JEE Main – 2025

23 JANUARY 2025 (Evening 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. If the area of the region $\{(x,y): -1 \le x \le 1, 0 \le y \le a + e^{|x|} - e^{-x}, a > 0\}$ is $\frac{e^2 + 8e + 1}{e}$, then the value of a is:

(1) 6 **(2)** 7 **(3)** 5 **(4)** 8

2. Let $X = R \times R$. Define a relation R on X as:

$(a_1, b_1)R(a_2, b_2) \Leftrightarrow b_1 = b_2$.

Statement I: R is an equivalence relation.

Statement II: For some $(a,b) \in X$, the set $S = \{(x,y) \in X : (x,y)R(a,b)\}$ represents a line parallel to $y = x$.

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

(1) Both Statement I and Statement II are true

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

(3) Both Statement I and Statement II are false

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

3. If in the expansion of $(1+x)^p(1-x)^q$, the coefficients of x and x^2 are 1 and –2, respectively, then $p^2 + q^2$ is equal to:

(1) 20 **(2)** 8 **(3)** 18 **(4)** 13

4. A spherical chocolate ball has a layer of ice-cream of uniform thickness around it. When the thickness of the ice-cream layer is 1 cm, the ice-cream melts at the rate of $81\, cm^3/\min$ and the thickness of the ice-cream layer decreases at the rate of $\frac{1}{4\pi} cm/\min$. The surface area (in cm^2) of the chocolate ball (without the ice-cream layer) is:

(1) $128\,\pi$ **(2)** $225\,\pi$ **(3)** $196\,\pi$ **(4)** $256\,\pi$

5. A rod of length eight units moves such that its ends A and B always lie on the line $x - y + 2 = 0$ and $y + 2 = 0$, respectively. If the locus of the point P, that divides the rod AB internally in the ratio 2 : 1 is $9(x^2 + \alpha y^2 + \beta xy + \gamma x + 28y) - 76 = 0$, then $\alpha - \beta - \gamma$ is equal to:

(1) 21 **(2)** 23 **(3)** 22 **(4)** 24

6. Let $\int x^3 \sin x\,dx = g(x) + C$, where C is the constant of integration.

If $8\left(g\left(\frac{\pi}{2}\right) + g'\left(\frac{\pi}{2}\right)\right) = \alpha\pi^3 + \beta\pi^2 + \gamma, \alpha, \beta, \gamma \in Z$, then $\alpha + \beta - \gamma$ equals:

(1) 55 **(2)** 47 **(3)** 62 **(4)** 48

7. Let $A = [a_{ij}]$ be a 3×3 matrix such that $A\begin{bmatrix}0\\1\\0\end{bmatrix} = \begin{bmatrix}0\\0\\1\end{bmatrix}, A\begin{bmatrix}4\\1\\3\end{bmatrix} = \begin{bmatrix}0\\1\\0\end{bmatrix}$ and $A\begin{bmatrix}2\\1\\2\end{bmatrix} = \begin{bmatrix}1\\0\\0\end{bmatrix}$, then a_{23} equals:

(1) 0 **(2)** 1 **(3)** –1 **(4)** 2

8. The number of complex numbers z, satisfying $|z| = 1$ and $\left|\frac{z}{\bar{z}} + \frac{\bar{z}}{z}\right| = 1$, is:

(1) 6 **(2)** 4 **(3)** 10 **(4)** 8

9. $\lim\limits_{x\to\infty} \frac{(2x^2 - 3x + 5)(3x-1)^{\frac{x}{2}}}{(3x^2 + 5x + 4)\sqrt{(3x+2)^x}}$ is equal to:

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

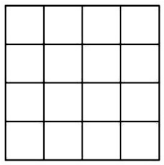
10. If the square of the shortest distance between the lines $\frac{x-2}{1} = \frac{y-1}{2} = \frac{z+3}{-3}$ and $\frac{x+1}{2} = \frac{y+3}{4} = \frac{z+5}{-5}$ is $\frac{m}{n}$, where m, n are coprime numbers, then $m + n$ is equal to:

(1) 21 **(2)** 9 **(3)** 14 **(4)** 6

11. The length of the chord of the ellipse $\frac{x^2}{4} + \frac{y^2}{2} = 1$, whose mid-point is $\left(1, \frac{1}{2}\right)$, is:

(1) $\frac{2}{3}\sqrt{15}$ **(2)** $\frac{1}{3}\sqrt{15}$ **(3)** $\frac{5}{3}\sqrt{15}$ **(4)** $\sqrt{15}$

12. A board has 16 squares as shown in the figure:



Out of these 16 squares, two squares are chosen at random. The probability that they have no side in common is:

(1) $\frac{4}{5}$ **(2)** $\frac{3}{5}$ **(3)** $\frac{7}{10}$ **(4)** $\frac{23}{30}$

13. If $I = \int_0^{\frac{\pi}{2}} \frac{\sin^{\frac{3}{2}} x}{\sin^{\frac{3}{2}} x + \cos^{\frac{3}{2}} x} dx$, then $\int_0^{2I} \frac{x \sin x \cos x}{\sin^4 x + \cos^4 x} dx$ equals:

(1) $\frac{\pi^2}{4}$ **(2)** $\frac{\pi^2}{12}$ **(3)** $\frac{\pi^2}{16}$ **(4)** $\frac{\pi^2}{8}$

14. Let the shortest distance from $(a, 0), a > 0$, to the parabola $y^2 = 4x$ be 4. Then the equation of the circle passing through the point $(a, 0)$ and the focus of the parabola, the having its centre on the axis of the parabola is:

(1) $x^2 + y^2 - 8x + 7 = 0$ **(2)** $x^2 + y^2 - 6x + 5 = 0$

(3) $x^2 + y^2 - 10x + 9 = 0$ **(4)** $x^2 + y^2 - 4x + 3 = 0$

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

(1) $\sqrt{17}$ **(2)** $\sqrt{15}$ **(3)** $\sqrt{13}$ **(4)** $\sqrt{14}$

16. Let $x = x(y)$ be the solution of the differential equation $y = \left(x - y\frac{dx}{dy}\right)\sin\left(\frac{x}{y}\right), y > 0$ and $x(1) = \frac{\pi}{2}$. Then $\cos(x(2))$ is equal to:

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

17. Let the point A divide the line segment joining the points $P(-1,-1,2)$ and $Q(5,5,10)$ internally in the ratio $r : 1 (r > 0)$. If O is the origin and $(\overrightarrow{OQ} \cdot \overrightarrow{OA}) - \frac{1}{5}|\overrightarrow{OP} \times \overrightarrow{OA}|^2 = 10$, then the value of r is:

(1) 7 **(2)** 3 **(3)** $\sqrt{7}$ **(4)** 14

18. Let $A = \{(x,y) \in R \times R : |x + y| \geq 3\}$ and $B = \{(x,y) \in R \times R : |x| + |y| \leq 3\}$.

If $C = \{(x,y) \in A \cap B : x = 0 \text{ or } y = 0\}$, then $\sum_{(x,y) \in C} |x + y|$ is:

(1) 15 **(2)** 18 **(3)** 24 **(4)** 12

19. Let the range of function $f(x) = 6 + 16\cos x \cdot \cos\left(\frac{\pi}{3} - x\right) \cdot \cos\left(\frac{\pi}{3} + x\right) \cdot \sin 3x \cdot \cos 6x, x \in R$ be $[\alpha, \beta]$. Then the distance of the point (α, β) from the line $3x + 4y + 12 = 0$ is:

(1) 8 **(2)** 10 **(3)** 11 **(4)** 9

20. The system of equations:

$x + y + z = 6$,

$x + 2y + 5z = 9$,

$x + 5y + \lambda z = \mu$,

has no solution if:

(1) $\lambda \neq 17, \mu \neq 18$ **(2)** $\lambda = 17, \mu \neq 18$ **(3)** $\lambda = 17, \mu = 18$ **(4)** $\lambda = 15, \mu \neq 17$

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. The roots of the quadratic equation $3x^2 - px + q = 0$ are 10^{th} and 11^{th} terms of an arithmetic progression with common difference $\frac{3}{2}$. If the sum of the first 11 terms of this arithmetic progression is 88, then q – 2p is equal to _____.

22. The variance of the numbers 8, 21, 34, 47, ..., 320 is _____.

23. Let α, β be the roots of the equation $x^2 - ax - b = 0$ with $\text{Im}(\alpha) < \text{Im}(\beta)$. Let $P_n = \alpha^n - \beta^n$. If $P_3 = -5\sqrt{7}i, P_4 = -3\sqrt{7}i$, $P_5 = 11\sqrt{7}i$ and $P_6 = 45\sqrt{7}i$, then $|\alpha^4 + \beta^4|$ is equal to _____.

24. The number of ways, 5 boys and 4 girls can sit in a row so that either all the boys sit together or no two boys sit together, is _____.

25. The focus of the parabola $y^2 = 4x + 16$ is the centre of the circle C of radius 5. If the value of λ, for which C passes through the point of intersection of the lines $3x - y = 0$ and $x + \lambda y = 4$, are λ_1 and $\lambda_2, \lambda_1 < \lambda_2$, then $12\lambda_1 + 29\lambda_2$ 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. Water of mass m gram is slowly heated to increase the temperature from T_1 to T_2. The change in entropy of the water, given specific heat of water is $1 Jkg^{-1} K^{-1}$, is:

(1) zero **(2)** $m(T_2 - T_1)$ **(3)** $m\ln\left(\frac{T_2}{T_1}\right)$ **(4)** $m\ln\left(\frac{T_1}{T_2}\right)$

27. Two point charges $-4\ \mu c$ and $4\ \mu c$, constituting an electric dipole, are placed at (–9, 0, 0) cm and (9, 0, 0) cm in a uniform electric field of strength $10^4\ N\ C^{-1}$. The work done on the dipole in rotating it from the equilibrium through 180° is:

(1) 12.4 mJ **(2)** 18.4 mJ **(3)** 14.4 mJ **(4)** 16.4 mJ

28. A ball having kinetic energy KE, is projected at an angle of 60° from the horizontal. What will be the kinetic energy of ball at the highest point of its flight?

(1) $\frac{(KE)}{16}$ **(2)** $\frac{(KE)}{4}$ **(3)** $\frac{(KE)}{2}$ **(4)** $\frac{(KE)}{8}$

29. A concave mirror of focal length f in air is dipped in a liquid of refractive index μ. Its focal length in the liquid will be:

(1) $\frac{f}{(\mu - 1)}$ **(2)** μf **(3)** f **(4)** $\frac{f}{\mu}$

30. In photoelectric effect an em-wave is incident on a metal surface and electrons are ejected from the surface. If the work function of the metal is 2.14 eV and stopping potential is 2V, what is the wavelength of the em-wave?

(Given $hc = 1242\ eVnm$ where h is the Planck's constant and c is the speed of light in vacuum.)

(1) 600 nm **(2)** 400 nm **(3)** 200 nm **(4)** 300 nm

31. A massless spring gets elongated by amount x_1 under a tension of 5N. Its elongation is x_2 under the tension of 7N. For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be:

(1) 39 N **(2)** 11 N **(3)** 15 N **(4)** 20 N

32. A circular disk of radius R meter and mass M kg is rotating around the axis perpendicular to the disk. An external torque is applied to the disk such that $\theta(t) = 5t^2 - 8t$, where $\theta(t)$ is the angular position of the rotating disc as a function of time t.

(1) 108 MR^2 **(2)** 60 MR^2 **(3)** 8 MR^2 **(4)** 72 MR^2

33. A galvanometer having a coil of resistance $30\ \Omega$ need 20 mA of current for full-scale deflection. If a maximum current of 3 A is to be measured using this galvanometer, the resistance of the shunt to be added to the galvanometer should be $\frac{30}{X}\Omega$, where X is:

(1) 596 **(2)** 447 **(3)** 298 **(4)** 149

34. Match List-I with List-II.

	List-I		List-II
(A)	Permeability of free space	**(I)**	$[ML^2T^{-2}]$
(B)	Magnetic field	**(II)**	$[MT^{-2}A^{-1}]$
(C)	Magnetic moment	**(III)**	$[MLT^{-2}A^{-2}]$
(D)	Torsional constant	**(IV)**	$[L^2A]$

Choose the correct answer from the options given below:

(1) (A) – (II), (B) – (I), (C) – (III), (D) – (IV) **(2)** (A) – (III), (B) – (II), (C) – (IV), (D) – (I)

(3) (A) – (IV), (B) – (III), (C) – (I), (D) – (II) **(4)** (A) – (I), (B) – (IV), (C) – (II), (D) – (III)

35. A plane electromagnetic wave of frequency 20 *MHz* travels in free space along the $+x$ direction. At a particular point in space and time, the electric field vector of the wave is $E_y = 9.3\ Vm^{-1}$. Then, the magnetic field vector of the wave at that point is:

(1) $B_z = 3.1\times10^{-8}\ T$ **(2)** $B_z = 1.55\times10^{-8}\ T$

(3) $B_z = 6.2\times10^{-8}\ T$ **(4)** $B_z = 9.3\times10^{-8}\ T$

36. Water flows in a horizontal pipe whose one end is closed with a valve. The reading of the pressure gauge attached to the pipe is P_1. The reading of the pressure gauge falls to P_2 when the valve is opened. The speed of water flowing in the pipe is proportional to:

(1) $P_1 - P_2$ **(2)** $(P_1 - P_2)^4$ **(3)** $\sqrt{P_1 - P_2}$ **(4)** $(P_1 - P_2)^2$

37. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The binding energy per nucleon is found to be practically independent of the atomic number A, for nuclei with mass numbers between 30 and 170.

Reason (R): Nuclear force is long range.

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

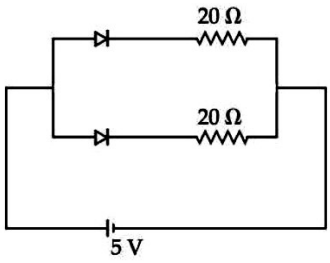
(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) (A) is false but (R) is true

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

(4) (A) is true but (R) is false

38. What is the current through the battery in the circuit shown below?



(1) 1.0 *A* **(2)** 1.5 *A* **(3)** 0.5 *A* **(4)** 0.25 *A*

39. The refractive index of the material of a glass prism is $\sqrt{3}$. The angle of minimum deviation is equal to the angle of the prism. What is the angle of the prism?

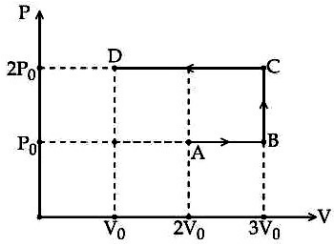
(1) 60° **(2)** 48° **(3)** 50° **(4)** 58°

40. The width of one of the two slits in Young's double slit experiment is d while that of the other slit is xd. If the ratio of the maximum to the minimum intensity in the interference pattern on the screen is 9 : 4 then what is the value of x?

(Assume that the field strength varies according to the slit width.)

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

41.



Using the given P-V diagram, the work done by an ideal gas along the path $ABCD$ is:

(1) $4P_0V_0$ **(2)** $-4P_0V_0$ **(3)** $3P_0V_0$ **(4)** $-3P_0V_0$

42. If a satellite orbiting the Earth is 9 times closer to the Earth than the Moon, what is the time period of rotation of the satellite? Given rotational time period of Moon = 27 days and gravitational attraction between the satellite and the moon is neglected.

(1) 27 days **(2)** 3 days **(3)** 1 days **(4)** 81 days

43. The equation of a transverse wave travelling along a string is $y(x,t) = 4.0\sin[20\times10^{-3}x + 600t]mm$, where x is in mm and t is in second. The velocity of the wave is:

(1) – 30 m/s **(2)** +60 m/s **(3)** +30 m/s **(4)** –60 m/s

44. Two charges $7\mu c$ and $-4\mu c$ are placed at (–7 cm, 0, 0) and (7 cm, 0, 0) respectively. Given, $\in_0 = 8.85\times10^{-12}C^2\ N^{-1}\ m^{-2}$, the electrostatic potential energy of the charge configuration is:

(1) $-1.5\ J$ **(2)** $-1.2\ J$ **(3)** $-1.8\ J$ **(4)** –2.0 J

45. The energy of a system is given as $E(t) = \alpha^3 e^{-\beta t}$, where t is the time and $\beta = 0.3\ s^{-1}$. The errors in the measurement of α and t are 1.2% and 1.6%, respectively. At t = 5 s, maximum percentage error in the energy is:

(1) 4% **(2)** 8.4% **(3)** 11.6% **(4)** 6%

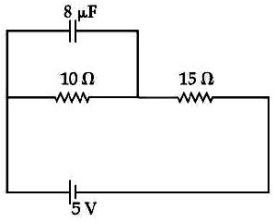
SECTION-2

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

46. An air bubble of radius 1.0 mm is observed at a depth of 20 cm below the free surface of a liquid having surface tension 0.095 J/m^2 and density $10^3\ kg/m^3$. The difference between pressure inside the bubble and atmospheric pressure is _____ N/m^2. (Take $g = 10\ m/s^2$)

47. A time varying potential difference is applied between the plates of a parallel plate capacitor of capacitance $2.5\ \mu F$. The dielectric constant of the medium between the capacitor plates is 1. It produces an instantaneous displacement current of $0.25\ mA$ in the intervening space between the capacitor plates, the magnitude of the rate of change of the potential difference will be _____ Vs^{-1}.

48. At steady state the charge on the capacitor, as shown in the circuit below, is _____ μC.



49. In a series *LCR* circuit, a resistor of $300\ \Omega$, a capacitor of 25 nF and an inductor of 100 mH are used. For maximum current in the circuit, the angular frequency of the ac source is _____ $\times 10^4$ radians s^{-1}.

50. A satellite of mass $\frac{M}{2}$ is revolving around earth in a circular orbit at a height of $\frac{R}{3}$ from earth surface. The angular momentum of the satellite is $M\sqrt{\frac{GMR}{x}}$. The value of x is _____, where M and R are the mass and radius of earth, respectively. (G is the gravitational constant)

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 effect of temperature on spontaneity of reactions are represented as:

	ΔH	ΔS	Temperature	Spontaneity
(A)	**+**	**–**	any T	Non spontaneous
(B)	**+**	**+**	low T	Spontaneous
(C)	**–**	**–**	low T	Non spontaneous
(D)	**–**	**+**	any T	Spontaneous

The incorrect combinations are:

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

(3) (B) and (C) only **(4)** (A) and (C) only

52. pH of water is 7 at 25°C. If water is heated to 80°C., it's pH will:

(1) H^+ concentration increases, OH^- concentration decreases

(2) Increase

(3) Remains the same

(4) Decrease

53. The α – Helix and β – Pleated sheet structures of protein are associated with its:

(1) Secondary structure **(2)** Primary structure

(3) Quaternary structure **(4)** Tertiary structure

54. Match List-I with List-II.

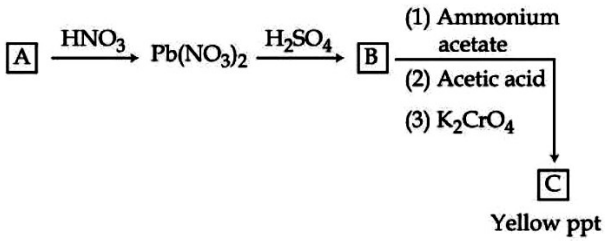
	List-I		**List-II**
(A)	Bronze	**(I)**	Cu, Ni
(B)	Brass	**(II)**	Fe, Cr, Ni, C
(C)	UK silver coin	**(III)**	Cu, Zn
(D)	Stainless steel	**(IV)**	Cu, Sn

Choose the correct answer from the options given below:

(1) (A) – (III), (B) – (IV), (C) – (II), (D) – (I) **(2)** (A) – (IV), (B) – (II), (C) – (III), (D) – (I)

(3) (A) – (IV), (B) – (III), (C) – (I), (D) – (II) **(4)** (A) – (III), (B) – (I), (C) – (IV), (D) – (II)

55. Identify A, B and C in the given below reaction sequence:



(1) $PbCl_2, Pb(SO_4)_2, PbCrO_4$ **(2)** $PbS, PbSO_4, Pb(CH_3COO)_2$

(3) $PbCl_2, PbSO_4, PbCrO_4$ **(4)** $PbS, PbSO_4, PbCrO_4$

56. Standard electrode potentials for a few half cells are mentioned below:

$E^{\circ}_{Cu^{2+}/Cu} = 0.34$ V, $E^{\circ}_{Zn^{2+}/Zn} = -0.76$ V

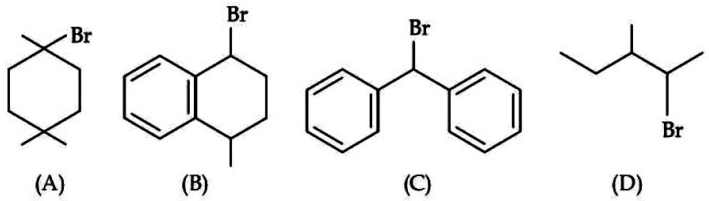
$E^{\circ}_{Ag^{+}/Ag} = 0.80$ V, $E^{\circ}_{Mg^{2+}/Mg} = -2.37$ V

Which one of the following cells gives the most negative value of ΔG°?

(1) $Zn \mid Zn^{2+}(1M) \mid\mid Ag^{+}(1M) \mid Ag$ **(2)** $Zn \mid Zn^{2+}(1M) \mid\mid Mg^{2+}(1M) \mid Mg$

(3) $Cu \mid Cu^{2+}(1M) \mid\mid Ag^{+}(1M) \mid Ag$ **(4)** $Ag \mid Ag^{+}(1M) \mid\mid Mg^{2+}(1M) \mid Mg$

57. The ascending order of relative rate of solvolysis of following compounds is:



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

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

58. Consider a binary solution of two volatile liquid components 1 and 2. x_1 and y_1 are the mole fractions of component 1 in liquid and vapour phase, respectively. The slope and intercept of the linear plot of $\frac{1}{x_1}$ vs $\frac{1}{y_1}$ are given respectively as:

(1) $\frac{P_2^0}{P_1^0}, \frac{P_2^0 - P_1^0}{P_2^0}$ **(2)** $\frac{P_1^0}{P_2^0}, \frac{P_2^0 - P_1^0}{P_2^0}$ **(3)** $\frac{P_2^0}{P_1^0}, \frac{P_1^0 - P_2^0}{P_2^0}$ **(4)** $\frac{P_1^0}{P_2^0}, \frac{P_1^0 - P_2^0}{P_2^0}$

59. Consider the reaction:

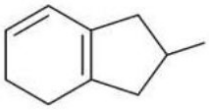
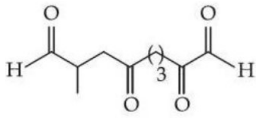
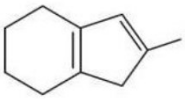
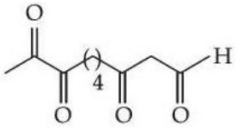
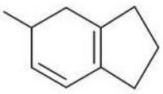
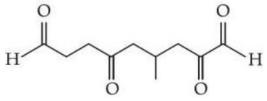
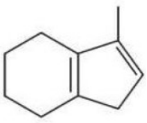
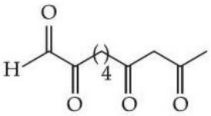
$$X_2Y(g) \rightleftharpoons X_2(g) + \frac{1}{2}Y_2(g)$$

The equation representing correct relationship between the degree of dissociation (x) of $X_2Y(g)$ with its equilibrium constant Kp is _____.

Assume x to be vary very small.

(1) $x = 3\sqrt{\frac{2Kp}{p}}$ **(2)** $x = 3\sqrt{\frac{Kp}{2p}}$ **(3)** $x = 3\sqrt{\frac{Kp}{p}}$ **(4)** $x = 3\sqrt{\frac{2Kp^2}{p}}$

60. Match List-I with List-II.

	List-I (Isomers of $C_{10}H_{14}$)		**List-II (Ozonolysis product)**
(A)		**(I)**	
(B)		**(II)**	
(C)		**(III)**	
(D)		**(IV)**	

Choose the correct answer from the options given below:

(1) (A)–(III), (B)–(II), (C)–(I), (D)–(IV) **(2)** (A)–(I), (B)–(IV), (C)–(III), (D)–(II)

(3) (A)–(III), (B)–(IV), (C)–(I), (D)–(II) **(4)** (A)–(II), (B)–(III), (C)–(I), (D)–(IV)

61. Given below are two statements about X-ray spectra of elements:

Statement (I): A plot of $\sqrt{v}$ (v = frequency of X-rays emitted) vs atomic mass is a straight line.

Statement (II): A plot of v(v = frequency of X-rays emitted) vs atomic number is a straight line.

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

(1) Both Statement I and Statement II are true

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

(3) Both Statement I and Statement II are false

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

62. Given below are two statements:

Statements (I): The boiling points of alcohols and phenols increase with increase in the number of C-atoms.

Statement (II): The boiling points of alcohols and phenols are higher in comparison to other class of compounds such as ethers, haloalkanes.

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

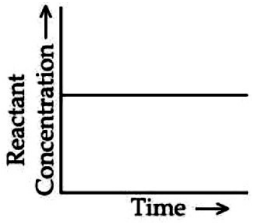
(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

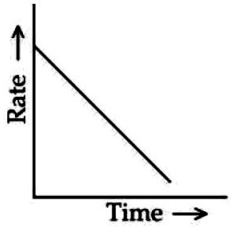
(4) Statement I is true but Statement II is false

63. Which of the following graphs most appropriately represents a zero order reaction?

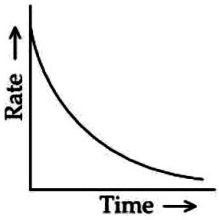
(1)



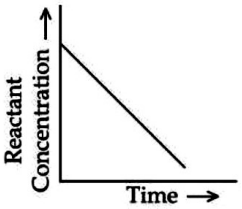
(2)



(3)



(4)



64. When a non-volatile solute is added to the solvent, the vapour pressure of the solvent decreases by 10 mm of Hg. The mole fraction of the solute in the solution is 0.2. What would be the mole fraction of the solvent if decreases in vapour pressure is 20 mm of Hg?

(1) 0.4 **(2)** 0.8 **(3)** 0.2 **(4)** 0.6

65. Consider the following reactions:

$$K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} [A] \xrightarrow[-H_2O]{H_2SO_4} [B] + K_2SO_4$$

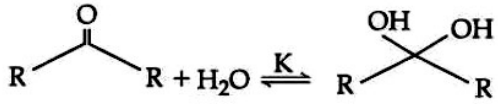
The products [A] and [B], respectively are:

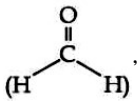
(1) $K_2Cr(OH)_6$ and Cr_2O_3 **(2)** K_2CrO_4 and CrO

(3) K_2CrO_4 and $K_2Cr_2O_7$ **(4)** K_2CrO_4 and Cr_2O_3

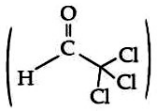
66. Given below are two statements:

Consider the following reaction,



Statement (I): In the case of folmaldehyde 

, K is about 2280, due to msall substitutnets, hydration is faster.

Statement (II): In the case of trichloro acetaldehyde 

, K is about 2000 due to –I effect of –Cl.

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

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

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

(3) Both Statement I and Statement II are false

(4) Both Statement I and Statement II are true

67. Given below are the atomic number of some group 14 elements. The atomic number of the element with lowest melting point is:

(1) 50 **(2)** 6 **(3)** 82 **(4)** 14

68. Given below are two statements:

Statement (I): For a given shell, the total number of allowed orbitals is given by n^2.

Statement (II): For any subshell, the spatial orientation of the orbitals is given by –l to +l values including zero.

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 true but Statement II is false

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

69. Identify the coordination complexes in which the central metal ion has d^4 configuration.

(A) $[FeO_4]^{2-}$ **(B)** $[Mn(CN)_6]^{3-}$ **(C)** $[Fe(CN)_6]^{3-}$

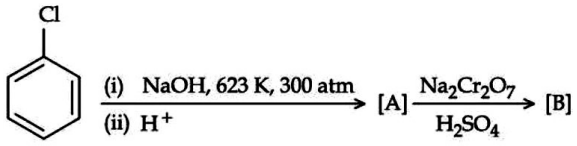
(D) $Cr_2(O-\overset{\overset{O}{\|}}{C}-Me)_4(H_2O)_2$ **(E)** $[NiF_6]^{2-}$

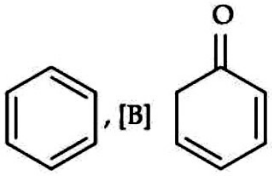
Choose the correct answer from the options given below:

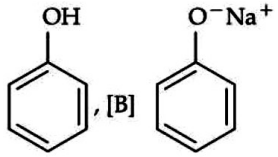
(1) (B) and (D) only **(2)** (C) and (E) only

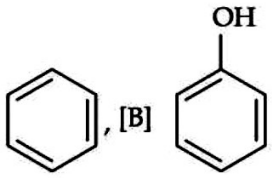
(3) (B), (C) and (D) only **(4)** (A), (B) and (E) only

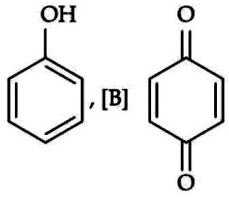
70. Identify the product [A] and [B], respectively in the following reaction:



(1) 

(2) 

(3) 

(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.

71. The bond dissociation enthalpy of X_2 ΔH°_{bond} calculated from the given data is _____ kJ mol^{-1}. (Nearest integer)

$M^+X^-(s) \rightarrow M^+(g) + X^-(g) \Delta H^\circ_{lattice} = 800$ kJ mol^{-1}

$M(s) \rightarrow M(g) \Delta H^\circ_{sub} = 100$ kJ mol^{-1}

$M(g) \rightarrow M^+(g) + e^-(g) \Delta H^\circ_i = 500$ kJ mol^{-1}

$X(g) + e^-(g) \rightarrow X^-(g) \Delta H^\circ_{eg} = -300$ kJ mol^{-1}

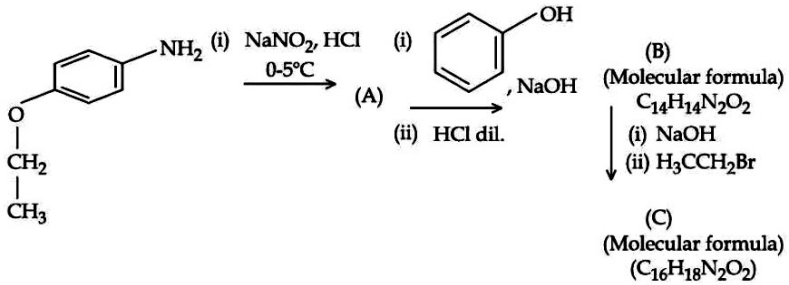
$M(s) + \frac{1}{2}X_2(g) \rightarrow M^+X^-(s) \Delta H^\circ_f = -400$ kJ mol^{-1}

[Given: M^+X^- is a pure ionic compound and X forms a diatomic molecule X_2 in gaseous state]

72. A compound 'X' absorbs 2 moles of hydrogen and 'X' upon oxidation with $KMnO_4 \mid H^+$ gives $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$, $CH_3-\overset{\overset{O}{\|}}{C}-OH$ and $CH_3-\overset{\overset{O}{\|}}{C}-CH_2CH_2-\overset{\overset{O}{\|}}{C}-OH$.

The total number of σ bonds present in the compound 'X' is _____.

73. Consider the following sequence of reactions.



Total number of sp^3 hybridized carbon atoms in the major product C formed is _____.

74. When 81.0 g of aluminium is allowed to react with 128.0 g of oxygen gas, the mass of aluminium oxide produced in grams is _____. (Nearest integer)

Given: Molar mass of Al is 27.0 g mol^{-1}

Molar mass of O is 16.0 g mol^{-1}

75. 0.01 mole of an organic compound (X) containing 10% hydrogen, on complete combustion produced 0.9 g H_2O. Molar mass of (X) is _____ g mol^{-1}.