AIEEE - 2006

Full Paper

Physics

1. The Kirchhoffs first law ($\Sigma i = 0$) and second law ($\Sigma iR = \Sigma E$), where the symbols have their usual meanings, are respectively based on :
   1) conservation of charge, conservation of momentum
   2) conservation of energy, conservation of charge
   3) conservation of momentum, conservation of charge
   4) conservation of charge, conservation of energy

2. Needles N_1, N_2 and N_3 are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively. A magnet when brought close to them will :
   1) attract N_1 and N_2 strongly but repel N_3
   2) attract N_1 strongly, N_2 weakly and repel N_3 weakly
   3) attract N_1 strongly, but repel N_2 and N_3 weakly
   4) attract all three of them

3. A material 'B' has twice the specific resistance of 'A'. A circular wire made of 'B' has twice the diameter of a wire made of 'A'. Then for the two wires to have the same resistance, the ratio (l_B / l_A) of their respective lengths must be :

   1) 1   2) 1/2   3) 1/4   4) 2

4. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be a :
   1) helix
   2) straight line
   3) ellipse
   4) cricle

5. An electric-dipole is placed at an angle of 30° to a non-uniform electric field. The dipole will experience
   1) a translational force only in the direction of the field
   2) a translational force only in a direction normal to the direction of the field
   3) a torque as well as a translational force
   4) a torque only

6. A particle located at x = 0 at time t = 0, starts moving along the positive x-direction with a

velocity 'v' that varies as $v = \alpha\sqrt{x}$. The displacement of the particle varies with time as :

1) t^2
2) t
3) $t^{1/2}$
4) t^3

7. A bomb of mass 16 kg at rest explodes into two pieces of masses 4 kg and 12 kg. The velocity of the 12 kg mass is 4 ms^{-1}. The kinetic energy of the other mass is

1) 144 J
2) 288 J
3) 192 J
4) 96 J

8. A whistle producing sound waves of frequencies 9500 Hz and above is approaching a stationary person with speed v ms^{-1}.The velocity of sound in air is 300 ms^{-1}. If the person can hear frequencies upto a maximum of 10,000 Hz, the maximum value of v upto which he can hear the whistle is :

1) $15\sqrt{2}$ ms^{-1}
2) $15/\sqrt{2}$ ms^{-1}
3) 15 ms^{-1}
4) 30 ms^{-1}

9. A mass of M kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is :

1) $Mg(\sqrt{2} + 1)$
2) $Mg\sqrt{2}$
3) $Mg/\sqrt{2}$
4) $Mg(\sqrt{2} - 1)$

10. A particle of mass 100 g is thrown vertically upwards with a speed of 5 m/s. The work done by the force of gravity during the time the particle goes up is :

1) -0.5 J
2) -1.25 J
3) 1.25 J
4) 0.5 J

11. The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 mm, is 4.4 m/s. The period of oscillation is :

1) 0.01 s
2) 10 s
3) 0.1 s
4) 100 s

12. Starting from the origin a body oscillates simple harmonically with a period of 2 s. After what time will its kinetic energy be 75% of the total energy ?

1) (1/6) s
2) (1/4) s
3) (1/3) s
4) (1/12) s

13. Assuming the sun to be a spherical body of radius R at a temperature of T K, evaluate the total radiant power, incident on earth, at a distance r from the sun :

1) $4 \pi r^2_0 \; R^2 \sigma T^4 / r^2$
2) $\pi r^2_0 \; R^2 \sigma T^4 / r^2$
3) $r^2_0 \; R^2 \sigma T^4 / 4\pi r^2$
4) $R^2 \sigma T^4 / r^2$

14. Which of the following units denotes the dimensions $[ML^2/Q^2]$, where Q denotes the electric charge ?

1) Wb/m^2
2) henry (H)
3) H/m^2
4) weber (Wb)

15. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further, find the magnitude of the force. Consider $g = 10 \text{ m/ s}^2$:

1) 4 N 2) 16 N 3) 20 N 4) 22 N

16. A string is stretched between fixed points separated by 75.0 cm. It is observed to have resonant frequencies of 420 Hz and 315 Hz. There are no other resonant frequencies between these two. Then, the lowest resonant frequency for this string is :

1) 105 Hz
2) 1.05 Hz
3) 1050 Hz
4) 10.5 Hz

17. Consider a two particle system with particles having masses m_1 and m_2. If the first particle is pushed towards the centre of mass through a distance d, by what distance should the second particle be moved, so as to keep the centre of mass at the same position'?

1) (m_2/m_1) d
2) $(m_1/(m_1 + m_2))$ d
3) (m_1/m_2) d

4) d

18. A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s. If the catching process is completed in 0.1s, the force of the blow exerted by the ball on the hand of the player is equal to :

1) 150 N
2) 3 N
3) 30 N
4) 300 N

19. In a common-base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA. The value of the base current amplification factor (β) will be :

1) 49 2) 50 3) 51 4) 48

20. A thermocouple is made from two metals, Antimony and Bismuth. If one junction of the couple is kept hot and the other is kept cold, then, an electric current will :

1) flow from Antimony to Bismuth at the hot junction
2) flow from Bismuth to Antimony at the cold junction
3) not flow through the thermocouple
4) flow from Antimony to Bismuth at the cold junction

21. The threshold frequency for a metallic surface corresponds to an energy of 6.2 eV and the stopping potential for a radiation incident on this surface is 5V. The incident radiation lies in :

1) ultra-violet region
2) infra -red region
3) visible region
4) X-ray region

22. An alpha nucleus of energy (1/2) mv^2 bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to :

1) v^2
2) 1/m
3) $1/v^4$
4) 1/Ze

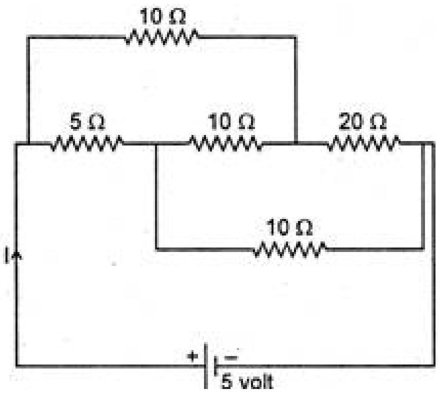
23. The time taken by a photoelectron to come out after the photon strikes is approximately :

1) 10^{-4}s
2) 10^{-10} s
3) 10^{-16} s
4) 10^{-1} s

24. When $_3Li^7$ nuclei are bombarded by protons, and the resultant nuclei are $_4Be^8$, the emitted particles will be :

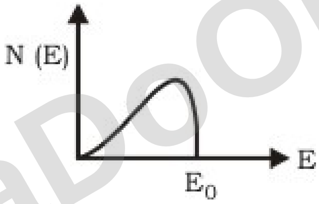
1) alpha particles
2) beta particles
3) gamma photons
4) neutrons

25. The current I drawn from the 5 volt source will be:



1) 0.33 A
2) 0.5 A
3) 0.67 A
4) 0.17 A

26. The energy spectrum of β-particles [number N(E) as a function of β-energy E] emitted from a radioactive source is :

1)


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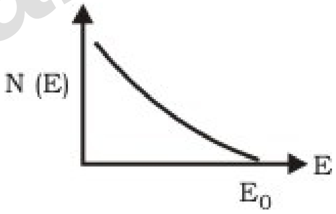

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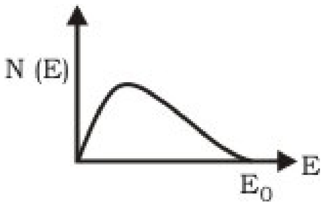
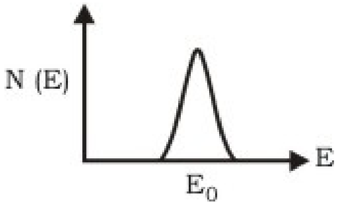


4)


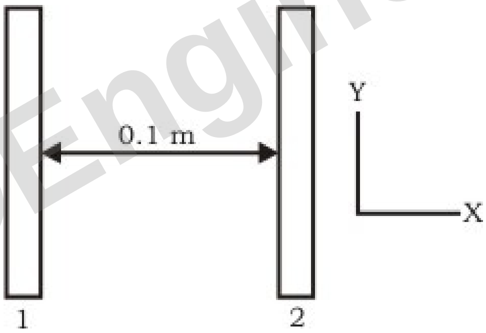
27. In a series resonant LCR circuit, the voltage across R is 100 volts and R = 1 kΩ with C = 2μF. The resonant frequency ω is 200 rad/s. At resonance the voltage across L is

1) 2.5×10^{-2} V
2) 40 V
3) 250 V
4) 4×10^{-3} V

28. The resistance of a bulb filament is 100Ω at a temperature of 100°C. If its temperature coefficient of resistance be 0.005 per °C, its resistance will become 200Ω at a temperature of :

1) 300°C
2) 400°C
3) 500°C
4) 200°C

29. Two insulating plates are both uniformly charged in such a way that the potential difference between them is $V_2 - V_l = 20$ V. (i.e., plate 2 is at a higher potential). The plates are separated by d = 0.1 m and can be treated as infinitely large. An electron is released from rest on the inner surface of plate 1. What is its speed when it hits plate 2 ?
($e = 1.6 \times 10^{-19}$C, $m_0 = 9.11 \times 10^{-31}$ kg)



1) 2.65×10^{6} m/s
2) 7.02×10^{12} m/s
3) 1.87×10^{6} m/s
4) 32×10^{-19} m/s

30. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil is :

1) N.A.B.R. ω
2) N.A.B
3) N.A.B.R.
4) N.A.B. ω

31. A solid which is not transparent to visible light and whose conductivity increases with

temperature is formed by :

1) ionic binding
2) covalent binding
3) Van der Waal's binding
4) metallic binding

32. The refractive index of glass is 1.520 for red light and 1.525 for blue light. Let D_1 and D_2 be angles of minimum deviation for red and blue light respectively in a prism of this glass then, :

1) $D_1 < D_2$
2) $D_1 = D_2$
3) D_1 can be less than or greater than D_2 depending upon the angle of prism
4) $D_1 > D_2$

33. If the ratio of the concentration of electrons to that of holes in a semiconductor is 7/5 and the ratio of currents is 7/4, then what is the ratio of their drift velocities ?

1) 5/8   2) 4/5   3) 5/4   4) 4/7

34. In a Whearstones bridge, three resistances P, Q and R are connected in the three arms and the fourth arm is formed by two resistances S_1 and S_2 connected in parallel. The condition for the bridge to be balanced will be :

1) $P/Q = (2R/(S_1 + S_2))$
2) $P/Q = (R(S_1 + S_2))/(S_1S_2)$
3) $P/Q = (R(S_1 + S_2))/(2S_1S_2)$
4) $P/Q = (R/(S_1 + S_2))$

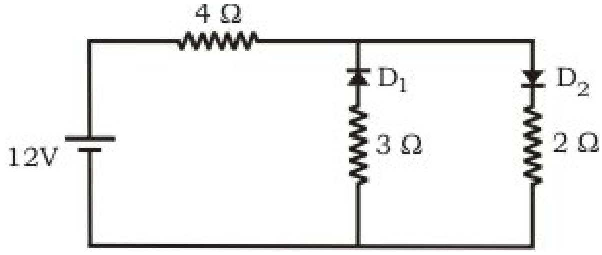
35. The flux linked with a coil at any instant 't' is given by :
$\phi = 10t^2 - 50t + 250$
The induced emf at t = 3 s is :

1) -190 V
2) -10 V
3) 10 V
4) 190 V

36. A long solenoid has 200 turns per cm and carries a current i. The magnetic field at its centre is 6.28×10^{-2} weber/m^2. Another long solenoid has 100 turns per cm and it carries a current i/3. The value of the magnetic field at its centre is :

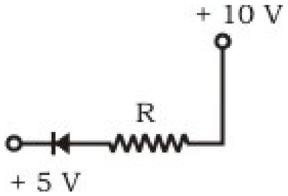
1) 1.05×10^{-2} weber/m^2
2) 1.05×10^{-5} weber/m^2
3) 1.05×10^{-3} weber/m^2
4) 1.05×10^{-4} weber/m^2

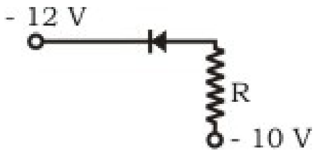
37. The circuit has two oppositely connected ideal diodes in parallel. What is the current flowing in the circuit ?

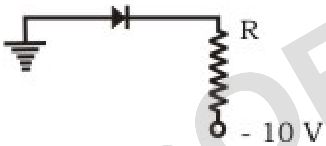


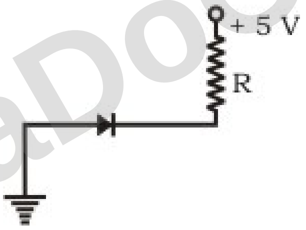
1) 1.71 A
2) 2.00 A
3) 2.31 A
4) 1.33 A

38. In the following, which one of the diodes is reverse biased ?

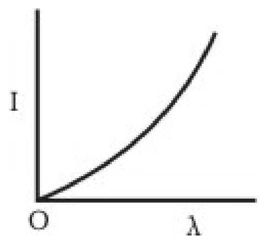
1)


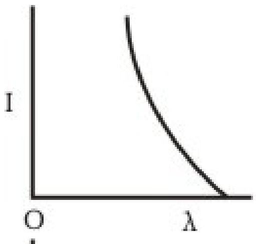
2)


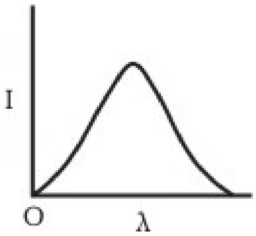
3)


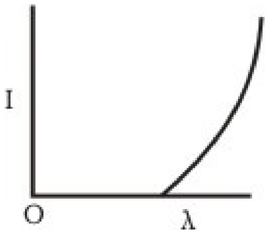
4)


39. The anode voltage of a photocell is kept fixed. The wavelength λ of the light falling on the cathode is gradually changed. The plate current I of the photocell varies as follows:

1)


2)


3)


4)


40. If the binding energy per nucleon in ^7_3Li and ^4_2He nuclei are 5.60 MeV and 7.06 MeV respectively, then in the reaction :

$p + {}^7_3Li \rightarrow 2\ {}^4_2He$

energy of proton must be :

1) 28.24 MeV
2) 17.28 MeV
3) 1.46 MeV
4) 39.2 MeV

41. An electric bulb is rated 220 volt -100 watt. The power consumed by it when operated on 110 volt will be

1) 75 watt
2) 40 watt
3) 25 watt
4) 50 watt

42. The 'rad' is the correct unit used to report the measurement of :

1) the ability of a beam of gamma ray photons to produce ions in a target
2) the energy delivered by radiation to a target
3) the biological effect of radiation
4) the rate of decay of a radioactive source

43. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time :

1) at the mean position of the platform

2) for an amplitude of g/ω^2

3) for an amplitude of g^2/ω^2

4) at the highest position of the platform

44. Four point masses, each of value rn, are placed at the corners of a square ABCD of side *l*. The moment of inertia of this system about an axis passing through A and parallel to BD is :

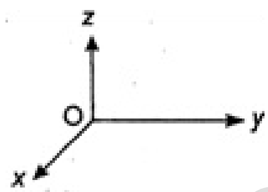
1) $2\ ml^2$

2) $\sqrt{3}\ ml^2$

3) $3ml^2$

4) ml^2

45. A force of $-F\hat{k}$ acts on O, the origin of the co-ordinate system. The torque about the point (1,-1) is



1) $F(\hat{i} - \hat{j})$
2) $-F(\hat{i} + \hat{j})$
3) $F(\hat{i} + \hat{j})$
4) $-F(\hat{i} - \hat{j})$

46. The potential energy of a 1 kg particle free to move along the x-axis is given by $V(x) = ((x^4/4) - (x^2/2))$ J.
The total mechanical energy of the particle is 2 J. Then, the maximum speed (in m/s) is
1) $3/\sqrt{2}$
2) $\sqrt{2}$
3) $1/\sqrt{2}$
4) 2

47. A thin circular ring of mass m and radius R is rotating about its axis with a constant angular velocity ω. Two objects each of mass M are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with an angular velocity ω' :

1) $(\omega\ (m + 2M))/m$
2) $(\omega(m - 2M))/(m + 2M)$
3) $\omega m/(m + M)$
4) $\omega m/(m + 2M)$

48. A wire elongates by *l* mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire will be (in

mm) :

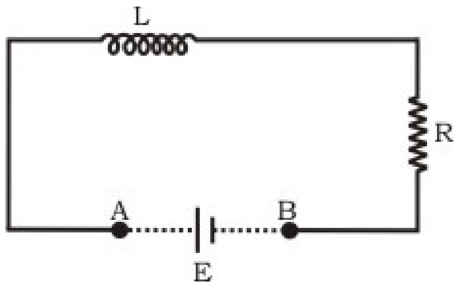
1) I

2) $2I$

3) zero

4) $I/2$

49. An inductor (L = 100 mH), a resistor (R = 10Ω) and a battery (E = 100 V) are. initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the points A and B. The current in the circuit 1 ms after the short circuit is :



1) 1/e A 2) e A 3) 0.1 A 4) 1 A

50. Two spherical conductors A and B of radii 1 mm and 2 mm are separated by a distance of 5 cm and are uniformly charged. If the spheres are connected by a conducting wire then in equilibrium condition, the ratio of the magnitude of the electric fields at the surfaces of spheres A and B is :

1) 4 : 1

2) 1 : 2

3) 2 : 1

4) 1 : 4

51. Two rigid boxes containing different ideal gases are placed on a table. Box A contains one mole of nitrogen at temperature T_0, while box B contains one mole of helium at temperature (7/3) T_0. The boxes are then put into thermal contact with each other, and heat flows between them until the gases reach a common final temperature (Ignore the heat capacity of boxes). Then, the final temperature of the gases, T_f, in terms of T_0 is :

1) T_f = (3/7) T_0

2) T_f = (7/3) T_0

3) T_f = (3/2) T_0

4) T_f = (5/2) T_0

52. The work of 146 kJ is performed in order to compress one kilo mole of a gas adiabatically and in this process the temperature of the gas increases by 7°C. The gas is :
($R = 8.3 J\ mol^{-1}\ K^{-1}$)

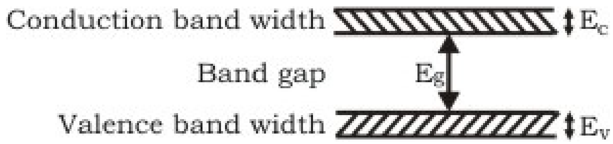
1) diatomic

2) triatomic

3) a mixture of monoatomic and diatomic

4) monoatomic

53. If the lattice constant of this semiconductor is decreased, then which of the following is correct ?



1) All E_c, E_g, E_v increase
2) E_c and E_v increase, but E_g decreases
3) E_c and E_v decrease, but E_g increases
4) All E_c, E_g, E_v decrease

54. The rms value of the electric field of the light coming from the sun is 720 N/C. The average total energy density of the electromagnetic wave is :

1) 4.58×10^{-6} J/m^3
2) 6.37×10^{-9} J/m^3
3) 81.35×10^{-12} J/m^3
4) 3.3×10^{-3} J/m^3

55. If the terminal speed of a sphere of gold (density = 19.5 kg/m^3) is 0.2 m/s in a viscous liquid (density = 1.5 kg/m^3), find the terminal speed of a sphere of silver (density = 10.5 kg/m^3) of the same size in the same liquid.

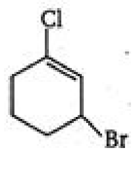
1) 0.4 m/s
2) 0.133 m/s
3) 0.1 m/s
4) 0.2 m/s

Chemistry

56. HBr reacts with $CH_2 = CH — OCH_3$ under anhydrous conditions at room temperature to give :

1) CH_3CHO and CH_3Br
2) $BrCH_2CHO$ and CH_3OH
3) $BrCH_2 — CH_2 — OCH_3$
4) $H_3C — CHBr — OCH_3$

57. The IUPAC name of the compound shown below is :



1) 2-bromo-6-chloroeyclohex-1-ene
2) 6-bromo-2-chlorocyclohexene
3) 3-bromo-1-chlorocyclohexene
4) 1-bromo-3-chlorocyclohexene

58. The increasing order of the rate of HCN addition to compounds A-D is :
(A) HCHO
(B) CH_3COCH_3
(C) $PhCOCH_3$
(D) PhCOPh
1) A < B < C < D
2) D < B < C < A
3) D < C < B < A
4) C < D < B < A

59. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms ?
1) 0.02
2) 3.125×10^{-2}
3) 1.25×10^{-2}
4) 2.5×10^{-2}

60. According to Bohr's theory, the angular momentum of an electron in 5th orbit is :
1) 25 (h/π)
2) 1.0 (h/π)
3) 10 (h/π)
4) 2.5 (h/π)

61. Which of the following molecules/ions does not contain unpaired electrons ?
1) O^{2-}_2
2) B_2
3) N^+_2
4) O_2

62. Total volume of atoms present in a face-centred cubic unit cell of a metal is (r is atomic radius) :
1) $(20/3)\ \pi r^3$
2) $(24/3)\ \pi r^3$
3) $(12/3)\ \pi r^3$
4) $(16/3)\ \pi r^3$

63. A reaction was found to be second order with respect to the concentration of carbon monoxide. If the concentration of carbon monoxide is doubled, with everything else kept the same, the rate of reaction will :

1) remain unchanged
2) triple
3) increases by a factor of 4
4) double

64. Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4 ?

1) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$
2) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_2 + 2H_2O$
3) $NaCl + H_2SO_4 \rightarrow NaHSO_2 + HCl$
4) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

65. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]\ Cl_2$ is :

1) nitrito-N-pentaminecobalt (III) chloride
2) nitrito-N-pentamminecobalt (II) chloride
3) pentammine nitrito-N-cobalt (II) chloride
4) pentaamine nitrito-N-cobalt (III) chloride

66. The term anomers of glucose refers to

1) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)
2) a mixture of (D)-glucose and (L)-glucose
3) enantiomers of glucose
4) isomers of glucose that differ in configuration at carbon one (C-1)

67. In the transformation of $^{238}U_{92}$ to $^{234}U_{92}$, if one emission is an α-particle, what should be the other emission (s) ?

1) Two β^-
2) Two β^- and one β^+
3) One β^- and one γ
4) One β^+ and one β^-

68. Phenyl magnesium bromide reacts with methanol to give :

1) a mixture of anisol and Mg(OH)Br
2) a mixture of benzene and Mg(OMe)Br
3) a mixture of toluene and Mg(OH)Br
4) a mixture of phenol and Mg(Me)Br

69. $CH_3Br + Nu^- \rightarrow CH_3 - Nu + Br^-$

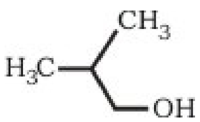
The decreasing order, of the rate of the above reaction with nucleophiles (Nu^-) A to D is:
[Nu^- = (A)PhO^-, (B)AcO^-, (C)HO^-, (D)CH_3O^-]

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

70. The pyrimidine bases present in DNA are :

1) cytosine and adenine
2) cytosine and guanine
3) cytosine and thymine
4) cytosine and uracil

71. Among the following the one that gives positive iodoform test upon reaction with I_2 and NaOH is

1) $CH_3CH2CH(OH)CH_2CH_3$
2) $C_6H_5CH_2CH_2OH$
3) 
4) $PhCHOHCH_3$

Q.72. The increasing order of stability of the following free radicals is :

1) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$
2) $(C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
3) $(C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C} < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$
4) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_3\dot{C} < (C_6H_5)2\dot{C}H$

73. Uncertainty in the position of an electron (mass 9.1×10^{-31} kg) moving with a velocity 300 ms^{-1}, accurate upon 0.001% will be:
($h = 6.63 \times 10^{-34}$ Js)

1) 19.2×10^{-2} m
2) 5.76×10^{-2} m
3) 1.92×10^{-2} m
4) 3.84×10^{-2} m

74. Phosphorus pentachloride dissociates as follows, in a closed reaction vessel,
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
If total pressure at equilibrium of the reaction mixture is P and degree of dissociation of PCl_5 is x, the partial pressure of PCl_3 will be :

1) $(x/(x+1))\,P$
2) $(2x/(1-x))\,P$
3) $(x/(x-1))\,P$
4) $(x/(1-x))\,P$

75. The standard enthalpy of formation (ΔH^o_f) at 298 K for methane, $CH_4(g)$, is - 74.8 kJ mol^{-1}. The additional information required to determine the average energy for C - H bond formation would be :
1) the dissociation energy of H_2 and enthalpy of sublimation of carbon
2) latent heat of vaporization of methane
3) the first four ionization energies of carbon and electron gain enthalpy of hydrogen
4) the dissociation energy of hydrogen molecule, H_2

76. Among the following mixtures, dipole-dipole as the major interaction, is present in :
1) benzene and ethanol
2) acetonitrile and acetone
3) KCl and water
4) benzene and carbon tetrachloride

77. Fluorobenzene (C_6H_5F) can be synthesized in the laboratory :
1) by heating phenol with HF and KF
2) from aniline by diazotisation followed by heating the diazonium salt with HBF_4
3) by direct fluorination of benzene with F_2 gas
4) by reacting bromobenzene with NaF solution

78. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct ?
1) MCl_2 is more volatile than MCl_4
2) MCl_2 is more soluble in anhydrous ethanol than MCl_4
3) MCl_2 is more ionic than MCl_4
4) MCl_2 is more easily hydrolysed than MCl_4

79. Which of the following statement is true ?
1) H_3PO_3 is a stronger acid than H_2SO_3
2) In aqueous medium HF is a stronger acid than HCl
3) $HClO_4$ is a weaker acid than $HClO_3$
4) HNO_3 is a stronger acid than HNO_2

80. The molar conductivities $\Lambda°_{NaOAc}$ and $\Lambda°_{HCl}$ at infinite dilution in water at 25°C are 91.0 and 426.2 S cm^2/mol respectively. To calculate $\Lambda°_{HOAc}$, the additional value required is :

1) $\Lambda°_{H_2O}$

2) $\Lambda°_{KCl}$

3) $\Lambda°_{NaOH}$

4) $\Lambda°_{NaCl}$

81. Which one of the following sets of ions represents a collection of isoelectronic species ?

1) K^+, Cl^-, Ca^{2+}, Sc^{3+}

2) Ba^{2+}, Sr^{2+}, K^+, S^{2-}

3) N^{3-}, O^{2-}, F^-, S^{2-}

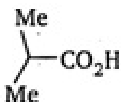
4) Li^+, Na^+, Mg^{2+}, Ca^{2+}

82. The correct order of increasing acid strength of the compounds :

(A) CH_2CO_2H

(B) $McOCH_2CO_2H$

(C) CF_3CO_2H

(D) 

1) B < D < A < C

2) D < A < C < B

3) D < A < B < C

4) A < D < C < B

83. In which of the following molecules/ions all the bonds are not equal ?

1) SF_4

2) SiF_4

3) XeF_4

4) BF_4

84. What products are expected from the disproportionation reaction of hypochlorous acid ?

1) $HClO_3$ and Cl_2O

2) $HClO_2$ and $HClO_4$

3) HCl and Cl_2O

4) HCl and $HClO_3$

85. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to from a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electron (s) in the nickel and geometry of this complex ion are respectively :

1) one, tetrahedral

2) two, tetrahedral

3) one, square planar
4) two, square planar

86. In $Fe(CO)_5$, the Fe–C bond possesses :
1) π-character only
2) both σ and π characters
3) ionic character
4) σ-character only

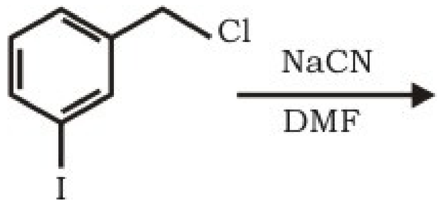
87. The increasing order of the first ionization enthalpies of the elements B, P, S and F (lowest first) is :
1) F < S < P < B
2) P < S < B < F
3) B < P < S < F
4) B < S < P < F

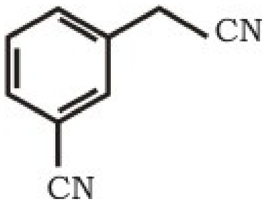
88. An ideal gas is allowed to expand both reversibly and irreversibly in an isolated system. If T_i is the initial temperature and T_f is the final temperature, which of the following statements is correct ?
1) $(T_f)_{irrev} > (T_f)_{rev}$
2) $T_f > T_i$ for reversible process but $T_f = T_i$ for irreversible process
3) $(T_f)_{rev} = (T_f)_{irrev}$
4) $T_f = T_i$ for both reversible and irreversible processes

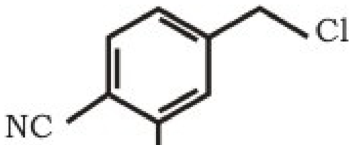
89. In Langmuir's model of adsorption of a gas on a solid surface :
1) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
2) the adsorption at a single site on the surface may involve multiple molecules at the same time
3) the mass of gas striking a given area of surface is proportional to the pressure of the gas
4) the mass of gas striking a given area of surface is independent of the pressure of the gas

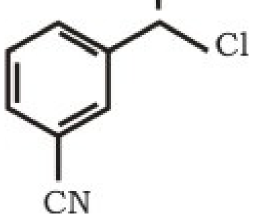
90. Rate of a reaction can be expressed by Arrhenius equation as :
$k = Ae^{-E/RT}$
In this equation, E represents :
1) the energy above which all the colliding molecules will react
2) the energy below which colliding molecules will not react
3) the total energy of the reacting molecules at a temperature, T
4) the fraction of molecules with energy greater than the activation energy of the reaction

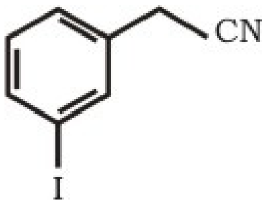
91. The structure of the major product formed in the following reaction is :



1) 

2) 

3) 

4) 

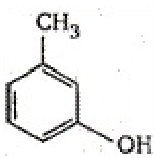
92. Reaction of trans-2-phenyl-1-bromocyclopentane on reaction with alcoholic KOH produces :

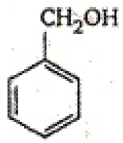
1) 4-phenylcyclopentene
2) 2-phenylcyclopentene
3) 1-phenylcyclopentene
4) 3-phenylcyclopentene

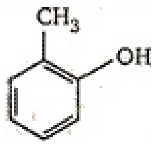
93. Increasing order of stability among the three main conformations (i.e., Eclipse, Anti, Gauche) of 2-fluoroethanol is :

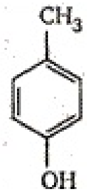
1) Eclipse, Gauche, Anti
2) Gauche, Eclipse, Anti
3) Eclipse, Anti, Gauche
4) Anti, Gauche, Eclipse

94. The structure of the compound that gives a tribromo derivative on treatment with bromine water is :

1) 

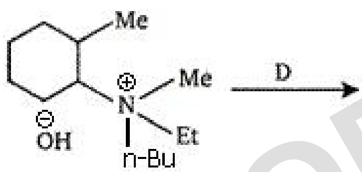
2) 

3) 

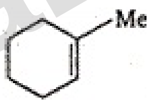
4) 

95. The decreasing values of bond angles from NH_3 (107°) to SbH_3 (91°) down group-15 of the periodic table is due to

   1) increasing bp-bp repulsion
   2) increasing p-orbital character in sp^3
   3) decreasing lp-bp repulsion
   4) decreasing electronegativity

96. 

The alkene formed as a major product in the above elimination reaction is :

   1) 
   2) $CH_2 = CH_2$
   3) 
   4) 

97. The 'spin-only' magnetic moment [in units of Bohr magneton, (μ_β)] of Ni^{2+} in aqueous solution would be (Atomic number of Ni = 28) :

   1) 2.84   2) 4.90   3) 0   4) 1.73

98. The equilibrium constant for the reaction
$SO_3(g) \rightleftharpoons SO_2(g) + (1/2)O_2(g)$
is $K_c = 4.9 \times 10^{-2}$. The value of K_c for the reaction

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3\,(g)$ will be :

1) 416
2) 2.40×10^{-3}
3) 9.8×10^{-2}
4) 4.9×10^{-2}

99. Following statements regarding the periodic trends of chemical reactivity of the alkali metals and the halogens are given. Which of these statements gives the correct picture ?

1) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group
2) In both the alkali metals and the halogens the chemical reactivity decreases with increase in atomic number down the group
3) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens
4) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group

100. Given the data at 25°C,

$Ag + I^- \rightarrow AgI + e^-$; $E° = 0.152V$

$Ag \rightarrow Ag^+ + e^-$; $E° = -0.800V$

What is the value of log K_{sp} for AgI ?

(2.303 (RT/F) = 0.059 V)

1) - 8.12
2) + 8.612
3) - 37.83
4) - 16.13

101. The following mechanism has been proposed for the reaction of NO with Br_2 to form NOBr :

$NO(g) + Br_2(g) \rightleftharpoons NOBr_2(g)$

$NOBr_2\,(g) + NO\,(g) \rightarrow 2NOBr\,(g)$

If the second step is the rate determining step, the order of the reaction with respect to NO (g) is :

1) 1 2) 0 3) 3 4) 2

102. Lanthanoid contraction is caused due to :

1) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
2) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge
3) the same effective nuclear charge from Ce to Lu
4) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge

103. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1 M is 100 Ω. The conductivity of this solution is 1.29 S m^{-1}. Resistance of the same cell

when filled with 0.2 M of the same solution is 520 Ω. The molar conductivity of 0.02 M solution of the electrolyte will be :

1) 124×10^{-4} S m^2 mol^{-1}

2) 1240×10^{-4} S m^2 mol^{-1}

3) 1.24×10^{-4} S m^2 mol^{-1}

4) 12.4×10^{-4} S m^2 mol^{-1}

104. The ionic mobility of alkali metal ions in aqueous solution is maximum for :

1) K^+

2) Rb^+

3) Li^+

4) Na^+

105. Density of a. 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is :

1) 1.14 mol kg^{-1}

2) 3.28 mol kg^{-1}

3) 2.28 mol kg^{-1}

4) 0.44 mol kg^{-1}

106. The enthalpy changes for the following processes are listed below :

Cl_2 (g) = 2Cl(g), 242.3 kJ mol^{-1}

I_2 (g) = 2I (g),151.0 kJ mol^{-1}

ICl (g) = I (g) + Cl (g), 211.3 kJ mol^{-1}

I_2 (s) = I_2 (g), 62.76 kJ mol^{-1}

Given that the standard states for iodine and chlorine are I_2(s) and Cl_2 (g), the standard enthalpy of formation of ICl (g) is :

1) - 14.6 kJ mol^{-1}

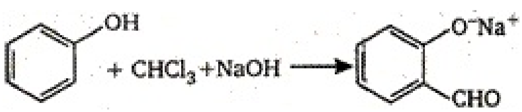
2) - 16.8 kJ mol^{-1}

3) + 16.8 kJ mol^{-1}

4) + 244.8 kJ mol^{-1}

107. How many EDTA (ethylenediaminetetra acetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion ?

1) six 2) three 3) one 4) two

108. 

The electrophile involved in the above reaction is:

1) dichloromethyl cation ($\overset{\oplus}{C}HCl_2$)

2) dichlorocarbene (: CCl_2)

3) trichloromethyl anion ($\bar{C}Cl_3$)

4) formyl cation ($\overset{\oplus}{C}HO$)

109. 18 g of glucose ($C_6H_{12}O_6$) is added to 178.2 g of water. The vapour pressure of water for this aqueous solution at 100°C is :

1) 759.00 torr

2) 7.60 torr

3) 76.00 torr

4) 752.40 torr

110. ($\Delta H - \Delta U$) for the formation of carbon monoxide (CO) from its elements at 298 K is :
($R = 8.314\ JK^{-1}\ mol^{-1}$)

1) $-1238.78\ J\ mol^{-1}$

2) $1238.78\ J\ mol^{-1}$

3) $-2477.57\ J\ mol^{-1}$

4) $2477.57\ J\ mol^{-1}$

Mathematics

111. If the roots of the quadratic equation $x^2 + px + q = 0$ are tan 30° and tan 15° respectively, then the value of $2 + q - p$ is :

1) 3 2) 0 3) 1 4) 2

112. The value of the integral $\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x}+\sqrt{x}}\,dx$ is :

1) 3/ 2 2) 2 3) 1 4) 1/ 2

113. Let W denote the words in the English dictionary. Define the relation R by :
R = {(x, y) ∈ W × W| the words x and y have at least one letter in common}. Then R is :

1) reflexive, symmetric and not transitive

2) reflexive, symmetric and transitive

3) reflexive, not symmetric and transitive

4) not reflexive, symmetric and transitive

114. The number of values of x in the interval [0, 3π] satisfying the equation $2\sin^2 x + 5\sin x - 3 = 0$ is :

1) 6 2) 1 3) 2 4) 4

115. If A and B are square matrices of size $n \times n$ such that $A^2 - B^2 = (A - B)(A + B)$, then which of the following will be always true ?

1) AB = BA
2) either of A or B is a zero matrix
3) either of A or B is an identity matrix
4) A = B

116. The value of $\sum_{k=1}^{10}\left(\sin\frac{2k\pi}{11} + i\cos\frac{2k\pi}{11}\right)$ is :

1) 1 2) - 1 3) - i 4) i

117. Any three vectors such that $\vec{a}\cdot\vec{b} \neq 0$, $\vec{b}\cdot\vec{c} \neq 0$, then $\vec{a}$ and $\vec{c}$ are :

1) inclined at an angle of $(\pi/6)$ between them
2) perpendicular
3) parallel
4) inclined at an angle of $(\pi/3)$ between them

118. All the values of m for which both roots of the equation $x^2 - 2mx + m^2 - 1 = 0$ are greater than -2 but less than 4 lie in the interval :

1) $m > 3$
2) $-1 < m < 3$
3) $1 < m < 4$
4) $-2 < m < 0$

119. ABC is triangle, right angled at A. The resultant of the forces acting along $\overrightarrow{AB}$, $\overrightarrow{AC}$, with magnitudes 1/ AB and 1/AC respectively is the force along $\overrightarrow{AD}$, where D is the foot of the perpendicular from A onto BC. The magnitude of the resultant is :

1) ((AB)(AC))/(AB + AC)
2) (1/AB) + (1/AC)
3) (1/AD)
4) $(AB^2 + AC^2)/((AB)^2 (AC)^2)$

120. Suppose a population A has 100 observations 101, 102, ..., 200 and another population B has 100 observations 151, 152, ..., 250. If V_A and V_B represent the variances of the two population respectively, then (V_A/V_B) is :

1) 9/4 2) 4/9 3) 2/3 4) 1

121. $$\int_{-\frac{3\pi}{2}}^{-\frac{\pi}{2}} [(x+\pi)^3 + \cos^2(x+3\pi)]\, dx \text{ is equal to :}$$

1) $(\pi^4/32) + (\pi/2)$

2) $\pi/2$

3) $(\pi/4) - 1$

4) $\pi^4/32$

122. In an ellipse, the distances between its foci is 6 and minor axis is 8. Then its eccentricity is :

1) 1/2 2) 4/5 3) $1/\sqrt{5}$ 4) 3/5

123. The locus of the vertices of the family of parabolas $y = (a^3x^2/3) + (a^2x/2) - 2a$ is:

1) $xy = 3/4$

2) $xy = 35/16$

3) $xy = 64/105$

4) $xy = 105/64$

124. A straight line through the point A (3, 4) is such that its intercept between the axes is bisected at A. Its equation is :

1) $3x - 4y + 7 = 0$

2) $4x + 3y = 24$

3) $3x + 4y = 25$

4) $x + y = 7$

125. The value of *a*, for which the points A, B, C with position vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $a\hat{i} - 3\hat{j} - \hat{k}$ respectively are the vertices of a right angled triangle with $C = (\pi/2)$ are :

1) -2 and -1

2) -2 and 1

3) 2 and -1

4) 2 and 1

126. $$\int_0^{\pi} x\, f(\sin x)\, dx \text{ is equal to :}$$

1) $$\pi \int_0^{\pi} f(\sin x)\, dx$$

2) $\frac{\pi}{2}\int_{0}^{\pi/2} f(\sin x)\,dx$

3) $\pi\int_{0}^{\pi/2} f(\cos x)\,dx$

4) $\pi\int_{0}^{\pi} f(\cos x)\,dx$

127. The two lines x = ay + b, z = cy + d and x = a' y + b' , z = c' y + d' are perpendicular to each other, if :

1) aa' + cc' = 1
2) (a/a') + (c/c') = -1
3) (a/a') + (c/c') = 1
4) aa' + cc' = -1

128. At an election, a voter may vote for any number of candidates not greater than the number to be elected. There are 10 candidates and 4 are to be elected. If a voter votes for at least one candidate, then the number of ways in which he can vote, is

1) 6210 2) 385 3) 1110 4) 5040

129. If the expansion in powers of x of the function (1/(1- ax) (1 - bx)) is $a_0 + a_1x + a_2x^2 + a_3x^3$ + ..., then a_n is :

1) $(a^n - b^n)/(b - a)$
2) $(a^{n+1} - b^{n+1})/(b - a)$
3) $(b^{n+1} - a^{n+1})/(b - a)$
4) $(b^n - a^n)/(b - a)$

130. For natural numbers m, n if $(1 - y)^m (1 + y)^n = 1 + a_1y + a_2y^2 + ...$ and $a_1 = a_2 = 10$, then (m, n) is :

1) (35, 20)
2) (45, 35)
3) (35, 45)
4) (20, 45)

131. A particle has two velocities of equal magnitude inclined to each other at an angle θ. If one of them is halved, the angle between the other and the original resultant velocity is bisected by the new resultant. Then θ is :

1) 120°
2) 45°

3) 60°

4) 90°

132. At a telephone enquiry system the number of phone calls regarding relevant enquiry follow Poisson distribution with an average of 5 phone calls during 10 minute time intervals. The probability that there is at the most one phone call during a 10 minute time period, is :

1) 6/5

2) 6/55

3) $6/e^5$

4) $6/5^e$

133. A body falling from rest under gravity passes a certain point P. It was at a distance of 400 m from P, 4 seconds prior to passing through P. If g = 10 m/s^2, then the height above the point P from where the body began to fall is :

1) 900 m

2) 320 m

3) 680 m

4) 720 m

134. The set of points, where f(x) = (x/(1 + |x|)) is differentiable, is :

1) (-∞, -1) ∪ (-1, ∞)

2) (-∞, ∞)

3) (0, ∞)

4) (-∞, 0) ∪ (0, ∞)

135. Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$, $a, b, \in N$. Then :

1) there exist more than one but finite number of B's such that AB = BA

2) there exists exactly one B such that AB = BA

3) there exists infinitely many B's such that AB = BA

4) there cannot exist any B such that AB = BA

136. Let a_1, a_2, a_3, ... cannot be terms of an AP. If $(a_1 + a_2 + ... + a_p)/(a_1 + a_2 + ... + a_q) = (P^2/q^2)$, p ≠ q, then (a_6/a_{21}) equals :

1) 7/2 2) 2/7 3) 11/41 4) 41/11

137. The function f (x) = (x/2) + (2/x) has a local minimum at:

1) x = -2

2) x = 0

3) x = 1

4) x = 2

138. Angle between the tangents to the curve $y = x^2 - 5x + 6$ at the points (2, 0) and (3, 0) is :

1) $\pi/2$
2) $\pi/6$
3) $\pi/4$
4) $\pi/3$

139. If x is real, the maximum value of $(3x^2 + 9x + 17)/(3x^2 + 9x + 7)$ is:

1) 41 2) 1 3) 17/7 4) 1/4

140. A triangular park is enclosed on two sides by a fence and on the third side by a straight river bank. The two sides having fence are of same length x. The maximum area enclosed by the park is :

1) $\sqrt{(x^3/8)}$
2) $(1/2)\, x^2$
3) $x\pi^2$
4) $(3/2)\, x^2$

141. If (a, a^2) falls inside the angle made by the lines $y = x/2$, $x > 0$ and $y = 3x$, $x > 0$, then *a* belongs to :

1) $(3, \infty)$
2) $(1/2, 3)$
3) $(-3, -(1/2))$
4) $(0, 1/2)$

142. If $x^m y^n = (x + y)^{m+n}$, then (dy/dx) is :

1) $((x + y)/xy)$
2) xy
3) x/y
4) y/x

143. If the lines $3x - 4y - 7 = 0$ and $2x - 3y - 5 = 0$ are two diameters of a circle of area π 49 square units, the equation of the circle is :

1) $x^2 + y^2 + 2x - 2y - 62 = 0$
2) $x^2 + y^2 - 2x + 2y - 62 = 0$
3) $x^2 + y^2 - 2x + 2y - 47 = 0$
4) $x^2 + y^2 - 2x - 2y - 47 = 0$

144. The image of the point (-1, 3, 4) in the plane $x - 2y = 0$ is:

1) $(9/5, -13/5, 4)$
2) $(-17/3, -19/3, 1)$

3) (8, 4, 4)

4) (-17/3, -19/3, 4)

145. The differential equation whose solution is $Ax^2 + By^2 = 1$, where A and B are arbitrary constant, is of :

1) first order and second degree

2) first order and first degree

3) second order and first degree

4) second order and second degree

146. The value of ${}_1\int^a (x)f\,')(x)\,dx$, $a > 1$, where [x] denotes the greatest integer not exceeding x, is :

1) [a] f(a) - {f(1) + f(2) + ... + f([a])}

2) [a] f([a]) - {f(1) + f(2) + ... + f(a)}

3) a f([a]) - {f(1) + f(2) + ... + f(a)}

4) a f(a) - {f(1) + f(2) + ... + f([a])}

147. Let C be the circle with centre (0, 0) and radius 3 units. The equation of the locus of the mid points of the chords of the circle C that subtend an angle of $(2\pi/3)$ at its centre, is :

1) $x^2 + y^2 = 1$

2) $x^2 + y^2 = 27/4$

3) $x^2 + y^2 = 9/4$

4) $x^2 + y^2 = 3/2$

148. If $a_1, a_2, \ldots, a_n$ are in HP, then the expression $a_1a_2 + a_2a_3 + \ldots. + a_{n-1}\, a_n$ is equal to :

1) $(n-1)\,(a_1 - a_n)$

2) na_1a_n

3) $(n - 1)\, a_1a_n$

4) $n(a_1 - a_n)$

149. If $z^2 + z + 1 = 0$, where z is complex number, then the value of
$(z + (1/z))^2 + (z^2 + (1/z^2))^2 + (z^3 + (1/z^3))^2 + \ldots. + (z^6 + (1/z^6))^2$ is :

1) 54 2) 6 3) 12 4) 18

150. If $0 < x < \pi$ and $\cos x + \sin x = 1/2$, then $\tan x$ is :

1) $(4 - \sqrt{7})/3$

2) $-(4 + \sqrt{7})/3$

3) $(1 + \sqrt{7})/4$

4) $(1 - \sqrt{7})/4$

Answer Key

1) 4	2) 2	3) 4	4) 2	5) 3	6) 1	7) 2	8) 3	9) 4	10) 2
11) 1	12) 1	13) 2	14) 2	15) 4	16) 1	17) 3	18) 3	19) 1	20) 4
21) 1	22) 2	23) 2	24) 3	25) 2	26) 3	27) 3	28) 2	29) 1	30) 4
31) 2	32) 1	33) 3	34) 2	35) 2	36) 1	37) 2	38) 4	39) 2	40) 2
41) 3	42) 3	43) 2	44) 3	45) 1	46) 1	47) 4	48) 1	49) 1	50) 1
51) 3	52) 1	53) 3	54) 1	55) 3	56) 4	57) 3	58) 3	59) 2	60) 4
61) 1	62) 4	63) 3	64) 1	65) 4	66) 4	67) 1	68) 2	69) 1	70) 3
71) 4	Q.72) 1	73) 3	74) 1	75) 1	76) 2	77) 2	78) 3	79) 4	80) 4
81) 1	82) 3	83) 1	84) 4	85) 2	86) 2	87) 4	88) 1	89) 3	90) 2
91) 4	92) 4	93) 3	94) 1	95) 4	96) 2	97) 1	98) 1	99) 4	100) 4
101) 4	102) 4	103) 4	104) 2	105) 3	106) 3	107) 3	108) 2	109) 4	110) 2
111) 1	112) 1	113) 1	114) 4	115) 1	116) 3	117) 3	118) 2	119) 3	120) 4
121) 2	122) 4	123) 4	124) 2	125) 4	126) 3	127) 4	128) 2	129) 3	130) 3
131) 1	132) 3	133) 4	134) 2	135) 3	136) 3	137) 4	138) 1	139) 1	140) 2
141) 2	142) 4	143) 3	144) 1	145) 3	146) 1	147) 3	148) 3	149) 3	150) 2