# JEE Main 2023 April 13 Shift 1 Question Paper

| Time Allowed :3 Hours | Maximum Marks :300 | Total Questions :90 |
|---|---|---|

## General Instructions

**Read the following instructions very carefully and strictly follow them:**

1. The test is of 3 hours duration.
2. The question paper consists of 90 questions, out of which 75 are to attempted. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
4. Each part (subject) has two sections.
   (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.
   (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer

## Mathmatics

### Section-A

**1.**

$$\int_0^{\infty} \frac{6}{e^{3x}+6e^{2x}+11e^{x}+6}dx$$

(1) $\log_e\left(\frac{32}{27}\right)$

(2) $\log_e\left(\frac{256}{81}\right)$

(3) $\log_e\left(\frac{512}{81}\right)$

(4) $\log_e\left(\frac{64}{27}\right)$

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**2. Among**

(S1) $\lim_{n\to\infty}\frac{1}{n}\left(2+4+6+\cdots+2n\right)=1$

(S2) $\lim_{n\to\infty}\frac{1}{16}\left(1^{15}+2^{15}+3^{15}+\cdots+n^{15}\right)=\frac{1}{16}$

(1) Only (S1) is true

(2) Both (S1) and (S2) are true

(3) Both (S1) and (S2) are false

(4) Only (S2) is true

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**3. The number of symmetric matrices of order 3, with all the entries from the set** $\{0,1,2,3,4,5,6,7,8,9\}$**, is:**

(1) $10^9$

(2) $10^6$

(3) $9^{10}$

(4) $6^{10}$

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**4. Let** $\mathbf{a}=\hat{i}+4\hat{j}+2\hat{k},\mathbf{b}=3\hat{i}-2\hat{j}+7\hat{k},\mathbf{c}=2\hat{i}-\hat{j}+4\hat{k}$**. If a vector** $\mathbf{d}$ **satisfies** $\hat{d}\times\hat{b}=\hat{c}\times\hat{b}$ **and** $\hat{d}\cdot\hat{a}=24$**, then** $|\hat{d}|^2$ **is equal to:**

(1) 323

(2) 423

(3) 413

(4) 313

---

**5. A coin is biased so that the head is 3 times as likely to occur as tail. This coin is tossed until a head or three tails occur. If $X$ denotes the number of tosses of the coin, then the mean of $X$ is:**

(1) $\frac{21}{16}$

(2) $\frac{15}{16}$

(3) $\frac{81}{64}$

(4) $\frac{37}{16}$

---

**6. Find the maximum value of the function**

$$\max_{0\le x\le\pi}\left\{x-2\sin x\cos x+\frac{1}{3}\sin 3x\right\}=$$

(1) 0

(2) $\pi$

(3) $\frac{5\pi+2+3\sqrt{3}}{6}$

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

---

**7. The set of all $a \in \mathbb{R}$ for which the equation**

$$x - |x - 1| + |x + 2| + a = 0$$

**has exactly one real root is:**

(1) $(-\infty, -3)$

(2) $(-\infty, \infty)$

(3) $(-6, \infty)$

(4) $(-6, -3)$

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**8. Let PQ be a focal chord of the parabola $y^2 = 36x$ of length 100, making an acute angle with the positive x-axis. Let the ordinate of $P$ be positive and $M$ be the point on**

**the line segment PQ such that $PM : MQ = 3 : 1$. Then which of the following points does NOT lie on the line passing through M and perpendicular to the line PQ?**

(1) $(3, 33)$

(2) $(6, 29)$

(3) $(-6, 45)$

(4) $(-3, 43)$

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**9. For the system of linear equations**

2x + 4y + 2az = b,

x + 2y + 3z = 4,

2x - 5y + 2z = 8,

**which of the following is NOT correct?**

(1) It has infinitely many solutions if $a = 3, b = 8$

(2) It has unique solution if $a = b = 8$

(3) It has unique solution if $a = b = 6$

(4) It has infinitely many solutions if $a = 3, b = 6$

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**10. Let $s_1, s_2, s_3, \ldots, s_{10}$ respectively be the sum to 12 terms of 10 A.P.s whose first terms are $1, 2, 3, \ldots, 10$ and the common differences are $1, 3, 5, \ldots, 19$ respectively. Then**

$$\sum_{i=1}^{10} s_i \text{ is equal to:}$$

(1) 7260

(2) 7380

(3) 7220

(4) 7360

---

**11. For the differentiable function** $f : \mathbb{R} - \{0\} \to \mathbb{R}$, **let** 3f(x) + $2f\left(\frac{1}{x}\right) = \frac{1}{x} - 10$, **then** $\left|f(3) + f\left(\frac{1}{4}\right)\right|$ **is equal to:**

(1) 13

(2) $\frac{29}{5}$

(3) $\frac{33}{5}$

(4) 7

---

**12. The negation of the statement** $((A \wedge (B \vee C)) \Rightarrow (A \vee B)) \Rightarrow A$ **is:**

(1) equivalent to $B \vee \sim C$

(2) a fallacy

(3) equivalent to $\sim C$

(4) equivalent to $\sim A$

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**13. Let the tangent and normal at the point** $\left(3\sqrt{3}, 1\right)$ on the ellipse $\frac{x^2}{36} + \frac{y^2}{4} =$ 1 meet the y-axis at the points A and B respectively. Let the circle C be drawn taking AB as a diameter a $2\sqrt{5}$ intersect C at the points P and Q. If the tangents at the points P and Q on the circle intersect at the p $\beta^2$ is equal to:

(1) $\frac{304}{5}$

(2) 60

(3) $\frac{314}{5}$

(4) 61

---

**14. The distance of the point** (-1, 2, 3) **from the plane** $\mathbf{r} \cdot (\hat{i} - 2\hat{j} + 3\hat{k}) = 10$ **parallel to the line of the shortest distance between the lines** r = ( - ) + $\lambda(2\hat{i} + \hat{k})$ and $\mathbf{r} = (2\hat{i} - \hat{j}) + \mu(\hat{i} - \hat{j} + \hat{k})$**is:**

(1) $2\sqrt{5}$

(2) $3\sqrt{5}$

(3) $3\sqrt{6}$

(4) $2\sqrt{6}$

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**15. Let**

$$\text{Let } B=\begin{bmatrix}1 & 3 & \alpha\\ 1 & 2 & 3\\ \alpha & \alpha & 4\end{bmatrix},$$

$\alpha > 2$ be the adjoint of a matrix $A$ and $|A| = 2$.

**Then**

$$\begin{bmatrix}\alpha & -2\alpha & \alpha\end{bmatrix}B\begin{bmatrix}\alpha\\ -2\alpha\\ \alpha\end{bmatrix} \text{ is equal to}$$

(1) 16

(2) 32

(3) 0

(4) -16

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**16. For $x \in \mathbb{R}$, two real valued functions $f(x)$ and $g(x)$ are such that,**

$$g(x) = \sqrt{x} + 1 \quad \text{and} \quad f \circ g(x) = x + 3 - \sqrt{x}.$$

**Then $f(0)$ is equal to:**

(1) 5

(2) 0

(3) -3

(4) 1

---

**17. Let the equation of the plane passing through the line of intersection of the planes** x

+ 2y + az = 2 and x - y + bz = 6a - 1 **be** x + y + tz = 5x. **For** $c \in \mathbb{Z}$, **if the distance of this plane from the point** $(a, -c, c)$ **is** $\frac{2}{\sqrt{a}}$, **then** a + b$_{\text{cis equal to:}}$

(1) -4

(2) 2

(3) -2

(4) 4

---

**18. Fractional part of the number** $\frac{4^{2022}}{15}$ **is equal to:**

(1) $\frac{4}{15}$

(2) $\frac{8}{15}$

(3) $\frac{1}{15}$

(4) $\frac{14}{15}$

---

**19. Let** $y = y_1(x)$ and $y = y_2(x)$ be the solution curves of the differential equation

$$\frac{dy}{dx} = y + 7$$

with initial conditions $y_1(0) = 0$ and $y_2(0) = 1$ respectively. Then the curves $y = y_1(x)$ and $y = y_2(x)$ intersect at:

(1) no point

(2) infinite number of points

(3) one point

(4) two points

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**20. The area of the region enclosed by the curve** $f(x) = \max\{\sin x, \cos x\}$, where $-\pi \leq x \leq \pi$ and the x-axis is:

(1) $2\sqrt{2}(\sqrt{2} + 1)$

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

(3) 4

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

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## Section-B

**21. The sum to 20 terms of the series** $2.2^2 - 3^2 + 2.4^2 - 5^2 + 2.6^2 - \ldots$ is equal to $--$.

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**22. Let the mean of the data**

| $x$ | 1 | 3 | 5 | 7 | 9 |
|---|---|---|---|---|---|
| Frequency $(f)$ | 4 | 24 | 28 | $\alpha$ | 8 |

**be 5. If** m and

$\sigma^2$ are respectively the mean deviation about the mean and the variance of the data, then

$$\frac{3\alpha}{m+\sigma^2} \text{ is equal to}\text{——-}$$

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**23. Let** $\alpha$ be the constant term in the binomial expansion of

$$\left(\sqrt{x} - \frac{6}{3x^2}\right)^n,\ n \leq 15.$$

If the sum of the coefficients of the remaining terms in the expansion is 649 and the coefficient of $x^{-n}$ is $\lambda\alpha$, then $\lambda$ is equal to——

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**24. Let** $\omega = zz + k_1 z + k_2 iz + \lambda(1+i),\ k_1, k_2 \in \mathbb{R}$. **Let** $\text{Re}(\omega) = 0$ be the circle C of radius 1 in the first quadrant touching the line $y = 1$ and the y-axis. If the curve $\text{Im}(\omega) = 0$ intersects C at A and B, then $30(AB)^2$ is equal to——-

**25. Let** $\mathbf{a} = 3\hat{i} + \hat{j} - \hat{k}$ and $\hat{c} = 2\hat{i} - 3\hat{j} + 3\hat{k}$. If
$\hat{b}$ is a vector such that $\hat{a} = \hat{b} \times \hat{c}$ and $\|\hat{b}\|^2 = 50$, then $\left|72 - \|\hat{b} - \hat{c}\|^2\right|$ is equal to—-

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**26. Let** $m_1$ and $m_2$ be the slopes of the tangents drawn from the point P(4,1)
to the hyperbola

$$\frac{y^2}{25} - \frac{x^2}{16} = 1.$$

If Q is the point from which the tangents drawn to H have slopes
—$m_1$| and $|m_2|$ and they make positive intercepts $\alpha$ and $\beta$ on the x-axis, then $\frac{(PQ)^2}{\alpha\beta}$ is equal to——

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**27. Let the image of the point** $\left(\frac{5}{3}, \frac{5}{3}, 8\right)$ in the plane $x - 2y + z - 2 = 0$
be P. If the distance of the point Q(6, -2, -2), $\alpha > 0$, from P is 13, then $\alpha$ is equal to——

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**28. Let for** $x \in \mathbb{R}$, $S_0(x) = x$, $S_k(x) = C_k x + k\int_0^x S_{k-1}(t)dt$ where
$C_0 = 1$, $C_k = 1 - \int_0^1 S_{k-1}(x)dx$, $k = 1, 2, 3, \ldots$. Then $S_2(3) + 6C_3$ is equal to——

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**29. If** $S = \left\{x \in \mathbb{R} : \sin^{-1}\left(\frac{x+1}{\sqrt{x^2+2x+2}}\right) - \sin^{-1}\left(\frac{x}{\sqrt{x^2+1}}\right) = \frac{\pi}{4}\right\}$, then $S$ is equal to——

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**30. The number of seven digit positive integers formed using the digits 1, 2, 3, and 4 only and the sum of the digits equal to 12 is:**

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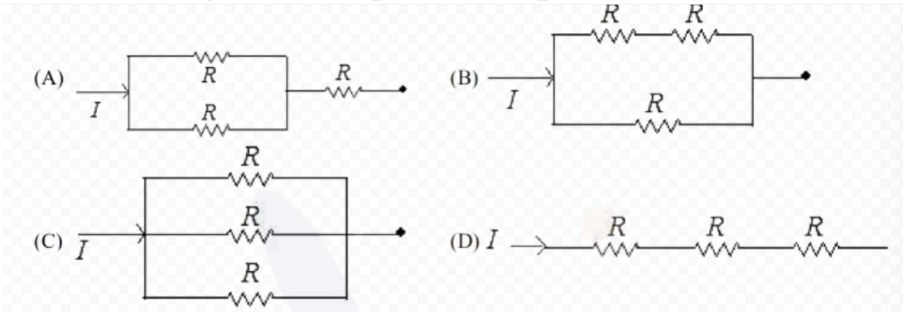
## Physics

## Section-A

**31. Different combination of 3 resistors of equal resistance $R$ are shown in the figures. The increasing order for power dissipation is:**




(1) $P_C < P_B < P_A < P_D$

(2) $P_C < P_D < P_A < P_B$

(3) $P_B < P_C < P_D < P_A$

(4) $P_A < P_B < P_C < P_D$

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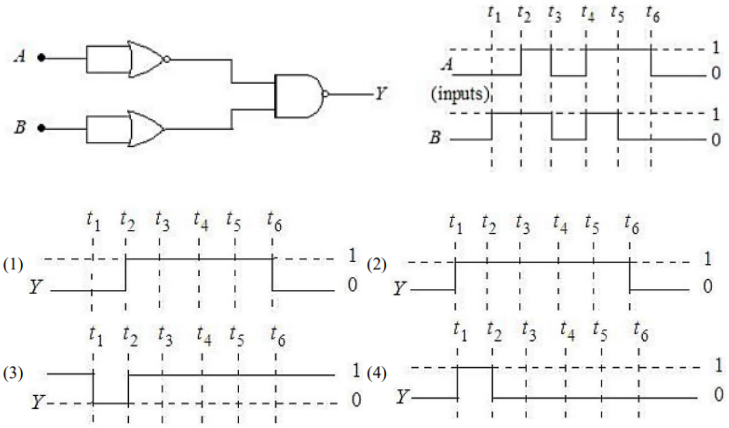
**32. For the following circuit and given inputs A and B, choose the correct option for output Y.**




The given circuit is a NAND gate, which gives an output Y based on the inputs A and B. The truth table for a NAND gate is:

$$\mathrm{Y} = \overline{A \cdot B}.$$

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**33. A bullet of 10 g leaves the barrel of the gun with a velocity of 600 m/s. If the barrel of the gun is 50 cm long and the mass of the gun is 3 kg, then the value of the impulse supplied to the gun will be:**

(1) 12 Ns

(2) 6 Ns

(3) 3 Ns

(4) 36 Ns

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**34. Which of the following Maxwell's equation is valid for time varying conditions but not valid for static conditions:**

(1) $\oint \vec{D} \cdot d\vec{A} = Q$

(2) $\oint \vec{E} \cdot d\vec{l} = -\frac{\partial \Phi_B}{\partial t}$

(3) $\oint \vec{E} \cdot d\vec{l} = 0$

(4) $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$

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**35. Match List – I with List – II**

| **List - I** (Layer of atmosphere) | **List - II** (Approximate height over Earth's surface) |
|---|---|
| (A) F1 - Layer | (I) 10 km |
| (B) D - Layer | (II) 170 - 190 km |
| (C) Troposphere | (III) 100 km |
| (D) E - Layer | (IV) 65 - 75 km |

**Choose the correct answer from the options given below:**

(1) A – II, B – I, C – IV, D – III

(2) A – II, B – IV, C – III, D – I

(3) A – II, B – IV, C – I, D – III

(4) A – III, B – IV, C – I, D – II

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**36. The rms speed of oxygen molecule in a vessel at particular temperature is $\left(1+\frac{5}{x}\right)^{\frac{1}{2}} \nu$, where $\nu$ is the average speed of the molecule. The value of $x$ will be: (Take $\pi = \frac{22}{7}$)**

(1) 28

(2) 27

(3) 8

(4) 4

---

**37. The ratio of powers of two motors is**

$$\frac{3\sqrt{x}}{\sqrt{x+1}},$$

**that are capable of raising 300 kg of water in 5 minutes and 50 kg of water in 2 minutes respectively from a well 100 m deep. The value of $x$ will be:**

(1) 16

(2) 2

(3) 4

(4) 2.4

---

**38. Two trains 'A' and 'B' of length $l$ and $l$ are travelling into a tunnel of length $L$ in parallel tracks from opposite directions with velocities 108 km/h and 72 km/h, respectively. If train 'A' takes 35 s less time than train 'B' to cross the tunnel, then length $L$ of the tunnel is:** (Given $l = 60$ m)

(1) 2700 m

(2) 1800 m

(3) 1200 m

(4) 900 m

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**39. Two bodies are having kinetic energies in the ratio 16 : 9. If they have the same linear momentum, the ratio of their masses respectively is:**

(1) 16 : 9

(2) 4 : 3

(3) 9 : 16

(4) 3 : 4

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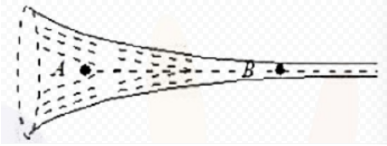
**40. The figure shows a liquid of given density flowing steadily in a horizontal tube of varying cross-section. Cross-sectional areas at A is 1.5 cm$^2$, and at B is 25 mm$^2$, if the speed of liquid at B is 60 cm/s then** $(P_A - P_B)$ **is:** (Given $P_A$ and $P_B$ are liquid pressures at A and B points, and density $\rho = 1000\,\text{kg/m}^3$. A and B are on the axis of the tube.)




(1) 175 Pa

(2) 36 Pa

(3) 27 Pa

(4) 135 Pa

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**41.**

$^{238}_{92}A \rightarrow ^{234}_{90}B + {}^{4}_{2}D + Q$

**In the given nuclear reaction, the approximate amount of energy released will be:**

**[Given, mass of** $^{238}_{92}A = 238.05079 \times 931.5\,\text{MeV/c}^2$**,**

$$\text{mass of } ^{234}_{90}B = 234.04363 \times 931.5\,\text{MeV/c}^2,$$

$$\text{mass of } ^{4}_{2}D = 4.00260 \times 931.5\,\text{MeV/c}^2]$$

(1) 4.25 MeV

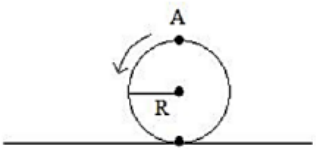
(2) 5.9 MeV

(3) 3.82 MeV

(4) 2.12 MeV

---

**42. A disc is rolling without slipping on a surface. The radius of the disc is** $R$**. At** $t = 0$**, the top most point on the disc is A as shown in the figure. When the disc completes half of its rotation, the displacement of point A from its initial position is:**




(1) $2R\sqrt{1+4\pi^2}$

(2) $R\sqrt{\pi^2+4}$

(3) $2R$

(4) $R\sqrt{\pi^2+1}$

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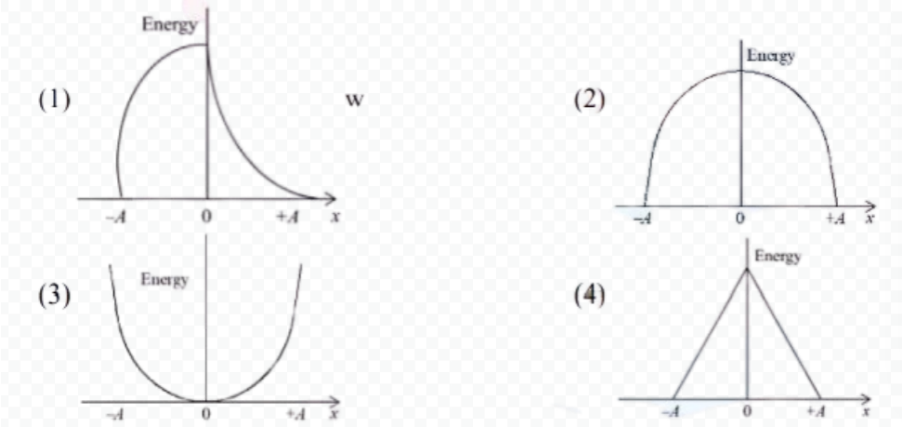
**43. Which graph represents the difference between total energy and potential energy of a particle executing SHM vs its distance from the mean position?**

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**44. Two charges each of magnitude 0.01 C and separated by a distance of 0.4 mm constitute an electric dipole. If the dipole is placed in an uniform electric field $\vec{E}$ of 10 dyne/C making 30° angle with $\vec{E}$, the magnitude of torque acting on dipole is:**

(1) $1.5 \times 10^{-9}$ Nm

(2) $2.0 \times 10^{-10}$ Nm

(3) $1.0 \times 10^{-8}$ Nm

(4) $4.0 \times 10^{-10}$ Nm

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**45. Under isothermal condition, the pressure of a gas is given by $P = aV^{-3}$, where $a$ is a constant and $V$ is the volume of the gas. The bulk modulus at constant temperature is equal to:**

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

(2) $2P$

(3) $P$

(4) $3P$

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**46. A planet having mass $9M_e$ and radius $4R_e$, where $M_e$ and $R_e$ are mass and radius of Earth respectively, has escape velocity in km/s given by:** (Given escape velocity on earth $V_e = 11.2 \times 10^3$ m/s)

(1) 11.2

(2) 67.2

(3) 33.6

(4) 16.8

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**47. A body of mass $(5 \pm 0.5)$ kg is moving with a velocity of $(20 \pm 0.4)$ m/s. Its kinetic energy will be:**

(1) $(1000 \pm 140)$ J

(2) $(500 \pm 140)$ J

(3) $(500 \pm 0.14)$ J

(4) $(1000 \pm 0.14)$ J

---

**48. The difference between threshold wavelengths for two metal surfaces A and B having work functions $\phi_A = 9$ eV and $\phi_B = 4.5$ eV in nm is:**
**Given, hc = 1242 eV nm**

(1) 276

(2) 264

(3) 540

(4) 138

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**49. The source of time varying magnetic field may be:**

(A) A permanent magnet

(B) An electric field changing linearly with time

(C) Direct current

(D) A decelerating charge particle

(E) An antenna fed with a digital signal

**Choose the correct answer from the options given below:**

(1) (B) and (D) only

(2) (C) and (E) only

(3) (D) only

(4) (A) only

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**50. A vessel of depth $d$ is half filled with oil of refractive index $n_1$ and the other half is filled with water of refractive index $n_2$. The apparent depth of this vessel when viewed from above will be:**

(1) $\frac{d(n_1+n_2)}{2n_1n_2}$

(2) $\frac{dn_1n_2}{(n_1+n_2)}$

(3) $\frac{dn_1n_2}{2(n_1+n_2)}$

(4) $\frac{2d(n_1+n_2)}{n_1n_2}$

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## Section-B

**51. When a resistance of 5 $\Omega$ is shunted with a moving coil galvanometer, it shows a full scale deflection for a current of 250 mA, however, when 1050 $\Omega$ resistance is connected with it in series, it gives full scale deflection for 25 volt. The resistance of the galvanometer is ——$\Omega$.**

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**52. The radius of the 2nd orbit of $He^+$ of Bohr's model is $r_1$ and that of the fourth orbit of $Be^{3+}$ is represented as $r_2$. Now the ratio $\frac{r_2}{r_1}$ is $x:1$. The value of $x$———**

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**53. A solid sphere is rolling on a horizontal plane without slipping. If the ratio of angular momentum about axis of rotation of the sphere to the total energy of the moving sphere is $\frac{\pi}{22}$, the value of its angular speed will be rad/s**

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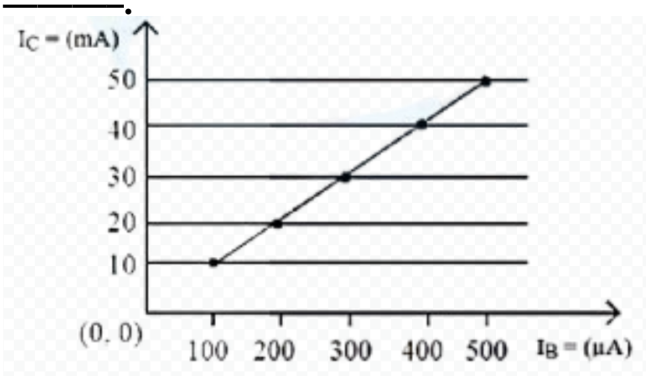
**54. A fish rising vertically upward with a uniform velocity of 8 m/s observes that a bird is diving vertically downward towards the fish with the velocity of 12 m/s. If the refractive index of water is $\frac{4}{3}$, then the actual velocity of the diving bird to pick the fish will be ———m/s.**

**55. The elastic potential energy stored in a steel wire of length 20 m stretched through 2 cm is 80 J. The cross sectional area of the wire is _____ mm$^2$.** (Given, y = $2.0 \times 10^1 1Nm^{-2)}$

**56. From the given transfer characteristic of a transistor in CE configuration, the value of power gain of this configuration is $10^x$, for $R_B = 10\,\text{k}\Omega$, $R_C = 1\,\text{k}\Omega$. The value of $x$ is _____.**




**57. In the given figure, an inductor and a resistor are connected in series with a battery of emf $E$ volt. $\frac{E^2}{2b}$ represents the maximum rate at which the energy is stored in the magnetic field (inductor). The numerical value of $\frac{b}{a}$ will be ———**

$$\text{Let } B = \begin{bmatrix} 1 & 3 & \alpha \\ 1 & 2 & 3 \\ \alpha & \alpha & 4 \end{bmatrix},$$

**58. A potential $V_0$ is applied across a uniform wire of resistance $R$. The power dissipation is $P_1$. The wire is then cut into two equal halves and a potential $V_0$ is applied across the length of each half. The total power dissipation across two wires is $P_2$. The ratio $P_2 : P_1$ is $\sqrt{x} : 1$. The value of $x$ is ———**

**59. At a given point of time the value of displacement of a simple harmonic oscillator is given as $y = A\cos(30°)$. If amplitude is 40 cm and kinetic energy at that time is 200 J, the value of force constant is $1.0 \times 10^x$ Nm$^{-1}$. The value of $x$ is ———**

**60. A thin infinite sheet charge and an infinite line charge of respective charge densities**

**$+\sigma$ and $+\lambda$ are placed parallel at a 5 m distance from each other. Points 'P' and 'Q' are at $\frac{3}{\pi}$ m and $\frac{4}{\pi}$ m perpendicular distances from the line charge towards the sheet charge, respectively. '$E_P$' and '$E_Q$' are the magnitudes of resultant electric field intensities at point 'P' and 'Q' respectively. If $\frac{E_P}{E_Q} = \frac{4}{a}$ for $2|\sigma| = |\lambda|$, then the value of $a$ is ———**

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## Chemistry

### Section-A

**61. Given below are two statements:**

**Statement I: Permutit process is more efficient compared to the synthetic resin method for the softening of water.**

**Statement II: Synthetic resin method results in the formation of soluble sodium salts.**

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

(1) Both the Statements I and II are correct

(2) Statement I is incorrect but Statement II is correct

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

(4) Both the Statements I and II are incorrect

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**62. Which one of the following is most likely a mismatch?**

(1) Zinc - Liquation

(2) Copper - Electrolysis

(3) Titanium - van Arkel Method

(4) Nickel - Mond process

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**63. The energy of an electron in the first Bohr orbit of hydrogen atom is $-2.18 \times 10^{-18}$ J. Its energy in the third Bohr orbit is ——.**

(1) $\frac{1}{27}$ of this value

(2) $\frac{1}{9}$ of this value

(3) One third of this value

(4) Three times this value

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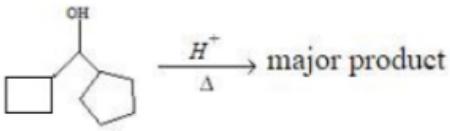
**64.**




**In the above reaction, left hand side and right hand side rings are named as 'A' and 'B' respectively. They undergo ring expansion. The correct statement for this process is:**

(1) Finally both rings will become six membered each.

(2) Ring expansion can go upto seven membered rings

(3) Finally both rings will become five membered each.

(4) Only A will become 6 membered.

---

**65. Match The following**

| Column-A | Column-B |
|---|---|
| a) Nylon 6 | I. Natural Rubber |
| b) Vulcanized Rubber | II. Cross Linked |
| c) cis-1, 4-polyisoprene | III. Caprolactam |
| d) Polychloroprene | IV. Neoprene |

Choose the correct answer from options given below:

(1) a $\rightarrow$ II, a $\rightarrow$ III, c $\rightarrow$ IV, d $\rightarrow$ I

(2) a $\rightarrow$ IV, b $\rightarrow$ III, c $\rightarrow$ II, d $\rightarrow$ I

(3) a $\rightarrow$ III, b $\rightarrow$ II, c $\rightarrow$ I, d $\rightarrow$ IV

(4) a $\rightarrow$ III, b $\rightarrow$ IV, c $\rightarrow$ I, d $\rightarrow$ II

---

**66. What happens when a lyophilic sol is added to a lyophobic sol?**

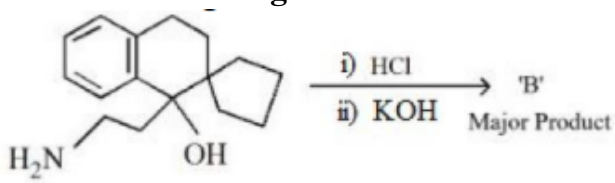
(1) Film of lyophobic sol is formed over lyophilic sol.

(2) Lyophilic sol is dispersed in lyophobic sol.

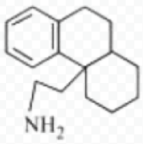
(3) Lyophobic sol is coagulated.

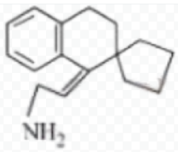
(4) Film of lyophilic sol is formed over lyophobic sol.

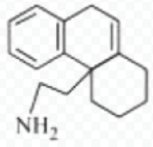
**67. In the reaction given below**

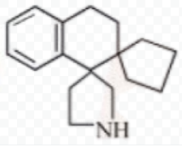



'B' is:

(1) 


(2) 


(3) 


(4) 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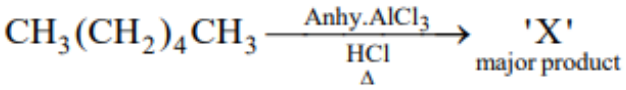
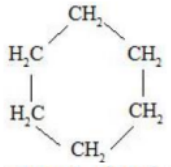
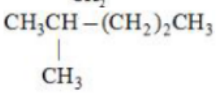
**68. In the following reaction 'X' is**




(1) $CH_3(CH_2)_4CH_2Cl$

(2) 


(3) $Cl-CH_2-(CH_2)_4-CH_2-Cl$

(4) 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**69. 2-Methyl propyl bromide reacts with $C_2H_5O^-$ and gives 'A' when reacted with $C_2H_5OH$ it gives 'B'. The mechanism followed in these reactions and the products 'A' and 'B' respectively are:**

(1) $SN_1$, A = tert-butyl ethyl ether; $SN_1$, B = 2-butyl ethyl ether

(2) $SN_2$, A = 2-butyl ethyl ether; $SN_2$, B = iso-butyl ethyl ether

(3) $SN_2$, A = iso-butyl ethyl ether; $SN_1$, B = tert-butyl ethyl ether

(4) $SN_1$, A = tert-butyl ethyl ether; $SN_2$, B = iso-butyl ethyl ether

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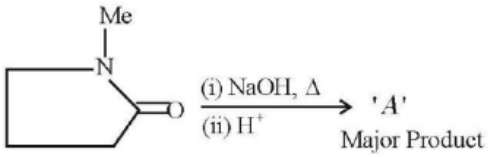
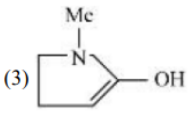
**70. In the reaction given below**

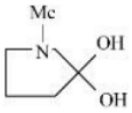



'A' is

(1) 


(2) 


(3) 


(4) 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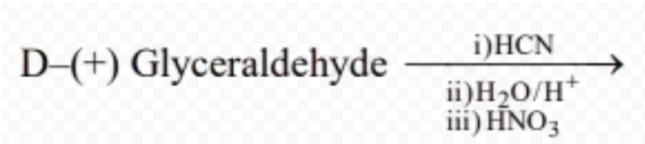
**71.**




The products formed in the above reaction are:

(1) Two optically active products

(2) One optically inactive and one meso product.

(3) One optically active and one meso product.

(4) Two optically inactive products.

---

**72. $ClF_5$ at room temperature is:**

(1) Colourless liquid with square pyramidal geometry

(2) Colourless gas with trigonal bipyramidal geometry

(3) Colourless gas with square pyramidal geometry

(4) Colourless liquid with trigonal bipyramidal geometry

---

**73. The pair of lanthanides in which both elements have high third-ionization energy is:**

(1) Dy, Gd

(2) Eu, Gd

(3) Lu, Yb

(4) Eu, Yb

---

**74. The mismatched combinations are**

A. Chlorophyll - Co

B. Water hardness - EDTA

C. Photography - $[Ag(CN)_2]^-$

D. Wilkinson catalyst - $[(PPh_3)_3RhCl]$

E. Chelating ligand - D-Penicillamine

Choose the correct answer from the options given below: (1) A and C Only

(2) D and E Only

(3) A and Only

(4) A, C, and E Only

---

**75. Which of the following statements are not correct?**

A. The electron gain enthalpy of F is more negative than that of Cl.

B. Ionization enthalpy decreases in a group of the periodic table.

C. The electronegativity of an atom depends upon the atoms bonded to it.

D. $Al_2O_3$ and NO are examples of amphoteric oxides.

Choose the most appropriate answer from the options given below:

(1) A, C, and D Only

(2) B and D Only

(3) A, B and D Only

(4) A, B, C and D

---

**76. The radical which mainly causes ozone depletion in the presence of UV radiation is:**

(1) $NO^{\cdot}$

(2) $OH^{\cdot}$

(3) $CH_3$

(4) $Cl^{\cdot}$

---

**77. In which of the following processes, the bond order increases and paramagnetic character changes to diamagnetic one?**

(1) $O_2 \rightarrow O_2^+$

(2) $O_2 \rightarrow O_2^{2-}$

(3) $NO \rightarrow NO^+$

(4) $N_2 \rightarrow N_2^+$

---

**78. The incorrect statement from the following for borazine is:**

(1) It is a cyclic compound.

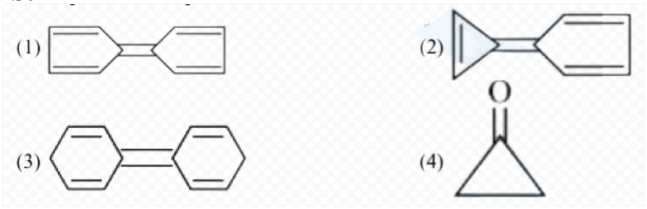
(2) It has electronic delocalization.

(3) It can react with water.

(4) It contains banana bonds.

---

**79. Among the following compounds, the one which shows the highest dipole moment is:**

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**80. $Be(OH)_2$ reacts with $Sr(OH)_2$ to yield an ionic salt. Choose the incorrect option related to this reaction from the following:**

(1) Be is tetrahedrally coordinated in the ionic salt.

(2) The reaction is an example of acid-base neutralization reaction.

(3) The element Be is present in the cationic part of the ionic salt.

(4) Both Sr and Be elements are present in the ionic salt.

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## Section-B

**81. Solution of 12 g of non-electrolyte (A) prepared by dissolving it in 1000 mL of water exerts the same osmotic pressure as that of 0.05M glucose solution at the same temperature. The empirical formula of A is $CH_2O$. The molecular mass of A is ——— g. (Nearest integer)**

---

**82. $KMnO_4$ is titrated with ferrous ammonium sulphate hexahydrate in the presence of dilute $H_2SO_4$. The number of water molecules produced for 2 molecules of $KMnO_4$ is ———.**

---

**83. 20 mL of calcium hydroxide was consumed when it was reacted with 10 mL of unknown solution of $H_2SO_4$. Also, 20 mL standard solution of 0.5 M HCl containing 2 drops of phenolphthalein was titrated with calcium hydroxide. The mixture showed pink colour when the burette displayed the value of 35.5 mL, whereas the burette of $H_2SO_4$ showed 25.5 mL initially. The concentration of $H_2SO_4$ is ——— M. (Nearest integer)**

---

**84. $t_{87.5}$ is the time required for the reaction to undergo 87.5% completion and $t_{50}$ is the time required for the reaction to undergo 50% completion. The relation between $t_{87.5}$ and $t_{50}$ for a first order reaction is ——— $t_{87.5}$. (Nearest integer)**

---

**85. A certain quantity of real gas occupies a volume of 0.15 $dm^3$ at 100 atm and 500 K when its compressibility factor is 1.07. Its volume at 300 atm and 300 K (When its compressibility factor is 1.4) is $\times 10^{-4}$ $dm^3$. (Nearest integer)**

---

**86. A metal surface of 100 $cm^2$ area has to be coated with nickel layer of thickness 0.001 mm. A current of 2 A was passed through a solution of $Ni(NO_3)_2$ for $x$ seconds to coat the desired layer. The value of $x$ is ————-. (Nearest integer)**

---

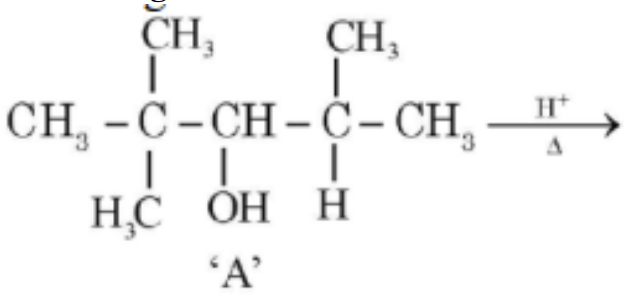
**87. 25.0 mL of 0.050 M $Ba(NO_3)_2$ is mixed with 25.0 mL of 0.020 M NaF. $K_{sp}$ of $BaF_2$ is $0.5 \times 10^{-6}$ at 298 K. The ratio of $[Ba^{2+}]$ $[F^-]$ and $K_{sp}$ is ————. (Nearest integer)**

---

**88. $A_2 + B_2 \rightarrow 2AB$. $\Delta H_f^0 = -200$ kJ $mol^{-1}$** $A_2$ and $B_2$ are diatomic molecules. If the bond enthalpies of $A_2$, $B_2$ and AB are in the ratio 1 : 0.5 : 1, then the bond enthalpy of $A_2$ is ———— kJ $mol^{-1}$. (Nearest integer)

**89. An organic compound gives 0.220 g of $CO_2$ and 0.126 g of $H_2O$ on complete combustion. If the % of carbon is 24, then the % of hydrogen is —— $\times 10^{-1}$. (Nearest integer)**

**90. For the given reaction:**




'A'

The total number of possible products formed by tertiary carbocation of A is ———.