

Q1. Given below are two statements:

Statement (I) : Planck's constant and angular momentum have the same dimensions.

Statement (II) : Linear momentum and moment of force have the same dimensions.

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

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

Q2. Position of an ant (S in metres) moving in Y – Z plane is given by $S = 2t^2\hat{j} + 5\hat{k}$ (where t is in second). The magnitude and direction of velocity of the ant at $t = 1$ s will be :

- | | |
|---|--|
| (1) 16 m s^{-1} in y -direction | (2) 4 m s^{-1} in x -direction |
| (3) 9 m s^{-1} in z -direction | (4) 4 m s^{-1} in y -direction |

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

- | | |
|----------------------|----------------------|
| (1) 6.0 cm | (2) 5.4 cm |
| (3) 4.8 cm | (4) 4.2 cm |

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

- | | |
|-------------|-------------|
| (1) $3 : 5$ | (2) $5 : 4$ |
| (3) $2 : 5$ | (4) $4 : 5$ |

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

- | | |
|---------|---------|
| (1) 6 | (2) 2 |
| (3) 3 | (4) 5 |

Q6. The acceleration due to gravity on the surface of earth is g . If the diameter of earth reduces to half of its original value and mass remains constant, then acceleration due to gravity on the surface of earth would be :

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

Q7. Given below are two statements :

Statement (I) : Viscosity of gases is greater than that of liquids.

Statement (II) : Surface tension of a liquid decreases due to the presence of insoluble impurities.

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

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

Q8. 0.08 kg air is heated at constant volume through 5°C . The specific heat of air at constant volume is $0.17 \text{ kcal kg}^{-1} \text{ }^\circ\text{C}^{-1}$ and $1 \text{ J} = 4.18 \text{ joule cal}^{-1}$. The change in its internal energy is approximately.

- | | |
|---------------------|---------------------|
| (1) 318 J | (2) 298 J |
| (3) 284 J | (4) 142 J |

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

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

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

- (1) $\sqrt{3}$ V (2) $\sqrt{6}$ V
 (3) 0 V (4) 3 V

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

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

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

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

Q15. A plane electromagnetic wave propagating in x -direction is described by

$E_y = (200 \text{ V m}^{-1}) \sin[1.5 \times 10^7 t - 0.05x]$; The intensity of the wave is :

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

- (1) 35.4 W m^{-2} (2) 53.1 W m^{-2}
 (3) 26.6 W m^{-2} (4) 106.2 W m^{-2}

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

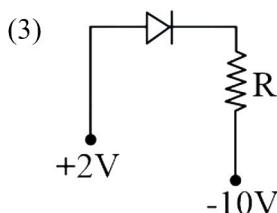
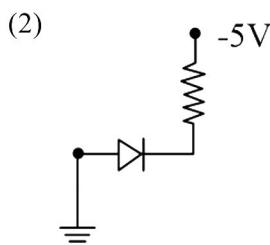
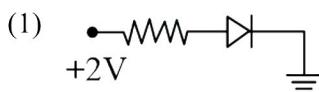
Q17. A convex lens of focal length 40 cm forms an image of an extended source of light on a photoelectric cell. A current I is produced. The lens is replaced by another convex lens having the same diameter but focal length 20 cm. The photoelectric current now is

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

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

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

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



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

- | | |
|--|---|
| (1) Radius of curvature of concave surface | (2) Specific rotation of liquids |
| (3) Thickness of thin plates | (4) Radius of curvature of convex surface |

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

Q22. Four particles, each of mass 1 kg are placed at four corners of a square of side 2 m. The moment of inertia of the system about an axis perpendicular to its plane and passing through one of its vertex is _____ kg m².

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

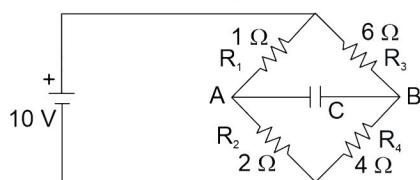
Q24. A particle executes simple harmonic motion with an amplitude of 4 cm. At the mean position, velocity of the particle is 10 cm s^{-1} . The distance of the particle from the mean position when its speed becomes 5 cm s^{-1} is $\sqrt{\alpha}$ cm, where $\alpha =$ _____.

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

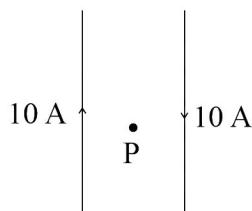
(Given, $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ SI units}$)

Q26. The charge accumulated on the capacitor connected in the following circuit is _____ μC .

(Given $C = 150 \mu\text{F}$)

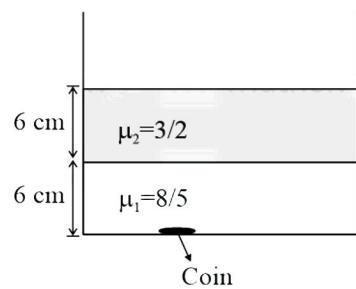


Q27. Two long, straight wires carry equal currents in opposite directions as shown in figure. The separation between the wires is 5.0 cm. The magnitude of the magnetic field at a point P midway between the wires is _____ μT . (Given: $\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$)



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

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



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

Q31. The electronic configuration for Neodymium is:

[Atomic Number for Neodymium 60]

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

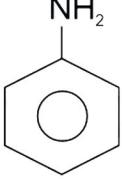
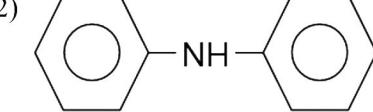
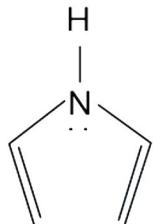
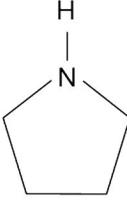
Q32. Which of the following electronic configuration would be associated with the highest magnetic moment?

- (1) $[\text{Ar}] 3d^7$
 (3) $[\text{Ar}] 3d^3$
- (2) $[\text{Ar}] 3d^8$
 (4) $[\text{Ar}] 3d^6$

Q33. Choose the polar molecule from the following :

- (1) CCl_4
 (3) $\text{CH}_2 = \text{CH}_2$
- (2) CO_2
 (4) CHCl_3

Q34. Which of the following is strongest Bronsted base?

- (1) 
- (2) 
- (3) 
- (4) 

Q35. Given below are two statements :

Statement (I) : Aqueous solution of ammonium carbonate is basic.

Statement (II) : Acidic/basic nature of salt solution of a salt of weak acid and weak base depends on K_a and K_b value of acid and the base forming it.

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

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

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

Assertion (A) : Melting point of Boron (2453 K) is unusually high in group 13 elements.

Reason (R) : Solid Boron has very strong crystalline lattice.

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

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

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

- (1) 1 - Ethyl - 5, 5 - dimethylcyclohexane
 (3) 1 - Ethyl - 3, 3 - dimethylcyclohexane

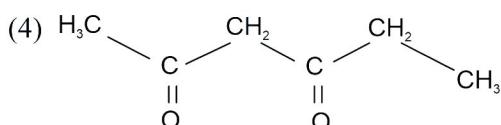
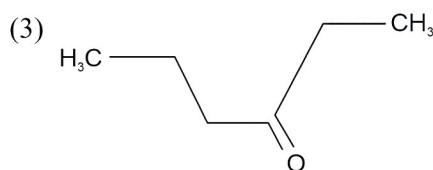
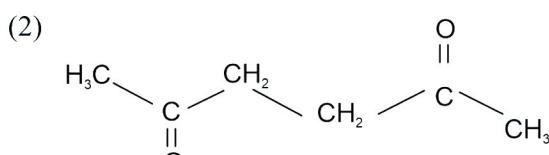
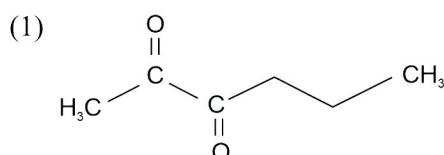
- (2) 3 – Ethyl – 1, 1 – dimethylcyclohexane
 (4) 1, 1 – Dimethyl – 3 – ethylcyclohexane

Q38.



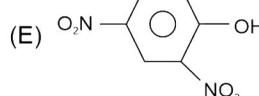
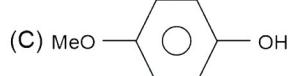
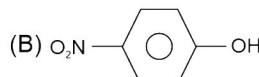
Cyclohexene is a type of an organic compound.

Q39. Which of the following has highly acidic hydrogen?



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

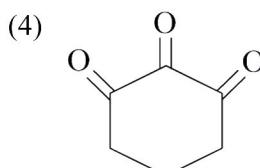
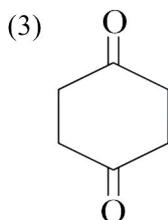
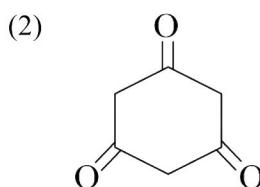
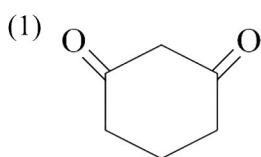
- (A) Bu - OH



Choose the correct answer from the options given below :

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

Q41. Highest enol content will be shown by :



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

- | | |
|--|--|
| (1) increased vapour pressure, increased boiling point | (2) increased vapour pressure, decreased boiling point |
| (3) decreased vapour pressure, decreased boiling point | (4) decreased vapour pressure, increased boiling point |

Q43. Element not showing variable oxidation state is :

- | | |
|--------------|--------------|
| (1) Bromine | (2) Iodine |
| (3) Chlorine | (4) Fluorine |

Q44. NaCl reacts with conc. H₂SO₄ and K₂Cr₂O₇ to give reddish fumes (B), which react with NaOH to give yellow solution (C). (B) and (C) respectively are ;

- | | |
|---|---|
| (1) CrO ₂ Cl ₂ , Na ₂ CrO ₄ | (2) Na ₂ CrO ₄ , CrO ₂ Cl ₂ |
| (3) CrO ₂ Cl ₂ , KHSO ₄ | (4) CrO ₂ Cl ₂ , Na ₂ Cr ₂ O ₇ |

Q45. Given below are two statements :

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

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

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

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

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

- | | |
|---|---|
| (1) Tetraanionic complex with coordination number six | (2) Neutral complex with coordination number four |
| (3) Dianionic complex with coordination number six | (4) Dianionic complex with coordination number four |

Q47. Consider the following complex ions

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

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

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

Q48. The correct statement regarding nucleophilic substitution reaction in a chiral alkyl halide is ;

- (1) Retention occurs in S_N1 reaction and inversion occurs in S_N2 reaction. (2) Racemisation occurs in S_N1 reaction and retention occurs in S_N2 reaction.
 (3) Racemisation occurs in both S_N1 and S_N2 reactions. (4) Racemisation occurs in S_N1 reaction and inversion occurs in S_N2 reaction.

Q49. Given below are two statements :

Statement (I) : p-nitrophenol is more acidic than m-nitrophenol and o-nitrophenol.

Statement (II) : Ethanol will give immediate turbidity with Lucas reagent.

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

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

Q50. Two nucleotides are joined together by a linkage known as :

- (1) Phosphodiester linkage (2) Glycosidic linkage
 (3) Disulphide linkage (4) Peptide linkage

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

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

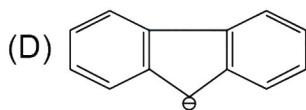
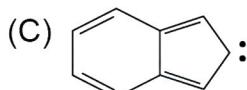
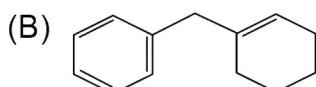
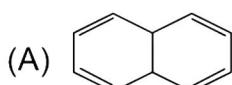
Q53. Sum of bond order of CO and NO^+ is

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

Q55. Among the following, total number of meta directing functional groups is (Integer based)

$-\text{OCH}_3, -\text{NO}_2, -\text{CN}, -\text{CH}_3 - \text{NHCOCH}_3, -\text{COR}, -\text{OH}, -\text{COOH}, -\text{Cl}$

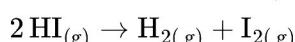
Q56. Among the given organic compounds, the total number of aromatic compounds is



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

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

Q59. Consider the following data for the given reaction



| | | | |
|----------------------------|-------|------|------|
| HI (mol L^{-1}) | 0.005 | 0.01 | 0.02 |
|----------------------------|-------|------|------|

| | | | |
|---|----------------------|----------------------|----------------------|
| Rate ($\text{mol L}^{-1} \text{ s}^{-1}$) | 7.5×10^{-4} | 3.0×10^{-3} | 1.2×10^{-2} |
|---|----------------------|----------------------|----------------------|

The order of the reaction is _____.

Q60. From the given list, the number of compounds with +4 oxidation state of Sulphur
 $\text{SO}_3, \text{H}_2\text{SO}_3, \text{SOCl}_2, \text{SF}_4, \text{BaSO}_4, \text{H}_2\text{S}_2\text{O}_7$

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

- | | |
|-------|-------|
| (1) 1 | (2) 0 |
| (3) 3 | (4) 2 |

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

- | | |
|-------|-------|
| (1) 9 | (2) 5 |
| (3) 7 | (4) 8 |

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

- | | |
|---------------|--------------|
| (1) $A = B^3$ | (2) $3A = B$ |
| (3) $B = A^3$ | (4) $A = 3B$ |

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

- | | |
|---------------------------------|------------------------------------|
| (1) $2\sqrt{2} < k \leq 3$ | (2) $2\sqrt{3} < k \leq 3\sqrt{2}$ |
| (3) $2\sqrt{3} < k < 3\sqrt{3}$ | (4) $2\sqrt{2} < k < 2\sqrt{3}$ |

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

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

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

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

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

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

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

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

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

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

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

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

Q71. Let $S = \{1, 2, 3, \dots, 10\}$. Suppose M is the set of all the subsets of S , then the relation

- $R = \{(A, B) : A \cap B \neq \emptyset; A, B \in M\}$ is :
- | | |
|-----------------------------------|--------------------|
| (1) symmetric and reflexive only | (2) reflexive only |
| (3) symmetric and transitive only | (4) symmetric only |

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

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

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

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

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

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

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

974.

Consider the function $f(x) = \begin{cases} b|x^2 - 7x + 12| & , x < 3 \\ 2^{\frac{\sin(x-3)}{x-[x]}} & , x > 3 \\ b & , x = 3 \end{cases}$, where $[x]$ denotes the greatest integer less than or equal

to x . If S denotes the set of all ordered pairs (a, b) such that $f(x)$ is continuous at $x = 3$, then the number of elements in S is :

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

Q76. If (a, b) be the orthocentre of the triangle whose vertices are $(1, 2)$, $(2, 3)$ and $(3, 1)$, and

$$I_1 = \int_a^b x \sin(4x - x^2) dx, I_2 = \int_a^b \sin(4x - x^2) dx, \text{ then } 36 \frac{I_1}{I_2} \text{ is equal to :}$$

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

- (1) $\log_{\frac{2}{3}} 2$ (2) $\log_4 3$
(3) $\log_3 4$ (4) $\log_{\frac{4}{3}} 2$

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

$\vec{a} \cdot \left((\vec{c} \times \vec{b}) - \vec{b} - \vec{c} \right)$ is equal to

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

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

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

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

Q83. Let the set of all $a \in R$ such that the equation $\cos 2x + a \sin x = 2a - 7$ has a solution be $[p, q]$ and

$$r = \tan 9^\circ - \tan 27^\circ - \frac{1}{\cot 63^\circ} + \tan 81^\circ, \text{ then } pqr \text{ is equal to } \underline{\hspace{2cm}}.$$

Q84.

Let $A = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$, $B = [B_1 \ B_2 \ B_3]$, where B_1, B_2, B_3 are column matrices, and $AB_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$,

$$\begin{aligned} AB_2 &= \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}, \quad AB_3 = \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix} \end{aligned}$$

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

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

Q86. Let for a differentiable function $f : (0, \infty) \rightarrow R$, $f(x) - f(y) \geq \log_e\left(\frac{x}{y}\right) + x - y, \forall x, y \in (0, \infty)$. Then

$$\sum_{n=1}^{20} f'\left(\frac{1}{n^2}\right) \text{ is equal to } \underline{\hspace{2cm}}$$

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

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

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

Q90. A fair die is tossed repeatedly until a six is obtained. Let X denote the number of tosses required and let

$$a = P(X = 3), b = P(X \geq 3) \text{ and } c = P(X \geq 6 \mid X > 3). \text{ Then } \frac{b+c}{a} \text{ is equal to } \underline{\hspace{2cm}}$$

ANSWER KEYS

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