

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_ STERLING_BT**

Paper -2(Adv-2021-P2-Model)

Date: 17-09-2023

Time: 02.00Pm to 05.00Pm

CTA-06

Max. Marks: 180

17-09-2023_Sr.Super60_ **NUCLEUS&STERLING_BT**_Jee-Adv(2021-P2)_CTA-06_Syllabus

PHYSICS : Thermal physics, Geometrical optics, Wave optics, General Physics, Kinematics, NLM, Friction, Circular motion, WPE, COM & Collisions, Rigid body Dynamics 1

CHEMISTRY : Nomenclature, Isomerism, GOC, Alkanes, Alkene & Alkyne, Benzene, Alkyl Halides & Aryl Halides, Alcohols, Phenols, Ethers & Amines, Aldehydes & Ketones, Carboxylic acid & Derivatives, Biomolecules, Polymers, Chemistry in Everyday Life & POC

MATHEMATICS : Functions & LCD, Application of Differentiation (AOD), TOTAL DIFFERENTIAL CALCULUS, Indefinite Integration, Definite Integration, Areas & Differential Equations, Total Integral Calculus

Name of the Student: _____

H.T. NO:

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**JEE-ADVANCE-2021-P2-Model**

Time: 3:00Hr's

IMPORTANT INSTRUCTIONS

Max Marks: 180

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 6)	Questions with Multiple Correct Choice with Partial mark	+4	-2	6	24
Sec – II(Q.N : 7 – 12)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 13 – 16)	Paragraph Questions with Single Answer Type	+3	-1	4	12
Sec – IV(Q.N : 17 – 19)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 20 – 25)	Questions with Multiple Correct Choice with Partial mark	+4	-2	6	24
Sec – II(Q.N : 26 – 31)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 32 – 35)	Paragraph Questions with Single Answer Type	+3	-1	4	12
Sec – IV(Q.N : 36– 38)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 39 – 44)	Questions with Multiple Correct Choice with Partial mark	+4	-2	6	24
Sec – II(Q.N : 45 – 50)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 51 – 54)	Paragraph Questions with Single Answer Type	+3	-1	4	12
Sec – IV(Q.N : 55 – 57)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

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CHANDRANATHAN
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**PHYSICS****Max. Marks: 60****SECTION-1(Maximum Marks: 24)****One or More Type**

- This section contains SIX (06) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONE OR MORE THAN ONE of these four option(s)
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4 If only (all) the correct option(s) is(are) chosen;
 Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
 Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
 Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
 Zero Marks : 0 If unanswered;
 Negative Marks : -2 In all other cases.

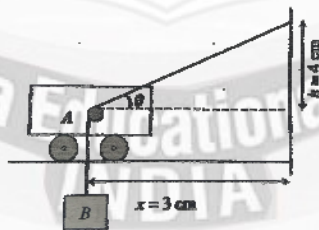
1. The velocity, acceleration and force in two systems of units are related as under

$$(i) v' = \frac{\alpha^2}{\beta} v \quad (ii) a' = (\alpha\beta) a \quad (iii) F' = \left(\frac{1}{\alpha\beta} \right) F$$

All the primed symbols belong to one system and unprimed ones belong to the other system. α and β are dimensionless constants. Which of the following is/are correct?

- A) Length standards of the systems are related by: $L' = \left(\frac{\alpha^3}{\beta^3} \right) L$
- B) Mass standards of the two systems are related by: $M' = \left(\frac{1}{\alpha^2 \beta^2} \right) M$
- C) Time standards of the two systems are related by: $T' = \left(\frac{\alpha}{\beta^2} \right) T$
- D) Momentum standards of the systems are related by: $P' = \left(\frac{1}{\beta^2} \right) P$

2. The string shown in figure is passing over small smooth pulley rigidly attached to trolley A. If the speed of trolley is constant and equal to v_A towards right, speed and magnitude of acceleration of block B at the instant shown in figure are



- A) $v_B = v_A, a_B = 0$ B) $a_B = 3a_A$ C) $v_B = \frac{3}{5} v_A$ D) $a_B = \frac{16v_A^2}{125}$



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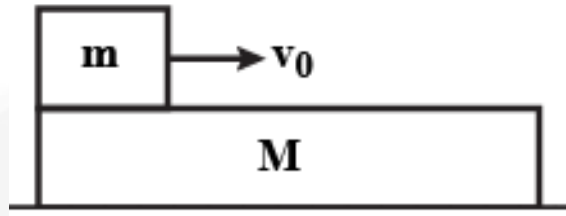
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3. The coefficient of friction between the block and plank is μ and its value is such that the block becomes stationary with respect to plank before it reaches the other end. Then:



- A) The work done by friction on the block is negative
 B) The work done by friction on the plank is positive
 C) The net work done by friction is negative
 D) Net work done by the friction is zero or positive
4. A particle is projected from ground at an angle θ . At certain instant the velocity vector \vec{v} of particle makes an angle α with horizontal. Choose the correct option(S).
- A) $\frac{d\vec{v}}{dt} = \vec{g}$
 B) Modulus of $\frac{d|\vec{v}|}{dt} = g \sin \alpha$
 C) Tangential acceleration has magnitude of $g \sin \alpha$
 D) Normal acceleration = $g \cos \alpha$
5. Velocity of a particle of mass 1kg changes from $\vec{v}_1 = (-2\hat{i} - 2\hat{j}) \text{ m/s}$ to $\vec{v}_2 = (\hat{i} - \hat{j}) \text{ m/s}$ after colliding with a plane surface.
- A) The angle made by the plane surface with the positive x-axis is $90^\circ + \tan^{-1}\left(\frac{1}{3}\right)$
 B) The angle made by the plane surface with the positive x-axis is $\tan^{-1}\left(\frac{1}{3}\right)$
 C) The direction of change in momentum makes an angle $\tan^{-1}\left(\frac{1}{3}\right)$ with the positive x-axis
 D) The direction of change in momentum makes an angle $90^\circ + \tan^{-1}\left(\frac{1}{3}\right)$ with the plane surface.





6. C_V and C_P denote the molar heat capacities of an ideal gas at constant volume and at constant pressure respectively then,
- A) $C_P - C_V$ is larger for a polyatomic ideal gas than for a mono atomic ideal gas
- B) $C_P + C_V$ is larger for a diatomic ideal gas than for a mono atomic ideal gas.
- C) $\frac{C_P}{C_V}$ is larger for a polyatomic ideal gas than for a diatomic ideal gas
- D) $C_P \cdot C_V$ is larger for a diatomic ideal gas than for a mono atomic ideal gas

SECTION-2(Maximum Marks: 12)

Paragraph with Numerical

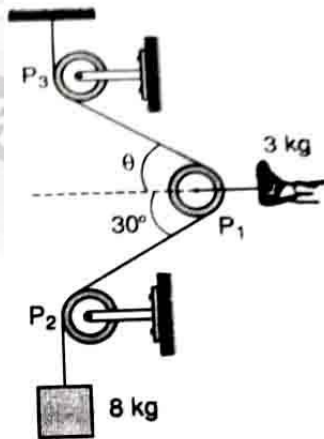
- This section contains THREE (03) question stems.
- There are TWO (02) questions corresponding to each question stem.
- The answer to each question is a NUMERICAL VALUE.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +2 If ONLY the correct numerical value is entered at the designated place;
Zero Marks : 0 In all other cases.

Question Stem for Question Nos. 7 and 8

Question stem

Very often it is required to place an injured limb of an accident victim in traction. Traction involves pulling of the limb gently for long periods of time using weights and pulleys. Suppose a broken leg of an accident victim is placed in traction. The patient is made to wear a special boot which has a pulley attached to its sole. Combined mass of foot and boot is 3 kg and a mass 8 kg hangs from the rope as shown in the figure. The boot (and also the foot) remain suspended by the ropes and do not touch the bed. In fact, the leg will remain horizontal and it will be pulled by the traction force along the horizontal.

Assuming that the pulleys are mass less and frictionless and the rope has also a negligible mass, answer these questions ($g = 10 \text{ m/s}^2$)



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7. Tension in the string in Newtons is
8. It is required that the traction force pulls the leg of the patient along the horizontal. Angle θ which the upper rope makes with the horizontal so as to achieve the given condition is nearly

Question Stem for Question Nos. 9 and 10

Question stem

A person standing on the roof of a building throws a ball vertically upward at an instant $t = 0$. The ball leaves his hand with an upward speed 20m/s and it is then in free fall. The ball rises to a certain height and then moves down. On its way down, the ball just misses to hit the roof of the building and keeps falling towards the earth. The ball hits earth at $t = 5\text{ sec}$. Considering that (i) The vertically upward direction is the positive Y-direction (ii) The position of ball at $t = 0$ is the origin (iii) The ball does not rebound and comes to rest at the same place where it hits earth and (iv) Air resistance is negligible, answer these questions.

(Take $g = 10\text{m/s}^2$)

9. Magnitude of maximum displacement of the ball from the initial position in meters is.....
10. Magnitude of average velocity of the ball from $t = 0$ to $t = 5\text{ sec}$ is

Question Stem for Question Nos. 11 and 12

Question Stem

Both ends of an aluminum rod of length 20 cm and cross sectional area 4 cm^2 are kept at a temperature 0°C . Thermal conductivity of aluminum is 205 W/(m-k) . The initial distribution of temperature along the rod can be expressed as. $T = 25\sin(15.7x)^\circ\text{C}$ Here length of the rod has been considered to be along the X direction and one of the ends as the origin so that 'x' in the initial temperature distribution equation refers to the x position of any point on the rod. Also the angle in the sine term is in radian provided that x is expressed in the SI system.

Answer the following questions.

11. Initially, the rate of heat flow at any end will be W
12. Initially, the rate of heat flow at the centre of the rod will be W

SECTION-3(Maximum Marks: 12) Paragraph with Single Answer Type

- This section contains TWO (02) paragraphs. Based on each paragraph, there are TWO (02) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 If ONLY the correct option is chosen;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);



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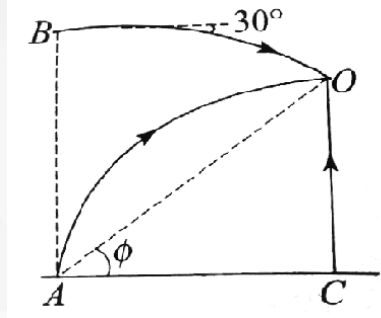
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**Paragraph-I**

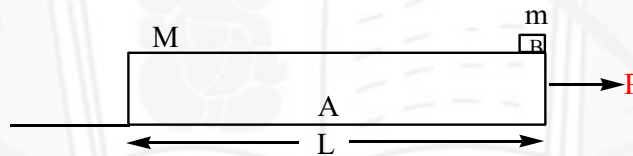
Points A and C are on the horizontal ground and A and B are in same vertical plane at a distance of 1500 m. Simultaneously bullets are fired from A, B and C and they collide at O. The bullet at B is fired at an angle of 30° with horizontal towards the ground at velocity 100 m/s. The bullet at C is fired vertically upward at velocity of 100 m/s. The bullet projected from A reaches its maximum height at O.



13. Find the time in which bullets will collide (Seconds):
 A) 10 B) 15 C) 20 D) 25
14. Find the elevation angle $\angle \phi = \angle OAC$:
 A) 60° B) 45° C) 30° D) 15°

Paragraph-II

A plank A of mass M rests on a smooth horizontal surface over which it can move without friction. A cube B of mass m lies on the plank at one edge. The coefficient of friction between the plank and the cube is μ . The size of cube is very small in comparison to the plank.



15. At what force P applied to the plank in the horizontal direction will the cube begin to slide towards the other end of the plank?
 A) $P > \mu(m + M)g$ B) $P > 0.5 \mu(m + M)g$
 C) $P = 0.5 \mu(m + M)g$ D) $P = \mu(m + M)g$
16. In what time will the cube fall from the plank if the length of the plank is l?
 A) $\sqrt{\frac{ML}{P - \mu g(M + m)}}$ B) $\sqrt{\frac{2ML}{P - \mu g(M + m)}}$





$$C) \sqrt{\frac{ML}{P + \mu g(M + m)}}$$

$$D) \sqrt{\frac{2ML}{P + \mu g(M + m)}}$$

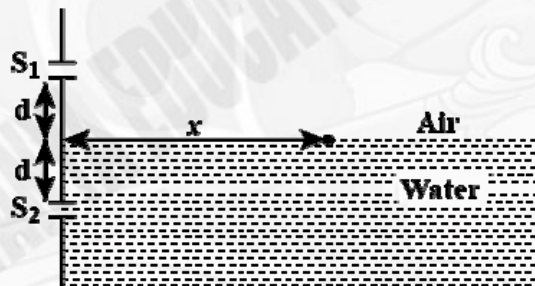
SECTION-4(Maximum Marks: 12)
Non-Negative Integer Answer Type

- This section contains THREE (03) questions.
- The answer to each question is a NON-NEGATIVE INTEGER.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct integer is entered;

Zero Marks : 0 In all other cases.

17. A Young's double slit interference arrangement with slits S_1 in air and S_2 is immersed in water (refractive index = $3/2$) as shown in the figure. The positions of maxima on the surface of water are given by $x^2 = p^2 m^2 \lambda^2 - d^2$, where λ is the wavelength of light in air (refractive index = 1), $2d$ is the separation between the slits and m is an integer. The value of p is



18. A metal rod AB of length $10x$ has its one end A in ice at $0^\circ C$ and the other end B in water at $100^\circ C$. If a point P on the rod is maintained at $400^\circ C$, then it is found that equal amounts of water and ice evaporate and melt per unit time. The latent heat of evaporation of water is 540 cal g^{-1} and latent heat of melting of ice is 80 cal g^{-1} . If the point P is at a distance of λx from the ice end A, find the value of λ . (Neglect any heat loss to the surrounding.)
19. Two capacitors with capacitance values $C_1 = (2000 \pm 10) \text{ pF}$ and $C_2 = (3000 \pm 15) \text{ pF}$ are connected in series. The voltage applied across this combination is $V = (5.00 \pm 0.02) V$. The percentage error in the calculation of the energy stored in this combination of capacitors is (rounded off to nearest integer)_____

CHEMISTRY

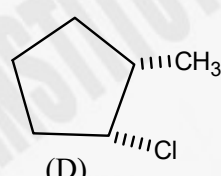
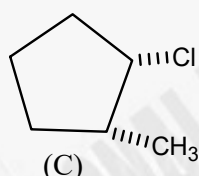
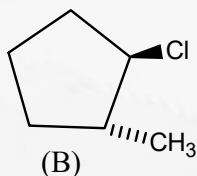
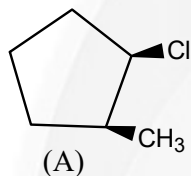
Max. Marks: 60

SECTION-1(Maximum Marks: 24)

One or More Type

- This section contains SIX (06) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONE OR MORE THAN ONE of these four option(s)
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4 If only (all) the correct option(s) is(are) chosen;
 Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
 Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
 Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
 Zero Marks : 0 If unanswered;
 Negative Marks : -2 In all other cases.

20. Which of the following isomers have diastereomeric relationship



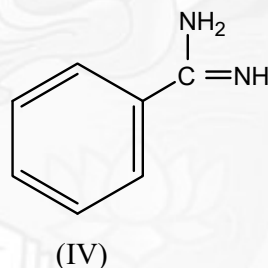
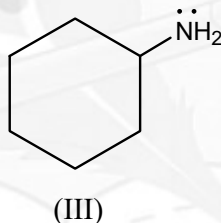
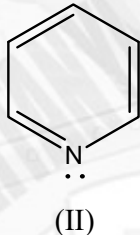
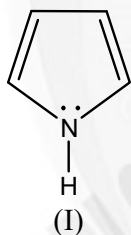
A) A and C

B) A and B

C) A and D

D) B and C

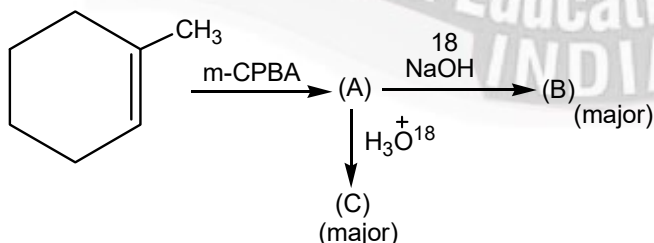
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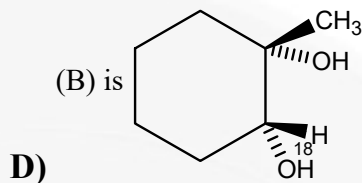
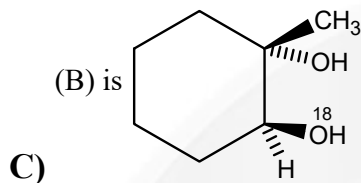
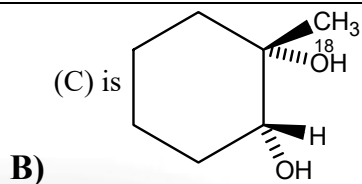
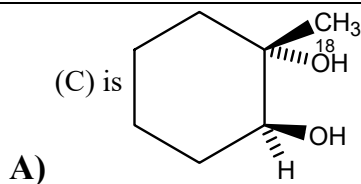
Which of the following statement(s) is/are correct?

- A) I and II are aromatic, but I is more basic than III
 B) I is anti-aromatic, II is aromatic and II is more basic than I
 C) The order of basicity of above compounds is IV > III > II > I
 D) The conjugate acid of II is less stabilized than conjugate acid of IV

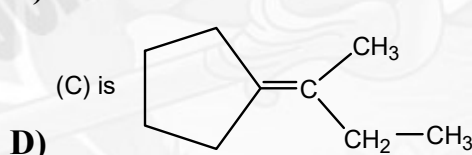
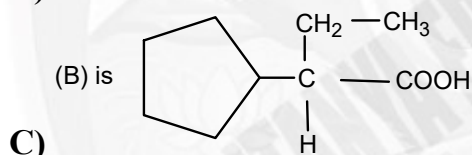
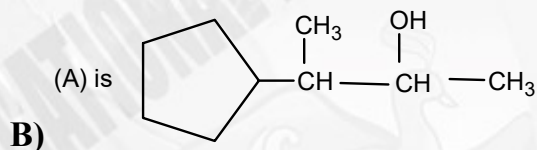
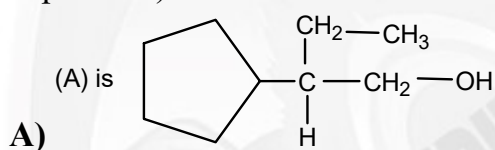
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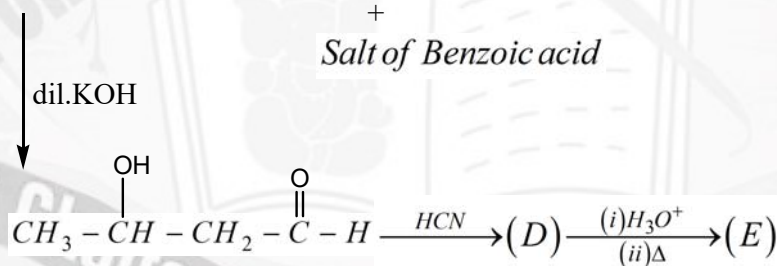
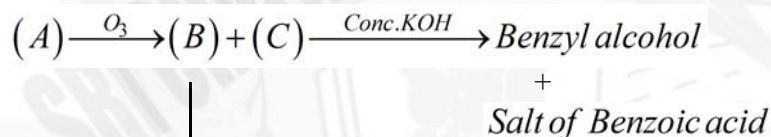
Choose the correct option(s)



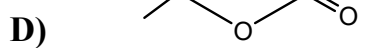
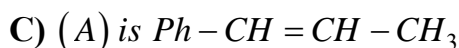
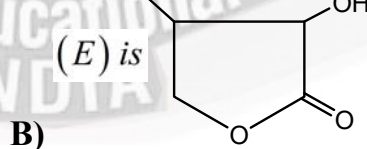
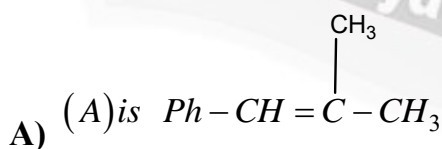
23. A chiral alcohol (A) ($C_9H_{18}O$) on oxidation gives (B) ($C_9H_{16}O_2$). (A) on heating in acidic medium gives compound (C) (C_9H_{16}) as major product, which on ozonolysis produces (D) (C_4H_8O) and cyclopentanone. Identify the correct answers. (Neglect ring expansion)



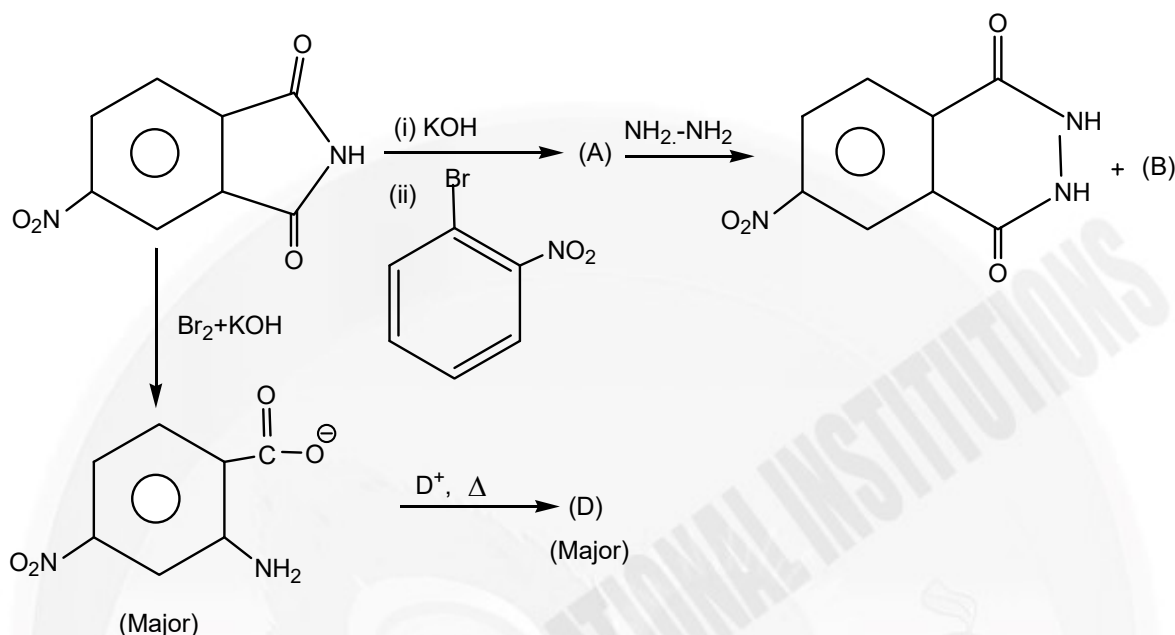
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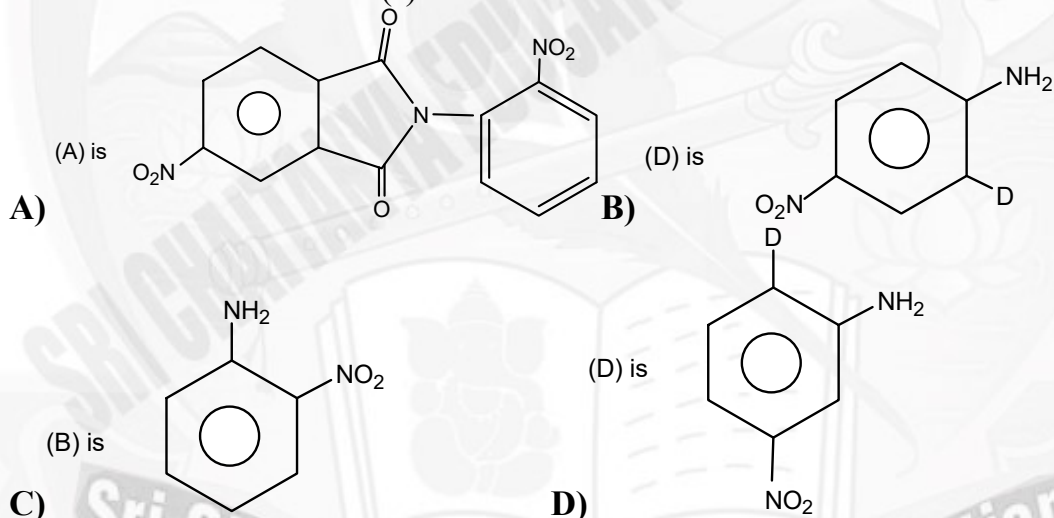
Choose the correct answer(s)



25.



Choose the correct answer(s)

**SECTION-2(Maximum Marks: 12)****Paragraph with Numerical**

- This section contains THREE (03) question stems.
- There are TWO (02) questions corresponding to each question stem.
- The answer to each question is a NUMERICAL VALUE.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +2 If ONLY the correct numerical value is entered at the designated place;
Zero Marks : 0 In all other cases.

Question Stem for Question Nos. 26 and 27**Question Stem**



1.26g of an organic compound was reacted under Kjeldahl's method and the ammonia evolved was absorbed in 100ml of 1N H_2SO_4 . The remaining acid solution was made upto 500ml by addition of water and 20ml of this dilute solution required 35 ml of $N/10$ caustic soda solution for complete neutralization.

26. Volume of H_2SO_4 required for neutralization of NH_3 is _____

27. Percentage of N_2 present in the compound is _____

Question Stem for Question Nos. 28 and 29

Question Stem

When 'x'g of Nitrobenzene reacts with 'y'g of Sn and HCl produces an organic compound, which on treating with dil. HCl produces 2.58g of an organic salt quantitatively.

(Use molar masses (in $g\ mol^{-1}$) of H, C, N, O, Cl and Sn as 1, 12, 14, 16, 35 and 119 respectively)

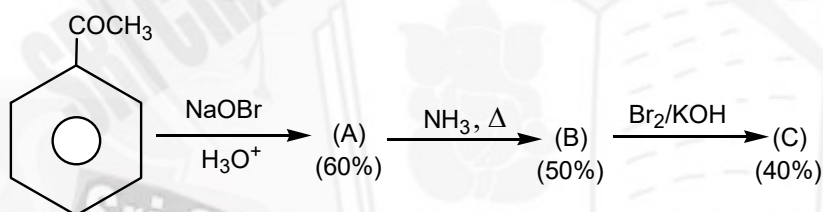
28. The value of 'x' is _____

29. The value of 'y' is _____

Question Stem for Question Nos. 30 and 31

Question Stem

When '150'g of Acetophenone involves in the following sequence of reactions gives 'x' g of compound (B) and 'y' g of compound (C).



30. The value of 'x' is _____

31. The value of 'y' is _____

SECTION-3(Maximum Marks: 12)

Paragraph with Single Answer Type

- This section contains TWO (02) paragraphs. Based on each paragraph, there are TWO (02) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 If ONLY the correct option is chosen;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

Paragraph-I:

Sec: Sr.Super60_STERLING_BT

Space for rough work

Page 12



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JEE MAIN 2023
SINGARAJU
VENKAT KUMAR
RANK 1
300
300



RANK 1

JEE Advanced 2023
VAVILALA
CHIVILAS REDDY
RANK 1
344
360



RANK 1

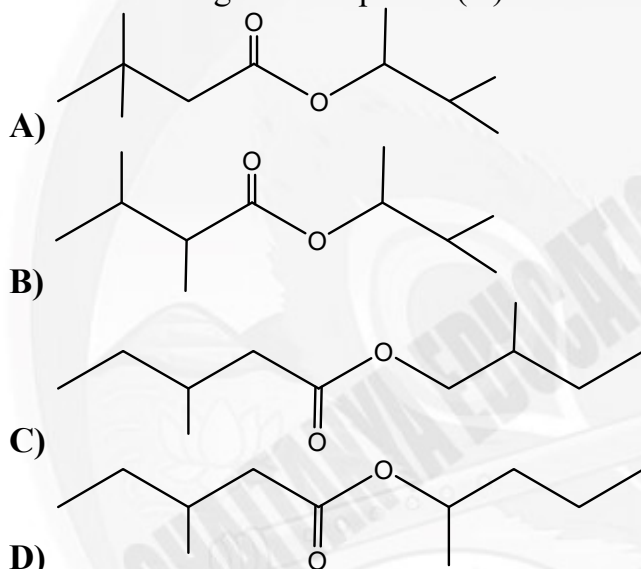
NEET 2023
NORA VARUN
CHANDRANATH
RANK 1
720
720



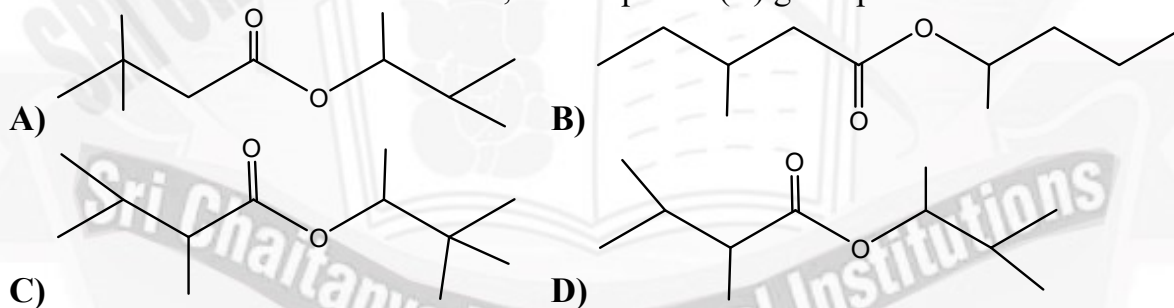
RANK 1

An organic compound (A) with molecular formula $C_{11}H_{22}O_2$ on hydrolysis gives two optically active compound (B) and (C). Compound (C) is soluble in NaOH and compound (B), which gives negative iodoform test on heating with conc. H_2SO_4 produces compound (D) with No diastereomers. When 'Ag' salt of compound (C) is treated with Br_2 , gives compound (E), which is also obtained when compound (B) is treated with $TsCl$ and then with $NaBr$.

32. Structure of organic compound (A) is



33. What would be the structure of 'A', If compound (B) gives positive iodoform test.

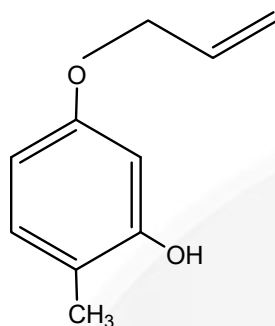


Paragraph-II:

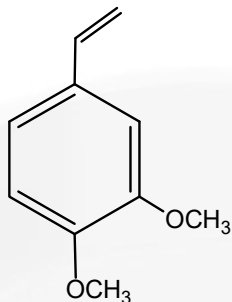
An organic compound (A) with molecular formula $C_{10}H_{12}O_2$ on treatment with CH_3I in alkali gives (B) $C_{11}H_{14}O_2$, which is insoluble in aq. NaOH and decolourises Br_2 / CCl_4 . Compound (A) on treatment with strong alkali alone gives an isomeric product (C), which on ozonolysis give (E) $C_8H_8O_3$, an isomer of isovaniline. (B) on treating with strong base gives (D), which on ozonolysis gives (F) ($C_9H_{10}O_3$).



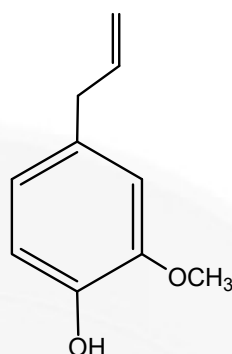
34. The structure of compound (A) is



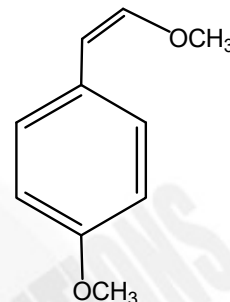
A)



B)

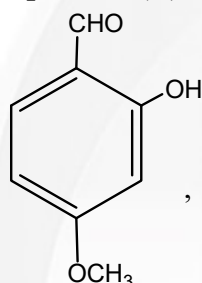


C)

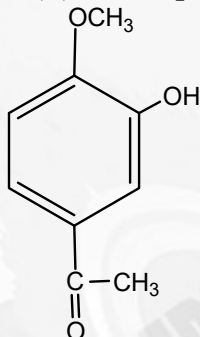


D)

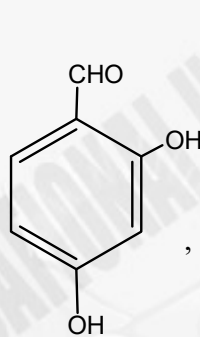
35. Compounds (E) and (F) are respectively.



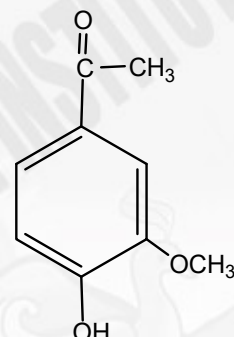
A)



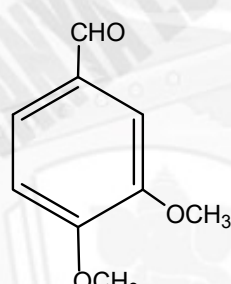
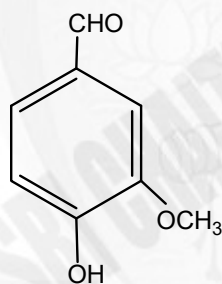
B)



C)



D)



SECTION-4(Maximum Marks: 12)

Non-Negative Integer Answer Type

- This section contains THREE (03) questions.
- The answer to each question is a NON-NEGATIVE INTEGER.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct integer is entered;

Zero Marks : 0 In all other cases.

36. How many number of following statements are correct?

- when pure α - D - glucopyranose is dissolved in water, its optical rotation slowly changes.
- α - D - glucopyranose and β - D - glucopyranose are anomers
- Methyl glucosides do not react with fehling's or Tollen's reagent



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344

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RANK

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NEET

2023

SRI CHAITANYA

EDUCATIONAL INSTITUTIONS

720

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RANK

1



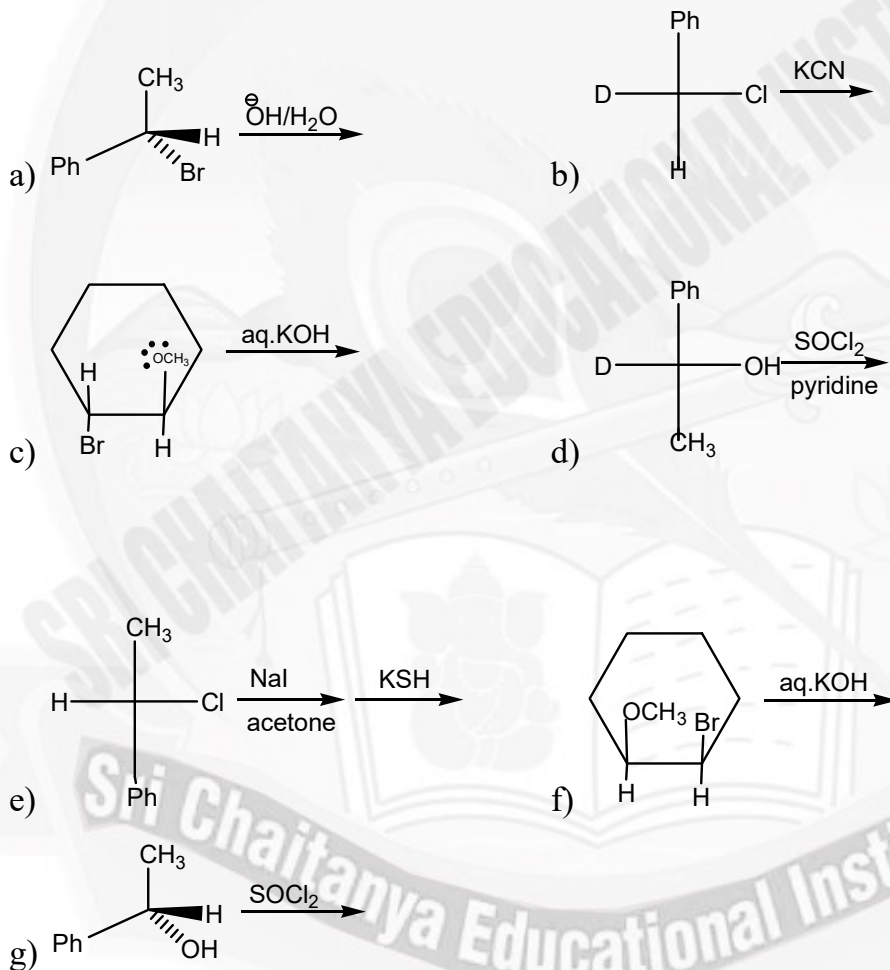
- iv) α - D - glucopyranose react with $NaHSO_3$ to form white precipitate
- v) α - D - methyl glucoside and β - D - methyl glucosides are anomers
- vi) Reduction of Fructose with Na-Hg / H_2O gives both sorbitol and mannitol

37. Amongst the following, the total no. of biodegradable polymers are:

PVC, Glyptal, Nylon 6,6, PHBV, Nylon - 2 - nylon - 6

Cellulose, PMMA, Dextran, Nylon 6, PAN.

38. How many of the following reactions proceed with retention of configuration?



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THE PERFECT HAT-TRICK WITH ALL-INDIA RANK 1
IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023

JEE MAIN 2023	RANK	JEE Advanced 2023	RANK	NEET 2023	RANK
SINGARAJU VENKAT KUMARINNYA	1	VAVILALA CHIDVILAS REDDY	1	ROOJA VARUN CHANDRANATHAN	1
300		341		720	

Infinite Learn

38
Years

**MATHEMATICS****Max. Marks: 60****SECTION-1(Maximum Marks: 24)****One or More Type**

- This section contains SIX (06) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONE OR MORE THAN ONE of these four option(s)
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4 If only (all) the correct option(s) is(are) chosen;
 Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
 Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
 Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
 Zero Marks : 0 If unanswered;
 Negative Marks : -2 In all other cases.

39. $f: R \rightarrow [-1, \infty)$ and $f(x) = \ln([\sin 2x + |\cos 2x|])$ (where $[.]$ greatest integer function).

- A) $R^- \cap$ range of 'f' is null set
 B) $f(x)$ is periodic but fundamental period not defined
 C) $f(x)$ is invertible in $\left[0, \frac{\pi}{4}\right]$
 D) $f(x)$ is not an onto function.

40. Let $\Phi\left(\frac{x+2y}{3}\right) = \frac{\Phi(x)+2\Phi(y)}{3} \forall x, y \in R$ and $\Phi'(0)=1$ and $\Phi(0)=2$ then

- A) $\phi(x)$ is continuous $\forall x \in R$
 B) $\phi(x)$ is differentiable $\forall x \in R$
 C) $\phi(x)$ is both continuous and differentiable
 D) $\phi(x)$ is discontinuous at $x=0$

41. If $\frac{d}{dx}\{f(x)\} = g(x)$ where $g(x) = e^{-x} \cdot f(x) + e^x \cdot f(-x)$ then (given $f(0)=0$)

- A) $g(x)$ is an even function B) $f(x)$ is an odd function
 C) $g^1(0) = f^1(0) = g(0)$ D) $g^1(0) \neq f(0)$

42. Let $f(x) = 2x^2 - \ln|x|$, $x \neq 0$, then $f(x)$ is

- A) monotonically increasing in $\left(-\frac{1}{2}, 0\right) \cup \left(\frac{1}{2}, \infty\right)$
 B) monotonically decreasing in $\left(-\frac{1}{2}, 0\right) \cup \left(\frac{1}{2}, \infty\right)$
 C) monotonically increasing in $\left(-\infty, -\frac{1}{2}\right) \cup \left(0, \frac{1}{2}\right)$
 D) monotonically decreasing in $\left(-\infty, -\frac{1}{2}\right) \cup \left(0, \frac{1}{2}\right)$

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THE PERFECT HAT-TRICK WITH ALL-INDIA RANK 1 IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023

JEE MAIN 2023	RANK	JEE ADVANCED 2023	RANK	NEET 2023	RANK
SINGARAJU VENKAT KISHORHNYA	1	VAVILALA CHIDVILAS REDDY	1	ROOJA VARUN CHANDRASEKHAR	1
300		344		720	



43. If $I_1 = \int_0^{\frac{\pi}{2}} \frac{\sin(\sin x)}{\sin x} dx$, $I_2 = \int_0^{\frac{\pi}{2}} \frac{\sin x}{x} dx$ and $I_3 = \int_0^{\frac{\pi}{2}} \frac{\sin(\tan x)}{\tan x} dx$

Then which of the following is true

- A) $I_1 > I_3$ B) $I_2 > I_3$ C) $I_1 > I_2$ D) $I_1 < I_2$

44. The curve whose sub tangent is 'n' times the abscissa of the point of contact and passes through the point (2,3), then

- A) For $n=1$ equation of the curve is $2y=3x$
 B) For $n=1$ equation of the curve is $2y^2=9x$
 C) For $n=2$ equation of the curve is $2y=3x$
 D) For $n=2$ equation of the curve is $2y^2=9x$

SECTION-2(Maximum Marks: 12)

Paragraph with Numerical

- This section contains THREE (03) question stems.
- There are TWO (02) questions corresponding to each question stem.
- The answer to each question is a NUMERICAL VALUE.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +2 If ONLY the correct numerical value is entered at the designated place;
 Zero Marks : 0 In all other cases.

Question Stem for Question Nos. 45 and 46

Question Stem

Consider the function $f: R \rightarrow (0, \infty)$ defined by $f(x) = 2^x + 2^{|x|}$

45. The number of solutions of the equation $f(x) = \ln \pi$ is
46. The area of the region bounded by the curves $y = f(x)$, $y = 0$, $x = -1$ and $x = 1$ is $\log_2(e^p)$ Then $2p =$

Question Stem for Question Nos. 47 and 48

Question Stem

Let $\lim_{x \rightarrow c} f(x) = l = \lim_{x \rightarrow c} h(x)$ and

$f(x) \leq g(x) \leq h(x) \forall x \in (c - \delta, c) \cup (c, c + \delta)$ for $\delta > 0$ then $\lim_{x \rightarrow c} g(x) = l$ this is called

squeeze principle or sandwich principle. Then answer the following questions.





47. $\lim_{x \rightarrow 0} \lim_{n \rightarrow \infty} \left(\frac{[1^2 x^x] + [2^2 x^x] + \dots + [n^2 x^x]}{n^3} \right) = p$ then (p^{-2}) is

(Where $[.]$ denotes the greatest integer function)

48. $\lim_{x \rightarrow 0} \left(\left[\frac{\sin x}{x} \right] + \left[\frac{\tan x}{x} \right] \right) =$ (Where $[.]$ denotes the greatest integer function)

Question Stem for Question Nos. 49 and 50

Question Stem

Let $f_n(x) = \sum_{r=1}^n \frac{\sin^2 x}{\cos^2\left(\frac{x}{2}\right) - \cos^2\left(\frac{2r+1}{2}x\right)}$ and let $g_n(x) = \prod_{r=1}^n f_r(x)$

49. Let $I_n = \int_0^{\pi} \frac{f_n(x)}{g_n(x)} dx$. If $\sum_{n=1}^{100} I_n = k\pi$, then the value of k is:

50. The value of $\left(\lim_{x \rightarrow 0} \int_0^x \frac{9dt}{xf_9(t)g_9(t)} \right)$ is:

SECTION-3(Maximum Marks: 12)

Paragraph with Single Answer Type

- This section contains TWO (02) paragraphs. Based on each paragraph, there are TWO (02) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 If ONLY the correct option is chosen;

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases.

Paragraph-I:

It can be shown that if $f(x)$ is continuous at 0 then $xf(x)$ is differentiable at $x=0$ by changing origin, we can say that if $f(x)$ is continuous at 'a' then $(x-a)f(x-a)$ is differentiable at $x=a$

51. The largest set over which $\frac{x \sin|x|}{1-|x|^2}$ is differentiable is

- A) $R - \{0, 1, -1\}$ B) R C) $R - \{-1, 1\}$ D) $\{-1, 1\}$

52. The number of points where the function $(x-3)|x^2-7x+12| + \cos|x-3|$ is not differentiable is

- A) one B) two C) three D) infinite



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**Paragraph-II:**

If f be a twice differentiable function such that $f''(x) > 0 \forall x \in R$. Let $h(x)$ is defined by

$$h(x) = f(\sin^2 x) + f(\cos^2 x) \text{ where } |x| < \frac{\pi}{2}$$

53. The number of critical points of $h(x)$ are

- A) 1 B) 2 C) 3 D) more than 3

54. $h(x)$ is increasing for $x \in$

- A) $\left(-\frac{\pi}{4}, \frac{\pi}{4}\right)$ B) $\left(-\frac{\pi}{2}, -\frac{\pi}{4}\right) \cup \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$
 C) $\left(-\frac{\pi}{4}, 0\right) \cup \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ D) $\left(-\frac{\pi}{2}, -\frac{\pi}{4}\right) \cup \left(0, \frac{\pi}{4}\right)$

SECTION-4(Maximum Marks: 12)
Non-Negative Integer Answer Type

- This section contains THREE (03) questions.
- The answer to each question is a NON-NEGATIVE INTEGER.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct integer is entered;

Zero Marks : 0 In all other cases.

55. If ' f ' is a polynomial function satisfying the condition

$$f(\tan x) + f(\cot x) = f(\tan x) \cdot f(\cot x) \quad \forall x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right) - \{0\} \text{ and } f(2) = 9 \text{ then the}$$

value of $\frac{f'(2)}{6}$ is.

56. If $f(n) = \frac{1}{\pi} \int_0^{\pi/2} \frac{\sin^2 n\theta}{\sin^2 \theta} d\theta$ then $\frac{f(15) + f(3)}{f(12) - f(10)} = \underline{\hspace{2cm}}$

57. If $f(x) = \frac{10\cos x + 5\cos 3x + \cos 5x}{\cos 6x + 6\cos 4x + 15\cos 2x + 10}$ then $f(0) + f'(0) + f''(0) = \dots\dots\dots$



JEE MAIN

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 SINGARAJU
 VENKAT KUMARINNYA
 RANGACHARI
 300



JEE Advanced

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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
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Category Ranks
Count

699

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