Q1. A particle moving in the xy-plane experiences a velocity dependent force $\vec{F} = k(v_y\hat{\imath} + v_x\hat{\jmath})$, where v_x and v_y are the x and y components of its velocity $\vec{v}$. If $\vec{a}$ is the acceleration of the particle, then which of the following statements is true for the particle?
(1) quantity $\vec{v} \times \vec{a}$ is constant in time
(2) $\vec{F}$ arises due to a magnetic field
(3) kinetic energy of particle is constant in time
(4) quantity $\vec{v} \cdot \vec{a}$ is constant in time

Q2. When a car is at rest, its driver sees rain drops falling on it vertically. When driving the car with speed v , he sees that rain drops coming at an angle 60° from the horizontal. On further increasing the speed of the car to $(1+\beta)$v, this angle changes to 45°. The value of β is close to :
(1) 0.50
(2) 0.41
(3) 0.37
(4) 0.73

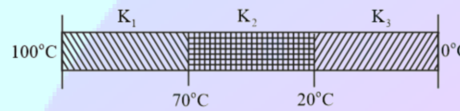
Q3. Particle A of mass m_1 moving with velocity $(\sqrt{3}\hat{\imath} + \hat{\jmath})\mathrm{ms}^{-1}$ collides with another particle B of mass m_2 which is at rest initially. Let $\vec{v}_1$ and $\vec{v}_2$ be the velocities of particles A and B after collision respectively. If $\mathrm{m}_1 = 2\ \mathrm{m}_2$ and after collision $\vec{v}_1 - (\hat{\imath} + \sqrt{3}\hat{\jmath})\mathrm{ms}^{-1}$, the angle between $\vec{v}_1$ and $\vec{v}_2$ is :
(1) 15°
(2) 60°
(3) -45°
(4) 105°

Q4. The linear mass density of a thin rod AB of length L varies from A to B as $\lambda(x) = \lambda_0\left(1 + \frac{x}{L}\right)$, where x is the distance from A. If M is the mass of the rod then its moment of inertia about an axis passing through A and perpendicular to the rod :
(1) $\frac{5}{12}\mathrm{ML}^2$
(2) $\frac{7}{18}\mathrm{ML}^2$
(3) $\frac{2}{5}\mathrm{ML}^2$
(4) $\frac{3}{7}\mathrm{ML}^2$

Q5. Two planets have masses M and 16 M and their radii are a and 2 a , respectively. The separation between the centres of the planets is 10a. A body of mass m is fired from the surface of the larger planet towards the smaller planet along the line joining their centres. For the body to be able to reach at the surface of smaller planet, the minimum firing speed needed is :
(1) $2\sqrt{\frac{GM}{a}}$
(2) $4\sqrt{\frac{GM}{a}}$
(3) $\sqrt{\frac{\mathrm{GM}^2}{\mathrm{ma}}}$
(4) $\frac{3}{2}\sqrt{\frac{5\mathrm{GM}}{a}}$

Q6. A fluid is flowing through a horizontal pipe of varying cross-section, with vms^{-1} at a point where the pressure is P Pascal. At another point where pressure $\frac{\mathrm{P}}{2}$ Pascal its speed is Vms^{-1}. If the density of the fluid is $\rho\mathrm{kg} - \mathrm{m}^{-3}$ and the flow is streamline, then V is equal to
(1) $\sqrt{\frac{P}{\rho} + v}$
(2) $\sqrt{\frac{2P}{\rho} + v^2}$
(3) $\sqrt{\frac{P}{2\rho} + v^2}$
(4) $\sqrt{\frac{P}{\rho} + v^2}$

Q7. Three rods of identical cross-section and length are made of three different materials of thermal conductivity K_1, K_2 and K_3, respectively. They are joined together at their ends to make a long rod (see figure). One end of the long rod is maintained at $100^\circ\mathrm{C}$ and the other at $0^\circ\mathrm{C}$ (see figure). If the joints of the rod are at $70^\circ\mathrm{C}$ and $20^\circ\mathrm{C}$ in steady and there is no loss of energy from the surface of the rod, the correct relationship between K_1, K_2 and K_3 is :



(1) $K_1 : K_3 = 2 : 3$, $K_2 : K_3 = 2 : 5$
(2) $K_1 < K_2 < K_3$
(3) $K_1 : K_2 = 5 : 2$, $K_1 : K_3 = 3 : 5$
(4) $K_1 > K_2 > K_3$

Q8. In a dilute gas at pressure P and temperature ' t ', the time between successive collision of a

molecule varies with T as :
(1) T
(2) $\frac{1}{\sqrt{T}}$
(3) $\frac{1}{\mathrm{T}}$
(4) $\sqrt{T}$

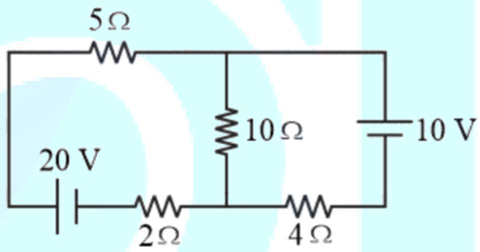
Q9. Assuming the nitrogen molecule is moving with r.m.s. velocity at 400 K , the de-Broglie wave length of nitrogen molecule is close to : (Given : nitrogen molecule weight : 4.64×10^{-26} kg, Boltzman constant : 1.38×10^{-23} J K^{-1}, Planck constant : 6.63×10^{-34} J s)
(1) 0.24□
(2) 0.20□
(3) 0.34□
(4) 0.44□

Q10. When a particle of mass m is attached to a vertical spring of spring constant k and released, its motion, is described by $y(t)=y_0 \sin^2 \omega t$, where ' y ' is measured from the lower end of upstretched spring. Then ω is :
(1) $\frac{1}{2}\sqrt{\frac{g}{y_0}}$
(2) $\sqrt{\frac{g}{y_0}}$
(3) $\sqrt{\frac{g}{2y_0}}$
(4) $\sqrt{\frac{2g}{y_0}}$

Q11. Two identical electric point dipoles have dipole have dipole moments $\overrightarrow{p_1}=\hat{p}\imath$ and $\overrightarrow{p_2}=-\mathrm{p}\mathrm{i}$ and are held on the x -axis at distance ' a ' from each other. When released, they move along the x -axis with the direction of their dipole moments remaining unchanged. If the mass of each dipole is ' m ', their speed when they are infinitely far apart is :
(1) $\frac{P}{a}\sqrt{\frac{1}{\pi\varepsilon_0 \mathrm{ma}}}$
(2) $\frac{\mathrm{P}}{\mathrm{a}}\sqrt{\frac{1}{2\pi\varepsilon_0 \mathrm{ma}}}$
(3) $\frac{\mathrm{P}}{\mathrm{a}}\sqrt{\frac{2}{\pi\varepsilon_0 \mathrm{ma}}}$
(4) $\frac{\mathrm{P}}{\mathrm{a}}\sqrt{\frac{3}{2\pi\varepsilon_0 \mathrm{ma}}}$

Q12. Consider the force F on a charge ' q ' due to a uniformly charged spherical shell of radius R carrying charge Q distributed uniformly over it. Which one of the following statements is true for F, if ' q ' is placed at distance r from the centre of the shell?
(1) $\mathrm{F}=\frac{1}{4\pi\epsilon_0}\frac{\mathrm{Qq}}{\mathrm{R}^2}$ for $\mathrm{r}<\mathrm{R}$
(2) $\frac{1}{4\pi\epsilon_0}\frac{\mathrm{qQ}}{\mathrm{R}^2}>\mathrm{F}>0$ for $\mathrm{r}<\mathrm{R}$
(3) $\mathrm{F}=\frac{1}{4\pi\epsilon_0}\frac{\mathrm{Qq}}{\mathrm{r}^2}$ for $\mathrm{r}>\mathrm{R}$
(4) $\mathrm{F}=\frac{1}{4\pi\epsilon_0}\frac{\mathrm{Qq}}{\mathrm{r}^2}$ for all r

Q13. In the figure shown, the current in the 10 V battery is close to :



(1) 0.71 A from positive to negative terminal
(2) 0.42 A from positive to negative terminal
(3) 0.21 A from positive to negative terminal
(4) 0.36 A from negative to postive terminal

Q14. A circuit to verify Ohm's law uses ammeter and voltmeter in series or parallel connected corrected correctly to the resistor. In the circuit :
(1) ammeter is always used in parallel and voltmeter is series
(2) Both ammeter and voltmeter must be connected in parallel
(3) ammeter is always connected in series and voltmeter in parallel
(4) Both ammeter and voltmeter must be connected in series

Q15. A charged particle going around in a circle can be considered to be a current loop. A particle of a mass m carrying charge q is moving in a plane with speed v under the influence of magnetic field $\vec{B}$. The magnetic moment of this moving particle is :
(1) $\frac{mv^2\vec{\mathrm{B}}}{2\,\mathrm{B}^2}$
(2) $-\frac{mv^2\vec{\mathrm{B}}}{2\pi\,\mathrm{B}^2}$

(3) $-\frac{mv^2 \overrightarrow{B}}{B^2}$
(4) $-\frac{mv^2 \overrightarrow{B}}{2 B^2}$

Q16. A square loop of side 2a and carrying current I is kept in xz plane with its centre at origin. A long wire carrying the same current I is placed parallel to z -axis and passing through point $(0, b, 0), (b \gg a)$. The magnitude of torque on the loop about z -axis will be :
(1) $\frac{2\mu_0 I^2 a^2}{\pi b}$
(2) $\frac{2\mu_0{}^2 a^2 b}{\pi(a^2+b^2)}$
(3) $\frac{\mu_0 I^2 a^2 b}{2\pi(a^2+b^2)}$
(4) $\frac{\mu_0{}^2 a^2}{2\pi \text{ b}}$

Q17.For a plane electromagnetic wave, the magnetic field at a point x and time t is :
$\overrightarrow{B}(x, t) = [1.2 \times 10^{-7} \sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t)\hat{k}] T$.
The instantaneous electric field $\overrightarrow{E}$ corresponding to $\overrightarrow{B}$ is :
(1) $\overrightarrow{E}(x, t) = [-36\sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t)\hat{j}] \frac{(2y}{m} \overrightarrow{E}(x, t) = [36\sin(1 \times 10^3 x + 0.5 \times 10^{11} t)\hat{j}] \frac{v}{m}$
(3) $\overrightarrow{E}(x, t) = [36\sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t)\hat{k}] \frac{(4)}{m} \overrightarrow{E}(x, t) = [36\sin(1 \times 10^3 x + 15 \times 10^{11} t)\hat{i}] \frac{v}{m}$

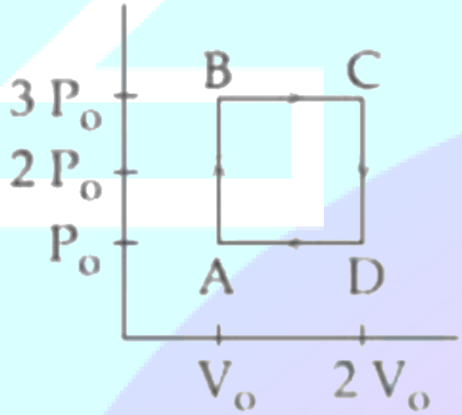
Q18. A double convex lens has power P and same radii of curvature r of both the surfaces. The radius of curvature of a surface of a plano-convex lens made of the same material with power 1.5 P is :
(1) $2R$
(2) $\frac{R}{2}$
(3) $\frac{3R}{2}$
(4) $\frac{R}{3}$

Q19. Given the masses of various atomic particles $m_P = 1{,}0072u$, $m_n = 1{,}0087u$, $m_e = 0.000548u$, $m_{\bar{v}} = 0$, $m_d = 2.0141u$, where p = proton, n ≡ neutron, e ≡ electron, $\bar{v}$ ≡ antineutrino and $\overline{d}$ ≡ deuteron. Which of the following process is allowed by momentum and energy conservation :
(1) $n + n \rightarrow$ deuterium atom (electron bound to the nucleus)
(3) $n + p \rightarrow d + \gamma$
(2) $p \rightarrow n + e^+ + \bar{v}$
(4) $e^+ + e^- \rightarrow \gamma$

Q20. A student measuring the diameter of a pencil of circular cross-section with the help of a vernier scale records the following four readings 5.50 mm, 5.55 mm, 5.34 mm, 5.65 mm. The average of these four reading is 5.5375 mm and the standard deviation of the data is 0.07395 mm . The average diameter of the pencil should therefore be recorded as :
(1) (5.5375 ± 0.0739)mm
(2) (5.5375 ± 0.0740)mm
(3) (5.538 ± 0.074)mm
(4) (5.54 ± 0.07)mm

Q21. The centre of mass of a solid hemisphere of radius 8 cm is xcm from the centre of the flat surface. Then value of x is

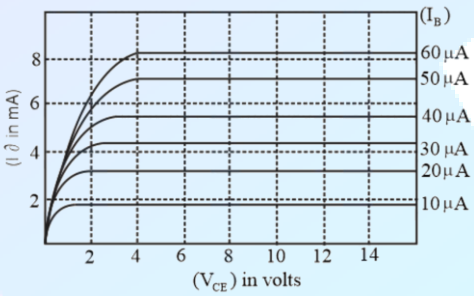
Q22.An engine operates by taking a monatomic ideal gas through the cycle shown in the figure. The percentage efficiency of the engine is close to



Q23. In a series LR circuit, power of 400 W is dissipated from a source of 250 V, 50 Hz. The power factor of the circuit is 0.8 . In order to bring the power factor to unity, a capacitor of value C is added in series to the L and R. Taking the value of C as $\left(\frac{n}{3\pi}\right) \mu F$, then value of n is

Q24. A Young's double-slit experiment is performed using monochromatic light of wavelength λ. The intensity of light at a point on the screen, where the path difference is λ, is K units. The intensity of light at a point where the path difference is $\frac{\lambda}{6}$ is given by $\frac{nK}{12}$, where n is an integer. The value of n is

Q25. The output characteristics of a transistor is shown in the figure. When V_{CE} is 10 V and $I_C = 4.0$ mA, then value of β_{ac} is



Q26. The average molar mass of chlorine is 35.5 g mol^{-1}. The ratio of ^{35}Cl to ^{37}Cl in naturally occurring chlorine is close to :
(1) 4: 1
(2) 3: 1
(3) 2: 1
(4) 1: 1

Q27. For a reaction $4M(s) + nO_2(g) \rightarrow 2M_2O_n(s)$
The free energy change is plotted as a function of temperature. The temperature below which the oxide is stable could be inferred from the plot as the point at which :
(1) the slope change from negative to positive
(2) the free energy change show a change from negative to positive value
(3) the slope changes from positive to negative
(4) the slope changes from positive to zero

Q28. The value of K_c us 64 at 800 K for the reaction
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
The value of K_c for the following reaction is :
$NH_3(g) \rightarrow \frac{1}{2} N_2(g) + \frac{3}{2} H_2(g)$
(1) $1/64$
(2) 8
(3) $1/4$
(4) $1/8$

Q29. Dihydrogen of high purity ($> 99.95\%$) is obtained through :
(1) The reaction of Zn with dilute HCl .
(2) The electrolysis of acidified water using Pt electrodes.
(3) The electrolysis of brine solution.
(4) The electrolysis of warm $Ba(OH)_2$ solution using Ni electrodes.

Q30. Match the following compounds (Column-I) with their uses (Column-II)
S. No.
Columns
S.No. Column-II
(I) $Ca(OH)_2$
(A) casts of statues
(II) NaCl
(B) white wash
(III) $CaSO_4 \cdot \frac{1}{2} H_2O$
(C) antacid
(IV) $CaCO_3$
(D) washing soda preparation
(1) (I)-(D), (II)-(A), (III)-(C), (IV)-(B)
(2) (I)-(B), (II)-(D), (III)-(A), (IV)-(C)
(3) (I)-(B), (II)-(C), (III)-(D), (IV)-(A)
(4) (I)-(D), (II)-(C), (III)-(B), (IV)-(A)

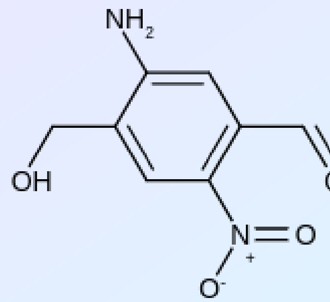
Q31. Match the following :

Test/Method
(i) Lucas Test
(ii) Dumas method
(iii) Kjeldahl's method
(iv) Hinsberg Test

Reagent

(a) $C_6H_5SO_2Cl/$ aq. KOH
(b) $HNO_3/AgNO_3$
(c) CuO/CO_3
(d) Conc. HCl and $ZnCl_2$
(e) H_2SO_4
(1) (i)-(d), (ii)-(c), (iii)-(b), (iv)-(e)
(2) (i)-(b), (ii)-(d), (iii)-(e), (iv)-(a)
(3) (i)-(d), (ii)-(c), (iii)-(e), (iv)-(a)
(4) (i)-(b), (ii)-(a), (iii)-(c), (iv)-(d)

Q32. The IUPAC name of following compound is :



(1) 2-nitro-4-hydroxymethyl-5-amino benzaldehyde
(2) 3-amino-4-hydroxymethyl-5-nitrogenzaldehyde
(3) 5-amino-4-hydroxymethyl-2-nitrobenzaldehyde
(4) 4-amino-2-formyl-5-hydroxymethyl nitrogenzene

Q33. A crystal is made up of metal ions $/M_1/$ and $/M_2'$ and oxide ions. Oxide ions form a ccp lattice structure. The cation M_1' occupies 50% of octahedral voids and the cation M_2' occupies 12.5% of tetrahedral voids of oxide lattice. The oxidation numbers of $/M_1'$ and $/M_2'$ are respectively :
(1) $+2, +4$
(2) $+1, +3$
(3) $+3, +1$
(4) $+4, +2$

Q34. A set of solutions is prepared using 180 g of water as a solvent and 10 g of different non-volatile solutes A, B and C . The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of $A = 100\ g\ mol^{-1}; B = 200\ g\ mol^{-1}; C = 10{,}000\ g\ mol^{-1}$]
(1) $B > C > A$
(2) $C > B > A$
(3) $A > B > C$
(4) $A > C > B$

Q35. For the given cell;
$Cu(s)|Cu^{2+}(C_1M)||Cu^{2+}(C_2M)|Cu(s)$ change in Gibbs energy (ΔG) is negative, it :
(1) $C_1 = C_2$
(2) $C_2 = \frac{C_1}{\sqrt{2}}$
(3) $C_1 = 2C_2$
(4) $C_2 = \sqrt{2}C_1$

Q36. The element that can be refined by distillation is :
(1) nickel
(2) zinc
(3) tin
(4) gallium

Q37. The reaction of NO with N_2O_4 at 250 K gives :
(1) N_2O
(2) NO_2
(3) N_2O_3
(4) N_2O_5

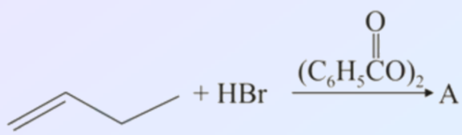
Q38. Reaction of an inorganic sulphite X with dilute H_2SO_4 generated compound Y . Reaction of Y with NaOH gives X . Further, the reaction of X with Y and water affords compound Z, Y and X , respectively, are :
(1) SO_2 and Na_2SO_3
(2) SO_3 and $NaHSO_3$
(3) SO_2 and $NaHSO_3$
(4) S and Na_2SO_3

Q39. Mischmetal is an alloy consisting mainly of :
(1) Lanthanoid metals
(2) actinoid and transition metals
(3) lanthanoid and actinoid metals
(4) actinoid metals

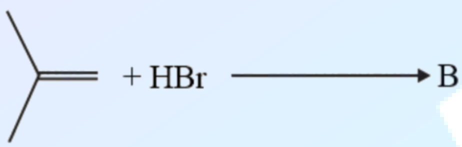
Q40. For a d^4 metal ion in an octahedral field, the correct electronic configuration is :
(1) $t_{2g}^3 e_g^1$ when $\Delta_O < P$
(2) $t_{2g}^3 e_g^1$ when $\Delta_O > P$
(3) $t_{2g}^4 e_g^0$ when $\Delta_O < P$
(4) $e_g^2 t_{2g}^2$ when $\Delta_O < P$

Q41. The increasing order of the boiling points of the major products A, B and C of the following reactions will be

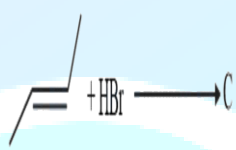
(a)



(b)



(c)



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

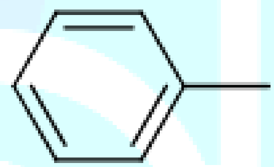
Q42. The correct match between Item-I (starting material) and Item-II (reagent) for the preparation of benzaldehyde is :

Item-I
(I) Benzene
(II) Benzonitrile
(III) Benzoyl Chloride

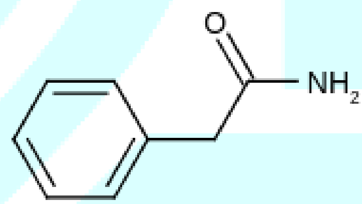
Item-II

(P) HCl and $SnCl_2, H_3O +$
(Q) $H_2, Pd - BaSO_4$, S and quinoline
(R) Co, HCl and $AlCl_3$
(1) (I)-(Q), (II)-(R) and (III)-(P)
(2) (I)-(P), (II)-(Q) and (III)-(R)
(3) (I)-(R), (II) −(P) and (III)-(Q)
(4) (I)-(R), (II) −(Q) and (III)-(P)

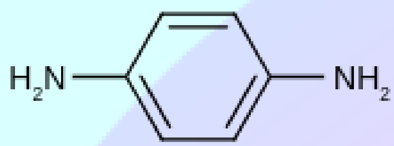
Q43. Which of the following compounds can be prepared in good yield by Gabriel phthalimide synthesis?
(1)
CH_2NH_2



(2) $CH_3 - CH_2 - NHCH_3$
(3)



(4)



Q44. The correct match between item - I and item - II is :
Item - I
Item - II
(a) Natural rubber
(I) 1, 3-butadiene + styrene
(b) Neoprene

(II) 1,3-butadiene
(c) Buna-N
(III) chloroprene
(d) Buna-S
(IV) Isoprene
(1) (a)-(III), (b)-(IV), (c)-(I), (d)-(II)
(2) (a)-(III), (b)-(IV), (c)-(II), (d)-(I)
(3) (a)-(IV), (b)-(III), (c)-(II), (d)-(I)
(4) (a)-(IV), (b)-(III), (c)-(I), (d)-(II)

Q45. Which one of the following statement is not true?
(1) Lactose contains α-glycosidic linkage between C_1 of galactose and C_4 of glucose
(3) Lactose ($C_{11}H_{22}O_{11}$) is a disaccharide and it contains 8 hydroxyl groups.
(2) Lactose is a reducing sugar and it gives Fehling's test.
(4) On acid hydrolysis, lactose gives one molecule of D(+) - glucose and one molecule of D(+) − galactose.

Q46. The atomic number of Unnilumium is .

Q47. If the solubility product of AB_2 is $3.20 \times 10^{-11} M^3$, then the solubility of AB_2 in pure water is $\times 10^{-4}$ mol L^{-1}
[Assuming that neither kind of ion reacts with water]
Q48. The rate of a reaction decreased by 3.555 times when the temperature was changed from 40 °C to 30°C. the activation energy (in kJmol^{-1}) of the reaction is .

Q49. For Freundlich adsorption isotherm, a plot of $\log(x/m)(y - axis)$ and $\log p(x - axis)$ gives a straight line, the intercept and slope fo rthe line is 0.4771 and 2 , respectively. The mass of gas, adsorbed per gram of adsorbent if the initial pressure is 0.04 atm is $\times 10^{-4}$ g.

Q50. A solution of phenol in chloroform when treated with aqueous NaOH gives compound Pas a major product. The mass percentage of carbon in P is -

Q51. If α and β are the roots of the equation $2x(2x + 1) = 1$, then β is equal to :
(1) $2\alpha(\alpha + 1)$
(2) $-2\alpha(\alpha + 1)$
(3) $2\alpha(\alpha - 1)$
(4) $2\alpha^2$

Q52. Let $z = x + iy$ be a non-zero complex number such that $z^2 = i|z|^2$, where $i = \sqrt{-1}$, then z lies on the :
(1) line, $y = -x$
(2) imaginary axis
(3) line, $y = x$
(4) real axis

Q53. The common difference of the A.P. $b_1, b_2, \ldots, b_m$ is 2 more than common difference of
A.P. $a_1, a_2, \ldots \ldots, a_n$. If $a_{40} = -159, a_{100} = -399$ and $b_{100} = a_{70}$, then b_1 is equal to :
(1) 81
(2) -127
(3) -81
(4) 127

Q54. If the constant term in the binomial expansion of $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$ is 405 , then |k| equals :
(1) 9
(2) 1
(3) 3
(4) 2

Q55. Let L denote the line in the xy-plane with x and y intercepts as 3 and 1 respectively. Then the image of the point $(-1, -4)$ in the line is :
(1) $\left(\frac{11}{5}, \frac{28}{5}\right)$
(2) $\left(\frac{29}{5}, \frac{8}{5}\right)$
(3) $\left(\frac{8}{5}, \frac{29}{5}\right)$
(4) $\left(\frac{29}{5}, \frac{11}{5}\right)$

Q56. The centre of the circle passing through the point (0,1) and touching the parabola $y = x^2$ at the point (2,4) is
(1) $\left(\frac{-53}{10}, \frac{16}{5}\right)$
(2) $\left(\frac{6}{5}, \frac{53}{10}\right)$
(3) $\left(\frac{3}{10}, \frac{16}{5}\right)$
(4) $\left(\frac{-16}{5}, \frac{53}{10}\right)$

Q57.If the normal at an end of latus rectum of an ellipse passes through an extremity of the minor axis, then the eccentricity e of the ellipse satisfies:
(1) $e^4+2e^2-1=0$
(2) $e^2+e-1=0$
(3) $e^4+e^2-1=0$
(4) $e^2+2e-1=0$

Q58. Consider the statement: "For an integer n, if n^3-1 is even, then n is odd". The contrapositive statement of this statement is:
(1) For an integer n, if n is even, then n^3-1 is odd.
(2) For an integer n, if n^3-1 is not even, then n is not odd.
(3) For an integer n, if n is even, then n^3-1 is even.(4) For an integer n, if n is odd, then n^3-1 is even.

Q59. The angle of elevation of the summit of a mountain from a point on the ground is 45°. After climbing up one km towards the summit at an inclination of 30° from the ground, the angle of elevation of the summit is found to be 60°. Then the height (in km) of the summit from the ground is :
(1) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$
(2) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$
(3) $\frac{1}{\sqrt{3}-1}$
(4) $\frac{1}{\sqrt{3}+1}$

Q60. Let$\theta=\frac{\pi}{5}$ and $A=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$. If $B=A+A^4$, then $\det(B)$:
(1) is one
(2) lies in (2,3)
(3) is zero
(4) lies in (1,2)

Q61. For a suitably chosen real constant a , let a function, $f:\mathbf{R}-\{-\mathbf{a}\}\rightarrow\mathbf{R}$ be defined by $f(x)=\frac{a-x}{a+x}$. Further supposed that for any real number $x\neq-a$, and $f(x)\neq-a$, $(f o f)(x)=x$. Then $f\left(-\frac{1}{2}\right)$ is equal to :
(1) $\frac{1}{3}$
(2) $-\frac{1}{3}$
(3) -3
(4) 3

Q62. Let $f:R\rightarrow R$ be a function defined by $f(x)=\max\{x,x^2\}$. Let S denote the set of all points in R, where f is not differentiable.Then :
(1) {0,1}
(2) {0}
(3) ϕ (an empty set)
(4) {1}

Q63. The set of all real values λ for which the function $f(x)=(1-\cos^2x).(\lambda+\sin x), x\varepsilon\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$, has exactly one maxima and exactly one minima, is :
(1) $\left(-\frac{1}{2},\frac{1}{2}\right)-\{0\}$
(2) $\left(-\frac{3}{2},\frac{3}{2}\right)$
(3) $\left(-\frac{1}{2},\frac{1}{2}\right)$
(4) $\left(-\frac{3}{2},\frac{3}{2}\right)-\{0\}$

Q64. For all twice differentiable functions $f:\mathbf{R}\rightarrow\mathbf{R}$, with $f(0)=f(1)=f(0)=0$,
(1) $f''(x)\neq0$ at every point $x\varepsilon(0,1)$
(2) $f''(x)=0$, for some $x\varepsilon(0,1)$
(3) $f''(0)=0$
(4) $f''(x)=0$, at every point $x\varepsilon(0,1)$

Q65. If the tangent to the curve, $y=f(x)=x\log_e x,(x>0)$ at a point $(c,f(c))$ is parallel to the line-segment joining the points (1,0) and (e,e),then c is equal to :
(1) $\frac{e-1}{e}$
(2) $e^{\left(\frac{1}{e-1}\right)}$
(3) $e^{\left(\frac{1}{1-e}\right)}$
(4) $\frac{1}{e-1}$

Q66. The integral $\int_1^2 e^x\cdot x^x(2+\log_e x)dx$ equals :
(1) $e(4e+1)$
(2) $4e^2-1$
(3) $e(4e-1)$
(4) $e(2e-1)$

Q67. The area (in sq. units) of the region enclosed by the curves $y=x^2-1$ and $y=1-x^2$ is equal to:

(1) $\frac{4}{3}$
(2) $\frac{8}{3}$
(3) $\frac{7}{2}$
(4) $\frac{16}{3}$

Q68. If $y = \left(\frac{2}{\pi}x - 1\right)\operatorname{cosec}x$ is the solution of the differential equation, $\frac{dy}{dx} + p(x)y = -\frac{2}{\pi}\operatorname{cosec}x, 0 < x < \frac{\pi}{2}$, then the function $p(x)$ is equal to :
(1) $\cot x$
(2) $\operatorname{cosec}x$
(3) $\sec x$
(4) $\tan x$

Q69. A plane P meets the coordinate axes at A, B and C respectively. The centroid of ΔABC is given to be $(1,1,2)$. Then the equation of the line through this centroid and perpendicular to the plane P is :
(1) $\frac{x-1}{2} = \frac{y-1}{1} = \frac{z-2}{1}$
(2) $\frac{x-1}{1} = \frac{y-1}{1} = \frac{z-2}{2}$
(3) $\frac{x-1}{2} = \frac{y-1}{2} = \frac{z-2}{1}$
(4) $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-2}{2}$

Q70. The probabilities of three events A, B and C are given $P(A) = 0.6, P(B) = 0.4$ and $P(C) = 0.5$. If $P(A \cup B) = 0.8, P(A \cap C) = 0.3, P(A \cap B \cap C) = 0.2, P(B \cap C) = \beta$ and $P(A \cup B \cup C) = \alpha$, where $0.85 \leq \alpha \leq 0.95$, then β lies in the interval :
(1) [0.35,0.36]
(2) [0.25,0.35]
(3) [0.20,0.25]
(4) [0.36,0.40]

Q71. The number of words (with or without meaning) that can be formed from all the letters of the word "LETTER" in which vowels never come together is.

Q72. Consider the data on x taking the values $0,2,4,8, \ldots \ldots, 2^n$ with frequencies ${}^nC_0, {}^nC_1, {}^nC_2, \ldots., {}^nC_n$ respectively. If the mean of this data is $\frac{728}{2^n}$, then n is equal to ..

Q73. The sum of distinct values of λ for which the system of equations:
$(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0$
$(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0$
$2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0$,
Has non-zero solutions, is

Q74. Suppose that a function f: $\mathbf{R} \rightarrow \mathbf{R}$ satisfies $f(x + y) = f(x)f(y)$ for all $x, y \epsilon R$ and $f(1) = 3$. If $\sum_{i=1}^{n} f(i) = 363$, then n is equal to

Q75. If $\vec{x}$ and $\vec{y}$ be two non-zero vectors such that $|\vec{x} + \vec{y}| = |\vec{x}|$ and $\overrightarrow{2x} + \lambda\vec{y}$ is perpendicular to $\vec{y}$, then the value of λ is

ANSWER KEYS

1. (1) athor	2. (4)	ma 3. (4)	4. (2)	5. (4)	6. (4)	ma 7. (1)	8. (2)
9. (1)	10. (3)	11. (2)	12. (3)	13. (3)	14. (3)	15. (4)	16. (2)
17. (1) athor	18. (4)	19. (3)	20. (4)	21. (3)	22. (19)	mo 23. (400)	24. (9) anco
25. (150)	26. (2)	27. (2)	28. (4)	29. (4)	30. (2)	31. (3)	32. (3)
33. (1)	34. (3)	35. (4)	36. (2)	37. (3)	38. (3)	39. (1)	40. (1)
41. (1)	42. (3)	43. (1)	44. (3)	45. (1)	46. (101)	47. (2)	48. (100)
49. (48)	50. (69)	51. (2)	52. (3)	53. (3)	54. (3)	55. (1)	56. (4)
57. (3)	58. (1)	ma 59. (3)	60. (4)	61. (4)	62. (1)	mo63. (4)	64. (4)
65. (2)	66. (3)	67. (2)	68. (1)	69. (3)	70. (2)	71. (120)	72. (6)
73. (3) athon	74. (5)	75. (1)					