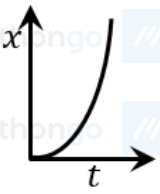
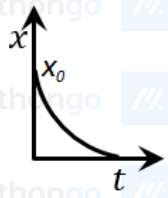
Q1. Electric field in a certain region is given by $\vec{E} = \frac{A}{x^2}\hat{i} + \frac{B}{y^3}\hat{j}$. The SI unit of A and B are :

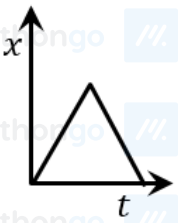
(1) N m^3 C^{-1}; N m^2 C^{-1}
(2) N m^2 C^{-1}; N m^3 C^{-1}
(3) N m^3 C; N m^2 C
(4) N m^2 C; N m^3 C

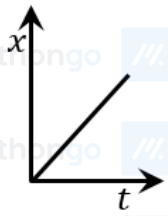
Q2. Match Column-I with Column-II :

Column-I (x-t graphs)

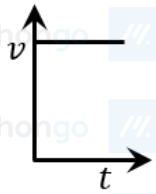
A 

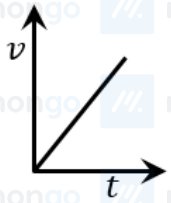
B 

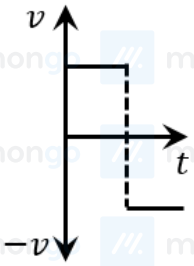
C 

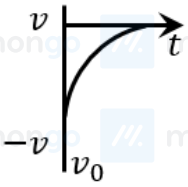
D 

Column-II (v-t graphs)

I 

II 

III 

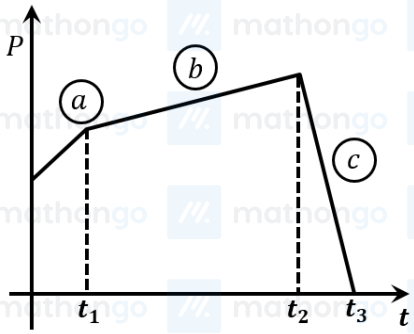
IV 

Choose the correct answer from the options given below:

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

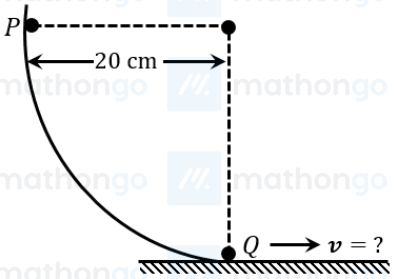
Q3. The figure represents the momentum time $(p - t)$ curve for a particle moving along an axis under the influence of the force. Identify the regions on the graph where the magnitude of the force is maximum and minimum respectively ?

If $t_3 - t_2 < t_1$



(1) c and a
(2) b and c
(3) c and b
(4) a and b

Q4. As per the given figure, a small ball P slides down the quadrant of a circle and hits the other ball Q of equal mass which is initially at rest. Neglecting the effect of friction and assume the collision to be elastic, the velocity of ball Q after collision will be : $\left(g = 10 \text{ m s}^{-2}\right)$



(1) 0
(2) 0.25 m s^{-1}
(3) 2 m s^{-1}
(4) 4 m s^{-1}

Q5. A ball of mass 200 g rests on a vertical post of height 20 m. A bullet of mass 10 g, travelling in horizontal direction, hits the centre of the ball. After collision both travels independently. The ball hits the ground at a distance 30 m and the bullet at a distance of 120 m from the foot of the post. The value of initial velocity of the bullet will be (if $g = 10$ m s^{-2}) :
(1) 120 m s^{-1}
(2) 60 m s^{-1}
(3) 400 m s^{-1}
(4) 360 m s^{-1}

Q6. If the gravitational field in the space is given as $-\frac{K}{r^2}$. Taking the reference point to be at $r = 2$ cm with gravitational potential $V = 10$ J kg^{-1}. Find the gravitational potentials at $r = 3$ cm in SI unit (Given, that $K = 6$ J cm kg^{-1})
(1) 9
(2) 11
(3) 12
(4) 10

Q7. Choose the correct relationship between Poisson ratio σ, bulk modulus (K) and modulus of rigidity η of a given solid object:
(1) $\sigma = \frac{3K - 2\eta}{6K + 2\eta}$
(2) $\sigma = \frac{6K + 2\eta}{3K - 2\eta}$
(3) $\sigma = \frac{3K + 2\eta}{6K + 2\eta}$
(4) $\sigma = \frac{6K - 2\eta}{3K - 2\eta}$

Q8. The height of liquid column raised in a capillary tube of certain radius when dipped in liquid A vertically is, 5 cm. If the tube is dipped in a similar manner in another liquid B of surface tension and density double the

values of liquid A, the height of liquid column raised in liquid B would be _____ m.

(1) 0.20 (2) 0.5

(3) 0.05 (4) 0.10

Q9. Heat is given to an ideal gas in an isothermal process.

A. Internal energy of the gas will decrease.

B. Internal energy of the gas will increase.

C. Internal energy of the gas will not change.

D. The gas will do positive work.

E. The gas will do negative work.

Choose the correct answer from the options given below :

(1) A and E only (2) B and D only

(3) C and E only (4) C and D only

Q10. The pressure (P) and temperature (T) relationship of an ideal gas obeys the equation $PT^2 =$ constant. The volume expansion coefficient of the gas will be :

(1) $3T^2$ (2) $\frac{3}{T^2}$

(3) $\frac{3}{T^3}$ (4) $\frac{3}{T}$

Q11. Two isolated metallic solid spheres of radii R and $2R$ are charged such that both have same charge density σ. The spheres are then connected by a thin conducting wire. If the new charge density of the bigger sphere is σ'. The ratio $\frac{\sigma'}{\sigma}$ is :

(1) $\frac{9}{4}$ (2) $\frac{4}{3}$

(3) $\frac{5}{3}$ (4) $\frac{5}{6}$

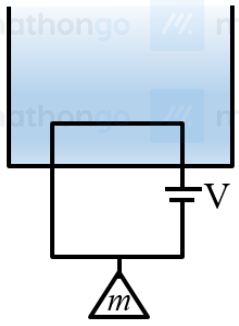
Q12. The charge flowing in a conductor changes with time as $Qt = \alpha t - \beta t^2 + \gamma t^3$, where α, β and γ are constants. Minimum value of current is:

(1) $\alpha - \frac{3\beta^2}{\gamma}$ (2) $\alpha - \frac{\gamma^2}{3\beta}$

(3) $\beta - \frac{\alpha^2}{3\gamma}$ (4) $\alpha - \frac{\beta^2}{3\gamma}$

Q13. A massless square loop, of wire of resistance 10 Ω, supporting a mass of 1 g, hangs vertically with one of its sides in a uniform magnetic field of 10^3 G, directed outwards in the shaded region. A dc voltage V is applied to the loop. For what value of V, the magnetic force will exactly balance the weight of the supporting mass of 1 g?

(If sides of the loop = 10 cm, $g = 10$ m s^{-2})



.

(1) $\frac{1}{10}$V (2) 100 V
(3) 1 V (4) 10 V

Q14. The magnetic moments associated with two closely wound circular coils A and B of radius $r_A = 10$ cm and $r_B = 20$ cm respectively are equal if: (Where N_A, I_A and N_B, I_B are number of turn and current of A and B respectively)
(1) $2N_AI_A = N_BI_B$ (2) $N_A = 2N_B$
(3) $N_AI_A = 4N_BI_B$ (4) $4N_AI_A = N_BI_B$

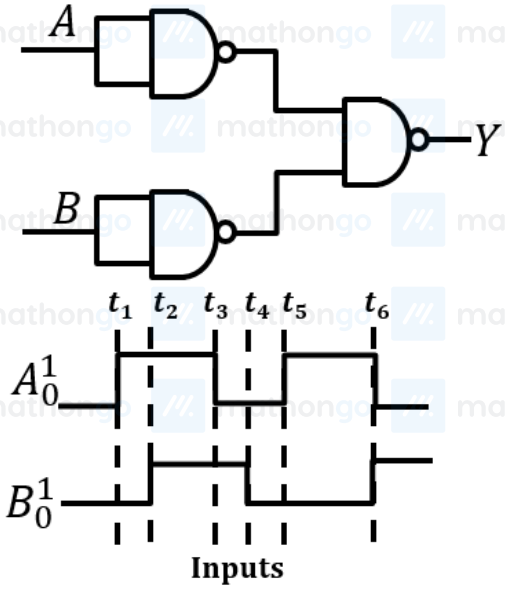
Q15. In a series LR circuit with $X_L = R$, power factor is P_1. If a capacitor of capacitance C with $X_C = X_L$ is added to the circuit the power factor becomes P_2. The ratio of P_1 to P_2 will be :
(1) 1:3 (2) 1:$\sqrt{2}$
(3) 1:1 (4) 1:2

Q16. A person has been using spectacles of power -1.0 diopter for distant vision and a separate reading glass of power 2.0 diopters. What is the least distance of distinct vision for this person:
(1) 10 cm (2) 40 cm
(3) 30 cm (4) 50 cm

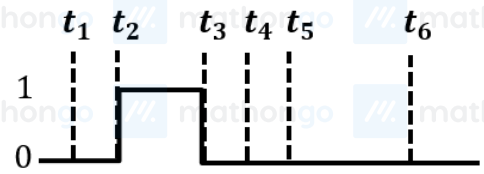
Q17. A small object at rest, absorbs a light pulse of power 20 mW and duration 300 ns. Assuming speed of light as 3×10^8 m s^{-1}. The momentum of the object becomes equal to :
(1) 0.5×10^{-17} kg m s^{-1} (2) 2×10^{-17} kg m s^{-1}
(3) 3×10^{-17} kg m s^{-1} (4) 1×10^{-17} kg m s^{-1}

Q18. Speed of an electron in Bohr's 7th orbit for Hydrogen atom is 3.6×10^6 m s^{-1}. The corresponding speed of the electron in 3rd orbit, in m s^{-1} is :
(1) 1.8×10^6 (2) 7.5×10^6
(3) 3.6×10^6 (4) 8.4×10^6

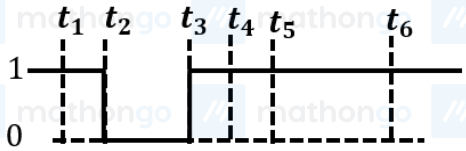
Q19. The output waveform of the given logical circuit for the following inputs A and B as shown below, is



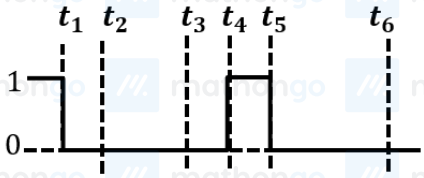
(1)



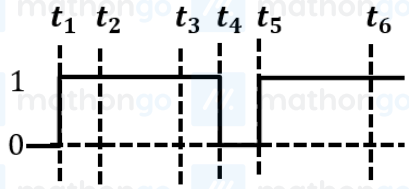
(2)



(3)



(4)



Q20. A sinusoidal carrier voltage is amplitude modulated. The resultant amplitude modulated wave has maximum and minimum amplitude of 120 V and 80 V respectively. The amplitude of each side band is :

(1) 15 V (2) 10 V

(3) 20 V (4) 5 V

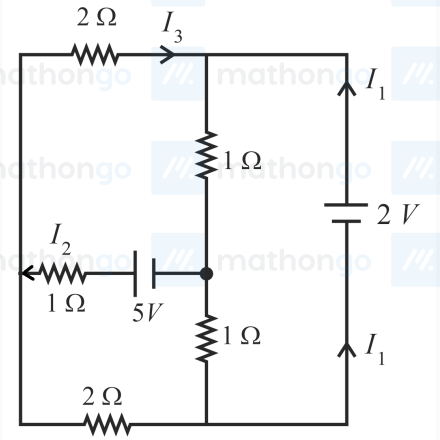
Q21. A horse rider covers half the distance with 5 m s^{-1} speed. The remaining part of the distance was travelled with speed 10 m s^{-1} for half the time and with speed 15 m s^{-1} for other half of the time. The mean speed of the rider averaged over the whole time of motion is $\frac{x}{7}$ m s^{-1}. The value of x is _____.

Q22. A thin uniform rod of length 2 m, cross sectional area A and density d is rotated about an axis passing through the centre and perpendicular to its length with angular velocity ω. If value of ω in terms of its rotational kinetic energy E is $\sqrt{\frac{\alpha E}{Ad}}$, then the value of α is _____.

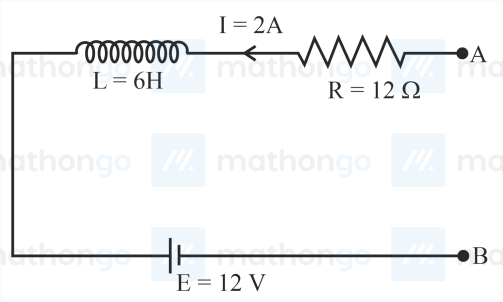
Q23. The general displacement of a simple harmonic oscillator is $x = A \sin \omega t$. Let T be its time period. The slope of its potential energy (U) – time (t) curve will be maximum when $t = \frac{T}{\beta}$. The value of β is _____.

Q24. A capacitor of capacitance 900 μ F is charged by a 100 V battery. The capacitor is disconnected from the battery and connected to another uncharged identical capacitor such that one plate of uncharged capacitor connected to positive plate and another plate of uncharged capacitor connected to negative plate of the charged capacitor. The loss of energy in this process is measured as $x \times 10^{-2}$ J. The value of x is _____.

Q25. In the following circuit, the magnitude of current I_1, is _____ A.

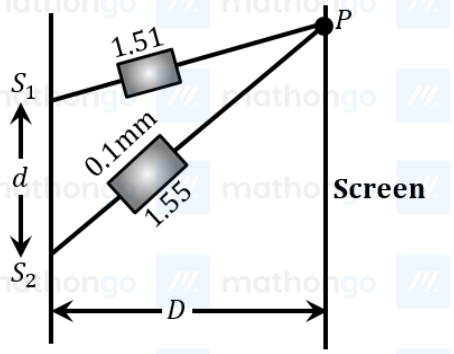


Q26. As per the given figure, if $\frac{dI}{dt} = -1$ A s^{-1}, then the value of V_{AB} at this instant will be _____ V.



Q27. In an experiment for estimating the value of focal length of converging mirror, image of an object placed at 40 cm from the pole of the mirror is formed at distance 120 cm from the pole of the mirror. These distances are measured with a modified scale in which there are 20 small divisions in 1 cm. The value of error in measurement of focal length of the mirror is $\frac{1}{K}$ cm. The value of K is _____.

Q28. In Young's double slit experiment, two slits S_1 and S_2 are d distance apart and the separation from slits to screen is D (as shown in figure). Now if two transparent slabs of equal thickness 0.1 mm but refractive index 1.51 and 1.55 are introduced in the path of beam $\lambda = 4000$ Å from S_1 and S_2 respectively. The central bright fringe spot will shift by _____ number of fringes.



Q29. A point source of light is placed at the centre of curvature of a hemispherical surface. The source emits a power of 24 W. The radius of curvature of hemisphere is 10 cm and the inner surface is completely reflecting. The force on the hemisphere due to the light falling on it is _____ $\times 10^{-8}$ N.

Q30. In a screw gauge, there are 100 divisions on the circular scale and the main scale moves by 0.5 mm on a complete rotation of the circular scale. The zero of circular scale lies 6 divisions below the line of graduation when two studs are brought in contact with each other. When a wire is placed between the studs, 4 linear scale divisions are clearly visible while 46^{th} division the circular scale coincide with the reference line. The diameter of the wire is _____ $\times 10^{-2}$ mm.

Q31. Match List - I with List - II

LIST-I (Atomic number)		LIST-II (Block of periodic table)	
(A)	37	I.	p-block
(B)	78	II.	d-block

(C)	52	III.	f-block
(D)	65	IV.	s-block

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

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

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

Q32. For OF_2 molecule consider the following:

(A) Number of lone pairs on oxygen is 2.

(B) FOF angle is less than $104.5°$.

(C) Oxidation state of O is -2.

(D) Molecule is bent 'V' shaped.

(E) Molecular geometry is linear.

Correct options are:

(1) C, D, E only (2) B, E, A only

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

Q33. Match List I with List II

	List I (molecules/ions)		List II (No. of lone pairs of e^- on central atom)
(A)	IF_7	I.	Three
(B)	ICl_4^-	II.	One
(C)	XeF_6	III.	Two
(D)	XeF_2	IV.	Zero

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

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

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

Q34. The alkaline earth metal sulphate(s) which are readily soluble in water is/are:

(A) $BeSO_4$

(B) $MgSO_4$

(C) $CaSO_4$

(D) $SrSO_4$

(E) $BaSO_4$

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

(1) A only (2) B only

(3) A and B (4) B and C

Q35. Lithium aluminium hydride can be prepared from the reaction of

(1) LiCl and Al_2H_6 (2) LiH and Al_2Cl_6

(3) LiCl, Al and H_2 (4) LiH and $AlOH_3$

Q36. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): In expensive scientific instruments, silica gel is kept in watch-glasses or in semipermeable membrane bags.

Reason (R): Silica gel adsorbs moisture from air via adsorption, thus protects the instrument from water corrosion (rusting) and / or prevents malfunctioning.

In the light of the above statements, choose the correct answer from the options given below:

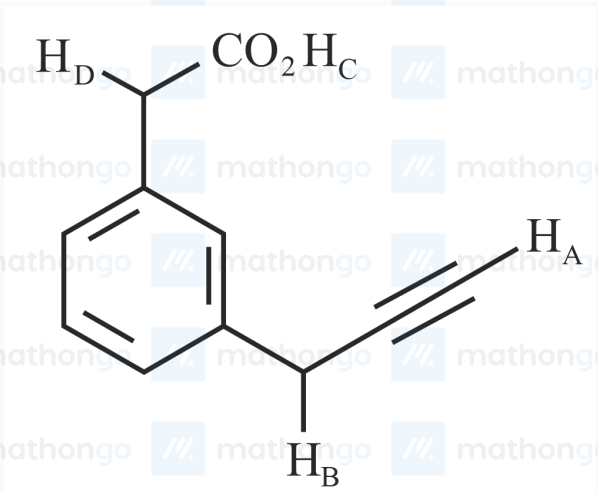
(1) (A) is false but (R) is true

(2) (A) is true but (R) is false

(3) Both (A) and (R) are true and (R) is the correct explanation of (A)

(4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Q37. What is the correct order of acidity of the protons marked $A - D$ in the given compounds?



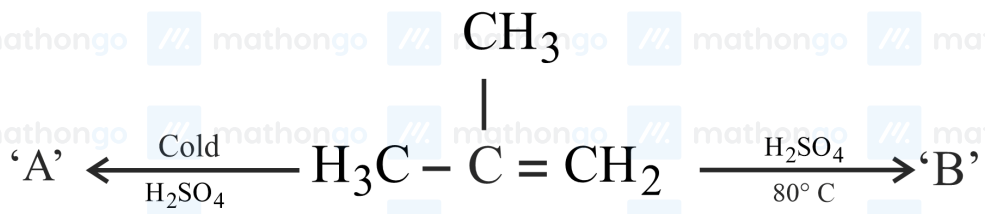
(1) $H_C > H_D > H_B > H_A$

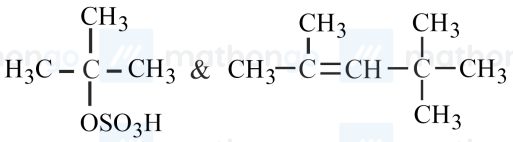
(2) $H_C > H_D > H_A > H_B$

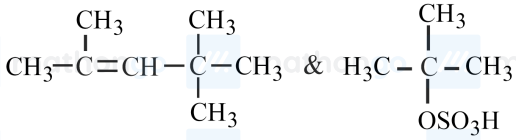
(3) $H_D > H_C > H_B > H_A$

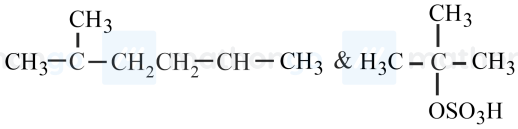
(4) $H_C > H_A > H_D > H_B$

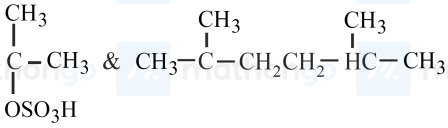
Q38. The major products 'A' and 'B', respectively, are



(1) 

(2) 

(3) 

(4) 

Q39. Formation of photochemical smog involves the following reaction in which A, B and C are respectively.

(i) $NO_2 \xrightarrow{hu} A + B$

(ii) $B + O_2 \rightarrow C$

(iii) $A + C \rightarrow NO_2 + O_2$

Choose the correct answer from the options given below:

(1) O, NO and NO_3^-

(2) O, N_2O and NO

(3) N, O_2 and O_3

(4) NO, O and O_3

Q40. In the extraction of copper, its sulphide ore is heated in a reverberatory furnace after mixing with silica to:

(1) separate CuO as $CuSiO_3$

(2) remove calcium as $CaSiO_3$

(3) decrease the temperature needed for roasting of Cu_2S

(4) remove FeO as $FeSiO_3$

Q41. During the qualitative analysis of SO_3^{2-} using dilute H_2SO_4, SO_2 gas is evolved which turns $K_2Cr_2O_7$ solution (acidified with dilute H_2SO_4):

(1) Black

(2) Red

(3) Green

(4) Blue

Q42. Which of the following is correct order of ligand field strength?

(1) $CO < en < NH_3 < C_2O_4^{2-} < S^{2-}$

(2) $S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

(3) $NH_3 < en < CO < S^{2-} < C_2O_4^{2-}$

(4) $S^{2-} < NH_3 < en < CO < C_2O_4^{2-}$

Q43. To inhibit the growth of tumours, identify the compounds used from the following:

(A) EDTA

(B) Coordination Compounds of Pt

(C) D-Penicillamine

(D) Cis - Platin

Choose the correct answer from the option given below:

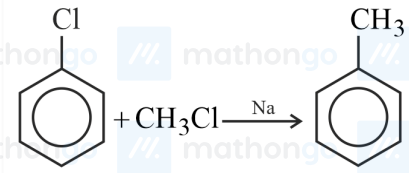
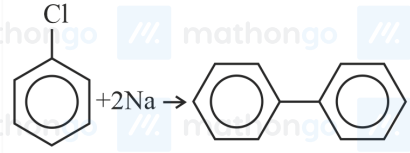
(1) B and D Only

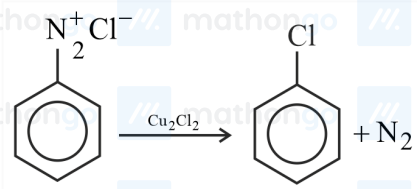
(2) C and D Only

(3) A and B Only

(4) A and C Only

Q44. Match List I with List II

List I		**List II**
A		I Fittig reaction
B		II Wurtz Fittig reaction

C 

III Finkelstein reaction

D $C_2H_5Cl + NaI \rightarrow C_2H_5I + Nacl$

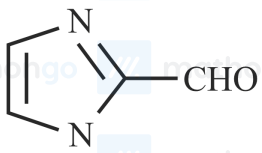
IV Sandmeyer reaction

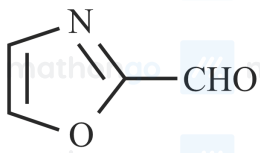
(1) A–II, B–I, C–III, D–IV
(2) A–III, B–II, C–IV, D–I
(3) A–IV, B–II, C–III, D–I
(4) A–II, B–I, C–IV, D–III

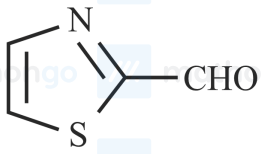
Q45. Which of the following compounds would give the following set of qualitative analysis?

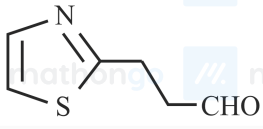
(i) Fehling's Test: Positive

(ii) Na fusion extract upon treatment with sodium nitroprusside gives a blood red colour but not prussian blue.

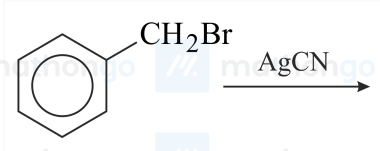
(1) 

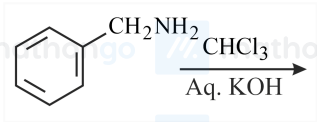
(2) 

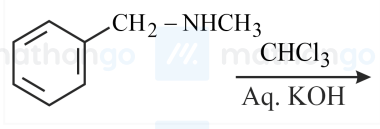
(3) 

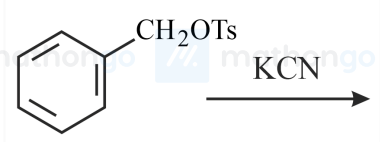
(4) 

Q46. Benzyl isocyanide can be obtained by:

(A) 

(B) 

(C) 

(D) 

Choose the correct answer from the options given below:

(1) A and D (2) Only B
(3) A and B (4) B and C

Q47. Caprolactam when heated at high temperature in presence of water, gives
(1) Teflon (2) Dacron
(3) Nylon 6, 6 (4) Nylon 6

Q48. Amongst the following compounds, which one is an antacid?
(1) Ranitidine (2) Meprobamate
(3) Terfenadine (4) Brompheniramine

Q49. In the wet tests for identification of various cations by precipitation, which transition element cation doesn't belong to group IV in qualitative inorganic analysis?
(1) Fe^{3+} (2) Zn^{2+}
(3) Co^{2+} (4) Ni^{2+}

Q50. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Ketoses give Seliwanoff's test faster than Aldoses.
Reason (R): Ketoses undergo β-elimination followed by formation of furfural.
In the light of the above statements, choose the correct answer from the options given below:
(1) (A) is false but (R) is true (2) Both (A) and (R) are true and (R) is the correct explanation of (A)
(3) (A) is true but (R) is false (4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Q51. The energy of one mole of photons of radiation of frequency 2×10^{12} Hz in $Jmol^{-1}$ is _____ .
(Nearest integer)
(Given: $h = 6.626 \times 10^{-34} Js$ $N_A = 6.022 \times 10^{23}$ mol^{-1})

Q52. When 2 litre of ideal gas expands isothermally into vacuum to a total volume of 6 litre, the change in internal energy is _____ J. (Nearest integer)

Q53. 600mL of 0.01M HCl is mixed with 400mL of 0.01M H_2SO_4. The pH of the mixture is _____ $\times 10^{-2}$.
(Nearest integer)
[Given $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 5 = 0.69$, $\log 7 = 0.84$, $\log 11 = 1.04$]

Q54. A 300mL bottle of soft drink has 0.2M CO_2 dissolved in it. Assuming CO_2 behaves as an ideal gas, the volume of the dissolved CO_2 at STP is _____ mL. (Nearest integer)
Given: At STP, molar volume of an ideal gas is 22.7L mol^{-1}

Q55. A solution containing 2 g of a non-volatile solute in 20 g of water boils at 373.52 K. The molecular mass of the solute is _____ $gmol^{-1}$. (Nearest integer)
Given, water boils at 373 K, K_b for water $= 0.52$K kg mol^{-1}

Q56. Some amount of dichloromethane CH_2Cl_2 is added to 671.141mL of chloroform $CHCl_3$ to prepare 2.6×10^{-3}M solution of CH_2Cl_2DCM. The concentration of DCM is _____ ppm (by mass).

Given: Atomic mass : $C = 12; H: 1; Cl = 35.5$ density of $CHCl_3 = 1.49 g\ cm^{-3}$

Q57. Consider the cell
$Pt_s H_2 g, 1 atm H^+ aq, 1M \mid Fe^{3+} aq, Fe^{2+} aq\ Pt\ s$
When the potential of the cell is 0.712 V at 298 K, the ratio Fe^{2+} / Fe^{3+} is
(Nearest integer)
Given: $Fe^{3+} + e^- = Fe^{2+}, E°Fe^{3+}, Fe^{2+} Pt = 0.771$ $\frac{2.303RT}{F} = 0.06$ V

Q58. If compound A reacts with B following first order kinetics with rate constant 2.011×10^{-3} s^{-1}. The time taken by A (in seconds) to reduce from 7 g to 2 g will be _____ . (Nearest Integer)
$\log 5 = 0.698, \log 7 = 0.845, \log 2 = 0.301$

Q59. The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is _____ .

Q60. A trisubstituted compound 'A', $C_{10}H_{12}O_2$ gives neutral $FeCl_3$ test positive. Treatment of compound 'A' with NaOH and CH_3Br gives $C_{11}H_{14}O_2$, with hydroiodic acid gives methyl iodide and with hot conc. NaOH gives a compound B, $C_{10}H_{12}O_2$. Compound 'A' also decolorises alkaline $KMnO_4$. The number of π bond/s present in the compound 'A' is _____ .

Q61. If the solution of the equation $\log_{\cos x} \cot x + 4\log_{\sin x} \tan x = 1, \quad x \in 0, \frac{\pi}{2}$ is $\sin^{-1}\frac{\alpha + \sqrt{\beta}}{2}$, where α, β are integers, then $\alpha + \beta$ is equal to:
(1) 3 (2) 5
(3) 6 (4) 4

Q62. If $a_n = \frac{-2}{4n^2 - 16n + 15}$, then $a_1 + a_2 + \ ... \ . + a_{25}$ is equal to:
(1) $\frac{51}{144}$ (2) $\frac{49}{138}$
(3) $\frac{50}{141}$ (4) $\frac{52}{147}$

Q63. If the coefficient of x^{15} in the expansion of $ax^3 + \frac{1}{bx^{\frac{1}{3}}}^{15}$ is equal to the coefficient of x^{-15} in the expansion of $ax^{\frac{1}{3}} - \frac{1}{bx^3}^{15}$, where a and b are positive real numbers, then for each such ordered pair a, b:
(1) $a = b$ (2) $ab = 1$
(3) $a = 3b$ (4) $ab = 3$

Q64. The coefficient of x^{301} in $1 + x^{500} + x1 + x^{499} + x^2 1 + x^{498} + \ ... \ . \ . + x^{500}$ is:
(1) ${}^{501}C_{302}$ (2) ${}^{500}C_{301}$
(3) ${}^{500}C_{300}$ (4) ${}^{501}C_{200}$

Q65. If $\tan 15° + \frac{1}{\tan 75°} + \frac{1}{\tan 105°} + \tan 195° = 2a$, then the value of $a + \frac{1}{a}$ is :
(1) 4 (2) $4 - 2\sqrt{3}$
(3) 2 (4) $5 - \frac{3}{2}\sqrt{3}$

Q66. A straight line cuts off the intercepts $\mathrm{OA}=\mathrm{a}$ and $\mathrm{OB}=\mathrm{b}$ on the positive directions of x-axis and $\mathrm{y}-$ axis respectively. If the perpendicular from origin O to this line makes an angle of $\frac{\pi}{6}$ with positive direction of y-axis and the

area of $\triangle \mathrm{OAB}$ is $\frac{98}{3} \sqrt{3}$, then $\mathrm{a}^2-\mathrm{b}^2$ is equal to:

(1) $\frac{392}{3}$ (2) 196

(3) $\frac{196}{3}$ (4) 98

Q67. Let $y = x + 2$, $4y = 3x + 6$ and $3y = 4x + 1$ be three tangent lines to the circle $(x - h)^2 + (y - k)^2 = r^2$. Then $h + k$ is equal to :

(1) 5 (2) $5\left(1 + \sqrt{2}\right)$

(3) 6 (4) $5\sqrt{2}$

Q68. If $P(h, k)$ be point on the parabola $x = 4y^2$, which is nearest to the point $Q(0, 33)$, then the distance of P from the directrix of the parabola $y^2 = 4(x + y)$ is equal to:

(1) 2 (2) 4

(3) 8 (4) 6

Q69. Among the statements:

$S1$: $p \vee q \Rightarrow r \Leftrightarrow p \Rightarrow r$

$S2$: $p \vee q \Rightarrow r \Leftrightarrow p \Rightarrow r \vee q \Rightarrow r$

(1) Only $(S1)$ is a tautology (2) Neither $(S1)$ nor $(S2)$ is a tautology

(3) Only $(S2)$ is a tautology (4) Both $(S1)$ and $(S2)$ are tautologies

Q70. The minimum number of elements that must be added to the relation $R = (a, b), (b, \mathrm{c})$ on the set $\{\mathrm{a}, \mathrm{b}, \mathrm{c}\}$ so that it becomes symmetric and transitive is:

(1) 4 (2) 7

(3) 5 (4) 3

Q71. Let $A = \begin{matrix} m & n \\ p & q \end{matrix}$, $d = A \neq 0$ and A - d Adj $A = 0$. Then

(1) $1 + d^2 = m + q^2$ (2) $1 + d^2 = m + q^2$

(3) $1 + d^2 = m^2 + q^2$ (4) $1 + d^2 = m^2 + q^2$

Q72. Let the system of linear equations

$x + y + kz = 2$

$2x + 3y - z = 1$

$3x + 4y + 2z = k$

have infinitely many solutions. Then the system

$k + 1 \quad x + 2k - 1 \quad y = 7$

$2k + 1x + k + 5y = 10$ has :

(1) infinitely many solutions (2) unique solution satisfying $x - y = 1$

(3) no solution (4) unique solution satisfying $x + y = 1$

Q73. Suppose $f: R \to 0, \infty$ be a differentiable function such that $5fx + y = fx \cdot fy, \quad \forall \quad x, \quad y \in R$, If $f3 = 320$, then $\sum_{n=0}^{5} fn$ is equal to:

(1) 6875 (2) 6575

(3) 6825 (4) 6528

Q74. The number of points on the curve $y = 54x^5 - 135x^4 - 70x^3 + 180x^2 + 210x$ at which the normal lines are parallel to $x + 90y + 2 = 0$ is:

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

Q75. If $[\ t$ denotes the greatest integer ≤ 1, then the value of $\frac{3e-1}{e}\int_1^2 x^2 e^{x+x^3}\,dx$ is :

(1) $e^9 - e$ (2) $e^8 - e$
(3) $e^7 - 1$ (4) $e^8 - 1$

Q76. Let the solution curve $y = y(x)$ of the differential equation $\frac{dy}{dx} - \frac{3x^5\tan^{-1}x^3}{1+x^{6\frac{3}{2}}}y = 2x\exp\frac{x^3 - \tan^{-1}x^3}{\sqrt{(1+x)^6}}$ pass through the origin. Then $y(1)$ is equal to:

(1) $\exp\frac{4-\pi}{4\sqrt{2}}$ (2) $\exp\frac{\pi-4}{4\sqrt{2}}$
(3) $\exp\frac{1-\pi}{4\sqrt{2}}$ (4) $\exp\frac{4+\pi}{4\sqrt{2}}$

Q77. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three non-zero vectors and $\hat{n}$ is a unit vector perpendicular to $\vec{c}$ such that $\vec{a} = \alpha\vec{b} - \hat{n}, \alpha \neq 0$ and $\vec{b}\cdot\vec{c} = 12$, then $\vec{c}\times\vec{a}\times\vec{b}$ is equal to:

(1) 15 (2) 9
(3) 12 (4) 6

Q78. The line l_1 passes through the point $2, 6, 2$ and is perpendicular to the plane $2x + y - 2z = 10$. Then the shortest distance between the line l_1 and the line $\frac{x+1}{2} = \frac{y+4}{3} = \frac{z}{2}$ is:

(1) 7 (2) $\frac{19}{3}$
(3) $\frac{19}{2}$ (4) 9

Q79. Let a unit vector $\overrightarrow{OP}$ make angle α, β, γ with the positive directions of the co-ordinate axes OX, OY, OZ respectively, where $\beta \in 0, \frac{\pi}{2}$. $\overrightarrow{OP}$ is perpendicular to the plane through points $1, 2, 3$, $2, 3, 4$ and $1, 5, 7$, then which one of the following is true ?

(1) $\alpha \in \frac{\pi}{2}, \pi$ and $\gamma \in \frac{\pi}{2}, \pi$ (2) $\alpha \in 0, \frac{\pi}{2}$ and $\gamma \in 0, \frac{\pi}{2}$
(3) $\alpha \in \frac{\pi}{2}, \pi$ and $\gamma \in 0, \frac{\pi}{2}$ (4) $\alpha \in 0, \frac{\pi}{2}$ and $\gamma \in \frac{\pi}{2}, \pi$

Q80. If an unbiased die, marked with $-2, -1, 0, 1, 2, 3$ on its faces is thrown five times, then the probability that the product of the outcomes is positive, is :

(1) $\frac{881}{2592}$ (2) $\frac{521}{2592}$
(3) $\frac{440}{2592}$ (4) $\frac{27}{288}$

Q81. Let $z = 1 + i$ and $z_1 = \frac{1+i\bar{z}}{\bar{z}\left(1-z\right)+\frac{1}{z}}$. Then $\frac{12}{\pi}\arg z_1$ is equal to

Q82. Number of 4-digit numbers (the repetition of digits is allowed) which are made using the digits 1, 2, 3 and 5 , and are divisible by 15 , is equal to

Q83. $\sum_{n=0}^{\infty}\frac{n^3\left(\left(2n\right)!\right)+\left(2n-1\right)\left(n!\right)}{\left(n!\right)\left(\left(2n\right)!\right)} = ae + \frac{b}{e} + c$ where a, b, $c \in \mathbb{Z}$ and $e = \sum_{n=0}^{\infty}\frac{1}{n!}$ Then $a^2 - b + c$ is equal to _____

Q84. The mean and variance of 7 observations are 8 and 16 respectively. If one observation 14 is omitted, a and b are respectively mean and variance of remaining 6 observation, then $a+3 \quad b$ - 5 is equal to _____

Q85. Let $S=\{1,2,3,4,5,6\}$. Then the number of oneone functions $f: S \rightarrow P(S)$, where $P(S)$ denote the power set of S, such that $f(n) \subset f(m)$ where $n<m$ is

Q86. Let $f^1 x=\frac{3x+2}{2x+3}, x \in R$ - -$\frac{3}{2}$. For $n \geq 2$, define $f^n x=f^1 o f^{n-1} x$. If $f^5 x=\frac{ax+b}{bx+a}$, $\gcd a,b=1$, then $a+b$ is equal to _____

Q87. $\lim_{x \to 0} \frac{48}{x^4} \int_0^x \frac{t^3}{t^6+1} dt$ is equal to

Q88. Let α be the area of the larger region bounded by the curve $y^2=8x$ and the lines $y=x$ and $x=2$, which lies in the first quadrant. Then the value of 3α is equal to

Q89. If the equation of the plane passing through the point $(1,1,2)$ and perpendicular to the line x - $3y+2z$ - $1=0=4x$ - $y+z$ is $Ax+By+Cz=1$, then $140(C-B+A)$ is equal to

Q90. If $\lambda_1<\lambda_2$ are two values of λ such that the angle between the planes $P_1: \vec{r}\left(3\hat{i}-5\hat{j}+\hat{k}\right)=7$ and $P_2: \vec{r} \cdot \left(\lambda\hat{i}+\hat{j}-3\hat{k}\right)=9$ is $\sin^{-1}\frac{2\sqrt{6}}{5}$, then the square of the length of perpendicular from the point $38\lambda_1, 10\lambda_2, 2$ to the plane P_1 is

ANSWER KEYS

1. (2)	**2.** (1)	**3.** (3)	**4.** (3)	**5.** (4)	**6.** (2)	**7.** (1)	**8.** (3)
9. (4)	**10.** (4)	**11.** (4)	**12.** (4)	**13.** (4)	**14.** (3)	**15.** (2)	**16.** (4)
17. (2)	**18.** (4)	**19.** (4)	**20.** (2)	**21.** (50)	**22.** (3)	**23.** (8)	**24.** (225)
25. (2)	**26.** (30)	**27.** (32)	**28.** (10)	**29.** (4)	**30.** (220)	**31.** (4)	**32.** (4)
33. (2)	**34.** (3)	**35.** (2)	**36.** (3)	**37.** (2)	**38.** (1)	**39.** (4)	**40.** (4)
41. (3)	**42.** (2)	**43.** (1)	**44.** (4)	**45.** (4)	**46.** (3)	**47.** (4)	**48.** (1)
49. (1)	**50.** (3)	**51.** (798)	**52.** (0)	**53.** (186)	**54.** (1362)	**55.** (100)	**56.** (148)
57. (10)	**58.** (623)	**59.** (3)	**60.** (4)	**61.** (4)	**62.** (3)	**63.** (2)	**64.** (4)
65. (1)	**66.** (1)	**67.** (1)	**68.** (4)	**69.** (2)	**70.** (2)	**71.** (1)	**72.** (4)
73. (3)	**74.** (3)	**75.** (2)	**76.** (1)	**77.** (3)	**78.** (4)	**79.** (1)	**80.** (2)
81. (9)	**82.** (21)	**83.** (26)	**84.** (37)	**85.** (3240)	**86.** (3125)	**87.** (12)	**88.** (22)
89. (15)	**90.** (315)						