MHT CET 2022 PCM Aug 7 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 2022**, 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.

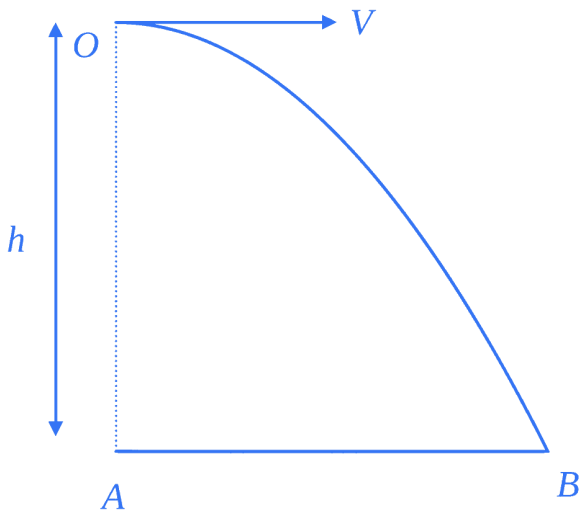
(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

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

1. A vehicle without passengers is moving on a frictionless horizontal road with velocity ' u ' can be stopped in a distance ' d '. Now 40% of it's weight is added. If the retardation remains same the stopping distance at velocity ' u ' is

(A) (1.6)d
(B) (1.4)d
(C) d
(D) (1.2)d

2. An aeroplane is flying in a horizontal direction with a velocity of 540 km/hr at a height of 1960 m . When it is vertically above the point A on the ground, a body is dropped from it. The body strikes the ground at point B. The distance AB is equal to $\left(g = 9.8\ m/s^2\right)$



(A) 2000 m
(B) 3000 m
(C) 3600 m
(D) 4000 m

3. When the bob of mass ' m ' moves in a horizontal circle of radius ' r ' with uniform speed ' v ' having length of string ' L ' describes a cone of semi vertical angle ' q ' the centripetal force acting on the bob is given by [g = acceleration due to gravity.]

(A) $\frac{mgL}{\sqrt{L^2-r^2}}$
(B) $\frac{\sqrt{L^2-r^2}}{mgL}$
(C) $\frac{mgr}{\sqrt{L^2-r^2}}$
(D) $\frac{mgr}{L^2-r^2}$

4. A solid sphere of radius ' R ' has mass ' M ' the moment of inertia of a solid sphere about an axis at a distance $\left(\frac{R}{2}\right)$ from the centre is

(A) $\frac{9}{20}MR^2$
(B) $\frac{7}{5}MR^2$
(C) $\frac{9}{5}MR^2$
(D) $\frac{13}{20}MR^2$

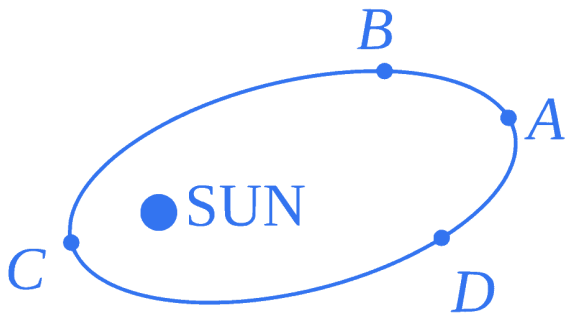
5. A solid sphere of mass ' M ' and radius ' R ' is rotating about its diameter. A solid cylinder of same mass and radius is also rotating about its geometrical 1 : 3 axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation (K_{sphere} to $K_{cylinder}$) will be

(A) 1 : 8
(B) 1 : 6
(C) 1 : 3
(D) 1 : 5

6. The escape velocity for a planet whose mass is six times the mass of earth and the radius is twice the radius of earth will be [V_e = escape velocity from the earth]

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

7. A planet is moving around the sun in an elliptical orbit at different positions A, B, C, D. The maximum rotational kinetic energy of a planet is at postion.



(A) D
(B) B
(C) A
(D) C

8. In capillary tube having area of cross-section ' A ', water rises to a height ' h '. If cross sectional area is reduced to $\frac{4}{9}$, the rise of water in the capillary tube is

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

9. A square frame of each side ' L ' is dipped in a soap solution and taken out. The force acting on the film formed is (T = surface tension of soap solution)

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

10. A water drop of radius ' r ' and volume ' V ' is kept in between the two identical glass plates such that it forms a thin layer of area ' A ' between the plates. A force ' F ' is applied such that the two plates separate from each other. The surface tension ' T ' of the liquid is

(A) $\frac{FV}{2A^2}$ (B) $\frac{A^2}{FV}$

(C) $\frac{AV}{F^2}$ (D) $\frac{FV}{4A^2}$

11. What is change in volume of an iron sphere of volume 500 cm^3, when it is heated from $0^\circ C$ to $\left(\alpha_{Iron} = 12 \times 10^{-6/^\circ}C\right)$?

(A) 1.8 cm^3 (B) 2 cm^3

(C) 1.4 cm^2 (D) 3 cm^3

12. A black sphere has radius ' R ' whose rate of radiation is ' E ' at temperature ' T '. if radius is made ' $\frac{R}{3}$ 'and temperature ' $3T$ ', the rate of radiation will be

(A) $3E$ (B) 16E

(C) E (D) 9E

13. 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 L_1 and L_2 are the lengths of the gas columns before and after the expansion respectively. The $\frac{T_2}{T_1}$ is

(A) $\left[\frac{L_1}{L_2}\right]^{2/3}$ (B) $\left[\frac{L_1}{L_2}\right]^{1/2}$

(C) $\left[\frac{L_2}{L_1}\right]^{1/2}$ (D) $\left[\frac{L_2}{L_1}\right]^{2/3}$

14. If R is universal gas constant the amount of heat needed to raise the temperature of 2 moles of an ideal monoatomic gas from 273 K to 373 K when no work is done is

(A) 150R (B) 100R

(C) 500R (D) 300R

15. If ' E ' is the kinetic energy per mole of an ideal gas and ' T ' is the absolute temperature, then the universal gas constant is given as

(A) $\frac{2T}{3E}$ (B) $\frac{2E}{3T}$

(C) $\frac{3T}{2E}$ (D) $\frac{3E}{2T}$

16. The molar specific heat at constant pressure of an ideal gas is $\frac{7}{2}R$. The gas is made up of molecules which are (R is the universal gas constant)

(A) Polyatomic (B) triatomic

(C) monoatomic (D) diatomic

17. Two particles 'A' and 'B' perform S.H.M., starting from mean position have periodic the ' T ' and $3T/2$ respectively. The phase difference between particles A and B when particle A completes one oscillation is

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

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

18. A body is executing S.H.M. Its potential energy is ' P_1 ' and ' P_2 ' at displacements ' x ' and ' y ' respectively. The potential energy at displacement $(x + y)$ is

(A) $\sqrt{P_1} - \sqrt{P_2} = \sqrt{p}$ (B) $p_1 + p_2 = p$

(C) $p_1 - p_2 = p$ (D) $\sqrt{p_1} + \sqrt{p_2} = \sqrt{p}$

19. A simple harmonic progressive wave is given by $y = y_0 \sin 2\pi\left(nt - \frac{x}{\lambda}\right)$. If the wave velocity is $\left(\frac{1}{8}\right)^{th}$ the maximum particle velocity then the wavelength is

(A) $\frac{\pi y_0}{16}$ (B) $\frac{\pi y_0}{2}$

(C) $\frac{\pi y_0}{4}$ (D) $\frac{\pi y_0}{8}$

20. A uniform wire of length L, diameter D and density ρ is stretched by a tension T length L and the diameter D is

(A) $f \propto \frac{L}{D}$ (B) $f \propto \frac{1}{LD}$

(C) $f \propto \frac{1}{L\sqrt{D}}$ (D) $f \propto \frac{1}{LD^2}$

21. Two sound waves of slightly different frequencies propagating in the same direction produce beats due to

(A) interference. (B) diffraction.

(C) reflection. (D) refraction.

22. A string in a musical instrument is 50 cm long and its fundamental frequency is 800 Hz. Keeping the tension applied to the string same, the change in the length to produce sound note of fundamental frequency 1000 Hz will be.

(A) 10 cm (B) 20 cm

(C) 60 cm (D) 40 cm

23. A progressive wave of frequency 50 Hz is travelling with velocity 350 m/s through a medium. The change in phase at a given time interval of 0.01 s is

(A) πrad (B) $\frac{\pi}{4}$rad

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

24. A spherical rubber balloon carries a charge, uniformly distributed over the surface. As the balloon is blown up and increases in size, the total electric flux coming out of the surface

(A) Becomes zero (B) Increases

(C) Decreases (D) Remains unchanged

25. A charge Q is enclosed by a Gaussian surface of radius R. If the radius is doubled then the outward electric flux will

(A) be reduced to half (B) be doubled

(C) remain the same (D) increase four times

26. An electric dipole of moment $\vec{p}$. is lying along a uniform electric field $\vec{E}$. The work done in rotating the dipole through 90° is $[\sin 0^\circ = \cos 90^\circ = 0,\ \cos 0^\circ = \sin 90^\circ = 1]$

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

(C) pE/2 (D) 3pp

27. Two parallel air capacitors have their plate areas 100 cm^2 and 500 cm^2, respectively. They have the same charge and potential. If the distance between the plates of the first capacitor is 0.5 mm, the distance between the plates of the second capacitor is

(A) 1 cm (B) 0.75 cm

(C) 0.25 cm (D) 0.52 cm

28. The length of a potentiometer wire is L. A cell of e.m.f. E is balanced at a length $\frac{L}{3}$ from the positive end of the wire. If the length of the wire is increased $\frac{L}{2}$ at what distance will the same cell gives a balance point?

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

(C) $\frac{L}{6}$ (D) $\frac{4L}{3}$

29. A galvanometer of resistance ' G ' is shunted by a resistance of 5Ω. To keep the main current in the circuit unchanged, the resistance to be put in series with the same galvanometer is

(A) $\frac{G^2}{S+G}$ (B) $\frac{5G}{S+G}$

(C) $\frac{G}{S+G}$ (D) $\frac{S^2}{S+G}$

30. A toroid has a core of inner radius r_1 and outer radius r_2, around which N turns of wire are wound. If the current in the wire is I then the magnetic field inside the toroid is (μ_0 = permeability of free space)

(A) $\frac{\mu_0 NI}{2\pi(r_1+r_2)}$ (B) $\frac{\mu_0 NI}{\pi(r_1+r_2)}$

(C) $\frac{\mu_0 NI}{2\pi(r_2-r_1)}$ (D) $\frac{\mu_0 NI}{\pi(r_2-r_1)}$

31. A metal wire is of length l has magnetic moment M. What is the new magnetic moment if it is bent in L-shape?

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

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

32. A rectangular coil of effective area 0.05 m^2 is suspended freely in a radial magnetic field of 0.01 Wb/m^2. The torsional constant of the suspension fiber is 5×10^{-9}Nm/ degree. If a current of 300μA is passed through it, then the angle through which the coil rotates is

(A) 60° (B) 30°

(C) 45° (D) 90°

33. A coil having effective area ' A ' is held with its plane normal to a magnetic field of induction ' B '. The magnetic induction is quickly reduced to 25% of its initial value in 1 second. The e.m.f. induced in the coil (in volt) will be

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

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

34. If the current flowing through a coil is reduced by 50% then, the energy in the coil will

(A) Be unchanged (B) Decrease by 25%

(C) Decrease by 75% (D) Increase

35. A metal rod of length ' 1 ' rotates about one of its ends in a plane perpendicular to a magnetic field of induction ' B '. If the e.m.f. induced between the ends of the rod is ' e ' then the number of revolutions made by the rod per second is

(A) $\frac{\pi\ell^2}{eB}$ (B) $\frac{e}{B\pi\ell^2}$

(C) $\frac{e}{B\pi^2 l}$ (D) $\frac{B^2}{e\pi\ell}$

36. The resonant frequency of a series LCR circuit is ' f_R '. The circuit is connected to a sinusoidally alternating e.m.f. of frequency ' $2f_R$ '. The inductive reactance becomes. ' X_{L_1} ' and capacitive reactance becomes ' X_{C_1} ' after changing the frequency. ' X_{C_1} ' is equal to

(A) $2X_{L_1}$ (B) $\frac{1}{4}X_{L_1}$

(C) $\frac{1}{2}X_{L_1}$ (D) x_{L_1}

37. The average value of a.c. voltage is given by $V = V_m \sin(\omega t)$ over time interval $t = 0$ to $= \frac{\pi}{\omega}$ is

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

(C) V_m (D) $\frac{2\,V_m}{\pi}$

38. A battery connected to a capacity $20\mu F$ is charged to a potential of 35 V. The battery is disconnected. A pure inductor coil of 200mH is connected across the capacitor so that LC oscillations are set up.The maximum current in the coil is

(A) 0.025 A (B) 0.25 A

(C) 0.035 A (D) 0.35 A

39. The critical angle is θ for a light going from medium P to medium Q. If speed of light in medium P is V_P then speed of light in medium Q is

(A) $\frac{V_p}{\sin\theta}$ (B) $V_p \tan\theta$

(C) $\frac{\sin\theta}{V_p}$ (D) $V_P \sin\theta$

40. A double convex lens made of glass has both radii of curvature of magnitude 20 cm. Incident light rays parallel to the axis of the lens will converge to a point at a distance ' L ' from the common pole P. The value of L is [Refractive index of glass $= 1.5$]

(A) 10 cm (B) 40 cm

(C) $\frac{20}{3}$ cm (D) 20 cm

41. On placing a thin film of mica of thickness 12×10^{-5} cm in the path of one of the interfering waves in Young's double slit experiment using monochromatic light, the fringe pattern shifts through a distance equal to width of a bright fringe. If wavelength used is $\lambda = 6 \times 10^{-5}$ cm, the refractive index of mica is

(A) 1.4 (B) 1.1

(C) 1.3 (D) 1.5

42. When the distance separations between the slit and screen is doubled, the angular separation between the fringes in slit diffraction experiment.

(A) First increase and then decreases (B) Remains same

(C) Increases (D) Decreases

43. In Young's double Slit experiment, we get 15 fringes per cm on the screen using light of wave length 5600Å. For the same setting how many fringes per cm will be obtained with the light of wavelength 7000Å ?

(A) 18 (B) 10

(C) 12 (D) 15

44. An electron of mass ' m ' and a photon have same energy E. The ratio of the de-Broglie wavelengths associated with them is (c = velocity of light in air)

(A) $\left[\frac{E}{2M}\right]^{\frac{1}{2}}$ (B) $\frac{1}{c}\left[\frac{E}{2m}\right]^{\frac{1}{2}}$

(C) $c(2mE)^{\frac{1}{2}}$ (D) $\frac{1}{c}\left[\frac{2m}{E}\right]^{\frac{1}{2}}$

45. When a certain metal surface is illuminated with light of frequency v, the stopping potential for the photoelectric current is V_s. When the same surface is illuminated by a light of frequency $\frac{v}{2}$, the stopping potential is $V_s/4$. The threshold frequency of photoelectric emission is

(A) $\frac{4v}{3}$ (B) $\frac{5v}{3}$

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

46. An electron in stationary hydrogen atom jumps from 4^{th} energy level to ground level. The velocity that the photon acquired as a result of electron transition will be (h = Planck's constant, R = Rydberg's constant, m = mass of photon)

(A) $\frac{11Rh}{16m}$ (B) $\frac{15Rh}{16m}$

(C) $\frac{9Rh}{16m}$ (D) $\frac{13Rh}{16m}$

47. Using Bohr's quantization, what is the rotational energy in the 2^{nd} orbit for a diatomic molecule? (I = moment of inertia of a diatomic molecule, h = Planck's constant)

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

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

48. Identify the devices which work on solar energy. (a) Photodiode (b) Photovoltaic cell. (c) LED (d) Photo thermal devices.

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

49. Identify the WRONG statement from the following. In an intrinsic semiconductor

(A) The number of free electrons is less than that in a conductor.
(B) The number of free electrons increases with temperature.
(C) There are no free electrons at any temperature except absolute zero.
(D) There are no free electrons at absolute zero temperature.

50. The output of OR gate is ' 1 '

(A) if either input is 'zero'
(B) Only if both inputs are 'zero'
(C) if either or both inputs are ' 1 '
(D) Only if both inputs are ' 1 '

51. What is percent atom economy if formula weight of reactants and formula weight of products respectively are 45u and 35u ?

(A) 77.8%
(B) 90.0%
(C) 80.5%
(D) 71.0%

52. How many mole of oxygen gas at STP are equivalent to 5.6 litre?

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

53. What does magnetic quantum number describe?

(A) Orientation of an orbital in the given subshell
(B) Spin of an electron
(C) Shape of an orbital
(D) Size of an orbital

54. What is the bond angle $O-S-O$ in SO_2 molecule?

(A) 180°
(B) 104.5°
(C) 119.5°
(D) 107°

55. Two lone pairs of electrons and two bond pairs of electrons are present in

(A) BF_3
(B) NH_3
(C) H_2O
(D) CO_2

56. Which among the following statements is NOT correct about dipole moment of NH_3 and NF_3 ?

(A) Fluorine is less electronegative than nitrogen.
(B) The dipole moment of NH_3 is more than that of NF_3.
(C) In NH_3 orbital dipole is in the same direction as that of resultant dipole moment of $N-H$ bonds.
(D) In NF_3 orbital dipole is in the opposite direction of the resultant dipole moment of three N-F bonds.

57. Identify the element having highest ionization enthalpy.

(A) Li
(B) K
(C) Rb
(D) Cs

58. Calculate the number of moles of the gas having volume 2.5 liter at 300 K and 4.5 atm ? $\left(R = 0.0821\ atmdm^3\ K^{-1}\ mol^{-1}\right)$

(A) 0.62
(B) 0.46
(C) 0.56
(D) 0.70

59. The enthalpies of combustion of C(graphite) and C(diamond) are -393.8 and $-395.3\ kJ\ mol^{-1}$ respectively. The enthalpy of conversion of C (graphite) to C (diamond) is

(A) $-12.5\ kJ\ mol^{-1}$
(B) $-789.1\ kJ\ mol^{-1}$
(C) $79.0\ kJ\ mol^{-1}$
(D) $1.5\ kJ\ mol^{-1}$

60. Calculate the change in internal energy of the system if 37.6 J of work is done by the system with heat loss of 14.6 J ?

(A) -52.2 J
(B) -549 J
(C) -12.57 J
(D) -23.0 J

61. Which among the following is true for the reactions involving only solids or liquids?

(A) $\Delta H > \Delta U$
(B) $\Delta H = \Delta U$
(C) $\Delta H < \Delta U$
(D) $\Delta H = \Delta U - \Delta nRT$

62. A weak monobasic acid is 2% dissociated in its 0.1M solution. What is its dissociation constant?

(A) 4.0×10^{-5}
(B) 1.0×10^{-5}
(C) 2.0×10^{-5}
(D) 2.5×10^{-5}

63. which among the following salts is formed of strong base and weak acid?

(A) $CuSO_4$
(B) $NaNO_3$
(C) NaCl
(D) KCN

64. What is the concentration of H_3O^+ions in a solution having POH value 9 ?

(A) 1.0×10^{-5}M
(B) 2.0×10^{-5}M
(C) 1.5×10^{-5}M
(D) 2.5×10^{-5}M

65. How many moles of electrons are required for the reduction of 3 mole ions if Zn^{2+} to Zn(s) ?

(A) 9
(B) 6
(C) 2
(D) 3

66. What is the oxidation state of nitrogen in N_3H ?

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

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

67. Identify the compound that does not correctly match with its common name

A) $H–CHO$: Formaldehyde

B) $C_6H_5–NH_2$: Aniline

C) $CH_3–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_3$: n–Butane

D) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–COOH$: Lactic acid

(A) (a) (B) (b)

(C) (c) (D) (d)

68. What is the IUPAC name of picric acid?

(A) m - Nirtobenzoic acid (B) 2, 4, 6 - Trinitrophenol

(C) 2, 4-Dinitrophenol (D) 2, 3 - Dinitrophenol

69. What quantity of oxygen is required for complete burning of 15.6 g benzene?

(A) 75 g (B) 88 g

(C) 48 g (D) 64 g

70. Calculate the density of an element with molar mass 27 g mol^{-1} having 4 atoms in a unit cell with edge length 405 pm

(A) 4.56 g cm^{-3} (B) 2.69 g cm^{-3}

(C) 1.53 g cm^{-3} (D) 3.10 g cm^{-3}

71. Calculate the edge length of unit cell that crystallises to form bcc structure. (Radius of atom is 2.17×10^{-8} cm, $\sqrt{3} = 1.732$)

(A) 4.3×10^{-8} cm (B) 2.5×10^{-8} cm

(C) 5.0×10^{-8} cm (D) 3.1×10^{-8} cm

72. What is the coordination number of sphere in simple cubic lattice?

(A) 6 (B) 8

(C) 4 (D) 12

73. Calculate the amount of solute dissolved in $3dm^3$ water having osmotic pressure 0.3 atm at 300 K (Molar mass of solute $= 108$ g mol^{-1}, $R = 0.0821$ atmdm^3 K^{-1} mol^{-1})

(A) 4.51 gram (B) 3.95 gram

(C) 3.45 gram (D) 5.26 gram

74. Which of the following solutes dissolved in water, having same concentration exhibits highest value of colligative property?

(A) urea (B) glucose

(C) sucrose (D) sodium chloride

75. What is the relation between the depression in freezing point and molar mass of non-volatile solute?

(A) $M_2 = \frac{1000\ K_f W_1}{\Delta T_f W_2}$ (B) $M_2 = \frac{\Delta T_f W_1}{1000\ K_f W_2}$

(C) $M_2 = \frac{1000 \Delta T_f W_2}{K_f W_1}$ (D) $M_2 = \frac{1000\ K_f W_2}{\Delta T_f W_1}$

76. Calculate molar conductivity at infinite dilution for NaBr if molar conductivity at infinite dilution for NaCl, KBr and KCl are 126, 152 and $150 \Omega^{-1}$ cm^2 mol^{-1} respectively

(A) $128 \Omega^{-1}$ cm^2 mol^{-1} (B) $302 \Omega^{-1}$ cm^2 mol^{-1}

(C) $278 \Omega^{-1}$ cm^2 mol^{-1} (D) $176 \Omega^{-1}$ cm^2 mol^{-1}

77. Identify the reaction taking place at anode during electrolysis of molten NaCl ?

(A) $2OH^- \rightarrow H_2O + \frac{1}{2}O_2 + 2e^-$

(B) $2H^+ 2e^- \rightarrow H_2$

(C) $Na^+ + le^- \rightarrow Na_{(s)}$

(D) $2Cl^- \rightarrow Cl_{2(\ g)} + 2e^-$

78. Identify the correct expression for rate of following reaction. $2\ N_2O_{5_{(g)}} \rightarrow 4NO_{2_{(g)}} + O_{2_{(g)}}$

(A) $\frac{1}{2}\frac{d[N_2O_5]}{dt}$ (B) $-\frac{d[NO_2]}{dt}$

(C) $-\frac{1}{2}\frac{d[N_2O_5]}{dt}$ (D) $\frac{1}{4}\frac{d[O_2]}{dt}$

79. A complex reaction takes place in 2 steps (i) $NO_{2(\ g)} + F_{2(\ g)} \rightarrow NO_2\ F_{(g)} + F_{(g)} +$ (slow) (ii) $F_{(g)} + NO_{2(\ g)} \rightarrow NO_2\ F_{(g)}$(fast) Identify the reaction intermediate?

(A) $F_{(g)}$ (B) $NO_{2(\ g)}$

(C) $F_{2(\ g)}$ (D) $NO_2\ F_{(g)}$

80. What is the time required for completion of 90% of a first order reaction?

(A) $\frac{2.303}{k}$ (B) $\frac{0.3010}{\text{k}}$

(C) $\frac{0.693}{2\text{k}}$ (D) $\frac{2 \times 0.693}{k}$

81. Which of the following is NOT a characteristic of chemisorption?

(A) Heat of adsorption is in the range of $40 - 200$ kJ mol^{-1}

(B) It is specific.

(C) It is irreversible

(D) Formation of multimolecular layer of adsorbate.

82. Which among the following hydrogen halides is thermally least stable?

(A) HBr

(B) HI

(C) HCl

(D) HF

83. Identify the strongest base from following.

(A) $Sm(OH)_3$

(B) $La(OH)_3$

(C) $Lu(OH)_3$

(D) $Pr(OH)_3$

84. Identify the element if it's observed and expected electronic

(A) Ca

(B) K

(C) Sc

(D) Rb

85. What is the number of primary amines possible for the compound having molecular formula $C_4H_{11}N$?

(A) 3

(B) 2

(C) 1

(D) 4

86. How many hybrid orbitals of cobalt ion are involved in formation of hexaammine cobalt (III) chloride complex?

(A) 6

(B) 3

(C) 2

(D) 4

87. Identify a ligand with single donor atom from following.

(A) OH^-

(B) NO_2^-

(C) SCN

(D) $(C_2O_4)^{2-}$

88. Which among the following compounds have highest boiling point?

(A) $CH_3CH_2CH_2Cl$

(B) CH_3CH_2Cl

(C) $CH_3CH(Cl)CH_2CH_3$

(D) CH_3Cl

89. Which among the following compounds converts alkyl halides to nitro alkanes?

(A) Silver nitrite

(B) alc. Potassium cyanide

(C) alc. Silver cyanide

(D) Potassium nitrite

90. Identify reducing agent used for the following conversion. $R - CHO \rightarrow R - CH_2 - OH$

(A) Na /Dry ether

(B) $K_2Cr_2O_7$/ dil. H_2SO_4

(C) $LiAlH_4/H_3O^+$

(D) Sn/HCl

91. Which among the following is a Lucas regent?

(A) $Na - Hg/H_2O$

(B) $HCl/ZnCl_2$

(C) $Zn - Hg/HCl$

(D) H_2/Ni

92. Which of the following compounds is obtained when $R - CHO$ is treated with dilute nitric acid?

(A) Ketones

(B) Carboxylic acids

(C) Alcohols

(D) Amides

93. Which among the following compounds is NOT used for the preparation of aromatic carboxylic acids from alkyl benzene?

(A) Diborane

(B) dilute nitric acid

(C) Alkaline potassium permanganate

(D) Chromic acid

94. The number of alcoholic $-OH$ and $-COOH$ group in citric acid respectively are

(A) 2 and 1

(B) 3 and 1

(C) 1 and 3

(D) 1 and 2

95. The end product in Hofmann's exhaustive of amines is

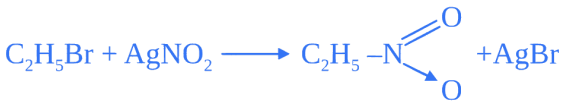
(A) Primary amine

(B) Secondary amine

(C) Tertiary amine

(D) Quaternary ammonium halide

96. Which among the following reactions does not occur?



(A)

(B) $C_2H_5Br + AgCN \rightarrow C_2H_5NC + AgBr$

(C) $C_2H_5Br + KCN \rightarrow C_2H_5NC + KBr$

(D) $C_2H_5Br + KNO_2 \rightarrow C_2H_5 - O - N = O + KBr$

97. Which among the following sugars is called as laevulose?

(A) Maltose (B) Galactose

(C) Glucose (D) Fructose

98. Which from following amino acids contains sulfur?

(A) Tryptophan (B) Histidine

(C) Serine (D) Cysteine

99. Which among the following polymers does NOT need peroxide initiator for synthesis?

(A) LDP (B) Nylon 6, 6

(C) Polyacrylonitrile (D) Teflon

100. Which among the following statements about HDP is NOT true?

(A) It melts at low temperature than LDP. (B) It is manufactured by applying low pressure than LDP manufacture process.

(C) It is stiffer than LDP. (D) It is crystalline.

101. If $f(x) = \frac{a^x - a^{-x}}{a^x + a^{-x}}$, where a, x satisfy the necessary conditions, then $f^{-1}(x) =$

(A) $\frac{1}{2}\log_a\left(\frac{1+x}{1-x}\right)$ (B) $\frac{1}{2}\log_a\left(\frac{1+x}{x}\right)$

(C) $\frac{1}{2}\log_a\left(\frac{2+x}{2-x}\right)$ (D) $\frac{1}{2}\log_a\left(\frac{x}{1-x}\right)$

102. Let $\cos(\alpha+\beta) = \frac{4}{5}$ and $\sin(\alpha-\beta) = \frac{5}{13}$, where $0 \le \alpha, \beta \le \frac{\pi}{4}$, then $\tan 2\alpha =$

(A) $\frac{19}{12}$ (B) $\frac{56}{33}$

(C) $\frac{25}{16}$ (D) $\frac{20}{7}$

103. The principal solutions of $\tan 3\theta = -1$ are

(A) $\left\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{5\pi}{4}, \frac{19\pi}{12}, \frac{23\pi}{12}\right\}$

(B) $\left\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{\pi}{16}, \frac{19\pi}{12}, \frac{23\pi}{24}\right\}$

(C) $\left\{\frac{\pi}{4}, \frac{\pi}{12}\right\}$

(D) $\left\{\frac{\pi}{4}, \frac{\pi}{12}, \frac{13\pi}{12}, \frac{7\pi}{4}, \frac{19\pi}{4}, \frac{23\pi}{12}\right\}$

104. In a triangle ABC, with usual notations $\angle A = 60°$, then $\left(1 + \frac{a}{c} + \frac{b}{c}\right)\left(1 + \frac{c}{b} - \frac{a}{b}\right) =$

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

(C) 1 (D) 3

105. Argument of $\frac{1-i\sqrt{3}}{1+i\sqrt{3}}$ is

(A) 210° (B) 120°

(C) 240° (D) 60°

106. A round table conference is to be held amongst 20 countries. If two particular delegates wish to sit together, then such arrangements can be done in ways.

(A) $2 \times (18)!$ (B) $\frac{19!}{2!}$

(C) 18! (D) $19! \times 2!$

107. The equation of the line perpendicular to $2x - 3y + 5 = 0$ and making an intercept 3 with positive Y-axis is

(A) $3x + 2y - 6 = 0$ (B) $3x + 2y + 6 = 0$

(C) $3x + 2y - 7 = 0$ (D) $3x + 2y - 12 = 0$

108. If the slope of one of the lines given by $ax^2 + 2hxy + by^2 = 0$ is two times the other, then

(A) $8h = 9ab^2$ (B) $8h^2 = 9ab^2$

(C) $8h^2 = 9ab$ (D) $8h = 9ab$

109. The joint equation of two lines passing through the origin and perpendicular to the lines given by $2x^2 + 5xy + 3y^2 = 0$ is

(A) $3x^2 + 5xy + 2y^2 = 0$

(B) $3x^2 - 5xy + 2y^2 = 0$

(C) $3x^2 - 5xy - 2y^2 = 0$

(D) $2x^2 - 5xy + 3y^2 = 0$

110. If the lines $2x - 3y = 5$ and $3x - 4y = 7$ are the diameters of a circle of area154sq $\cdot$ units, then equation of the circle is (Take $\pi = \frac{22}{7}$)

(A) $x^2 + y^2 - 2x + 2y - 47 = 0$

(B) $x^2 + y^2 - 2x + 2y - 49 = 0$

(C) $x^2 + y^2 - 2x - 2y - 47 = 0$

(D) $x^2 + y^2 - 2x - 2y - 49 = 0$

111. $\lim_{x\to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\operatorname{cosec} x} =$

(A) 0 (B) 1

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

112. Which of the following statement pattern is contradiction?

(A) $S_3 \equiv (\sim p \wedge q) \wedge (\sim q)$

(B) $S_2 \equiv (p \to q) \vee (p \wedge \sim q)$

(C) $S_1 \equiv (\sim p \vee \sim q) \vee (p \vee \sim q)$

(D) $S_4 \equiv (\sim p \wedge q) \vee (\sim q)$

113. For the simple statements p, q, and $r, p \to (q \vee r)$ is logically equivalent to

(A) $(p \vee q) \to r$

(B) $(p \to q) \vee (p \to r)$

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

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

114. If the standard deviation of first n natural numbers is 2 , then the value of n is

(A) 7 (B) 5

(C) 4 (D) 6

115. With reference to the principal values, if $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then $x^{100} + y^{100} + z^{100} =$

(A) 2 (B) 3

(C) 1 (D) 6

116. If matrix $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ is such that $AX = I$, where I is 2×2 unit matrix, then $X =$

(A) $\frac{1}{5}\begin{bmatrix} -3 & -2 \\ -4 & -1 \end{bmatrix}$ (B) $\frac{1}{5}\begin{bmatrix} -3 & 2 \\ 4 & -1 \end{bmatrix}$

(C) $\frac{1}{5}\begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$ (D) $\frac{1}{5}\begin{bmatrix} 3 & -2 \\ -4 & 1 \end{bmatrix}$

117. If $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then $A =$

(A) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$

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

118. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & -3 \\ -1 & 2 & 3 \end{bmatrix}$, then $A_{31} + A_{32} + A_{33} =$ where A_{ij}, where $A = [a_{ij}]_{3\times 3}$

(A) 10 (B) 1

(C) 0 (D) 11

119. Give that $f(x)\begin{cases} = \frac{1-\cos 4x}{x^2} & \text{if } x < 0 \\ = a & \text{if } x = 0, \text{ is continuous} \\ = \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4} & \text{if } x > 0 \end{cases}$ at $x = 0$, then $a =$

(A) 2 (B) 8

(C) 4 (D) 16

120. If $y = \sec^{-1}\left(\frac{x+x^{-1}}{x-x^{-1}}\right)$, then $\frac{dy}{dx} =$

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

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

121. The second derivative of $a\sin^3 t$ w.r.t $a\cos^3 t$ at $t = \frac{\pi}{4}$ is

(A) $\frac{-4\sqrt{2}}{3a}$ (B) $\frac{4\sqrt{2}}{3a}$

(C) $\frac{4\sqrt{3}}{3a}$ (D) $\frac{1}{12a}$

122. If $x^y = e^{x-y}$, then $\frac{dy}{dx} =$

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

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

123. If surrounding air is kept at 20°C and body cools from 80°C to 70°C in 5 minutes, then the temperature of the body after 15 minute will be

(A) 52.7°C (B) 51.7°C

(C) 54.7°C (D) 50.7°C

124. If $y = 4x - 5$ is tangent to the curve $y^2 = px^3 + q$ at $(2, 3)$, then

(A) $p = 2, q = -7$ (B) $p = 2, q = 7$

(C) $p = -2, q = 7$ (D) $p = -2, q = -7$

125. 20 meters of wire is available to fence of a flowerbed in the form of a circular sector. If the flowerbed is to have maximum surface area, then the radius of the circle is

(A) 8 m (B) 4 m

(C) 2 m (D) 5 m

126. The function $f(x) = 2x^3 - 9x^2 + 12x + 29$ is monotonically increasing in the interval

(A) $(-\infty, 1) \cup (2, \infty)$ (B) $(-\infty, \infty)$

(C) $(2, \infty)$ (D) $(-\infty, 1)$

127. $\int \frac{e^x}{(2+e^x)(e^x+1)}dx =$ (where C is a constant of integration.)

(A) $\frac{e^x+1}{e^x+2} + C$ (B) $\log\left(\frac{e^x+2}{e^x+1}\right) + C$

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

128. $\int \frac{5\left(x^6+1\right)}{x^2+1}\,dx =$ (Where C is a constant of integration.)

(A) $5\left(x^7+1\right) + \log\left(x^2+1\right) + C$

(B) $x^5 - \frac{5x^3}{3} + 5x + C$

(C) $\frac{5x^7}{7} + 5x + 5\tan^{-1} x + C$

(D) $5\tan^{-1} x + \log\left(x^2+1\right) + C$

129. $\int_2^3 \frac{\log x}{x}dx =$

(A) $\frac{1}{2}\log 6 \log 3$ (B) $\log 6 \log \frac{3}{2}$

(C) $\frac{1}{2}\log 6 \log \frac{3}{2}$ (D) $2\log 6 \log \frac{3}{2}$

130. If $\int \frac{2e^x+3e^{-x}}{3e^x+4e^{-x}}dx = Ax + B\log\left(3e^{2x}+4\right) + C$, then values of A and B are respectively (where C is a constant of integration.)

(A) $\frac{3}{4}, \frac{-1}{24}$ (B) $\frac{3}{4}, \frac{1}{24}$

(C) $\frac{4}{3}, -24$ (D) $\frac{1}{4}, \frac{1}{24}$

131. $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} f(x)dx =$ Where $f(x) = \sin|x| + \cos|x|, x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

(A) 0 (B) 8

(C) 4 (D) 2

132. The area of the region bounded by the y-axis, $y = \cos x, y = \sin x$, when $0 \le x \le \frac{\pi}{4}$, is

(A) $(\sqrt{2}-1)$ sq. units (B) $2(\sqrt{2}-1)$ sq. units

(C) $(\sqrt{2}+1)$ sq. units (D) $\sqrt{2}$ sq. units

133. For the differential equation $\left[1-\left(\frac{dy}{dx}\right)^2\right]^{5/2} = 8\frac{d^2y}{dx^2}$ has the order and degree

(A) 2 and 1 (B) 2 and 3

(C) 2 and 6 (D) 2 and 2

134. The general solution of differential equation $e^{\frac{1}{2}\left(\frac{dy}{dx}\right)} = 3^x$ is (where C is a constant of integration.)

(A) $y = x\log 3 + C$ (B) $y = x^2\log 3 + C$

(C) $y = 2x\log 3 + C$ (D) $x = (\log 3)y^2 + C$

135. The general solution of the differential equation $x^2 + y^2 - 2xy\frac{dy}{dx} = 0$ is (where C is a constant of integration.)

(A) $2\left(x^2 - y^2\right) + x = C$

(B) $x^2 + y^2 = Cx$

(C) $x^2 - y^2 = Cx$

(D) $x^2 + y^2 = Cy$

136. The particular solution of the differential equation $\frac{dy}{dx} - e^x = ye^x$, when $x = 0$ and $y = 1$ is

(A) $\log\left(\frac{y+1}{2}\right) = \frac{e^x}{2} - \frac{1}{2}$

(B) $\log\left(\frac{y+1}{2}\right) = e^x - 1$

(C) $\log(y-1) = e^x - 1$

(D) $\log 2(y-1) = e^x - 1$

137. Given three vectors $\bar{a}, \bar{b}, \bar{c}$, two of which are collinear. If $\bar{a}+\bar{b}$ is collinear with $\bar{c}$ and $\bar{b}+\bar{c}$ is collinear with $|\bar{a}| = |\bar{b}| = |\bar{c}| = \sqrt{2}$, then $\bar{a}\cdot\bar{b} + \bar{b}\cdot\bar{c} + \bar{c}\cdot\bar{a} =$

(A) 5 (B) -3

(C) 3 (D) -1

138. If $\bar{a}$ and $\bar{b}$ are two vectors such that $|\vec{a}| = |\vec{b}| = \sqrt{2}$ with $\vec{a}\cdot\vec{b} = -1$, then the angle between $\bar{a}$ and $\bar{b}$ is

(A) $\frac{3\pi}{4}$ (B) $\frac{5\pi}{6}$

(C) $\frac{5\pi}{9}$ (D) $\frac{2\pi}{3}$

139. Let a, b, c be distinct non-negative umbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}, \hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is

(A) the arithmetic mean of a and b. (B) the harmonic mean of a and b.

(C) the geometric mean of a and b. (D) not arithmetic mean of a and b.

140. If $\vec{a}, \vec{b}, \vec{c}$ are position vectors of points A, B, C respectively, with $2\vec{a} + 3\vec{b} - 5\vec{c} = \vec{0}$, then the ratio in which point C divides segment AB is

(A) 2:3 internally (B) 2:3 externally

(C) 3:2 internally (D) 3:2 externally

141. If the position vectors of the point A and B are $3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} - 2\hat{j} - 4\hat{k}$ respectively, then the equation of the plane through B and perpendicular to AB is

(A) $2x + 3y + 6z + 9 = 0$

(B) $2x + 3y + 6z - 11 = 0$

(C) $2x + 3y + 6z + 28 = 0$

(D) $2x - 3y - 6z - 32 = 0$

142. The vector projection of $\bar{b}$ on, $\bar{a} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and $\bar{b} = 7\hat{i} - 5\hat{j} - \hat{k}$

(A) $\frac{6(3\hat{i}+2\hat{j}+5\hat{k})}{\sqrt{38}}$ (B) $\frac{3(3\hat{i}+2\hat{j}+5\hat{k})}{38}$

(C) $\frac{3(3\hat{i}+2\hat{j}+5\hat{k})}{19}$ (D) $\frac{3(3\hat{i}+2\hat{j}+5\hat{k})}{\sqrt{38}}$

143. The angle between two lines $\frac{x+1}{2} = \frac{y+3}{2} = \frac{z-4}{-1}$ and $\frac{x-4}{1} = \frac{y+4}{2} = \frac{z+1}{2}$ is

(A) $\cos^{-1}\left(\frac{4}{9}\right)$ (B) $\cos^{-1}\left(\frac{2}{9}\right)$

(C) $\cos^{-1}\left(\frac{1}{9}\right)$ (D) $\cos^{-1}\left(\frac{5}{9}\right)$

144. The ratio in which the plane $\bar{r}.(\hat{i} - 2\hat{j} + 3\hat{k}) = 17$ divides the line joining the points $-2\hat{i} + 4\hat{j} + 7\hat{k}$ and $3\hat{i} - 5\hat{j} + 8\hat{k}$

(A) 10:3 (B) 3 : 10

(C) 5 : 3 (D) 4 : 5

145. If the line passing through the points $(a, 1, 6)$ and $(3, 4, b)$ crosses the yz-plane at the point $\left(0, \frac{17}{2}, \frac{-13}{2}\right)$, then

(A) $a = -5, n = 1$ (B) $a = 5, b = 1$

(C) $a = -5, b = -1$ (D) $a = 5, b = -1$

146. The objective function of L.L.P defined over the convex set attains its optimum value at

(A) all the corner points. (B) at least two of the corner points.

(C) none of the corner points. (D) at least one of the corner points.

147. For a Binomial distribution, $n = 6$, if $9P(X = 4) = P(X = 2)$, then $q =$

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

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

148. A random variable X has the following probability distribution

X	0	1	2	3	4	5	6
$P(X)$	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

Then $P\left(X^3 2\right) =$

(A) $\frac{45}{49}$ (B) $\frac{15}{49}$

(C) $\frac{1}{49}$ (D) $\frac{40}{49}$

149. Five letters are placed at random in five addressed envelopes. The probability that all the letters are not dispatched in the respective right envelopes is

(A) $\frac{1}{120}$ (B) $\frac{1}{5}$

(C) $\frac{119}{120}$ (D) $\frac{4}{5}$

150. Two numbers are selected at random from the first six positive integers. If X denotes the larger of two numbers, then $\text{Var}(X) =$

(A) $\frac{1}{3}$ (B) $\frac{14}{3}$

(C) $\frac{14}{9}$ (D) $\frac{70}{3}$

- End of Question Paper -