2006

PHYSICS

1. The Kirchhoff's first law ($\Sigma i = 0$) and second law ($\Sigma iR = \Sigma E$), where the symbols have their usual meanings, are respectively based on
   (a) conservation of charge, conservation of momentum
   (b) conservation of energy, conservation of charge
   (c) conservation of momentum, conservation of charge
   (d) 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
   (a) attract N_1 and N_2 strongly but repel N_3
   (b) attract N_1 strongly, N_2 weakly and repel N_3 weakly
   (c) attract N_1 strongly, but repel N_2 and N_3 weekly
   (d) 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
   (a) 1   (b) $\frac{1}{2}$
   (c) $\frac{1}{4}$ (d) 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
   (a) helix   (b) straight line
   (c) ellipse   (d) circle

5. An electric dipole is placed at an angle of 30˚ to a non-uniform electric field. The dipole will experience
   (a) a translational force only in the direction of the field
   (b) a translational force only in a direction normal to the direction of the field
   (c) a torque as well as a translational force
   (d) 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
   (a) t^2 (b) t
   (c) $t^{1/2}$ (d) 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
   (a) 144 J   (b) 288 J
   (c) 192 J   (d) 96 J

8. A whistle producing sound waves of frequencies 9500 Hz and above is approaching a stationary person with speed v ms^{-1}. If the person can hear frequencies upto a maximum of 10000 Hz, the maximum value of v upto which he can hear the whistle is
   (a) $15\sqrt{2}$ ms^{-1}
   (b) $15/\sqrt{2}$ ms^{-1}
   (c) 15 ms^{-1}
   (d) 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
   (a) $Mg(\sqrt{2} + 1)$
   (b) $Mg\sqrt{2}$
   (c) $\frac{Mg}{\sqrt{2}}$
   (d) $Mg(\sqrt{2} - 1)$

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
    (a) -0.5 J
    (b) -125 J
    (c) 1.25 J
    (d) 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
    (a) 0.01 s
    (b) 10 s
    (c) 0.1 s
    (d) 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 7.5% of the total energy?
    (a) $\frac{1}{6}$ s
    (b) $\frac{1}{4}$ s
    (c) $\frac{1}{3}$ s
    (d) $\frac{1}{12}$ 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.
    (a) $4\pi r_0^2 R^2 \sigma T^4 / r^2$
    (b) $\pi r_0^2 R^2 \sigma T^4 / r^2$
    (c) $r_0^2 R^2 \sigma T^4 / 4\pi r^2$
    (d) $R^2 \sigma T^4 / r^2$

14. Which of the following units denote the dimensions $[ML^2 / Q^2]$, where Q denotes the electric charge?
    (a) Wb/m^2
    (b) Henry (H)
    (c) H/m^2
    (d) 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 m/s^2]
    (a) 4 N
    (b) 16 N
    (c) 20 N
    (d) 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
(a) 105 Hz
(b) 1.05 Hz
(c) 1050 Hz
(d) 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?
(a) m_2/m_1 d
(b) $m_1/m_1 + m_2$ d
(c) m_1/m_2 d
(d) 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 0.1 s, the force of the blow exerted by the ball on the hand of the player is equal to
(a) 150 N
(b) 3 N
(c) 30 N
(d) 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
(a) 49
(b) 50
(c) 51
(d) 48

20. A thermocouple is made of two metals. Antimony and Bismuth. If one junction kept cold, then an electric current will
(a) flow from Antimony to Bismuth at the hot junction
(b) flow from Bismuth to Antimony at the cold junction
(c) not flow through the thermocouple
(d) flor from Antimony to Bismuth at the cold junction

21. The threshold frequency for metallic surface corresponds to an energy of 6.2 eV and stopping potential for a radiation incident on this surface is 5V. The incident radiation lies in
(a) ultraviolet region
(b) infrared region
(c) visible region
(d) X-ray region

22. An alpha nucleus of energy $\frac{1}{2} mv^2$ bombards a heavy nuclear target of charge Ze. Then, the distance of closest approach for the alpha nucleus will be proportional to
(a) v^2
(b) $1/m$
(c) $1/v^4$
(d) $1/Ze$

23. The time taken by a photoelectron to come out after the photon strikes is approximately
(a) 10^{-4}s
(b) 10^{-10}s
(c) 10^{-16}s
(d) 10^{-1}s

24. When $_3Li^7$ nuclei are bombarded by protons and the resultant nuclei are $_4Be^8$, the emitted particles will be
    (a) alpha particles   (b) beta particles
    (c) gamma photons   (d) neutrons

25. The current I drawn from the 5 V source will be
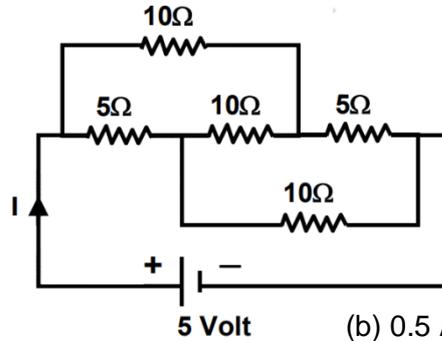
   (a) 0.33 A   (b) 0.5 A
    (c) 0.67 A   (d) 0.17 A

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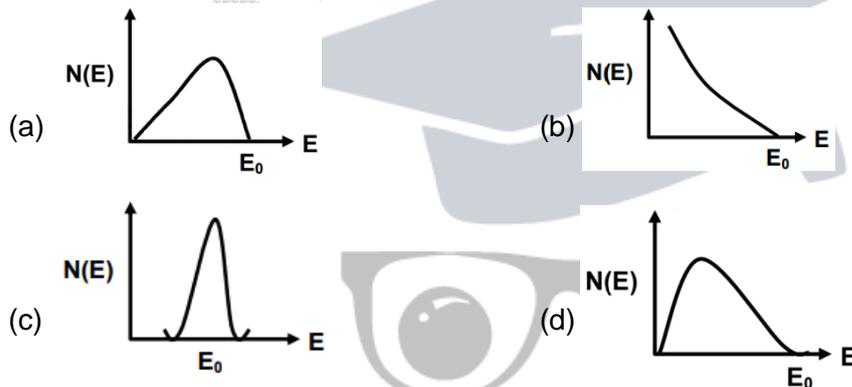

27. In a series resonant LCR circuit, the voltage across R is 100 V and R = 1k Ω with C = 2μ F. The resonant frequency ω is 200 rad/s. At resonance, the voltage across L is
    (a) 2.5×10^{-2} V   (b) 40 V
    (c) 250 V   (d) 4×10^{-3} V

28. The resistance of a bulb filament is 100 Ω at a temperature of 100°C. If its temperature coefficient of resistance is 0.005/°C, its resistance will become 200 Ω at a temperature of
    (a) 300°C   (b) 400°C
    (c) 500°C   (d) 200°C

29. Two insulating plates are both uniformly charged in such a way that the potential difference between them is $V_2 - V_1 = 20$ V (i.e., plate 2 is at a higher potential). The plates are separated by $a = 0.1$ 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)
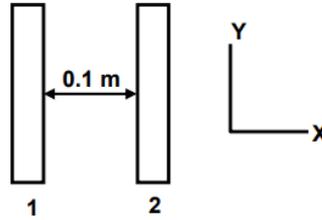
(a) 2.65×10^6 m/s

(b) 7.02×10^{12} m/s

(c) 1.87×10^6 m/s

(d) 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

(a) NABRω

(b) NAB

(c) NABR

(d) NABω
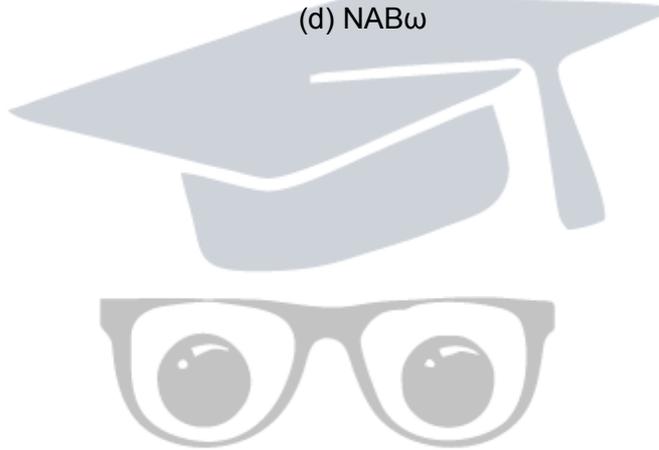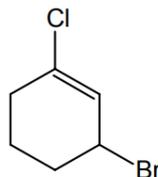
CHEMISTRY

31. HBr reacts with $CH_2 = CH - OCH_3$ under anhydrous conditions at room temperature to give
    (a) CH_3CHO and CH_3Br
    (b) $BrCH_2CHO$ and CH_3OH
    (c) $BrCH_2 - CH_2 - OCH_3$
    (d) $H_3C - CHBr - OCH_3$

32. The IUPAC name of the compound shown below is

    (a) 2-bromo-6-chlorocyclohex-1-ene
    (b) 6-bromo-2chlorocyclohexene
    (c) 3-bromo-1-chlorocyclohexene
    (d) 1-bromo-3-chlorocyclohexene

33. The increasing order of the rate of HCN addition to compounds I-IV is
    (I) HCHO
    (II) CH_3COCH_3
    (III) $PhCOCH_3$
    (IV) PhCOPh
    (a) I < II < III < IV
    (b) IV < II < III < I
    (c) IV < III < II < I
    (d) III < IV < II < I

34. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms?
    (a) 0.02
    (b) 3.125×10^{-2}
    (c) 1.25×10^{-2}
    (d) 2.5×10^{-2}

35. According to Bohr's theory, the angular momentum of an electron in 5th orbit is
    (a) $25\frac{h}{\pi}$
    (b) $1.0\frac{h}{\pi}$
    (c) $10\frac{h}{\pi}$
    (d) $2.5\frac{h}{\pi}$

36. Which of the following molecules/ions does not contain unpaired electrons?
    (a) O_2^{2-}
   (b) B_2
    (c) N_2^{+}
    (d) O_2

37. Total volume of atoms present in a face-centred cubic unit cell of a metal is (r is atomic radius)
    (a) $\frac{20}{3}\pi r^3$
    (b) $\frac{24}{3}\pi r^3$
    (c) $\frac{12}{3}\pi r^3$
    (d) $\frac{16}{3}\pi r^3$

38. 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 ratio of reaction will
    (a) remain unchanged
    (b) triple
    (c) increases by a factor of 4
    (d) double

39. Which of the following chemical reactions depicts the oxidising behaviour of H_2SO_4?
    (a) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$
    (b) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$
    (c) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$
    (d) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

40. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]Cl_2$ is
    (a) nitrito-N-pentaaminecobalt (III) chloride
    (b) nitrito-N-pentaaminecobalt (II) chloride
    (c) pentaamine nitrito-N-cobalt (II) chloride
    (d) pentaamine nitrito-N-cobalt (III) chloride

41. The term anomers of glucose refers to
    (a) isomers of glucose that differ in configurations at carbons one and four (C-1 and C-4)
    (b) a mixture of (D)-glucose and (L)-glucose
    (c) enantiomers of glucose
    (d) isomers of glucose that differ in configuration at carbon one (C-1)

42. In the transformation of $^{238}_{92}U$ to $^{234}_{92}U$, if one emission is an α-particle, what should be the other emission(s)?
    (a) Two β^- (b) Two β^- and one B^+
    (c) One β^- and one γ   (d) One β^+ and one B^-

43. Phenyl magnesium bromide reacts with methanol to give
    (a) a mixture of anisol and Mg(OH)Br
    (b) a mixture of benzene and Mg(OMe)Br
    (c) a mixture of toluene and Mg(OH)Br
    (d) a mixture of phenol and Mg(Me)Br

44. $CH_3Br + Nu^- \rightarrow CH_3 - Nu + Br^-$ The decreasing order of the rate of the above reaction with nucleophiles (Nu⁻) I to IV is
    [Nu^- = (I)PhO^-,(II)AcO^-,(III)HO^-,(IV)CH_3O^-]
    (a) IV > III > I < II   (b) IV > III > II > I
    (c) I > II > III > IV   (d) II > IV > III > I

45. The pyrimidine bases present in DNA are
    (a) cytosine and adenine   (b) cytosine and guanine
    (c) cytosine and thymine   (d) cytosine and uracil

46. Among the following the one that gives positive iodoform test upon reaction with I_2 and NaOH is
    (a) $CH_3CH_2CH(OH)CH_2CH_3$ (b) $C_6H_5CH_2CH_2OH$
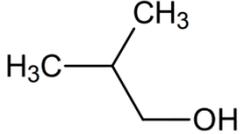
    (c)
    $$H_3C-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}$$
    (d) $PhCHOHCH_3$

47. The increasing order of stability of the following free radicals is
    (a) $(CH_3)_2$ CH$<$ $(CH_3)_3$ C $<$ $(C_6H_5)_2$ CH $<$ $(C_6H_5)_3$ C
    (b) $(C_6H_5)_3$ C $<$ $(C_6H_5)_2$ CH $<$ $(CH_3)_3$ C $<$ $(CH_3)_2$ CH
    (c) $(C_6H_5)_2$ CH $<$ $(C_6H_5)_3$ C $<$ $(CH_3)_3$ C $<$ $(CH_3)_2$ CH
    (d) $(CH_3)_2$ CH $<$ $(CH_3)_3$ C $<$ $(C_6H_5)_3$ C $<$ $(C_6H_5)_2$ CH

48. 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 = 6.63×10^{-34} Js)
    (a) 19.2×10^{-2} m   (b) 5.76×10^{-2} m
    (c) 1.92×10^{-2} m   (d) 3.84×10^{-2} m

49. 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
    (a) (x / x + 1) p   (b) (2x / 1 – x) p
    (c) (x / x – 1) p   (d) (x / 1 – x) p

50. The standard enthalpy of formation ($\Delta H°_f$) 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
    (a) the dissociation energy of H_2 and enthalpy of sublimation of carbon
    (b) latent heat of vaporisation of methane
    (c) the first four ionisation energies of carbon and electron gain enthalpy of hydrogen
    (d) the dissociation energy of hydrogen molecule, H_2

51. Among the following mixtures, dipole-dipole as the major interaction, is present in
    (a) benzene and ethanol   (b) acetonitrile and acetone
    (c) KCl and water   (d) benzene and carbon tetrachloride

52. Fluorobenzene (C_6H_5F) can be synthesized in the laboratory
    (a) by heating phenol with HF and KF
    (b) from anline by diazotisation followed by heating the diazonium salt with HBF_4
    (c) by direct fluorination of benzene with F_2 gas
    (d) by reacting bromobenzene with NaF solution

53. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct?
    (a) MCl_2 is more volatile than MCl_4
    (b) MCl_2 is more soluble I anhydrous ethanol than MCl_4
    (c) MCl_2 is more ionic than MCl_4
    (d) MCl_2 is more easily hydrolysed than MCl_4

54. Which of the following statement is true?
    (a) H_3PO_3 is a stronger acid than H_2SO_3
    (b) In aqueous medium HF is a stronger acid than HCl
    (c) $HClO_4$ is a weaker acid than $HClO_3$
    (d) HNO_3 is a stronger acid than HNO_2

55. The molar conductivities Λ°_{NaOAc} the Λ°_{HCl} at infinite dilution in water at 25°C are 91.0 and 426.2 S cm^2/ mol respectively. To calculate $\Lambda^\circ_{HOAc,}$ the additional value required?
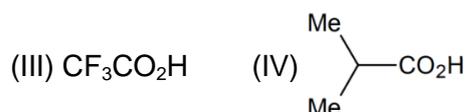   (a) $\Lambda^\circ H_2O$
    (b) Λ°_{KCl}
    (c) $\Lambda^\circ NaOH$
    (d) $\Lambda^\circ NaCl$

56. Which one of the following sets of ions represents a collection of isoelectronic species?
    (a) K^+, Cl^-, Ca^{2+}, Sc^{3+}
    (b) Ba^{2+}, Sr^{2+}, K^+, S^{2-}
    (c) N^{3-}, O^{2-}, F^-, S^{2-}
    (d) Li^+, Na^+, Mg^{2+}, Ca^{2+}

57. The correct order of increasing acid strength of the compounds
    (I) CH_3CO_2H (II) $MeOCH_2CO_2H$

    (III) CF_3CO_2H (IV) $\begin{array}{c} Me \\ \diagdown \\ \diagup \\ Me \end{array}\!\!-CO_2H$

    (a) II < IV < I < III
    (b) IV < I < III < II
    (c) IV < I < II < III
    (d) I < IV < III < II

58. In which of the following molecules/ions, all the bonds are not equals?
    (a) SF_4
    (b) SIF_4
    (c) XeF_4
    (d) BF_4^-

59. What products are expected from the disproportionation reaction of hypochlorous acid?
    (a) HCl_3 and Cl_2O
    (b) $HClO_2$ and $HClO_4$
    (c) HCl and Cl_2O
    (d) HCl and $HClO_3$

60. Nickel (Z = 28) combines with a uninegative monodentate ligand $[NiX_4]^{2-}$. The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively
    (a) one, tetrahedral
    (b) two, tetrahedral
    (c) one, square planar
    (d) two, square planar

61. 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
    (a) 3   (b) 0
    (c) 1   (d) 2

62. The value of the integral $\int_3^6 \sqrt{x}/\sqrt{9-x} + \sqrt{x}\, dx$ is
    (a) $\frac{3}{2}$ (b) 2
    (c) 1   (d) $\frac{1}{2}$

63. Let W denotes the words in the English dictionary. Define the relation R by R = {(x, y) ε W x W : the words x and y have atleast one letter I common}. Then, R is
    (a) reflexive, symmetric and not transitive
    (b) reflexive, symmetric and transitive
    (c) reflexive, not symmetric and transitive
    (d) not reflexive, symmetric and transitive

64. The number of values of x in the interval [0, 3π] satisfying the equation $2 \sin^2 z + 5 \sin x - 3 = 0$ is
    (a) 6   (b) 1
    (c) 2   (d) 4

65. If A and B are square matrices of size n x n such that $A^2 - B^2 = (A - B)(A + B)$, then which of the following will be always true?
    (a) AB = BA   (b) Either of A or B is a zero matrix
    (c) Either of A or B is an identity matrix   (d) A = B

66. The value of $\sum_{k=1}^{10}(\sin\frac{2k\pi}{11} + i \cos 2k\pi/11)$ is
    (a) 1   (b) -1
    (c) –i   (d) i

67. If (a x b) x c = a x (b x c), where a, b and c are any three vectors such that a.b ≠ 0, b.c ≠ 0, then a and c are
    (a) inclined at an angle of $\frac{\pi}{6}$ between them
    (b) perpendicular
    (c) parallel
    (d) inclined at an angle of $\frac{\pi}{3}$ between them

68. 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
    (a) m > 3   (b) -1 < m < 3
    (c) 1 < m < 4   (d) -1 < m < 0

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

(a) $\frac{(AB)(AC)}{AB+AC}$

(b) $\frac{1}{AB} + \frac{1}{AC}$

(c) $\frac{1}{AD}$

(d) $AB^2 + AC^2 / (AB)^2(AC)^2$

70. 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 populations respectively, then V_A/V_B is

(a) $\frac{9}{4}$

(b) $\frac{4}{9}$

(c) $\frac{2}{3}$

(d) 1

71. $\int_{-3\pi/2}^{-\pi/2}[(x + \pi)^3 + \cos^2(x + 3\pi)]\,dx$ is equal to

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

(b) $\pi/2$

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

(d) $\pi^4/32$

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

(a) $\frac{1}{2}$

(b) $\frac{4}{5}$

(c) $\frac{1}{\sqrt{5}}$

(d) $\frac{3}{5}$

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

(a) $xy = \frac{3}{4}$

(b) $xy = \frac{35}{16}$

(c) $xy = \frac{64}{105}$

(d) $xy = \frac{105}{64}$

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

(a) $3x - 4y + 7 = 0$

(b) $4x + 3y = 24$

(c) $3x + 4y = 25$

(d) $x + y = 7$

75. The value of a, for which the points A, B, C with position vectors 2i – j + k, I – 3j – 5k and ai – 3j + k respectively are the vertices of a right angled triangle with $C = \frac{\pi}{2}$ are

(a) -2 and -1

(b) -2 and 1

(c) 2 and -1

(d) 2 and 1

76. $\int_0^\pi xf(\sin x)\,dx$ is equal to

(a) $\pi\int_0^\pi f(\sin x)\,dx$

(b) $\frac{\pi}{2}\int_0^{\pi/2} f(\sin x)\,dx$

(c) $\pi\int_0^{\pi/2} f(\cos x)\,dx$

(d) $\pi\int_0^\pi f(\cos x)\,dx$

77. The two lines x = ay + b, z = cy + d and x = a'y + b' z = c'y + d' perpendicular to each other, if
   (a) aa' + cc' = 1
   (b) $\frac{a}{a'} + \frac{c}{c'}$ = -1
   (c) $\frac{a}{a'} + \frac{c}{c'}$ = 1
   (d) aa' + cc' = -1

78. 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 atleast one candidate, then the number of ways in which he can vote, is
   (a) 6210
   (b) 385
   (c) 1110
   (d) 5040

79. If the expansion in powers of x of the function $\frac{1}{(1-ax)(1-bx)}$. is $a_0 + a_1x + a_2x^2 + a_3x^3 + \ldots$, then a_n is
   (a) $a^n - b^n / b - a$
   (b) $a^{n+1} - b^{n+1}/b - a$
   (c) $b^{n+1} - a^{n+1}/b - a$
   (d) $b^n - a^n / b - a$

80. For natural numbers m, n, if $(1-y)^m (1 + y)^n = 1 + a_1y + a_2y^2 + \ldots$ and $a_1 = a_2 = 10$, then (m, n) is
   (a) (35, 20)
   (b) (45, 35)
   (c) (35, 45)
   (d) (20, 45)

81. 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
   (a) 120°
   (b) 45°
   (c) 60°
   (d) 90°

82. 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 min time intervals. The probability that there is atmost one phone call during a 10 min time period, is
   (a) $\frac{5}{6}$
   (b) $\frac{6}{55}$
   (c) $6/e^5$
   (d) $6/5^e$

83. A body falling from rest under gravity passes a certain point P. It was at a distance of 400 m from P, 4 s prior to passing through P. If g = 10m/s^2, then the height above the point P from where the body began to fall is
   (a) 900 m
   (b) 320 m
   (c) 680 m
   (d) 720 m

84. The set of points, where f(x) = $\frac{x}{1+|x|}$ is differentiable, is
   (a) (-∞, -1) ∪ (-1,∞)
   (b) (-∞, ∞)
   (c) (0, ∞)
   (d) (-∞,0) ∪ (0,∞)

85. Let A = $\begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix}$ and B = $\begin{matrix} a & 0 \\ 0 & b \end{matrix}$, a, b, ε N.
   Then,
   (a) there exist more than one but finite number of B's such that AB = BA
   (b) there exists exactly one B such that AB=BA
   (c) there exist infinitely many B's such that AB=BA
   (d) there cannot exist any B such that AB=BA

86. Let a_1, a_2, a_3, … be terms of an AP. If $a_1 + a_2 + … + a_p / a_1 + a_2 + … + a_q$, p ≠ q, then a_6/a_{21} equals
   (a) $\frac{7}{2}$ (b) $\frac{2}{7}$
   (c) $\frac{11}{41}$ (d) $\frac{41}{11}$

87. The function f(x) = $\frac{x}{2} + \frac{2}{x}$ has a local minimum at
   (a) x = -2   (b) x = 0
   (c) x = 1   (d) x = 2

88. Angle between the tangents to the curve $y = x^2 – 5x + 6$ at the points (2, 0) and (3, 0) is
   (a) π/2   (b) π/6
   (c) π/4   (d) π/3

89. If x is real, the maximum value of $3x^2 + 9x + 17/3x^2 + 9x + 7$ is
   (a) 41   (b) 1
   (c) 17/7   (d) 1/4

90. 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 area of same length x. The maximum area enclosed by the park is
   (a) $\sqrt{\dfrac{x^3}{8}}$ (b) $\frac{1}{2} x^2$
   (c) πx^3 (d) $\frac{3}{2} x^2$