MHT CET 2021 PCM Sep 23 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. The moment of inertia of a body about the given axis, rotating with angular velocity 1 rad/s is numerically equal to 'P' times its rotational kinetic energy. The value of 'P' is

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

(C) 2 (D) 1

2. An electron in a circular orbit of radius 0.05 nm performs 10^{14} revolutions/second. What is the magnetic moment due to the rotation of electron?

$$(e = 1.6 \times 10^{-19} C)$$

(A) 3.21×10^{-23} (B) 2.16×10^{-23}

(C) 3.21×10^{-22} (D) 1.26×10^{-23}

3. A glass rod of radius 'r_1' is inserted symmetrically into a vertical capillary tube of radius 'r_2' ($r_1 < r_2$) such that their lower ends are at same level. The arrangement is dipped in water. The height to which water will rise into the tube will be ($\rho =$ density of water, T = surface tension in water, g = acceleration due to gravity)

(A) $\frac{2T}{(r_2 - r_1)\rho g}$ (B) $\frac{T}{(r_2^2 - r_1^2)\rho g}$

(C) $\frac{T}{(r_2 - r_1)\rho g}$ (D) $\frac{2T}{(r_2^2 - r_1^2)\rho g}$

4. de-Broglie wavelength associated with an electron accelerated through a potential difference 'V' is 'λ'. When the accelerating potential is increased to '4 V', de-Broglie wavelength.

(A) reduces to half (B) remains the same

(C) reduces to $(1/4)^{th}$ (D) increases by 25%

5. When the temperature of a semiconductor is increased, its resistance and electric conductivity respectively.

(A) increases and decreases (B) decreases and decreases

(C) increases and increases (D) decreases and increases

6. A bob of simple pendulum of mass 'm' perform SHM with amplitude 'A' and period 'T'. Kinetic energy of pendulum of displacement

$$x = \frac{A}{2}$$

will be

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

(C) $\frac{2m\pi A^2}{3T}$ (D) $\frac{3m\pi^2 A^2}{2T^2}$

7. Two positive ions, each carrying a charge 'q' are separated by a distance 'd'. If 'F' is the force of repulsion between the ions, the number of electrons from each ion will be (ε = charge on ε_k = permittivity of free space)

(A) $\sqrt{\frac{4\pi\epsilon_0 d^2}{e^2}}$ (B) $\sqrt{\frac{4\pi\epsilon_0 Fd}{e^2}}$

(C) $\sqrt{\frac{4\pi\epsilon_0 Fd^2}{e}}$ (D) $\sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$

8. Two circular loops P and Q are made from a uniform wire. The radii of P and Q are R_1 and R_2 respectively. The momentsw of inertia about their own axis are I_P and I_Q respectively. If

$$\frac{I_P}{I_Q} = \frac{1}{8}$$

then

$$\frac{R_2}{R_1}$$

is

(A) 4 (B) 3

(C) 2 (D) 5

9. A metre scale is supported on a wedge at its centre of gravity. A body of weight 'w'. is suspended from the 20 cm mark and another weight of 25 gram is suspended from 74 cm mark balance it and the metre scale remains perfectly horizontal. Neglecting the weight of the metre scale, the weight of the body is

(A) 20 gram-wt (B) 15 gram-wt

(C) 33 gram-wt (D) 30 gram-wt

10. A circuit containing resistance R_1, inductance L_1 and capacitance C_1 connected in series resonates at the same frequency 'f_0' as another circuit containing R_2, L_2 and C_2 in series. If two circuits are connected in series then the new frequency at resonance is

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

(C) $2f_r$ (D) f_r

11. An object executes SHM along x-axis with amplitude 0.06 m. At certain distance 'x' metre from mean position, it has kinetic energy 10 J and potential energy 8 J. the distance 'x' will be

(A) 0.08 m (B) 0.02 m
(C) 0.04 m (D) 0.06 m

12. Three charges $-q, Q$ and $-q$ are placed at equal distances on a straight line. If the total potential energy of the system of three charges is zero then the ratio

$$\frac{Q}{q}$$

is

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

13. In photoelectric effect, the photo current

(A) does not depend on the frequency of photon but depends on intensity of incident light.
(B) decreases with Increase in frequency of incident photon.
(C) increases with increase in frequency of incident photon.
(D) depends with on intensity of incident radiation and its frequency.

14. If the potential difference across a capacitor is increased from 5 V to 15 V, then the ratio of final energy to initial energy stored in the capacitor is

(A) 1 : 3 (B) 27 : 1
(C) 3 : 1 (D) 9 : 1

15. A body of mass 'm' and radius of gyration 'K' has an angular momentum 'L'. Then its angular velocity is

(A) $\frac{L}{mK^2}$ (B) $\frac{mK^2}{L}$
(C) $\frac{K^2}{mL}$ (D) $mK^2\ L$

16. In Young's double slit experiment, the intensity at a point where path difference is

$$\frac{\lambda}{6}$$

(λ being the wavelength of light used) is I'. If 'I_0' denotes the maximum intensity, then

$$\frac{I}{I_0}$$

is equal to

$$\left(\cos 0^\circ = 1, \cos 60^\circ = \frac{1}{\lambda}\right)$$

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

17. In Young's double slit experiment, the distance of n^{th} dark band from the central bright band in terms of bandwidth 'β' is

(A) $n\beta$ (B) $(n-1)\beta$
(C) $(n-0.5)\beta$ (D) $(n+0.5)\beta$

18. A uniform rope of length 12 m and mass 6 kg hangs vertically from the rigid support. A block of mass 2 kg is attached to the free end of the rope. A transverse pulse of wavelength 0.06 m is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is

(A) 0.8 m (B) 0.16 m
(C) 0.12 m (D) 0.4 m

19. For an ideal gas,

$$R = \frac{2}{3}C_v$$

. This suggests that the gas consists of molecules, which are [R = universal gas constant]

(A) polyatomic (B) diatomic
(C) monoatomic (D) a mixture of diatomic and polyatomic molecules

20. For a two input AND gate, the four entries are shown in the truth table. Identify the correct ones out of these

(A, B = input, Y = output)

Entry	A	B	Y
1	0	1	0
2	1	0	0
3	1	1	1
4	0	0	1

(A) 1 and 2 only (B) 1, 2 and 3 only
(C) 1, 3 and 4 only (D) 2 and 4 only

21. A projectile is thrown with an initial velocity $(a\hat{i} + b\hat{j})$m/s, where $\hat{i}$ and $\hat{j}$ are unit vectors along horizontal and vertical directions respectively. If the range of the projectile is twice the maximum height reached by it, then

(A) b = 2a (B) b = 4a
(C) b = $\frac{a}{2}$ (D) b = a

22. To determine the internal resistance of a cell by using a potentiometer, the null point is at 1 m when shunted by 3Ω resistance and at a length 1.5 m, when cell is shunted by 6Ω resistance The internal resistance of the cell is

(A) 1Ω (B) 4Ω
(C) 2Ω (D) 6Ω

23. The rms speed of a gas molecule is 'V' at pressure 'P'. If the pressure is increased by two times, then the rms speed of the gas molecule at the same temperature will be

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

24. A body executes SHM under the action of force 'F_1' with time period 'T_1'. If the force is changed to 'F_2', it executes SHM with period 'T_2'. If both the forces 'F_1' and 'F_2' act simultaneously in the same direction on the body, its time period is

(A) $\frac{\sqrt{T_1^2 - T_2^2}}{T_1 T_2}$ (B) $\frac{T_1 T_2}{\sqrt{T_1^2 - T_2^2}}$
(C) $\frac{\sqrt{T_1^2 + T_2^2}}{T_1 T_2}$ (D) $\frac{T_1 T_2}{\sqrt{T_1^2 + T_2^2}}$

25. A long solenoid carrying current I_1 produces magnetic field B_1 along its axis. If the current is reduced to 20% and number of turns per cm are increased five times then new magnetic field B_2 is equal to

(A) B_1 (B) $\frac{B_1}{5}$
(C) $5B_1$ (D) $0.25B_1$

26. A conducting loop of resistance 'R' is moved to magnetic field, the total induced charge depends upon

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

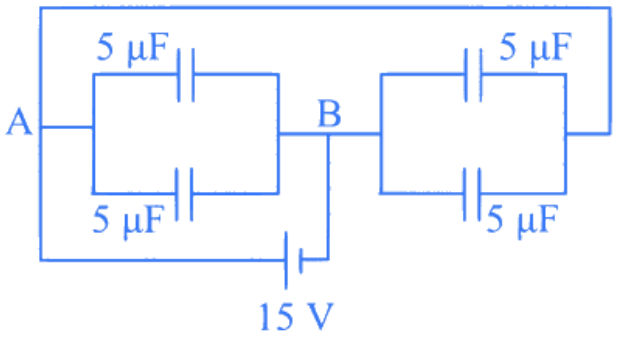
27. Equal volumes of two gases, having their densities in the ratio of 1 : 16 exert equal pressures on the walls of two containers. The ratio of their rms speads ($C_1 : C_2$) is

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

28. The self inductance of solenoid of length 31.4 cm, area of cross section 10^{-3} m^2 having total number of turns 500 will be nearly [$\mu_0 = 4\pi \times 10^{-7}$ SI unit]

(A) 3×10^{-6}H (B) 2×10^{-6}H
(C) 0.5×10^{-6}H (D) 4×10^{-6}H

29. The charge on each capacitor when a voltage source os 15 V is connected in the circuit as shown, is



(A) 75 μC (B) 150 μC
(C) 30 μC (D) 60 μC

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30. According to de-Broglie hypothesis if an electron of mass 'm' is accelerated by potential difference 'V', the associated wavelength is 'λ'. When a proton of mass 'M' is accelerated through potential difference 9 V, then the wavelength associated with it is

(A) $\frac{\lambda}{3}\sqrt{\frac{\mathrm{m}}{\mathrm{M}}}$ (B) $\frac{3}{2}\sqrt{\frac{m}{M}}$

(C) $\frac{\lambda}{3}\sqrt{\frac{M}{m}}$ (D) $\frac{3}{\lambda}\sqrt{\frac{\mathrm{M}}{\mathrm{m}}}$

31. What is the effect of pressure on the speed of sound in a medium, if pressure is doubled at constant temperature?

(A) Remains same (B) Reduced to half

(C) Gets doubled (D) Becomes 4 times

32. Two sound waves having wavelengths 5.0 m and 5.5 m propagates in a gas with velocity 300 m/s. The number of heats produced per second is

(A) six (B) two

(C) three (D) one

33. In biprism experiment, 6^{th} bright band with wavelength 'λ_1' coincides with 7^{th} dark band with wavelength 'λ_2' then the ratio $\lambda_1 : \lambda_2$ is (other setting remains the same)

(A) 7 : 6 (B) 13 : 12

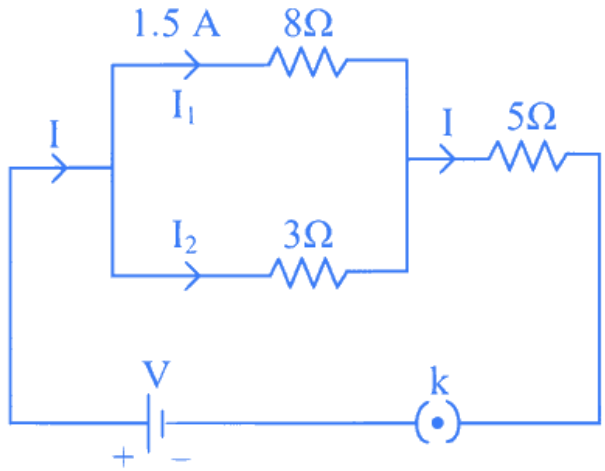
(C) 12 : 13 (D) 6 : 7

34. The time period of a satellite of earth is 5 hours. If the separation between the earth and the satellite will satellite is increased to four times the previous value, the new time period of the satellite will be

(A) 20 hours (B) 40 hours

(C) 80 hours (D) 10 hours

35. In the given circuit, the current in 8Ω resistance is 1.5 A. The total current (I) flowing in the circuit is



(A) 5 A (B) 4.5 A

(C) 3 A (D) 5.5 A

36. 'Circle of least confusion' refers to which one of the following defects occurring in images formed by mirrors or lenses?

(A) Distortion (B) Coma

(C) Astigmatism (D) Spherical aberration

37. An ice cube of edge 1 cm melts in a gravity free container. The approximate surface area of water formed is (water is in the form of spherical drop)

(A) $(36\pi)^{1/3}$ cm^2 (B) $(24\pi)^{1/3}$ cm^2

(C) $(28\pi)^{1/3}$ cm^2 (D) $(12\pi)^{1/3}$ cm^2

38. A plano-convex lens of refractive index (μ_1' fits exactly into a plano-concave lens of refractive index μ_2. Their plane surface are parallel to each other. 'R' is the radius of curvature of the curved surface of the lenses. The focal length of the combination is

(A) $\frac{\mathrm{R}}{\mu_1-\mu_2}$ (B) $\frac{R}{2(\mu_1+\mu_2)}$

(C) $\frac{2R}{\mu_1-\mu_2}$ (D) $\frac{\mathrm{R}}{2(\mu_1-\mu_2)}$

39. A cylindrical rod has temperatures 'T_1' and 'T_2' at its ends. The rate of flow of heat is 'Q_1' cal s^{-1}. If length and radius of the rod are doubled keeping temperature constant, then the rate of flow of heat 'Q_2' will be

(A) $Q_2 = \frac{Q_1}{2}$ (B) $Q_2 = \frac{Q_1}{4}$

(C) $Q_2 = 4Q_1$ (D) $Q_2 = 2Q_1$

40. Energy of electron in the second orbit of hydrogen atom is E. The energy of electron 'E_3' in the third orbit of helium (He) atom will be

(A) $E_3 = \frac{4E}{9}$ (B) $E_3 = \frac{16E}{3}$

(C) $E_3 = \frac{16E}{9}$ (D) $E_3 = \frac{4E}{3}$

41. A series L-C-R circuit containing a resistance of 120 Ω has angular frequency 4×10^5 rad s^{-1}. At resonance the voltage across resistance and inductor are 60 V and 40 V respectively, then the value of inductance will be

(A) 0.2 mH (B) 0.4 mH

(C) 0.8 mH (D) 0.6 mH

42. A body of mass 'M' and radius 'R', situated on the surface of the earth becomes weightless at its equator when the rotational kinetic energy of the earth reaches a critical value 'K'. The value of 'K' is given by [Assume the earth as a solid sphere, g = gravitational acceleration on the earth's surfacde]

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

(C) $\frac{1}{4}$MgR (D) $\frac{1}{5}$MgR

43. A circuit has self-inductance 'L' H and carries a current 'I' A. To prevent sparking when the circuit is switched off, a capacitor which can withstand 'V' volt is used. The least capacitance of the capacitor connected across the switch must be equal to

(A) $\frac{IV}{L}$ (B) $L(\frac{V}{L})^2$

(C) $L(\frac{I}{V})^2$ (D) $\frac{LI}{V}$

44. A straight wire of diameter 0.4 mm carrying a current of 2 A is replaced by another wire of 0.8 mm diameter carrying the same current. The magnetic field at distance (R) from both the wires is 'B_1' and 'B_2' respectively. The relation between B_1 and B_2 is

(A) $B_1 = \frac{B_2}{2}$ (B) $B_1 = B_2$

(C) $B_1 = 2\,B_2$ (D) $B_1 = \frac{B_2}{3}$

45. In a CE transistor, a change of 8.0 mA in the emitter current produces a change of 7.8 mA in the collector current. What change in the base current is necessary to produce the same change in the collector current?

(A) 200μA (B) 50μA

(C) 100μA (D) 150μA

46. Water rises upto a height of 4 cm in a capillary tube. The lower end of the capillary tube is at a depth of 8 cm below the water level. The mouth pressure required to blow an air bubble at the lower end of the capillary will be 'X' cm of water, where X is equal to

(A) 10 (B) 8

(C) 6 (D) 12

47. The initial pressure and volume of a gas is 'P' and 'V' respectively. First by isothermal process gas is expanded to volume '9 V' and then by adiabatic process its volume is compressed to 'V' then its final pressure is (Ratio of specific heat at constant pressure to constant volume

$$= \frac{3}{2}$$

)

(A) 6 P (B) 27 P

(C) 3 P (D) 9 P

48. A particle is performing U.C.M. along the circumference of a circle of diameter 50 cm with frequency 2 Hz. The acceleration of the particle in m/s^2 is

(A) $2\pi^2$ (B) $4\pi^2$

(C) $8\pi^2$ (D) π^2

49. The frequency of a tuning fork is 220 Hz and the velocity of sound in air is 330 m/s. When the tuning fork completes 80 vibrations, the distance travelled by the

(A) 120 m (B) 60 m

(C) 53 m (D) 100 m

50. Two point charges $+3\mu$C and $+8\mu$C repel each other with a force of 40 N. If a charge of -5μC is added to each of them, then force between them will become

(A) -10 N (B) 10 N

(C) 20 N (D) -20 N

51. Which of the following statements about tropone is true?

(A) It is heterocyclic having molecular formula $C_5H_{10}O$.
(B) It is benzenoid having molecular formula $C_{10}H_8O$.
(C) It is non-benzenoid having molecular formula C_7H_6O.
(D) It is heterocyclic having molecular formula C_7H_6O.

52. Edge length of unit cell of BCC structure is 352 pm. What is radius of the atom?

(A) 176.3 pm
(B) 304.8 pm
(C) 152.4 pm
(D) 252.4 pm

53. What is the constant external pressure of an ideal gas when expanded from $2 \times 10^{-2}\ m^3$ to $3 \times 10^{-2}\ m^3$, if the work done by the gas is -5.09 kJ ?

(A) $5.09 \times 10^5 Nm^{-2}$
(B) $1.01 \times 10^5 Nm^{-2}$
(C) $2.02 \times 10^5 Nm^{-2}$
(D) $5.60 \times 10^5 Nm^{-2}$

54. The conductivity of 0.012 M NaBr solution is 2.67×10^{-4} S cm^{-1}. What is it's molar conductivity?

(A) 26.7 S cm^2 mol^{-1}
(B) 32.04 S cm^2 mol^{-1}
(C) 12.2 S cm^2 mol^{-1}
(D) 22.2 S cm^2 mol^{-1}

55. How many molecules of ammonia gas are present in 67.2 dm^3, measured at S.T.P.?

(A) 2.0×10^{24}
(B) 1.0×10^{23}
(C) 1.8×10^{22}
(D) 5.0×10^{24}

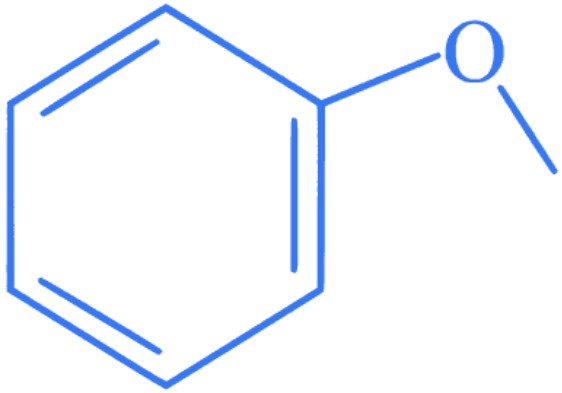
56. What is the formal charge on 'C' atom in

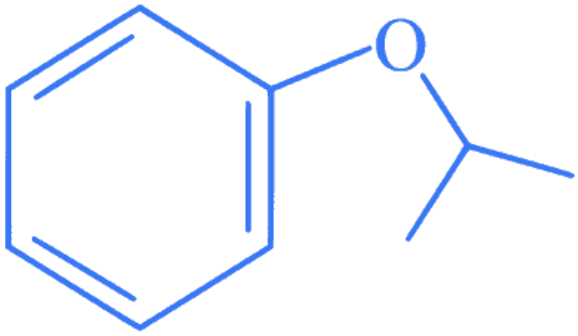


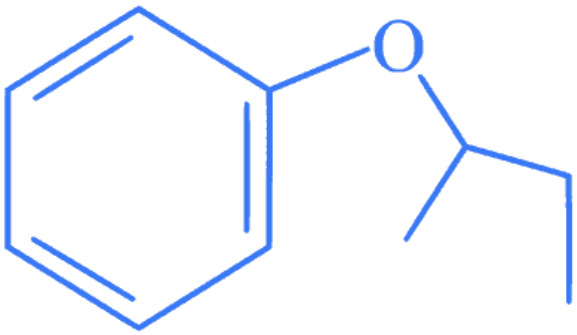
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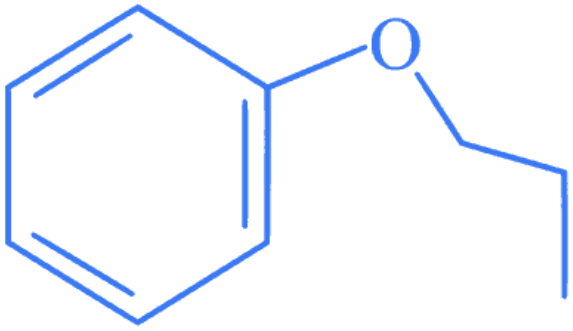
(A) -1
(B) -2
(C) $+1$
(D) Zero

57. Identify 2-propoxy benzene from following :

(A)


(B)


(C)


(D)


58. Identify the chiral molecule from the following:

(A) 2-Bromo-2-methylbutane
(B) 2-Bromo-3-methylbutane
(C) 3-Bromopentane
(D) 2-Bromopropane

59. Which among the followings is an allylic halide?

(A) 1-Chloropropene (B) 2-Chloropropene
(C) 3-Chloropropene (D) 4-Chlorobut-1-ene

60. Which among the following salts undergoes hydrolysis?

(A) Na_2SO_4 (B) KCl
(C) NH_4Cl (D) KNO_3

61. What is the SI unit of density?

(A) kg dm^3 (B) kg m^{-3}
(C) kg m^3 (D) kg dm^{-3}

62. What is value of spin only magnetic moment of

$$Ni(Z = 28)$$

in +2 oxidation state?

(A) 3.1 BM (B) 0.0 BM
(C) 2.8 BM (D) 1.7 BM

63. IUPAC name of the compound $(CH_3)_4C$ is

(A) 2-Methylbutane (B) Neopentane
(C) 2,2-Dimethylpropane (D) 2-Methylpentane

64. What is IUPAC name of catechol?

(A) Benzene-1,3,5-triol (B) Benzene-1,2-diol
(C) Benzene-1,3-diol (D) Benzene-1,4-diol

65. At 298 K, 0.1M solution of acetic acid is 1.34% ionized. What is the dissociation constant of acetic acid?

(A) 1.4×10^{-3} (B) 1.8×10^{-5}
(C) 1.6×10^{-3} (D) 1.34×10^{-5}

66. During a process, system absorbs 710 J of heat and increases the internal energy by 460 J. What is the work performed by system?

(A) −250 J (B) −1170 J
(C) −710 J (D) −460 J

67. For simple cubic crystal edge length is expressed as

(A) $a = 2r$ (B) $a = \frac{r}{2}$
(C) $a = \sqrt{2}r$ (D) $a = \frac{r}{\sqrt{2}}$

68. Identify the use of mixture of Ar and N_2 from following.

(A) For magnetic resonance imaging (B) For production of lasers
(C) To fill in electric bulbs (D) To produce low temperature for research work

69. Which of the following is an alkali metal?

(A) Barium (B) Rubidium
(C) Strontium (D) Gallium

70. During the electrolysis of fused NaCl, the product obtained at anode is

(A) $Na_{(s)}$ (B) $Cl_{2\,(g)}$
(C) $O_{2\,(g)}$ (D) $Na_{(l)}$

71. Identify product B in following reaction.
Propanone

$$\xrightarrow{Ba(OH)_2} A \xrightarrow[-H_2O]{\Delta} B$$

(A) 2-Methylpentan-3-one (B) 4-Hydroxy-4-methylpentan-2-one
(C) 4-Methylpent-3-en-2-one (D) 2-Methylpent-2-en-4-one

72. Which among the following oxides is acidic in nature?

(A) N_2O_5 (B) NO
(C) Na_2O (D) CO

73. The units of monosaccharides present in raffinose are

(A) Two Galactose and one Fructose (B) Two Fructose and one Glucose
(C) Two Glucose and one Fructose (D) Glucose, Fructose and Galactose (one unit of each)

74. Identify the protein present in nail.

(A) Albumin (B) Keratin
(C) Myosin (D) Legumelin

75. Identify the products of following reaction :

$$C_6H_5COOC_2H_5 \xrightarrow[\text{dil. } H_2SO_4]{\Delta}$$

(A) $C_6H_5OH + C_2H_5OH$
(B) $C_6H_5COOH + C_2H_5COOH$
(C) $C_6H_5COOH + C_2H_5OH$
(D) $C_6H_5OH + C_2H_5COOH$

76. An element is found to crystallize with BCC structure having density 8.55 g cm^{-3}. What is the edge length of unit cell? (At. mass of element = 93)

(A) $(3.61 \times 10^{-23})^{1/3}$ cm

(B) $(3.91 \times 10^{-20})^{1/3}$ cm

(C) $(3.01 \times 10^{-24})^{1/3}$ cm

(D) $(3.30 \times 10^{-20})^{1/3}$ cm

77. Which of the following elements in their respective oxidation states does not develop spin only magnetic moment? [$Ti(Z = 22), Zn(Z = 30), V(Z = 23), Cu(Z = 29)$]

(A) Cu^{2+} (B) Zn^{2+}

(C) Ti^{3+} (D) V^{3+}

78. What is IUPAC name of $[Co(H_2O)(NH_3)_5]I_3$?

(A) Pentaammineaquacobalt (III) iodide

(B) Pentaammineaquocobalt iodide

(C) Monoaquapentaammine triiodo cobaltate

(D) Pentaammineaquatriiodo cobaltate

79. What is effective atomic number of Pt in $[Pt(NH_3)_4]^{2+}$? (Given atomic number of Pt = 78)

(A) 76 (B) 84

(C) 72 (D) 86

80. Which among following compounds is a secondary amine?

(A) Hexane-1,6-diamine

(B) N,N-Dimethylbenzenamine

(C) N-methylbenzenamine

(D) Prop-2-en-1-amine

81. What is vapour pressure of a solution containing 1 mol of a non-volatile solute in 36 g of water? ($P_1^0 = 400$ mmHg)

(A) 334 mm Hg (B) 267 mm Hg

(C) 240 mm Hg (D) 284 mm Hg

82. pH of soft drink is 3.6. Calculate the concentration of hydrogen ions in it.

(A) 2.51×10^{-4}M (B) 2.3×10^{-3}M

(C) 2.0×10^{-3}M (D) 2.81×10^{-4}M

83. Which of the following solutions behaves nearly as an ideal solution?

(A) Benzene + toluene (B) Phenol + aniline

(C) Chloroform + acetone (D) Ethanol + acetone

84. Identify monomers used for manufacturing of Terylene?

(A) Propylene glycol and Terephthalic acid (B) Ethylene glycol and Terephthalic acid

(C) Propylene glycol and Phthalic acid (D) Ethylene glycol and Phthalic acid

85. What is the frequency of yellow light having wavelength 580 nm ?

(A) 193×10^{-9} Hz (B) 517×10^{-14} Hz

(C) 5.17×10^{14} Hz (D) 580×10^{-9} Hz

86. Which of the following equations represents integrated rate law for zero order reaction?

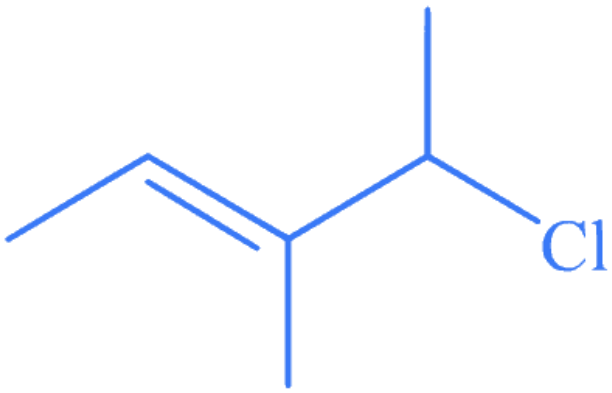
(A) $k = \frac{[A]_t - [A]_0}{t}$

(B) $k = \frac{1}{t}\log_{10}\frac{[A]_0}{[A]_t}$

(C) $k = \frac{[A]_0 - [A]_t}{t}$

(D) $k = \frac{t}{2.303} \times \log_{10}\frac{[A]_0}{[A]_t}$

87. The IUPAC name of following compound is



(A) 2-Chloro-3-methylpent-3-ene (B) 4-Chloro-3-methylpent-2-ene

(C) 1-Chloro-1,2-dimethylbut-2-ene (D) 4-Chloro-3,4-dimethylbut-2-ene

88. Identify the compound formed from elements X, Y, Z having oxidation state +2, +5, −2 respectively.

(A) $X(Y_4Z)$ (B) $X_3(YZ_4)_2$

(C) $X_3(YZ_2)_2$ (D) XYZ_2

89. Which of the following statements is true for adsorption?

(A) It is accompanied by evolution of heat.
(B) It is a bulk phenomenon.
(C) It is independent of surface area.
(D) It is independent of temperature.

90. Which of following compounds does not undergo vinyl polymerization?

(A) ϵ-Caprolactam
(B) Vinyl cyanide
(C) Tetrafluoroethylene
(D) Ethylene

91. Identify the hetero atom and number of double bonds respectively present in furan?

(A) S, 2
(B) O, 2
(C) N, 2
(D) O, 1

92. Identify compound A from following reaction.

$$A + C_2H_5MgBr \xrightarrow[ety]{drer} B \xrightarrow{H_3O^+}$$

3-methylpentan-3-ol

(A) Butanal
(B) Propanone
(C) Propanal
(D) Butanone

93. How many hydrogen atoms are bonded to ammonium ion during solvation?

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

94. What is the weight of Al deposited at cathode when 1 ampere current is passed through molten $AlCl_3$ for 9650 seconds? (At mass of Al = 27)

(A) 3.0 g
(B) 9.0 g
(C) 13.6 g
(D) 0.9 g

95. Ammonia and oxygen react at high temperature as

$$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(g)}.$$

If rate of formation of $NO_{(g)}$ is 3.6×10^{-3} mol L^{-1} s^{-1} then rate of disappearance of ammonia is

(A) 7.2×10^{-3} mol L^{-1} s^{-1}
(B) 1.2×10^{-3} mol L^{-1} s^{-1}
(C) 2.4×10^{-3} mol L^{-1} s^{-1}
(D) 3.6×10^{-3} mol L^{-1} s^{-1}

96. Which among the following is NOT an intensive property?

(A) Surface tension
(B) Heat capacity
(C) Viscosity
(D) Temperature

97. Which of the following represents integrated rate law equation for gas phase first order reaction, $A_{(g)} \rightarrow B_{(g)} + C_{(g)}$ if

P_i = initial pressure of A

P = total pressure of reaction mixture at time ?

(A) $k = 2.303 \times \log_{10} \frac{P_i}{2P_i - P}$
(B) $k = \frac{2.303}{t} \times \log_{10} \frac{P_i}{2P_i - P}$
(C) $k = \frac{1}{t} \ln \frac{2P_i - P}{P_i}$
(D) $k = \frac{2.303}{t} \times \log_{10} \frac{P_i - P}{P_i}$

98. The solution containing 6 g urea (molar mass 60) per dm^3 of water and another solution containing 9 g of solute A per dm^3 water freezes at same temperature. What is molar mass of A ?

(A) 90
(B) 180
(C) 54
(D) 120

99. Which of following is used for synthesis of adipic acid enzymatically by Drath and Frost?

(A) Benzene
(B) Glucose
(C) Fructose
(D) Galactose

100. Identify the product formed when ethyl benzene reacts with nitric acid.

(A) o-Nitro ethylbenzene
(B) Ethoxybenzene
(C) p-Nitro ethylbenzene
(D) Benzoic acid

101. The vectors

$$\overrightarrow{AB} = 3\hat{i} + 4\hat{k}$$

and

$$\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$$

are the sides of a triangle ABC. The length of the median through A is

(A) $\sqrt{33}$ units (B) $\sqrt{288}$ units

(C) $\sqrt{18}$ units (D) $\sqrt{72}$ units

102. The principal solutions of

$$\cot x = \sqrt{3}$$

are

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

(C) $\frac{\pi}{6}, \frac{7\pi}{6}$ (D) $\frac{\pi}{3}, \frac{7\pi}{3}$

103. The area of the region included between the parabolas

$$y^2 = 8x$$

and

$$x^2 = 8y$$

, is

(A) $\frac{128}{3}$ sq. units (B) $\frac{64}{3}$ sq. units

(C) $\frac{32\sqrt{8}}{3}$ sq. units (D) $\frac{16\sqrt{8}}{3}$ sq. units

104. "If two triangles are congruent, then their areas are equal." is the given statement, then the contrapositive of the inverse of the given statement is
(Where p : Two triangles are congruent, q : Their areas are equal)

(A) If two triangles are not congruent. then their areas are equal.

(B) If two triangles are not congruent, then their areas are not equal.

(C) If areas of two triangles are equal, then they are congruent.

(D) If areas of two triangles are not equal, then they arc congruent.

105. Radium decomposes at the rate proportional to the amount present at any time. If P% of amount disappears in one year, then amount of radium left after 2 years is

(A) $(10 - \frac{P}{10})^2$ (B) $x_0[1 + \frac{P}{100}]^2$

(C) $x_0[1 - \frac{P}{100}]^2$ (D) $x_0[10 - \frac{P}{10}]^2$

106. The minimum value of the objective function

$$z = 4x + 6y$$

subject to $x + 2y \geq 80, 3x + y \geq 75, x, y \geq 0$ is

(A) 324 (B) 250

(C) 320 (D) 254

107. The joint equation of pair of lines through the origin and having slopes $(1 + \sqrt{2})$ and

$$\frac{1}{(1 + \sqrt{2}\ )}$$

is

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

(B) $x^2 - 2\sqrt{2}\ xy - y^2 = 0$

(C) $x^2 - 2\sqrt{2}xy + y^2 = 0$

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

108. If

$$4ab = 3h^2$$

, then the ratio of slopes of the lines represented by

$$ax^2 + 2hxy + by^2 = 0$$

is

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

(C) $\sqrt{3} : 1$ (D) $1 : 3$

109. If

$$A = \begin{bmatrix} 5 & 6 & 3 \\ -4 & 3 & 2 \\ -4 & -7 & 3 \end{bmatrix}$$

, then cofactors of all elements of second row are respectively.

(A) $-39, 3, 11$ (B) $-39, 27, 11$

(C) $39, -3, -11$ (D) $39, -27, 11$

110. A man is known to speck truth 3 out of 4 times. He throws a die and reports that it is 6. Then the probability that it is actually 6 is

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

(C) $\frac{3}{8}$ (D) $\frac{5}{6}$

111. If

$$\bar{a} = 2\hat{i} + 3\hat{j} - \hat{k}, \bar{b} = -\hat{i} + 2\hat{j} - 4\hat{k}$$

and

$$\bar{c} = \hat{i} + \hat{j} - 2\hat{k}$$

, then

$$(\bar{a} \times \bar{b}) \cdot (\bar{a} \times \bar{c}) =$$

(A) -30 (B) 84

(C) 70 (D) 984

112. The differential equation obtained by eliminating A and B from

$$y = A\cos\omega t + B\sin\omega t$$

(A) $\frac{d^2y}{dt^2} + \omega^2 y = 0$ (B) $\frac{\mathrm{d}^2y}{\mathrm{dt}^2} + \omega \mathrm{y}^2 = 0$

(C) $\frac{d^2y}{dt^2} - \omega^2 y = 0$ (D) $\frac{d^2y}{dt^2} - \omega y^2 = 0$

113. The Cartesian equation of a plane which passes through the points A$(2, 2, 2)$ and making equal nonzero intercepts on the co-ordinate axes is

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

(C) $2x + y + z = 7$ (D) $x - y + z =$

114. If

$$y = x\tan y$$

, then

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

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

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

115.

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

(A) 1 (B) $\frac{\pi}{\sqrt{7}}$

(C) 0 (D) $\frac{2}{\sqrt{7}}$

116. The distance between the lines

$$3x + 4y = 9$$

and

$$6x + 8y = 15$$

is

(A) 5 units (B) 3 units

(C) 0.3 units (D) 0.5 units

117. The equation of common tangent to the circles

$$x^2 + y^2 - 4x + 10y + 20 = 0$$

and

$$x^2 + y^2 + 8x - 6y - 24 = 0$$

is

(A) $3x - 4y + 11 = 0$ (B) $3x - 4y - 11 = 0$

(C) $-3x - 4y + 11 = 0$ (D) $3x + 4y + 11 = 0$

118. The radius of a circular plate is increasing at the rate of 0.01 cm/sec, when the radius is 12 cm. Then the rate at which the area increases is

(A) 60 π sq.cm/sec (B) 0.24 π sq.cm/sec

(C) 1.2 π sq.cm/sec (D) 24 π sq.cm/sec

119. The mean of the numbers obtained on throwing a die having written 1 on three faces, 2 on two faces and 5 on one face is

(A) 5 (B) $\frac{8}{3}$

(C) 1 (D) 2

120. The particular solution of the differential equation

$$y(1 + \log x)\frac{dx}{dy} - x\log x = 0$$

when

$$x = e, y = e^2$$

is

(A) $y^2 = e^4 \log x$ (B) $y = e^2 \log x$

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

121. If G$(\bar{g})$, H$(\bar{h})$ and P$(\bar{p})$ are respectively centroid, orthocenter and circumcentre of a triangle and

$$\mathrm{xp} + \mathrm{yh} + \mathrm{zg} = 0$$

, then x, y, z are respectively.

(A) $1, 1, -2$ (B) $1, 3, -4$

(C) $2, 1, -3$ (D) $2, 3, -5$

122. The co-ordinates of the foot of the perpendicular drawn from the point $2\hat{i} - \hat{j} + 5\hat{k}$ to the line

$$\vec{r} = (11\hat{i} - 2\hat{j} - 8\hat{k}) + \lambda(10\hat{i} - 4\hat{j} - 11\hat{k})$$

are

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

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

123. Which of the following matrices are invertible?

$$A = \begin{bmatrix} 2 & 3 \\ 10 & 15 \end{bmatrix}, B$$
$$= \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 3 \\ 1 & 2 & 3 \end{bmatrix}, C$$
$$= \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 4 & 6 & 8 \end{bmatrix}, D$$
$$= \begin{bmatrix} 2 & 4 & 2 \\ 1 & 1 & 0 \\ 1 & 4 & 5 \end{bmatrix}$$

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

124. If
$$^{11}C_4 + {}^{11}C_5 + {}^{12}C_6 + {}^{13}C_7 = {}^{14}C_5$$
, then value of r is

(A) 11 (B) 14
(C) 7 (D) 3

125.
$$\int \sec^{-1} x dx =$$

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

126. If the standard deviation of data is 12 and mean is 72, then coefficient of variation is

(A) 15.67% (B) 14.67%
(C) 13.67% (D) 16.67%

127. If
$$x = a(\theta + \sin\theta)$$
and
$$y = a(1 - \cos\theta)$$
then
$$\left(\frac{d^2y}{dx^2}\right)_{at\ \theta = \pi/2} =$$

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

128. If $\sin(y + z - x), \sin(z + x - y)$ and $\sin(x + y - z)$ are in AP, then

(A) $\tan y = \tan x + \tan z$
(B) $\tan y = \tan x - \tan z$
(C) $2\tan y = \tan x + \tan z$
(D) $2\tan y = \tan x - \tan z$

129. The negation of inverse of $\sim p \to q$ is

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

130. Let
$$a = 2\hat{i} + \hat{j} - 2\hat{k}$$
and
$$b = \hat{i} + \hat{j}$$
. If $\overline{c}$ is a vector such that
$$a \cdot c = |c|, |c - a| = 2\sqrt{2}$$
and the angle between $\overline{a} \times \overline{b}$ and $\overline{c}$ is 60°. Then
$$|(a \times b) \times c| =$$

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

131.
If the function given byf(x)
$$= -2\sin x \quad -\pi \le x < -(\pi/2)$$
$$= a\sin x + b \quad -(\pi/2) < x < (\pi/2)$$
$$= \cos x \quad (\pi/2) \le x \le \pi$$
is continuous in $[-\pi, \pi]$, then the value of $(3a + 2b)^3$ is

(A) 1 (B) 8
(C) -1 (D) -8

132. If
$$\tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}$$
, where
$$x > 0$$
, then
$$x =$$

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

133. The projection of
$$\overline{a} = \hat{i} - 2\hat{j} + \hat{k}$$
on
$$\overline{b} = 2\hat{i} - \hat{j} + \hat{k}$$
is

(A) 5 (B) $5\sqrt{6}$
(C) $\frac{5}{\sqrt{6}}$ (D) $\sqrt{6}$

134. Let two cards are drawn at random from a pack of 52 playing cards. Let X be the number of aces obtained. Then the value of E(X) is

(A) $\frac{5}{13}$ (B) $\frac{1}{13}$

(C) $\frac{2}{13}$ (D) $\frac{37}{221}$

135. The order and degree of the differential equation

$$\frac{d^2y}{dx^2} = \sqrt{\frac{dy}{dx}}$$

are respectively

(A) 2, 3 (B) 3, 3

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

136.

$$\int_1^3 \left[\tan^{-1}\left(\frac{x}{x^2-1}\right) + \tan^{-1}\left(\frac{x^2-1}{x}\right)\right]dx =$$

(A) π (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{2}$ (D) 2π

137. If amplitude of $(z-2-3i)$ is

$$\frac{3\pi}{4}$$

, then locus of z is (where

$$z = x + iy$$

)

(A) $x+y=1$ (B) $x+y=5$

(C) $x-y=-5$ (D) $x-y=1$

138. A fair coin is tossed 100 times. The probability of getting a head for even number of times is

(A) $\frac{1}{2}$ (B) $\frac{3}{8}$

(C) $\frac{1}{8}$ (D) $\frac{3}{4}$

139. If

$$\int \frac{\sqrt{x}}{x(x+1)}dx = k\tan^{-1} m + c$$

, (where c is constant of integration), then

(A) $k=1, m=\sqrt{x}$ (B) $k=2, m=\sqrt{x}$

(C) k = 1, m = x (D) k = 2, m = x

140. The equation of tangent to the curve

$$y = \sqrt{2}\ \sin\left(2x + \frac{\pi}{4}\right)$$

at

$$x = \frac{\pi}{4}$$

, is

(A) $2x+y-\frac{\pi}{2}-1=0$ (B) $2x-y-\frac{\pi}{2}+1=0$

(C) $x+y-\frac{\pi}{2}-1=0$ (D) $x-y-\frac{\pi}{2}+1=0$

141. With usual notations in $\triangle$ABC, if

$$\frac{\sin A}{\sin C} = \frac{\sin(A-B)}{\sin(B-C)}$$

, then a^2, b^2, c^2 are in

(A) Not in AP (B) HP

(C) AP (D) GP

142. The general solution of the differential equation

$$\cos(x+y)\frac{dy}{dx} = 1$$

is

(A) $y = \tan(x+y) + c$ (B) $y = \sec(x+y) + c$

(C) $y = \tan(\frac{x+y}{2}) + c$ (D) $y = \cot(\frac{x+y}{2}) + c$

143. The derivative of the function $\cot^{-1}\left[(\cos 2x)^{1/2}\right]$ at

$$x = \pi/6$$

is

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

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

144. The domain of the function $\log_{10}\left(x^2-5x+6\right)$ is

(A) $(-\infty, \infty)$ (B) $(-\infty, 2) \cup (3, \infty)$

(C) $(2, 3)$ (D) None of these

145. If

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

and

$$\bar{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$$

are coplanar, then λ is the root of the equation

(A) $x^2 + 3x = 6$ (B) $x^2 + 2x = 4$

(C) $x^2 + 3x = 4$ (D) $x^2 + 2x = 6$

146. The area of the triangle ABC is $10\sqrt{3}$ cm^2, angle B is 60° and its perimeter is 20 cm, then

$$\ell(\text{AC}) =$$

(A) 10 cm (B) 8 cm

(C) 5 cm (D) 7 cm

147. If the slopes of the lines given by the equation

$$ax^2 + 2hxy + by^2 = 0$$

are in the ratio 5 : 3, then the ratio

$$h^2 : ab =$$

(A) 15 : 16 (B) 5 : 3

(C) 3 : 5 (D) 16 : 15

148. For all real x, the minimum value of the function

$$f(x) = \frac{1 - x + x^2}{1 + x + x^2}$$

is

(A) $\frac{1}{3}$ (B) 0

(C) 3 (D) 1

149.

$$\int \frac{dx}{\cos x \sqrt{\cos 2x}} =$$

(A) $\sin^{-1}(\tan x) + c$

(B) $\frac{1}{2}\log|\tan(\frac{\pi}{4} + x)| + c$

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

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

150. If the function defined by

$$f(x) = K(x - x^2)$$

if

$$0 < x < 1 = 0$$

, otherwise is the p.d.f. of a r.v.X, then the value of

$$P\left(X < \frac{1}{2}\right)$$

is

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

(C) $\frac{1}{4}$ (D) $\frac{2}{3}$

- End of Question Paper -