{114}$

(C) $\sqrt{117}$ (D) None of the above

146. The circumradius of a triangle whose sides are 10 units, 8 units and 6 units is

(A) 4 units (B) 2 units

(C) 3 units (D) 5 units

147. The eccentricity of the hyperbola which passes through the points $(3, 0)$ and $(3\sqrt{2}, 2)$ is

(A) $\sqrt{13}$ (B) $\frac{\sqrt{13}}{4}$

(C) $\frac{\sqrt{13}}{3}$ (D) $\frac{\sqrt{13}}{2}$

148.

$$\cos^4\frac{\pi}{8} + \cos^4\frac{3\pi}{8} + \cos^4\frac{5\pi}{8} + \cos^4\frac{7\pi}{8} =$$

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

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

149. The straight line passing through $(-3, 6)$ and midpoint of the line segment joining the points $(4, -5)$ and $(-2, 9)$ have inclination

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

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

150. The general solution of differential equation $(y^2 - x^2)\,dx = xy\,dy (x \neq 0)$ is

(A) $2x^2\log x + y^2 + 2cx^2 = 0$, where c is the constant of integration

(B) $2x^2\log x - y^2 + 2cx^2 = 0$, where c is the constant of integration

(C) $x^2\log x + y^2 + 2cx^2 = 0$, where c is the constant of integration

(D) $x^2\log x - y^2 + 2cx^2 = 0$, where c is the constant of integration

- End of Question Paper -