MHT CET 2026 PCM May 13 Shift 1 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

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

General Instructions

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

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

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

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

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

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

1. The percentage error in the measurement of mass and speed are 2% and 3% respectively. The maximum error in the estimation of kinetic energy is

(A) 11%
(B) 8%
(C) 5%
(D) 1%

2. The real force F acting on particle of mass m performing circular motion acts along the radius of circle r and is directed forwards the centre of the circle. The magnitude of square root of such a force is (T = periodic time)

(A) $\frac{2\pi\sqrt{mr}}{T}$
(B) $\frac{Tmr}{4\pi}$
(C) $\frac{2\pi T}{\sqrt{mr}}$
(D) $\frac{T^2mr}{4\pi}$

3. A particle is projected from ground with speed u and at an angle θ with horizontal. If at maximum height from ground, the speed of a particle is half times its initial velocity of projection then its maximum height attained is ($\cos 60^\circ = 0.5$, $\sin 60^\circ = \sqrt{3}/2$) (g = acceleration due to gravity)

(A) $\frac{2u^2}{g}$
(B) $\frac{3u^2}{8g}$
(C) $\frac{u^2}{g}$
(D) $\frac{u^2}{2g}$

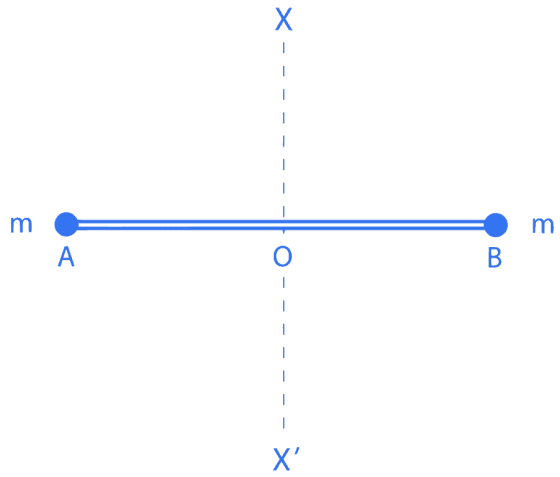
4. A particle moves from position $3\hat{i} + 2\hat{j} - 6\hat{k}$ to $14\hat{i} + 13\hat{j} + 9\hat{k}$ due to uniform force of $(4\hat{i} + \hat{j} + 3\hat{k})$ N. If displacement is in metre then work done will be

(A) 100 J
(B) 200 J
(C) 300 J
(D) 250 J

5. A block of mass 'm' collides with another stationary block of mass '2m'. The lighter block comes to rest after collision. If the velocity of the first block is 'V' then the coefficient of restitution is

(A) 0.5
(B) 0.4
(C) 0.6
(D) 0.8

6. The moment of inertia of two equal masses each of mass m at separation L connected by a rod of mass M about an axis passing through centre and perpendicular to the length of rod is



(A) $\frac{(M+3m)L^2}{12}$
(B) $\frac{(M+6m)L^2}{12}$
(C) $\frac{ML^2}{4}$
(D) $\frac{ML^2}{12}$

7. Moment of inertia of a thin uniform rod rotating about the perpendicular axis passing through its centre is I. If the same rod is bent in to a ring and its moment of inertia about its diameter is I_1, then the ratio I/I_1 is

(A) $\frac{2\pi^2}{3}$
(B) $\frac{3\pi^2}{2}$
(C) $\frac{5\pi^2}{3}$
(D) $\frac{8\pi^2}{3}$

8. If mean radius of earth is 'R', its angular velocity is 'ω' and acceleration due to gravity at the surface of the earth is 'g' then the cube of the radius of the orbit of geostationary satellite will be

(A) $\frac{R^2\omega^2}{g}$
(B) $\frac{R^2g^2}{\omega^2}$
(C) $\frac{R^2g}{\omega}$
(D) $\frac{R^2g}{\omega^2}$

9. When a big drop of water is formed from n small drops of water, the energy loss is 3E, where E is the energy of the big drop. If R is the radius of big drop and r is the radius of the smaller drop then number of smaller drops n is

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

10. When one end of a capillary tube is dipped in water, water rises to a height h. The upward force of 105 dyne due to surface tension is balanced by the force due to weight of water column. The inner circumference of the capillary 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

11. Two solid spheres of same material but of mass M and 8M fall simultaneously on a viscous liquid and their terminal velocities are V and nV, then the value of n is

(A) 16 (B) 8

(C) 4 (D) 2

12. Heat energy is incident on the surface at the rate of 1000 J/min. If coefficient of absorption is 0.8 and coefficient of reflection is 0.1 then heat energy transmitted by the surface in 5 minute is

(A) 100 J (B) 500 J

(C) 700 J (D) 900 J

13. The total radiant energy per unit area normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose outer surface radiates as a black body at a temperature 'T' K is (σ = Stefan's constant)

(A) $\frac{\sigma r^2 T^4}{R^2}$ (B) $\frac{\sigma r^2 T^4}{4\pi R^2}$

(C) $\frac{\sigma r^4 T^4}{R^4}$ (D) $\frac{4\pi\sigma r^2 T^4}{R^2}$

14. Two rods A and B are of equal lengths. Their ends are kept between the same temperatures and their area cross-sections are A_1 and A_2, thermal conductivities are K_1 and K_2. The rate of heat transmission in the two rods will be equal if

(A) $K_1 A_2 = K_2 A_1$ (B) $K_1 A_1 = K_2 A_2$

(C) $K_1 A_1^2 = K_2 A_2^2$ (D) $K_1 = K_2$

15. Six moles of oxygen gas is heated from 20°C to 35°C at constant volume. If specific heat capacity at constant pressure is 8 cal $\text{mol}^{-1}\text{k}^{-1}$ and gas constant is 2 cal $\text{mol}^{-1}\text{k}^{-1}$. The change in internal energy of the gas is

(A) 180 cal (B) 300 cal

(C) 360 cal (D) 540 cal

16. Out of the following relations which one is true in the case of an adiabatic process, where $\gamma = C_p/C_v$?

(A) $P^{(1-\gamma)}T^{\gamma} =$ constant (B) $P^{\gamma}T^{(1-\gamma)} =$ constant

(C) $PT^{\gamma} =$ constant (D) $P^{\gamma}T =$ constant

17. At what temperature, the kinetic energy of a gas molecule is half of the value at 27°C ?

(A) 13.5°C (B) -123°C

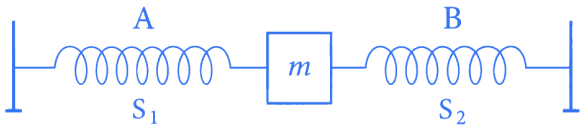
(C) 75K (D) 13.5K

18. A particle oscillates simple harmonically along a straight line with period 8 s and amplitude $8\sqrt{2}$ m. It starts from mean position then the ratio of the distances travelled by it in the 2^{nd} second and the first second of its motion is $\left(\sin 45^\circ = \frac{1}{\sqrt{2}}\right)$ $(\sin 90^\circ = 1)$

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

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

19. S_1 and S_2 are two identical springs. The frequency of oscillation of mass m is F. If one spring is removed, the frequency will become



(A) F (B) $2F$

(C) $\sqrt{2}F$ (D) $F/\sqrt{2}$

20. A body has time period T_1 under the action of one force and T_2 under the action of another force. The square of the time period when both the forces are acting in the same direction is

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

(C) $T_1^2 + T_2^2$ (D) $\frac{T_1^2 T_2^2}{(T_1^2+T_2^2)}$

21. The fundamental frequency of a closed pipe is 400 Hz. If $\frac{1}{3}^{rd}$ pipe is filled with water then the frequency of 3^{rd} harmonic of the pipe will be (Neglect end correction)

(A) 1200 Hz (B) 1800 Hz

(C) 600 Hz (D) 300 Hz

22. A stretched wire of length 110 cm is divided in to 3 segments whose frequencies are in the ratio 1 : 2 : 3. Their respective lengths must be

(A) 20 cm, 30 cm, 60 cm (B) 60 cm, 30 cm, 20 cm

(C) 60 cm, 20 cm, 30 cm (D) 30 cm, 60 cm, 20 cm

23. Two points on a travelling wave having frequency 500 Hz and velocity 300 m/s are 60° out of phase, then the minimum distance between the two points is

(A) 0.2 m (B) 0.1 m

(C) 0.5 m (D) 0.4 m

24. A whistle sends out 256 waves in a second. If the whistle approaches the observer with velocity $\left(\frac{1}{3}\right)^{rd}$ of the velocity of sound in air. The number of waves per second observer will receive is

(A) 384 (B) 192

(C) 300 (D) 200

25. Three point charges $+q, -2q$ and $-2q$ are placed at the vertices of an equilateral triangle of side a. The work done by some external force to increase their separation to '$2a$' will be $\left(K = \frac{1}{4\pi\varepsilon_0}\right)$

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

(C) $\frac{qK}{a^2}$ (D) zero

26. If 100 J of work has to be done in moving an electric charge of 4 C from a place, where potential is -10 V to another place where potential is V volt. The value of V is

(A) 5 V (B) 10 V

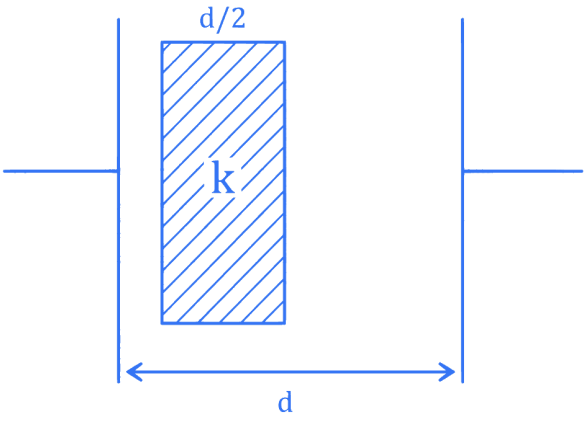
(C) 25 V (D) 15 V

27. Two point charges, $+2C$ and $+6C$ repel each other with a force of 12N. If a charge of $(-4C)$ is given to each of these charges, the force now is

(A) 4N, repulsive (B) 4N, attractive

(C) 12N, attractive (D) 8N, repulsive

28. Find the capacitance of the Parallel plate capacitor shown in the figure.
(A = area of each plate, ε_0 = permittivity of free space)



(A) $\frac{2KA\varepsilon_0}{(K+1)d}$ (B) $\frac{2KA\varepsilon_0}{d}$

(C) $\frac{(K+1)A\varepsilon_0}{2d}$ (D) $\frac{2KA\varepsilon_0}{(K^2+1)d}$

29. The resistances in two arms of the metre bridge are 5Ω and $R\ \Omega$ respectively, null point is obtained at length l_1. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6l_1$. The resistance R is

(A) 10 Ω (B) 15 Ω

(C) 20 Ω (D) 25 Ω

30. In a potentiometer, the null point is obtained on 7^{th} wire. What should we do to change the null point on 9^{th} wire by keeping all other quantities same ?

(A) Decrease resistance in series with battery (B) Increase resistance in main Circuit

(C) Decrease resistance in main circuit (D) Increase applied e.m.f.

31. Six very long insulated copper wires are bound together to form a cable. The currents carried by the wires are $i_1 = 10$A, $i_2 = -13$A, $i_3 = 10$ A, $i_4 = 7$A, $i_5 = -12$A and $i_6 = 18$ A. The magnetic induction at a perpendicular distance of 10 cm from the cable is ($\mu_0 = 4\pi \times 10^{-7}$ SI units)

(A) 40 μT (B) 375 μT

(C) 30 μT (D) 35 μT

32. An arc of a circle of radius R subtends an angle $\pi/2$ at the centre. It carries a current I. The magnetic field at the centre will be (μ_0 = permeability of free space)

(A) $\frac{\mu_0 I}{2R}$ (B) $\frac{\mu_0 I}{8R}$

(C) $\frac{\mu_0 I}{4R}$ (D) $\frac{2\mu_0 I}{5R}$

33. An iron rod is placed parallel to magnetic field of intensity H. The magnetic flux through the rod is Φ and its cross-sectional area is A. The magnetic permeability (μ) of the rod is

(A) ΦAH (B) $\frac{AH}{\Phi}$

(C) $\frac{\Phi}{AH}$ (D) $A/\Phi H$

34. An air cored coil has a self inductance of 0.1 H. A soft iron core of relative permeability 1000 is introduced inside cored coil and number of turns reduced to $\left(\frac{1}{10}\right)^{th}$. The value of self inductance now becomes

(A) 1 mH (B) 10 mH

(C) 1 H (D) 10 H

35. A circular ring of diameter 20 cm has a resistance of 0.01 Ω. The charge that will flow through the ring, if it is turned from a position perpendicular to a uniform magnetic field of 2T to a position parallel to the field is (in coulomb) ($\because \cos 0^\circ = 1, \cos 90^\circ = 0$)

(A) π (B) 2π

(C) $\pi/2$ (D) 4π

36. For series LCR circuit, the current is observed to lead the applied voltage. An additional capacitor C_1 when joined with capacitor C, makes the power factor of the circuit unity. The capacitor C_1 must be connected in

(A) series with C and has magnitude $\frac{C}{(\omega^2 LC-1)}$ (B) series with C and has magnitude $\frac{(1-\omega^2 LC)}{\omega^2 L}$

(C) parallel with C and has magnitude $\frac{(1-\omega^2 LC)}{\omega^2 L}$ (D) parallel with C and has magnitude $\frac{C}{(\omega^2 LC-1)}$

37. What is the value of inductance L for which the current is maximum in series LCR circuit with $C = 10\ \mu$F and $\omega = 1000/$s ?

(A) 100 mH (B) 1 mH

(C) 10 mH (D) 1000 mH

38. In an LCR series circuit, a. c. voltage source is connected in series. When L is removed from the circuit, the phase difference between the voltage and the current is $\pi/3$. If instead C is removed, the phase difference is again $\pi/3$. The power factor of the circuit is $\left(\tan\frac{\pi}{3} = \sqrt{3}\right)$

(A) 0.5 (B) $\frac{1}{\sqrt{2}}$

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

39. A transformer having efficiency 90% is working on 200 V and 3 KW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil, respectively, are

(A) 300 V, 15 A (B) 450 V, 15 A

(C) 450 V, 13.5 A (D) 600 V, 15 A

40. Three immiscible transparent liquids with refractive indices $\frac{3}{2}$, $\frac{4}{3}$ and $\frac{6}{5}$ are arranged one above the other. The depths of the liquids are 3 cm, 4 cm and 6 cm respectively. The apparent depth of the vessel is

(A) 10 cm (B) 9 cm

(C) 8 cm (D) 7 cm

41. In Young's double slit experiment, the slit width is 1 mm and screen is at a distance 2 m from slits. Light of 600 nm is used. If a thin glass plate of refractive index 1.5 of thickness 0.06 mm is placed over one of the slits then there will be a lateral displacement of the fringes by

(A) 0 cm (B) 6 cm

(C) 10 cm (D) 15 cm

42. The ratio of intensity at the centre of a bright fringe to the intensity at a point distant $\left(\frac{1}{4}\right)^{th}$ of the distance between two successive bright fringes will be ($\cos 0^\circ = 1, \cos 90^\circ = 0$)

(A) 4 (B) 3

(C) 2 (D) 1

43. The wavelength of light used in Young's double slit experiment, is λ. The intensity at a point on the screen is I, where the path difference is $\frac{\lambda}{6}$. If I_0 is the maximum intensity then the ratio I to I_0 is $\left(\cos 30^\circ = \frac{\sqrt{3}}{2}\right)$

(A) 0.866 (B) 0.5

(C) 0.707 (D) 0.75

44. A parallel beam of light is incident normally on a plane surface absorbing 40% of light and reflecting the rest. If the incident beam carries 60 W of power the force exerted by it on the surface is (C = velocity of light = 3×10^8 m/s)

(A) 3.2×10^{-8} N (B) 3.2×10^{-7} N

(C) 5.12×10^{-7} N (D) 5.12×10^{-8} N

45. The frequency of the incident light falling on a photosensitive metal plate is doubled, the kinetic energy of the emitted photoelectrons is

(A) double the earlier value (B) unchanged

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

46. The ratio of minimum wavelengths of Lyman and Balmer series will be

(A) 1.25 (B) 0.25

(C) 5 (D) 10

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

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

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

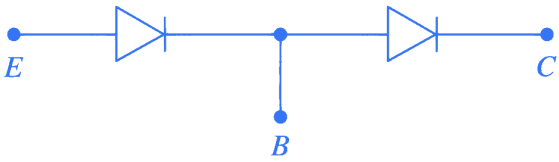
48. In common emitter amplifier, using output resistance 5000 Ω and input resistance 2000 Ω, if the peak value of input signal voltage is 10 mV and $\beta = 50$, then peak value of output voltage is

(A) 5×10^{-6} V (B) 12.50×10^{-6} V

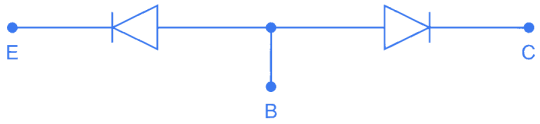
(C) 1.25 V (D) 125.0 V

49. An n-p-n transistor can be considered to be equivalent to two diodes connected. Which one of the following figure is correct?

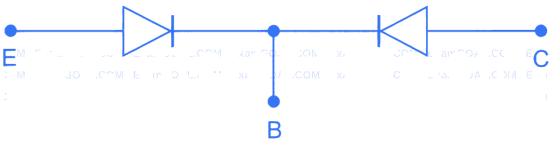
(A)



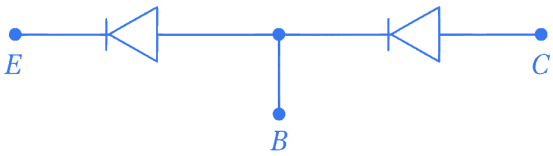
(B)



(C)



(D)



50. There is no hole current in good conductors because they

(A) have large forbidden energy gap. (B) have overlapping valence and conduction bands.

(C) are full of electrons. (D) have no valence band.

51. Calculate the number of molecules in 2 mol of MgO.

(A) 2×10^{22} (B) 6.022×10^{23}

(C) 1.2044×10^{24} (D) 6.022×10^{22}

52. The number of unpaired electrons in Cu^{+2} and Fe^{+3} respectively are-

(A) 2 and 3 (B) 3 and 2

(C) 1 and 5 (D) 2 and 4

53. What is the shape of ClF_3 according to VSEPR theory ?

(A) Trigonal Bipyramidal (B) T - shape

(C) See saw (D) Trigonal planar

54. A sample of nitrogen gas occupies a volume of 320 cm^3 at STP. Calculate its volume at 66°C and 0.825 bar pressure

(A) 481.6 cm^3 (B) 332.4 cm^3

(C) 80 cm^3 (D) 104.9 cm^3

55. 1 mole of an ideal gas expands isothermally and reversibly from an initial volume of 10 L to a final volume of 20 L at 300K. Calculate the work done in expanding the gas. (R = 8.314 J K^{-1} mol $^{-1}$)

(A) −750 J (B) −1500 J

(C) −1729 J (D) −3456 J

56. Calculate the change in internal energy of the system if 40 kJ of work is done by the system, and it absorbs 20 kJ of heat

(A) −20 kJ (B) 20 kJ

(C) −60 kJ (D) 40 kJ

57. Which of the following is an extensive property?

(A) Melting point (B) Density

(C) Mass (D) Viscosity

58. A weak monobasic acid is 18% dissociated in 0.05 M solution. Calculate the concentration of solution if it is 10% dissociated .

(A) 0.162 M. (B) 0.141 M.

(C) 0.184 M. (D) 0.125 M.

59. The solubility product of sparingly soluble salt BA at 25°C is 6.0×10^{-13}. What is the solubility of it?

(A) 7.746×10^{-7} mol dm^{-3} (B) 7.142×10^{-7} mol dm^{-3}

(C) 7.344×10^{-7} mol dm^{-3} (D) 7.964×10^{-7} mol dm^{-3}

60. Identify conjugate bases of HCO_3^- and HS^- respectively.

(A) H_2CO_3 and H_2S (B) CO_3^{--} and S^{--}

(C) HCO_3^{--} and H_2S (D) $H_2CO_3^{--}$ and S^-

61. Find the oxidation number of S in Marshall's acid.

(A) +5 (B) +4

(C) +7 (D) +6

62. Which of the following compounds has a nitrogen atom with two different oxidation states?

(A) NH_4NO_3 (B) N_2H_4

(C) N_3H (D) NH_2CONH_2

63. Which of the following metals does not form MH_2 type hydride when heated with hydrogen under normal conditions?

(A) Be (B) Mg

(C) Ca (D) Sr

64. Which of the following is gamma isomer of BHC ?

(A) DDT (B) Chloroform

(C) Chlorobenzene (D) Lindane

65. How can you identify the presence of halogen in given haloalkane?

(A) On heating with alcohol. (B) On heating with KOH followed by treatment with dilute $AgNO_3$.

(C) On heating with AgX. (D) On heating with KOH and NaOH.

66. Which of the following effects involves the delocalization of pi electrons in a molecule?

(A) Inductive effect (B) Resonance effect

(C) Electromeric effect (D) Hyperconjugation

67. Identify the product when but-2-yne is treated with H_2 gas in the presence of Lindlar's catalyst.

(A) Cis-But-2-ene (B) Trans-But-2-ene
(C) Mixture of both (D) Butane

68. What type of unit cell is formed by silver?

(A) BCC (B) FCC
(C) SC (D) Base centered

69. Calculate the number of atoms in 0.6 g metal that forms bcc structure having density 8.5 g cm^{-3}, if the volume of unit cell is 3.6×10^{-23} cm^3

(A) 2.8×10^{21} (B) 3.92×10^{21}
(C) 4.7×10^{21} (D) 4.15×10^{21}

70. A compound is formed by two elements X and Y, atoms of the element Y as anion make ccp and those of the element X as cation occupy all the octahedral voids. What is the formula of the compound ?

(A) X_3Y_4 (B) X_4Y_3
(C) X_2Y_3 (D) XY

71. A 0.1 molal aqueous solution of $K_3[Fe(CN)_6]$ freezes at $-0.85°C$. If K_f for water is 1.86 K kg mol^{-1}, what is the van't Hoff factor for this solution?

(A) 3.0 (B) 3.5
(C) 4.0 (D) 4.57

72. What is the molar mass of a solute when a solution is prepared by dissolving 0.8 g of solute in 0.3 dm^3 of water having osmotic pressure 0.2 atm at 300 K (R = 0.082 atm dm^3 K^{-1} mol^{-1})

(A) 300 g/mol (B) 280 g/mol
(C) 328 g/mol (D) 345 g/mol

73. If ΔT_b of 0.5 m urea solution is x^0C find the expected value of ΔT_b for 0.5 m $Al_2(SO_4)_3$

(A) $2x^0$C (B) $3x^0$C
(C) $5x^0$C (D) $4x^0$C

74. The standard EMF of the cell, Ni | Ni^{2+} || Cu^{2+} | Cu is 0.59 Volt. The standard reduction potential of a copper electrode is 0.34 volt. What is the standard electrode potential of nickel electrode ?

(A) 0.25 volt (B) -0.25 volt
(C) 0.93 volt (D) -0.93 volt

75. Which of the following statements is NOT true about electrolysis of aqueous sodium chloride ?

(A) H_2 gas is liberated at anode. (B) Cl_2 gas is released at anode.
(C) NaCl solution is converted to sodium hydroxide. (D) O_2 gas is not liberated at anode.

76. The rate of reaction, $A + B \rightarrow C$ is 3.6×10^{-2} mol dm^{-3} s^{-1} when $[A] = [B] = 0.2$ mol dm^{-3}. Calculate the rate constant if the reaction is first order in A and second order in B.

(A) 4.5 mol^{-2} dm^6 s^{-1} (B) 3.6 mol^{-2} dm^6 s^{-1}
(C) 5.4 mol^{-2} dm^6 s^{-1} (D) 2.7 mol^{-2} dm^6 s^{-1}

77. The rate constant for a first order reaction is 4.606×10^{-3} s^{-1}. Calculate the time required to reduce 2.0 g of the reactant to 0.2 g .

(A) 200 s (B) 500 s
(C) 1000 s (D) 100 s

78. Which of the following statements is correct regarding the rate of reaction?

(A) It increases as the reaction proceeds. (B) It decreases as the reaction proceeds.
(C) It depends on the concentration of products. (D) It remains constant as the reaction proceeds.

79. Which of the following is the correct Arrhenius equation expressing the effect of temperature on the rate constant of a reaction?

(A) $k = E_a/(RT)$ (B) $k = Ae^{(-E_a/RT)}$
(C) $k = Ae^{(E_a/RT)}$ (D) $k = e^{(-E_a/RT)}$

80. The phenomenon in which adsorption and absorption take place simultaneously is called

(A) Sorption (B) Adsorption
(C) Desorption (D) Deposition

81. Identify the Chlorous acid from the following.

(A) HClO (B) HOClO
(C) $HClO_3$ (D) $HClO_4$

82. Which of the following 3d transition metal ions in its respective oxidation state forms a colorless compound ?

(A) Fe^{3+} (B) Mn^{2+}
(C) Ti^{4+} (D) Cu^{2+}

83. Which of the following properties do the lanthanoides and actinoides resemble?

(A) Electronic configuration
(B) Ionisation enthalpy
(C) Formation of complexes
(D) Oxidation state

84. What is the effective atomic number of metal ion in the complex $[Pd(NH_3)_6]^{4+}$?

(A) 54
(B) 86
(C) 36
(D) 50

85. Which of the following is a hexadentate ligand?

(A) EDTA
(B) Ethylenediamine
(C) Tetracyanonickelate Ion
(D) Tetraamminecopper(II) ion

86. What is the major product of the reaction of $(CH_3)_3$C-Br with CH_3ONa ?

(A) Isobutane
(B) Isobutylene
(C) Tertiary butyl methyl ether
(D) Sodiun tertiary butoxide

87. Which of the following compounds is obtained when potassium cyanide reacts with alkyl halide?

(A) Alkyl isocyanide
(B) Alkyl nitrite
(C) Nitroalkane
(D) Alkyl nitrile

88. Which of the following compounds is NOT a dihydric phenol?

(A) Quinol
(B) Resorcinol
(C) Catechol
(D) Phloroglucinol

89. Which of the following is trihydric phenol?

(A) Cresol
(B) Quinol
(C) Catechol
(D) Phloroglucinol

90. Which of the following carbonyl compounds is most reactive toward nucleophilic addition?

(A) Ethanal
(B) Benzaldehyde
(C) Methanal
(D) Propanone

91. Identify the product obtained when benzaldehyde is oxidized by $KMnO_4$.

(A) Benzoic acid
(B) Benzyl alcohol
(C) Toluene
(D) Benzene

92. Which of the following has a higher acidic character than benzoic acid?

(A) Acetic acid
(B) p-Methoxybenzoic acid
(C) p-Bromobenzoic acid
(D) p-Aminobenzoic acid

93. Which of the following set of conditions is used to convert acetamide into ethyl amine ?

(A) $LiAlH_4$ / Na
(B) $LiAlH_4$ / ether
(C) Sn / HCl
(D) NH_3(alc.)

94. Which of the following types of reactions converts acetamide into methyl amine?

(A) Friedel-Craft's reaction
(B) Hofmann reaction
(C) Hoffmann bromamide degradation reaction
(D) Hinsberg reaction

95. How many subunits are held together to form the three-dimensional shape of hemoglobin?

(A) Two
(B) Three
(C) Four
(D) Five

96. Which of the following forms regarding the structure of a DNA molecule is true?

(A) Linear
(B) Branched
(C) Single helix
(D) Double helix

97. Which polymer is known as teflon?

(A) Polyvinyl chloride
(B) Polytetrafluoroethylene
(C) Polyacrylonitrile
(D) Polyurethane

98. Which of the following is used to make paints and lacquers ?

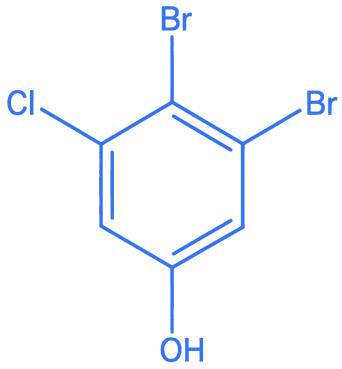
(A) Glyptal
(B) Styrene
(C) Perspex
(D) Polycarbonate

99. Identify the property of dichlorodiphenyltrichloroethane.

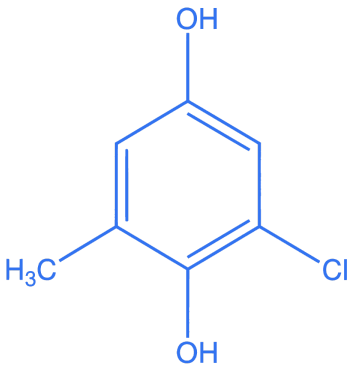
(A) Antiseptic
(B) Anesthetic
(C) Insecticidal
(D) Antibiotic

100. Identify the correct structure of chloroxylenol.

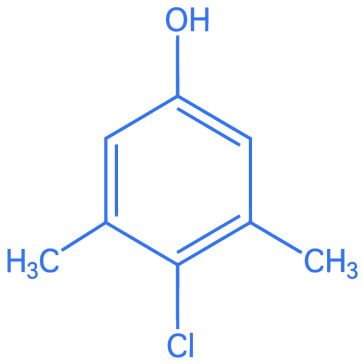
(A)



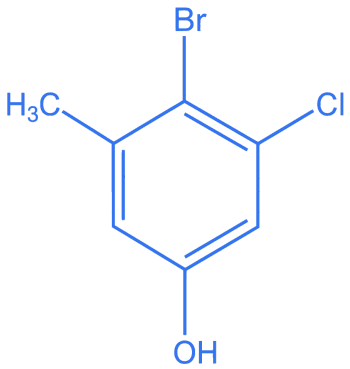
(B)



(C)



(D)



101. If $f(x)=\frac{2}{x+5}$ and $g(x)=x^2-1$, then the positive value of x satisfying $(f\circ g)(x)=\frac{1}{10}$ is

(A) 4 (B) 2

(C) 6 (D) 16

102. If $\frac{\cos A+\sin A}{\cos A-\sin A}=\cot(2A)$, where $A\in\left(0,\frac{\pi}{2}\right)-\left\{\frac{\pi}{4}\right\}$, then the value of A (in degrees) is...

(A) 15 (B) 22.5

(C) 30 (D) 60

103. In $\triangle ABC$ with usual notations, if a,c,b are in Arithmetic Progression (A.P.), then the value of $\frac{a\cos B-b\cos A}{a-b}$ is:

(A) 0 (B) 1

(C) 2 (D) 3

104. If $z=\frac{\sqrt{3}+i}{2}$, then the value of z^{69} is

(A) $-i$ (B) i

(C) -1 (D) 1

105. A teacher has 2 different books on English, 3 different books on physics, and 4 different books on mathematics. These books are to be placed on the shelf so that all books of the same subjects are together. The number of different ways this can be done is:

(A) 1278 (B) 1728

(C) 1872 (D) 1782

106. The minimum value of $e^{2x}+e^{-2x}$ is .....

(A) -2 (B) 0

(C) 1 (D) 2

107. With usual notations, if the perimeter of a triangle is $2s$, then its maximum area is:

(A) $\frac{s^2}{3}$ (B) $\frac{\sqrt{3}s^2}{4}$

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

108. A straight line passes through the point $(3,3)$ and intersects the positive x and y axes at the points $A(h,0)$ and $B(0,k)$ respectively. If O is the origin, then the minimum area of $\triangle OAB$ is:

(A) 9 square units. (B) 18 square units.

(C) 27 square units. (D) 36 square units.

109. If the equation $x^2-y^2-x+\lambda y-2=0$ (where $\lambda>0$) represents a pair of lines, then the coordinates of their point of intersection are:

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

(C) $\left(\frac{3}{2},\frac{1}{2}\right)$ (D) $(0,-1)$

110. The Cartesian coordinates of a point P with parameter $\theta=\frac{5\pi}{6}$ on the circle $x^2+y^2-2x+4y+1=0$ are...

(A) $(1,0)$ (B) $(0,-2+\sqrt{3})$

(C) $(-1,-2)$ (D) $(-\sqrt{3}+1,-1)$

111. In an ellipse with semi-minor axis OB, S and S' are its foci, $a>b$ and $\angle SBS'$ is a right angle, then the eccentricity of the ellipse is..

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

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

112. The equation of a circle passing through the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ and having a center at $(0,-4)$ is :

(A) $x^2+y^2-8y-9=0$

(B) $x^2+y^2+8y-9=0$

(C) $x^2+y^2+8y-41=0$

(D) $x^2+y^2-8y-41=0$

113. The value of $\lim_{x\to\infty}\left(\sqrt[3]{x^3+6x^2+1}-x\right)$ is:

(A) 0 (B) 1

(C) 2 (D) ∞

114. The dual of the statement pattern $\sim p\to\sim(\sim p\to q)$ is...

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

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

115. If the statement pattern $(p\vee\sim q)\wedge(\sim p\vee q)$ is true, then which of the following is true?

(A) $p=T,q=F$ (B) both p and q have the same truth value

(C) $p\to\sim q$ is a contradiction (D) $p=F,q=T$

116. Consider the following statements:
(i) $\sim (p \wedge \sim q)$
(ii) $(p \to q) \leftrightarrow (\sim q \to \sim p)$
Result 1 : (i) and (ii) are logically equivalent
Result 2 : (ii) is a contradiction
then which of the following is correct?

(A) Result 1 is true, Result 2 is true
(B) Result 1 is true, Result 2 is false
(C) Result 1 is false, Result 2 is true
(D) Result 1 is false, Result 2 is false

117. If $\sin^{-1}\left(\frac{x}{5}\right) + \csc^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then the value of x is

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

118. If $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$, then the determinant of $(A^2 - 2A)^{-1}$ is...

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

119. Let $A^T = \begin{bmatrix} 1 & 1 & 2 \\ 1 & -1 & 1 \\ 1 & 2 & -1 \end{bmatrix}$, $B^T = [6 \quad 5 \quad 1]$ and $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. If $AX = B$, then the values of x, y, z are.....

(A) $x = 2, y = 1, z = 3$
(B) $x = 3, y = 2, z = 1$
(C) $x = 1, y = 2, z = 3$
(D) $x = 2, y = 3, z = 1$

120. The number of points of discontinuity of the function $f(x) = \frac{1}{\log|x^2-1|}$ (where $|\cdot|$ denotes the modulus function) is:

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

121. If $f(x) = 2^{2x-1}$ and $\phi(x) = -2^x + x\log 4$, such that $f'(x) > \phi'(x)$, then the set of all possible values of x is...

(A) $(-\infty, 0)$
(B) $(0, \infty)$
(C) $[0, \infty)$
(D) $(0, 1)$

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

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

123. If $y = x - e^x$, then $\frac{d^2x}{dy^2} = ...$

(A) $-\frac{e^x}{(1-e^x)^3}$
(B) $\frac{e^x}{(e^x-1)^3}$
(C) $\frac{1}{(1-e^x)^3}$
(D) $\frac{e^x}{(1-e^x)^3}$

124. If $x = \sqrt{2^{\tan^{-1}t}}$ and $y = \sqrt[3]{2^{\cot^{-1}t}}$, then $\frac{dy}{dx} = ...$

(A) $\frac{2x^2}{3y^3}$
(B) $\frac{-2x}{3y}$
(C) $\frac{-2y}{3x}$
(D) $\frac{2y}{3x}$

125. Let $f(x)$ be the cubic polynomial having one of its roots as $x = -1$. If $f(0) = 4, f'(0) = 0, f''(1) = 0$, then...

(A) $f(x)$ is increasing in $(-\infty, 0) \cup (2, \infty)$
(B) $f(x)$ is decreasing in $(-\infty, 0) \cup (2, \infty)$
(C) $f(x)$ is increasing in $(0, 2)$
(D) $f(x)$ is decreasing in $(2, \infty)$

126. The radius of a spherical soap bubble is increasing at a constant rate of 0.5 cm/sec. At the instant when the radius is 5 cm, the rate at which its volume is increasing is...

(A) 25π cm^3/sec
(B) 50π cm^3/sec
(C) 100π cm^3/sec
(D) 10π cm^3/sec

127. If $\int \frac{\log(\log x)}{4x(\log x)^2}dx = k\left[\frac{1+\log(\log x)}{\log x}\right] + c$, then the value of k is...

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

128. The value of the integral $\int \frac{dx}{x\sqrt{1-x^3}}$ is equal to...

(A) $\frac{1}{3}\log\left|\frac{\sqrt{1-x^3}+1}{\sqrt{1-x^3}-1}\right| + c$
(B) $\frac{1}{3}\log\left|\frac{\sqrt{1-x^3}-1}{\sqrt{1-x^3}+1}\right| + c$
(C) $\frac{1}{3}\log\left|\frac{\sqrt{1-x^3}-1}{\sqrt{1-x^3}-1}\right| + c$
(D) $\frac{2}{3}\log\left|\frac{\sqrt{1-x^3}-1}{\sqrt{1-x^3}+1}\right| + c$

129. The value of the integral $\int \frac{dx}{3+\sin 2x+\sin^2 x} =$ .....

(A) $\frac{1}{\sqrt{13}}\tan^{-1}\left(\frac{4\tan x+1}{\sqrt{13}}\right) + c$
(B) $\frac{2}{\sqrt{11}}\tan^{-1}\left(\frac{4\tan x+2}{\sqrt{11}}\right) + c$
(C) $\frac{1}{11}\tan^{-1}\left(\frac{2\tan x+1}{11}\right) + c$
(D) $\frac{1}{\sqrt{11}}\tan^{-1}\left(\frac{4\tan x+1}{\sqrt{11}}\right) + c$

130. The value of the integral $\int \frac{x^2+1}{(x+1)^2}dx =$ .....

(A) $x - 2\log|x+1| - \frac{2}{x+1} + c$

(B) $x - 2\log|x+1| + \frac{2}{x+1} + c$

(C) $x + 2\log|x+1| + c$

(D) $x - 2\log|x+1| + c$

131. Let $I_n = \int_n^{n+1} x[x]dx$, where $[x]$ denotes greatest integer function and $n \in N$. If $I_n = 18$, then the value of n is...

(A) 3 (B) 4

(C) 5 (D) 6

132. The values of a for which $\int_0^a (3x^2 + 4x - 5)dx < a^3 - 2$ are...

(A) $\frac{1}{2} < a < 2$ (B) $\frac{1}{2} \le a \le 2$

(C) $a \le \frac{1}{2}$ (D) $a \ge 2$

133. The value of the integral $\int_{10}^{20} \frac{1}{(x-3)(x-2)}dx$ is...

(A) $\log\left(\frac{34}{21}\right)$ (B) $\log\left(\frac{17}{7}\right)$

(C) $\log\left(\frac{17}{18}\right)$ (D) $\log\left(\frac{68}{63}\right)$

134. The area bounded by $5x^2 - y = 0$ and $2x^2 - y + 9 = 0$ is (in sq.units)...

(A) $12\sqrt{3}$ (B) $6\sqrt{3}$

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

135. The rate of disintegration of a radioactive element at any time t is proportional to its mass at that time. Then the time during which the original mass of 4.5 gm will disintegrate to a mass of 1.5 gm. is...(where k is proportionality constant)

(A) $\frac{1}{k}\log 3$ (B) $-\frac{1}{k}\log 3$

(C) $k\log\left(\frac{1}{3}\right)$ (D) $\frac{1}{k}\log\left(\frac{3}{2}\right)$

136. The solution of the differential equation $y^2 - x^2\frac{dy}{dx} = xy\frac{dy}{dx}$ is ...

(A) $\frac{y}{x} + \log|y| = c$ (B) $\frac{y}{x} + \log|x| = c$

(C) $\frac{y^2}{x} + \log|y| = c$ (D) $\frac{y}{x^2} + \log|y| = c$

137. The order of the differential equation representing the family of all parabolas having a fixed latus rectum of length $4a$ and an axis parallel to the x-axis is...

(A) 1 (B) 2

(C) 3 (D) 4

138. Let $\vec{u}$ and $\vec{v}$ be unit vectors such that the angle between them is $\theta = \frac{\pi}{6}$. If the adjacent sides of a parallelogram are represented by the vectors $\vec{a} = 2\vec{u} + 3\vec{v}$ and $\vec{b} = \vec{u} - \vec{v}$, then the area of the parallelogram is

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

(C) 2.5 (D) $16\sqrt{3}$

139. If the volume of a tetrahedron with coterminous edges $\vec{a}, \vec{b}$ and $\vec{c}$, (where $\vec{a}$ is a unit vector) is 13 cubic units and the angle between $\vec{a}$ and $\vec{b} \times \vec{c}$ is $\frac{\pi}{3}$, then $|\vec{b} \times \vec{c}|$ is

(A) 156 (B) 78

(C) 39 (D) 1

140. The plane passing through the point $(5, 1, 2)$ and perpendicular to the line $2x - 4 = y - 4 = z - 5$ will meet the line at the point

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

(C) $(2, 3, 1)$ (D) $(1, 2, 3)$

141. The equation of the plane passing through the point $(0, 4, 3)$ and containing the line $\frac{x-1}{1} = \frac{y-3}{3} = \frac{z-2}{2}$ is $ax + by + cz + d = 0$, $(a \ge 0)$. The value of $(a + b + c + d)$ is

(A) 0 (B) 1

(C) 2 (D) 3

142. Let A be the point on line $x - 1 = y - 2 = z - 1$ and B be the foot of perpendicular drawn from A on a plane $2x - y + z = 8$ and $AB = 4$. If C is the point of intersection of the line and the plane, then the square of the distance between B and C is:

(A) 20 (B) 32

(C) 48 (D) 56

143. 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 (α, β) equals

(A) $(5, -15)$ (B) $(-5, 5)$

(C) $(6, -17)$ (D) $(-6, 7)$

144. A line makes the same angle α with each of the X and Z axes. If the angle β which it makes with the Y-axis is such that $\sin^2\beta = 2\sin^2\alpha$, then the value of $\cos^2\alpha$ is ...

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

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

145. The sum of the lengths of the projections of $2\hat{i} + 3\hat{j} + 4\hat{k}$ on the coordinate axes is

(A) 5 (B) 9

(C) 18 (D) $\sqrt{29}$

146. The ratio and the coordinates of the point where the segment joining $(3, 5, 6)$ and $(4, 6, -3)$ is divided by the YZ-plane are respectively:

(A) $4 : 3$ internally, $(0, 2, 33)$ (B) $3 : 4$ internally, $(0, 2, 33)$

(C) $3 : 4$ externally, $(0, 2, 33)$ (D) $4 : 3$ externally, $(2, 0, 33)$

147. The maximum value of $Z = 7x - 6y$ subject to $0 \leq x \leq 5$ and $0 \leq y \leq 3$ is...

(A) 17 (B) 18

(C) 35 (D) 53

148. If the mean of a binomial distribution is twice its variance and $n = 18$, then the probability of success is...

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

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

149. A continuous random variable X has the following probability distribution function (p.d.f.)

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

If $P(X > a) = 0.5$, then the value of a is...

(A) $\sqrt[3]{6.75}$ (B) $\sqrt[3]{13.5}$

(C) $\sqrt[3]{9}$ (D) $\sqrt[3]{18}$

150. A fair die is thrown. The odds in favor of getting a number which is a perfect square on the uppermost face of the die are...

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

(C) $\frac{1}{3}$ (D) $\frac{1}{6}$

- End of Question Paper -