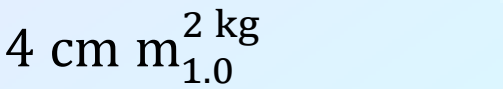
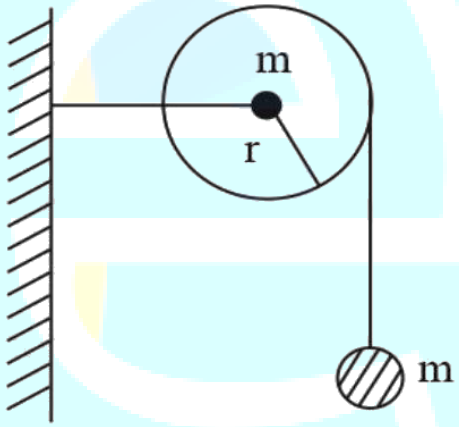
Q1. A 60 HP electric motor lifts an elevator having a maximum total load capacity of 2000 kg . If the frictional force on the elevator is 4000 N , the speed of the elevator at full load is close to : $(1\text{HP} = 746\text{ W}, g = 10\text{ m s}^{-2})$
(1) 1.7 m s^{-1}
(2) 1.9 m s^{-1}
(3) 1.5 m s^{-1}
(4) 2.0 m s^{-1}

Q2. Three point particles of masses 1.0 kg, 1.5 kg and 2.5 kg are placed at three corners of a right angle triangle of sides 4.0 cm, 3.0 cm and 5.0 cm as shown in the figure. The centre of mass of the system is at a point:



(1) 0.6 cm right and 2.0 cm above 1 kg mass.
(2) 1.5 cm right and 1.2 cm above 1 kg mass.
(3) 2.0 cm right and 0.9 cm above 1 kg mass.
(4) 0.9 cm right and 2.0 cm above 1 kg mass.

Q3.



As shown in the figure, a bob of mass m is tied to a massless string whose other end portion is wound on a fly wheel (disc) of radius r and mass m. When released from rest the bob starts falling vertically. When it has covered a distance of h, the angular speed of the wheel will be:
(1) $\frac{1}{\text{r}}\sqrt{\frac{4\text{gh}}{3}}$
(2) $r\sqrt{\frac{3}{2\text{gh}}}$
(3) $\frac{1}{\text{r}}\sqrt{\frac{2\text{gh}}{3}}$
(4) $r\sqrt{\frac{3}{4gh}}$

Q4. The radius of gyration of a uniform rod of length l, about an axis passing through a point $\frac{l}{4}$ away from the centre of the rod, and perpendicular to it, is:
(1) $\frac{1}{4}l$
(2) $\frac{1}{8}l$
(3) $\sqrt{\frac{7}{48}}l$
(4) $\sqrt{\frac{3}{8}}l$

Q5. A satellite of mass M is launched vertically upwards with an initial speed u from the surface of the earth. After it reaches height R (= radius of the earth), it ejects a rocket of mass $\frac{M}{10}$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the rocket is (is the gravitational constant; M_e is the mass of the earth):
(1) $\frac{M}{20}\left(u^2 + \frac{113}{200}\frac{GM_e}{R}\right)$
(2) $5M\left(u^2 - \frac{119}{200}\frac{GM_e}{R}\right)$
(3) $\frac{3M}{8}\left(u + \sqrt{\frac{5GM_e}{6R}}\right)^2$
(4) $\frac{M}{20}\left(u - \sqrt{\frac{2GM_e}{3R}}\right)^2$

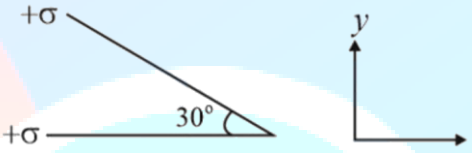
Q6. Speed of a transverse wave on a straight wire (mass 6.0 g , length 60 cm and area of cross-section 1.0 mm^2 is 90 m s^{-1}. If the Young's modulus of wire is 16×10^{11} N m^{-2}, the extension of wire over its natural length is:
(1) 0.03 mm
(2) 0.02 mm
(3) 0.04 mm
(4) 0.01 mm

Q7. A litre of dry air at STP expands adiabatically to a volume of 3 litres. If $\gamma = 1.40$, the work done by air is: $(3^{1.4} = 4.6555)$ [Take air to be an ideal gas]

(1) 60.7 J
(2) 90.5 J
(3) 100.8 J
(4) 48 J

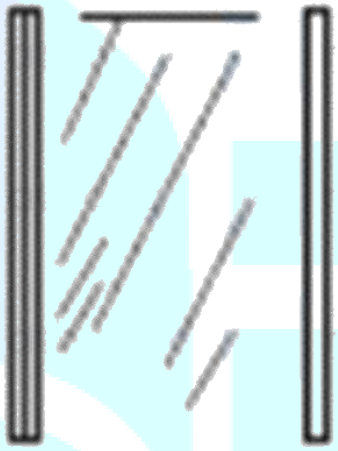
Q8. Two moles of an ideal gas, with $\frac{C_P}{C_V} = \frac{5}{3}$, are mixed with three moles of another ideal gas $\frac{C_P}{C_V} = \frac{4}{3}$. The value of $\frac{C_P}{C_V}$ for the mixture is
(1) 1.45
(2) 1.50
(3) 1.47
(4) 1.42

Q9. Two infinite planes each with uniform surface charge density $+\sigma$ are kept in such a way that the angle between them is 30°. The electric field in the region shown between them is given by:



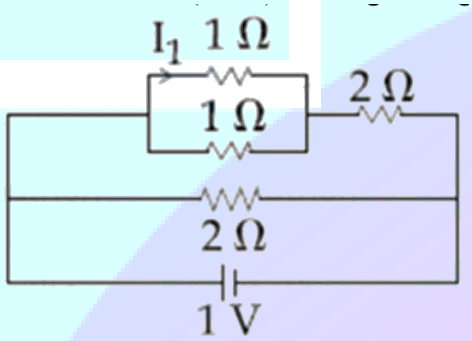
(1) $\frac{\sigma}{2\epsilon_0}\left[(1+\sqrt{3})\hat{y} - \frac{\hat{x}}{2}\right]$
(2) $\frac{\sigma}{\epsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y} + \frac{\hat{x}}{2}\right]$
(3) $\frac{\sigma}{2\epsilon_0}\left[(1+\sqrt{3})\hat{y} + \frac{\hat{x}}{2}\right]$
(4) $\frac{\sigma}{2\epsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right)\hat{y} - \frac{\hat{x}}{2}\right]$

Q10.



A parallel plate capacitor has plates of area A separated by distance d between them. It is filled with a dielectric which has a dielectric constant that varies as $K(x) = K_0(1+\alpha x)$ where x is the distance measured from one of the plates. If $(\alpha d) \ll 1$, the total capacitance of the system is best given by the expression:
(1) $\frac{AK_0\varepsilon_0}{d}\left(1+\frac{\alpha d}{2}\right)$
(2) $\frac{AK_0\varepsilon_0}{d}\left[1+\left(\frac{\alpha d}{2}\right)^2\right]$
(3) $\frac{AK_0\varepsilon_0}{d}\left(1+\frac{\alpha^2 d^2}{2}\right)$
(4) $\frac{AK_0\varepsilon_0}{d}(1+\alpha d)$

Q11. The current I_1 (in) flowing through 1Ω resistor in the following circuit is:



(1) 0.4
(2) 0.5
(3) 0.2
(4) 0.25

Q12. A long solenoid of radius R carries a time (t) dependent current $I(t) = I_0 t(1-t)$. A ring of radius $2R$ is placed coaxially near its middle. During the time interval $0 \le t \le 1$, the induced current (I_R) and the induced EMF(V_R) in the ring change as:
(1) Direction of I_R remains unchanged and V_R is maximum at $t = 0.5$
(2) At $t = 0.25$ direction of I_R reverses and V_R is maximum
(3) Direction of I_R remains unchanged and V_R is zero at $t = 0.25$
(4) At $t = 0.5$ direction of I_R reverses and V_R is zero

Q13. Consider a circular coil of wire carrying constant current I, forming a magnetic dipole. The magnetic flux through an infinite plane that contains the circular coil and excluding the circular coil area is given by ϕ_i The magnetic flux through the area of the circular coil area is given by ϕ_0. Which of the following option is correct?
(1) $\phi_i = \phi_0$
(2) $\phi_i > \phi_0$
(3) $\phi_i < \phi_0$
(4) $\phi_i = -\phi_0$

Q14. A LCR circuit behaves like a clamped harmonic oscillator. Comparing it with a physical spring-mass damped oscillator having damping constant ' b ', the correct equivalence would be:
(1) $L \leftrightarrow m, C \leftrightarrow k, R \leftrightarrow b$
(2) $L \leftrightarrow \frac{1}{b}, C \leftrightarrow \frac{1}{m}, R \leftrightarrow \frac{1}{k}$
(3) $L \leftrightarrow k, C \leftrightarrow b, R \leftrightarrow m$
(4) $L \leftrightarrow m, C \leftrightarrow \frac{1}{k}, R \leftrightarrow b$

Q15. If the magnetic field in a plane electromagnetic wave is given by $\vec{B} = 3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{j}T$, then what will be expression for electric field ?
(1) $\vec{E} = \left(60\sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}\,\frac{\text{V}}{\text{m}}\right)$
(2) $\vec{E} = \left(9\sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}\,\frac{\text{V}}{\text{m}}\right)$
(3) $\vec{E} = \left(3 \times 10^{-8}\sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{j}\,\frac{\text{V}}{\text{m}}\right.$
(4) $\vec{E} = \left(3 \times 10^{-8}\sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{\imath}\,\frac{\text{V}}{\text{m}}\right)$

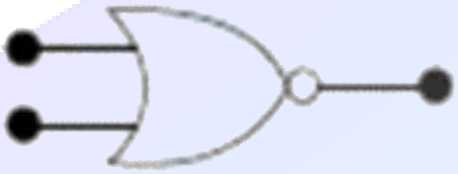
Q16. If we need a magnification of 375 from a compound microscope of tube length 150 mm and an objective of focal length 5 mm , the focal length of the eye-piece, should be close to:
(1) 22 mm
(2) 2 mm
(3) 4 mm
(4) 33 mm

Q17. A polarizer - analyser set is adjusted such that the intensity of light coming out of the analyser is just 36% of the original intensity. Assuming that the polarizer - analyser set does not absorb any light, the angle by which the analyser needs to be rotated further, to reduce the output intensity to zero, is $\left(\sin^{-1}\left(\frac{3}{5}\right) = 37^\circ\right)$
(1) 53°
(2) 37°
(3) 90°
(4) 45°

Q18. Visible light of wavelength 6000×10^{-8} cm falls normally on a single slit and produces a diffraction pattern. It is found that the second diffraction minimum is at 60° from the central maximum. If the first minimum is produced at θ_1, then θ_1 is close to
(1) 20°
(2) 30°
(3) 25°
(4) 45°

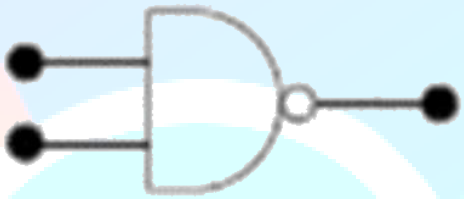
Q19. The time period of revolution of electron in its ground state orbit in a hydrogen atom is 1.6×10^{-16} s. The frequency of revolution of the electron in its first excited state (in s^{-1}) is:
(1) 1.6×10^{14}
(2) 7.8×10^{14}
(3) 6.2×10^{15}
(4) 5.6×10^{12}

Q20. Which of the following gives a reversible operation?
(1)

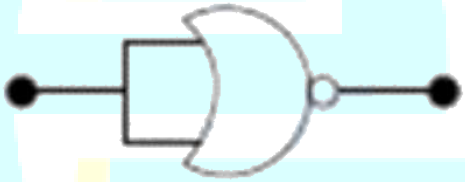


(2)

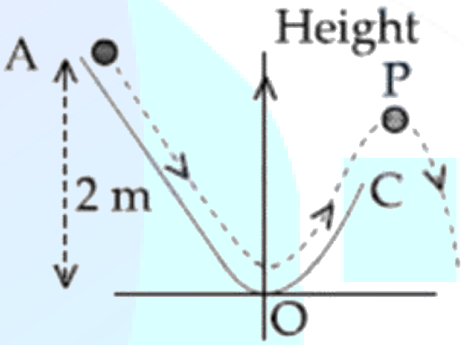
(3)



(4)



Q21. A particle (m = 1 kg) slides down a frictionless track (AOC) starting from rest at a point A (height 2 m). After reaching C, the particle continues to move freely in air as a projectile. When it reaching its highest point P (height 1 m), the kinetic energy of the particle (in J) is: (Figure drawn is schematic and not to scale; take $g = 10\ \text{ms}^{-2}$) -.



Q22. A non-isotropic solid metal cube has coefficients of linear expansion as: $5 \times 10^{-5}/^{\circ}\text{C}$ along the x -axis and $5 \times 10^{-6}/^{\circ}\text{C}$ along the y and the z -axis. If the coefficient of volume expansion of the solid is $\text{C} \times 10^{-6}/^{\circ}\text{C}$ then the value of C is

Q23. A Carnot engine operates between two reservoirs of temperatures 900 K and 300 K . The engine performs 1200 J of work per cycle. The heat energy (in J) delivered by the engine to the low temperature reservoir, in a cycle, is

Q24. A loop ABCDEFA of straight edges has six corner points $A(0,0,0), B(5,0,0), C(5,5,0), D(0,5,0), E(0,5,5)$ and $F(0,0,5)$. The magnetic field in this region is $\vec{B} = (3\hat{\imath} + 4\hat{k})T$. The quantity of flux through the loop ABCDEFA (in Wb) is

Q25. A beam of electromagnetic radiation of intensity $6.4 \times 10^{-5}\ \text{W/cm}^2$ is comprised of wavelength, $= 310$ nm. It falls normally on a metal (work function $= 2\text{eV}$) of surface area of $1\ \text{cm}^2$. If one in 10^3 photons ejects an election, total number of electrons ejected in 1 s is 10^x. $(hc = 1240\text{eVnm}, 1\text{eV} = 1.6 \times 10^{-19}J)$, then x is

Q26. Amongst the following statements, that which was not proposed by Dalton was :
(1) chemical reactions involve reorganization of atoms. These are neither created nor destroyed in a chemical reaction.
(2) all the atoms of a given element have identical properties including identical mass. Atoms of different elements differ in mass.
(3) when gases combine or reproduced in a chemical (4) matter consists of indivisible atoms. reaction they do so in a simple ratio by volume provided all gases are at the same T & P.

Q27. The number of orbitals associated with quantum numbers $n = 5,\ m_s = +\frac{1}{2}$ is:
(1) 11
(2) 25
(3) 50
(4) 15

Q28. The electron gain enthalpy (in $\frac{kJ}{mol}$) of fluorine, chlorine, bromine and iodine, respectively, are
(1) $-296, -325, -333$ and -349
(2) $-349, -333, -325$ and -296
(3) $-333, -349, -325$ and -296
(4) $-333, -325, -349$ and -296

Q29. The dipole moments of $CCl_4, CHCl_3$ and CH_4 are in the order
(1) $CHCl_3 < CH_4 = CCl_4$
(2) $CCl_4 < CH_4 < CHCl_3$
(3) $CH_4 < CCl_4 < CHCl_3$
(4) $CH_4 = CCl_4 < CHCl_3$

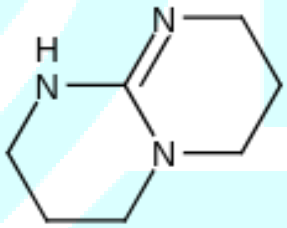
Q30. The relative strength of the interionic/ intermolecular forces in a decreasing order is:
(1) dipole-dipole > ion-dipole > ion-ion
(2) ion-dipole > ion-ion > dipole-dipole
(3) ion-dipole > dipole-dipole > ion-ion
(4) ion-ion > ion-dipole > dipole-dipole

Q31. Oxidation number of potassium in K_2O, K_2O_2 and KO_2, respectively, is:
(1) $+2, +1$ and $+\frac{1}{2}$
(2) $+1, +1$ and +1
(3) $+1, +4$ and +2
(4) $+1, +2$ and +4

Q32. In comparison to the zeolite process for the removal of permanent hardness, the synthetic resin method is
(1) less efficient as it exchanges only anions.
(2) more efficient as it can exchange both cations as well as anions.
(3) less efficient as the resins cannot be regenerated.
(4) more efficient as it can exchange only cations.

Q33. A solution of m - chloroaniline, m - chlorophenol and m - chlorobenzoic acid in ethyl acetate was extracted initially with a saturated solution of $NaHCO_3$ to give fraction A . The left over organic phase was extracted with dilute NaOH solution to give fraction B. The final organic layer was labelled as fraction C . Fractions A, B and C, contain respectively:
(1) m - chlorobenzoic acid, m - chloroaniline and m - chlorophenol
(3) m - chlorophenol, m - chlorobenzoic acid and m − chloroanilinc
(2) m − chlorobenzoic acid, m − chlorophenol and m - chloroaniline
(4) m - chloroaniline, m - chlorobenzoic acid and m - chlorophenol

Q34. The increasing order of pK_b for the following compounds will be :
$NH_2 - CH = NH$,
(A)



(B)

CH_3NHCH_3

(C)
(1) (B) < (C) < (A)
(2) (A) < (B) < (C)
(3) (C) < (A) < (B)
(4) (B) < (A) < (C)

Q35. Consider the following reactions:
(a) $(CH_3)_3CCH(OH)CH_3 \xrightarrow{\text{conc. } H_2SO_4}$
(b) $(CH_3)_2CHCH(Br)CH_3 \xrightarrow{\text{alc. KOH}}$
(c) $(CH_3)_2CHCH(Br)CH_3 \xrightarrow{(CH_3)_3O^{\ominus}K^{\oplus}}$

$(CH_3)_2 \underset{OH}{C} - CH_2 - CHO \xrightarrow{\Delta}$

(d)

Which of the reaction(s) will not produce Saytzeff product?
(1) (a), (c) and (d)
(2) (d) only
(3) (c) only
(4) (b) and (d)

Q36. At 35 °C, the vapour pressure of CS_2, is 512 mm Hg and that of acetone is 144 mmHg . A solution of CS_2 in acetone has a total vapour pressure of 600 mmHg . The false statement amongst the following is:
(1) Raoult's law is not obeyed by this system
(2) a mixture of $100 mL CS_2$ and 100 mL acetone has a volume < 200 mL
(3) CS_2 and acetone are less attracted to each other than to themselves
(4) heat must be absorbed in order to produce the solution at $35°C$

Q37. Given that the standard potentials $(E°)$ of Cu^{2+}/Cu and Cu^{+}/Cu are 0.34 V and 0.522 V respectively, the $E°$ of $Cu^{2+}/Cu^{+}$is:
(1) 0.182 V
(2) +0.158 V
(3) -0.182 V
(4) -0.158 V

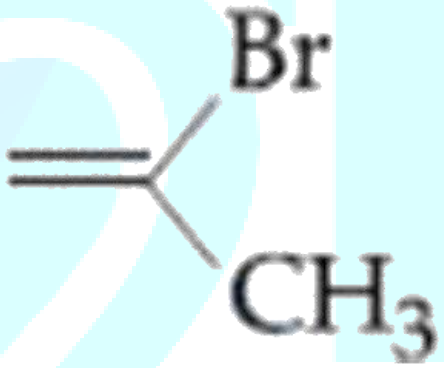
Q38. The purest form of commercial iron is:
(1) pig iron
(2) wrought iron
(3) cast iron
(4) scrap iron and pig iron

Q39. The atomic radius of Ag is closest to
(1) Au
(2) Ni
(3) Cu
(4) Hg

Q40. The IUPAC name of the complex $[Pt(NH_3)_2Cl(NH_2CH_3)]Cl$ is
(1) Diamminechlorido (methanamine) platinum (II)
(2) Diammine(methanamine)chlorido platinum (II) chloride chloride
(3) Diamminechlorido (aminomethane) platinum (II)(4) Bisammine (methanamine) chlorido platinum chloride (II) chloride

Q41. The theory that can completely/properly explain the nature of bonding in $[Ni(CO)_4]$ is:
(1) Werner's theory
(2) Molecular orbital theory
(3) Crystal field theory
(4) Valence bond theory

Q42.1-methyl ethylene oxide when treated with an excess of HBr produces
(1)



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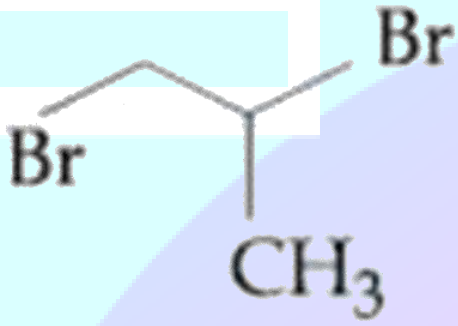

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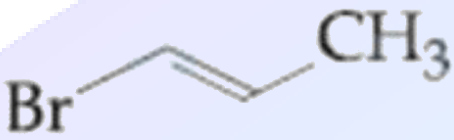

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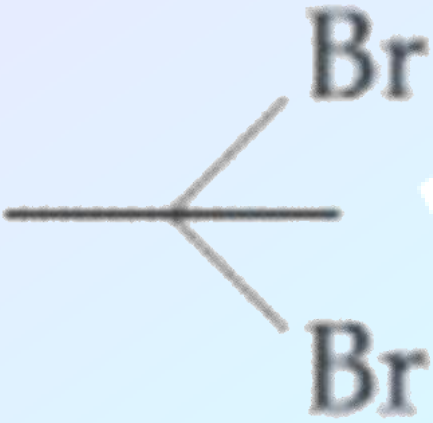
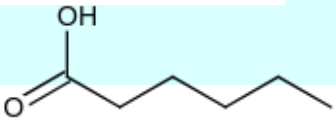


Q43. What is the product of following reaction?

$$\text{Hex} - 3 - \text{ynal} \xrightarrow{\text{(i) } NaBH_4} \xrightarrow{\text{(ii) } CO_2H_2O^+} PBr_3$$

(1)



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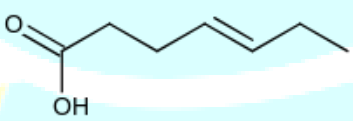

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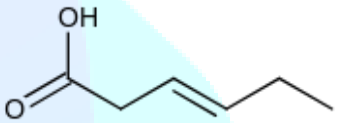

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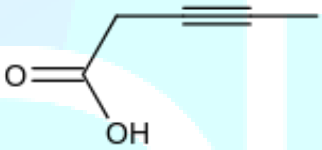
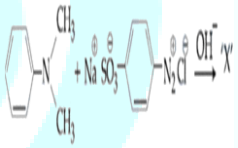


Q44. Consider the following reaction:



The product ' X ' is used:
(1) in protein estimation as an alternative to ninhydrin
(2) in acid base titration as an indicator
(3) as food grade colourant
(4) in laboratory test for phenols

Q45. Match the following :
(i) Riboflavin
(ii) Thiamine
(iii) Pyridoxine
(iv) Ascorbic acid
(a) Beriberi
(b) Scurvy
(c) Cheilosis
(d) Convulsions
(1) (i) - (a), (ii) - (d), (iii) - (c), (iv) - (b)
(2) (i) - (c), (ii) - (d), (iii) - (a), (iv) - (b)
(3) (i) - (c), (ii) - (a), (iii) - (d), (iv) - (b)
(4) (i) - (d), (ii) - (b), (iii) - (a), (iv) - (c)

Q46. For the reaction;
$A(l) \rightarrow 2\ B(g)$
$\Delta U = 2.1 kcal, \Delta S = 20 cal K^{-1}$ at 300 K .
Hence ΔG in kcal is .

Q47. Two solutions, A and B , each of 100 L was made by dissolving 4 g of NaOH and 9.8 g of H_2SO_4 in water, respectively. The pH of the resultant solution obtained from mixing 40 L of solution A and 10 L of solution B is
. ($\log 2 = 0.3$)

Q48. During the nuclear explosion, one of the products is ^{90}Sr with half life of 6.93 years. If 1μ g of ^{90}Sr was absorbed in the bones of a newly born baby in place of Ca , how much time, in years, is required to reduce it
by 90% if it is not lost metabolically .

Q49. Chlorine reacts with hot and concentrated NaOH and produces compounds (X) and (Y). Compound (X) gives white precipitate with silver nitrate solution. The average bond order between Cl and O atoms in (Y) is
-.

Q50. The number of chiral carbons in chloramphenicol is .

Q51. Let α and β be two real roots of the equation $(k+1)\tan^2 x - \sqrt{2}\cdot\lambda\tan x = (1-k)$, where $k(\neq -1)$ and λ are real numbers. If $\tan^2(\alpha+\beta) = 50$, then a value of λ is
(1) $10\sqrt{2}$
(2) 10
(3) 5
(4) $5\sqrt{2}$

Q52. If $\text{Re}\left(\frac{z-1}{2z+i}\right) = 1$, where $z = x + iy$, then the point (x, y) lies on a
(1) circle whose centre is at $\left(-\frac{1}{2}, -\frac{3}{2}\right)$
(2) straight line whose slope is $-\frac{2}{3}$
(3) straight line whose slope is $\frac{3}{2}$
(4) circle whose diameter is $\frac{\sqrt{5}}{2}$

Q53. Total number of 6 - digit numbers in which only and all the five digits 1,3,5,7 and 9 appears, is
(1) $\frac{1}{2}(6!)$
(2) 6 !
(3) 5^6
(4) $\frac{5}{2}(6!)$

Q54. Five numbers are in A.P., whose sum is 25 and product is 2520 . If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is
(1) 27
(2) 7
(3) $\frac{21}{2}$
(4) 16

Q55. The greatest positive integer k, for which $49^k + 1$ is a factor of the sum $49^{125} + 49^{124} + \cdots + 49^2 + 49 + 1$, is
(1) 32
(2) 63
(3) 60
(4) 35

Q56. If $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to
(1) -32
(2) -64
(3) -128
(4) 128

Q57. If the distance between the foci of an ellipse is 6 and the distance between its directrix is 12 , then the length of its latus rectum is
(1) $\sqrt{3}$
(2) $3\sqrt{2}$
(3) $\frac{3}{\sqrt{2}}$
(4) $2\sqrt{3}$

Q58. For two statements p and q, the logical statement $(p \rightarrow q) \wedge (q \rightarrow \sim p)$ is equivalent to
(1) p
(2) q
(3) $\sim p$
(4) $\sim q$

Q59.
Let α be a root of the equation $x^2 + x + 1 = 0$ and the matrix $A = \frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha^4 \end{bmatrix}$, then the matrix A^{31} is equal to
(1) A^3
(2) I_3
(3) A^2
(4) A

Q60. If the system of linear equations
$2x + 2ay + az = 0$
$2x + 3by + bz = 0$
$2x + 4cy + cz = 0$,
where $a, b, c \in R$ are non-zero and distinct; has a non-zero solution, then
(1) $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in $A.P.$
(2) a, b, c are in $G.P.$
(3) $a + b + c = 0$
(4) a, b, c are in A.P.

Q61. If $g(x) = x^2 + x - 1$ and $(g \circ f)(x) = 4x^2 - 10x + 5$, then $f\left(\frac{5}{4}\right)$ is equal to
(1) $\frac{3}{2}$
(2) $-\frac{1}{2}$
(3) $\frac{1}{2}$
(4) $-\frac{3}{2}$

Q62. If $y(\alpha) = \sqrt{2\left(\frac{\tan\alpha + \cot\alpha}{1+\tan^2\alpha}\right) + \frac{1}{\sin^2\alpha}}, \alpha \in \left(\frac{3\pi}{4}, \pi\right)$, then $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$ is
(1) 4
(2) $\frac{4}{3}$
(3) -4
(4) $-\frac{1}{4}$

Q63. Let $x^k + y^k = a^k, (a, k > 0)$ and $\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$, then k is
(1) $\frac{3}{2}$
(2) $\frac{4}{3}$
(3) $\frac{2}{3}$
(4) $\frac{1}{3}$

Q64. Let the function, $f: [-7,0] \to R$ be continuous on $[-7,0]$ and differentiable on $(-7,0)$. If $f(-7) = -3$ and $f'(x) \leq 2$ for all $x \in (-7,0)$, then for all such functions $f, f(-1) + f(0)$ lies in the interval
(1) $(-\infty, 20]$
(2) $[-3,11]$
(3) $(-\infty, 11]$
(4) $[-6,20]$

Q65. If $f(a + b + 1 - x) = f(x)$, for all x, where a and b are fixed positive real numbers, then $\frac{1}{a+b}\int_a^b x(f(x) + f(x+1))dx$ is equal to
(1) $\int_{a-1}^{b-1} f(x+1)dx$
(2) $\int_{a-1}^{b-1} f(x)dx$
(3) $\int_{a+1}^{b+1} f(x)dx$
(4) $\int_{a+1}^{b+1} f(x+1)dx$

Q66. The area of the region (in sq. units), enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line $y = x$, is
(1) $\frac{1}{6}(24\pi - 1)$
(2) $\frac{1}{3}(6\pi - 1)$
(3) $\frac{1}{3}(12\pi - 1)$
(4) $\frac{1}{6}(12\pi - 1)$

Q67. If $y = y(x)$ is the solution of the differential equation, $e^y\left(\frac{dy}{dx} - 1\right) = e^x$ such that $y(0) = 0$, then $y(1)$ is equal to
(1) $1 + \log_e 2$
(2) $2 + \log_e 2$
(3) $2e$
(4) $\log_e 2$

Q68. A vector $\vec{a} = \alpha\hat{\imath} + 2\hat{\jmath} + \beta\hat{k}(\alpha, \beta \in R)$ lies in the plane of the vectors, $\vec{b} = \hat{\imath} + \hat{\jmath}$ and $\vec{c} = \hat{\imath} - \hat{\jmath} + 4\hat{k}$. If $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then
(1) $\vec{a} \cdot \hat{\imath} + 3 = 0$
(2) $\vec{a} \cdot \hat{\imath} + 1 = 0$
(3) $\vec{a} \cdot \hat{k} + 2 = 0$
(4) $\vec{a} \cdot \hat{k} + 4 = 0$

Q69. Let P be a plane passing through the points $(2,1,0), (4,1,1)$ and $(5,0,1)$ and R be any point $(2,1,6)$.Then the image of R in the plane P is
(1) $(6,5,2)$
(2) $(6,5,-2)$
(3) $(4,3,2)$
(4) $(3,4,-2)$

Q70. An unbiased coin is tossed 5 times. Suppose that a variable X is assigned the value k when k consecutive heads are obtained for $k = 3,4,5$, otherwise X takes the value -1 . Then the

expected value of X, is

(1) $\frac{3}{16}$

(2) $\frac{1}{8}$

(3) $-\frac{3}{16}$

(4) $-\frac{1}{8}$

Q71. If the sum of the coefficients of all even powers of x in the product $(1+x+x^2+\cdots+x^{2n})(1-x+x^2-x^3+\cdots+x^{2n})$ is 61 , then n is equal to

Q72. Let $A(1,0), B(6,2)$ and $C\left(\frac{3}{2},6\right)$ be the vertices of a triangle ABC. If P is a point inside the triangle ABC such that the triangles APC, APB and BPC have equal areas, then the length of the line segment PQ, where Q is the point $\left(-\frac{7}{6},-\frac{1}{3}\right)$, is

Q73. $\lim_{x\to 2}\frac{3^x+3^{3-x}-12}{3^{-\frac{x}{2}}-3^{1-x}}$ is equal to

Q74. If the variance of the first n natural numbers is 10 and the variance of the first m even natural numbers is 16 , then the value of $m+n$ is equal to

Q75. Let S be the set of points where the function, $f(x)=|2-|x-3|, x\in R$, is not differentiable. Then $\sum_{x\in S} f(f(x))$ is equal to

ANSWER KEYS

1. (2)	2. (4)	ma. 3. 1)	4. (3)	5. (2)	6. (1)	ma 7. (2)	8. (4)
9. (4)	10. (1)	11. (3)	12. (4)	13. (4)	14. (4)	15. (2)	16. (1)
17. (2)	18. (3)	19. (2)	20. (4)	21. (10)	22. (60)	mo 23. (600)	24. (175)
25. (11)	26. (3)	27. (2)	28. (3)	29. (4)	30. (4)	31. (2)	32. (2)
33. (2)	34. (4)	35. (3)	36. (2)	37. (2)	38. (2)	39. (1)	40. (1)
41. (2)	42. (2)	43. (4)	44. (2)	45. (3)	46. (-2.7)	47. (10.6)	48. (23.03)
49. (1.67)	50. (2)	51. (2)	52. (4)	53. (4)	54. (4)	55. (2)	56. (3)
57. (2)	58. (3)	59. (1)	60. (1)	61. (2)	62. (1)	63. (3)	64. (1)
65. (1)	66. (4)	67. (1)	68. (3)	69. (2)	70. (2)	71. (30)	72. (5)
73. (36)	74. (18)	75. (3)					