JEE Main 2023 (24 Jan Shift 1) Question Paper

Physics Questions

Q1. hello dummy text

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

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

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

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

Q2. The maximum vertical height to which a man can throw a ball is 136 m. The maximum horizontal distance upto which he can throw the same ball is

(1) 192 m

(2) 136 m

(3) 272 m

(4) 68 m

Q3. As per given figure, a weightless pulley P is attached on a double inclined frictionless surface. The tension in the string (massless) will be (if $g = 10\ m/s^2$)

(1) $4\sqrt{3} + 1$ N

(2) $4\sqrt{3} + 1$ N

(3) $4\sqrt{3} - 1$ N

(4) $4\sqrt{3} - 1$ N

Q4. Given below are two statements:

Statement I: An elevator can go up or down with uniform speed when its weight is balanced with the tension of its cable.

Statement II: Force exerted by the floor of an elevator on the foot of a person standing on it is more than his/her weight when the elevator goes down with increasing speed.

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

(1) Both Statement I and Statement II are false

(2) Statement I is true but Statement II is false

(3) Both Statement I and Statement II are true

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

Q5. The weight of a body at the surface of earth is 18 N. The weight of the body at an altitude of 3200 km above the earth's surface is (given, radius of earth $R_e = 6400$ km)

(1) 9.8 N

(2) 4.9 N

(3) 19.6 N

(4) 8 N

Q6. A 100 m long wire having cross-sectional area 6.25×10^{-4} m² and Young's modulus is 10^{10} N/m² is subjected to a load of 250 N, then the elongation in the wire will be:

(1) 6.25×10^{-3} m

(2) 4×10^{-4} m

(3) 6.25×10^{-6} m

(4) 4×10^{-3} m

Q7. 1 g of a liquid is converted to vapour at 3×10^5 Pa pressure. If 10% of the heat supplied is used for increasing the volume by 1600 cm³ during this phase change, then the increase in internal energy in the process will be:

(1) 4320 J

(2) 432000 J

(3) 4800 J

(4) 4.32×10^8 J

Q8. Given below are two statements:

Statement I: The temperature of a gas is -73 °C. When the gas is heated to 527 °C, the root mean square speed of the molecules is doubled.

Statement II: The product of pressure and volume of an ideal gas will be equal to translational kinetic energy of the molecules.

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 true but Statement II is false

(3) Both Statement I and Statement II are false

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

Q9. A travelling wave is described by the equation $y(x,t) = 0.05 \sin(8x - 4t)$ m. The velocity of the wave is:

[All the quantities are in SI unit]

(1) 4 m/s

(2) 2 m/s

(3) 0.5 m/s

(4) 8 m/s

Q10. If two charges q_1 and q_2 are separated with distance d and placed in a medium of dielectric constant k. What will be the equivalent distance between charges in air for the same electrostatic force?

(1) $d\sqrt{k}$

(2) $k\sqrt{d}$

(3) $1.5d\sqrt{k}$

(4) $2d\sqrt{k}$

Q11. As shown in the figure, a network of resistors is connected to a battery of 24 V with an internal resistance of 3 Ω. The currents through the resistors R_4 and R_5 are I_4 and I_5 respectively. The values of I_4 and I_5 are:

$R_1 = 2\Omega$, $R_4 = 20\Omega$, $R_5 = 5\Omega$, $R_6 = 2\Omega$, $R_7 = 2\Omega$, $R_8 = 5\Omega$

(1) $I_4 = 8/5$ A and $I_5 = 2/5$ A

(2) $I_4 = 24/5$ A and $I_5 = 6/5$ A

(3) $I_4 = 8/5$ A and $I_5 = 24/5$ A

(4) $I_4 = 2/5$ A and $I_5 = 8/5$ A

Q12. Two long straight wires P and Q carrying equal current 10 A each were kept parallel to each other at 5 cm distance. Magnitude of magnetic force experienced by 10 cm length of wire P is F_1. If distance between wires is halved and currents on them are doubled, force F_2 on 10 cm length of wire P will be:

(1) $8F_1$

(2) $10F_1$

(3) $F_1/8$

(4) $F_1/10$

Q13. A circular loop of radius R is carrying current i A. The ratio of magnetic field at the centre of circular loop and at a distance R from the center of the loop on its axis is:

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

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

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

(4) $1:\sqrt{2}$

Q14. A conducting loop of radius $10/\sqrt{\pi}$ cm is placed perpendicular to a uniform magnetic field of 0.5 T. The magnetic field is decreased to zero in 0.5 s at a steady rate. The induced emf in the circular loop at 0.25 s is:

(1) emf = 1mV

(2) emf = 10mV

(3) emf = 100mV

(4) emf = 5mV

Q15. If E and K represent electric field and propagation vectors of the EM waves in vacuum, then magnetic field vector is given by: (ω - angular frequency)

(1) $(1/\omega)K \times E$

(2) $\omega E \times K$

(3) $\omega K \times E$

(4) $K \times E$

Q16. Given below are two statements:

Statement I: If the Brewster's angle for the light propagating from air to glass is θ_B, then Brewster's angle for the light propagating from glass to air is $\pi/2 - \theta_B$.

Statement II: The Brewster's angle for the light propagating from glass to air is $\tan^{-1}(\mu_g)$, where μ_g is the refractive index of glass.

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

(1) Both Statements I and Statement II are true.

(2) Statement I is true but Statement II is false.

(3) Both Statement I and Statement II are false.

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

Q17. From the photoelectric effect experiment, following observations are made. Identify which of these are correct

A. The stopping potential depends only on the work function of the metal.

B. The saturation current increases as the intensity of incident light increases.

C. The maximum kinetic energy of a photo electron depends on the intensity of the incident light.

D. Photoelectric effect can be explained using wave theory of light.

Choose the correct answer from the options given below:

(1) B, C only

(2) A, C, D only

(3) B only

(4) A, B, D only

Q18. Consider the following radioactive decay process:

$^{218}_{84}A \rightarrow A_1 \rightarrow A_2 \rightarrow A_3 \rightarrow A_4 \rightarrow A_5 \rightarrow A_6$

The mass number and the atomic number of A_6 are given by:

(1) 210 and 82

(2) 210 and 84

(3) 210 and 80

(4) 211 and 80

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

Assertion A: Photodiodes are preferably operated in reverse bias condition for light intensity measurement.

Reason R: The current in the forward bias is more than the current in the reverse bias for a p-n junction diode.

In the light of the above statement, choose the correct 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

Q20. A modulating signal is a square wave, as shown in the figure. If the carrier wave is given as $c(t) = 2\sin(8\pi t)$ volts, the modulation index is:

(1) 1/4

(2) 1/2

(3) 1/3

(4) 1/2

Chemistry Questions

Q32. Decreasing order of the hydrogen bonding in following forms of water is correctly represented by

A. Liquid water

B. Ice

C. Impure water

(1) A = B > C

(2) B > A > C

(3) C > B > A

(4) A > B > C

Q33. Order of Covalent bond;

A. KF > KI; LiF > KF

B. KF < KI; LiF > KF

C. $SnCl_4 > SnCl_2$; CuCl > NaCl

D. LiF > KF; CuCl > NaCl

E. KF < KI; CuCl > NaCl

(1) C, E Only

(2) B, C Only

(3) B, C, E Only

(4) A, B Only

Q34. Match Column I with Column II

Column I

A. Soda ash

B. Chlorophyll

C. Used in Whitewashing

D. Dentistry, ornamental work

Column II

I. $CaSO_4$

II. $Ca(OH)_2$

III. Na_2CO_3

IV. Mg^{2+} ions

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

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

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

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

Q35. Reaction of BeO with ammonia and hydrogen fluoride gives 'A' which on thermal decomposition gives BeF_2 and NH_4F. What is 'A'?

(1) H_3NBeF_3

(2) $(NH_4)_2BeF_4$

(3) NH_4BeF_3

(4) $(NH_4)_2Be_2F_6$

Q36. Increasing order of stability of the resonance structure is:

A. [Structure A]

B. [Structure B]

C. [Structure C]

D. [Structure D]

(1) C, D, B, A

(2) C, A, B, D

(3) D, C, A, B

(4) D, C, B, A

Q37. Which of the following is true about freons?

(1) These are chlorofluorocarbon compounds

(2) These are chemicals causing skin cancer

(3) These are radicals of chlorine and chlorine monoxide

(4) All radicals are called freons

Q38. In the depression of freezing point experiment

A. Vapour pressure of the solution is less than that of pure solvent

B. Vapour pressure of the solution is more than that of pure solvent

C. Only solute molecules solidify at the freezing point

D. Only solvent molecules solidify at the freezing point

(1) A and D only

(2) B and C only

(3) A and C only

(4) A only

Q39. Statement I: For colloidal particles, the values of colligative properties are of small order as compared to values shown by true solutions at same concentration.

Statement II: For colloidal particles, the potential difference between the fixed layer and the diffused layer of same charges is called the electrokinetic potential or zeta potential.

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

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

(2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Q40. Match List I with List II.

List I

A. Reverberatory furnace

B. Electrolytic cell

C. Blast furnace

D. Zone refining furnace

List II

I. Pig iron

II. Aluminium

III. Silicon

IV. Copper

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

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

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

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

Q41. An ammoniacal metal salt solution gives a brilliant red precipitate on addition of dimethylglyoxime. The metal ion is:

(1) Cu^{2+}

(2) Ni^{2+}

(3) Fe^{2+}

(4) Co^{2+}

Q42. Which of the Phosphorus oxoacid can create silver mirror from $AgNO_3$ solution?

(1) HPO_3

(2) $H_4P_2O_5$

(3) $H_4P_2O_6$

(4) $H_4P_2O_7$

Q43. The magnetic moment of a transition metal compound has been calculated to be 3.87 BM. The metal ion is

(1) Cr^{2+}

(2) Mn^{2+}

(3) V^{2+}

(4) Ti^{2+}

Q44. The primary and secondary valencies of cobalt respectively in $Co(NH_3)_5ClCl_2$ are:

(1) 3 and 5

(2) 2 and 6

(3) 2 and 8

(4) 3 and 6

Q45. Assertion A: Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI, the rate of hydrolysis increases.

Reason R: I^- is a good nucleophile as well as a good leaving group.

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

(1) A is false but R is true

(2) A is true but R is false

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

(4) Both A and R are true and R is not the correct explanation of A

Q46. In the following given reaction 'A' is

$CH_3C{=}CH_2 + HBr \rightarrow$ 'A' (major product)

(1) CH_3CBrCH_3

(2) $CH_3CH_2CH_2Br$

(3) $CH_3CHBrCH_3$

(4) $CH_3CBr_2CH_3$

Q47. A' and 'B' formed in the following set of reactions are:

$OH\text{-}CH_2OH + HBr \rightarrow A$

$O\text{-}CH_2OH + HBr \rightarrow B$

(1) A = [Structure 1], B = [Structure 2]

(2) A = [Structure 3], B = [Structure 4]

(3) A = [Structure 5], B = [Structure 6]

(4) A = [Structure 7], B = [Structure 8]

Q48. 'R' formed in the following sequence of reaction is:

$NaCN/HOAc \rightarrow$ 'P' $\rightarrow EtOH/H^+ \rightarrow$ 'Q' $\rightarrow$ (i) 2MeMgBr (ii) $H_3O^+ \rightarrow$ 'R' (major product)

(1) [Structure 1]

(2) [Structure 2]

(3) [Structure 3]

(4) [Structure 4]

Q49. Compound X undergoes following sequence of reactions to give the Lactone Y.

(1) [Structure 1]

(2) [Structure 2]

(3) [Structure 3]

(4) [Structure 4]

Q50. Given below are two statements:

Statement I: Noradrenaline is a neurotransmitter.

Statement II: Low level of noradrenaline is not the cause of depression in human.

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

(1) Both statement 1 and 2 are correct.

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

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

(4) Both statement 1 and 2 are correct

Mathematics Questions

Q61. Let p, q ∈ R and $(1 - \sqrt{3}i)^{200} = 2^{199}(p + iq)$, $i = \sqrt{-1}$. Then, $p + q + q^2$ and $p - q + q^2$ are roots of the equation.

(1) $x^2 + 4x - 1 = 0$

(2) $x^2 - 4x + 1 = 0$

(3) $x^2 + 4x + 1 = 0$

(4) $x^2 - 4x - 1 = 0$

Q62. For three positive integers p, q, r, x^(pq²) = y^(qr) = z^(p²r) and r = pq + 1 such that 3, 3log_yx, 3log_zy, 7log_xz are in A.P. with common difference 1/2. The r - p - q is equal to

(1) 2

(2) 6

(3) 12

(4) -6

Q63. The value of $\sum_{r=0}^{22} {}^{23}C_r$ is

(1) ${}^{45}C_{23}$

(2) ${}^{44}C_{23}$

(3) ${}^{45}C_{24}$

(4) ${}^{44}C_{22}$

Q64. Let a tangent to the curve $y^2 = 24x$ meet the curve xy = 2 at the points A and B. Then the midpoints of such line segments AB lie on a parabola with the

(1) directrix 4x = 3

(2) directrix 4x = -3

(3) Length of latus rectum 3/2

(4) Length of latus rectum 2

Q65. $\lim_{t\to 0} [1/\sin^2 t + 1/(2\sin^2 t) + 1/(3\sin^2 t) + ... + 1/(n\sin^2 t)]$ is equal to

(1) $n^2 + n$

(2) n

(3) (n+1)/2

(4) n^2

Q66. The compound statement $(\neg(P \wedge Q)) \vee ((\neg P) \wedge Q) \Rightarrow ((\neg P) \wedge (\neg Q))$ is equivalent to

(1) $((\neg P) \vee Q) \wedge ((\neg Q) \vee P)$

(2) $(\neg Q) \vee P$

(3) $((\neg P) \vee Q) \wedge (\neg Q)$

(4) $(\neg P) \vee Q$

Q67. The relation $R = \{(a, b): \gcd(a, b) = 1, 2a \neq b, a, b \in Z\}$ is:

(1) transitive but not reflexive

(2) symmetric but not transitive

(3) reflexive but not symmetric

(4) neither symmetric nor transitive

Q68. If A and B are two non-zero $n \times n$ matrices such that $A^2 + B = A^2B$, then

(1) $AB = I$

(2) $A^2B = I$

(3) $A^2 = I$ or $B = I$

(4) $A^2B = BA^2$

Q69. Let N denote the number that turns up when a fair die is rolled. If the probability that the system of equations

$x + y + z = 1$

$2x + Ny + 2z = 2$

$3x + 3y + Nz = 3$

has unique solution is $k/6$, then the sum of value of k and all possible values of N is

(1) 18

(2) 19

(3) 20

(4) 21

Q70. Let α be a root of the equation $(a - c)x^2 + (b - a)x + (c - b) = 0$ where a, b, c are distinct real numbers such that the matrix $[\alpha^2\ \alpha\ 1; 1\ 1\ 1; a\ b\ c]$ is singular. Then the value of $(a-c)^2/((b-a)(c-b)) + (b-a)^2/((a-c)(b-a)) + (c-b)^2/((a-c)(b-a))$ is

(1) 6

(2) 3

(3) 9

(4) 12

Q71. $\tan^{-1}((1+\sqrt{3})/(3+\sqrt{3})) + \sec^{-1}((8+4\sqrt{3})/(6+3\sqrt{3})) =$

(1) $\pi/4$

(2) $\pi/2$

(3) $\pi/3$

(4) $\pi/6$

Q72. The equation $x^2 - 4x + [x] + 3 = x[x]$, where $[x]$ denotes the greatest integer function, has:

(1) exactly two solutions in $(-\infty, \infty)$

(2) no solution

(3) a unique solution in $(-\infty, 1)$

(4) a unique solution in $(-\infty, \infty)$

Q73. Let $f(x) = \{0; x=0, x^2\sin(1/x); x\neq 0\}$ then at $x = 0$

(1) f is continuous but not differentiable

(2) f is continuous but f' is not continuous

(3) both f and f' are continuous

(4) f' is continuous but not differentiable

Q74. The area enclosed between the curves $y^2 + 4x = 4$ and $y - 2x = 2$ is

(1) 25/3

(2) 22/3

(3) 9

(4) 23/3

Q75. Let $y = y(x)$ be the solution of the differential equation $x^3dy + (xy - 1)dx = 0$, $x > 0$, $y(1/2) = 3 - e$. Then $y(1)$ is equal to

(1) 1

(2) e

(3) 2 - e

(4) 3

Q76. Let $u = i - j + 2k$, $v = 2i + j - k$, $v\cdot w = 2$ and $v \times w = u + \lambda v$, then $u\cdot w$ is equal to

(1) 1

(2) 3/2

(3) 2

(4) 2/3

Q77. Let PQR be a triangle. The points A, B and C are on the sides QR, RP and PQ respectively such that $QA/AR = RB/BP = PC/CQ = 1/2$. Then (Area ΔPQR)/(Area ΔABC) is equal to

(1) 4

(2) 1

(3) 2

(4) 5/2

Q78. The distance of the point (7, -3, -4) from the plane containing the points (2, -3, 1), (-1, 1, -2) and (3, -4, 2) is equal to:

(1) 4

(2) 5

(3) $5\sqrt{2}$

(4) $4\sqrt{2}$

Q79. The distance of the point (-1, 9, -16) from the plane $2x + 3y - z = 5$ measure parallel to the line $(x+4)/3 = (2-y)/4 = (z-3)/12$ is

(1) $13\sqrt{2}$

(2) 31

(3) 26

(4) $20\sqrt{3}$

Q80. Let Ω be the sample space and $A \subseteq \Omega$ be an event. Given below are two statements:

(S1): If $P(A) = 0$, then $A = \varphi$

(S2): If $P(A) = 1$, then $A = \Omega$

Then

(1) only (S1) is true

(2) only (S2) is true

(3) both (S1) and (S2) are true

(4) both (S1) and (S2) are false

Numerical Answer Questions

Q21. Vectors $a(i + bj + k)$ and $2i - 3j + 4k$ are perpendicular to each other when $3a + 2b = 7$, the ratio of a to b is x/2. The value of x is _____.

Q22. A spherical body of mass 2 kg starting from rest acquires a kinetic energy of 10000 J at the end of 5th second. The force acted on the body is _____ N.

Q23. Solid sphere A is rotating about an axis PQ. If the radius of the sphere is 5 cm, then its radius of gyration about PQ will be $\sqrt{x}$ cm. The value of x is _____.

Q24. A hole is drilled in a metal sheet. At 27 °C, the diameter of hole is 5 cm. When the sheet is heated to 177 °C, the change in the diameter of hole is $d \times 10^{-3}$ cm. The value of d will be _____, if coefficient of linear expansion of the metal is 1.6×10^{-5}/°C.

Q25. A block of mass 2 kg is attached with two identical springs of spring constant 20 N/m each. The block is placed on a frictionless surface and the ends of the springs are attached to rigid supports. When the mass is displaced from its equilibrium position, it executes a simple harmonic motion. The time period of oscillation is $\pi/\sqrt{x}$ in SI unit. The value of

x is _____.

Q26. A stream of a positively charged particles having q/m = 2×10^{11} C/kg and velocity $v_0 = 3 \times 10^7$ i m/s is deflected by an electric field 1.8 i kV/m. The electric field exists in a region of 10 cm along x direction. Due to the electric field, the deflection of the charge particles in the y direction is _____ mm.

Q27. A hollow cylindrical conductor has length of 3.14 m, while its inner and outer diameters are 4 mm and 8 mm respectively. The resistance of the conductor is n $\times 10^{-3}$ Ω. If the resistivity of the material is 2.4×10^{-8} Ωm. The value of n is _____.

Q28. In the circuit shown in the figure, the ratio of the quality factor and the band width is _____ s.

Q29. As shown in the figure, a combination of a thin plano-concave lens and a thin plano-convex lens is used to image an object placed at infinity. The radius of curvature of both the lenses is 30 cm and refraction index of the material for both the lenses is 1.75. Both the lenses are placed at distance of 40 cm from each other. Due to the combination, the image of the object is formed at distance x = _____ cm, from concave lens.

Q30. Assume that protons and neutrons have equal masses. Mass of a nucleon is 1.6×10^{-27} kg and radius of nucleus is 1.5×10^{-15} A^(1/3) m. The approximate ratio of the nuclear density and water density is n $\times 10^{13}$. The value of n is _____.

Q31. It is observed that characteristic X-ray spectra of elements show regularity. When frequency to the power 'n' i.e. v^n of X-rays emitted is plotted against atomic number Z, the following graph is obtained. The value of 'n' is _____.

Q51. If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____ nm. (Nearest integer)

Q52. For independent process at 300 K.

Process | ΔH / kJmol^{-1} | ΔS / JK^{-1}

A | -25 | -80

B | -22 | 40

C | 25 | -50

D | 22 | 20

The number of non-spontaneous process from the following is _____.

Q53. The dissociation constant of acetic is x $\times 10^{-5}$. When 25 mL of 0.2 M CH_3COONa solution is mixed with 25 mL of 0.02 M CH_3COOH solution, the pH of the resultant solution is found to be equal to 5. The value of x is _____.

Q54. Uracil is base present in RNA with the following structure. % of N in uracil is _____.

Q55. When $Fe_{0.93}O$ is heated in presence of oxygen, it converts to Fe_2O_3. The number of correct statement/s from the following is _____.

A. The equivalent weight of $Fe_{0.93}O$ is _____.

B. The number of moles of Fe^{2+} and Fe^{3+} in 1 mole of $Fe_{0.93}O$ is 0.79 and 0.14 respectively.

C. $Fe_{0.93}O$ is metal deficient with lattice comprising of cubic closed packed arrangement of O^{2-} ions.

D. The % composition of Fe^{2+} and Fe^{3+} in $Fe_{0.93}O$ is 85% and 15% respectively.

Q56. 5 g of NaOH was dissolved in deionized water to prepare a 450 mL stock solution. What volume (in mL) of this solution would be required to prepare 500 mL of 0.1 M solution? Given: Molar Mass of Na, O and H is 23, 16 and 1 g mol^{-1} respectively.

Q57. At 298 K, a 1 litre solution containing 10 mmol of $Cr_2O_7^{2-}$ and 100 mmol of Cr^{3+} shows a pH of 3.0. Given: $Cr_2O_7^{2-} \rightarrow Cr^{3+}$; $E^0 = 1.330$ V and 2.303RT/F = 0.059 V. The potential for the half cell reaction is $x \times 10^{-3}$ V. The value of x is _____.

Q58. The number of correct statement/s from the following is _____.

A. Larger the activation energy, smaller is the value of the rate constant.

B. The higher is the activation energy, higher is the value of the temperature coefficient.

C. At lower temperatures, increase in temperature causes more change in the value of k than at higher temperature.

D. A plot of ln k vs 1/T is a straight line with slope equal to $-E_a/R$.

Q59. The d-electronic configuration of $CoCl_4^{2-}$ in tetrahedral crystal field is e^m t_2^n. The sum of m and number of unpaired electrons is _____.

Q60. Number of moles of AgCl formed in the following reaction is _____.

Q81. Let $\lambda \in R$ and let the equation E be $|x|^2 - 2|x| + |\lambda - 3| = 0$. Then the largest element in the set $S = \{x + \lambda : x$ is an integer solution of E$\}$ is _____.

Q82. A boy needs to select five courses from 12 available courses, out of which 5 courses are language courses. If he can choose at most two language courses, then the number of ways he can choose five courses is _____.

Q83. The number of 9 digit numbers, that can be formed using all the digits of the number 123412341 so that the even digits occupy only even places, is _____.

Q84. The 4th term of GP is 500 and its common ratio is 1/m, $m \in N$. Let S_n denote the sum of the first n terms of this GP. If $S_6 > S_5 + 1$ and $S_7 < S_6 + 1/2$, then the number of possible values of m is _____.

Q85. Suppose $\sum_{r=0}^{2023} r^2 \cdot {}^{2023}C_r = 2023 \times \alpha \times 2^{2022}$, then the value of α is _____.

Q86. Let a tangent to the curve $9x^2 + 16y^2 = 144$ intersect the coordinate axes at the points A and B. Then, the minimum length of the line segment AB is _____.

Q87. Let C be the largest circle centred at (2, 0) and inscribed in the ellipse $x^2/36 + y^2/16 = 1$. If $(1, \alpha)$ lies on C, then $10\alpha^2$ is equal to _____.

Q88. The value of $(8/\pi) \int_0^{\pi/2} (\cos x)^{2023} / ((\sin x)^{2023} + (\cos x)^{2023})\, dx$ is _____.

Q89. The value of $12 \int_0^3 |x^2 - 3x + 2|\, dx$ is _____.

Q90. The shortest distance between the lines (x-2)/3 = (y+1)/2 = (z-6)/2 and (x-6)/3 = (1-y)/2 = (z+8)/0 is equal to _____.

Answer Keys

1. (2)	2. (3)	3. (2)	4. (2)	5. (4)	6. (4)	7. (1)	8. (2)
9. (3)	10. (1)	11. (4)	12. (1)	13. (3)	14. (2)	15. (1)	16. (2)
17. (3)	18. (3)	19. (2)	20. (4)	21. (1)	22. (40)	23. (110)	24. (12)
25. (5)	26. (2)	27. (2)	28. (10)	29. (120)	30. (11)	31. (3)	32. (2)
33. (3)	34. (1)	35. (2)	36. (2)	37. (1)	38. (1)	39. (3)	40. (1)
41. (2)	42. (2)	43. (3)	44. (4)	45. (3)	46. (3)	47. (4)	48. (2)
49. (1)	50. (2)	51. (492)	52. (2)	53. (10)	54. (25)	55. (4)	56. (180)
57. (917)	58. (3)	59. (7)	60. (2)	61. (2)	62. (1)	63. (1)	64. (1)
65. (2)	66. (1)	67. (4)	68. (4)	69. (3)	70. (2)	71. (3)	72. (4)

73. (2)	74. (3)	75. (1)	76. (1)	77. (2)	78. (3)	79. (3)	80. (3)
81. (5)	82. (546)	83. (60)	84. (12)	85. (1012)	86. (7)	87. (118)	88. (2)
89. (22)	90. (14)						