Q1. In an experiment to measure focal length (f) of convex lens, the least counts of the measuring scales for the position of object (u) and for the position of image (v) are $\Delta\mathrm{u}$ and $\Delta\mathrm{v}$, respectively. The error in the measurement of the focal length of the convex lens will be:

(1) $2f\left[\frac{\Delta\mathrm{u}}{\mathrm{u}}+\frac{\Delta\mathrm{v}}{\mathrm{v}}\right]$ (2) $\frac{\Delta\mathrm{u}}{\mathrm{u}}+\frac{\Delta\mathrm{v}}{\mathrm{v}}$

(3) $f^2\left[\frac{\Delta\mathrm{u}}{\mathrm{u}^2}+\frac{\Delta\mathrm{v}}{\mathrm{v}^2}\right]$ (4) $f\left[\frac{\Delta\mathrm{u}}{\mathrm{u}}+\frac{\Delta\mathrm{v}}{\mathrm{v}}\right]$

Q2. The equation of stationary wave is : $y=2a\sin\left(\frac{2\pi nt}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$. Which of the following is NOT correct :

(1) The dimensions of n/λ is [T] (2) The dimensions of n is $\left[\mathrm{LT}^{-1}\right]$

(3) The dimensions of x is [L] (4) The dimensions of nt is [L]

Q3. A body travels $102.5\ \mathrm{m}$ in n^{th} second and $115.0\ \mathrm{m}$ in $(\mathrm{n}+2)^{\mathrm{th}}$ second. The acceleration is :

(1) $6.25\ \mathrm{m/s^2}$ (2) $12.5\ \mathrm{m/s^2}$

(3) $9\ \mathrm{m/s^2}$ (4) $5\ \mathrm{m/s^2}$

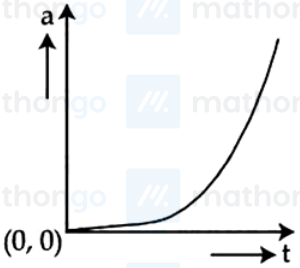
Q4. The co-ordinates of a particle moving in $x-y$ plane are given by : $x=2+4\mathrm{t}, y=3\mathrm{t}+8\mathrm{t}^2$. The motion of the particle is :

(1) uniformly accelerated having motion along a parabolic path. (2) uniform motion along a straight line.

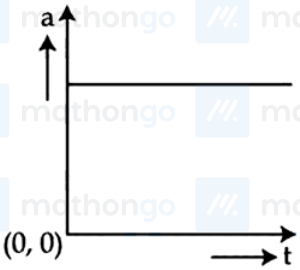
(3) uniformly accelerated having motion along a straight line. (4) non-uniformly accelerated.

Q5. A wooden block, initially at rest on the ground, is pushed by a force which increases linearly with time t. Which of the following curve best describes acceleration of the block with time:

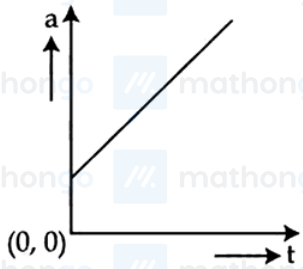
(1)



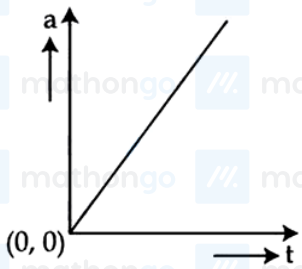
(2)



(3)



(4)



Q6. If a rubber ball falls from a height h and rebounds upto the height of $h/2$. The percentage loss of total energy of the initial system as well as velocity ball before it strikes the ground, respectively, are :

(1) $50\%, \sqrt{2\mathrm{gh}}$ (2) $50\%, \sqrt{\mathrm{gh}}$

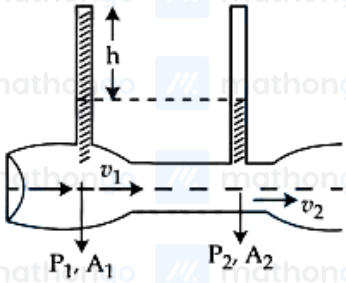
(3) $40\%, \sqrt{2\mathrm{gh}}$ (4) $50\%, \sqrt{\frac{\mathrm{gh}}{2}}$

Q7. A metal wire of uniform mass density having length L and mass M is bent to form a semicircular arc and a particle of mass m is placed at the centre of the arc. The gravitational force on the particle by the wire is :

(1) $\frac{GmM\pi^2}{L^2}$ (2) $\frac{GMm\pi}{2L^2}$

(3) 0 (4) $\frac{2GmM\pi}{L^2}$

Q8. Given below are two statements: Statement I : When speed of liquid is zero everywhere, pressure difference at any two points depends on equation $P_1 - P_2 = \rho g(h_2 - h_1)$. Statement II : In ventury tube shown



$2gh = v_1^2 - v_2^2$

In the light of the above statements, choose the most appropriate answer from the options given below.

(1) Both Statement I and Statement II are correct. (2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct. (4) Both Statement I and Statement II are incorrect.

Q9. The resistances of the platinum wire of a platinum resistance thermometer at the ice point and steam point are 8Ω and 10Ω respectively. After inserting in a hot bath of temperature $400^\circ C$, the resistance of platinum wire is :

(1) 10Ω (2) 8Ω

(3) 16Ω (4) 2Ω

Q10. On celcius scale the temperature of body increases by $40^\circ C$. The increase in temperature on Fahrenheit scale is :

(1) $68^\circ F$ (2) $75^\circ F$

(3) $72^\circ F$ (4) $70^\circ F$

Q11. P-T diagram of an ideal gas having three different densities ρ_1, ρ_2, ρ_3 (in three different cases) is shown in the

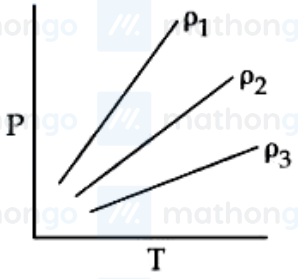


figure. Which of the following is correct :

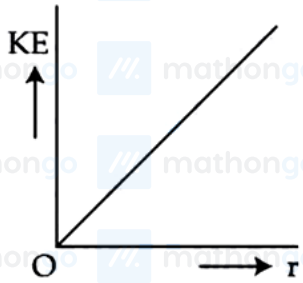
(1) $\rho_1 > \rho_2$ (2) $\rho_2 < \rho_3$

(3) $\rho_1 = \rho_2 = \rho_3$ (4) $\rho_1 < \rho_2$

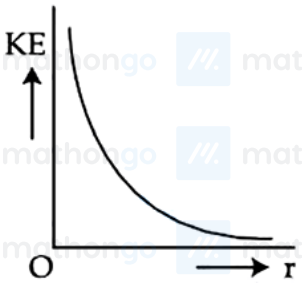
Q12. An infinitely long positively charged straight thread has a linear charge density λCm^{-1}. An electron revolves along a circular path having axis along the length of the wire. The graph that correctly represents the variation

of the kinetic energy of electron as a function of radius of circular path from the wire is :

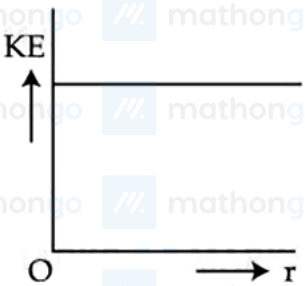
(1)



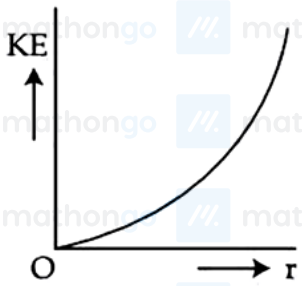
(2)



(3)



(4)



Q13. To measure the internal resistance of a battery, potentiometer is used. For $\mathrm{R} = 10\Omega$, the balance point is observed at $l = 500$ cm and for $\mathrm{R} = 1\Omega$ the balance point is observed at $l = 400$ cm. The internal resistance of the battery is approximately :

(1) 0.2Ω (2) 0.3Ω

(3) 0.4Ω (4) 0.1Ω

Q14. An electron is projected with uniform velocity along the axis inside a current carrying long solenoid. Then :

(1) the electron will continue to move with uniform velocity along the axis of the solenoid.

(2) the electron will be accelerated along the axis.

(3) the electron path will be circular about the axis.

(4) the electron will experience a force at 45° to the axis and execute a helical path.

Q15. In an ac circuit, the instantaneous current is zero, when the instantaneous voltage is maximum. In this case, the source may be connected to : A. pure inductor. B. pure capacitor. C. pure resistor. D. combination of an inductor and capacitor. Choose the correct answer from the options given below :

(1) A, B and C only (2) A and B only

(3) B, C and D only (4) A, B and D only

Q16. The electric field in an electromagnetic wave is given by $\overrightarrow{\mathrm{E}} = \hat{i}40\cos\omega(\mathrm{t} - z/\mathrm{c})\mathrm{NC}^{-1}$. The magnetic field induction of this wave is (in SI unit) :

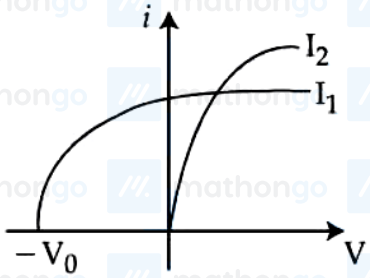
(1) $\overrightarrow{\mathrm{B}} = \hat{k}\frac{40}{\mathrm{C}}\cos\omega(\mathrm{t} - z/\mathrm{c})$ (2) $\vec{B} = \hat{j}40\cos\omega(t - z/c)$

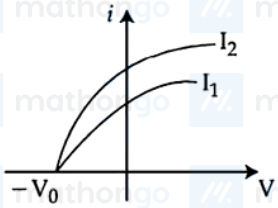
(3) $\overrightarrow{\mathrm{B}} = \hat{i}\frac{40}{\mathrm{C}}\cos\omega(\mathrm{t} - z/\mathrm{c})$ (4) $\overrightarrow{\mathrm{B}} = \hat{j}\frac{40}{\mathrm{C}}\cos\omega(\mathrm{t} - z/\mathrm{c})$

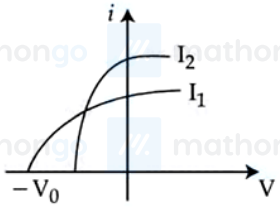
Q17. An effective power of a combination of 5 identical convex lenses which are kept in contact along the principal axis is 25D. Focal length of each of the convex lens is :

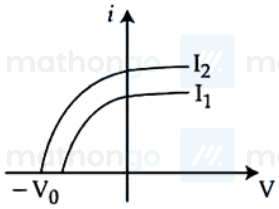
(1) 20 cm (2) 50 cm
(3) 500 cm (4) 25 cm

Q18. Which figure shows the correct variation of applied potential difference (V) with photoelectric current (I) at two different intensities of light $(I_1 < I_2)$ of same wavelengths :

(1)


(2)


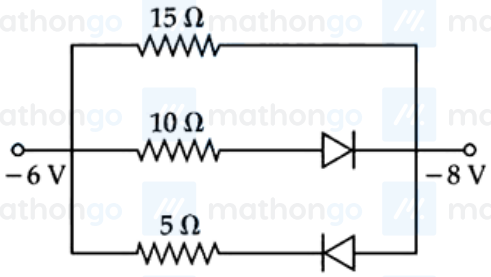
(3)


(4)


Q19. Which of the following nuclear fragments corresponding to nuclear fission between neutron $\left({}_0^1\mathrm{n}\right)$ and uranium isotope $\left({}_{92}^{235}\mathrm{U}\right)$ is correct :

(1) ${}_{56}^{144}\mathrm{Ba} + {}_{36}^{89}\mathrm{Kr} + 4{}_0^1\mathrm{n}$ (2) ${}_{56}^{144}\mathrm{Ba} + {}_{36}^{89}\mathrm{Kr} + 3{}_0^1\mathrm{n}$
(3) ${}_{56}^{140}\mathrm{Xe} + {}_{38}^{94}\mathrm{Sr} + 3{}_0^1\mathrm{n}$ (4) ${}_{51}^{153}\mathrm{Sb} + {}_{41}^{99}\mathrm{Nb} + 3{}_0^1\mathrm{n}$

Q20. The value of net resistance of the network as shown in the given figure is :



(1) 6Ω (2) $(5/2)\Omega$
(3) $(15/4)\Omega$ (4) $(30/11)\Omega$

Q21. Two forces $\vec{F}_1$ and $\vec{F}_2$ are acting on a body. One force has magnitude thrice that of the other force and the resultant of the two forces is equal to the force of larger magnitude. The angle between $\vec{F}_1$ and $\vec{F}_2$ is $\cos^{-1}\left(\frac{1}{n}\right)$. The value of $|n|$ is _____.

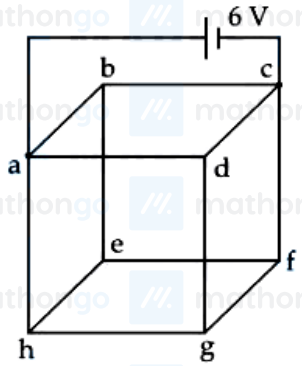
Q22. A solid sphere and a hollow cylinder roll up without slipping on same inclined plane with same initial speed v. The sphere and the cylinder reaches upto maximum heights h_1 and h_2, respectively, above the initial level. The ratio $h_1 : h_2$ is $\frac{n}{10}$. The value of n is_____.

Q23. An elastic spring under tension of 3 N has a length a. Its length is b under tension 2 N. For its length $(3a - 2b)$, the value of tension will be_____N.

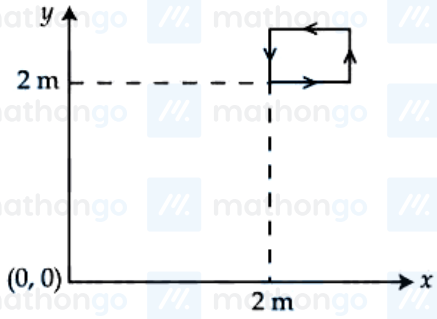
Q24. A soap bubble is blown to a diameter of 7 cm.36960erg of work is done in blowing it further. If surface tension of soap solution is 40dyne/cm then the new radius is_____ cm Take $\left(\pi = \frac{22}{7}\right)$

Q25. An infinite plane sheet of charge having uniform surface charge density $+\sigma_s \mathrm{C/m^2}$ is placed on $x - y$ plane. Another infinitely long line charge having uniform linear charge density $+\lambda_e \mathrm{C/m}$ is placed at $z = 4$ m plane and parallel to y-axis. If the magnitude values $|\sigma_s| = 2\,|\lambda_e|$ then at point $(0, 0, 2)$, the ratio of magnitudes of electric field values due to sheet charge to that of line charge is $\pi\sqrt{n} : 1$. The value of n is_____.

Q26. Twelve wires each having resistance 2Ω are joined to form a cube. A battery of 6 V emf is joined across point a and c. The voltage difference between e and f is _____V.



Q27. The magnetic field existing in a region is given by $\vec{B} = 0.2(1 + 2x)\hat{k}$ T. A square loop of edge 50 cm carrying 0.5 A current is placed in $x - y$ plane with its edges parallel to the $x - y$ axes, as shown in figure. The magnitude of the net magnetic force experienced by the loop is_____ mN.



Q28. A alternating current at any instant is given by $i = [6 + \sqrt{56}\sin(100\pi t + \pi/3)]$ A. The rms value of the current is _____ A.

Q29. Two wavelengths λ_1 and λ_2 are used in Young's double slit experiment. $\lambda_1 = 450$ nm and $\lambda_2 = 650$ nm. The minimum order of fringe produced by λ_2 which overlaps with the fringe produced by λ_1 is n. The value of n is _____.

Q30. A hydrogen atom changes its state from $n = 3$ to $n = 2$. Due to recoil, the percentage change in the wave length of emitted light is approximately 1×10^{-n}. The value of n is_____. [Given
Rhc $= 13.6\mathrm{eV}, \mathrm{hc} = 1242\mathrm{eVnm}, \mathrm{h} = 6.6 \times 10^{-34}$ J s mass of the hydrogenatom $= 1.6 \times 10^{-27}$ kg]

Q31. Number of elements from the following that CANNOT form compounds with valencies which match with their respective group valencies is _____. B, C, N, S, O, F, P, Al, Si

(1) 7 (2) 3
(3) 5 (4) 6

Q32. The correct order of first ionization enthalpy values of the following elements is : (A) O (B) N (C) Be (D) F (E) B Choose the correct answer from the options given below :

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

Q33. Which one of the following molecules has maximum dipole moment?

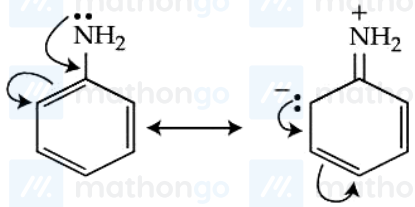
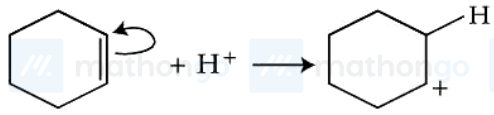
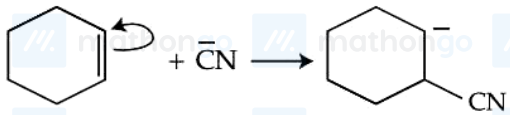
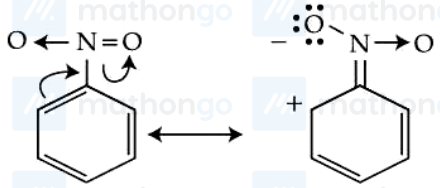
(1) NF_3 (2) CH_4
(3) PF_5 (4) NH_3

Q34. Number of molecules/ions from the following in which the central atom is involved in sp^3 hybridization is

$NO_3^-, BCl_3, ClO_2^-, ClO_3$

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

Q35. Match **List I** with **List II** :

List - I Mechanism steps		**List - II** Effect
(A)		(I) − E effect
(B)		(II) − R effect
(C)		(III) + E effect
(D)		(IV) + R effect

Choose the **correct** answer from the options given below :

Match List I with List II :

Choose the correct answer from the options given below :

(1) (A) - (IV), (B) - (III), (C) - (I), (D) - (II) (2) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(3) (A) - (III), (B) - (I), (C) - (II), (D) - (IV) (4) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

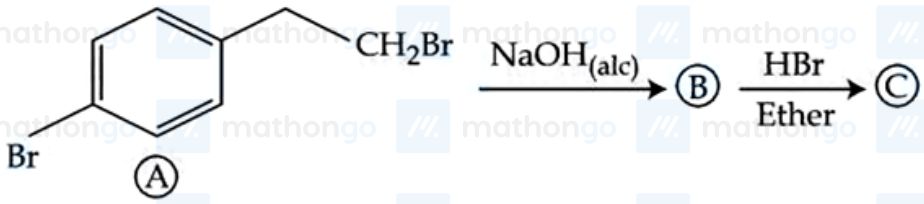
Q36. Which of the following nitrogen containing compound does not give Lassaigne's test?

(1) Urea (2) Phenyl hydrazine
(3) Glycene (4) Hydrazine

Q37. Which among the following is incorrect statement?

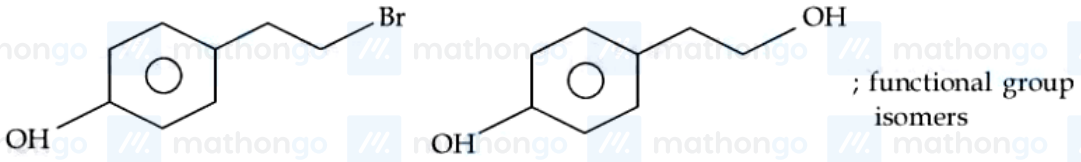
(1) Electromeric effect dominates over inductive effect
(2) The electromeric effect is, temporary effect
(3) Hydrogen ion (H^+)shows negative electromeric effect
(4) The organic compound shows electromeric effect in the presence of the reagent only.

Q38.



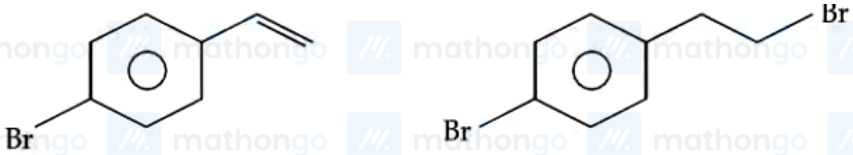
Identify (B) and (C) and how are (A) and (C) related ?

(1)



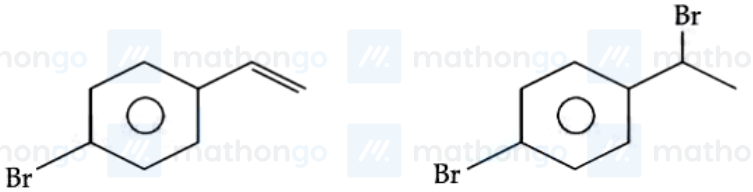
; functional group isomers

(2)



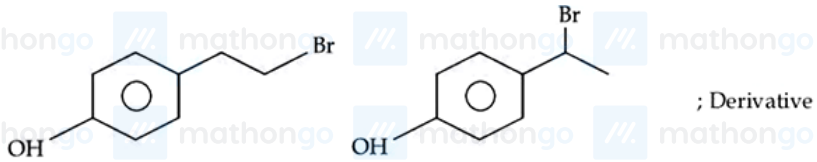
; chain isomers

(3)



; positon isomers

(4)



; Derivative

Q39. The Molarity (M) of an aqueous solution containing 5.85 g of NaCl in 500 mL water is : (Given : Molar Mass Na : 23 and Cl : $35.5 gmol^{-1}$)

(1) 2 (2) 20
(3) 4 (4) 0.2

Q40. What pressure (bar) of H_2 would be required to make emf of hydrogen electrode zero in pure water at $25^\circ C$?

(1) 10^{-7} (2) 0.5
(3) 1 (4) 10^{-14}

Q41. One of the commonly used electrode is calomel electrode. Under which of the following categories, calomel electrode comes?

(1) Oxidation - Reduction electrodes
(2) Metal ion - Metal electrodes
(3) Gas - Ion electrodes
(4) Metal - Insoluble Salt - Anion electrodes

Q42. What will be the decreasing order of basic strength of the following conjugate bases?
$^{-}OH, R\overline{O}, CH_3C\overline{OO}, C\overline{l}$
(1) $R\overline{O} > {}^{-}OH > CH_3C\overline{OO} > C\overline{l}$
(2) $C\overline{l} > R\overline{O} > {}^{-}OH > CH_3C\overline{OO}$
(3) ${}^{-}OH > R\overline{O} > CH_3C\overline{OO} > C\overline{l}$
(4) $C\overline{l} > {}^{-}OH > R\overline{O} > CH_3C\overline{OO}$

Q43. The element which shows only one oxidation state other than its elemental form is :
(1) Cobalt
(2) Titanium
(3) Nickel
(4) Scandium

Q44. Number of complexes from the following with even number of unpaired " d " electrons is
$[V(H_2O)_6]^{3+}, [Cr(H_2O)_6]^{2+}, [Fe(H_2O)_6]^{3+}, [Ni(H_2O)_6]^{3+}, [Cu(H_2O)_6]^{2+}$ [Given atomic numbers : $V = 23, Cr = 24, Fe = 26, Ni = 28 Cu = 29$]
(1) 2
(2) 1
(3) 4
(4) 5

Q45. The correct sequence of ligands in the order of decreasing field strength is :
(1) $NCS^{-} > EDTA^{4-} > CN^{-} > CO$
(2) $CO > H_2O > F^{-} > S^{2-}$
(3) $S^{2-} > -OH > EDTA^{4-} > CO$
(4) ${}^{-}OH > F^{-} > NH_3 > CN^{-}$

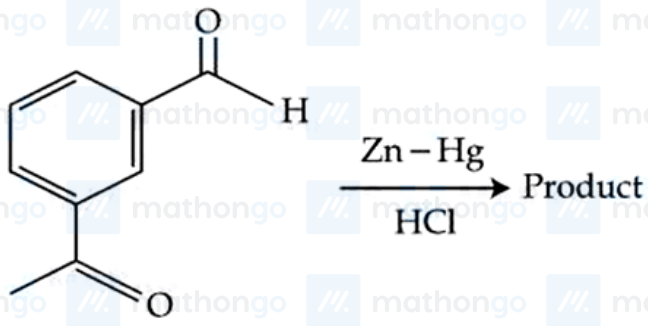
Q46. Identify the correct set of reagents or reaction conditions ' X ' and ' Y ' in the following set of transformation

$$CH_3-CH_2-CH_2-Br \xrightarrow{'X'} \text{Product} \xrightarrow{'Y'} CH_3-\underset{\underset{Br}{|}}{CH}-CH_3$$

(1) X = dil.aq. NaOH, 20°C, Y = $Br_2/CHCl_3$
(2) X = conc.alc. NaOH, 80°C, Y = $Br_2/CHCl_3$
(3) X = dil.aq. NaOH, 20°C, Y = HBr /acetic acid
(4) X = conc.alc. NaOH, 80°C, Y = HBr/ acetic acid

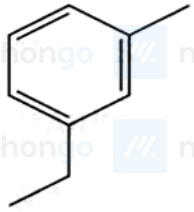
Q47. Given below are two statements : Statements I : Acidity of α-hydrogens of aldehydes and ketones is responsible for Aldol reaction. Statement II : Reaction between benzaldehyde and ethanal will NOT give Cross - Aldol product. In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Statement I is correct but Statement II is incorrect
(2) Both Statement I and Statement II are correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is incorrect but Statement II is correct

Q48.

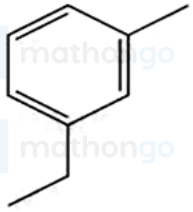


Identify the product in the following reaction :

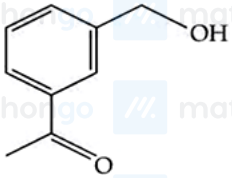
(1)



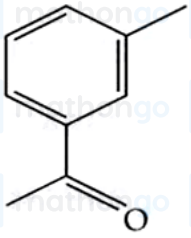
(2)



(3)



(4)



Q49. In the precipitation of the iron group (III) in qualitative analysis, ammonium chloride is added before adding ammonium hydroxide to :

(1) increase concentration of Cl^- ions

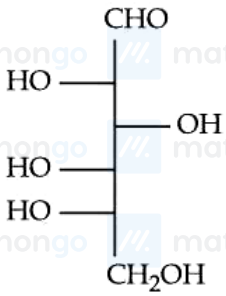
(2) increase concentration of NH_4^+ ions

(3) prevent interference by phosphate ions

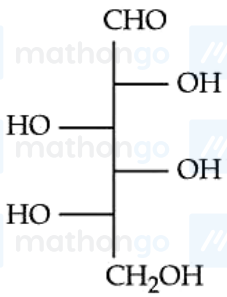
(4) decrease concentration of ^-OH ions

Q50. Which of the following is the correct structure of L-Glucose?

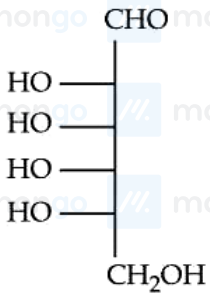
(1)



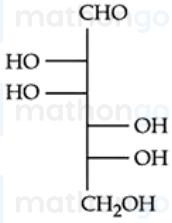
(2)



(3)



(4)



Q51. The de-Broglie's wavelength of an electron in the 4^{th} orbit is $\pi a_0 \cdot (a_0 = \text{Bohr's radius})$

Q52. Number of molecules/species from the following having one unpaired electron is
$O_2, O_2^{-1}, NO, CN^{-1}, O_2^{2-}$

Q53. The enthalpy of formation of ethane (C_2H_6) from ethylene by addition of hydrogen where the bond-energies of $C-H, C-C, C=C, H-H$ are 414 kJ, 347 kJ, 615 kJ and 435 kJ respectively is ____ kJ

Q54. Only 2 mL of $KMnO_4$ solution of unknown molarity is required to reach the end point of a titration of 20 mL of oxalic acid (2M) in acidic medium. The molarity of $KMnO_4$ solution should be ____ M.

Q55. The number of different chain isomers for C_7H_{16} is

Q56. 2.5 g of a non-volatile, non-electrolyte is dissolved in 100 g of water at 25°C. The solution showed a boiling point elevation by 2°C. Assuming the solute concentration is negligible with respect to the solvent concentration, the vapor pressure of the resulting aqueous solution is ____ mm of Hg (nearest integer) [Given : Molal boiling point elevation constant of water $(K_b) = 0.52\ K.\ kgmol^{-1}$, 1 atm pressure = 760 mm of Hg, molar mass of water = 18 g mol^{-1}]

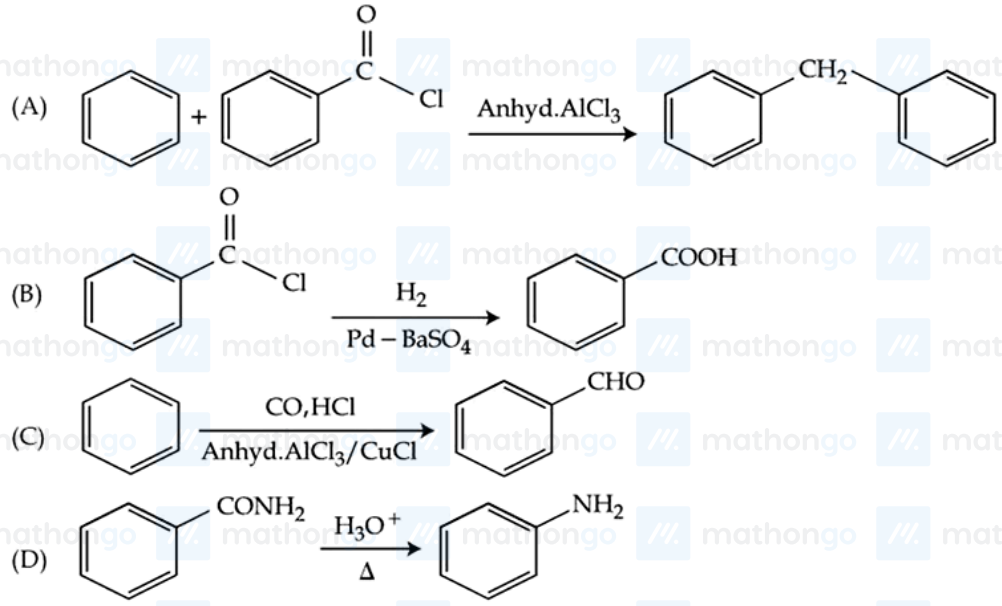
Q57. Consider the following transformation involving first order elementary reaction in each step at constant temperature as shown below. $A + B \underset{\text{Step 3}}{\overset{\text{Step 1}}{C}} \xrightarrow{\text{Step 2}} P$ Some details of the above reactions are listed below.

Step	Rate constant (sec^{-1})	Activation energy (kJ mol^{-1})
1	k_1	300
2	k_2	200
3	k_3	Ea_3

If the overall rate constant of the above transformation (k) is given as $k = \frac{k_1 k_2}{k_3}$ and the overall activation energy (E_a) is 400 kJ mol^{-1}, then the value of Ea_3 is ____ $kJmol^{-1}$ (nearest integer)

Q58. Consider the following reaction $MnO_2 + KOH + O_2 \rightarrow A + H_2O$. Product ' A ' in neutral or acidic medium disproportionate to give products ' B ' and ' C ' along with water. The sum of spin-only magnetic moment values of B and C is ____ BM. (nearest integer) (Given atomic number of Mn is 25)

Q59. The number of the correct reaction(s) among the following is _____



Q60. Xg of ethylamine is subjected to reaction with $NaNO_2/HCl$ followed by water; evolved dinitrogen gas which occupied 2.24 L volume at STP. X is $\times 10^{-1}$ g.

Q61. If 2 and 6 are the roots of the equation $ax^2 + bx + 1 = 0$, then the quadratic equation, whose roots are $\frac{1}{2a+b}$ and $\frac{1}{6a+b}$, is :

(1) $2x^2 + 11x + 12 = 0$ (2) $x^2 + 8x + 12 = 0$

(3) $4x^2 + 14x + 12 = 0$ (4) $x^2 + 10x + 16 = 0$

Q62. Let α and β be the sum and the product of all the non-zero solutions of the equation $(\bar{z})^2 + |z| = 0$, $z \in \mathrm{C}$. Then $4\left(\alpha^2 + \beta^2\right)$ is equal to :

(1) 6 (2) 8

(3) 2 (4) 4

Q63. There are 5 points P_1, P_2, P_3, P_4, P_5 on the side AB, excluding A and B, of a triangle ABC. Similarly there are 6 points $\mathrm{P}_6, \mathrm{P}_7, \ldots, \mathrm{P}_{11}$ on the side BC and 7 points $\mathrm{P}_{12}, \mathrm{P}_{13}, \ldots, \mathrm{P}_{18}$ on the side CA of the triangle. The number of triangles, that can be formed using the points $\mathrm{P}_1, \mathrm{P}_2, \ldots, \mathrm{P}_{18}$ as vertices, is :

(1) 776 (2) 796

(3) 751 (4) 771

Q64. Let the first three terms $2, p$ and q, with $q \neq 2$, of a G.P. be respectively the 7^{th}, 8^{th} and 13^{th} terms of an A.P. If the 5^{th} term of the G.P. is the n^{th} term of the A.P., then n is equal to:

(1) 163 (2) 151

(3) 177 (4) 169

Q65. The sum of all rational terms in the expansion of $\left(2^{\frac{1}{5}} + 5^{\frac{1}{3}}\right)^{15}$ is equal to :

(1) 3133 (2) 931

(3) 6131 (4) 633

Q66. The vertices of a triangle are $A(-1,3), B(-2,2)$ and $C(3,-1)$. A new triangle is formed by shifting the sides of the triangle by one unit inwards. Then the equation of the side of the new triangle nearest to origin is :

(1) $x+y+(2-\sqrt{2})=0$ (2) $-x+y-(2-\sqrt{2})=0$

(3) $x+y-(2-\sqrt{2})=0$ (4) $x-y-(2+\sqrt{2})=0$

Q67. A square is inscribed in the circle $x^2+y^2-10x-6y+30=0$. One side of this square is parallel to $y=x+3$. If (x_i, y_i) are the vertices of the square, then $\boldsymbol{\Sigma}\left(x_i^2+y_i^2\right)$ is equal to:

(1) 148 (2) 152

(3) 160 (4) 156

Q68. Let $\alpha, \beta \in \mathbf{R}$. Let the mean and the variance of 6 observations $-3, 4, 7, -6, \alpha, \beta$ be 2 and 23 , respectively. The mean deviation about the mean of these 6 observations is :

(1) $\frac{13}{3}$ (2) $\frac{16}{3}$

(3) $\frac{11}{3}$ (4) $\frac{14}{3}$

Q69. Let $\alpha \in (0, \infty)$ and $A=\begin{bmatrix}1 & 2 & \alpha \\ 1 & 0 & 1 \\ 0 & 1 & 2\end{bmatrix}$. If $\det\left(\text{adj}\left(2A-A^T\right) \cdot \text{adj}\left(A-2A^T\right)\right)=2^8$, then $(\det(A))^2$ is equal to:

(1) 36 (2) 16

(3) 1 (4) 49

Q70. If the system of equations $\begin{aligned} x+(\sqrt{2}\sin\alpha)y+(\sqrt{2}\cos\alpha)z&=0 \\ x+(\cos\alpha)y+(\sin\alpha)z&=0 \\ x+(\sin\alpha)y-(\cos\alpha)z&=0 \end{aligned}$ has a non-trivial solution, then $\alpha \in \left(0, \frac{\pi}{2}\right)$ is equal to :

(1) $\frac{11\pi}{24}$ (2) $\frac{5\pi}{24}$

(3) $\frac{7\pi}{24}$ (4) $\frac{3\pi}{4}$

Q71. If the domain of the function $\sin^{-1}\left(\frac{3x-22}{2x-19}\right)+\log_e\left(\frac{3x^2-8x+5}{x^2-3x-10}\right)$ is $(\alpha, \beta]$, then $3\alpha+10\beta$ is equal to:

(1) 100 (2) 95

(3) 97 (4) 98

Q72. Let the sum of the maximum and the minimum values of the function $f(x)=\frac{2x^2-3x+8}{2x^2+3x+8}$ be $\frac{\mathrm{m}}{\mathrm{n}}$, where $\gcd(\mathrm{m}, \mathrm{n})=1$. Then $\mathrm{m}+\mathrm{n}$ is equal to :

(1) 195 (2) 201

(3) 217 (4) 182

Q73. Let $f: \mathbf{R} \to \mathbf{R}$ be a function given by $f(x)=\begin{cases}\frac{1-\cos 2x}{x^2}, & x<0 \\ \alpha, & x=0 \\ \frac{\beta\sqrt{1-\cos x}}{x}, & x>0\end{cases}$, where $\alpha, \beta \in \mathbf{R}$. If f is continuous at $x=0$, then $\alpha^2+\beta^2$ is equal to :

(1) 3 (2) 12

(3) 48 (4) 6

Q74. Let $f(x)=x^5+2e^{x/4}$ for all $x \in \mathbf{R}$. Consider a function $g(x)$ such that $(g \circ f)(x)=x$ for all $x \in \mathbf{R}$. Then the value of $8g'(2)$ is :

(1) 2 (2) 8
(3) 4 (4) 16

Q75. Let $f(x)=\begin{cases}-2, & -2 \leq x \leq 0 \\ x-2, & 0<x \leq 2\end{cases}$ and $h(x)=f(|x|)+|f(x)|$. Then $\int_{-2}^{2} h(x)dx$ is equal to :

(1) 1 (2) 6
(3) 4 (4) 2

Q76. One of the points of intersection of the curves $y=1+3x-2x^2$ and $y=\frac{1}{x}$ is $\left(\frac{1}{2}, 2\right)$. Let the area of the region enclosed by these curves be $\frac{1}{24}(l\sqrt{5}+\mathrm{m})-\mathrm{n}\log_e(1+\sqrt{5})$, where $l,\ \mathrm{m}, \mathrm{n} \in \mathbf{N}$. Then $l+\mathrm{m}+\mathrm{n}$ is equal to

(1) 29 (2) 31
(3) 30 (4) 32

Q77. If the solution $y=y(x)$ of the differential equation $\left(x^4+2x^3+3x^2+2x+2\right)dy-\left(2x^2+2x+3\right)dx=0$ satisfies $y(-1)=-\frac{\pi}{4}$, then $y(0)$ is equal to :

(1) $\frac{\pi}{2}$ (2) $-\frac{\pi}{2}$
(3) 0 (4) $\frac{\pi}{4}$

Q78. Let a unit vector which makes an angle of 60° with $2\hat{i}+2\hat{j}-\hat{k}$ and angle 45° with $\hat{i}-\hat{k}$ be $\vec{C}$. Then $\vec{C}+\left(-\frac{1}{2}\hat{i}+\frac{1}{3\sqrt{2}}\hat{j}-\frac{\sqrt{2}}{3}\hat{k}\right)$ is :

(1) $\frac{\sqrt{2}}{3}\hat{i}-\frac{1}{2}\hat{k}$ (2) $\left(\frac{1}{\sqrt{3}}+\frac{1}{2}\right)\hat{i}+\left(\frac{1}{\sqrt{3}}-\frac{1}{3\sqrt{2}}\right)\hat{j}+\left(\frac{1}{\sqrt{3}}+\frac{\sqrt{2}}{3}\right)\hat{k}$
(3) $\frac{\sqrt{2}}{3}\hat{i}+\frac{1}{3\sqrt{2}}\hat{j}-\frac{1}{2}\hat{k}$ (4) $-\frac{\sqrt{2}}{3}\hat{i}+\frac{\sqrt{2}}{3}\hat{j}+\left(\frac{1}{2}+\frac{2\sqrt{2}}{3}\right)\hat{k}$

Q79. Let the point, on the line passing through the points $P(1,-2,3)$ and $Q(5,-4,7)$, farther from the origin and at distance of 9 units from the point P, be (α, β, γ). Then $\alpha^2+\beta^2+\gamma^2$ is equal to :

(1) 165 (2) 160
(3) 155 (4) 150

Q80. Three urns A, B and C contain 7 red, 5 black; 5 red, 7 black and 6 red, 6 black balls, respectively. One of the urn is selected at random and a ball is drawn from it. If the ball drawn is black, then the probability that it is drawn from urn A is :

(1) $\frac{5}{18}$ (2) $\frac{5}{16}$
(3) $\frac{4}{17}$ (4) $\frac{7}{18}$

Q81. Let $a=1+\frac{{}^2C_2}{3!}+\frac{{}^3C_2}{4!}+\frac{{}^4C_2}{5!}+\ldots$, $\mathrm{b}=1+\frac{{}^1C_0+{}^1C_1}{1!}+\frac{{}^2C_0+{}^2C_1+{}^2C_2}{2!}+\frac{{}^3C_0+{}^3C_1+{}^3C_2+{}^3C_3}{3!}+\ldots$
Then $\frac{2b}{a^2}$ is equal to

Q82. Let the length of the focal chord PQ of the parabola $y^2=12x$ be 15 units. If the distance of PQ from the origin is p, then $10\mathrm{p}^2$ is equal to _____

Q83. Let A be a square matrix of order 2 such that $|A| = 2$ and the sum of its diagonal elements is -3 . If the points (x, y) satisfying $\mathrm{A}^2 + x\ \mathrm{A} + y\mathrm{I} = \mathrm{O}$ lie on a hyperbola, whose length of semi major axis is x and semi minor axis is y, eccentricity is e and the length of the latus rectum is l, then $81\left(e^4 + l^2\right)$ is equal to

Q84. If $\lim_{x\to 1} \frac{(5x+1)^{1/3}-(x+5)^{1/3}}{(2x+3)^{1/2}-(x+4)^{1/2}} = \frac{\mathrm{m}\sqrt{5}}{\mathrm{n}(2\mathrm{n})^{2/3}}$, where $\gcd(\mathrm{m}, \mathrm{n}) = 1$, then $8\ \mathrm{m} + 12\mathrm{n}$ is equal to_____

Q85. In a survey of 220 students of a higher secondary school, it was found that at least 125 and at most 130 students studied Mathematics; at least 85 and at most 95 studied Physics; at least 75 and at most 90 studied Chemistry; 30 studied both Physics and Chemistry; 50 studied both Chemistry and Mathematics; 40 studied both Mathematics and Physics and 10 studied none of these subjects. Let m and n respectively be the least and the most number of students who studied all the three subjects. Then $\mathrm{m} + \mathrm{n}$ is equal to _____

Q86. Let A be a 3×3 matrix of non-negative real elements such that $A\begin{bmatrix}1\\1\\1\end{bmatrix} = 3\begin{bmatrix}1\\1\\1\end{bmatrix}$. Then the maximum value of $\det(\mathrm{A})$ is _____

Q87. If $\int_0^{\frac{\pi}{4}} \frac{\sin^2 x}{1+\sin x \cos x}\,\mathrm{d}x = \frac{1}{\mathrm{a}}\log_{\mathrm{e}}\left(\frac{\mathrm{a}}{3}\right) + \frac{\pi}{\mathrm{b}\sqrt{3}}$, where $\mathrm{a}, \mathrm{b} \in \mathbf{N}$, then $\mathrm{a} + \mathrm{b}$ is equal to_____

Q88. Let the solution $y = y(x)$ of the differential equation $\frac{\mathrm{d}y}{\mathrm{d}x} - y = 1 + 4\sin x$ satisfy $y(\pi) = 1$. Then $y\left(\frac{\pi}{2}\right) + 10$ is equal to _____

Q89. Let ABC be a triangle of area $15\sqrt{2}$ and the vectors $\overrightarrow{\mathrm{AB}} = \hat{i} + 2\hat{j} - 7\hat{k}, \overrightarrow{\mathrm{BC}} = \mathrm{a}\hat{i} + \mathrm{b}\hat{j} + \mathrm{ck}$ and $\overrightarrow{\mathrm{AC}} = 6\hat{i} + \mathrm{d}\hat{j} - 2\hat{k},\ \mathrm{d} > 0$. Then the square of the length of the largest side of the triangle ABC is _____

Q90. If the shortest distance between the lines $\frac{x+2}{2} = \frac{y+3}{3} = \frac{z-5}{4}$ and $\frac{x-3}{1} = \frac{y-2}{-3} = \frac{z+4}{2}$ is $\frac{38}{3\sqrt{5}}\mathrm{k}$, and $\int_0^{\mathrm{k}} [x^2]\mathrm{d}x = \alpha - \sqrt{\alpha}$, where $[x]$ denotes the greatest integer function, then $6\alpha^3$ is equal to_____

ANSWER KEYS

1. (3)	**2.** (1)	**3.** (1)	**4.** (1)	**5.** (4)	**6.** (1)	**7.** (4)	**8.** (2)
9. (3)	**10.** (3)	**11.** (1)	**12.** (3)	**13.** (2)	**14.** (1)	**15.** (4)	**16.** (4)
17. (1)	**18.** (2)	**19.** (2)	**20.** (1)	**21.** (6)	**22.** (7)	**23.** (5)	**24.** (7)
25. (16)	**26.** (1)	**27.** (50)	**28.** (8)	**29.** (9)	**30.** (7)	**31.** (2)	**32.** (1)
33. (4)	**34.** (3)	**35.** (1)	**36.** (4)	**37.** (3)	**38.** (3)	**39.** (4)	**40.** (4)
41. (4)	**42.** (1)	**43.** (4)	**44.** (1)	**45.** (2)	**46.** (4)	**47.** (1)	**48.** (1)
49. (4)	**50.** (1)	**51.** (8)	**52.** (2)	**53.** (125)	**54.** (8)	**55.** (9)	**56.** (707)
57. (100)	**58.** (4)	**59.** (1)	**60.** (45)	**61.** (2)	**62.** (4)	**63.** (3)	**64.** (1)
65. (1)	**66.** (3)	**67.** (2)	**68.** (1)	**69.** (2)	**70.** (2)	**71.** (3)	**72.** (2)
73. (2)	**74.** (4)	**75.** (4)	**76.** (3)	**77.** (4)	**78.** (1)	**79.** (3)	**80.** (1)
81. (8)	**82.** (72)	**83.** (233)	**84.** (100)	**85.** (45)	**86.** (27)	**87.** (8)	**88.** (7)
89. (54)	**90.** (48)						