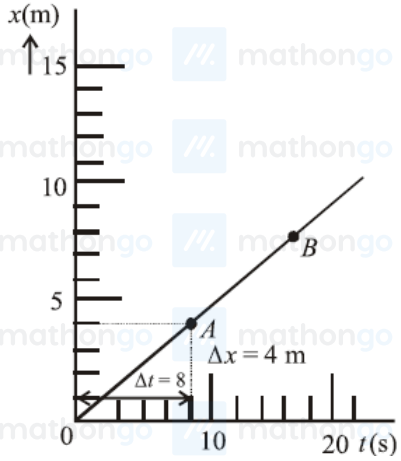
Q1. Given that $K =$ energy, $V =$ velocity, $T =$ time. If they are chosen as the fundamental units, then what is dimensional formula for surface tension?

(1) $\left[KV^{-2}\,\mathrm{T}^{-2}\right]$ (2) $\left[K^2V^2T^{-2}\right]$

(3) $\left[K^2V^{-2}T^{-2}\right]$ (4) $\left[KV^2T^2\right]$

Q2. The graph of an object's motion (along the $x-$ axis) is shown in the figure. The instantaneous velocity of the object at points A and B are v_A and v_B respectively. Then



(1) $v_A = v_B = 0.5\ \mathrm{m/s}$ (2) $v_A = 0.5\ \mathrm{m/s} < v_B$

(3) $v_A = 0.5\ \mathrm{m/s} > v_B$ (4) $v_A = v_B = 2\ \mathrm{m/s}$

Q3. A car of mass 1000 kg is moving at a speed of 30 m/s. Brakes are applied to bring the car to rest. If the net retarding force is 5000 N, the car comes to stop after travelling d m in t s. Then

(1) $d = 150, t = 5$ (2) $d = 120, t = 8$

(3) $d = 180, t = 6$ (4) $d = 90, t = 6$

Q4. An engine pumps water continuously through a hose. Water leaves the hose with velocity v and m is mass per unit length of the water jet. If this jet hits a surface and came to rest instantaneously, the force on the surface is

(1) mv^3 (2) mv^2

(3) $\frac{1}{2}mv^2$ (4) $\frac{1}{2}mv^3$

Q5. A particle gets displaced by $\Delta\vec{r} = (2\hat{i} + 3\hat{j} + 4\hat{k})\mathrm{m}$ under the action of a force $\vec{F} = (7\hat{i} + 4\hat{j} + 3\hat{k})$. The change in its kinetic energy is

(1) 38 J (2) 70 J

(3) 52.5 J (4) 126 J

Q6. A circular hole of diameter R is cut from a disc of mass M and radius R; the circumference of the cut passes through the centre of the disc. The moment of inertia of the remaining portion of the disc about an axis perpendicular to the disc and passing through its centre is

(1) $\left(\frac{15}{32}\right)MR^2$ (2) $\left(\frac{1}{8}\right)MR^2$

(3) $\left(\frac{3}{8}\right)MR^2$ (4) $\left(\frac{13}{32}\right)MR^2$

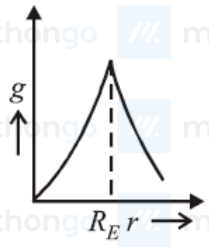
Q7. A solid sphere having mass m and radius r rolls down an inclined plane. Then its kinetic energy is

(1) $\frac{5}{7}$ rotational and $\frac{2}{7}$ translational (2) $\frac{2}{7}$ rotational and $\frac{5}{7}$ translational

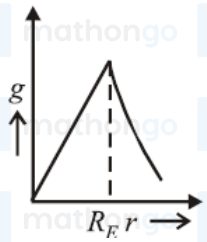
(3) $\frac{2}{5}$ rotational and $\frac{3}{5}$ translational (4) $\frac{1}{2}$ rotational and $\frac{1}{2}$ translational

Q8. Which graph correctly presents the variation of acceleration due to gravity with the distance from the centre of the earth (radius of the earth $= R_E$)?

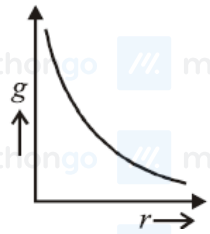
(1)



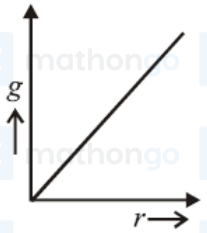
(2)



(3)



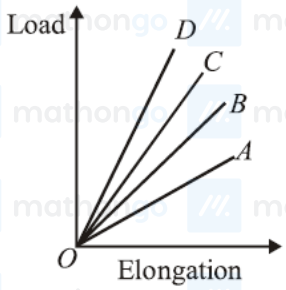
(4)



Q9. A structural steel rod has a radius of 10 mm and length of 1.0 m. A 100kN force stretches it along its length. Young's modulus of structural steel is $2 \times 10^{11}\text{Nm}^{-2}$. The percentage strain is about

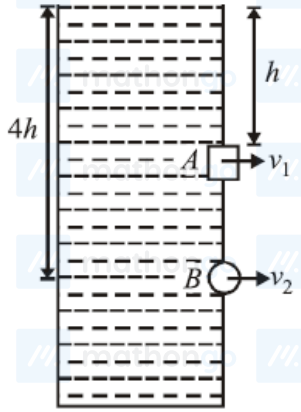
(1) 0.16%
(2) 0.32%
(3) 0.08%
(4) 0.24%

Q10. The load versus elongation graphs for four wires of same length and made of the same material are shown in the figure. The thinnest wire is represented by the line



(1) OA
(2) OC
(3) OD
(4) OB

Q11. A square hole of side length ℓ is made at a depth of h and a circular hole of radius r is made at a depth of 4 h from the surface of water in a water tank kept on a horizontal surface. If $\ell << h, r << h$ and the rate of water flow from the holes is the same, then r is equal to



(1) $\frac{\ell}{\sqrt{2\pi}}$ (2) $\frac{\ell}{\sqrt{3\pi}}$
(3) $\frac{\ell}{3\pi}$ (4) $\frac{\ell}{2\pi}$

Q12. The heat radiated per unit area in 1 hour by a furnace whose temperature is 3000 K is ($\sigma = 5.7 \times 10^{-8}$ W m^{-2} K^{-4})
(1) 1.7×10^{10} J (2) 1.1×10^{12} J
(3) 2.8×10^{8} J (4) 4.6×10^{6} J

Q13. A perfect gas at 27°C is heated at constant pressure so as to double its volume. The final temperature of the gas will be, close to
(1) 327°C (2) 200°C
(3) 54°C (4) 300°C

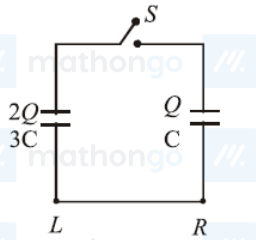
Q14. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: In an adiabatic process, change in internal energy of a gas is equal to work done on/ by the gas in the process. Statement 2: The temperature of a gas remains constant in an adiabatic process.
(1) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.
(2) Statement 1 is true, Statement 2 is false.
(3) Statement 1 is false, Statement 2 is true.
(4) Statement 1 is false, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

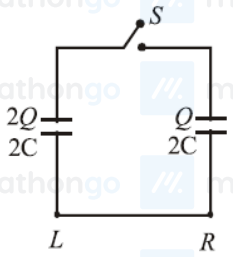
Q15. Following are expressions for four plane simple harmonic waves (i) $y_1 = A\cos 2\pi\left(n_1 t + \frac{x}{\lambda_1}\right)$ (ii) $y_2 = A\cos 2\pi\left(n_1 t + \frac{x}{\lambda_1} + \pi\right)$ (iii) $y_3 = A\cos 2\pi\left(n_2 t + \frac{x}{\lambda_2}\right)$ (iv) $y_4 = A\cos 2\pi\left(n_2 t - \frac{x}{\lambda_2}\right)$ The pairs of waves which will produce destructive interference and stationary waves respectively in a medium, are
(1) (iii, iv), (i, ii) (2) (i, iii), (ii, iv)
(3) (i, iv), (ii, iii) (4) (i, ii), (iii, iv)

Q16. This question has Statement 1and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: In the resonance tube experiment, if the tuning fork is replaced by another identical turning fork but with its arm having been filled, the length of the air column should be increased to obtain resonance again. Statement 2: On filling the arms, the frequency of a tuning fork increases.
(1) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.
(2) Statement 1 is true, Statement 2 is false.
(3) Statement 1 is false, Statement 2 is true.
(4) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

Q17. The electric potential $V(x)$ in a region around the origin is given by $V(x) = 4x^2$ volts. The electric charge enclosed in a cube of 1 m side with its centre at the origin is (in coulomb)
(1) $8\varepsilon_0$ (2) $-4\varepsilon_0$
(3) 0 (4) $-8\varepsilon_0$

Q18. Two circuits (a) and (b) have charged capacitors of capacitance C, 2C and 3C with open switches. Charges on each of the capacitor are as shown in the figures. On closing the switches





Circuit (a) Circuit (b)

(1) No charge flows in (a) but charge flows from R to L in (b)

(2) Charges flow from L to R in both (a) and (b)

(3) Charges flow from R to L in (a) and from L to R in (b)

(4) No charge flows in (a) but charge flows from L to R in (b)

Q19. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: The possibility of an electric bulb fusing is higher at the time of switching ON. Statement 2: Resistance of an electric bulb when it is not lit up is much smaller than when it is lit up.

(1) Statement 1 is true, Statement 2 is false

(2) Statement 1 is false, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

(3) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.

(4) Statement 1 is false, Statement 2 is true.

Q20. A bar magnet of length 6 cm has a magnetic moment of 4 J T^{-1}. Find the strength of magnetic field at a distance of 200 cm from the centre of the magnet along its equatorial line.

(1) 4×10^{-8} tesla

(2) 3.5×10^{-8} tesla

(3) 5×10^{-8} tesla

(4) 3×10^{-8} tesla

Q21. The velocity of certain ions that pass undeflected through crossed electric field $E = 7.7\mathrm{kV/m}$ and magnetic field $B = 0.14$ T is

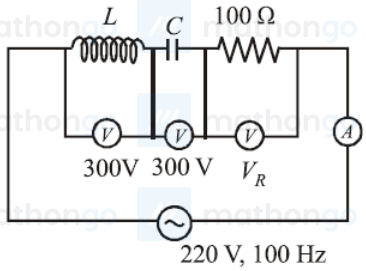
(1) 18 km/s

(2) 77 km/s

(3) 55 km/s

(4) 1078 km/s

Q22. In an LCR circuit shown in the following figure, what will be the readings of the voltmeter across the resistor and ammeter if an a.c. source of 220 V and 100 Hz is connected to it as shown?



(1) $800\ \text{V}, 8\ \text{A}$
(2) $110\ \text{V}, 1.1\ \text{A}$
(3) $300\ \text{V}, 3\ \text{A}$
(4) $220\ \text{V}, 2.2\ \text{A}$

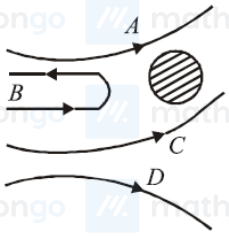
Q23. Which of the following processes play a part in the formation of a rainbow? (i) Refraction (ii) Total internal reflection (iii) Dispersion (iv) Interference
(1) (i), (ii) and (iii)
(2) (i) and (ii)
(3) (i), (ii) and (iv)
(4) (iii) and (iv)

Q24. In a Young's double slit experiment with light of wavelength λ, fringe pattern on the screen has fringe width β. When two thin transparent glass (refractive index μ) plates of thickness t_1 and t_2 $(t_1 > t_2)$ are placed in the path of the two beams respectively, the fringe pattern will shift by a distance
(1) $\frac{\beta(\mu-1}{\lambda}\left(\frac{t_1}{t_2}\right)$
(2) $\frac{\mu\beta}{\lambda}\frac{t_1}{t_2}$
(3) $\frac{\beta(\mu-1}{\lambda}(t_1 - t_2$
(4) $\left(\mu - 1\frac{\lambda}{\beta}\right)(t_1 + t_2 \quad)$

Q25. Two polaroids have their polarizing directions parallel so that the intensity of a transmitted light is maximum. The angle through which either polaroid must be turned if the intensity is to drop by one-half is
(1) 135°
(2) 90°
(3) 120°
(4) 180°

Q26. The electron of a hydrogen atom makes a transition from the $(n+1)^{\text{th}}$ orbit to the n^{th} orbit. For large n the wavelength of the emitted radiation is proportional to
(1) n
(2) n^3
(3) n^4
(4) n^2

Q27. In the Rutherford experiment, α-particles are scattered from a nucleus as shown. Out of the four paths, which

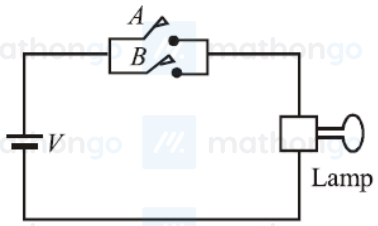


path is not possible?
(1) D
(2) B
(3) C
(4) A

Q28. A sample originally contained 10^{20} radioactive atoms, which emit α-particles. The ratio of α particles emitted in the third year to that emitted during the second year is 0.3. How many α particles were emitted in the first year?

(1) 3×10^{18}
(2) 3×10^{19}
(3) 5×10^{18}
(4) 7×10^{19}

Q29. Which logic gate with inputs A and B performs the same operation as that performed by the following circuit?



(1) NAND gate
(2) OR gate
(3) NOR gate
(4) AND gate

Q30. Broadcasting antennas are generally
(1) vertical type
(2) both vertical and horizontal type
(3) omni directional type
(4) horizontal type

Q31. The concentrated sulphuric acid that is peddled commercial is $95\% H_2SO_4$ by weight. If the density of this commercial acid is 1.834 g cm^{-3}, the molarity of this solution is
(1) 17.8M
(2) 12.0M
(3) 10.5M
(4) 15.7M

Q32. The ratio of number of oxygen atoms (O) in 16.0 g ozone (O_3), 28.0 g carbon monoxide (CO) and 16.0 oxygen (O_2) is (Atomic mass : $C = 12, O = 16$ and Avogadro's constant $N_A = 6.0 \times 10^{23}$ mol^{-1})
(1) 3 : 1 : 2
(2) 1 : 1 : 2
(3) 3 : 1 : 1
(4) 1 : 1 : 1

Q33. The limiting line in Balmer series will have a frequency of (Rydberg constant, $R_\infty = 3.29 \times 10^{15}$ cycles /s)
(1) 8.22×10^{14} s^{-1}
(2) 3.29×10^{15} s^{-1}
(3) 3.65×10^{14} s^{-1}
(4) 5.26×10^{13} s^{-1}

Q34. In which of the following arrangements, the sequence is not strictly according to the property written against it?
(1) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power
(2) $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing basic strength
(3) $HF < HCl < HBr < HI$: increasing acid strength
(4) $B < C < O < N$: increasing first ionisation enthalpy.

Q35. Among the following, the species having the smallest bond is
(1) NO^-
(2) NO^+
(3) O_2
(4) NO

Q36. Based on lattice energy and other considerations, which one of the following alkali metal chloride is expected to have the highest melting point?

(1) NaCl (2) KCl
(3) LiCl (4) RbCl

Q37. For 1 mol of an ideal gas at a constant temperature T, the plot of $(\log P)$ against $(\log V)$ is a (P : Pressure, V : Volume)
(1) Straight line parallel to x-axis. (2) Straight line with a negative slope.
(3) Curve starting at origin. (4) Straight line passing through origin.

Q38. The entropy of a sample of a certain substance increases by $0.836\ \mathrm{J\ K^{-1}}$ on adding reversibly $0.3344\ \mathrm{J}$ of heat at constant temperature. The temperature of the sample is:
(1) $2.5\ \mathrm{K}$ (2) $0.3\ \mathrm{K}$
(3) $0.016\ \mathrm{K}$ (4) $0.4\ \mathrm{K}$

Q39. The electron affinity of chlorine is $3.7\mathrm{eV}$.1 gram of chlorine is completely converted to Cl^- ion in a gaseous state. $\left(1\mathrm{eV} = 23.06\mathrm{kcalmol}^{-1}\right)$. Energy released in the process is
(1) $4.8\mathrm{kcal}$ (2) $7.2\mathrm{kcal}$
(3) $8.2\mathrm{kcal}$ (4) $2.4\mathrm{kcal}$

Q40. The solubility (in mol L^{-1}) of AgCl $\left(K_{\mathrm{sp}} = 1.0 \times 10^{-10}\right)$ in a $0.1\mathrm{MKCl}$ solution will be
(1) 1.0×10^{-9} (2) 1.0×10^{-10}
(3) 1.0×10^{-5} (4) 1.0×10^{-11}

Q41. Which of the oxide groups among the following cannot be reduced by carbon?
(1) $\mathrm{Cu_2O}, \mathrm{SnO_2}$ (2) $\mathrm{CaO}, \mathrm{K_2O}$
(3) $\mathrm{PbO}, \mathrm{Fe_2O_4}$ (4) $\mathrm{Fe_2O_3}, \mathrm{ZnO}$

Q42. Which of the following cannot be represented by resonance structures?
(1) Dimethyl ether (2) Nitrate anion
(3) Carboxylate anion (4) Toluene

Q43. Copper wire test for halogens is known as
(1) Duma's Test (2) Beilstein's Test
(3) Liebig's Test (4) Lassigne's Test

Q44. The IUPAC name of the compound < smiles>CC1CO1 < /smiles> is
(1) 1, 2-Propoxide (2) Propylene oxide
(3) 1,2-Oxo propane (4) 1, 2-Epoxy propane

Q45. Among the following the order of reactivity towards nucleophilic addition is
(1) $\mathrm{CH_3CHO} > \mathrm{CH_3COCH_3} > \mathrm{HCHO}$ (2) $\mathrm{HCHO} > \mathrm{CH_3CHO} > \mathrm{CH_3COCH_3}$
(3) $\mathrm{CH_3CHO} > \mathrm{HCHO} > \mathrm{CH_3COCH_3}$ (4) $\mathrm{CH_3COCH_3} > \mathrm{CH_3CHO} > \mathrm{HCHO}$

Q46. Green house gases can be arranged in 'Global Warming Potential' sequence as
(1) $\mathrm{N_2O} > \mathrm{CFC} > \mathrm{CH_4} > \mathrm{CO_2}$ (2) $\mathrm{CFC} > \mathrm{N_2O} > \mathrm{CH_4} > \mathrm{CO_2}$
(3) $\mathrm{CFC} > \mathrm{CO_2} > \mathrm{N_2O} > \mathrm{CH_4}$ (4) $\mathrm{CO_2} > \mathrm{CFC} > \mathrm{N_2O} > \mathrm{CH_4}$

Q47. Among the following which is the best description of water in the solid phase?

(1) Covalent solid (2) Molecular solid
(3) Ionic solid (4) Network solid

Q48. A solid has a ' *bcc* ' structure. If the distance of nearest approach between two atoms is $1.73\mathring{A}$, the edge length of the cell is

(1) 314.20pm (2) 1.41pm
(3) 200pm (4) 216pm

Q49. A battery is constructed of Cr and $Na_2Cr_2O_7$. The unbalanced chemical equation when such a battery discharges is following:

$$Na_2Cr_2O_7 + Cr + H^+ \rightarrow Cr^{3+} + H_2O + Na^+$$

If one Faraday of electricity is passed through the battery during the charging, the number of moles of Cr^{3+} removed from the solution is

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

Q50. K_1, K_2 and K_3 are the equilibrium constants of the following reactions (I), (II) and (III) respectively: (I) $N_2 + 2O_2 \rightleftharpoons 2NO_2$ (II) $2NO_2 \rightleftharpoons N_2 + 2O_2$ (III) $NO_2 \rightleftharpoons \frac{1}{2} N_2 + O_2$ The correct relation from the following is

(1) $K_1 = \frac{1}{K_2} = \frac{1}{K_3}$ (2) $K_1 = \frac{1}{K_2} = \frac{1}{(K_3)^2}$
(3) $K_1 = \sqrt{K_2} = K_3$ (4) $K_1 = \frac{1}{K_2} = K_3$

Q51. Reaction rate between two substance A and B is expressed as following: rate $= k[A]^n[B]^m$ If the concentration of A is doubled and concentration of B is made half of initial concentration, the ratio of the new rate to the earlier rate will be:

(1) $m + n$ (2) $n - m$
(3) $\frac{1}{2^{(m+n)}}$ (4) $2^{(n-m)}$

Q52. If x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p, Freundlich adsorption isotherm gives a straight line on plotting

(1) x/m vs p (2) x/m vs $1/p$
(3) $\log x/m$ vs $\log p$ (4) $\log x/m$ vs p

Q53. The d-electron configurations of $Cr^{2+}, Mn^{2+}, Fe^{2+}$ and Co^{2+} are d^4, d^5, d^6 and d^7 respectively. Which one of the following will exhibit the lowest paramagnetic behaviour? (Atomic no. $Cr = 24, Mn = 25, Fe = 26, Co = 27$).

(1) $[Co(H_2O)_6]^{2+}$ (2) $[Cr(H_2O)_6]^{2+}$
(3) $[Mn(H_2O)_6]^{2+}$ (4) $[Fe(H_2O)_6]^{2+}$

Q54. Which is not the correct Statement? (At. nos. $Ce = 58, Lu = 71, La = 57, Yb = 70$)

(1) Colour of Yb^{3+} ion is pink. (2) La^{3+} is diamagnetic.
(3) Ce^{4+} has f^0 configuration. (4) Lu^{3+} had f^{14} configuration.

Q55. How many cyclic structures are possible for C_4H_6 ?

(1) 3 (2) 5

(3) 6 (4) 4

Q56. The most basic compound among the following is

(1) Acetanilide (2) Benzylamine

(3) p-Nitro aniline (4) Aniline

Q57. $C_2H_5Br \xrightarrow{AgCN} X \xrightarrow[Zn-Rg/HCl]{Reduction} Y$, Here Y is

(1) Ethyl methyl amine (2) n-propylamine

(3) Isopropylamine (4) Ethylamine

Q58. Which one of the following is a chain growth polymerisation?

(1) Nucleic acid (2) Polystyrene

(3) Protein (4) Starch

Q59. Which one of the following compounds is an antifertility drug?

(1) Aspirin (2) Chloromycetin

(3) Saheli (4) Penicillin

Q60. All of the following statements apply to proteins except

(1) Proteins generally have no definite melting point (2) Proteins contain the grouping - CONH–

(3) Proteins have high molecular weight (4) Proteins can only contain the elements C, H, O and N.

Q61. The value of k for which the equation $(K-2)x^2+8x+K+4=0$ has both roots real, distinct and negative is

(1) 6 (2) 3

(3) 4 (4) 1

Q62. Let Z_1 and Z_2 be any two complex number. Statement 1: $|Z_1-Z_2| \geq |Z_1|-|Z_2|$ Statement 2: $|Z_1+Z_2| \leq |Z_1|+|Z_2|$

(1) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation of Statement 1.

(2) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

(3) Statement 1 is true, Statement 2 is false.

(4) Statement 1 is false, Statement 2 is true.

Q63. If the number of 5-element subsets of the set $A=\{a_1,a_2,\ldots,a_{20}\}$ of 20 distinct elements is k times the number of 5-element subsets containing a_4, then k is

(1) 5 (2) $\frac{20}{7}$

(3) 4 (4) $\frac{10}{3}$

Q64. The difference between the fourth term and the first term of a Geometrical Progresssion is 52. If the sum of its first three terms is 26 , then the sum of the first six terms of the progression is

(1) 63 (2) 189
(3) 728 (4) 364

Q65. The sum of the series $1^2 + 2.2^2 + 3^2 + 2.4^2 + 5^2 + 2.6^2 + \ldots\ldots + 2(2m)^2$ is
(1) $m(2m+1)^2$ (2) $m^2(m+2)$
(3) $m^2(2m+1)$ (4) $m(m+2)^2$

Q66. If $f(y) = 1 - (y-1) + (y-1)^2 - (y-1)^3 + \ldots - (y-1)^{17}$ then the coefficient of y^2 in it is
(1) ${}^{17}C_2$ (2) ${}^{17}C_3$
(3) ${}^{18}C_2$ (4) ${}^{18}C_3$

Q67. If the straight lines $x + 3y = 4, 3x + y = 4$ and $x + y = 0$ form a triangle, then the triangle is
(1) scalene (2) equilateral triangle
(3) isosceles (4) right angled isosceles

Q68. The point of intersection of the lines $\left(a^3+3\right)x + ay + a - 3 = 0$ and $\left(a^5+2\right)x + (a+2)y + 2a + 3 = 0$ (a real) lies on the y-axis for
(1) no value of a (2) more than two values of a
(3) exactly one value of a (4) exactly two values of a

Q69. The equation of the circle passing through the point $(1, 2)$ and through the points of intersection of $x^2 + y^2 - 4x - 6y - 21 = 0$ and $3x + 4y + 5 = 0$ is given by
(1) $x^2 + y^2 + 2x + 2y + 11 = 0$ (2) $x^2 + y^2 - 2x + 2y - 7 = 0$
(3) $x^2 + y^2 + 2x - 2y - 3 = 0$ (4) $x^2 + y^2 + 2x + 2y - 11 = 0$

Q70. Statement 1: $y = mx - \frac{1}{m}$ is always a tangent to the parabola, $y^2 = -4x$ for all non-zero values of m.
Statement 2: Every tangent to the parabola, $y^2 = -4x$ will meet its axis at a point whose abscissa is non-negative.
(1) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation of Statement 1.
(2) Statement 1 is false, Statement 2 is true.
(3) Statement 1 is true, Statement 2 is false.
(4) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

Q71. If the eccentricity of a hyperbola $\frac{x^2}{9} - \frac{y^2}{b^2} = 1$, which passes through $(K, 2)$, is $\frac{\sqrt{13}}{3}$, then the value of K^2 is
(1) 18 (2) 8
(3) 1 (4) 2

Q72. $\lim_{x\to 0}\left(\frac{x-\sin x}{x}\right)\sin\left(\frac{1}{x}\right)$
(1) equals 1 (2) equals 0
(3) does not exist (4) equals -1

Q73. The Statement that is TRUE among the following is
(1) The contrapositive of $3x + 2 = 8 \Rightarrow x = 2$ is $x \neq 2 \Rightarrow 3x + 2 \neq 8$.
(2) The converse of $\tan x = 0 \Rightarrow x = 0$ is $x \neq 0 \Rightarrow \tan x = 0$.
(3) $p \Rightarrow q$ is equivalent to $p \vee \sim q$.
(4) $p \vee q$ and $p \wedge q$ have the same truth table.

Q74. The frequency distribution of daily working expenditure of families in a locality is as follows:

Expenditure in ₹. (x):	0-50	50-100	100-150	150-200	200-250
No. of families (f):	24	33	37	b	25

If the mode of the distribution is Rs. 140, then the value of b is

(1) 34 (2) 31
(3) 26 (4) 36

Q75. If two vertical poles 20 m and 80 m high stand apart on a horizontal plane, then the height (in m) of the point of intersection of the lines joining the top of each pole to the foot of other is

(1) 16 (2) 18
(3) 50 (4) 15

Q76. Let X and Y are two events such that $P(X \cup Y =)PX \cap (Y.\quad)$ Statement 1: $P\left(X \cap Y' = \dot{P}X' \cap (Y = 0\quad\right.$) Statement 2: $P(X)PY \in 2)PX \cap Y(\quad)$

(1) Statement 1 is false, Statement 2 is true.
(2) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.
(3) Statement 1 is true, Statement 2 is false.
(4) Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation of Statement 1.

Q77. If $A = \begin{pmatrix} \alpha - 1 \\ 0 \\ 0 \end{pmatrix}, B = \begin{pmatrix} \alpha + 1 \\ 0 \\ 0 \end{pmatrix}$ be two matrices, then AB^T is a non-zero matrix for $|\alpha|$ not equal to

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

Q78. If the system of equations

$$x + y + z = 6$$
$$x + 2y + 3z = 10$$
$$x + 2y + \lambda z = 0$$

has a unique solution, then λ is not equal to

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

Q79. The range of the function $f(x) = \frac{x}{1+|x|}, x \in R$, is

(1) R (2) $(-1, 1)$
(3) $R - \{0\}$ (4) $[-1, 1]$

Q80. Let $f(x) = \sin x, g(x) = x$. Statement 1: $f(x) \leqslant gx($ for $)$x in $(0, \infty)$ Statement 2: $f(x) \leq 1$ for x in $(0, \infty)$ but $g(x) \to \infty$ as $x \to \infty$.

(1) Statement 1 is true, Statement 2 is false.
(2) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1.
(3) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1.
(4) Statement 1 is false, Statement 2 is true.

Q81. If $x + |y| = 2y$, then y as a function of x, at $x = 0$ is
(1) differentiable but not continuous
(2) continuous but not differentiable
(3) continuous as well as differentiable
(4) neither continuous nor differentiable

Q82. If a circular iron sheet of radius 30 cm is heated such that its area increases at the uniform rate of $6\pi \text{cm}^2/\text{hr}$, then the rate (in mm/hr) at which the radius of the circular sheet increases is
(1) 1.0
(2) 0.1
(3) 1.1
(4) 2.0

Q83. Let $f(x)$ be an indefinite integral of $\cos^3 x$. Statement 1: $f(x)$ is a periodic function of period π. Statement 2: $\cos^3 x$ is a periodic function.
(1) Statement 1 is true, Statement 2 is false.
(2) Both the Statements are true, but Statement 2 is not the correct explanation of Statement 1.
(3) Both the Statements are true, and Statement 2 is correct explanation of Statement 1.
(4) Statement 1 is false, Statement 2 is true.

Q84. If $\int_e^x tf(t)dt = \sin x - x\cos x - \frac{x^2}{2}$, for all $x \in R - \{0\}$, then the value of $f\left(\frac{\pi}{6}\right)$ is
(1) 1/2
(2) 1
(3) 0
(4) $-1/2$

Q85. The parabola $y^2 = x$ divides the circle $x^2 + y^2 = 2$ into two parts whose areas are in the ratio
(1) $9\pi + 2 : 3\pi - 2$
(2) $9\pi - 2 : 3\pi + 2$
(3) $7\pi - 2 : 2\pi - 3$
(4) $7\pi + 2 : 3\pi + 2$

Q86. Let $y(x)$ be a solution of $\frac{(2+\sin x}{(1+y)}\frac{dy)}{dx} = \cos x$. If $y(0) = 2$, then $y\left(\frac{\pi}{2}\right)$ equals
(1) $\frac{5}{2}$
(2) 2
(3) $\frac{7}{2}$
(4) 3

Q87. $ABCD$ is parallelogram. The position vectors of A and C are respectively, $3\hat{i} + 3\hat{j} + 5\hat{k}$ and $\hat{i} - 5\hat{j} - 5\hat{k}$. If M is the midpoint of the diagonal DB, then the magnitude of the projection of $\overrightarrow{OM}$ on $\overrightarrow{OC}$, where O is the origin, is
(1) $7\sqrt{51}$
(2) $\frac{7}{\sqrt{50}}$
(3) $7\sqrt{50}$
(4) $\frac{7}{\sqrt{51}}$

Q88. If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} + \hat{j} + (2\lambda - 1\hat{k})$ are coplanar vectors, then λ is equal to
(1) 0
(2) -1
(3) 2
(4) 1

Q89. The values of a for which the two points $(1, a, 1)$ and $(-3, 0, a)$ lie on the opposite sides of the plane $3x + 4y - 12z + 13 = 0$, satisfy

(1) $0 < a < \frac{1}{3}$
(2) $-1 < a < 0$
(3) $a < -1$ or $a < \frac{1}{3}$
(4) $a = 0$

Q90. A line with positive direction cosines passes through the point $P(2, -1, 2)$ and makes equal angles with the coordinate axes. If the line meets the plane $2x + y + z = 9$ at point Q, then the length PQ equals

(1) $\sqrt{2}$
(2) 2
(3) $\sqrt{3}$
(4) 1

ANSWER KEYS

1. (1)	**2.** (1)	**3.** (4)	**4.** (2)	**5.** (1)	**6.** (4)	**7.** (2)	**8.** (2)
9. (1)	**10.** (1)	**11.** (1)	**12.** (1)	**13.** (1)	**14.** (2)	**15.** (4)	**16.** (3)
17. (3)	**18.** (3)	**19.** (3)	**20.** (3)	**21.** (3)	**22.** (4)	**23.** (1)	**24.** (3)
25. (1)	**26.** (2)	**27.** (3)	**28.** (2)	**29.** (2)	**30.** (1)	**31.** (1)	**32.** (4)
33. (1)	**34.** (2)	**35.** (2)	**36.** (1)	**37.** (2)	**38.** (4)	**39.** (4)	**40.** (1)
41. (2)	**42.** (1)	**43.** (2)	**44.** (4)	**45.** (2)	**46.** (2)	**47.** (2)	**48.** (3)
49. (3)	**50.** (2)	**51.** (4)	**52.** (3)	**53.** (1)	**54.** (1)	**55.** (2)	**56.** (2)
57. (1)	**58.** (2)	**59.** (3)	**60.** (4)	**61.** (2)	**62.** (2)	**63.** (3)	**64.** (3)
65. (1)	**66.** (4)	**67.** (3)	**68.** (1)	**69.** (4)	**70.** (4)	**71.** (1)	**72.** (2)
73. (1)	**74.** (4)	**75.** (1)	**76.** (2)	**77.** (3)	**78.** (4)	**79.** (2)	**80.** (3)
81. (2)	**82.** (2)	**83.** (4)	**84.** (4)	**85.** (2)	**86.** (3)	**87.** (4)	**88.** (1)
89. (4)	**90.** (3)						