Sec: Sr.Super60_STERLING BT	**JEE-ADV_2023-P1**	**Date: 24-08-2025**
Time: 09.00Am to 12.00Noon	**RPTA-03**	**Max. Marks :180**

MATHEMATICS : AOD

CHEMISTRY : Alkene & Alkyne: Preparation, properties and reactions of alkenes and alkynes. Physical properties of alkenes and alkynes (boiling point, density and dipole moments), Acidity of alkynes, Acid catalysed hydration of alkenes and alkynes (excluding the stereochemistry of addition and elimination), Reactions of alkenes, Preparation of alkenes and alkynes by elimination reactions, Electrophilic addition reactions of alkenes with X2, HX, HOX (X=halogen), Effect of peroxide on addition reactions, cyclic polymerization reaction of alkynes, Addition reactions of alkynes, Metal acetylides.Reactions of alkenes with KMnO4 and ozone, Reduction of alkenes and alkynes Benzene: Reactions of benzene, Structure and aromaticity, Electrophilic Substitution Reactions, halogenation, nitration, sulphonation, friedel- crafts alkylation and acylation, Effect of directing groups (mono substituted benzenes) in these reactions.

PHYSICS : Ray Optics: Refraction at plane and spherical surfaces
Geometrical Optics: Total internal reflection, Thin lenses, Combinations of mirrors and thin lenses, Magnification.
Experiments: focal length of a convex lens and convex and concave mirrors using UV method (parallax method), The plot of the angle of deviation vs angle of incidence for a triangular prism. Refractive index of a glass slab using a travelling microscope. Deviation and dispersion of light by a prism (Important for ADVANCED)

Name of the Student: _____   **H.T. NO:** ☐☐☐☐☐☐☐☐☐☐

JEE-ADVANCE-2023-P1-Model

Time:3Hr's   **IMPORTANT INSTRUCTIONS**   Max Marks: 180

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 3)	Questions with Multiple Correct Choice with partial mark!	+4	-2	3	12
Sec – II(Q.N : 4 – 7)	Questions with Single Correct Choice	+3	-1	4	12
Sec – III(Q.N : 8 – 13)	Questions with Integer Answer Type	+4	0	6	24
Sec – IV(Q.N : 14 – 17)	Matching Type	+3	-1	4	12
Total				**17**	**60**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 18 – 20)	Questions with Multiple Correct Choice with partial mark	+4	-2	3	12
Sec – II(Q.N : 21 – 24)	Questions with Single Correct Choice	+3	-1	4	12
Sec – III(Q.N : 25 – 30)	Questions with Integer Answer Type	+4	0	6	24
Sec – IV(Q.N : 31 – 34)	Matching Type	+3	-1	4	12
Total				**17**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 35 – 37)	Questions with Multiple Correct Choice with partial mark	+4	-2	3	12
Sec – II(Q.N : 38 – 41)	Questions with Single Correct Choice	+3	-1	4	12
Sec – III(Q.N : 42 – 47)	Questions with Integer Answer Type	+4	0	6	24
Sec – IV(Q.N : 48 – 51)	Matching Type	+3	-1	4	12
Total				**17**	**60**

MATHEMATICS   **Max Marks: 60**

SECTION – I
(ONE OR MORE CORRECT ANSWER TYPE)

This section contains **THERE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated <u>according to the following marking scheme :</u>

Full Marks :+4 **ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks: +3 If all the four options are correct but **ONLY** three options are chosen;
Partial Marks: +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct ;
Partial Marks: +1 If two or more options are correct but **ONLY** two options are chosen, and it is a correct option ;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –2 In all other cases.

**For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then
choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks;
choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e.
the question is unanswered) will get 0 marks; and choosing any other combination of options will get -2 marks.**

1. Let $P(x)$ be a polynomial with real coefficient such that

$$\left(x^2 + x + 1\right)p(x-1) = (x^2 - x + 1)p(x) \ \forall x \in R \text{ and } p(1)=3 \text{ then}$$

    1) The number of points of local maximum/minimum of the function $\left\|p(x)\right| - 1\right|$ is 3

    2) The number of points of local maximum/minimum of the function $\left\|p(x)\right| - 1\right|$ is 2

    3) $\displaystyle\int_0^1 \frac{1}{p(x) + x}dx = \frac{1}{2}$

    4) $\displaystyle\int_0^1 \frac{1}{p(x) + x}dx = 1$

2. $f(x) = x\sin \pi x \ \ x > 0$ then for all natural numbers, $f'(x)$ vanishes at

    A) unique point in the interval $\left(n, n + \dfrac{1}{2}\right)$ B) a unique point in the interval $\left(n + \dfrac{1}{2}, n + 1\right)$

    C) a unique point in the interval $(n, n + 1)$ D) two point in the interval $(n, n + 1)$

3. $f : R \to R$ is a differentiable function such that $f'(x) > 3f(x) \ \forall x \in R$ and $f(0) = 1$ then

    A) f(x) is decreases in $(0, \infty)$ B) $f'(x) < e^{3x}$ in $(0, \infty)$

    C) f(x) is increasing in $(0, \infty)$ D) $f(x) > e^{3x}$ in $(0, \infty)$

SECTION – II
(SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated <u>according to the following marking scheme:</u>

Full Marks   : +3 If **ONLY** the correct option is chosen;
Zero Marks   :   0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : −1 In all other cases

4. $f(x) = \int_{-1}^{x} t(e^t - 1)(t-1)(t-2)^3(t-3)^5 \, dt$ has local maxima at x=_____

   A) 0   B) 1   C) 2   D) 3

5.   A function f(x) satisfied $(x-y)f(x+y) - (x+y)f(x-y) = 2(x^2 y - y^3)$ and given

   f(1) = 2 the number of critical points which are also points of local maxima and minima

   of $y = |f(x)|$ is

   A) 3   B) 2   C) 1   D) 4

6.   Let $f(x) = 1 - x - x^3$. Find all real values of x satisfying the inequality,

   $1 - f(x) - f^3(x) > f(1-5x)$.

   A) $(-\infty,0)\cup(2,\infty)$ B) $(-5,-1)$ C) $(-2,0)\cup(2,\infty)$ D) $(-4,4)$

7.   Let $f(x) = \begin{cases} xe^{ax} & , x \le 0 \\ x + ax^2 - x^3 & , x > 0 \end{cases}$

   Where a is constant in which of the following intervals $f'(x)$ is increasing

   A) $\left(-\infty, \dfrac{a}{3}\right)$ a<0   B) $\left(-\infty, \dfrac{-2}{a}\right)\cup\left(\dfrac{a}{3},\infty\right)$

   C) $\left(-\dfrac{2}{a}, \dfrac{a}{3}\right)$ $a>0$ D) $\left(-\dfrac{2}{a}, \infty\right), a < 0$

SECTION-III
(NON-NEGATIVE INTEGER.)

This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated <u>according to the following marking scheme</u>
Full Marks : +4 If ONLY the correct integer is entered; Zero Marks : 0 In all other cases.

8. $f(x) = \int_0^1 e^{|t-x|} dt \quad (0 \le x \le 1)$ then the max value of f(x) is k then

[k] is____ ([.] denotes the greatest integer function)

9 $f(x) = ax^3 + bx^2 + cx + 4 \quad (a,b,c \in R) \quad f''\left(-\frac{2}{3}\right) = 0$ tangent draw to the graph of

the function y=f (x) at $x = -\frac{2}{3}$ is $y = \frac{5x}{3} + \frac{100}{27}$ If g is inverse of f , then $\frac{d}{dx}\big(g(x)f(g(x))\big)$

at x=4 is λ then $12\lambda = $____

10. Suppose that f (0) = -3 and $f'(x) \le 5 \ \forall x \in R$ then the largest value which $f(2)$ can

assume is _____

11. A rectangle with one side lying in x- axis is to be inscribed in the closed region of

xy-plane bounded by the lines y=0 y= 3x & y= 30-2x . If m is the largest area of such a

rectangle then the value of $\frac{2m}{27} = $

12. Let $f(x) = ax + \cos 2x + \sin x + \cos x$ is defined $\forall x \in R$ & $a \in R$ is strictly increasing

function If the range of a is $\left[\frac{m}{n}, \infty\right)$ is the minimum value of $|m - n| = $ ____

13. Let $f(x)$ be a non-constant thrice differentiable function defined on $(-\infty, \infty)$ such that

$f(3 + x) = f(3 - x)$ and $f'\left(\frac{3}{2}\right) = 0 = f'(2) = f'(5)$. determine the minimum number of zeroes

of $g(x) = (f''(x))^2 + f'(x)f'''(x)$ in the interval $[1,6]$.

SECTION – IV
(MATCHING TYPE)

This section contains **FOUR (04)** Matching List Sets.
• Each set has **ONE** Multiple Choice Question.
• Each set has **TWO** lists : **List-I** and **List-II.**
• **List-I** has **Four** entries (I), (II), (III) and (IV) and **List-II** has **Five** entries (P), (Q), (R), (S) and (T).
• **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the
condition asked in the Multiple Choice Question.
• Answer to each question will be evaluated <u>according to the following marking scheme :</u>
Full Marks:+3 **ONLY** if the option corresponding to the correct combination is chosen;
Zero Marks: 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks: –1 In all other cases.

14. Tangent is drawn at any point (x, y), on the curve $f(x, y) = 0$ which intersects the x-axis at $(x_{i+1}, 0)$. now again, tangent is drawn at (x_{i+1}, y_{i+1}) which intersects the x-axis at $(x_{i+2}, 0)$ and so on (i= 1, 2, …….. n) match the following COLUMN-I with COLUMN-II

	COLUMN-I		COLUMN-II
P)	$xy^2 = 1$	**1)**	The sequence x_1, x_2, x_3........ terms in G.P
Q)	$y = e^{-3x}$	**2)**	The sequence x_1, x_2, x_3........ is periodic with period 2
R)	$y = -\cot^{-1} x$	**3)**	The sequence x_1, x_2, x_3........ terms are increasing A.P
S)	$y^2 = x$	**4)**	The sequence x_1, x_2, x_3........ is increasing, but not in A.P
		5)	The sequence x_1, x_2, x_3........ terms are decreasing

A) P-1, Q-3, R-4, S-2   B) P-1, Q-3, R-5, S-2

C) P-3, Q-1, R-5, S-2   D) P-3, Q-1, R-2, S-5

15. Match the following

	COLUMN-I		COLUMN-II
P)	If position of the tangent at any point on the curve $x = at^3, y = at^4$ between the axes is divided by the abscissa of the point of contact in the ratio m: n externally, then $\|n + m\|$ is equal to (m and n are coprime)	**1)**	1
Q)	The area of triangle formed by normal at the point (1, 0) on the curve x = $e^{\sin y}$ with axes is	**2)**	$\dfrac{1}{2}$
R)	If the angle between curves $x^2 y = 1$ and $y = e^{2(1-x)}$ at the point (1, 1) is θ then $\tan \theta$ is equal to	**3)**	7
S)	The length of sub-tangent at any point on the curve $y = be^{x/3}$ is equal to	**4)**	3
		5)	0

A) P-3, Q-5, R-2, S-4   B) P-3, Q-2, R-5, S-4

C) P-3, Q-4, R-5, S-4   D) P-3, Q-2, R-4, S-5

16. Match the following

	COLUMN-I		COLUMN-II
P)	The least value of $\alpha \in R$, for which $4\alpha x^2 + \dfrac{1}{x} \geq 1$ for all $x > 0$ is	**1)**	**2**
Q)	If $5f(x) + 4f\left(\dfrac{1}{x}\right) = x^2 - 2, \forall x \neq 0$ and $y = 9x^2 f(x)$ Then y is strictly increasing in	**2)**	$\dfrac{1}{27}$
R)	The number of points in $(-\infty, \infty)$ for which $x^2 - x\sin x - \cos x = 0$	**3)**	-1
S)	The slope of the tangent to the curve $y = \sqrt{4 - x^2}$ at the point where the ordinate and the abscissa are equal is	**4)**	$\left(-\dfrac{1}{\sqrt{5}}, 0\right) \cup \left(\dfrac{1}{\sqrt{5}}, \infty\right)$
		5)	1

A) P-3, Q-1, R-2, S-4   B) P-3, Q-4, R-1, S-2
C) P-4, Q-1, R-2, S-3   D) P-2, Q-4, R-1, S-3

17.

	COLUMN-I		COLUMN-II
P	Let F(x)=f(x)g(x)h(x) for all real x where f,g,h are differentiable functions at some point x_0 then $F'(x_0) = 21F(x_0), f'(x_0) = 4f(x_0)$, $g'(x_0) = -7g(x_0)$ and $h'(x_0) = kh(x_0)$ then $\dfrac{k}{6} =$	**1**	-2
Q	If $g(x) = f(x) + f(1-x)$ and $f''(x) > 0, x \in (0,1)$ If g is decreasing In the interval $(0,a)$, and increasing in $(\alpha, 1)$ Then $\tan^{-1}(2\alpha) + \tan^{-1}\left(\dfrac{1}{\alpha}\right) + \tan^{-1}\left(\dfrac{\alpha+1}{\alpha}\right) =$	**2**	$5f^2(c)f'(c)$
R	The area of triangle formed by normal at the point (1,0) on the curve $x = e^{\sin y}$ with axes is $\left|\dfrac{2t+1}{6}\right|$ sq.units , then the value of t is	**3**	π
S	Let $f:[2,7] \to (0,\infty)$ be a continuous and differentiable Function, then for $c \in [2,7], \dfrac{(f(7)-f(2))((f(7))^2 + f(2)f(7) + (f(2))^2)}{3} =$	**4**	4
		5	$\pi/2$

A) P-3, Q-1, R-2, S-4   B) P-4, Q-3, R-1, S-2
C) P-4, Q-2, R-1, S-3   D) P-2, Q-4, R-1, S-3

PHYSICS   **Max Marks: 60**

SECTION – I
(ONE OR MORE CORRECT ANSWER TYPE)

This section contains **THERE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated <u>according to the following marking scheme :</u>

Full Marks :+4 **ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks: +3 If all the four options are correct but **ONLY** three options are chosen;
Partial Marks: +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct ;
Partial Marks: +1 If two or more options are correct but **ONLY** two options are chosen, and it is a correct option ;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –2 In all other cases.
For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then
choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks;
choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e.
the question is unanswered) will get 0 marks; and choosing any other combination of options will get -2 marks.

18. A ray of light is incident on a glass slab, which of the following statements are correct?
    A) The angle of refratction is always less than the angle of incidence.
    B) The emergent ray is parallel to the incident ray
    C) The emergent ray is always deviated from its original direction
    D) The speed of light in the glass is less than that in air

19. A point object is placed at 30 cm from a convex lens $\left(\mu = \frac{3}{2} \right)$ of focal length 20 cm. Its

final image will be formed at infinity, if

    A) The whole system is immersed in a liquid of refractive index $\frac{9}{8}$.

    B) The whole system is immersed in a liquid of refractive index $\frac{4}{3}$

    C) A concave lens of focal length 60 cm is placed in contact with the first lens.
    D) Another convex lens of focal length 60 cm is placed at 30 cm from the first lens.

20. A ray of light is incident grazing along the face AB to a right angled prism as shown. It emerges out of face AC, as shown, e=angle of emergence. Refractive indixes of different media have been shown in the diagram. Choose correct alternative.
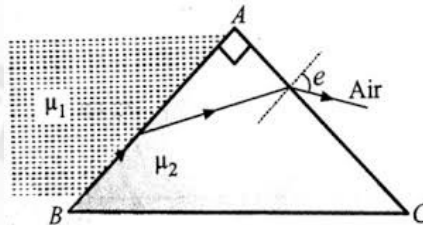
    A) $\mu_1^2 + \sin^2 e = \mu_2^2$ **B)** $\mu_2^2 + \sin^2 e = \mu_1^2$ **C)** $\mu_1^2 + \cos^2 e = \mu_2^2$

    D) If the ray just fails to emerges out of the face AC of the prism, for $\mu_2 = \sqrt{3}$, angle of

refraction of face AB is $\sin^{-1} \sqrt{\dfrac{2}{3}}$

SECTION – II
(SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

*Full Marks*   : +3 If **ONLY** the correct option is chosen;
Zero Marks   : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : −1 In all other cases

21. A man of height 'h' is walking away from a street lamp with a constant velocity 'v'. The height of the street lamp is 3h the rate at which the length of the man's shadow is increasing when he is at a distance 10h from the base of street lamp is

A) $\dfrac{v}{2}$ B) $\dfrac{v}{3}$ C) 2V   D) $\dfrac{v}{6}$

22. Two plane mirrors A and B are aligned parallel to each other as shown in figure. A light ray is incident at an angle $30°$ at a point just inside one end of A. The plane of incidence with the plane of the figure. Find the maximum number of reflections (including the first one) the light ray suffers before it emerges out.
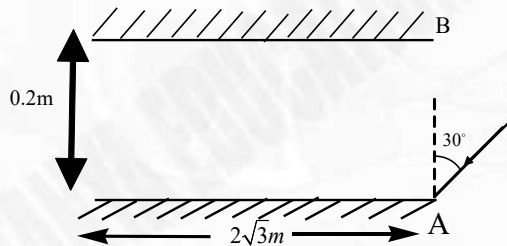
A) 30   B) 45   C) 60   D) 15

23. If one face of a prism of prism angle 30^0 and $\mu = \sqrt{2}$ is silvered, the incident ray retraces its initial path what is the angle of incidence.
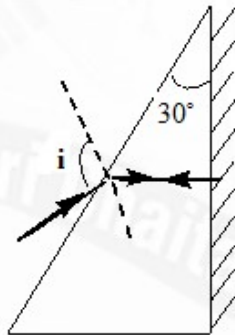
A) 30^0 B) 60^0 C) 45^0 D) 90^0

24. Two plane-concave lenses (1 and 2) of glass of refractive index 1.5 have radii of curvature 25 cm and 20 cm. They are placed in contact with their curved surfaces towards each other and the space between them is filled with liquid of refractive index $\dfrac{4}{3}$

Then the combination is
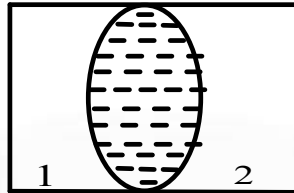
A) Convex of focal length 70 cm

B) Concave of focal length 70 cm

C) Concave of focal length 66.6 cm

D) Convex of focal length 66.6 cm

## SECTION-III

(NON-NEGATIVE INTEGER.)

This section contains **SIX (06)** questions.

• The answer to each question is a **NON-NEGATIVE INTEGER**.

• For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

• Answer to each question will be evaluated <u>according to the following marking scheme</u>

Full Marks : +4 If ONLY the correct integer is entered; Zero Marks : 0 In all other cases..

25. A Screen is placed 60 cm from an object. The image of the object on the screen is formed by a convex lens at two different locations separated by 20cm the focal length of the lens is _____ cm (nearly)

26. Find the position of the image formed by the lens combination given in the figure
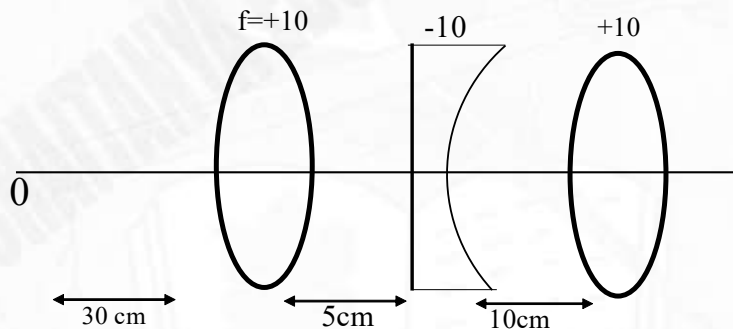
27. An object is placed on the principal axis of convex lens of focal length 10 cm as shown. A plane mirror is placed on the other side of lens at a distance of 25 cm, the image produced by the plane mirror is 5cm inside the mirror the distance of object from the lens is _____cm.
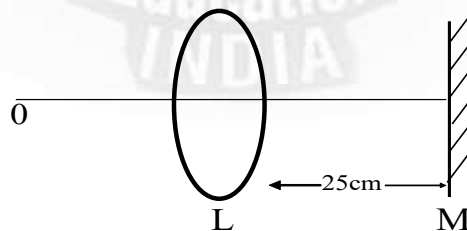
28. Two immiscible liquids of refractive indices $\frac{9}{4}$ and $\frac{4}{3}$ respectively are put in a beaker as shown in the figure. The height of each column is 6cm. A coin is placed at the bottom of the beaker. For near normal vision, the apparent depth of the coin is cm_____(nearly)
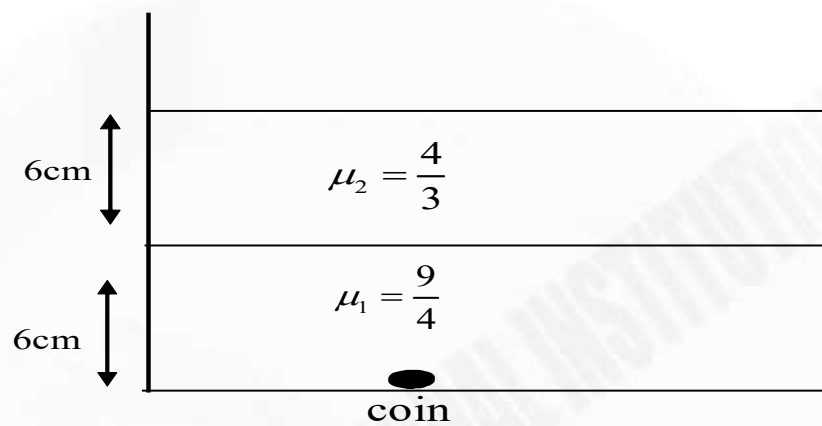
29. Find the lateral shift of light ray while it is pass through a parallel glass slab of thickness 10 cm placed in air. The angle of incidence in air is 60^0 and the angle of refraction in glass is 45^0 (take $\sin 15^0 = 0.258$) (Round off nearest integer)
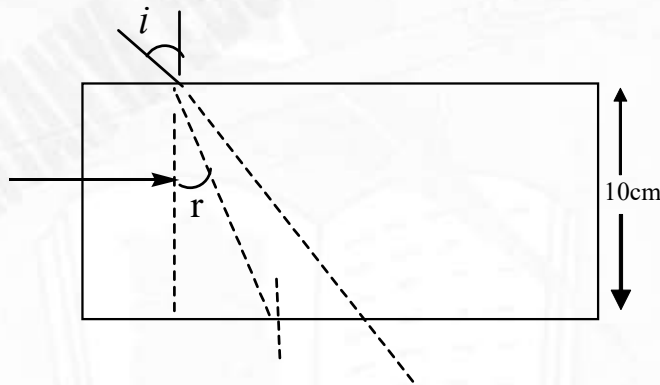
30. If two prisms are combined, as shown in figure find the total angle of deviation suffered by a white ray of light incident on the combination

$$\mu_v = 1.5, \mu_R = 1.4 \qquad \mu_v^1 = 1.7, \mu_R^1 = 1.5$$

SECTION – IV
(MATCHING TYPE)

This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists : **List-I** and **List-II.**
- **List-I** has **Four** entries (I), (II), (III) and (IV) and **List-II** has **Five** entries (P), (Q), (R), (S) and (T).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated <u>according to the following marking scheme :</u>

Full Marks:+3 **ONLY** if the option corresponding to the correct combination is chosen;
Zero Marks: 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks: –1 In all other cases.

31. In column-I optical instruments are given. In column-II , there are results corresponding to a given situation. Match optical instrument of column-I with the results in column-II.

	Column-I		Column-II
A)	Concave mirror	**P)**	Parallel rays can be obtained by using point source
B)	Convex mirror	**Q)**	Real image can be obtain for real object
C)	Concave lens	**R)**	Virtual and diminished image can be obtained for real object
D)	Convex lens	**S)**	Real and magnified image can be obtained for real object
		T)	For a point object moving along optical axis, the image also moves in the same direction of motion of the object
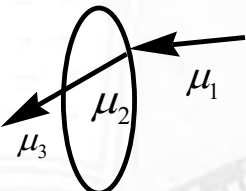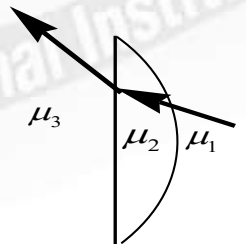
A) **A**-Q S , **B**-S T, **C**-R, **D** -R S   B) **A**- PQS, **B**-R, **C**-RT, **D**-PQST

C) **A**-PQS, **B**-RT, **C**-QR, **D**-PQ   D) **A**-P, **B**-PQR, **C**-RT, **D**-QS

32. Two transparent media of refractive indices μ_1 & μ_3 have a solid lens shaped transparent material of refractive index μ_2 between them as shown in figures in column-II. In column different relationships between μ_1, μ_2, & μ_3 are given. Match them to the ray diagrams shown in column-II

	Column-I		Column-II
A)	$\mu_1 < \mu_2$	**p)**	
B)	$\mu_1 > \mu_2$	**q)**	

C)	$\mu_2 = \mu_3$	**r)**	
D)	$\mu_2 > \mu_3$	**s)**	
		t)	

A) A– p, r ; B - q, s, t ; C - p, r, t ; D – q , s
B) A - p, r ; B - p, s, t ; C - q, r, t ; D - p, q
C) A - p, r ; B - r , s, t ; C- r, s, q ; D - r, t
D) A - p, r ; B - q, r, s ; C - p, s, r ; D -q, t

33. A glass disk whose plane surfaces are parallel is cut as shown in figure, then the lenses so obtained are moved apart. What will happen to a beam of parallel rays falling on to the system? (f is the focal length of converging lens).
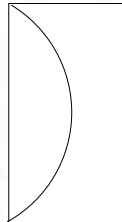
	Column-I		**Column-II**
A)		**1)**	Emerging rays are converging and image distance from $L_2 < f$
B)		**2)**	Emerging rays are diverging and image distance from $L_2 < f$
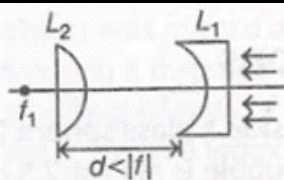
C)		3)	Emerging rays are converging and image distance from $L_2 > f$
D)		4)	Emerging rays are diverging and image distance from $L_2 > f$
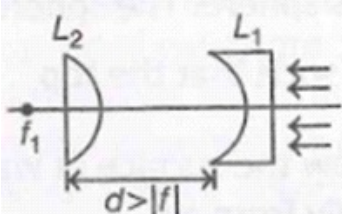
A) A – 1, 3;B -2; C – 1; D - 3   **B)** A – 2; B – 4;C – 3; D -1

C) A - 1, 3 ; B – 2;C – 3;D - 3   **D)** A – 3; B – 2;C – 4; D -1

34. Light is incident at surface PQ of prism as shown in column I then match the column II (Surrounding medium is air in all cases)

	Column-I		Column-II
A)		1)	Total internal reflection takes place at surface QR.
B)		2)	Light emerges normally from the surface QR.
C)		3)	Light emerges parallel to surface QR.
		4)	When light ray passes through the prism it is parallel to the base PR.

A) A - 2, B - 3, C - 1,4   **B)** A - 3, B - 4, C - 1,2

C) A - 1, B - 2, C - 3,4   **D)** A - 2, B - 1, C - 3,4

CHEMISTRY   **Max Marks: 60**

SECTION – I
(ONE OR MORE CORRECT ANSWER TYPE)

This section contains **THERE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated <u>according to the following marking scheme :</u>

Full Marks :+4 **ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks: +3 If all the four options are correct but **ONLY** three options are chosen;
Partial Marks: +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct ;
Partial Marks: +1 If two or more options are correct but **ONLY** two options are chosen, and it is a correct option ;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –2 In all other cases.

For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks; choosing ONLY (A) and (B) will get +2 marks; choosing ONLY (A) and (D) will get +2 marks; choosing ONLY (B) and (D) will get +2 marks; choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark; choosing ONLY (D) will get +1 mark; choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of options will get -2 marks.

35. Which of the following statements are correct?
   A) Tans 2-butene have smallest heat of hydrogenation per mole when compared to 1-Butene , cis 2-butene, 1,3 butadiene
   B) The presence of weaker π bonds make alkenes less stable than alkane
   C) Benzene and polynuclear hydrocarbons containing more than two benzene rings fused together are toxic and said to possess cancer producing property
   D) Cycloheptatrienyl cation have aromatic character.

36. Which of the following statements are correct?
   A) Isobutylene molar heat of hydrogenation higher than 2-Methyl but-1-ene in KJ
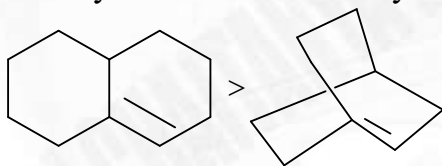
   B) Stability order

   C) In E_2 elimination reactivity of the substance $3^0 > 2^0 > 1^0$ (alkyl halide)
   D) 1- bromo 1-Methyl cyclohexane in E_2 elimination Major product is 1-methylcyclohexene.

37. A compound with molecular formula C_4H_9Cl behave differently towards $LiAlH_4$ and $NaBH_4$ its Structure can be ?
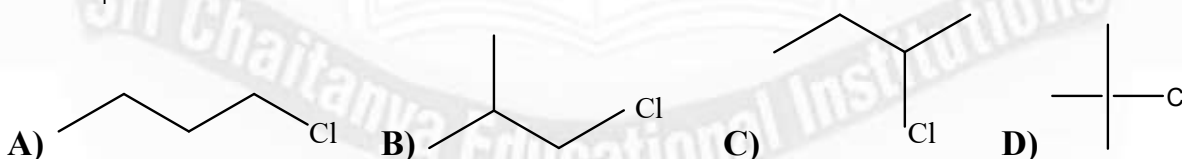
   A)   **B)**   **C)**   **D)**

SECTION – II
(SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated <u>according to the following marking scheme:</u>

Full Marks   : +3 If **ONLY** the correct option is chosen;
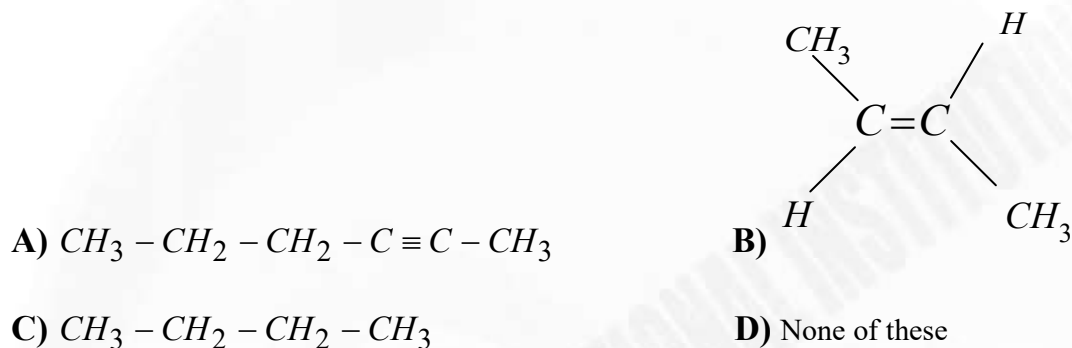*Zero Marks*   :   0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : −1 In all other cases

38. An unknown compound (A) has a molecular formula C_4H_6. When (A) is treated with excess of Br_2 a new substance (B) with formula $C_4H_6Br_4$ is formed. (A) forms a white ppt with Ammonical silver nitrate solution (A) may be
   A) But-1-yne   B) But-2-yne   C) But-1-ene   D) But-2-ene

39. $CH_3 - C \equiv C - CH_3 \xrightarrow{NaNH_2} A.$ The product A is?

   A) $CH_3 - CH_2 - CH_2 - C \equiv C - CH_3$ B)

   C) $CH_3 - CH_2 - CH_2 - CH_3$ D) None of these

40. The metal-ammonia reduction proceeds by addition of an electron to the alkyne to form_____?
   A) Only radical   B) Only anion   C) radical anion   D) radical cation

41. Which of the following compound is Aromatic nature?

   A)   B)   C)   D) Both A & B

SECTION-III
(NON-NEGATIVE INTEGER.)

This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated <u>according to the following marking scheme</u>
Full Marks : +4 If ONLY the correct integer is entered; Zero Marks : 0 In all other cases.

42. Number of peaks (transition states) obtained in the energy profile diagram in the given reaction
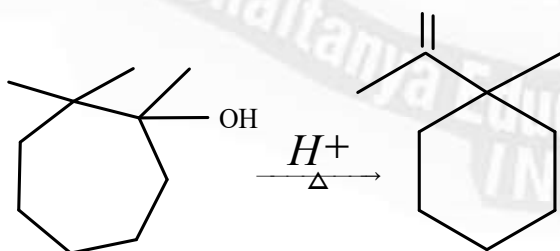
43. Pent 2-yne is treated with a cold dilute solution of neutral permanganate then produce one product that product contain how many lone pairs_____

44. In a given reaction the product contain how many number of π bonds?

$$CH_3\text{-}CH_2\text{-}CH\text{-}CH\text{-}CH_3 \xrightarrow[200^0C]{KOH(fused)} product \quad ?$$
$$\overset{|}{Br} \quad \overset{|}{Br}$$
$$45\%$$
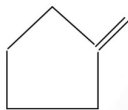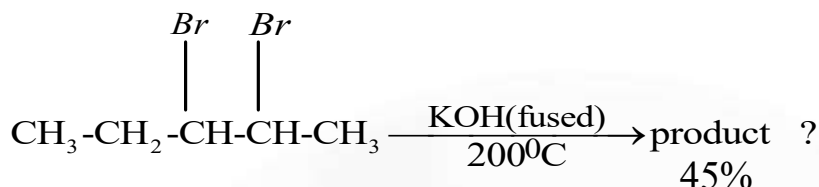
45. Theoretically how many mono bromo allylic substitution products are formed when the above compound is treated with NBS?

46.

$$\xrightarrow{CH_3-CH_2-ONa} X \text{ major product}$$

$$\xrightarrow{(CH_3)_3CONa} Y \text{ major product}$$
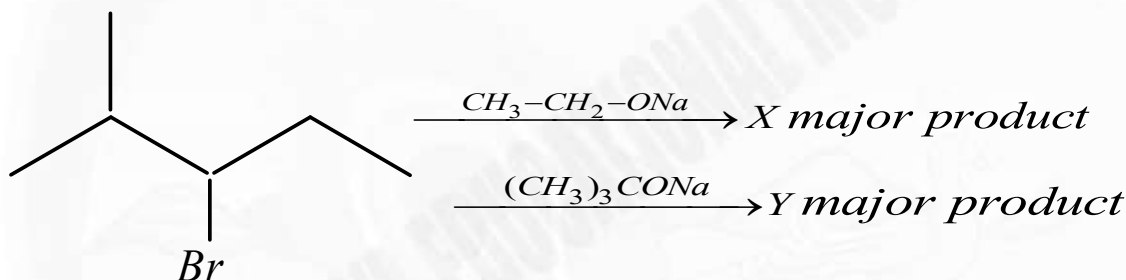
If x is the number of hydrogen involved in hyper conjugation in 'X' and y is the number of hydrogens involved in hyper conjugation in Y, then the value of (X-Y) is ?

47. How many of the following statements are correct?

I) In hydrogenation process (alkenes & alkynes) pt & pd catalyse the reaction at room temperature but relatively higher temperature and pressure are not required with nickel catalyst.

II) 1,3,5,7 octatetraene contain 17 σ bonds, 4π bonds

III) In alkene (ethene) C-H bond length 110 pm

IV) All Aldo oximes exhibit Geometrical Isomerism (except formaldehyde aldo oxime)

SECTION – IV
(MATCHING TYPE)

This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists : **List-I** and **List-II.**
- **List-I** has **Four** entries (I), (II), (III) and (IV) and **List-II** has **Five** entries (P), (Q), (R), (S) and (T).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme :
Full Marks:+3 **ONLY** if the option corresponding to the correct combination is chosen;
Zero Marks: 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks: –1 In all other cases..

48.   Match the following choose the correct option.

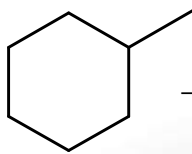|	COLUMN-I		COLUMN-II
1)	Furan	a)	Six membered ring
2)	Pyran	b)	Aromatic
3)	Thiophene	c)	Five membered ring
4)	Pyrrole	d)	Non Aromatic

A) 1-c, 2-a, 3-b, 4-d   B) 1-a, 2-c, 3-d, 4-b
C) 1-b, 2-a, 3-c, 4-d   D) 1-b, 2-a, 3-b, 4-c

49.   Match the following choose the correct option.

	List-I		List-II
1)	$CH_3\text{-}CH\text{=}CH_2 \xrightarrow[R_2O_2]{HCl}$	a)	$CH_3\text{-}\underset{\underset{Cl}{\|}}{CH}\text{-}CH_3$
2)	$Ph\text{-}CH\text{=}CH\text{-}CH_3 \xrightarrow{HBr}$	b)	$Ph\text{-}\underset{\underset{Br}{\|}}{CH}\text{-}CH_2\text{-}CH_3$
3)	$H_3C\text{-}CH\text{=}CH\text{-}CH_3 \xrightarrow[R_2O_2]{HBr}$	c)	$Ph\text{-}\underset{\underset{Cl}{\|}}{CH}\text{-}CH_2\text{-}CH_3$
4)	$Ph\text{-}CH\text{=}CH\text{-}CH_3 \xrightarrow[R_2O_2]{HCl}$	d)	$CH_3\text{-}CH_2\text{-}\underset{\underset{Br}{\|}}{CH}\text{-}CH_3$
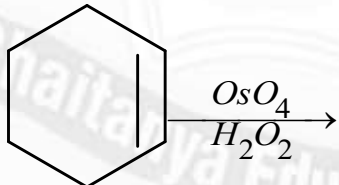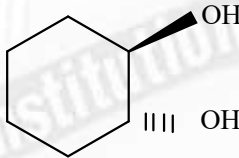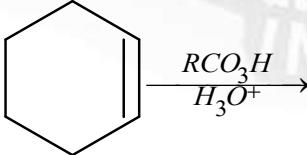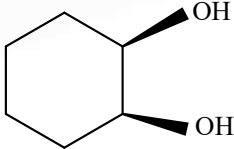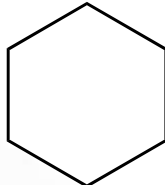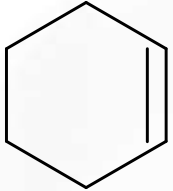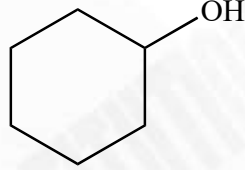
A) 1-a, 2-b, 3-d, 4-c   B) 1-b, 2-a, 3-d, 4-c
C) 1-d, 2-c, 3-d, 4-b   D) 1-c, 2-a, 3-b, 4-d

50.   Match the following choose the correct option.

	COLUMN-I		COLUMN-II
1)	$\xrightarrow[H_2O_2]{OsO_4}$	a)	
2)	$\xrightarrow[H_3O^+]{RCO_3H}$	b)	

3)	OH $\xrightarrow[ii) H_2/Pt]{i) H_2SO_4}$	c)	
4)	$\xrightarrow[ii)H_2O_2/OH^-]{i)BH_3THF}$	d)	OH

A) 1-b, 2-a, 3-c, 4-d   B) 1-c, 2-d, 3-b, 4-c
C) 1-d, 2-b, 3-a, 4-c   D) 1-a, 2-b, 3-c, 4-d

51.   Match the following choose the correct option.

	COLUMN-I (reactions)		COLUMN-II (products)
1)	$4C_2H_2 \xrightarrow[THF]{Ni(CN)_4}$	a)	Pyrrole
2)	$C_2H_2 \xrightarrow[Al_2O_3\Delta]{NH_3}$	b)	Cyclooctatetraene
3)	$C_2H_2 \xrightarrow{HCN}$	c)	Acrylo nitrile
4)	$3C_2H_2 \xrightarrow[tube]{\text{Re}d\ hot\ Fe}$	d)	Benzene

A) 1-b, 2-a, 3-c, 4-d   B) 1-b, 2-a, 3-d, 4-c
C) 1-a, 2-c, 3-b, 4-d   D) 1-c, 2-a, 3-b, 4-d