Q1. Match List I with List II

	List I		List II
A.	Torque	I.	$\mathrm{M\,L^{-2}\,T^{-2}}$
B.	Stress	II.	$\mathrm{M\,L^{2}\,T^{-2}}$
C.	Pressure gradient	III.	$\mathrm{M\,L^{-1}\,T^{-1}}$
D.	Coefficient of viscosity	IV.	$\mathrm{M\,L^{-1}\,T^{-2}}$

Choose the correct answer from the options given below :

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

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

Q2. Given below are two statements:

Statement I: Area under velocity-time graph gives the distance travelled by the body in a given time.

Statement II: Area under acceleration-time graph is equal to the change in velocity in the given time.

In the light of given statements, choose the correct answer 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 correct but Statement II is false (4) Statement I is incorrect but Statement II is true

Q3. The trajectory of projectile, projected from the ground is given by $y = x - \frac{x^2}{20}$. Where x and y are measured in meter. The maximum height attained by the projectile will be.

(1) 200 m (2) 10 m

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

Q4. A bullet of mass 0.1 kg moving horizontally with speed $400\ \mathrm{m\,s^{-1}}$ hits a wooden block of mass 3.9 kg kept on a horizontal rough surface. The bullet gets embedded into the block and moves 20 m before coming to rest. The coefficient of friction between the block and the surface is _____.

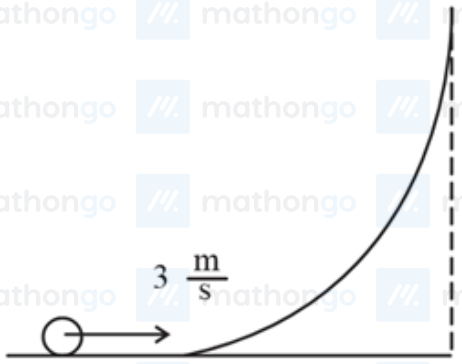
(1) 0.90 (2) 0.50

(3) 0.65 (4) 0.25

Q5. A body of mass 5 kg is moving with a momentum of 10 kg $\mathrm{m\,s^{-1}}$. Now a force of 2 N acts on the body in the direction of its motion for 5 s. The increase in the Kinetic energy of the body is _____ J.

Q6. A hollow spherical ball of uniform density rolls up a curved surface with an initial velocity $3\ \mathrm{m\,s^{-1}}$ (as shown in figure). Maximum height with respect to the initial position covered by it will be _____ cm

(take, $g = 10\ \mathrm{m\,s^{-2}}$)



Q7. The orbital angular momentum of a satellite is L, when it is revolving in a circular orbit at height h from earth surface. If the distance of satellite from the earth centre is increased by eight times to its initial value, then the new angular momentum will be

(1) 8 L (2) 9 L
(3) 4 L (4) 3 L

Q8. The acceleration due to gravity at height h above the earth if $h \ll R$ (Radius of earth) is given by

(1) $g' = g\left(1 - \frac{h^2}{2R^2}\right)$ (2) $g' = \mathrm{g}\left(1 - \frac{\mathrm{h}}{2\mathrm{R}}\right)$
(3) $g' = \mathrm{g}\left(1 - \frac{2\mathrm{h}}{\mathrm{R}}\right)$ (4) $g' = g\left(1 - \frac{2h^2}{R^2}\right)$

Q9. A hydraulic automobile lift is designed to lift vehicles of mass $5000\ \mathrm{kg}$. The area of cross section of the cylinder carrying load is $250\ \mathrm{cm}^2$. The maximum pressure the smaller piston would have to bear is [Assume $\mathrm{g} = 10\ \mathrm{m\ s^{-2}}$]

(1) $20 \times 10^6\ \mathrm{Pa}$ (2) $2 \times 10^5\ \mathrm{Pa}$
(3) $200 \times 10^6\ \mathrm{Pa}$ (4) $2 \times 10^6\ \mathrm{Pa}$

Q10. A steel rod of length 1 m and cross-sectional area $10^{-4}\ \mathrm{m}^2$ is heated from $0^\circ\mathrm{C}$ to $200^\circ\mathrm{C}$ without being allowed to extend or bend. The compressive tension produced in the rod is $\_\_\_\_ \times 10^4$ N. (Given Young's modulus of steel $= 2 \times 10^{11}\ \mathrm{N\ m^{-2}}$, coefficient of linear expansion $= 10^{-5}\ \mathrm{K^{-1}}$)

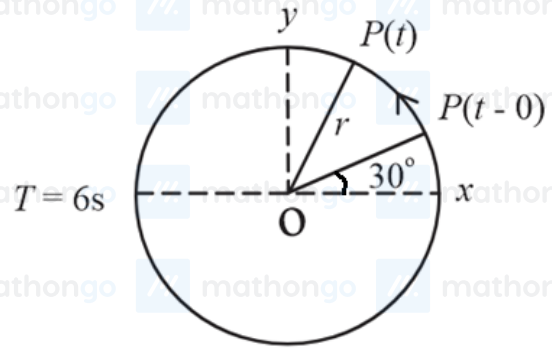
Q11. Work done by a Carnot engine operating between temperatures $127^\circ\mathrm{C}$ and $27^\circ\mathrm{C}$ is $2\ \mathrm{kJ}$. The amount of heat transferred to the engine by the reservoir is:

(1) $8\ \mathrm{kJ}$ (2) $2.67\ \mathrm{kJ}$
(3) $2\ \mathrm{kJ}$ (4) $4\ \mathrm{kJ}$

Q12. The temperature at which the kinetic energy of oxygen molecules becomes double than its value at $27^\circ\mathrm{C}$ is

(1) $927^\circ\mathrm{C}$ (2) $327^\circ\mathrm{C}$
(3) $1227^\circ\mathrm{C}$ (4) $627^\circ\mathrm{C}$

Q13. For particle P revolving round the centre O with radius of circular path r and regular velocity ω, as shown in below figure, the projection of OP on the x-axis at time t is



(1) $x(t) = r\ \cos(\omega t - \frac{\pi}{6})$ (2) $x(t) = r\ \cos(\omega t + \frac{\pi}{6})$

(3) $x(t) = r\ \sin(\omega t + \frac{\pi}{6})$ (4) $x(t) = r\ \cos(\omega t)$

Q14. A guitar string of length 90 cm vibrates with a fundamental frequency of 120 Hz. The length of the string producing a fundamental of 180 Hz will be _____ cm

Q15. Electric potential at a point P due to a point charge of 5×10^{-9} C is 50 V. The distance of P from the point charge is:

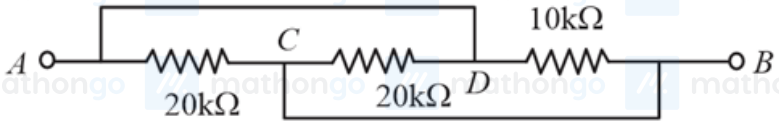
(Assume, $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m^2 C^{-2})

(1) 9 cm (2) 3 cm

(3) 0.9 cm (4) 90 cm

Q16. A 600 pF capacitor is charged by 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. Electrostatic energy lost in the process is _____ μJ.

Q17. The equivalent resistance between A and B as shown in figure is:



(1) 10 kΩ (2) 5 kΩ

(3) 20 kΩ (4) 30 kΩ

Q18. The number density of free electrons in copper is nearly 8×10^{28} m^{-3}. A copper wire has its area of cross-section $= 2 \times 10^{-6}$ m^2 and is carrying a current of 3.2 A. The drift speed of the electrons is _____ $\times 10^{-6}$ m s^{-1}.

Q19. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Electromagnets are made of soft iron.

Reason R : Soft iron has high permeability and low retentivity.

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

(1) **A** is not correct but **R** is correct (2) **A** is correct but **R** is not correct

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

Q20. The ratio of magnetic field at the centre of a current carrying coil of radius r to the magnetic field at distance r from the centre of coil on its axis is $\sqrt{x}:1$. The value of x is _____.

Q21. An emf of 0.08 V is induced in a metal rod of length 10 cm held normal to a uniform magnetic field of 0.4 T, when move with a velocity of:

(1) $0.5\ \text{m s}^{-1}$ (2) $20\ \text{m s}^{-1}$

(3) $3.2\ \text{m s}^{-1}$ (4) $2\ \text{m s}^{-1}$

Q22. A series combination of resistor of resistance $100\ \Omega$ inductor of inductance 1 H and capacitor of capacitance $6.25\ \mu\text{F}$ is connected to an ac source. The quality factor of the circuit will be _____.

Q23. The waves emitted when a metal target is bombarded with high energy electrons are

(1) Microwaves (2) Infrared rays

(3) X-rays (4) Radio Waves

Q24. Two transparent media having refractive indices 1.0 and 1.5 are separated by a spherical refracting surface of radius of curvature 30 cm. The centre of curvature of surface is towards denser medium and a point object is placed on the principal axis in rarer medium at a distance of 15 cm from the pole of the surface. The distance of image from the pole of the surface is cm.

Q25. The width of fringe is 2 mm on the screen in a double slit experiment for the light of wavelength of 400 nm. The width of the fringe for the light of wavelength 600 nm will be:

(1) 4 mm (2) 2 mm

(3) 1.33 mm (4) 3 mm

Q26. In photoelectric effect

A. The photocurrent is proportional to the intensity of the incident radiation.

B. Maximum kinetic energy with which photoelectrons are emitted depends on the intensity of incident light.

C. Max K.E. with which photoelectrons are emitted depends on the frequency of incident light.

D. The emission of photoelectrons require a minimum threshold intensity of incident radiation.

E. Max K.E. of the photoelectrons is independent of the frequency of the incident light.

Choose the correct answer from the options given below:

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

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

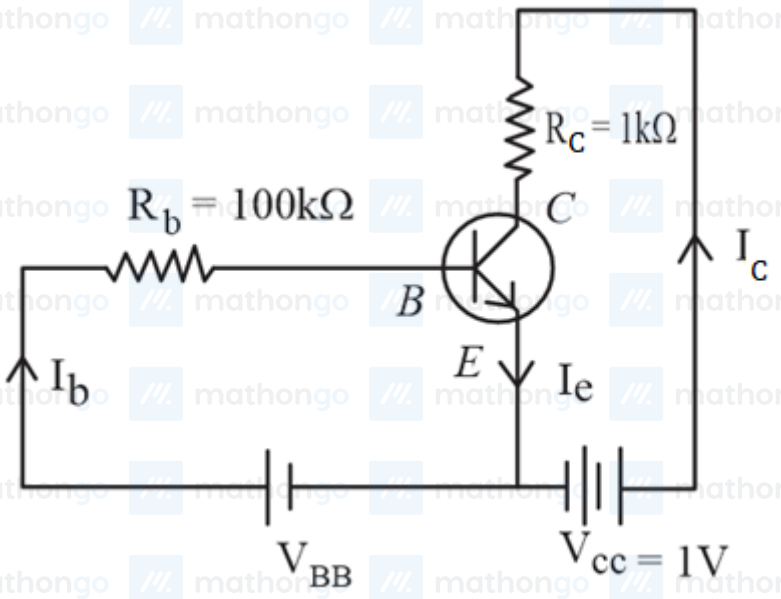
Q27. The ratio of wavelength of spectral lines H_α and H_β in the Balmer series is $\frac{x}{20}$. The value of x is _____.

Q28. A radio active material is reduced to $\frac{1}{8}$ of its original amount in 3 days. If 8×10^{-3} kg of the material is left after 5 days the initial amount of the material is

(1) 40 g (2) 32 g

(3) 64 g (4) 256 g

Q29. For a given transistor amplifier circuit in CE configuration $V_{CC}=1\ \text{V}, R_C=1\ \text{k}\Omega, R_b=100\ \text{k}\Omega$ and $\beta=100$. Value of base current $I_b$is



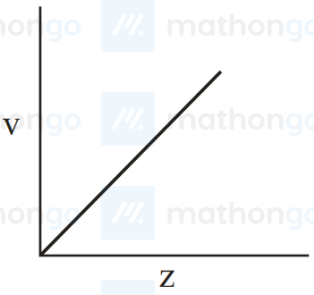
(1) $I_b = 1.0\ \mu A$
(2) $I_b = 0.1\ \mu A$
(3) $I_b = 100\ \mu A$
(4) $I_b = 10\ \mu A$

Q30. The power radiated from a linear antenna of length l is proportional to
(Given, λ = Wavelength of wave):
(1) $\frac{l}{\lambda}$
(2) $\left(\frac{l}{\lambda}\right)^2$
(3) $\frac{l}{\lambda^2}$
(4) $\frac{l^2}{\lambda}$

Q31. Which of the following have same number of significant figures?
(A) 0.00253
(B) 1.0003
(C) 15.0
(D)163
Choose the correct answer from the options given below
(1) A, B and C only
(2) C and D only
(3) B and C only
(4) A, C and D only

Q32. Henry Moseley studied characteristic X-ray spectra of elements. The graph which represents his observation correctly is
Given v = Frequency of X-ray emitted
Z = Atomic number

(1)



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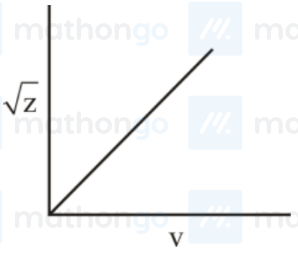

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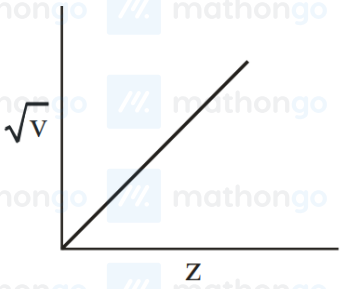

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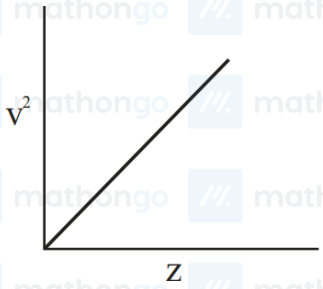


Q33. The number of atomic orbitals from the following having 5 radial nodes is

$7s,\ 7p,\ 6s,\ 8p,\ 8d$

Q34. The number of species trom the following carrying a single lone pair on central atom Xenon is

$XeF_5^+, XeO_3, XeO_2\ F_2, XeF_5^-, XeO_3\ F_2, XeOF_4, XeF_4$

Q35. Arrange the following gases in increasing order of van der Waals constant 'a'

(A) Ar

(B) CH_4

(C) H_2O

(D) C_6H_6

Choose the correct option from the following.

(1) D, C, B and A

(2) B, C, D and A

(3) C, D, B and A

(4) A, B, C and D

Q36. For complete combustion of ethene,

$C_2H_4(g) + 3O_2(g) \rightarrow 2\,CO_2(g) + 2H_2O(l)$

the amount of heat produced as measured in bomb calorimeter is 1406 kJ mol^{-1} at 300 K. The minimum value of $T\Delta S$ needed to reach equilibrium is $(-)$ kJ. (Nearest integer)

Given: $R = 8.3\ J\ K^{-1}\ mol^{-1}$

Q37. The incorrect statements from the following is:

A. The electrical work that a reaction can perform at constant pressure and temperature is equal to the reaction Gibbs energy.

B. E°_{cell} is dependent on the pressure.

C. $\frac{dE^{\circ}_{cell}}{dT} = \frac{\Delta_r S^{\circ}}{nF}$

D. A cell is operating reversibly if the cell potential is exactly balanced by an opposing source of potential difference.

Q38. Given below are two statements:

Statement-I : Methyl orange is a weak acid.

Statement-II : The benzenoid form of methyl orange is more intense/deeply coloured than the quinonoid form.

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

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

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

Q39. The solubility product of $BaSO_4$ is 1×10^{-10} at 298 K. The solubility of $BaSO_4$ in $0.1M\ K_2SO_4(aq)$ solution is ------$\times 10^{-9}$ g L^{-1}(nearest integer).

Given: Molar mass of $BaSO_4$ is 233 g mol^{-1}

Q40. Given below are two statements:

Statement I: In redox titration, the indicators used are sensitive to change in pH of the solution.

Statement II: In acid-base titration, the indicators used are sensitive to change in oxidation potential.

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

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

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

Q41. Which of the following can reduce decomposition of H_2O_2 on exposure to light

(1) Urea (2) Alkali

(3) Glass containers (4) Dust

Q42. For a good quality cement, the ratio of lime to the total of the oxides of Si, Al and Fe should be as close as to

(1) 4 (2) 1

(3) 2 (4) 3

Q43. Given below are two statements: One is labelled as Assertion $\mathbf{A}$ and the other is labelled as Reason $\mathbf{R}$

Assertion $\mathbf{A}$: Sodium is about 30 times as abundant as potassium in the oceans.

Reason $\mathbf{R}$: Potassium is bigger in size than sodium.

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

(1) Both $\mathbf{A}$ and $\mathbf{R}$ are true and $\mathbf{R}$ is the correct explanation of $\mathbf{A}$ (2) $\mathbf{A}$ is true but $\mathbf{R}$ is false

(3) Both $\mathbf{A}$ and $\mathbf{R}$ are true but $\mathbf{R}$ is NOT the correct explanation of $\mathbf{A}$ (4) Both $\mathbf{A}$ and $\mathbf{R}$ are false

Q44. The descending order of acidity for the following carboxylic acid is-

(A) CH_3COOH

(B) $F_3C - COOH$

(C) $ClCH_2 - COOH$

(D) $FCH_2 - COOH$

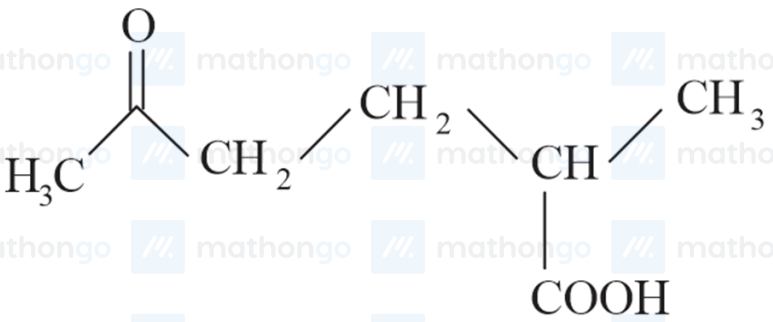
(E) $BrCH_2 - COOH$

Choose the correct answer from the options given below:

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

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

Q45. The correct IUPAC nomenclature for the following compound is:



(1) 2-Methyl-5-oxohexanoic acid (2) 2-Formyl-5-methylhexan-6-oic acid

(3) 5-Methyl-2-oxohexan-6-oic acid (4) 5-Formyl-2-methylhexanoic acid

Q46. Which of these reactions is not a part of breakdown of ozone in stratosphere?

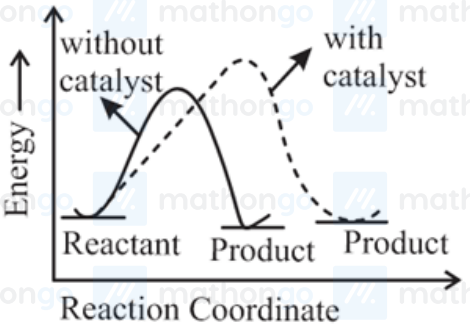
(1) $2\,\overset{\odot}{Cl}\,O(g) \rightarrow ClO_2(g) + \overset{\odot}{Cl}(g)$ (2) $\overset{\odot}{ClO}(g) + O(g) \rightarrow O_2(g) + \overset{\odot}{Cl}$

(3) $\overset{\odot}{Cl}(g) + O_3(g) \rightarrow O_2(g) + \overset{\odot}{ClO}(g)$ (4) $CF_2Cl_2(g) \overset{uv}{\rightarrow} \overset{\odot}{Cl}(g) + \overset{\odot}{C}F_2Cl(g)$

Q47. If the boiling points of two solvents X and Y (having same molecular weights) are in the ratio 2: 1 and their enthalpy of vaporizations are in the ratio 1 : 2, then the boiling point elevation constant of X is m times the boiling point elevation constant of Y. The value of m is (nearest integer).

Q48. The correct reaction profile diagram for a positive catalyst reaction.

(1)



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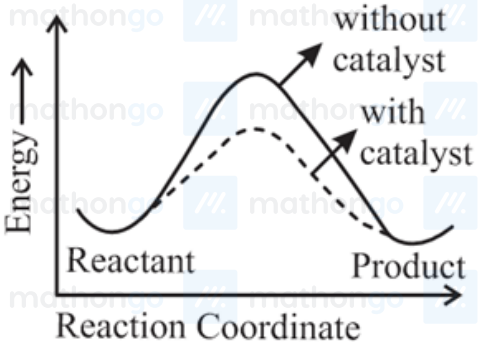

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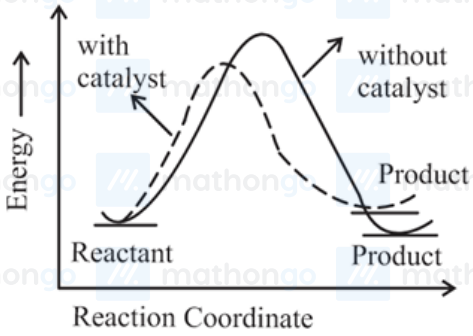

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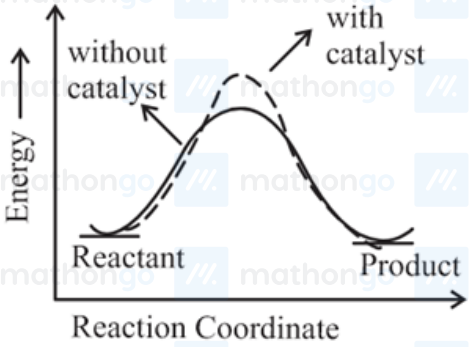


Q49. The statement/s which are true about antagonists from the following is/are:

A. They bind to the receptor site.

B. Get transferred inside the cell for their action.

C. Inhibit the natural communication of the body.

D. Mimic the natural messenger.

Choose the correct answer from the options given below:

(1) B only

(2) A, C and D

(3) A and C

(4) A and B

Q50. Coagulating value of the electrolytes $AlCl_3$ and NaCl tor $As_2\ S_3$ are 0.09 and 50.04 respectively. The coagulating power of $AlCl_3$ is x times the coagulating power of NaCl. The value of x is

Q51. In Hall-Heroult process, the following is used for reducing Al_2O_3 :-

(1) Magnesium

(2) Na_3AlF_6

(3) Graphite

(4) CaF_2

Q52. The ratio of sigma and π bonds present in pyrophosphoric acid is

Q53. Match List-I with List-II

	LIST-I Coordination Complex		**LIST-II Number of unpaired electrons**
A.	$[Cr(CN)_6]^{3-}$	I.	0
B.	$[Fe(H_2O)_6]^{2+}$	II.	3
C.	$[Co(NH_3)_6]^{3+}$	III.	2

D. $[Ni(NH_3)_6]^{2+}$ IV. 4

Choose the correct answer from the options given below:

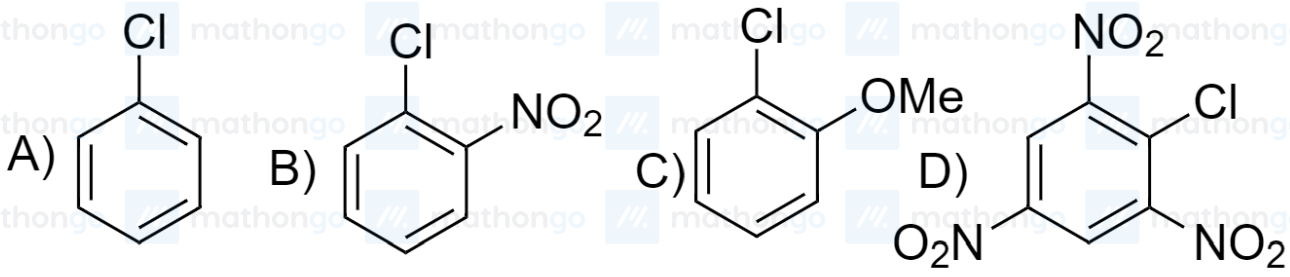
(1) A-II, B-IV, C-I, D-III (2) A-III, B-IV, C-I, D-II

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

Q54. The observed magnetic moment of the complex $[Mn(NCS)_6)]^{x-}$ is 6.06 BM. The numerical value of x is

Q55. The sum of oxidation state of the metals in $Fe(CO)_5$, VO^{2+} and WO_3 is

Q56. The correct order of reactivity of following haloarenes towards nucleophilic substitution with aqueous NaOH is:



Choose the correct answer from the options given below:

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

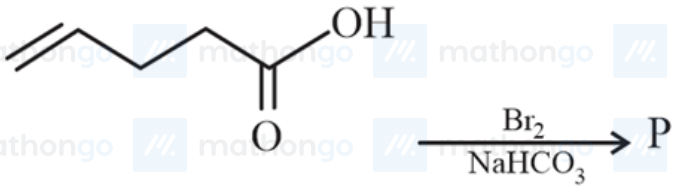
(3) D > C > B > A (4) D > B > A > C

Q57. A compound 'X' when treated with phthalic anhydride in presence of concentrated H_2SO_4 yields 'Y'. 'Y' is used as an acid/base indicator. 'X' and 'Y' are respectively

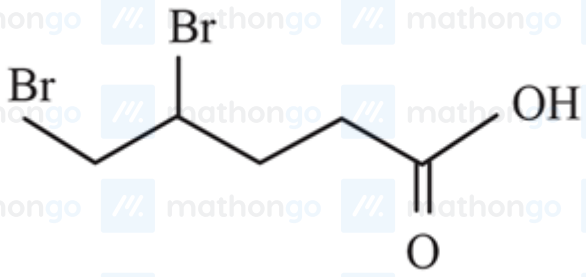
(1) Anisole, methyl orange (2) Salicylaldehyde, Phenolphthalein

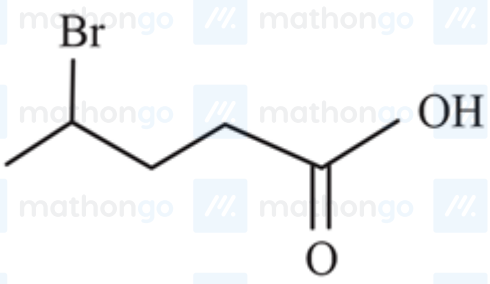
(3) Toludine, Phenolphthalein (4) Carbolic acid, Phenolphthalein

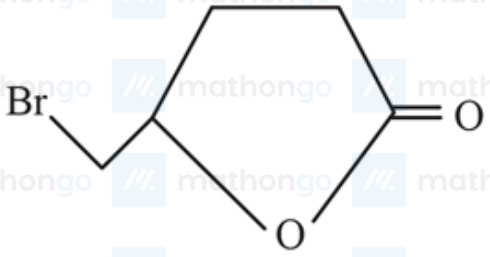
Q58. Major product 'P' formed in the following reaction is

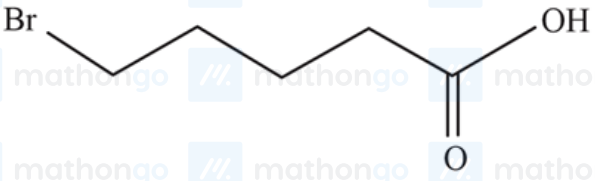


Major product

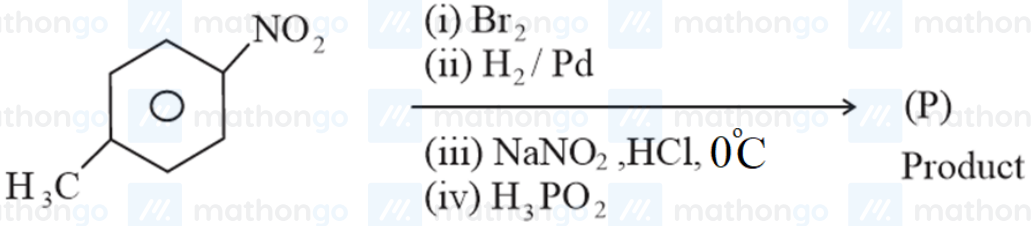
(1) 

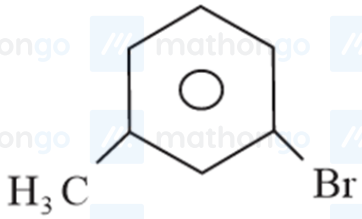
(2) 

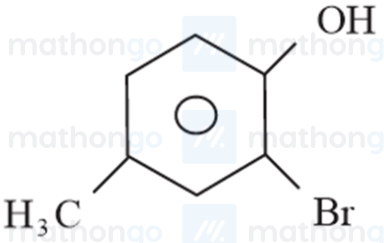
(3) 

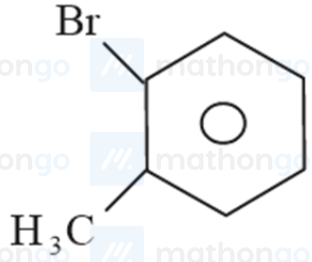
(4) 

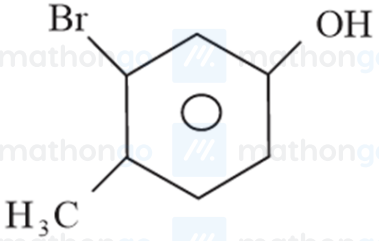
Q59. The product (P) formed from the following multistep reaction is:



(1) 

(2) 

(3) 

(4) 

Q60. Match List I with List II

	List I **Natural amino acid**		**List II** **One Letter Code**
(A)	Glutamic acid	(I)	Q
(B)	Glutamine	(II)	W
(C)	Tyrosine	(III)	E

(D) Tryptophan (IV) Y

Choose the correct answer from the options given below:

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

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

Q61. Let m and n be the numbers of real roots of the quadratic equations $x^2-12x+[x]+31=0$ and $x^2-5|x+2|-4=0$ respectively, where $[x]$ denotes the greatest integer $\leq x$. Then m^2+mn+n^2 is equal to

Q62. Let $A=\left\{\theta\in(0,\ 2\pi):\frac{1+2i\sin\theta}{1-i\sin\theta}\ \text{ is }\ \text{purely }\ \text{imaginary}\right\}$ Then the sum of the elements is in A is

(1) 4π (2) 3π

(3) π (4) 2π

Q63. If the number of words, with or without meaning. which can be made using all the letters of the word MATHEMATICS in which C and S do not come together, is $(6!)k$ then k is equal to

(1) 2835 (2) 5670

(3) 1890 (4) 945

Q64. Let a_n be n^{th} term of the series $5+8+14+23+35+50+\ldots\ldots$ and $S_n=\sum_{k=1}^{n}a_k$. Then $S_{30}-a_{40}$ is equal to

(1) 11310 (2) 11260

(3) 11290 (4) 11280

Q65. Let $0<z<y<x$ be three real numbers such that $\frac{1}{x},\frac{1}{y},\frac{1}{z}$ are in an arithmetic progression and $x,\sqrt{2}y,z$ are in a geometric progression. If $xy+yz+zx=\frac{3}{\sqrt{2}}xyz$, then $3(x+y+z)^2$ is equal to

Q66. The absolute difference of the coefficients of x^{10} and x^7 in the expansion of $\left(2x^2+\frac{1}{2x}\right)^{11}$ is equal to

(1) 13^3-13 (2) 11^3-11

(3) 10^3-10 (4) 12^3-12

Q67. $25^{190}-19^{190}-8^{190}+2^{190}$ is divisible by

(1) neither 14 nor 34 (2) 14 but not by 34

(3) 34 but not by 14 (4) both 14 and 34

Q68. The value of $36\left(4\ \cos^2\ 9^\circ-1\right)\left(4\ \cos^2\ 27^\circ-1\right)\left(4\ \cos^2\ 81^\circ-1\right)\left(4\ \cos^2\ 243^\circ-1\right)$ is

(1) 54 (2) 18

(3) 27 (4) 36

Q69. Let $A(0,1),\ B(1,1)$ and $C(1,0)$ be the mid-points of the sides of a triangle with incentre at the point D. If the focus of the parabola $y^2=4ax$ passing through D is $\left(\alpha+\beta\sqrt{2},0\right)$, where α and β are rational numbers, then $\frac{\alpha}{\beta^2}$ is equal to

(1) 8 (2) 12

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

Q70. Let O be the origin and OP and OQ be the tangents to the circle $x^2+y^2-6x+4y+8=0$ at the points P and Q on it. If the circumcircle of the triangle OPQ passes through the point $\left(\alpha, \frac{1}{2}\right)$, then a value of α is

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

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

Q71. The ordinates of the points P and Q on the parabola with focus $(3,0)$ and directrix $x=-3$ are in the ratio $3:1$. If $R(\alpha, \beta)$ is the point of intersection of the tangents to the parabola at P and Q, then $\frac{\beta^2}{\alpha}$ is equal to

Q72. If $\alpha>\beta>0$ are the roots of the equation $ax^2+bx+1=0$, and $\lim\limits_{x \to \frac{1}{\alpha}}\left(\frac{1-\cos\left(x^2+bx+a\right)}{2(1-\alpha x)^2}\right)^{\frac{1}{2}}=\frac{1}{k}\left(\frac{1}{\beta}-\frac{1}{\alpha}\right)$, then k is equal to

(1) 2β (2) α

(3) 2α (4) β

Q73. The negation of $(p \wedge(-q)) \vee(-p)$ is equivalent to

(1) $p \wedge(-q)$ (2) $p \wedge q$

(3) $p \vee(q \vee(-p))$ (4) $p \wedge(q \wedge(-p))$

Q74. Let the mean and variance of 12 observations be $\frac{9}{2}$ and 4 respectively. Later on, it was observed that two observations were considered as 9 and 10 instead of 7 and 14 respectively. If the correct variance is $\frac{m}{n}$, where m and n are coprime, then $m+n$ are coprime, then $m+n$ is equal to

(1) 315 (2) 316

(3) 314 (4) 317

Q75. Let $A=\{1,2,3,4,5,6,7\}$. Then the relation $R=\{(x, y) \in A \times A: x+y=7\}$ is

(1) an equivalence relation (2) symmetric but neither reflexive nor transitive

(3) transitive but neither symmetric nor reflexive (4) reflexive but neither symmetric nor transitive

Q76. If $A=\begin{bmatrix}1 & 5 \\ \lambda & 10\end{bmatrix}$, $A^{-1}=\alpha A+\beta I$ and $\alpha+\beta=-2$, then $4\alpha^2+\beta^2+\lambda^2$ is equal to :

(1) 12 (2) 19

(3) 14 (4) 10

Q77. Let S be the set of all values of $\theta \in[-\pi, \pi]$ for which the system of linear equations

$x+y+\sqrt{3}z=0$

$-x+\left(\tan\theta\right)y+\sqrt{7}z=0$

$x+y+(\tan\theta)z=0$

has non-trivial solution.Then $\frac{120}{\pi}\sum_{\theta \in S}\theta$ is equal to

(1) 20 (2) 40

(3) 30 (4) 10

Q78. If domain of the function $\log_e\left(\frac{6x^2+5x+1}{2x-1}\right)+\cos^{-1}\left(\frac{2x^2-3x+4}{3x-5}\right)$ is $(\alpha, \beta) \cup(\gamma, \delta)$, then $18\left(\alpha^2+\beta^2+\gamma^2+\delta^2\right)$ is equal to

Q79. Let $R = \{a, b, c, d, e\}$ and $S = \{1, 2, 3, 4\}$. Total number of onto functions $f : R \to S$ such that $f(a) \neq 1$, is equal to _____.

Q80. Let k and m be positive real numbers such that the function $f(x) = \begin{cases} 3x^2 + k\sqrt{x+1}, & 0 < x < 1 \\ mx^2 + k^2, & x \geq 1 \end{cases}$ is differentiable for all $x > 0$. Then $\frac{8f'(8)}{f'(\frac{1}{8})}$ is equal to

Q81. The integral $\int \left(\left(\frac{x}{2}\right)^x + \left(\frac{2}{x}\right)^x\right) \log_2 x \, dx$ is equal to

(1) $\left(\frac{x}{2}\right)^x + \left(\frac{2}{x}\right)^x + C$ (2) $\left(\frac{x}{2}\right)^x - \left(\frac{2}{x}\right)^x + C$

(3) $\left(\frac{x}{2}\right)^x \log_2\left(\frac{x}{2}\right) + C$ (4) $\left(\frac{x}{2}\right)^x \log_2\left(\frac{2}{x}\right) + C$

Q82. Let $[t]$ denote the greatest integer function. If $\int_0^{2.4} [x^2] dx = \alpha + \beta\sqrt{2} + \gamma\sqrt{3} + \delta\sqrt{5}$, then $\alpha + \beta + \gamma + \delta$ is equal to

Q83. Let the area enclosed by the lines $x + y = 2$, $y = 0$, $x = 0$ and the curve $f(x) = \min\{x^2 + \frac{3}{4}, 1 + [x]\}$ where $[x]$ denotes the greatest integer $\leq x$, be A. Then the value of $12A$ is

Q84. Let the solution curve $x = x(y), 0 < y < \frac{\pi}{2}$, of the differential equation $(\log_e(\cos y))^2 \cos y \, dx - (1 + 3x \log_e(\cos y)) \sin y \, dy = 0$ satisfy $x\left(\frac{\pi}{3}\right) = \frac{1}{2\log_e 2}$. If $x\left(\frac{\pi}{6}\right) = \frac{1}{\log_e m - \log_e n}$, where m and n are coprime, then mn is equal to

Q85. Let the vectors $\overrightarrow{u_1} = \hat{i} + \hat{j} + a\hat{k}$, $\overrightarrow{u_2} = \hat{i} + b\hat{j} + \hat{k}$, and $\overrightarrow{u_3} = c\hat{i} + \hat{j} + \hat{k}$ be coplanar. If the vectors $\overrightarrow{v_1} = (a+b)\hat{i} + c\hat{j} + c\hat{k}$, $\overrightarrow{v_2} = a\hat{i} + (b+c)\hat{j} + a\hat{k}$ and $\overrightarrow{v_3} = b\hat{i} + b\hat{j} + (c+a)\hat{k}$ are also coplanar, then $6(a+b+c)$ is equal to

(1) 0 (2) 4

(3) 12 (4) 6

Q86. The area of the quadrilateral $ABCD$ with vertices $A(2, 1, 1)$, $B(1, 2, 5)$, $C(-2, -3, 5)$ and $D(1, -6, -7)$ is equal to

(1) 48 (2) $8\sqrt{38}$

(3) 54 (4) $9\sqrt{38}$

Q87. For $a, b \in Z$ and $|a - b| \leq 10$, let the angle between the plane $P: \; ax + y - z = b$ and the line $L: \; x - 1 = a - y = z + 1$ be $\cos^{-1}\left(\frac{1}{3}\right)$ If the distance of the point $(6, -6, 4)$ from the plane P is $3\sqrt{6}$, then $a^4 + b^2$ is equal to

(1) 32 (2) 85

(3) 25 (4) 48

Q88. Let P be the plane passing through the line $\frac{x-1}{1} = \frac{y-2}{-3} = \frac{z+5}{7}$ and the point $(2, 4, -3)$. If the image of the point $(-1, 3, 4)$ in the plane P is (α, β, γ), then $\alpha + \beta + \gamma$ is equal to

(1) 10 (2) 12

(3) 9 (4) 11

Q89. Let P_1 be the plane $3x - y - 7z = 11$ and P_2 be the plane passing through the points $(2, -1, 0)$, $(2, 0, -1)$, and $(5, 1, 1)$. If the foot of the perpendicular drawn from the point $(7, 4, -1)$ on the line of intersection of the

planes P_1 and P_2 is (α, β, γ), then $\alpha + \beta + \gamma$ is equal to

Q90. If the probability that the random variable X takes values x is given by $P(X = x) = k(x + 1)3^{-x}$, $x = 0, 1, 2, 3, \ldots\ldots$, where k is a constant, then $P(X \geq 2)$ is equal to

(1) $\frac{7}{27}$
(2) $\frac{7}{18}$
(3) $\frac{11}{18}$
(4) $\frac{20}{27}$

ANSWER KEYS

1. (3)	**2.** (4)	**3.** (3)	**4.** (4)	**5.** (4)	**6.** (3)	**7.** (4)	**8.** (1)
9. (2)	**10.** (2)	**11.** (4)	**12.** (2)	**13.** (3)	**14.** (4)	**15.** (3)	**16.** (4)
17. (3)	**18.** (4)	**19.** (4)	**20.** (2)	**21.** (30)	**22.** (75)	**23.** (4)	**24.** (60)
25. (6)	**26.** (125)	**27.** (8)	**28.** (4)	**29.** (30)	**30.** (27)	**31.** (4)	**32.** (3)
33. (4)	**34.** (4)	**35.** (2)	**36.** (1)	**37.** (3)	**38.** (3)	**39.** (3)	**40.** (1)
41. (1)	**42.** (2)	**43.** (3)	**44.** (3)	**45.** (1)	**46.** (4)	**47.** (4)	**48.** (3)
49. (3)	**50.** (3)	**51.** (3)	**52.** (4)	**53.** (1411)	**54.** (1)	**55.** (233)	**56.** (8)
57. (556)	**58.** (6)	**59.** (4)	**60.** (10)	**61.** (1)	**62.** (2)	**63.** (3)	**64.** (4)
65. (3)	**66.** (4)	**67.** (1)	**68.** (3)	**69.** (3)	**70.** (2)	**71.** (4)	**72.** (2)
73. (3)	**74.** (1)	**75.** (1)	**76.** (3)	**77.** (2)	**78.** (1)	**79.** (1)	**80.** (1)
81. (9)	**82.** (150)	**83.** (16)	**84.** (20)	**85.** (180)	**86.** (309)	**87.** (6)	**88.** (17)
89. (12)	**90.** (11)						