



# 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-06

Date: **16-08-2025**

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**.

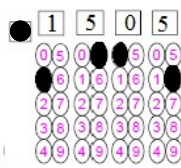
- The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

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** : Definite Integration

**PHYSICS** : Properties of matter: Hooke's law, Young's modulus, Modulus of rigidity and bulk modulus in mechanics. Surface energy and surface tension, angle of contact, drops, bubbles and capillary rise. Viscosity, Stoke's law; Terminal velocity, Experiments: Young's modulus - elasticity of the material Surface tension of water by capillary rise and effect of detergent.

**CHEMISTRY** : Aldehydes & Ketones :  
Aldehydes & Ketones: Preparation of aldehydes and ketones from acid chlorides and nitriles; aldehydes from esters; benzaldehyde from toluene and benzene; conversion of alcohols into aldehydes and ketones  
Reactions: oxidation, reduction, oxime and hydrazone formation; Aldol condensation and Family aldol reactions,. Cannizzaro reaction; haloform reaction and nucleophilic addition reactions with  $\text{RMgX}$ ,  $\text{NaHSO}_3$ ,  $\text{HCN}$ , water, alcohol,  $\text{RSH}$ , amine and derivatives



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

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

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

1. If  $\lim_{a \rightarrow \infty} \frac{1}{a} \int_0^a \frac{x^2 + ax + 1}{1 + x^4} \cdot \tan^{-1}\left(\frac{1}{x}\right) dx$  is equal to  $\frac{\pi^2}{k}$  where  $k \in N$ , then  $\frac{k}{2}$  equals  
 1) 4                      2) 6                      3) 2                      4) 8
2. Let  $y = f(x)$  be a quadratic function with  $f'(2) = 1$ . Then the value of the integral  $\int_{2-\pi}^{2+\pi} f(x) \sin\left(\frac{x-2}{2}\right) dx =$  \_\_\_\_\_  
 1) 16                      2) 8                      3) 6                      4) 10
3. Let  $f(x)$  be a differentiable function satisfying  $f(x) + f\left(x + \frac{1}{2}\right) = 1 \quad \forall x \in R$   
 $g(x) = \int_0^x f(t) dt$ . If  $g(1) = 1$ , then the value of  $\sum_{n=2}^{\infty} \left( \frac{8}{\sum_{k=1}^n \left( g(x+k^2) - g(x+k) \right)} \right)$  is \_\_\_\_\_  
 1) 6                      2) 4                      3) 3                      4) 2
4. Let  $\int x^2 \frac{d}{dx} \left( \frac{3x^2 + 1}{x^7 + 2x^5 + 2x^4 + x^3 + 2x^2 + 5x} \right) dx = f(x) - \tan^{-1}(g(x)) + c$ , where  $c$  is the constant of integration, then  $\int_0^1 g(x) dx =$   
 1)  $\frac{5}{8}$                       2)  $\frac{3}{8}$                       3)  $\frac{7}{8}$                       4)  $\frac{1}{8}$





5. Let the function  $f(x)$  and  $g(x)$  are differentiable and strictly increasing  $\forall x \in R$ . Also

$$f(0) = 2, f(1) = 3 \text{ and } f'(x) \text{ is continuous. If } f^2(x) = 1 + g^2(x)$$

$$J = \int_0^1 \frac{f(x) \cdot g'(x) - f'(x) \cdot g(x)}{f^2(x)g(x)} dx, \text{ then the value of } (6J + 1) \text{ is equal to } \ln \frac{a}{b}, \text{ where}$$

$a, b \in N$ . Then the minimum value of  $(a + b)$  is

- 1) 27                      2) 25                      3) 18                      4) 35

6.  $f(x)$  is a continuous function for all real values of  $x$  and satisfies

$$\int_0^x f(t) dt = \int_x^1 t^2 f(t) dt + \frac{x^{16}}{8} + \frac{x^6}{3} + a, \text{ then the value of 'a' is equal to}$$

- 1)  $-\frac{1}{24}$                       2)  $\frac{17}{24}$                       3)  $\frac{1}{7}$                       4)  $-\frac{167}{840}$

7. If  $\int_0^{1/2} \tan^{-1} \left( \frac{1}{2} \left( \sqrt{\frac{1+x}{x}} - \sqrt{\frac{x}{1+x}} \right) \right) dx = p \ln(2 + \sqrt{3}) - \frac{\pi}{q}$ , then  $pq$  (product of  $p, q$ ) is equal

to:

- 1) 6                      2) 2                      3) 4                      4)  $1/2$

8. If  $f\left(\frac{x}{y}\right) = \frac{f(x)}{f(y)} \forall x, y \in R, y \neq 0, f'(x)$  exists for all  $x, f(2) = 4$  then  $\lim_{n \rightarrow \infty} \sum_{r=1}^n e^{\frac{r}{n}} f\left(\frac{\sqrt{r}}{n}\right)$

is equal to

- 1)  $-\frac{1}{2}$                       2)  $1/2$                       3)  $-1$                       4)  $1$

9. If the value of definite integral  $\int_{\frac{1}{3}}^{\frac{1}{2}} \left\{ x \left[ \frac{2}{x} \right] \right\} dx = \frac{m}{n}$  where  $m$  and  $n$  are coprime then the

absolute value of  $(m-n)$ . [Note:  $[k]$  denotes greatest integer less than or equal to  $k$  and  $\{k\}$  denotes fractional part of  $k$ ].

- 1) 386                      2) 382                      3) 388                      4) 389







10. Let  $f(x)$  and  $g(x)$  be two differentiable functions satisfying  $f(x) + 3g(x) = x^2 + x + 6$  and  $2f(x) + 4g(x) = 2x^2 + 4$  and  $J = \int_0^{\pi/4} \ln(g(\tan^2 x) - f(\tan x) - 8) dx$  then  $\frac{3\pi \ln 2}{J} =$
- 1) 4                      2) 8                      3) 7                      4) 5
11. The value of  $\left| 36 \int_0^1 \left( \sqrt{\frac{1}{4x^2} + \frac{1}{x} - x} - \sqrt{\frac{x^4}{4} - x + 1} - \frac{1}{2x} \right) dx \right|$
- 1) 4                      2) 6                      3) 12                      4) 9
12. The value of the summation,  $\sum_{n=0}^{\infty} \left( \frac{1}{3n+1} - \frac{1}{3n+2} \right) = \frac{a\pi}{b\sqrt{c}}$  then  $a + b + c =$  \_\_\_\_\_
- 1) 5                      2) 7                      3) 9                      4) 10
13. If  $\int_0^{\infty} \left( \frac{\sin x}{x} \right)^3 dx = A$  and  $\int_0^{\infty} \left( \frac{x - \sin x}{x^3} \right) dx = \frac{aA}{b}$  where  $a$  &  $b$  are relative prime then  $a + b =$
- 1) 5                      2) 3                      3) 7                      4) 9
14. If  $g(x) = \int \frac{b^2 - \sin x (a^2 + 2b^2 \sin x)}{(a^2 \cos x + b^2 \sin x \cos x)^3} dx = \lambda \frac{\sec^2 x}{(f(x))^2} + C$  and  $\int_0^{\frac{\pi}{2}} f(x) dx = \frac{a^2 \pi}{k_1} + \frac{b^2}{k_2}$  then the value of  $k_1 + k_2 + \left| \frac{1}{\lambda} \right| =$
- 1) 2                      2) 4                      3) 6                      4) 5
15. The value of the definite integral,  $\int_1^e \frac{1 + x^2 \ln x}{x + x^2 \ln x} dx =$  \_\_\_\_\_
- 1)  $e - \ln(e+1)$       2)  $\ln(e+1) - e$       3)  $e + \ln(e+1)$       4)  $2e - \ln(e+1)$
16. Suppose that  $f$  is a function from  $\mathbb{R} \rightarrow \mathbb{R}$  such that  $f(x) + f\left(1 - \frac{1}{x}\right) = \tan^{-1} x$   
 $\forall x \neq 0 \in \mathbb{R}$   $y = \arctan x$  means  $-\frac{\pi}{2} < y < \frac{\pi}{2}$  and  $\tan y = x$ , then  $\int_0^1 f(x) dx =$
- 1)  $\frac{\pi}{8}$                       2)  $\frac{\pi}{4}$                       3)  $\frac{3\pi}{8}$                       4)  $\frac{3\pi}{4}$





17. The number of elements in the range of the function  $f(x) = \int_{-1}^1 \frac{\sin x}{(1 - 2t \cos x + t^2)} dt$  is \_\_\_\_\_
- 1) 2                      2) 3                      3) 4                      4) 0
18. Let  $f$  be a twice differentiable function such that  $f''(t) = \int_{12t}^{t^3+6t^2} \ln \left| \frac{x+8}{(t+2)^3 - x} \right| dx$  ( $\forall t \in R$ ) and  $f(1) = 2f(2) = 2$ , then the value of  $\int_{-1}^1 f(x) dx =$
- 1) 0                      2) 2                      3) 4                      4) 6
19. Let  $f(x) = x + \frac{a}{\pi^2 - 4} \sin x + \frac{b}{\pi^2 - 4} \cos x$ ,  $x \in R$  be a function which satisfies  $f(x) = x + \int_0^{\pi/2} \sin(x+y)f(y) dy$ . Then  $(a+b)$  is equal to
- 1)  $-\pi(\pi+2)$             2)  $-2\pi(\pi+2)$             3)  $-2\pi(\pi-2)$             4)  $-\pi(\pi-2)$
20. The value of the expression  $\frac{\left(1^4 + \frac{1}{4}\right)\left(3^4 + \frac{1}{4}\right) \dots \left((2n-1)^4 + \frac{1}{4}\right)}{\left(2^4 + \frac{1}{4}\right)\left(4^4 + \frac{1}{4}\right) \dots \left((2n)^4 + \frac{1}{4}\right)} = \frac{1}{f(n)}$  for all natural numbers  $n$ , then the value of  $\int_0^1 \frac{dx}{f(x)} =$  \_\_\_\_\_
- 1)  $\frac{1}{2} \left( \tan^{-1} 5 + \frac{\pi}{4} \right)$                       2)  $\frac{1}{2} \left( \tan^{-1} 5 - \frac{\pi}{4} \right)$
- 3)  $\frac{1}{2} \left( \frac{\pi}{4} - \tan^{-1} 5 \right)$                       4)  $\frac{1}{4} \left( \frac{\pi}{4} - \tan^{-1} 5 \right)$

### 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  $a$  be a real number. If the value of definite integral  $\int_{-\pi+a}^{3\pi+a} |x-a-\pi| \sin\left(\frac{x}{2}\right) dx$  is equal to  $-16$  then sum of all the values of  $a$  in the interval  $[0, 314]$  is  $k\pi$ . Then the value of  $k$  is \_\_\_\_\_
22. Let  $f(t)$  be a cubic polynomial such that  $\cos 3x = f(\cos x)$  holds  $\forall x \in R$  and  $J = \int_0^1 f^2(t) \sqrt{1-t^2} dt$ . Then the value of  $\frac{(2016)J}{\pi} =$ .
23.  $\left( \int_0^a x(e^x - x - 1) dx \right) t^2 + \left( \int_0^a (\tan x - x) dx \right) t + \int_0^a (\sin x - x) dx = 0$  has roots  $\alpha(a)$  and  $\beta(a)$ . Then the value of  $\lim_{a \rightarrow 0^+} \left| \frac{1}{\alpha(a)} - \frac{1}{\beta(a)} \right|$
24.  $I_1 = \int_0^\pi \frac{\sin 884x \sin 1122x}{\sin x} dx$ ,  $I' = \int_0^1 \frac{x^{238} (x^{1768} - 1)}{(x^2 - 1)} dx$  then the value of  $\frac{I_1}{I'} =$
25. If  $L = \int_0^\infty \frac{\ln(1+x+\sqrt{x(1+x)})}{(x+1)\sqrt{x(1+x)}} dx$  and  $M = \sum_{k=1}^\infty \frac{15^k}{(5^k - 3^k)(5^{k+1} - 3^{k+1})}$ , then  $[L+M] =$  \_\_\_\_\_ (when  $[.]$  denotes greatest integer function)





## PHYSICS

Max Marks: 100

SECTION-I  
(SINGLE CORRECT ANSWER TYPE)

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

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

26. A sphere having radius  $r$  and density  $2\rho$  is projected vertically upwards in a liquid of density  $\rho$  and viscosity  $\eta$  with a velocity  $v_0 = \frac{2\rho r^2 g}{9\eta}$ . Assume that the height of liquid column is very large and gravity is uniform. The time (in terms of  $v_0$  and  $g$ ) when the sphere is at its highest position is
- 1)  $\frac{v_0}{g} \ln 3$       2)  $\frac{2v_0}{g} \ln 3$       3)  $\frac{v_0}{g} \ln 2$       4)  $\frac{2v_0}{g} \ln 2$
27. A needle of length  $l$  and density  $\rho$  will float on a liquid of surface tension  $\sigma$  if its radius  $r$  is less than or equal to
- 1)  $\sqrt{\frac{2\sigma}{\pi\rho l g}}$       2)  $\sqrt{\frac{2\sigma l}{\pi\rho g}}$       3)  $\sqrt{\frac{\sigma}{\pi\rho g}}$       4)  $\sqrt{\frac{2\sigma}{\pi\rho g}}$
28. Water rises to a height of  $16.3 \text{ cm}$  in a capillary of height  $18 \text{ cm}$  above the water level. If the tube is cut at a height of  $12 \text{ cm}$ ,
- 1) Water will come as a fountain from the capillary tube  
2) Water will stay at a height of  $12 \text{ cm}$  in the capillary tube  
3) The height of the water in the capillary will be  $10.3 \text{ cm}$   
4) Water will flow down the sides of the capillary tube
29. In a surface tension experiment with a capillary tube, water rises upto  $0.1 \text{ m}$ . If the same experiment is repeated in an artificial satellite, which is revolving around the earth, water will rise in the capillary tube upto a height of :
- 1)  $0.1 \text{ m}$       2)  $0.2 \text{ m}$   
3)  $0.98 \text{ m}$       4) full length of the capillary tube







30. A glass rod of radius 1 mm is inserted symmetrically into a glass capillary tube with inside radius 2 mm. Then the whole arrangement is brought in contact of the surface of water. Surface tension of water is  $7 \times 10^{-2} \text{ N/m}$ . To what height will the water rise in the capillary? ( $\theta = 0^\circ$ )
- 1) 1.4 cm      2) 4.2 cm      3) 2.1 cm      4) 6.8 cm
31. A small drop of water of surface tension  $\sigma$  is squeezed between two clean glass plates so that a thin layer of thickness  $d$  and area  $A$  is formed between them. If the angle of contact is zero, the force required to pull the plates apart is:
- 1)  $\frac{\sigma A}{d}$       2)  $\frac{2\sigma A}{d}$       3)  $\frac{4\sigma A}{d}$       4)  $\frac{8\sigma A}{d}$
32. A hollow sphere has a small hole in it. On lowering the sphere in a tank of water, it is observed that water enters into the hollow sphere at a depth of 40 cm below the surface. Surface tension of water is  $7 \times 10^{-2} \text{ N/m}$ . The diameter of the hole is approximately:
- 1) 0.21 mm      2) 0.14 mm      3) 0.07 mm      4) 0.7 mm
33. Match the following:

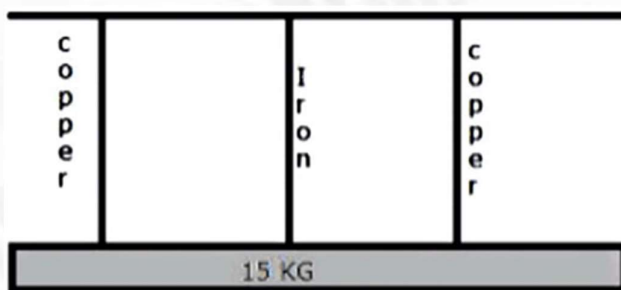
Column-I	Column-II
(I) Splitting of bigger drop into small droplets	(P) Temperature increases
(II) Formation of bigger drop from small droplets	(Q) Temperature decreases
(III) Spraying liquid	(R) Surface energy increases
	(S) Surface energy decreases

- 1)  $I \rightarrow PS, II \rightarrow QR, III \rightarrow PR$       2)  $I \rightarrow PS, II \rightarrow QR, III \rightarrow QR$
- 3)  $I \rightarrow QR, II \rightarrow PS, III \rightarrow QR$       4)  $I \rightarrow QR, II \rightarrow PS, III \rightarrow PR$
34. A raindrop reaching the ground with terminal velocity has momentum  $p$ . Another drop of twice the radius, also reaching the ground with terminal velocity, will have momentum:
- 1)  $4p$       2)  $8p$       3)  $16p$       4)  $32p$

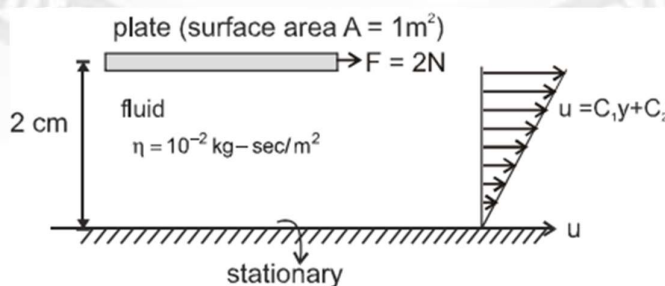




35. A marble of mass  $x$  and diameter  $2r$  is gently released in a tall cylinder containing honey. If the marble displaces mass  $y$  ( $< x$ ) of the liquid, then the terminal velocity is proportional to:
- 1)  $x + y$       2)  $x - y$       3)  $\frac{x+y}{r}$       4)  $\frac{x-y}{r}$
36. Two capillary tubes of the same length  $l$  and radii  $r$  and  $2r$  are fitted to the bottom of a vessel with pressure head  $p$  in parallel with each other. What should be the radius of the single tube of the same length  $l$  that can replace the two so that the rate of flow is not affected?
- 1)  $17^{1/4}r$       2)  $17r$       3)  $8.5r$       4)  $\sqrt{17}r$
37. A rigid bar of mass  $15\text{kg}$  is supported symmetrically by three wires each of  $1\text{m}$  long. Those at each end are of Copper and the middle one is of Iron. Determine the ratio of diameters of Iron to that of copper wires if each is to have the same tension. (Young's modulus of Iron is  $2 \times 10^{11} \text{Nm}^{-2}$  And that of copper is  $1 \times 10^{11} \text{Nm}^{-2}$ )



- 1)  $1:\sqrt{2}$       2)  $\sqrt{2}:1$       3)  $1:2$       4)  $1:4$
38. The velocity of any particle in fluid is given by  $u = C_1y + C_2$  as shown in figure ( $C_1$  &  $C_2$  are constants,  $y$  is the vertical distance measured from the stationary surface) In the given figure, if force of  $2\text{N}$  is required to maintain constant velocity of plate, the speed of plate ( $\text{m/sec.}$ ) is equal to



- 1) 0      2) 4      3) 2      4) 1

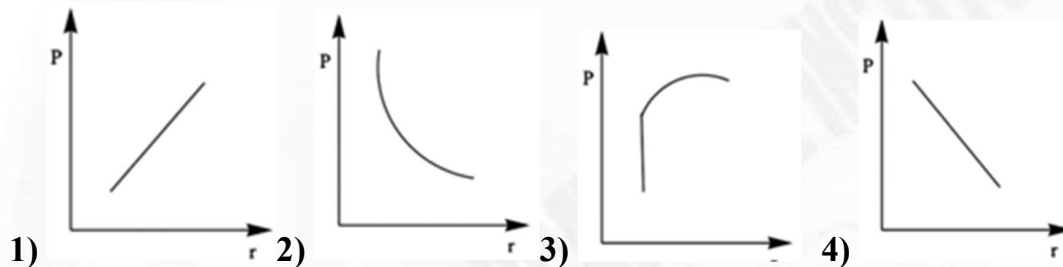




39. A horizontally oriented copper rod of length  $l$  is rotated about a vertical axis passing through its middle. The rotated frequency at which the rod ruptures is (Take breaking strength of copper is  $\sigma$  and density of copper is  $\rho$ )

1)  $\frac{1}{2\pi} \sqrt{\frac{3\sigma}{\rho l^2}}$       2)  $\frac{1}{2\pi} \sqrt{\frac{8\sigma}{\rho l^2}}$       3)  $\frac{1}{2\pi} \sqrt{\frac{5\sigma}{\rho l^2}}$       4)  $\frac{1}{2\pi} \sqrt{\frac{6\sigma}{\rho l^2}}$

40. A spherical soap bubble is blown such that its radius increases at a constant rate. Which of the following curves represents power required to increase surface energy of the bubble versus radius of bubble.



41. Maximum stress that can be applied to wire which supports on elevator is  $\sigma$ . Mass of elevator is  $m$  and it is moved upwards with an acceleration of  $g/2$ . Minimum diameter of wire (Neglecting weight of wire) must be

1)  $\sqrt{\frac{2mg}{\pi\sigma}}$       2)  $\sqrt{\frac{3mg}{2\pi\sigma}}$       3)  $\sqrt{\frac{5mg}{2\pi\sigma}}$       4)  $\sqrt{\frac{6mg}{\pi\sigma}}$

42. This question has Statement-I: and Statement – II. Of the four choices given after the Statements, choose the one that best describes the two statements.

Statement – 1: A capillary is dipped in a liquid and liquid rises to a height  $h$  in it. As the temperature of the liquid is raised, the height  $h$  increases (if the density of the liquid and the angle of contact remain the same).

Statement – 2: Surface tension of a liquid decreases with the rise in its temperature.

- 1) Statement – 1 is true, Statement – 2 is true; Statement – 2 is not the correct explanation for Statement – 1.  
 2) Statement – 1 is false, Statement – 2 is true.  
 3) Statement – 1 is true, Statement – 2 is false.  
 4) Statement – 1 is true, Statement – 2 is true: Statement – 2 is the correct explanation for Statement – 1.





43. Given below are two statements: One is labelled as Assertion (A) and other is labelled as Reason (R).

Assertion (A): Time period ( $T$ ) of oscillation of liquid drop depends on surface tension ( $S$ ), if density of the liquid is  $\rho$  and radius of the drop is  $r$ , then  $T = k\sqrt{\rho r^3 / S^{3/2}}$  is dimensionally correct, where  $K$  is dimensionless.

Reason (R): Using dimensional analysis we get R.H.S having different dimension than that of time period.

In the light of above statements, choose the correct answer from the options given below.

- 1) Both A and R are true and R is the correct explanation of A.
- 2) Both A and R are true but R is not the correct explanation of A
- 3) A is true but R is false
- 4) A is false but R is true.

44. Given below are two statements:

Statement – I: Viscosity of gases is greater than that of liquids.

Statement – II: Surface tension of a liquid decreases due to the presence of insoluble impurities.

In the light of the above statements. Choose the most appropriate answer from the options given below:

- 1) Statement I is correct but statement II is incorrect
  - 2) Statement I is incorrect but Statement II is correct
  - 3) Both Statement I and Statement II are incorrect
  - 4) Both Statement I and Statement II are correct
45. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason

Assertion A: Steel is used in the construction of buildings and bridges.

Reason R: Steel is more elastic and its elastic limit is high.

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

- 1) Both A and R are correct and R is the correct explanation of A
- 2) Both A and R are correct but R is NOT the correct explanation of A
- 3) A is correct but R is not correct
- 4) A is not correct but R is correct







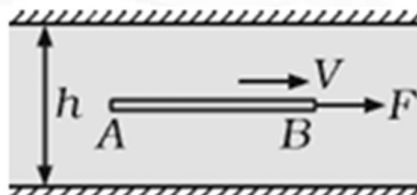
## SECTION-II

### (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**).

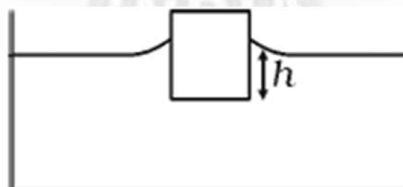
**Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases**

46. A wire having a length  $L$  and cross – sectional area  $A$  is suspended at one of its ends from a ceiling. Density and Young's modulus of material of the wire are  $\rho$  and  $Y$ , respectively. Its strain energy due to its own weight is  $\frac{\rho^2 g^2 AL^3}{nY}$ . Find the value of  $n$ .
47. Eight equal drops of water each of radius  $2\text{ mm}$  are falling through air with a terminal velocity of  $16\text{ cm/s}$ . The eight drops combine to form a big drop then the terminal velocity of big drop is  $V\text{ cm/s}$ , then  $V =$
48. A ball rises to the surface of a liquid with constant velocity. The density of the liquid is four times the density of the material of the ball. The ratio of frictional force of the liquid on the rising ball to the weight of the ball is
49. A thin plate AB of large area  $A$  is placed symmetrically in a small gap of height  $h$  filled with water of viscosity  $\eta_0$  and the plate has a constant velocity  $V$  by applying a force  $F$  as shown in the figure. If the gap is filled with some other liquid of viscosity  $0.75\eta_0$ , at what minimum distance (in cm) from top wall should the plate be placed in the gap, so that the plate can again be pulled at the same constant velocity  $V$ , by applying the same force  $F$ ? (Take  $h = 20\text{ cm}$ )



50. A cube of side  $a$  and mass  $m$  floats on the surface of water as shown in figure. The surface tension and density of water are  $T$  and  $\rho_w$  respectively. If angle of contact between cube and water surface is zero, find the distance  $h$  (in meters) between the lower face of cube and surface of the water.

(Take  $m = 1\text{ kg}$ ,  $g = 10\text{ m/s}^2$ ,  $aT = 10/4\text{ unit}$  and  $\rho_w a^2 g = 10\text{ unit}$ )







54. Type of reactions which are given by cinnamaldehyde from the following list.

- i) Nucleophilic addition    ii) Nucleophilic substitution    iii) Electrophilic addition  
iv) Electrophilic substitution    v) Free radical substitution

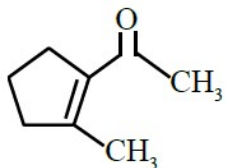
1) i, iii, iv and v only

2) i, ii, iii and v only

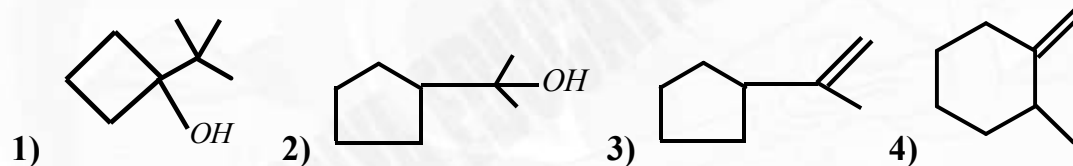
3) i, iii, and iv only

4) ii, iii, iv and v only

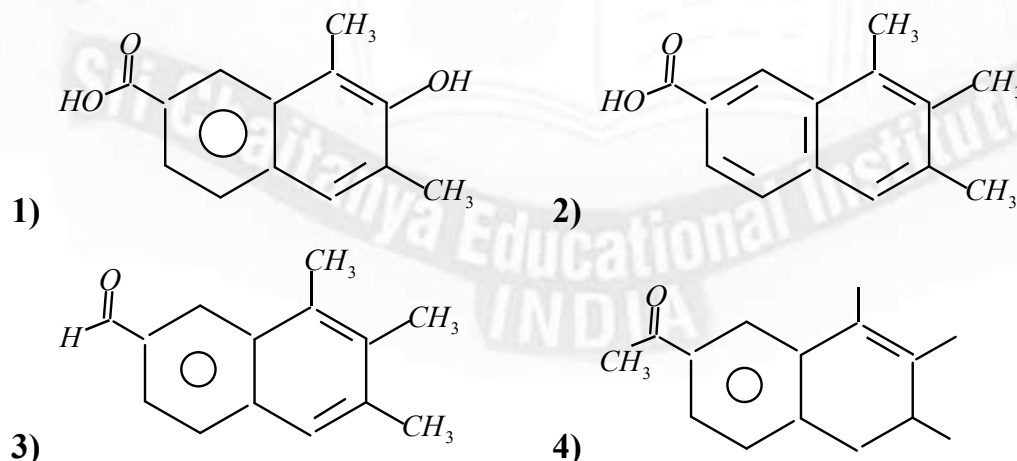
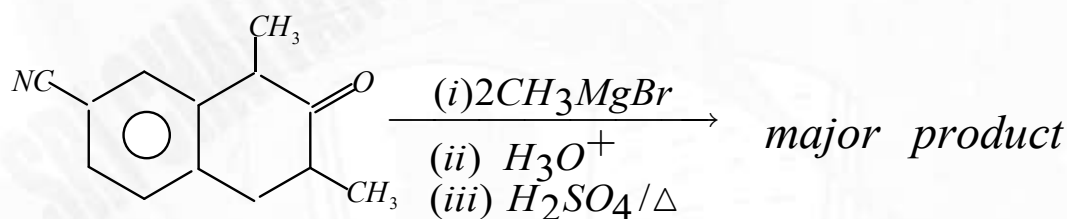
55. A molecule (P) on treatment with acid undergoes rearrangement and gives (Q). (Q) on ozonolysis followed by reflux under alkaline condition gives (R). The structure of (R) is given below



The structure of 'P' can not be:

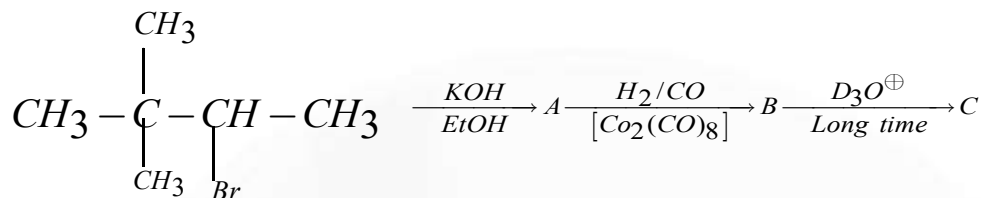


56. Which one of the following is the major product of the given reaction?





57. consider the following reaction sequence



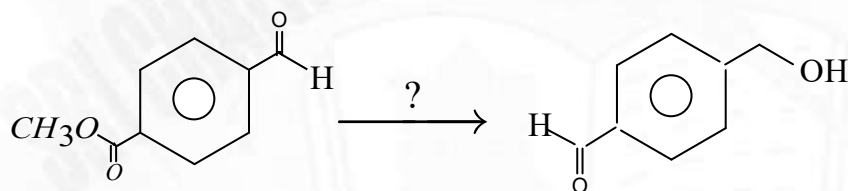
Structure of product 'C' is

- 1)  $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CHO} \\ | \\ \text{CH}_3 \end{array}$       2)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CD}_2 - \text{CDO}$
- 3)  $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CD}_2 - \text{CHO} \\ | \\ \text{CH}_3 \end{array}$       4)  $\text{CD}_3 - \text{CD}_2 - \text{CD}_2 - \text{CD}_2 - \text{CDO}$

58. Which of the following compounds form stable hydrates

- a) Cyclo propanone      b) Trichloroacetaldehyde  
c) Formaldehyde      d) Trifluoroacetaldehyde
- 1) Only a, b and d      2) Only a, b and c  
3) a, b, c and d      4) Only d.

59. Give the suitable reagents for the following conversion



1.  $\begin{array}{c} \text{SH} \\ | \\ \text{SH} \end{array}$  / Dry HCl      1.  $\begin{array}{c} \text{OH} \\ | \\ \text{OH} \end{array}$  / Dry HCl
2.  $\text{LiAlH}_4$       2.  $\text{NaBH}_4$
3.  $\text{H}_3\text{O}^+$       3.  $\text{H}_3\text{O}^+$
- 1)      2)      3)      4)
1.  $\text{LiAlH}_4$       1.  $\begin{array}{c} \text{OH} \\ | \\ \text{OH} \end{array}$  / Dry HCl
2.  $\text{H}^+$       2.  $\text{H}^+$





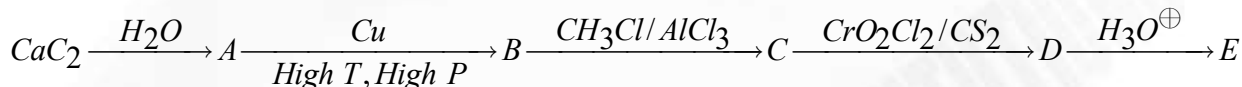


60. The correct order of reactivity of the following compounds with  $\text{CH}_3\text{MgBr}$

i)  $\text{PhCOPh}$  ii)  $\text{CH}_3\text{CHO}$  iii)  $\text{C}_6\text{H}_5\text{CHO}$  iv)  $\text{P-NO}_2\text{C}_6\text{H}_4\text{CHO}$  v)  $\text{HCHO}$  is

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

61. Consider the following reaction sequence



Number of carbon atoms in the product 'E' is

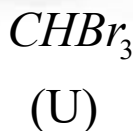
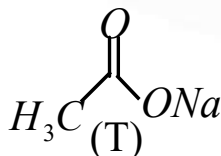
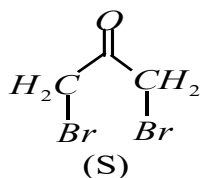
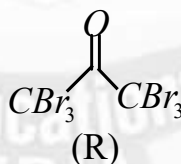
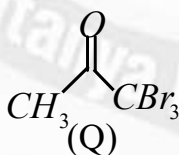
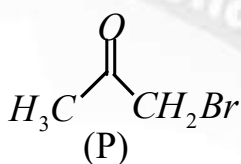
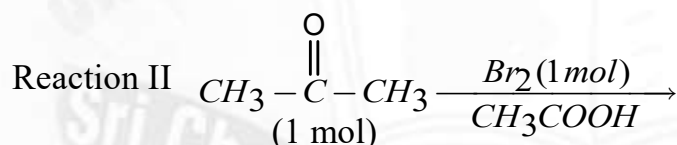
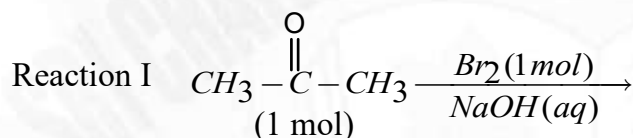
- 1) 6                      2) 7                      3) 5                      4) 8

62. Statement – I: Benzaldehyde gives a positive test with Benedicts and Fehling's Solution

Statement – II: Benzaldehyde gives positive test with Tollen's reagent

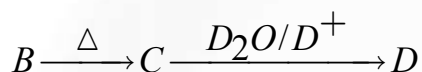
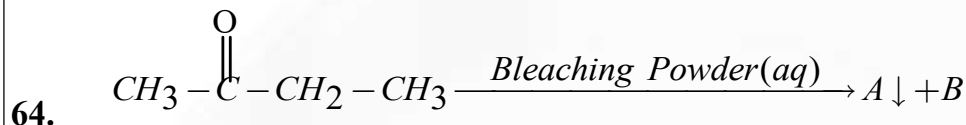
- 1) Statement – I is correct but statement – II is incorrect  
 2) Both statement – I and statement – II is incorrect  
 3) Both statement – I and statement – II is correct  
 4) Statement – I is incorrect but statement – II is correct.

63. After completion of the reactions (I and II) the organic compound(s) in the reaction mixture is (are)





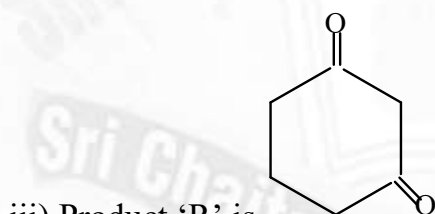
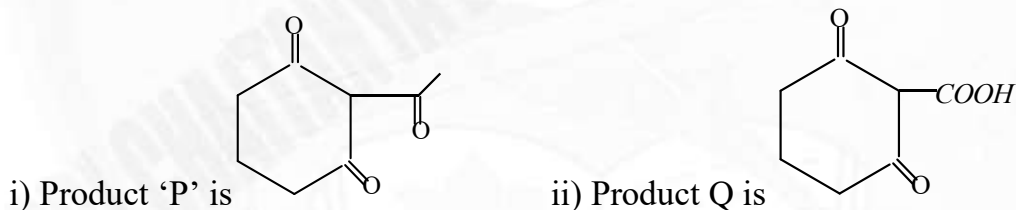
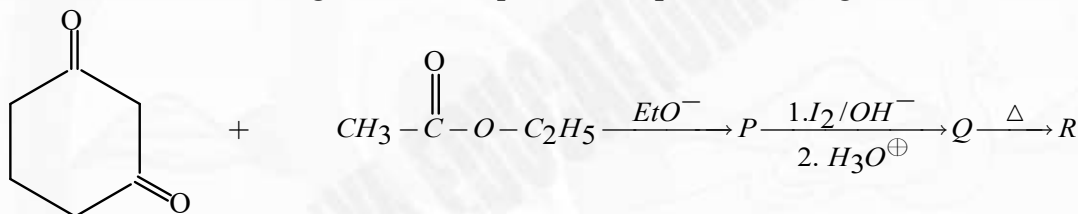
- 1) Reaction I: P and Reaction II: P  
 2) Reaction I: U, acetone and Reaction II: Q, Acetone  
 3) Reaction I: T, U, acetone and Reaction II: P  
 4) Reaction I: R, acetone and Reaction II: s, acetone



Number of deuterium atoms in product 'D' is

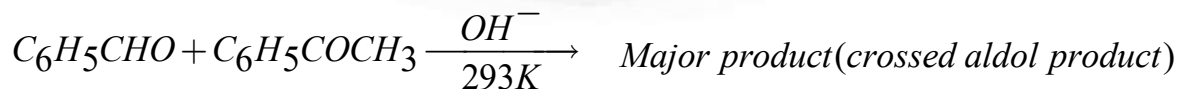
- 1) 4                      2) 3                      3) 6                      4) 5

65. Consider the following reaction sequence and products are given choose the correct one.



- 1) only (iii) is correct                      2) only (ii) and (iii) are correct  
 3) only (i) is correct                      4) (i),(ii) and (iii) are correct

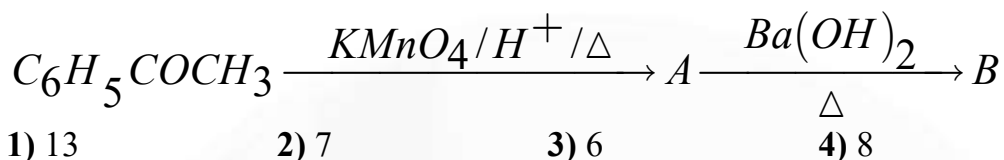
66. Consider the following reaction, the D.U value of Major product of the following reaction is



- 1) 10                      2) 9                      3) 4                      4) 5



67. Consider the following reaction, the number of  $SP^2$  carbon atoms in the final major organic product(**B**) is



- 68.** Assertion :- Aldehydes and Ketones react with hydrogen cyanide ( $\text{HCN}$ ) to yield cyanohydrins.

Reason :- Reaction of  $HCN$  with aldehyde and ketones catalyzed by base generated cyanide ion adds to carbonyl compound to yield corresponding cyanohydrin.

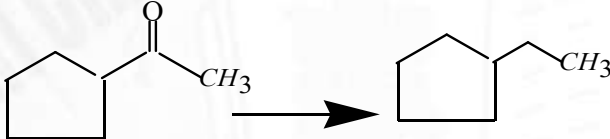
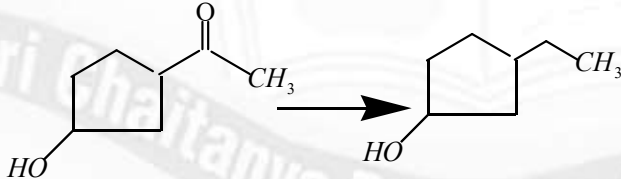

- 1) Both A and R are correct and R is correct explanation of A
- 2) A is true but R is false
- 3) A is false but R is true
- 4) Both A and R are correct but R is NOT the correct explanation of A

69. Match the following columns

COMPOUND		B.P (Kelvin)	
P)	Methoxyethane	I	322
Q)	Propanal	II	329
R)	Acetone	III	370
S)	Propan –1- ol	IV	281

- 1) P – IV, Q – I, R – II, S – III      2) P – III, Q – II, R – I, S – IV  
3) P – II, Q – III, R – II, S – IV      4) P – I, Q – II, R – III, S – IV

- 70.** Match the following columns

Column – I (conversion)		Column – II (Suitable reagent)	
P)		I	$H_2 / Pd - BaSO_4$
Q)		II	$LiAlH_4$
R)	$R - C \equiv N \rightarrow R - CH = NH$	III.	$NH_2 - NH_2 / OH^- / \Delta$
S)		IV	Red $P + HI / \Delta$
		V	$Zn - Hg / Con\ HCl$



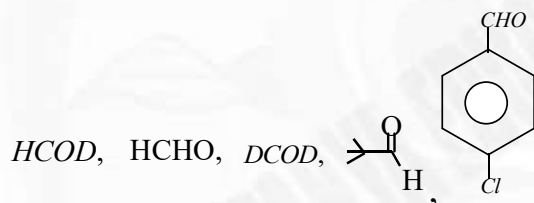
- 1) P – III,IV,V; Q – III; R – I; S- III, IV, V
- 2) P – III, IV; Q – III, II; R – I, II; S – III, V
- 3) P – IV,V; Q – II; R – I,II; S – III, V
- 4) P – III,IV,V; Q – III; R – II,III; S – III, IV

## SECTION-II (NUMERICAL VALUE TYPE)

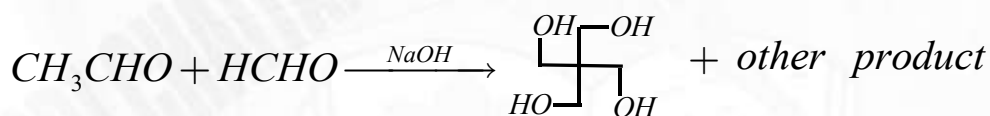
This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and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

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

71. How many mole of  $HCHO$  would be used by  $NH_3$  to prepare one mole of a compound which is used in the treatment of urinary infection assume 100% efficiency of the reaction.
72. Give number of compounds which can give Cannizaro reaction out of the following  $HCOOH$ ,  $phCHO$ ,  $CCl_3CHO$ ,

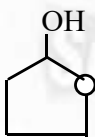


73.



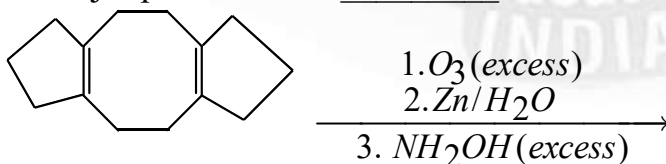
The number of moles of  $HCHO$  used in the above reaction is 'x', the value of 'x' is

74. The number of compounds which are giving positive Tollen's test is/are Benzaldehyde, Acetophenone, Hemiacetal of acetaldehyde



, Glucose, Fructose, Mannose, Cyclic ketal of acetone and  $R-C \equiv CH$

75. In the reaction given below the total number of carbon atoms having  $sp^2$  hybridisation in the major product 'P' is \_\_\_\_\_







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