Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.S60_Elite, Target & LIIT-BTs	JEE-MAIN(**Theory Based Test**)	Date: 27-12-2024
Time: **09.00Am to 12.00Pm**	GTM-10/05	Max. Marks: 300

IMPORTANT INSTRUCTION:

1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black** Ball Point **Pen** only.

2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.

3. The test is of **3 hours** duration.

4. The Test Booklet consists of **75 Questions.** The maximum marks are **300.**

5. There are **three** parts in the question paper 1,2,3 consisting of **Mathematics, Physics** and **Chemistry** having **25 Questions** in each subject and subject having **two sections.**

    (I) Section –I contains **20 Multiple Choice Questions** with only one correct option.

    Marking scheme: +4 for correct answer, **0** if not attempt and **-1** in all other cases.

    (II) Section-II contains **05 Numerical Value Type Questions.**

■   The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

    To cancel any attempted question bubble on the question number box.

    For example: To cancel attempted Question 21. Bubble on 21 as shown below
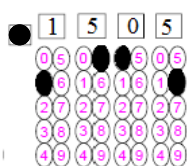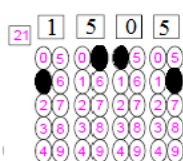
Question Answered for Marking   **Question Cancelled for Marking**

Marking scheme: +4 for correct answer, **0** if **not attempt** and **-1** in all other cases.

6. Use **Blue / Black Point Pen only** for writing particulars / marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**

7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electron device etc, except the Identity Card inside the examination hall.

8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Hall. **However, the candidate are allowed to take away this Test Booklet with them.**

10. Do not fold of make any stray marks on the Answer Sheet

Name of the Candidate (in Capital): _____

Admission Number:

Candidate's Signature: _____   **Invigilator's Signature:** _____

27-12-2024_Sr.S60_Elite, Target & LIIT-BTs
Jee-Main-GTM-10/05 (Theory Based)_Test Syllabus

MATHEMATICS : Theory Based Test

PHYSICS   : Theory Based Test

CHEMISTRY   : Theory Based Test

MATHEMATICS
Max Marks: 100

SECTION-I (SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

1. Let f(x) be a real function

Number of correct statements among the following.

Statement I: If f(x) is an odd function on R and is known to be an increasing function for x > 0 then it is also decreasing function for x < 0

Statement II: If f(x) is an odd function and $\lim_{x \to 0} f(x)$ exists then $\lim_{x \to 0} f(x) = 0$

Statement III: If f(x) is an even function on R and is known to be increasing for x > 0, then it is decreasing function for x < 0

Statement IV: If f(x) is an even function and $f(0)$ exists then $\lim_{x \to 0^+} f(x) = \lim_{x \to 0^-} f(x)$

1) 1   **2)** 2   **3)** 0   **4)** 3

2. Let f(x) be continuous on [a, b] and differentiable on (a, b)

Number of correct statements among the following.

Statement I: If f(x) is strictly increasing on (a, b) then $f^1(x) \geq 0$ for all $x \in (a, b)$

Statement II: If f(x) is strictly decreasing on (a, b) then $f^1(x) < 0$ for all $x \in (a, b)$

Statement III: f(x) and $f^1(x)$ have opposite sign, for all x, then $f^2(x)$ is a decreasing function

Statement IV: f(x) and $f^1(x)$ have opposite sign, for all x, then $|f(x)|$ is an increasing function

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

3. Which of the following must be the true value of the statements below in that order.

Statement I: $\arg(\bar{z}) = -\arg(z)$ for any complex number z

Statement II: If $|z - z_1| - |z - z_2| = k$ where $k < |z_1 - z_2|$, Then the locus of z is a hyperbola

Statement III: $z_1, z_2 ..... z_n$ be the complex numbers representing the vertices of n – sided regular polygon, and "z_o" is its centre, then $\sum_{i=1}^{n} z_i^2 = n z_0^2$

Statement IV: If $z_1^2 + z_2^2 + z_1 z_2 = 0$, then z_1, z_2 and origin form an equilateral triangle.

1) TFFT   **2)** FFTF   **3)** FFTT   **4)** TTTT

4. Let the function $f : R \to R$ be defined by $f(x) = x^3 - x^2 + (x-1)\sin x$ and let $g : R \to R$ be

an arbitrary function.

Let $fg : R \to R$ be the product function defined by $(fg)(x) = f(x)g(x)$.

Then Number of correct statements among the following.

A) If g is discontinuous at x = 1, then fg can never be differentiable at x = 1

B) If fg is differentiable at x = 1, then g is continuous at x = 1

C) If fg is differentiable at x = 1, then g must be differentiable at x = 1

1)3   **2)**2   **3)**1   **4)**0

5. Which of the following must be the true value of the statements below in that order.

Statement I: $\int e^{ax}.\sin bx\, dx = \dfrac{e^{ax}}{a^2 + b^2}\left(a\sin bx - b\cos bx\right) + c,$ where $a, b \in R - \{0\}$ and c is

arbitrary real number

Statement II: $\int \dfrac{f'(x)}{\left(f(x)\right)^n} dx = \dfrac{\left(f(x)\right)^{-n+1}}{-n+1}$ where $n \neq 1$ and $f(x)$ is a positive differentiable

function

Statement III: $\int e^{kx}\dfrac{\left(f(kx) + f^1(kx)\right)}{k} dx = e^{kx} f(kx) + c$ where $k, c \in R$

Statement IV: Let $F(x)$ be an indefinite integral of $\sin^2 x$, then the function $F(x)$ satisfies

$F(x + \pi) = F(x)$ for all real x.

1) TFFT   **2)** TFTF   **3)** TFTT   **4)** TFFF

6. Which of the following must be the true value of the statements below in that order.

Statement I: For $x \in R$, let $\tan^{-1}(x) \in \left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right).$ Then the minimum value of the function

$f : R \to R$, defined by $f(x) = \displaystyle\int_{0}^{x\tan^{-1}x} \dfrac{e^{(t-\cos t)}}{1 + t^{2023}} dt$ is zero

Statement II: If f(x) is a periodic function with period T, then

$$\int_{a+nT}^{b+nT} f(x)dx = \int_a^b f(x)dx, n \in Z, a, b \in R$$

Statement III: If $\psi(x) \le \phi(x)$ for $a \le x \le b$, then $\int_a^b |\psi(x)| dx \le \int_a^b |\phi(x)| dx$

1) TTF   **2)** FTF   **3)** FTT   **4)** TTT

7.   Consider the given statements

Statement I: If f(x) is bounded for $x \in [a, b]$, then area bounded by curve y = f(x), x – axis,

x = a and x = b is $\int_a^b f(x)dx$

Statement II: If f(x) is bounded and differentiable for $x \in [a, b]$, then the area between

$y = f(x) \, and \, y = f^{-1}(x)$ is equal to the double the value of $\int_a^b |f(x) - x| dx$

1) Only **Statement I** is true   **2)** Only **Statement II** is true
3) Both **Statement I** and **II** are True   **4)** Both **Statement I** and **II** are false

8.   Let $y = y(x)$ be the solution of the differential equation $\dfrac{dy}{dx} + 2y = f(x)$, where

$f(x) = \begin{cases} 1, & x \in [0, 1] \\ 0, & \text{otherwise} \end{cases}$ If $y(0) = 0$, then $y(\ln 2)$ is

1) $\dfrac{e^2 - 1}{4e^2}$ **2)** $\dfrac{e^2 - 1}{2e^2}$ **3)** $\dfrac{1}{4}$ **4)** $\dfrac{3}{8}$

9.   Let $\bar{x}$, M and σ^2 be respectively the mean, mode and variance of n observations $x_1, x_2.....x_n$

and $d_i = -x_i - a$, i = 1, 2, …,n where a is any number

Statement 1: variance of $d_1, d_2,...d_n$ is σ^2

Statement 2: Mean and mode of $d_1, d_2,....d_n$ are $-\bar{x} - a$ and $-M - a$ respectively

1)Statement 1 and Statement 2 are both false

2) Statement 1 and Statement 2 are both true

3)Statement 1 is true and Statement 2 is false

4)Statement 1 is false and Statement 2 is true

10. Number of correct statements among the following.

Statement I: If f, g: $R \rightarrow R$ defined as $f(x) = \begin{cases} x, & if \ x \ is \ rational \\ 0, & if \ x \ is \ irrational \end{cases}$ and

$g(x) = \begin{cases} 0, & if \ x \ is \ rational \\ x, & if \ x \ is \ irrational \end{cases}$, then, f $-$g is one-one and onto

Statement II: $f(x) = \sin x + \cos ax$ is periodic function then a must be rational

Statement III: If $f: A \rightarrow B$ and $g: B \rightarrow C$ are functions such that $gof: A \rightarrow C$ is one -one then f must be one -one

1)1   **2)**2   **3)**0   **4)**3

11. Which of the following is true?

1) $\dfrac{dy}{dx}$ for $y = \sin^{-1}(\cos x)$, where $x \in (0, \pi)$, is -1

2) $\dfrac{dy}{dx}$ for $y = \sin^{-1}(\cos x)$, where $x \in (0, 2\pi)$, is 1

3) $\dfrac{dy}{dx}$ for $y = \cos^{-1}(\sin x)$, where $x \in \left(-\pi, \dfrac{\pi}{2}\right)$, is -1

4) $\dfrac{dy}{dx}$ for $y = \cos^{-1}(\sin x)$, where $x \in \left(-\dfrac{\pi}{2}, \dfrac{3\pi}{2}\right)$, is -1

12. Consider the following Statements

Statement-I: If both functions $f(x)$ and $g(x)$ have limits at $x = a$, then

$$\underset{x \to a}{Lt}\left[f(g(x))\right] = \left[\underset{x \to a}{Lt} f(g(x))\right] \quad [\ ] \text{ denotes G.I.F}$$

Statement-2: A function may fail to have a limit at a point in its domain but functional

value at   x = a exists (i.e. f(a) exists)

1) Only **Statement I** is true   **2)** Only **Statement II** is true

3) Both **Statement I** and **II** are True   **4)** Both **Statement I** and **II** are false

13. Which of the following is always true

1) One root of the equation $ax^2 + bx + c = 0,$ in the form of $p + \sqrt{q}$ then other root is

$$p - \sqrt{q} \ \left(p \in z, q \in z^+\right)$$

2) If the equation $ax^2 + bx + c = 0$ is satisfied by more than two distinct numbers

(real or complex), then it becomes an identity.

3) If a = 2 and b, c are integers and the roots of the quadratic equation $ax^2 + bx + c = 0$ are

rational, then the roots must be integers

4) a, b, c are in A.P and G.P then (a, b, c) can be (k, k, k) for all $k \in R$

14. Two players, P_1 and P_2, play a game against each other. In every round of the game,

each player rolls a fair die once, where the six faces of the die have six distinct numbers. Let

x and y denote the readings on the die rolled by P_1 and P_2, respectively. If $x > y$, then P_1

scores 5 points and P_2 scores 0 point. If $x = y$, then each player scores 2 points. If $x < y$,

then P_1 scores 0 point and P_2 scores 5 points. Let X_i and Y_i be the total scores of

P_1 and P_2, respectively, after playing the ith round.

List – I	List – II
I) Probability of $(X_2 \geq Y_2)$ is	P) $\dfrac{3}{8}$
II) Probability of $(X_2 > Y_2)$ is	Q) $\dfrac{11}{16}$
III) Probability of $(X_3 = Y_3)$	R) $\dfrac{5}{16}$
IV) Probability of $(X_3 > Y_3)$	S) $\dfrac{355}{864}$
	T) $\dfrac{77}{432}$

1) $I \to Q; II \to R; III \to T; IV \to S$ **2)** $I \to Q; II \to R; III \to T; IV \to T$

3) $I \to P; II \to R; III \to Q; IV \to S$ **4)** $I \to P; II \to R; III \to Q; IV \to T$

15. Which of the following is/are true

Statement I: A variable circle cuts two fixed perpendicular lines so that each intercept is of different length, then locus of the centre of the circle is hyperbola.

Statement II: If the eccentric angles of the extremities of a focal chord of a Hyperbola

$\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$ are $\theta_1 \& \theta_2$ Then eccentricity of the Hyperbola $e = \dfrac{\cos\left(\dfrac{\theta_1 + \theta_2}{2}\right)}{\cos\left(\dfrac{\theta_1 - \theta_2}{2}\right)} = \dfrac{\sin(\theta_1 + \theta_2)}{\sin(\theta_1) + \sin(\theta_2)}$

1) Only **Statement I** is true   **2)** Only **Statement II** is true

3) Both **Statement I** and **II** are True   **4)** Both **Statement I** and **II** are false

16. Consider the following Statements

Statement I: General form $ax + by + c = 0$ (here a, b and c are the parameters and $a, b, c \in R$)

always represents a straight line

Statement II: A line $ax + by + 1 = 0$, is such that the algebraic sum of the perpendiculars on it, from a number of points (x_i, y_i), $(i = 1, 2, \ldots, n)$. is zero, then the line always passes through a fixed point is $(\overline{x}, \overline{y})$ *Where* $\overline{x} = \dfrac{\sum x_i}{n}$ *and* $\overline{y} = \dfrac{\sum y_i}{n}$

1) Only **Statement I** is true   2) Only **Statement II** is true

3) Both **Statement I** and **II** are True   4) Both **Statement I** and **II** are false

17. Which of the following must be the true value of the statements below in that order.

    Statement I: If $\vec{a} = 2\hat{i} + \hat{j} + k$, and $\vec{b}$ and $\vec{c}$ be two nonzero vectors such that $\left|\vec{a} + \vec{b} + \vec{c}\right| = \left|\vec{a} + \vec{b} - \vec{c}\right|$ and $\vec{b}.\vec{c} = 0$ then $\left|\vec{a} + \lambda\vec{c}\right| \geq \left|\vec{a}\right|$ for all $\lambda \in R$

    Statement II: If the vectors $\overrightarrow{PQ}, \overrightarrow{QR}, \overrightarrow{RS}, \overrightarrow{ST}, \overrightarrow{TU}$ and $\overrightarrow{UP}$ represent the sides of regular hexagon then $\overrightarrow{PQ} \times \left(\overrightarrow{RS} + \overrightarrow{ST}\right) \neq \vec{0}$

    Statement III: Four points A,B,C & D with position vectors $\vec{a}, \vec{b}, \vec{c}$ & $\vec{d}$ respectively, are coplanar, then there exists constants x, y, z and w such that $x\vec{a} + y\vec{b} + z\vec{c} + w\vec{d} = \vec{0}$ where x + y + z + w = 0 but not all x, y, z and w are zero

    1) TFF   2) TFT   3) FFT   4) TTT

18. Which of the following must be the true value of the statements below in that order.
    Statement I: For square matrices A and B of same order. (with real entries) (O is null matrix and I is Identity matrix of same order as A and B). If AB = O then $\left(\det A\right)^2 + \left(\det B\right)^2 = 0$

   **Statement II**: If l_i, m_i, n_i $(i = 1, 2, 3)$ denote the direction cosines of 3 mutual perpendicular vectors then $A = \begin{pmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{pmatrix}$ is an orthogonal matrix

    Statement III: For two distinct Lines with shortest distance $d \neq 0$ we can have a point A on line one and point B on line two such that AB=d then A and B be unique points on them in all possible cases
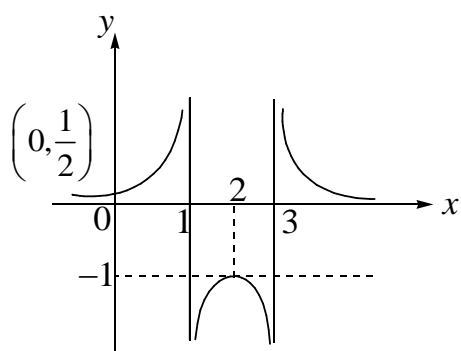
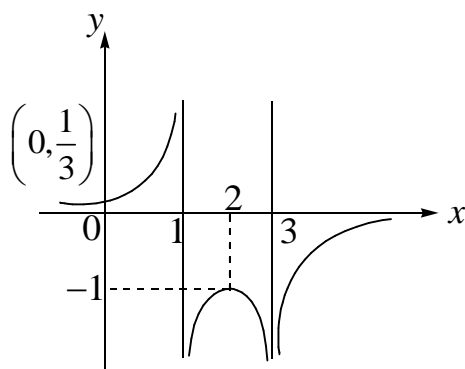   1) FFT   2) FFF   3) FTF   4) FTT

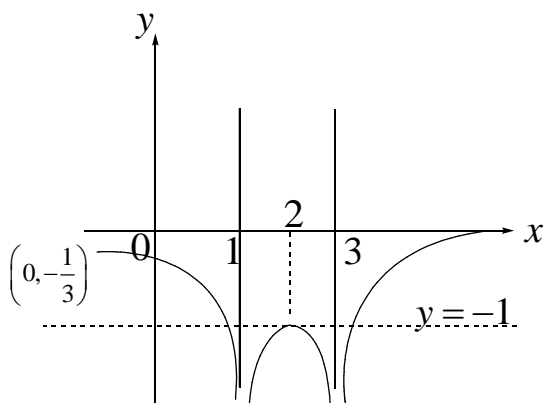**19.** Graph of $y = f(x)$ is given below
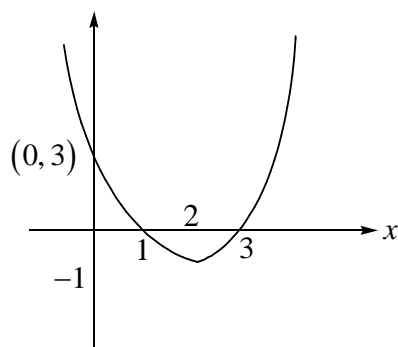
Then graph of $y = \dfrac{-1}{|f(x)|}$ is best represented by
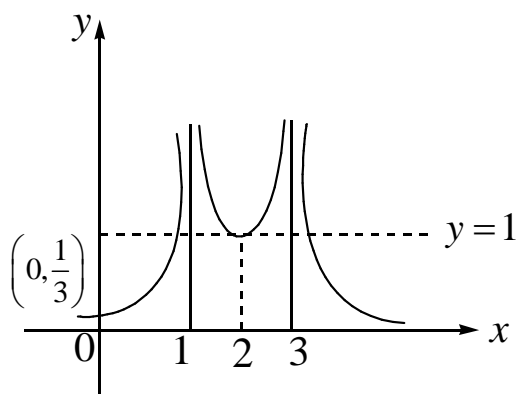

1)

2)

3)

4)

20. Which of the following must be the true value of the statements below in that order.

Statement I: There are "n", $(n \geq 3)$ straight lines, drawn in a plane, no two of which are parallel and no three pass through the same point, and the points of intersection of these lines are joined. Then the number of fresh lines, hence made is $\dfrac{n(n-1)(n-2)(n-3)}{8}$

Statement II: Vertices of n-sided regular polygon, joined to form a triangle then number of obtuse angled triangle, is $= n.^{\frac{n}{2}-1}C_2$, if n is even $(n > 4)$

1) TT   2) TF   3) FT   4) FF

SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**
Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases

21. Let $P(a_1, b_1)$ and $Q(a_2, b_2)$ be two distinct points on a circle with center $C(\sqrt{2}, \sqrt{3})$. Let O be the origin and OC be perpendicular to both CP and CQ. If the area of the triangle OCP is $\sqrt{35}$, then $a_1^2 + a_2^2 + b_1^2 + b_2^2$ is equal to_____.

22. Let Q be the cube with the set of vertices $\{(x_1, x_2, x_3) \in R^3 : x_1, x_2\ x_3 \in \{0,1\}\}$. Let F be the set of all twelve lines containing the diagonals of the six faces of the cube Q. Let S be the set all four lines containing the main diagonals of the cube Q; for instance, the line passing through the vertices $(0,0,0)$ and $(1,1,1)$ is in S. For lines l_1 and l_2, let $d(l_1, l_2)$ denote the shortest distance between them. Then the maximum value of $d(l_1, l_2)$, as l_1 varies over F and l_2 varies over S, is λ. Find the value of λ^{-2}

23. Number of correct statements among the following is k. Then 2k is _____

Statement I: Chord joining the points $P\left(at_1^2, 2at_1\right) \& Q\left(at_2^2, 2at_2\right)$ of the parabola $y^2 = 4ax$ passes

through focus of the parabola, length of the focal chord $PQ = |a|\left(t_1 + \dfrac{1}{t_1}\right)^2 \geq 4a$

Statement II: Let $P = \left\{\theta : \sin\theta - \cos\theta = \sqrt{2}\cos\theta\right\}$ and $Q = \left\{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\right\}$ be two sets. Then P=Q

Statement III: If a,b,c,d and p are distinct non zero real numbers such that $\left(a^2 + b^2 + c^2\right)p^2 - 2\left(ab + bc + cd\right)p + \left(b^2 + c^2 + d^2\right) \leq 0$ then a,b,c,d are in G.P

24. Number of correct statements among the following is k. Then 3k is _____

Statement I: For two given events A and B, $P\left(A \cap B\right)$ is not less than P (A) +P (B) -1

Statement II: The number of symmetric relations defined on the set {1,2,3,4} which are not reflexive is 20

Statement III: $\lim\limits_{n\to\infty}\left\{\left(a^{\frac{1}{2}} - a^{\frac{1}{3}}\right)\left(a^{\frac{1}{2}} - a^{\frac{1}{5}}\right)\dots\dots\left(a^{\frac{1}{2}} - a^{\frac{1}{2n+1}}\right)\right\} = o$, if a>1

25. Number of correct statements among the following is k. then 2k is _____

Statement I: Let $A = \{1, 2, 3, 4, 5, 6, 7\}$. Define $B = \{T \subseteq A : \text{either } 1 \notin T \text{ or } 2 \in T\}$ and C={T $\subseteq$ A : the sum of all the elements of 'T' is a prime number}. Then the number of elements in the set $B \cup C$ is 107

Statement II: If sum of n terms of any sequence is a quadratic in 'n', then the sequence is an AP

Statement III: Let $x = (8\sqrt{3} + 13)^{13}$ and $y = (7\sqrt{2} + 9)^9$. If [t] denotes the greatest integer $\leq t$, then $[x] + [y]$ is even

Statement IV: The expression $\left(x + \left(x^3 - 1\right)^{\frac{1}{2}}\right)^5 + \left(x - \left(x^3 - 1\right)^{\frac{1}{2}}\right)^5$ is a polynomial of degree 7

PHYSICS   **Max Marks: 100**

SECTION-I (SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and −1 in all other cases.

26. A potential difference is applied across the ends of a metallic wire. If the potential difference is doubled, then the drift velocity:

1) will be doubled   **2)** will be halfed

3) will be quadrupled   **4)** will remain unchanged

27. Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then:

1) negative and distributed uniformly over its surface.

2) negative and appears only at the point on the sphere closest to the point charge

3) negative and distributed non-uniformly over its entire surface of the sphere

4) zero

28. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ towards west. The electric and magnetic fields in the room are

1) $\dfrac{ma_0}{e}\ east, \dfrac{3ma_0}{ev_0}\ down$ **2)** $\dfrac{ma_0}{e}\ west, \dfrac{2ma_0}{ev_0}\ up$

3) $\dfrac{ma_0}{e}\ west, \dfrac{2ma_0}{ev_0}\ down$ **4)** $\dfrac{ma_0}{e}\ east, \dfrac{3ma_0}{ev_0}\ up$

29. A square loop, carrying a steady current I, is placed in a horizontal plane near a long straight conductor carrying a steady current I_1 at a distance d from the conductor as shown in figure. The loop will experience:

Sec: **Sr.S60_Elite, Target & LIIT-BTs**   *Page 13*
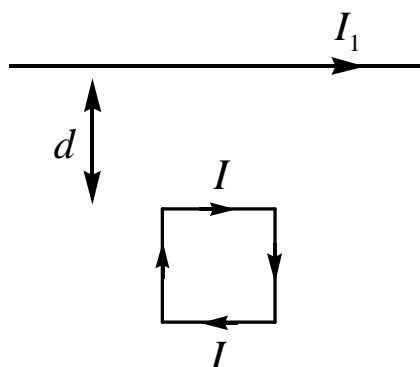
1) A net attractive force towards the conductor

2) A net repulsive force away from the conductor

3) A net torque acting upward perpendicular to the horizontal plane

4) A net torque acting downward normal to the horizontal plane

30. Two wires A and B of same length and made of same material are hanging from the same roof. The figure shows the load F versus extension $\Delta \ell$ graph for the two wires then:
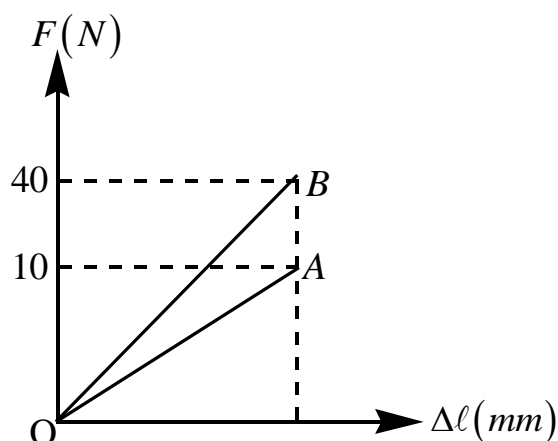
1) The elasticity of wire A is greater than that of B

2) The cross-sectional area of wire A is equal to that of B

3) The ratio of radii of wires A to B is 1:2

4) The ratio of area of cross-section of wires A to B 4:1

31. The spring balance A reads 2kg with a block m suspended from it. A balance B reads 5kg when a beaker with liquid is put on the pan of the balance. The two balances are now so arranged that the hanging mass is inside the liquid in the beaker as shown in the figure in this situation:
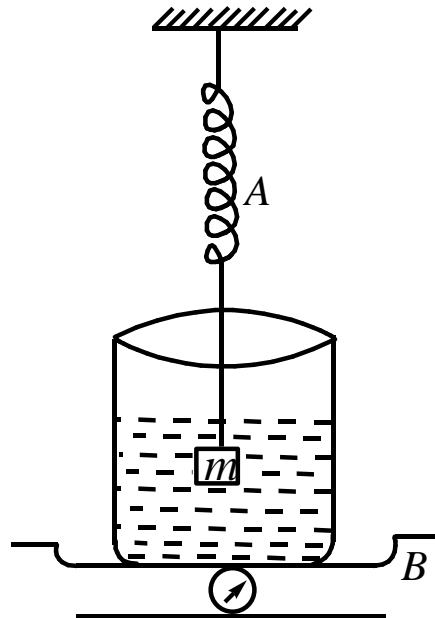
1) the balance A will read more than 2kg

2) the balance B will read more than 5kg

3) the balance A will read less than 2kg and B will read less than 5kg

4) the balances A and B will read 2kg and 5kg respectively

32. A spherical ball falls through viscous medium with terminal velocity v. If this ball is replaced by another ball of the same mass but half the radius, then the terminal velocity will be (neglect the effect of buoyancy):

1) v　　　　　　　**2)** 2v　　　　　　　**3)** 4v　　　　　　　**4)** 8v

33. The graphs show the variation of current I (y-axis) in two photocells A & B as a function of the applied voltage V(x-axis) when light of same frequency is incident on the cell. Which of the following is the correct conclusion drawn from the data?
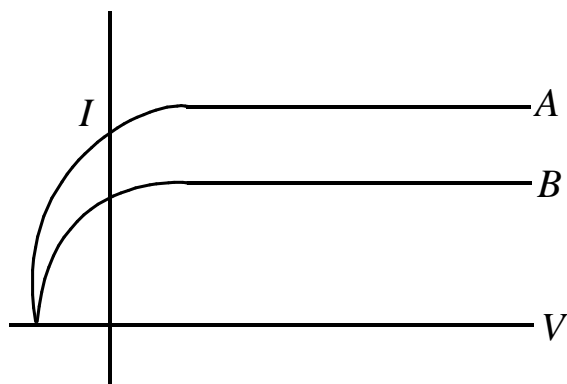
1) Cathodes of the two cells are made from the same substance, the intensity of light used are different

2) Cathodes are made from different substances and the intensity of light is the same

3) Cathode substances as well as intensity of light are different

4) no conclusion can be drawn

34. For the position (x) -time (t) graph shown of a particle in one dimensional motion. Choose the correct alternatives from below

a) Particle was released from rest at $t = 0$

b) At C particle will reverse its direction of motion

c) Average velocity for motion between B and D is positive

d) At E, velocity $= 0$ and acceleration > 0
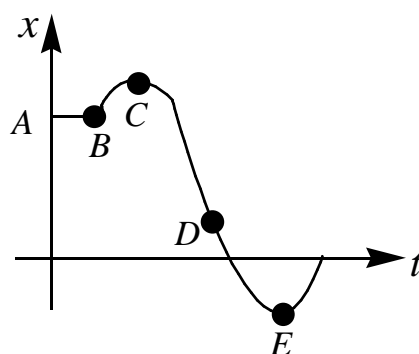
1) a, b   **2)** a, b, d   **3)** a, d   **4)** b, c, d

35. Assertion: The direction of the frictional force on an object is opposite to the actual motion (Kinetic friction) or the impending motion (static friction) of the object relative to the surface with which it is in contact.

Reason: Friction force always opposes the motion

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

2) Both A and R are true and R is NOT the correct explanation of A

3) A is true but R is false

4) A is false but R is true

36. A plane glass sheet is kept over various coloured pictures. The least raised picture is

1) Green **2)** Yellow **3)** Violet **4)** Red

37. In a reflecting telescope, a secondary mirror is used to

1) remove spherical aberration

2) reduce the problem of mechanical support

3) make chromatic aberration zero

4) move the eyepiece outside the telescope tube

38. One cannot see through fog, more appropriate answer is

1) Fog absorbs all the incident light falling on it

2) Light suffers total reflection at droplets

3) Refractive index of the fog is infinity

4) Light is scattered by the droplets

39. When a body is under pure rolling, the fraction of its total kinetic energy which is purely rotational is $\frac{2}{5}$. Identify the body.

1) Hollow sphere **2)** Sphere **3)** Ring **4)** Disc

Sec: **Sr.S60_Elite, Target & LIIT-BTs** *Page 17*

40. Two springs have their force constant as k_1 and k_2 $(k_1 > k_2)$. When they are stretched by the same force up to equilibrium

1) No work is done by this force in case of both the springs

2) Equal work is done by this force in case of both the springs

3) More work is done by this force in case of second spring

4) More work is done by this force in case of first spring

41. A particle (bob) of mass 1kg is performing vertical circular motion. Then:
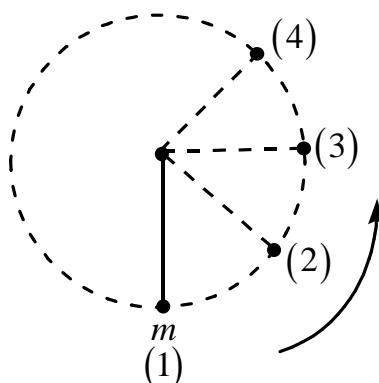
1) Power delivered by tension at point (4) is negative.

2) Power delivered by tension at point (2) is positive.

3) Power delivered by gravitational force at point (3) is zero

4) Power delivered by gravitational force at point (4) is negative

42. Which of the following statements is true about the magnetic susceptibility x_m of paramagnetic substance?

1) Value of x_m is inversely proportional to the absolute temperature of the sample

2) Value of x_m is directly proportional to the absolute temperature of the sample

3) x_m is negative at all temperatures

4) x_m does not depend on the temperature of the sample

43. **Assertion (A):** A small metal ball is charged to a potential of +1 V. It is introduced into a large hollow metal sphere charged to a potential of +10,000V and comes into contact with the inside surface of the sphere. The ball's charge passes to the sphere completely.

Reason (R): Positive charge flows from a body at lower potential to another body at higher potential

1) If both A and R are true and R is correct explanation of A

2) If both A and R are true but R is not the correct explanation of A

3) If A is true but R is false

4) If both A and R are false

44. **Statement-I:** The fundamental frequency of an open organ pipe increases as the temperature is increased.

Statement-II: As the temperature increases, the velocity of sound increases more rapidly than length of the pipe.

1) Statement-I is true, Statement-II is true; Statement-II is correct explanation for Statement-I.

2) Statement-I is true, Statement-II is true; Statement-II is not a correct explanation for Statement-I

3) Statement-I is true, Statement-II is false

4) Statement-I is false, Statement-II is true.

45. The potential of electrostatic field is given by $\phi = xy,$ where x & y are coordinate. Which of the following is correct?

1) Electric field at all points on positive x-axis is in positive y-direction.

2) Electric field at all points of positive y-axis is in negative x-direction.

3) Electric field at $(2, 2)$ is $\sqrt{2}\,N/m.$

4) Electric field at x, y makes an angle $\theta = \tan^{-1}\left(\dfrac{y}{x}\right)$ with x-axis

SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases

Note:

From: Question number's 41 to 45 rules for Answer marking

If your answer is options 2,4 Then you have to fill the OMR sheet as '24'

If your answer is options 1,3,4 Then you have to fill the OMR sheet as '134'

And if your answer is options 1,2,3,4 then you have to fill the OMR sheet as '1234'

46. Hydrogen gas absorbs radiations of wavelength λ_0 and consequently emit radiations of 6 different wavelengths of which three wavelengths are shorter than λ_0. Choose the **CORRECT** statement(s).

1) The final energy state of the atom is $n = 4$

2) The initial state of the atom may be $n = 2$

3) There are two transitions in balmer series

4) There are three transitions belonging to Lyman series.

47. Select the **CORRECT** statement(s) for a particle performing SHM with angular frequency 'ω'. (in undamped SHM)

1) The displacement is zero in one time period

2) The distance travelled is 2A in one time period

3) Average acceleration is zero in one time period

4) Total energy of system remains constant with time

48. If a satellite orbits as close to the earth's surface as possible

1) Its speed is maximum

2) Time period of its revolution is minimum

3) The total energy of the 'earth plus satellite' system is minimum

4) The total energy of the 'earth plus satellite' system is maximum

49. Number of collisions per second of molecules of a gas on the wall of a container per m^2 will:

1) Increase if temperature and volume both are doubled.

2) Increase if temperature and volume both are halved.

3) Increase if pressure and temperature both are doubled.

4) Increase if pressure and temperature both are halved.

50. Choose the correct statement(s)

1) The density of nuclear matter is independent of the size of the nucleus.

2) The binding energy of nuclei first increases and then decreases as its mass number increases

3) A free neutron is stable

4) A free proton is stable

CHEMISTRY   **Max Marks: 100**

SECTION-I (SINGLE CORRECT ANSWER TYPE)

This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and −1 in all other cases.

51. For the following given reaction
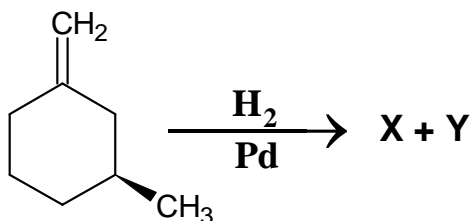
[X] & [Y] are-

1) Enantiomer of each other   **2)** Diastereomer of each other

3) Both are meso compounds   **4)** Constitutional isomer of each other

52. The major products A and B in the following reactions are:

For More Material Join: @JEEAdvanced_2025
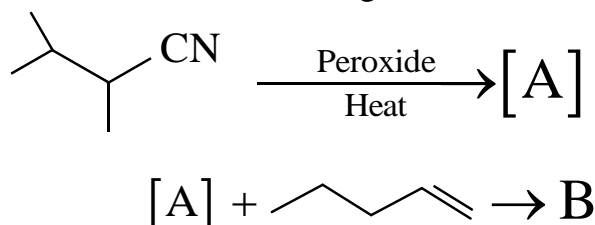
53. Choose the correct option [true or false] for the following compounds

I) In C_2 molecule only π bonds are present

II) In C_2 molecule one π bond and one σ bond is present

III) C_2 molecule is paramagnetic if s – p mixing is not operative

IV) Correct order of dipolemoment for chloromethanes is

$$CCl_4 < CHCl_3 < CH_2Cl_2 < CH_3Cl$$

1) TFTT   **2)** FTFF   **3)** TFTF   **4)** TFFF

54.

$$A \xleftarrow[\text{Fe}]{\text{Br}_2} \text{(benzene ring with } CH=CH_2) \xrightarrow[\Delta]{\text{KMnO}_4} B$$

Compound A and B respectively are :
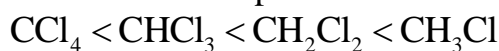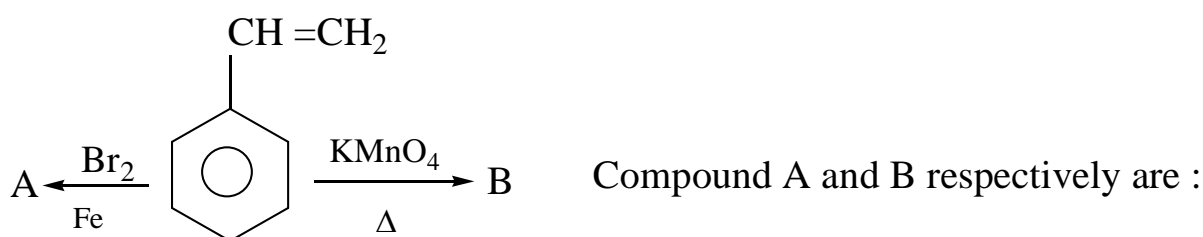
1) o – bromo styrene, benzoic acid   **2)** p – bromo styrene, benzaldehyde

3) m – bromo styrene, benzaldehyde   **4)** styrene dibromide, benzoic acid

55. The specific conductance of a saturated solution of silver bromide is $k\ Scm^{-1}$. The limiting ionic conductivity of $Ag^+\ and\ Br^-$ ions are x and y, respectively. The solubility of silver bromide in $gL^{-1}$is:

(molar mass of AgBr =188)

1) $\dfrac{k \times 1000}{x - y}$ **2)** $\dfrac{k}{x + y} \times 188$ **3)** $\dfrac{k \times 1000 \times 188}{x + y}$ **4)** $\dfrac{x + y}{k} \times \dfrac{1000}{188}$

56.

(4-methylphenol) $\xrightarrow[\text{2) p-Toulene sulphonyl chloride}]{\text{1) Conc. HNO}_3}$ (A) $\xrightarrow{\text{HO—} \bigcirc \text{—OCH}_3}$ (B) $\xrightarrow[\text{3) H}_3\text{PO}_2]{\text{1) Pd/C-H}_2 \quad \text{2) dil. HNO}_2}$ (C)
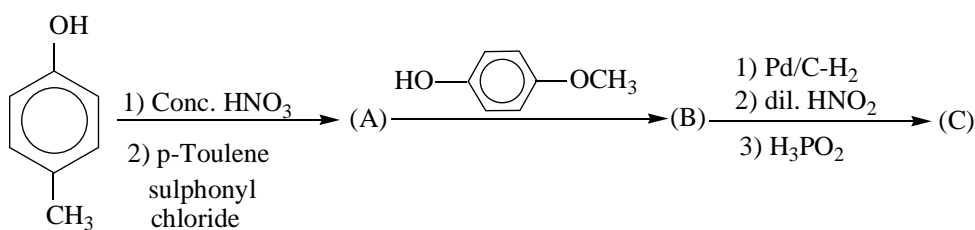
What is the final product (C)?

For More Material Join: @JEEAdvanced_2025

1) MeO—⬡—⬡—Me   **2)** MeO—⬡—O—⬡—Me

3) Me—⬡—O—⬡—Me   **4)** MeO—⬡—O—⬡
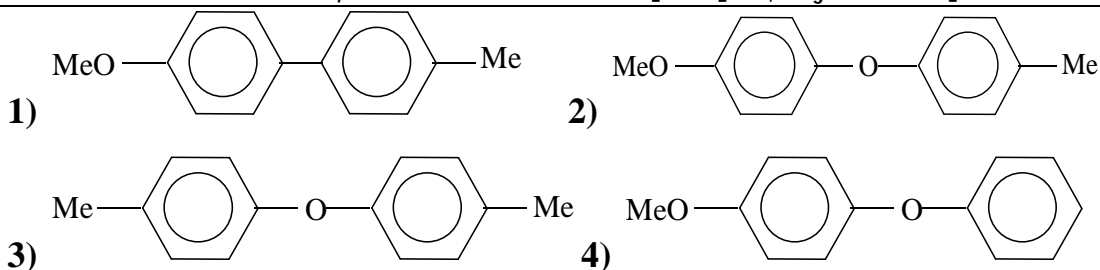
57. The degree of dissociation (α) of a weak electrolyte, $A_x B_y$ is related to Vant't Hoff factor (i) by the expression:

1) $\alpha = \dfrac{i-1}{(x+y-1)}$ **2)** $\alpha = \dfrac{i-1}{(x+y+1)}$ **3)** $\alpha = \dfrac{x+y-1}{i-1}$ **4)** $\alpha = \dfrac{x+y+1}{i-1}$

58. In Cannizaro reaction, correct order of rate of reaction with respect to substrate

CHO
⬡
is
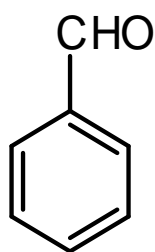
1) $p-Me_2N < p-NMe_2 < p-alkyl < H < p-Cl < m-Cl < m-NO_2$

2) $p-MeO < p-NMe_2 < p-alkyl < H < m-Cl < m-NO_2 < p-Cl$

3) $p-Me_2N < p-MeO < p-alkyl < H < p-Cl < m-Cl < m-NO_2$

4) $p-MeO < p-NMe_2 < p-alkyl < H < m-NO_2 < m-Cl < p-Cl$

59. The formation of $O_2^+ \left[PtF_6 \right]^-$ is the basis for the formation of xenon fluorides. This is because:

1) O_2 and Xe have comparable sizes

2) both O_2 and Xe are gases

3) O_2 and Xe have comparable ionization energies

4) O_2 and Xe have same electron gain enthalpy

60. Graph between log k and 1/T [k is rate constant $\left(s^{-1}\right)$ and T the temperature (K)] is a

straight line OX = 5, $\theta = \tan^{-1}(1/2.303)$. Hence $-E_a$ will be
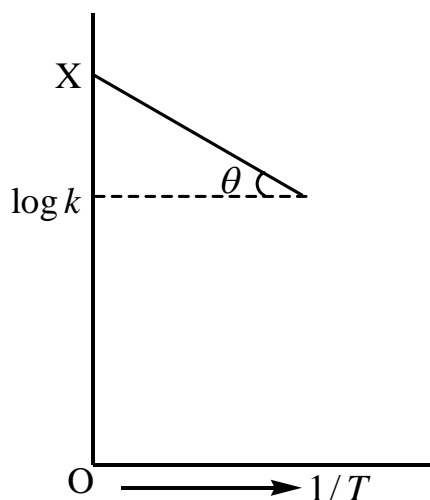
1) $2.303 \times 2\,cal$ **2)** $2/2.303\,cal$ **3)** 2 cal   **4)** $\dfrac{2.303}{2}cal$

61. Assertion:- $Na_2Cr_2O_7$ cannot be used as a primary standard in titrations.

Reason: - $Na_2Cr_2O_7$ is hygroscopic in nature

1) Assertion is True, Reason is true: Reason is the correct explanation for Assertion.
2) Assertion is true Reason is true: Reason is not the correct explanation for Assertion.
3) Assertion is True, Reason is False.
4) Assertion is False, Reason is true.

62. A student added aqueous chlorine to aqueous sodium bromide and the resulting mixture was shaken with an equal volume of trichloroethane
Which diagram best represents the observation made?
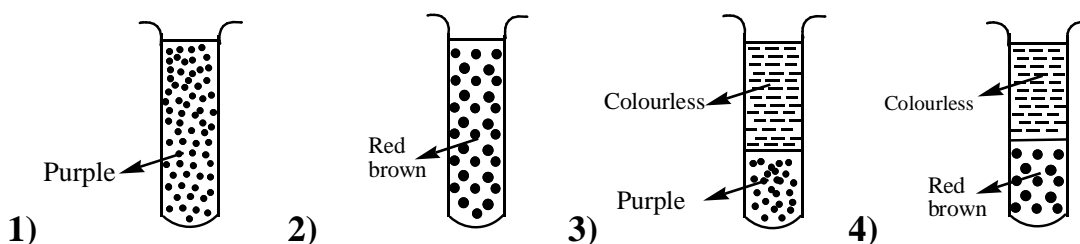
63. Which of the following is the most soluble in water?

1) $Bi_2S_3 \left(K_{SP} = 1 \times 10^{-70} \right)$
2) $Ag_2S \left(K_{SP} = 6 \times 10^{-51} \right)$

3) $CuS \left(K_{SP} = 8 \times 10^{-37} \right)$
4) $MnS \left(K_{SP} = 7 \times 10^{-16} \right)$

64. INCORRECT statement for the below sequence is

$$P_1 + NaOI \longrightarrow P_3 \text{(yellow ppt)} + P_4$$
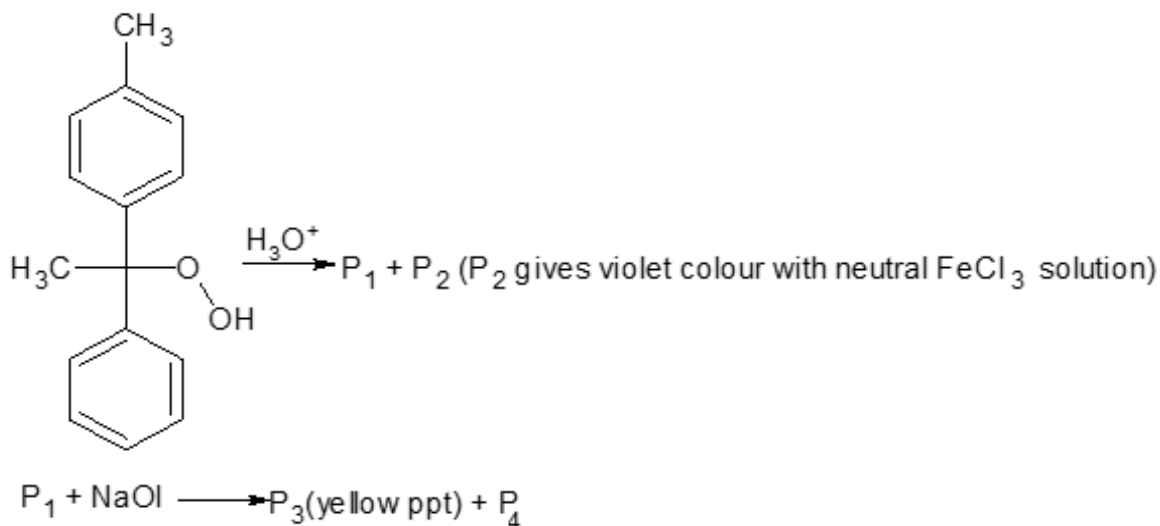
1) P_3 on reaction with Ag gives acetylene
2) P_4 on reaction with sodalime gives toluene
3) P_4 on reaction with sodalime gives benzene
4) P_1 on reaction with 2,4-DNP gives coloured compound

65. Match the Column – I and Column – II

	Column – I		Column – II
A)	Hypophosphoric acid	P)	All hydrogens are ionizable in water
B)	Pyrophosphoric acid	Q)	Lewis acid
C)	Boric acid	R)	Monobasic acid
D)	Hypophosphorous acid	S)	sp^3 hybridized central atom
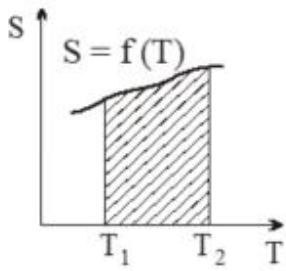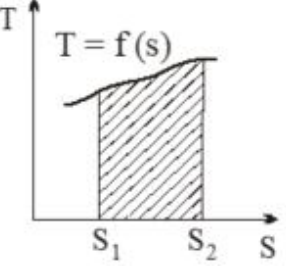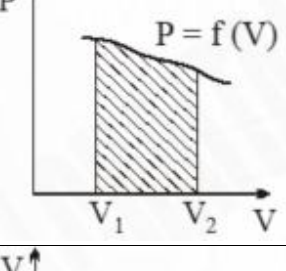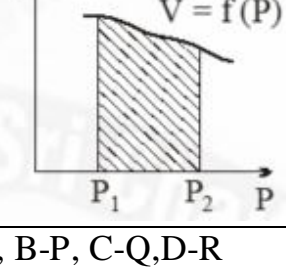
1) A-PS; B-PS; C-QR; D-RS
2) A-QR; B-PS; C-PQ; D-RS

3) A-PS; B-QR; C-RS; D-S
4) A-QS; B-PR; C-PQ; D-P

66. Which of the following statements are correct with respect to $[NiCl_4]^{2-}$ and $[Ni(PPh_3)_2 Cl_2]$?

1) In both cases Ni undergoes dsp^2 hybridisation

2) $[Ni(PPh_3)_2 Cl_2]$ is tetrahedral

3) $[Ni(PPh_3)_2 Cl_2]$ is square planar

4) $[NiCl_4]^{-2}$ is square planar

67. Which one of the following order is not in accordance with the property stated against it?

1) $F > Cl > Br > I$: Electro negativity

2) $F_2 > Cl_2 > Br_2 > I_2$: Bond dissociation energy

3) $F_2 > Cl_2 > Br_2 > I_2$: Oxidizing power

4) $HI > HBr > HCl > HF$: Acidic strength

68. For a reversible adiabatic ideal gas expansion $\dfrac{dP}{P}$ is equal to

1) $\gamma \dfrac{dV}{V}$ **2)** $-\gamma \dfrac{dV}{V}$ **3)** $\left(\dfrac{\gamma}{\gamma-1}\right)\dfrac{dV}{V}$ **4)** $\dfrac{dV}{V}$

69. Saturated solution of KNO_3 with agar-agar is used to make 'salt bridge' because:

1) size of K^+ is greater than that of NO_3^-

2) velocity of NO_3^- is greater than that of K^+

3) velocities of both K^+ and NO_3^- are nearly the same

4) both velocities and size of K^+ and NO_3^- ions are same

70. Match the Column – I and Column – II

	Column – I (Graphs)		Column – II (Area shown in the graph represents the magnitude of)
A)		P)	q
B)		Q)	w
C)		R)	$(\Delta G)T$
D)		S)	$(\Delta G)P$

1) A-S, B-P, C-Q,D-R   **2)** A-S, B-Q, C-P,D-R

3) A-P, B-R, C-Q,D-S   **4)** A-R, B-P, C-S,D-R

SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999.** If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i,e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11).**

Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases

71. Among the following, the number of aromatic compound(s) is.....

72.
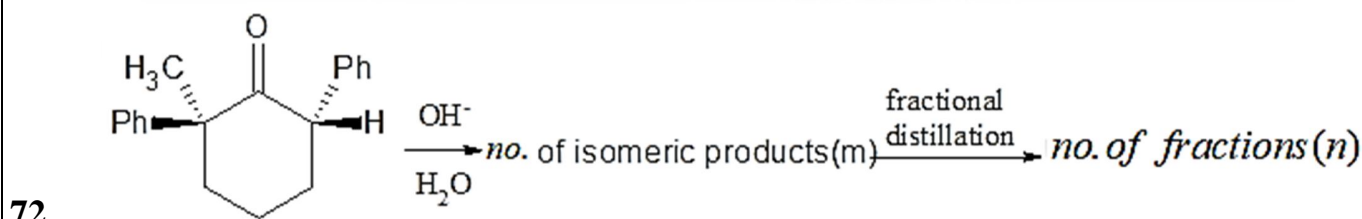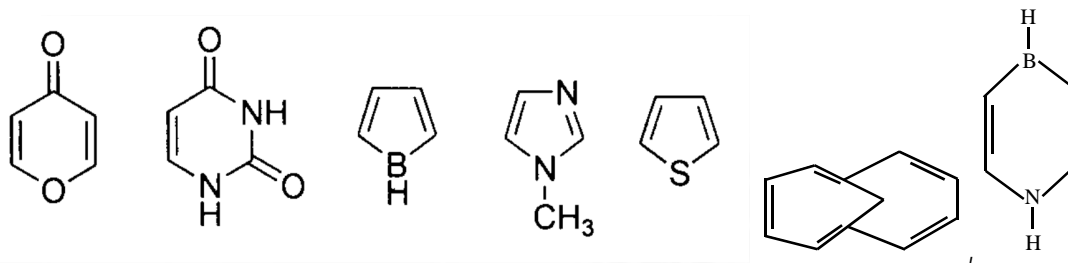
The value of (m + n) is

73. The product **P** obtained through the following sequence of reactions

$$\bigcirc \xrightarrow[\text{conc. } H_2SO_4 \text{, warm}]{\text{conc. } HNO_3} \textbf{L} \xrightarrow[\text{heat}]{Br_2 \text{,Fe}} \textbf{M} \xrightarrow{Sn/HCl} \textbf{N} \xrightarrow[\text{ii) } Cu_2Cl_2]{\text{i) } NaNO_2 \text{,HCl}} \textbf{P}$$
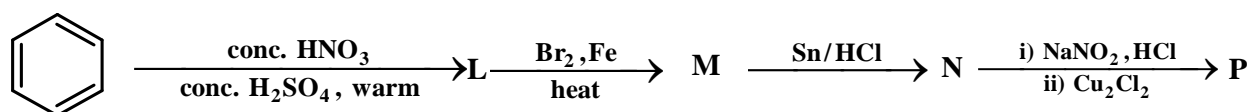
According to **IUPAC** nomenclature, what position will be assign to **chlorine** atom from 1 to 6 in product **P**

74. Maximum number of atoms present in a plane in diborane is X. Maximum number of atoms present in a plane in Borazine is Y. Then, what is the value of $\dfrac{X+Y}{2}$?

(Consider those planes which contain maximum number of atoms)

75. What will be the n-factor of the reactant in the following reaction?

$$Mn(NO_3)_2 \xrightarrow{\Delta} MnO_2 + NO$$