MHT CET 2025 PCM Apr 22 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 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. A vehicle is moving with uniform speed along 3 different shaped roads as horizontal, concave and convex. The surface of road on which, the normal reaction on vehicle is maximum is

(A) convex
(B) concave
(C) horizontal
(D) same on all the 3 surface

2. $_{88}R_a^{226}$ is converted into $_{82}P_b^{206}$ by emission of alpha (α) and beta (β) particles. The number of alpha and beta particles emitted are respectively

(A) 5, 4
(B) 4, 5
(C) 6, 4
(D) 4, 6

3. In a Young's double slit experiment wavelength of light used is 6000 $\mathring{A}$. The first order maxima and tenth order maxima fall at 14.50 mm and 16.75 mm from the particular reference point in the interference pattern respectively. If the wavelength is changed to 5500 $\mathring{A}$ then the position of zero order and tenth order maxima are respectively
[The other arrangements remaining same]

(A) 14.25 mm, 16.55 mm
(B) 12.25 mm, 14.55 mm
(C) 10.25 mm, 12.55 mm
(D) 16.25 mm, 18.55 mm

4. In a pure silicon crystal electron-hole concentration is 10^{16} per m^3 at 301 K . Now 10^{21} atoms of phosphorus are added per cubic metre. The new hole concentration in silicon is (in per m^3)

(A) 10^5
(B) 10^{11}
(C) 10^{19}
(D) 10^{21}

5. A vehicle is moving with a constant speed of 10 m/s in a circular horizontal track of radius 20 m . A bob is suspended from the roof of a vehicle by a massless string. The angle made by the string with the vertical will be (acceleration due to gravity, g = 10 m/s^2)

(A) $\tan^{-1}(0.5)$
(B) $\tan^{-1}(0.6)$
(C) $\tan^{-1}(0.7)$
(D) $\tan^{-1}(0.8)$

6. Assuming human pupil to have radius of 0.25 cm and comfortable viewing distance of 25 cm , the minimum separation between the two objects that human eye can resolve at 500 nm wavelength is nearly

(A) 330μ m
(B) 30μ m
(C) 1μ m
(D) 100μ m

7. Four charges $2\mu C, -3\mu C, 4\mu C, -4\mu C$ and $-1\mu C$ are enclosed by the Gaussian surface of radius 2 m . Net outward flux through the Gaussian surface is (in $\mu V - m$) [ε_0 = permittivity of free space]

(A) $\frac{2}{\epsilon_0}$
(B) zero
(C) $\frac{3}{\epsilon_0}$
(D) $\frac{5}{\epsilon_0}$

8. A solid sphere of mass ' m ' and radius ' R ' is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with angular speed twice that of sphere. The ratio of kinetic energy of sphere to kinetic energy of cylinder will be

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

9. A person standing between two parallel cliffs fires a gun and hears two echoes, first echo after 1 second and the second echo after 3 second. The distance between the two cliffs is (Velocity of sound = 340 m/s)

(A) 340 m
(B) 680 m
(C) 1020 m
(D) 1360 m

10. A series combination of 10 capacitors, each of value ' C_1 ' is charged by a source of potential difference ' 4 V '. When another parallel combination of 8 capacitors, each of value ' C_2 ' is charged by a source of potential difference ' V ', it has the same total energy stored in it as in the first combination. The value of ' C_2 ' is

(A) $\frac{C_1}{5}$
(B) $\frac{8}{5}C_1$
(C) $\frac{64}{5}C_1$
(D) $\frac{C_1}{40}$

11. A solid sphere and thin walled hollow sphere have same mass and same material. Which of them have greater moment of inertia about their diameter?
[I_h = moment of inertia of hollow sphere about an axis coinciding with its diameter, I_5 = moment of inertia of solid sphere about an axis coinciding with its diameter]

(A) $I_s > I_h$ (B) $I_h \geq I_s$
(C) $I_h > I_s$ (D) $I_h = I_s$

12. The total charge induced in a conducting loop when it is moved in a uniform magnetic field depends on

(A) initial magnetic flux only. (B) final magnetic flux only.
(C) the total change in magnetic flux. (D) the rate of change of magnetic flux.

13. A rectangular film of liquid is expanded from $(5\text{ cm} \times 4\text{ cm})$ to $(7\text{ cm} \times 8\text{ cm})$. If the work done is 3×10^{-4} J, the surface tension of the liquid is (nearly)

(A) 0.4 N/m (B) 0.04 N/m
(C) 0.4 dyne /cm (D) 4.0 N/m

14. The temperature of a body on Kelvin scale is ' x ' K. When it is measured by a Fahrenheit thermometer, it is found to be ' x ' °F. The value of ' x ' is (nearly)

(A) 40 (B) 313
(C) 574 (D) 301

15. A capillary tube is taken from earth's surface to moon's surface. The rise of liquid column on the moon's surface is (acceleration due to gravity on the earth's surface is six times that of moon's surface)

(A) zero. (B) six times that on the earth's surface.
(C) equal to that on the earth's surface. (D) $(\frac{1}{6})^{\text{th}}$ that on the earth's surface.

16. Two thin lenses having R_1, R_2 as the radii of curved surfaces are kept coaxially together. Their power is proportional to

(A) $R_1 + R_2$ (B) $R_1 - R_2$
(C) $\frac{R_1 R_2}{R_1 + R_2}$ (D) $\frac{R_1 + R_2}{R_1 R_2}$

17. For a gas at a particular temperature on an average, the quantity which remains same for all molecules is

(A) velocity (B) momentum
(C) kinetic energy (D) angular momentum

18. In a common emitter transistor amplifier, the output voltage and input voltage have a phase difference of

(A) 0^c (B) $\frac{\pi^c}{2}$
(C) $\frac{3\pi^c}{4}$ (D) π^c

19. A body of mass 100 gram is tied to a spring of spring constant 8 N/m, while the other end of a spring is fixed. If the body moves in a circular path on smooth horizontal surface with constant angular speed 8rad/s then the ratio of extension in the spring to its natured length will be

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

20. The voltmeter has range 10 V and its internal resistance is 50Ω. To increase the range of voltmeter to 15 V , the resistance which is to be connected is

(A) 125Ω resistance in parallel (B) 125Ω resistance in series
(C) 25Ω resistance in parallel (D) 25Ω resistance in series

21. If 120 J of thermal energy is incident on area 3 m^2, the amount of heat transmitted is 12 J , coefficient of absorption is 0.6 , then the amount of heat reflected is

(A) 24 J (B) 30 J
(C) 36 J (D) 40 J

22. A circular coil of wire consisting of ' n ' tums each of radius 8 cm carries a current of 0.4 A . The magnitude of the magnetic field at the centre of coil is 3.14×10^{-4} T. The value of ' n ' is
[Take $\mu_0 = 12.56 \times 10^{-7}$ SI unit]

(A) 1 (B) 10
(C) 100 (D) 1000

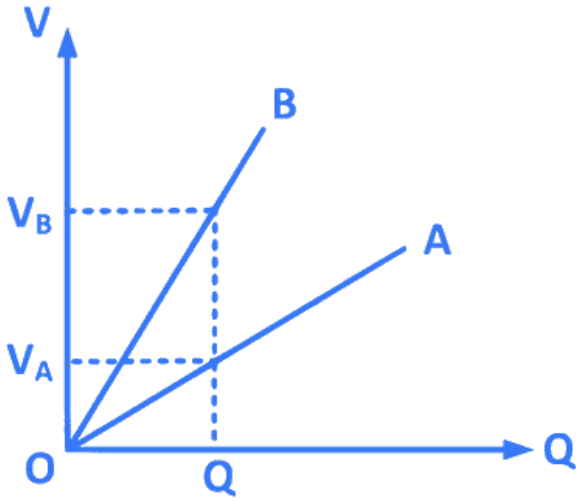
23. There are two identical small holes on the opposite side of a tank containing full of a liquid. The tank is open at the top. The difference in height between the two holes is ' h '. As the liquid comes out of the two holes, the tank will experience a net horizontal force proportional to



(A) $h^{3/2}$ (B) h^2

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

24. The graph shows the variation of voltage (v) across the plates of two parallel plate capacitos A and B versus increase of charge Q stored in them. Then



(A) capacity of both capacitors is same. (B) capacity of A is higher than B.

(C) capacity of B is higher than A. (D) capacity of both is zero.

25. If force $\vec{F} = -3\hat{i} + \hat{j} + 5\hat{k}$ acts along $\vec{r} = 7\hat{i} + 3\hat{j} + \hat{k}$ then the torque acting at that point is

(A) $(14\hat{i} - 38\hat{j} + 16\hat{k})$ (B) $(-14\hat{i} + 34\hat{j} - 16\hat{k})$

(C) $(21\hat{i} + 4\hat{j} + 4\hat{k})$ (D) $(4\hat{i} + 4\hat{j} + 6\hat{k})$

26. Susceptibility of a paramagnetic substance is

(A) negative and large. (B) negative and small.

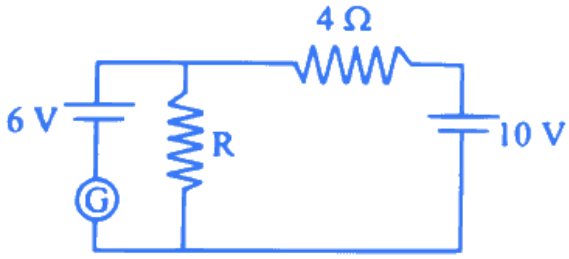
(C) positive and large. (D) positive and small.

27. When an ideal gas $\left(\gamma = \frac{5}{3}\right)$ is heated under constant pressure, then what percentage of given heat energy will be utilised in doing external work?

(A) 60% (B) 20%

(C) 30% (D) 40%

28. In the given electrical network, the value of resistance ' R ' when the current in the galvanometer will be zero, is



(A) 4Ω (B) 6Ω

(C) 7Ω (D) 10Ω

29. When a photosensitive metal surface is illuminated with radiation of wavelength ' λ_1 ', the stopping potential is ' V_1 '. If the same surface is illuminated with radiation of wavelength ' $3\lambda_1$ ', the stopping potential is $\frac{V_1}{6}$. The threshold wavelength for the photosensitive metal surface is

(A) $\frac{3}{2}\lambda_1$ (B) $2\lambda_1$

(C) $5\lambda_1$ (D) $6\lambda_1$

30. The mean kinetic energy of the molecules of an ideal gas at 399°C is ' E '. The temperature at which the mean kinetic energy of its molecules will be ' E/2 ', is

(A) 336°C (B) 276°C

(C) 123°C (D) 63°C

31. Three capacitors each of capacitance ' C ' and breakdown voltage ' V ' are connected in series. The capacitance and breakdown voltage of the series combination will be respectively

(A) 3C, 3 V (B) $\frac{C}{3}, \frac{V}{3}$

(C) 3C, $\frac{V}{3}$ (D) $\frac{C}{3}$, 3 V

32. When alternating current is passed through L – R series circuit, the power factor is $\frac{\sqrt{3}}{2}$ and $R = 50\Omega$, then the value of L is

$$\left[\cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}, \sin\frac{\pi}{6} = \frac{1}{2}, \tan\frac{\pi}{6} = \frac{1}{\sqrt{3}}\right]$$

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

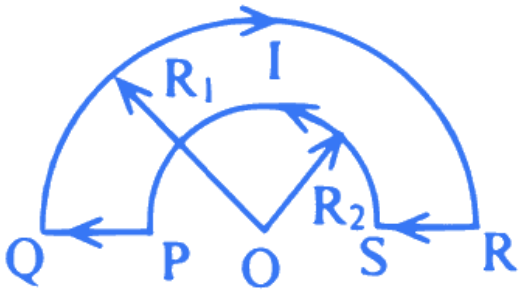
(C) $\frac{1}{2\sqrt{3}\pi}$ (D) $\frac{1}{\sqrt{3}\pi}$

33. Time period of a simple pendulum on earth's surface is ' T '. It time period becomes ' xT ' when taken to a height ' $2R$ ' above earth's surface. The value of x will be (R = radius of earth)

(A) 2 (B) 4

(C) 1 (D) 3

34. The wire loop PQRSP formed by joining two semicircular wire of radii R_1 and R_2 carries a current I as shown. The magnitude of the magnetic field at the centre ' O ' is



(A) $\frac{\mu_0 I}{4}[\frac{1}{R_1} - \frac{1}{R_2}]$ (B) $\frac{\mu_0 I}{4}[\frac{1}{R_2} - \frac{1}{R_1}]$

(C) $\frac{\mu_0 I}{2\pi}[\frac{1}{R_1} - \frac{1}{R_2}]$ (D) $\frac{\mu_0 I}{2\pi}[\frac{1}{R_2} - \frac{1}{R_1}]$

35. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = \left(t\hat{i} + 2t^2\hat{j}\right)$ N, where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axis. The power developed by above force at time t = 3 second will be

(A) 337.5 W (B) 228.5 W

(C) 422.5 W (D) 126.5 W

36. The period of oscillating simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$ where length ' l ' is 100 cm with error 1 mm . Period is 2 second. The time of 100 oscillations is measured by a stopwatch of least count 0.1s. The percentage error in gravitational acceleration ' g ' is

(A) 0.2% (B) 0.1%

(C) 1% (D) 2%

37. If a centre tap transformer is used with two p-n junction diodes for full wave rectification then output voltage of rectifier with respect to each diode is (secondary voltage of transformer = V_s)

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

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

38. Out of the following transitions in hydrogen atom, identify the transition which emits photons of highest frequency.

(A) n = 1 to n = 2 (B) n = 2 to n = 1

(C) $n = 2$ to $n = 6$ (D) $n = 6$ to $n = 2$

39. An organ pipe has fundamental frequency 80 Hz . If its one end is closed, the frequencies produced will be (in Hz) (Neglect end correction)

(A) 40, 80, 120, 160 (B) 40, 80, 160, 240

(C) 40, 120, 200, 280 (D) 80, 160, 240, 320

40. An a.c. e.m.f. of peak value 230 V and frequency 50 Hz is connected to a circuit with $R = 11.5\Omega$, L = 2.5H and a capacitor all in series. The value of capacitance is ' C ' for the current in the circuit to be maximum. The value of ' C ' and maximum current are respectively ($\pi^2 = 10$)

(A) 4μ F, 20 A (B) 5μ F, 10 A

(C) 2μ F, 20 A (D) 8μ F, 12 A

41. A gas undergoes a change in which its pressure ' P ' and volume ' V ' are related as PV^n = constant, where n is a constant. If the specific heat of the gas in this change is zero, then the value of n is (γ = adiabatic ratio)

(A) $1 - \gamma$ (B) $\gamma + 1$

(C) $\gamma - 1$ (D) γ

42. From photoelectric effect experiment, select the correct statement.

(A) Photoelectric effect can be explained using wave theory of light.

(B) The maximum kinetic energy of a photoelectron depends on the intensity of incident light.

(C) The stopping potential depends only on the work function of the metal.

(D) The saturation current increases as the intensity of incident light increases.

43. The equation of wave is $y = 60\sin(1200t - 6x)$, where ' y ' is in micron, ' t ' is in second and ' x ' is in metre. The ratio of maximum particle velocity to the wave velocity of wave propagation is

(A) 36
(B) 3.6×10^{-5}
(C) 3.6×10^{-4}
(D) 3.6×10^{-6}

44. Two satellites P and Q go round a planet in circular orbits having radii ' $3R$ ' and ' R ' respectively. If the speed of satellite P is ' $2V$ ', the speed of the satellite Q will be

(A) $2\sqrt{3}$ V
(B) $\frac{2\,\mathrm{V}}{\sqrt{3}}$
(C) $\frac{\mathrm{V}}{2}$
(D) $\frac{\mathrm{V}}{\sqrt{3}}$

45. For a particle performing S.H.M.; the total energy is ' n ' times the kinetic energy, when the displacement of a particle from mean position is $\frac{\sqrt{3}}{2}$ A, where A is the amplitude of S.H.M. The value of ' n ' is

(A) 2
(B) 3
(C) 4
(D) 6

46. A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet while it is passing through the ring is

(A) more than acceleration due to gravity.
(B) less than acceleration due to gravity.
(C) depends on the diameter of ring and length of magnet.
(D) depends on pole strength of magnet.

47. In a single slit diffraction pattern, identify the incorrect statement from the following.

(A) The fringes have unequal width.
(B) The fringes have unequal intensity.
(C) The fringes have unequal width and unequal intensity.
(D) The fringes have equal width and equal intensity.

48. If an alternating voltage is applied across a p-n junction diode in series with a load then

(A) no voltage appears across load.
(B) a pulsating voltage appears across load.
(C) an a.c. voltage appears across load.
(D) a d.c. voltage appears across load which is not pulsating.

49. Two waves of same frequency (n) are approaching each other with same velocity 12 m/s along the same linear path and interfere. The distance between two consecutive nodes is

(A) 12 n
(B) $\frac{12}{n}$
(C) 6 n
(D) $\frac{6}{n}$

50. A coil of resistance 400Ω is placed in a magnetic field. If the magnetic flux ' ϕ, (Wb) linked with the coil varies with time ' t ' (s) as $\phi = 50\mathrm{t}^2 + 4$, the current in the coil at t = 2 s will be

(A) 1 A
(B) 2 A
(C) 0.5 A
(D) 0.1 A

51. Identify the conjugate acid-base pair respectively from following equilibrium reaction.

$$HPO_{4(aq)}^{2-} + H_2O_{(\ell)} \rightleftharpoons PO_{4(aq)}^{3-} + H_3O_{(aq)}^{+}$$

(A) $H_3O^+$and H_2O (B) H_2O and HPO_4^{2-}
(C) PO_4^{3-} and H_3O^+ (D) $H_3O^+$and HPO_4^{2-}

52. Which from following nitrogen bases either of purine or pyrimidine does NOT contain $-NH_2$ group attached with its ring?

(A) Adenine (B) Thymine
(C) Guanine (D) Cytosine

53. Which from following amino acids contains heterocyclic ring at a side chain (R) group?

(A) Threonine (B) Histidine
(C) Cysteine (D) Valine

54. Calculate the volume occupied by all particles in fcc unit cell if volume of unit cell is 1.6×10^{-23} cm^3.

(A) 4.088×10^{-23} cm^3 (B) 2.156×10^{-23} cm^3
(C) 1.184×10^{-23} cm^3 (D) 3.226×10^{-23} cm^3

55. Calculate the number of Cl^-ions in 222 g unhydrous calcium chloride?
(At. mass Ca = 40, Cl = 35.5)

(A) N_A (B) 2 N_A
(C) 3 N_A (D) $4N_A$

56. Which from following mixtures exhibits positive deviation from Raoult's law?

(A) Ethanol and acetone (B) Benzene and toluene
(C) Chloroform and acetone (D) Phenol and aniline

57. What is the difference in oxidation number of Mn in $KMnO_4$ and MnO_2 ?

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

58. Calculate the work done in joule if 2 moles of an ideal gas expand isothermally from $15.5dm^3$ to $20dm^3$ at constant pressure 1 atm .

(A) -456 J (B) -228 J
(C) -684 J (D) -912 J

59. Nitric oxide reacts with H_2 according to reaction. $2NO_{(g)} + 2H_{2(g)} \rightarrow N_{2(g)} + 2H_2O_{(g)}$, identify correct relation for disappearance of reactant and appearance of product.

(A) $\frac{1}{2}\frac{d[NO]}{dt} = -\frac{d[H_2]}{dt}$ (B) $\frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[H_2O]}{dt}$
(C) $-\frac{d[N_2]}{dt} = \frac{1}{2}\frac{d[H_2O]}{dt}$ (D) $\frac{d[H_2]}{dt} = -\frac{1}{2}\frac{d[N_2]}{dt}$

60. The solubility of sparingly soluble salt AX_2 is 1×10^{-4} $moldm^{-3}$ at 298 K . Calculate its solubility product.

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

61. Which of the following is used as Green solvent?

(A) Supercritical CO_2 (B) $CHCl_3$
(C) CH_2Cl_2 (D) CCl_4

62. What is vapour density of O_2 gas?

(A) 8 (B) 16
(C) 32 (D) 22.4

63. Identify the correct statement regarding geometry and lone pair of electrons present in CH_4 and $SiCl_4$.

(A) Both have same geometry with two lone pair of electrons each.
(B) Both have different geometry with one lone pair of electrons each.
(C) Both have same geometry with no lone pair of electrons each.
(D) Both have different geometry with no lone pair of electrons each.

64. What type of hybridisation is present in square planar geometry of complex $[Ni(CN)_4]^{2-}$

(A) sp^3 (B) dsp^2
(C) sp^3 d (D) sp^3 d^2

65. What are the different types of bonds formed by sulphur with oxygen in thiosulfuric acid?

(A) One double bond and two single bond
(B) One double bond and one single bond
(C) Two double bond and one single bond
(D) Two double bond and two single bond

66. Which of the following is not an alkali metal?

(A) Lithium
(B) Potassium
(C) Beryllium
(D) Caesium

67. What is formula of mustard gas?

(A) $COCl_2$

(B) $Cl - CH_2 - CH_2 - S - CH_2 - CH_2 - Cl$

(C) CCl_3NO_2

(D) $CCl_2\ F_2$

68. Rate law for the reaction $aA + bB \rightarrow cC + dD$ is $r = k[A][B]$, the rate of reaction doubles if

(A) Concentration of both A and B are doubled.
(B) Concentration of A is doubled and concentration of B is kept constant.
(C) Concentration of B is doubled and concentration of A is halved.
(D) Concentration of A is kept constant and concentration of B is halved.

69. Which of the following reactions exhibit minimum standard reduction potential?

(A) $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$

(B) $F_{2(g)} + 2e^- \longrightarrow 2\ F^-_{(aq)}$

(C) $Li^+_{(aq)} + e^- \longrightarrow Li_{(s)}$

(D) $Cl_{2(g)} + 2e^- \longrightarrow 2Cl^-_{(aq)}$

70. Which from following dopants is used in germanium to produce p-type semiconductor?

(A) B
(B) P
(C) As
(D) Sb

71. Calculate the osmotic pressure of 0.5 M aqueous solution of nonvolatile solute at 300 K .

$$\left[R = 0.0821\ atmdm^3\ K^{-1}\ mol^{-1}\right]$$

(A) 9.51 atm
(B) 12.32 atm
(C) 15.60 atm
(D) 6.75 atm

72. 1.8 g water is vapourised by supplying 4 kJ heat at 100°C. What is the heat of vapourisation of water at same temperature?

(A) 8 kJ mol^{-1}
(B) 40 kJ mol^{-1}
(C) 18 kJ mol^{-1}
(D) 32 kJ mol^{-1}

73. Calculate the number of moles of nonvolatile solute dissolved in 0.3 kg solvent if $\Delta T_b = 0.3$ K and K_b for solvent is 1.8 K kg mol^{-1}.

(A) 0.051
(B) 0.044
(C) 0.062
(D) 0.073

74. Which from following is NOT hydrogen like species?

(A) Li^{+2}
(B) Be^{+3}
(C) Li^+
(D) He^+

75. Identify the monomer of natural rubber.

(A) Isoprene
(B) Polyacrylonitrile
(C) Chloroprene
(D) Tetrafluoroethylene

76. Identify strongest base from following in aqueous medium.

(A) NH_3
(B) CH_3NH_2
(C) $(CH_3)_2NH$
(D) $(CH_3)_3\ N$

77. Identify neutral ligand from following.

(A) Nitrato
(B) Cyano
(C) Aqua
(D) Iodo

78. Identify a weakest base from following

(A) $Eu(OH)_3$
(B) $La(OH)_3$
(C) $Lu(OH)_3$
(D) $Gd(OH)_3$

79. Which among the following has lowest boiling point?

(A) $CH_3 - O - CH_2 - CH_3$

(B) $CH_3 - COOH$

(C) $CH_3 - CH_2 - CH_2 - CH_3$

(D) $CH_3 - CH_2 - CH_2 - OH$

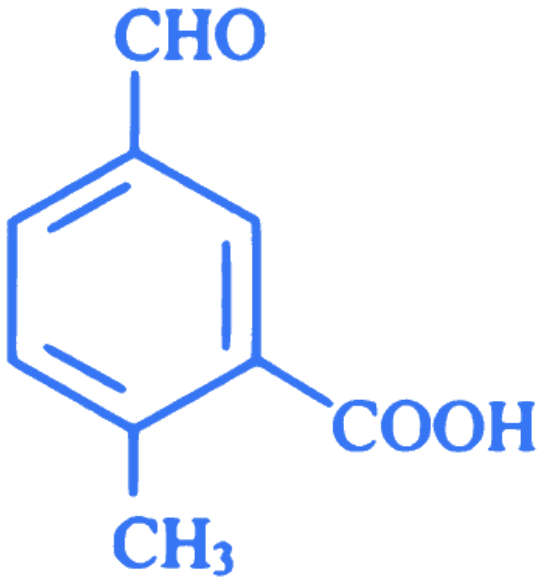
80. Which from following is a non benzenoid aromatic compound?

(A) Aniline
(B) Tropone
(C) Naphthalene
(D) Phenol

81. Phenol on reaction with aqueous solution of bromine gives

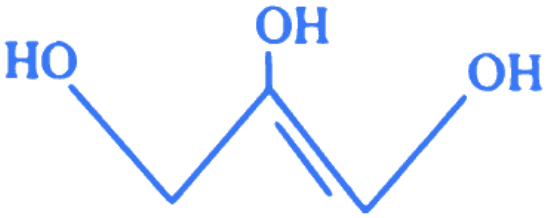
(A) o-Bromophenol
(B) m-Bromophenol
(C) p-Bromophenol
(D) 2,4,6-tribromophenol

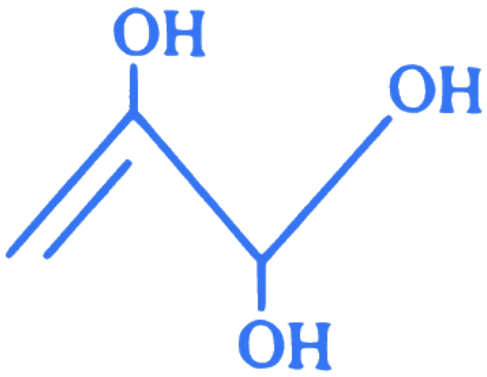
82. What is IUPAC name of the following compound?

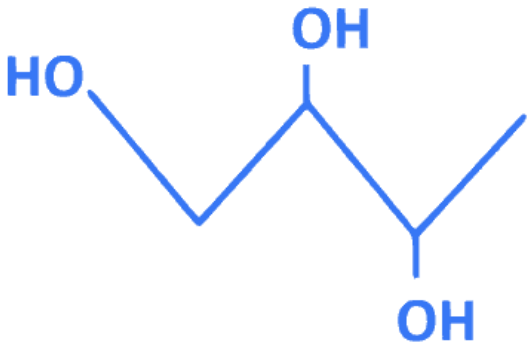


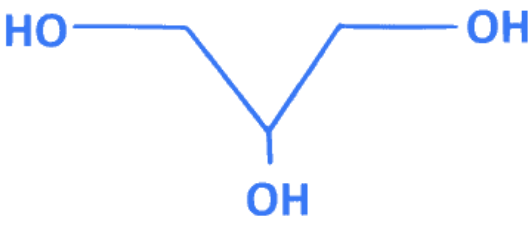
(A) 3-Carboxy-4-methylbenzaldehyde
(B) 5-Carboxy-4-methylbenzaldehyde
(C) 3-Formyl-6-methylbenzoic acid
(D) 5-Formyl-2-methylbenzoic acid

83. Which of the following is a bond line structure of glycerol?

(A)


(B)


(C)


(D)


84. Which of the following has highest reactivity for S_N1 reactions?

(A) n-Butyl iodide
(B) sec-butyl iodide
(C) Isobutyl iodide
(D) tert-Butyl iodide

85. The reaction of bromobenzene with bromomethane and sodium metal in dry ether to give toluene is

(A) Wurtz reaction
(B) Fittig reaction
(C) Friedel crafts reaction
(D) Wurtz-Fittig reaction

86. What is the number of structural isomers possible for alkene with molecular formula C_5H_{10} ?

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

87. If standard reduction potential (E°) of $\left(Ni^{+2}_{(aq)} \mid Ni_{(s)}\right)$ and $\left(Al^{+3}_{(aq)} \mid Al_{(s)}\right)$ are -0.25 V and -1.66 V respectively. What is standard emf of cell reaction $2Al_{(s)} + 3Ni^{+2}_{(aq)} \longrightarrow 2Al^{+3}_{(aq)} + 3Ni_{(s)}$

(A) +2.57 V (B) -2.57 V
(C) +1.41 V (D) -1.91 V

88. Which of the following is NOT obtained when a mixture of chloroethane and 1-chloropropane is treated with sodium metal in dry ether?

(A) Propane (B) Butane
(C) Pentane (D) Hexane

89. Calculate the value of dissociation constant of weak monoacidic base if it dissociates to 2% in 0.1 M solution?

(A) 6×10^{-5} (B) 4×10^{-5}
(C) 2×10^{-5} (D) 1×10^{-5}

90. Which from following process does NOT results in coagulation?

(A) electrophoresis (B) by adding excess solvent
(C) by mixing two oppositely charged sols (D) by boiling

91. Calculate the number of unit cell in 1 cm^3 volume of metal if volume of unit cell is 3.448×10^{-23} cm^3

(A) 2.5×10^{22} (B) 3.2×10^{22}
(C) 2.9×10^{22} (D) 3.7×10^{22}

92. Identify the catalyst used in following reaction at 500°C ?

$$CO + H_2O \rightleftharpoons CO_2 + H_2$$

(A) $Fe - Cr$ (B) Ni
(C) $Co - Th$ (D) Platinised asbestos

93. Hydroboration-oxidation of but-1-ene forms

(A) Butanal (B) Butanone
(C) Butan-1-ol (D) Butan-2-ol

94. Which from following reactión results in azo coupling?

(A) $C_6H_5NH_2 \xrightarrow{HNO_2}$
(B) $C_6H_5\ N_2Cl + C_6H_5OH \xrightarrow{OH^-}$
(C) $C_6H_5\ N_2Cl \xrightarrow{HBF_4}$
(D) $C_6H_5\ N_2Cl \xrightarrow[HCl]{Cu\ (Powder)}$

95. Identify the source of gallic acid from following

(A) Clove (B) Wintergreen
(C) Citrus fruits (D) Indian gooseberry

96. Calculate the standard enthalpy change of following reaction

$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(\ell)}$$

If $\Delta_f H^\circ\left(CH_4\right) = -75\ kJ\ mol^{-1}$

$\Delta_f H^\circ\left(CO_2\right) = -394\ kJ\ mol^{-1}$

$\Delta_f H^\circ\left(H_2O\right) = -286\ kJ\ mol^{-1}$

(A) -891 kJ (B) -1041 kJ
(C) -966 kJ (D) -1782 kJ

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

Dry ice $\xrightarrow[dry\ ether]{CH_3MgBr}$ A $\xrightarrow{H_3O^+}$ B

(A) Methanoic acid (B) Ethanoic acid
(C) Methanol (D) Ethanol

98. Which from following polymers is used to prepare shoe soles?

(A) Polyacrylamide (B) Perspex
(C) Buna- N (D) Glyptal

99. Half life of a first order reaction is 20 minutes. The time taken to reduce the initial concentration of reactant to $(1/10)^{th}$ is _____

(A) 46.60 min (B) 66.46 min
(C) 79.68 min (D) 88.00 min

100. If $E^\cdot\left(Mg^{+2}_{(aq)} \mid Mg_{(s)}\right) = -2.37$ V. What is potential for $Mg_{(s)} \longrightarrow Mg^{+2}(0.01M) + 2e^-$ at 298 K ?

(A) +2.3108 V (B) -2.3108 V
(C) +2.4292 V (D) -2.4292 V

101. If $y = y(x)$ and $\left(\frac{2+\sin x}{y+1}\right)\frac{dy}{dx} = -\cos x, y(0) = 1$, then $y\left(\frac{\pi}{2}\right) =$

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

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

102. If $A = \begin{bmatrix} 1 & \cot\frac{\theta}{2} \\ -\cot\frac{\theta}{2} & 1 \end{bmatrix}$ then $A^{-1} =$

(A) $\text{cosec}^2\frac{\theta}{2}\ A^T$ (B) $\frac{-\sin^2\theta}{2}A^T$

(C) $(\frac{1+\cos\theta}{2})A^T$ (D) $(\frac{1-\cos\theta}{2})A^T$

103. If $\bar{a}, \bar{b}, \bar{c}$ are three unit vectors such that $|\bar{a}+\bar{b}|^2 + |\bar{a}+\bar{c}|^2 = 8$, then $|\bar{a}+3\bar{b}|^2 + |\bar{a}+3\bar{c}|^2 =$

(A) 26 (B) 32

(C) 22 (D) 36

104. The probability that a certain kind of component will survive a given test is $\frac{2}{3}$. The probability that at most 2 components out of 4 tested, will survive is

(A) $\frac{31}{3^4}$ (B) $\frac{32}{3^4}$

(C) $\frac{33}{3^4}$ (D) $\frac{35}{3^4}$

105. From the following options, the nearest line to the origin is ....

(A) $3x - 4y + 4 = 0$ (B) $2x - 3y = 5$

(C) $4x - 3y + 12 = 0$ (D) $5x - 2y = 3$

106. If the truth value of the statement pattern $[p \wedge \sim r] \rightarrow \sim r \wedge q$ is False, then which of the following has truth value False?

(A) $(p \vee r) \rightarrow \sim r$ (B) $(r \vee q) \rightarrow \sim p$

(C) $\sim (p \vee q) \rightarrow \sim r$ (D) $\sim (r \vee q) \rightarrow \sim p$

107. $\bar{a} = \hat{i} - \hat{j}, \bar{b} = \hat{j} - \hat{k}, \bar{c} = \hat{k} - \hat{i}$ then a unit vector $\bar{d}$ such that $\bar{a}\cdot\bar{d} = 0 = [\bar{b}\bar{c}\bar{d}]$ is

(A) $\pm(\frac{\hat{i}+\hat{j}+3\hat{k}}{\sqrt{11}})$ (B) $\pm(\frac{-\hat{j}+\hat{k}}{\sqrt{2}})$

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

108. In $\triangle ABC$, with usual notations, if $a^4 + b^4 + c^4 - 2a^2c^2 - 2c^2b^2 = 0$, then $\angle C = \ldots$

(A) 135° (B) 120°

(C) 150° (D) 125°

109. If the planes $\bar{r}\cdot(2\hat{i} - \lambda\hat{j} + \hat{k}) = 3$ and $\bar{r}\cdot(4\hat{i} - \hat{j} + \mu\hat{k}) = 5$ are parallel, then $\lambda + \mu =$

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

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

110. If x is real, then the difference between the greatest and least values of $\frac{x^2-x+1}{x^2+x+1}$ is

(A) $\frac{10}{3}$ (B) $\frac{8}{3}$

(C) $\frac{5}{3}$ (D) $\frac{1}{3}$

111. The perimeter of a square whose two sides have equations $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{4}$ and $\frac{x}{2} = \frac{y-1}{3} = \frac{z+1}{4}$ is

(A) $\frac{\sqrt{673}}{\sqrt{29}}$ units (B) $\frac{4\sqrt{673}}{\sqrt{29}}$ units

(C) $\frac{4\sqrt{573}}{\sqrt{29}}$ units (D) $\frac{4}{\sqrt{29}}$ units

112. In a triangle ABC with usual notations if, $\tan\left(\frac{B-C}{2}\right) = x\cot\frac{A}{2}$, then $x =$

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

(C) $\frac{b-c}{b+c}$ (D) $\frac{a+b}{a-b}$

113. A coin is tossed until one head appears or a tail appears 4 times in succession. The probability distribution of the number of tosses is

(A)

X	1	2	3	4
P(X = x)	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{4}$

(B)

X	1	2	3	4
P(X = x)	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{8}$

(C)

X	1	2	3	4
P(X = x)	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{2}$

(D)

X	1	2	3	4
P(X = x)	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

114. The degree of the differential equation $\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2\log\left(\frac{d^2y}{dx^2}\right)$ is

(A) 1 (B) 2

(C) 3 (D) Not defined

115. If the sum of the squares of the distances of a point $P(x, y, z)$ from the three co-ordinate axes is 324 , then the distance of point P from the origin is ....

(A) 18 (B) 162

(C) $9\sqrt{2}$ (D) 324

116. For a real number x, $[x]$ denotes the greatest integer less than or equal to x. Then the value of

$$\left[\frac{1}{2}\right]+\left[\frac{1}{2}+\frac{1}{100}\right]+\left[\frac{1}{2}+\frac{2}{100}\right]+\left[\frac{1}{2}+\frac{3}{100}\right]+\left[\frac{1}{2}+\frac{99}{100}\right]=$$

(A) 49 (B) 100
(C) 0 (D) 50

117. The angle between the lines $3x = 2y = -z$ and $-x = 6y = -4z$ is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{2}$ (D) $\frac{\pi}{6}$

118. If $y + \frac{d}{dx}(xy) = x(\sin x + \log x)$ then

(A) $y = \cos x + \frac{2\sin x}{x} + \frac{2}{x^2}\cos x + \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$, where c is the constant of integration.

(B) $y = -\cos x - \frac{2}{x}\sin x + \frac{2}{x^2}\cos x + \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$ where c is the constant of integration.

(C) $y = -\cos x + \frac{2}{x}\sin x + \frac{2}{x^2}\cos x + \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$ where c is the constant of integration.

(D) $y = \cos x - \frac{2}{x}\sin x + \frac{2}{x^3}\cos x + \frac{x}{3}\log x - \frac{x}{9} + \frac{c}{x^2}$ where c is the constant of integration.

119. If the pair of straight lines $xy - x + y - 1 = 0$ and the line $x + ky - 3 = 0$ are concurrent, then the value of k is equal to

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

120. If the function

$$f(x) = \begin{cases} x + a\sqrt{2}\ \sin x & \text{if } 0 \le x \le \frac{\pi}{4} \\ 2x\cot x + b & \text{if } \frac{\pi}{4} < x \le \frac{\pi}{2} \\ a\cos 2x - b\sin x & \text{if } \frac{\pi}{2} < x \le \pi \end{cases}$$

is continuous in $[0, \pi]$ then $a - b =$

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{12}$
(C) $\frac{5\pi}{12}$ (D) $\frac{7\pi}{12}$

121. Which of the following statements has the truth value T ?
A: cube roots of unity are in Geometric progression and their sum is 1
B: $4 + 7 > 10$ iff $2 + 8 < 10$
C: $\exists x \in \mathbb{N}$ such that $x^2 - 3x + 2 = 0$ and $\exists n \in \mathbb{N}$ such that n is an odd number
D: $3 + i$ is a complex number or $\sqrt{2} + \sqrt{3} = \sqrt{5}$

(A) only A (B) B, C&D
(C) both A and C (D) both C and D

122. The p.d.f. of a continuous random variable X is $f(x) = \begin{cases} \frac{x^2}{18} & , \text{ if } -3 < x < 3 \\ 0 & \text{otherwise} \end{cases}$
Then $P[|X| < 2] =$

(A) $\frac{1}{27}$ (B) $\frac{2}{13}$
(C) $\frac{8}{27}$ (D) $\frac{4}{27}$

123. The population of a town increases at a rate proportional to the population at that time. If the population increases from forty thousand to eighty thousand in 20 years, then the population in another 40 years will be

(A) 240000 (B) 160000
(C) 320000 (D) 640000

124. If the vectors $m\hat{i} + m\hat{j} + n\hat{k}, \hat{i} + \hat{k}, n\hat{i} + n\hat{j} + p\hat{k}$ lie in a plane then...

(A) $m + n + p = 0$ (B) m, n, p are in A.P.
(C) m, n, p are in G.P. (D) n, m, p are in G.P.

125. The value of

$$\sin^2 5^\circ + \sin^2 10^\circ + \ldots + \sin^2 15 + \ldots \ldots \ldots \ldots \ldots \ldots + \sin^2 85^\circ + \sin^2 90^\circ =$$

(A) $\frac{19}{2}$ (B) $\frac{3}{2}$
(C) $\frac{23}{2}$ (D) $\frac{21}{2}$

126. The area bounded by the curve $x = 2 - y - y^2$ and the Y -axis is

(A) $\frac{7}{6}$ sq. units (B) $\frac{13}{2}$ sq. units
(C) $\frac{9}{2}$ sq. units (D) $\frac{27}{2}$ sq. units

127. If $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right) + \sec^{-1}\left(\frac{1+x^2}{1-x^2}\right)$ then the value of $\frac{dy}{dx}$ at $x = \sqrt{3}$ is

(A) 1 (B) $\frac{1}{2}$
(C) 0 (D) $\frac{1}{4}$

128.

$$\int_{\frac{\pi}{3}}^{\frac{2\pi}{3}} \frac{x}{1+\sin x}dx =$$

(A) $\pi(\sqrt{3}-2)$ (B) $\pi(2-\sqrt{3})$

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

129.

$$\int_0^2 \frac{3x+1}{x^2+4}dx =$$

(A) $\log(2\sqrt{2})+\frac{\pi}{4}$ (B) $\log(2\sqrt{2})+\frac{\pi}{6}$

(C) $\log(2\sqrt{2})+\frac{\pi}{8}$ (D) $\log(2\sqrt{2})+\frac{\pi}{12}$

130.

$$\int \frac{\sin 2x \cos 2x}{\sqrt{4-\cos^4 2x}}dx =$$

(A) $\frac{1}{4}\sin^{-1}(\frac{\cos^2 2x}{2})+c$, where c is the constant of integration.

(B) $\frac{-1}{4}\sin^{-1}(\frac{\cos^2 2x}{2})+c$, where c is the constant of integration.

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

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

131.

$$\int \frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha}dx =$$

(A) $2\cos x + 2x\cos\alpha + c$, where c is the constant of integration.

(B) $2\cos x - 2x\cos\alpha + c$, where c is the constant of integration.

(C) $2\sin x + 2x\cos\alpha + c$, where c is the constant of integration.

(D) $2\sin x + 2x\sin\alpha + c$, where c is the constant of integration.

132. 21 friends were invited for a party. Two round tables can accommodate 12 and 9 friends each, The number of ways of the seating arrangements of friends is .....

(A) $11! \times 8!$ (B) $12! \times 9!$

(C) $\frac{35}{9} \times 19!$ (D) $\frac{20!}{12!8!} \times 11! \times 9!$

133. The area of a parallelogram whose diagonals are the vectors $2\bar{a}-\bar{b}$ and $4\bar{a}-5\bar{b}$, where $\bar{a}$ and $\bar{b}$ are unit vectors forming an angle of 45° is

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

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

134.

$$\lim_{x\to\infty}\left(\frac{x+8}{x+1}\right)^{x+5} = \ldots$$

(A) e^4 (B) e^5

(C) e^{11} (D) e^7

135.

$$\cot^{-1}\left(2\cos\left(2\operatorname{cosec}^{-1}(\sqrt{2}\,)\right)\right) = \ldots$$

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

(C) $\frac{\pi}{4}$ (D) 0

136. If $z = x + iy$ is a complex number, then the equation $\left|\frac{z+i}{z-i}\right| = \sqrt{3}$ represents the

(A) circle with centre $(2,0)$ and radius $\sqrt{3}$

(B) circle with centre $(0,2)$ and radius $\sqrt{3}$

(C) circle with centre $(0,0)$ and radius $\sqrt{3}$

(D) circle with centre $(0,-2)$ and radius $\sqrt{3}$

137. If $\int \frac{2x^2+3}{(x^2-1)(x^2-4)}dx = \log\left[\left(\frac{x-2}{x+2}\right)^a \cdot \left(\frac{x+1}{x-1}\right)^b\right] + c$, (where c is the constant of integration) then the value of $a+b$ is equal to

(A) $\frac{1}{12}$ (B) $\frac{21}{12}$

(C) $\frac{-1}{12}$ (D) $\frac{-21}{12}$

138. For $N \in \mathbb{N}$, $\frac{d^n}{dx^n}(\log x) =$

(A) $\frac{(n-1)!}{x^n}$ (B) $\frac{n!}{x^n}$

(C) $\frac{(n-2)!}{x^n}$ (D) $(-1)^{n-1}\frac{(n-1)!}{x^n}$

139. In a single toss of a fair die, the odds against the event that number 4 or 5 turns up is

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

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

140. If $f(x) = x \cdot e^{x(1-x)}$, then $f(x)$ is

(A) increasing in $\mathbb{R}$ (B) increasing in $(\frac{-1}{2}, 1)$

(C) decreasing in $\mathbb{R}$ (D) decreasing in $[-\frac{1}{2}, 1]$

141. The approximate value of $\sqrt[3]{64 \cdot 04}$ is

(A) 4.00043 (B) 4.00076

(C) 4.00083 (D) 4.00064

142. The X and Y intercepts of the tangent to the hyperbola $\frac{x^2}{20} - \frac{y^2}{5} = 1$ which is perpendicular to the line $4x + 3y = 7$, are respectively

(A) $\frac{-10}{3}, \frac{-5}{3}$ (B) $\frac{10}{3}, \frac{-5}{2}$

(C) $\frac{10}{3}, \frac{5}{2}$ (D) $\frac{10}{3}, \frac{5}{3}$

143. If the lines $\frac{x-1}{2} = \frac{y+1}{k} = \frac{z}{2}$ and $\frac{x+1}{5} = \frac{y+1}{2} = \frac{z}{k}$ are coplanar, then the equation of the plane containing these lines are

(A) $x \pm y + z = 0$ (B) $y \pm z + 1 = 0$

(C) $2x \pm y = 0$ (D) $x \pm z + 1 = 0$

144. The line $y = mx + 3$ is tangent to the parabola $y^2 = 4x$, if the value of m is

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

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

145. If the tangent and the normal at the point $(\sqrt{3}, 1)$ to the circle $x^2 + y^2 = 4$, and the X -axis form a triangle, then the area (in sq.units) of this triangle is

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

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

146. If

$3\sin^{-1}\left(\frac{2x}{1+x^2}\right) - 4\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) + 2$

$\tan^{-1}\left(\frac{2x}{1-x^2}\right) = \frac{\pi}{3}$

then the value of $x =$

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

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

147. If $x = a\cos^3\theta y = a\sin^3\theta$

Then $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} =$

(A) $\tan^2\theta$ (B) $\sec^2\theta$

(C) $\sec\theta$ (D) $\tan\theta$

148. If the difference between the maximum and minimum values of the objective function $z = 7x - 8y$, subject to the constraints $x + y \leqslant 20, y \geqslant 5, x, y \geqslant 0$ is $5k + 200$, then the value of k is

(A) 3 (B) 4

(C) 5 (D) 6

149. The number of solutions of $16^{\sin^2 x} + 16^{\cos^2 x} = 10$ in $0 \leqslant x \leqslant 2\pi$ are

(A) 8 (B) 10

(C) 6 (D) 4

150. Let the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lie in the plane $x + 3y - \alpha z + \beta = 0$, then the value of $(\beta - \alpha)$ is equal to

(A) 1 (B) 13

(C) 7 (D) -6

- End of Question Paper -