JEE Main – 2025

22nd JANUARY 2025 (Morning Shift)

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Subjects** (Subject I: **Mathematics**, Subject II: **Physics**, Subject III: **Chemistry**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2** contains **5 Numerical Value Type Questions**. The answer to each question is an **integer** ranging from 0 to 999.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. On completion of the test, the candidate must hand over the Answer Sheet to the **Invigilator** on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them**.

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

SUBJECT I: MATHEMATICS	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

1. Let z_1, z_2 and z_3 be three complex numbers on the circle $|z|=1$ with $\arg(z_1)=\frac{-\pi}{4}, \arg(z_2)=0$ and $\arg(z_3)=\frac{\pi}{4}$. If $\left|z_1\bar{z}_2+z_2\bar{z}_3+z_3\bar{z}_1\right|^2=\alpha+\beta\sqrt{2}, \alpha,\beta\in Z$, then the value of $\alpha^2+\beta^2$ is:

(1) 24 **(2)** 29 **(3)** 41 **(4)** 31

2. Let $f(x)$ be a real differentiable function such that $f(0)=1$ and $f(x+y)=f(x)f'(y)+f'(x)f(y)$ for all $x,y\in R$. Then $\sum_{n=1}^{100}\log_e f(n)$ is equal to:

(1) 2384 **(2)** 5220 **(3)** 2525 **(4)** 2406

3. The product of all solutions of the equation $e^{5(\log_e x)^2+3}=x^8, x>0,$ is:

(1) $e^{\frac{8}{5}}$ **(2)** e^2 **(3)** e **(4)** $e^{\frac{6}{5}}$

4. Let $L_1:\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $L_2:\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$ be two lines. Then which of the following points lies on the line of the shortest distance between L_1 and L_2 ?

(1) $\left(2,3,\frac{1}{3}\right)$ **(2)** $\left(\frac{8}{3},-1,\frac{1}{3}\right)$

(3) $\left(\frac{14}{3},-3,\frac{22}{3}\right)$ **(4)** $\left(-\frac{5}{3},-7,1\right)$

5. The area of the region, inside the circle $\left(x-2\sqrt{3}\right)^2+y^2=12$ and outside the parabola $y^2=2\sqrt{3}x$ is:

(1) $3\pi+8$ **(2)** $6\pi-8$ **(3)** $6\pi-16$ **(4)** $3\pi-8$

6. Using the principal values of the inverse trigonometric functions, the sum of the maximum and the minimum values of $16\left(\left(\sec^{-1}x\right)^2+\left(\operatorname{cosec}^{-1}x\right)^2\right)$ is:

(1) $31\pi^2$ **(2)** $24\pi^2$ **(3)** $18\pi^2$ **(4)** $22\pi^2$

7. Let $a_1, a_2, a_3, \ldots$ be a G.P. of increasing positive terms. If $a_1a_5=28$ and $a_2+a_4=29$, then a_6 is equal to:

(1) 812 **(2)** 628 **(3)** 784 **(4)** 526

8. Let $A=\{1,2,3,\ldots,10\}$ and $B=\left\{\frac{m}{n}: m,n\in A, m<n \text{ and } \gcd(m,n)=1\right\}$. Then $n(B)$ is equal to:

(1) 29 **(2)** 37 **(3)** 36 **(4)** 31

9. A coin is tossed three times. Let X denote the number of times a tail follows a head. If μ and σ^2 denote the mean and variance of X, then the value of $64\left(\mu+\sigma^2\right)$ is:

(1) 48 **(2)** 51 **(3)** 64 **(4)** 32

10. Let the triangle PQR be the image of the triangle with vertices (1, 3), (3, 1) and (2, 4) in the line $x+2y=2$. If the centroid of ΔPQR is the point (α,β), then $15(\alpha-\beta)$ is equal to:

(1) 24 **(2)** 22 **(3)** 19 **(4)** 21

11. The number of non-empty equivalence relations on the set {1, 2, 3} is:

(1) 5 **(2)** 6 **(3)** 4 **(4)** 7

12. Let the parabola $y=x^2+px-3$, meet the coordinate axes at the points P, Q and R. If the circle C with centre at $(-1,-1)$ passes through the points P, Q and R, then the area of ΔPQR is:

(1) 5 **(2)** 6 **(3)** 4 **(4)** 7

13. Let $x=x(y)$ be the solution of the differential equation $y^2dx+\left(x-\frac{1}{y}\right)dy=0$. If $x(1)=1$, then $x\left(\frac{1}{2}\right)$ is:

(1) $3+e$ **(2)** $\frac{3}{2}+e$ **(3)** $3-e$ **(4)** $\frac{1}{2}+e$

14. Two balls are selected at random one by one without replacement from a bag containing 4 white and 6 black balls. If the probability that the first selected ball is black, given that the second selected ball is also black, is $\frac{m}{n}$, where $\gcd(m,n)=1$, then $m+n$ is equal to:

(1) 11 **(2)** 4 **(3)** 13 **(4)** 14

15. Let the foci of a hyperbola be (1, 14) and (1, –12). If it passes through the point (1, 6), then the length of its latus-rectum is:

(1) $\frac{25}{6}$ **(2)** $\frac{144}{5}$ **(3)** $\frac{288}{5}$ **(4)** $\frac{24}{5}$

16. Let for $f(x)=7\tan^8x+7\tan^6x-3\tan^4x-3\tan^2x$, $I_1=\int_0^{\pi/4}f(x)dx$ and $I_2=\int_0^{\pi/4}xf(x)dx$. Then $7I_1+12I_2$ is equal to:

(1) 2π **(2)** π **(3)** 1 **(4)** 2

17. If $\sum_{r=1}^{n}T_r=\frac{(2n-1)(2n+1)(2n+3)(2n+5)}{64}$, then $\lim_{n\to\infty}\sum_{r=1}^{n}\left(\frac{1}{T_r}\right)$ is equal to:

(1) 0 **(2)** 1 **(3)** $\frac{1}{3}$ **(4)** $\frac{2}{3}$

18. From all the English alphabets, five letters are chosen and are arranged in alphabetical order. The total number of ways, in which the middle letter is 'M', is:

(1) 5148 **(2)** 6084 **(3)** 14950 **(4)** 4356

19. Let $f:R\to R$ be a twice differentiable function such that $f(x+y)=f(x)f(y)$ for all $x,y\in R$. If $f'(0)=4a$ and f satisfies $f''(x)-3af'(x)-f(x)=0,\ a>0$, then the area of the region $R=\{(x,y)\,|\,0\le y\le f(ax),0\le x\le 2\}$ is:

(1) e^4-1 **(2)** e^2-1 **(3)** e^2+1 **(4)** e^4+1

20. A circle C of radius 2 lies in the second quadrant and touches both the coordinate axes. Let r be the radius of a circle that has centre at the point (2, 5) and intersects the circle C at exactly two points. If the set of all possible values of r is the interval (α,β), then $3\beta-2\alpha$ is equal to:

(1) 10 **(2)** 12 **(3)** 14 **(4)** 15

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

21. Let $L_1:\frac{x-1}{3}=\frac{y-1}{-1}=\frac{z+1}{0}$ and $L_2:\frac{x-2}{2}=\frac{y}{0}=\frac{z+4}{\alpha},\alpha\in R$, be two lines, which intersect at the point B. If P is the foot of perpendicular from the point $A(1,1,-1)$ on L_2, then the value of $26\alpha(PB)^2$ is _____.

22. Let the function,

$$f(x)=\begin{cases}-3ax^2-2, & x<1\\ a^2+bx, & x\ge 1\end{cases}$$

be differentiable for all $x\in R$, where $a>1,b\in R$. If the area of the region enclosed by $y=f(x)$ and the line $y=-20$ is $\alpha+\beta\sqrt{3},\alpha,\beta\in Z$, then the value of $\alpha+\beta$ is _____.

23. Let $\vec{c}$ be the projection vector of $\vec{b}=\lambda\hat{i}+4\hat{k},\lambda>0$, on the vector $\vec{a}=\hat{i}+2\hat{j}+2\hat{k}$. If $|\vec{a}+\vec{c}|=7$, then the area of the parallelogram formed by the vectors $\vec{b}$ and $\vec{c}$ is _____.

24. If $\sum_{r=0}^{5}\frac{{}^{11}C_{2r+1}}{2r+2}=\frac{m}{n},\gcd(m,n)=1$, then $m-n$ is equal to _____.

25. Let A be a square matrix of order 3 such that $\det(A)=-2$ and $\det\left(3adj\left(-6adj\left(3A\right)\right)\right)=2^{m+n}\cdot 3^{mn},m>n$. Then $4m+2n$ is equal to _____.

SUBJECT II: PHYSICS	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

26. An electron is made to enter symmetrically between two parallel and equally but oppositely charged metal plates, each of 10 cm length. The electron emerges out of the electric field region with a horizontal component of velocity $10^6\ m/s$. If the magnitude of the electric field between the plates is 9.1 V/cm, then the vertical component of velocity of electron is:

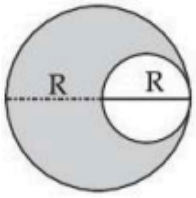
(mass of electron $= 9.1+10^{-31} kg$ and charge of electron $= 1.6\times10^{-19} C$)

(1) $16\times10^6\ m/s$ **(2)** 0 **(3)** $16\times10^4\ m/s$ **(4)** $1\times10^6\ m/s$

27. Given is a thin convex lens of glass (refractive index μ) and each side having radius of curvature R. One side is polished for complete reflection. At what distance form the lens, an object be placed on the optic axis so that the image gets formed on the object itself?

(1) $\frac{R}{(2\mu-1)}$ **(2)** $\frac{R}{(2\mu-3)}$ **(3)** $\frac{R}{\mu}$ **(4)** μR

28. A uniform circular disc of radius 'R' and mass 'M' is rotating about an axis perpendicular to its plane and passing through its centre. A small circular part of radius $R/2$ is removed from the original disc as shown in the figure. Find the moment of inertia of the remaining part of the original disc about the axis as given above.



(1) $\frac{13}{32}MR^2$ **(2)** $\frac{9}{32}MR^2$

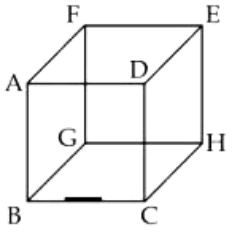
(3) $\frac{7}{32}MR^2$ **(4)** $\frac{17}{32}MR^2$

29. An amount of ice of mass $10^{-3} kg$ and temperature $-10°C$ is transformed to vapour of temperature $110°C$ by applying heat. The total amount of work required for this conversion is,

(Take, specific heat of ice = 2100 $Jkg^{-1}K^{-1}$, specific heat of water $= 4180 Jkg^{-1}K^{-1}$, specific heat of steam $= 1920 Jkg^{-1}K^{-1}$, Latent heat of ice $= 3.35\times10^5 Jkg^{-1}$ and Latent heat of steam $= 2.25\times10^6 Jkg^{-1}$)

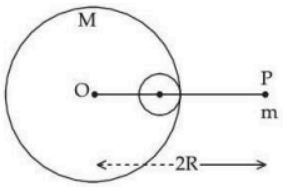
(1) 3024 J **(2)** 3003 J **(3)** 3022 J **(4)** 3043 J

30. A line charge of length $\frac{'a'}{2}$ is kept at the center of an edge *BC* of a cube *ABCDEFGH* having edge length $'a'$ as shown in the figure. If the density of lien charge is λC per unit length, then the total electric flux through all the faces of the cube will be _____. (Take, ϵ_0 as the free space permittivity)



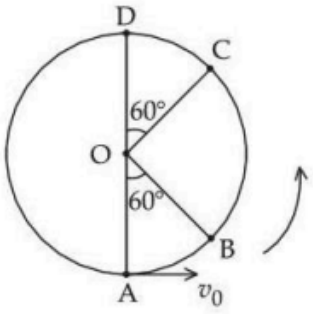
(1) $\frac{\lambda a}{4\epsilon_0}$ **(2)** $\frac{\lambda a}{8\epsilon_0}$ **(3)** $\frac{\lambda a}{16\epsilon_0}$ **(4)** $\frac{\lambda a}{2\epsilon_0}$

31. A small point of mass *m* is placed at a distance $2R$ from the centre $'O'$ of a big uniform solid sphere of mass *M* and radius *R*. The gravitational force on $'m'$ due to *M* is F_1. A spherical part of radius $\frac{R}{3}$ is removed from the big sphere as shown in the figure and the gravitational force on *m* due to remaining part of *M* is found to be F_2. The value of ratio $F_1 : F_2$ is:



(1) 12 : 11 **(2)** 12 : 9 **(3)** 11 : 10 **(4)** 16 : 9

32. A bob of mass *m* is suspended at a point *O* by a light string of length *l* and left to perform vertical motion (circular) as shown in figure. Initially, by applying horizontal velocity v_0 at the point $'A'$, the string becomes slack when, the bob reaches at the point $'D'$. The ratio of the kinetic energy of the bob at the points *B* and *C* is _____.



(1) 4 **(2)** 1 **(3)** 2 **(4)** 3

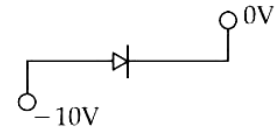
33. A closed organ and an open organ tube are filled by two different gases having same bulk modulus but different densities ρ_1 and ρ_2, respectively. The frequency of 9th harmonic of closed tube is identical with 4th harmonic of open tube. If the length of the closed tube is 10 cm and the density ratio of the gases is $\rho_1 : \rho_2 = 1 : 16$, then the length of the open tube is:

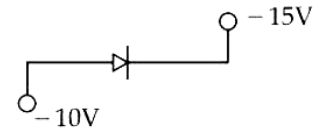
(1) $\frac{20}{9}cm$ **(2)** $\frac{15}{9}cm$ **(3)** $\frac{15}{7}cm$ **(4)** $\frac{20}{7}cm$

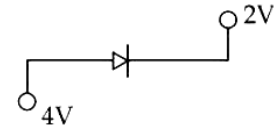
34. Two spherical bodies of same materials having radii 0.2 m and 0.8 m are placed in same atmosphere. The temperature of the smaller body is 800 K and temperature of the bigger body is 400 K. If the energy radiated from the smaller body is E, the energy radiated from the bigger body is (assume, effect of the surrounding temperature to be negligible),

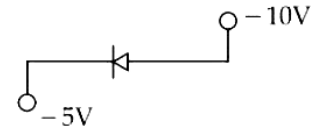
(1) $256\,E$ **(2)** $16\,E$ **(3)** E **(4)** $64\,E$

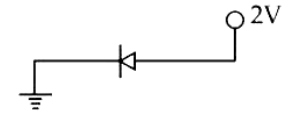
35. Which of the following circuits represents a forward biases diode?

(A) 

(B) 

(C) 

(D) 

(E) 

Choose the correct answer from the options given below:

(1) (C) and (E) only **(2)** (B), (C) and (E) only

(3) (B), (D) and (E) only **(4)** (A) and (D) only

36. Given below are two statements:

Statement-I: The equivalent emf of two nonideal batteries connected in parallel is smaller than either of the two emfs.

Statement-II: The equivalent internal resistance of two nonideal batteries connected in parallel is smaller than the internal resistance of either of the two batteries.

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

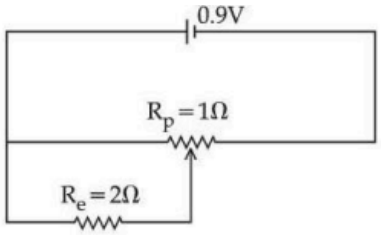
(3) Both Statement-I and Statement-II are true

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

37. If B is magnetic field and μ_0 is permeability of free space, then the dimensions of (B/μ_0) is:

(1) $ML^2T^{-2}A^{-1}$ **(2)** $MT^{-2}A^{-1}$ **(3)** $LT^{-2}A^{-1}$ **(4)** $L^{-1}A$

38.



Sliding contact of a potentiometer is in the middle of the potentiometer wire having resistance $R_p = 1\Omega$ as shown in the figure. An external resistance of $R_e = 2\Omega$ is connected via the sliding contact. The electric current in the circuit is:

(1) 1.0 A **(2)** 0.3 A **(3)** 1.35 A **(4)** 0.9 A

39. An electron in the ground state of the hydrogen atom has the orbital radius of $5.3\times10^{-11}m$ while that for the electron in third excited state is $8.48\times10^{-10}m$. The ratio of the de Broglie wavelengths of electron in the ground state to that in the excited state is:

(1) 16 **(2)** 3 **(3)** 9 **(4)** 4

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

Assertion-(A) : If Young's double slit experiment is performed in an optically denser medium than air, then the consecutive fringes come closer.

Reason-(R) : The speed of light reduces in an optically denser medium than air while its frequency does not change.

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

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

(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) (A) is false btu (R) is true

41. The work functions of cesium (Cs) and lithium (Li) metals are 1.9 eV and 2.5 eV, respectively. If we incident a light of wavelength 550 nm on these two metal surfaces, then photo-electric effect is possible for the case of:

(1) Both Cs and Li **(2)** Neither Cs nor Li

(3) Li only **(4)** Cs only

42. Given below are two statements:

Statement-I : In a vernier callipers, one vernier scale division is always smaller than one main scale division.

Statement-II : The vernier constant is given by one main scale division multiplied by the number of vernier scale divisions.

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

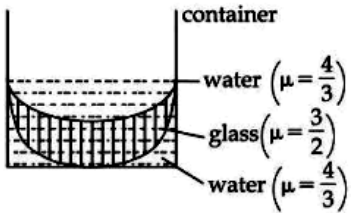
(3) Both Statement-I and Statement-II are false

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

43. A parallel-plate capacitor of capacitance $40\mu F$ is connected to a 100 V power supply. Now the intermediate space between the plates is filled with a dielectric material of dielectric constant $K = 2$. Due to the introduction of dielectric material, the extra charge and the change in the electrostatic energy in the capacitor, respectively, are:

(1) 8 mC and 2.0 J **(2)** 2 mC and 0.4 J **(3)** 2 mC and 0.2 J **(4)** 4 mC and 0.2 J

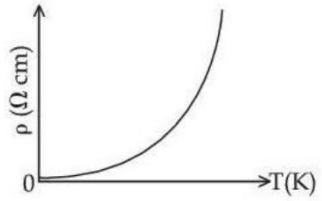
44. In the diagram given below, there are three lenses formed. Considering negligible thickness of each of them as compared to $|R_1|$ and $|R_2|$, i.e., the radii of curvature for upper and lower surfaces of the glass lens, the power of the combination is:

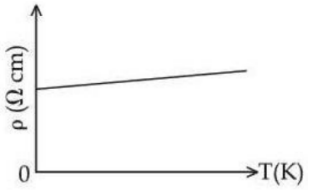


(1) $\frac{1}{6}\left(\frac{1}{|R_1|}+\frac{1}{|R_2|}\right)$ **(2)** $\frac{1}{6}\left(\frac{1}{|R_1|}-\frac{1}{|R_2|}\right)$

(3) $-\frac{1}{6}\left(\frac{1}{|R_1|}-\frac{1}{|R_2|}\right)$ **(4)** $-\frac{1}{6}\left(\frac{1}{|R_1|}+\frac{1}{|R_2|}\right)$

45. Which of the following resistivity (ρ) v/s temperature (*T*) curves is most suitable to be used in wire bound standard resistors?

(1)


(2)


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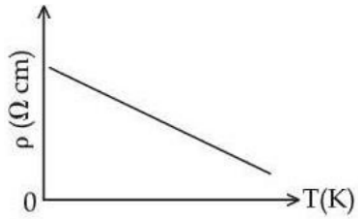
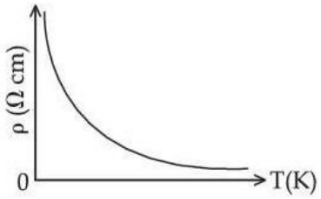


(4)


SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

46. A particle is projected at an angle of 30° from horizontal at a speed of 60 m/s. The height traversed by the particle in the first second is h_0 and height traversed in the last second, before it reaches the maximum height, is h_1. The ratio $h_0 : h_1$ is _____.

[Take, $g = 10 m/s^2$]

47. The driver sitting inside a parked car is watching vehicles approaching from behind with the help of his side view mirror, which is a convex mirror with radius of curvature R = 2 m. Another car approaches him from behind with a uniform speed of 90 km/hr. When the car is at a distance of 24 m from his, the magnitude of the acceleration of the image of the car in the side view mirror is 'a'. The value of 100a is _____ m/s^2.

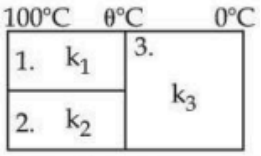
48. The position vectors of two 1 kg particles, (A) and (B), are given by

$\vec{r}_A = \left(\alpha_1 t^2 \hat{i} + \alpha_2 t \hat{j} + \alpha_3 t \hat{k}\right) m$ and $\vec{r}_B = \left(\beta_1 t \hat{i} + \beta_2 t^2 \hat{j} + \beta_3 t \hat{k}\right) m$, respectively;

$\left(\alpha_1 = 1 m/s^2, \alpha_2 = 3nm/s, \alpha_3 = 2m/s, \beta_1 = 2m/s, \beta_2 = -1 m/s^2, \beta_3 = 4pm/s\right)$, where t is time, n and p are constants. At $t = 1s, \left|\vec{V}_A\right| = \left|\vec{V}_B\right|$ and velocities $\vec{V}_A$ and $\vec{V}_B$ of the particles are orthogonal to each other. At t = 1s, the magnitude of angular momentum of particle (A) with respect to the position of particle (B) is $\sqrt{L}\, kgm^2 s^{-1}$. The value of L is _____.

49. Two soap bubbles of radius 2 cm and 4 cm, respectively, are in contact with each other. The radius of curvature of the common surface, in cm, is _____.

50. Three conductors of same length having thermal conductivity $k_1 k_2$ and k_3 are connected as shown in figure.



Area of cross sections of 1st and 2nd conductor are same and for 3rd conductor it is double of the 1st conductor. The temperatures are given in the figure. In steady state condition, the value of θ is _____°C.

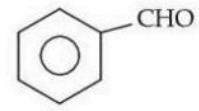
(Given: $k_1 = 60 Js^{-1}m^{-1}K^{-1}, k_2 = 120 Js^{-1}m^{-1}K^{-1}, k_3 = 135 Js^{-1}m^{-1}K^{-1}$)

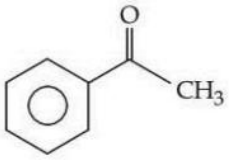
SUBJECT III: CHEMISTRY	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

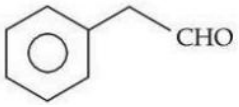
51. The compounds which give positive Fehling's test are:

(A) 

(B) 

(C) $HOCH_2-CO-(CHOH)_3-CH_2-OH$

(D) $CH_3-\overset{\overset{O}{\|}}{C}-H$

(E) 

Choose the correct answer from the options given below:

(1) (A), (B) and (C) only **(2)** (A), (D) and (E) only

(3) (A), (C) and (D) only **(4)** (C), (D) and (E) only

52. Given below are two statements:

Statement-I: CH_3-O-CH_2-Cl will undergo S_N1 reaction though it is a primary halide.

Statement-II: $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-Cl$ will not undergo S_N2 reaction very easily though it is a primary halide.

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

(1) Statement-I is incorrect but Statement-II is correct

(2) Both Statement-I and Statement-II are incorrect

(3) Statement-I is correct but Statement-II is incorrect

(4) Both Statement-I and Statement-II are correct

53. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of CO_2 is converted into CO on addition of graphite. If total pressure at equilibrium is 0.8 atm, then K_p is:

(1) 0.18 atm **(2)** 3 atm **(3)** 0.3 atm **(4)** 1.8 atm

54. A solution of aluminium chloride is electrolysed for 30 minutes using a current of 2A. The amount of the aluminium deposited at the cathode is _____.

[Given: molar mass of aluminium and chlorine are 27 g mol^{-1} and 35.5 g mol^{-1} respectively Faraday constant = 96500 C mol^{-1}]

(1) 1.660 g **(2)** 0.441 g **(3)** 1.007 g **(4)** 0.336 g

55. Given below are two statements:

Statement-I: One mole of propyne reacts with excess of sodium to liberate half a mole of H_2 gas.

Statement-II: Four of propyne reacts with $NaNH_2$ to liberate NH_3 gas which occupies 224 mL at STP.

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

(1) Statement-I is incorrect but Statement-II is correct

(2) Both Statement-I and Statement-II are correct

(3) Statement-I is correct but Statement-II is incorrect

(4) Both Statement-I and Statement-II are incorrect

56. Which of the following statement is not true for radioactive decay?

(1) Decay constant does not depend upon temperature

(2) Decay constant increases with increase in temperature

(3) Amount of radioactive substance remained after three half lives is $\frac{1}{8}$ th of original amount

(4) Half life is $\ln 2$ times of $\frac{1}{\text{rate constant}}$

57. How many different stereoisomers are possible for the given molecule?

$$CH_3 - \underset{\underset{OH}{|}}{CH} - CH = CH - CH_3$$

(1) 2 **(2)** 1 **(3)** 4 **(4)** 3

58. Match List-I with List-II.

	List-I		List-II
(A)	$Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$	(I)	Ionisation Enthalpy
(B)	B < C < O < N	(II)	Metallic character
(C)	B < Al < Mg < K	(III)	Electronegativity
(D)	Si < P < S < Cl	(IV)	Ionic radii

Choose the correct answer from the options given below:

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

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

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

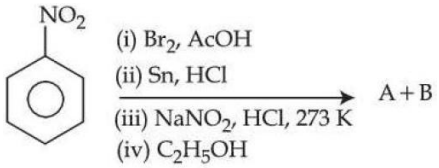
(4) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)

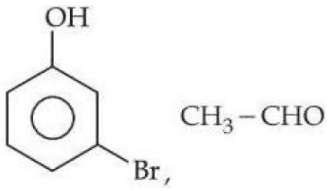
59. In which of the following complexes the CFSE, Δ_0 will be equal to zero?

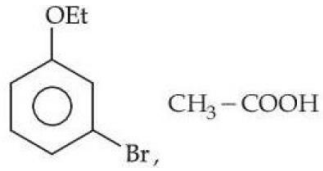
(1) $\left[Fe(en)_3\right]Cl_3$ **(2)** $\left[Fe(NH_3)_6\right]Br_2$

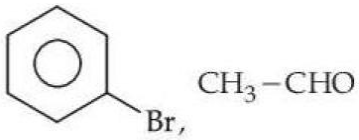
(3) $K_3\left[Fe(SCN)_6\right]$ **(4)** $K_4\left[Fe(CN)_6\right]$

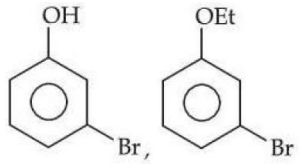
60. The products formed in the following reaction sequence are:



(1) 

(2) 

(3) 

(4) 

61. Which of the following electronegativity order is incorrect?

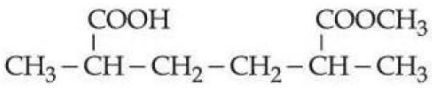
(1) $S < Cl < O < F$ **(2)** $Mg < Be < B < N$

(3) $Al < Si < C < N$ **(4)** $Al < Mg < B < N$

62. Which of the following acids is a vitamin?

(1) Ascorbic acid **(2)** Aspartic acid **(3)** Adipic acid **(4)** Saccharic acid

63. The IUPAC name of the following compound is:



(1) Methyl-6-carboxy-2,5-dimethylhexanoate

(2) 6-Methoxycarbonyl-2,5-dimethylhexanoic acid

(3) Methyl-5-carboxy-2-methylhexanoate

(4) 2-Carboxy-5-methoxycarbonylhexane

64. A liquid when kept inside a thermally insulated closed vessel at 25°C was mechanically stirred from outside. What will be the correct option for the following thermodynamic parameters?

(1) $\Delta U = 0, q < 0, w > 0$ **(2)** $\Delta U < 0, q = 0, w > 0$

(3) $\Delta U > 0, q = 0, w > 0$ **(4)** $\Delta U = 0, q = 0, w = 0$

65. Radius of the first excited state of Helium ion is given as:

$a_0 \rightarrow$ radius of first stationary state of hydrogen atom.

(1) $r = 2a_0$ **(2)** $r = \frac{a_0}{4}$ **(3)** $r = \frac{a_0}{2}$ **(4)** $r = 4a_0$

66. The incorrect statements regarding geometrical isomerism are:

(A) Propene shows geometrical isomerism

(B) Trans isomer has identical atoms/groups on the opposite sides of the double bond

(C) Cis-but-2-ene has higher dipole moment than trans-but-2-ene

(D) 2-methylbut-2-ene shows two geometrical isomers

(E) Trans-isomer has lower melting point than cis isomer

Choose the correct answer from the options given below:

(1) (A) and (E) only **(2)** (B) and (C) only

(3) (C), (D) and (E) only **(4)** (A), (D) and (E) only

67. Arrange the following solutions in order of their increasing boiling points.

(i) 10^{-4} M NaCl (ii) 10^{-4} M Urea

(iii) 10^{-3} M NaCl (iv) 10^{-2} M NaCl

(1) (i) < (ii) < (iii) < (iv) **(2)** (iv) < (iii) < (i) < (ii)

(3) (ii) < (i) ≡ (iii) < (iv) **(4)** (ii) < (i) < (iii) < (iv)

68. Which of the following electrolyte can be used to obtain $H_2S_2O_8$ by the process of electrolysis?

(1) Acidified dilute solution of sodium sulphate

(2) Dilute solution of sodium sulphate

(3) Dilute solution of sulphuric acid

(4) Concentrated solution of sulphuric acid

69. From the magnetic behaviour of $\left[NiCl_4\right]^{2-}$ (paramagnetic) and $\left[Ni(CO)_4\right]$ (diamagnetic), choose the correct geometry and oxidation state.

(1) $\left[NiCl_4\right]^{2-}: Ni^{II}$, tetrahedral
$\left[Ni(CO)_4\right]: Ni^{II}$, square planar

(2) $\left[NiCl_4\right]^{2-}: Ni(0)$, tetrahedral
$\left[Ni(CO)_4\right]: Ni(0)$, square planar

(3) $\left[NiCl_4\right]^{2-}: Ni^{II}$, square planar
$\left[Ni(CO)_4\right]: Ni(0)$, square planar

(4) $\left[NiCl_4\right]^{2-}: Ni^{II}$, tetrahedral
$\left[Ni(CO)_4\right]: Ni(0)$, tetrahedral

70. Lanthanoid ions with $4f^7$ configuration are:

(A) Eu^{2+} **(B)** Gd^{3+}

(C) Eu^{3+} **(D)** Tb^{3+}

(E) Sm^{2+}

Choose the correct answer from the options given below:

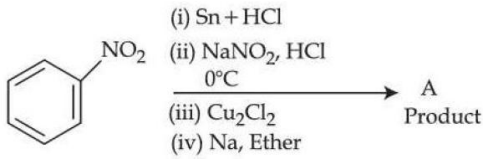
(1) (B) and (C) only **(2)** (A) and (B) only

(3) (B) and (E) only **(4)** (A) and (D) only

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

71. Consider the following sequence of reactions:



Molar mass of the product formed (A) is _____ $g\,mol^{-1}$.

72. The number of molecules/ions that show linear geometry among the following is _____.

$SO_2, BeCl_2, CO_2, N_3^-, NO_2, F_2O, XeF_2, NO_2^+, I_3^-, O_3$

73. Some CO_2 gas was kept in a sealed container at a pressure of 1 atm and at 273 K. This entire amount of CO_2 gas was later passed through an aqueous solution of $Ca(OH)_2$. The excess unreacted $Ca(OH)_2$ was later neutralized with 0.1 M of 40 mL HCl. If the volume of the sealed container of CO_2 was x, then x is _____ cm^3 (nearest integer).

[Given: The entire amount of $CO_2(g)$ reacted with exactly half the initial amount of $Ca(OH)_2$ present in the aqueous solution.]

74. In Carius method for estimation of halogens, 180 mg of an organic compound product 143.5 mg of AgCl. The percentage composition of chlorine in the compound is _____%.

(Given: molar mass in $g\,mol^{-1}$ of Ag: 108, Cl : 35.5)

75. $A \rightarrow B$

The molecule A changes into its isomeric form B by following a first order kinetics at a temperature of 1000 K. If the energy barrier with respect to reactant energy for such isomeric transformation is $191.48\,kJ\,mol^{-1}$ and the frequency factor is 10^{20}, the time required for 50% molecules of A to become B is _____picoseconds (nearest integer). [R = 8.314 $J\,K^{-1}\,mol^{-1}$]