



# 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**

Time: **09.00Am to 12.00Pm**

JEE-MAIN

RPTM-02

Date: **12-08-2023**

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 90 questions. The maximum marks are **300**.
5. There are **three** parts in the question paper 1,2,3 consisting of **Physics, Chemistry and Mathematics** having **30 questions** in each subject and subject having **two sections**.

**(I) Section –I** contains 20 **multiple choice** questions with only one correct option.

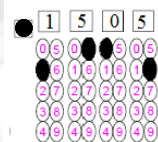
**Marking scheme:** +4 for correct answer, 0 if not attempt and -1 in all other cases.

**(II) Section-II** contains 10 **Numerical Value Type** questions. Attempt any 5 questions only, if more than 5 questions attempted, First 5 attempted questions will be considered.

- 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: \_\_\_\_\_

**12-08-23\_ **Sr.Super60\_NUCLEUS&STERLING\_BT** \_ Jee-Main\_ **RPTM-02**\_Test Syllabus****PHYSICS**

: Geometrical optics: Rectilinear propagation of light; Reflection and refraction at plane and spherical surfaces; Total internal reflection; Deviation and dispersion of light by a prism; Thin lenses; Combinations of mirrors and thin lenses; Magnification. Experiments: focal length of a concave mirror, convex mirror and a convex lens using u-v method ( parallax method), The plot of the angle of deviation vs angle of incidence for a triangular prism. Refractive index of a glass slab using a travelling microscope.

**15Q-RPTM.2 SYLLABUS+15Q CUMULATIVE SYLLABUS****CHEMISTRY**

: GOC: Inductive effect, Resonance and hyperconjugation; Keto-enol tautomerism; Hydrogen bonding- definition and their effects on physical properties of alcohols and carboxylic acids; Inductive and resonance effects on acidity and basicity of organic acids and bases; Polarity and inductive effects in alkyl halides; Reactive intermediates produced during homolytic and heterolytic bond cleavage; Formation, structure and stability of carbocations, carbanions and free radicals Alkanes: Preparation, properties and reactions of alkanes. Homologous series, physical properties of alkanes (melting points, boiling points and density) and effect of branching on them; Combustion and halogenations of alkanes (including allylic and benzylic halogenation); Preparation of alkanes by Wurtz reaction and decarboxylation reaction, Corey-House Reaction.

**15Q-RPTM.2 SYLLABUS+15Q CUMULATIVE SYLLABUS**

**MATHEMATICS** : Application of Differentiation (AOD)

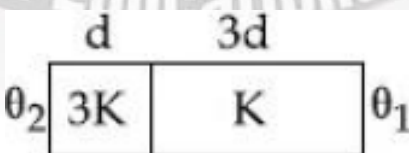
**15Q-RPTM.2 SYLLABUS+15Q CUMULATIVE SYLLABUS**

**PHYSICS****Max Marks: 100****(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.

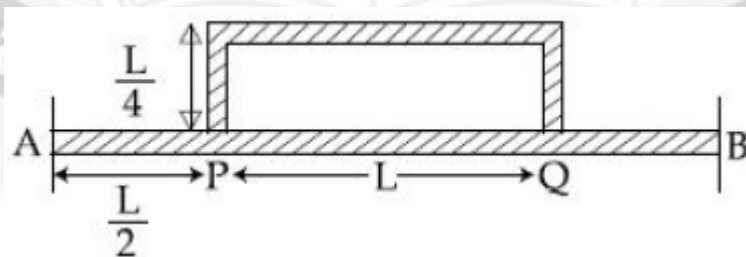
- Assertion A: Efficiency of a reversible heat engine will be highest at  $-273^{\circ}\text{C}$  temperature of cold reservoir  
Reason R: Efficiency of Carnots engine depends not only on temperature of cold junction but it depends on the temperature of hot reservoir too and is given as  $\eta = 1 - \frac{T_2}{T_1}$ 
  - A true, R false
  - Both A and R true but R is not correct explanation of A
  - A false R is true
  - Both A and R true but R is correct explanation of A
- A thermally insulated vessel contains 150 g of water at  $0^{\circ}\text{C}$ . Then, the air from the vessel is pumped out adiabatically. A fraction of water turns into ice and the rest evaporate at  $0^{\circ}\text{C}$  itself. The mass of evaporated water will be closest to (Latent heat of vaporization of water  $= 2.10 \times 10^6 \text{ J kg}^{-1}$  and latent heat of fusion of water  $= 3.36 \times 10^5 \text{ J kg}^{-1}$ )
  - 150 g
  - 20g
  - 130g
  - 35g
- A massless spring ( $k=800 \text{ N/m}$ ), attached with a mass (500g) is completely immersed in 1kg of water. The spring is stretched by 2 cm and released, so that it starts vibrating. What would be the order of magnitude of the change in the temperature of water when the vibrations stop completely? (Assume that the water container and spring receive negligible heat and specific heat of mass  $= 400 \text{ J/kg K}$ , specific heat of water  $= 4184 \text{ J/kg K}$ )
  - $10^{-4} \text{ K}$
  - $10^{-3} \text{ K}$
  - $10^{-1} \text{ K}$
  - $10^{-5} \text{ K}$
- Two materials having coefficient of thermal conductivity '3K' and 'K' and thickness of 'd' and '3d' respectively, are joined to form a slab as shown in the figure. The temperatures of the outer surfaces are  $\theta_2$  and  $\theta_1$  respectively, ( $\theta_2 > \theta_1$ ). The temperature at the interface is
  - $\frac{\theta_2 + \theta_1}{2}$
  - $\frac{\theta_1}{3} + \frac{2\theta_2}{3}$
  - $\frac{\theta_1}{6} + \frac{5\theta_2}{6}$
  - $\frac{\theta_1}{10} + \frac{9\theta_2}{10}$







5. When  $M_1$  gram of ice at  $-10^\circ\text{C}$  (specific heat  $= 0.5 \text{ cal g}^{-1}\text{C}^{-1}$ ) is added to  $M_2$  gram of water at  $50^\circ\text{C}$ , finally no ice is left and the water is at  $0^\circ\text{C}$ . The value of latent heat of ice, in  $\text{cal g}^{-1}$  is
- 1)  $\frac{50M_2}{M_1} - 5$       2)  $\frac{50M_1}{M_2} - 50$       3)  $\frac{50M_2}{M_1}$       4)  $\frac{5M_2}{M_1} - 5$
6. A certain amount of monoatomic ideal gas undergoes a process  $\rho U^3 = \text{const}$  where  $\rho$  is density and  $U$  internal energy of gas then the ratio of  $\frac{dW}{dQ}$  for this process is
- 1)  $\frac{2}{3}$       2)  $\frac{3}{4}$       3)  $\frac{1}{3}$       4)  $\frac{3}{5}$
7. STATEMENT A: In primary rainbow observer sees red color on the top and violet color on the bottom  
STATEMENT B : In primary rainbow light suffers total internal reflection twice before coming out of water drops
- 1) A and B are correct      2) A correct B incorrect  
3) A incorrect B correct      4) Both A and B are incorrect
8. Temperature difference of  $120^\circ\text{C}$  is maintained between two ends of a uniform rod AB of length  $2L$ . Another bent rod PQ, of same cross-section as AB and length is connected across AB (see figure). In steady state, temperature difference between P and Q will be close to



- 1)  $45^\circ$       2)  $35^\circ\text{C}$       3)  $75^\circ\text{C}$       4)  $60^\circ\text{C}$



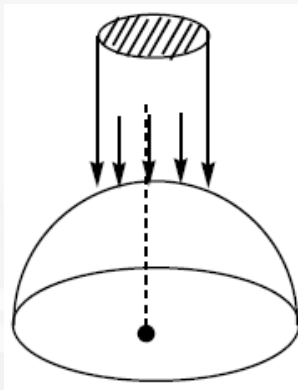


9. A heat source at  $T = 10^3 K$  is connected to another heat reservoir at  $T = 10^2 K$  by a copper slab which is 1 m thick. Given that the thermal conductivity of copper is  $0.1 WK^{-1}m^{-1}$ , the energy flux through it in the steady state is
- 1)  $90 Wm^{-2}$       2)  $65 Wm^{-2}$       3)  $120 Wm^{-2}$       4)  $200 Wm^{-2}$
10. Unknown metal of mass 192 g heated to a temperature of  $100^0 C$  was immersed into a brass calorimeter of mass 128 g containing 240 g of water at a temperature of  $8.4^0 C$ . Calculate the specific heat of the unknown metal, if water temperature stabilizes at  $21.5^0 C$ . (Take, specific heat of brass is  $394 Jkg^{-1}K^{-1}$ )
- 1)  $916 J kg^{-1}K^{-1}$     2)  $654 J kg^{-1}K^{-1}$     3)  $1232 J kg^{-1}K^{-1}$       4)  $458 J kg^{-1}K^{-1}$
11. Ice at  $-20^0 C$  is added to 50g of water at  $40^0 C$ . When the temperature of the mixture reaches  $0^0 C$ , it is found that 20g of ice is still unmelted. The amount of ice added to the water was close to (Take, specific heat of water =  $4.2 J / g / ^0 C$  specific heat of ice =  $2.1 J / g / ^0 C$  and heat of fusion of water at  $0^0 C = 334 J / g$ )
- 1) 40 g      2) 50 g      3) 60 g      4) 100 g
12. A thermometer graduated according to a linear scale reads a value  $x_0$ , when in contact with boiling water and  $x_0 / 3$ , when in contact with ice. What is the temperature when in the contact with the object reads  $x_0 / 2$  ?
- 1) 35      2) 60      3) 40      4) 25
13. A bird is flying up at an angle  $\sin^{-1}(3/5)$  with the horizontal. A fish in a pond looks at that bird when it is vertically above the fish. The angle at which the bird appears to fly (to the fish) is: [ $n_{water} = 4/3$ ]
- 1)  $\sin^{-1}(3/5)$     2)  $\sin^{-1}(4/5)$     3)  $45^0$       4)  $\sin^{-1}(9/16)$

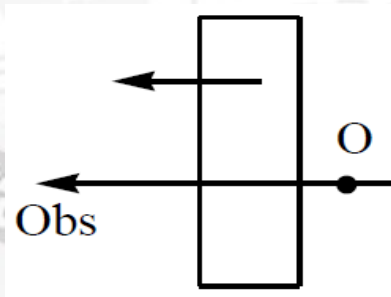




14. A cylindrical beam of diameter ( $d = R$ ) is incident on a glass hemisphere of radius  $R$  and refractive index ( $\mu = \sqrt{2}$ ) on the curved surface symmetrically as shown in the figure. The radius of circular bright spot formed on the flat surface of the hemisphere is:  
(using snell's Law)



- 1)  $\frac{R}{4\sqrt{2}}[2\sqrt{2} - \sqrt{7} + \sqrt{3}]$       2)  $\frac{R}{2\sqrt{2}}[2\sqrt{2} - \sqrt{7} + \sqrt{3}]$   
 3)  $\frac{R}{4\sqrt{2}}[2\sqrt{2} + \sqrt{7} - \sqrt{3}]$       4)  $\frac{R}{10}[\sqrt{21} - 1]$
15. In the figure shown a slab of refractive index  $\frac{3}{2}$  is moved towards a stationary observer at 2m/s. A point 'O' is observed by the observer with the help of paraxial rays through the slab. Both 'O' and observer lie in air. The velocity with which the image will move is

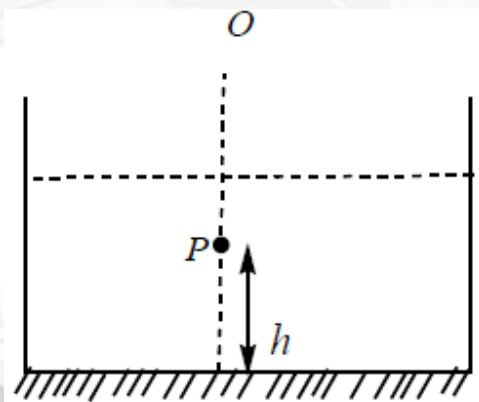


- 1) 2 m/s towards left      2)  $\frac{4}{3}$  m/s towards left  
 3) 3 m/s towards left      4) zero.





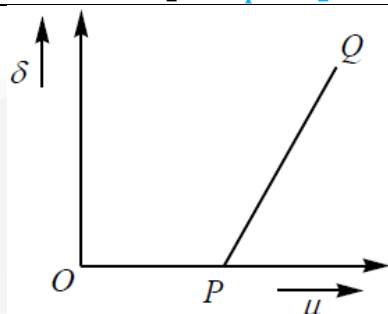
16. A light ray incident along vector  $2i + 4j + \sqrt{5}k$  strikes on the x-z plane from medium I of refractive index  $\sqrt{3}$  and enters into medium II of refractive index is  $\mu_2$ . The value of  $\mu_2$  for which the value of angle of refraction becomes  $90^\circ$ , is
- 1)  $\frac{4\sqrt{3}}{5}$       2)  $\frac{3\sqrt{3}}{5}$       3)  $\frac{2\sqrt{3}}{5}$       4)  $\frac{\sqrt{3}}{5}$
17. A ray is incident on a spherical body ( $\mu = \sqrt{3}$ ) making an angle  $60^\circ$  with the normal drawn at the point of incidence. The ray after passing through sphere gets incident on the further surface of sphere and get reflected and refracted. Then the angle between the reflected and refracted rays at this surface is
- 1)  $45^\circ$       2)  $90^\circ$       3)  $120^\circ$       4)  $150^\circ$
18. A plane mirror is placed at bottom of a tank containing a liquid of refractive index  $\mu$ . P is a small object at a height 'h' above the mirror. An observer "O" vertically above P outside the liquid observes P & its image in the mirror. The apparent distance between these two will be



- 1)  $2\mu h$       2)  $\frac{2h}{\mu}$       3)  $\frac{2h}{\mu-1}$       4)  $h\left(1 + \frac{1}{\mu}\right)$
19. For a small angled prism, angle of prism A, the angle of minimum deviation ( $\delta$ ) varies with the refractive index of the prism as shown in the graph

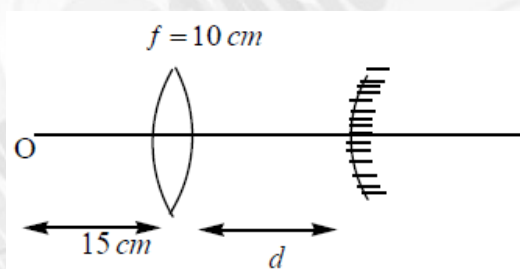






- 1) Point P corresponds to  $\mu > 1$       2) Slope of the line PQ =  $A/2$   
 3) Slope = A      4) None of the above statements is true

20. An object is placed in front of convex lens of focal length ( $f=10$  cm). The distance  $d$  for which image of the object will coincide with the object (irrespective of focal length of the mirror)



- 1) 30      2) 20      3) 0      4) 15

**(NUMERICAL VALUE TYPE)**

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

21. A non- isotropic solid metal cube has coefficients of linear expansion as  $5 \times 10^{-6} / ^\circ\text{C}$  along the x-axis and  $5 \times 10^{-6} / ^\circ\text{C}$  along the y and the z-axis. If coefficient of volume expansion of the solid  $C \times 10^{-6} / ^\circ\text{C}$  then the value of C is \_\_\_\_\_
22. M gram of steam at  $100^\circ\text{C}$  is mixed with 200g of ice at its melting point in a thermally insulated container. If it produces liquid water at  $40^\circ\text{C}$  [heat of vaporization of water is 540 cal/g and heat and heat of fusion of ice is 80 cal/g], the value of M is \_\_\_\_\_





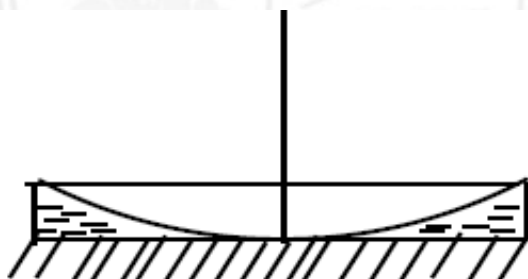


23. Three containers  $C_1$ ,  $C_2$  and  $C_3$  have water at different temperatures. The table below shows the final temperature  $T$  when different amounts of water (given in liters) are taken from each container and mixed (assume no loss of heat during the process)

$C_1$	$C_2$	$C_3$	$T$
1l	2l	-	$60^\circ\text{C}$
-	1l	2l	$30^\circ\text{C}$
2l	-	1l	$60^\circ\text{C}$
1l	1l	1l	$\theta$

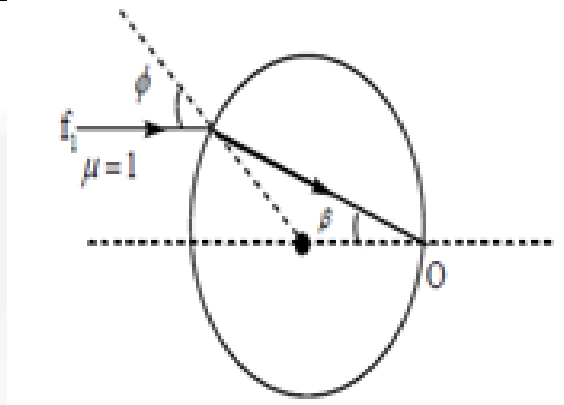
The value of  $\theta$  (in  $^\circ\text{C}$  to the nearest integer) is \_\_\_\_\_

24. A thin plano-convex lens ( $\mu = \frac{3}{2}$ ) of focal length 12.5 cm is placed on a horizontal plane mirror as shown in the figure. The space between the lens and the mirror is filled with water ( $\mu_w = \frac{4}{3}$ ). Find the distance (in mm) above the lens at which a point object is placed on its principal axis so that the object coincides with its own image.

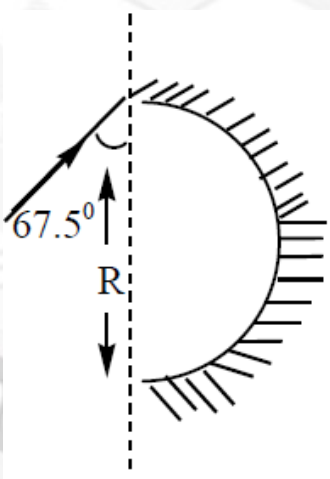


25. A ray of light enters a spherical drop of refractive index ( $\mu = \frac{5}{4}$ ) as shown in the figure. The value of  $1000 \cos \beta$  is (where  $\phi$  is the angle for which the ray after refraction passes through the point O as shown in the figure).



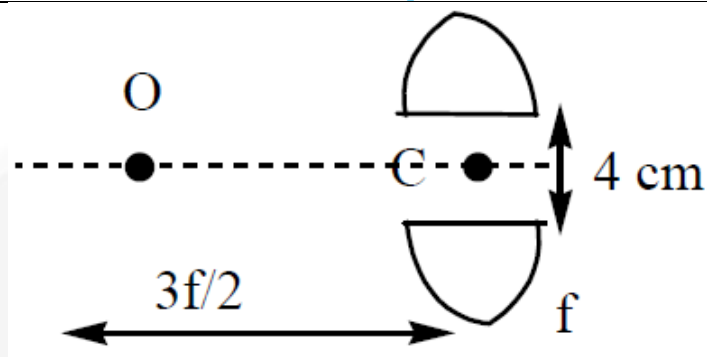


26. Two thin symmetrical lenses of different nature have equal radii of curvature of all faces  $R = 20 \text{ cm}$ . The lenses are put close together and immersed in water. The focal length of the system is 24 cm. The difference between refractive indices of the lenses is  $\left(\frac{5}{n}\right)$ . Find  $n$ . The refractive index of water is  $\frac{4}{3}$ .
27. A Ray incident on a spherical mirror which subtends an angle  $\theta$  on its center of curvature where  $\theta$  is slightly greater than  $180^\circ$ . Find number of reflection that may occurs before the ray comes out of the mirror. (including the first reflection)

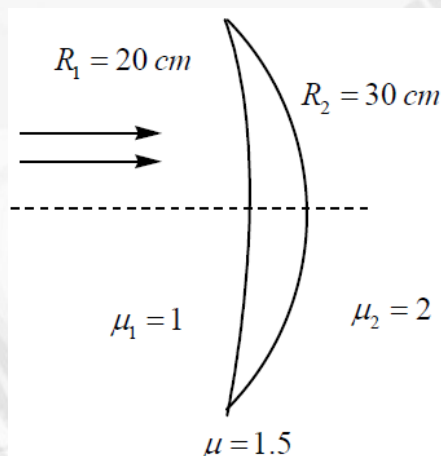


28. A split lens has two parts separated by 4 cm and focal length is  $f$ . An object is placed at a distance  $3f/2$  from C as shown in figure. The distance between the images formed by the two halves (in cm) is.



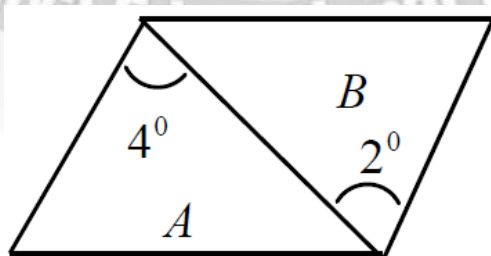


29. Magnitude of focal length of the lens shown in the figure is



30. Two thin prisms are combined as shown in the figure. Find the total angular dispersion suffered by a white light after it is passed through the combination of two prisms. The refractive indices of prisms A and B for different lights are listed in the table below.

Color	Prism A	Prism B
Violet	1.5	1.7
Yellow	1.45	1.6
Red	1.4	1.5

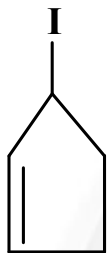




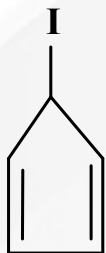
**CHEMISTRY****Max Marks: 100****(SINGLE CORRECT ANSWER TYPE)**

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.



(a)



(b)



(c)

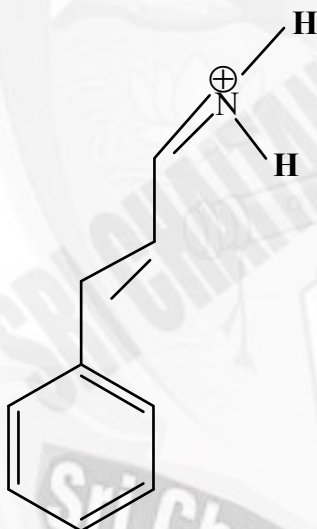
31.

Rate of abstraction of iodine by  $\text{Ag}^{\oplus}$  is

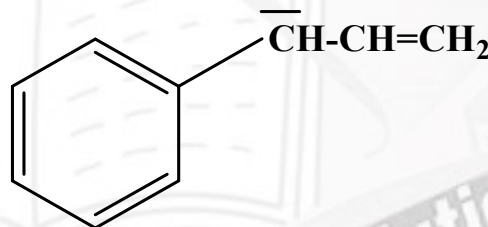
- 1)  $a > b > c$       2)  $b > a > c$       3)  $c > a > b$       4)  $a > c > b$

32.

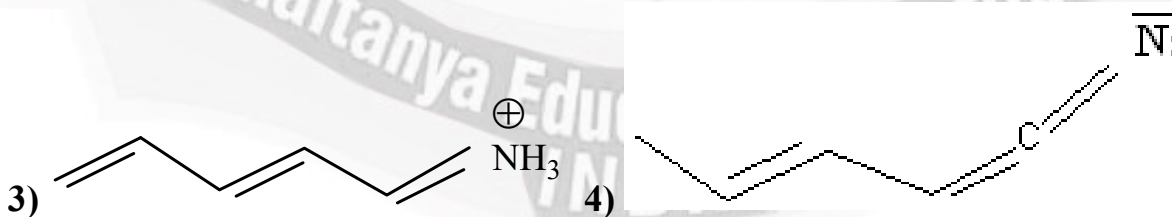
Which of the following is not a valid resonating structure?



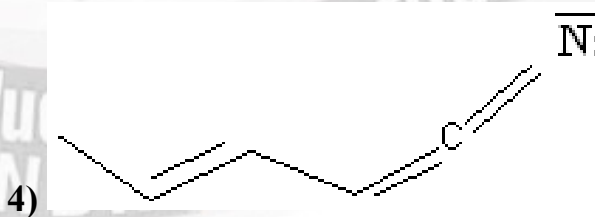
1)



2)



3)

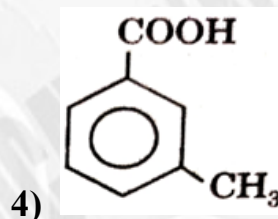
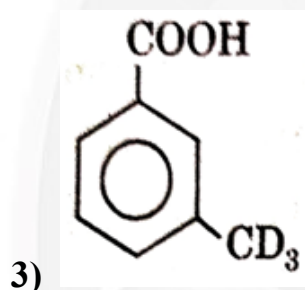
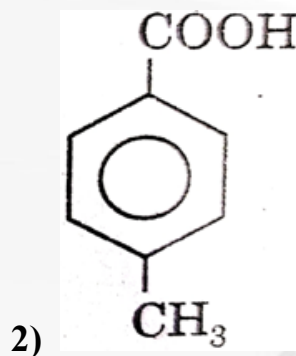
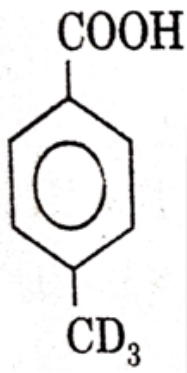


4)





33. Which of the following is least acidic?

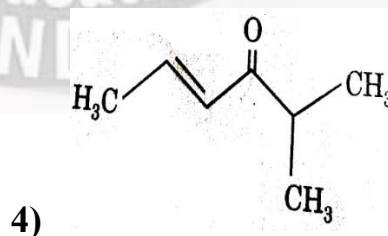
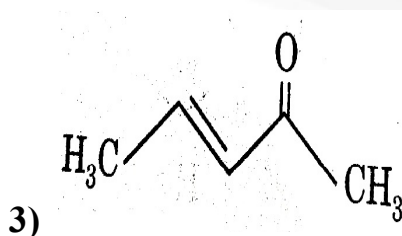
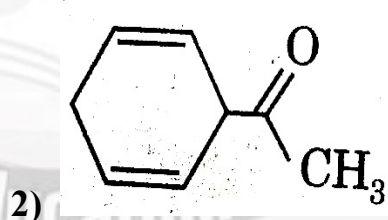
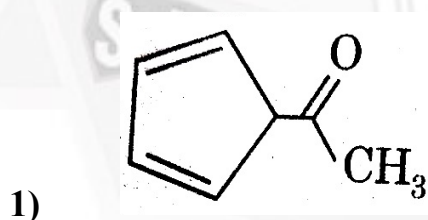


34. Assertion (A): 2, 4 – hexanedione is more acidic than that of Ethanoic Acid.

Reason (R): Active Methylene hydrogen is less acidic than Ethanoic Acid.

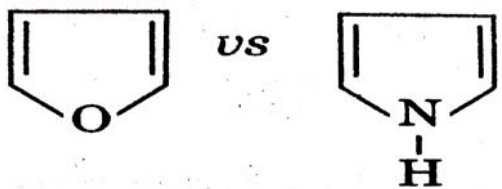
- 1) Both A and R are true. R is the correct explanation of A.
- 2) Both A and R are true. R is not correct explanation of A.
- 3) A is true but R is false.
- 4) A is false but R is true.

35. Which of the following will be most acidic?

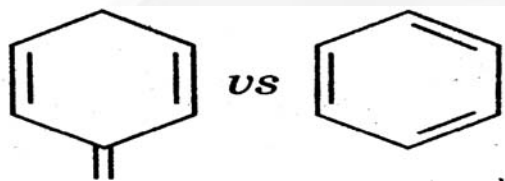




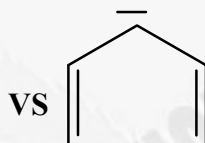
36. In which of the following the 2<sup>nd</sup> structure having more resonance energy?



1)



2)



4) All of these

37. Energies of three resonating structures of a compound are  $E_1$ ,  $E_2$  and  $E_3$  respectively and energy of real molecule is  $E_0$ . If  $E_1 > E_2 > E_3$  then the resonance energy will be:

1)  $(E_1 + E_2 + E_3) - E_0$

2)  $E_1 - E_0$

3)  $E_3 - E_0$

4)  $\frac{E_1 + E_2 + E_3}{3}$

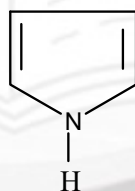
38. Correct statement about inductive effect is

1) It is a temporary effect.

2) It decreases as the distance increases.

3) It doesn't depend upon the electro negativity.

4) It operates though  $\pi$ -bond only



39. Assertion (A):  is more basic than 

Reason (R): Conjugate Acid of Pyridine is aromatic but that of Pyrrole is anti-aromatic.

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

2) Both A and R are true. R is not correct explanation of A.

3) A is true but R is false.

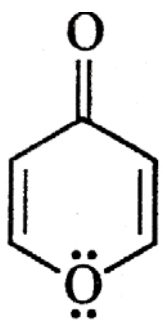
4) A is false but R is true.



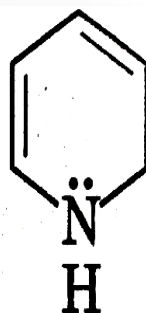




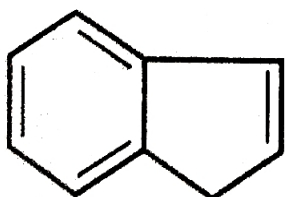
40. Which of the following compound is non-aromatic?



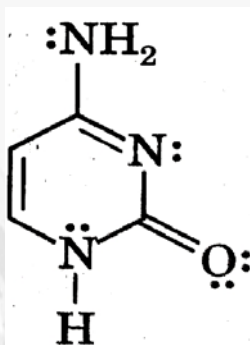
1)



2)



3)



4)

41. Among the following molecules, the correct order of C – C bond length is :

- 1)  $C_2H_6 > C_2H_4 > C_6H_6 > C_2H_2$
- 2)  $C_2H_6 > C_6H_6 > C_2H_4 > C_2H_2$  ( $C_6H_6$  is benzene)
- 3)  $C_2H_4 > C_2H_6 > C_2H_2 > C_6H_6$
- 4)  $C_2H_6 > C_2H_4 > C_2H_2 > C_6H_6$

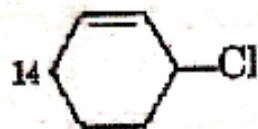
42. Consider the basicity of the following aromatic amines :

- (P) aniline                      (Q) p-nitroaniline  
(R) p-methoxyaniline      (S) p-methylaniline

The correct order of decreasing basicity is :

- 1)  $R > S > P > Q$
- 2)  $R > S > Q > P$
- 3)  $P > Q > R > S$
- 4)  $S > R > Q > P$

43. How many products containing 12 carbons are obtained in following reaction?  
(including stereo)



Na  
dry ether → Products (including stereo isomers)

1) 3

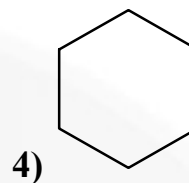
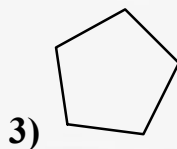
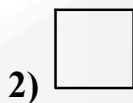
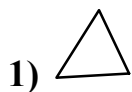
2) 4

3) 10

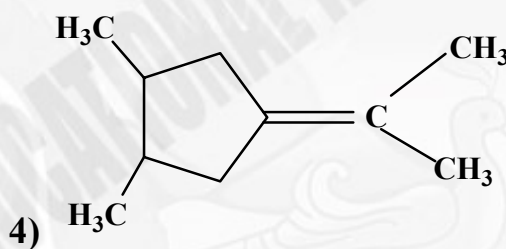
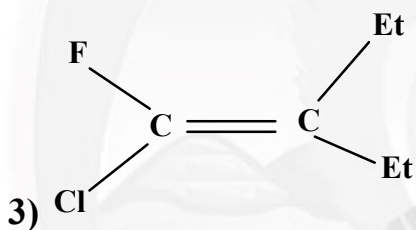
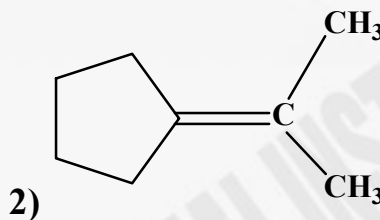
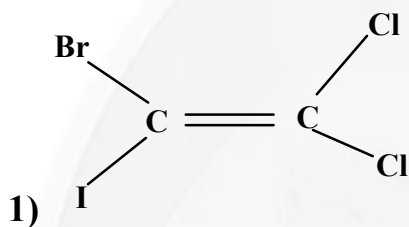
4) 12



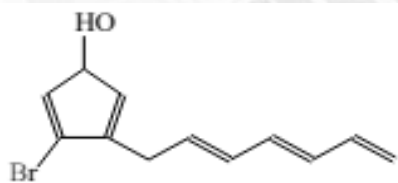
44. Which of the following will have maximum heat of combustion per  $CH_2$  (magnitude)



45. Which of the following compound can show geometrical isomerism

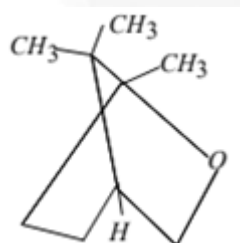


46. Correct IUPAC name of the following compound is



- 1) 3-(Hepta-2,4,6-trienyl)-4-bromo cyclopenta-2,4,-dien-1-ol
- 2) 7-(2-Bromo-4-hydroxy cyclopenta-1,4-dienyl)hepta-1,3,5-triene
- 3) 7-(5-Bromo-3-hydroxy cyclopenta-1,4-dienyl)hepta-1,3,5-triene
- 4) 3-Bromo-4-(hepta-2,4,6-trienyl) cyclopenta-2,4-dien-1-ol

47. The number of chiral centres and stereo isomers present in the following compound



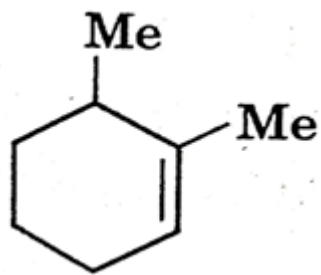
- 1) 2,4
- 2) 1,2
- 3) 2,2
- 4) Compound is optically inactive





48. Pure (R)-mandelic acid has specific rotation of  $-154^\circ$  and sample contains 60% of (R) isomer and 40% of its enantiomers. Specific rotation  $[\alpha]$  of mixture is

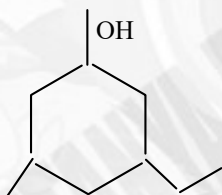
- 1)  $+31^\circ$       2)  $-31^\circ$       3)  $+62^\circ$       4)  $-62^\circ$



49.

IUPAC name of this compound is:

- 1) 1,2-dimethyl cyclohex-2-ene      2) 1,2-dimethyl cyclohex-1-ene  
3) 2,3-dimethyl cyclohex-1-ene      4) 1,6-dimethyl cyclohex-1-ene



50. Assertion (A): IUPAC name of this compound is

5-Ethyl-3-methyl Cyclohexanol-1

Reason (R): It is having three chiral carbons.

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

#### (NUMERICAL VALUE TYPE)

Section-II contains 10 Numerical Value Type questions. Attempt any 5 questions only. First 5 attempted questions will be considered if more than 5 questions attempted. 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.

51.  $\xrightarrow{\text{NBS}}$  Product(s). Number of allyl bromo derivatives formed during reaction will be: (including stereo)

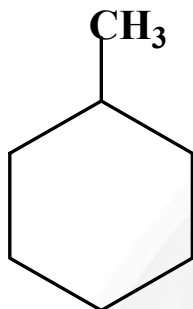
52. No. of possible monochlorinated product (only structural isomers) of iso-octane





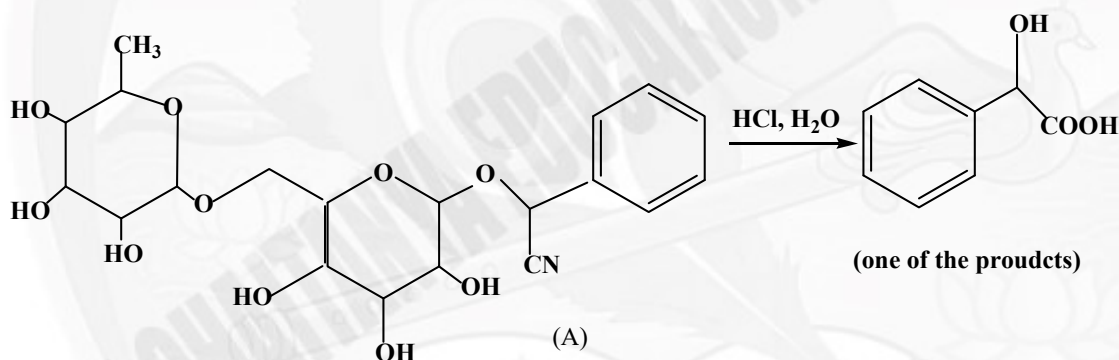


53.



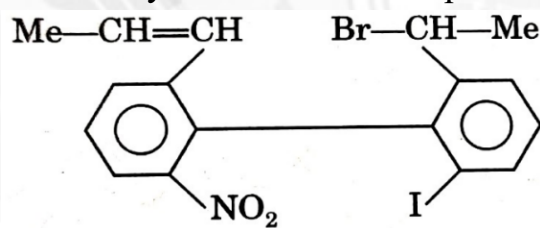
The above compound is mono chlorinated through free radical substitution reaction. If the total number of possible isomers ( Including stereo isomers ) that can be formed = P then the value of  $\frac{P}{3} = ?$

54.

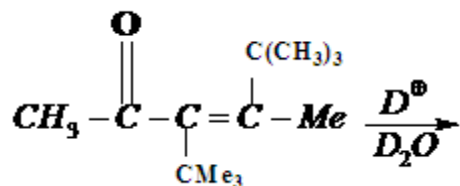


Number of chiral centers present in ( A ) is :

55. How many stereoisomers are possible for the following compound?



56. What will be the number of hydrogen atoms ( Y ) replaced by D on prolonged treatment with  $D^{\oplus} / D_2O$ ?



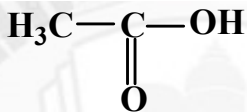
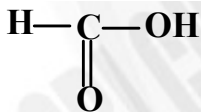
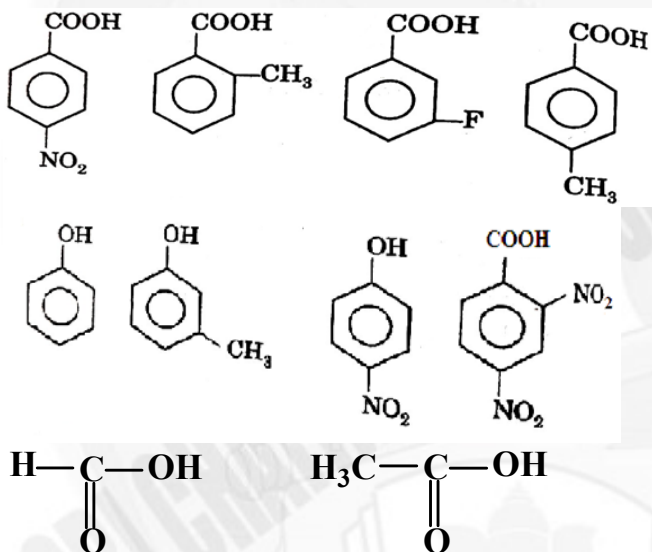
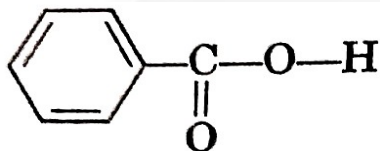


57. How many geometrical isomers are possible by

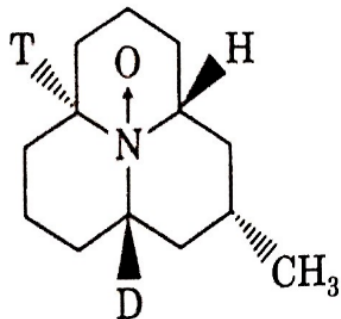


58. How many cyclic alkenes (excluding stereoisomer) will produce methyl cyclohexane on catalytic hydrogenation?

59. Number of compounds which are more acidic than



60. How many chiral carbon atoms are present in the following compound?



**MATHEMATICS****Max Marks: 100****(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.

61. If the tangent at  $P(t_1)$  on the curve  $y = 8t^3 - 1$ ,  $x = 4t^2 + 1$  is normal at  $Q(t_2)$  then  $\frac{t_1}{t_2} =$
- 1) -1                      2) -2                      3) -3                      4) -4
62. If the local maximum value of the function  $f(x) = \left(\frac{\sqrt{3}e}{2\sin x}\right)^{\sin^2 x}$ ,  $x \in \left(0, \frac{\pi}{2}\right)$  is  $\frac{k}{e}$ , then  $\left(\frac{k}{e}\right)^8 + \frac{k^8}{e^5} + k^8$  is equal to
- 1)  $e^5 + e^6 + e^{11}$       2)  $e^3 + e^5 + e^{11}$       3)  $e^3 + e^6 + e^{11}$       4)  $e^3 + e^6 + e^{10}$
63. A balloon is in the shape of a cone surmounted by a hemi sphere. The diameter of the sphere is equal to the height of the cone. If the height of the balloon is 9cm then the rate of change in its volume is \_\_\_\_\_ times the rate of change in its height is
- 1)  $64\pi$                       2)  $6\pi$                       3)  $12\pi$                       4)  $3\pi$
64. Consider the function  $f(x) = 51x^{101} - 2323x^{100} - 45x + 1035$
- STATEMENT-I:  $f(x) = 0$  has one real root in  $\left(45^{\frac{1}{100}}, 46\right)$
- STATEMENT-II :  $F(x) = \frac{x^{102}}{2} - 23x^{101} - \frac{45x^2}{2} + 1035x$  satisfies all conditions of Rolle's theorem  $\left(45^{\frac{1}{100}}, 46\right)$
- 1) Both statements are true and statement II is the correct explanation of statement I
- 2) Both statements are true but statement II is not correct explanation of statement I
- 3) Statement I is true, statement II is false
- 4) Statement I is false, statement II is true







65. Consider the following statements  
Statement – I: If  $f$  and  $g$  are continuous and monotonic on  $R$ , then,  $f + g$  is also a monotonic function.  
Statement- II: If  $f(x)$  is a continuous decreasing function  $\forall x > 0$ , and  $f(1)$  is positive, then,  $f(x) = 0$  happens exactly at one value of  $x$ . Then,
- 1) Both I and II are true                      2) I is true, II is false  
3) I is false, II is true                      4) both I and II are false
66. Let  $f(x) = \lim_{n \rightarrow \infty} \frac{x^{2n-1} + ax^3 + bx^2}{x^{2n} + 1}$  is continuous for all  $x \in R$ . If point  $A(-a, 3)$  and  $B((b+1), -1)$  are points of relative maximum and minimum of a cubic polynomial  $y = g(x)$ , then the value of  $g(2)$  is:
- 1) 1                      2) 2                      3) 3                      4) 4
67. The point  $P$  on the curve  $y = x^2 + 1$  such that the tangent at  $P$ ,  $y = 0$ ,  $x = 0$  and  $x = 1$  form a trapezium of the greatest area is
- 1)  $\left(\frac{1}{2}, \frac{5}{4}\right)$                       2)  $\left(\frac{-1}{2}, 1\right)$                       3)  $(1, 2)$                       4)  $(-1, 2)$
68. A point on the curve  $y = \frac{2}{3}x^3 + \frac{1}{2}x^2$ , the tangent at which makes equal angles with axes is
- 1)  $\left(\frac{1}{2}, \frac{5}{24}\right)$  and  $\left(-1, -\frac{1}{6}\right)$                       2)  $\left(\frac{1}{2}, \frac{4}{9}\right)$  and  $(-1, 0)$   
3)  $\left(\frac{1}{3}, \frac{1}{7}\right)$  and  $\left(-3, \frac{1}{2}\right)$                       4)  $\left(\frac{1}{3}, \frac{4}{47}\right)$  and  $\left(-1, -\frac{1}{3}\right)$
69. A kite is moving horizontally at a height of 151.5 mts. If the speed of the kite is 10 meters/sec. How fast is string being paid out when the kite is 250 mts from the boy who is flying it if the height of the boy is 1.5 meters (answer should be expression in meters/sec)
- 1) 4                      2) 6                      3) 10                      4) 8
70. If the domain of the function
- $$f(x) = \log_e(4x^2 + 11x + 6) + \sin^{-1}(4x + 3) + \cos^{-1}\left(\frac{10x + 6}{3}\right)$$
- is  $(\alpha, \beta]$ , then  $36|\alpha + \beta|$  is equal to
- 1) 63                      2) 45                      3) 72                      4) 54





71. The quadratic equation whose roots are 'l' and 'm' where  $l = \lim_{x \rightarrow 0} Lt \frac{\sin 3x}{x}$  and  $m = \lim_{x \rightarrow 0} Lt \frac{2 \tan x}{x(1 + \tan^2 x)}$  is

- 1)  $x^2 + 5x + 6 = 0$     2)  $x^2 - 5x + 6 = 0$     3)  $x^2 - 5x - 6 = 0$     4)  $x^2 + 5x - 6 = 0$

72. If both  $f(x)$  &  $g(x)$  are differentiable functions at  $x = x_0$ . Then the function defined as,  $h(x) = \text{Maximum}\{f(x), g(x)\}$ .

- 1) is always differentiable at  $x = x_0$   
 2) Is not differentiable at  $x = x_0$ .  
 3) is differentiable at  $x = x_0$  when  $f(x_0) \neq g(x_0)$   
 4) is differentiable at  $x = x_0$  if  $f(x_0) = g(x_0)$

73. If  $f(x) = \frac{1}{(x-1)(x-2)}$  and  $g(x) = \frac{1}{x^2}$  then which is not a point of discontinuity of  $f(g(x))$  among following options

- 1)  $\pm \frac{1}{2}$     2)  $\pm \frac{1}{\sqrt{2}}$     3)  $\pm 1$     4) 0

74. Consider of the following statements is/are true?

STATEMENT-1: If  $f$  is differentiable at  $x = c$ , then  $\lim_{h \rightarrow 0} \frac{f(c+h) - f(c-h)}{2h}$  exists and equals  $f'(c)$ .

STATEMENT-2: Let  $g(x) = \begin{cases} x^2 \sin \frac{1}{x^2}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ , then  $g'$  exists and  $g'$  is continuous,

everywhere on  $\mathbb{R}$

- 1) Both I and II are true    2) I is true, II is false  
 3) I is false, II is true    4) both I and II are false

75. If  $f(x) = x^4 \tan x^3 - x \ln(1 + x^2)$ , then the value of  $\frac{d^4 f(x)}{dx^4}$  at  $x = 0$ , is:

- 1) 0    2) 1    3)  $\frac{1}{5}$     4)  $\frac{1}{15}$





76. The function  $f : [0, 3] \rightarrow [1, 29]$ , defined by  $f(x) = 2x^3 - 15x^2 + 36x + 1$ , is:
- One-one and onto
  - One-one but not onto
  - Onto but not One-one
  - Neither one-one nor onto
77. Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be given as
- $$f(x) = \begin{cases} 2x + \alpha^2, & x \geq 2 \\ \frac{\alpha x}{2} + 10, & x < 2 \end{cases}$$
- .If  $f(x)$  is into function then least integral positive value of  $\alpha$  is:
- 1
  - 2
  - 3
  - 4
78. If  $f(x) = (x^{2023} + 1)|x^2 - 4x - 5| + \sin|x| + \cos(|x - 1|)$  then  $f(x)$  not differentiable at ... (where  $|\cdot|$  denotes modulus)
- No points
  - 2 points
  - 3 points
  - 4 points
79. Let  $f$  be a differentiable function satisfying
- $$f(x + y) = f(x) + f(y) - 2xy + (e^x - 1)(e^y - 1), \quad \forall x, y \in \mathbb{R} \text{ and } f^1(0) = 1$$
- then the value of  $\{f(2)\} - e^2 =$  where  $\{.\}$  represents the fractional part function
- 1
  - 4
  - 7
  - 5
80. Let  $g(x) = \frac{1}{f^{-1}(x)}$ . Given the following data

x	0	1	2	3	4
$f(x)$	-2	-1	2	4	6
$f^1(x)$	1/2	2/3	1	4/3	5/3

The value of  $g^1(4)$  is:

- $\frac{-1}{12}$
- $\frac{-1}{15}$
- $\frac{-2}{15}$
- $\frac{-4}{15}$

(NUMERICAL VALUE TYPE)

**Section-II** contains 10 **Numerical Value Type** questions. Attempt any 5 questions only. First 5 attempted questions will be considered if more than 5 questions attempted. 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.







81. Let  $f(x) = \begin{cases} |x^2 - 3x| + a, & 0 \leq x < \frac{3}{2} \\ -2x + 3, & x \geq \frac{3}{2} \end{cases}$ . If  $f(x)$  has a local maxima at  $x = \frac{3}{2}$ , and the greatest value of 'a' is k, then  $|4k|$  is.....
82. Let  $f(x) = 30 - 2x - x^3$ , then find the number of positive integral values of x which satisfies  $f(f(f(x))) > f(f(-x))$
83. The coordinates of the point on the curve  $(x^2 + 1)(y - 3) = x$  where a tangent to the curve has the least slope are given by  $(a, b)$  where  $a + 4b + 2\sqrt{3} =$
84. The number of points lying in  $\{(x, y) / |x| \leq 10, |y| \leq 3\}$ , on the curve  $y^2 = x - \sin x$ , at which the tangents to the curve are parallel to x - axis, is
85. Rolle's theorem holds for the function  $f(x) = x^3 + mx^2 + nx$  on the interval  $[1, 2]$  and the value of c is  $\frac{4}{3}$ . Then  $m + n =$
86.  $L = \lim_{x \rightarrow 0} \frac{\sqrt{\frac{\cos 2x + (1 + 3x)^{1/3}}{2}} - \sqrt[3]{\frac{4\cos^3 x - \ln(1 + x)^4}{4}}}{x}$ , then the value of '12L' is
87. If  $f(x) = \begin{cases} x - 3 & x < 0 \\ x^2 - 3x + 2 & x \geq 0 \end{cases}$  and let  $g(x) = f(|x|) + |f(x)|$ . The number of points where the function g(x) non differentiable is
88. If  $f(x) + 2f(1 - x) = x^2 + 1 \forall x \in R$ , then  $3f(5)$  is equal to
89. Let  $g : R \rightarrow R$  satisfies  $g(x + y) + g(x - y) = 2x^2 + 2y^2 \quad \forall x, y \in R$ , then the number of solutions of  $g(x) = 2^x$  is \_\_\_\_\_
90. Let  $f : \left[\frac{\pi}{3}, \frac{2\pi}{3}\right] \rightarrow [\alpha, \beta]$ , where  $f(x) = \sqrt{3} \sin x - \cos x + 2$  be a bijection, then  $f^{-1}(x) = \sin^{-1}\left(\frac{x}{m} - 1\right) + \frac{\pi}{n}$  where  $(\beta + n - m - \alpha) =$  \_\_\_\_\_



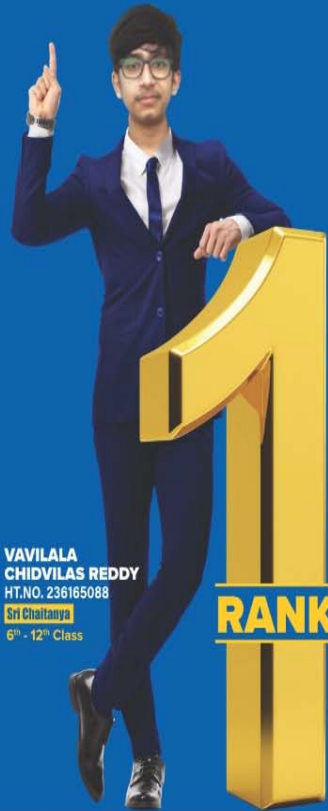




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**D VENKATA YUGESH**  
HT.No. 236043359



RANK

**19**

**MOULIK JINDAL**  
HT.No. 237021004



RANK

**22**

**D PRATAP SINGH**  
HT.No. 232008139



RANK

**23**

**SHAIK SAHIL CHANDA**  
HT.No. 236132870



RANK

**26**

**SONI MAYANK**  
HT.No. 232097025



RANK

**33**

**GOYAL NAMAN**  
HT.No. 232029345



RANK

**37**

**SUMEDH SS**  
HT.No. 231028088



RANK

**38**

**V DEERAJ SATHVIK REDDY**  
HT.No. 236067151



RANK

**44**

**V VERGIYA KAUSHAL**  
HT.No. 231004058



RANK

**46**

**SUTHAR HARSHAL**  
HT.No. 231005060



RANK

**58**

**ABHI JAIN**  
HT.No. 232091036



RANK

**61**

**RIDAM JAIN**  
HT.No. 232068021



RANK

**62**

**SUTHAR HARSH**  
HT.No. 232100028



RANK

**63**

**SOJITRA DIPEN**  
HT.No. 231017001



RANK

**65**

**D PANENDRANADHA REDDY**  
HT.No. 236050298



RANK

**67**

**GUNDA SUSHANTH**  
HT.No. 236129732



RANK

**68**

**HARSH TAYA**  
HT.No. 237021178



RANK

**69**

**KRISH GUPTA**  
HT.No. 232066189



RANK

**73**

**KUNCHAKURTHY VIVEK**  
HT.No. 236134093



RANK

**81**

**N DHARMA TEJA REDDY**  
HT.No. 236050138



RANK

**84**

**S VENKAT KOUNDINYA**  
HT.No. 236130679



RANK

**87**

**MRUNAL SHRIKANT**  
HT.No. 23104138



RANK

**92**

**SAMOTA APURVA**  
HT.No. 232098210



RANK

**97**

**N PRINCE BRANHAM REDDY**  
HT.No. 236054112

BELOW  
**20** »  
All India Open  
Category Ranks

**10**  
RANKS (50%)

BELOW  
**100** »  
All India Open  
Category Ranks

**32**

BELOW  
**1000** »  
All India Open  
Category Ranks

**181**

BELOW  
**100** »  
All India  
Category Ranks  
Count

**89**

BELOW  
**1000** »  
All India  
Category Ranks  
Count

**699**

NUMBER OF RANKS QUALIFIED  
**3,621**

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