Q1. Given below are two statements:
Statement (I) : Planck's constant and angular momentum have the same dimensions.
Statement (II) : Linear momentum and moment of force have the same dimensions.
In light of the above statements, choose the correct answer from the options given below :
(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are false
(3) Both Statement I and Statement II are true
(4) Statement I is false but Statement II is true

Q2. Position of an ant (S in metres) moving in Y − Z plane is given by $\mathrm{S}=2\mathrm{t}^2\hat{\mathrm{j}}+5\hat{\mathrm{k}}$ (where t is in second). The magnitude and direction of velocity of the ant at $\mathrm{t}=1$ s will be :
(1) 16 m s^{-1} in y-direction
(2) 4 m s^{-1} in x-direction
(3) 9 m s^{-1} in z-direction
(4) 4 m s^{-1} in y-direction

Q3. A train is moving with a speed of 12 m s^{-1} on rails which are 1.5 m apart. To negotiate a curve radius 400 m, the height by which the outer rail should be raised with respect to the inner rail is (Given, $g=10$ m s^{-2}):
(1) 6.0 cm
(2) 5.4 cm
(3) 4.8 cm
(4) 4.2 cm

Q4. Two bodies of mass 4 g and 25 g are moving with equal kinetic energies. The ratio of magnitude of their linear momentum is :
(1) 3 : 5
(2) 5 : 4
(3) 2 : 5
(4) 4 : 5

Q5. A body of mass 1000 kg is moving horizontally with a velocity 6 m s^{-1}. If 200 kg extra mass is added, the final velocity (in m s^{-1}) is:
(1) 6
(2) 2
(3) 3
(4) 5

Q6. The acceleration due to gravity on the surface of earth is g. If the diameter of earth reduces to half of its original value and mass remains constant, then acceleration due to gravity on the surface of earth would be :
(1) $\frac{g}{4}$
(2) $2g$
(3) $\frac{g}{2}$
(4) $4g$

Q7. Given below are two statements :
Statement (I) : Viscosity of gases is greater than that of liquids.
Statement (II) : Surface tension of a liquid decreases due to the presence of insoluble impurities.
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) Statement I is incorrect but Statement II is correct
(3) Both Statement I and Statement II are incorrect
(4) Both Statement I and Statement II are correct

Q8. 0.08 kg air is heated at constant volume through 5°C. The specific heat of air at constant volume is 0.17 kcal kg^{-1} $^{\circ}\mathrm{C}^{-1}$ and 1 J = 4.18 joule cal^{-1}. The change in its internal energy is approximately.
(1) 318 J
(2) 298 J
(3) 284 J
(4) 142 J

Q9. The average kinetic energy of a monatomic molecule is 0.414 eV at temperature:

(Use $K_B = 1.38 \times 10^{-23}$ J mol^{-1} K^{-1})

(1) 3000 K (2) 3200 K

(3) 1600 K (4) 1500 K

Q10. An electric charge 10^{-6} μC is placed at origin $(0,\ 0)$ m of X $-$ Y co-ordinate system. Two points P and Q are situated at $\left(\sqrt{3},\ \sqrt{3}\right)$ m and $\left(\sqrt{6},\ 0\right)$ m respectively. The potential difference between the points P and Q will be :

(1) $\sqrt{3}$ V (2) $\sqrt{6}$ V

(3) 0 V (4) 3 V

Q11. A wire of resistance R and length L is cut into 5 equal parts. If these parts are joined parallelly, then resultant resistance will be :

(1) $\frac{R}{25}$ (2) $\frac{R}{5}$

(3) $25R$ (4) $5R$

Q12. A wire of length 10 cm and radius $\sqrt{7} \times 10^{-4}$ m connected across the right gap of a meter bridge. When a resistance of 4.5 Ω is connected on the left gap by using a resistance box, the balance length is found to be at 60 cm from the left end. If the resistivity of the wire is R $\times 10^{-7}$ Ω m, then value of R is :

(1) 63 (2) 70

(3) 66 (4) 35

Q13. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If $\vec{E}$ and $\vec{B}$ represent the electric and magnetic fields respectively, then the region of space may have :

(A) $E = 0,\ B = 0;$ (B) $E = 0,\ B \neq 0;$ (C) $E \neq 0,\ B = 0;$ (D) $E \neq 0,\ B \neq 0$

Choose the most appropriate answer from the options given below :

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

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

Q14. A rectangular loop of length 2.5 m and width 2 m is placed at 60° to a magnetic field of 4 T. The loop is removed from the field in 10 sec. The average emf induced in the loop during this time is

(1) -2 V (2) $+2$ V

(3) $+1$ V (4) -1 V

Q15. A plane electromagnetic wave propagating in x-direction is described by $E_y = \left(200 \text{ V m}^{-1}\right) \sin\left[1.5 \times 10^7 \text{t} - 0.05\text{x}\right]$; The intensity of the wave is :

(Use $\epsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2})

(1) 35.4 W m^{-2} (2) 53.1 W m^{-2}

(3) 26.6 W m^{-2} (4) 106.2 W m^{-2}

Q16. If the refractive index of the material of a prism is $\cot\left(\frac{\text{A}}{2}\right)$, where A is the angle of prism then the angle of minimum deviation will be

(1) $\pi - 2$ A (2) $\frac{\pi}{2} - 2$ A

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

Q17. A convex lens of focal length 40 cm forms an image of an extended source of light on a photoelectric cell. A current I is produced. The lens is replaced by another convex lens having the same diameter but focal length 20 cm. The photoelectric current now is

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

(3) $2I$ (4) I

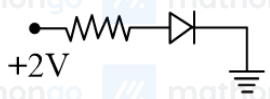
Q18. The radius of third stationary orbit of electron for Bohr's atom is R. The radius of fourth stationary orbit will be:

(1) $\frac{4}{3}R$ (2) $\frac{16}{9}R$

(3) $\frac{3}{4}R$ (4) $\frac{9}{16}R$

Q19. Which of the following circuits is reverse - biased ?

(1)



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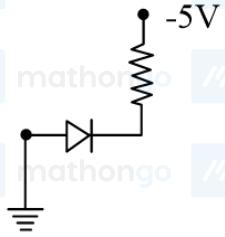

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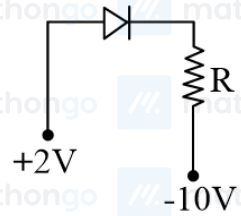
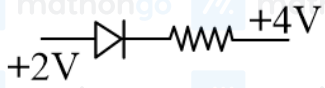


(4)



Q20. Identify the physical quantity that cannot be measured using spherometer :

(1) Radius of curvature of concave surface (2) Specific rotation of liquids

(3) Thickness of thin plates (4) Radius of curvature of convex surface

Q21. A particle starts from origin at $t = 0$ with a velocity $5\hat{i}$ m s^{-1} and moves in $x - y$ plane under action of a force which produces a constant acceleration of $\left(3\hat{i} + 2\hat{j}\right)$ m s^{-2}. If the x-coordinate of the particle at that instant is 84 m, then the speed of the particle at this time is $\sqrt{\alpha}$ m s^{-1}. The value of α is _____.

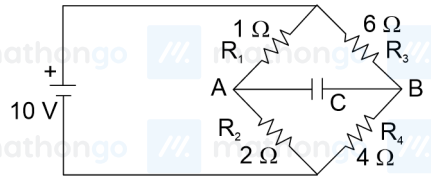
Q22. Four particles, each of mass 1 kg are placed at four corners of a square of side 2 m. The moment of inertia of the system about an axis perpendicular to its plane and passing through one of its vertex is _____ kg m^2.

Q23. If average depth of an ocean is 4000 m and the bulk modulus of water is 2×10^9 N m^{-2}, then fractional compression $\frac{\Delta V}{V}$ of water at the bottom of ocean is $\alpha \times 10^{-2}$. The value of α is _____, (Given, g $= 10$ m s^{-2}, $\rho = 1000$ kg m^{-3})

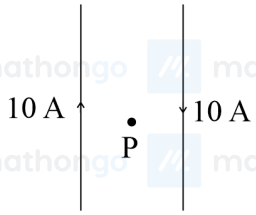
Q24. A particle executes simple harmonic motion with an amplitude of 4 cm. At the mean position, velocity of the particle is 10 cm s^{-1}. The distance of the particle from the mean position when its speed becomes 5 cm s^{-1} is $\sqrt{\alpha}$ cm, where α =_____.

Q25. A thin metallic wire having cross sectional area of 10^{-4} m^2 is used to make a ring of radius 30 cm. A positive charge of 2π C is uniformly distributed over the ring, while another positive charge of 30 pC is kept at the centre of the ring. The tension in the ring is _____ N; provided that the ring does not get deformed (neglect the influence of gravity).
(Given, $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ SI units)

Q26. The charge accumulated on the capacitor connected in the following circuit is _____μC.
(Given C = 150 μF)

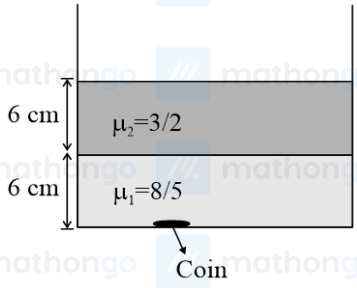


Q27. Two long, straight wires carry equal currents in opposite directions as shown in figure. The separation between the wires is 5.0 cm. The magnitude of the magnetic field at a point P midway between the wires is _____ μT . (Given: $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1})



Q28. Two coils have mutual inductance 0.002 H. The current changes in the first coil according to the relation $i = i_0 sin\omega t$, where $i_0 = 5$ A and $\omega = 50\pi$ rad s^{-1}. The maximum value of emf in the second coil is $\frac{\pi}{\alpha}$ V. The value of α is

Q29. Two immiscible liquids of refractive indices $\frac{8}{5}$ and $\frac{3}{2}$ respectively are put in a beaker as shown in the figure. The height of each column is 6 cm. A coin is placed at the bottom of the beaker. For near normal vision, the apparent depth of the coin is $\frac{\alpha}{4}$ cm. The value of α is _____.



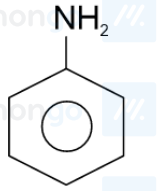
Q30. In a nuclear fission process, a high mass nuclide $(A \approx 236)$ with binding energy 7.6 MeV /Nucleon dissociated into two middle mass nuclides $(A \approx 118)$, having binding energy of 8.6 MeV /Nucleon. The energy released in the process would be _____ MeV.

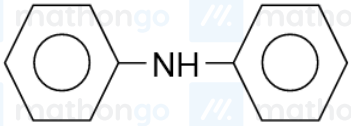
Q31. The electronic configuration for Neodymium is:
[Atomic Number for Neodymium 60]

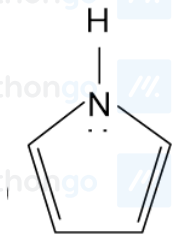
(1) $[Xe]\ 4f^4\ 6s^2$ (2) $[Xe]\ 5f^4 7s^2$
(3) $[Xe]\ 4f^6\ 6s^2$ (4) $[Xe]\ 4f^1 5d^1 6s^2$

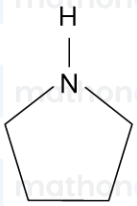
Q32. Which of the following electronic configuration would be associated with the highest magnetic moment ?
(1) $[Ar]\ 3d^7$ (2) $[Ar]\ 3d^8$
(3) $[Ar]\ 3d^3$ (4) $[Ar]\ 3d^6$

Q33. Choose the polar molecule from the following :
(1) CCl_4 (2) CO_2
(3) $CH_2 = CH_2$ (4) $CHCl_3$

Q34. Which of the following is strongest Bronsted base?
(1) 

(2) 

(3) 

(4) 

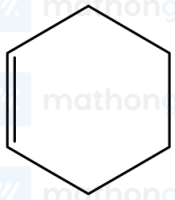
Q35. Given below are two statements :
Statement (I) : Aqueous solution of ammonium carbonate is basic.
Statement (II) : Acidic/basic nature of salt solution of a salt of weak acid and weak base depends on K_a and K_b value of acid and the base forming it.
In the light of the above statements, choose 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) Both Statement I and Statement II are incorrect
(4) Statement I is incorrect but Statement II is correct

Q36. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Melting point of Boron $(2453\ K)$ is unusually high in group 13 elements.
Reason (R) : Solid Boron has very strong crystalline lattice.
In the light of the above statements, choose the most appropriate answer from the options given below ;
(1) Both (A) and (R) are correct but (R) Is not the correct explanation of (A)
(2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(3) (A) is true but (R) is false
(4) (A) is false but (R) is true

Q37. IUPAC name of following compound (P) is :

(1) $1-\text{Ethyl}-5,\ 5-\text{dimethylcyclohexane}$ (2) $3-\text{Ethyl}-1,1-\text{dimethylcyclohexane}$
(3) $1-\text{Ethyl}-3,\ 3-\text{dimethylcyclohexane}$ (4) $1,1-\text{Dimethyl}-3-\text{ethylcyclohexane}$

Q38.

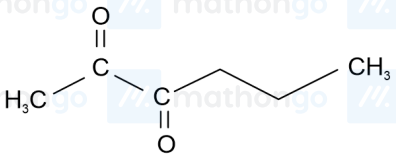


Cyclohexene is _____ type of an organic compound.

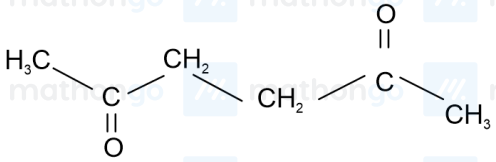
(1) Benzenoid aromatic (2) Benzenoid non-aromatic
(3) Acyclic (4) Alicyclic

Q39. Which of the following has highly acidic hydrogen?

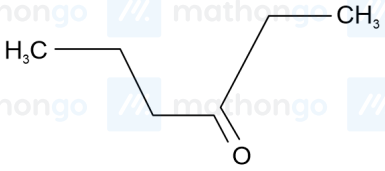
(1)



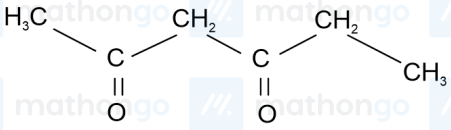
(2)



(3)



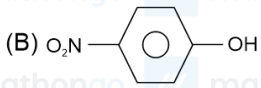
(4)



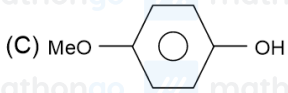
Q40. The ascending order of acidity of $-OH$ group in the following compounds is :

(A) $Bu-OH$

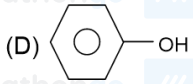
(B)



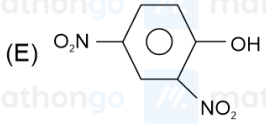
(C)



(D)



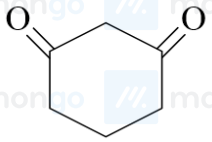
(E)

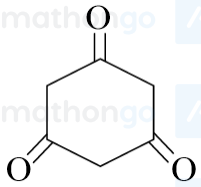


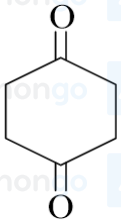
Choose the correct answer from the options given below :

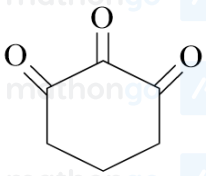
(1) $(A) < (D) < (C) < (B) < (E)$ (2) $(C) < (A) < (D) < (B) < (E)$
(3) $(C) < (D) < (B) < (A) < (E)$ (4) $(A) < (C) < (D) < (B) < (E)$

Q41. Highest enol content will be shown by :

(1) 

(2) 

(3) 

(4) 

Q42. A solution of two miscible liquids showing negative deviation from Raoult's law will have :

(1) increased vapour pressure, increased boiling point

(2) increased vapour pressure, decreased boiling point

(3) decreased vapour pressure, decreased boiling point

(4) decreased vapour pressure, increased boiling point

Q43. Element not showing variable oxidation state is :

(1) Bromine

(2) Iodine

(3) Chlorine

(4) Fluorine

Q44. NaCl reacts with conc. H_2SO_4 and $K_2Cr_2O_7$ to give reddish fumes (B), which react with NaOH to give yellow solution (C). (B) and (C) respectively are ;

(1) CrO_2Cl_2, Na_2CrO_4

(2) Na_2CrO_4, CrO_2Cl_2

(3) CrO_2Cl_2, $KHSO_4$

(4) CrO_2Cl_2, $Na_2Cr_2O_7$

Q45. Given below are two statements :

Statement (I) : The 4f and 5f - series of elements are placed separately in the Periodic table to preserve the principle of classification.

Statement (II) : s-block elements can be found in pure form in nature.

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

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are false

Q46. Yellow compound of lead chromate gets dissolved on treatment with hot NaOH solution. The product of lead formed is a :

(1) Tetraanionic complex with coordination number six

(2) Neutral complex with coordination number four

(3) Dianionic complex with coordination number six

(4) Dianionic complex with coordination number four

Q47. Consider the following complex ions

$P = [FeF_6]^{3-}$, $Q = [V(H_2O)_6]^{2+}$, $R = [Fe(H_2O)_6]^{2+}$

The correct order of the complex ions, according to their spin only magnetic moment values (in B.M.) is :

(1) $R < Q < P$ (2) $R < P < Q$
(3) $Q < R < P$ (4) $Q < P < R$

Q48. The correct statement regarding nucleophilic substitution reaction in a chiral alkyl halide is ;
(1) Retention occurs in S_N1 reaction and inversion occurs in S_N2 reaction.
(2) Racemisation occurs in S_N1 reaction and retention occurs in S_N2 reaction.
(3) Racemisation occurs in both S_N1 and S_N2 reactions.
(4) Racemisation occurs in S_N1 reaction and inversion occurs in S_N2 reaction.

Q49. Given below are two statements :
Statement (I) : p-nitrophenol is more acidic than m-nitrophenol and o-nitrophenol.
Statement (II) : Ethanol will give immediate turbidity with Lucas reagent.
In the light of the above statements, choose the correct answer from the options given below :
(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are true
(3) Both Statement I and Statement II are false
(4) Statement I is false but Statement II is true

Q50. Two nucleotides are joined together by a linkage known as :
(1) Phosphodiester linkage
(2) Glycosidic linkage
(3) Disulphide linkage
(4) Peptide linkage

Q51. Mass of methane required to produce 22 g of CO after complete combustion is g. (Given Molar mass in g mol^{-1}, $C = 12.0$, $H = 1.0$, $O = 16.0$)

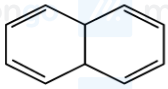
Q52. The number of electrons present in all the completely filled subshells having $n = 4$ and $s = +\frac{1}{2}$ is ____
(Where n = principal quantum number and s = spin quantum number)

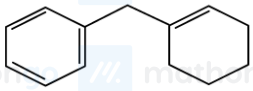
Q53. Sum of bond order of CO and NO^+ is

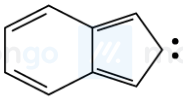
Q54. If three moles of an ideal gas at 300 K expand isothermally from 30 dm^3 to 45 dm^3 against a constant opposing pressure of 80 kPa, then the amount of heat transferred is _____J.

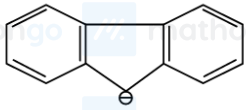
Q55. Among the following, total number of meta directing functional groups is (Integer based)
$-OCH_3, -NO_2, -CN, -CH_3 -NHCOCH_3, -COR, -OH, -COOH, -Cl$

Q56. Among the given organic compounds, the total number of aromatic compounds is

(A) 

(B) 

(C) 

(D) 

Q57. 3−Methylhex-2-ene on reaction with HBr in presence of peroxide forms an addition product (A). The number of possible stereoisomers for ' A ' is _____.

Q58. The mass of silver (Molar mass of Ag : $108\,\mathrm{gmol}^{-1}$) displaced by a quantity of electricity which displaces $5600\ \mathrm{mL}$ of O_2 at S.T.P. will be _____ g.

Q59. Consider the following data for the given reaction

$2\,\mathrm{HI}_{(\mathrm{g})} \rightarrow \mathrm{H}_{2(\mathrm{g})} + \mathrm{I}_{2(\mathrm{g})}$

$\mathrm{HI}\left(\mathrm{molL}^{-1}\right)$	0.005	0.01	0.02
Rate $\left(\mathrm{molL}^{-1}\ \mathrm{s}^{-1}\right)$	7.5×10^{-4}	3.0×10^{-3}	1.2×10^{-2}

The order of the reaction is _____.

Q60. From the given list, the number of compounds with $+4$ oxidation state of Sulphur

$\mathrm{SO}_3, \mathrm{H}_2\,\mathrm{SO}_3, \mathrm{SOCl}_2, \mathrm{SF}_4, \mathrm{BaSO}_4, \mathrm{H}_2\,\mathrm{S}_2\mathrm{O}_7$

Q61. If $\mathrm{S} = \mathrm{z} \in \mathrm{C} : |\mathrm{z} - \mathrm{i}| = |\mathrm{z} + \mathrm{i}| = |\mathrm{z} - 1|$, then, $\mathrm{n}(\mathrm{S})$ is:

(1) 1 (2) 0

(3) 3 (4) 2

Q62. The number of common terms in the progressions $4, 9, 14, 19, \ldots\ldots$, up to 25^{th} term and $3, 6, 9, 12, \ldots$. up to 37^{th} term is :

(1) 9 (2) 5

(3) 7 (4) 8

Q63. If A denotes the sum of all the coefficients in the expansion of $\left(1 - 3x + 10x^2\right)^n$ and B denotes the sum of all the coefficients in the expansion of $\left(1 + x^2\right)^n$, then :

(1) $\mathrm{A} = \mathrm{B}^3$ (2) $3\,\mathrm{A} = \mathrm{B}$

(3) $\mathrm{B} = \mathrm{A}^3$ (4) $\mathrm{A} = 3\,\mathrm{B}$

Q64. ${}^{n-1}C_r = \left(k^2 - 8\right){}^nC_{r+1}$ if and only if :

(1) $2\sqrt{2} < k \leq 3$ (2) $2\sqrt{3} < \mathrm{k} \leq 3\sqrt{2}$

(3) $2\sqrt{3} < \mathrm{k} < 3\sqrt{3}$ (4) $2\sqrt{2} < \mathrm{k} < 2\sqrt{3}$

Q65. The portion of the line $4x + 5y = 20$ in the first quadrant is trisected by the lines L_1 and L_2 passing through the origin. The tangent of an angle between the lines L_1 and L_2 is :

(1) $\frac{8}{5}$ (2) $\frac{25}{41}$
(3) $\frac{2}{5}$ (4) $\frac{30}{41}$

Q66. Four distinct points $(2k, 3k), (1, 0), (0, 1)$ and $(0, 0)$ lie on a circle for k equal to :

(1) $\frac{2}{13}$ (2) $\frac{3}{13}$
(3) $\frac{5}{13}$ (4) $\frac{1}{13}$

Q67. If the shortest distance of the parabola $y^2 = 4x$ from the centre of the circle $x^2 + y^2 - 4x - 16y + 64 = 0$ is d, then d^2 is equal to :

(1) 16 (2) 24
(3) 20 (4) 36

Q68. The length of the chord of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, whose mid point is $\left(1, \frac{2}{5}\right)$, is equal to:

(1) $\frac{\sqrt{1691}}{5}$ (2) $\frac{\sqrt{2009}}{5}$
(3) $\frac{\sqrt{1741}}{5}$ (4) $\frac{\sqrt{1541}}{5}$

Q69. If $a = \lim\limits_{x \to 0} \frac{\sqrt{1+\sqrt{1+x^4}}-\sqrt{2}}{x^4}$ and $b = \lim\limits_{x \to 0} \frac{\sin^2 x}{\sqrt{2}-\sqrt{1+\cos x}}$, then the value of ab^3 is :

(1) 36 (2) 32
(3) 25 (4) 30

Q70. Let $a_1, a_2, \ldots, a_{10}$ be 10 observations such that $\sum_{k=1}^{10} a_k = 50$ and $\sum_{\forall k<j} a_k \cdot a_j = 1100$. Then the standard deviation of $a_1, a_2, \ldots, a_{10}$ is equal to :

(1) 5 (2) $\sqrt{5}$
(3) 10 (4) $\sqrt{115}$

Q71. Let $S = \{1, 2, 3, \ldots, 10\}$. Suppose M is the set of all the subsets of S, then the relation $R = \{(A, B) : A \cap B \neq \phi; A, B \in M\}$ is :

(1) symmetric and reflexive only (2) reflexive only
(3) symmetric and transitive only (4) symmetric only

Q72. Consider the matrix $f(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$. Given below are two statements :

Statement I: $f(-x)$ is the inverse of the matrix $f(x)$.

Statement II: $f(x)\ f(y) = f(x + y)$.

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

(1) Statement I is false but Statement II is true (2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false (4) Both Statement I and Statement II are true

Q73. The function $f : N - \{1\} \to N$; defined by $f(n) =$ the highest prime factor of n, is :

(1) both one-one and onto (2) one-one only
(3) onto only (4) neither one-one nor onto

Q74. Consider the function $f(x)=\begin{cases}\frac{a(7x-12-x^2)}{b|x^2-7x+12|} & , x<3 \\ 2^{\frac{\sin(x-3)}{x-[x]}} & , x>3 \\ b & , x=3\end{cases}$, where $[x]$ denotes the greatest integer less than or equal to x. If S denotes the set of all ordered pairs $(a,\ b)$ such that $f(x)$ is continuous at $x=3$, then the number of elements in S is :

(1) 2 (2) Infinitely many

(3) 4 (4) 1

Q75. If $\int_0^1 \frac{1}{\sqrt{3+x}+\sqrt{1+x}}dx=a+b\sqrt{2}+c\sqrt{3}$, where a, b, c are rational numbers, then $2a+3\,b-4c$ is equal to :

(1) 4 (2) 10

(3) 7 (4) 8

Q76. If $(a,\ b)$ be the orthocentre of the triangle whose vertices are $(1,2),(2,3)$ and $(3,1)$, and $I_1=\int_a^b x\sin\left(4x-x^2\right)dx, I_2=\int_a^b \sin\left(4x-x^2\right)dx$, then $36\frac{I_1}{I_2}$ is equal to :

(1) 72 (2) 88

(3) 80 (4) 66

Q77. Let $x=x(t)$ and $y=y(t)$ be solutions of the differential equations $\frac{dx}{dt}+ax=0$ and $\frac{dy}{dt}+by=0$ respectively, $a, b \in R$. Given that $x(0)=2\ ;\ y(0)=1$ and $3\,y(1)=2\,x(1)$, the value of t, for which $x(t)=y(t)$, is :

(1) $\log_{\frac{2}{3}} 2$ (2) $\log_4 3$

(3) $\log_3 4$ (4) $\log_{\frac{4}{3}} 2$

Q78. If $\vec{a}=\hat{i}+2\hat{j}+\hat{k},\ \vec{b}=3\left(\hat{i}-\hat{j}+\hat{k}\right)$ and $\vec{c}$ be the vector such that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}\cdot\vec{c}=3$, then $\vec{a}\cdot\left(\left(\vec{c}\times\vec{b}\right)-\vec{b}-\vec{c}\right)$ is equal to

(1) 32 (2) 24

(3) 20 (4) 36

Q79. The distance, of the point $(7,-2,11)$ from the line $\frac{x-6}{1}=\frac{y-4}{0}=\frac{z-8}{3}$ along the line $\frac{x-5}{2}=\frac{y-1}{-3}=\frac{z-5}{6}$, is :

(1) 12 (2) 14

(3) 18 (4) 21

Q80. If the shortest distance between the lines $\frac{x-4}{1}=\frac{y+1}{2}=\frac{z}{-3}$ and $\frac{x-\lambda}{2}=\frac{y+1}{4}=\frac{z-2}{-5}$ is $\frac{6}{\sqrt{5}}$, then the sum of all possible values of λ is :

(1) 5 (2) 8

(3) 7 (4) 10

Q81. If α satisfies the equation $x^2+x+1=0$ and $(1+\alpha)^7=A+B\alpha+C\alpha^2,\ A,\ B, C \geq 0$, then $5(3\,A-2\,B-C)$ is equal to

Q82. If $8=3+\frac{1}{4}(3+p)+\frac{1}{4^2}(3+2p)+\frac{1}{4^3}(3+3p)+\ldots\infty$, then the value of p is

Q83. Let the set of all $a \in R$ such that the equation $\cos 2x + a \sin x = 2a - 7$ has a solution be $[p,\ q]$ and $r = \tan 9^\circ - \tan 27^\circ - \frac{1}{\cot 63^\circ} + \tan 81^\circ$, then pqr is equal to _____.

Q84. Let $\mathrm{A} = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$, $\mathrm{B} = [\mathrm{B}_1 \quad \mathrm{B}_2 \quad \mathrm{B}_3]$, where $\mathrm{B}_1, \mathrm{B}_2, \mathrm{B}_3$ are column matrices, and $\mathrm{AB}_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$, $\mathrm{AB}_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}, \mathrm{AB}_3 = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$

If $\alpha = |\mathrm{B}|$ and β is the sum of all the diagonal elements of B, then $\alpha^3 + \beta^3$ is equal to

Q85. Let $f(x) = x^3 + x^2 f'(1) + x f''(2) + f'''(3),\ x \in R$. Then $f'(10)$ is equal to

Q86. Let for a differentiable function $f : (0, \infty) \to R$, $f(x) - f(y) \geq \log_e\left(\frac{x}{y}\right) + x - y, \forall x, y \in (0, \infty)$. Then $\sum_{n=1}^{20} f'\left(\frac{1}{n^2}\right)$ is equal to

Q87. Let the area of the region $\{(x, y) : x - 2y + 4 \geq 0,\ x + 2y^2 \geq 0, x + 4y^2 \leq 8, y \geq 0\}$ be $\frac{m}{n}$, where m and n are coprime numbers. Then $\mathrm{m} + \mathrm{n}$ is equal to _____.

Q88. If the solution of the differential equation $(2x + 3y - 2)dx + (4x + 6y - 7)dy = 0,\ y(0) = 3$, is $\alpha x + \beta y + 3\log_e|2x + 3y - \gamma| = 6$, then $\alpha + 2\beta + 3\gamma$ is equal to _____.

Q89. The least positive integral value of α, for which the angle between the vectors $\alpha\hat{\mathrm{i}} - 2\hat{\mathrm{j}} + 2\hat{\mathrm{k}}$ and $\alpha\hat{\mathrm{i}} + 2\alpha\hat{\mathrm{j}} - 2\hat{\mathrm{k}}$ is acute, is _____.

Q90. A fair die is tossed repeatedly until a six is obtained. Let X denote the number of tosses required and let $\mathrm{a} = \mathrm{P}(\mathrm{X} = 3), \mathrm{b} = \mathrm{P}(\mathrm{X} \geq 3)$ and $\mathrm{c} = \mathrm{P}(\mathrm{X} \geq 6 \mid \mathrm{X} > 3)$. Then $\frac{\mathrm{b}+\mathrm{c}}{\mathrm{a}}$ is equal to

ANSWER KEYS

1. (1)	**2.** (4)	**3.** (2)	**4.** (3)	**5.** (4)	**6.** (4)	**7.** (2)	**8.** (3)
9. (2)	**10.** (3)	**11.** (1)	**12.** (3)	**13.** (3)	**14.** (3)	**15.** (2)	**16.** (1)
17. (4)	**18.** (2)	**19.** (4)	**20.** (2)	**21.** (673)	**22.** (16)	**23.** (2)	**24.** (12)
25. (3)	**26.** (400)	**27.** (160)	**28.** (2)	**29.** (31)	**30.** (236)	**31.** (1)	**32.** (4)
33. (4)	**34.** (4)	**35.** (1)	**36.** (2)	**37.** (2)	**38.** (4)	**39.** (4)	**40.** (4)
41. (2)	**42.** (4)	**43.** (4)	**44.** (1)	**45.** (3)	**46.** (4)	**47.** (3)	**48.** (4)
49. (1)	**50.** (1)	**51.** (8)	**52.** (16)	**53.** (6)	**54.** (1200)	**55.** (4)	**56.** (3)
57. (4)	**58.** (108)	**59.** (2)	**60.** (3)	**61.** (1)	**62.** (3)	**63.** (1)	**64.** (1)
65. (4)	**66.** (3)	**67.** (3)	**68.** (1)	**69.** (2)	**70.** (2)	**71.** (4)	**72.** (4)
73. (4)	**74.** (4)	**75.** (4)	**76.** (1)	**77.** (4)	**78.** (2)	**79.** (2)	**80.** (2)
81. (5)	**82.** (9)	**83.** (48)	**84.** (28)	**85.** (202)	**86.** (2890)	**87.** (119)	**88.** (29)
89. (5)	**90.** (12)						

Q1. The resistance $R = \frac{V}{I}$, where $V = (200 \pm 5)$ V and $I = (20 \pm 0.2)$ A, the percentage error in the measurement of R is :

(1) 3.5% (2) 7%

(3) 3% (4) 5.5%

Q2. A body starts moving from rest with constant acceleration covers displacement S_1 in first $(p-1)$ seconds and S_2 in first p seconds. The displacement $S_1 + S_2$ will be made in time :

(1) $(2p+1)$ s (2) $\sqrt{(2p^2-2p+1)}$ s

(3) $(2p-1)$ s (4) $\left(2p^2-2p+1\right)$ s

Q3. If the radius of curvature of the path of two particles of same mass are in the ratio $3:4$, then in order to have constant centripetal force, their velocities will be in the ratio of:

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

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

Q4. A block of mass 100 kg slides over a distance of 10 m on a horizontal surface. If the co-efficient of friction between the surfaces is 0.4 , then the work done against friction (in J) is:

(1) 4200 (2) 3900

(3) 4000 (4) 4500

Q5. The potential energy function (in J) of a particle in a region of space is given as $U = \left(2x^2 + 3y^3 + 2z\right)$. Here $x,\ y$ and z are in meter. The magnitude of x - component of force (in N) acting on the particle at point $P(1,\ 2,\ 3)$ m is:

(1) 2 (2) 6

(3) 4 (4) 8

Q6. At what distance above and below the surface of the earth a body will have same weight? (Take radius of earth as R)

(1) $\sqrt{5}\mathrm{R} - \mathrm{R}$ (2) $\frac{\sqrt{3}R-R}{2}$

(3) $\frac{R}{2}$ (4) $\frac{\sqrt{5}R-R}{2}$

Q7. Given below are two statements:

Statement I : If a capillary tube is immersed first in cold water and then in hot water, the height of capillary rise will be smaller in hot water.

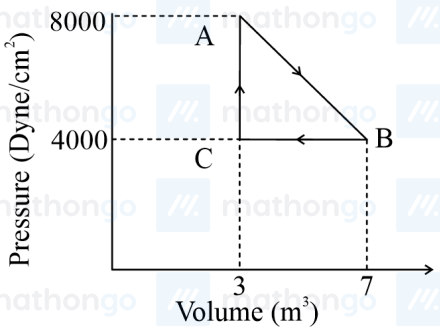
Statement II : If a capillary tube is immersed first in cold water and then in hot water, the height of capillary rise will be smaller in cold water.

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

(1) Both Statement I and Statement II are true (2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false (4) Statement I is false but Statement II is true

Q8. A thermodynamic system is taken from an original state A to an intermediate state B by a linear process as shown in the figure. Its volume is then reduced to the original value from B to C by an isobaric process. The total work done by the gas from A to B and B to C would be :



(1) 33800 J
(2) 2200 J
(3) 600 J
(4) 800 J

Q9. Two vessels A and B are of the same size and are at same temperature. A contains 1 g of hydrogen and B contains 1 g of oxygen. P_A and P_B are the pressures of the gases in A and B respectively, then $\frac{P_A}{P_B}$ is :

(1) 16
(2) 8
(3) 4
(4) 32

Q10. Two charges of $5Q$ and $-2Q$ are situated at the points $(3a,\ 0)$ and $(-5a,\ 0)$ respectively. The electric flux through a sphere of radius $4a$ having centre at origin is:

(1) $\frac{2Q}{\varepsilon_0}$
(2) $\frac{5Q}{\varepsilon_0}$
(3) $\frac{7Q}{\varepsilon_0}$
(4) $\frac{3Q}{\varepsilon_0}$

Q11. Match List I with List II

List I		List II	
A.	$\oint \vec{B}.\vec{dl} = \mu_0 i_c + \mu_0 \varepsilon_0 \frac{d\phi_E}{dt}$	I.	Gauss' law for electricity
B.	$\oint \vec{E}.\vec{dl} = \frac{d\phi_B}{dt}$	II.	Gauss' law for magnetism
C.	$\oint \vec{E}.\vec{dA} = \frac{Q}{\varepsilon_0}$	III.	Faraday law
D.	$\oint \vec{B}.\vec{dA} = 0$	IV.	Ampere – Maxwell law

Chose the correct answer from the options given below

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

Q12. A capacitor of capacitance 100 μF is charged to a potential of 12 V and connected to a 6.4 mH inductor to produce oscillations. The maximum current in the circuit would be :

(1) 3.2 A
(2) 1.5 A
(3) 2.0 A
(4) 1.2 A

Q13. The electric current through a wire varies with time as $I = I_0 + \beta t$, where $I_0 = 20$ A and $\beta = 3$ A s^{-1}. The amount of electric charge crossed through a section of the wire in 20 s is:

(1) 80 C (2) 1000 C
(3) 800 C (4) 1600 C

Q14. A galvanometer having coil resistance 10 Ω shows a full scale deflection for a current of 3 mA. For it to measure a current of 8 A, the value of the shunt should be:
(1) $3 \times 10^{-3} \Omega$ (2) $4.85 \times 10^{-3} \Omega$
(3) $3.75 \times 10^{-3} \Omega$ (4) $2.75 \times 10^{-3} \Omega$

Q15. The deflection in moving coil galvanometer falls from 25 divisions to 5 division when a shunt of 24 Ω is applied. The resistance of galvanometer coil will be:
(1) 12 Ω (2) 96 Ω
(3) 48 Ω (4) 100 Ω

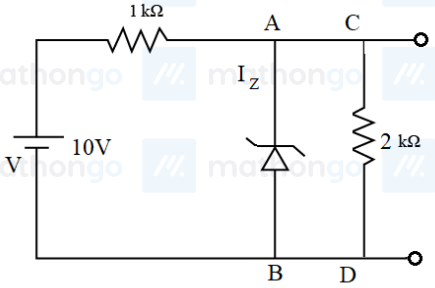
Q16. A convex mirror of radius of curvature 30 cm forms an image that is half the size of the object. The object distance is :
(1) −45 cm (2) 45 cm
(3) −15 cm (4) 15 cm

Q17. A biconvex lens of refractive index 1.5 has a focal length of 20 cm in air. Its focal length when immersed in a liquid of refractive index 1.6 will be:
(1) −16 cm (2) −160 cm
(3) +160 cm (4) +16 cm

Q18. The de-Broglie wavelength of an electron is the same as that of a photon. If velocity of electron is 25% of the velocity of light, then the ratio of K.E. of electron and K.E. of photon will be:
(1) $\frac{1}{1}$ (2) $\frac{1}{8}$
(3) $\frac{8}{1}$ (4) $\frac{1}{4}$

Q19. The explosive in a Hydrogen bomb is a mixture of ${}_1H^2$, ${}_1H^3$ and ${}_3Li^6$ in some condensed form. The chain reaction is given by ${}_3Li^6 + {}_0n^1 \rightarrow {}_2He^4 + {}_1H^3$; ${}_1H^2 + {}_1H^3 \rightarrow {}_2He^4 + {}_0n^1$
During the explosion the energy released is approximately [Given : $M(\mathrm{Li}) = 6.01690$ amu, $M({}_1H^2) = 2.01471$ amu, $M({}_2He^4) = 4.00388$ amu and 1 amu = 931.5 MeV]
(1) 28.12 MeV (2) 12.64 MeV
(3) 16.48 MeV (4) 22.22 MeV

Q20. In the given circuit, the breakdown voltage of the Zener diode is 3.0 V. What is the value of I_z ?



(1) 3.3 mA (2) 5.5 mA
(3) 10 mA (4) 7 mA

Q21. A ball rolls off the top of a stairway with horizontal velocity u. The steps are 0.1 m high and 0.1 m wide. The minimum velocity u with which that ball just hits the step 5 of the stairway will be $\sqrt{x}$ m s^{-1}, where $x =$ _____ [use $g = 10$ m s^{-2}].

Q22. A cylinder is rolling down on an inclined plane of inclination 60°. Its acceleration during rolling down will be $\frac{x}{\sqrt{3}}$ m s^{-2}, where x = _____(use $g = 10$ m s^{-2}).

Q23. In a test experiment on a model aeroplane in wind tunnel, the flow speeds on the upper and lower surfaces of the wings are 70 m s^{-1} and 65 m s^{-1} respectively. If the wing area is 2 m^2, the lift of the wing is _____N. (Given density of air $= 1.2$ kg m^{-3})

Q24. When the displacement of a simple harmonic oscillator is one third of its amplitude, the ratio of total energy to the kinetic energy is $\frac{x}{8}$, where $x =$_____.

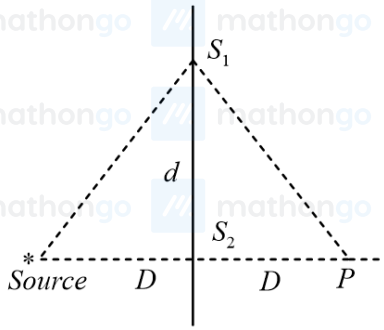
Q25. An electron is moving under the influence of the electric field of a uniformly charged infinite plane sheet S having surface charge density $+\sigma$. The electron at $t = 0$ is at a distance of 1 m from S and has a speed of 1 m s^{-1}. The maximum value of σ, if the electron strikes S at $t = 1$ s is $\alpha\left[\frac{m\epsilon_0}{e}\right]$ $\frac{\text{C}}{\text{m}^2}$. The value of α is _____.

Q26. A $16\ \Omega$ wire is bend to form a square loop. A 9 V battery with internal resistance $1\ \Omega$ is connected across one of its sides. If a 4 μF capacitor is connected across one of its diagonals, the energy stored by the capacitor will be $\frac{x}{2}$ μJ, where $x =$_____.

Q27. The magnetic potential due to a magnetic dipole at a point on its axis situated at a distance of 20 cm from its center is 1.5×10^{-5} T m. The magnetic moment of the dipole is _____ A m^2. (Given : $\frac{\mu_0}{4\pi} = 10^{-7}$ T m A^{-1})

Q28. A square loop of side 10 cm and resistance $0.7\ \Omega$ is placed vertically in the east-west plane. A uniform magnetic field of 0.20 T is set up across the plane in the north-east direction. The magnetic field is decreased to zero in 1 s at a steady rate. Then, the magnitude of induced emf is $\sqrt{x} \times 10^{-3}$ V. The value of x is _____.

Q29. In a double slit experiment shown in figure, when light of wavelength 400 nm is used, dark fringe is observed at P. If $D = 0.2$ m, the minimum distance between the slits S_1 and S_2 is α mm. Write the value of 10α to the nearest integer.



Q30. When a hydrogen atom going from $n = 2$ to $n = 1$ emits a photon, its recoil speed is $\frac{x}{5}$ m s^{-1}. Where $x =$ _____. (Use: mass of hydrogen atom $= 1.6 \times 10^{-27}$ kg, charge of electron $e = 1.6 \times 10^{-19}$ C)

Q31. The correct set of four quantum numbers for the valence electron of rubidium atom $(Z = 37)$ is:

(1) $5, 0, 0, +\frac{1}{2}$ (2) $5, 0, 1, +\frac{1}{2}$

(3) $5, 1, 0, +\frac{1}{2}$ (4) $5, 1, 1, +\frac{1}{2}$

Q32. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: The first ionisation enthalpy decreases across a period.

Reason R: The increasing nuclear charge outweighs the shielding across the period.

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

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

(2) A is true but R is false

(3) A is false but R is true

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

Q33. Which of the following is not correct?

(1) ΔG is negative for a spontaneous reaction

(2) ΔG is positive for a spontaneous reaction

(3) ΔG is zero for a reversible reaction

(4) ΔG is positive for a non-spontaneous reaction

Q34. Chlorine undergoes disproportionation in alkaline medium as shown below :

$$a Cl_2(g) + b OH^-(aq) \rightarrow c ClO^-(aq) + d Cl^-(aq) + e H_2O(l)$$

The values of a, b, c and d in a balanced redox reaction are respectively :

(1) 1, 2, 1 and 1

(2) 2, 2, 1 and 3

(3) 3, 4, 4 and 2

(4) 2, 4, 1 and 3

Q35. $KMnO_4$ decomposes on heating at 513 K to form O_2 along with

(1) MnO_2 & K_2O_2

(2) K_2MnO_4 & Mn

(3) Mn & KO_2

(4) K_2MnO_4 & MnO_2

Q36. Given below are two statements :

Statement I : The electronegativity of group 14 elements from Si to Pb gradually decreases.

Statement II : Group 14 contains non-metallic, metallic, as well as metalloid elements.

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

(1) Statement I is false but Statement II is true

(2) Statement I is true but Statement II is false

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Q37. The interaction between π bond and lone pair of electrons present on an adjacent atom is responsible for

(1) Hyperconjugation

(2) Inductive effect

(3) Electromeric effect

(4) Resonance effect

Q38. The difference in energy between the actual structure and the lowest energy resonance structure for the given compound is:

(1) electromeric energy

(2) resonance energy

(3) ionization energy

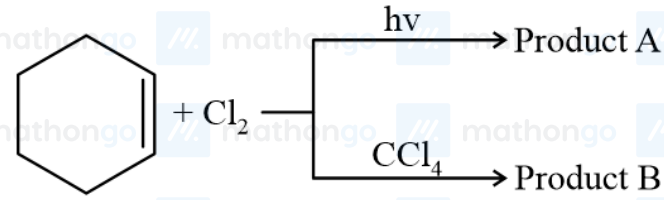
(4) hyperconjugation energy

Q39. Appearance of blood red colour, on treatment of the sodium fusion extract of an organic compound with $FeSO_4$ in presence of concentrated H_2SO_4 indicates the presence of element/s

(1) Br (2) N

(3) N and S (4) S

Q40. Identify product A and product B



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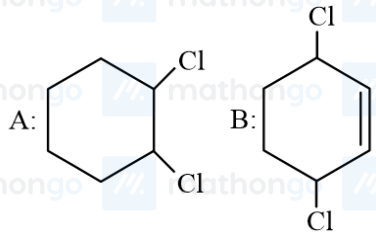

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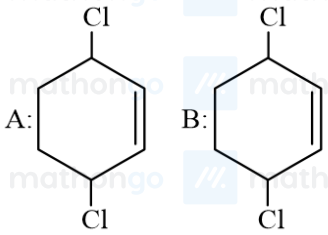

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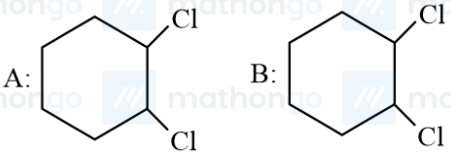

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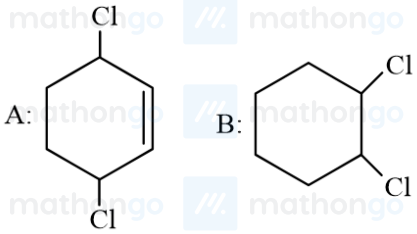
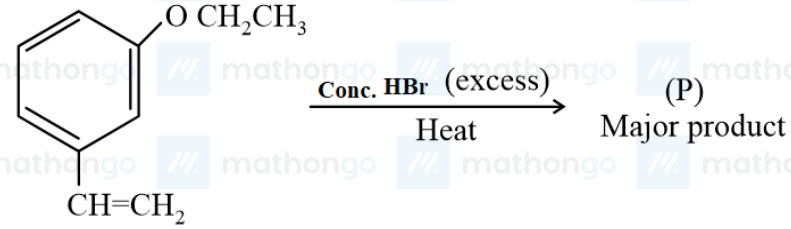
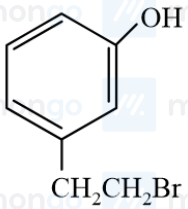


Q41. The major product(P) in the following reaction is



(1)



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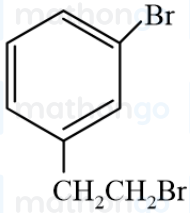

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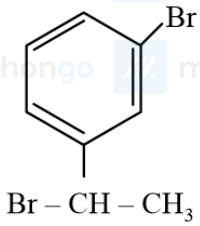

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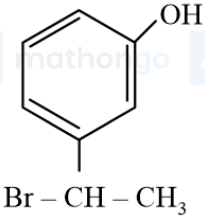
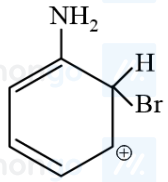
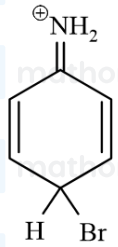
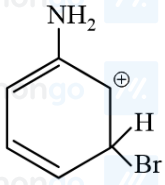
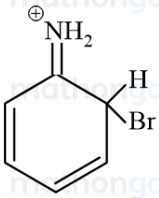


Q42. The arenium ion which is not involved in the bromination of Aniline is

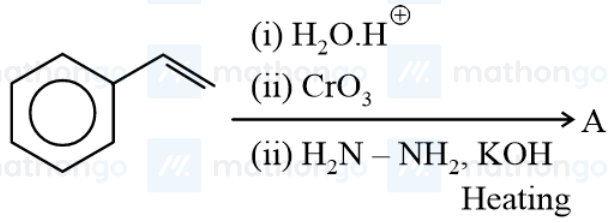
(1) 

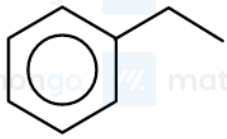
(2) 

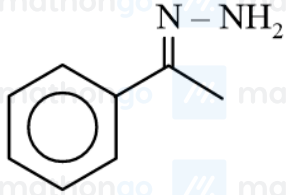
(3) 

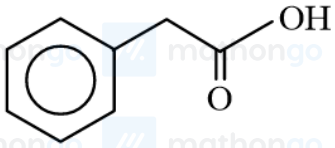
(4) 

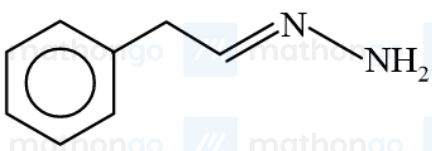
Q43. The final product A formed in the following multistep reaction sequence is



(1) 

(2) 

(3) 

(4) 

Q44. Identify the incorrect pair from the following :

(1) Fluorspar- BF_3

(2) Cryolite- Na_3AlF_6

(3) Fluoroapatite- $3Ca_3(PO_4)_2 \cdot CaF_2$

(4) Carnallite- $KCl \cdot MgCl_2 \cdot 6H_2O$

Q45. In chromyl chloride test for confirmation of Cl^- ion, a yellow solution is obtained. Acidification of the solution and addition of amyl alcohol and 10% H_2O_2 turns organic layer blue indicating formation of chromium pentoxide. The oxidation state of chromium in that is

(1) $+6$

(2) $+5$

(3) $+10$

(4) $+3$

Q46. In alkaline medium. MnO_4^- oxidises I^- to

(1) IO_4^-

(2) IO^-

(3) I_2

(4) IO_3^-

Q47. In which one of the following metal carbonyls, CO forms a bridge between metal atoms?

(1) $[Co_2(CO)_8]$ (2) $[Mn_2(CO)_{10}]$

(3) $[Os_3(CO)_{12}]$ (4) $[Ru_3(CO)_{12}]$

Q48. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : Aryl halides cannot be prepared by replacement of hydroxyl group of phenol by halogen atom.

Reason R : Phenols react with halogen acids violently.

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

(1) Both A and R are true but R is NOT the correct explanation of A

(2) A is false but R is true

(3) A is true but R is false

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

Q49. Type of amino acids obtained by hydrolysis of proteins is :

(1) β (2) α

(3) δ (4) γ

Q50. Match List I with List I

List I (Substances)	List II (Element Present)
A. Ziegler catalyst	I. Rhodium
B. Blood Pigment	II. Cobalt
C. Wilkinson catalyst	III. Iron
D. Vitamin B12	IV. Titanium

Choose the correct answer from the options given below:

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

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

Q51. Number of compounds with one lone pair of electrons on central atom amongst following is _

$O_3, H_2O, SF_4, ClF_3, NH_3, BrF_5, XeF_4$

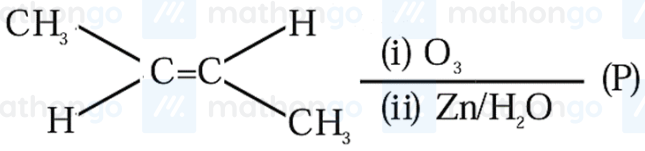
Q52. The number of species from the following which are paramagnetic and with bond order equal to one is

$H_2, He_2^+, O_2^+, N_2^{2-}, O_2^{2-}, F_2, Ne_2^+, B_2$

Q53. For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, $K_p = 0.492$ atm at 300 K. K_c for the reaction at same temperature is $\_\_\_\_\_ \times 10^{-2}$. (Given :$R = 0.082$ L atm mol^{-1} K^{-1})

Q54. Number of compounds among the following which contain sulphur as heteroatom is____.

Furan,Thiophene, Pyridine, Pyrrole, Cysteine, Tyrosine

Q55. 

Consider the given reaction. The total number of oxygen atoms present per molecule of the product (P) is _____.

Q56. A solution of H_2SO_4 is 31.4% H_2SO_4 by mass and has a density of 1.25 g/mL. The molarity of the H_2SO_4 solution is M (nearest integer) [Given molar mass of $H_2SO_4 = 98\ g\ mol^{-1}$]

Q57. The osmotic pressure of a dilute solution is 7×10^5 Pa at 273 K. Osmotic pressure of the same solution at 283 K is _____ $\times 10^4\ Nm^{-2}$.(Nearest integer)

Q58. The mass of zinc produced by the electrolysis of zinc sulphate solution with a steady current of 0.015 A for 15 minutes is _ ___ $\times 10^{-4}$ g. (Atomic mass of zinc = 65.4 amu)

Q59. For a reaction taking place in three steps at same temperature, overall rate constant $K = \frac{K_1K_2}{K_3}$. If Ea_1, Ea_2 and Ea_3 are 40, 50 and 60 kJ / mol respectively, the overall Ea is _____ kJ / mol.

Q60. From the compounds given below, number of compounds which give positive Fehling's test is Benzaldehyde, Acetaldehyde, Acetone, Acetophenone,Methanal, 4-nitrobenzaldehyde, cyclohexane carbaldehyde.

Q61. If $z = \frac{1}{2} - 2i$, is such that $|z+1| = \alpha z + \beta(1+i), i = \sqrt{-1}$ and $\alpha, \beta \in R$, then $\alpha + \beta$ is equal to

(1) -4 (2) 3

(3) 2 (4) -1

Q62. In an A.P., the sixth term $a_6 = 2$. If the $a_1a_4a_5$ is the greatest, then the common difference of the A.P., is equal to

(1) $\frac{3}{2}$ (2) $\frac{8}{5}$

(3) $\frac{2}{3}$ (4) $\frac{5}{8}$

Q63. If in a G.P. of 64 terms, the sum of all the terms is 7 times the sum of the odd terms of the G.P, then the common ratio of the G.P. is equal to

(1) 7 (2) 4

(3) 5 (4) 6

Q64. If $\alpha, -\frac{\pi}{2} < \alpha < \frac{\pi}{2}$ is the solution of $4\cos\theta + 5\sin\theta = 1$, then the value of $\tan\alpha$ is

(1) $\frac{10-\sqrt{10}}{6}$ (2) $\frac{10-\sqrt{10}}{12}$

(3) $\frac{\sqrt{10}-10}{12}$ (4) $\frac{\sqrt{10}-10}{6}$

Q65. Let $(5, \frac{a}{4})$, be the circumcenter of a triangle with vertices $A(a, -2)$, $B(a, 6)$ and $C(\frac{a}{4}, -2)$. Let α denote the circumradius, β denote the area and γ denote the perimeter of the triangle. Then $\alpha + \beta + \gamma$ is

(1) 60 (2) 53

(3) 62 (4) 30

Q66. In a Δ ABC, suppose y $=$ x is the equation of the bisector of the angle B and the equation of the side AC is $2x - y = 2$. If 2 $AB = BC$ and the point A and B are respectively $(4, 6)$ and (α, β), then $\alpha + 2\beta$ is equal to

(1) -4 (2) 42

(3) 2 (4) -1

Q67. $\lim\limits_{x \to \frac{\pi}{2}} \left(\frac{1}{(x-\frac{\pi}{2})^2} \int_{x^3}^{(\frac{\pi}{2})^3} \cos\left(\frac{1}{t^3}\right) dt \right)$ is equal to

(1) $\frac{3\pi}{8}$ (2) $\frac{3\pi^2}{4}$

(3) $\frac{3\pi^2}{8}$ (4) $\frac{3\pi}{4}$

Q68. Let R be a relation on $Z \times Z$ defined by $(a,\ b)R(c,\ d)$ if and only if $ad - bc$ is divisible by 5 . Then R is

(1) Reflexive and symmetric but not transitive (2) Reflexive but neither symmetric not transitive

(3) Reflexive, symmetric and transitive (4) Reflexive and transitive but not symmetric

Q69. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \alpha & \beta \\ 0 & \beta & \alpha \end{bmatrix}$ and $\left|2A\right|^3 = 2^{21}$ where $\alpha, \beta \in Z$, Then a value of α is

(1) 3 (2) 5

(3) 17 (4) 9

Q70. Let A be a square matrix such that $\mathrm{AA}^{\mathrm{T}} = \mathrm{I}$. Then $\frac{1}{2}\ \mathrm{A}\left[\left(\mathrm{A} + \mathrm{A}^{\mathrm{T}}\right)^2 + \left(\mathrm{A} - \mathrm{A}^{\mathrm{T}}\right)^2\right]$ is equal to

(1) $\mathrm{A}^2 + \mathrm{I}$ (2) $\mathrm{A}^3 + \mathrm{I}$

(3) $\mathrm{A}^2 + \mathrm{A}^{\mathrm{T}}$ (4) $\mathrm{A}^3 + \mathrm{A}^{\mathrm{T}}$

Q71. If $f(x) = \begin{cases} 2 + 2x, & -1 \le x < 0 \\ 1 - \frac{x}{3}, & 0 \le x \le 3 \end{cases}$; $g(x) = \begin{cases} -x, & -3 \le x \le 0 \\ x, & 0 < x \le 1 \end{cases}$, then range of $(f \circ g(x))$ is

(1) $(0, 1]$ (2) $[0, 3)$

(3) $[0, 1]$ (4) $[0, 1)$

Q72. Consider the function $f : \left[\frac{1}{2}, 1\right] \to \mathrm{R}$ defined by $f(x) = 4\sqrt{2}x^3 - 3\sqrt{2}x - 1$. Consider the statements

(I) The curve $y = f(x)$ intersects the x-axis exactly at one point

(II) The curve $y = f(x)$ intersects the x-axis at $x = \cos\frac{\pi}{12}$

Then

(1) Only (II) is correct (2) Both (I) and (II) are incorrect

(3) Only (I) is correct (4) Both (I) and (II) are correct

Q73. Suppose $f(x) = \frac{\left(2^x + 2^{-x}\right)\tan x\sqrt{\tan^{-1}(x^2 - x + 1)}}{\left(7x^2 + 3x + 1\right)^3}$. Then the value of $f'(0)$ is equal to

(1) π (2) 0

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

Q74. If the value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \left(\frac{x^2 \cos x}{1 + \pi^x} + \frac{1 + \sin^2 x}{1 + e^{(\sin x)^{2023}}} \right) dx = \frac{\pi}{4}(\pi + a) - 2$, then the value of a is

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

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

Q75. For $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, if $y(x)=\int \frac{\operatorname{cosec} x+\sin x}{\operatorname{cosec} x \sec x+\tan x \sin ^2 x} d x$ and $\lim\limits_{x \rightarrow\left(\frac{\pi}{2}\right)^{-}} y(x)=0$ then $y\left(\frac{\pi}{4}\right)$ is equal to

(1) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (2) $\frac{1}{2}\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

(3) $-\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (4) $\frac{1}{\sqrt{2}}\tan^{-1}\left(-\frac{1}{2}\right)$

Q76. A function $y=f(x)$ satisfies $f(x) \sin 2x+\sin x-\left(1+\cos^2 x\right) f'(x)=0$ with condition $f(0)=0$. Then $f\left(\frac{\pi}{2}\right)$ is equal to

(1) 1 (2) 0

(3) -1 (4) 2

Q77. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-zero vectors such that $\vec{b}$ and $\vec{c}$ are non-collinear if $\vec{a}+5\vec{b}$ is collinear with $\vec{c}, \vec{b}+6\vec{c}$ is collinear with $\vec{a}$ and $\vec{a}+\alpha\vec{b}+\beta\vec{c}=\vec{0}$, then $\alpha+\beta$ is equal to

(1) 35 (2) 30

(3) -30 (4) -25

Q78. Let O be the origin and the position vector of A and B be $2\hat{i}+2\hat{j}+\hat{k}$ and $2\hat{i}+4\hat{j}+4\hat{k}$ respectively. If the internal bisector of $\angle AOB$ meets the line AB at C, then the length of OC is

(1) $\frac{2}{3}\sqrt{31}$ (2) $\frac{2}{3}\sqrt{34}$

(3) $\frac{3}{4}\sqrt{34}$ (4) $\frac{3}{2}\sqrt{31}$

Q79. Let PQR be a triangle with $R(-1,4,2)$. Suppose $M(2,1,2)$ is the mid point of PQ. The distance of the centroid of ΔPQR from the point of intersection of the line $\frac{x-2}{0}=\frac{y}{2}=\frac{z+3}{-1}$ and $\frac{x-1}{1}=\frac{y+3}{-3}=\frac{z+1}{1}$ is

(1) 69 (2) 9

(3) $\sqrt{69}$ (4) $\sqrt{99}$

Q80. A fair die is thrown until 2 appears. Then the probability, that 2 appears in even number of throws, is

(1) $\frac{5}{6}$ (2) $\frac{1}{6}$

(3) $\frac{5}{11}$ (4) $\frac{6}{11}$

Q81. Let α, β be the roots of the equation $x^2-x+2=0$ with $\operatorname{Im}(\alpha)>\operatorname{Im}(\beta)$. Then $\alpha^6+\alpha^4+\beta^4-5\alpha^2$ is equal to

Q82. All the letters of the word $GTWENTY$ are written in all possible ways with or without meaning and these words are written as in a dictionary. The serial number of the word $GTWENTY$ IS

Q83. If $\frac{{}^{11}C_1}{2}+\frac{{}^{11}C_2}{3}+\ldots\ldots+\frac{{}^{11}C_9}{10}=\frac{n}{m}$ with $\gcd(n,m)=1$, then $n+m$ is equal to

Q84. Equations of two diameters of a circle are $2x-3y=5$ and $3x-4y=7$. The line joining the points $\left(-\frac{22}{7},-4\right)$ and $\left(-\frac{1}{7},3\right)$ intersects the circle at only one point $P(\alpha,\beta)$. Then $17\beta-\alpha$ is equal to

Q85. If the points of intersection of two distinct conics $x^2+y^2=4b$ and $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ lie on the curve $y^2=3x^2$, then $3\sqrt{3}$ times the area of the rectangle formed by the intersection points is _____.

Q86. If the mean and variance of the data $65, 68, 58, 44, 48, 45, 60, \alpha, \beta, 60$ where $\alpha>\beta$ are 56 and 66. 2 respectively, then $\alpha^2+\beta^2$ is equal to

Q87. Let $\mathrm{f}(\mathrm{x}) = 2^{\mathrm{x}} - \mathrm{x}^2,\ \mathrm{x} \in \mathrm{R}$. If m and n are respectively the number of points at which the curves $\mathrm{y} = \mathrm{f}(\mathrm{x})$ and $\mathrm{y} = \mathrm{f}'(\mathrm{x})$ intersects the x−axis, then the value of $\mathrm{m} + \mathrm{n}$ is

Q88. The area (in sq. units) of the part of circle $x^2 + y^2 = 169$ which is below the line $5x - y = 13$ is $\frac{\pi\alpha}{2\beta} - \frac{65}{2} + \frac{\alpha}{\beta}\sin^{-1}\left(\frac{12}{13}\right)$ where α, β are coprime numbers. Then $\alpha + \beta$ is equal to

Q89. If the solution curve $y = y(x)$ of the differential equation $\left(1 + y^2\right)(1 + \log_e x)dx + xdy = 0, x > 0$ passes through the point $(1, 1)$ and $y(e) = \frac{\alpha - \tan\left(\frac{3}{2}\right)}{\beta + \tan\left(\frac{3}{2}\right)}$, then $\alpha + 2\beta$ is

Q90. A line with direction ratio $2, 1, 2$ meets the lines $\mathrm{x} = \mathrm{y} + 2 = \mathrm{z}$ and $\mathrm{x} + 2 = 2\mathrm{y} = 2\mathrm{z}$ respectively at the point P and Q. if the length of the perpendicular from the point $(1, 2, 12)$ to the line PQ is l, then l^2 is

ANSWER KEYS

1. (1)	**2.** (2)	**3.** (1)	**4.** (3)	**5.** (3)	**6.** (4)	**7.** (3)	**8.** (4)
9. (1)	**10.** (2)	**11.** (3)	**12.** (2)	**13.** (2)	**14.** (3)	**15.** (2)	**16.** (3)
17. (2)	**18.** (2)	**19.** (4)	**20.** (2)	**21.** (2)	**22.** (10)	**23.** (810)	**24.** (9)
25. (8)	**26.** (81)	**27.** (6)	**28.** (2)	**29.** (2)	**30.** (17)	**31.** (1)	**32.** (3)
33. (2)	**34.** (1)	**35.** (4)	**36.** (1)	**37.** (4)	**38.** (2)	**39.** (3)	**40.** (4)
41. (4)	**42.** (3)	**43.** (1)	**44.** (1)	**45.** (1)	**46.** (4)	**47.** (1)	**48.** (3)
49. (2)	**50.** (4)	**51.** (4)	**52.** (1)	**53.** (2)	**54.** (2)	**55.** (1)	**56.** (4)
57. (73)	**58.** (46)	**59.** (30)	**60.** (3)	**61.** (2)	**62.** (2)	**63.** (4)	**64.** (3)
65. (2)	**66.** (2)	**67.** (3)	**68.** (1)	**69.** (2)	**70.** (4)	**71.** (3)	**72.** (4)
73. (3)	**74.** (1)	**75.** (4)	**76.** (1)	**77.** (1)	**78.** (2)	**79.** (3)	**80.** (3)
81. (13)	**82.** (553)	**83.** (2041)	**84.** (2)	**85.** (432)	**86.** (6344)	**87.** (5)	**88.** (171)
89. (3)	**90.** (65)						

Q1. If mass is written as $m = kc^P G^{-1/2} h^{1/2}$, then the value of P will be : (Constants have their usual meaning with k a dimensionless constant)

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

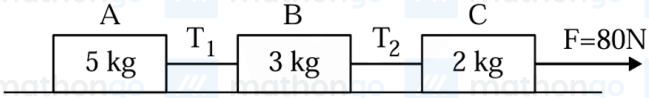
(3) 2 (4) $-\frac{1}{3}$

Q2. Projectiles A and B are thrown at angles of 45° and 60° with vertical respectively from top of a 400 m high tower. If their times of flight are same, the ratio of their speeds of projection $v_A : v_B$ is:

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

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

Q3. Three blocks A, B and C are pulled on a horizontal smooth surface by a force of 80 N as shown in figure. The tensions T_1 and T_2 in the string are respectively:



(1) 40N, 64N (2) 60N, 80N

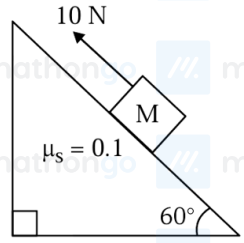
(3) 88N, 96N (4) 80N, 100N

Q4. A block of mass m is placed on a surface having vertical cross section given by $y = \frac{x^2}{4}$. If coefficient of friction is 0.5, the maximum height above the ground at which block can be placed without slipping is:

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

(3) $\frac{1}{6}$ m (4) $\frac{1}{3}$ m

Q5. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 60° by a force of 10 N parallel to the inclined surface as shown in figure. When the block is pushed up by 10 m along inclined surface, the work done against frictional force is : $g = 10$ m s^{-2}



(1) $5\sqrt{3}$ J (2) 5 J

(3) 5×10^3 J (4) 10 J

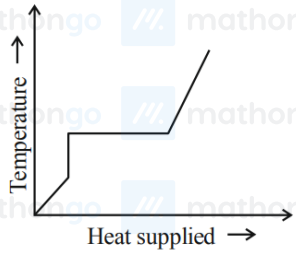
Q6. Escape velocity of a body from earth is 11.2 km s^{-1}. If the radius of a planet be one-third the radius of earth and mass be one-sixth that of earth, the escape velocity from the plate is:

(1) 11.2 km s^{-1} (2) 8.4 km s^{-1}

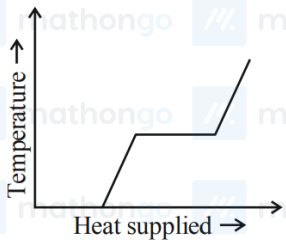
(3) 4.2 km s^{-1} (4) 7.9 km s^{-1}

Q7. A block of ice at -10 °C is slowly heated and converted to steam at 100 °C. Which of the following curves represent the phenomenon qualitatively:

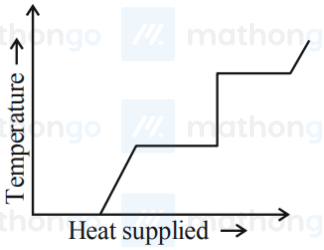
(1)



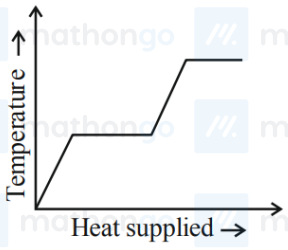
(2)



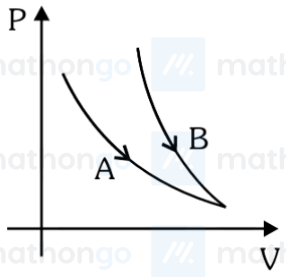
(3)



(4)



Q8. Choose the correct statement for processes A & B shown in figure.



(1) $PV^{\gamma} = k$ for process B and $PV = k$ for process A. (2) $PV = k$ for process B and A.
(3) $\frac{P^{\gamma-1}}{T^{\gamma}} = k$ for process B and $T = k$ for process A. (4) $\frac{T^{\gamma}}{P^{\gamma-1}} = k$ for process A and $PV = k$ for process B.

Q9. If three moles of monoatomic gas $\gamma = \frac{5}{3}$ is mixed with two moles of a diatomic gas $\gamma = \frac{7}{5}$, the value of adiabatic exponent γ for the mixture is:

(1) 1.75 (2) 1.40
(3) 1.52 (4) 1.35

Q10. A particle of charge -q and mass m moves in a circle of radius r around an infinitely long line charge of linear density $+\lambda$. Then time period will be given as:
(Consider k as Coulomb's constant)

(1) $T^2 = \frac{4\pi^2}{2k\lambda q} m r^3$ (2) $T = 2\pi r \sqrt{\frac{m}{2k\lambda q}}$
(3) $T = \frac{1}{2\pi r}\sqrt{\frac{m}{2k\lambda q}}$ (4) $T = \frac{1}{2\pi}\sqrt{\frac{2k\lambda q}{m}}$

Q11. When a potential difference V is applied across a wire of resistance R, it dissipates energy at a rate W. If the wire is cut into two halves and these halves are connected mutually parallel across the same supply, the energy dissipation rate will become:

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

Q12. An alternating voltage $V(t) = 220\sin 100\pi t$ volt is applied to a purely resistive load of 50 Ω. The time taken for the current to rise from half of the peak value to the peak value is:

(1) 5 ms (2) 3.3 ms
(3) 7.2 ms (4) 2.2 ms

Q13. Match List I with List II

List I	List II
A. Gauss's law of magnetostatics	i. $\oint \vec{E} \cdot d\vec{a} = \frac{1}{\varepsilon_0} \int \rho dV$
B. Faraday's law of electro magnetic induction	ii. $\oint \vec{B} \cdot d\vec{a} = 0$
C. Ampere's law	iii. $\oint \vec{E} \cdot d\vec{l} = \frac{-d}{dt} \int \vec{B} \cdot d\vec{a}$
D. Gauss's law of electrostatics	iv. $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$

Choose the correct answer from the options given below:

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

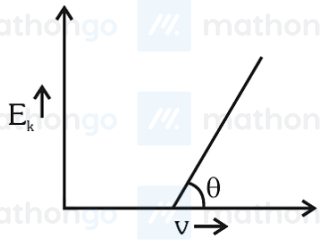
Q14. A beam of unpolarised light of intensity I_0 is passed through a polaroid A and then through another polaroid B which is oriented so that its principal plane makes an angle of 45° relative to that of A. The intensity of emergent light is :

(1) $\frac{I_0}{4}$ (2) I_0
(3) $\frac{I_0}{2}$ (4) $\frac{I_0}{8}$

Q15. If the total energy transferred to a surface in time t is 6.48×10^5 J, then the magnitude of the total momentum delivered to this surface for complete absorption will be :

(1) 2.46×10^{-3} kg m s^{-1} (2) 2.16×10^{-3} kg m s^{-1}
(3) 1.58×10^{-3} kg m s^{-1} (4) 4.32×10^{-3} kg m s^{-1}

Q16. For the photoelectric effect, the maximum kinetic energy E_k of the photoelectrons is plotted against the frequency (v) of the incident photons as shown in figure. The slope of the graph gives



(1) Ratio of Planck's constant to electric charge (2) Work function of the metal
(3) Charge of electron (4) Planck's constant

Q17. An electron revolving in n^{th} Bohr orbit has magnetic moment μ_n. If $\mu_n \propto n^x$, the value of x is:

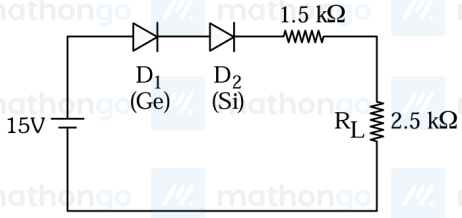
(1) 2 (2) 1
(3) 3 (4) 0

Q18. In a nuclear fission reaction of an isotope of mass M, three similar daughter nuclei of same mass are formed. The speed of a daughter nuclei in terms of mass defect ΔM will be :

(1) $\sqrt{\frac{2c\Delta M}{M}}$ (2) $\frac{\Delta Mc^2}{3}$

(3) $c\sqrt{\frac{2\Delta M}{M}}$ (4) $c\sqrt{\frac{3\Delta M}{M}}$

Q19. In the given circuit, the voltage across load resistance (R_L) is:



(1) 8.75 V (2) 9.00 V

(3) 8.50 V (4) 14.00 V

Q20. If 50 Vernier divisions are equal to 49 main scale divisions of a travelling microscope and one smallest reading of main scale is 0.5 mm the Vernier constant of travelling microscope is:

(1) 0.1 mm (2) 0.1 cm

(3) 0.01 cm (4) 0.01 mm

Q21. A vector has magnitude same as that of $\vec{A} = 3\hat{j} + 4\hat{j}$ and is parallel to $\vec{B} = 4\hat{i} + 3\hat{j}$. The x and y components of this vector in first quadrant are x and 3 respectively where x = ____.

Q22. Two discs of moment of inertia $I_1 = 4$ kg m^2 and $I_2 = 2$ kg m^2 about their central axes & normal to their planes, rotating with angular speeds 10 rad s^{-1} & 4 rad s^{-1} respectively are brought into contact face to face with their axe of rotation coincident. The loss in kinetic energy of the system in the process is _____J .

Q23. A big drop is formed by coalescing 1000 small identical drops of water. If E_1 be the total surface energy of 1000 small drops of water and E_2 be the surface energy of single big drop of water, the $E_1 : E_2$ is x: 1, where $x =$ _____.

Q24. A simple pendulum is placed at a place where its distance from the earth's surface is equal to the radius of the earth. If the length of the string is 4 m, then the time period of small oscillations will be _____s. [take $g = \pi^2$ m s^{-2}]

Q25. A point source is emitting sound waves of intensity 16×10^{-8} W m^{-2} at the origin. The difference in intensity (magnitude only) at two points located at a distances of 2 m and 4 m from the origin respectively will be _____ $\times 10^{-8}$ W m^{-2}.

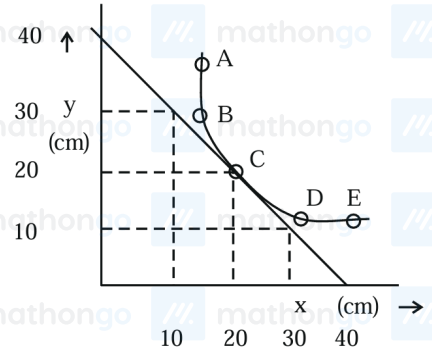
Q26. Two identical charged spheres are suspended by strings of equal lengths. The string make an angle of 37° with each other. When suspended in a liquid of density 0.7 g cm^{-3}, the angle remains same. If density of material of the sphere is 1.4 g cm^{-3}, the dielectric constant of the liquid is _____ $\tan 37° = \frac{3}{4}$

Q27. Two resistance of 100Ω and 200Ω are connected in series with a battery of 4 V and negligible internal resistance. A voltmeter is used to measure voltage across 100Ω resistance, which gives reading as 1 V. The resistance of voltmeter must be _____ Ω.

Q28. The current of 5 A flows in a square loop of sides 1 m is placed in air. The magnetic field at the centre of the loop is $X\sqrt{2} \times 10^{-7}$ T. The value of X is _____.

Q29. A power transmission line feeds input power at 2.3 kV to a step down transformer with its primary winding having 3000 turns. The output power is delivered at 230 V by the transformer. The current in the primary of the transformer is 5 A and its efficiency is 90%. The winding of transformer is made of copper. The output current of transformer is ____A.

Q30. In an experiment to measure the focal length (f) of a convex lens, the magnitude of object distance (x) and the image distance (y) are measured with reference to the focal point of the lens. The y - x plot is shown in figure. The focal length of the lens is ____cm.



Q31. Given below are two statements:

Statement - I: Along the period, the chemical reactivity of the element gradually increases from group 1 to group 18.

Statement - II: The nature of oxides formed by group 1 element is basic while that of group 17 elements is acidic.

In the the light above statements, choose the most appropriate from the questions given below:

(1) Both statement I and Statement II are true.
(2) Statement I is true but Statement II is False.
(3) Statement I is false but Statement II is true.
(4) Both Statement I and Statement II is false.

Q32. Given below are two statements:

Statement-I: Since fluorine is more electronegative than nitrogen, the net dipole moment of NF_3 is greater than NH_3.

Statement-II: In NH_3, the orbital dipole due to lone pair and the dipole moment of NH bonds are in opposite direction, but in NF_3 the orbital dipole due to lone pair and dipole moments of N-F bonds are in same direction.

In the light of the above statements. Choose the most appropriate from the options given below.

(1) Statement I is true but Statement II is false.
(2) Both Statement I and Statement II are false.
(3) Both statement I and Statement II is are true.
(4) Statement I is false but Statement II is are true.

Q33. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

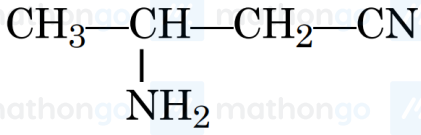
Assertion A : H_2Te is more acidic than H_2 S.

Reason R: Bond dissociation enthalpy of H_2Te is lower than H_2 S.

In the light of the above statements. Choose the most appropriate from the options given below.

(1) Both A and R are true but R is NOT the correct explanation of A.
(2) Both A and R are true and R is the correct explanation of A.
(3) A is false but R is true.
(4) A is true but R is false.

Q34. IUPAC name of following compound is

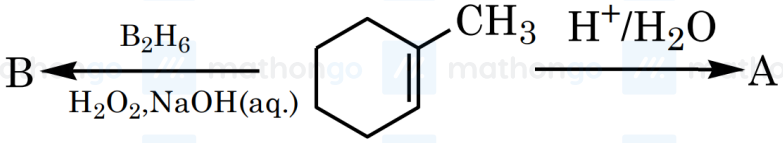


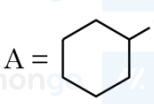
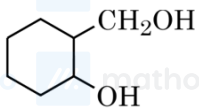
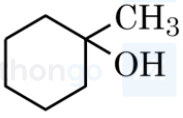
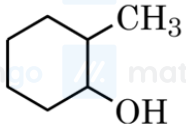
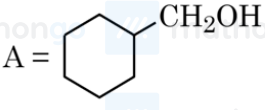
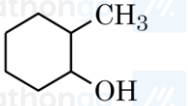
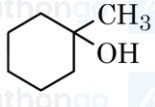
(1) 2 – Aminopentanenitrile
(2) 2 – Aminobutanenitrile
(3) 3 – Aminobutanenitrile
(4) 3 – Aminopropanenitrile

Q35. Which among the following purification methods is based on the principle of "Solubility" in two different solvents?
(1) Column Chromatography
(2) Sublimation
(3) Distillation
(4) Differential Extraction

Q36. The correct stability order of carbocations is
(1) $CH_3\overset{+}{C} > CH_3 - \overset{+}{C}H_2 > CH_3\overset{+}{C}H > \overset{+}{C}H_3$
(2) $\overset{+}{C}H_3 > CH_3\overset{+}{C}H > CH_3 - \overset{+}{C}H_2 > CH_3\overset{+}{C}$
(3) $CH_3\overset{+}{C} > CH_3\overset{+}{C}H > CH_3 - \overset{+}{C}H_2 > \overset{+}{C}H_3$
(4) $\stackrel{+\quad}{\mathrm{C}\mathrm{H}_3}>\mathrm{CH}_3-\stackrel{+ \quad}{\mathrm{C}\mathrm{H}_2}>\mathrm{CH}_3-\underset{| \atop \stackrel{ \atop }{\huge \mathrm{CH}_3}}{\stackrel{+ \quad}{\mathrm{C}\mathrm{H}}}>\left(\mathrm{CH}_3\right)\mathrm{C}^{+}$

Q37. Product A and B formed in the following set of reactions are:



(1) A =  B = 
(2) A =  B = 
(3) A = 
(4) A =  B = 

Q38. If a substance 'A' dissolves in solution of a mixture of 'B' and 'C' with their respective number of moles as n_A, n_B and n_C, mole fraction of C in the solution is:

(1) $\frac{n_C}{n_A \times n_B \times n_C}$ (2) $\frac{n_C}{n_A + n_B + n_C}$
(3) $\frac{n_C}{n_A - n_B - n_C}$ (4) $\frac{n_B}{n_A + n_B}$

Q39. The solution from the following with highest depression in freezing point/lowest freezing point is
(1) 180 g of acetic acid dissolved in 1 L of aqueous solution. (2) 180 g of acetic acid dissolved in benzene
(3) 180 g of benzoic acid dissolved in benzene (4) 180 g of glucose dissolved in water

Q40. Reduction potential of ions are given below:
ClO_4^- IO_4^- BrO_4^-
$E° = 1.19$ V ; $E° = 1.65$ V; $E° = 1.74$ V
The correct order of their oxidising power is:
(1) $ClO_4^- > IO_4^- > BrO_4^-$ (2) $BrO_4^- > IO_4^- > ClO_4^-$
(3) $BrO_4^- > ClO_4^- > IO_4^-$ (4) $IO_4^- > BrO_4^- > ClO_4^-$

Q41. Choose the correct statements about the hydrides of group 15 elements.
A. The stability of the hydrides decreases in the order $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$
B. The reducing ability of the hydrides increases in the order $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$
C. Among the hydrides, NH_3 is strong reducing agent while BiH_3 is mild reducing agent.
D. The basicity of the hydrides increases in the order $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$
Choose the most appropriate from the option given below:
(1) B and C only (2) C and D only
(3) A and B only (4) A and D only

Q42. The orange colour of $K_2Cr_2O_7$ and purple colour of $KMnO_4$ is due to
(1) Charge transfer transition in both. (2) $d \rightarrow d$ transition in $KMnO_4$ and charge transfer transitions in $K_2Cr_2O_7$.
(3) $d \rightarrow d$ transition in $K_2Cr_2O_7$ and charge transfer transitions in $KMnO_4$. (4) $d \rightarrow d$ transition in both.

Q43. *A* and *B* formed in the following reactions are:
$CrO_2Cl_2 + 4NaOH \rightarrow A + 2NaCl + 2H_2O$
$A + 2HCl + 2H_2O_2 \rightarrow B + 3H_2O$
(1) $A = Na_2CrO_4$, $B = CrO_5$ (2) $A = Na_2Cr_2O_4$, $B = CrO_4$
(3) $A = Na_2Cr_2O_7$, $B = CrO_3$ (4) $A = Na_2Cr_2O_7$, $B = CrO_5$

Q44. Alkaline oxidative fusion of MnO_2 gives "A " which on electrolytic oxidation in alkaline solution produces *B*. *A* and *B* respectively are:
(1) Mn_2O_7 and MnO_4^- (2) MnO_4^{2-} and MnO_4^-
(3) Mn_2O_3 and MnO_4^{2-} (4) MnO_4^{2-} and Mn_2O_7

Q45. The molecule/ion with square pyramidal shape is:
(1) $Ni(CN)_4^{2-}$ (2) PCl_5
(3) BrF_5 (4) PF_5

Q46. The coordination geometry around the manganese in decacarbonyldimanganese0

(1) Octahedral
(2) Trigonal bipyramidal
(3) Square pyramidal
(4) Square planar

Q47. Given below are two statements:

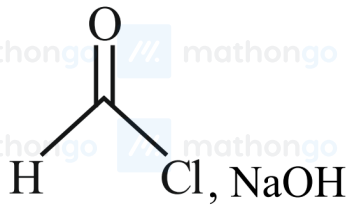
Statement - I: High concentration of strong nucleophilic reagent with secondary alkyl halides which do not have bulky substituents will follow S_N2 mechanism.

Statement - II: A secondary alkyl halide when treated with a large excess of ethanol follows S_N1 mechanism.

In the the light of the above statements, choose the most appropriate from the questions given below:

(1) Statement I is true but Statement II is false.
(2) Statement I is false but Statement II is true.
(3) Both statement I and Statement II are false.
(4) Both statement I and Statement II are true.

Q48. Salicylaldehyde is synthesized from phenol, when reacted with

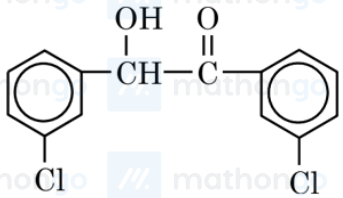
(1) 

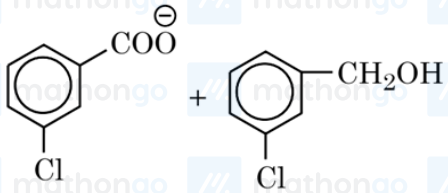
(2) CO_2 , NaOH

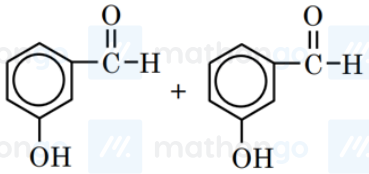
(3) CCl_4 , NaOH

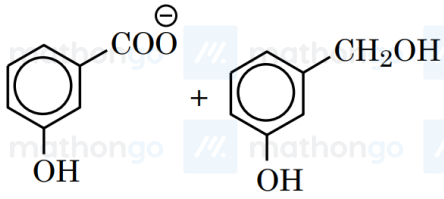
(4) $HCCl_3$, NaOH

Q49. m-chlorobenzaldehyde on treatment with 50%KOH solution yields

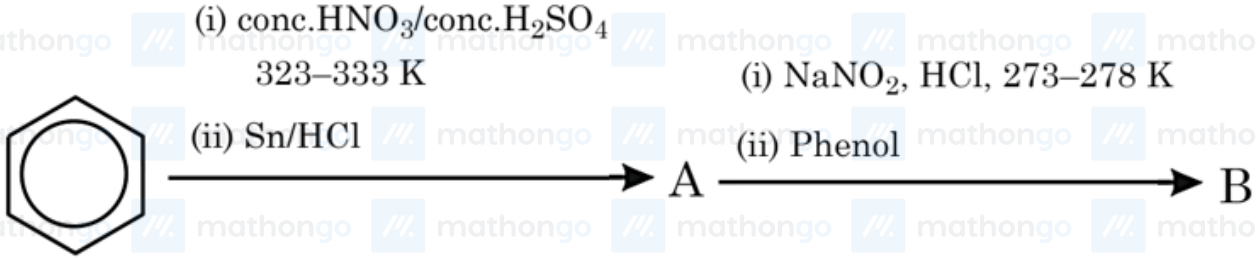
(1) 

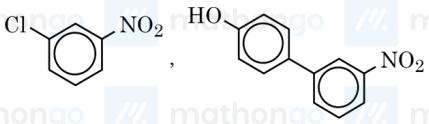
(2) 

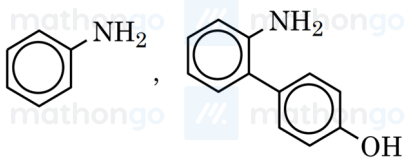
(3) 

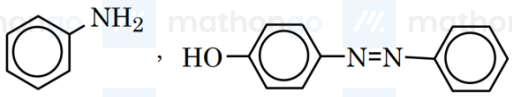
(4) 

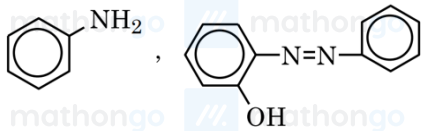
Q50. The products A and B formed in the following reaction scheme are respectively



(1) 

(2) 

(3) 

(4) 

Q51. Number of spectral lines obtained in He^+ spectra, when an electron makes transition from fifth excited state to first excited state will be

Q52. Two reactions are given below:

$2Fe_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow Fe_2O_{3(s)}, \Delta H^o = -822 \text{ kJ/mol}$

$C_{(s)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{(g)}, \Delta H^o = -110 \text{ kJ/mol}$

Then enthalpy change for following reaction

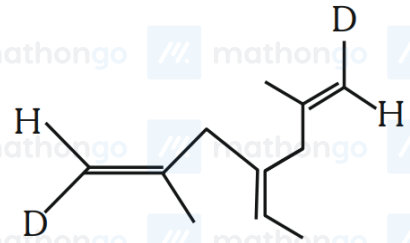
$3C_{(s)} + Fe_2O_{3(s)} \rightarrow 2Fe_{(s)} + 3CO_{(g)}$

Q53. The pH of an aqueous solution containing 1M benzoic acid $pK_a = 4.20$ and 1M sodium benzoate is 4.5. The volume of benzoic acid solution in 300 mL of this buffer solution is _____mL.

Q54. Total number of species from the following which can undergo disproportionation reaction _____.

$H_2O_2, ClO_3^-, P_4, Cl_2, Ag, Cu^{+1}, F_2, NO_2, K^+$

Q55. Number of geometrical isomers possible for the given structure is/are _____.



Q56. NO_2 required for a reaction is produced by decomposition of N_2O_5 in CCl_4 as by equation

$2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$

The initial concentration of N_2O_5 is 3 mol L^{-1} and it is 2.75 mol L^{-1} after 30 minutes.

The rate of formation of NO_2 is $x \times 10^{-3}$ mol L^{-1} min_{-1}, value of x is _____.

Q57. Number of complexes which show optical isomerism among the following is _____.

cis - $Cr(ox)_2Cl_2^{3-}$, $Co(en)_3^{3+}$, cis - $Pt(en)_2Cl_2^{2+}$, cis - $Co(en)_2Cl_2^{+}$, trans - $Pt(en)_2Cl_2^{2+}$, trans - $Cr(ox)_2Cl_2^{3-}$

Q58. 2 - chlorobutane + $Cl_2 \rightarrow C_4H_8Cl_2$ (isomers)

Total number of optically active isomers shown by $C_4H_8Cl_2$, obtained in the above reaction is _____.

Q59. Number of metal ions characterized by flame test among the following is _____.
$Sr^{2+}, Ba^{2+}, Ca^{2+}, Cu^{2+}, Zn^{2+}, Co^{2+}, Fe^{2+}$

Q60. The total number of correct statements, regarding the nucleic acids is _____.
A. RNA is regarded as the reserve of genetic information.
B. DNA molecule self-duplicates during cell division
C. DNA synthesizes proteins in the cell.
D. The message for the synthesis of particular proteins is present in DNA
E. Identical DNA strands are transferred to daughter cells.

Q61. If z is a complex number, then the number of common roots of the equation $z^{1985} + z^{100} + 1 = 0$ and $z^3 + 2z^2 + 2z + 1 = 0$, is equal to :
(1) 1 (2) 2
(3) 0 (4) 3

Q62. Let a and b be two distinct positive real numbers. Let 11^{th} term of a GP, whose first term is a and third term is b, is equal to p^{th} term of another GP, whose first term is a and fifth term is b. Then p is equal to
(1) 20 (2) 25
(3) 21 (4) 24

Q63. Suppose 28 - p, p, 70 - α, α are the coefficient of four consecutive terms in the expansion of $(1+x)^n$. Then the value of 2α - $3p$ equals
(1) 7 (2) 10
(3) 4 (4) 6

Q64. For $\alpha, \beta \in 0, \frac{\pi}{2}$ let $3\sin(\alpha+\beta) = 2\sin(\alpha-\beta)$ and a real number k be such that $\tan\alpha = \tan\beta$. Then the value of k is equal to
(1) -5 (2) 5
(3) $\frac{2}{3}$ (4) $-\frac{2}{3}$

Q65. If $x^2 - y^2 + 2hxy + 2gx + 2fy + c = 0$ is the locus of a point, which moves such that it is always equidistant from the lines $x + 2y + 7 = 0$ and $2x - y + 8 = 0$, then the value of $g + c + h - f$ equals
(1) 14 (2) 6
(3) 8 (4) 29

Q66. Let $A(\alpha, 0)$ and $B(0, \beta)$ be the points on the line $5x + 7y = 50$. Let the point P divide the line segment AB internally in the ratio 7: 3. Let $3x - 25 = 0$ be a directrix of the ellipse $E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and the corresponding focus be S. If from S, the perpendicular on the x - axis passes through P, then the length of the latus rectum of E is equal to
(1) $\frac{25}{3}$ (2) $\frac{32}{9}$
(3) $\frac{25}{9}$ (4) $\frac{32}{5}$

Q67. Let P be a point on the hyperbola H: $\frac{x^2}{9} - \frac{y^2}{4} = 1$, in the first quadrant such that the area of triangle formed by P and the two foci of H is $2\sqrt{13}$. Then, the square of the distance of P from the origin is

(1) 18 (2) 26
(3) 22 (4) 20

Q68. Let $R = \begin{matrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{matrix}$ be a non-zero 3×3 matrix, where $x\sin\theta = y\sin\theta + \frac{2\pi}{3} = z\sin\theta + \frac{4\pi}{3} \neq 0, \theta \in (0, 2\pi)$.
For a square matrix M, let Trace$M$ denote the sum of all the diagonal entries of M. Then, among the statements:
I Trace $(R) = 0$
(II) If Trace $(\text{adj}(\text{adj}(R))) = 0$, then R has exactly one non-zero entry.
(1) Both (I) and (II) are true (2) Only (II) is true
(3) Neither (I) nor (II) is true (4) Only (I) is true

Q69. Consider the system of linear equations $x + y + z = 5, x + 2y + \lambda^2 z = 9$ and $x + 3y + \lambda z = \mu$, where $\lambda, \mu \in R$. Then, which of the following statement is NOT correct ?
(1) System has infinite number of solution if $\lambda = 1$ and $\mu = 13$ (2) System is inconsistent if $\lambda = 1$ and $\mu \neq 13$
(3) System has unique solution if $\lambda \neq 1$ and $\mu \neq 13$ (4) System is consistent if $\lambda \neq 1$ and $\mu = 13$

Q70. If the domain of the function $fx = \log_e \frac{2x+3}{4x^2 + x - 3} + \cos^{-1}\frac{2x-1}{x+2}$ is $(\alpha, \beta]$, then the value of $5\beta - 4\alpha$ is equal to
(1) 10 (2) 12
(3) 11 (4) 9

Q71. Let $f: R \to R$ be a function defined $fx = \frac{x}{1 + x^{4^{1/4}}}$ and $gx = ffffx$ then $18\int_0^{\sqrt{2\sqrt{5}}} x^2 gx dx$
(1) 33 (2) 36
(3) 42 (4) 39

Q72. Let a and b be real constants such that the function f defined by $fx = \begin{matrix} x^2 + 3x + a, & x \leq 1 \\ bx + 2, & x > 1 \end{matrix}$ be differentiable on R. Then, the value of $\int_{-2}^{2} fx dx$ equals
(1) $\frac{15}{6}$ (2) $\frac{19}{6}$
(3) 21 (4) 17

Q73. Let $f: R - \{0\} \to R$ be a function satisfying $f\frac{x}{y} = \frac{f(x)}{f(y)}$ for all $x, y, f(y) \neq 0$. If $f'(1) = 2024$, then
(1) $xf'x - 2024fx = 0$ (2) $xf'x + 2024fx = 0$
(3) $x'(x) + f(x) = 2024$ (4) $xf'(x) - 2023f(x) = 0$

Q74. Let $fx = x + 3^2 x - 2^3, x \in [-4, 4]$. If M and m are the maximum and minimum values of f, respectively in $[-4, 4]$, then the value of $M - m$ is :
(1) 600 (2) 392
(3) 608 (4) 108

Q75. Let $y = f(x)$ be a thrice differentiable function in $(-5, 5)$. Let the tangents to the curve $y = f(x)$ at $(1, f(1))$ and $(3, f(3))$ make angles $\frac{\pi}{6}$ and $\frac{\pi}{4}$, respectively with positive x-axis. If $27\int_1^3 f't^2 + 1f''tdt = \alpha + \beta\sqrt{3}$ where α, β are integers, then the value of $\alpha + \beta$ equals

(1) -14 (2) 26
(3) -16 (4) 36

Q76. Let $f: R \to R$ be defined $fx = ae^{2x} + be^{x} + cx$. If $f\left(0\right) = -1, f'\log_e 2 = 21$ and $\int_0^{\log 4} fx - cxdx = \frac{39}{2}$, then the value of $|a+b+c|$ equals:
(1) 16 (2) 10
(3) 12 (4) 8

Q77. Let $\vec{a} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$, $\alpha, \beta \in R$. Let a vector $\vec{b}$ be such that the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{4}$ and $\vec{b}^{2} = 6$, If $\vec{a} \cdot \vec{b} = 3\sqrt{2}$, then the value of $\alpha^2 + \beta^2 \mid \vec{a} \times \vec{b}|^2$ is equal to
(1) 90 (2) 75
(3) 95 (4) 85

Q78. Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\left|\vec{b}\right| = 1$ and $\left|\vec{b} \times \vec{a}\right| = 2$ Then $\left|\left(\vec{b} \times \vec{a}\right) - \vec{b}\right|^2$ is equal to
(1) 3 (2) 5
(3) 1 (4) 4

Q79. Let $L_1: \vec{r} = \hat{i} - \hat{j} + 2\hat{k} + \lambda\hat{i} - \hat{j} + 2\hat{k}$, $\lambda \in R$, $L_2: \vec{r} = \hat{j} - \hat{k} + \mu 3\hat{i} + \hat{j} + p\hat{k}$, $\mu \in R$ and $L_3: \vec{r} = \delta\left(l\hat{i} + m\hat{j} + n\hat{k}\right)$, $\delta \in R$ be three lines such that L_1 is perpendicular to L_2 and L_3 is perpendicular to both L_1 and L_2. Then the point which lies on L_3 is
(1) $(-1, 7, 4)$ (2) $(-1, -7, 4)$
(3) $(1, 7, -4)$ (4) $(1, -7, 4)$

Q80. Bag A contains 3 white, 7 red balls and bag B contains 3 white, 2 red balls. One bag is selected at random and a ball is drawn from it. The probability of drawing the ball from the bag A, if the ball drawn in white, is :
(1) $\frac{1}{4}$ (2) $\frac{1}{9}$
(3) $\frac{1}{3}$ (4) $\frac{3}{10}$

Q81. The number of real solutions of the equation \(x\left(x^2+3|x|+5|x-1|+6|x-2|\right)=0\) is _____.

Q82. In an examination of Mathematics paper, there are 20 questions of equal marks and the question paper is divided into three sections : A, B and C. A student is required to attempt total 15 questions taking at least 4 questions from each section. If section A has 8 questions, section B has 6 questions and section C has 6 questions, then the total number of ways a student can select 15 questions is _____.

Q83. Let S_n be the sum to n-terms of an arithmetic progression $3, 7, 11, \ldots \ldots$, if $40 < \frac{6}{n(n+1)} \sum_{k=1}^{n} S_k < 42$, then n equals _____.

Q84. Let $\alpha = \sum_{k=0}^{n} \frac{{}^{n}C_k{}^{2}}{k+1}$ and $\beta = \sum_{k=0}^{n-1} \frac{{}^{n}C_k \, {}^{n}C_{k+1}}{k+2}$. If $5\alpha = 6\beta$, then n equals

Q85. Consider two circles $C_1: x^2 + y^2 = 25$ and $C_2: (x-\alpha)^2 + y^2 = 16$, where $\alpha \in (5, 9)$. Let the angle between the two radii (one to each circle) drawn from one of the intersection points of C_1 and C_2 be $\sin^{-1}\frac{\sqrt{63}}{8}$. If the length of common chord of C_1 and C_2 is β, then the value of $(\alpha\beta)^2$ equals _____.

Q86. If the variance σ^2 of the data $\begin{matrix} x_i & 0 & 1 & 5 & 6 & 10 & 12 & 17 \\ f_i & 3 & 2 & 3 & 2 & 6 & 3 & 3 \end{matrix}$ is k then the value of k is _____ {where . denotes the greatest integer funciton}

Q87. The number of symmetric relations defined on the set $\{1, 2, 3, 4\}$ which are not reflexive is _____.

Q88. The area of the region enclosed by the parabola $(y - 2)^2 = x - 1$, the line $x - 2 \quad y + 4 = 0$ and the positive coordinate axes is _____.

Q89. Let $Y = Y(X)$ be a curve lying in the first quadrant such that the area enclosed by the line $Y - y = Y'(x)(X - x)$ and the co-ordinate axes, where (x, y) is any point on the curve, is always $\frac{-y^2}{2Y'(x)} + 1, Y'x \neq 0$. If $Y(1) = 1$, then $12 \quad Y(2)$ equals _____.

Q90. Let a line passing through the point $(-1, 2, 3)$ intersect the lines $L_1: \frac{x - 1}{3} = \frac{y - 2}{2} = \frac{z + 1}{-2}$ at $M(\alpha, \beta, \gamma)$ and $L_2: \frac{x + 2}{-3} = \frac{y - 2}{-2} = \frac{z - 1}{4}$ at $N(a, b, c)$. Then the value of $\frac{(\alpha + \beta + \gamma)^2}{(a + b + c)^2}$ equals _____.

ANSWER KEYS

1. (1)	**2.** (4)	**3.** (1)	**4.** (1)	**5.** (2)	**6.** (4)	**7.** (4)	**8.** (1)
9. (3)	**10.** (2)	**11.** (4)	**12.** (2)	**13.** (4)	**14.** (1)	**15.** (2)	**16.** (4)
17. (2)	**18.** (3)	**19.** (1)	**20.** (4)	**21.** (4)	**22.** (24)	**23.** (10)	**24.** (8)
25. (3)	**26.** (2)	**27.** (200)	**28.** (40)	**29.** (45)	**30.** (20)	**31.** (3)	**32.** (2)
33. (2)	**34.** (3)	**35.** (4)	**36.** (3)	**37.** (2)	**38.** (2)	**39.** (1)	**40.** (2)
41. (3)	**42.** (1)	**43.** (1)	**44.** (2)	**45.** (3)	**46.** (1)	**47.** (4)	**48.** (4)
49. (4)	**50.** (3)	**51.** (10)	**52.** (492)	**53.** (100)	**54.** (6)	**55.** (4)	**56.** (17)
57. (4)	**58.** (6)	**59.** (4)	**60.** (3)	**61.** (2)	**62.** (3)	**63.** (1)	**64.** (1)
65. (1)	**66.** (4)	**67.** (3)	**68.** (3)	**69.** (3)	**70.** (2)	**71.** (4)	**72.** (4)
73. (1)	**74.** (3)	**75.** (2)	**76.** (4)	**77.** (1)	**78.** (2)	**79.** (1)	**80.** (3)
81. (1)	**82.** (11376)	**83.** (9)	**84.** (10)	**85.** (1575)	**86.** (29)	**87.** (960)	**88.** (5)
89. (20)	**90.** (196)						

Q1. If two vectors $\vec{A}$ and $\vec{B}$ having equal magnitude R are inclined at an angle θ, then

(1) $\vec{A}-\vec{B}=\sqrt{2}R\sin\frac{\theta}{2}$ (2) $\vec{A}+\vec{B}=2R\sin\frac{\theta}{2}$

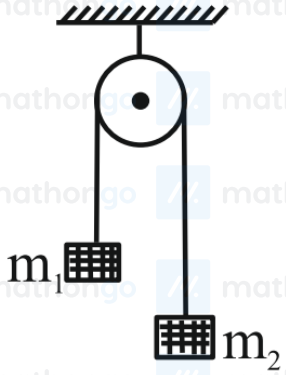
(3) $\vec{A}+\vec{B}=2R\cos\frac{\theta}{2}$ (4) $\vec{A}-\vec{B}=2R\cos\frac{\theta}{2}$

Q2. Consider two physical quantities A and B related to each other as $E=\frac{B-x^2}{At}$ where E, x and t have dimensions of energy, length and time respectively. The dimension of AB is

(1) $L^{-2}M^{1}T^{0}$ (2) $L^{2}M^{-1}T^{1}$

(3) $L^{-2}M^{-1}T^{1}$ (4) $L^{0}M^{-1}T^{1}$

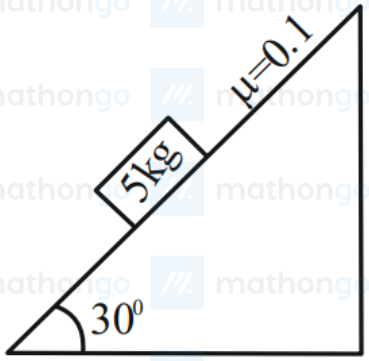
Q3. A light string passing over a smooth light fixed pulley connects two blocks of masses m_1 and m_2. If the acceleration of the system is $\frac{g}{8}$, then the ratio of masses is



(1) $\frac{9}{7}$ (2) $\frac{8}{1}$

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

Q4. A block of mass 5 kg is placed on a rough inclined surface as shown in the figure. If $\vec{F}_1$ is the force required to just move the block up the inclined plane and $\vec{F}_2$ is the force required to just prevent the block from sliding down, then the value of $\vec{F}_1-\vec{F}_2$ is: [Use $g=10$ m s^{-2}]



(1) $25\sqrt{3}$ N (2) $5\sqrt{3}$ N

(3) $\frac{5\sqrt{3}}{2}$ N (4) 10 N

Q5. A body of mass 2 kg begins to move under the action of a time dependent force given by $\vec{F}=6t\ \hat{i}+6t^2\ \hat{j}$ N. The power developed by the force at the time t is given by:

(1) $6t^4+9t^5$ W (2) $3t^3+6t^5$ W

(3) $9t^5+6t^3$ W (4) $9t^3+6t^5$ W

Q6. The mass of the moon is $\frac{1}{144}$ times the mass of a planet and its diameter $\frac{1}{16}$ times the diameter of a planet. If the escape velocity on the planet is v, the escape velocity on the moon will be:

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

(3) $\frac{v}{12}$ (4) $\frac{v}{6}$

Q7. A small spherical ball of radius r, falling through a viscous medium of negligible density has terminal velocity v. Another ball of the same mass but of radius $2r$, falling through the same viscous medium will have terminal velocity:

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

(3) $4v$ (4) $2v$

Q8. A gas mixture consists of 8 moles of argon and 6 moles of oxygen at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

(1) $29 \quad RT$ (2) $20 \quad RT$

(3) $27 \quad RT$ (4) $21 \quad RT$

Q9. The speed of sound in oxygen at S.T.P. will be approximately:

(Given, $R = 8.3$ J K^{-1}, $\gamma = 1.4$)

(1) 310 m s^{-1} (2) 333 m s^{-1}

(3) 341 m s^{-1} (4) 325 m s^{-1}

Q10. Force between two point charges q_1 and q_2 placed in vacuum at r cm apart is F. Force between them when placed in a medium having dielectric $K = 5$ at $\frac{r}{5}$ cm apart will be:

(1) $\frac{F}{25}$ (2) $5F$

(3) $\frac{F}{5}$ (4) $25F$

Q11. By what percentage will the illumination of the lamp decrease if the current drops by 20%?

(1) 46% (2) 26%

(3) 36% (4) 56%

Q12. The resistance per centimeter of a meter bridge wire is r, with $X \quad \Omega$ resistance in left gap. Balancing length from left end is at 40 cm with $25 \quad \Omega$ resistance in right gap. Now the wire is replaced by another wire of $2r$ resistance per centimeter. The new balancing length for same settings will be at

(1) 20 cm (2) 10 cm

(3) 80 cm (4) 40 cm

Q13. A uniform magnetic field of 2×10^{-3} T acts along positive Y-direction. A rectangular loop of sides 20 cm and 10 cm with current of 5 A is in Y-Z plane. The current is in anticlockwise sense with reference to negative X axis. Magnitude and direction of the torque is :

(1) 2×10^{-4} N m along positive Z –direction (2) 2×10^{-4} N m along negative Z-direction

(3) 2×10^{-4} N m along positive X-direction (4) 2×10^{-4} N m along positive Y-direction

Q14. An AC voltage $V = 20\sin 200\pi t$ is applied to a series LCR circuit which drives a current $I = 10\sin 200\pi t + \frac{\pi}{3}$. The average power dissipated is:

(1) 21.6 W (2) 200 W
(3) 173.2 W (4) 50 W

Q15. Given below are two statements:

Statement I: Electromagnetic waves carry energy as they travel through space and this energy is equally shared by the electric and magnetic fields.

Statement II: When electromagnetic waves strike a surface, a pressure is exerted on the surface.

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

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

Q16. When unpolarized light is incident at an angle of 60° on a transparent medium from air. The reflected ray is completely polarized. The angle of refraction in the medium is

(1) 30° (2) 60°
(3) 90° (4) 45°

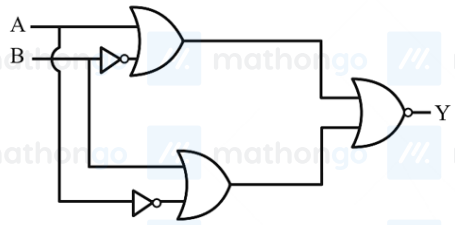
Q17. In a photoelectric effect experiment a light of frequency 1.5 times the threshold frequency is made to fall on the surface of photosensitive material. Now if the frequency is halved and intensity is doubled, the number of photo electrons emitted will be:

(1) Doubled (2) Quadrupled
(3) Zero (4) Halved

Q18. The mass number of nucleus having radius equal to half of the radius of nucleus with mass number 192 is:

(1) 24 (2) 32
(3) 40 (4) 20

Q19. The output of the given circuit diagram is



(1)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

(2)

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	0

(3)

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	0

(4)

A	B	Y
0	0	0
1	0	0
0	1	1
1	1	0

Q20. The measured value of the length of a simple pendulum is 20 cm with 2 mm accuracy. The time for 50 oscillations was measured to be 40 seconds with 1 second resolution. From these measurements, the accuracy in the measurement of acceleration due to gravity is $N\%$. The value of N is:

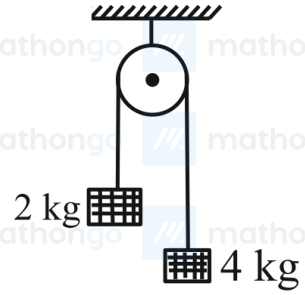
(1) 4 (2) 8

(3) 6 (4) 5

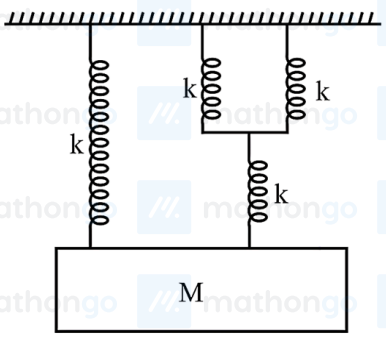
Q21. Two identical spheres each of mass 2 kg and radius 50 cm are fixed at the ends of a light rod so that the separation between the centers is 150 cm. Then, moment of inertia of the system about an axis perpendicular to the rod and passing through its middle point is $\frac{x}{20}$ kg m^2, where the value of x is

Q22. A body of mass m is projected with a speed u making an angle of 45^o with the ground. The angular momentum of the body about the point of projection, at the highest point is expressed as $\frac{\sqrt{2}mu^3}{Xg}$. The value of X is_____.

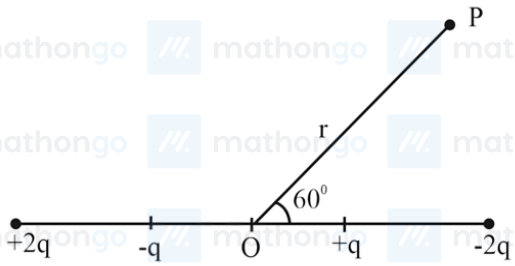
Q23. Two blocks of mass 2 kg and 4 kg are connected by a metal wire going over a smooth pulley as shown in figure. The radius of wire is 4.0×10^{-5} m and Young's modulus of the metal is 2.0×10^{11} N m^{-2}. The longitudinal strain developed in the wire is $\frac{1}{\alpha\pi}$. The value of α is _____. [Use $g = 10$ m s^{-2})



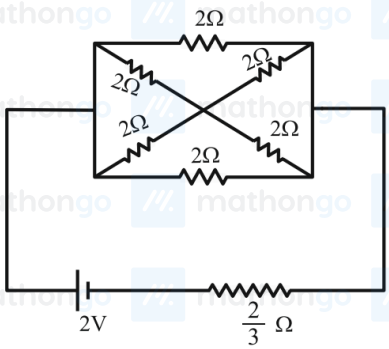
Q24. The time period of simple harmonic motion of mass M in the given figure is $\pi\sqrt{\frac{\alpha M}{5K}}$, where the value of α is _____.



Q25. The distance between charges $+q$ and $-q$ is $2l$ and between $+2q$ and $-2q$ is $4l$. The electrostatic potential at point P at a distance r from centre O is $-\alpha\frac{ql}{r^2}\times 10^9$ V, where the value of α is _____. (Use $\frac{1}{4\pi\varepsilon_0}=9\times 10^9$ N m^2 C^{-2})



Q26. In the following circuit, the battery has an emf of 2 V and an internal resistance of $\frac{2}{3}$ Ω. The power consumption in the entire circuit is _____ W.



Q27. Two circular coils P and Q of 100 turns each have same radius of π cm. The currents in P and R are 1 A and 2 A respectively. P and Q are placed with their planes mutually perpendicular with their centers coincide. The resultant magnetic field induction at the center of the coils is $\sqrt{x}$ mT, where $x=$ _____. [Use $\mu_0=4\pi\times 10^{-7}$ T m A^{-1}]

Q28. The magnetic flux ϕ (in weber) linked with a closed circuit of resistance 8 Ω varies with time (in seconds) as $\phi=5t^2-36t+1$. The induced current in the circuit at $t=2$ s is _____ A.

Q29. Light from a point source in air falls on a convex curved surface of radius 20 cm and refractive index 1.5. If the source is located at 100 cm from the convex surface, the image will be formed at _____ cm from the object.

Q30. A nucleus has mass number A_1 and volume V_1. Another nucleus has mass number A_2 and volume V_2. If relation between mass number is $A_2 = 4A_1$, then $\frac{V_2}{V_1} =$ _____.

Q31. A sample of $CaCO_3$ and $MgCO_3$ weighed 2 .21 g is ignited to constant weight of 1 .152 g. The composition of the mixture is:
(Given molar mass in g mol^{-1}, $CaCO_3$: 100, $MgCO_3$: 84)
(1) 1 .187 g $CaCO_3 + 1$ .023 g $MgCO_3$ (2) 1 .023 g $CaCO_3 + 1$ .023 g $MgCO_3$
(3) 1 .187 g $CaCO_3 + 1$ .187 g $MgCO_3$ (4) 1 .023 g $CaCO_3 + 1$ .187 g $MgCO_3$

Q32. The four quantum numbers for the electron in the outer most orbital of potassium (atomic no. 19) are
(1) $n = 4, l = 2, m = -1, s = +\frac{1}{2}$ (2) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$
(3) $n = 3, l = 0, m = -1, s = +\frac{1}{2}$ (4) $n = 2, l = 0, m = 0, s = +\frac{1}{2}$

Q33. Consider the following elements.

Group ↓ A'B' → Period
C'D'

Which of the following is/are true about A', B', C' and D' ?
A. Order of atomic radii: $B' < A' < D' < C'$
B. Order of metallic character : $B' < A' < D' < C'$
C. Size of the element : $D' < C' < B' < A'$
D. Order of ionic radii : $B'^{+} < A'^{+} < D'^{+} < C'^{+}$
Choose the correct answer from the options given below:
(1) A only (2) A, B and D only
(3) A and B only (4) B, C and D only

Q34. Which of the following is least ionic?
(1) $BaCl_2$ (2) AgCl
(3) KCl (4) $CoCl_2$

Q35. $A_g \rightleftharpoons B_g + \frac{C}{2^g}$. The correct relationship between K_P, α and equilibrium pressure P is
(1) $K_P = \frac{\alpha^{\frac{1}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{1}{2}}}$ (2) $K_P = \frac{\alpha^{\frac{3}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{1}{2}} 1 - \alpha}$
(3) $K_P = \frac{\alpha^{\frac{1}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{3}{2}}}$ (4) $K_P = \frac{\alpha^{\frac{1}{2}} P^{\frac{1}{2}}}{2 + \alpha^{\frac{3}{2}}}$

Q36. Given below are two statements :
Statement I: S_8 solid undergoes disproportionation reaction under alkaline conditions to form S^{2-} and $S_2O_3^{2-}$
Statement II: ClO_4^- can undergo disproportionation reaction under acidic condition.
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) Statement I is incorrect but statement II is correct
(3) Both statement I and statement II are incorrect (4) Both statement I and statement II are correct

Q37. Given below are two statements :

Statement I: Group 13 trivalent halides get easily hydrolysed by water due to their covalent nature.

Statement II: $AlCl_3$ upon hydrolysis in acidified aqueous solution forms octahedral $AlH_2O_6^{3+}$ ion.

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

(1) Statement I is true but statement II is false

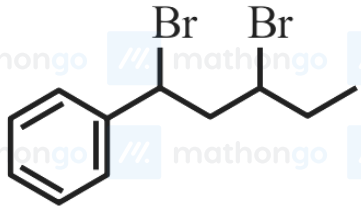
(2) Statement I is false but statement II is true

(3) Both statement I and statement II are false

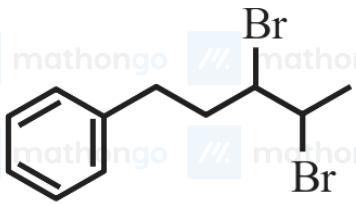
(4) Both statement I and statement II are true

Q38. Identify structure of 2, 3-dibromo-1-phenylpentane.

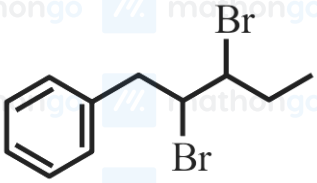
(1)



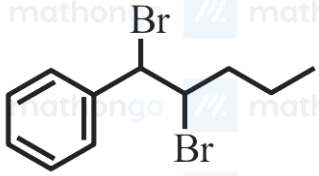
(2)



(3)



(4)



Q39. The fragrance of flowers is due to the presence of some steam volatile organic compounds called essential oils. These are generally insoluble in water at room temperature but are miscible with water vapour in the vapour phase. A suitable method for the extraction of these oils from the flowers is:

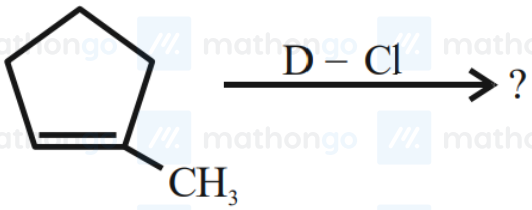
(1) crystallisation

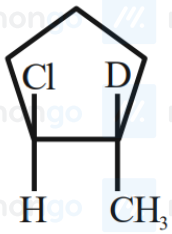
(2) distillation under reduced pressure

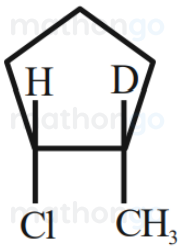
(3) distillation

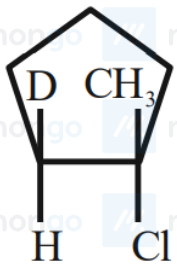
(4) steam distillation

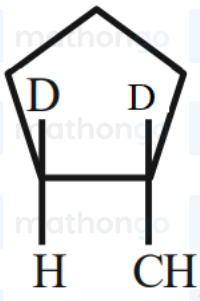
Q40. Major product of the following reaction is:



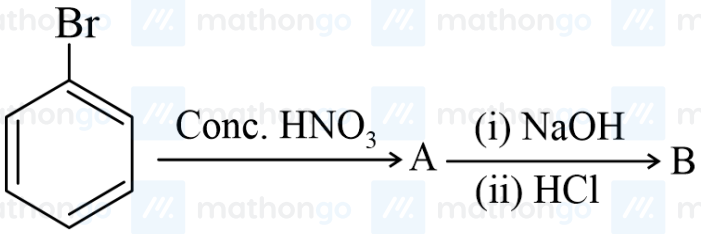
(1) 

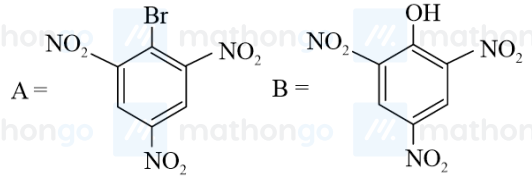
(2) 

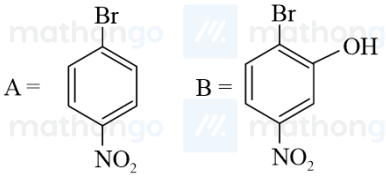
(3) 

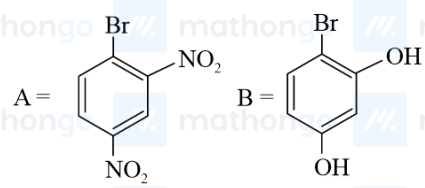
(4) 

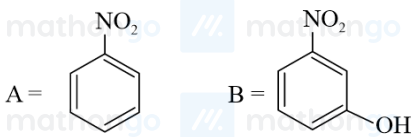
Q41. Identify *A* and *B* in the following reaction sequence.



(1) 

(2) 

(3) 

(4) 

Q42. Choose the correct statements from the following

A. All group 16 elements form oxides of general formula EO_2 and EO_3 where $E = S,\ \ Se,\ \ Te$ and Po. Both the types of oxides are acidic in nature.

B. TeO_2 is an oxidising agent while SO_2 is reducing in nature.

C. The reducing property decreases from H_2S to H_2Te down the group.

D. The ozone molecule contains five lone pairs of electrons.

Choose the correct answer from the options given below:

(1) A and D only

(2) B and C only

(3) C and D only

(4) A and B only

Q43. Choose the correct statements from the following

A. Mn_2O_7 is an oil at room temperature B. V_2O_4 reacts with acid to give VO_2^{2+}

C. CrO is a basic oxide D. V_2O_5 does not react with acid

Choose the correct answer from the options given below:

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

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

Q44. Select the option with correct property:

(1) $NiCO_4$ and $NiCl_4^{2-}$ both diamagnetic (2) $NiCO_4$ and $NiCl_4^{2-}$ both paramagnetic

(3) $NiCl_4^{2-}$ diamagnetic, $NiCO_4$ paramagnetic (4) $NiCO_4$ diamagnetic, $NiCl_4^{2-}$ paramagnetic

Q45. Match List I with List II

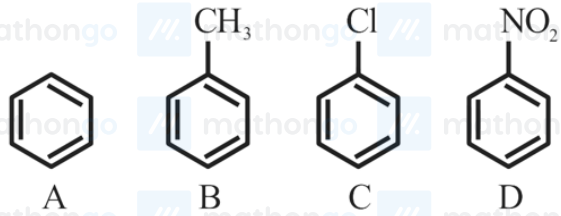
	LIST – I (Complex ion)		LIST – II (Electronic Configuration
A.	$CrH_2O_6^{3+}$	I.	$t_{2g}^2e_g^0$
B.	$FeH_2O_6^{3+}$	II.	$t_{2g}^3e_g^0$
C.	$NiH_2O_6^{2+}$	III.	$t_{2g}^3e_g^2$
D.	$VH_2O_6^{3+}$	IV.	$t_{2g}^6e_g^2$

Choose the correct answer from the options given below :

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

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

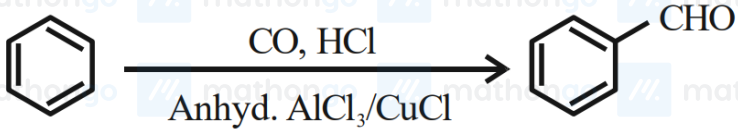
Q46. The correct order of reactivity in electrophilic substitution reaction of the following compounds is:



(1) B > C > A > D (2) D > C > B > A

(3) A > B > C > D (4) B > A > C > D

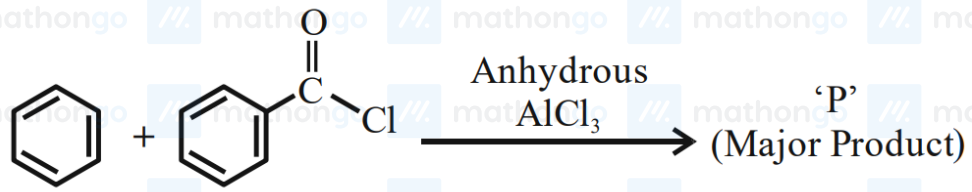
Q47. Identify the name reaction.

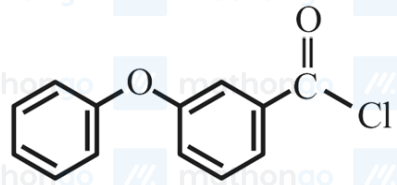


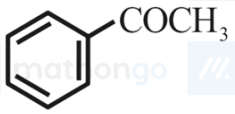
(1) Stephen reaction (2) Etard reaction

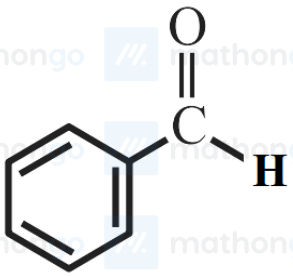
(3) Gatterman-koch reaction (4) Rosenmund reduction

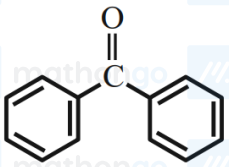
Q48. Identify major product '*P*' formed in the following reaction.



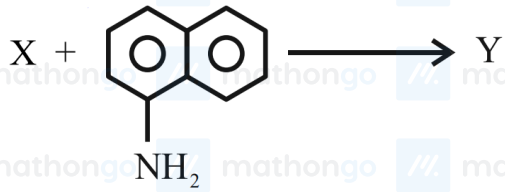
(1) 

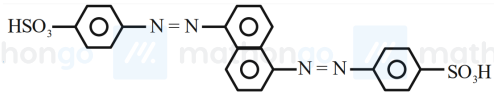
(2) 

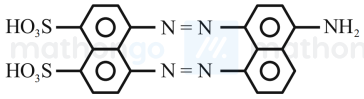
(3) 

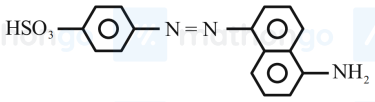
(4) 

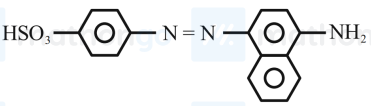
Q49. The azo-dye *Y* formed in the following reactions is Sulphanilic acid $+ \quad NaNO_2 + CH_3COOH \rightarrow X$



(1) 

(2) 

(3) 

(4) 

Q50. Given below are two statements :

Statement I: Aniline reacts with con. H_2SO_4 followed by heating at $453 - 473$ K gives p-aminobenzene sulphonic acid, which gives blood red colour in the 'Lassaigne's test'.

Statement II: In Friedel - Craft's alkylation and acylation reactions, aniline forms salt with the $AlCl_3$ catalyst. Due to this, nitrogen of aniline acquires a positive charge and acts as deactivating group.

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

(1) Statement I is false but statement II is true
(2) Both statement I and statement II are false
(3) Statement I is true but statement II is false
(4) Both statement I and statement II are true

Q51. The molarity of 1L orthophosphoric acid H_3PO_4 having 70% purity by weight (specific gravity 1 .54 g cm^{-3}) is _____ M. (Molar mass of $H_3PO_4 = 98$ g mol^{-1})

Q52. A diatomic molecule has a dipole moment of 1 .2 D. If the bond distance is $1\overset{o}{A}$, then fractional charge on each atom is _____ $\times 10^{-1}$ esu. (Given $1D = 10^{-18}$ esu cm)

Q53. If 5 moles of an ideal gas expands from 10L to a volume of 100L at 300K under isothermal and reversible condition then work, w, is $-x$ J. The value of x is - _____.
(Given R = 8 .314 J K^{-1} mol^{-1})

Q54. Number of isomeric products formed by monochlorination of 2-methylbutane in presence of sunlight is _____.

Q55. The values of conductivity of some materials at 298 .15 K in Sm^{-1} are
2.1×10^{3}, 1.0×10^{-16}, $1.2 \times 10, 3.91$, 1.5×10^{-2}, 1×10^{-7}, 1.0×10^{3}. The number of conductors among the materials is _____.

Q56. r = kA for a reaction, 50% of A is decomposed in 120 minutes. The time taken for 90% decomposition of A is _____ minutes.

Q57. Number of moles of H^{+} ions required by 1 mole of MnO_4^{-} to oxidise oxalate ion to CO_2 is _____.

Q58. In the reaction of potassium dichromate, potassium chloride and sulfuric acid (conc.), the oxidation state of the chromium in the product is + _____.

Q59. A compound x with molar mass $108g$ mol^{-1} undergoes acetylation to give product with molar mass $192g$ mol^{-1}. The number of amino groups in the compound x is _____.

Q60. From the vitamins $A, B_1, B_6, B_{12}, C, D, E$ and K, the number vitamins that can be stored in our body is _____.

Q61. The number of solutions, of the equation $e^{\sin x} - 2e^{-\sin x} = 2$ is
(1) 2 (2) more than 2
(3) 1 (4) 0

Q62. Let z_1 and z_2 be two complex number such that $z_1 + z_2 = 5$ and $z_1^3 + z_2^3 = 20 + 15i$. Then $z_1^4 + z_2^4$ equals-
(1) $30\sqrt{3}$ (2) 75
(3) $15\sqrt{15}$ (4) $25\sqrt{3}$

Q63. The number of ways in which 21 identical apples can be distributed among three children such that each child gets at least 2 apples, is
(1) 406 (2) 130
(3) 142 (4) 136

Q64. Let 2^{nd}, 8^{th} and 44^{th}, terms of a non-constant $A.P.$ be respectively the 1^{st}, 2^{nd} and 3^{rd} terms of $G.P.$ If the first term of A.P. is 1 then the sum of first 20 terms is equal to-
(1) 980 (2) 960
(3) 990 (4) 970

Q65. If for some m, n; ${}^{6}C_m + 2{}^{6}C_{m+1} + {}^{6}C_{m+2} > {}^{8}C_3$ and ${}^{n-1}P_3 : {}^{n}P_4 = 1:8$, then ${}^{n}P_{m+1} + {}^{n+1}C_m$ is equal to
(1) 380 (2) 376
(3) 384 (4) 372

Q66. Let $Aa,\ b,\ B3,\ 4$ and $-6,\ -8$ respectively denote the centroid, circumcentre and orthocentre of a triangle. Then, the distance of the point $P2a+3, 7b+5$ from the line $2x+3y-4=0$ measured parallel to the line $x-2y-1=0$ is

(1) $\frac{15\sqrt{5}}{7}$ (2) $\frac{17\sqrt{5}}{6}$

(3) $\frac{17\sqrt{5}}{7}$ (4) $\frac{\sqrt{5}}{17}$

Q67. Let a variable line passing through the centre of the circle $x^2+y^2-16x-4y=0$, meet the positive co-ordinate axes at the point A and B. Then the minimum value of $OA+OB$, where O is the origin, is equal to

(1) 12 (2) 18

(3) 20 (4) 24

Q68. Let P be a parabola with vertex $2,\ 3$ and directrix $2x+y=6$. Let an ellipse $E: \frac{x^2}{a^2}+\frac{y^2}{b^2}=1,\ a>b$ of eccentricity $\frac{1}{\sqrt{2}}$ pass through the focus of the parabola P. Then the square of the length of the latus rectum of E, is

(1) $\frac{385}{8}$ (2) $\frac{347}{8}$

(3) $\frac{512}{25}$ (4) $\frac{656}{25}$

Q69. Let $f: \rightarrow R \rightarrow 0,\infty$ be strictly increasing function such that $\lim_{x\to\infty}\frac{f7x}{fx}=1$. Then, the value of $\lim_{x\to\infty}\frac{f5x}{fx}-1$ is equal to

(1) 4 (2) 0

(3) $\frac{7}{5}$ (4) 1

Q70. Let the mean and the variance of 6 observation $a,\ b,\ 68,\ 44,\ 48,\ 60$ be 55 and 194, respectively if $a>b$, then $a+3b$ is

(1) 200 (2) 190

(3) 180 (4) 210

Q71. Let A be a 3×3 real matrix such that $A\begin{matrix}1\\0\\1\end{matrix}=2\begin{matrix}1\\0\\1\end{matrix}$, $A\begin{matrix}-1\\0\\1\end{matrix}=4\begin{matrix}-1\\0\\1\end{matrix}$, $A\begin{matrix}0\\1\\0\end{matrix}=2\begin{matrix}0\\1\\0\end{matrix}$. Then, the system $A-3I\begin{matrix}x\\y\\z\end{matrix}=\begin{matrix}1\\2\\3\end{matrix}$ has

(1) unique solution (2) exactly two solutions

(3) no solution (4) infinitely many solutions

Q72. If $a=\sin^{-1}\sin5$ and $b=\cos^{-1}\cos5$, then a^2+b^2 is equal to

(1) $4\pi^2+25$ (2) $8\pi^2-40\pi+50$

(3) $4\pi^2-20\pi+50$ (4) 25

Q73. If the function $f: -\infty, -1 \rightarrow a, b$ defined by $fx=e^{x^3-3x+1}$ is one-one and onto, then the distance of the point $P2b+4,\ a+2$ from the line $x+e^{-3}y=4$ is:

(1) $2\sqrt{1+e^6}$ (2) $4\sqrt{1+e^6}$

(3) $3\sqrt{1+e^6}$ (4) $\sqrt{1+e^6}$

Q74. Consider the function $f: 0, \infty \to R$ defined by $fx = e^{-\log_e x}$. If m and n be respectively the number of points at which f is not continuous and f is not differentiable, then $m + n$ is

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

Q75. Let $f, g: 0, \quad \infty \to R$ be two functions defined by $fx = \int_{-x}^{x} t - t^2 e^{-t^2} dt$ and $gx = \int_0^{x^2} t^{\frac{1}{2}} e^{-t^2} dt$. Then the value of $9f\sqrt{\log_e 9} + g\sqrt{\log_e 9}$ is equal to

(1) 6 (2) 9
(3) 8 (4) 10

Q76. The area of the region enclosed by the parabola $y = 4x - x^2$ and $3y = x - 4^2$ is equal to

(1) $\frac{32}{9}$ (2) 4
(3) 6 (4) $\frac{14}{3}$

Q77. The temperature Tt of a body at time $t = 0$ is $160^\circ \quad F$ and it decreases continuously as per the differential equation $\frac{dT}{dt} = -KT - 80$, where K is positive constant. If $T15 = 120^\circ \quad F$, then $T45$ is equal to

(1) $85^\circ \quad F$ (2) $95^\circ \quad F$
(3) $90^\circ \quad F$ (4) $80^\circ \quad F$

Q78. Let α, β, γ be mirror image of the point $2, 3, 5$ in the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. Then $2\alpha + 3\beta + 4\gamma$ is equal to

(1) 32 (2) 33
(3) 31 (4) 34

Q79. The shortest distance between lines L_1 and L_2, where $L_1: \frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+4}{2}$ and L_2 is the line passing through the points $A-4, 4, 3, \quad B-1, 6, 3$ and perpendicular to the line $\frac{x-3}{-2} = \frac{y}{3} = \frac{z-1}{1}$, is

(1) $\frac{121}{\sqrt{221}}$ (2) $\frac{24}{\sqrt{117}}$
(3) $\frac{141}{\sqrt{221}}$ (4) $\frac{42}{\sqrt{117}}$

Q80. A coin is biased so that a head is twice as likely to occur as a tail. If the coin is tossed 3 times, then the probability of getting two tails and one head is-

(1) $\frac{2}{9}$ (2) $\frac{1}{9}$
(3) $\frac{2}{27}$ (4) $\frac{1}{27}$

Q81. Let a, b, c be the length of three sides of a triangle satisfying the condition $a^2 + b^2x^2 - 2ba + c$ $x + b^2 + c^2 = 0$. If the set of all possible values of x is in the interval $\alpha, \beta,$ then $12\alpha^2 + \beta^2$ is equal to _____.

Q82. Let the coefficient of x^r in the expansion of $x + 3^{n-1} + x + 3^{n-2}x + 2 + x + 3^{n-3}x + 2^2 + \ldots + x + 2^{n-1}$ be α_r. If $\sum_{r=0}^{n} \alpha_r = \beta^n - \gamma^n, \beta, \gamma \in N$, then the value of $\beta^2 + \gamma^2$ equals _____.

Q83. Let $A-2, -1, \quad B1, 0, \quad C\alpha, \beta$ and $D\gamma, \delta$ be the vertices of a parallelogram $ABCD$. If the point C lies on $2x - y = 5$ and the point D lies on $3x - 2y = 6$, then the value of $\alpha + \beta + \gamma + \delta$ is equal to _____.

Q84. If $\lim_{x \to 0} \frac{ax^2e^x - b\log_e 1 + x + cxe^{-x}}{x^2 \sin x} = 1$, then $16a^2 + b^2 + c^2$ is equal to _____.

Q85. Let $A = 1, 2, 3, . \ldots 100$. Let R be a relation on A defined by $x, \quad y \in R$ if and only if $2x = 3y$. Let R_1 be a symmetric relation on A such that $R \subset R_1$ and the number of elements in R_1 is n. Then the minimum value of n is _____.

Q86. Let A be a 3×3 matrix and $\det A = 2$. If $n = \det \underbrace{adj adj . \ldots adj}_{2024 - \text{times}} A$, then the remainder when n is divided by 9 is equal to _____.

Q87. $\frac{120}{\pi^3} \int_0^{\pi} \frac{x^2 \sin x \cos x}{\sin^4 x + \cos^4 x} dx$ is equal to _____.

Q88. Let $y = yx$ be the solution of the differential equation $\sec^2 x dx + e^{2y} \tan^2 x + \tan x dy = 0, \ 0 < x < \frac{\pi}{2}, y\frac{\pi}{4} = 0$. If $y\frac{\pi}{6} = \alpha$, then $e^{8\alpha}$ is equal to _____.

Q89. Let $\vec{a} = 3\hat{i} + 2\hat{j} + \hat{k}, \vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} + \vec{b} \times \vec{c} = 2\vec{a} \times \vec{b} + 24\hat{j} - 6\hat{k}$ and $\vec{a} - \vec{b} + \hat{i} . \vec{c} = -3$. Then $\vec{c}^2$ is equal to _____.

Q90. A line passes through $A4, -6, -2$ and $B16, -2, 4$. The point Pa, b, c where a, b, c are non-negative integers, on the line AB lies at a distance of 21 units, from the point A. The distance between the points Pa, b, c and $Q4, -12, 3$ is equal to _____.

ANSWER KEYS

1. (3)	**2.** (2)	**3.** (1)	**4.** (2)	**5.** (4)	**6.** (1)	**7.** (1)	**8.** (3)
9. (1)	**10.** (2)	**11.** (3)	**12.** (4)	**13.** (2)	**14.** (4)	**15.** (2)	**16.** (1)
17. (3)	**18.** (1)	**19.** (3)	**20.** (3)	**21.** (53)	**22.** (8)	**23.** (12)	**24.** (12)
25. (27)	**26.** (3)	**27.** (20)	**28.** (2)	**29.** (200)	**30.** (4)	**31.** (1)	**32.** (2)
33. (2)	**34.** (2)	**35.** (2)	**36.** (1)	**37.** (4)	**38.** (3)	**39.** (4)	**40.** (3)
41. (1)	**42.** (4)	**43.** (2)	**44.** (4)	**45.** (4)	**46.** (4)	**47.** (3)	**48.** (4)
49. (4)	**50.** (4)	**51.** (11)	**52.** (0)	**53.** (-28721)	**54.** (6)	**55.** (4)	**56.** (399)
57. (8)	**58.** (6)	**59.** (2)	**60.** (5)	**61.** (4)	**62.** (2)	**63.** (4)	**64.** (4)
65. (4)	**66.** (3)	**67.** (2)	**68.** (4)	**69.** (2)	**70.** (3)	**71.** (1)	**72.** (2)
73. (1)	**74.** (3)	**75.** (3)	**76.** (3)	**77.** (3)	**78.** (2)	**79.** (3)	**80.** (1)
81. (36)	**82.** (25)	**83.** (32)	**84.** (81)	**85.** (66)	**86.** (7)	**87.** (15)	**88.** (9)
89. (38)	**90.** (22)						