Sri Chaitanya IIT Academy.,India.

A.P T.S KARNATAKA TAMILNADU MAHARASTRA DELHI RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

Sec:Sr.Super60_NUCLEUS & STERLING_BT **Paper -1(Adv-2022-P1-Model)** **Date: 20-08-2023**

Time: 09.00Am to 12.00Pm **RPTA-03** **Max. Marks: 180**

20-08-2023_Sr.Super60_NUCLEUS&STERLING_BT_Jee-Adv(2022-P1)_RPTA-03_Syllabus

PHYSICS : Wave optics: Wave nature of light: Huygen's principle, interference limited to Young's double slit experiment. Diffraction due to a single slit. Polarization of light, plane polarized light; Brewster's law, Polaroids. Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers, Resolving power of microscopes and astronomical telescopes.

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

MATHEMATICS : TOTAL DIFFERENTIAL CALCULUS

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

JEE-ADVANCE-2022-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 – 8)	Questions with Numerical Value Answer Type	+3	0	8	24
Sec – II(Q.N : 9 – 14)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – III(Q.N : 15 – 18)	Matching Type	+3	-1	4	12
Total				**18**	**60**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 19 – 26)	Questions with Numerical Value Answer Type	+3	0	8	24
Sec – II(Q.N : 27 – 32)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – III(Q.N : 33 – 36)	Matching Type	+3	-1	4	12
Total				**18**	**60**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 37 – 44	Questions with Numerical Value Answer Type	+3	0	8	24
Sec – II(Q.N : 45 – 50)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – III(Q.N : 51 – 54)	Matching Type	+3	-1	4	12
Total				**18**	**60**

MATHEMATICS

Max Marks: 60

SECTION – I
(NUMERICAL VALUE TYPE)

This section contains **EIGHT (08)** questions.

- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will bee evaluated according to the following marking scheme :

Full Marks:+3 **ONLY** if the correct numerical value is entered ;
Partial Mark: 0 In all other cases.

1. If domain of function

$$f(x)=\frac{1}{\sqrt{\sin(\cos x)}}+\sin^{-1}\left(\frac{2x}{\pi}\right)+\frac{1}{\{x\}}+\frac{1}{\ln\left(1-\left[\tan\frac{x}{2}\right]-\left[-\tan\frac{x}{2}\right]\right)}\text{ is}$$

$x\in(a,b)-\{c,d,e\}$ then the value of a + b + c + d + e, where [ ] is GIF and { } is fractional part of x.

2. If $\lim_{n\to\infty}\left(\frac{1}{1^2}+\frac{1}{2^2}+\ldots\ldots+\frac{1}{n^2}\right)=\frac{\pi^2}{6}$ and

$S=\lim_{n\to\infty}\left(\frac{1}{1^3\cdot2^3}+\frac{1}{2^3\cdot3^3}+\frac{1}{3^3\cdot4^3}+\ldots\ldots+\frac{1}{n^3\cdot(n+1)^3}\right)$, then $S+\pi^2$ is

3. Consider the function $f(x)=\frac{\sin3x(\cos6x+\cos4x)}{\sin x(\cos8x+\cos2x)}$

If the range of the function is $(-\infty,a)\cup(a,b)\cup(c,d)\cup(d,\infty)$ where a < b < c < d The value of a + b + c + d =

4. Let $y=f(x),(f:R\to R)$ be an explicit function defined by the implicit equation $x^3+y^3+3\left(x^2+y^2\right)+3(x+y)=14$ and the function $g(x)$ be the inverse of $f(x)$. If $\frac{d}{dx}\{f(x+g(x))\cdot g(x+f(x))\}$, at $x=-1+\sqrt[3]{15}$ is equal to $\lambda(15)^{2/3}$, where $\lambda\in I$, then the value of $|\lambda|$ is

5. Let $f:R\to R$ be a function defined by $f(x)=-x^3-3x^2-6x+1$. Number of integers in the solution set of x satisfying the inequality $f\left(f\left(x^3+f(x)\right)\right)\geq f\left(f\left(-f(x)-x^3\right)\right)$ is

6. Let $f(x)=\begin{cases}\lim\limits_{n\to\infty}\left(\frac{ax}{n}\left(\sum\limits_{K=1}^{n}\frac{\left[K^2-e^{-x}+K-1\right]}{K(K+1)}\right)\right)+\lambda, & x>0\\ b, & x=0\\ \lim\limits_{n\to\infty}\sum\limits_{K=1}^{n}\frac{\left\{K^2+K+e^{x}-1\right\}}{K(K+1)}, & x<0\end{cases}$

is differentiable in R, (where [.] and {.} denotes G.I.F and F.P. F respectively) then the value of $f'(-\ln 1)+f'(-\ln 2)+f'(-\ln 4)+f'(-\ln 8)+\ldots\ldots\infty$ is

7. If α is the root of the equation $x-\tan x=3$, where $\alpha\in\left(\frac{\pi}{2},\frac{3\pi}{2}\right)$; then the value of

$$\left(\lim_{x\to\alpha^+}\left[\frac{\max\left(\tan x,\{x\}\right)}{x-3}\right]\right)+\left(\lim_{x\to\alpha^+}\left[\frac{\min\left(\tan x,\{x\}\right)}{x-3}\right]\right)$$

$$+\left(\lim_{x\to\alpha^-}\left[\frac{\min\left(\tan x,\{x\}\right)}{x-3}\right]\right)+\left(\lim_{x\to\alpha^-}\left[\frac{\max\left(\tan x,\{x\}\right)}{\tan x}\right]\right)$$

is...(where [.] denotes the greatest integer function and {.} fractional part function)

8. If $f(x)=x-\sin x, g(x)=Cos^{-1}\left(e^{-\frac{x^4}{2}}\right)$ *and* $h(x)=Tan^{-1}\left(\frac{2x}{1+x^2}\right)$ then

$$\left|\lim_{x\to0}\left(\frac{f(x)-g(x)}{x^2}\right)\right|+3\left|\lim_{x\to0}\left(\frac{f(2x)-h(x^3)}{x^3}\right)\right|+3\left|\lim_{x\to0}\left(\frac{3f(x)}{x^3}\right)\right|=\_\_\_\_$$

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

This section contains **SIX (06)** 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 according to the following marking scheme :

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.

9. $f:N\to A$ and $g:N\to B$ are two onto functions such that

$f(n)=\left[n\sec^2\theta\right]$ and $g(n)=\left[n\operatorname{cosec}^2\theta\right]$, for some θ and $n\in N$ where N is set of natural numbers, if $\sec^2\theta$ is irrational, (where[.] denotes the greatest integer function) then

which of following is/are true

A) $A \cap B = \phi$

B) $A \cup B = N$

C) f and g are bijective functions

D) $A \cap B$ is non-empty finite set

10. Let $f:(0,\infty) \to R$ be a differentiable function satisfying the equation $2f(x) = f(xy) + f\left(\frac{x}{y}\right); \forall x > 0, y > 0$. If $f(1) = 0$ and $f'(1) = 1$. Then which of following is/are true

A) $f(x)$ has no local maxima and no local minima

B) $\lim\limits_{x \to 0}\left[\frac{f(x+1)}{x}\right] = 0$, where [k] denotes greatest integer function less than or equal to k

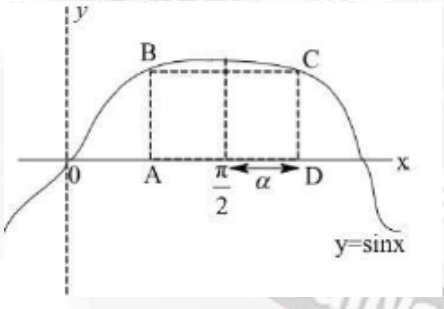
C) $f(x) = ex$ has no real solutions

D) The equation $2e.f(x) = x$ has exactly one real solution

11. Which of the following is/are correct

A) Let $f(x) = 2x^3 - 9x^2 + 12x + 8$, the number of values of x for which $y = f(f(x))$ attains local extremum is 3

B) A rectangle ABCD is inscribed in the region bounded by $y = \sin x$, x -axis where $x \in [0, \pi]$ (as shown in figure), then area of rectangle is maximum when $\alpha = \cot\alpha$



C) If the two curves $y = ax^3 - 6ax^2 + (12a+12)x - (8a+16)$ where $a \in R$ and $y = x^3$ touches each other at some point, then one of the possible value of 'a' is $\sqrt[3]{2} + \sqrt[3]{3}$

D) Let $f(x) = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5$ be a polynomial of degree 5 which increases in the interval $(-\infty, 1]$ and $[3, \infty)$ and decreases in the interval $(1,3)$. Given that $f(0) = 2, f(1) = \frac{88}{15}$ and $f'(2) = 0$, then a_5 is equal to 1/5.

12. Which of the following is/are incorrect

A) If l_1 and l_2 are the least and greatest distances between parallel tangents drawn to the curve $f(x)=x-\sin x$ where $x\in\left(\frac{-\pi}{6},\frac{13\pi}{6}\right)$ then the value (l_1+l_2) is π

B) Let $f(x)=2x^3-3x^2-x+\frac{3}{2}$ then $f(f(x))=0$ has minimum 6 real roots

C) If $P(n)=\prod_{r=3}^{n}\frac{\left(r^3+3r\right)^2}{r^6-64}$, then value of $\lim\limits_{n\to\infty}$ P(n) is 36/7, $(n\in N)$

D) Let f be an even function satisfying

$$f(x-2)=f\left(x+\left[\frac{6x^2+13}{x^2+2}\right]\right)\forall x\in R \text{ and } f(x)=\begin{cases}3x, & 0\le x<1\\ 4-x, & 1\le x\le 4\end{cases}$$

Where [k] denotes greatest integer function less than or equal to k then value of $\sum_{r=1}^{2022} f\left(\frac{-r}{2023}\right)+f(2021)+f(2022)+f(2023)+f(2024)$ is 3036

13. Let $f:R\to R$ be defined by $f(x)=\begin{cases}2x^2\ln|x|-5x^2, & x\neq 0\\ 0, & x=0\end{cases}$

Which of the following statement (s) is/are correct?

A) $f(x)$ has exactly one local maximum and two local minimum points

B) $f(x)$ is strictly increasing in $(10,\infty)$

C) Absolute minimum value of $f(x)$ exist but absolute maximum value of $f(x)$ does not exist

D) In the interval $x\in(0,\infty)$, $f(x)=2023$ have two distinct real roots

14. Let $f(x)$ be a non-constant, thrice differentiable function defined on R such that $y=f(x)$ is symmetric about line $x=1$ and $f(-1)=f'\left(\frac{1}{4}\right)=f'\left(\frac{1}{2}\right)=0$, then which of following is/are correct statement(s)?

A) $f''(x)=0$ has atleast four real roots in the interval $(0,2)$

B) $f'''(x)=0$ has atleast 3 real roots in the interval (0,2)

C) there exist at least one $C\in\left(\frac{3}{2},\frac{7}{4}\right)$ such that $f'(C)+Cf''(C)=0$

D) for some $C\in\left(1,\frac{3}{2}\right)$, $f'(C)=Cf''(C)$

SECTION – III
(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 chosed (i.e. the question is unanswered);
Negative Marks: –1 In all other cases.

15.

	Column-1		Column-2
A)	$f_1(x)=\|\|x-6\|-\|x-8\|\|-\left\|x^2-4\right\|+3x-\|x-7\|^3, x\in R$	**P)**	$f_2(x)$ is continuous $\forall x\in R$ but not differentiable at 2 points on R
B)	$f_2(x)=\left(x^2-9\right)\left\|x^2+11x+24\right\|+\sin\|x-7\|$ $+\cos\|x-4\|+(x-1)^{3/5}\sin(x-1), x\in R$	**Q)**	$f_1(x)$ is continuous $\forall x\in R$ but not differentiable at 5 points on R
C)	$f_3(x)=\begin{cases}(x+1)^{3/5}-\frac{3\pi}{2} & ,x<-1\\ \left(x-\frac{1}{2}\right)\cos^{-1}\left(4x^3-3x\right) & ,-1\le x\le 1\\ (x-1)^{5/3} & ,1<x<2\end{cases}$	**R)**	$f_4(x)$ is discontinuous at 3 points as well as not differentiable at 3 point on $[-1,2\pi]$
D)	$f_4(x)=\{\sin x\}\{\cos x\}+\left(\sin^3\pi\{x\}\right)([x]), x\in[-1,2\pi]$ (where [.] denotes the greatest integer function and {.} fractional part function)	**S)**	$f_3(x)$ is continuous $\forall x\in(-\infty,2)$ but not differentiable at 3 points $(-\infty,2)$

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

16. Let $f:R^+\to R$ be an strictly increasing function, such that $xf(x)+2>0$ and $f(x)\cdot f\left(\frac{xf(x)+4}{x}\right)=1$

	LIST -1		LIST -02
A)	The value of $\left[f'(1)\right]$ is : ([.] denotes G.I.F)	**P)**	2
B)	Number of point(s) of inflection of f(x) is	**Q)**	1
C)	The value of $\left[1-f(1)\right]$ is: [.] denotes G.I.F)	**R)**	0
D)	Number of solution(s) of $\sin x-f(8)=0$ in interval $[-\pi,2\pi]$ is	**S)**	4

A) $A \to P : B \to P : C \to S : D \to R$ **B)** $A \to S : B \to R : C \to P : D \to Q$

C) $A \to Q : B \to R : C \to P : D \to S$ **D)** $A \to Q : B \to R : C \to S : D \to P$

17.

	Column-1		Column-2
A)	Let f(x) be a non-constant thrice differentiable function defined on $(-\infty,\infty)$ such that $f\left(\frac{x+13}{2}\right)=f\left(\frac{3-x}{2}\right)$ and $f'(0)=f'\left(\frac{1}{2}\right)=f'(2)=f'(3)=f'\left(\frac{9}{2}\right)=0$ then the minimum number of zeroes of $h(x)=(f''(x))^2+f'(x)f'''(x)$ in the interval [0,9] is 2 k then k is equal to____	**P)**	10
B)	If the maximum value of $\left\lvert\sqrt{x^4-7x^2-4x+20}-\sqrt{x^4+9x^2+16}\right\rvert$ is P , then the value of [P] (where [.] denotes GIF)	**Q)**	8
C)	Consider a function $f(x)$ where $f:R^+\to R$ such that $f(2023)=1$ and $f(x)f(y)+f\left(\frac{2023}{x}\right)f\left(\frac{2023}{y}\right)=2f(xy),\forall x,y\in R^+$ then $\frac{10f(2)}{f(1)+f(2)}=$	**R)**	5
D)	If α and β $(\alpha<\beta)$ are roots of equation $\lim_{t\to\infty}\cos^{-1}\left[\sin\left(\tan^{-1}\left(\frac{\sqrt{tx}}{\sqrt{tx^2-3tx+t-1}-x}\right)\right)\right]=\frac{\pi}{6}$ then the value of $\left(8^{\alpha}+2^{\beta}-\alpha\beta\right)$	**S)**	9

A) $A \to Q : B \to P : C \to P : D \to R$ **B)** $A \to S : B \to Q : C \to R : D \to S$

C) $A \to P : B \to R : C \to S : D \to P$ **D)** $A \to P : B \to Q : C \to R : D \to S$

18.

	Column-1		Column-2
A)	If $f(x)=\lim_{n\to\infty}\left(\sum_{r=1}^{n} r\cos^r x\right)$ where $x\in R-\{n\pi, n\in I\}$, then the value of $\left[\lim_{x\to 0}\left((1-\cos x)^2 f(x)\right)^{\frac{1}{\cos x-1}}\right]$ is (where [.] is greatest integer function)	**P)**	2
B)	If the function $f(x)$ is given by $f(x)=x^8-22x^5-6x^3+3x^2+55$ then the number of integral solutions of the equation $f(x)=0$ is	**Q)**	0
C)	The number of local maxima of function $f(x)=x^2+4\cos x+5$ is k and $g(x)=2\lvert x\rvert^3+3x^2-12\lvert x\rvert+1$, where $x\in[-1,2]$ then greatest value of $g(x)$ is m then m-k is	**R)**	4
D)	If $f: R-\{-1\}\to R$ and $f(x)$ (which is not a constant function and $f(x)\neq x, x\neq 0,-2$)is a differentiable function satisfies $f(x+f(y)+xf(y))=y+f(x)+yf(x), \forall x,y\in R-\{-1\}$ then the value of $2023\{1+f(2022)\}$ is	**S)**	1

A) $A\to P: B\to Q: C\to S: D\to R$ **B)** $A\to P: B\to P: C\to S: D\to R$

C) $A\to P: B\to Q: C\to R: D\to S$ **D)** $A\to P: B\to P: C\to P: D\to R$

PHYSICS **Max Marks: 60**

SECTION – I
(NUMERICAL VALUE TYPE)

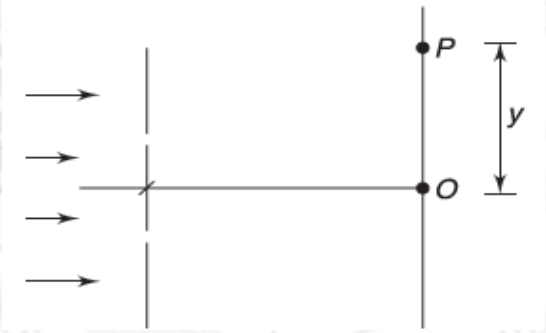
This section contains **EIGHT (08)** questions.

- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will bee evaluated according to the following marking scheme :

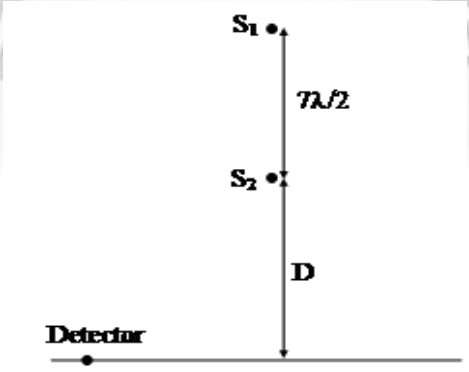
Full Marks:+3 **ONLY** if the correct numerical value is entered ;
Partial Mark: 0 In all other cases.

19. Three coherent sources S_1, S_2 and S_3 can throw light on a screen. With S_1 switched on intensity at a point P on the screen was observed to be I. With only S_2 on, intensity at P was $2I$ and when all three are switched on the intensity at P becomes zero. Intensity at P is I when S_1 and S_2 are kept on. Find the phase difference between the waves reaching at P from sources S_1 and S_3. (Answer in radians)

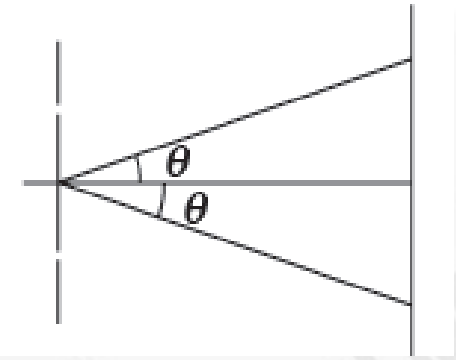
20. In young's double slit experiment, when the slit plane is illuminated with light of wavelength λ_1, it was observed that point P is closest point from central maximum O, where intensity was 25% the intensity at O. When the light of wavelength λ_2 is used, point P happens to be the nearest point from O where intensity is 75% of that at O. Find the ratio $\frac{\lambda_1}{\lambda_2}$.



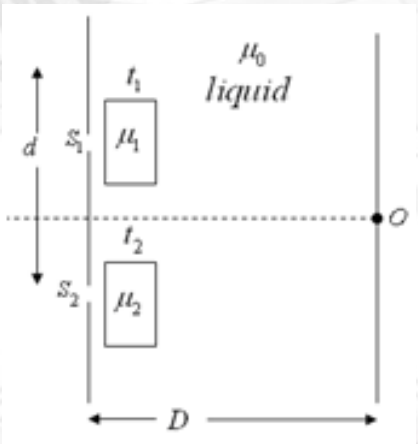
21. Two point sound sources S_1 and S_2 emitting sound of wavelength λ are kept separated by a distance $7\lambda/2$ as shown. A detector is moved along the line shown from $-\infty$ to $+\infty$. Find the number of minimas observed by the detector. (Assume $D >>> \lambda$)



22. In Young's double-slit experiment, the separation between two slits is d = 0.08 mm and the wavelength of light used is $\lambda = 5000\,\mathring{A}$. Find the number of maxima in the angular range $-\sin^{-1}(0.6) \le \theta \le \sin^{-1}(0.6)$.

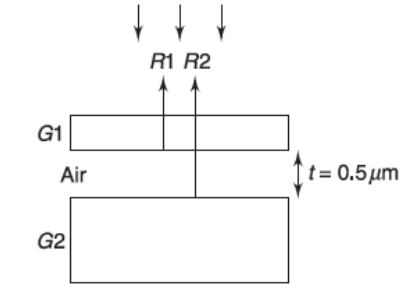


23. A liquid of refractive index μ_0 is filled between slits and screen. Initially the central maxima is at point O on screen, with no slabs in front of slits. Now two slabs of refractive index μ_1 and μ_2, with thickness t_1 and t_2 respectively are placed in front of slits as shown, So that the position of central maxima does not change. Find the ratio of $\frac{t_1}{t_2}$, if $\mu_0 = 1.5,\ \mu_1 = 1.8$ *and* $\mu_2 = 2.1$.



24. Two rectangular pieces of plane glass are laid one upon the other on a table. A thin strip of paper is placed between them at one edge so that a very thin wedge of air is formed. The plates are illuminated at normal incidence by 540-nm light from a mercury vapour lamp. Interference fringes are formed with 15 fringes per centimetre. Find the angle of wedge in multiples of 1/10000 of a radian (refractive index of air is 1)

25. A thin glass slab $G1$ is held over a large glass slab $G2$, creating an air gap of uniform thickness $t = 0.5\mu m$ between them. Electromagnetic wave having wavelengths



ranging from 0.4 μm to 1.15 μm is incident normally on the slab $G1$. When interference between waves reflected from boundaries of air gap (the two reflected waves are shown in fig as $R1$ and $R2$) was studied, it was found that only two wavelengths interfered constructively. One of these two wavelengths is $\lambda_1 = 0.04\mu m$. Find the other wavelength (λ_2) that interferes constructively.(In micrometers)

26. A parallel beam of white light falls from air on a thin film whose refractive index is $4/3$. The medium on both sides of the film is air. The angle of incdidence is 53°. Find the minimum film thickness if reflected light is most intense for $\lambda = 600\,nm$.
(In nanometer)

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

This section contains **SIX (06)** 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 according to the following marking scheme :

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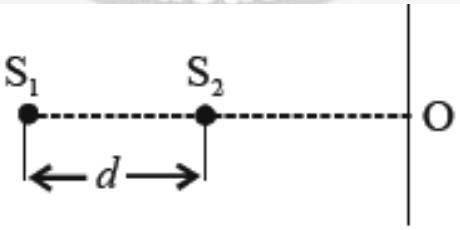
Partial Marks: +1 If two or more options are correct but **ONLY** two options are chosen, and it is a correct option ;
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : –2 In all other cases.

27. Two point monochromatic and coherent sources of light of wavelength λ are placed on the dotted line in front of an infinite screen. The sources emit waves out of phase with S_1 leading in phase. The distance between S_1 and S_2 is d while their distance from the screen is much larger.



A) if d is $\frac{3\lambda}{2}$, at O maxima will be observed

B) if d is $\frac{11\lambda}{6}$, then intensity at O will be $\frac{1}{4}$ of maximum intensity

C) If d is 3λ, O will be a minima

D) if d is $\frac{7\lambda}{6}$, the intensity at O will be $\frac{3}{4}$ of maximum intensity

28. In the Young's double slit experiment, the interference pattern is found to have an intensity ratio between the bright and dark fringes as 25/9. This implies that

A) the intensities at the screen due to each of the two slits are 16 units and 1 units respectively

B) the intensities at the screen due to the two slits are 25 units and 9 units respectively

C) the amplitude ratio is 5/3

D) the amplitude ratio is 4

29. Young's double slit experiment is conducted with a slit separation of $0.5\,\text{mm}$, with the distance between the slit and screen being $1\,\text{m}$. The wavelength of light used is 5000Å. The width of fringes formed on the screen if a parallel beam of light is incident, making an angle of $1/1000$ radian with the normal to the plane of the double slit is β. Choose the correct options

A) $\beta = 1mm$

B) Central maxima shifts when the angle of the beam is made zero

C) Central maxima doesn't shift when the angle of the beam is made zero

D) $\beta = 0.1mm$

30. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance $d(>>b)$ from the slits. At a point on the screen directly in front of one of the slits, certain wavelengths are missing. Some of these missing wavelengths are

A) $\lambda = \frac{b^2}{d}$ **B)** $\lambda = \frac{2b^2}{d}$ **C)** $\lambda = \frac{b^2}{3d}$ **D)** $\lambda = \frac{2b^2}{3d}$

31. Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beam is $\pi/2$ at a point A and π at point B. Then the difference between resultant intensities at A and B is.

A) 2I **B)** 4I **C)** 5I **D)** 7I

32. In Young's double slit experiment, if the entire setup is shifted to water from air, to keep fringe width unchanged (refractive indices of water and air are 4/3 and 1 respectively)

A) Distance between slits and screen can be increased by 33.3%

B) Distance between slits can be reduced by 25%

C) Distance between slits can be increased to 3 times and distance between slits and screen can be increased to 4 times

D) none of the above

SECTION – III
(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 closed (i.e. the question is unanswered);
Negative Marks: –1 In all other cases.

33.

	Column I		Column II
A)	When incoherent light waves superpose	**P)**	Energy distribution is constant with time
B)	When coherent light waves superpose	**Q)**	Energy distribution is not constant with time
C)	In YDSE with all standard conditions and monochromatic light	**R)**	Average Intensity at minimas is zero
D)	In YDSE with all standard conditions and white light	**S)**	Average Intensity at minimas is practically non zero

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

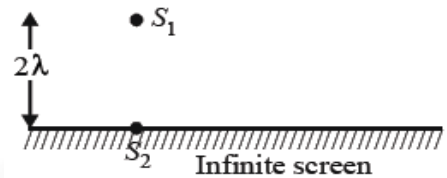
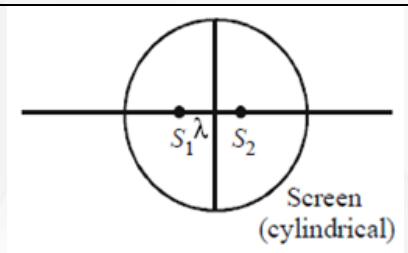
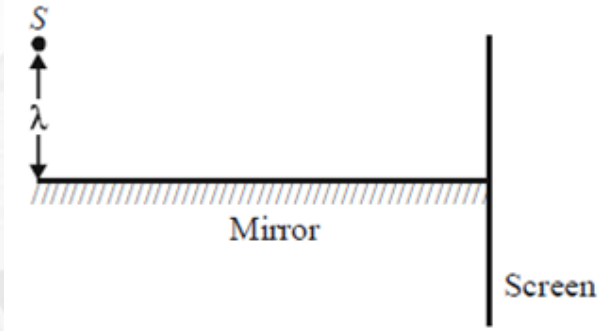
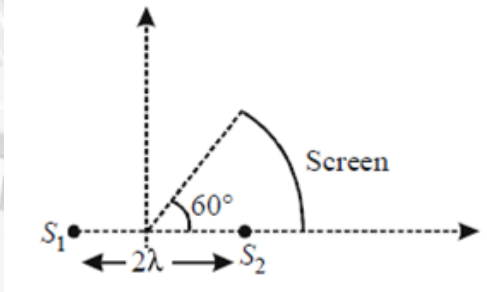
34.

	Column-1		Column-2
A)	If Young's double slit experiment is performed in water instead of air then the fringe pattern will	**P)**	equal
B)	If the distance between slits in YDSE is reduced, the fringe width will	**Q)**	decrease
C)	If blue light is used instead of red light in YDSE, the fringe width will	**R)**	increase
D)	For best contrast between maxima and minima in the interference pattern of Young's double slit experiment the intensity of light emerging out of the two slits should be	**S)**	shrink

A) A-s; B-r; C-q; D-p
B) A-r; B-s; C-q; D-p
C) A-s; B-r; C-p; D-q
D) A-r; B-s; C-p; D-q

35. S_1 and S_2 in column I represent coherent point sources, S represents a point source.

$\lambda =$ wavelength of light emitted by the sources.

	Column-1		Column-2
A)		**P)**	Number of maxima = 2
B)		**Q)**	Number of minima = 2
C)		**R)**	Number of maxima = 4
D)		**S)**	Number of minima = 4
		(t)	Number of maxima = 7

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

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

C) A- q; B- s; C-s; D-t

D) A-p; B- s; C-s, t; D-p

36.

	Column-1		Column-2
A)	The fringe width for red colour as compared to that for violet colour is approximately	**P)**	half
B)	In a Young's double slit experiment, the distance between the slits is halved and the distance between slit and screen is doubled then the fringe width will become	**Q)**	double
C)	If the distance of a surface from light source is doubled then the power received will become	**R)**	quarter times
D)	Light from a lamp is falling normally on a small surface. If the surface is tilted to 60° from this position, then the power received by the surface will become	**S)**	four times

A) A-q; B-s; C-p; D-q **B)** A-s; B-p; C-q; D-r

C) A-q; B-s; C-r; D-p **D)** A-p; B-q; C-r; D-s

CHEMISTRY **Max Marks: 60**

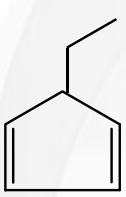
SECTION – I
(NUMERICAL VALUE TYPE)

This section contains **EIGHT (08)** questions.

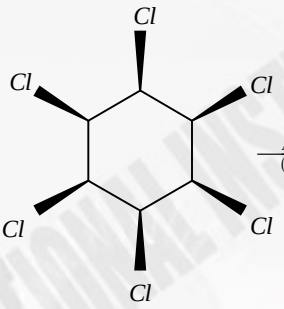
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will bee evaluated according to the following marking scheme :

Full Marks:+3 **ONLY** if the correct numerical value is entered ;
Partial Mark: 0 In all other cases.

37. Consider following reactions:

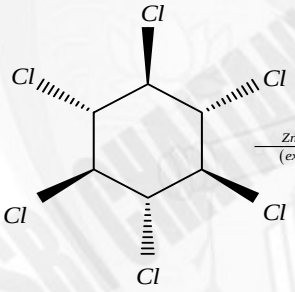
1) 

$\xrightarrow[\Delta]{}$ Major product

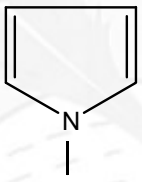
2) 

$\xrightarrow[(excess)\Delta]{Alc.KOH}$ Major product

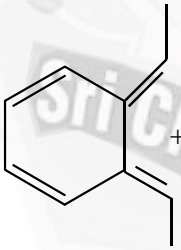
3) 
$\xrightarrow[\Delta]{Al_2O_3-Cr_2O_3}$ *Major product*

4) 

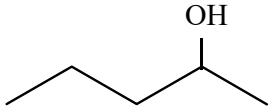
$\xrightarrow[(excess)]{Zn\ dust}$ Major product

5) 

$+CHCl_3 \xrightarrow{KOH}$ Major product

6) 
$+CH_2=CH-COOEt \xrightarrow[\Delta]{}$ Major product

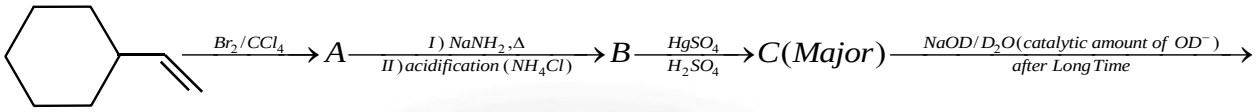
How many of the above reactions gives benzene as the major product

38. 

$\xrightarrow[\Delta]{conc.H_2SO_4}$ *mixture of alkenes* $\xrightarrow[reagent]{Bayer's}$ Product(s)

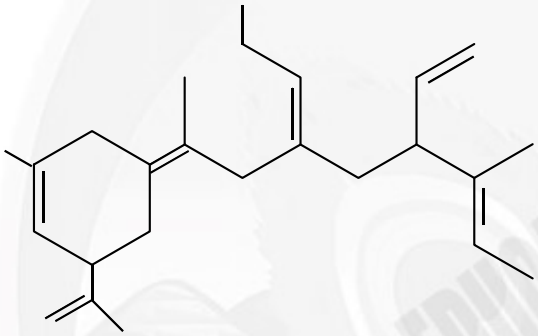
Total diols formed after final reaction will be:

39. Consider the following reaction scheme

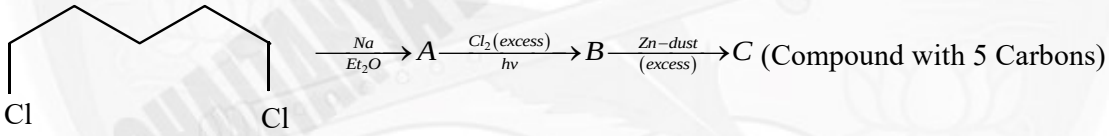


If number of product of deuterium atoms present in the final product is x and its degree of un saturation y then x + y = ?

40. Number of different carbonyl compounds formed in the reductive ozonolysis of following compound.

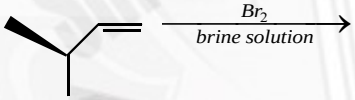


41.



If Number of chlorine atoms in C is x and unsaturation of C is y. Then $x + y = ?$

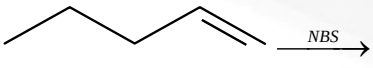
42.



total number of possible organic products including stereo isomers

43. Acetylene can be prepared by heating iodoform(CHI_3) with excess of silver powder. How many moles of silver iodide will be produced for the formation of 13 gram of acetylene.

44.



Product(s).Number of allyl bromo derivatives formed during reaction will be:

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

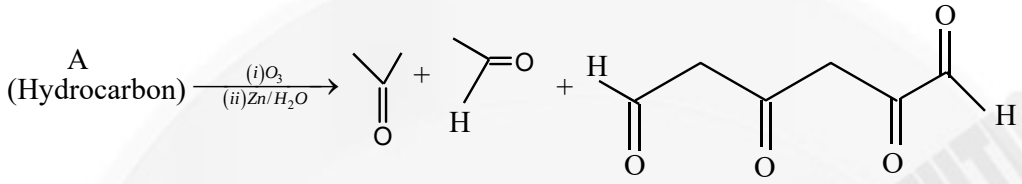
This section contains **SIX (06)** questions.

- 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 according to the following marking scheme :

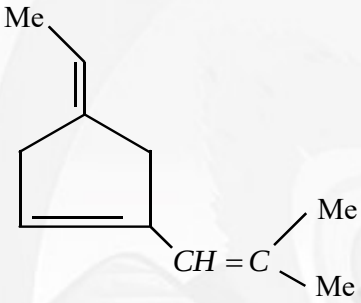
Full Marks :+4 **ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks: +3 If all the four options are correct but **ONLY** three options are chosen;
Partial Marks: +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct ;
Partial Marks: +1 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.

45.



Structure of A can be:

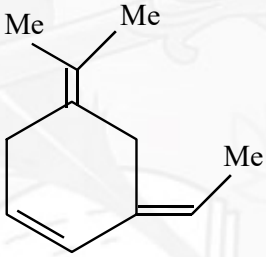
A)



B)

C)

D)



46. $\overset{14}{C}H_2 = CH - CH_3 \xrightarrow{Br_2/h\upsilon} \xrightarrow[Dry\ ether.\Delta]{Na}$ Products

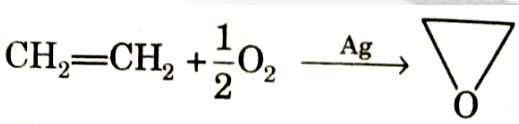
Products can be:

A) $CH_2 = CH - \overset{14}{C}H_2 - CH_2 - CH = \overset{14}{C}H_2$ **B)** $CH_2 = CH - CH_2 - CH_2 - CH = CH_2$

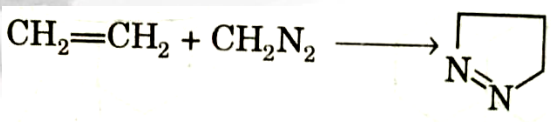
C) $CH_2 = CH - \overset{14}{C}H_2 - \overset{14}{C}H_2 - CH = CH_2$ **D)** $\overset{14}{C}H_2 = CH - CH_2 - CH_2 - CH = \overset{14}{C}H_2$

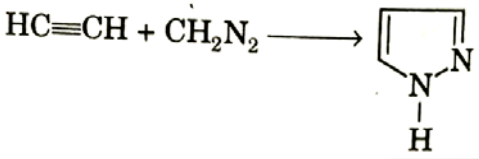
47. Select correct option(s):

A)

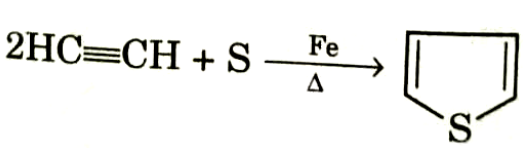


B)



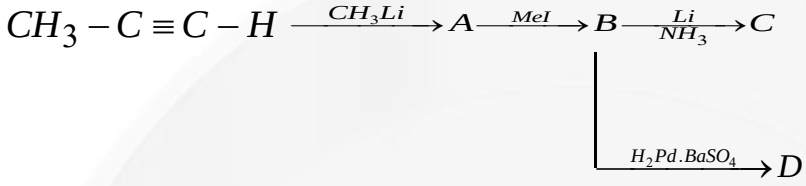


C)



D)

48.

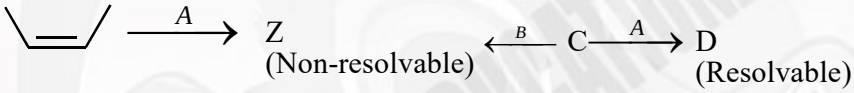


C and D are:

A) Enantiomers **B)** Diastereoisomers

C) Geometrical isomers **D)** Structural isomers

49.



Select correct statement(s):

A) A is *cold alkaline* $KMnO_4$

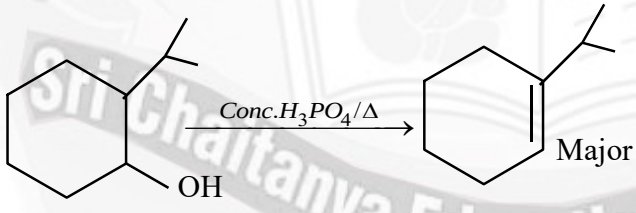
B) B is $I.RCO_3H$ $II.H_3O^+$

C) C is obtained when D is heated with conc. H_2SO_4

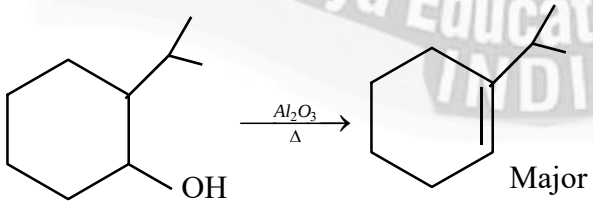
D) Reaction C to Z is stereo non-selective

50. Select correct option:

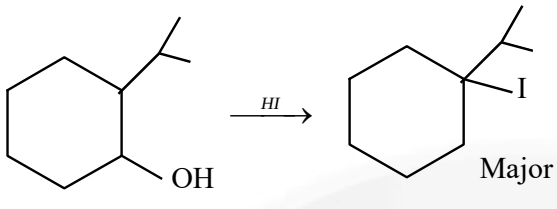
A)



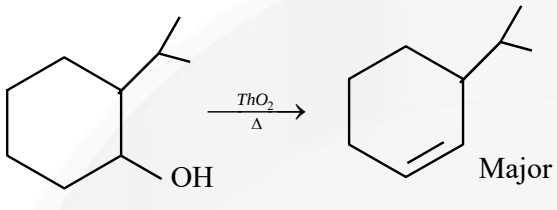
B)



C)



D)



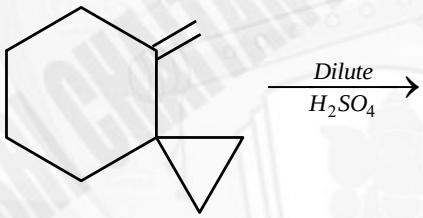
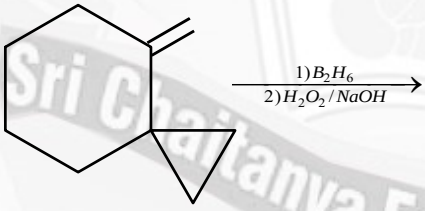
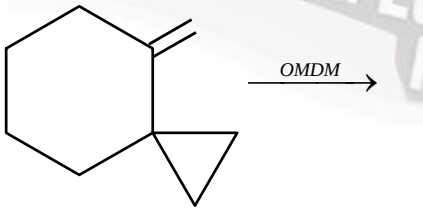
SECTION – III
(MATCHING TYPE)

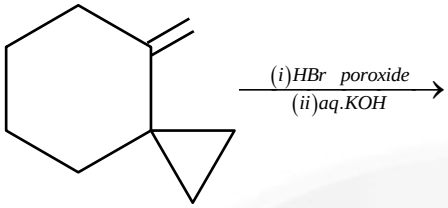
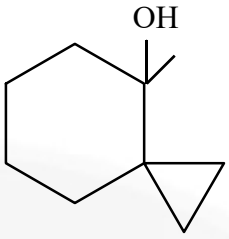
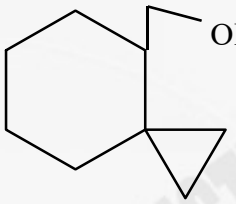
This section contains **FOUR (04)** Matching List Sets.

- 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 chosed (i.e. the question is unanswered);
Negative Marks: –1 In all other cases.

51. Match the following

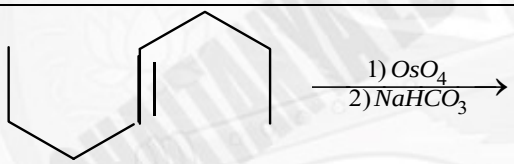
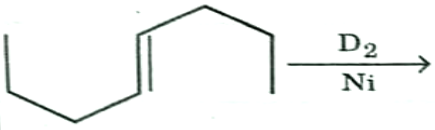
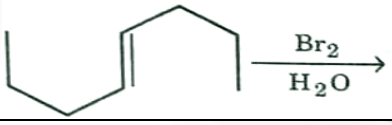
Column-I		Column-II	
a)		**p)**	Over all reaction involves Markonikoff's addition of water on alkene
b)		**q)**	Over all reaction involves Anti-Markonikoff's addition of water molecule on alkene
c)		**r)**	Reaction involves carbocation rearrangement.

d)		**s)**	 is major product
		t)	 is major product

A) $(a-pr),(b-qt),(c-ps),(d-qt)$ **B)** $(a-pr),(b-qt),(c-ps),(d-s)$

C) $(a-pr),(b-qr),(c-p),(d-t)$ **D)** $(a-ps),(b-qt),(c-s),(d-t)$

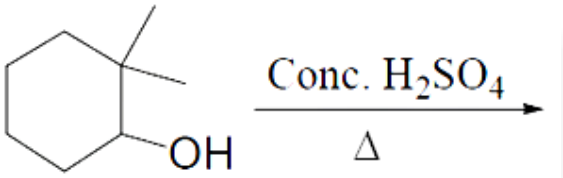
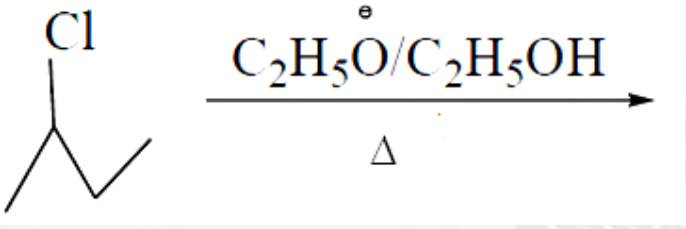
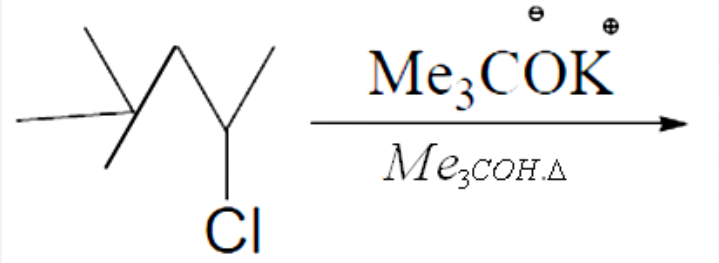
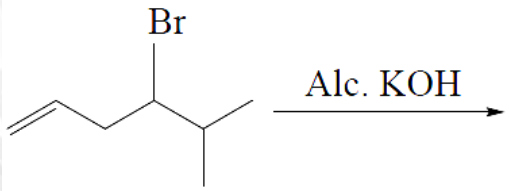
52. Match the following column:

Column-I		Column-II	
a)		**p)**	Optically inactive due to internal compensation
b)		**q)**	Optically inactive due to external compensation
c)		**r)**	Product have presence of two chiral center
d)		**s)**	Diastereomers will be formed

A) $(a-q,r),(b-p,r),(c-q,r),(d-q,r)$ **B)** $(a-pq),(b-s),(c-s),(d-pqrt)$

C) $(a-pq),(b-s),(c-s),(d-qt)$ **D)** $(a-pq),(b-s),(c-s),(d-t)$

53. Match the column-I and column-II

Column-I		Column-II	
a)		**p)**	Hofmann`s product
b)		**q)**	Saytzeff`s product
c)		**r)**	Transition state
d)		**s)**	Carbocation

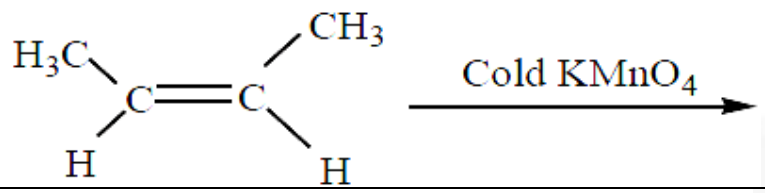
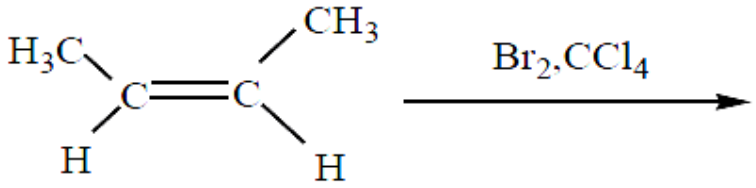
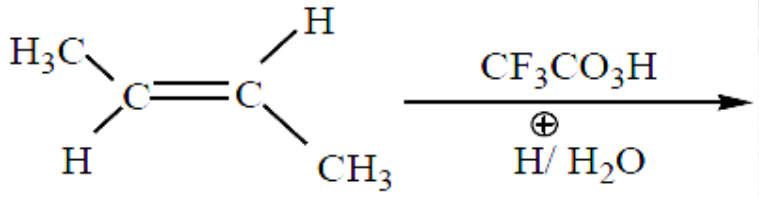
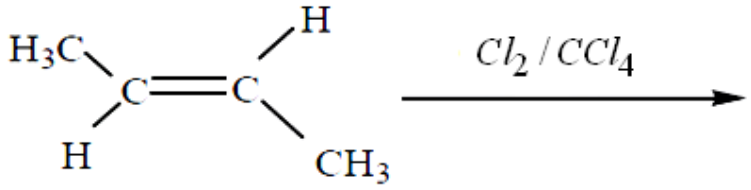
A) A – Q,R,S; B – Q,R; C – P,R; D – Q,R.

B) A – Q,S; B – Q,R; C – P,R; D – P,R.

C) A – Q,R,S; B – Q,R; C – P,R; D – P,R.

D) A – P,R; B– Q; C – P,R; D – P,R.

54. Match the column –I and column –II

Column-I		Column-II	
a)		**p)**	Racemic mixture
b)		**q)**	Erythro product
c)		**r)**	Thero product
d)		**s)**	Meso product

A) A – P,R; B – Q,S; C – R,S; D – Q,R
B) A – Q,S; B – P,R; C – Q,S; D – Q,S
C) A – P,S; B – Q,S; C - Q,S; D – P,S
D) A – Q,S; B – Q,S; C – R,S; D – P,R

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