CHEMISTRY

SECTION A

1. If 0.01 M solution of an electrolyte has a resistance of 40 ohms in a cell having a cell constant of 0.4 cm^{-1}, then its molar conductance in $ohm^{-1}\ cm^{-2}\ mol^{-1}$.
   (a) 10^2 (b) 10^4
   (c) 10 (d) 10^3

2. A process has ΔH = 200 J mol^{-1} and ΔS = 40 $JK^{-1}\ mol^{-1}$. Out of the values given below, the minimum temperature above which the process will be spontaneous
   (a) 20 K (b) 12 K
   (c) 5 K (d) 4 K

3. Na^+, Mg^{2+}, Al^{3+} and Si^{4+} ions are isolectronic. Then of ionic radii of these ions
   (a) $Na^+ > Mg^{2+} > Al^{3+} > Si^{4+}$
   (b) $Na^+ < Mg^{2+} < Al^{3+} < Si^{4+}$
   (c) $Na^+ > Mg^{2+} > Al^{3+} < Si^{4+}$
   (d) $Na^+ < Mg^{2+} > Al^{3+} > Si^{4+}$

4. Which is formed , when acetonitrile is hydrolysed partially with cold concnetrated HCl ?
   (a) Acetic acid (b) Acetamide
   (c) Mthyl cyanide
   (d) Acetic anyhydrides

5. Consider the reaction : $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$. The equality relationship between $\frac{d[NH_3]}{dt}$ and $-\frac{d[H_2]}{dt}$ is
   (a) $+\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$
   (b) $+\frac{d[NH_3]}{dt} = -\frac{3}{2}\frac{d[H_2]}{dt}$
   (c) $+\frac{d[NH_3]}{dt} = -\frac{d[H_2]}{dt}$
   (d) $+\frac{d[NH_3]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$

6. The hybrid state of S in SO_3 in similar to that of
   (a) C in C_2H_2 (b) C in C_2H_4
   (c) C in CH_4 (d) C in CO_2

7. To distinguish between salicylic acid and phenol, one can use
   (a) $NaHCO_3$ solution
   (b) 5% NaOH solution
   (c) neutral $FeCl_3$
   (d) bromine water

8. One part of an element A combines with two parts of another B. Six parts of the element C combine with four parts of the element B. If Aand C combine together the raito of thier weights will be governed by
   (a) Law of definite proportion
   (b) Law of multiple proportion
   (c) Law of reciprocal proportion
   (d) Law of conservation of mass

9. Which of the following involves transfer of five electrons ?
   (a) $MnO_4^- \rightarrow Mn^{2+}$ (b) $CrO_4^{2-} \rightarrow Cr^{3+}$
   (c) $MnO_4^{2-} \rightarrow MnO_2$
   (d) $Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$

10. The dissociation constant of two acids HA_1 and HA_2 are 3.14 x 10^{-4} and 1.96 x 10^{-5} respectively. The relativestrength of the acids will be approximately
    (a) 1 : 4 (b) 4 : 1
    (c) 1 : 16 (d) 16 : 1

11. The product(s) obtained via oxymercuation ($HgSO_4$ + H_2SO_4) of 1-butyne would be
    (a) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$
    (b) CH_3 - CH_2 - CH_2 - CHO
    (c) CH_3 - CH_2 - CHO + HCHO
    (d) CH_3CH_2COOH + HCOOH

12. In order to refine “blister copper”, it is melted in a furnance and is stirred with green logs of wood. The purpose is
    (a) to expel the dissolved gases in blister copper
    (b) to bring the impuirites to surface and oxidize them
    (c) to increase the carbon content of copper
    (d) to reduce the metalli oxide impurities with hydrocabon gases liberated from the wood.

13. Which is correct statement ?
(a) Starch is a polymer of α-glucose.
(b) In cyclic structure of fructose, there are four carbons and one oxygen atom
(c) Amylose is a component of cellulose
(d) Proteins are composed of only one type of amino acids.

14. The pure crystalline substance of being heated gradually first forms a turbid liquid at constant temperature and still at higher temperature turbidity completley disappears. The behaviour is a characteristic of substance forming
(a) Allotropic (b) Liquid
(c) Isomeric (d) Isomorphous

15. The crystgal field stablization energy (CFSE) is the highest for
(a) $[CoF_4]^{2-}$ (b) $[Co(NCS)_4]^{2-}$
(c) $[Co(NH_3)_6]^{3+}$ (d) $[CoCl_4]^{2-}$

16. Identify the correct statement for change of Gibb's energy for a system (ΔG_{system}) at constant temperature and pressure
(a) If $(\Delta G_{system}) = 0$, the system has attained equilibrium
(b) If (ΔG_{system}), the system is still moving in a particular direction
(c) If $(\Delta G_{system}) < 0$, the proces is not spontaneous
(d) If $(\Delta G_{system}) >$), the process is not spontaneous.

17. The strongest Lewis acid is
(a) BF_3 (b) BCl_3
(c) BBr_3 (d) BI_3

18. Which of the following undergoes nucleophilic substitution exclusively by S_N1 mechanism ?
(a) Ethyl chloride (b) Isopropyl chloride
(c) Chlorobenzene (d) Benzyl chloride

19. The smog is essentially cuased by the presence of
(a) Oxides of sulphur and nitrogen
(b) O_2 and N_2
(c) O_2 and O_3
(d) O_3 and N_2

20. Which of the following functional groups cannot be reduced to alcohol using $NaBH_4$ in ethanolic solution ?
(a) R - O - R (b) RCOCl
(c) R - COOH (d) R - CHO

SECTION B

INTEGER TYPE QUESTIONS
(DO ANY FIVE QUESTIONS)

21. The dipole moment of HBr is 1.6×10^{-30} coulomb meter and interatomic spacing is 1 $\mathring{A}$. What is the % ionic character of HBr ?

22. 16 g of oxygen and 3 g of hydrogen are mixed and kept at 760 mm of Hg pressure and 0^oC. Calcualte the total volume occupied by the mixture in mL.

23. What is the number of geometrical isomers in case of a compound with the structure : CH_3 - CH = CH = CH = CH - C_2H_5.

24. Naturally occurring boron consists of two isotopes whose atomic weights are 10.01 and 11.01. The atomic weight of natural boron is 10.81. Calculate the percentage of isotope with atomic weight 11.01 in natural boron.

25. The value of P_0 for benzene is 640 mm of Hg. The vapour pressure of solution containing 2.5 g substance in 39 g benzene is 600 mm of Hg. What is the molecular mass of X ?

26. A flask of 10 dm^3 capacity contians O_2 gas at 100 kPa and 300 K. The gas pressure is reduced to 10 Pa by attaching the flask to a pump. If now 2.8 g of N_2 is introduced, assuming ideal behaivour, the final pressure in the flask is _____.
(R = 8.3 kPa dm3 K^{-1} mol^{-1})

27. In water (H - O - H) bond angle is 105^o. The distance between (O - H) is 1.0 A^o u_{H_2O} = 1.827 D. The magnitude of charge on the H-atom in water molecule in esu is _____.
(Given cos 52.5^o = 0.609)

28. 20 mL of x M HCl neutralises completely 10 mL of 0.1 M $NaHCO_3$ solution and a further 5 mL of 0.2 M Na_2CO_3 solution to methyl orange end point. The value of x is _____

29. Elevation in boiling point studies of $Ca(NO_3)_2$ gives molar mass as 131.2. The degree of dissociation of $Ca(NO_3)_2$ is _____.

30. A solution of zirconium phosphate contains 8 x 10^{-5} M PO_4^{3-} ions. The Ksp of zirconium phosphate is x x 10^{-3} M^7. The value of x is _____.

PHYSICS

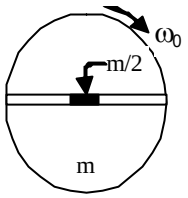
SECTION A

31. A spherical solid ball of volume V is made of a material of density ρ_1.It is falling through a liquid of density $\rho_2(\rho_2 < \rho_1)$. Assume that the liquid applies a viscous force on the ball that is proportional to the square of its speed v, i.e., $F_{viscous} = -kv^2(k > 0)$. The terminal speed of the ball is

(a) $\sqrt{\frac{V_g(\rho_1-\rho_2)}{k}}$ (b) $\frac{Vg\rho_1}{k}$

(c) $\sqrt{\frac{Vg\rho_1}{k}}$ (d) $\frac{V_g(\rho_1-\rho_2)}{k}$

32. A disc of mass m and radius R is free to rotate in horizontal plane about a vertical smooth fixed axis passing through its centre. There is a smooth groove along the diameter of the disc and two small balls of mass m/2 each are placed in it on either side of the centre of the disc as shown in figure. The disc is given initial angular velocity ω_0 and relased. The net work done by force exerted by disc on one of the balls (for the duration ball remains on th disc) is



(a) $\frac{2mR^2\omega_0^2}{9}$ (b) $\frac{mR^2\omega_0^2}{18}$

(c) $\frac{mR^2\omega_0^2}{6}$ (d) $\frac{mR^2\omega_0^2}{9}$

33. Radius of moon is 1/4 times that of earch and mass is 1/81 times that of earth. The point at which gravitational field due to earth becomes equal and opposite to that of moon, is (Distance between centres of earth and moon is 60R, where R is radius of earth)

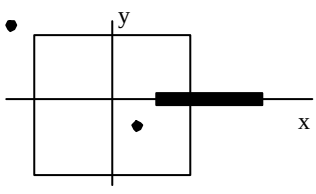
(a) 5.75 R frtom centre of moon
(b) 16 R from surface of moon
(c) 53 R from centre of earth
(d) 54 R from centre fo earth

34. Each corner of cube of side *l* has a negative charge, -q. The electrostatic potential energy of a charge q at the centre of the cube is

(a) $-\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ (b) $\frac{\sqrt{3}q^2}{4\pi\varepsilon_0 l}$

(c) $\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ (d) $-\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 l}$

35. A disc of radius a/4 having a uniformly distributed charge 6C is placed in the x - y plane with its centre at (-a/2, 0, 0). A rod of length a carrying a uniformly distributed charge 8C is placed on the x-axis from x = a/4to x = 5a/4. Two point charges -7C and 3C are placed at (a/4, -a/4, 0) and (-3a/4, 3a/4, 0), respectively. Consider a cubical surface formed six surfaces $x = \pm a/2$, $y = \pm a/2$, $z = \pm a/2$. The electric flux through this cubical surface is



(a) $\frac{-2C}{\varepsilon_0}$ (b) $\frac{2C}{\varepsilon_0}$

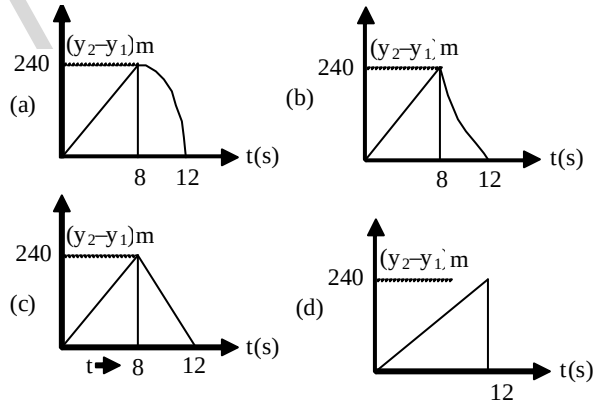
(c) $\frac{10C}{\varepsilon_0}$ (d) $\frac{12C}{\varepsilon_0}$

36. A potentiometer wire is 100 cm long and constant pontential difference is maintained across it. Two cells are connected in sereis first to support one another and then in oppoiste direction. The balance points are obtained at 50 cm and is 10 cm from the positive end of the wire in the two cases. The ratio of emf's is
(a) 5 : 1 (b) 5 : 4
(c) 3 : 4 (d) 3 : 2

37. A box of mass 2 kg is placed on the roof of a car. The box would remain stationary untill the car attains a maximum acceleration. Coefficient of static friction between the box and the roof of the car is 0.2 and g = 10 ms^{-2}. The maximum acceleration of the car, for the box to remain stationary is
(a) 8 ms^{-2} (b) 6 ms^{-2}
(c) 4 ms^{-2} (d) 2 ms^{-2}

38. The dimension of $\frac{e^2}{4\pi\varepsilon_0 hc}$, where e, ε_0, h and c are electric charge, electric permittivity, Planck's constant and velocity of light in vacuum respectively , is
(a) $[M^0L^0T^0]$ (b) $[ML^0T^0]$
(c) $[M^0LT^0]$ (d) $[M^0L^0T]$

39. Two stones are thrown up simultaneously from the edge of a cliff 240 m high with iniital speed of 10 m/s and 40 m/s respectively. Which of the following graph betst represents the time variation of relative position of the second stone with respect to the first)
(Assume stones do not rebound after hitting the ground and neglect air resistance, take g = 10 m/s^2)
(The figures are schematic and not drawn to scale)



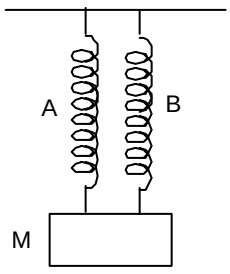
40. A photon of 1.7 x 10^{-13} joule is absorbed by a material under special circumstances. The correct statement is
(a) Electrons of the atoms of absorbed material will go the higher energy states
(b) Electron amd positorn pair will be created
(c) Only positron will be produced
(d) Photoelectric effect will occur and electron will be produced.

41. In an experiment with nPn transistor amplifier in common emitter configuration, the current gain of the transistor is 100. If the collector current changes by 1 mA, what will be the change in emitter current ?
(a) 1.1 mA (b) 1.01 mA
(c) 0.01 mA (d) 10 mA

42. Sinusoidal carrier voltage of frequency 1.5 mHz and amplitude 50 V is amplitude modulated by sunusoidal voltage of frequency 10 kHZ producing 50% modulation. The lower and upper side-band frequencies in kHz are
(a) 1490, 1510 (b) 1510, 1490
(c) $\frac{1}{1490}, \frac{1}{1510}$ (d) $\frac{1}{1510}, \frac{1}{1490}$

43. An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have equal cross sectional areal A. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure is P_0.The piston is slightly displaced from the equilibrium position and released. Assuming that the system is completely isolated from its surrounding, the piston executes a simple harmonic motion with frequency
(a) $\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$ (b) $\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$
(c) $\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$ (d) $\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\gamma P_0}}$

44. A body of mass M, executes vertical SHM with periods t_1 and t_2, when separately attached to spring A and spring B respectively. The period of SHM, when the body executes SHM, as shown in the figure is t_0. Then



(a) $t_0^{-1} = t_1^{-1} + t_2^{-1}$
(b) $t_0 = t_1 + t_2$
(c) $t_0^2 = t_1^2 + t_2^2$
(d) $t_0^{-2} = t_1^{-2} + t_2^{-2}$

45. Let $\bar{\upsilon}, \upsilon_{rms}$ and υ_p respectivley denote the mean speed, root mean square speed and most probable speed fo the molecules in an ideal monoatomic gas at absolute temperature T. The mass of molecule is m. Then

(a) No molecule can have speed greater than $\sqrt{2}\,\upsilon_{rms}$

(b) No molecule can have speed less than $\upsilon_p/\sqrt{2}$

(c) $\upsilon_p = \bar{\upsilon} < \bar{\upsilon}_{rms}$

(d) The average kinetic energy of a molecule is $\frac{3}{4}m\upsilon_p^2$

46. The fundamental frequency of a sonometer wire of length l is f_0. A bridge is now introduced at a distance of Δl from the centre of the wire ($\Delta l << l$). The number of beats heard if both sides of the bridges are set into vibration in their fundamental modes are

(a) $\frac{8f_0\Delta l}{l}$ (b) $\frac{f_0\Delta l}{l}$

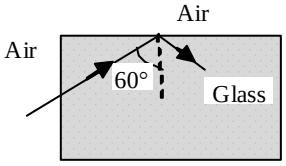
(c) $\frac{2f_0\Delta l}{l}$ (d) $\frac{4f_0\Delta l}{l}$

47. In a uniform magnetic field of induction B a wire in the form of a semicircle of radius r rotates about the diameter of the circle with an angular frequency ω. The axis of rotation is perpendiuclar to the field. If the total resistance of the circuit is R, the mean power generated per period of ratation is

(a) $\frac{(B\pi r^2\omega)^2}{2R}$ (b) $\frac{(B\pi r^2\omega)^2}{8R}$

(c) $\frac{B\pi r^2\omega}{2R}$ (d) $\frac{(B\pi r\omega^2)^2}{8R}$

48. A light ray from air is incident (as shown in figure) at one end of a glass fiber (refractive index $\mu = 1.5$) making an incidence angle of 60^o on the lateral surface, so that it undergoes a total internal reflection. How much time would it take to traverse the straight fiber of length 1 km



(a) 3.33 μs (b) 6.67 μs
(c) 5.77 μs (d) 3.85 μs

49. The electric and the magnetic field associated with an E.M. wave, propagating along the +z axis , can be represented by

(a) $\left[\vec{E} = E_0\hat{i}, \vec{B} = B_0\hat{j}\right]$

(b) $\left[\vec{E} = E_0\vec{k}, \vec{B} = B_0\hat{j}\right]$

(c) $\left[\vec{E} = E_0\hat{j}, \vec{B} = B_0\hat{i}\right]$

(d) $\left[\vec{E} = E_0\hat{j}, \vec{B} = B_0\hat{k}\right]$

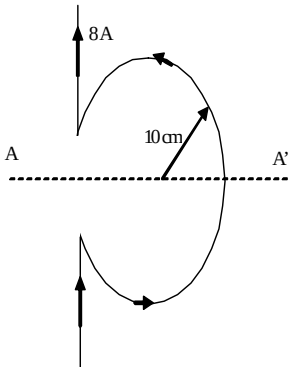
50. In an electrical circuit R, L, C and an a.c. voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage the current in the circuit is $\pi/3$. If instead, C is removed from the circuit, the phase difference is again $\pi/3$. The power factor of the circut is

(a) 1/2 (b) $1/\sqrt{2}$
(c) 1 (d) $\sqrt{3}/2$

SECTION B

INTEGER TYPE QUESTIONS (DO ANY FIVE QUESTIONS)

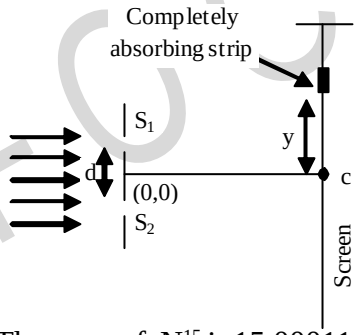
51. A long, straight wire is turned into a loop of radius 10 cm (as shown in figure). If a current is 8 ampere is passed through the loop, then the value of the magnetic field B at the centre C of the loop will be (in Wb/m^2)



52. A mass 2.9 kg suspended from a string of length 50 cm is at rest. Another body of mass 100 g which is moving horizontally with a velcoity of 150 m/s strikes and sticks to it. What is the tension (in newton) in th string when it makes an angle of 60^o with vertical ?

53. Figure shows two, identical narrow slits S_1 and S_2. A very small completely absorbing strip is placed at distance 'y' from the point C. 'C' is the point on the screen equidistant from S_1 and S_2. Assume $\lambda << d << D$, where λ, d and D have usual meaning.

When S_2 is covered the force due to light acting on strip is 'f' and when both slits are opened the force acting on strip is 2f. The minimum positive 'y'

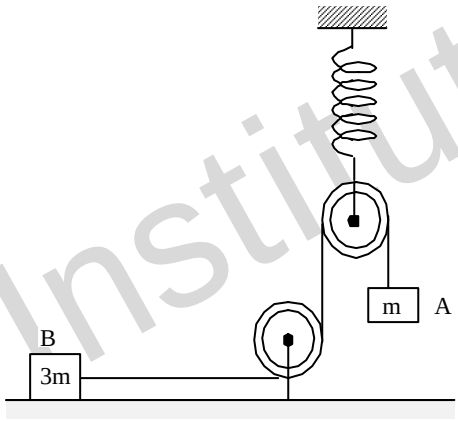


54. The mass of $_7N^{15}$ is 15.00011 amu, mass of $_8O^{16}$ is 15.99492 amu and m_p = 1.00783 amu. Determine binding energy (n MeV) of last proton of $_8O^{16}$.

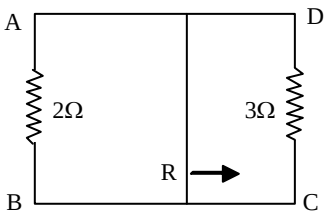
55. A calorometer of water equivalent 5×10^{-3} kg contains 25×10^{-3} kg of water. It takes 3 minutes to cool from 28^oC to 21^oC. When the same calorometer is filled with 30×10^{-3} kg of turpentine oil then it takes 2 minutes to cool from 28^oC to 21^oC. Find out the specific heat (in cal/g^oC) of turpentine oil

56. An ideal gas heat engine operates in a Carnot's cycle between 227^oC and 127^oC. It absorbs 6×10^4 J at high temperautre. The amount of heat converted into work is N x 10^4 J. Find the value of N ?

57. In the given figure, string, spring and pulleys are massless. Block A, performing SHM of amplitude 1 metre and time period $\pi/2$ sec. If block B remains at rest, find the minimum vlue of co-efficient of friction between block B and surface. ($g = 10\ m/s^2$)

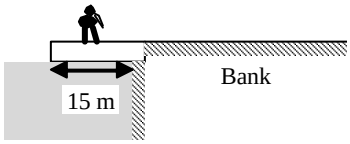


58. The rectangular loop with sliding connector of length 10 cm is situated in uniform magnetic field perpendicular to the plane of loop. The magnetic induction is 0.1 Tesla and resistance of connector (R) is 1 ohm. The sides AB and CD have resistances 2 ohm and 3 ohm respectively. Find the current (in A) in the connector during motion with constant velocity one metre/sec.



59. In an electrical circuit R, L, C and an a.c. voltage source are all connected in series. When L is removed from the cirucit, the phase difference between the voltage and the current in the circuit is $\pi/3$. If instead, C is removed from the circuit, the phase difference is again $\pi/3$. What is the power factor of the circuit ?

60. A man of mass m is standing on one end of a plank of mass 2m floating on a river. The other end just touches the bank of the river as shown in figure. With what minimum speed (in m/s) w.r.t. the plank should the man jump to get out of the river. All surfaces are smooth and plank is always in level with the bank. Given that the legnth of the plank is 15 m.



MATHEMATICS

61. For $x > 0$, $\lim\limits_{x\to 0}\left((\sin x)^{1/x} + \left(\frac{1}{x}\right)^{\sin x}\right)$ is

(a) 0 (b) -1
(c) 1 (d) 2

62. If $\tan q_1 \tan q_2 = -\frac{a^2}{b^2}$, then the chord joining two points $(a\cos q_1, b\sin q_1)$, and $(a\cos q_2, b\sin q_2)$ on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ will subtend a right angle at

(a) Focus (b) Centre
(c) End of the major axes
(d) End of minor axes

63. Domain of definition of the function

$f(x) = \frac{3}{4-x^2} + \log_{10}(x^2 - x)$, is

(a) $(-1, 0) \cup (1, 2) \cup (2, \infty)$
(b) $(0, 2)$
(c) $(-1, 0) \cup (0, 2)$
(d) $(1, 2) \cup (2, \infty)$

64. For positive numbers x, y, z the numerical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is

(a) 0 (b) 1
(c) 2 (d) None of these

65. If S* (p, q, r) is the dual of the compound statement S(p, q, r) and $S(p, q, r) = \sim p \wedge [\sim(q \vee r)]$ then S* (~p, ~q, ~r) is equivalent to

(a) S(p, q, r) (b) ~S (~p, ~q, ~r)
(c) ~ S(p, q, r) (d) S*(p, q, r)

66. The value of a so that the sum of the squares of the roots of the equation $x^2 - (a - 2)x - a + 1 = 0$ assume the least value, is

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

67. Common roots of the equations $2\sin^2 x + \sin^2 2x = 2$ and $\sin 2x + \cos 2x = \tan x$, are

(a) $x = (2n - 1)\frac{\pi}{2}$ (b) $x = (2n + 1)\frac{\pi}{4}$

(c) $x = (2n + 1)\frac{\pi}{3}$ (d) None of these

68. A particular solution of

$\log\left(\frac{dy}{dx}\right) = 3x + 4y$, $y(0) = 0$ is

(a) $e^{3x} + 3e^{-4y} = 4$ (b) $4e^{3x} - 3e^{-4y} = 3$
(c) $3e^{3x} + 4e^{4y} = 7$ (d) $4e^{3x} + 3e^{-4y} = 7$

69. If $f(x) = \frac{1}{2}x - 1$, then on the interval $[0, \pi]$

(a) tan [f(x)] and 1/f(x) are both continuous
(b) tan [f(x)] and 1/f(x) are both discontinuous
(c) tan [f(x)] and $f^{-1}(x)$ are both continuous
(d) tan [f(x)] is continuousbut 1/f(x) is not.

70. If $\frac{a+bx}{a-bx} = \frac{b+cx}{b-cx} = \frac{c+dx}{c-dx}$, $x \neq 0$, then a, b, c, d are in

(a) A.P. (b) H.P.
(c) G.P. (d) None.

71. The value of $\int_2^4 \{(|x-2|+|x-3|\}\,dx$

(a) 1 (b) 2
(c) 3 (d) 5

72. The angles of elevation of the top of a tower (A)from (B) and bottom (D) at a building of height a are 30^o and 45^o respectively. If the tower and the builidng stand at the same level, then the height of the tower is

(a) $a\sqrt{3}$ (b) $\frac{a\sqrt{3}}{\sqrt{3}-1}$

(c) $\frac{a(3+\sqrt{3})}{2}$ (d) $a(\sqrt{3}-1)$

73. The locus of the centres of the circles which touch externally the circle $x^2 + y^2 = a^2$ and $x^2 + y^2 = 4ax$, will be
(a) $12x^2 - 4y^2 - 24ax + 9a^2 = 0$
(b) $12x^2 + 4y^2 - 24ax + 9a^2 = 0$
(c) $12x^2 - 4y^2 + 24ax + 9a^2 = 0$
(d) $12x^2 + 4y^2 + 24ax + 9a^2 = 0$

74. The equation of the plane passing through the points (2, -1, 0), (3, -4, 5) and parallel to the line $2x = 3y = 4z$ is
(a) 29(x - 2) + 27(y + 1) - 22z = 0
(b) 29(x - 2) - 27(y + 1) - 22z = 0
(c) 29(x - 2) + 27(y + 1) + 22z = 0
(d) None of these.

75. Let r be the range and $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$ be the S.D. of a set observations $x_1, x_2, ...x_n$, then

(a) $S \le r\sqrt{\frac{n}{n-1}}$ (b) $S = r\sqrt{\frac{n}{n-1}}$

(c) $S \ge r\sqrt{\frac{n}{n-1}}$ (d) None of these.

76. If $\vec{a}+\vec{b}=0, |\vec{a}|=3, |\vec{b}|=5, |\vec{c}|=7$, then the angle between $\vec{a}$ and $\vec{b}$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$

(c) $\frac{2\pi}{3}$ (d) $\frac{\pi}{6}$

77. If at least one value of the complex number z = x + iy satisfy the condition $|z+\sqrt{2}| = a^2 - 3a + 2$ and the inequality $|z + i\sqrt{2}| < a^2$, then
(a) a > 2 (b) a = 2
(c) a < 2 (d) None of these.

78. A letter is known to have come either from LONDON or CLIFTON; on the postmark only the two consecutive letters ON are legible. The probability that it came from LONDON is

(a) $\frac{5}{17}$ (b) $\frac{12}{17}$

(c) $\frac{17}{30}$ (d) $\frac{3}{5}$

79. If $\int f(x)\,\text{six}\cos x\,dx = \frac{1}{2(b^2-a^2)}\log_e(f(x)) + A$, $b \ne \pm a$, then $\{f(x)\}^{-1}$ is equal to
(a) $a^2\sin^2 x + b^2\cos^2 x + C$
(b) $a^2\sin^2 x - b^2\cos^2 x + C$
(c) $a^2\cos^2 x + b^2\sin^2 x + C$
(d) $a^2\cos^2 x - b^2\sin^2 x + C$

80. If f(x) is differentiable and strictly incrasing function, then the value of $\lim_{x\to 0}\frac{f(x^2)-f(x)}{f(x)-f(0)}$ is
(a) 1 (b) 0
(c) -1 (d) 2

SECTION B

INTEGER TYPE QUESTIONS
(DO ANY FIVE QUESTIONS)

81. Assuming the balls to be identical except for difference in colours, the number of ways in which one or more balls can be selected from 10 white, 9 green and 7 black balls is

82. The number of integral points (integral point means both the coordinates should be integer) exactly in the interior of the triangle vertices (0, 0), (0, 21) and (21, 0) is

83. If a and b are the roots of the equation $x^2 - 4x + 1 = 0$ $(a > b)$ then the value of

$$f(\alpha, \beta) = \frac{\beta^3}{2}\operatorname{cosec}^2\left(\frac{1}{2}\tan^{-1}\frac{\beta}{\alpha}\right) + \frac{\alpha^3}{2}\sec^2\left(\frac{1}{2}\tan^{-1}\frac{\alpha}{\beta}\right)$$

is

84. Find the number of irrational terms in the expansion of $(\sqrt[8]{5} + \sqrt[6]{2})^{100}$

85. The area enclosed by $2|x| + 3|y| \leq 6$ is

86. If $z_1 = 2 - 5i$, $z_2 = 3 - i$, if magnitude of projection of z_1 and z_2 is λ, then the value of $\frac{\sqrt{10}.\lambda}{11}$ is

87. If the product of roots of the equation $x^2 - 3xk + 2e^{2\ln(k)} - 1 = 0$ is 7, then roots are real if k =

88. If $a_1, a_2, a_3 \ldots a_{10}$ is A.P. and $h_1, h_2, h_3 \ldots h_{10}$ is in H.P. If $a_1 = h_1 = 2$, $a_{10} = h_0 = 3$ then the value of a_4h_7 is

89. If λ, μ, ν are positive numbers greater than 10, such that μ, ν have respectively 1 and 0 at their unit place and $\Delta = \begin{vmatrix} \lambda & 4 & 1 \\ \mu & 0 & 1 \\ \nu & 1 & 0 \end{vmatrix}$ if $(\lambda + 1)$ is divisible by 10, then λ has at its unit place.

90. If $P(A \cup B) = P(A \cap B)$ then the value of $\frac{P(A)}{P(B)}$ is