AIEEE - 2002
Physics and Chemistry

1. Which statement is incorrect ?
(a) all reversible cycles have same efficiency
(b) reversible cycle has more efficiency than an irreversible one
(c) Carnot cycle is a reversible one
(d) Carnot cycle has the maximum efficiency in all cycles

2. Length of a string tied to two rigid supports is 40 cm. Maximum length (wave length in cm) of a stationary wave produced on it is
(a) 20 (b) 80 (c) 40 (d)120

3. The power factor of an AC circuit having resistance (R) and inductance (L) connected in series and an angular velocity ω is
(a) $R/\omega L$ (b) $R/(R^2+\omega^2L^2)^{1/2}$ (c) $\omega L/R$ (d) $R/(R^2-\omega^2L^2)^{1/2}$

4. An astronomical telescope has a large aperture to
(a) reduce spherical aberration (b) have high resolution
(c) increase span of observation (d) have low dispersion

5. The kinetic energy needed to project a body of mass m from the earth surface (radius R) to infinity is
(a) mgR/2 (b) 2mgR (c) mgR (d) mgR/4

6. If an ammeter is to be used in place of a voltmeter, then we must connect with the ammeter a
(a) low resistance in parallel (b) high resistance in parallel
(c) high resistance in series (d) low resistance in series

7. If in a circular coil A of radius R, current I is flowing and in another coil B of radius 2R a current 2I is flowing, then the ratio of the magnetic fields B_A and B_B, produced by them will be
(a) 1 (b) 2 (c) 1/2 (d) 4

8. If two mirrors are kept at 60^0 to each other, then the number of images formed by them is
(a) 5 (b) 6 (c) 7 (d) 8

9. A wire when connected to 220 V mains supply has power dissipation P_1. Now the wire is cut into two equal pieces which are connected in parallel to the same supply. Power dissipation in this case is P_2. Then $P_2 : P_1$ is
(a) 1 (b) 4 (c) 2 (d) 3

10. If 13.6 eV energy is required to ionize the hydrogen atom, then the energy required to remove an electron from n = 2 is
(a) 10.2 eV (b) 0 eV (c) 3.4 eV (d) 6.8 eV

11. Tube A has both ends open while tube B has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is
(a) 1 : 2 (b) 1 : 4 (c) 2 : 1 (d) 4 : 1

12. A tuning fork arrangement (pair) produces 4 beats / sec with one fork of frquency 288 cps. A little wax is placed on the unknown fork and it then produces 2 beats /sec. The frequency of the unknown fork is
(a) 286 cps (b) 292 cps (c) 294 cps (d) 288 cps

13. A wave $y = a\sin(\omega t - kx)$ on a string meets with another wave producing a node at x = 0. Then the equation of the unknown wave is

(a) $y = a\sin(\omega t + kx)$ (b) $y = -a\sin(\omega t + kx)$

(c) $y = a\sin(\omega t - kx)$ (d) $y = -a\sin(\omega t - kx)$

14. On moving a charge of 20 coulombs by 2cm, 2 J of work is done, then the potential difference between the points is

(a) 0.1 V (b) 8 V (c) 2 V (d) 0.5 V

15. If an electron and a proton having same momenta enter perpendicular to a magnetic field, then

(a) curved path of electron and proton will be same (ignoring the sense of revolution)

(b) they will move undeflected

(c) curved path of electron is more curved than that of the proton

(d) path of proton is more curved

16. In a simple harmonic oscillator, at the mean position

(a) kinetic energy is minimum, potential energy is maximum

(b) both kinetic and potential energies are maximum

(c) kinetic energy is maximum, potential energy is minimum

(d) both kinetic and potential energies are minimum

17. Initial angular velocity of a circular disc of mass M is ω_1. Then two small spheres of mass m are attached gently to diametrically opposite points on the edge of the disc. What is the final angular velocity of the disc?

(a $\left(\frac{M+m}{M}\right)\omega_1$ (b) $\left(\frac{M+m}{m}\right)\omega_1$ (c) $\left(\frac{M}{M+4m}\right)\omega_1$ (d) $\left(\frac{M}{M+2m}\right)\omega_1$

18. The minimum velocity (in ms^{-1}) with which a car driver must traverse a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is

(a) 60 (b) 30 (c) 15 (d) 25

19. A cylinder of height 20 m is completely filled with water. The velocity of efflux of water (in ms^{-1}) through a small hole on the side wall of the cylinder near its bottom is

(a) 10 (b) 20 (c) 25.5 (d) 5

20. A spring of force constant 800 N/m has an extension of 5 cm. The work done is extending it from 5 cm to 15 cm is

(a) 16 J (b) 8 J (c) 32 J (d) 24 J

21. Two identical particles move towards each other with velocity 2v and v respectively. The velocity of centre of mass is

(a) v (b) v/3 (c) v/2 (d) zero

22. If a current is passed through a spring then the spring will

(a) expand (b) compress (c) remains same (d) none of these

23. Heat given to a body which raises its temperature by 1^0C is

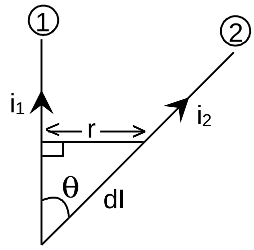
(a) water equivalent (b) thermal capacity (c) specific heat (d) temperature gradient

24. At absolute zero, Si acts as

(a) non metal (b) metal (c) insulator (d) none of these

25. Electromagnetic waves are transverse in nature is evident by
(a) polarization (b) interference (c) reflection (d) diffraction

26. Wires 1 and 2 carrying currents i_1 and i_2 respectively are inclined at an angle θ to each other. What is the force on a small element dl of wire 2 at a distance of r from wire 1 (as shown in the figure) due to the magnetic field of wire 1?



(A) $\frac{\mu_0}{2\pi r} i_1 i_2\, dl \tan\theta$ (b) $\frac{\mu_0}{2\pi r} i_1 i_2\, dl \sin\theta$

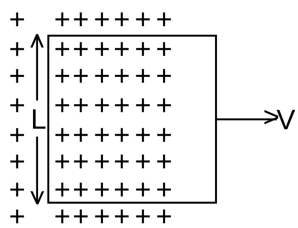
(c) $\frac{\mu_0}{2\pi r} i_1 i_2\, dl \cos\theta$ (d) $\frac{\mu_0}{4\pi r} i_1 i_2\, dl \sin\theta$

27. At a specific instant emission of radioactive compound is deflected in a magnetic field. The compound can emit
(i) electrons (ii) protons (iii) He^{2+} (iv) neutrons
The emission at instant can be
(a) i, ii, iii (b) i, ii, iii, iv (c) iv (d) ii, iii

28. Sodium and copper have work functions 2.3 eV and 4.5 eV respectively. Then the ratio of the wave lengths is nearest to
(a) 1 : 2 (b) 4 : 1 (c) 2 : 1 (d) 1 : 4

29. Formation of covalent bonds in compounds exhibits
(a) wave nature of electron (b) particle nature of electron
(c) both wave and particle nature of electron (d) none of these

30. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane at the loop exists everywhere with half the loop outside the field, as shown in figure. The induced emf is



(a) zero (b) RvB (c) VBL/R (d) VBL

31. Infra red radiation is detected by
(a) spectrometer (b) pyrometer (c) nanometer (d) photometer

32. If N_0 is the original mass of the substance of half- life period $t_{1/2}$ = 5 years, then the amount of substance left after 15 years is
(a) $N_0/8$ (b) $N_0/16$ (c) $N_0/2$ (d) $N_0/4$

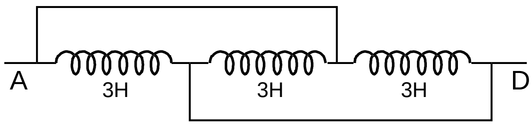
33. By increasing the temperature, the specific resistance of a conductor and a semiconductor
(a) increases for both (b) decreases for both
(c) increases, decreases (d) decreases, increases

34. If there are n capacitors in parallel connected to V volt source, then the energy stored is equal to
(a) CV (b) $\frac{1}{2}nCV^2$ (c) CV^2 (d) $\frac{1}{2n}CV^2$

35. Which of the following is more closed to a black body?
(a) black board paint (b) green leaves (c) black holes (d) red roses

36. The inductance between A and D is

(a) 3.66 H (b) 9 H (c) 0.66 H (d) 1 H



37. A ball whose kinetic energy is E, is projected at an angle of 45^0 to the horizontal. The kinetic energy of the ball at the highest point of its flight will be

(a) E (b) $E/\sqrt{2}$ (c) E/2 (d) zero

38. From a building two balls A and B are thrown such that A is thrown upwards A and B downwards (both vertically). If v_A and v_B are their respective velocities on reaching the ground, then

(a) $v_B > v_A$ (b) $v_A = v_B$
(c) $v_A > v_B$ (d) their velocities depend on their masses

39. If a body looses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?

(a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm

40. If suddenly the gravitational force of attraction between Earth and a satellite revolving around it becomes zero, then the satellite will

(a) continue to move in its orbit with same velocity
(b) move tangentially to the originally orbit in the same velocity
(c) become stationary in its orbit (d) move towards the earth.

41. Cooking gas containers are kept in a lorry moving with uniform speed. The temperature of the gas molecules inside will

(a) increase (b) decrease
(c) remain same (d) decrease for some, while increase for others

42. When temperature increases, the frequency of a tuning fork

(a) increases (b) decreases
(c) remains same (d) increases or decreases depending on the material

43. If mass-energy equivalence is taken into account, when water is cooled to form ice, the mass of water should

(a) increase (b) remain unchanged
(c) decrease (d) first increase then decrease

44. The energy band gap is maximum in

(a) metals (b) superconductors (c) insulators (d) semiconductors

45. The part of a transistor which is most heavily doped to produce large number of majority carriers is

(a) emmiter (b) base
(c) collector (d) can be any of the above three

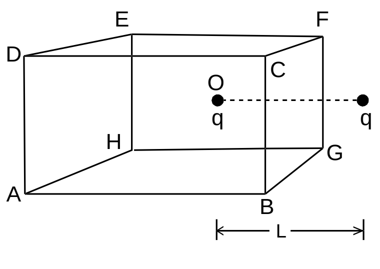
46. Energy required to move a body of mass m from an orbit of radius 2R to 3R is

(a) $GMm/12R^2$ (b) $GMm/3R^2$ (c) GMm/8R (d) GMm/6R

47. If a spring has time period T, and is cut into n equal parts, then the time period of each part will be

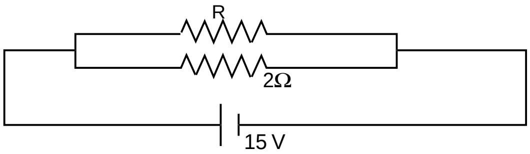
(a) $T\sqrt{n}$ (b) $T/\sqrt{n}$ (c) nT
(d) T

48. A charged particle q is placed at the centre O of cube of length L (A B C D E F G H). Another same charge q is placed at a distance L from O. Then the electric flux through ABCD is



(a) $q/4\pi\epsilon_0 L$ (b) zero (c) $q/2\pi\epsilon_0 L$ (d) $q/3\pi\epsilon_0 L$

49. If in the circuit, power dissipation is 150 W, then R is



(a) 2Ω (b) 6Ω
(c) 5Ω (d) 4Ω

50. Wavelength of light used in an optical instrument are $\lambda_1 = 4000\overset{0}{\text{A}}$ and $\lambda_2 = 5000\overset{0}{\text{A}}$, then ratio of their respective resolving powers (corresponding to λ_1 and λ_2) is
(a) 16 : 25 (b) 9 : 1 (c) 4 : 5 (d) 5 : 4

51. A child swinging on a swing in sitting position, stands up, then the time period of the swing will
(a) increase (b) decrease (c) remains same
(d) increases if the child is tall and decreases if the child is short

52. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively
(a) g, g (b) g - a, g - a (c) g - a, g (d) a, g

53. The mass of product liberated on anode in an electrochemical cell depends on
(a) $(It)^{1/2}$ (b) IT (c) I/t (d) I^2t
(where t is the time period, for which the current is passed)

54. At what temperature is the r.m.s. velocity of a hydrogen molecule equal to that of an oxygen molecule at 47^0 C?
(a) 80 K (b) - 73 K (c) 3 K (d) 20 K

55. The time period of a charged particle undergoing a circular motion in a uniform magnetic field is independent of its
(a) speed (b) mass (c) charge (d) magnetic induction

56. A solid sphere, a hallow sphere and a ring are released from top of an inclined plane (frictionless) so that they slide down the plane. Then maximum acceleration down the plane is for (no rolling)
(a) solid sphere (b) hollow sphere (c) ring (d) all same

57. In a transformer , number of turns in the primary coil are 140 and that in the secondary coil are 280. If current in primary coil is 4A, then that in the secondary coil is
(a) 4 A (b) 2 A (c) 6 A (d) 10 A

58. Even Carnot engine cannot give 100% efficiency because we cannot
(a) prevent radiation (b) find ideal sources
(c) reach absolute zero temperature (d) eliminate friction

59. Moment of inertia of a circular wire of mass M and radius R about its diameter is
(a) $MR^2/2$ (b) MR^2 (c) $2MR^2$ (d) $MR^2/4$

60. When forces F_1, F_2, F_3 are acting on a particle of mass m such that F_2 and F_3 are mutually perpendicular, then the particle remains stationary. If the force F_1 is now removed then the acceleration of the particle is
(a) F_1/m (b) F_2F_3/mF_1 (c) $(F_2 - F_3)/m$ (d) F_2/m

61. Two forces are such that the sum of their magnitudes is 18 N and their resultant is 12 N which is perpendicular to the smaller force. Then the magnitudes of the forces are
(a) 12 N, 6 N (b) 13 N, 5 N (c) 10 N, 8 N (d) 16 N, 2 N

62. Speeds of two identical cars are u and 4u at the specific instant. The ratio of the respective distances in which the two cars are stopped from that instant is
(a) 1 : 1 (b) 1 : 4 (c) 1 : 8 (d) 1 : 16

63. 1 mole of a gas with $\gamma = 7/5$ is mixed with 1 mole of a gas with $\gamma = 5/3$, then the value of γ for the resulting mixture is
(a) 7/5 (b) 2/5 (c) 24/16 (d) 12/7

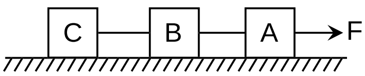
64. If a charge q is placed at the centre of the line joining two equal charges Q such that the system is in equilibrium then the value of q is
(a) Q/2 (b) -Q/2 (c) Q/4 (d) -Q/4

65. Capacitance (in F) of a spherical conductor with radius 1 m is
(a) 1.1×10^{-10} (b) 10^{-6} (c) 9×10^{-9} (d) 10^{-3}

66. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is g/8, then the ratio of the masses is
(a) 8 : 1 (b) 9 : 7 (c) 4 : 3 (d) 5 : 3

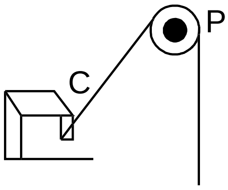
67. Two spheres of the same material have radii 1 m and 4m and temperatures 4000 K and 2000 K respectively. The ratio of the energy radiated per second by the first sphere to that by the second is
(a) 1 : 1 (b) 16 : 1 (c) 4 : 1 (d) 1 : 9

68. Three identical blocks of masses m = 2kg are drawn by a force F = 10.2 N with an acceleration of 0.6 ms^{-2} on a frictions surface, then what is the tension (in N) in the string between the blocks B and C ?



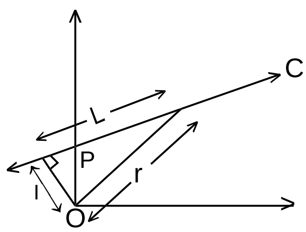
(a) 9.2 (b) 7.8 (c) 4 (d) 9.8

69. One end of a massless rope, which passes over a massless and frictionless pulley P is tied to a hook C while the other end is free. Maximum tension that the rope can bear is 360 N. With what value of maximum safe acceleration (in ms^{-2}) can a man of 60 kg climb on the rope?



(a) 16 (b) 6 (c) 4 (d) 8

70. A particle of mass m moves along line PC with velocity v as shown. What is the angular momentum of the particle about P?



(a) mvL (b) mvl
(c) mvr (d) zero

71. Which of the following is used in optical fibres ?
(a) total internal reflection (b) scattering (c) diffraction
(d) refraction

72. The escape velocity of a body depends upon mass as
(a) m^0 (b) m^1 (c) m^2 (d) m^3

73. Which of the following are not electromagnetic waves?
(a) cosmic rays (b) gamma rays (c) $\beta -$rays (d) X- rays

74. Identify the pair whose dimensions are equal
(a) torque and work (b) stress and energy (c) force and stress (d) force and work

75. If θ_i, is the inversion temperature , θ_n is the neutral temperature, θ_c is the temperature of the cold junction, then
(a) $\theta_i + \theta_c = \theta_n$ (b) $\theta_i - \theta_c = 2\theta_n$ (c) $\frac{\theta_i + \theta_C}{2} = \theta_n$ (d) $\theta_c - \theta_i = 2\theta_n$

76. When H_2S is passed through Hg_2S we get
(a) HgS (b) HgS + Hg_2S (c) Hg_2S (d) Hg_2S_2

77. Alum helps in purifying water by
(a) forming Si complex with clay particles
(b) sulphate part which combines with the dirt and removes it
(c) coagulating the mud particles
(d) making mud water soluble

78. A square planar complex is formed by hybridisation of which atomic orbitals ?
(a) s, p_x, p_y, d_{yz} (b) $s, p_x, p_y, d_{x^2-y^2}$ (c) s, p_x, p_y, d_{z^2} (d) s, p_y, p_z, d_{xy}

79. Polymer formation from monomers starts by
(a) condensation reaction between monomers
(b) coordinate reaction between monomers
(c) conversion of monomer to monomer ions by protons
(d) hydrolysis of monomers

80. The type of isomerism present in nitropentamine chromium (III) chloride is
(a) optical (b) linkage (c) ionization (d) polymerisation

81. Arrangement of $(CH_3)_3$ - C-, $(CH_3)_2$ - CH-, CH_3 - CH_2 - when attached to benzyl or an unsaturated group in increasing order of inductive effect is
(a) $(CH_3)_3$-C - < $(CH_3)_2$ - CH - < CH_3 - CH_2 (b) CH_3 - CH_2 - < $(CH_3)_2$- < CH - < $(CH_3)_3$ - C -
(c) $(CH_3)_2$ - CH - < $(CH_3)_3$ - C - < CH_3, - CH_2 (d) $(CH_3)_3$-C - < CH_3 - CH_2 - $(CH_3)_2$ - CH-

82. CH_3 - Mg - Br is an organo metallic compound due to
(a) Mg - Br bond (b) C - Mg bond (c) C - Br bond (d) C - H bond

83. 1 M NaCl and 1 M HCl are present in an aqueous solution. The solution is
(a) not a buffer solution with pH < 7 (b) not a buffer solution with pH > 7
(c) a buffer solution with pH < 7 (d) a buffer solution with pH > 7

84. Species acting as both Bronsted acid and base is
(a) $(HSO_4)^{-1}$ (b) Na_2CO_3 (c) NH_3 (d) OH^{-1}

85. Let the solubility of an aqueous solution of $Mg(OH)_2$ be x then its k_{sp} is
(a) $4x^3$ (b) $108x^5$ (c) $27x^4$ (d) 9x

86. Units of rate constant of first and zero order reactions in terms of molarity M unit are respectively
(a) sec^{-1}, $Msec^{-1}$ (b) sec^{-1}, M (c) $Msec^{-1}$, sec^{-1} (d) M, sec^{-1}

87. In XeF_2, XeF_4, XeF_6 the numebr of lone pairs of Xe are respectively
(a) 2, 3, 1 (b) 1, 2, 3 (c) 4, 1, 2 (d) 3, 2, 1

88. In which of the folloiwng species the interatomic bond angle is $109^0 28'$?
(a) NH_3, $(BF_4)^{-1}$ (b) $(NH_4)^+$, BF_3 (c) NH_3, BF_4 (d) $(NH_2)^{-1}$, BF_3

89. For the reaction A + 2B $\longrightarrow$ C, rate is given by R = [A] $[B]^2$ then the order of the reaction is
(a) 3 (b) 6 (c) 5 (d) 7

90. RNA is different from DNA because RNA contains
(a) ribose sugar and thymine (b) ribose sugar and uracil
(c) deoxyribose sugar and thymine (d) deoxyribose sugar and uracil

91. Which of the following are arranged in an increasing order of their bond strengths ?

(a) $O_2^- < O_2 < O_2^+ < O_2^{2-}$ (b) $O_2^{2-} < O_2^- < O_2 < O_2^+$

(c) $O_2^- < O_2^{2-} < O_2 < O_2^+$ (d) $O_2^+ < O_2 < O_2^- < O_2^{2-}$

92. If an endothermic reaction is non- spantaneous at freezing point of water and becomes feasible at its boiling point, then

(a) ΔH is $-$ve, ΔS is $+$ve (b) ΔH and ΔS both are $+$ve

(c) ΔH and ΔS both are $-$ve (d) ΔH is $+$ve, ΔS is $-$ve

93. A heat engine absorbs heat Q_1 at temperature T_1 and heat Q_2 at temperature T_2. Work done by the engine is $J(Q_1 + Q_2)$. This data

(a) violates 1st law of thermodynamics (b) violates 1st law of thermodynamics if Q_1 is -ve

(c) violates 1st law of thermodynamics if Q_2 is -ve

(d) does not violate 1st law of thermodynamics

94. Most common oxidation states of Ce (cerium) are

(a) +2, +3 (b) +2, +4 (c) +3, +4 (d) +3, +5

95. Arrange Ce^{+3}, La^{+3}, Pm^{+3} and Yb^{+3} in increasing order of their ionic radii

(a) $Yb^{+3} < Pm^{+3} < Ce^{+3} < La^{+3}$ (b) $Ce^{+3} < Yb^{+3} < Pm^{+3} < La^{+3}$

(c) $Yb^{+3} < Pm^{+3} < La^{+3} < Ce^{+3}$ (d) $Pm^{+3} < La^{+3} < Ce^{+3} < Yb^{+3}$

96. KO_2 (potassium super oxide) is used in oxygen cylinders in space and submarines because it

(a) absorbs CO_2 and increases O_2 content (b) eliminates moisture

(c) absorbs CO_2 (d) produces ozone.

97. A similarity between optical and geometrical isomerism is that

(a) each forms equal number of isomers for a given compound

(b) If in a compound one is present then so is the other

(c) both are included in stereoisomerism (d) they have no similarity

98. Which of the following does not show geometrical isomerism?

(a) 1, 2-dichloro - 1- pentene (b) 1, 3 - dichloro - 2- pentene

(c) 1, 1- dichloro - 1- pentene (d) 1, 4 - dichloro - 2- pentene

99. In case of nitrogen, NCl_3 is possible but not NCl_5 while in case of phosphorous, PCl_3 as well as PCl_5 are possible. It is due to

(a) availability of vacant d orbitals in P but not in N

(b) lower electronegativity of P than N

(c) lower tendency of H - bond formation in P than N

(d) occurrence of P in solid while N in gaseous state at room temperature

100. For an ideal gas, number of moles per litre in terms of its pressure P, gas contant R and temperature T is

(a) PT/R (b) PRT (c) P/RT (d) RT/P

101. The formation of gas at the surface of tungsten due to adsorption is the reaction of order

(a) 0 (b) 1 (c) 2 (d) insufficient data

102. The solubility of $Mg(OH)_2$ is S moles/litre. The solubility product under the same condition is

(a) $4S^3$ (b) $3S^4$ (c) $4S^2$ (d) S^3

103. How do we differentiate between Fe^{3+} and Cr^{3+} in group III?

(a) by taking excess of NH_4OH solution (b) by increasing NH_4^+ ion concentration
(c) by decreasing OH^- ion concentration (d) both (b) and (c)

104. In a compound C, H and N atoms are present in 9 : 1 : 35 by weight. Molecular weight of compound is 108. Molecular formula of compound is

(a) $C_2H_6N_2$ (b) C_3H_4N (c) $C_6H_8N_2$ (d) $C_9H_{12}N_3$

105. The functional group, which is found in amino acid is

(a) -COOH group (b) - NH_2 group (c) - CH_3 group (d) both (a) and (b)

106. Conductivity (unit Siemen's S) is directly proportional to area of the vessel and the concentration of the solution in it and is inversely proportional to the length of the vessel then the unit of the constant of proportionality is

(a) $Sm\ mol^{-1}$ (b) $Sm^2\ mol^{-1}$ (c) $S^{-2}m^2\ mol$ (d) $S^2m^2\ mol^{-2}$

107. In a hydrogen atom, if energy of an electron in ground state is 13.6 eV, then that in the 2nd excited state is

(a) 1.51 eV (b) 3.4 eV (c) 6.04 eV (d) 13.6 eV

108. Which of the following statements is true ?

(a) HF is less polar than HBr
(b) absolutely pure water does not contain any ions
(c) chemical bond formation take place when forces of attraction overcome the forces of repulsion
(d) in covalency transference of electron takes place

109. Which of the following compounds has wrong IUPAC name ?

(a) $CH_3-CH_2-CH_2-COO-CH_2CH_3 \longrightarrow$ ethyl butanoate

(b) $CH_3-\underset{\displaystyle CH}{\underset{|}{C}}H-CH_2-CHO \longrightarrow$ 3-methyl–butanal

(c) $CH_3-\underset{\displaystyle OH}{\underset{|}{C}}H-\underset{\displaystyle CH_3}{\underset{|}{C}}H-CH_3 \longrightarrow$ 2 - methyl–3–butanol

(d) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}H-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-CH_3 \longrightarrow$ 2–methyl–3–pentanone

110. $CH_3CH_2COOH \xrightarrow[\text{red P}]{Cl_2} A \xrightarrow{\text{alc. KOH}} B$. What is B?

(a) CH_3CH_2COCl (b) CH_3CH_2CHO (c) $CH_2 = CHCOOH$ (d) $ClCH_2CH_2COOH$

111. Aluminium is extracted by the electrolysis of

(a) bauxite (b) alumina (c) alumina mixed with molten cryolite
(d) molten cryolite

112. The metal extracted by leaching with a cyanide is

(a) Mg (b) Ag (c) Cu (d) Na

113. Value of gas constant R is

(a) 0.082 litre atm (b) 0.987 cal $mol^{-1}K^{-1}$ (c) 8.3 J mol^{-1} K^{-1} (d) 83 erg mol^{-1} K^{-1}

114. Freezing point of an aqueous solution is (-0.186)^{0}C. Elevation of boiling point of the same solution is K_b = 0.512 ^{0}C, K_f = 1.86 ^{0}C, find the increase in boiling point.
(a) 0.186 ^{0}C (b) 0.0512 ^{0}C (c) 0.092 ^{0}C (d) 0.2372 ^{0}C

115. EMF of a cell in terms of reduction potental of its left and right electrodes is
(a) $E = E_{left} - E_{right}$ (b) $E = E_{left} + E_{right}$ (c) $E = E_{right} - E_{left}$ (d) $E = -(E_{right} + E_{left})$

116. Uncertainity in position of a minute particle of mass 25 g in space is 10^{-5} m. What is the uncertainity in its velocity (in ms^{-1}) ? (h = 6.6 $\times$ 10^{-34} Js)
(a) 2.1 $\times$ 10^{-34} (b) 0.5 $\times$ 10^{-34} (c) 2.1 $\times 10^{-28}$ (d) 0.5 $\times$ 10^{-23}

117. Which of these will not react with acetylene ?
(a) NaOH (b) ammonical $AgNO_3$ (c) Na (d) HCl

118 Change in volume of the system does not alter the number of moles in which of the following equilibria ?
(a) $N_2(g) + O_2(g) \rightleftharpoons 2\ NO(g)$ (b) $PCl_5\ (g) \rightleftharpoons PCl_3\ (g) + Cl_2\ (g)$
(c) $N_2\ (g) + 3H_2\ (g) \rightleftharpoons 2NH_3\ (g)$ (d) $SO_2Cl_2\ (g) \rightleftharpoons SO_2\ (g) + Cl_2\ (g)$

119. For the reactions,
$C + O_2 \longrightarrow CO_2 \quad ; \Delta H = -393J$
$2Zn + O_2 \longrightarrow 2ZnO \; ; \Delta H = -412J$
(a) carbon can oxidise Zn (b) oxidation of carbon is not feasible
(c) oxidation of Zn is not feasible (d) Zn can oxidise carbon

120. Which of the following ions has the maximum magnetic moment ?
(a) Mn^{+2} (b) Fe^{+2} (c) Ti^{+2} (d) Cr^{+2}

121. In which of the following species is the underlined carbon having sp^3 hybridisation?
(a) $CH_3\underline{C}OOH$ (b) $CH_3\underline{C}H_2OH$ (c) $CH_3\underline{C}OCH_3$ (d) $CH_2 = \underline{C}H - CH_3$

122. Racemic mixture is formed by mixing two
(a) isomeric compounds (b) chiral compounds
(c) meso compounds (d) optical isomers

123. The differential rate law for the reaction $H_2 + I_2 \rightarrow 2HI$ is
(a) $-\frac{d[H_2]}{dt} = -\frac{d[I_2]}{dt} = -\frac{d[HI]}{dt}$ (b) $\frac{d[H_2]}{dt} = \frac{d[I_2]}{dt} = \frac{1}{2}\frac{d[HI]}{dt}$
(c) $\frac{1}{2}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[I_2]}{dt} = -\frac{d[HI]}{dt}$ (d) $-2\frac{d[H_2]}{dt} = -2\frac{d[I_2]}{dt} = \frac{d[HI]}{dt}$

124. Number of sigma bonds in P_4O_{10} is
(a) 6 (b) 7 (c) 17 (d) 16

125. Kinetic theory of gases proves
(a) only Boyle's law (b) only Charles' law (c) only Avogadro's law (d) all of these

126. A metal M readily forms its sulphate MSO_4 which is water - soluble. It forms its oxide MO which becomes inert on heating. It forms an insoluble hydroxide $M(OH)_2$ which is soluble in NaOH solution. Then M is
(a) Mg (b) Ba (c) Ca (d) Be

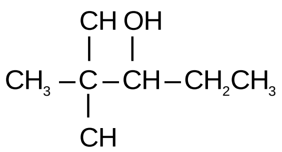
127. If ϕ denotes reduction potential, then which is true ?
(a) $E^0_{cell} = \phi_{right} - \phi_{left}$ (b) $E^0_{cell} = \phi_{left} + \phi_{right}$ (c) $E^0_{cell} = \phi_{left} - \phi_{right}$ (d) $E^0_{cell} = -(\phi_{left} + \phi_{right})$

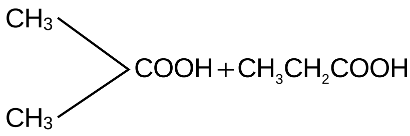
128. What is the product when acetylene reacts with hypochlorous acid ?

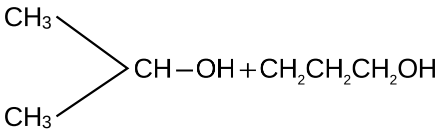
(a) CH_3COCl (b) $ClCH_2CHO$ (c) Cl_2CHCHO (d) ClCHCOOH

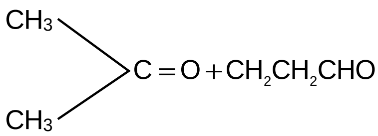
129. On vigorous oxidation by permanganate solution

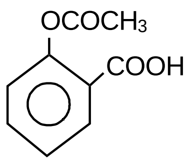
$(CH_3)_2C = CH - CH_2 - CHO$ gives

(a) 

(b) 

(c) 

(d) 

130. The compound  is used as

(a) antiseptic (b) antibiotic (c) analgesic (d) pesticide

131. What will be the emf for the given cell Pt | H_2 (P_1) | H^+ (aq) | | H_2 (P_2) | Pt

(a) $\frac{RT}{f}\log\frac{P_1}{P_2}$ (b) $\frac{RT}{2f}\log\frac{P_1}{P_2}$ (c) $\frac{RT}{f}\log\frac{P_2}{P_1}$ (d) none of these

132. When primary amine reacts with chloroform in ethanoic KOH then the product is

(a) an isocyanide (b) an aldehyde (c) a cyanide (d) an alcohol

133. Which of the following reaction is possible at anode?

(a) $2Cr^{3+} + 7H_2O \rightarrow Cr_2O_7^{2-} + 14H^+$ (b) $F_2 \rightarrow 2F^-$

(c) $(1/2)\ O_2 + 2H^+ \rightarrow H_2O$ (d) none of these

134. The reaction : $(CH_3)_3C-Br \xrightarrow{H_2O} (CH_3)_3-C-OH$

(a) elimination reaction (b) substitution reaction

(c) free radical reaction (d) displacement reaction

135. If half-life of a substance is 5 yrs, then the total amount of substance left after 15 years, when initial amount is 64 grams is

(a) 16 grams (b) 2 grams (c) 32 grams (d) 8 grams

136. Cyanide process is used for the extraction of

(a) barium (b) aluminium (c) boron (d) silver

137. Which is the correct order of ionic sizes ?

(a) Ce > Sn > Yb > Lu (b) Sn > Ce > Lu > Yb (c) Lu > Yb > Sn > Ce (d) Sn > Yb > Ce > Lu

(Atomic Number : Ce = 58, Sn = 50, Yb = 70 and Lu = 71)

138. With increase of temperature, which of these changes?

(a) molality (b) weight fraction of solute

(c) fraction of solute present in water (d) mole fraction

139. The integrated rate equation is Rt = log C_0 - log C_t . The straight line graph is obtained by plotting

(a) time vs log C_t (b) $\frac{1}{\text{time}}$ vs C_t (c) time vs C_t (d) $\frac{1}{\text{time}}$ vs $\frac{1}{C_t}$

140. In which of the following reactions, increase in the volume at constant temperature does not affect the number of moles at equilibrium

(a) $2NH_3 \rightarrow N_2 + 3H_2$ (b) $C(g) + (1/2)O_2(g) \rightarrow CO(g)$

(c) $H_2(g) + O_2(g) \rightarrow H_2O_2(g)$ (d) none of these

141. When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrodes are

cathode	**anode**	**cathode**	**anode**
(a) pure zinc	pure copper	(b) impure sample	pure copper
(c) impure zinc	impure sample	(d) pure copper	impure sample

142. The most stable ion is

(a) $[Fe(OH)_3]^{3-}$ (b) $[Fe(Cl)_6]^{3-}$ (c) $[Fe(CN)_6]^{3-}$ (d) $[Fe(H_2O)_6]^{3+}$

143. β - particle is emitted in radioactivity by

(a) conversion of proton to neutron (b) from outermost orbit

(c) conversion of neutron to proton (d) β -particle is not emitted

144. In mixture A and B component show -ve deviation as

(a) $\Delta V_{mix} > 0$ (b) $\Delta H_{mix} < 0$

(c) A - B interaction is weaker than A - A and B - B interaction

(d) A - B interaction is stronger than A - A and B - B interaction

145. The heat required to raise the temperature of body by 1 K is called

(a) specific heat (b) thermal capacity (c) water equivalent (d) none of these

146. Na and Mg crystallize in BCC and FCC type crystals respectively, then the number of atoms of Na and Mg present in the unit cell of their respective crystal is

(a) 4 and 2 (b) 9 and 14 (c) 14 and 9 (d) 2 and 4

147. Number of atoms in 558.5 gram Fe (at.wt. of Fe = 55.85 g mol^{-1}) is

(a) twice that in 60 g carbon (b) 6.023×10^{22}

(c) half that in 8g He (d) $558.5 \times 6.023 \times 10^{23}$

148. When $KMnO_4$ acts as an oxidising agent and ultimately forms $[MnO_4]^{-1}$, MnO_2, Mn_2O_3, Mn^{+2} then the number of electrons transferred in each case respectively is

(a) 4, 3, 1, 5 (b) 1, 5, 3, 7 (c) 1, 3, 4, 5 (d) 3, 5, 7, 1

149. Which of the following is a redox reaction ?

(a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$ (b) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

(c) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$ (d) $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

150. For the reaction $CO(g) + (1/2)O_2(g) = CO_2(g)$, K_p / K_c is

(a) RT (b) $(RT)^{-1}$ (c) $(RT)^{-1/2}$ (d) $(RT)^{1/2}$

AIEEE - 2002
Mathematics

1. If $\alpha \neq \beta$ but $\alpha^2 = 5\alpha - 3$ and $\beta^2 = 5\beta - 3$ then the equation having α / β and β / α as its roots is
(a) $3x^2 - 19x + 3 = 0$ (b) $3x^2 + 19x - 3 = 0$
(c) $3x^2 - 19x - 3 = 0$ (d) $x^2 - 5x + 3 = 0$

2. If y = $(x+\sqrt{1+x^2})^n$, then $(1+x^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx}$ is
(a) n^2y (b) $-n^2y$ (c) $-y$ (d) $2x^2y$

3. If 1, $\log_9(3^{1-x}+2)$, $\log_3(4.3^x-1)$ are in A.P. then x equals
(a) $\log_3 4$ (b) $1+\log_3 4$ (c) $1-\log_4 3$ (d) $\log_4 3$

4. A problem in mathematics is given to three students A, B, C and their respective probability of solving the problem is $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$. Probability that the problem is solved is
(a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) $\frac{1}{3}$

5. The period of $\sin^2\theta$ is
(a) π^2 (b) π (c) 2π (d) $\pi/2$

6. l, m, n are the p^{th}, q^{th} and r^{th} term of a G.P. all positive, then $\begin{vmatrix} \log l & p & 1 \\ \log m & q & 1 \\ \log n & r & 1 \end{vmatrix}$ equals
(a) -1 (b) 2 (c) 1 (d) 0

7. $\lim_{x \to 0} \frac{\sqrt{1-\cos 2x}}{\sqrt{2}x}$ is
(a) 1 (b) -1 (c) zero (d) does not exist

8. A triangle with vertices (4, 0), (-1, -1), (3, 5) is
(a) isosceles and right angled (b) isosceles but not right angled
(c) right angled but not isosceles (d) neither right angled nor isoceles

9. In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class is 72, then what is the average of the girls?
(a) 73 (b) 65 (c) 68 (d) 74

10. $\cot^{-1}(\sqrt{\cos\alpha}) = \tan^{-1}(\sqrt{\cos\alpha}) = x$, then $\sin x =$
(a) $\tan^2\left(\frac{\alpha}{2}\right)$ (b) $\cot^2\left(\frac{\alpha}{2}\right)$ (c) $\tan\alpha$ (d) $\cot\left(\frac{\alpha}{2}\right)$

11. The order and degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^{2/3} = 4\frac{d^3y}{dx^3}$ are

(a) $(1, \frac{2}{3})$ (b) (3, 1) (c) (3, 3) (d) (1, 2)

12. A plane which passes through the point (3, 2, 0) and the line $\frac{x-4}{1} = \frac{y-7}{5} = \frac{z-4}{4}$ is

(a) x - y + z = 1 (b) x + y + z = 5 (c) x + 2y - z = 1 (d) 2x - y + z = 5

13. The solution of the equation $\frac{d^2y}{dx^2} = e^{-2x}$

(a) $\frac{e^{-2x}}{4}$ (b) $\frac{e^{-2x}}{4} + cx + d$ (c) $\frac{1}{4}e^{-2x} + cx^2 + d$ (d) $\frac{1}{4}e^{-4x} + cx + d$

14. $\lim_{x\to\infty}\left(\frac{x^2+5x+3}{x^2+x+3}\right)^{\frac{1}{x}}$

(a) e^4 (b) e^2 (c) e^3 (d) 1

15. The domain of $\sin^{-1} [\log_3 (x/3)]$ is

(a) [1, 9] (b) [-1,9] (c) [-9, 1] (d) [-9, -1]

16. The value of $2^{1/4}, 4^{1/8}, 8^{1/6} + ... \infty$ is

(a) 1 (b) 2 (c) 3/2 (d) 4

17. Fifth term of a GP is 2, then the product of its 9 terms is

(a) 256 (b) 512 (c) 1024 (d) none of these

18. $\int_0^{10\pi} |\sin x|\, dx$ is

(a) 20 (b) 8 (c) 10 (d) 18

19. $I_n = \int_0^{\pi/4} \tan^n x\, dx$ then $\lim_{n\to\infty} n[I_n + I_{n-2}]$ equals

(a) $\frac{1}{2}$ (b) 1 (c) ∞ (d) zero

20. $\int_0^{\sqrt{2}} [x^2]dx$ is

(a) $2-\sqrt{2}$ (b) $2+\sqrt{2}$ (c) $\sqrt{2}-1$ (d) $\sqrt{2}-2$

21. $\int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{1+\cos^2 x}dx$ is

(a) $\frac{\pi^2}{4}$ (b) π^2 (c) zero (d) $\frac{\pi}{2}$

22. Let f(x) = 4 and $f'(x) = 4$. Then $\lim_{x \to 2} \frac{xf(2) - 2f(x)}{x - 2}$ is given by

(a) 2 (b) - 2 (c) - 4 (d) 3

23. z and w are two non zero complex no.s such that | z | = | w | and Arg z + Arg w = π then z equals

(a) $\overline{w}$ (b) $-\overline{w}$ (c) w (d) - w

24. If | z-4 | < | z-2 |, its solution is given by

(a) Re(z) > 0 (b) Re(z) < 0 (c) Re (z) > 3 (d) Re(z) > 2

25. The locus of the centre of a circle which touches the circle $| z - z_1 | = a$ and $| z - z_2 | = b$ externally (z, z_1 and z_2 are complex numbers) will be

(a) an ellipse (b) a hyperbola (c) a circle (d) none of these

26. Sum of infinite number of terms of GP is 20 and sum of their square is 100. The common ratio of GP is

(a) 5 (b) 3/5 (c) 8/5 (d) 1/5

27. $1^3 - 2^3 + 3^3 - 4^3 + ... + 9^3 =$

(a) 425 (b) - 425 (c) 475 (d) - 475

28. Difference between the corresponding roots of $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ is same and $a \neq b$, then

(a) a + b + 4 = 0 (b) a + b - 4 = 0 (c) a - b - 4 = 0 (d) a - b + 4 = 0

29. Product of real roots of the equation $t^2x^2 + |x| + 9 = 0$

(a) is always positive (b) is always negative

(c) does not exist (d) none of these

30. If p and q are the roots of the equation $x^2 + px + q = 0$, then

(a) p =1, q = -2 (b) p = 0, q = 1 (c) p = -2, q = 0 (d) p = -2, q = 1

31. If a, b, c are distinct +ve real numbers and $a^2 + b^2 + c^2 = 1$ then ab + bc + ca is

(a) less than 1 (b) equal to 1 (c) greater than 1 (d) any real no.

32. Total number of four digit odd numbers that can be formed using 0, 1, 2, 3, 5, 7 (using repetition allowed) are

(a) 216 (b) 375 (c) 400 (d) 720

33. Number greater than 1000 but less than 4000 is formed using the digits 0, 1, 2, 3, 4 (repetition allowed) is

(a) 125 (b) 105 (c) 375 (d) 625

34. Five digit number divisible by 3 is formed using 0, 1, 2, 3, 4, 6 and 7 without repetition. Total number of such numbers are

(a) 312 (b) 3125 (c) 120 (d) 216

35. The sum of integers from 1 to 100 that are divisible by 2 or 5 is

(a) 3000 (b) 3050 (c) 3600 (d) 3250

36. The coefficients of x^p and x^q in the expansion of $(1+x)^{p+q}$ are

(a) equal (b) equal with opposite signs

(c) reciprocals of each other (d) none of these

37. If the sum of the coefficients in the expansion of $(a + b)^n$ is 4096, then the greatest coefficient in the expansion is

(a) 1594 (b) 792 (c) 924 (d) 2924

38. The positive integer just greater than $(1+0.0001)^{10000}$ is
(a) 4 (b) 5 (c) 2 (d) 3

39. r and n are positive integers r > 1, n > 2 and coefficient of $(r + 2)^{th}$ term and $3r^{th}$ term in the expansion of $(1+x)^{2n}$ are equal, then n equals
(a) 3r (b) 3r + 1 (c) 2r (d) 2r + 1

40. If a > 0 discriminant of $ax^2 + 2bx + c$ is -ve, then $\begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix}$ is
(a) +ve (b) $(ac - b^2)(ax^2 + 2bx + c)$ (c) -ve (d) 0

41. If $a_n = \sqrt{7+\sqrt{7+\sqrt{7+.....}}}$ having n radical signs then by methods of mathematical induciton which is true
(a) $a_n > 7 \; \forall \; n \geq 1$ (b) $a_n > 7 \; \forall \; n \geq 1$ (c) $a_n < 4 \; \forall \; n \geq 1$ (d) $a_n < 3 \; \forall \; n \geq 1$

42. The sides of a triangle are 3x + 4y, 4x+37 and 5x + 57 where x, y > 0 then the triangle is
(a) right angled (b) obtuse angled (c) equilateral (d) none of these

43. Locus of mid point of the portion between the axes of $x\cos\alpha + y\sin\alpha = p$ where p is constant is
(a) $x^2 + y^2 = \frac{4}{p^2}$ (b) $x^2 + y^2 = 4p^2$ (c) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{2}{p^2}$ (d) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$

44. If the pair of lines $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ intersect on the y - axis then
(a) $2fgh = bg^2 + ch^2$ (b) $bg^2 \neq ch^2$ (c) abc = 2fgh (d) none of these

45. The point of lines represented by $3ax^2+5xy + (a^2-2)y^2 = 0$ and perpendicular to each other for
(a) two values of a (b) $\forall$ a (c) for one value of a (d) for no values of a

46. If the chord y = mx + 1 of the circle $x^2 + y^2 = 1$ subtends an angle of measure 45^0 at the major segment of the circle then value of m is
(a) $2 \pm \sqrt{2}$ (b) $-2 \pm \sqrt{2}$ (c) $-1 \pm \sqrt{2}$ (d) none of these

47. The centres of a set of circles, each of radius 3, lie on the circle $x^2 + y^2 = 25$. The locus of any point in the set is
(a) $4 \leq x^2 + y^2 \leq 64$ (b) $x^2 + y^2 \leq 25$ (c) $x^2 + y^2 \geq 25$ (d) $3 \leq x^2 + y^2 \leq 9$

48. The centre of the circle passing through (0, 0) and (1, 0) and touching the circle $x^2 + y^2 = 9$ is
(a) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{2}, -\sqrt{2}\right)$ (c) $\left(\frac{3}{2}, \frac{1}{2}\right)$ (d) $\left(\frac{1}{2}, \frac{3}{2}\right)$

49. The equation of a circle with origin as a centre and passing through equilateral triangle whose median is of length 3a is
(a) $x^2 + y^2 = 9a^2$ (b) $x^2 + y^2 = 16a^2$ (c) $x^2 + y^2 = 4a^2$ (d) $x^2 + y^2 = a^2$

50. Two common tangents to the circle $x^2 + y^2 = 2a^2$ and parabola $y^2 = 8ax$ are
(a) $x = \pm (y + 2a)$ (b) $y = \pm (x + 2a)$ (c) $x = \pm (y + a)$ (d) $y = \pm (x + a)$

51. In a triangle with sides a, b, c, $r_1 > r_2 > r_3$ (which are the ex- radii) then
(a) a > b > c (b) a < b < c (c) a > b and b < c (d) a < b and b > c

52. The number of solution of tan x + sec x = 2cos x in $[0, 2\pi)$ is
(a) 2 (b) 3 (c) 0 (d) 1

53. Which one is not periodic
(a) $| \sin 3x | + \sin^2 x$ (b) $\cos\sqrt{x} + \cos^2 x$ (c) $\cos 4x + \tan^2 x$ (d) $\cos 2x + \sin x$

54. $\lim_{n\to\infty} \frac{1^p + 2^p + 3^p + ... + n^p}{n^{p+1}}$ is
(a) $\frac{1}{p+1}$ (b) $\frac{1}{1-p}$ (c) $\frac{1}{p} - \frac{1}{p-1}$ (d) $\frac{1}{p+2}$

55. $\lim_{x\to 0} \frac{\log x^n - [x]}{[x]}$, $n \in N$ ([x] denotes greatest integer less than or equal to x)
(a) has value -1 (b) has value 0 (c) has value 1 (d) does not exist

56. If f(1) = 1, $f'(1) = 2$, then $\lim_{x\to 1} \frac{\sqrt{f(x)} - 1}{\sqrt{x} - 1}$ is
(a) 2 (b) 4 (c) 1 (d) 1/2

57. f is defined in [-5, 5] as f(x) = x if x is rational and = -x is irrational. Then
(a) f(x) is continuous at every x, except x = 0
(b) f(x) is discontinuous at every x, except x = 0
(c) f(x) is continuous everywhere
(d) f(x) is discontinuous everywhere

58. f(x) and g(x) are two differentiable functions on [0, 2] such that $f''(x) - g''(x) = 0$
$f'(1) = 2g'(1) = 4f(2) = 3g(2) = 9$ then f(x) - g(x) at x = 3/2 is
(a) 0 (b) 2 (c) 10 (d) 5

59. If f(x + y) = f(x) . f(y) $\forall$ x.y and f(5) =2, $f'(0) = 3$ then $f'(5)$ is
(a) 0 (b) 1 (c) 6 (d) 2

60. The maximum distance from origin of a point on the curve $x = a \sin t - b \sin\left(\frac{at}{b}\right)$
$y = a \cos t - b \cos\left(\frac{at}{b}\right)$, both a, b > 0 is
(a) a - b (b) a + b (c) $\sqrt{a^2 + b^2}$ (d) $\sqrt{a^2 - b^2}$

61. If 2a + 3b + 6c = 0 $(a, b, c \in R)$ then the quadratic equation $ax^2 + bx + c = 0$ has
(a) at least one root in [0, 1] (b) at least one root in [2, 3]
(c) at least one root in [4, 5] (d) none of these

62. If y = f(x) makes +ve intercept of 2 and 0 unit on x and y axes and encloses an area of 3/4 square unit with the axes then $\int_0^2 x f'(x)\, dx$ is
(a) 3/2 (b) 1 (c) 5/4 (d) -3/4

63. The area bounded by the curves y = lnx, y = ln |x|, y = | ln x | and y = | ln | |x| is
(a) 4 sq. units (b) 6 sq. units (c) 10 sq. units (d) none of these

64. If $|\vec{a}| = 4$, $|\vec{b}| = 2$ and the angle between $\vec{a}$ and $\vec{b}$ is $\pi/6$ then $(\vec{a}\times\vec{b})^2 = 2$ is equal to
(a) 48 (b) 16 (c) $\vec{a}$ (d) none of these

65. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $[\vec{a}\ \vec{b}\ \vec{c}]=4$ then $[\vec{a}\times\vec{b}\ \ \vec{b}\times\vec{c}\ \ \vec{c}\times\vec{a}]=$
(a) 16 (b) 64 (c) 4 (d) 8

66. If $\vec{a}, \vec{b}, \vec{c}$ are vectors such that $\vec{a}+\vec{b}+\vec{c}=0$ and $|\vec{a}| = 7, |\vec{b}| = 5, |\vec{c}| = 3$ then angle between vector $\vec{b}$ and $\vec{c}$ is
(a) 60 (b) 30^0 (c) 45^0 (d) 90^0

67. If | a |=5, | b | = 4, | c | = 3 thus what will be the value of | a.b + b.c + c.a |, given that $\vec{a}+\vec{b}+\vec{c}=0$
(a) 25 (b) 50 (c) - 25 (d) - 50

68. $3\lambda\vec{c}+2\mu(\vec{a}\times\vec{b})=0$ then
(a) $3\lambda+2\mu=0$ (b) $3\lambda=2\mu$ (c) $\lambda=\mu$ (d) $\lambda+\mu=0$

69. $\vec{a}=3\hat{i}-5\hat{j}$ and $\vec{b}=6\hat{i}+3\hat{j}$ are two vectors and $\vec{c}$ is a vector such that $\vec{c}=\vec{a}\times\vec{b}$ then $|\vec{a}|:|\vec{b}|:|\vec{c}|$
(a) $\sqrt{34}:\sqrt{45}:\sqrt{39}$ (b) $\sqrt{34}:\sqrt{45}:39$ (c) 34 : 39 : 45 (d) 39 : 35 : 34

70. If $\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}$ then $\vec{a}+\vec{b}+\vec{c}=$
(a) abc (b) -1 (c) 0 (d) 2

71. A and B are events such that $P(A\cup B)=3/4$, $P(A\cap B)=1/4$, $P(\overline{A})=2/3$ then $P(\overline{A}\cap B)$ is
(a) 5/12 (b) 3/8 (c) 5/8 (d) 1/4

72. A die is tossed 5 times. Getting an odd number is considered a success. Then the variance of distribution of success is
(a) 8/3 (b) 3/8 (c) 4/5 (d) 5/4

73. The d.r. of normal to the plane through (1, 0, 0) , (0, 1, 0) which makes an angle $\pi/4$ with plane x + y = 3 are
(a) $1, \sqrt{2}, 1$ (b) $1, 1, \sqrt{2}$ (c) 1, 1, 2 (d) $\sqrt{2}, 1, 1$

74. The sum of two forces is 18 N and resultant whose direction is at right angles to the smaller force is 12 N. The magnitude of the two forces are
(a) 13, 5 (b) 12, 6 (c) 14, 4 (d) 11, 7

75. A bead of weight w can slide on smooth circular wire in a vertical plane. The bead is attached by a light thread to the highest point of the wire and in equilibrium, the thread is taut and make an angle θ with the vertical then tension of the thread and reaction of the wire on the bead are
(a) T = w cos θ R = w tan θ (b) T = 2w cos θ R = w
(c) T = w R = w sin θ (d) T = w sin θ R = w cot θ