Q1. A person travels x distance with velocity v_1 and then x distance with velocity v_2 in the same direction. The average velocity of the person is v, then the relation between v, v_1 and v_2 will be

(1) $v = \frac{v_1 + v_2}{2}$

(2) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

(3) $v = v_1 + v_2$

(4) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Q2. Two projectiles are projected at $30°$ and $60°$ with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:

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

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

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

(4) 1 : 3

Q3. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A : An electric fan continues to rotate for some time after the current is switched off.

Reason R: Fan continues to rotate due to inertia of motion.

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

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

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

Q4. Given below are two statements:

Statement I : Rotation of the earth shows effect on the value of acceleration due to gravity (g).

Statement II : The effect of rotation of the earth on the value of g at the equator is minimum and that at the pole is maximum.

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 true

(3) Both Statement I and Statement II are false

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

Q5. The time period of a satellite, revolving above earth's surface at a height equal to R will be (Given $g = \pi^2$ m s^{-2}, $R = $ radius of earth)

(1) $\sqrt{2R}$

(2) $\sqrt{8R}$

(3) $\sqrt{32R}$

(4) $\sqrt{4R}$

Q6. Young's moduli of the material of wires A and B are in the ratio of 1 : 4, while its area of cross sections are in the ratio of 1 : 3. If the same amount of load is applied to both the wires, the amount of elongation produced in the wires A and B will be in the ratio of [Assume length of wires A and B are same]

(1) 12 : 1

(2) 1 : 36

(3) 36 : 1

(4) 1 : 12

Q7. A gas is compressed adiabatically, which one of the following statement is NOT true?

(1) There is no heat supplied to the system

(2) There is no change in the internal energy

(3) The temperature of the gas increases

(4) The change in the internal energy is equal to the work done on the gas

Q8. A gas mixture consists of 2 moles of oxygen and 4 moles of neon at temperature T. Neglecting all vibrational modes, the total internal energy of the system will be:

(1) $11RT$ (2) $8RT$

(3) $4RT$ (4) $16RT$

Q9. For a periodic motion represented by the equation $y = \sin\omega t + \cos\omega t$ the amplitude of the motion is

(1) 1   (2) 0.5

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

Q10. The distance between two plates of a capacitor is d and its capacitance is C_1, when air is the medium between the plates. If a metal sheet of thickness $\frac{2d}{3}$ and of the same area as plate is introduced between the plates, the capacitance of the capacitor becomes C_2 . The ratio $\frac{C_2}{C_1}$ is

(1) 3 : 1   (2) 2 : 1

(3) 4 : 1   (4) 1 : 1

Q11. In a metallic conductor, under the effect of applied electric field, the free electrons of the conductor

(1) Drift from higher potential to lower potential   (2) Move with the uniform velocity throughout from lower potential to higher potential

(3) Move in the straight line paths in the same direction   (4) Move in the curved paths from lower potential to higher potential

Q12. A bar magnet is released from rest along the axis of a very long vertical copper tube. After some time the magnet will

(1) Move down with an acceleration equal to g   (2) Oscillate inside the tube

(3) Move down with almost constant speed   (4) Move down with an acceleration greater than g

Q13. Given below are two statements:

Statement I: For diamagnetic substance -1 ≤ x < 0, where x is the magnetic susceptibility.

Statement II: Diamagnetic substance when placed in an external magnetic field, tend to move from stronger to weaker part of the field. In the light of the above statements, choose the correct answer from the options give below.

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

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

Q14. The amplitude of magnetic field in an electromagnetic wave propagating along y-axis is 6.0×10^{-7} T. The maximum value of electric field in the electromagnetic wave is

(1) 2×10^{15} V m^{-1} (2) 180 V m^{-1}

(3) 6.0×10^{-7} V m^{-1} (4) 5×10^{14} V m^{-1}

Q15. The ratio of intensities at two points P and Q on the screen in a Young's double slit experiment where phase difference between two waves of same amplitude are $\frac{\pi}{3}$ and $\frac{\pi}{2}$, respectively are
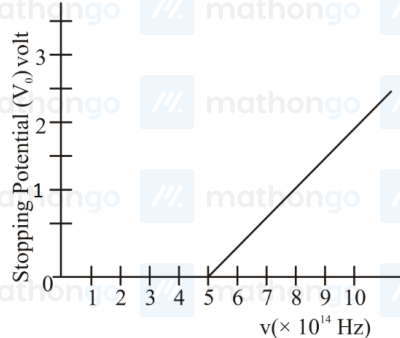
(1) 2 : 3   (2) 1 : 3

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

Q16. The variation of stopping potential V_0 as a function of the frequency (ν) of the incident light for a metal is shown in figure. The work function of the surface is

(1) 2.98 eV

(2) 2.07 eV

(3) 1.36 eV

(4) 18.6 eV

Q17. The half life of a radioactive substance is T. The time taken, for disintegrating $\frac{7}{8}^{th}$ part of its original mass will be:
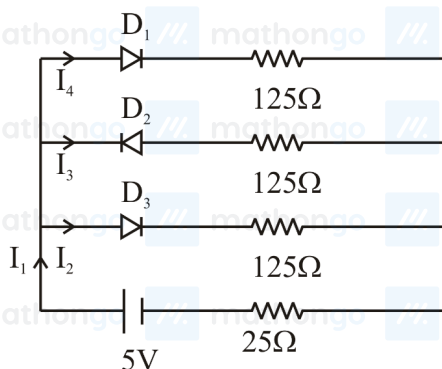
(1) $2T$

(2) $3T$

(3) T

(4) $8T$

Q18. If each diode has a forward bias resistance of 25Ω in the below circuit,

Which of the following options is correct?

(1) $\frac{I_1}{I_2} = 1$

(2) $\frac{I_2}{I_3} = 1$

(3) $\frac{I_1}{I_2} = 2$

(4) $\frac{I_3}{I_4} = 1$

Q19. A massage signal of frequency 3 kHz is used to modulate a carrier signal of frequency 1.5 MHz. The bandwidth of the amplitude modulated wave is

(1) 6 MHz

(2) 6 kHz

(3) 3 MHz

(4) 3 kHz

Q20. In an experiment with vernier callipers of least count 0.1 mm, when two jaws are joined together the zero of vernier scale lies right to the zero of the main scale and 6th division of vernier scale coincides with the main scale division. While measuring the diameter of a spherical bob, the zero of vernier scale lies in between 3.2 cm and 3.3 cm marks and 4th division of vernier scale coincides with the main scale division. The diameter of bob is measured as

(1) 3.22 cm

(2) 3.18 cm

(3) 3.26 cm

(4) 3.25 cm

Q21. If the maximum load carried by an elevator is 1400 kg $(600$ kg-Passengers $+800$ kg-elevator$)$, which is moving up with a uniform speed of 3 m s^{-1} and the frictional force acting on it is 2000 N, then the maximum power used by the motor is _____ kW. $g = 10$ m s^{-2}

Q22. A force of $-P\hat{k}$ acts on the origin of the coordinate system. The torque about the point $(2, -3)$ is $P\left(a\hat{i} + b\hat{j}\right)$, The ratio of $\frac{a}{b}$ is $\frac{x}{2}$. The value of x is

Q23. Figure below shows a liquid being pushed out of the tube by a piston having area of cross section 2.0 cm^2. The area of cross section at the outlet is 10 mm^2. If the piston is pushed at a speed of 4 cm s^{-1}, the speed of outgoing fluid is _____ cm s^{-1}
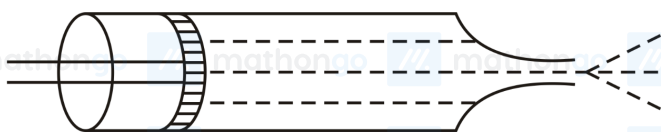

Q24. A rectangular block of mass 5 kg attached to a horizontal spiral spring executes simple harmonic motion of amplitude 1 m and time period 3.14 s. The maximum force exerted by spring on block is ___ N.

Q25. An electron revolves around an infinite cylindrical wire having uniform linear charge density 2×10^{-8} C m^{-1} in circular path under the influence of attractive electrostatic field as shown in the figure. The velocity of electron with which it is revolving is _____ $\times 10^6$ m s^{-1}. Given mass of electron $= 9 \times 10^{-31}$ kg
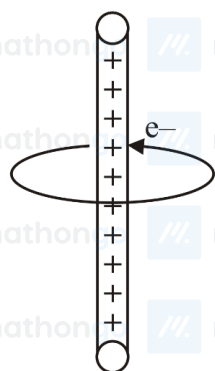
Q26. A rectangular parallelopiped is measured as 1 cm $\times 1$ cm $\times 100$ cm. If its specific resistance is $3 \times 10^{-7} \Omega$ m, then the resistance between its two opposite rectangular faces will be _____ $\times 10^{-7} \Omega$.
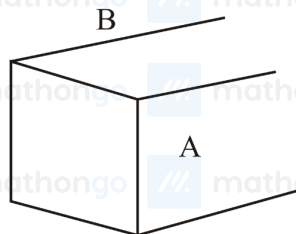

Q27. A straight wire carrying a current of 14 A is bent into a semicircular arc of radius 2.2 cm as shown in the figure. The magnetic field produced by the current at the centre O of the arc is _____ $\times$ 10^{-4} T

Q28. A square loop of side 2.0 cm is placed inside a long solenoid that has 50 turns per centimetre and carries a sinusoidally varying current of amplitude 2.5 A and angular frequency 700 rad s^{-1}. The central axes of the loop and solenoid coincide. The amplitude of the emf induced in the loop is $x \times 10^{-4}$ V. The value of x is _____ (Take, $\pi = \frac{22}{7}$)

Q29. A point object O is placed in front of two thin symmetrical coaxial convex lenses L_1 and L_2 with focal length 24 cm and 9 cm respectively. The distance between two lenses is 10 cm and the object is placed 6 cm away from lens L_1 as shown in the figure. The distance between the object and the image formed by the system of two lenses is _____ cm
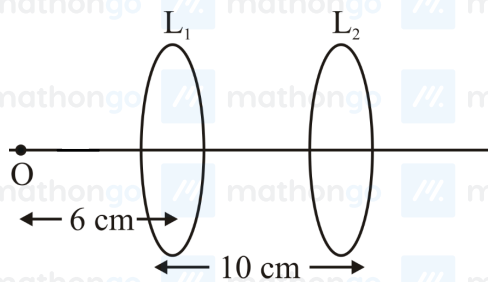
Q30. If 917 Å be the lowest wavelength of Lyman series then the lowest wavelength of Balmer series will be Å.

Q31. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A: 3.1500 g of hydrated oxalic acid dissolved in water to make 250.0 mL solution will result in 0.1 M oxalic acid solution.

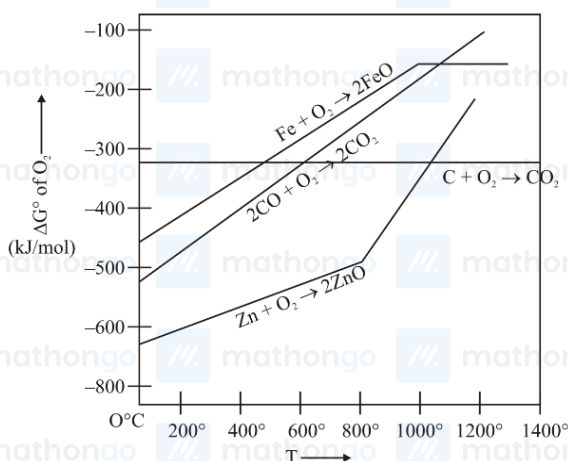**Reason R**: Molar mass of hydrated oxalic acid is 126 g mol^{-1}.

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

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

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

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

(4) **A** is false but **R** is true

Q32. Match List-I with List-II

List-I		List-II	
A	16 g of CH_4 (g)	I	Weighs 28g
B	1 g of $H_2(g)$	II	60.2×10^{23} electrons
C	1 mole of N_2 (g)	III	Weighs 32g
D	0.5 mol of $SO_2(g)$	IV	Occupies 11.4 L volume at STP

Choose the correct answer from the options given below:

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

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

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

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

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

Assertion A : The energy required to form Mg^{2+} from Mg is much higher than that required to produce Mg^+

Reason R: Mg^{2+} is small ion and carry more charge than Mg^+

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

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

Q34. The correct order of metallic character is

(1) $K > Be > Ca$

(2) $Be > Ca > K$

(3) $Ca > K > Be$

(4) $K > Ca > Be$

Q35. Gibbs energy vs T plot for the formation of oxides is given below.

For the given diagram, the correct statement is-

(1) At $600°C$, CO cannot reduce FeO

(2) At $600°C$, CO can reduce ZnO

(3) At $600°C$, C can reduce ZnO

(4) At $600°C$, C can reduce FeO

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

Assertion A : Physical properties of isotopes of hydrogen are different.

Reason R : Mass difference between isotopes of hydrogen is very large.

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

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

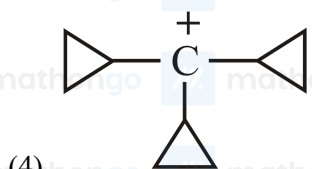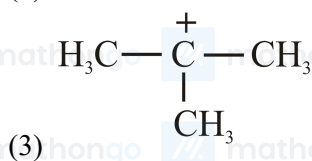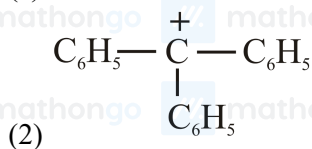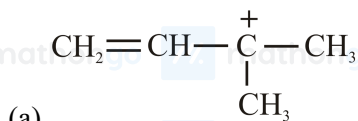**Q37.** Number of water molecules in washing soda and soda ash respectively are :

(1) 1 and 10   (2) 10 and 1

(3) 10 and 0   (4) 1 and 0

Q38. The decreasing order of hydride affinity for following carbocations is:

(a)

$$CH_2=CH-\overset{+}{\underset{\underset{CH_3}{|}}{C}}-CH_3$$

(2)

$$C_6H_5-\overset{+}{\underset{\underset{C_6H_5}{|}}{C}}-C_6H_5$$

(3)

$$H_3C-\overset{+}{\underset{\underset{CH_3}{|}}{C}}-CH_3$$

(4)

Choose the correct answer from the options given below:

(1) C, A, D, B   (2) C, A, B, D
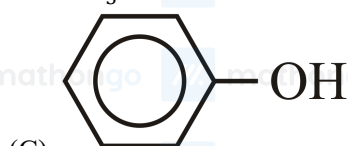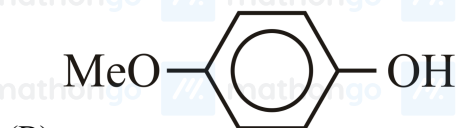
(3) A, C, D, B   (4) A, C, B, D

Q39. The correct order for acidity of the following hydroxyl compound is

(A) CH_3OH

(B) $CH_{3\,3}COH$

(C)

(D)

(E)

Choose the correct answer from the options given below:

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

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

Q40. In Carius tube, an organic compound ' X ' is treated with sodium peroxide to form a mineral acid ' Y '. The solution of $BaCl_2$ is added to ' Y ' to form a precipitate ' Z '. ' Z ' is used for the quantitative estimation of an

extra element. ' X ' could be

(1) Cytosine

(2) A nucleotide

(3) Methionine

(4) Chloroxylenol

Q41. The delicate balance of CO_2 and O_2 is NOT disturbed by

(1) Respiration

(2) Burning of coal

(3) Deforestation

(4) Burning of petroleum

Q42. The correct relationships between unit cell edge length 'a' and radius of sphere 'r' for face-centred and body-centred cubic structures respectively are:

(1) $2\sqrt{2}\,r = a$ and $\sqrt{3}\,r = 4a$

(2) $r = 2\sqrt{2}\,a$ and $4r = \sqrt{3}\,a$

(3) $r = 2\sqrt{2}\,a$ and $\sqrt{3}\,r = 4a$

(4) $2\sqrt{2}\,r = a$ and $4r = \sqrt{3}\,a$

Q43. Ferric chloride is applied to stop bleeding because

(1) Blood absorbs $FeCl_3$ and forms a complex.

(2) Cl^- ions cause coagulation of blood.

(3) Fe^{3+} ions coagulate blood which is a negatively charged sol.

(4) $FeCl_3$ reacts with the constituents of blood which is a positively charged sol.

Q44. Match List-I with List-II.

List-I Complex		List-II Crystal Field splitting energy (Δ_0)	
A.	$[Ti(H_2O)_6]^{2+}$	I.	-1.2
B.	$[V(H_2O)_6]^{2+}$	II.	-0.6
C.	$[Mn(H_2O)_6]^{3+}$	III.	0
D.	$[Fe(H_2O)_6]^{3+}$	IV.	-0.8

Choose the correct answer from the options given below:

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

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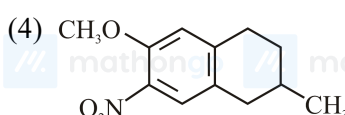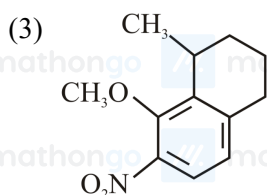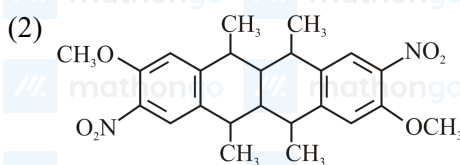
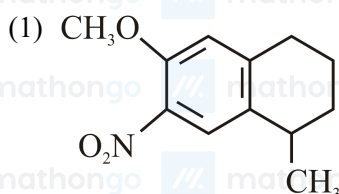(3) A-IV, B-I, C-II, D-III

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

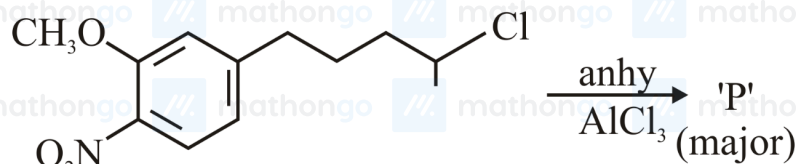**Q45.** The correct order of the number of unpaired electrons in the given complexes is

(A) $[Fe(CN)_6]^{3-}$

(B) FeF_6^{3-}

(C) CoF_6^{3-}

(D) $Cr(oxalate)_3^{3-}$

(E) $Ni(CO)_4$

Choose the correct answer from the options given below:

(1) E < A < D < C < B

(2) E < A < B < D < C

(3) A < E, C < B < D

(4) A < E < D < C < B

Q46. The major product 'P' formed in the given reaction is

(1)

(2)

(3)

(4)

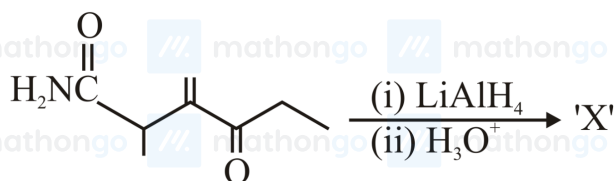**Q47.** Incorrect method of preparation for alcohols from the following is:

(1) Reaction of Ketone with RMgBr followed by hydrolysis.

(2) Reaction of alkyl halide with aqueous NaOH.

(3) Hydroboration-oxidation of alkene.

(4) Ozonolysis of alkene

Q48. In the reaction given below

The product 'X' is :

(1)

(2)

(3)

(4)
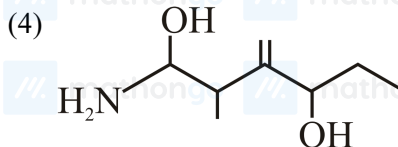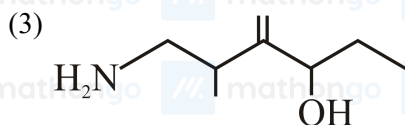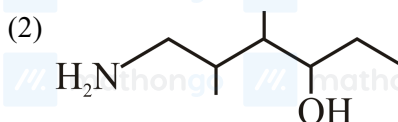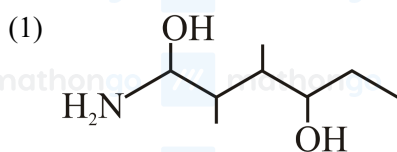
Q49. Buna - S can be represented as:

(1)
$$\left[CH=CH-CH=CH-\underset{\underset{C_6H_5}{|}}{CH}-CH_2 \right]_n$$

(2)
$$\left[CH_2-CH=CH-CH_2-\underset{\underset{C_6H_5}{|}}{CH}-CH_2 \right]_n$$

(3)
$$\left[CH_2-CH=\underset{\underset{C_6H_5}{|}}{C}-CH=CH-CH_2 \right]_n$$

(4)
$$\left[CH_2-CH=CH-CH=\underset{\underset{C_6H_5}{|}}{C}-CH_2 \right]_n$$
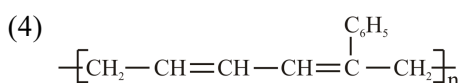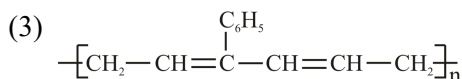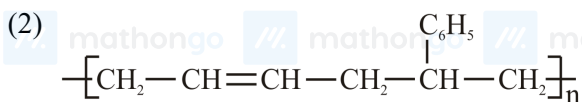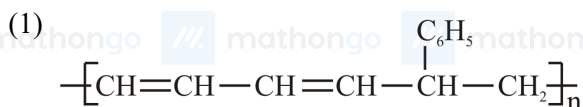
Q50. The reaction used for preparation of soap from fat is :

(1) An addition reaction

(2) Reduction reaction

(3) Alkaline hydrolysis reaction

(4) An oxidation reaction

Q51.

$n + 1$

1.47×10^{-17} J

n

The electron in the nth orbit of Li^{2+} is excited to $(n+1)$ orbit using the radiation of energy 1.47×10^{-17} J (as shown in the diagram). The value of n is _____

Given : $R_H = 2.18 \times 10^{-18}$ J

Q52. For a metal ion, the calculated magnetic moment is 4.90 BM. This metal ion has _____ number of unpaired electrons

Q53. The number of molecules from the following which contain only two lone pair of electrons is _____

$H_2O, N_2, CO, XeF_4, NH_3, NO, CO_2, \quad F_2$

Q54. $A(g) \rightleftharpoons 2 \ B(\ g) + C(g)$

For the given reaction, if the initial pressure is 450 mmHg and the pressure at time t is 720 mmHg at a constant temperature T and constant volume V. The fraction of $A(g)$ decomposed under these conditions is $x \times 10^{-1}$. The value of x is (nearest integer)

Q55. The number of endothermic process/es from the following is _____.

A. $I_2(\ g) \rightarrow 2I(g)$

B. $HCl(g) \rightarrow H(g) + Cl(g)$

C. $H_2O(l) \rightarrow H_2O(g)$

D. $C(s) + O_2(\ g) \rightarrow CO_2(\ g)$

E. Dissolution of ammonium chloride in water

Q56. In alkaline medium, the reduction of permanganate anion involves a gain of _____ electrons.

Q57. An aqueous solution of volume 300 cm^3 contains 0.63 g of protein. The osmotic pressure of the solution at 300 K is 1.29 mbar. The molar mass of the protein is $gmol^{-1}$.

Given : $R = 0.083$ $L_{bar}K^{-1}$ mol^{-1}

Q58. The specific conductance of $0.0025M$ acetic acid is 5×10^{-5} S cm^{-1} at a certain temperature. The dissociation constant of acetic acid is _____ $\times 10^{-7}$.(Nearest integer)

Consider limiting molar conductivity of CH_3COOH as 400 S cm^2 mol^{-1}

Q59. The number of incorrect statement/s from the following is _____

A. The successive half lives of zero order reactions decreases with time.

B. A substance appearing as reactant in the chemical equation may not affect the rate of reaction

C. Order and molecularity of a chemical reaction can be a fractional number

D. The rate constant units of zero and second order reaction are $molL^{-1}\ s^{-1}$ and $mol^{-1}\ L\ s^{-1}$ respectively

Q60. The difference in the oxidation state of Xe between the oxidised product of Xe formed on complete hydrolysis of XeF_4 and XeF_4 is

Q61. Let $S = z = x + iy : \frac{2z - 3i}{4z + 2i}$ is a real number $\}$. Then which of the following is **NOT** correct?

(1) $y + x^2 + y^2 \neq -\frac{1}{4}$

(2) $(x, y) = 0, -\frac{1}{2}$

(3) $x = 0$

(4) $y \in -\infty, -\frac{1}{2} \cup -\frac{1}{2}, \infty$

Q62. Eight persons are to be transported from city A to city B in three cars of different makes. If each car can accommodate at most three persons, then the number of ways, in which they can be transported, is

(1) 1120

(2) 3360

(3) 1680

(4) 560

Q63. If $S_n = 4 + 11 + 21 + 34 + 50 + \ ...$ to n terms, then $\frac{1}{60}S_{29} - S_9$ is equal to

(1) 223

(2) 226

(3) 220

(4) 227

Q64. Let the number $(22)^{2022} + (2022)^{22}$ leave the remainder α when divided by 3 and β when divided by 7. Then $(\alpha^2 + \beta^2)$ is equal to

(1) 20

(2) 13

(3) 5

(4) 10

Q65. If the coefficients of x and x^2 in $(1 + x)^p (1 - x)^q$ are 4 and -5 respectively, then $2p + 3q$ is equal to

(1) 60

(2) 69

(3) 66

(4) 63

Q66. Let $S = x \in -\frac{\pi}{2}, \frac{\pi}{2} : 9^{1 - \tan^2 x} + 9^{\tan^2 x} = 10$ and $\beta = \sum_{x \in S} \tan^2 \frac{x}{3}$, then $\frac{1}{6}(\beta - 14)^2$ is equal to

(1) 16

(2) 8

(3) 64

(4) 32

Q67. Let A be the point $1, 2$ and B be any point on the curve $x^2 + y^2 = 16$. If the centre of the locus of the point P, which divides the line segment $A\ B$ in the ratio $3:2$ is the point $C\alpha, \beta$, then the length of the line segment AC is

(1) $\frac{3\sqrt{5}}{5}$

(2) $\frac{4\sqrt{5}}{5}$

(3) $\frac{2\sqrt{5}}{5}$

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

Q68. Let a circle of radius 4 be concentric to the ellipse $15x^2 + 19y^2 = 285$. Then the common tangents are inclined to the minor axis of the ellipse at the angle

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

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

(3) $\frac{\pi}{6}$

(4) $\frac{\pi}{12}$

Q69. The statement $\sim p \lor \sim p \land q$ is equivalent to

(1) $\sim p \land q$

(2) $p \land q \land \sim p$

(3) $\sim p \land q \land q$

(4) $\sim p \lor q$

Q70. Let μ be the mean and σ be the standard deviation of the distribution

X_i	0	1	2	3	4	5
f_i	$k+2$	$2k$	k^2-1	k^2-1	k^2+1	$k-3$

where $\Sigma f_i = 62$. If x denotes the greatest integer $\leq x$, then $\mu^2 + \sigma^2$ is equal to

(1) 9

(2) 8

(3) 7

(4) 6

Q71. Let $A = 2, 3, 4$ and $B = 8, 9, 12$. Then the number of elements in the relation
$R = a_1, b_1, a_2, b_2 \in A \times B, A \times B : a_1$ divides b_2 and a_2 divides b_1 is

(1) 36

(2) 24

(3) 18

(4) 12

Q72. If $A = \frac{1}{5!6!7!} \begin{vmatrix} 5! & 6! & 7! \\ 6! & 7! & 8! \\ 7! & 8! & 9! \end{vmatrix}$, then adj adj $2A$ is equal to

(1) 2^{20}

(2) 2^8

(3) 2^{12}

(4) 2^{16}

Q73. Let $gx = fx + f1 - x$ and $f''x > 0, x \in 0, 1$. If g is decreasing in the interval $0, \alpha$ and increasing in the interval $\alpha, 1$, then $\tan^{-1}2\alpha + \tan^{-1}\frac{1}{\alpha} + \tan^{-1}\frac{\alpha+1}{\alpha}$ is equal to

(1) π

(2) $\frac{5\pi}{4}$

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

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

Q74. For $\alpha, \beta, \gamma, \delta \in \mathbb{N}$, if $\int \frac{x2x}{e} + \frac{e2x}{x}\log_e x\,dx = \frac{1}{\alpha}\frac{x\beta x}{e} - \frac{1}{\gamma}\frac{e\delta x}{x} + C$, where $e = \sum_{n=0}^{\infty}\frac{1}{n!}$ and C is constant of integration, then $\alpha + 2\beta + 3\gamma - 4\delta$ is equal to

(1) 1

(2) 4

(3) -4

(4) -8

Q75. Let f be a continuous function satisfying $\int_0^{t^2} f(x) + x^2\,dx = \frac{4}{3}t^3, \forall t > 0$. Then $f\frac{\pi^2}{4}$ is equal to

(1) $\pi^2 1 - \frac{\pi^2}{16}$

(2) $-\pi 1 + \frac{\pi^3}{16}$

(3) $\pi 1 - \frac{\pi^3}{16}$

(4) $-\pi^2 1 + \frac{\pi^2}{16}$

Q76. Let $\vec{a} = 2\hat{i} + 7\hat{j} - \hat{k}$, $\vec{b} = 3\hat{i} + 5\hat{k}$ and $\vec{c} = \hat{i} - \hat{j} + 2\hat{k}$ Let $\vec{d}$ be a vector which is perpendicular to both $\vec{a}$ and $\vec{b}$, and $\vec{c} \cdot \vec{d} = 12$. Then $-\hat{i} + \hat{j} - \hat{k} \cdot \vec{c} \times \vec{d}$ is equal to

(1) 24

(2) 44

(3) 42

(4) 48

Q77. If the points P and Q are respectively the circumcenter and the orthocentre of a ΔABC, then $\overrightarrow{PA} + \overrightarrow{PB} + \overrightarrow{PC}$ is equal to _____

(1) $2\overrightarrow{QP}$

(2) $2\overrightarrow{PQ}$

(3) $\overrightarrow{PQ}$

(4) $\overrightarrow{QP}$

Q78. Let the image of the point P (1, 2, 6) in the plane passing through the points A (1, 2, 0) and B (1, 4, 1) C (0, 5, 1) be Q (α, β, γ). Then $\alpha^2 + \beta^2 + \gamma^2$ equal to

(1) 65   (2) 62

(3) 76   (4) 70

Q79. Let the line $\frac{x}{1} = \frac{6-y}{2} = \frac{z+8}{5}$ intersect the lines $\frac{x-5}{4} = \frac{y-7}{3} = \frac{z+2}{1}$ and $\frac{x+3}{6} = \frac{3-y}{3} = \frac{z-6}{1}$ at the points A and B respectively. Then the distance of the mid-point of the line segment AB from the plane $2x - 2y + z = 14$ is

(1) 3   (2) $\frac{11}{3}$

(3) 4   (4) $\frac{10}{3}$

Q80. Let a die be rolled n times. Let the probability of getting odd numbers seven times be equal to the probability of getting odd numbers nine times. If the probability of getting even numbers twice is $\frac{k}{2^{15}}$, then k is equal to

(1) 60   (2) 15

(3) 90   (4) 30

Q81. The sum of all the four-digit numbers that can be formed using all the digits 2, 1, 2, 3 is equal to ____.

Q82. Suppose $a_1, a_2, 2, a_3, a_4$ be in an arithmetico-geometric progression. If the common ratio of the corresponding geometric progression is 2 and the sum of all 5 terms of the arithmetico-geometric progression is $\frac{49}{2}$, then a_4 is equal to _____

Q83. Let the equations of two adjacent sides of a parallelogram $ABCD$ be $2x - 3y = -23$ and $5x + 4y = 23$. If the equation of its one diagonal AC is $3x + 7y = 23$ and the distance of A from the other diagonal is d, then $50d^2$ is equal to _____

Q84. Let S be the set of values of λ, for which the system of equations
$6\lambda x - 3y + 3z = 4\lambda^2$, $2x + 6\lambda y + 4z = 1$ and $3x + 2y + 3\lambda z = \lambda$ has no solution. Then, $12 \sum_{\lambda \in S} \lambda$ is equal to
_____.

Q85. If the domain of the function $fx = \sec^{-1}\frac{2x}{5x+3}$ is $[\alpha, \beta) \cup (\gamma, \delta]$, then $3\alpha + 10\beta + \gamma + 21\delta$ is equal to
_____

Q86. In the figure, $\theta_1 + \theta_2 = \frac{\pi}{2}$ and $\sqrt{3}BE = 4AB$. If the area of ΔCAB is $2\sqrt{3} - 3$ unit^2, when $\frac{\theta_2}{\theta_1}$ is the largest, then the perimeter (in unit) of ΔCED is equal to
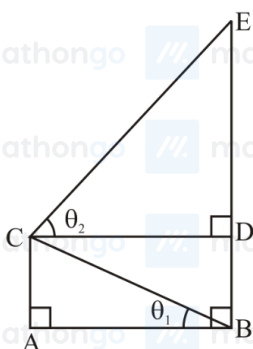
Q87. Let the quadratic curve passing through the point $-1, 0$ and touching the line $y = x$ at $1, 1$ be $y = fx$. Then the x-intercept of the normal to the curve at the point $\alpha, \alpha + 1$ in the first quadrant is

Q88. If the area of the region $x, y: x^2 - 2 \le y \le x$ is A, then $6A + 16\sqrt{2}$ is equal to _____

Q89. Let the tangent at any point P on a curve passing through the points $1, 1$ and $\frac{1}{10}, 100$, intersect positive x-axis and y-axis at the points A and B respectively. If $P\ A:\ P\ B = 1:\ k$ and $y = yx$ is the solution of the differential equation $e^{\frac{dy}{dx}} = kx + \frac{k}{2}, y0 = k$, then $4y1 - 5\log_e 3$ is equal to _____

Q90. Let the foot of perpendicular from the point $A4, 3, 1$ on the plane $P:\ x - y + 2z + 3 = 0$ be N. If $B\left(5, \alpha, \beta\right), \alpha, \beta \in \mathbb{Z}$ is a point on plane P such that the area of the triangle ABN is $3\sqrt{2}$, then $\alpha^2 + \beta^2 + \alpha\beta$ is equal to _____

ANSWER KEYS

1. (4)	**2.** (4)	**3.** (3)	**4.** (4)	**5.** (3)	**6.** (1)	**7.** (2)	**8.** (1)
9. (4)	**10.** (1)	**11.** (4)	**12.** (3)	**13.** (4)	**14.** (2)	**15.** (4)	**16.** (2)
17. (2)	**18.** (3)	**19.** (2)	**20.** (2)	**21.** (48)	**22.** (3)	**23.** (80)	**24.** (20)
25. (8)	**26.** (3)	**27.** (2)	**28.** (44)	**29.** (34)	**30.** (3668)	**31.** (3)	**32.** (2)
33. (4)	**34.** (4)	**35.** (4)	**36.** (1)	**37.** (3)	**38.** (2)	**39.** (4)	**40.** (3)
41. (1)	**42.** (4)	**43.** (3)	**44.** (3)	**45.** (1)	**46.** (1)	**47.** (4)	**48.** (3)
49. (2)	**50.** (3)	**51.** (1)	**52.** (4)	**53.** (3)	**54.** (3)	**55.** (4)	**56.** (3)
57. (40535)	**58.** (66)	**59.** (1)	**60.** (2)	**61.** (2)	**62.** (3)	**63.** (1)	**64.** (3)
65. (4)	**66.** (4)	**67.** (1)	**68.** (1)	**69.** (2)	**70.** (2)	**71.** (1)	**72.** (4)
73. (1)	**74.** (2)	**75.** (3)	**76.** (2)	**77.** (3)	**78.** (1)	**79.** (3)	**80.** (1)
81. (26664)	**82.** (16)	**83.** (529)	**84.** (24)	**85.** (24)	**86.** (6)	**87.** (11)	**88.** (27)
89. (5)	**90.** (7)						