MHT CET 2021 PCM Sep 24 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 2021**, 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 current 'I' produces a magnetic flux 'ϕ' per turn in a coil of 'n' turns. Self inductance of the coil is 'L'. The relation between them is

(A) $nLI = \varrho$ (B) $\frac{nL}{I} = \varrho$

(C) $\frac{LI}{n^2} = \varrho$ (D) $\frac{LI}{n} = \varrho$

2. A rejector circuit is the resonant circuit in which

(A) L – C – R are connected in parallel. (B) L – C – R are connected in series.

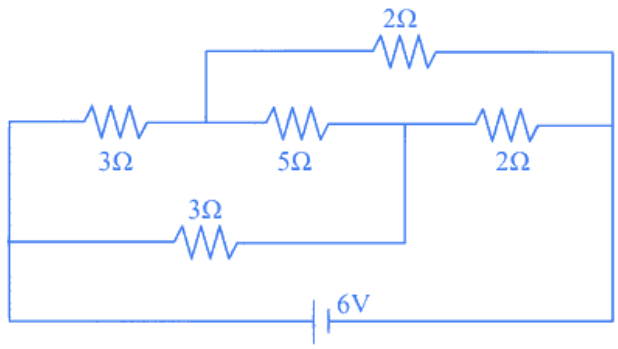
(C) C – R are connected in series. (D) L-R are connected in series.

3. A light of wavelength 'λ' and intensity 'I' falls on photosensitive material. If 'N' photo electrons are emitted, each with kinetic energy 'E', then

(A) $E \propto I, N \propto \lambda$ (B) $E \propto I, N \propto I$

(C) $E \propto I, N \propto \frac{1}{\lambda}$ (D) $E \propto \frac{1}{\lambda}, N \propto I$

4. The current drawn from the battery in the given network is (Internal resistance of the battery is negligible)



(A) 2.4 A (B) 1.6 A

(C) 2.0 A (D) 3.0 A

5. The moment of inertia of a thin uniform rod of mass 'M' and length 'L' about an axis passing through a point at a distance

$$\frac{L}{4}$$

from one of its ends and perpendicular to the length of the rod is

(A) $\frac{ML^2}{48}$ (B) $\frac{7ML^2}{48}$

(C) $\frac{5ML^2}{48}$ (D) $\frac{9ML^2}{48}$

6. A current

$$I = 10\sin(100\pi t)$$

ampere, is passed in a coil which induces a maximum emf 5π volt in neighbouring coil. The mutual inductance of two coils is

(A) 5 mH (B) 10 mH

(C) 15 mH (D) 25 mH

7. The average density of the earth is [g is acceleration due to gravity]

(A) inversely proportional to g^2. (B) directly proportional to g.

(C) inversely proportional to g. (D) directly proportional to g^2.

8. Two bar magnets 'P' and 'Q' are kept in uniform magnetic field 'B' with magnetic moments 'M_P' and 'M_Q' respectively. Magnet 'P' is oscillating with frequency twice that of magnet 'Q'. If the moment of inertia of the magnet 'P' is twice that of magnet 'Q' then

(A) $M_Q = 2M_P$ (B) $M_P = 2M_Q$

(C) $M_P = 8M_Q$ (D) $M_Q = 8MP_P$

9. Which one of the following is NOT a correct expression for an ideal gas?

[

$C_p =$

Molar specific heat of a gas at constant pressure,

$C_v =$

Molar specific heat of a gas at constant volume,

Y =

Ratio of two specific heats of a gas,

R =

Universal gas constant]

(A) $C_v = C_p + R$ (B) $R = C_v(\gamma - 1)$

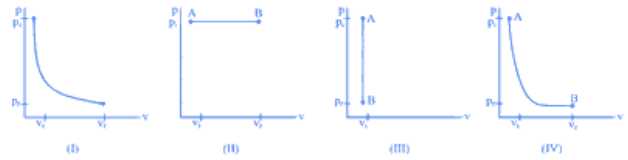
(C) $\frac{C_v}{C_p} = \frac{1}{\gamma}$ (D) $R = \frac{C_p(\gamma-1)}{\gamma}$

10. The molecular masses of helium and oxygen are 4 and 32 respectively. The ratio of r.m.s. speed of helium at 327° to r.m.s. speed of oxygen at 27° will be

(A) 1 : 6 (B) 8 : 1

(C) 1 : 8 (D) 4 : 1

11. Which one of the following p-V diagram is correct for an isochoric process:



(A) IV (B) II

(C) III (D) I

12. A magnetic dipole of magnetic moment M, is freely suspended in a magnetic field of induction B. The minimum and maximum values of potential energy of the dipole, respectively are

(A) $-MB, +MB$ (B) $0, MB$

(C) $0, 2MB$ (D) MB, 0

13. In series LCR circuit, at resonance the peak value of current will be [E_0 is peak emf, R is resistance, ωL is inductive reactance and ωC is capacitive]

(A) $\frac{E_0}{R}$ (B) $\frac{E_0}{\sqrt{2}R}$

(C) $\frac{E_0}{\sqrt{R^2+(\omega L-\frac{1}{\omega C})^2}}$ (D) $\frac{E_0}{\sqrt{2}\sqrt{R^2+(\omega L-\frac{1}{\omega C})^2}}$

14. A particle is moving along the circular path with constant speed and centripetal acceleration 'a'. If the speed is doubled, the ratio of its acceleration after and before the change is

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

(C) 2 : 1 (D) 4 : 1

15. The displacement of a particle performing S.H.M. is given by

$$x = 5\sin(3t + 3)$$

, where x is in cm and t is in second. The maximum acceleration of the particle will be

(A) 15 cm s^{-2} (B) 30 cm s^{-2}

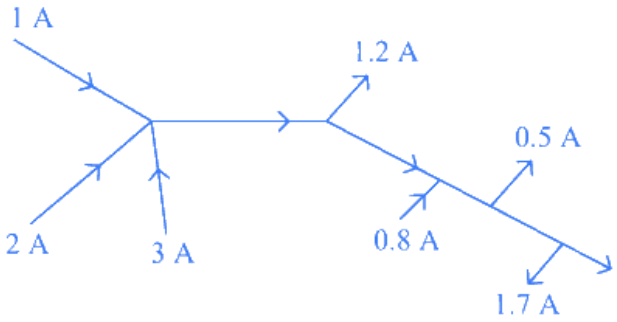
(C) 45 cm s^{-2} (D) 90 cm s^{-2}

16. A cylindrical tube open at both ends has fundamental frequency 'n' in air. The tube is dipped vertically in water so that one-fourth of it is in water. The fundamental frequency of the air column becomes

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

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

17. In the following electrical network, the value of 1 is



(A) 1.5 A (B) 3.0 A

(C) 3.4 A (D) 2.5 A

18. The half life of a radioactive substance is 30 minute. The time taken between 40% decay and 85% decay of the same radioactive substance is

(A) 15 minute (B) 90 minute

(C) 60 minute (D) 30 minute

19. Two monochromatic beams of intensities I and 4 I respectively are superposed to form a steady interference pattern. The maximum and minimum intensities in the pattern are

(A) 4I and I (B) 9 I and 3I

(C) 5 I and 3 I (D) 9 I and I

20. Three charges each of $+1\mu$C are placed at the corners of an equilateral triangle. If the repulsive force between any two charges is F, then the net force on either charge will be [

$$\cos 60^\circ = 0.5$$

]

(A) 2F (B) 3F

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

21. Velocity of sound waves in air is 'V' m/s. For a particular sound wave in air, path difference of 'x' cm is equivalent to phase difference $n\pi$. The frequency of this wave is

(A) $\frac{Vn}{x}$ (B) $\frac{V}{nx}$

(C) $\frac{Vn}{2x}$ (D) $\frac{2x}{V}$

22. Choose the correct statement. In conductors

(A) valance band and conduction band overlap each other.

(B) valance band and conduction band are separated by large energy gap.

(C) valancè band and conduction band are separated by a small energy gap.

(D) a very small number of electrons are available for electrical conduction.

23. For a transistor, the current ratio

$$\alpha_{dc} = \frac{69}{70}$$

, the current gain β_{dc} is

(A) 67

(B) 69

(C) 71

(D) 66

24. 'n' small drops of same size fall through air with constant velocity 5 cm/s. They coalesce to form a big drop. The terminal velocity of the big drop is

(A) $7n^{2/3}$ cm/s

(B) $5n^{2/3}$ cm/s

(C) $3n^{2/3}$ cm/s

(D) $9n^{2/3}$ cm/s

25. The depth from the surface of the earth of radius R, at which acceleration due to gravity will be 60% of the value on the earth surface is

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

(B) $\frac{2R}{5}$

(C) $\frac{3R}{5}$

(D) $\frac{5R}{3}$

26. A body of mass 'm' is moving with speed 'V' along a circular path of radius 'r'. Now the speed is reduced to

$$\frac{V}{2}$$

and radius is increased to '3r'. For this change, initial centripetal force needs to be

(A) increased by $\frac{7}{12}$ times

(B) increased by $\frac{10}{12}$ times

(C) decreased by $\frac{11}{12}$ times

(D) decreased by $\frac{1}{12}$ times

27. The path difference between two interfering light waves meeting at a point on the screen is

$$\left(\frac{57}{2}\right)\lambda$$

. The bond obtained at that point is

(A) 29^{th} bright band

(B) 57^{th} dark band

(C) 57^{th} bright band

(D) 29^{th} dark band

28. Pressure inside two soap bubbles are 1.01 atm and 1.03 atm. The ratio between their volumes is (Pressure outside the soap bubble is 1 atmosphere)

(A) 9 : 1

(B) 27 : 1

(C) 81 : 1

(D) 3 : 1

29. The length and diameter of a metal wire used in sonometer is doubled. The fundamental frequency will change from 'n' to

(A) $\frac{n}{4}$

(B) 2n

(C) 4n

(D) $\frac{n}{2}$

30. An alternating e.m.f. is

$$e = e_0 \sin \omega t$$

. In what time the e.m.f. will have half its maximum value, if 'e' starts from zero? (

$$T =$$

time period,

$$\sin 30^\circ = 0.5$$

)

(A) $\frac{T}{12}$

(B) $\frac{T}{16}$

(C) $\frac{T}{4}$

(D) $\frac{T}{8}$

31. A ray of light is incident on one face of an equilateral glass prism having refractive index $\sqrt{2}$. It produces the emergent ray which just. grazes along the adjacent face. The value of angle of incidence is

$$\left(\sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}}\right)$$

(A) $\sin^{-1}(\frac{1}{\sqrt{2}}\sin 15^\circ)$

(B) $\sin^{-1}(\sqrt{2}\sin 30^\circ)$

(C) $\sin^{-1}(\frac{1}{\sqrt{2}}\sin 45^\circ)$

(D) $\sin^{-1}(\sqrt{2}\sin 15^\circ)$

32. The input a.c. voltage of frequency 60 Hz is applied to half-wave rectifier and also to full-wave rectifier. The output frequency in case of half-wave rectifier and that in case of full wave rectifier is respectively.

(A) 120 Hz, 60 Hz

(B) 60 Hz, 120 Hz

(C) 60 Hz, 60 Hz

(D) 120 Hz, 120 Hz

33. Three point masses, each of mass 'm' are kept at the corners of an equilateral triangle of side 'L'. The system rotates about the centre of the triangle without any change in the separation of masses during rotation. The period of rotation is directly proportional to

$$\left(\cos 30^\circ = \frac{\sqrt{3}}{2}\right)$$

(A) L (B) $L^{1/2}$

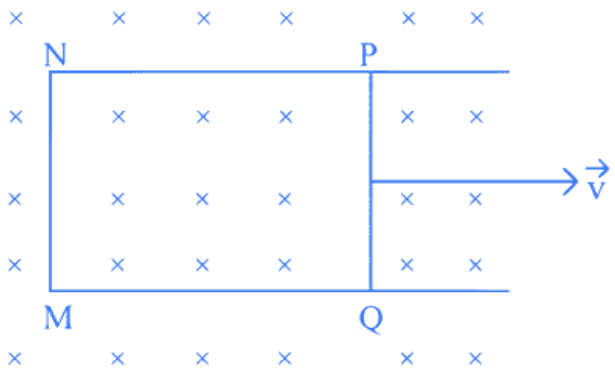
(C) $L^{3/2}$ (D) L^{-2}

34. A closed organ pipe and an open organ pipe of same length produce 2 beats per second when they are set into vibrations together in fundamental mode. The length of open pipe is now halved and that of closed pipe is doubled. The number of beats produced per second will be

(A) 4 (B) 3

(C) 8 (D) 7

35. A rectangular loop PQMN with movable arm PQ of length 12 cm and resistance 2Ω is placed in a uniform magnetic field of 0.1 T acting perpendicular to the plane of the loop as shown in figure. The resistances of the arms MN, NP and MQ are negligible. The current induced in the loop when arm PQ is moved with velocity 20 ms^{-1} is



(A) 0.12 A (B) 0.06 A

(C) 0.24 A (D) 0.18 A

36. Assume that for solar radiation, surface temperature of the sun is 6000 K. If Wien's constant 'b' is 2.897×10^{-3} mK, the value of maximum wavelength will be

(A) $4828 \overset{o}{A}$ (B) $3648 \overset{o}{A}$

(C) $6400 \overset{o}{A}$ (D) $5890 \overset{o}{A}$

37. The kinetic energy of a light body and a heavy body is same. Which one of them has greater momentum?

(A) A body having high velocity. (B) Heavy body.

(C) Light body. (D) A body having large displacement.

38. Four electric charges +q, +q, −q and −q are placed in order at the corners of a square of side 2 L. The electric potential at point midway between the two positive charges is

(A) $\frac{1}{4\pi\vartheta_0}\frac{2q}{L}(1-\sqrt{5})$ (B) zero

(C) $\frac{1}{4\pi\vartheta_0}\frac{2q}{L}(1+\frac{1}{\sqrt{5}})$ (D) $\frac{1}{4\pi\vartheta_0}\frac{2q}{L}(1-\frac{1}{\sqrt{5}})$

39. White light consists of wavelengths from 480 nm to 672 nm. What will be the wavelength range when white light is passed through glass of refractive index 1.6?

(A) 420 nm − 672 nm (B) 300 nm − 480 nm

(C) 300 nm − 420 nm (D) 300 nm − 672 nm

40. A metal sphere cools at the rate of 1.5°C/min when its temperature is 80°C. At what rate will it cool when its temperature falls to 50°C. [Temperature of surrounding is 30°C]

(A) 0.9°C/min (B) 0.6°C/min

(C) 1.5°C/min (D) 1.2°C/min

41. The ratio of energies of photons produced due to transition of electron of hydrogen atom from its (i) second to first energy level and (ii) highest energy level to second energy level is

(A) 6 : 1 (B) 3 : 1

(C) 12 : 1 (D) 8 : 1

42. The length of the seconds pendulum is lm on earth. If the mass and diameter of the planet is 1.5 times that of the earth, the length of the seconds pendulum on the planet will be nearly

(A) 0.67 m (B) 0.45 m

(C) 0.60 m (D) 0.76 m

43. A solenoid 2 m long and 4 cm in diameter has 4 layers of windings of 1000 turns each and carries a current of 5 A. What is the magnetic field at its centre along the axis? [

$$\mu_0 = 4\pi \times 10^{-7}$$

Wb/Am]

(A) 10^{-3} T (B) $2\pi \times 10^{-3}$ T

(C) $4\pi \times 10^{-3}$ T (D) $8\pi \times 10^{-3}$ T

44. A particle of charge 'q' and mass 'm' moves in a circular orbit of radius 'r' with angular speed 'ω'. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(A) ω and q (B) ω and m

(C) q and m (D) ω, q and m

45. A battery is used to charge a parallel plate capacitor till the potential difference between the plates becomes equal to the e.m.f. of the battery. The ratio of the energy stored int he capacitor to the work done by the battery will be

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

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

46. In a photoelectric experiment, a graph of maximum kinetic energy (KE_{max}) against the frequency of incident radiation (v) is plotted. If A and B are the intercepts on the X and Y axis respectively then the Planck's constant is given by

(A) A + B (B) $\frac{B}{A'}$

(C) A $\times$ B (D) $\frac{A}{B}$

47. If the work done in blowing a soap bubble of volume 'V' is 'W', then the work done in blowing a soap bubble of volume '2 V' will be

(A) 2 W (B) $(4)^{1/3}$ W

(C) W (D) $\sqrt{2}$ W

48. A monochromatic ray of light travels through glass slab and water column. The number of waves in glass slab of thickness 4 cm is the same as in water column of height 5 cm. If refractive index of glass is

$$\frac{5}{3}$$

then refractive index of water is

(A) 1.33 (B) 1.30

(C) 1.25 (D) 1.10

49. Capacitors of capacities C_1, C_2 and C_3 are connected in series. If the combination is connected to a supply of 'V' volt, then potential difference across capacitor 'C_1' is

(A) $\frac{C_2C_3+C_1C_3+C_1C_2}{C_1C_2V}$ (B) $\frac{C_2C_3+C_1C_3+C_1C_2}{C_1C_2C_3V}$

(C) $\frac{C_2C_3V}{C_2C_3+C_1C_3+C_1C_2}$ (D) $\frac{C_1C_2C_3V}{C_2C_3+C_1C_3+C_1C_2}$

50. A monoatomic gas is suddenly compressed to $(1/8)^{th}$ of its initial volume adiabatically. The ratio of the final pressure to initial pressure of the gas is

($\gamma = 5/3$)

(A) 32 (B) 8

(C) $\frac{40}{3}$ (D) $\frac{24}{5}$

51. Which of the following is an alkali metal?

(A) Ba (B) Cs
(C) Ca (D) Sr

52. The electrical conductance of unit volume (1 cm^3) of solution is called as

(A) electrical resistance (B) resistivity
(C) molar conductivity (D) conductivity

53. What is oxidation state of cobalt in a coordination complex if it's EAN is 36 and the value of C.N. is 6 (Given: Atomic number of cobalt = 27).

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

54. Which among the following cations will not form coloured compounds? (Atomic number $Cu = 29, Ti = 22, V = 23, Mn = 25$)

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

55. Which of the following aldehydes is less reactive towards nucleophilic addition reaction?

(A) Benzaldehyde (B) Formaldehyde
(C) Acetaldehyde (D) Butyraldehyde

56. Which of the following is an aldohexose?

(A) Ribose (B) Glucose
(C) Fructose (D) Threose

57. Cannizzaro reaction is an example of

(A) Elimination reaction (B) Disproportionation reaction
(C) Decomposition reaction (D) Nucleophilic addition reaction

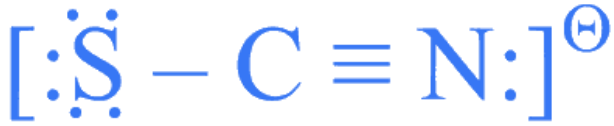
58. The solution containing 3 g urea (molar mass 60) per dm^3 of water and another solution containing 4.5 g of solute A per dm^3 boils at same temperature, then what is molar mass of A ?

(A) 54 g mol^{-1} (B) 180 g mol^{-1}
(C) 120 g mol^{-1} (D) 90 g mol^{-1}

59. Which following statement is true for vinylic halide?

(A) Halogen atom is bonded to 'sp' hybridized carbon atom.
(B) Halogen atom is bonded to 'sp^2', hybridized carbon atom of aromatic ring.
(C) Halogen atom is bonded to '$sp^{3,}$' hybridized carbon atom next to carbon- carbon double bond.
(D) Halogen atom is bonded to 'sp^2', hybridized carbon atom of aliphatic chain.

60. What is the formal charge on 'N' atom in



ion?

(A) zero (B) +3
(C) −2 (D) +2

61. Identify the product 'B' in the following series of reactions.

$CH_3COOH + CH_3CH_2OH \overset{H^+}{\rightleftharpoons} A \xrightarrow[Ni/Pd,\,\Delta]{H_2}$ B

(A) CH_3OH
(B) C_2H_5OH
(C) $CH_3CH_2 - O - CH_3$
(D) $CH_3CH_2 - O - CH_2CH_3$

62. The solubility of sparingly soluble salt AB_2 is 1.0×10^{-4} mol dm^{-3}. What is it's solubility product?

(A) 2×10^{-12} (B) 4×10^{-8}
(C) 4×10^{-12} (D) 2×10^{-8}

63. Which element from following in +3 oxidation state forms colourless compounds?

(A) Sc (Z = 21) (B) Ti (Z = 22)
(C) V (Z = 23) (D) Fe (Z = 26)

64. Which among the following compounds contains amino group?

(A) N-Phenylbenzenamine

(B) 4-Bromoaniline

(C) N,N-Dimethylbenzenamine

(D) N-Methylmethanamine

65. What is IUPAC name of phloroglucinol?

(A) Benzene-1, 3-diol (B) Benzene-1,4-diol

(C) Benzene-1,3,5-triol (D) Benzene-1,2,3-triol

66. In a first reaction 60% of reactant decomposes in 4.606 min. What is half life of reaction? (k = 0.1989 min^{-1})

(A) 3.48 min (B) 2.4 min

(C) 3.0 min (D) 1.74 min

67. The density of chromium metal is 7 g cm^{-3}. If edge length of unit cell is 300 pm, identify the type of unit cell. (At mass Cr = 52)

(A) Body centred cubic (B) Simple cubic

(C) Hexagonal close pack (D) Face centred cubic

68. How many gram of H_2O are present in 0.25 mol of it?

(A) 0.25 g (B) 5.4 g

(C) 4.5 g (D) 6.1 g

69. Identify molecular formula of pyridine from following

(A) $C_5H_{11}N$ (B) C_4H_4S

(C) C_4H_4O (D) C_5H_5N

70. Which of the following is a first step in mechanism of heterogenous catalysis?

(A) Desorption of reaction product from catalyst surface (B) Adsorption of reactant molecules on catalyst

(C) Occurrence of chemical reaction on catalyst surface to form an intermediate (D) Diffusion of reactants towards catalyst surface

71. Which of the following carboxylic acids has lowest boiling point?

(A) Butyric acid (B) Propionic acid

(C) Acetic acid (D) Valeric acid

72. For the reaction, $2A + B \rightarrow 2C$, rate of disappearance of A is 0.076 mol s^{-1}. What is the rate of disappearance of B ?

(A) 0.076 mol s^{-1} (B) 0.038 mol s^{-1}

(C) 0.019 mol s^{-1} (D) 0.095 mol s^{-1}

73. Which of following is an example of cross-linked polymers?

(A) PVC (B) Acetate rayon

(C) High density polyethylene (D) Melamine

74. For isochoric process, the first law of thermodynamics can be expressed as

(A) $\Delta U = Q_V$ (B) $-\Delta U = Q - P\Delta V$

(C) $-\Delta U = -W$ (D) $W = -Q$

75. Which of the following alcohols has lowest boiling point?

(A) sec-Butyl alcohol (B) tert-Butyl alcohol

(C) iso-Butyl alcohol (D) n-Butyl alcohol

76. What is the pH of 0.005 M H_2SO_4 solution?

(A) 5.0 (B) 2.3

(C) 3.3 (D) 2.0

77. The solubility product expression for $Ca_3(PO_4)_2$ is represented as

(A) $K_{sp} = [Ca^{2+}]^2[PO_4{}^{3-}]^2$

(B) $K_{sp} = [Ca^{2+}]^3[PO_4{}^{3-}]^2$

(C) $K_{sp} = [Ca^{2+}][PO_4{}^{2}]^3$

(D) $K_{sp} = [Ca^{2+}][PO_4{}^{2}]$

78. Which among the following is NOT a feature of S_N1 mechanism?

(A) Involve only backside attack of nucleophile. (B) In an optically active substrate the product formed is racemic.

(C) Two step mechanism. (D) Heterolysis of C – X bond forms carbocation intermediate.

79. An element has BCC structure with edge length of unit cell 600 pm. What is the atomic radius of element?

(A) $\sqrt{3} \times 150$ pm (B) 150 pm

(C) 300 pm (D) $\frac{300}{\sqrt{2}}$ pm

80. When certain volume of gas expands against a constant external pressure of 2.40×10^5 Pa at 300 K to 2.2×10^{-3} m^3. If the work obtained is -0.048 kJ. What is the initial volume of the gas?

(A) 2×10^{-3} m^3 (B) 4.5×10^{-2} m^3

(C) 1.5×10^{-3} m^3 (D) 2.8×10^{-2} m^3

81. Which among the following pairs of electronic effect and it's example is NOT correct?

(A) Hyper conjugation : Propene (B) Resonance : Nitromethane

(C) $(-)$R effect: $C_6H_5NH_2$ (D) Electromeric effect: Acetone

82. A certain mass of a gas occupies volume of 250 mL at 2 atm. Calculate the volume of gas if pressure is increased to 2.5 atm at constant temperature.

(A) 352.0 mL (B) 300.0 mL

(C) 200 mL (D) 443.0 mL

83. Vapour pressure of solution and of pure solvent are P_1 and $P_1{}^0$ respectively. If

$$\frac{P_1}{P_1^0}$$

is 0.15, find the mole fraction of solute.

(A) 0.66 (B) 0.85

(C) 0.15 (D) 0.33

84. Which of the following pairs of compounds is isomorphous?

(A) $NaCl, KCl$ (B) $NaF, NaNO_3$

(C) $CaCl_2, NaNO_3$ (D) $CaCO_3, NaNO_3$

85. What is internal energy change when 62 J of work is done on the system and 128 J of heat is transferred to surrounding?

(A) -62 J (B) -190 J

(C) -128 J (D) -66 J

86. Which of the following catalyst/reagent is used to convert C $\equiv$ C triple bond to

C = C

double bond to form cis isomer of alkene?

(A) Na/liquid NH_3 (B) Pd $-$ C, quinolone

(C) $ZnCl_2/HCl$ (D) Na/Hg in H_2O

87. Which among the following reactions exhibits the reducing property of ozone?

(A) $PbS_{(s)} + 4O_{3(g)} \rightarrow PbSO_{4(s)} + 4O_{2(g)}$

(B) $BaO_{2\,(g)} + O_{3(g)} \rightarrow BaO_{(s)} + 2O_{2\,(g)}$

(C) $NO_{(g)} + O_{3(g)} \rightarrow NO_{2(g)} + O_{2(g)}$

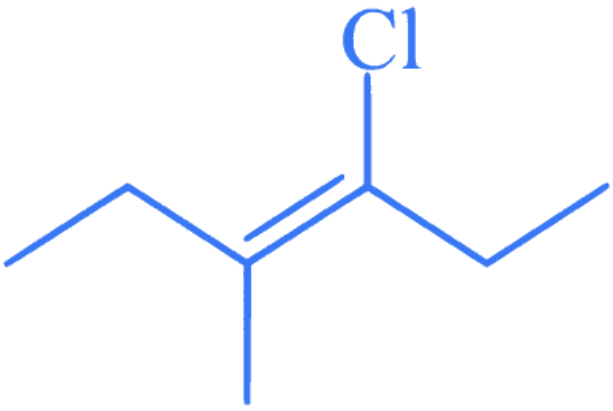
(D) $2KI_{(qq)} + H_2O_{(l)} + O_{3(g)} \rightarrow 2KOH_{(aq)} + I_{2(g)} + O_2(g)$

88. Which of the following is a correct bridged name of deoxyriboseadenosine monophosphate?

(A) AMP (B) dAMP

(C) dTMP (D) UMP

89. What is IUPAC name of the following compound?



(A) 4-Chloro-4-ethyl-3-methylbut-3-ene (B) 4-Chloro-3-methylhex-3-ene

(C) 3-Chloro-4-ethylbut-3-ene (D) 3-Chloro-4-methylhex-3-ene

90. Which among following compounds of chlorine possesses Cl atom in highest oxidation state?

(A) Chlorous acid (B) Chloric acid

(C) Perchloric acid (D) Hypochlorous acid

91. According to Raoult's law mole fraction of solute in solution in given by formula

(A) $\frac{\Delta P}{P_1^0}$ (B) $\frac{P_1^0}{P_1}$

(C) $\frac{P_1^0}{\Delta P}$ (D) $\frac{P_1}{P_1^0}$

92. What is maximum number of electrons accommodated in a subshell having azimuthal quantum number, $\ell = 2$?

(A) 10 (B) 12

(C) 14 (D) 18

93. Half-life and rate constant for first order reaction are related by equation,

(A) $t_{1/2} = \frac{k}{0.693}$ (B) $k = \frac{[A]_0 - [A]_1}{t_{1/2}}$

(C) $t_{1/2} = \frac{0.693}{k}$ (D) $t_{1/2} = \frac{[A]_1 - [A]_0}{k}$

94. What is the conductivity of 0.02 M HCl solution if molar conductivity of the solution at 25°C is 412.3 Ω^{-1} cm^{-1} mol^{-1} ?

(A) 8.880×10^{-3} Ω^{-1} cm^{-1} (B) 8.414×10^{-3} Ω^{-1} cm^{-1}

(C) 8.624×10^{-3} Ω^{-1} cm^{-1} (D) 8.246×10^{-3} Ω^{-1} cm^{-1}

95. Which among the following is a source of wool?

(A) Goat (B) Silk worm

(C) Sheep (D) Blended cotton

96. What is percentage atom economy during conversion of reactant to product if formula weight of reactants is 246 u and of product is 123 u?

(A) 40.00% (B) 50.00%

(C) 47.00% (D) 21.5%

97. What is the charge required for the reduction of moles of Cu^{2+} to Cu?

(A) 2.89×10^5 C (B) 1.93×10^5 C

(C) 9.65×10^5 C (D) 3.86×10^5 C

98. Which of the following amine is weakest base?

(A) Trimethyl amine (B) Methyl amine

(C) Diethyl amine (D) Aniline

99. Which of following is NOT a redox reaction?

(A) $CH_3CHO + Cu(OH)_2 \longrightarrow CH_3COOH + Cu_2O$

(B) $SnCl_4 + FeCl_2 \longrightarrow FeCl_3 + SnCl_2$

(C) $H_2SO_4 + Ca(OH)_2 \longrightarrow CaSO_4 + H_2O$

(D) $C_2H_5OH + [O] \longrightarrow CH_3CHO + H_2O$

100. Which among the following is a correct order of increasing field strength of ligands?

(A) $I^- < OH^- < NH_3 < S^{2-}$

(B) $NH_3 < OH^- < I^- < S^{2-}$

(C) $OH^- < S^{2-} < I^- < NH_3$

(D) $I^- < S^{2-} < OH^- < NH_3$

101. The probability that at least one of the events E_1 and E_2 occurs is 0.6. If the simultaneous occurrence of E_1 and E_2 is $0.2, P\left(E_1'\right) + P\left(E_2'\right) =$

(A) 0.4 (B) 1.6

(C) 1.2 (D) 0.8

102.

$$\lim_{x \to 0} \frac{\sqrt{1 - \cos x^2}}{1 - \cos x} =$$

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

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

103. If

$$A = \begin{bmatrix} \lambda & i \\ i & -\lambda \end{bmatrix}$$

and A^{-1} does not exist, then $\lambda =$

(where $i = \sqrt{-1}$)

(A) ± 2 (B) ± 1

(C) 0 (D) ± 3

104. The distance 's' in meters covered by a particle in t seconds is given by $s = 2 + 27t - t^3$. The particle will stop after _____ distance.

(A) 65 meters (B) 80 meters

(C) 56 meters (D) 60 meters

105. If the polar co-ordinates of a point are $\left(2, \frac{\pi^c}{4}\right)$, then its Cartesian co-ordinates are

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

(C) $(2, \sqrt{2})$ (D) $(\sqrt{2}, 2)$

106.

$$\int e^x \left(\frac{1 + \sin x}{1 + \cos x}\right) dx =$$

(A) $e^x \tan\frac{x}{2} + c$ (B) $e^x \cot\frac{x}{2} + c$

(C) $e^x \cos\frac{x}{2} + c$ (D) $e^x \sin\frac{x}{2} + c$

107. The negation of $'\forall x \in N, x^2 + x$ is even number' is

(A) $\forall x \in N, x^2 + x$ is not an even number.

(B) $\forall x \in N, x^2 + x$ is not an odd number.

(C) $\exists x \in N$ such that $x^2 + x$ is an even number.

(D) $\exists x \in N$ such that $x^2 + x$ is not an even number.

108.

$$\int_2^5 2[x]dx = \{ \text{where [x] denotes the greatest integer function } \leq x\}$$

(A) 18 (B) 16

(C) 12 (D) 24

109.

$$\int_0^{\pi} x \sin x \cos^4 x dx =$$

(A) $\frac{\pi}{10}$ (B) $\frac{2\pi}{5}$

(C) $\frac{\pi}{5}$ (D) $\frac{\pi}{8}$

110. The equation of the plane which passes through (2, −3, 1) and is normal to the line joining the points (3, 4, −1) and (2, −1, 5) is given by

(A) $x + 5y - 6z + 19 = 0$

(B) $x - 5y + 6z - 23 = 0$

(C) $x + 5y + 6z + 7 = 0$

(D) $x - 5y - 6z - 11 = 0$

111. A committee of 5 is to be formed out of 6 men and 4 ladies. The number of ways this can be done, when at most 2 ladies are included, is

(A) 240 (B) 186

(C) 60 (D) 120

112. In a triangle ABC with usual notations a = 2, b = 3, then value of $\frac{\cos 2A}{a^2} - \frac{\cos 2B}{b^2}$ is

(A) $\frac{5}{36}$ (B) $\frac{1}{4}$

(C) $\frac{1}{9}$ (D) $\frac{13}{36}$

113. The particular solution of the differential equation

$$\left(1+e^{2x}\right)dy+e^{x}\left(1+y^{2}\right)dx=0$$

at

$$x=0$$

and y = 1 is

(A) $\tan^{-1}e^{x}-\tan^{-1}y=0$

(B) $\tan^{-1}e^{x}+\tan^{-1}y=\frac{\pi}{2}$

(C) $2\tan^{-1}e^{x}+\tan^{-1}y=\frac{3\pi}{4}$

(D) $\tan^{-1}e^{x}-\tan^{-1}y=\frac{3\pi}{4}$

114. If

$$y=1+xe^{y}$$

, then

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

(A) $\frac{e^{y}}{2-y}$ (B) $\frac{e^{y}}{2+y}$

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

115. Two dice are thrown simultaneously. If X denotes the number of sixes, then the expectation of X is

(A) 3 (B) 2

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

116. If $G(3,-5,r)$ is the centroid of $\triangle ABC$, where $A\equiv(7,-8,1), B\equiv(p,q,5), C\equiv(q+1,5p,0)$ are vertices of the triangle ABC, then the values of p,q,r are respectively

(A) $-2,3,2$ (B) $-4,5,4$

(C) $6,5,4$ (D) $2,-2,3$

117. The acute angle between the lines

$$\left(x^{2}+y^{2}\right)\sin\theta+2xy=0$$

is

(A) θ (B) $\frac{\pi}{2}+\theta$

(C) $\frac{\pi}{2}-\theta$ (D) $\frac{\theta}{2}$

118. For any non-zero vectors $\bar{a},\bar{b},\bar{c}$, the value of $\bar{a}\cdot[(\bar{b}\times\bar{c})\times(\bar{a}+\bar{b}+\bar{c})]$ is

(A) $2[\bar{a}\bar{b}\bar{c}]$ (B) $[\bar{a}\bar{b}\bar{c}]$

(C) $[\bar{a}\bar{c}\bar{b}]$ (D) 0

119. If the lines

$$\frac{2x-4}{\lambda}=\frac{y-1}{2}=\frac{z-3}{1}$$

and

$$\frac{x-1}{1}=\frac{3y-1}{\lambda}=\frac{z-2}{1}$$

are perpendicular to each other, then

$$\lambda=$$

(A) $\frac{-7}{6}$ (B) $\frac{6}{7}$

(C) $\frac{-6}{7}$ (D) $\frac{7}{6}$

120. The order and degree of the differential equation

$$\sqrt{\frac{dy}{dx}}-4\frac{dy}{dx}-7x=0$$

are respectively.

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

(C) 1 and 1 (D) 2 and 1

121. If

$$x=e^{t}(\sin t-\cos t)$$

and

$$y=e^{t}(\sin t+\cos t)$$

, then

$$\frac{dy}{dx}$$

at

$$t=\frac{\pi}{3}$$

is

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

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

122. If the lines represented by

$$(k^{2}+2)x^{2}+3xy-6y^{2}=0$$

are perpendicular to each other, then the values of K are

(A) ±3 (B) ±4

(C) ±1 (D) ±2

123. If

$$\bar{a}=3\hat{i}+\hat{j}-\hat{k},\bar{b}=2\hat{i}-\hat{j}+23\hat{k}$$

and

$$\bar{c}=7\hat{i}-\hat{j}+23\hat{k}$$

, then which of the following is valid.

(A) $\bar{a},\bar{b},\bar{c}$ are mutually perpendicular.

(B) $\bar{a},\bar{b},\bar{c}$ are non-coplanar.

(C) $\bar{a}$ and $\bar{b}$ are collinear.

(D) $\bar{a},\bar{b},\bar{c}$ are coplanar.

124. For the set of 50 observations, the sum of their squares is 3050 , their arithmetic mean is 6. Hence the standard deviation of these observations is

(A) 5 (B) 3

(C) 4 (D) 6

125. If

$$y = 2x$$

is a chord of circle

$$x^2 + y^2 - 10x = 0$$

, then the equation of circle with this chord as diameter is

(A) $x^2 + y^2 - 2x - 4y = 0$

(B) $x^2 + y^2 + 2x + 4y = 0$

(C) $x^2 + y^2 - 2x + 4y = 0$

(D) $x^2 + y^2 + 2x - 4y = 0$

126. If

$$\sin^2 x + \cos^2 y = 1$$

, then

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

(A) $\frac{\sin^2 x}{\sin^2 y}$ (B) $\frac{\sin^2 y}{\sin 2x}$

(C) $\frac{\sin 2x}{\sin 2y}$ (D) $\frac{-\sin^2 y}{\sin^2 x}$

127. If

$$f(x) = 2\{x\} + 5x$$

, where $\{x\}$ is fractional part function, then $f(-1.4)$ is

(A) 8.2 (B) -8.2

(C) -5.8 (D) -5

128. The curve

$$y = ax^3 + bx^2 + cx + 5$$

touches X-axis at $P(-2, 0)$ and cuts Y-axis at a point Q, where its gradient is 3, then

(A) $\mathrm{a} = \frac{1}{2},\ \mathrm{b} = \frac{3}{4}, \mathrm{c} = 3$

(B) $\mathrm{a} = \frac{1}{2},\ \mathrm{b} = \frac{-1}{4}, \mathrm{c} = -3$

(C) $a = \frac{1}{2}, b = \frac{-3}{4}, c = -3$

(D) $a = \frac{-1}{2}, b = \frac{-3}{4}, c = 3$

129. The area of the region bounded by the curve

$$y = 2x - x^2$$

and X-axis is

(A) $\frac{2}{3}$ sq. units (B) $\frac{4}{3}$ sq. units

(C) $\frac{5}{3}$ sq. units (D) $\frac{8}{3}$ sq. units

130. The equation of a line with slope

$$-\frac{1}{\sqrt{2}}$$

and makes an intercept of $2\sqrt{2}$ units on negative direction of y-axis is

(A) $\sqrt{2}y - x + 4 = 0$

(B) $x + \sqrt{2}y + 2\sqrt{2} = 0$

(C) $\sqrt{2}y + x + 4 = 0$

(D) $x + \sqrt{2}\ y - 2\sqrt{2}\ = 0$

131. If

$$\frac{3 + 2\mathrm{i}}{1 + \mathrm{i}} = \frac{1}{2}(\mathrm{x} + \mathrm{iy})$$

, then $\mathrm{x} - \mathrm{y} =$

(A) 4 (B) 3

(C) 6 (D) 5

132. If the angle between the vectors

$$\mathrm{a} = 2\lambda^2\hat{\mathrm{i}} + 4\lambda\hat{\mathrm{j}} + \hat{\mathrm{k}}$$

and

$$\mathrm{b} = 7\hat{\mathrm{i}} - 2\hat{\mathrm{j}} + \lambda\hat{\mathrm{k}}$$

is obtuse, then $\lambda \in$

(A) $(0, \frac{1}{2}]$ (B) $(0, \frac{1}{2})$

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

133. A population P grew at the rate given by the equation

$$\frac{dP}{dt} = 0.5P$$

, then the population will become double in

(A) 20 (log 2) years (B) 10 (log 2) years

(C) 5 (log 2) years (D) 12 (log 2) years

134. If

$$A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$$

, and

$$A(\mathrm{adj}\,A) = kI$$

, then the value of $(k + 1)^4$ is

(A) 256 (B) 81

(C) 16 (D) 625

135.

$$\int \cos^3 x e^{\log(\sin x)^2} dx =$$

(A) $\frac{\sin^3 x}{3} - \sin^5 x + c$ (B) $\frac{\sin^3 x}{3} - \frac{\sin^5 x}{5} + c$

(C) $\frac{\sin^3 x}{3} + \frac{\sin^5 x}{5} + c$ (D) $\sin^3 x + \sin^5 x + c$

136. The probability distribution of a random variable X is

X = x	1	2	3	.....	n
P(X = x)	$\frac{1}{n}$	$\frac{1}{n}$	$\frac{1}{n}$	.....	$\frac{1}{n}$

then Var(X) =

(A) $\frac{n^2-1}{12}$ (B) $\frac{n^2-n}{6}$

(C) $\frac{n^2-n}{12}$ (D) $\frac{n^2-1}{6}$

137. If p : It is raining.
q : Weather is pleasant
then simplified form of the statement "It is not true, if it is raining then weather is not pleasant" is

(A) It is not raining or weather is pleasant. (B) It is raining or weather is not pleasant.

(C) It is raining or weather is pleasant. (D) It is raining and the weather is pleasant.

138. If

$$f(x) = x,$$

for $x \leq 0$

$$= 0,$$

for

$$x > 0$$

, then the function $f(x)$ at

$$x = 0$$

is

(A) not continuous and not differentiable. (B) not continuous but differentiable.

(C) continuous but not differentiable. (D) continuous and differentiable.

139. A fair coin is tossed for a fixed number of times. If probability of getting 7 heads is equal to probability of getting 9 heads, then probability of getting 2 heads is

(A) $\frac{1}{15}$ (B) $\frac{15}{2^{13}}$

(C) $\frac{15}{2^8}$ (D) $\frac{2}{15}$

140. The region represented by the inequalities $x \geq 6, y \geq 3, 2x + y \geq 10, x \geq 0, y \geq 0$ is

(A) origin side of all the inequalities (B) unbounded

(C) polygon (D) bounded

141. IF

$$AX = B$$

, where

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, B = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$$

, then

$$2x + y - z =$$

(A) 2 (B) 1

(C) 4 (D) -2

142.

$$\int \frac{dx}{e^x + e^{-x} + 2} =$$

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

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

143. The co-ordinates of the points on the line

$$\frac{x+2}{1} = \frac{y-1}{2} = \frac{z+1}{-2}$$

at a distance of 12 units from the point A$(-2, 1, -1)$ are

(A) $(2, 9, -9), (-6, -7, 7)$

(B) $(2, 9, 7), (6, 5, -9)$

(C) $(6, 9, -5), (-10, 9, -5)$

(D) $(6, -7, 3), (-10, 9, 3)$

144. The value of $\tan^{-1} 2 + \tan^{-1} 3$ is

(A) $(\frac{3\pi}{4})^c$ (B) $(\frac{\pi}{2})^c$

(C) $(\frac{\pi}{4})^c$ (D) $(\frac{\pi}{6})^\circ$

145. If $\bar{a} + \bar{b}, \bar{b} + \bar{c}, \bar{c} + \bar{a}$ are coterminus edges of a parallelopiped, then its volume is

(A) 0 (B) $4[\bar{b}\bar{a}\bar{c}]$

(C) $3[\bar{a}\bar{c}\bar{b}]$ (D) $2[\bar{a}\bar{b}\bar{c}]$

146. The differential equation of all parabolas whose axis is y-axis, is

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

(C) $x\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$ (D) $\frac{d^2y}{dx^2} - y = 0$

147. The minimum value of the function f(x) = x log x is

(A) $-e$ (B) e

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

148. The general solution of the differential equation

$$\frac{dy}{dx} = \tan\left(\frac{y}{x}\right) + \frac{y}{x}$$

is

(A) $\sin(\frac{y}{x}) = cy$ (B) $\cos(\frac{y}{x}) = cy$

(C) $\cos(\frac{y}{x}) = cx$ (D) $\sin(\frac{y}{x}) = cx$

149.

$$\tan A + 2\tan 2A + 4\tan 4A + 8\cot 8A =$$

(A) $\tan 2A$ (B) $\cot A$

(C) $\tan A$ (D) $\cot 2A$

150. If the vector equation of the plane

$$\bar{r} = (2\hat{i} + \hat{k}) + \lambda\hat{i} + \mu(\hat{i} + 2\hat{j} - 3\hat{k})$$

in scalar product form is given by

$$r \cdot (3\hat{j} + 2\hat{k}) = \alpha$$

then

$$\alpha =$$

(A) 2 (B) 3

(C) 1 (D) 0

- End of Question Paper -