



# 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-BT**

Time: **09.00Am to 12.00Pm**

JEE-MAIN

RPTM-03

Date: **26-07-2025**

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**.

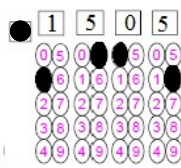
- The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

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:

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Candidate's Signature: \_\_\_\_\_

Invigilator's Signature: \_\_\_\_\_



**MATHEMATICS : AOD**

**PHYSICS**

: SHM: Linear and angular simple harmonic motions, SHM in rigid body systems. Experiment: Determination of g using simple pendulum, Forced and damped oscillation (in one dimension), Resonance (Deleted for MAINS);

**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  $X_2$ ,  $HX$ ,  $HOX$  ( $X$ =halogen); Effect of peroxide on addition reactions; cyclic polymerization reaction of alkynes, Addition reactions of alkynes; Metal acetylides. Reactions of alkenes with  $KMnO_4$  and ozone; Reduction of alkenes and alkynes



**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.**

- Let  $f(x) = 3\sqrt{x-2} + \sqrt{4-x}$  be a real valued function. If  $\alpha$  and  $\beta$  are respectively the minimum and the maximum values of 'f', then  $\alpha^2 + 2\beta^2$  is equal to  
 1) 42                      2) 38                      3) 24                      4) 44
- For the function  

$$f(x) = \sin x + 3x - \frac{2}{\pi}(x^2 + x), \text{ where } x \in \left[0, \frac{\pi}{2}\right],$$
  
 Consider the following two statements:  
**Statement-I:**  $f$  is increasing in  $\left(0, \frac{\pi}{2}\right)$   
**Statement -II:**  $f'$  is decreasing in  $\left(0, \frac{\pi}{2}\right)$   
 Between the above two statements:  
 1) Only **Statement-II** is true  
 2) Only **Statement-I** is true  
 3) Both **Statement-I** and **Statement-II** are false  
 4) Both **Statement-I** and **Statement-II** are true
- The number of critical points of the function  $f(x) = (x-2)^{2/3}(2x+1)$  is  
 1) 1                      2) 2                      3) 0                      4) 3
- If the function  $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$ , where  $a > 0$ , attains its local maximum and local minimum values at p and q, respectively, such that  $p^2 = q$ , then  $f(3)$  is equal to :  
 1) 55                      2) 10                      3) 23                      4) 37





5. If  $f(x) = \begin{cases} x^3(1-x), & x \leq 0 \\ x \log_e x + 3x, & x > 0 \end{cases}$ , then which of the following is not true?
- 1)  $f(x)$  has point of maxima at  $x = 0$     2)  $f(x)$  has point of minima at  $x = e^{-4}$   
 3)  $f(x)$  has range  $R$     4)  $f(x)$  not continuous at  $x = 0$
6. The shortest distance between the curves  $y^2 = 8x$  and  $x^2 + y^2 + 12y + 35 = 0$  is :
- 1)  $2\sqrt{3} - 1$     2)  $\sqrt{2}$     3)  $3\sqrt{2} - 1$     4)  $2\sqrt{2} - 1$
7. Let  $a > 0$ . If the function  $f(x) = 6x^3 - 45ax^2 + 108a^2x + 1$  attains its local maximum and minimum values at the points  $x_1$  and  $x_2$  respectively such that  $x_1 x_2 = 54$ , then  $a + x_1 + x_2$  is equal to .....
- 1) 15    2) 18    3) 24    4) 13
8. Consider the region  $R = \left\{ (x, y) : x \leq y \leq 9 - \frac{11}{3}x^2, x \geq 0 \right\}$ . The area, of the largest rectangle of sides parallel to the coordinate axes and inscribed in  $R$ , is:
- 1)  $\frac{625}{111}$     2)  $\frac{730}{119}$     3)  $\frac{567}{121}$     4)  $\frac{821}{123}$
9. Let  $(2, 3)$  be the largest open interval in which the function  $f(x) = 2 \log_e(x-2) - x^2 + ax + 1$  is strictly increasing and  $(b, c)$  be the largest open interval, in which the function  $g(x) = (x-1)^3(x+2-a)^2$  is strictly decreasing. Then  $100(a+b-c)$  is equal to:
- 1) 280    2) 360    3) 420    4) 160
10. The sum of all local minimum values of the function  $f(x) = \begin{cases} 1-2x, & x < -1 \\ \frac{1}{3}(7+2|x|), & -1 \leq x \leq 2 \\ \frac{11}{18}(x-4)(x-5), & x > 2 \end{cases}$
- 1)  $\frac{171}{72}$     2)  $\frac{131}{72}$     3)  $\frac{157}{72}$     4)  $\frac{167}{72}$







11. Let  $M$  and  $m$  respectively be the maximum and the minimum values of

$$f(x) = \begin{vmatrix} 1 + \sin^2 x & \cos^2 x & 4 \sin 4x \\ \sin^2 x & 1 + \cos^2 x & 4 \sin 4x \\ \sin^2 x & \cos^2 x & 1 + 4 \sin 4x \end{vmatrix}, x \in \mathbb{R}$$

Then  $M^4 - m^4$  is equal to :

- 1) 1280                      2) 1295                      3) 1040                      4) 1215
12. Let  $f(x)$  be cubic polynomial on  $\mathbb{R}$  which increases in the interval  $(-\infty, 0) \cup (1, \infty)$  and decreases in the interval  $(0, 1)$ . If  $f'(2) = 6$  and  $f(2) = 2$ , then the value of

$$\tan^{-1}(f(1)) + \tan^{-1}\left(f\left(\frac{3}{2}\right)\right) + \tan^{-1}(f(0)) \text{ is equal to :}$$

- 1)  $\tan^{-1} 2$                       2)  $\cot^{-1} 2$                       3)  $-\tan^{-1} 2$                       4)  $-\cot^{-1} 2$
13. Let  $f(x)$  be a polynomial of degree four having extreme values at  $x = 1$  and  $x = 2$ . If

$$\lim_{x \rightarrow 0} \left[ 1 + \frac{f(x)}{x^2} \right] = 3, \text{ then } f(2) \text{ is equal to :}$$

- 1) -8                      2) -4                      3) 0                      4) 4
14. Let a rectangle ABCD of sides 2 and 4 be inscribed in another rectangle PQRS such that the vertices of the rectangle ABCD lie on the sides of the rectangle PQRS. Let  $a$  and  $b$  be the sides of the rectangle PQRS when its area is maximum. Then  $(a + b)^2$  is equal to :

- 1) 72                      2) 60                      3) 80                      4) 64
15. A window is in the shape of a rectangle surmounted by a semi circle. If the perimeter of the window is of fixed length ' $l$ ' then the maximum area of the window is

1)  $\frac{l^2}{2\pi + 4}$                       2)  $\frac{l^2}{\pi + 8}$                       3)  $\frac{l^2}{2\pi + 8}$                       4)  $\frac{l^2}{8\pi + 4}$

16. Let  $|\cos \theta \cos(60 - \theta) \cos(60 + \theta)| \leq \frac{1}{8}, \theta \in [0, 2\pi]$ , then the sum of all  $\theta \in [0, 2\pi]$ , where  $\cos 3\theta$  attains its maximum value, is :

1)  $9\pi$                       2)  $18\pi$                       3)  $6\pi$                       4)  $15\pi$





17. Let the set of all positive values of  $\lambda$ , for which the point of local minimum of the function  $(1+x(\lambda^2-x^2))$  satisfies  $\frac{x^2+x+2}{x^2+5x+6} < 0$ , be  $(\alpha, \beta)$ . then  $\alpha^2 + \beta^2$  is equal to ....

1) 28                      2) 55                      3) 58                      4) 39

18. Match the Column – I with values of Column – II:

	COLUMN – I		COLUMN – II
A)	The number of Integral values of 'b' for which $f(x) = \int_0^x (t^4 + (b+1)t^3 + (b+2)t^2 + (b+1)t + 1) dt$ always increases	p)	3
B)	If $f(x) = x - 2\sin x, 0 \leq x \leq 2\pi$ is increasing in $[a\pi, b\pi]$ then a+b is	q)	2
C)	If function $f(x) = x^3 + ax^2 + bx + c, a, b \in N$ is monotonic increasing, then least positive integral value of $\frac{a^2}{b}$ is	r)	1
D)	Let $f(x) = \frac{a \sin x + 2 \cos x}{\sin x + \cos x}$ is monotonically increasing then integral value of 'a' can be	s)	0
		t)	4

1) A – p; B – q; C – r; D – p                      2) A – s; B – t; C – q; D – p  
 3) A – t; B – p; C – t; D – q                      4) A – s; B – t; C – r; D – q

19. A sphere of 10cm radius has a uniform thickness of ice around it. Ice is melting at rate  $50 \text{ cm}^3 / \text{min}$  when thickness is 5cm then rate of change of thickness is

1)  $\frac{1}{36\pi}$                       2)  $\frac{1}{18\pi}$                       3)  $\frac{1}{9\pi}$                       4)  $\frac{1}{12\pi}$

20. The maximum value of the function  $f(x) = 3x^3 - 18x^2 + 27x - 40$  on the set

$S = \{x \in \mathbb{R} : x^2 + 30 \leq 11x\}$  is :

1) -222                      2) -122                      3) 122                      4) 222





## 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 the maximum and minimum values of  $\left(\sqrt{8x - x^2} - 12 - 4\right)^2 + (x - 7)^2$ ,  $x \in \mathbb{R}$  be  $M$  and  $m$ , respectively, Then  $M^2 - m^2$  is equal to .....
22. Consider,  $f(x) = \cos 2x + 2x\lambda^2 + (2\lambda + 1)(\lambda - 1)x^2$ ,  $\lambda \in \mathbb{R}$ .  
If  $\alpha \neq \beta$  and  $f\left(\frac{\alpha + \beta}{2}\right) < \frac{f(\alpha) + f(\beta)}{2}$  for all  $\alpha$  and  $\beta$ , then smallest positive integral value of  $\lambda$  is
23. Let  $A(4, -2)$ ,  $B(1, 1)$  and  $C(9, -3)$  be the vertices of a triangle  $ABC$ . Then the maximum area of the parallelogram  $AFDE$ , formed with vertices  $D$ ,  $E$  and  $F$  on the sides  $BC$ ,  $CA$  and  $AB$  of the triangle  $ABC$  respectively, is .....
24. Let  $f(x) = \begin{cases} 3x, & x < 0 \\ \min\{1 + x + [x], x + 2[x]\}, & 0 \leq x \leq 2 \\ 5, & x > 2 \end{cases}$ , where  $[.]$  denotes greatest integer function. If  $\alpha$  and  $\beta$  are the number of points, where 'f' is not continuous and is not differentiable, respectively, then  $\alpha + \beta$  equals .....
25. Let  $S = \{\sin^2 2\theta : (\sin^4 \theta + \cos^4 \theta)x^2 + (\sin 2\theta)x + (\sin^6 \theta + \cos^6 \theta) = 0 \text{ has real roots}\}$ . If  $\alpha$  and  $\beta$  be the smallest and largest elements of the set  $S$ , respectively, then  $3((\alpha - 2)^2 + (\beta - 1)^2)$  equals .....





## PHYSICS

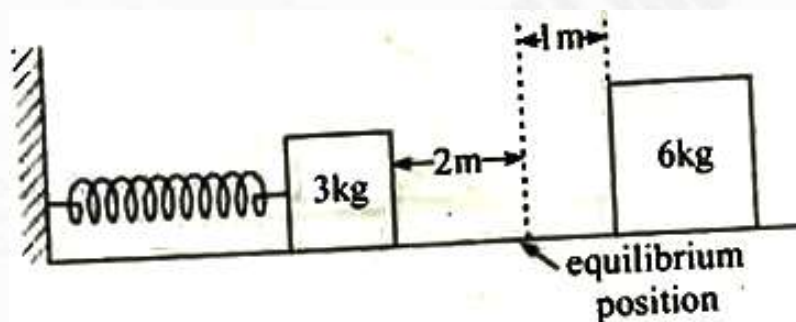
Max Marks: 100

SECTION-I  
(SINGLE CORRECT ANSWER TYPE)

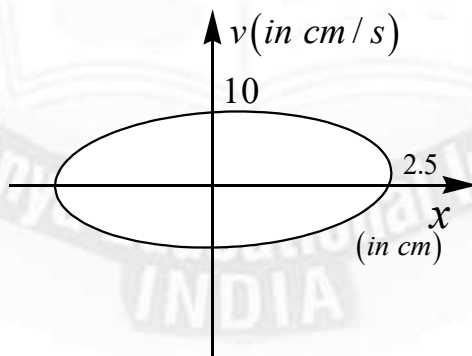
This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

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

26. Two blocks of masses 3kg and 6kg rest on a horizontal smooth surface. The 3 kg block is attached to a spring with a force constant  $k = 900 \text{ Nm}^{-1}$  which is compressed 2m from the equilibrium position as shown in fig. The 6 kg mass is at rest at 1 m from mean position, 3kg mass strikes the 6kg mass and the two stick together. The amplitude of the resulting motion is in meters



- 1)  $\sqrt{3}$       2)  $\sqrt{2}$       3) 1.5      4)  $\frac{\sqrt{3}}{2}$
27. The fig. shows a graph between velocity and displacement (from mean position) of a particle of mass 2 kg performing SHM. If potential energy at mean position is  $-\frac{1}{100} \text{ J}$ . Find the total energy (in J)



- 1)  $\frac{1}{100}$       2)  $\frac{1}{10}$       3) 0      4) 1

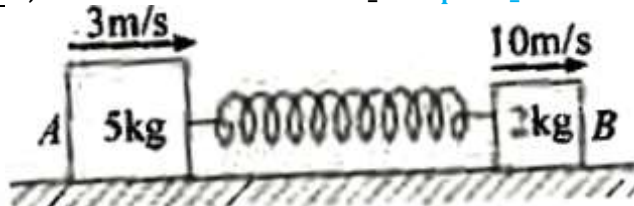






28. Assertion (A) : A spring of spring constant 'K' is fixed to the ceiling of a lift. The other end of the spring is attached to a block of mass 'm'. The mass is in equilibrium. Now the lift accelerates downwards with an acceleration  $2g$ . Then the min. potential energy of the spring during the motion of the block will be 0.  
Reason (R) : In SHM the particle experiences maximum acceleration at its extreme position
- 1) Both A and R are true and the R is the correct explanation of the A
  - 2) Both A and R are true but R is not the correct explanation of the A
  - 3) A is true but R is false.
  - 4) A is false R is true
29. Assertion (A) The potential energy  $U$  of a particle of mass 2 kg is given by  $U = 20 + (x - 4)^2$  J. If total mechanical energy of the particle is 36J, the amplitude of the particle is 4m  
Reason (R) : In the above case the angular frequency of the particle is 1rad/s
- 1) Both A and R are true and the R is the correct explanation of the A
  - 2) Both A and R are true but R is not the correct explanation of the A
  - 3) A is true but R is false.
  - 4) A is false R is true
30. A block is placed on a horizontal plank. The plank is performing SHM along a vertical line with amplitude of 40 cm. The block just loses contact with the plank when the plank is momentarily at rest. Then ( $g=10\text{m/s}^2$ ) Choose incorrect option.
- 1) The period of its oscillations is  $\frac{2\pi}{5}$  sec
  - 2) The block weights on the plank double its weight, when the plank is at one of the positions of momentary rest
  - 3) The block weighs 0.75 times its weight on the plank, halfway down from the mean position.
  - 4) The block weighs is true weight on the plank, when velocity of the plank is maximum
31. Two blocks A(5 kg) and B(2 kg) attached to the ends of a spring constant 1120 N/m are placed on a smooth horizontal plane with the spring undeformed. Simultaneously velocities of 3 m/s and 10 m/s along the line of the spring in the same direction are imparted to A and B then after how much time the first maximum compression occurs.



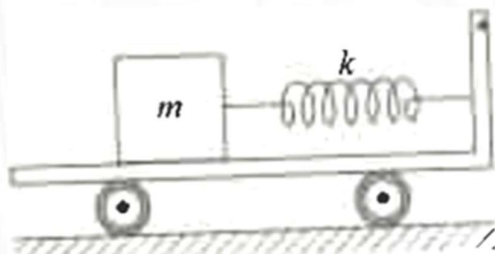


- 1)  $\frac{3\pi}{56}$       2)  $\frac{\pi}{56}$       3)  $\frac{\pi}{28}$       4)  $\frac{\pi}{14}$

32. Density of a liquid varies with depth as  $\rho = \alpha h$ . A small ball of density  $\rho_0$  is released from the free surface of the liquid. Then choose incorrect option

- 1) The ball will execute SHM of amplitude  $\frac{\rho_0}{\alpha}$   
 2) The mean position of the ball will be at a depth  $\frac{\rho_0}{2\alpha}$  from the free surface  
 3) The ball will sink to a maximum depth of  $\frac{2\rho_0}{\alpha}$   
 4) The angular frequency of block is  $\sqrt{\rho_0 \alpha g}$

33. A block of mass 'm' is attached to a massless spring of force constant 'k', the other end of which is fixed from the wall of a truck as shown in fig. The block is placed over a smooth surface and initially the spring is unstretched. Suddenly the truck starts moving towards right with a constant acceleration  $a_0$ . As seen from the truck (choose incorrect option).



- 1) The particle will execute SHM  
 2) The time period of oscillations will be  $2\pi\sqrt{\frac{m}{k}}$   
 3) The amplitude of oscillations will be  $\frac{ma_0}{k}$   
 4) The energy of oscillations will be  $\frac{m^2 a_0^2}{k}$



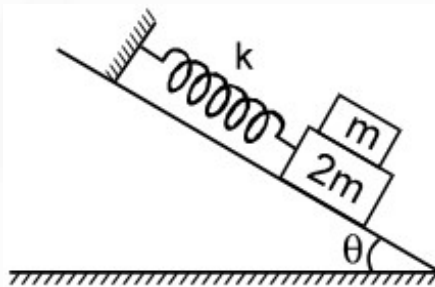


34. The position of a particle w.r.t origin varies according to the relation  $x = 3 \sin 100t + 8 \cos^2 50t$ . Which of the following is/are correct about this motion
- 1) The motion of the particle is not SHM
  - 2) The amplitude of the SHM of the particle is 5 units
  - 3) The amplitude of the resultant SHM is  $\sqrt{73}$  units
  - 4) The maximum displacement of the particle from the origin is 11 units.
35. Statement – I : If a hole were drilled through the centre of earth, i.e along the diameter and a ball is dropped from rest into the hole at one end, it will not get out of the other end of the hole.
- Statement-II: It will execute SHM and will be seen at the other end after 43.2 min from the time it is dropped
- 1) Both statement-I and statement II are correct and statement II is the correct explanation of statement I
  - 2) Both Statement- I and statement II are correct but statement II is not the correct explanation of statement I
  - 3) Statement I is correct but statement II is incorrect
  - 4) Statement II is correct but statement I is incorrect
36. A street car moves rectilinearly from station A (here car stops) to the next station B (here also car stops) with an acceleration varying according to the law  $f = a - bx$ , where 'a' and 'b' are positive constants and 'x' is the distance from station A. The distance between the two stations and the maximum velocity are :
- 1)  $x = \frac{2a}{b}$ ;  $v_{\max} = \frac{a}{\sqrt{b}}$
  - 2)  $x = \frac{b}{2a}$ ;  $v_{\max} = \frac{a}{b}$
  - 3)  $x = \frac{a}{2b}$ ;  $v_{\max} = \frac{b}{\sqrt{a}}$
  - 4)  $x = \frac{2a}{b}$ ;  $v_{\max} = \frac{\sqrt{a}}{b}$

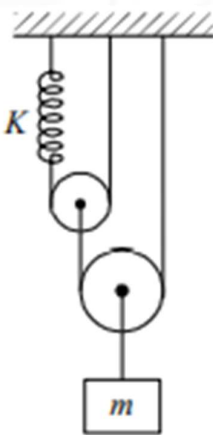




37. The coefficient of friction between block of mass 'm' and 2m is  $\mu = 2 \tan \theta$ . There is no friction between block of mass 2m and inclined plane. The maximum amplitude of two block system for which there is not relative motion between both the blocks.



- 1)  $g \sin \theta \sqrt{\frac{k}{m}}$       2)  $\frac{mg \sin \theta}{k}$       3)  $\frac{3mg \sin \theta}{k}$       4) None of these
38. Statement – I: The bob of a simple pendulum is a hollow ball full of water. If a fine hole is made at the bottom of the ball, then the time period will vary till the ball gets empty and then becomes constant  
Statement-II: The time period of simple pendulum is independent of mass of bob, but it depends on distance of centre of mass of the bob from the suspension point
- 1) Both statement-I and statement II are correct and statement II is the correct explanation of statement I  
2) Both statement-I and statement II are correct but statement II is not the correct explanation of statement I  
3) Statement I is correct but statement II is incorrect  
4) Statement II is correct but statement I is incorrect
39. Find the natural frequency of oscillation of the system as shown in fig. Pulleys are massless and friction less. Spring and string are also massless.



- 1)  $\frac{1}{7\pi} \sqrt{\frac{k}{m}}$       2)  $\frac{1}{2\pi} \sqrt{\frac{k}{m}}$       3)  $\frac{2}{\pi} \sqrt{\frac{k}{m}}$       4)  $\frac{1}{\pi} \sqrt{\frac{2k}{m}}$







40. A uniform square plate of side 'a' is hinged at one of its corners. It is suspended such that it can rotate about horizontal axis. Find out its time period of small oscillation about its equilibrium position :

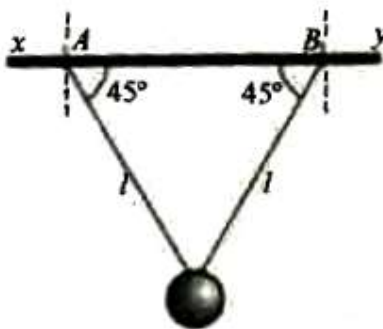
1)  $\pi\sqrt{\frac{2\sqrt{2}a}{g}}$       2)  $2\pi\sqrt{\frac{2a}{g}}$       3)  $2\pi\sqrt{\frac{\sqrt{2}a}{3g}}$       4)  $2\pi\sqrt{\frac{2\sqrt{2}a}{3g}}$

41. The time period of oscillation of the particle in SHM is 'T' Then match the following

Column-I	Column-II
a) $\frac{3}{8}$ th of oscillation from extreme position	e) $\frac{2T}{3}$
b) $\frac{3}{8}$ th of oscillation from mean position	f) $\frac{T}{3}$
c) $\frac{5}{8}$ th of oscillation from extreme position	g) $\frac{7T}{12}$
d) $\frac{5}{8}$ th of oscillation from mean position	h) $\frac{5T}{12}$

- 1) a-e, b-g, c-h, d-f      2) a-f, b-h, c-e, d-g  
3) a-f, b-e, c-h, d-g      4) a-e, b-f, c-g, d-h

42. Two light strings, each of length 'l' are fixed at points A and B on a fixed horizontal rod xy. A small bob is tied by both strings and in equilibrium, the strings are making angle  $45^\circ$  with the rod. If the bob is slightly displaced normal to the plane of the strings and released then period of the resulting small oscillation will be:



1)  $2\pi\sqrt{\frac{2\sqrt{2}l}{g}}$       2)  $2\pi\sqrt{\frac{\sqrt{2}l}{g}}$       3)  $2\pi\sqrt{\frac{l}{g}}$       4)  $2\pi\sqrt{\frac{l}{\sqrt{2}g}}$





43. When a particle of mass  $m$  is attached to a vertical spring of spring constant  $k$  and released, its motion is described by  $y(t) = y_0 \sin^2 \omega t$ , where 'y' is measured from the lower end of unstretched spring. If 'g' is the acceleration due to gravity then find  $\omega$ .

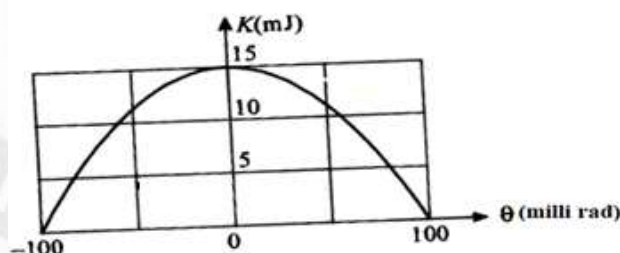
1)  $\sqrt{\frac{2g}{y_0}}$       2)  $\frac{1}{2}\sqrt{\frac{g}{y_0}}$       3)  $\sqrt{\frac{g}{2y_0}}$       4)  $\sqrt{\frac{g}{y_0}}$

44. A block of mass 'm' is suspended from a spring and executes vertical SHM of time period 'T' as shown in fig. The amplitude of the SHM is A and spring is never in compressed state during the oscillation. The magnitude of minimum force exerted by spring on the block is :



1)  $mg - \frac{4\pi^2}{T^2}mA$     2)  $mg + \frac{4\pi^2}{T^2}mA$     3)  $mg - \frac{\pi^2}{T^2}mA$     4)  $mg + \frac{\pi^2}{T^2}mA$

45. Fig. shows the kinetic energy 'K' of a simple pendulum versus its angle  $\theta$  from the vertical. The pendulum bob has mass 0.2 kg. The length of the pendulum is equal to ( $g = 10 \text{ m/s}^2$ )



1) 2.0 m      2) 1.8 m      3) 1.5 m      4) 1.2 m

### 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**

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**360**



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**720**



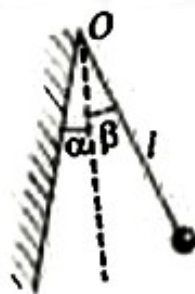
**RANK 1**



46. A particle performs SHM of amplitude  $A$  along a straight line. When it is at a distance  $\frac{\sqrt{3}}{2}A$  from mean position, its kinetic energy gets increased by an amount  $\frac{1}{2}m\omega^2 A^2$  due to an impulsive force. Then its new amplitude becomes  $\sqrt{n}A$  find  $n$ .
47. A meter stick swinging in vertical plane about an fixed horizontal axis passing through its one end undergoes small oscillation of frequency  $f_0$ . If the bottom half of the stick were cut off, then its new frequency of small oscillation would become  $\sqrt{n}f_0$  find  $n$ .



48. A small ball is suspended by a thread of length  $l = 1\text{ m}$  at the point 'O' on the wall, forming a small angle  $\alpha = 2^\circ$  with the vertical (as shown in fig.) Then the thread with ball was deviated through a small angle  $\beta = 4^\circ$  and set free. Assuming the collision of the ball against the wall to be perfectly elastic. The oscillation period of such a pendulum is  $\frac{k}{3}\text{ sec}$ . find  $k$  (Take  $g = \pi^2$ )



49. A body is performing simple harmonic with an amplitude of 10 cm. The velocity of the body was tripled by air Jet when it is at 5 cm from its mean position. The new amplitude of vibration is  $\sqrt{x}$  cm. The value of 'x' is .....
50. The time taken by a particle performing SHM to pass from point A and B where its velocities are same is 2 s. After another 2 s it returns to B. Find the time period of oscillations [in seconds].

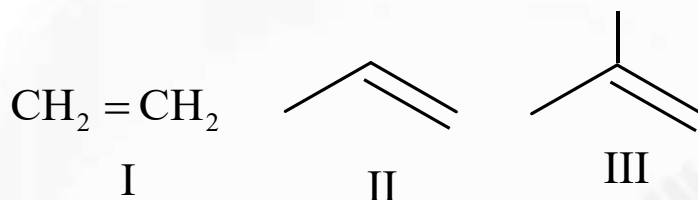


**CHEMISTRY****Max Marks: 100****SECTION-I  
(SINGLE CORRECT ANSWER TYPE)**

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.

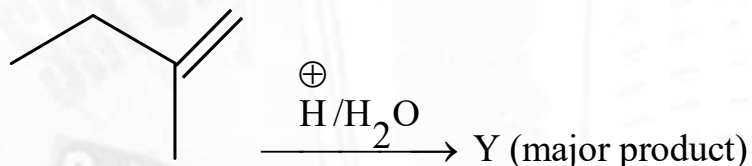
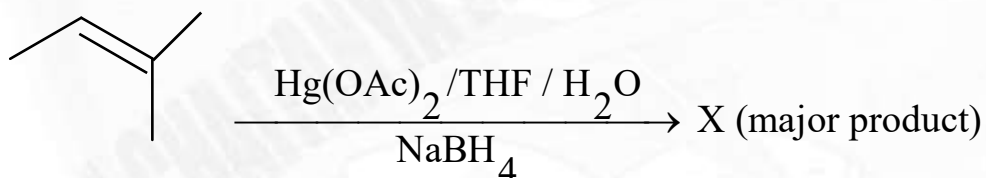
**Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.**

51. Select the incorrect order against given properties with respect to given set of compounds



- 1) Reactivity towards electrophilic addition reaction:  $\text{III} > \text{II} > \text{I}$
- 2) Stability order :  $\text{III} > \text{II} > \text{I}$
- 3) Heat of hydrogenation :  $\text{III} > \text{II} > \text{I}$
- 4) Heat of combustion :  $\text{III} > \text{II} > \text{I}$

52. Which of the following statement is/are correct about products X and Y



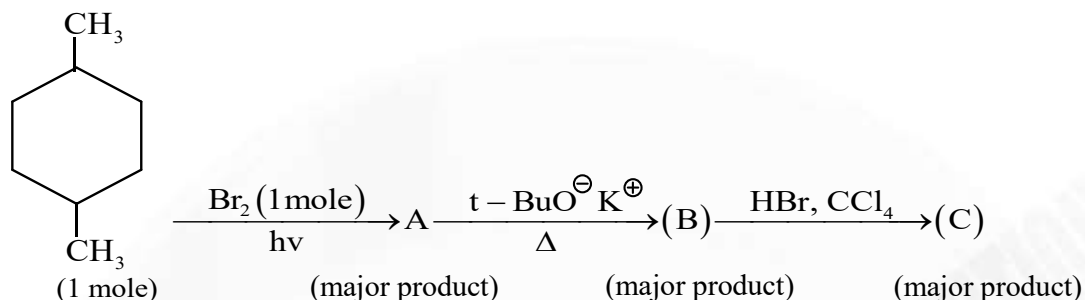
- i) Product X is can form two isomers only    ii) Product Y is optically inactive
  - iii) Acidic strength order of X & Y is  $\text{X} > \text{Y}$
  - iv) Products X & Y both are identical
  - v) Products X & Y both are positional isomers
- 1) i, ii, iii & v are correct                      2) iv only correct
  - 3) ii, iv only correct                            4) All are correct

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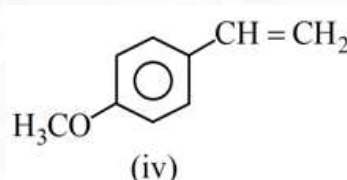
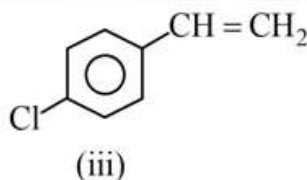
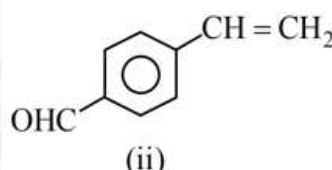
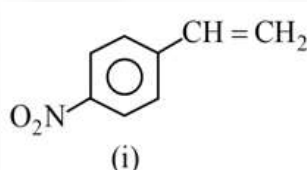


53. Consider the following reaction sequence, the correct statement is :



- 1) Product A and C is same                      2)  $\alpha$ -H in major product B is 2  
 3) Product C is optically active.            4) Major product B has one chiral centre.

54. Rate of electrophilic addition reaction is ?



- 1) iv > iii > i > ii                              2) iv > iii > ii > i  
 3) i > ii > iii > iv                              4) i > ii > iv > iii

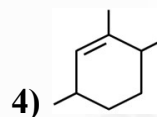
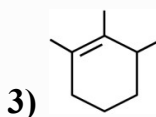
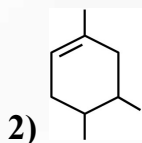
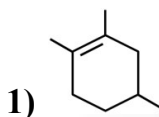
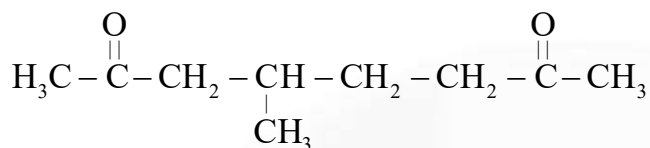
55.  $\text{CH}_3 - \underset{\text{CH}_3}{\text{C}} = \text{CH}_2 \xrightarrow{\text{HCl}} \text{A} \xrightarrow{\text{Alc KOH}} \text{B} \xrightarrow{\text{H}_2 / \text{Pd}} \text{C}$ . Incorrect statement is/are

about products A, B and C?

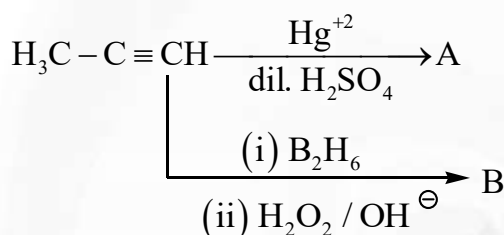
- 1) A is a haloalkane  
 2) C have zero  $\pi$ -bond  
 3) C cannot be oxidized by  $\text{KMnO}_4$   
 4) Product B on reaction with baeyer's reagent gives diols.



56. Which of the following alkene on ozonolysis will give the bellow mentioned product ?



57.

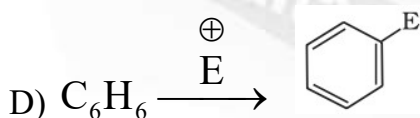
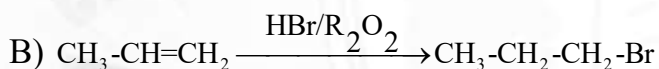
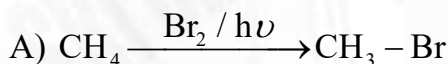


Correct statements about products A and B ?

- 1) A is an aldehyde                      2) B is a ketone
- 3) A & B are positional isomers        4) A & B are functional group isomers

**58.** Match the following :

**Column – I**



**Column – II**

### I) Free radical addition reaction

## II) Electrophilic substitution reaction

### III) Free radical substitution reaction

#### IV) Electrophilic addition reaction

- 1) A – IV; B – III; C – II; D – I      2) A – III; B – I; C – II; D – IV  
3) A – III; B – I; C – IV; D – II      4) A – IV; B – II; C – I; D – III



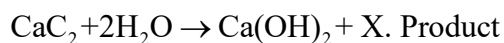
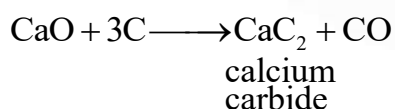
59. In which one of the following reactions, products (major) given is correct

- 1)
- 2)
- 3)
- 4)

60. In which of the following reactions the product is meso ?

- 1)  $CH_3 - C \equiv C - C_2H_5 \xrightarrow[2) Br_2]{1) Na / NH_3 (liq)}$
- 2)  $CH_3 - C \equiv C - CH_3 \xrightarrow[2) KMnO_4 \text{ cold, dilute}]{1) Na / NH_3 (liq)}$
- 3)  $But - 2 - yne \xrightarrow{Pd, BaSO_4, H_2} A \xrightarrow{KMnO_4 \text{ cold, dilute}}$
- 4)  $But - 1 - yne \xrightarrow[2) Br_2]{1) Na / NH_3 (liq)}$

61. Which of the following statements is/are correct about product X, in the given below reaction.





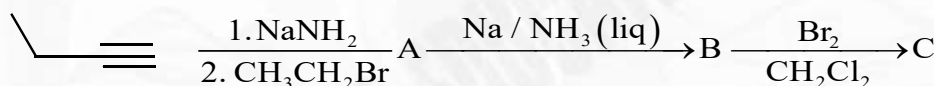
- i) Product X is  $C_2H_2$   
 ii) Each carbon atom of X has two sp hybridised orbitals.  
 iii) The bond strength of the product X (bond enthalpy  $823 \text{ kJ mol}^{-1}$ ) is more than C = C bond (bond enthalpy  $681 \text{ kJ mol}^{-1}$ )  
 iv) Product X is  $C_2H_4$
- 1) i, ii & iv are only correct                      2) i, ii & iii are only correct  
 3) iv only correct                                      4) iii, iv are only correct

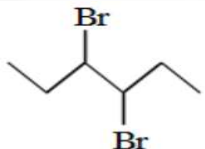
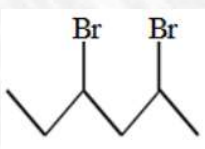
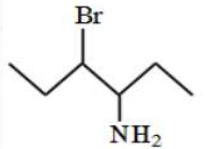
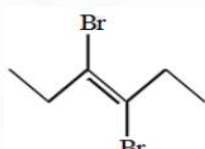
62. Statement -I: Alkynes are weakly polar in nature.

Statement -II : Calcium carbide is prepared by heating quick lime with coke.

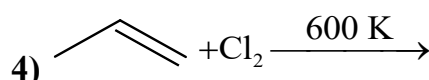
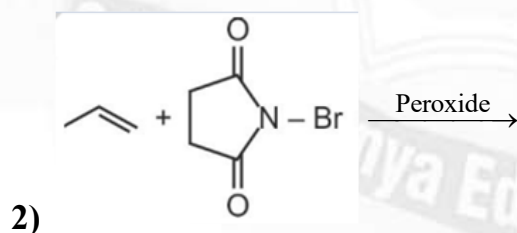
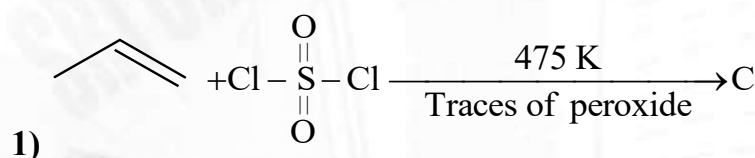
- 1) Statement-I is correct and Statement-II is incorrect  
 2) Both Statement- I & Statement-II are incorrect  
 3) Statement-II is correct and Statement-I is incorrect  
 4) Both Statement -I & Statement- II are correct

63. The final product, C, of the following reaction sequence ?



- 1)  2)  3)  4) 

64. Which of the following will not produce allyl halide as a major product?



65. Consider the following reactions given below?

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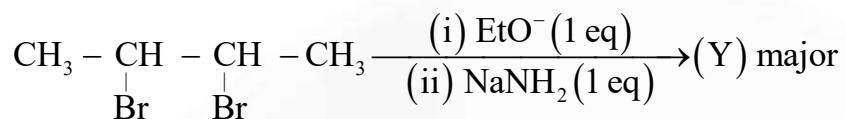
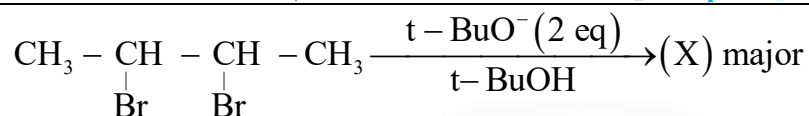
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720



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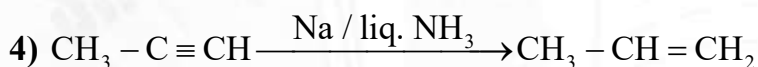
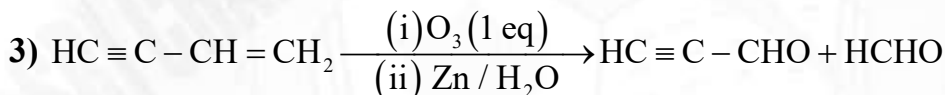
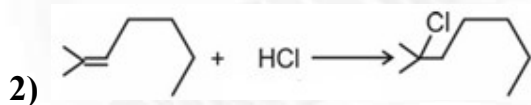
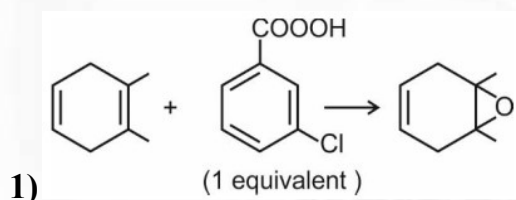




Which of the given statement is not correct about Products (X) and (Y)

- 1) (X) and (Y) are identical
- 2) (X) and (Y) are functional isomers
- 3) (X) can also be formed by acid catalysed dehydration of butane 1,3-diol
- 4) (Y) can also be formed by the reaction of 2,2,3,3 tetra bromobutane with Zn dust,  $\Delta$

66. Which of the following reaction is incorrectly matched



67. Statement I: One mole of propyne reacts with excess of sodium to liberate half a mole of gas.

Statement II: propyne & but-2-yne can be distinguished by Na metal

- 1) Statement-I is correct and Statement-II is incorrect
- 2) Both Statement- I & Statement-II are incorrect
- 3) Statement-II is correct and Statement-I is incorrect
- 4) Both Statement –I & Statement- II are correct

68. Assertion (A): Addition of HCl to 3-Methyl-1 butene gives 2-Chloro-2-methyl butane



**Reason (R):** Rearrangement of carbocation to more stable carbocation leads to formation of major product

- 1) If both assertion and reason are true and the reason is the correct explanation of the assertion
- 2) If both assertion and reason are true but reason is not the correct explanation of the assertion
- 3) If assertion is true but reason is false.
- 4) If the assertion is false reason is true

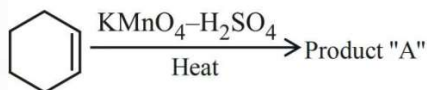
**69. Assertion (A):** In the following reaction, the final product is meso compound



**Reason (R):** Anti addition of  $\text{Cl}_2$  on trans-2,3 dibromo-2-butene results in meso form of the final product

- 1) If both assertion and reason are true but reason is not the correct explanation of the assertion
- 2) If both assertion and reason are true and the reason is the correct explanation of the assertion
- 3) If assertion is true but reason is false.
- 4) If the assertion is false reason is true

70. Consider the given chemical reaction:



Product A is

- 1) Picric acid      2) Oxalic acid      3) Acetic acid      4) Adipic acid

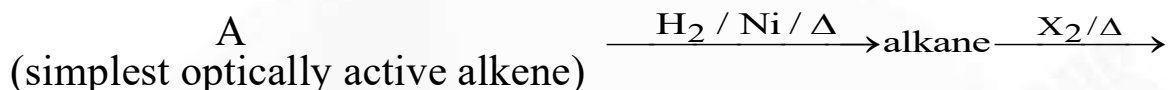
**SECTION-II**  
**(NUMERICAL VALUE TYPE)**

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**).

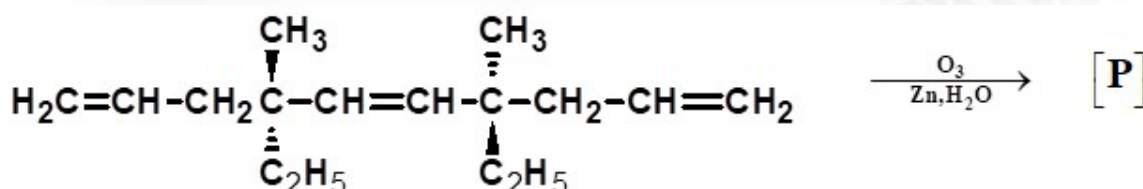
**Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases**



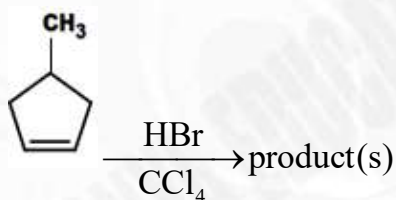
71. The total number of monohalogenated organic products for alkane product in the following  
(including stereoisomers) reaction is .....



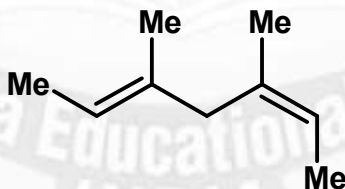
72. Find out the number of different product(s) formed



73. Find the total number of possible isomeric product (s) in the following reaction



74. In bromination of propyne, with bromine 1, 1, 2, 2-tetrabromopropane is obtained in 27% yield. The amount of 1, 1, 2, 2-tetrabromopropane obtained from 1g of bromine in this reaction is .....  $\times 10^{-1}$  g. (nearest integer)  
(Molar mass : Bromine = 80 g/mol)
75. Complete catalytic hydrogenation of the following compound produces saturated hydrocarbon (X). The number of stereoisomeric products of (X) formed are







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**10**  
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**10**

BELOW  
**100**  
ALL INDIA CATEGORY  
RANKS COUNT

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