Q1. A wire of $1\ \Omega$ has a length of 1 m. It is stretched till its length increases by 25%. The percentage change in resistance to the nearest integer is :

(1) 12.5% (2) 76%
(3) 25% (4) 56%

Q2. If C and V represent capacity and voltage respectively then what are the dimensions of λ where $C/V = \lambda$?

(1) $\left[\mathrm{M}^{-2}\ \mathrm{L}^{-4}\ \mathrm{I}^{3}\ \mathrm{T}^{7}\right]$ (2) $\left[\mathrm{M}^{-2}\ \mathrm{L}^{-3}\mathrm{I}^{2}\ \mathrm{T}^{6}\right]$
(3) $\left[\mathrm{M}^{-1}\ \mathrm{L}^{-3}\mathrm{I}^{-2}\ \mathrm{T}^{-7}\right]$ (4) $\left[\mathrm{M}^{-3}\ \mathrm{L}^{-4}\mathrm{I}^{3}\ \mathrm{T}^{7}\right]$

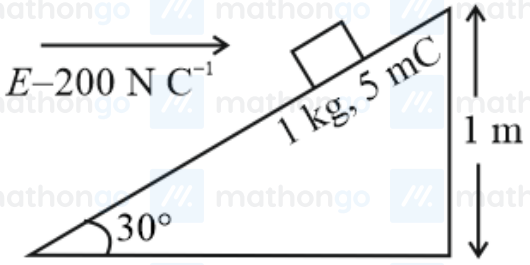
Q3. A scooter accelerates from rest for time t_1 at constant rate a_1 and then retards at constant rate a_2 for time t_2 and comes to rest. The correct value of $\frac{t_1}{t_2}$ will be :

(1) $\frac{a_2}{a_1}$ (2) $\frac{a_1}{a_2}$
(3) $\frac{a_1+a_2}{a_1}$ (4) $\frac{a_1+a_2}{a_2}$

Q4. The trajectory of a projectile in a vertical plane is $y = \alpha x - \beta x^2$, where α and β are constants and x & y are respectively the horizontal and vertical distances of the projectile from the point of projection. The angle of projection θ and the maximum height attained H are respectively given by

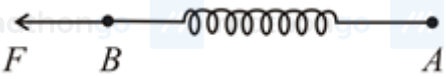
(1) $\tan^{-1}\alpha,\ \frac{4\alpha^2}{\beta}$ (2) $\tan^{-1}\left(\frac{\beta}{\alpha}\right),\ \frac{\alpha^2}{\beta}$
(3) $\tan^{-1}\beta,\ \frac{\alpha^2}{2\beta}$ (4) $\tan^{-1}\alpha,\ \frac{\alpha^2}{4\beta}$

Q5. An inclined plane making an angle of 30° with the horizontal is placed in a uniform horizontal electric field $200\frac{\mathrm{N}}{\mathrm{C}}$ as shown in the figure. A body of mass 1 kg and charge 5 mC is allowed to slide down from rest at a height of 1 m. If the coefficient of friction is 0.2, find the time taken by the body to reach the bottom.
$\left[g = 9.8\ \mathrm{m\ s^{-2}};\ \sin 30^\circ = \frac{1}{2};\ \cos 30^\circ = \frac{\sqrt{3}}{2}\right]$



(1) 0.92 s (2) 1.3 s
(3) 0.46 s (4) 2.3 s

Q6. Two masses A and B, each of mass M are fixed together by a massless spring, A force acts on the mass B as shown in figure. If the mass A starts moving away from mass B with acceleration a, then the acceleration of mass B will be :



(1) $\frac{MF}{F+Ma}$ (2) $\frac{F+Ma}{M}$
(3) $\frac{Ma-F}{M}$ (4) $\frac{F-Ma}{M}$

Q7. A cord is wound round the circumference of wheel of radius r, The axis of the wheel is horizontal and the moment of inertia about it is I. A weight mg is attached to the cord at the end. The weight falls from rest. After falling through a distance h, the square of angular velocity of wheel will be

(1) $\frac{2mgh}{I+mr^2}$ (2) $\frac{2mgh}{I+2mr^2}$

(3) $2gh$ (4) $\frac{2gh}{I+mr^2}$

Q8. The length of metallic wire is l_1 when tension in it is T_1. It is l_2 when the tension is T_2. The original length of the wire will be :

(1) $\frac{T_2l_1+T_1l_2}{T_1+T_2}$ (2) $\frac{l_1+l_2}{2}$

(3) $\frac{T_2l_1-T_1l_2}{T_2-T_1}$ (4) $\frac{\mathrm{T_1}l_1-\mathrm{T_2}l_2}{\mathrm{T_2}-\mathrm{T_1}}$

Q9. The internal energy (U), pressure (P) and volume (V) of an ideal gas are related as $U = 3PV + 4$. The gas is

(1) either monoatomic or diatomic (2) polyatomic only

(3) monoatomic only (4) diatomic only

Q10. Given below are two statements:

Statement I: A second's pendulum has a time period of 1 second.

Statement II: It takes precisely one second to move between the two extreme positions. 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

Q11. A particle executes S.H.M., the graph of velocity as a function of displacement is :

(1) a circle (2) a helix

(3) a parabola (4) an ellipse

Q12. A tuning fork A of unknown frequency produces 5 beats s^{-1} with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats s^{-1}. What is the frequency of fork A ?

(1) 335 Hz (2) 338 Hz

(3) 345 Hz (4) 342 Hz

Q13. Given below are two statements

Statement I : An electric dipole is placed at the centre of a hollow sphere. The flux of electric field through the sphere is zero, but the electric field is not zero anywhere in the sphere.

Statement II : If R is the radius of a solid metallic sphere and Q be the total charge on it. The electric field at any point on the spherical surface of radius $r(< R)$ is zero but the electric flux passing through this closed spherical surface of radius r is not

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

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

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

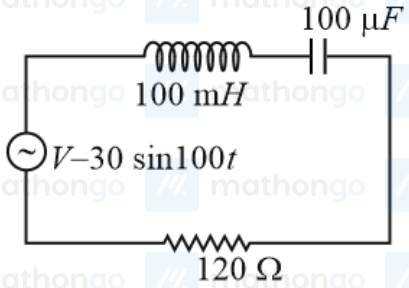
Q14. An aeroplane, with its wings spread 10 m, is flying at a speed of 180 km h^{-1} in a horizontal direction. The total intensity of earth's field at that part is 2.5×10^{-4} Wb m^{-2} and the angle of dip is 60°. The emf induced

between the tips of the plane wings will be

(1) 108.25 mV (2) 54.125 mV

(3) 88.37 mV (4) 62.50 mV

Q15. Find the peak current and resonant frequency of the following circuit (as shown in figure).



(1) 2 A and 50 Hz (2) 0.2 A and 100 Hz

(3) 2 A and 100 Hz (4) 0.2 A and 50 Hz

Q16. Given below are two statements : one is labeled as Assertion A and the other is labeled as Reason R.

Assertion A: For a simple microscope, the angular size of the object equals the angular size of the image.

Reason R: Magnification is achieved as the small object can be kept much closer to the eye than 25 cm and hence it subtends a large angle. In the light of the above statements, choose the most appropriate answer from the options given below:

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

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

Q17. The incident ray, reflected ray and the outward drawn normal are denoted by the unitvectors $\vec{a}, \vec{b}$ and $\vec{c}$ respectively. Then choose the correct relation for these vectors.

(1) $\vec{b} = \vec{a} + 2\vec{c}$ (2) $\vec{b} = 2\vec{a} + \vec{c}$

(3) $\vec{b} = \vec{a} - 2\left(\vec{a} \cdot \vec{c}\right)\vec{c}$ (4) $\vec{b} = \vec{a} - \vec{c}$

Q18. The recoil speed of a hydrogen atom after it emits a photon in going from $n = 5$ state to $n = 5$ state will be

(1) $4.17\ \text{m s}^{-1}$ (2) $2.19\ \text{m s}^{-1}$

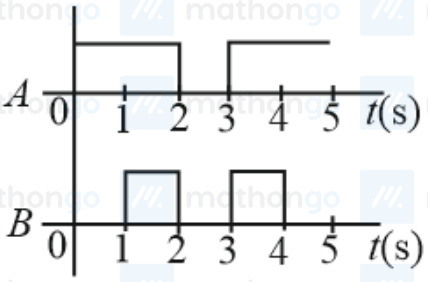
(3) $4.34\ \text{m s}^{-1}$ (4) $3.25\ \text{m s}^{-1}$

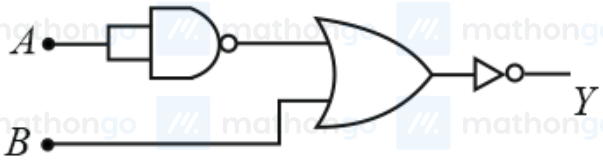
Q19. A radioactive sample is undergoing α decay, At any time t_1, its activity is A and another time t_2, the activity is $\frac{A}{5}$. What is the average life time for the sample ?

(1) $\frac{\ln 5}{t_2 - t_1}$ (2) $\frac{\ln(t_2 + t_1)}{2}$

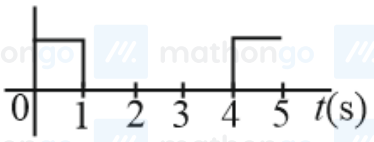
(3) $\frac{t_2 - t_1}{\ln 5}$ (4) $\frac{t_1 - t_2}{\ln 5}$

Q20. Draw the output signal Y in the given combination of gates.

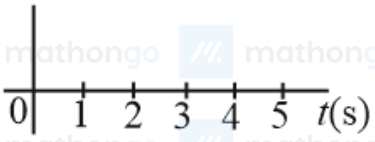




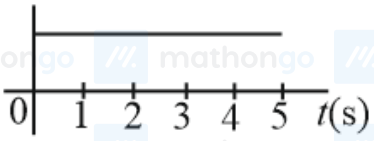
(1)



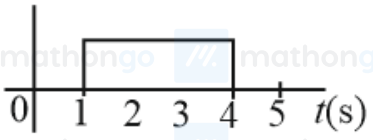
(2)



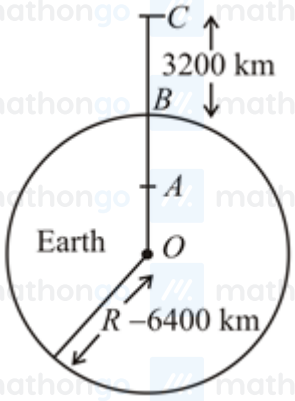
(3)



(4)



Q21. In the reported figure of earth, the value of acceleration due to gravity is same at point A and C but it is smaller than that of its value at point B (surface of the earth). The value of $OA : AB$ will be $x : 5$. The value of x is



Q22. 1 mole of rigid diatomic gas performs a work of $\frac{Q}{5}$ when heat Q is supplied to it. The molar heat capacity of the gas during this transformation is $\frac{xR}{8}$. The value of x is
[R universal gas constant]

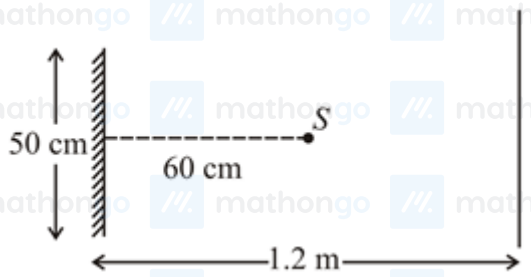
Q23. The volume V of a given mass of monoatomic gas changes with temperature T according to the relation $V = KT^{\frac{2}{3}}$. The workdone when temperature changes by 90 K will be xR. The value of x is
[R universal gas constant]

Q24. A particle executes S.H.M. with amplitude A and time period T. The displacement of the particle when its speed is half of maximum speed is $\frac{\sqrt{x}A}{2}$. The value of x is

Q25. Time period of a simple pendulum is T. The time taken to complete $\frac{5}{8}$ oscillations starting from mean position is $\frac{\alpha}{12}T$. The value of α is _____.

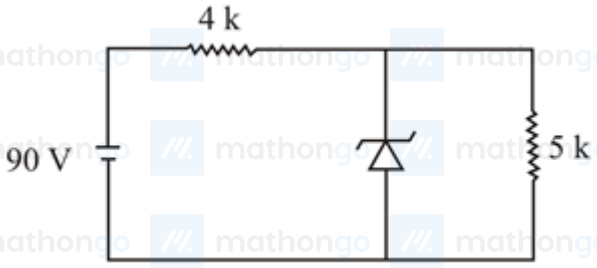
Q26. 27 similar drops of mercury are maintained at 10 V each. All these spherical drops combine into a single big drop. The potential energy of the bigger drop is _____ times that of a smaller drop.

Q27. A point source of light S, placed at a distance 60 cm infront of the centre of a plane mirror of width 50 cm, hangs vertically on a wall. A man walks infront of the mirror along a line parallel to the mirror at a distance 1.2 m from it (see in the figure). The distance between the extreme points where he can see the image of the light source in the mirror is__cm



Q28. Two stream of photons, possessing energies equal to twice and ten times the work function of metal are incident on the metal surface successively. The value of ratio of maximum velocities of the photoelectrons emitted in the two respective cases is $x : 3$ The value of x is

Q29. The zener diode has a $V_z = 30$ V. The current passing through the diode for the following circuit is___mA.



Q30. If the highest frequency modulating a carrier is 5 kHz, then the number of AM broadcast stations accommodated in a 90 kHz bandwidth are

Q31. The correct order of electron gain enthalpy is:

(1) $S > O > Se > Te$ (2) $O > S > Se > Te$

(3) $S > Se > Te > O$ (4) $Te > Se > S > O$

Q32. Which pair of oxides is acidic in nature?

(1) B_2O_3, CaO (2) N_2O, BaO

(3) CaO, SiO_2 (4) B_2O_3, SiO_2

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

Assertion A : In TlI_3, isomorphous to CsI_3, the metal is present in $+1$ oxidation state.

Reason R : Tl metal has fourteen f electrons in its electronic configuration.

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

(1) A is correct but R is not correct

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

(3) A is not correct but R is correct

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

Q34. Match List-I with List-II.

List-I (Molecule)		List-II (Bond order)	
(a)	Ne_2	(i)	1
(b)	N_2	(ii)	2
(c)	F_2	(iii)	0
(d)	O_2	(iv)	3

Choose the correct answer from the options given below:

(1) (a) $\rightarrow$ (ii), (b) $\rightarrow$ (i), (c) $\rightarrow$ (iv), (d) $\rightarrow$ (iii)

(2) (a) $\rightarrow$ (iii), (b) $\rightarrow$ (iv), (c) $\rightarrow$ (i), (d) $\rightarrow$ (ii)

(3) (a) $\rightarrow$ (i), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (iii), (d) $\rightarrow$ (iv)

(4) (a) $\rightarrow$ (iv), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (ii), (d) $\rightarrow$ (i)

Q35. Calgon is used for water treatment. Which of the following statement is NOT true about Calgon?

(1) It is polymeric compound and is water soluble.

(2) Calgon contains the 2^{nd} most abundant element by weight in the Earth's crust.

(3) It is also known as Graham's salt.

(4) It doesnot remove Ca^{2+} ion by precipitation.

Q36. Which of the following forms of hydrogen emits low energy β^- particles?

(1) Deuterium ^2_1H

(2) Proton H^+

(3) Tritium ^3_1H

(4) Protium ^1_1H

Q37. In $\overset{1}{C}H_2 = \overset{2}{C} = \overset{3}{C}H - \overset{4}{C}H_3$ molecule, the hybridization of carbon 1, 2, 3 and 4 respectively, are :

(1) $sp^2,\ sp^3,\ sp^2,\ sp^3$

(2) $sp^2,\ sp,\ sp^2,\ sp^3$

(3) $sp^2,\ sp^2,\ sp^2,\ sp^3$

(4) $sp^3,\ sp,\ sp^3,\ sp^3$

Q38. The nature of charge on resulting colloidal particles when $FeCl_3$ is added to excess of hot water is:

(1) positive

(2) sometimes positive and sometimes negative

(3) neutral

(4) negative

Q39. Match List-I with List-II

List-I		List-II	
(a)	Sodium Carbonate	(i)	Deacon
(b)	Titanium	(ii)	Castner-Kellner
(c)	Chlorine	(iii)	van-Arkel
(d)	Sodium hydroxide	(iv)	Solvay

Choose the correct answer from the options given below:

(1) (a) $\rightarrow$ (i), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (iv), (d) $\rightarrow$ (ii)

(2) (a) $\rightarrow$ (iii), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (i), (d) $\rightarrow$ (iv)

(3) (a) $\rightarrow$ (iv), (b) $\rightarrow$ (i), (c) $\rightarrow$ (ii), (d) $\rightarrow$ (iii)

(4) (a) $\rightarrow$ (iv), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (i), (d) $\rightarrow$ (ii)

Q40. Match List-I with List-II.

List-I		List-II	
(a)	Siderite	(i)	Cu
(b)	Calamine	(ii)	Ca
(c)	Malachite	(iii)	Fe
(d)	Cryolite	(iv)	Al
		(v)	Zn

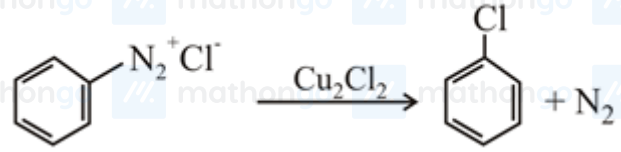
Choose the correct answer from the options given below:

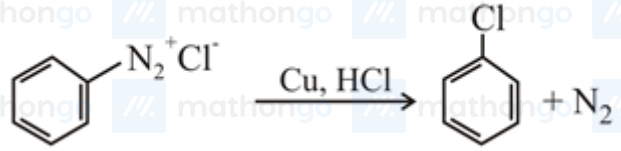
(1) (a) → (iii), (b) → (i), (c) → (v), (d) → (ii) (2) (a) → (i), (b) → (ii), (c) → (v), (d) → (iii)

(3) (a) → (iii), (b) → (v), (c) → (i), (d) → (iv) (4) (a) → (i), (b) → (ii), (c) → (iii), (d) → (iv)

Q41. Match List-I with List-II.

List-I List-II

(a)  (i) Wurtz reaction

(b)  (ii) Sandmeyer reaction

(c) $2\,CH_3\,CH_2\,Cl + 2Na \xrightarrow{\text{Ether}} C_2H_5 - C_2H_5 + 2\,NaCl$ (iii) Fittig reaction

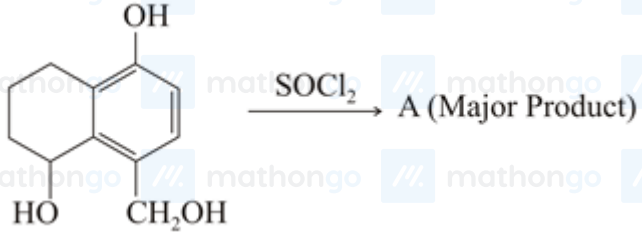
(d) $2C_6H_5Cl + 2Na \xrightarrow{\text{Ether}} C_6H_5 - C_6H_5 + 2\,NaCl$ (iv) Gatterman reaction

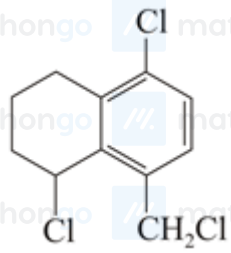
Choose the correct answer from the options given below:

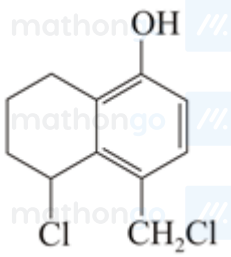
(1) (a) → (iii), (b) → (iv), (c) → (i), (d) → (ii) (2) (a) → (ii), (b) → (i), (c) → (iv), (d) → (iii)

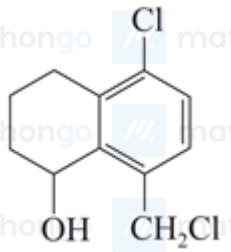
(3) (a) → (iii), (b) → (i), (c) → (iv), (d) → (ii) (4) (a) → (ii), (b) → (iv), (c) → (i), (d) → (iii)

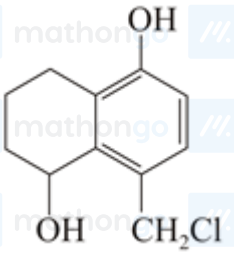
Q42. Identify A in the given reaction.



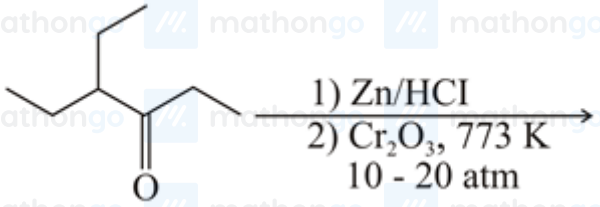
(1) 

(2) 

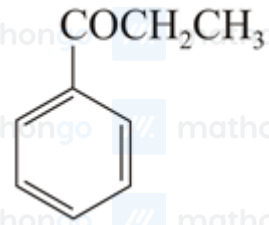
(3) 

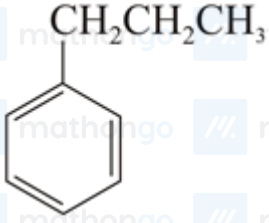
(4) 

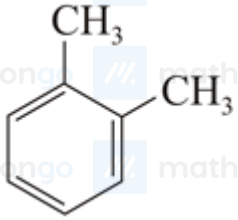
Q43.

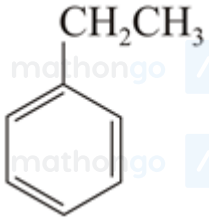


Considering the above reaction, the major product among the following is:

(1) 

(2) 

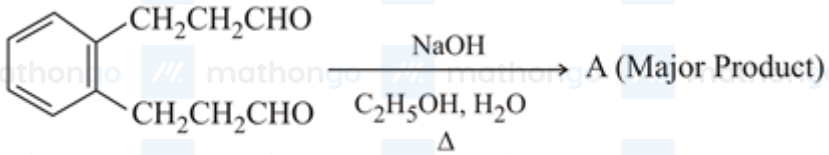
(3) 

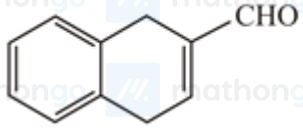
(4) 

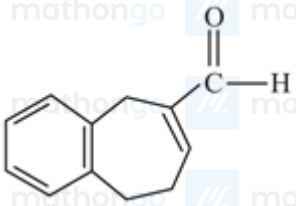
Q44. 2, 4 – DNP test can be used to identify :

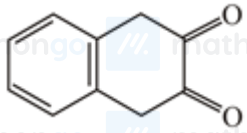
(1) aldehyde
(2) amine
(3) halogens
(4) ether

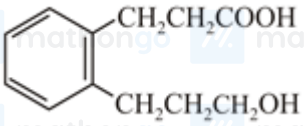
Q45. Identify A in the given chemical reaction.



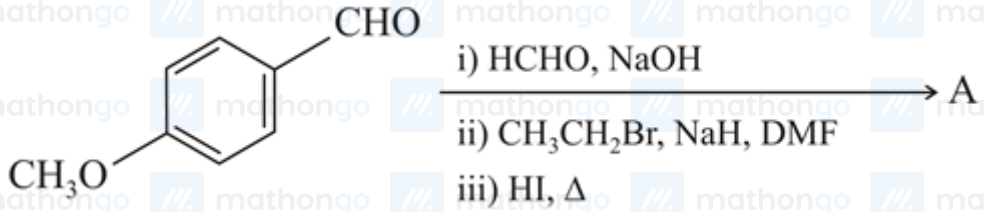
(1) 

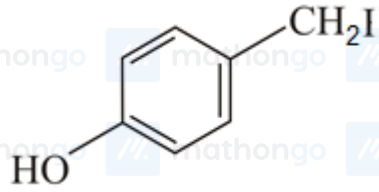
(2) 

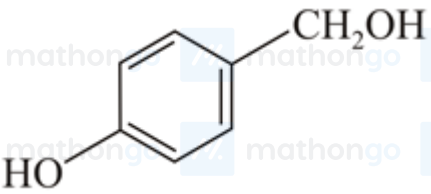
(3) 

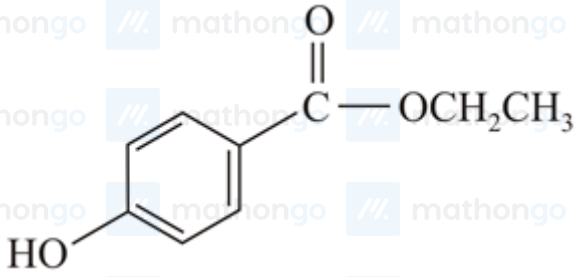
(4) 

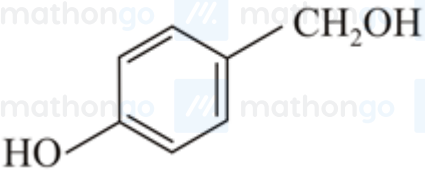
Q46. Identify A in the following chemical reaction.



(1) 

(2) 

(3) 

(4) 

Q47. Ceric ammonium nitrate and $CHCl_3$ / alc. KOH are used for the identification of functional groups present in _ and _ respectively.

(1) amine, phenol
(2) alcohol, amine
(3) amine, alcohol
(4) alcohol, phenol

Q48. A. Phenyl methanamine
B. N, N-Dimethylaniline
C. N-Methyl aniline
D. Benzenamine
Choose the correct order of basic nature of the above amines.

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

Q49. Match List-I with List-II.

List-I	List-II
(a) Sucrose	(i) $\beta-D-$Galactose and $\beta-D-$Glucose
(b) Lactose	(ii) $\alpha-D-$Glucose and $\beta-D-$Fructose
(c) Maltose	(iii) $\alpha-D-$Glucose and $\alpha-D-$Glucose

Choose the correct answer from the options given below:

(1) (a) $\rightarrow$ (iii), (b) $\rightarrow$ (ii), (c) $\rightarrow$ (i)
(2) (a) $\rightarrow$ (iii), (b) $\rightarrow$ (i), (c) $\rightarrow$ (ii)
(3) (a) $\rightarrow$ (ii), (b) $\rightarrow$ (i), (c) $\rightarrow$ (iii)
(4) (a) $\rightarrow$ (i), (b) $\rightarrow$ (iii), (c) $\rightarrow$ (ii)

Q50. Seliwanoff test and Xanthoproteic test are used for the identification of _ and _ respectively.
(1) aldoses, ketoses
(2) ketoses, proteins
(3) proteins, ketoses
(4) ketoses, aldoses

Q51. The $NaNO_3$ weighed out to make 50 mL of an aqueous solution containing 70.0 mg Na^+ per mL is_ g. (Rounded off to the nearest integer) [Given : Atomic weight in $gmol^{-1}$ – Na : 23; N : 14; O : 16]

Q52. A ball weighing 10 g is moving with a velocity of 90 m s^{-1}. If the uncertainty in its velocity is 5%, then the uncertainty in its position is _ $\times 10^{-33}$ m. (Rounded off to the nearest integer)
[Given: $h = 6.63 \times 10^{-34}$ Js]

Q53. The average S – F bond energy in kJ mol^{-1} of SF_6 is _. (Rounded off to the nearest integer)
[Given : The values of standard enthalpy of formation of $SF_6(g)$, S(g) and F(g) are -1100, 275 and 80 kJ mol^{-1} respectively.]

Q54. The pH of ammonium phosphate solution, if pk_a of phosphoric acid and pk_b of ammonium hydroxide are 5.23 and 4.75 respectively, is

Q55. In mildly alkaline medium, thiosulphate ion is oxidized by MnO_4^- to "A". The oxidation state of sulphur in "A" is_

Q56. The number of octahedral voids per lattice site in a lattice is_. (Rounded off to the nearest integer)

Q57. When 12.2 g of benzoic acid is dissolved in 100 g of water, the freezing point of solution was found to be $-0.93\ ^\circ C$ $\left(K_f(H_2O) = 1.86\ K\ kg\ mol^{-1}\right)$. The number (n) of benzoic acid molecules associated (assuming 100% association) is _.

Q58. Emf of the following cell at 298 K in V is $x \times 10^{-2}$
$Zn\left|Zn^{2+}(0.1M)\right|\left|Ag^+(0.01M)\right|Ag$
The value of x is _____ (Rounded off to the nearest integer)
$\left[\text{Given : } E^\theta_{Zn^{2+}/Zn} = -0.76\ V;\ E^\theta_{Ag^+/Ag} = +0.80\ V;\ \frac{2.303RT}{F} = 0.059\right]$

Q59. If the activation energy of a reaction is 80.9 kJ mol^{-1}, the fraction of molecules at 700 K, having enough energy to react to form products is e^{-x}. The value of x is (Rounded off to the nearest integer) [Use $R = 8.31\ J\ K^{-1}\ mol^{-1}$]

Q60. The number of stereo isomers possible for $[Co(ox)_2(Br)(NH_3)]^{2-}$ is _____.
[ox = oxalate]

Q61. A natural number has prime factorization given by $n = 2^x 3^y 5^z$, where y and z are such that $y + z = 5$ and $y^{-1} + z^{-1} = \frac{5}{6}, y > z$. Then the number of odd divisors of n, including 1, is:

(1) 12 (2) 6

(3) 11 (4) $6x$

Q62. The sum of the series $\sum_{n=1}^{\infty} \frac{n^2+6n+10}{(2n+1)!}$ is equal to

(1) $\frac{41}{8}e + \frac{19}{8}e^{-1} + 10$ (2) $\frac{41}{8}e + \frac{19}{8}e^{-1} - 10$

(3) $-\frac{41}{8}e + \frac{19}{8}e^{-1} - 10$ (4) $\frac{41}{8}e - \frac{19}{8}e^{-1} - 10$

Q63. If $0 < a, b < 1$, and $\tan^{-1} a + \tan^{-1} b = \frac{\pi}{4}$, then the value of $(a+b) - \left(\frac{a^2+b^2}{2}\right) + \left(\frac{a^3+b^3}{3}\right) - \left(\frac{a^4+b^4}{4}\right) + \ldots$ is :

(1) $\log_e\left(\frac{e}{2}\right)$ (2) e

(3) $e^2 - 1$ (4) $\log_e 2$

Q64. If the locus of the mid-point of the line segment from the point $(3, 2)$ to a point on the circle, $x^2 + y^2 = 1$ is a circle of radius r, then r is equal to

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

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

Q65. Let $A(1, 4)$ and $B(1, -5)$ be two points. Let P be a point on the circle $((x-1))^2 + (y-1)^2 = 1$, such that $(PA)^2 + (PB)^2$ have maximum value, then the points, P, A and B lie on

(1) a hyperbola (2) a straight line

(3) an ellipse (4) a parabola

Q66. Let $f(x)$ be a differentiable function at $x = a$ with $f'(a) = 2$ and $f(a) = 4$. Then $\lim\limits_{x \to a} \frac{xf(a) - af(x)}{x - a}$ equals:

(1) $a + 4$ (2) $2a - 4$

(3) $4 - 2a$ (4) $2a + 4$

Q67. Let $F_1(A, B, C) = (A \wedge \sim B) \vee [\sim C \wedge (A \vee B)] \vee \sim A$ and $F_2(A, B) = (A \vee B) \vee (B \to \sim A)$ be two logical expressions. Then :

(1) F_1 is a tautology but F_2 is not a tautology (2) F_1 is not a tautology but F_2 is a tautology

(3) Both F_1 and F_2 are not tautologies (4) F_1 and F_2 both are tautologies

Q68. Consider the following system of equations:

$x + 2y - 3z = a$

$2x + 6y - 11z = b$

$x - 2y + 7z = c$

where a, b and c are real constants. Then the system of equations :

(1) has a unique solution when $5a = 2b + c$ (2) has no solution for all a, b and c

(3) has infinite number of solutions when $5a = 2b + c$ (4) has a unique solution for all a, b and c

Q69. Let $A = \{1, 2, 3, \ldots, 10\}$ and $f : A \to A$ be defined as

$$f(k) = \begin{cases} k+1 & \text{if } k \text{ is odd} \\ k & \text{if } k \text{ is even} \end{cases}$$

Then the number of possible functions $g : A \to A$ such that $gof = f$ is:

(1) ${}^{10}C_5$ (2) 5^5

(3) $5!$ (4) 10^5

Q70. Let $f(x) = \sin^{-1} x$ and $g(x) = \frac{x^2-x-2}{2x^2-x-6}$. If $g(2) = \lim\limits_{x\to 2} g(x)$, then the domain of the function fog is

(1) $(-\infty, -1] \cup [2, \infty)$ (2) $\left(-\infty, -2\right] \cup \left[-\frac{3}{2}, \infty\right)$

(3) $\left(-\infty, -2\right] \cup \left[-\frac{4}{3}, \infty\right)$ (4) $(-\infty, -2] \cup [-1, \infty)$

Q71.

Let $f : R \to R$ be defined as $f(x) = \begin{cases} 2\sin\left(-\frac{\pi x}{2}\right), & \text{if } x < -1 \\ |ax^2 + x + b|, & \text{if } -1 \le x \le 1 \\ \sin(\pi x), & \text{if } x > 1 \end{cases}$

If $f(x)$ is continuous on R, then $a + b$ equals :

(1) 1 (2) 3

(3) -3 (4) -1

Q72. The triangle of maximum area that can be inscribed in a given circle of radius 'r' is :

(1) An equilateral triangle having each of its side of length $\sqrt{3}r$. (2) An isosceles triangle with base equal to $2r$.

(3) An equilateral triangle of height $\frac{2r}{3}$. (4) A right angle triangle having two of its sides of length $2r$ and r.

Q73. For $x > 0$, if $f(x) = \int_1^x \frac{\log_e t}{(1+t)} dt$, then $f(e) + f\left(\frac{1}{e}\right)$ is equal to

(1) 0 (2) $\frac{1}{2}$

(3) -1 (4) 1

Q74. Let $f(x) = \int_0^x e^t f(t)dt + e^x$ be a differentiable function for all $x \in R$. Then $f(x)$ equals :

(1) $e^{(e^x-1)}$ (2) $e^{e^x} - 1$

(3) $2e^{e^x} - 1$ (4) $2e^{(e^x-1)} - 1$

Q75. Let A_1 be the area of the region bounded by the curves $y = \sin x, y = \cos x$ and y-axis in the first quadrant. Also, let A_2 be the area of the region bounded by the curves $y = \sin x, y = \cos x$, x-axis and $x = \frac{\pi}{2}$ in the first quadrant. Then,

(1) $2A_1 = A_2$ and $A_1 + A_2 = 1 + \sqrt{2}$ (2) $A_1 : A_2 = 1 : \sqrt{2}$ and $A_1 + A_2 = 1$

(3) $A_1 : A_2 = 1 : 2$ and $A_1 + A_2 = 1$ (4) $A_1 = A_2$ and $A_1 + A_2 = \sqrt{2}$

Q76. Let slope of the tangent line to a curve at any point $P(x, y)$ be given by $\frac{xy^2+y}{x}$. If the curve intersects the line $x + 2y = 4$ at $x = -2$, then the value of y, for which the point $(3, y)$ lies on the curve, is :

(1) $-\frac{4}{3}$ (2) $\frac{18}{35}$

(3) $-\frac{18}{19}$ (4) $-\frac{18}{11}$

Q77. If vectors $\overrightarrow{a_1} = x\hat{i} - \hat{j} + \hat{k}$ and $\overrightarrow{a_2} = \hat{i} + y\hat{j} + z\hat{k}$ are collinear, then a possible unit vector parallel to the vector $x\hat{i} + y\hat{j} + z\hat{k}$ is:

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

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

Q78. Let L be a line obtained from the intersection of two planes $x+2y+z=6$ and $y+2z=4$. If point $P(\alpha,\beta,\gamma)$ is the foot of perpendicular from $(3,2,1)$ on L, then the value of $21(\alpha+\beta+\gamma)$ equals:

(1) 102 (2) 142

(3) 68 (4) 136

Q79. If the mirror image of the point $(1,3,5)$ with respect to the plane $4x-5y+2z=8$ is (α,β,γ), then $5(\alpha+\beta+\gamma)$ equals :

(1) 43 (2) 47

(3) 41 (4) 39

Q80. A seven digit number is formed using digits $3,3,4,4,4,5,5$. The probability, that number so formed is divisible by 2, is

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

(3) $\frac{1}{7}$ (4) $\frac{6}{7}$

Q81. Let α and β be two real numbers such that $\alpha+\beta=1$ and $\alpha\beta=-1$. Let $p_n=(\alpha)^n+(\beta)^n$, $p_{n-1}=11$ and $p_{n+1}=29$ for some integer $n\geqslant 1$. Then, the value of p_n^2 is _____.

Q82. Let z be those complex numbers which satisfy $|z+5|\leq 4$ and $z(1+i)+\bar{z}(1-i)\geqslant -10, i=\sqrt{-1}$. If the maximum value of $|z+1|^2$ is $\alpha+\beta\sqrt{2}$, then the value of $(\alpha+\beta)$ is

Q83. The total number of 4-digit numbers whose greatest common divisor with 18 is 3 is _____.

Q84. If the arithmetic mean and the geometric mean of the p^{th} and q^{th} terms of the sequence $-16,8,-4,2,\ldots$ satisfy the equation $4x^2-9x+5=0$, then $p+q$ is equal to _____.

Q85. Let L be a common tangent line to the curves $4x^2+9y^2=36$ and $(2x)^2+(2y)^2=31$. Then the square of the slope of the line L is _____.

Q86. Let $X_1,X_2,\ldots,X_{18}$ be eighteen observations such that $\sum_{i=1}^{18}(X_i-\alpha)=36$ and $\sum_{i=1}^{18}(X_i-\beta)^2=90$, where α and β are distinct real numbers. If the standard deviation of these observations is 1, then the value of $|\alpha-\beta|$ is _____.

Q87. If the matrix $A=\begin{bmatrix}1&0&0\\0&2&0\\3&0&-1\end{bmatrix}$ satisfies the equation $A^{20}+\alpha A^{19}+\beta A=\begin{bmatrix}1&0&0\\0&4&0\\0&0&1\end{bmatrix}$ for some real numbers α and β, then $\beta-\alpha$ is equal to _____.

Q88. Let the normals at all the points on a given curve pass through a fixed point (a,b). If the curve passes through $(3,-3)$ and $\left(4,-2\sqrt{2}\right)$, given that $a-2\sqrt{2}\,b=3$, then $\left(a^2+b^2+ab\right)$ is equal to _____.

Q89. Let a be an integer such that all the real roots of the polynomial $2x^5+5x^4+10x^3+10x^2+10x+10$ lie in the interval $(a,a+1)$. Then, $|a|$ is equal to _____.

Q90. If $I_{m,n}=\int_0^1 x^{m-1}(1-x)^{n-1}dx$, for $m,n\geqslant 1$, and $\int_0^1\frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}dx=\alpha I_{m,n}$, $\alpha\in R$, then α equals _____.

ANSWER KEYS

1. (4)	**2.** (1)	**3.** (1)	**4.** (4)	**5.** (2)	**6.** (4)	**7.** (1)	**8.** (3)
9. (2)	**10.** (1)	**11.** (4)	**12.** (1)	**13.** (3)	**14.** (1)	**15.** (4)	**16.** (4)
17. (3)	**18.** (1)	**19.** (3)	**20.** (1)	**21.** (4)	**22.** (25)	**23.** (60)	**24.** (3)
25. (7)	**26.** (243)	**27.** (150)	**28.** (1)	**29.** (9)	**30.** (9)	**31.** (3)	**32.** (4)
33. (4)	**34.** (2)	**35.** (2)	**36.** (3)	**37.** (2)	**38.** (1)	**39.** (4)	**40.** (3)
41. (4)	**42.** (2)	**43.** (4)	**44.** (1)	**45.** (2)	**46.** (1)	**47.** (2)	**48.** (1)
49. (3)	**50.** (2)	**51.** (13)	**52.** (1)	**53.** (309)	**54.** (7)	**55.** (6)	**56.** (1)
57. (2)	**58.** (147)	**59.** (14)	**60.** (3)	**61.** (1)	**62.** (4)	**63.** (4)	**64.** (4)
65. (2)	**66.** (3)	**67.** (2)	**68.** (3)	**69.** (4)	**70.** (3)	**71.** (4)	**72.** (1)
73. (2)	**74.** (4)	**75.** (2)	**76.** (3)	**77.** (4)	**78.** (1)	**79.** (2)	**80.** (2)
81. (324)	**82.** (48)	**83.** (1000)	**84.** (10)	**85.** (3)	**86.** (4)	**87.** (4)	**88.** (9)
89. (2)	**90.** (1)						