Q1. The distance of the Sun from earth is 1.5×10^{11} m and its angular diameter is 2000″ when observed from the earth. The diameter of the Sun will be

(1) 2.45×10^{10} m (2) 1.45×10^{10} m

(3) 1.45×10^{9} m (4) 0.14×10^{9} m

Q2. The SI unit of a physical quantity is Pascal - sec. The dimensional formula of this quantity will be

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

(3) $ML^{-1}T^{-1}$ (4) $ML^{-1}T^{-2}$

Q3. If L, C and R are the self inductance, capacitance and resistance respectively, which of the following does not have the dimension of time?

(1) $\sqrt{LC}$ (2) $\frac{L}{R}$

(3) CR (4) $\frac{L}{C}$

Q4. When a ball is dropped into a lake from a height 4.9 m above the water level, it hits the water with a velocity v and then sinks to the bottom with the constant velocity v. It reaches the bottom of the lake 4.0 s after it is dropped. The approximate depth of the lake is

(1) 39.2 m (2) 19.6 m

(3) 73.5 m (4) 29.4 m

Q5. One end of a massless spring of spring constant k and natural length l_0 is fixed while the other end is connected to a small object of mass m lying on a frictionless table. The spring remains horizontal on the table. If the object is made to rotate at an angular velocity ω about an axis passing trough fixed end, then the elongation of the spring will be

(1) $\frac{k-m\omega^2 l_0}{m\omega^2}$ (2) $\frac{m\omega^2 l_0}{k+m\omega^2}$

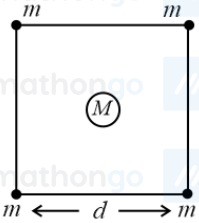
(3) $\frac{m\omega^2 l_0}{k-m\omega^2}$ (4) $\frac{k+m\omega^2 l_0}{m\omega^2}$

Q6. A stone tide to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of change in its velocity, as it reaches a position where the string is horizontal, is $\sqrt{x(u^2-gL)}$. The value of x is

(1) 2 (2) 3

(3) 4 (4) 1

Q7. Four spheres each of mass m form a square of side d (as shown in figure). A fifth sphere of mass M is situated at the centre of square. The total gravitational potential energy of the system is



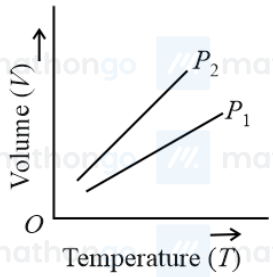
(1) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)m+4\sqrt{2}M\right]$ (2) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)M+4\sqrt{2}m\right]$

(3) $-\frac{Gm}{d}\left[3m^2+4\sqrt{2}M\right]$ (4) $-\frac{Gm}{d}\left[6m^2+4\sqrt{2}M\right]$

Q8. A lead bullet penetrates into a solid object and melts. Assuming that 40% of its kinetic energy is used to heat it, the initial speed of bullet is
(Given, initial temperature of the bullet $= 127^{\circ}\text{C}$,
Melting point of the bullet $= 327^{\circ}\text{C}$,
Latent heat of fusion of lead $= 2.5 \times 10^4\ \text{J kg}^{-1}$,
Specific heat capacity of lead $= 125\ \text{J kg K}^{-1}$)

(1) $125\ \text{m s}^{-1}$ (2) $500\ \text{m s}^{-1}$
(3) $250\ \text{m s}^{-1}$ (4) $600\ \text{m s}^{-1}$

Q9. For a perfect gas, two pressures P_1 and P_2 are shown in figure. The graph shows



(1) $P_1 > P_2$ (2) $P_1 < P_2$
(3) $P_1 = P_2$ (4) Insufficient data to draw any conclusion

Q10. According to kinetic theory of gases,
A. The motion of the gas molecules freezes at 0°C.
B. The mean free path of gas molecules decreases if the density of molecules is increased.
C. The mean free path of gas molecules increases if temperature is increased keeping pressure constant.
D. Average kinetic energy per molecule per degree of freedom is $\frac{3}{2}k_BT$ (for monoatomic gases).
Choose the most appropriate answer from the options given below

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

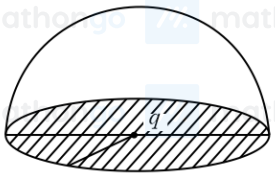
Q11. The equation of a particle executing simple harmonic motion is given by $x = \sin\pi\left(t + \frac{1}{3}\right)$ m. At $t = 1$ s, the speed of particle will be (Given: $\pi = 3.14$)

(1) $157\ \text{cm s}^{-1}$ (2) $0\ \text{cm s}^{-1}$
(3) $272\ \text{cm s}^{-1}$ (4) $314\ \text{cm s}^{-1}$

Q12. If a wave gets refracted into a denser medium, then which of the following is true?

(1) Wavelength, speed and frequency decreases.
(2) Wavelength increases, speed decreases and frequency remains constant.
(3) Wavelength and speed decreases but frequency remains constant.
(4) Wavelength, speed and frequency increases.

Q13. If a charge q is placed at the centre of a closed hemispherical non-conducting surface, the total flux passing through the flat surface would be

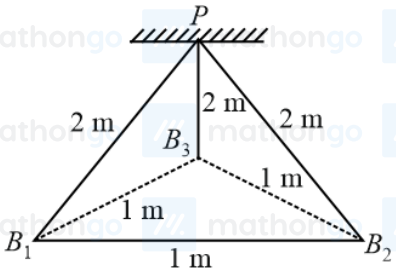


(1) $\frac{q}{\varepsilon_0}$ (2) $\frac{q}{2\varepsilon_0}$

(3) $\frac{q}{4\varepsilon_0}$ (4) $\frac{q}{2\pi\varepsilon_0}$

Q14. Three identical charged balls each of charge $2C$ are suspended from a common point P by silk threads of 2 m each (as shown in figure). They form an equilateral triangle of side 1 m.

The ratio of net force on a charged ball to the force between any two charged balls will be



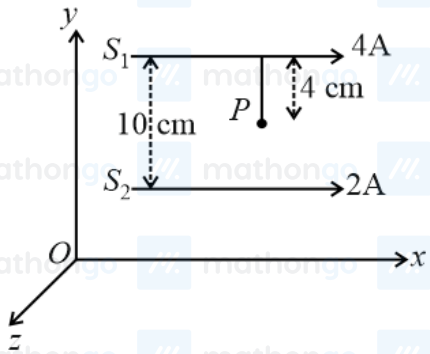
(1) $\sqrt{3}:1$ (2) $\sqrt{3}:2$

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

Q15. Two long parallel conductors S_1 and S_2 are separated by a distance 10 cm and carrying currents of 4 A and 2 A respectively. The conductors are placed along x-axis in $X-Y$ plane. There is a point P located between the conductors (as shown in figure).

A charge particle of 3π coulomb is passing through the point P with velocity $\overrightarrow{v}=\left(2\hat{i}+3\hat{j}\right)$ m s^{-1}; where $\hat{i}$ & $\hat{j}$ represents unit vector along x & $y$axis respectively.

The force acting on the charge particle is $4\pi\times10^{-5}\left(-x\hat{i}+2\hat{j}\right)$ N. The value of x is



(1) 2 (2) 1

(3) 3 (4) -3

Q16. Given below are two statements :

Statement I: A time varying electric field is a source of changing magnetic field and vice-versa. Thus a disturbance in electric or magnetic field creates EM waves.

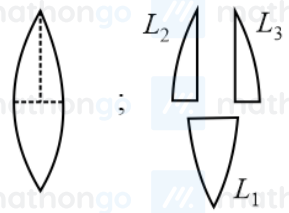
Statement II: In a material medium, the EM wave travels with speed $v=\frac{1}{\sqrt{\mu_0\epsilon_0}}$.

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) 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

Q17. A convex lens has power P. It is cut into two halves along its principal axis. Further one piece (out of the two halves) is cut into two halves perpendicular to the principal axis (as shown in figures). Choose the incorrect option for the reported pieces.



(1) Power of $L_1 = \frac{P}{2}$ (2) Power of $L_2 = \frac{P}{2}$

(3) Power of $L_3 = \frac{P}{2}$ (4) Power of $L_1 = P$

Q18. Given below are two statements

Statement I: In hydrogen atom, the frequency of radiation emitted when an electron jumps from lower energy orbit (E_1) to higher energy orbit (E_2), is given as $hf = \mathrm{E}_1 - \mathrm{E}_2$

Statement II: The jumping of electron from higher energy orbit (E_2) to lower energy orbit (E_1) is associated with frequency of radiation given as $f = \frac{(\mathrm{E}_2 - \mathrm{E}_1)}{h}$. This condition is Bohr's frequency condition.

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) 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.

Q19. For a transistor to act as a switch, it must be operated in

(1) Active region (2) Saturation and cut-off region

(3) Cutoff region only (4) Saturated region only

Q20. We do not transmit low frequency signal to long distances because

(a) The size of the antenna should be comparable to signal wavelength which is unreal solution for a signal of longer wavelength.

(b) Effective power radiated by a long wavelength baseband signal would be high.

(c) We want to avoid mixing up signals transmitted by different transmitter simultaneously.

(d) Low frequency signal can be sent to long distances by superimposing with a high frequency wave as well.

Therefore, the most suitable option will be :

(1) All statements are true (2) (a), (b) and (c) are true only

(3) (a), (c) and (d) are true only (4) (b), (c) and (d) are true only

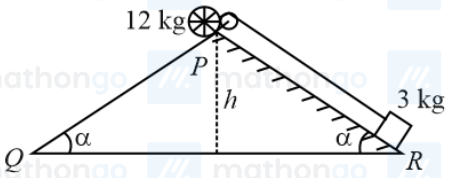
Q21. A mass of $10\ \mathrm{kg}$ is suspended vertically by a rope of length $5\ \mathrm{m}$ from the roof. A force of $30\ \mathrm{N}$ is applied at the middle point of rope in horizontal direction. The angle made by upper half of the rope with vertical is $\alpha = \tan^{-1}\left(x \times 10^{-1}\right)$. The value of x is _____ .

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

Q22. A rolling wheel of 12 kg is on an inclined plane at position P and connected to a mass of 3 kg through a string of fixed length and pulley as shown in figure.

Consider PR as friction free surface.

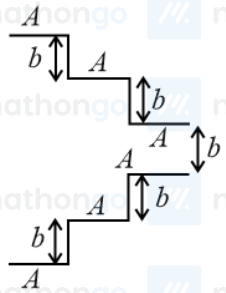
The velocity of centre of mass of the wheel when it reaches at the bottom Q of the inclined plane PQ will be $\frac{1}{2}\sqrt{xgh}$ m s^{-1}. The value of x (rounded off to the nearest integer) is _____.



Q23. A diatomic gas $(\gamma = 1.4)$ does 400 J of work when it is expanded isobarically. The heat given to the gas in the process is _____ J.

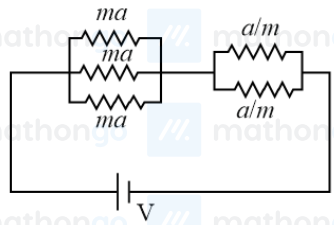
Q24. A particle executes simple harmonic motion. Its amplitude is 8 cm and time period is 6 s. The time it will take to travel from its position of maximum displacement to the point corresponding to half of its amplitude, is _____ s

Q25. A parallel plate capacitor is made up of stair like structure with a plate area A of each stair and that is connected with a wire of length b, as shown in the figure. The capacitance of the arrangement is $\frac{x}{15}\frac{\varepsilon_0 A}{b}$, The value of x is _____ .



Q26. The current density in a cylindrical wire of radius $r = 4.0$ mm is 1.0×10^6 A^2 m^2. The current through the outer portion of the wire between radial distances $\frac{r}{2}$ and r is $x\pi$ A; where x is

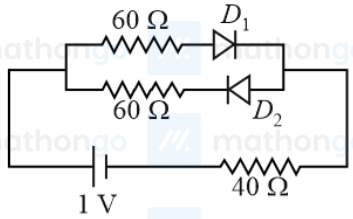
Q27. In the given circuit 'a' is an arbitrary constant. The value of m for which the equivalent circuit resistance is minimum, will be $\sqrt{\frac{x}{2}}$. The value of x is _____ .



Q28. A metallic rod of length 20 cm is placed in North-South direction and is moved at a constant speed of 20 m s^{-1} towards East. The horizontal component of the Earth's magnetic field at that place is 4×10^{-3} T and the angle of dip is 45°. The emf induced in the rod is _____ mV.

Q29. A deuteron and a proton moving with equal kinetic energy enter into to a uniform magnetic field at right angle to the field. If r_d and r_p are the radii of their circular paths respectively, then the ratio $\frac{r_d}{r_p}$ will be $\sqrt{x}:1$ where x is _____ .

Q30. The cut-off voltage of the diodes (shown in figure) in forward bias is 0.6 V. The current through the resister of 40Ω is _____ mA.



Q31. The correct order of ionic size of $N^{3-}, Na^+, F^-, Mg^{2+}$ and O^{2-} is :

(1) $Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$ (2) $N^{3-} < O^{2-} < F < Na^+ < Mg^{2+}$

(3) $F^- < Na^+ < O^{2-} < Mg^{2+} < N^{3-}$ (4) $Na^+ < F^- < Mg^{2+} < O^{2-} < N^{3-}$

Q32. Identify the incorrect statement for PCl_5 from the following.

(1) In this molecule, orbitals of phosphorous are assumed to undergo sp^3d hybridization.

(2) The geometry of PCl_5 is trigonal bipyramidal.

(3) PCl_5 has two axial bonds stronger than three equatorial bonds.

(4) The three equatorial bonds of PCl_5 lie in a plane.

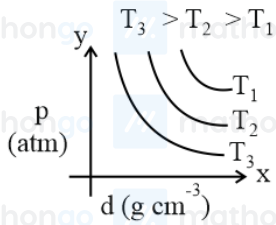
Q33. The correct order of increasing intermolecular hydrogen bond strength is

(1) $HCN < H_2O < NH_3$ (2) $HCN < CH_4 < NH_3$

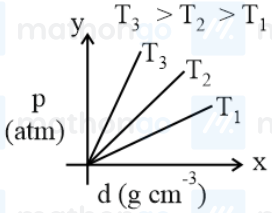
(3) $CH_4 < HCN < NH_3$ (4) $CH_4 < NH_3 < HCN$

Q34. Which amongst the given plots is the correct plot for pressure (p) vs density (d) for an ideal gas?

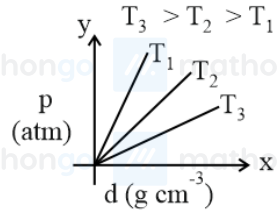
(1)



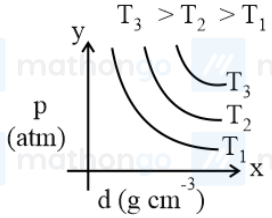
(2)



(3)



(4)

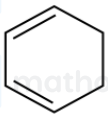


Q35. Which of the following is most stable?

(1) 

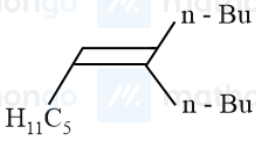
(2) 

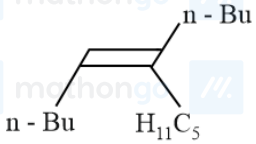
(3) 

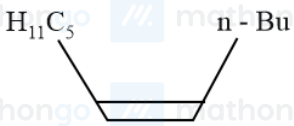
(4) 

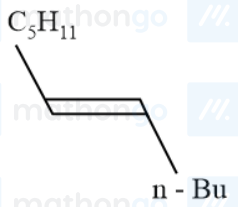
Q36. What will be the major product of following sequence of reactions?

$$\text{n - Bu - } \equiv \xrightarrow[\text{(ii) Lindlar cat, } H_2]{\text{(i) n - BuLi, n - } C_5H_{11}Cl}$$

(1) 

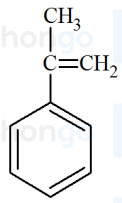
(2) 

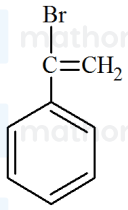
(3) 

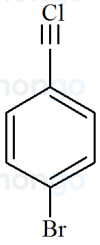
(4) 

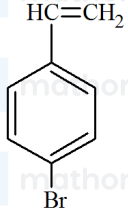
Q37. Product 'A' of following sequence of reactions is

$$\text{Ethylbenzene} \xrightarrow[\text{(b) } Cl_2, \Delta \text{ (c) alc. KOH}]{\text{(a) } Br_2, Fe} \text{'A' (Major product)}$$

(1) 

(2) 

(3) 

(4) 

Q38. In 3 d series, the metal having the highest M^{2+}/M standard electrode potential is

(1) Cr
(2) Fe
(3) Cu
(4) Zn

Q39. Statement I: Leaching of gold with cyanide ion in absence of air / O_2 leads to cyano complex of Au(III).

Statement II: Zinc is oxidized during the displacement reaction carried out for gold extraction.

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

(1) Both Statement 1 and statement 2 are correct

(2) Both Statement 1 and statement 2 are incorrect

(3) Statement 1 is correct but statement 2 is incorrect

(4) Statement 1 is incorrect but statement 2 is correct

Q40. The gas produced by treating an aqueous solution of ammonium chloride with sodium nitrite is

(1) NH_3 (2) N_2

(3) N_2O (4) Cl_2

Q41. Given below are two statements: one is labelled as Assertion and the other is labelled as Reason.

Assertion: Flourine forms one oxoacid.

Reason: Flourine has smallest size amongst all halogens and is highly electronegative.

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

(1) Both assertion and reason are correct and reason is the correct explanation of assertion.

(2) Both assertion and reason are correct and but reason is not the correct explanation of assertion.

(3) Assertion is correct and reason is incorrect

(4) Assertion is incorrect and reason is correct

Q42. On the surface of polar stratospheric clouds, hydrolysis of chlorine nitrate gives A and B while its reaction with HCl produces B and C. A. B and C are, respectively

(1) $HOCl, HNO_3, Cl_2$ (2) $Cl_2, HNO_3, HOCl$

(3) $HClO_2, HNO_2, HOCl$ (4) $HOCl, HNO_2, Cl_2O$

Q43. The 'f' orbitals are half and completely filled, respectively in lanthanide ions [Given : Atomic no. $Eu, 63 : Sm, 62 : Tm, 69; Tb, 65; Yb, 70; Dy, 66$]

(1) Eu^{2+} and Tm^{2+} (2) Sm^{2+} and Tm^{3+}

(3) Tb^{4+} and Yb^{2+} (4) Dy^{3+} and Yb^{3+}

Q44. Arrange the following coordination compounds in the increasing order of magnetic moments. (Atomic numbers: $Mn = 25; Fe = 26$)

A. $[FeF_6]^{3-}$

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

C. $[MnCl_6]^{3-}$ (high spin)

D. $[Mn(CN)_6]^{3-}$

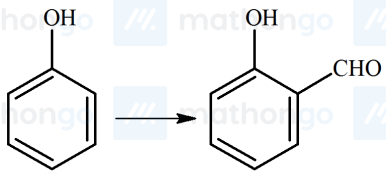
Choose the correct answer from the options given below

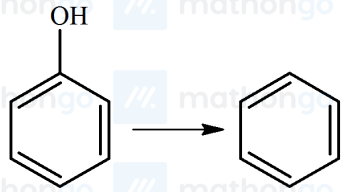
(1) $A < B < D < C$ (2) $B < D < C < A$

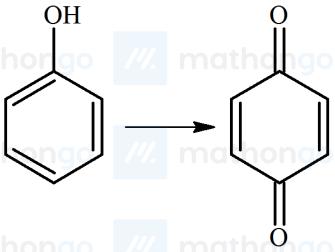
(3) $A < C < D < B$ (4) $B < D < A < C$

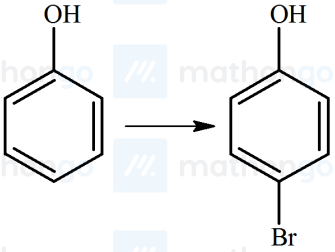
Q45. Match List-I with List-II

List-I **List-II**

A 

B 

C 

D 

I Br_2 in CS_2

II $Na_2Cr_2O_7/H_2SO_4$

III Zn

IV $CHCl_3$ / NaOH

Question: Choose the correct answer from the options given below

(1) A – IV, B – III, C – II, D – I

(2) A – IV, B – III, C – I, D – II

(3) A – II, B – III, C – I, D – IV

(4) A – IV, B – II, C – III, D – I

Q46. Decarboxylation of all six possible forms of diaminobenzoic acids $C_6H_3(NH_2)_2COOH$ yields three products A, B and C. Three acids give a product 'A', two acids gives a product 'B' and one acid give a product 'C'. The melting point of product 'C' is

(1) 63 °C

(2) 90 °C

(3) 104 °C

(4) 142 °C

Q47. Which is true about Buna-N?

(1) It is a linear polymer of 1, 3-butadiene.

(2) It is obtained by copolymerization of 1, 3 - butadiene and styrene.

(3) It is obtained by copolymerization of 1, 3 - butadiene and acrylonitrile.

(4) The suffix N in Buna- N stands for its natural occurrence.

Q48. Match List-I with List-II

	List-I		**List-II**
(A)	Antipyretic	(I)	Reduces pain
(B)	Analgesic	(II)	Reduces stress

(C)	Tranquilizer	(III)	Reduces fever
(D)	Antacid	(IV)	Reduces acidity(stomach)

Choose the correct answer from the options given below

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

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

Q49. Match List I with List II.

	List-I (Anion)		**List-II (gas evolved on reaction with dil. H_2SO_4)**
(A)	CO_3^{2-}	(I)	Colourless gas which turns lead acetate paper black.
(B)	S^{2-}	(II)	Colourless gas which turns acidified potassium dichromate solution green.
(C)	SO_3^{2-}	(III)	Brown fumes which turns acidified KI solution containing starch blue.
(D)	NO_2^-	(IV)	Colourless gas evolved with brisk effervescence, which turns lime water milky.

Choose the correct answer from the options given below

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

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

Q50. Given below are two statements.

Statement I: Maltose has two $\alpha-D-$ glucose units linked at C_1 and C_4 and is a reducing sugar.

Statement II: Maltose has two monosaccharides: α-D-glucose and β-D-glucose linked at C_1 and C_6 and it is a non-reducing sugar.

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

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

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

Q51. 116 g of a substance upon dissociation reaction, yields 7.5 g of hydrogen, 60 g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C are 1, 16 and 12, respectively. The data agrees with how many formulae of the following?

A. CH_3COOH

B. $HCHO$

C. CH_3OOCH_3

D. CH_3CHO

Q52. Consider the following set of quantum numbers.

	n	l	m_l
A	3	3	-3
B	3	2	-2
C	2	1	$+1$
D	2	2	$+2$

The number of correct sets of quantum numbers is

Q53. When 5 moles of He gas expand isothermally and reversibly at 300 K from 10 litre to 20 litre, the magnitude of the maximum work obtained is J. [nearest integer] (Given : $R = 8.3\ J\ K^{-1}\ mol^{-1}$ and $\log 2 = 0.3010$)

Q54. p^H value of $0.001\ M$ NaOH solution is

Q55. BeO reacts with HF in presence of ammonia to give [A] which on thermal decomposition produces [B] and ammonium fluoride. Oxidation state of Be in [A] is

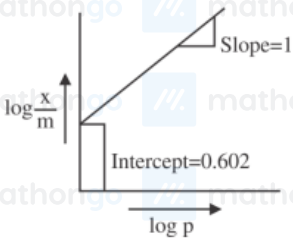
Q56. 0.25 g of an organic compound containing chlorine gave 0.40 g of silver chloride in Carius estimation. The percentage of chlorine present in the compound is [in nearest integer]
(Given: Molar mass of Ag is 108 g mol^{-1} and that of Cl is 35.5 g mol^{-1})

Q57. A solution containing 2.5×10^{-3} kg of a solute dissolved in 75×10^{-3} kg of water boils at 373.535 K. The molar mass of the solute is mol^{-1}. [nearest integer] (Given : $K_b(H_2O) = 0.52\ K\ kg\ mol^{-1}$ and boiling point of water = 373.15 K)

Q58. For the reaction taking place in the cell:
$Pt(s)H_2(g)H^+(aq)\ ||\ Ag^+(aq)|Ag(s)$
$E^{\circ}_{cell} = +0.5332$ V.
The value of $\Delta_f G^{\ominus}$ is $kJmol^{-1}$. (in nearest integer)

Q59. It has been found that for a chemical reaction with rise in temperature by 9 K the rate constant gets doubled. Assuming a reaction to be occurring at 300 K, the value of activation energy is found to be $kJmol^{-1}$. [nearest integer] (Given $\ln 10 = 2.3, R = 8.3\ J\ K^{-1}\ mol^{-1}, \log 2 = 0.30$)

Q60.



If the initial pressure of a gas is 0.03 atm, the mass of the gas adsorbed per gram of the adsorbent is____ $\times 10^{-2}$ g

Q61. The number of points of intersection $|z-(4+3i)| = 2|$ and $|z| + |z-4| = 6, z \in C$ is
(1) 1 (2) 2
(3) 3 (4) 4

Q62. Let for some real numbers α and $\beta, a = \alpha - i\beta$. If the system of equations $4ix + (1+i)y = 0$ and $8\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right)x + \bar{a}y = 0$ has more than one solution then $\frac{\alpha}{\beta}$ is equal to
(1) $2-\sqrt{3}$ (2) $2+\sqrt{3}$
(3) $-2+\sqrt{3}$ (4) $-2-\sqrt{3}$

Q63. Let $S = 2 + \frac{6}{7} + \frac{12}{7^2} + \frac{20}{7^3} + \frac{30}{7^4} + \ldots\ldots$ then $4S$ is equal to

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

Q64. If $a_1, a_2, a_3 \ldots$ and $b_1, b_2, b_3 \ldots$. are A.P. and $a_1 = 2, a_{10} = 3, a_1 b_1 = 1 = a_{10} b_{10}$ then $a_4 b_4$ is equal to
(1) $\frac{28}{27}$ (2) $\frac{28}{24}$
(3) $\frac{23}{26}$ (4) $\frac{22}{23}$

Q65. $\alpha = \sin 36^\circ$ is a root of which of the following equation
(1) $16x^4 - 20x^2 + 5 = 0$ (2) $16x^4 + 20x^2 + 5 = 0$
(3) $10x^4 - 10x^2 - 5 = 0$ (4) $16x^4 - 10x^2 + 5 = 0$

Q66. The set of values of k for which the circle $C : 4x^2 + 4y^2 - 12x + 8y + k = 0$ lies inside the fourth quadrant and the point $\left(1, -\frac{1}{3}\right)$ lies on or inside the circle C is
(1) An empty set (2) $\left(6, \frac{95}{9}\right]$
(3) $\left[\frac{80}{9}, 10\right)$ (4) $\left(9, \frac{92}{9}\right]$

Q67. If the equation of the parabola, whose vertex is at $(5, 4)$ and the directrix is $3x + y - 29 = 0$, is $x^2 + ay^2 + bxy + cx + dy + k = 0$, then $a + b + c + d + k$ is equal to
(1) 575 (2) -575
(3) 576 (4) -576

Q68. Which of the following statement is a tautology?
(1) $((\sim q) \wedge p) \wedge q$ (2) $((\sim q) \wedge p) \wedge (p \wedge (\sim p))$
(3) $((\sim q) \wedge p) \vee (p \vee (\sim p))$ (4) $(p \wedge q) \wedge (\sim(p \wedge q))$

Q69. The mean and variance of the data $4, 5, 6, 6, 7, 8, x, y$ where $x < y$ are 6 and $\frac{9}{4}$ respectively. Then $x^4 + y^2$ is equal to
(1) 320 (2) 420
(3) 162 (4) 674

Q70. Let A and B be two 3×3 matrices such that $AB = I$ and $|A| = \frac{1}{8}$ then $|adj(Badj(2A))|$ is equal to
(1) 128 (2) 32
(3) 64 (4) 102

Q71. Let $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}, a \in R$. Then the sum of the squares of all the values of a for $2f'(10) - f'(5) + 100 = 0$ is
(1) 117 (2) 106
(3) 125 (4) 136

Q72. The value of $\cot\left(\sum_{n=1}^{50} \tan^{-1}\left(\frac{1}{1+n+n^2}\right)\right)$ is
(1) $\frac{25}{26}$ (2) $\frac{50}{51}$
(3) $\frac{26}{25}$ (4) $\frac{52}{51}$

Q73. If m and n respectively are the number of local maximum and local minimum points of the function $f(x)=\int_0^{x^2}\frac{t^2-5t+4}{2+e^t}dt$, then the ordered pair (m,n) is equal to

(1) $(2,3)$ (2) $(3,2)$

(3) $(2,2)$ (4) $(3,4)$

Q74. Let f be a differentiable function in $\left(0,\frac{\pi}{2}\right)$. If $\int_{\cos x}^1 t^2 f(t)dt=\sin^3 x+\cos x$, then $\frac{1}{\sqrt{3}}f'\left(\frac{1}{\sqrt{3}}\right)$ is equal to

(1) $6-9\sqrt{2}$ (2) $6+\frac{9}{\sqrt{2}}$

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

Q75. The integral $\int_0^1\frac{1}{7^{\left[\frac{1}{x}\right]}}dx$, where $[\cdot]$ denotes the greatest integer function, is equal to

(1) $1-6\ln\left(\frac{6}{7}\right)$ (2) $1+6\ln\left(\frac{6}{7}\right)$

(3) $1-7\ln\left(\frac{6}{7}\right)$ (4) $1+7\ln\left(\frac{6}{7}\right)$

Q76. If the solution curve of the differential equation $\left(\left(\tan^{-1}y\right)-x\right)dy=\left(1+y^2\right)dx$ passes through the point $(1,0)$ then the abscissa of the point on the curve whose ordinate is $\tan(1)$ is

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

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

Q77. Let $\vec{a}$ and $\vec{b}$ be the vectors along the diagonal of a parallelogram having area $2\sqrt{2}$. Let the angle between $\vec{a}$ and $\vec{b}$ be acute. $\left|\vec{a}\right|=1$ and $\left|\vec{a}.\vec{b}\right|=\left|\vec{a}\times\vec{b}\right|$. If $\vec{c}=2\sqrt{2}\left(\vec{a}\times\vec{b}\right)-2\vec{b}$, then an angle between $\vec{b}$ and $\vec{c}$ is

(1) $\frac{-\pi}{4}$ (2) $\frac{5\pi}{6}$

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

Q78. Let the foot of the perpendicular from the point $(1,2,4)$ on the line $\frac{x+2}{4}=\frac{y-1}{2}=\frac{z+1}{3}$ be P. Then the distance of P from the plane $3x+4y+12z+23=0$ is

(1) $\frac{50}{13}$ (2) $\frac{63}{13}$

(3) $\frac{65}{13}$ (4) 4

Q79. The shortest distance between the lines $\frac{x-3}{2}=\frac{y-2}{3}=\frac{z-1}{-1}$ and $\frac{x+3}{2}=\frac{y-6}{1}=\frac{z-5}{3}$ is

(1) $\frac{18}{\sqrt{5}}$ (2) $\frac{22}{3\sqrt{5}}$

(3) $\frac{46}{3\sqrt{5}}$ (4) $6\sqrt{3}$

Q80. If a point $A(x,y)$ lies in the region bounded by the y-axis, straight lines $2y+x=6$ and $5x-6y=30$, then the probability that $y<1$ is

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

(3) $\frac{2}{3}$ (4) $\frac{6}{7}$

Q81. Let α,β be the roots of the equation $x^2-4\lambda x+5=0$ and α,γ be the roots of the equation $\mathrm{x}^2-\left(3\sqrt{2}+2\sqrt{3}\right)\mathrm{x}+7+3\lambda\sqrt{3}=0$. If $\beta+\gamma=3\sqrt{2}$, then $(\alpha+2\beta+\gamma)^2$ is equal to

Q82. If the sum of the coefficients of all the positive powers of x, in the binomial expansion of $\left(x^n+\frac{2}{x^5}\right)^7$ is 939, then the sum of all the possible integral values of n is

Q83. Let a circle C of radius 5 lie below the x-axis. The line $L_1 = 4x + 3y + 2$ passes through the centre P of the circle C and intersects the line $L_2 : 3x - 4y - 11 = 0$ at Q. The line L_2 touches C at the point Q. Then the distance of P from the line $5x - 12y + 51 = 0$ is

Q84. Let $[t]$ denote the greatest integer $\leq t$ and $\{t\}$ denote the fractional part of t. Then integral value of α for which the left hand limit of the function $f(x) = [1 + x] + \frac{\alpha^{2[x]+\{x\}}+[x]-1}{2[x]+\{x\}}$ at $x = 0$ is equal to $\alpha - \frac{4}{3}$ is _____

Q85. Let A be a matrix of order 2×2, whose entries are from the set $\{0, 1, 2, 3, 4, 5\}$. If the sum of all the entries of A is a prime number $p, 2 < p < 8$, then the number of such matrices A is

Q86. Let $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Define $f : S \to S$ as $f(n) = \begin{cases} 2n, & \text{if } n = 1, 2, 3, 4, 5 \\ 2n - 11 & \text{if } n = 6, 7, 8, 9, 10 \end{cases}$

Let $g : S \geq S$ be a function such that $\text{fog}(n) = \begin{cases} n + 1 & , \text{ if } n \text{ is odd} \\ n - 1 & , \text{ if } n \text{ is even} \end{cases}$, then

$g(10)(g(1) + g(2) + g(3) + g(4) + g(5))$ is equal to

Q87. If $y(x) = (x^x)^x, x > 0$ then $\frac{d^2x}{dy^2} + 20$ at $x = 1$ is equal to

Q88. If the area of the region $\left\{(x, y) : x^{\frac{2}{3}} + y^{\frac{2}{3}} \leq 1, x + y \geq 0, y \geq 0\right\}$ is A, then $\frac{256\text{A}}{\pi}$ is

Q89. Let $y = y(x)$ be the solution of the differential equation

$\left(1 - x^2\right)dy = \left(xy + \left(x^3 + 2\right)\sqrt{1 - x^2}\right)dx, -1 < x < 1$

and $y(0) = 0$. If $\int_{-\frac{1}{2}}^{\frac{1}{2}} \sqrt{1 - x^2}y(x)dx = k$ then k^{-1} is equal to

Q90. Let $S = \{E, E_2 \ldots E_8\}$ be a sample space of raddom experiment such that $P(E_n) = \frac{n}{36}$ for every $n = 1, 2 \ldots . 8$. Then the number of elements in the set $\left\{A \subset S : P(A) \geq \frac{4}{5}\right\}$ is _____.

ANSWER KEYS

1. (3)	**2.** (3)	**3.** (4)	**4.** (4)	**5.** (3)	**6.** (1)	**7.** (1)	**8.** (2)
9. (1)	**10.** (2)	**11.** (1)	**12.** (3)	**13.** (2)	**14.** (1)	**15.** (3)	**16.** (3)
17. (1)	**18.** (4)	**19.** (2)	**20.** (3)	**21.** (3)	**22.** (3)	**23.** (1400)	**24.** (1)
25. (23)	**26.** (12)	**27.** (3)	**28.** (16)	**29.** (2)	**30.** (4)	**31.** (1)	**32.** (3)
33. (3)	**34.** (2)	**35.** (1)	**36.** (3)	**37.** (4)	**38.** (3)	**39.** (4)	**40.** (2)
41. (1)	**42.** (1)	**43.** (3)	**44.** (2)	**45.** (1)	**46.** (4)	**47.** (3)	**48.** (1)
49. (4)	**50.** (3)	**51.** (2)	**52.** (2)	**53.** (8630)	**54.** (11)	**55.** (2)	**56.** (40)
57. (45)	**58.** (51)	**59.** (59)	**60.** (12)	**61.** (2)	**62.** (1)	**63.** (2)	**64.** (1)
65. (1)	**66.** (4)	**67.** (4)	**68.** (3)	**69.** (1)	**70.** (3)	**71.** (3)	**72.** (3)
73. (1)	**74.** (3)	**75.** (2)	**76.** (2)	**77.** (4)	**78.** (3)	**79.** (1)	**80.** (2)
81. (98)	**82.** (57)	**83.** (11)	**84.** (3)	**85.** (180)	**86.** (190)	**87.** (16)	**88.** (36)
89. (320)	**90.** (19)						