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 **Paper -2(Adv-2020-P2-Model)** **Date: 10-09-2023**

Time: 02.00Pm to 05.00Pm **CTA-04** **Max. Marks: 198**

10-09-2023_Sr.Super60_NUCLEUS_BT_Jee-Adv(2020-P2)_CTA-04_Syllabus

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

(RPTA.1 TO RPTA.6 SYLLABUS)

CHEMISTRY : Nomenclature, Isomerism, GOC, Alkanes, Alkene & Alkyne, Benzene, Alkyl Halides & Aryl Halides, Alcohols, Phenols , Ethers & Amines, Aldehydes & Ketones, Carboxylic acid & Derivatives

(RPTA.1 TO RPTA.6 SYLLABUS)

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

(RPTA.1 TO RPTA.6 SYLLABUS)

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

JEE-ADVANCE-2020-P2-Model

Time: 3:00Hour's **IMPORTANT INSTRUCTIONS** **Max Marks: 198**

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 6)	Questions With Integer Answer Type	3	-1	6	18
Sec – II(Q.N : 7 – 12)	**Questions with Multiple Correct Choice +1 partial marks**	4	-2	6	24
Sec – III(Q.N : 13 – 18)	Questions with Numerical Value Answer Type	4	0	6	24
Total				**18**	**66**

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 19 – 24)	Questions With Integer Answer Type	3	-1	6	18
Sec – II(Q.N : 25 – 30)	**Questions with Multiple Correct Choice +1 partial marks**	4	-2	6	24
Sec – III(Q.N : 31 – 36)	Questions with Numerical Value Answer Type	4	0	6	24
Total				**18**	**66**

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 37 – 42)	Questions With Integer Answer Type	3	-1	6	18
Sec – II(Q.N : 43 – 48)	**Questions with Multiple Correct Choice +1 partial marks**	4	-2	6	24
Sec – III(Q.N : 49 – 54)	Questions with Numerical Value Answer Type	4	0	6	24
Total				**18**	**66**

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PHYSICS **Max Marks: 66**

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains SIX (06) questions.
- The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.
- 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 :+3 If ONLY the correct integer is entered;
Zero Marks :0 If the question is unanswered;
Negative Marks :-1 In all other cases

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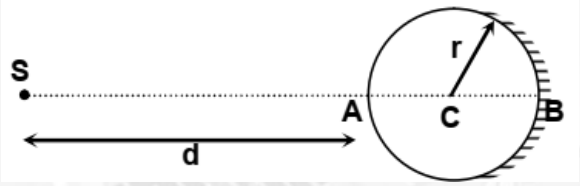
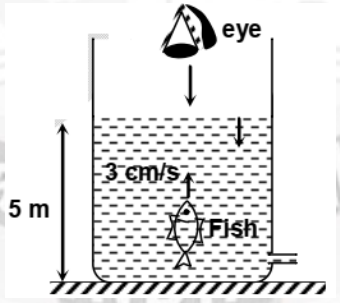
1. A very expensive diamond is polished into a perfect sphere of radius r = 1cm. The back surface of the sphere is then covered with silver. At what distance (in cm) in front of the sphere should a small source of light S be placed in order for the image to coincide with the source? (The index of refraction of diamond is $\mu = 2.4$)



2. A tank having cross sectional area A has a hole at the bottom of area of cross section $A_1 = A/1000$. Bottom of the tank is a plane mirror. The tank contains water of refractive index 4/3. At the instant, when height of the water in the tank is h = 5 m, a fish is rising vertically in the tank with a velocity 3 cm/sec toward the surface. Find the velocity of the fish as observed by the observer looking directly at the fish (in cm/s). (Take g = $10\,m/s^2$)
[Take speed of liquid from hole is $\sqrt{2gh}$]



3. An object moving along x-axis such that $x = \left(t^2 - 4t + 6\right)$m find distance travelled by particle from t = 0 to t = 3sec

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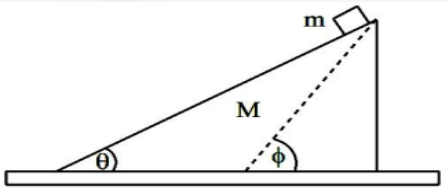
4. The wedge shown can slide without friction on a horizontal floor. Mass of the wedge is M and its angle of inclination is $\theta = 30^0$. A block of mass 'm' slides down the wedge without friction when released on its inclined face. If path of the block relative to the ground makes an angle of $\phi = 60^0$ with the horizontal, find the ratio of mass of the block to that of the wedge $\left(\frac{m}{M}\right)$



5. If the dimensions of length are expressed as $G^x c^y h^z$; where G, c and h are the universal gravitational constant, speed of light and Planck's constant respectively, then (z – y) is

6. A pendulum is hanging from a peg inserted in a vertical wall. Its bob is stretched in horizontal position from the wall and is left free to move. The bob hits on the wall the coefficient of restitution is $\frac{2}{\sqrt{5}}$. After how many collisions the amplitude of vibration will become less than 60^0

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

•This section contains SIX (06) questions.
•Each question has FOUR options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
•For each question, choose the option(s) corresponding to (all) the correct answer(s).
•Answer to each question will be evaluated **according to the following marking scheme:**
Full Marks:+4 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;
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Negative Marks: -2 In all other cases.

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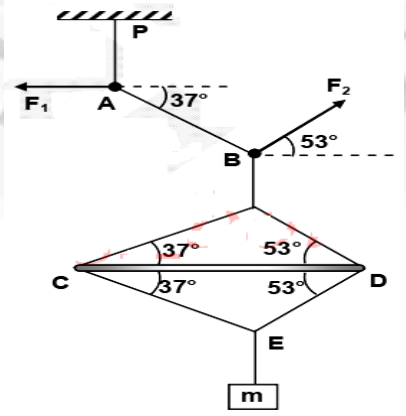
7. Block is in equilibrium and the tension in the string AB is 300 N. Then choose the correct option(s). (Take g = 10 m/s^2, $\tan 37^0 = \frac{3}{4}$ and neglect the mass of the rod CD)



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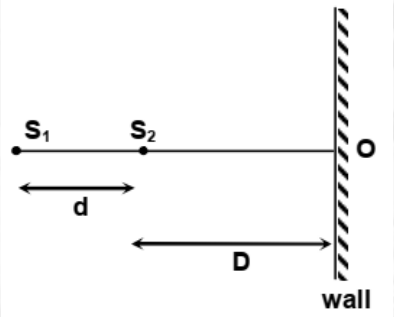
A) The tension in the string CE is 300 N

B) The ratio of force F_2 *and* F_1, $\left(\left|\frac{F_2}{F_1}\right|\right)$ *is* $\frac{5}{3}$

C) Force of compression in the rod CD is 480 N

D) Mass of the block is 50 kg

8. Two point sources are placed on a straight line separated by distance $d = 10\lambda$ where λ is wavelength of the light produced by sources. Both sources having same frequency and are placed at a distance D(>>d) = 2m from a wall which is perpendicular to straight line as shown in the fig. Both the sources are sending waves of equal intensity. Then which of the following is/are correct



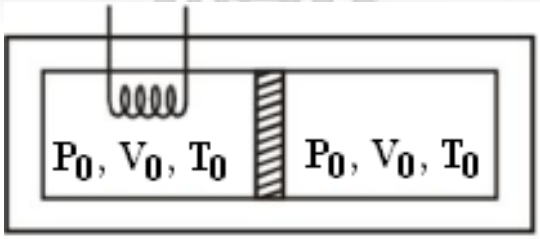
A) The locus of point on the wall having equal intensity are circle.

B) No. of dark rings will be observed on the wall are 10

C) Radius of 4th bright ring from O is 8/3m (exclude the position of O)

D) Radius of 4th bright ring from of is $\sqrt{21}\,m$ (exclude the position of O)

9. Fig. shows a double chambered vessel with thermally insulated walls and partitions. On each side there are n-moles of an ideal mono atomic gas. Initially the pressure, volume and temperature in each side is P_0, V_0, T_0. The heater in first chamber supplies heat very slowly till the gas in the first chamber expands such that the pressure, volume and temperature of the gas on the left side is P_1, V_1, T_1 respectively and on right chamber is $P_2 = \frac{27P_0}{8}, V_2$ *and* T_2 respectively



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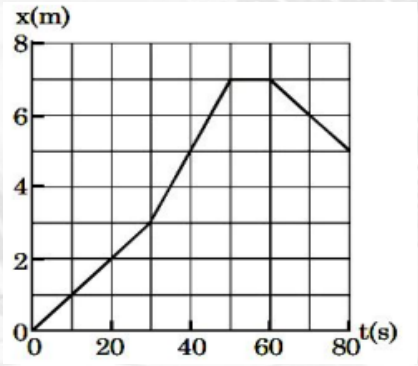
A) Volume of first chamber is $\left[2-\left(\frac{8}{27}\right)^{3/5}\right]V_0$

B) Temperature in second chamber is $\left(\frac{27}{8}\right)^{2/5}T_0$

C) Work done on the gas in second chamber in terms of molar heat capacity at constant volume and T_0 *is* $nC_VT_0\left[\left(\frac{27}{8}\right)^{2/5}-1\right]$

D) Work done on the gas in first chamber in terms of molar heat capacity at constant volume and T_0 *is* $nC_VT_0\left[\left(\frac{27}{8}\right)^{2/5}-1\right]$

10. Graph represents motion of an object along X–axis for 80s



A) the magnitude of displacement of the object for entire journey is 5 m

B) the distance the object travelled 9 m

C) speed of object at t = 20 s is 0.1 m/s

D) average speed for entire journey is 0.05 m/s

11. A block starting from rest slides down a rough fixed incline having angle of inclination 53^0. It covers 12 m in first two seconds i.e. from t = 0 to t = 2 sec. then

A) Velocity at t = 2 sec will be 12 m/s.

B) Distance covered in next 4 seconds will be 48 m.

C) Coefficient of friction between block & incline will be $\frac{1}{3}$

D) Coefficient of friction between block & incline will be $\frac{2}{3}$

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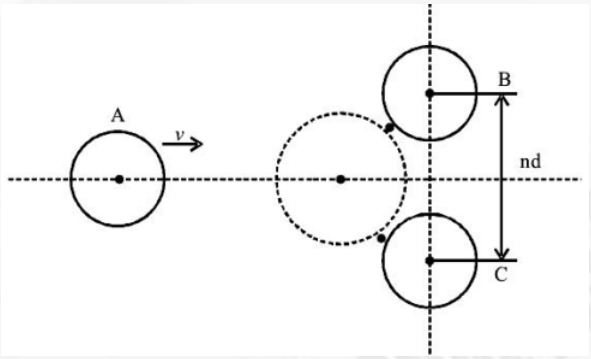
12. Three identical discs A, B and C rest on a smooth horizontal plane as shown in figure. The disc A is set in motion with velocity 'v' along the $\perp^r$ bisector of line BC. The distance between disc B and C is n times the diameter of each disc. For which of the following values of 'n' will the disc A continue moving after elastic collision.



A) $n=\sqrt{2.5}$ **B)** $n=\sqrt{2}$ **C)** $n=\sqrt{1.5}$ **D)** $n=\sqrt{3}$

SECTION – III
(NUMERICAL VALUE TYPE)

• This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
• For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
• Answer to each question will be evaluated according to the following marking scheme:
Full Marks: +4 If ONLY the correct numerical value is entered;
Zero Marks: 0 **In** all other cases..

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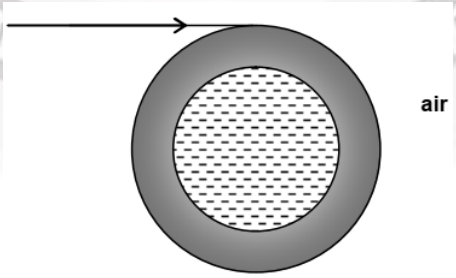
13. A capillary tube made of a material of refractive index 2. The outer radius of the tube is $\sqrt{3}R$ and inner radius is R. The tube is filled with a liquid of refractive index 1.5 A light ray is incident on the tube at grazing incidence (angle of incidence approximately $\approx 90^0$) on the outer surface of capillary tube as shown in the fig. The net angle of deviation is k^0. Find the value of 'k'



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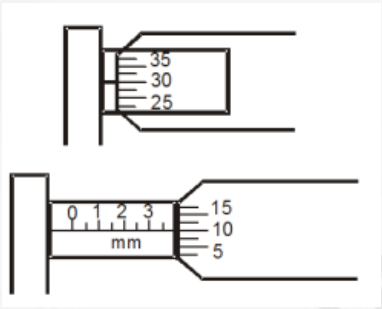
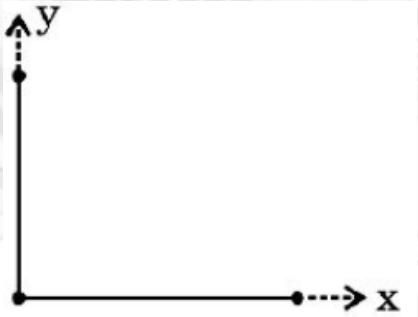
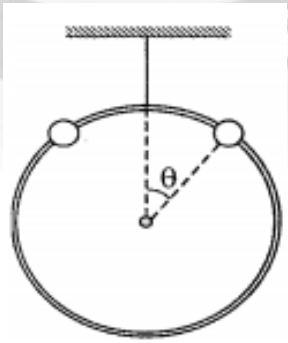
14. The pitch of screw gauge is 0.75 mm and there are 50 divisions on the circular scale. When nothing is put between the studs it shows the following where zero of mains scale is not visible. Now thickness of a metal plate is measured and when the plate is put between the studs it shows the following. The thickness of metal plate is (in mm) :



15. Two uniform rods of same length but different density are arranged as shown in the diagram. Centre of mass of this arrangement lies on a line ax + by = *l*. (*l* is the length of rod) find a + b = ?



16. A circular ring of mass 3 kg is suspended from an inextensible string, and two beads of mass 'm' slide on it without friction as shown in the figure. The beads are released simultaneously from the top of the ring and slide down symmetrically with respect to the vertical as shown. The ring will start to rise when $\theta = 60^0$. Then the value of 'm' in kg is



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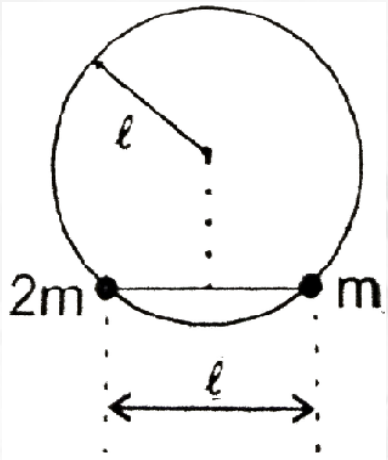
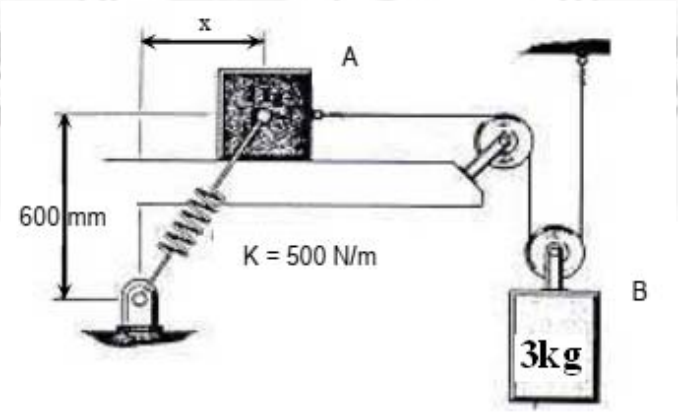
17. Two beads of mass 2m and m are connected by a rod of length *l* and of negligible mass are free to move in a circular wire frame of radius *l* as shown. Both are given speed 'v' tangentially in anti clock wise direction (when the rod is in horizontal position). The speed 'v' so that the rod becomes vertical is $\sqrt{\left(\frac{n\sqrt{n}-1}{n}\right)gl}$. Find the value of 'n'



18. Figure shows two blocks A and B are connected through pulley and spring system. Block A, on a frictionless surface, has a mass of 2 Kg, Block B, suspended by cables, has a mass of 3 Kg. The spring has a stiffness of k = 500 N/m and an unstretched length of 400 mm. the system is released from rest in the position shown (x = 800 mm).The speed of the block A (rounded off to the nearest higher integer) in m/s when x = 0 mm is

$\left[g = 10 m/s^2\right]$



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CHEMISTRY **Max Marks: 66**

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains SIX (06) questions.
- The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtualNumeric keypad in the place designated to enter the answer.
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19. How many of the following statements are correct?

A) Nitriles are selectively reduced by diisobutyl aluminium hydride, to imines followed by hydrolysis to give aldehydes

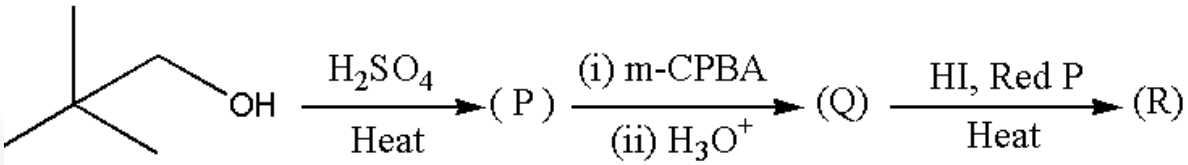
B) In Etards reaction chromyl chloride (CrO_2Cl_2) oxidizes methyl group to a chromium complex.

C) Phenyl or vinyl to the carboxylic acid, increases the acidity of corresponding carboxylic acid

D) Butan-2-ol and butan-1-ol can be differentiated by $(I_2 + NaOH)$

E) Propanal and propanone can be differentiated by 2, 4-DNP test

20. For the given reaction



Correct satatements is / are about products:
i) Number of all possible monobromo products for (R) are 6 (including stereo)
ii) (P) Show positive bromine water test
iii) Q) Gives methane gas with CH_3MgBr
iv) (Q) Can react with Na metal
v) (Q) gives negative Lucas test
vi) (P) Upon reductive ozolysis gives acetone and acetaldehyde

21. In the bellow given reaction total number of Carbon atoms present in organic product 'C' is

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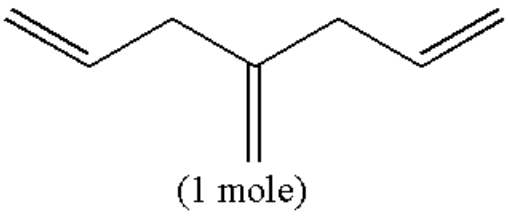
$$CH_3CHO \xrightarrow{K_2Cr_2O_7} (A) \xrightarrow{Ca(OH)_2} (B) \xrightarrow{\Delta} (C)\,(\text{organic product})$$

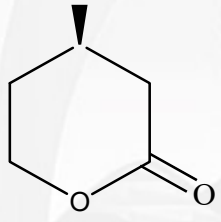
22.

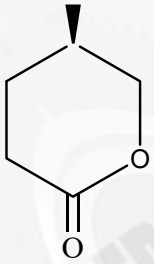


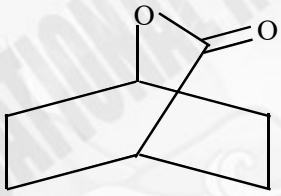
$$\xrightarrow[\text{Heat}]{\text{i. } KMnO_4,\ H^+} \underset{\textbf{p-moles}}{A + B\ (gas)}$$

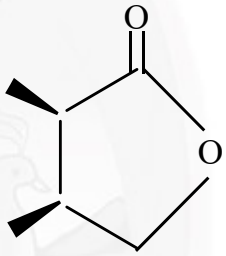
Find the value of 'p'?

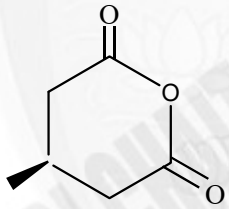
23. Find the number of compounds which on reduction with $LiAlH_4$ give optically inactive?

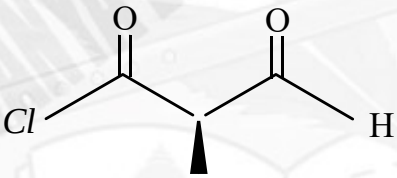
a) 

b) 

c) 

d) 

e) 

f) 

24. In the following Hofmann's bromamide reaction, how many different organic products would be formed?

$$H_3C-\overset{\overset{O}{\|}}{C}-NH_2 + CH_3CH_2-\overset{\overset{O}{\|}}{C}-\overset{15}{N}H_2 + Br_2 \xrightarrow{NaOH}$$

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

•This section contains SIX (06) questions.
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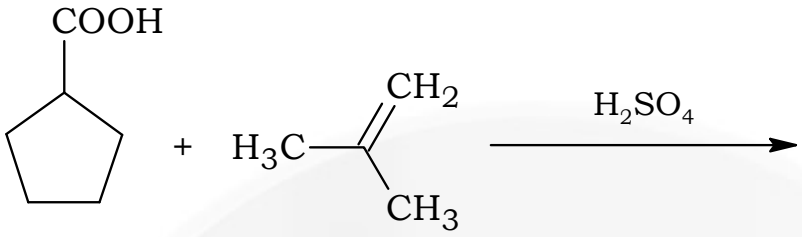
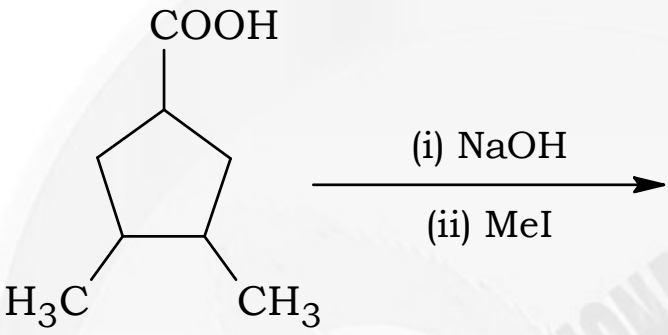
25. Which of the following reactions result in an ester?

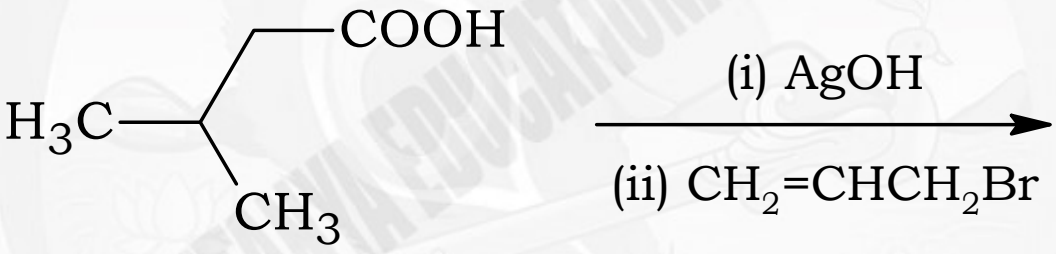
A)



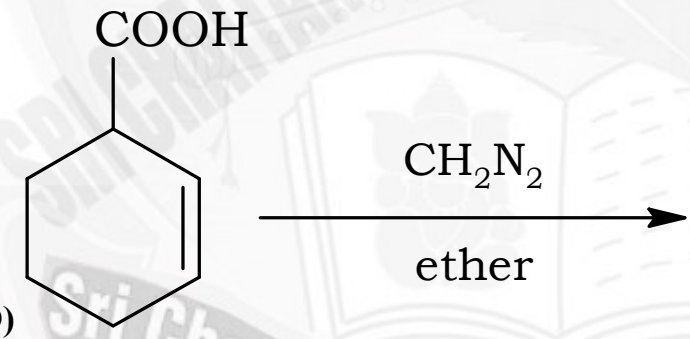
B)



C)

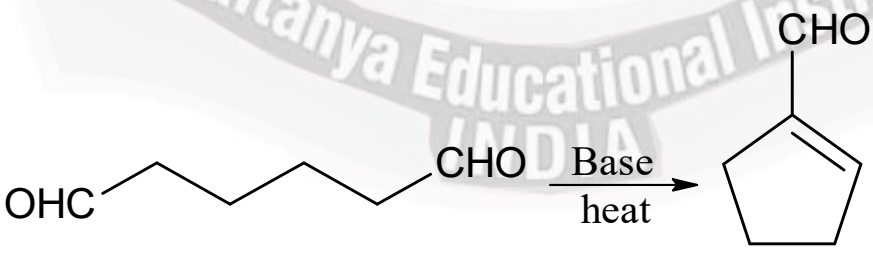


D)



26. Which of the following reaction is/are correctly matched

A)



B) $CH_3CH_2CH_2OH \xrightarrow{SOCl_2} \xrightarrow{KCN} \xrightarrow{Sn/HCl} CH_3CH_2CH_2CHO$

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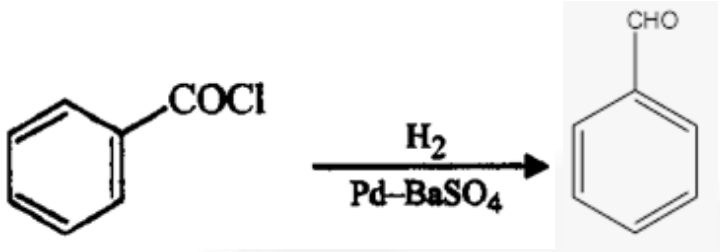
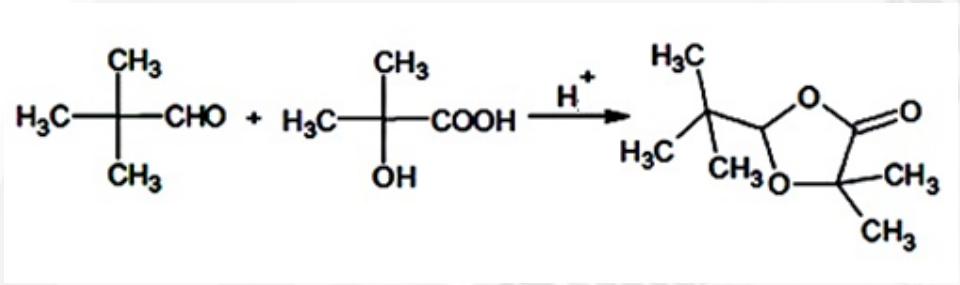
C)



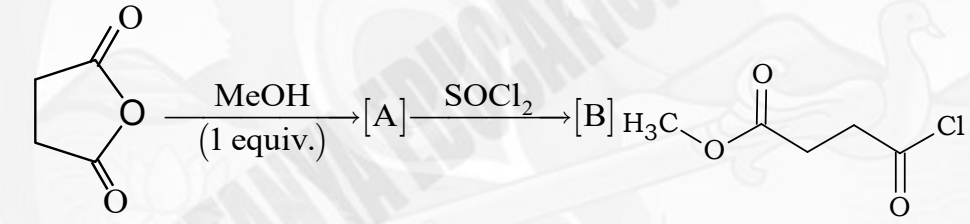
D) $CH \equiv CH \xrightarrow{Hg^{+2}/H_2SO_4} A \xrightarrow{Zn\text{-}Hg\ /\ HCl} C_2H_6$

27. Which of the following reactions is/are correct

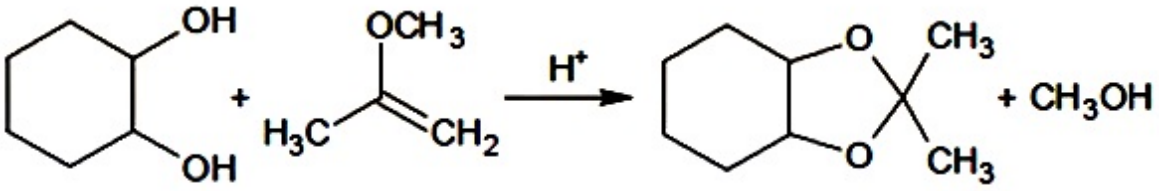
A)



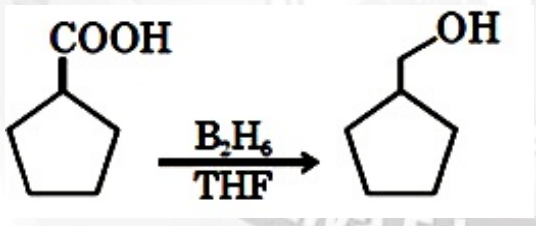
B)



C)



D)



28. Which of the following is true for 3-methyl-2-butanone

A) It may be prepared by CrO_3 oxidation of 2-butanol

B) Reaction with $NaBH_4$ gives a secondary alcohol

C) It may be prepared by acidic $HgSO_4$ / H_2SO_4 catalysed hydration of 3-methyl-1-butyne

D) It forms a silver mirror on treatment with $Ag(NH_3)_2^+$

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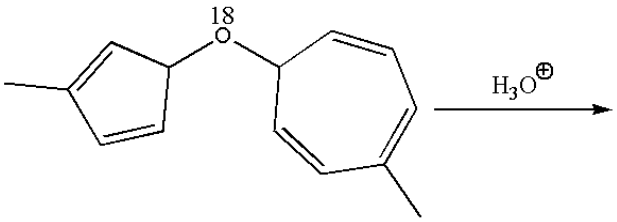
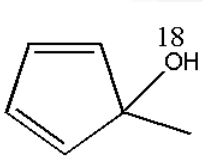
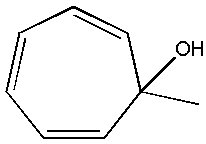
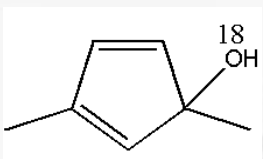
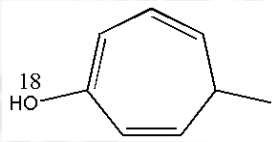
29. The product(s) obtained in the below reaction is /are

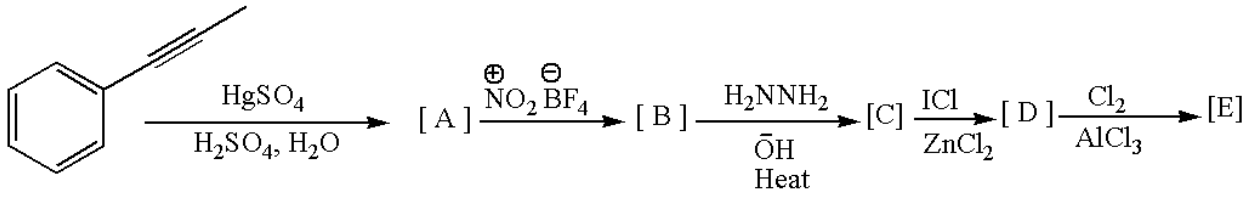


A) 

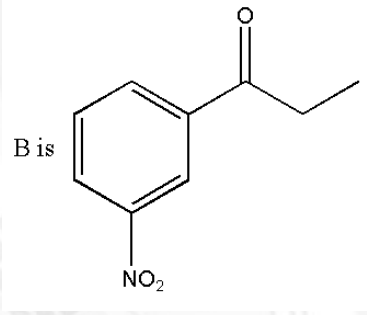
B) 

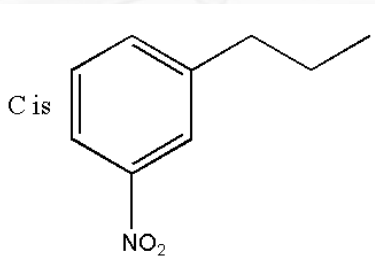
C) 

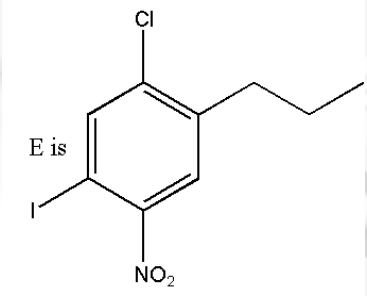
D) 

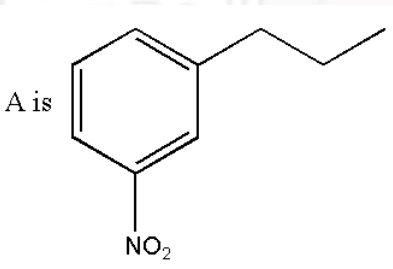
30. 

Which of the following is /are correct regarding above sequence of reactions?

A) 

B) 

C) 

D) 

SECTION – III
(NUMERICAL VALUE TYPE)

• This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
• For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
• Answer to each question will be evaluated according to the following marking scheme:
Full Marks: +4 If ONLY the correct numerical value is entered;

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Zero Marks: 0 **In** all other cases..

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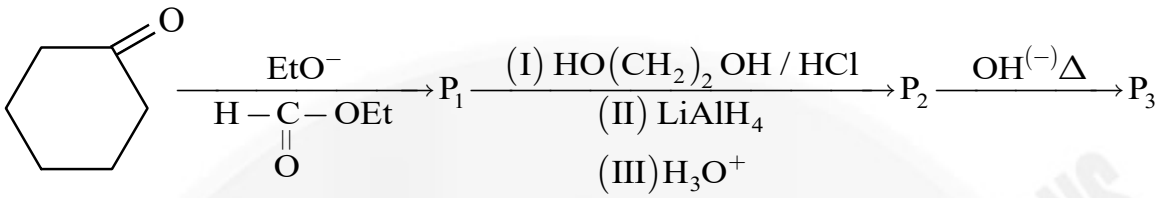
31.



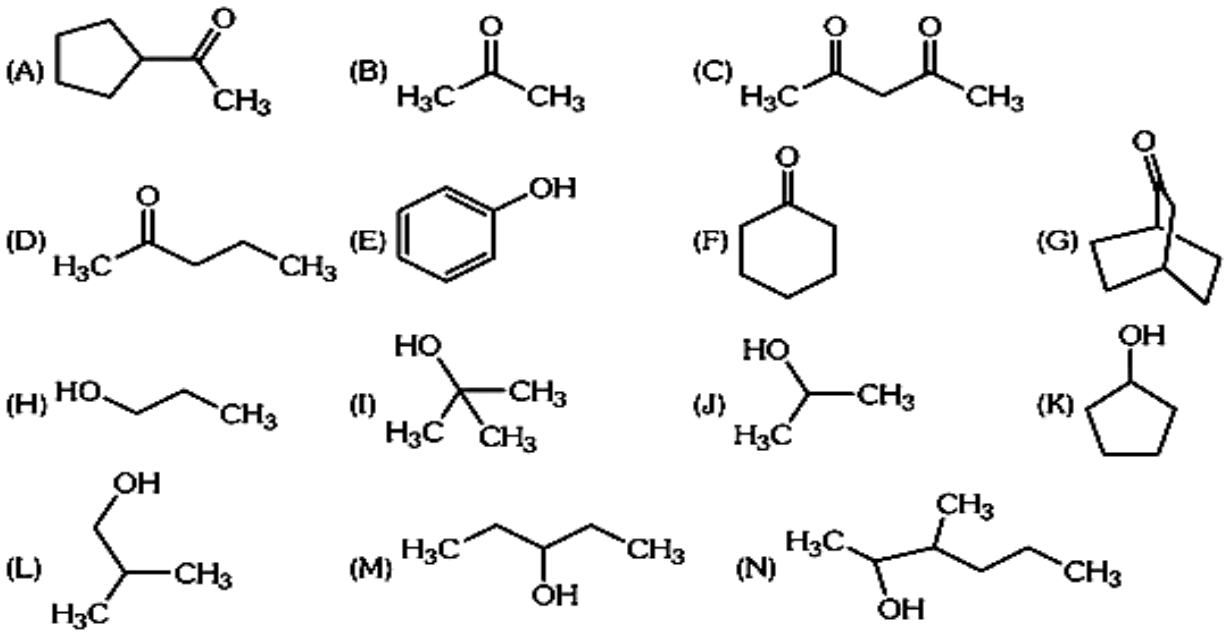
In the P_1, P_2 *and* P_3 total number products having -CHO functional group = x

and total compounds will go for elimination through $E1_{CB}$ = y, y/x is

32. In the bellow given compound:

If the total number compounds that gives reaction with NaOI = X

and total number compounds that gives lucas test immediately with anhy $ZnCl_2 = Y$ and total number of alcohols which react with $Cu/300^0$ to give alkene is Z, then $\frac{Y+Z}{X}$ is



33.

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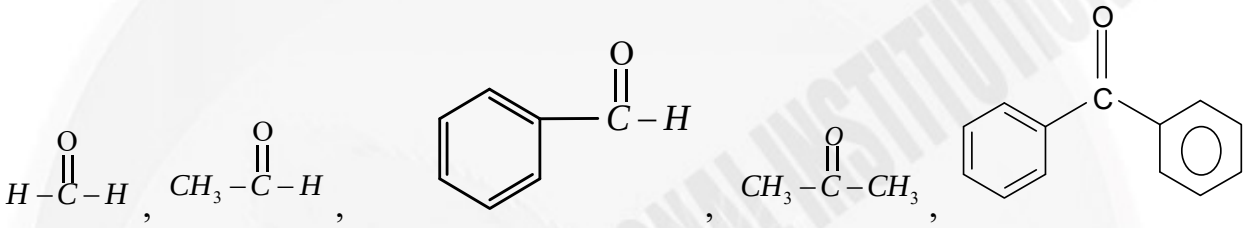
The number of the reagents from the following list, which can effect the above conversion.

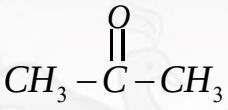
A) Na , Dry ether B) (i) NaCN (ii) H_3O^+ (iii) NaOH (iv) Electrolysis

C) Aq. NaOH D) Mg , R-OH

E) (i)Mg, dryether (ii) CO_2 (iii) H_3O^+ (iv) $LiAlH_4$ (v) H_3O^+ (vi) HI, Red P

34. In the given below compound



a) Number of compounds which are more reactive than  towards nucleophile addition is x

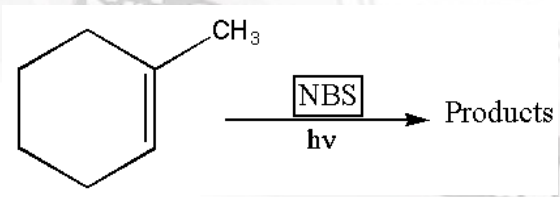
b) Number of compounds which give aldol and haloform (both) reaction is y

c) Number of compounds which give Tertiary alcohols reaction with RMgX is z

the answer is x, y, z. if your answer x is 1 y is 2 z is 3. write answer 123 on OMR sheet

35. A carbonyl compound of formula $C_9H_{10}O(A)$, which is a benzene derivative gives orange precipitate with 2, 4-D.N.P and also gives yellow precipitate with I_2 in presence of aqueous NaOH. The total no. of isomers possible for A are ……

36.



The number of all possible monobromo products (including stereoisomers) are___.

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JEE Advanced 2023 RANK 1 341/360
NEET 2023 RANK 1 720/720

MATHEMATICS **Max Marks: 66**

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains SIX (06) questions.
- The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.
- 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: +3 If ONLY the correct integer is entered;
Zero Marks: 0 If the question is unanswered;
Negative Marks: -1 In all other cases

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37. Find the value of $2l$, where $l = \lim\limits_{m\to\infty}\sum\limits_{k=1}^{m}\left(\frac{(-1)^{k-1}}{k}.\lim\limits_{n\to\infty}\sum\limits_{r=0}^{n}\frac{1}{1+k.2^r}\right)$

38. If (α_1,β_1), (α_2,β_2), ..., (α_n,β_n) are the points on the curve $S: y=\sin(x+y)\forall x\in[-4\pi, 4\pi]$ such that the tangents at these points to S are perpendicular to the line $(\sqrt{2}-1)x+y=0$ then the value of $\left[\frac{\sum\limits_{k=1}^{n}(|\alpha_k|-|\beta_k|)}{11}\right]$ is

(where [.] denotes greatest integer function)

39. If $\int\limits_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\frac{(\pi-4\theta)\tan\theta}{1-\tan\theta}\,d\theta=\pi\ln k-\frac{\pi^2}{w}$, find (kw), where k, w $\in$ N

40. Consider the following functions $f(x)=\tan(\pi x^3)\sqrt{9+\tan^2\pi x}\sqrt[3]{27+\tan^3\pi x}$ and $g(x)=\frac{\cos^{-1}x+\tan^{-1}x-\cos x\times\cos^{-1}x-\cos x\times\tan^{-1}x}{(1+x^2)\cot^{-1}x}$. The digit at the tens place in the value of $\frac{1}{\pi}(f'(-2)+\pi g''(0))$ is equal to

41. If $\int\frac{f'(x)x-f(x)}{(f(x)+x)\sqrt{f(x)x-x^2}}\,dx$ is equal to $\sqrt{m}\tan^{-1}\left(\sqrt{\frac{f(x)-x}{nx}}\right)+c$, where m, n $\in$ R and 'c' is constant of integration (x > 0) then $\frac{m}{n}$ is equal to

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JEE Advanced 2023 VAVILALA CHAITANYA REDDY RANK 1
NEET 2023 BORA VARUN CHAKRAVARTHI RANK 1

42. Let a_n denote the nth term in the infinite sequence 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, ……,, where natural number 'k', occurs exactly k-times. If $a_n = m$ and $l = \left(\lim\limits_{m\to\infty}\left(\frac{m}{\sqrt{n}}\right)\right)^2$, then $3l^2$ is equal to

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

•This section contains SIX (06) questions.
•Each question has FOUR options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
•For each question, choose the option(s) corresponding to (all) the correct answer(s).
•Answer to each question will be evaluated **according to the following marking scheme:**
Full Marks: +4 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 none of the options is chosen (i.e. the question is unanswered);
Negative Marks: -2 In all other cases.

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43. If $f'(x) = \frac{1}{1+x^2};\ \forall x \in (-\infty, -1] \cup [1, \infty)$ *and* $f\left(\sqrt{3}\right) = \frac{\pi}{6}$, *then* $f\left(-\sqrt{3}\right)$ can be equal to

A) $\frac{\pi}{6}$ **B)** $\frac{\pi}{2}$ **C)** $\frac{5\pi}{6}$ **D)** $-\frac{\pi}{2}$

44. Let $I = \int\limits_{-\infty}^{\infty} \frac{\sin\left(x+\frac{1}{x}\right)\cos\left(x-\frac{1}{x}\right)}{x+\frac{1}{x}}.dx$, *then*

A) $I = \int\limits_{0}^{\infty} \frac{\sin 2x + \sin\frac{2}{x}}{x+\frac{1}{x}}.dx$ **B)** $I = \int\limits_{0}^{\infty} \frac{\sin 2x + \sin\frac{2}{x}}{x+\frac{1}{x}}.\frac{dx}{x^2}$

C) $I = \int\limits_{0}^{\infty} \frac{\sin x}{x}.dx$ **D)** $I = \int\limits_{0}^{\infty} \frac{\sin\frac{2}{x}}{x}.dx$

45. If $\alpha, \beta \in R,\ \beta \neq 0,\ n \in N$ *and* $\lim\limits_{n\to\infty} \frac{\sqrt[n^2]{(1!)(2!)(3!).....(n!)}}{n^\alpha} = \beta$, then

A) $\alpha^2 + \frac{1}{3}\ln\beta = 0$ **B)** $2\alpha + 4\ln\beta = -2$

C) $\alpha^2 + \frac{1}{3}\ln\beta = \frac{1}{2}$ **D)** $2\alpha + 4\ln\beta = 4$

46. Consider the series $f(x) = 1 + 3\sin^2 x + 5\sin^4 x + ...\infty,\ g(x) = \cos x + \cos 3x + \cos 5x +$ …..n terms, then

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NEET 2023 RANK 1 720/720

A) $\int f(x)dx = \tan x + \frac{2\tan^3 x}{3} + C$ (where C is constant of integration, $x \neq (2n+1)\frac{\pi}{2}$)

B) $\lim_{x\to 0}\left(f(x)\right)^{\frac{\cos ec^2 x}{g^2(x)}} = e^{\frac{3}{n^2}}$

C) If $I_{2n} = \int_0^{\frac{\pi}{2}} g(x)dx$, then maximum value of $(I_{2n+2} - I_{2n})$ *is* $\frac{1}{5}$ *for* $n \in [1,6], n \in N$

D) If $x \in [0, \pi]$ *and* $n = 4$, then equation g(x) = 0 has 9 solutions

47. Let $f:[0,1] \to \mathbb{R}$ be a continuous function on [0, 1]. Which of the following options is/are always correct, if $\int_0^1 f(x).\,dx = 0$? $\left(\text{note that } \lambda = \int_0^c f(x)\,dx\right)$

A) There exists at least one $c \in (0,1)$, such that $f(c) = \lambda$

B) There exists at least one $c \in (0,1)$, such that $(1-c)f(c) = c\lambda$

C) There exists at least one $c \in (0,1)$, such that $f(c) = c\lambda$

D) There exists at least one $c \in (0,1)$, such that $f(c) = (1-2c)\lambda$

48. $\int \frac{x^4}{\left(x^4+1\right)^2}dx = \frac{-x}{A\left(x^4+1\right)} + \frac{1}{8\sqrt{2}}\tan^{-1}\left(f(x)\right) - \frac{1}{16\sqrt{2}}\ln\left(\frac{x^2-\sqrt{2}x+1}{g(x)}\right) + C$, where f(1) = 0, then

A) A = 4 **B)** $g(\sqrt{2}) = 5$ **C)** $f(\sqrt{2}) = \frac{1}{2}$ **D)** $f(3) = \frac{1}{9}$

SECTION – III
(NUMERICAL VALUE TYPE)

- This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks: +4 If ONLY the correct numerical value is entered;
Zero Marks: 0 **In** all other cases..

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JEE Advanced 2023 RANK 1
NEET 2023 RANK 1

49. Consider the Fibonaaci sequence, defined as $F_{n+1} = F_n + F_{n-1}$ for $n \geq 1$, $F_0 = F_1 = 1$. The terms are {1, 1, 2, 3, 5, 8, 13, 21, 34, ……}. We modify it, with the notation $F^{/i}$, for $i = 2,3,$ …….. to indicate :

$F^{/2} = 2,5,13,34,89,223,.....$

$F^{/3} =$ 4, 16, 68, 288, 1220, ……..

$F^{/4} =$ 7, 47, 322, 2207, 15127, …..

That is, say for $F^{/3}$ we take first three elements of the Fibonaaci sequence to get first term of $F^{/3}$, 1 + 1 + 2 = 4, then 3 + 5 + 8 = 16 and so on and same goes for $F^{/j}$.

If we let $L_i = \lim\limits_{n\to\infty} \dfrac{F_{n+1}^{/i}}{F_n^{/i}}, i \in N - \{1\}$, then find value of $\lim\limits_{n\to\infty} \sum\limits_{i=2}^{n} \dfrac{1}{L_i}$

50. Let P(r) denote number of points (x, y) (where x, y ∈ I) which lie inside or on the boundary of the region enclosed by the curve whose joint equation is

$|xy| - r(|x| + |y|) + r^2 = 0, r \in N$ and if $\lim\limits_{n\to\infty} \dfrac{\left(\sum\limits_{r=1}^{r=n} P(r)\right) - \lambda n^3}{an^2 + bn + c} = \dfrac{1}{2}$ then find the value of $a - 3\lambda$

51. Find out the value of

$$\min_{p.q.r.s \in R^+} \left(\sqrt{p^2 + (20-q)^2} + \sqrt{q^2 + (21-r)^2} + \sqrt{r^2 + (20-s)^2} + \sqrt{s^2 + (21-p)^2} \right)$$

52. Find the value of $I = \int_0^7 \left(\left(x + \sqrt{x^2+1} \right)^{1/3} + \left(x - \sqrt{x^2+1} \right)^{1/3} \right) dx$

53. Let m, n, p, q are real numbers such that

$\left| \sqrt{x^2+1} - \left(mx^2 + n \right) \right| \leq 1 \forall x \in [p, q]$

If the largest value of q – p satisfying the given conditions, is equal to $4\sqrt{a + b\sqrt{2}}$; $a, b \in N$, then the value of a + b is equal to ……

54. Consider the following functions $f(x) = \dfrac{1 - x^2 + 4x}{1 + x^2}$, $g(x) = \dfrac{3 - 4x + 3x^2}{1 - x^2}$, $h(x) = \dfrac{2x}{1 - x^2}$

If $a, b \in \mathbb{R}$ and f(a) = g(b), then find the value of $h^2(a) + h^2(b)$

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