MHT CET 2026 PCM May 13 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

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

General Instructions

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

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

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

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

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

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

1. The vector $\vec{P} = a\hat{i} + a\hat{j} + 3\hat{k}$ and $\vec{Q} = a\hat{i} - 2\hat{j} - \hat{k}$ are perpendicular to each other. Then positive value of 'a' is

(A) 3 (B) 4

(C) 9 (D) 13

2. The resistance of a conductor is $R = V/I$ where voltage $V = 100 \pm 5$ V and current $I = 10 \pm 0.2$ A. The error in the calculation of R is

(A) 5% (B) 7%

(C) 5.2% (D) 2.5%

3. If two spheres are projected at angles 45° and 60° with horizontal and the maximum heights reached are same. The ratio of their initial velocities is ($\sin 45^\circ = \frac{1}{\sqrt{2}}$, $\sin 60^\circ = \frac{\sqrt{3}}{2}$)

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

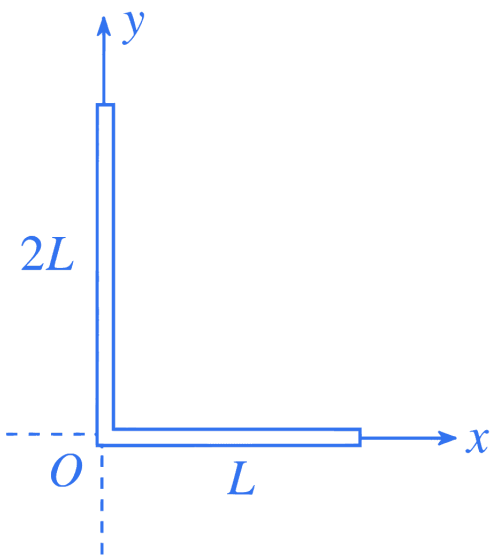
(C) 2 : 3 (D) $\sqrt{3} : \sqrt{2}$

4. A spring has length l and force constant k. It is cut into 2 springs of length l_1 and l_2 such that $l_1 = nl_2$ (n=an integer). The force constant of the spring of length l_2 is $\left(k \propto \frac{1}{l}\right)$

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

(C) k (D) $\frac{k}{(n+1)}$

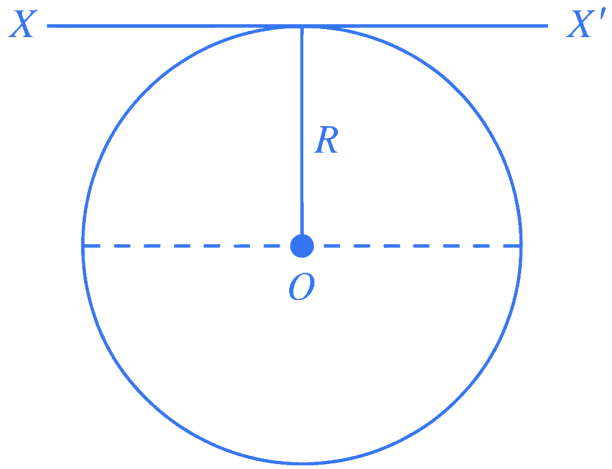
5. Figure shows a composite system of two uniform rods of length as shown. The co-ordinates of the centre of mass of the system of rods are



(A) $\left(\frac{L}{2}, \frac{2L}{3}\right)$ (B) $\left(\frac{L}{4}, \frac{2L}{3}\right)$

(C) $\left(\frac{L}{6}, \frac{2L}{3}\right)$ (D) $\left(\frac{L}{6}, \frac{L}{3}\right)$

6. A thin wire of length L and uniform linear mass density ρ is bent into a circular loop with centre at 'O' as shown in figure. The moment of inertia of the loop about the axis XX' is



(A) $\frac{\rho L^3}{16\pi^2}$ (B) $\frac{\rho L^3}{8\pi^2}$

(C) $\frac{5}{16}\rho L^3\pi$ (D) $\frac{3\rho L^3}{8\pi^2}$

7. The ratio of radius of gyration of circular disc about a tangential axis in its plane and of a circular ring of the same radius about a tangential axis in its plane is

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

(C) $\sqrt{5}:\sqrt{6}$ (D) $1:\sqrt{2}$

8. The difference between angular speed of minute hand and second hand of a clock is (in rad/s)

(A) $\frac{59\pi}{900}$ (B) $\frac{59\pi}{1800}$

(C) $\frac{59\pi}{2400}$ (D) $\frac{59\pi}{3600}$

9. The magnitude of gravitational field at distance r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are E_1 and E_2 respectively. If $r_1 > R$ and $r_2 < R$, then the ratio E_1/E_2 is

(A) $\frac{R^2}{r_1 r_2}$ (B) $\frac{R^3}{r_1 r_2^2}$

(C) $\frac{R^3}{r_1^2 r_2}$ (D) $\frac{R^4}{r_1^2 r_2^2}$

10. A wooden cube (density d) of side L floats on a liquid of density ρ with its upper and lower surfaces horizontal. If the cube is pushed slightly down and released, it performs S.H.M. of period T. The value of T is (g = acceleration due to gravity)

(A) $2\pi\sqrt{\frac{L\rho}{(\rho-d)g}}$ (B) $2\pi\sqrt{\frac{Ld}{\rho g}}$

(C) $2\pi\sqrt{\frac{L\rho}{dg}}$ (D) $2\pi\sqrt{\frac{Ld}{(\rho-d)g}}$

11. When a large bubble rises from bottom of a water lake to its surface, then its radius doubles. If the atmospheric pressure is equal to the pressure of height H of a certain water column then the depth of lake will be

(A) $2H$ (B) H

(C) $7H$ (D) $4H$

12. What is the radius of the biggest aluminium coin of thickness t and density ρ, which will be able to float on the water surface of surface tension T? (g = acceleration due to gravity)

(A) $\frac{4T}{3\rho g t}$ (B) $\frac{4T}{\rho g t}$

(C) $\frac{2T}{\rho g t}$ (D) $\frac{T}{\rho g t}$

13. The excess pressure inside a spherical drop of water is four times that of another drop. Their respective mass ratio is

(A) $1:16$ (B) $8:1$

(C) $1:4$ (D) $1:64$

14. If 150 J of energy is incident on area 2m^2 and amount of heat reflected is 15 J, coefficient of absorption is 0.6 the amount of energy transmitted is

(A) 50 J (B) 45 J

(C) 40 J (D) 30 J

15. The radiation emitted by a star A is 10000 times that of the sun. If surface temperature of sun and star A are 6000 K and 2000 K respectively, the ratio of radii of star A and sun is

(A) $1200:1$ (B) $900:1$

(C) $600:1$ (D) $300:1$

16. Two hot bodies B_1 and B_2 have temperature 100°C and 80°C respectively at $t = 0$. The temperature of the surroundings is 40°C. The ratio of the respective rates of cooling R_1 and R_2 of these two bodies at $t = 0$ will be

(A) $R_1 : R_2 = 3:2$ (B) $R_1 : R_2 = 5:4$

(C) $R_1 : R_2 = 2:3$ (D) $R_1 : R_2 = 4:5$

17. A monoatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston suddenly. If L_1 and L_2 be the lengths of the gas column before and after expansion respectively, then $\frac{T_1}{T_2}$ is

(A) $\left(\frac{L_1}{L_2}\right)^{\frac{2}{3}}$ (B) $\left(\frac{L_1}{L_2}\right)$

(C) $\left(\frac{L_2}{L_1}\right)$ (D) $\left(\frac{L_2}{L_1}\right)^{\frac{2}{3}}$

18. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio C_p/C_v for the gas is

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

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

19. A balloon contains 500 m^3 of He at 27°C and 1 atmospheric pressure. Then, volume of He at -3°C and 0.5 atmospheric pressure will be

(A) 700 m^3 (B) 900 m^3

(C) 1000 m^3 (D) 500 m^3

20. The time period of a simple pendulum inside a stationary lift is $\sqrt{5}$ s. The time period when the lift moves upwards with an acceleration $\frac{g}{4}$ is (g = acceleration due to gravity)

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

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

21. A spring of mass 0.2 kg/m has length $l = 0.6$ m. It is fixed at both ends and stretched such that is has a tension 80 N. The string vibrates in three segments with amplitude 0.5 cm. The amplitude of transverse (particle) velocity is

(A) 9.42 m/s (B) 3.14 m/s

(C) 1.57 m/s (D) 6.28 m/s

22. The path difference between two waves $Y_1 = a_1 \sin\left(\omega t - \frac{2\pi x}{\lambda}\right)$ and $Y_2 = a_2 \cos\left(\omega t - \frac{2\pi x}{\lambda} + \Phi\right)$ is

(A) $\frac{\lambda\Phi}{2\pi}$ (B) $\frac{\lambda}{2\pi}\left(\Phi + \frac{\pi}{2}\right)$

(C) $\frac{\lambda}{2\pi}\left(\Phi - \frac{\pi}{2}\right)$ (D) $\frac{2\pi\Phi}{\lambda}$

23. An organ pipe closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe a normal person can hear is (neglect end connection)

(A) 4 (B) 13

(C) 6 (D) 9

24. Two sirens situated one km apart are producing sound of frequency 330 Hz. The observer starts moving from one siren to the other with a speed of 2 m/s. If the speed of sound is 330 m/s, What will be the beat frequency heard by the observer?

(A) 8 Hz (B) 4 Hz

(C) 6 Hz (D) 1 Hz

25. Two charges of equal magnitude 'q' are placed in air at a distance '$2a$' apart and third charge $-2q$ is placed at mid-point. The potential energy of the system is (ϵ_0 = permittivity of free space)

(A) $-\frac{q^2}{8\pi\epsilon_0 a}$ (B) $-\frac{3q^2}{8\pi\epsilon_0 a}$

(C) $-\frac{5q^2}{8\pi\epsilon_0 a}$ (D) $-\frac{7q^2}{8\pi\epsilon_0 a}$

26. Three charges $2q$, $-q$ and $-q$ are located at the vertices of an equilateral triangle. At the centre of the triangle

(A) the field is zero but potential is not zero (B) the field is not zero but potential is zero

(C) both field and potential are zero (D) both field and potential are not zero

27. Charge q_2 of mass 'm' revolves around a stationary charge q_1 in a circular orbit of radius 'r'. The orbital periodic time of q_2 would be $\left(k = \frac{1}{4\pi\epsilon_0}\right)$

(A) $\left[\frac{4\pi^2 mr^3}{kq_1q_2}\right]^{\frac{1}{2}}$ (B) $\left[\frac{kq_1q_2}{4\pi^2 mr^3}\right]^{\frac{1}{2}}$

(C) $\left[\frac{4\pi^2 mr^4}{kq_1q_2}\right]^{\frac{1}{2}}$ (D) $\left[\frac{4\pi^2 mr^2}{kq_1q_2}\right]^{\frac{1}{2}}$

28. A slab of material of dielectric constant k has the same area as the plates of the parallel plate capacitor but has thickness $\frac{3d}{4}$, where d is the separation of the plates. How is the capacitance changed, when the slab is inserted between the plates? (C = original capacitance)

(A) $\frac{4kC}{(k+3)}$ (B) $\frac{(k+3)C}{4k}$

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

29. A current of 0.01 A passes through the potentiometer wire of resistivity 10^6 Ω cm and area of cross-section 10^{-2} cm^2. The potential gradient is (in V/m)

(A) 10^9 (B) 10^{11}

(C) 10^{10} (D) 10^8

30. An ammeter has resistance R and range I. What resistance should be connected in parallel with it to increase its range by nI?

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

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

31. Two circular coils A and B are made from the same wire but the radius of coil A is twice that of coil B. What is the ratio of potential difference applied across them, so that the magnetic field at their centres is the same?

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

(C) 6 : 1 (D) 2 : 1

32. The magnitude of the magnetic field inside a long solenoid is increased by

(A) decreasing its radius
(B) decreasing the current through it
(C) increasing its area of cross-section
(D) introducing a medium of higher permeability

33. A domain in a ferromagnetic substance is in the form of a cube of side 'L'. If it contains 'N' atoms and each atomic dipole moment M then the magnetisation of the domain is

(A) $\frac{N}{ML^3}$
(B) $\frac{MN}{L^3}$
(C) $\frac{M}{NL^3}$
(D) MNL^3

34. A varying magnetic flux linking a coil is $\Phi = xt^2$. If at time $t = 3$ s, the e.m.f. induced is 9V then the magnitude of x is (in Wb/s^2)

(A) 1.5
(B) 0.66
(C) 0.33
(D) 0.75

35. 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

36. A step down transformer has 50 turns on secondary and 1000 turns on primary winding. If a transformer is connected to 220 V and 1 A a.c. source, what is the output current of the transformer?

(A) $\frac{1}{20}$ A
(B) 20 A
(C) 100 A
(D) 2 A

37. An inductance of negligible resistance, whose reactance is 120 Ω at 200 Hz is connected to a 240 V, 60 Hz Power line. The current in the inductor is

(A) 6.66 A
(B) 6.60 A
(C) 5.45 A
(D) 54.5 A

38. In an a.c. circuit, if the power factor changes from 0.5 to 0.25 then the increase in impedance is

(A) twice
(B) half
(C) four times
(D) eight times

39. An alternating voltage $V = 200\sqrt{2}\sin(100t)$ volt is connected to a 1 μF capacitor through an a.c. ammeter. The reading of the ammeter will be

(A) 10 mA
(B) 20 mA
(C) 40 mA
(D) 80 mA

40. How much water should be filled in a container of height 21 cm, so that it appears half filled to the observer when viewed from the top of the container? ($\mu = 4/3$)

(A) 8 cm
(B) 10.5 cm
(C) 12 cm
(D) 14 cm

41. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 μm and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum

(A) remain unshifted
(B) shift downward by nearly two fringes
(C) shift upward by nearly two fringes
(D) shift downward by 10 fringes

42. Two coherent sources P and Q produce interference at a point A on the screen where there is a dark band which is formed between 4^{th} bright band and 5^{th} bright band. Wavelength of light used is 6000 Å. The path difference between PA and QA is $x \times 10^{-4}$ cm. The value of x is

(A) 1.4
(B) 2.7
(C) 4.5
(D) 6.2

43. In double slit experiment, the two slits are 1 mm apart and the screen is placed 1 m away. A monochromatic light of wavelength 500 nm is used. What will be the width of each slit for obtaining ten maxima of double slit within the central maxima of single slit pattern?

(A) 0.2 mm
(B) 0.1 mm
(C) 0.5 mm
(D) 0.02 mm

44. The energy of a photon is equal to the kinetic energy of a proton. If λ_1 is the de-Broglie wavelength of a proton, λ_2 is the wavelength associated with the photon and if the energy of the photon is E then (λ_1/λ_2) is proportional to

(A) E^4
(B) $\sqrt{E}$
(C) E^2
(D) E

45. A point source of light is used in a photoelectric effect. If the source is moved farther from the emitting metal, then the stopping potential

(A) will increase
(B) will decrease
(C) will remain constant
(D) will either increase or decrease

46. When an electron in hydrogen atom revolves in a stationary orbit, it

(A) does not radiate light though its velocity changes
(B) does not radiate light and velocity remains unchanged
(C) radiates light but its velocity is unchanged
(D) radiates light with the change of energy

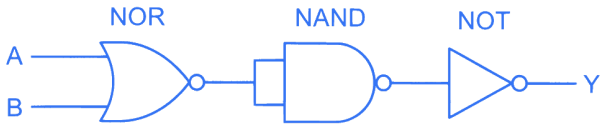
47. Two radioactive substances A and B have decay constant 5λ and λ respectively. At $t = 0$, they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $\left(\frac{1}{e}\right)^2$ after a time interval

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

48. In an n-p-n transistor the collector current is 9 mA. If 90% of the electrons from the emitter reach the collector then

(A) $\beta = 9.0$
(B) the base current is 10 mA
(C) the emitter current is 1 mA
(D) $\beta = 0.9$

49. The following circuit is equivalent to



(A) AND gate
(B) NAND gate
(C) NOR gate
(D) OR gate

50. The forward biased diode connection is

(A)


(B)


(C)


(D)


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51. Calculate the number of atoms in each of the following.
(a) 11.2 g nitrogen (b) 1.15 g sodium

(A) Atoms of nitrogen $= 4.818 \times 10^{23}$ and atoms of sodium $= 3.011 \times 10^{22}$.
(B) Atoms of nitrogen $= 6.022 \times 10^{23}$ and atoms of sodium $= 4.802 \times 10^{22}$.
(C) Atoms of nitrogen $= 1.204 \times 10^{23}$ and atoms of sodium $= 5.604 \times 10^{22}$.
(D) Atoms of nitrogen $= 3.011 \times 10^{23}$ and atoms of sodium $= 1.204 \times 10^{22}$.

52. What is the angular momentum of an electron in the 4th stationary state of hydrogen atom? ($h = 6.626 \times 10^{-34}$ Js)

(A) 4.22×10^{-34} JS
(B) 2.6504×10^{-34} JS
(C) 3.313×10^{-34} JS
(D) 1.325×10^{-34} JS

53. Which element from following does NOT belong to group 16?

(A) S
(B) Te
(C) Po
(D) At

54. Identify the structure of XeF_6 molecule from following.

(A) Square planar
(B) Trigonal bipyramidal
(C) Distorted octahedral
(D) Square pyramidal

55. Find the new volume of the gas at temperature at 25°C by keeping constant pressure. If the same gas occupies 240 dm^3 volume at 10°C.

(A) 252.72 dm^3
(B) 227.91 dm^3
(C) 225.27 dm^3
(D) 272.19 dm^3

56. What is the enthalpy of vaporization of methanol, if 17.64 kJ heat is required for vaporization of 16 g of it?

(A) 17.64 kJ/mol
(B) 35.28 kJ/mol
(C) 52.92 kJ/mol
(D) 70.56 kJ/mol

57. If X moles of O_2 gas expand isothermally and reversibly from volume 2 dm^3 to volume 20 dm^3 at 300 K, the work obtained is -17.232 kJ. Calculate the value of X.
[$R = 8.314$ J $K^{-1}mol^{-1}$]

(A) 1
(B) 0.5
(C) 2
(D) 3

58. Which of the following statements regarding entropy is correct?

(A) It decreases in spontaneous process.
(B) Change in entropy of sublimation is negative.
(C) It measures randomness.
(D) It is path dependent.

59. Which of the following covalent bonds has the highest bond enthalpy?

(A) C – H
(B) C – C
(C) O – H
(D) C = C

60. One litre of a buffer solution containing 0.01 M NH_4Cl and 0.1 M NH_4OH has pK_b value of 5. Find the pH.

(A) 9
(B) 10
(C) 4
(D) 6

61. What is degree of ionization of water at 298 K?

(A) 1.8×10^{-6}
(B) 1.8×10^{-7}
(C) 1.8×10^{-8}
(D) 1.8×10^{-9}

62. Which of the following is not amphoteric?

(A) H_2O
(B) HCl
(C) NH_3
(D) HCO_3^-

63. Which of the following is the strongest reducing agent?

(A) Ag^+
(B) Li
(C) F_2
(D) Au^+

64. What is the oxidation number of phosphorus in $Ca_3(PO_4)_2$?

(A) +1
(B) +3
(C) +5
(D) +7

65. Which compound is used in medicine as barium meal for intestinal x-ray?

(A) Barium chloride (B) Barium sulphate

(C) Barium sulphide (D) Barium nitrate

66. Which of the following compounds is optically active?

(A) C_2H_5-OH (B) $(CH_3)_2CH$-CH_2-Cl

(C) CH_3-$CH(Cl)C_2H_5$ (D) CCl_2F_2

67. Identify the correct pair of functional isomers.

(A) Ethyl alcohol and propanone (B) Ethene and propyne

(C) n-Butane and isobutane (D) Ethyl alcohol and dimethyl ether

68. Which of the following is the chemical name of Gammexane?

(A) Hexachlorobenzene (B) Benzyl chloride

(C) Benzene hexachloride (D) Chlorobenzene

69. Identify the catalyst used for hydrogenation of oil.

(A) V_2O_5 (B) Fe

(C) Raney Ni (D) MnO_2

70. Identify the product obtained when phenyl ethene is oxidised using potassium permanganate in dil H_2SO_4.

(A) Phthalic acid (B) p-ethenyl benzoic acid

(C) Benzoic acid (D) Salicylic acid

71. Find out the number of unit cells present in 100 g of an element if density of it is 9.0 g cm^{-3}. [Volume of unit cell $= 4.445 \times 10^{-23} cm^3$]

(A) 3.0×10^{23} (B) 3.5×10^{23}

(C) 2.5×10^{23} (D) 2.0×10^{23}

72. A metal crystallizes to form fcc unit cells. Calculate the void volume of a unit cell if the edge length of the unit cell is 390 pm.

(A) 2.847×10^{-23} cm^3 (B) 1.898×10^{-23} cm^3

(C) 1.542×10^{-23} cm^3 (D) 5.932×10^{-23} cm^3

73. Copper crystallises in a face-centred cubic lattice with a unit cell length of 361 pm. What is the radius of copper atom in pm?

(A) 157.6 (B) 181.5

(C) 108.4 (D) 127.6

74. Calculate the mass of solute dissolved in 100 g solvent that produces boiling point elevation 0.5 K.
[K_b for solvent $= 2$ K kg mol^{-1} & Molar mass of solute $= 120$ g mol^{-1}]

(A) 2 g. (B) 3 g.

(C) 4 g. (D) 5 g.

75. The relative lowering of vapor pressure obtained by dissolving 72 g of solute in 1000 g of water is 7.2×10^{-3}. Determine the molar mass of the solute

(A) 158 g mol^{-1} (B) 180 g mol^{-1}

(C) 192 g mol^{-1} (D) 164 g mol^{-1}

76. Identify the correct statement from the following.

(A) The vapor pressure of solution containing chloroform and acetone is lower than vapor pressure of pure chloroform and acetone at same temperature.

(B) The vapor pressure of aqueous solution containing nonvolatile solute increases with increasing solute concentration.

(C) The vapor pressure of liquid decreases with increase in temperature.

(D) The lowering in vapor pressure in dilute solutions is greater than concentrated solutions at the same temperature.

77. When 6 g Cu metal is deposited at the cathode during the passage of 3 ampere current through its salt solution for x minutes. Calculate the value of x if the molar mass of copper is 63.5 g mol^{-1}

(A) 50.1 minutes (B) 202.6 minutes

(C) 152 minutes (D) 101.3 minutes

78. Calculate the electrode potential of Mg^{2+}/Mg electrode having 0.01 M concentration of Mg^{2+} ($E^{\circ}Mg^{2+}/Mg = -2.36$ V).

(A) -2.42 V (B) -2.30 V

(C) -2.89 V (D) 1.84 V

79. Calculate the rate constant of first order reaction if the slope of graph of $\log[A]_0/[A]_t$ versus time is 8.5×10^{-3} s^{-1}.

(A) 2.728×10^{-2} s^{-1} (B) 2.258×10^{-2} s^{-1}

(C) 1.132×10^{-2} s^{-1} (D) 1.958×10^{-2} s^{-1}

80. Which of the following statements is correct?

(A) The order of reaction is always equal to molecularity.

(B) The order of chemical reaction is determined experimentally.

(C) The molecularity of reaction can be fractional.

(D) The order of reaction depends only on stoichiometric coefficients.

81. For a reaction $A \rightarrow$ Product, the rate constant is 6.09×10^{-3} $hour^{-1}$. What is the order of the reaction?

(A) Zero (B) 1.5

(C) 1 (D) 2

82. Which of the following properties is NOT true regarding emulsion?

(A) The droplets in emulsions are often negatively charged and can be precipitated by electrolysis.

(B) Emulsions exhibit Brownian movement and Tyndall effect.

(C) The two liquids in emulsion can not be seperated by heating, freezing etc.

(D) The emulsions are stabilised by addition of third component called emulsifying agent.

83. The effective magnetic moment (μ) of Cr^{3+} is measured as 3.87 Bohr magnetons (BM). Determine the number of unpaired electrons in Cr^{3+}.

(A) 3 (B) 2

(C) 4 (D) 5

84. Which complex exhibits geometrical isomerism?

(A) $[Co(NH_3)_6]^{3+}$ (B) $[PtCl_2(NH_3)_2]$

(C) $[CuCl_4]^{2-}$ (D) $[Ni(CN)_4]^{2-}$

85. What is the coordination number in complexes?

(A) Number of Ligands in the coordination sphere.

(B) Number of coordinate bonds formed by the central metal with ligands.

(C) Number of ions in the compound.

(D) Number of atoms in the ligand.

86. Which of the following type of reactions is found in halogenation, sulphonation and Friedel-crafts reaction of haloarenes?

(A) Nucleophilic reaction of benzene

(B) Electrophilic reaction of benzene

(C) Addition reaction of benzene

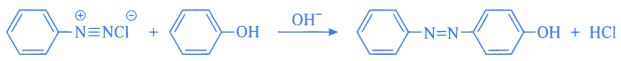
(D) Nucleophilic substitution reaction of benzene

87. Which of the following alkyl halides is least reactive towards SN^2 reaction?

(A) Methyl chloride (B) Chloroethane

(C) 1-Chlorobutane (D) Tertiary Butyl chloride

88.



Identify the type of above reaction.

(A) Nucleophilic aromatic substitution reaction.

(B) Nucleophilic aromatic addition reaction

(C) Electrophilic aromatic substitution reaction.

(D) Electrophilic aromatic addition reaction.

89. What is the final product of the oxidation reaction of a primary alcohol by acidified $K_2Cr_2O_7$?

(A) Aldehyde (B) ketone

(C) carboxylic acid (D) alkene

90. Which of the following is the correct order of acidic strength of following compounds?
i. CH_3OH,
ii. $(CH_3)_3C.OH$,
iii. C_6H_5OH,
iv. p-NO_2-C_6H_4OH

(A) iv > iii > i > ii (B) iv > iii > ii > i
(C) iii > iv > i > ii (D) iii > iv > ii > i

91. What is a name of tert. Butyl alcohol according to carbinol systeme?

(A) Trimethyl carbinol (B) Dimethyl ethyl carbinol
(C) Methyl carbinol (D) Ethyl carbinol

92. Which of the following compounds is obtained when an acetic acid is treated with reagent $LiAlH_4$?

(A) Acetaldehyde (B) Methane
(C) Ethyl alcohol (D) Methyl alcohol

93. Identify the carboxylic acid having least pKa value from following.

(A) CH_3COOH (B) I-CH_2COOH
(C) F-CH_2COOH (D) Br-CH_2COOH

94. Which of the following amines is secondary and has formula $C_4H_{11}N$?

(A) 2-Aminobutane.
(B) 1-Amino-2-methylpropane
(C) N,N-Dimethylethanamine
(D) N-ethylethanamine

95. Which of the following compounds is obtained when alkyl cyanides are reacted with sodium and ethanol?

(A) Primary amine (B) Secodary amine
(C) Tertiary amine (D) Amide

96. Why is tryptophan called an essential amino acid?

(A) It contains an aromatic nucleus. (B) It cannot be synthesized by the human body.
(C) It is a constituent of some enzymes. (D) It is a neutral amino acid.

97. What are the basic building blocks of proteins?

(A) Monosaccharides (B) Fatty acids
(C) Amino acids (D) Nucleotides

98. Which of the following substances is used as accelerator for vulcanization of rubber?

(A) Manganese dioxide (B) Zinc butyl xanthate
(C) Hydrogen sulphide (D) Zinc acetate

99. Which of the following is a biodegradable polymer?

(A) Nylon 6 (B) Nylon 6,6
(C) Both Nylon 6 and Nylon 6,6 (D) Viscose rayon

100. Which of the following medicinal plants is used to extract antimocrobial substance for cold?

(A) Wintergreen (B) Indian gooseberry
(C) Cinnamon (D) Citrus fruit

101. If $f(x)=\frac{1}{\sqrt{x}}, g(x)=3-2x-x^2$ then $\int[(f\circ g)(e^x)]\cdot e^x dx=\cdots\cdots\cdots$

(A) $\frac{1}{2}\sin^{-1}\left(\frac{e^x+1}{2}\right)+c$ (B) $\sin^{-1}\left(\frac{e^x-1}{4}\right)+c$

(C) $\sin^{-1}\left(\frac{e^x+2}{2}\right)+c$ (D) $\sin^{-1}\left(\frac{e^x+1}{2}\right)+c$

102. If $f(x)=\sin^{-1}\left[\log_{1/2}\left(\frac{x^2}{2}\right)\right]$, then the domain of the function $f(x)$ is:

(A) $[-2,-1]\cup[1,2]$ (B) $[-\sqrt{2},-1]\cup[1,\sqrt{2}]$

(C) $[-1,0)\cup(0,1]$ (D) $[-2,2]-\{0\}$

103. The value of expression $\tan 9^\circ-\tan 27^\circ-\tan 63^\circ+\tan 81^\circ$ is....

(A) 1 (B) 2

(C) 4 (D) 8

104. The general solution of the equation $2\sin^2 x+\sin^2 2x=2$ is $x=(2n+1)\alpha$ or $x=m\pi\pm\beta$, $m,n\in\mathbb{Z}$, then α and β are the roots of the quadratic equation _____

(A) $8x^2-6\pi x+\pi^2=0$ (B) $4x^2-6\pi x+\pi^2=0$

(C) $8x^2+6\pi x+\pi^2=0$ (D) $4x^2+6\pi x+\pi^2=0$

105. If in a triangle ABC, $\frac{\cos A}{a}=\frac{\cos B}{b}=\frac{\cos C}{c}$ and the side $a=2$, then the area of the triangle is:

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

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

106. In $\triangle ABC$, with usual notations, the value of $\text{cosec}\left(\frac{A}{2}\right)\text{cosec}\left(\frac{B}{2}\right)\text{cosec}\left(\frac{C}{2}\right)$ is:

(A) $\frac{[A\triangle ABC]^2}{abcs}$ (B) $\frac{abcs}{[A\triangle ABC]^2}$

(C) $\frac{[A\triangle ABC]}{abcs}$ (D) $\frac{abcs}{[A\triangle ABC]}$

107. If $z_1=3\cdot e^{\frac{5\pi}{12}i}$ and $z_2=4\cdot e^{\frac{\pi}{12}i}$ then $z_1\cdot z_2=\cdots\cdots$

(A) 12 (B) $12i$

(C) $e^{\frac{\pi}{2}i}$ (D) $e^{\frac{\pi}{2}}$

108. The sum of the greatest values of ${}^{15}C_r$ and ${}^{12}C_r$ is equal to

(A) 6718 (B) 5353

(C) 5511 (D) 7359

109. The points on the line $x+y-4=0$ which are at one unit distance from the line $4x+3y-10=0$ are...

(A) $(5,-1)$ and $(-2,6)$ (B) $(3,1)$ and $(-7,11)$

(C) $(9,-5)$ and $(-11,15)$ (D) $(-4,8)$ and $(2,2)$

110. The polar coordinates of point P are $\left(\sqrt{2},\frac{\pi}{4}\right)$. If Q is the image of P about y axis, then the polar coordinates of Q are _____

(A) $\left(\sqrt{2},\frac{-3\pi}{4}\right)$ (B) $\left(-\sqrt{2},\frac{\pi}{4}\right)$

(C) $\left(-\sqrt{2},\frac{3\pi}{4}\right)$ (D) $\left(\sqrt{2},\frac{3\pi}{4}\right)$

111. The coordinates of the foot of the perpendicular from the point $(2,3)$ on the line $y=3x+4$ is given by ...

(A) $\left(\frac{37}{10},\frac{-1}{10}\right)$ (B) $\left(\frac{-1}{10},\frac{37}{10}\right)$

(C) $\left(\frac{10}{37},-10\right)$ (D) $\left(\frac{2}{3},-\frac{1}{3}\right)$

112. If two lines represented by the equation $x^2+bcy^2=(b+c)xy$ are coincident, then ____

(A) $b=c^2$ (B) $b^2=c$

(C) $b=c$ (D) $b=-c$

113. If the tangent to the circle $x^2+y^2=5$ at point $(1,-2)$ also touches the circle $x^2+y^2-8x+6y+k=0$, then $\frac{k}{5}=\cdots\cdots\cdots$

(A) 20 (B) 4

(C) 5 (D) $\frac{19}{2}$

114. The equation of the hyperbola formed by the locus of the point of intersection of the lines $\sqrt{5}x-y-2\sqrt{5}\mu=0$, and $\sqrt{5}\mu x+\mu y-2\sqrt{5}=0$, where μ is a variable parameter, is...

(A) $\frac{x^2}{4}-\frac{y^2}{20}=1$ (B) $\frac{x^2}{16}-\frac{y^2}{20}=1$

(C) $\frac{x^2}{20}-\frac{y^2}{4}=1$ (D) $\frac{x^2}{20}-\frac{y^2}{16}=1$

115. $\lim_{x\to 0}\frac{1-\cos(1-\cos x)}{x^4}=$

(A) $\frac{1}{2}$ (B) $\frac{1}{6}$

(C) $\frac{1}{10}$ (D) $\frac{1}{8}$

116. The compound statement $[\sim(p\to q)\vee\sim(p\wedge r)]\wedge p$ is logically equivalent to:

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

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

117. The negation of the contrapositive of the statement $(p \vee q) \to r$ is logically equivalent to..

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

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

118. The dual of the statement pattern $(p \wedge q) \wedge \sim (p \vee q)$ is a:

(A) tautology (B) contradiction

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

119. Let $A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & -1 \\ 1 & 1 \end{bmatrix}$. If the variables x and y satisfy the matrix equation $(A^{-1} + B)\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ -2 \end{bmatrix}$, then the value of $x + 3y$ is.....

(A) 8 (B) 10

(C) 12 (D) 14

120. If matrix $\begin{pmatrix} x & 1 & 2 \\ 2 & 4 & x \\ -3 & 3 & 2 \end{pmatrix}$ is non-invertible matrix and distinct values of x are a and b then $9(a^2 + b^2) = \cdots\cdots\cdots$

(A) 271 (B) 721

(C) 217 (D) -278

121. Let $y = \frac{1}{3x-5}$ and if $\frac{d^4y}{dx^4} = 1944$, then the value of x is

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

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

122. If $y = 2^x + (\sin x)^x$, then $\frac{dy}{dx} =$

(A) $2^x \log 2 + (\sin x)^x [x \cot x + \log(\sin x)]$

(B) $2^x \log 2 + (\sin x)^x [x \cot x - \log(\sin x)]$

(C) $2^x \log 2 + (\sin x)^x [-x \cot x - \log(\sin x)]$

(D) $2^x \log 2 + (\sin x)^x [-x \cot x + \log(\sin x)]$

123. If $y = \sin(2 \sin^{-1} x)$, then $\frac{dy}{dx} =$ _____

(A) $\frac{2-4x^2}{\sqrt{1-x^2}}$ (B) $\frac{2+4x^2}{\sqrt{1-x^2}}$

(C) $\frac{4x^2-1}{2\sqrt{1-x^2}}$ (D) $\frac{1-2x^2}{\sqrt{1-x^2}}$

124. If $x^y \cdot y^x = 1$ then the value of $\frac{dy}{dx}$ is

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

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

125. If $f(x)$ is a differentiable function of x, then $\lim_{h\to 0} \frac{[f(x+h)]^2 - [f(x)]^2}{2h} =$

(A) $[f(x)]^2$ (B) $f(x) \cdot f'(x)$

(C) $f(x) + f'(x)$ (D) $[f(x) \cdot f'(x)]^2$

126. A water tank in the house of an inverted cone is being emptied at the rate of 2 cubic feet per second. The height of the cone is 8 feet and the radius is 4 feet, then the rate of change of the water level when the depth is 6 feet.

(A) $\frac{2}{9\pi} ft/sec$ (B) $\frac{4}{9\pi} ft/sec$

(C) $\frac{8}{9\pi} ft/sec$ (D) $\frac{10}{9\pi} ft/sec$

127. The approximate value of $\sin^{-1}(0.51)$ is .....

[Given $\pi = 3.1416$, $\frac{2}{\sqrt{3}} = 1.1547$]

(A) 0.535247 (B) 0.535547

(C) 0.535347 (D) 0.535147

128. The radius of a spherical balloon increases at the rate of 4 cm/sec. The rate at which its surface area increases, when the radius is 5 metres is

(A) 160π cm^2/sec (B) 1600π cm^2/sec

(C) 16000π cm^2/sec (D) 16000 cm^2/sec

129. If $f'(x) = k(\cos x - \sin x)$, $f'(0) = 5$, $f\left(\frac{\pi}{2}\right) = 19$, Then $f(x) =$

(A) $14(\cos x - \sin x) + 5$

(B) $14(\cos x + \sin x) + 5$

(C) $5(\cos x - \sin x) + 14$

(D) $5(\cos x + \sin x) + 14$

130. $\int \frac{4x+5}{2x+1} dx =$

(A) $2x + \frac{3}{2}\log|2x+1| + c$

(B) $2x - \frac{3}{2}\log|2x+1| + c$

(C) $x + \frac{3}{2}\log|2x+1| + c$

(D) $x - \frac{3}{2}\log|2x+1| + c$

131. $\int \sqrt{x} \sec\left(x^{\frac{3}{2}}\right) \tan\left(x^{\frac{3}{2}}\right) dx =$

(A) $\frac{2}{3}\sin\left(x^{\frac{3}{2}}\right) + c$ (B) $\frac{2}{3}\tan\left(x^{\frac{3}{2}}\right) + c$

(C) $\frac{2}{3}\cot\left(x^{\frac{3}{2}}\right) + c$ (D) $\frac{2}{3}\sec\left(x^{\frac{3}{2}}\right) + c$

132. If $\int_0^1 \tan^{-1}\left[\frac{1}{1-x+x^2}\right] dx = 2k$, then the value of k is:

(A) $2\int_0^1 \tan^{-1} x dx$ (B) $\int_0^1 \cot^{-1} x dx$

(C) 0 (D) $\int_0^1 \tan^{-1} x dx$

133. If $\int_0^\infty \frac{1}{(x^2+1)(x^2+16)}dx = \frac{\pi}{k^2-9}$, then $k = \ldots$

(A) ± 2 (B) ± 5

(C) ± 4 (D) ± 7

134. If $\int_{-1}^{4} f(x)dx = 4$ and $\int_2^4 (5 - f(x))dx = 7$ then $\int_2^{-1} f(x)dx =$

(A) 0 (B) -5

(C) -1 (D) -4

135. The area between the curves $y = 1 - |x|$ and $y = |x| - 1$ is ..... square units.

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

(C) 3 (D) 4

136. The differential equation of all parabolas which have $4a$ as latus rectum and whose axis is parallel to the X-axis is $2a\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^k = 0$, then the value of k is...

(A) 1 (B) 2

(C) 3 (D) 4

137. If the curve $y = f(x)$ passes through the point $(1, 2)$ and satisfies the differential equation $xdy + (y + x^3y^2)dx = 0$, then the equation of curve is...

(A) $xy = 2$ (B) $y = 2x$

(C) $x^2y = 2$ (D) $x^3y = 2$

138. The differential equation of the equation $y = a\cos(x + b)$ is

(A) $\frac{d^2y}{dx^2} + y = 0$ (B) $\frac{d^2y}{dx^2} - y = 0$

(C) $\frac{dy}{dx} + y = 0$ (D) $\frac{dy}{dx} - y = 0$

139. The cartesian equation of the line passing through the point $\hat{i} + 2\hat{j} + 3\hat{k}$ and perpendicular to the vectors $\hat{i} + \hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + \hat{k}$ is

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

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

140. If the vector $\vec{a} = x\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + y\hat{j} + z\hat{k}$ are collinear, then a possible unit vector parallel to the vector $\hat{i} + y\hat{j} + z\hat{k}$ is...

(A) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$ (B) $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$

(C) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$ (D) $\frac{1}{\sqrt{3}}(-\hat{i} - \hat{j} - \hat{k})$

141. $\vec{a}, \vec{b}, \vec{c}$ represent three concurrent edges of a rectangular parallelopiped whose lengths are $5, 2$ and 3 units respectively, then $(\vec{a} + \vec{b} + \vec{c}) \cdot (\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}) =$

(A) 10 (B) 90

(C) 60 (D) 30

142. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then the angle between $\vec{a}$ and $\vec{b}$ is

(A) 0° (B) 45°

(C) 90° (D) 180°

143. The vector equation of the plane determined by the lines $x = y, z = 0$ and $x + y = 0, z = 0$ is

(A) $\vec{r} \cdot (\hat{i} + \hat{j}) = 0$ (B) $\vec{r} \cdot (\hat{i} - \hat{j}) = 0$

(C) $\vec{r} \cdot (2\hat{i}) = 0$ (D) $\vec{r} \cdot \hat{k} = 0$

144. If the point $Q(\alpha, \beta, \gamma)$ is the mirror image of $P(10, 15, 20)$ in the plane $\vec{r} = \hat{k} + \lambda(-\hat{i} + \hat{j}) + \mu(-\hat{i} + \hat{k})$, $\lambda, \mu \in \mathbb{R}$ then the value of $3(\alpha + \beta + \gamma)$ is

(A) -45 (B) -120

(C) -105 (D) -129

145. If M is the foot of the perpendicular drawn from $A(4, 3, 2)$ on the line joining the points $B(2, 4, 1)$ and $C(4, 5, 3)$, the co-ordinates of M are

(A) $\left(\frac{41}{9}, \frac{28}{9}, \frac{19}{9}\right)$ (B) $\left(\frac{28}{9}, \frac{41}{9}, \frac{19}{9}\right)$

(C) $\left(\frac{9}{28}, \frac{9}{41}, \frac{9}{19}\right)$ (D) $\left(\frac{19}{9}, \frac{41}{9}, \frac{28}{9}\right)$

146. Let a and b be the distances from the point $(2, 3, 4)$ to the XY plane and Y-Axis respectively. Then $a^2 + b^2 =$

(A) 10 (B) 29

(C) 22 (D) 36

147. The minimum value of $z = 4x + 2y$ subject to the constraints $3x + y \geq 27, x + y \geq 21, x + 2y \geq 30, x \geq 0, y \geq 0$ is

(A) 0 (B) 48

(C) 60 (D) 80

148. Suppose that 60% of all families own a mobile set. If 11 families are interviewed at random, then the probability that 8 families own a mobile set is..... (Given that $(0.6)^8 = 0.0168$)

(A) 0.1235 (B) 0.1677

(C) 0.1774 (D) 0.5321

149. Let X be a continuous r. v. with p. d. f.

$f(x) = \begin{cases} kx^3, & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$

then $P\left(X \leq \frac{3}{4} | X > \frac{1}{4}\right) = \ldots$

(A) $\frac{1}{16}$ (B) $\frac{255}{256}$

(C) $\frac{16}{51}$ (D) $\frac{11}{165}$

150. If a fair die is thrown, then the odds in favor of getting a perfect square on the uppermost face are:

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

(C) 1 : 2 (D) 2 : 5

- End of Question Paper -