



Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

Sec: Sr.Super60_NUCLEUS & STERLING_BT

Paper -2(Adv-2022-P2-Model)

Date: 24-09-2023

Time: 02.00Pm to 05.00Pm

CTA-05 & CTA-07

Max. Marks: 180

24-09-2023_Sr.Super60_NUCLEUS & STERLING_BT_Jee-Adv(2022-P2)_CTA-05 & CTA-07_Syllabus

MATHEMATICS : Functions & LCD, Application of Differentiation (AOD), TOTAL

DIFFERENTIAL CALCULUS, Indefinite Integration, Definite Integration, Areas & Differential Equations , Total Integral Calculus, Vectors & 3D-Geometry

PHYSICS : Thermal physics, Geometrical optics, Wave optics, General Physics, Kinematics, NLM, Friction, Circular motion, WPE, COM & Collisions, Rigid body Dynamics 1, Rigid body Dynamics 2

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, 1.Classification of Elements and Periodicity in Properties, 2.Chemical bonding and Molecular Structure, 3.Hydrogen

Name of the Student: _____

H.T. NO:

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**JEE-ADVANCE-2022-P2-Model**

Time:3Hr's

IMPORTANT INSTRUCTIONS

Max Marks: 180

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Integer Answer Type	+3	-1	8	24
Sec – II(Q.N : 9 – 14)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – III(Q.N : 15 – 18)	Questions with Single Correct Choice	+3	-1	4	12
Total				18	60

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 19 – 26)	Questions with Integer Answer Type	+3	-1	8	24
Sec – II(Q.N : 27 – 32)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – III(Q.N : 33 – 36)	Questions with Single Correct Choice	+3	-1	4	12
Total				18	60

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 37 – 44)	Questions with Integer Answer Type	+3	-1	8	24
Sec – II(Q.N : 45 – 50)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – III(Q.N : 51 – 54)	Questions with Single Correct Choice	+3	-1	4	12
Total				18	60

Sec: Sr.Super60_NUCLEUS & STERLING_BT

Space for rough work

Page 2

**Sri Chaitanya**
Educational Institutions**THE PERFECT HAT-TRICK WITH ALL- INDIA RANK 1
IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023****JEE MAIN**RANK
SINGARAJU
VENKAT KOSHIRAJU
RANK 1
300
300**JEE Advanced**RANK
VAVILALA
CHIRUVAAS REDDY
RANK 1
341
360**NEET**RANK
RISHI VARUN
CHANDRASEKHAR
RANK 1
720
720



MATHEMATICS

Max Marks : 60

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains EIGHT (08) 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

1. If $f(x) = \prod_{k=1}^{\infty} \left(\frac{1 + 2 \cos\left(\frac{2x}{3^k}\right)}{3} \right)$, then number of points where $\left[xf(x) \right] + |xf(x)| + (x-1)|x^2 - 3x + 2|$ is non-differentiable in $x \in (0, 4\pi)$ is equal to (where $[.]$ denotes greatest integer function)
2. For $x \in \mathbb{R}$, let $\tan^{-1}(x) \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. The minimum value of the function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \int_0^{x \tan^{-1} x} \frac{e^{(t-\cos t)}}{1+t^{2023}} dt$ is R, then $R + 2$ is equal to _____
3. If $(a-a')^2 + (b-b')^2 + (c-c')^2 = 8$, $(ab'-a'b)^2 + (bc'-b'c)^2 + (ca'-c'a)^2 = 2$. Then the perpendicular distance of the line $a'x + b'y + c'z = 1$, $ax + by + cz = 1$ from origin is $(a', b', c', a, b, c \in \mathbb{R})$:
4. If the value of limit, $\lim_{x \rightarrow 0} \frac{(1+x)^{\frac{1}{x}} - e + \frac{ex}{2}}{ex^2} = \frac{A}{B}$ where A and B are relatively prime positive integers, then the value of $\frac{A+B}{7}$ is _____
5. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function, satisfying $f((x-y)^2) = (f(x))^2 - 2xf(y) + y^2 \forall x, y \in \mathbb{R}$ Number of possible functions that satisfy above functional equation is _____





6. Let $f(x) = \sin^8(x) + \cos^8(x) + \frac{3}{8}\sin^4(2x)$. Let $f^{(n)}(x)$ be the n th derivative of f .

The largest integer a such that 2^a divides $\left|f^{(2020)}\left(\frac{\pi}{12}\right)\right|$ is R , then value of unit's place in R is _____

7. The point of intersection C of the plane $8x + y + 2z = 0$ and the line joining the points $A(-3, -6, 1)$ and $B(2, 4, -3)$ divides the line segment AB internally in the ratio $k : 1$. If a, b, c ($|a|, |b|, |c|$ are pair wise coprime) are the direction ratios of the perpendicular from the point C on the line $\frac{1-x}{1} = \frac{y+4}{2} = \frac{z+2}{3}$, then $|a+b+c|$ is equal to _____.

8. The minimum possible value of $\sqrt{58-42x} + \sqrt{149-140\sqrt{1-x^2}}$ where $-1 \leq x \leq 1$ is \sqrt{R} then the absolute difference of largest and smallest digit of R is _____

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.

9. Let $S = (0,1) \cup (1,2) \cup (3,4)$ and $T = \{0,1,2,3,4\}$. Then which of the following statements is(are) true?

- A) There are infinitely many functions from S to T
 B) There are infinitely many strictly increasing functions from S to T
 C) The number of continuous functions from S to T is at most 120
 D) Every continuous function from S to T is differentiable

10. Let $f : [0,1] \rightarrow [0,1]$ be the function defined by $f(x) = \frac{x^3}{3} - x^2 + \frac{5}{9}x + \frac{17}{36}$.

Consider the square region $S = [0,1] \times [0,1]$. Let $G = \{(x,y) \in S : y > f(x)\}$ be called the green region and $R = \{(x,y) \in S : y < f(x)\}$ be called the red region. Let

$L_h = \{(x,h) \in S : x \in [0,1]\}$ be the horizontal line drawn at a height $h \in [0,1]$. Then which of the following statements is(are) true?





- A) There exists an $h \in \left[\frac{1}{4}, \frac{2}{3}\right]$ such that the area of the green region above the line L_h equals the area of the green region below the line L_h
- B) There exists an $h \in \left[\frac{1}{4}, \frac{2}{3}\right]$ such that the area of the red region above the line L_h equals the area of the red region below the line L_h
- C) There exists an $h \in \left[\frac{1}{4}, \frac{2}{3}\right]$ such that the area of the green region above the line L_h equals the area of the red region below the line L_h
- D) There exists an $h \in \left[\frac{1}{4}, \frac{2}{3}\right]$ such that the area of the red region above the line L_h equals the area of the green region below the line L_h

11. Let O is the circumcentre of the triangle ABC. D, E, F are midpoints of sides BC, CA, AB respectively. P, Q, R are centroids of triangles ADC, BEA, CFB. Identify the **TRUE** statements from the following.

- A) If $OR \perp AD$, then $AB = BC$ B) If $OP \perp AE$, then $BA \perp AC$
 C) If $OQ \perp BE$, then $AB = AC$ D) If $OP \perp AD$, then $CB = AC$

12. The value(s) of x satisfying the equation $x^9 + \frac{9}{8}x^6 + \frac{27}{64}x^3 - x + \frac{219}{512} = 0$ is

- A) $\frac{-1 + \sqrt{13}}{4}$ B) $\frac{-1}{2}$
 C) $\frac{-1 - \sqrt{13}}{4}$ D) more than two real and distinct values

13. Consider $f(x) = \int \left(\frac{e^{x^2}(4x^2 - 1)}{\frac{3}{x^2}} \right) dx$ with $f(1) = 2e$. If $A = \int_{\frac{1}{e}}^e f(x) dx$, then which of the following statements is/are **CORRECT**?

- A) maximum value of $f(x)$ is $\sqrt{2}e^{\frac{11}{4}}$ B) minimum value of $f(x)$ is $2\sqrt{2}e^{\frac{1}{4}}$
 C) $A > 2\sqrt{2}e^{\frac{1}{4}} \left(e - \frac{1}{e} \right)$ D) $A < \left(1 - \frac{2}{e} \right) e^{\left(\frac{1}{e^2} + \frac{1}{2} \right)} + (2e - 1)e^{\left(e^2 - \frac{1}{2} \right)}$





14. A tetrahedron has all its faces triangles with sides 13, 14, 15. The volume of the tetrahedron is $R\sqrt{N}$, (where R and N are two digit natural numbers) then which of the following is/are **CORRECT**?

A) $R + N < 100$ B) $|R - N| < 20$ C) $R + N > 100$ D) $|R - N| > 30$

SECTION – III
(SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** 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

15.
$$\int_0^{\pi} \frac{x \sin 2x \sin\left(\frac{\pi}{2} \cos x\right)}{2x - \pi} dx =$$

A) $\frac{8}{\pi^2}$ B) $\frac{4}{\pi^2}$ C) $\frac{2}{\pi^2}$ D) $\frac{1}{\pi^2}$

16. Let $y = y(x)$ be the solution of the differential equation

$(3y^2 - 5x^2)y dx + 2x(x^2 - y^2)dy = 0$ such that $y(1) = 1$. then $\left|(y(2))^3 - 12y(2)\right|$ is equal to :

A) $32\sqrt{2}$ B) 64 C) $16\sqrt{2}$ D) 32

17. If a point $P(\alpha, \beta, \gamma)$ satisfying $\begin{bmatrix} \alpha & \beta & \gamma \end{bmatrix} \begin{bmatrix} 2 & 10 & 8 \\ 9 & 3 & 8 \\ 8 & 4 & 8 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$ lies on the plane

$2x + 4y + 3z = 5$ then $6\alpha + 9\beta + 7\gamma$ is equal to :

A) -1 B) $\frac{11}{5}$ C) $\frac{5}{4}$ D) 11

18. Let the solution curve $y = y(x)$ of the differential equation

$$\frac{dy}{dx} - \frac{3x^5 \tan^{-1}(x^3)}{(1+x^6)^{\frac{3}{2}}} y = 2x \exp\left(\frac{x^3 - \tan^{-1} x^3}{\sqrt{1+x^6}}\right)$$
 pass through the origin. Then $y(1)$ is equal to :

A) $\exp\left(\frac{4-\pi}{4\sqrt{2}}\right)$ B) $\exp\left(\frac{\pi-4}{4\sqrt{2}}\right)$ C) $\exp\left(\frac{1-\pi}{4\sqrt{2}}\right)$ D) $\exp\left(\frac{4+\pi}{4\sqrt{2}}\right)$





PHYSICS

Max Marks:60

SECTION-I
(INTEGER ANSWER TYPE)

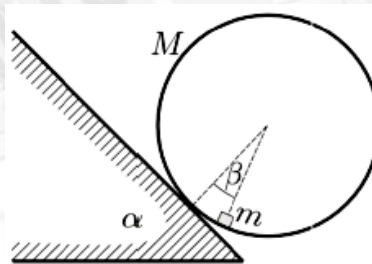
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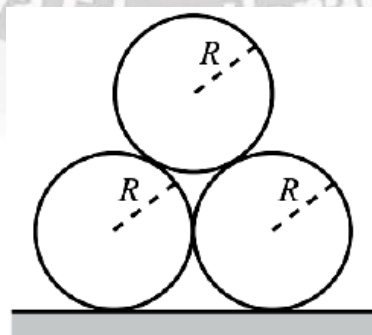
Zero Marks:0 If the question is unanswered;

Negative Marks:-1 In all other cases

19. A small sphere with mass $m = 1 \text{ g}$ is moving along a smooth surface, sliding back and forth and colliding elastically with a wall and a block. The mass of the rectangular block is $M = 1 \text{ kg}$, the initial velocity of the sphere is $v_0 = 10 \text{ m/s}$. What is the velocity of the sphere at the instant when the distance between the block and the wall has doubled as compared with the initial distance?
20. An empty cylinder with mass M is rolling without slipping along a slanted surface, whose angle of inclination is $\alpha = 45^\circ$. On its inner surface can slide freely a small block of mass $m = M/2$. What is the angle β between the normal to the slanted surface and the straight line segment connecting the centre of the cylinder and the block? If $\tan \beta = \frac{2}{n}$, find $n = ?$



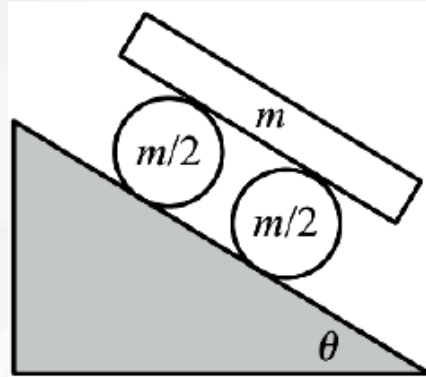
21. Three identical cylinders with moments of inertia $I = \frac{mR^2}{2}$ are situated as shown in fig. Find the initial downward acceleration of the top cylinder? There is friction between the bottom two cylinders and the ground (so they roll without slipping), but there is no friction between any of the cylinders. ($g = 10 \text{ m/s}^2$)

JEE MAIN
2023SINGARAJU
VENKAT KISHORENNA
RANK 1
300RANK
1JEE Advanced
2023VAVILALA
CHIRUVAAS REDDY
RANK 1
341RANK
1NEET
2023KOTLA VARUN
RANK 1
720RANK
1

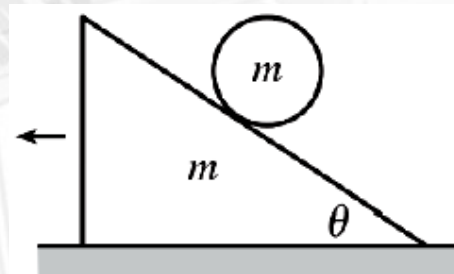


22. A board lies on top of two uniform cylinders that lie on a fixed plane inclined at an angle θ , as shown in fig. The board has mass m , and each of the cylinders has mass $m/2$. The system is released from rest. If there is no slipping between any of the surfaces, what is the acceleration (a) of the board? If $a = \frac{12K}{11}$. Find $K = ?$

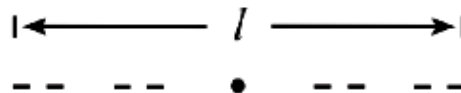
$$(\theta = 37^\circ, g = 10 \text{ m/s}^2)$$



23. A cylinder of mass m is held motionless on a plane of same mass and angle of inclination θ . The plane rests on frictionless horizontal surface. The cylinder is released. Assuming that it rolls without slipping on the plane, what is the horizontal acceleration (a) of the plane? $\theta = 45^\circ$ ($g = 10 \text{ m/s}^2$) If $a = \sqrt{K}$. Find $K = ?$

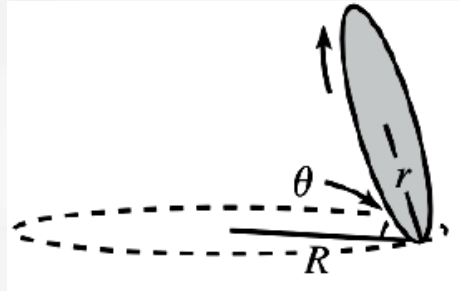


24. Take a stick of length ℓ , and remove the middle third. Then remove the middle third from each of the remaining two pieces. Then remove the middle third from each of the remaining four pieces, and so on, forever. Let the final object have mass m , and let the axis be through the center, perpendicular to the stick; see fig. If moment of inertia of such a stick is $\frac{1}{n} m \ell^2$, find $n = ?$

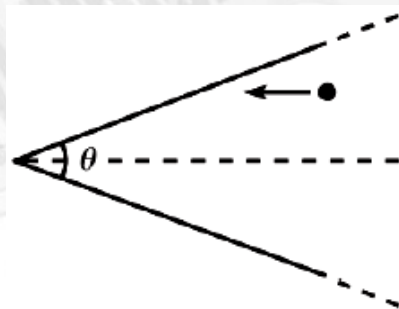




25. Initial conditions have been set up so that a coin of radius r rolls around in a circle, as shown in fig. The contact point on the ground traces out a circle, of radius R , and the coin makes a constant angle θ with the horizontal. The coin rolls without slipping (assume that the friction with the ground is as large as needed). What is the angular-velocity Ω , of the circular motion of the contact point on the ground? Where ($R = 6\text{m}$, $r = 2\text{m}$, $\theta = 53^\circ$) ($g = 10 \text{ m/s}^2$)



26. A ball is thrown against a wall of a very long triangular room which has vertex angle θ . The initial direction of the ball is parallel to the angle bisector see fig. How many (elastic) bounces does the ball make? Assume that the walls are frictionless. ($\theta = 30^\circ$)



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:

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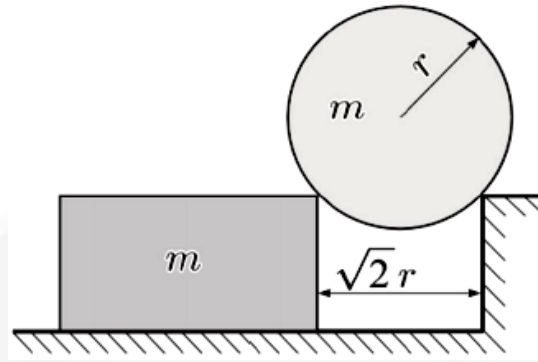
Partial Marks: +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

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

Negative Marks: -2 In all other cases.

27. Two slippery horizontal surfaces form a step. A block with the same height as the step is pushed near the step, and a cylinder with radius r is placed on the gap. Both the cylinder and the block have mass m . Find the normal force N between the cylinder and the step at the moment when distance between the block and the step is $\sqrt{2}r$. Initially, the block and the step were very close together and all bodies were at rest. Friction is zero everywhere. Will the cylinder first separate from the block or the step?





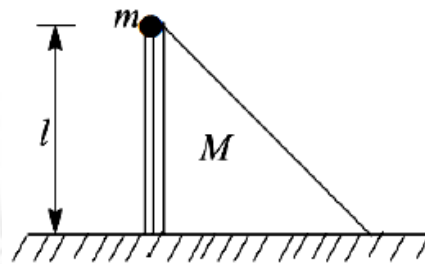
A) $N = \frac{mg(5\sqrt{2} - 4)}{6}$

B) $N = \frac{mg(6\sqrt{2} - 4)}{6}$

C) First separate from block

D) Separate simultaneously from block and step

28. A weightless rod of length ℓ with a small load of mass m at one of its end is held vertical with its lower end hinged on a horizontal surface. The load touches a wedge right sets the system in motion (see figure), with rod rotating freely in vertical plane about its lower end. There is no friction. If the rod forms an angle $\theta = \frac{\pi}{3}$ with the vertical at the moment the load separates from the wedge, then



A) The mass ratio $\frac{M}{m} = 3$

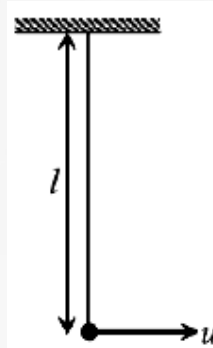
B) The speed of the wedge at that moment will be $\sqrt{\frac{g\ell}{8}}$

C) The mass ratio $\frac{M}{m} = 4$

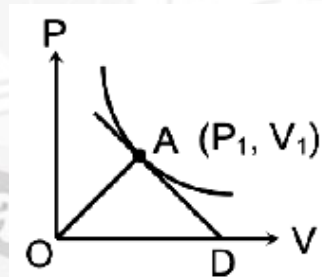
D) The speed of the bob at that moment will be $\sqrt{\frac{g\ell}{2}}$



29. A particle of mass m is attached to one end of the light inextensible string and other end of the string is fixed in vertical plane as shown. Now particle is given horizontal velocity $u = \sqrt{\frac{5}{2} g \ell}$, then which of the following statement/s is/are **CORRECT**?



- A) The string makes angle with the downward vertical is 60° when acceleration of the particle is horizontal.
- B) The tension in string is $2 mg$ when acceleration of the particle is horizontal.
- C) The speed of the particle is $\sqrt{\frac{3}{2} g \ell}$ when acceleration of the particle is horizontal.
- D) The particle will not complete the circle.
30. n moles of an ideal gas undergo an isothermal process at temperature T . P - V graph of the process is as shown in the figure. A point $A(V_1, P_1)$ is located on the P - V curve. Tangent at point A , cuts the V -axis at point D . AO is the line joining the point A to the origin O of PV diagram. Then,

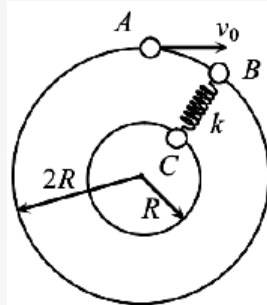


- A) Coordinates of points D is $\left(\frac{3V_1}{2}, 0\right)$ B) Coordinates of points D is $(2V_1, 0)$
- C) Area of the triangle AOD is nRT D) Area of the triangle AOD is $\frac{3}{4} nRT$

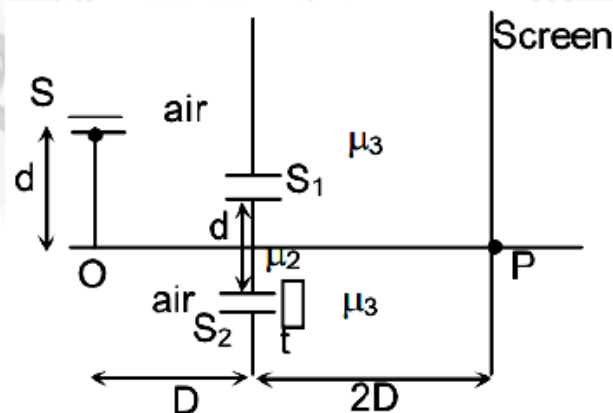




31. Three particles each of mass m , can slide on fixed frictionless circular tracks in the same horizontal plane as shown. Particle A moves with velocity v_0 and hits particle B elastically. Assuming that B and C are initially at rest and lie along a radial line and the spring is initially relaxed before impact, then



- A) The velocity of B immediately after impact is v_0
- B) The velocity of C when the stretch in the spring is maximum is $\frac{2v_0}{5}$
- C) The velocity of B when the stretch in the spring is maximum is $\frac{4v_0}{5}$
- D) The maximum stretch in the spring is $\sqrt{\frac{m}{4k}}v_0$
32. Consider the situation shown in the figure. Two slits S_1 and S_2 are placed symmetrically about the line OP which is perpendicular to screen and bisector to line joining the slits. The space between screen and slits is filled with a liquid of refractive index μ_3 . A plate of thickness t and refractive index μ_2 is placed in front of one of the slit. A source S is placed above OP at a distance d in front of slit.
- (Given that $D = 1\text{m}$, $d = 2\text{mm}$, $t = 6 \times 10^{-6}\text{m}$, $\mu_2 = 1.2$, $\mu_3 = 1.8$, Choose the correct alternatives)





- A) Position of central maxima from point P is $1/9$ mm.
 B) Position of central maxima from point P is $2/9$ mm.
 C) If slab is removed, the central maxima shifts by a distance of 2 mm.
 D) If slab is removed, the central maxima shifts by a distance of $20/9$ mm.

SECTION – III
(SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** 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:

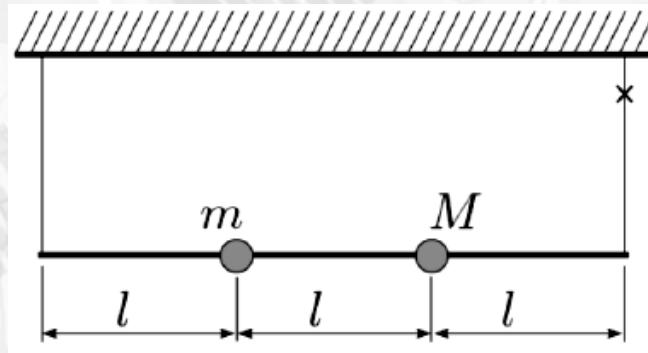
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Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

Negative Marks : -1 In all other cases

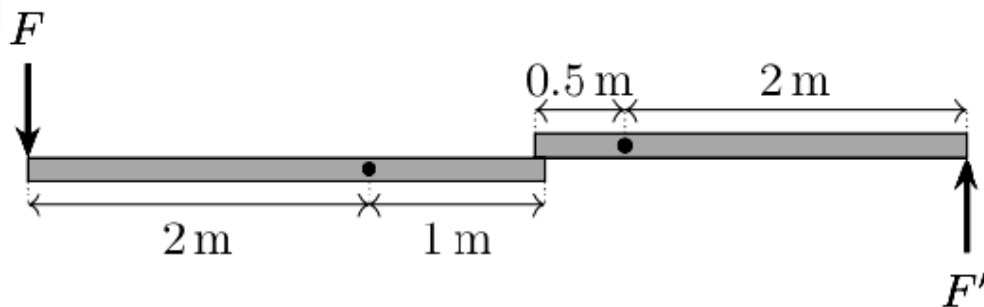
33. A light rod with length 3ℓ is attached to the ceiling by two strings with equal lengths.

Two balls with masses m and M are fixed to the rod, the distance between them and their distances from the ends of the rod are all equal to ℓ . Find the tension in the second string right after the first has been cut.



- A) $\frac{Mmg}{m+2M}$ B) $\frac{Mmg}{m+4M}$ C) $\frac{Mmg}{2(m+2M)}$ D) $\frac{Mmg}{2(m+4M)}$

34. Two massless rods are attached to frictionless pivots, with their ends touching. The distances between the pivot points and the endpoints of the rods are shown below.





Neglecting friction between the rods, if a force F is applied at the left end of the left rod, what force F' must be applied at the right end of the right rod to keep the system in equilibrium?

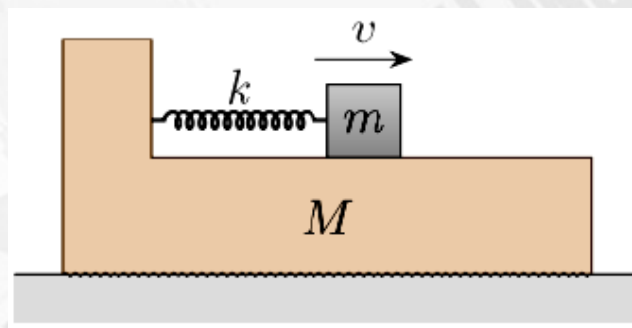
A) $\frac{F}{8}$

B) $\frac{F}{2}$

C) $\frac{4F}{7}$

D) $\frac{6F}{5}$

35. An object of mass $m = 1 \text{ kg}$ is attached to a platform of mass $M = 4 \text{ kg}$ with a spring of spring constant $k = 400 \text{ N/m}$. There is no friction between the object and the platform, and the coefficient of static friction between the platform and the ground is $\mu = 0.1$. The object is placed at its equilibrium position, and then given a horizontal velocity v .



For what v will the platform never slip on the ground?

A) $v \leq 0.1 \text{ m/s}$ B) $v \leq 0.2 \text{ m/s}$ C) $v \leq 0.25 \text{ m/s}$ D) $v \leq 0.4 \text{ m/s}$

36. A ball is released from rest above an inclined plane and bounces elastically down the plane. As the ball progresses down the plane, the time and the distance between each collision will:
- A) Remain the same, and increase B) Increase, and remain the same
C) Decrease, and increase D) Decrease, and remain the same



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CHIRUVAAS REDDY
RANK 1
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NEET 2023

KOTA VARUN
RANK 1
720

CHEMISTRY

Max Marks : 60

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains EIGHT (08) 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:**

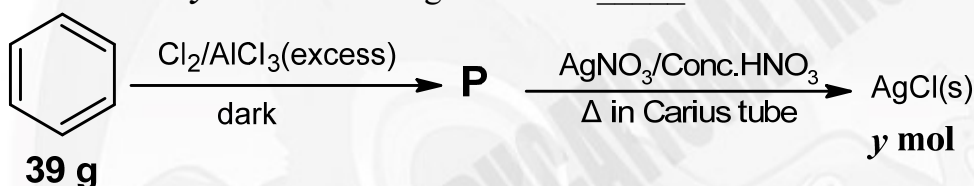
Full Marks: +3 If ONLY the correct integer is entered;

Zero Marks: 0 If the question is unanswered;

Negative Marks: -1 In all other cases

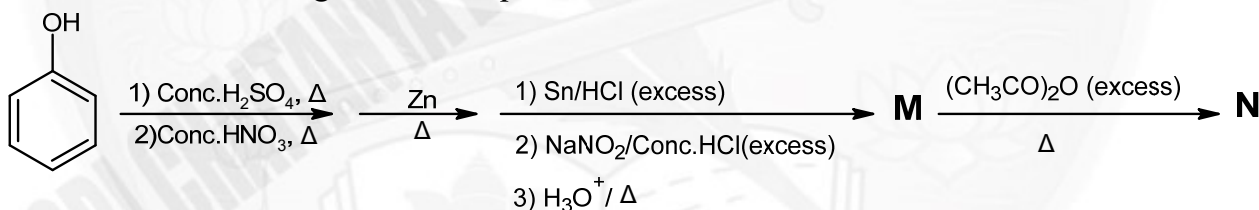
37. An alkene 'X' contains five C – C σ bonds, twelve C – H σ bonds and one C – C π bond. 'X' on reductive ozonolysis gives two distinct aldehydes as the products. Stereoisomers are subjected to ozonolysis separately. If the number of isomeric alkenes which exist for 'X' [including stereoisomers] is x , the value of $(x - 9)$ is ____.

38. The value of y in the following scheme is ____.



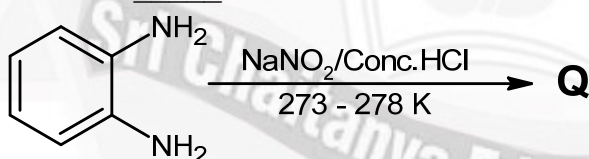
[Atomic masses: H = 1, C = 12, Cl = 35.5, Ag = 108]

39. Consider the following reaction sequence:



The number of oxygen atoms in a molecule of N is ____.

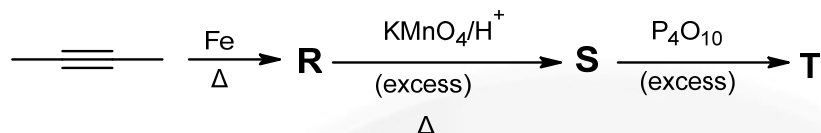
40. The number of nitrogen atoms in the major organic product, Q, of the reaction given below is ____.



41. Consider all the esters of molecular formula $\text{C}_7\text{H}_{14}\text{O}_2$, excluding stereoisomers. They are all treated with an excess of methyl magnesium iodide and then acidified to give alcohols. Each ester produces two different alcohols [excluding stereoisomers], both of which react with Br_2/NaOH to give bromoform. The number of esters, satisfying all these criteria, is ____.

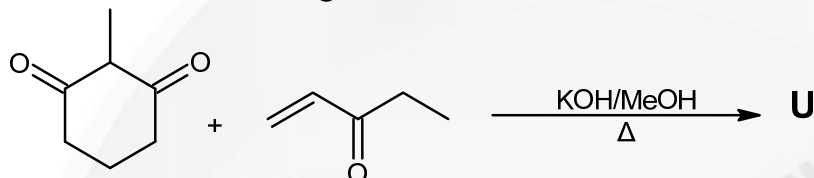


42. The total number of atoms in the empirical formula of the final product, **T**, of the reaction sequence given below is ____.



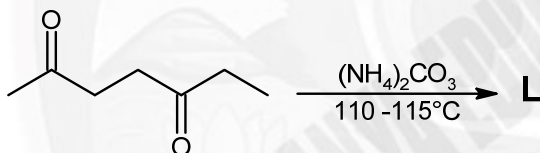
The molar mass of **T** is 54 g/mol less than **S**.

43. Consider the reaction given below:



The number of chiral carbon atoms in the compound obtained by the reduction of the major product, **U**, using H_2 / Ni is ____.

44. The number of sp^2 hybridized atoms in the major organic product, **L**, of the following reaction is ____.



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.

45. The first ($\Delta_r H_1$) and the second ($\Delta_r H_2$) ionization enthalpies (in kJ mol^{-1}) and the ($\Delta_{eg} H$) electron gain enthalpy (in kJ mol^{-1}) of a few elements are given below:

Elements	$\Delta_r H_1$	$\Delta_r H_2$	$\Delta_{eg} H$
I	520	7300	-60
II	419	3051	-48
III	1681	3374	-328
IV	1008	1846	-295
V	2372	5251	+48
VI	738	1451	-40

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300		341		720	



Choose the correct option(s):

A) The most reactive metal is **II**.

B) **III** and **IV** are both non-metals, **III** being the most reactive non-metal.

C) **VI** is a metal, and it can form a stable binary halide of the formula MX (X =halogen).

D) **V** is the most unreactive element.

46. A solid mixture contains $CaSO_4$ and camphor. The components of the mixture may be separated by

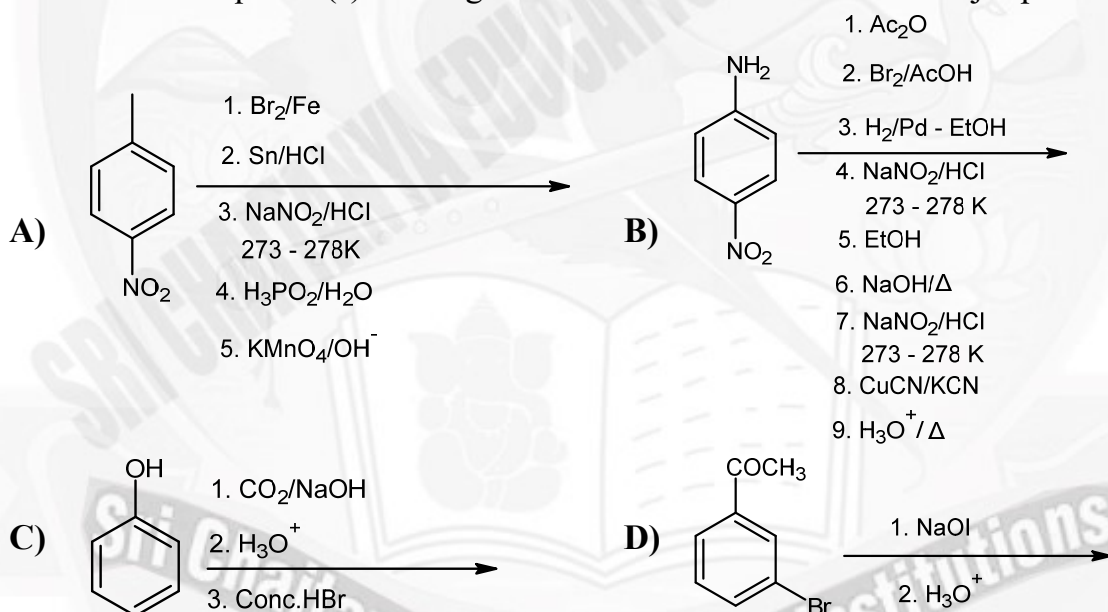
A) dissolution of the mixture in water followed by filtration, and crystallization of $CaSO_4$ from the filtrate.

B) Sublimation

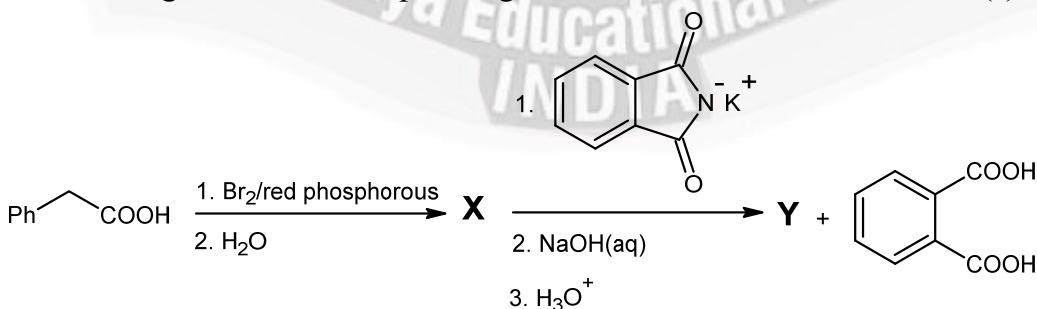
C) dissolution of the mixture in ether followed by filtration and recovering camphor from the filtrate by evaporating it to dryness.

D) Steam distillation

47. The reaction sequence(s) which give *o*-bromobenzoic acid as the major product is(are)



48. Considering the reaction sequence given below, the correct statement(s) is(are)





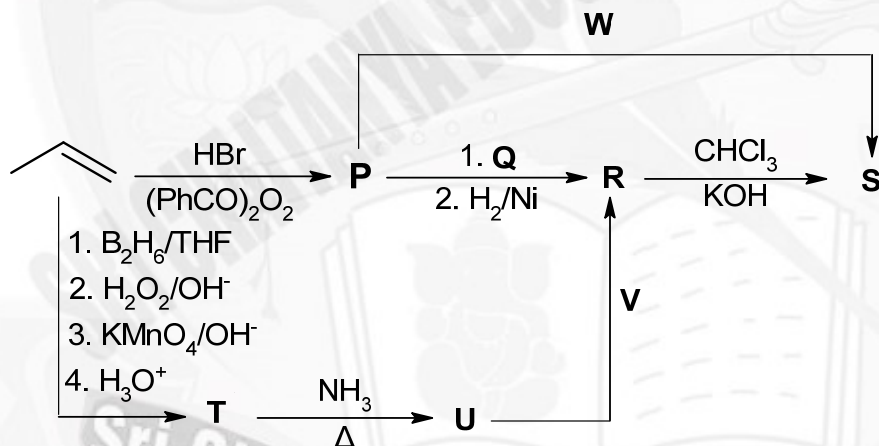
- A) X can be reduced to a primary alcohol by NaBH_4 .
- B) Treating X with conc. NH_4OH solution followed by acidification gives Y.
- C) The organic products obtained by treating X with excess NaOH(aq) followed by acidification, and treating Y with a solution of NaNO_2 in aq. HCl are the same.
- D) X is a naturally occurring amino acid.

49. Consider the transformation given below:



The reagent(s) which can bring about this transformation is(are)

- A) (i) B_2H_6 ; (ii) $\text{H}_2\text{O}_2/\text{NaOH}$; (iii) $\text{CrO}_3/\text{Pyridine/HCl}$
- B) (i) $\text{HBr}/(\text{C}_6\text{H}_5\text{CO})_2\text{O}_2$; (ii) KCN ; (iii) SnCl_2/HCl ; (iv) H_2O
- C) (i) $\text{HBr}/\text{R}_2\text{O}_2$; (ii) KOH(aq) ; (iii) Ag/Δ
- D) (i) $\text{H}_2\text{O}/\text{H}^+$; (ii) CrO_3 (anhydrous)
50. Correct option(s) for the following sequence of reactions is(are)



- A) $\text{Q} = \text{AgNO}_2$; $\text{W} = \text{AgCN}$ B) $\text{R} = \text{propan-1-amine}$, $\text{V} = \text{H}_2/\text{Pt}$
- C) $\text{U} = \text{propanamide}$; $\text{V} = \text{LiAlH}_4$ D) $\text{Q} = \text{KNO}_2$; $\text{W} = \text{KCN}$

SECTION – III (SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** 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:

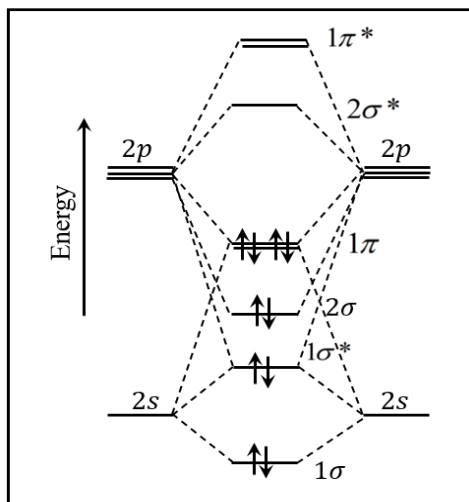
Full Marks : +3 If **ONLY** the correct option is chosen;

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

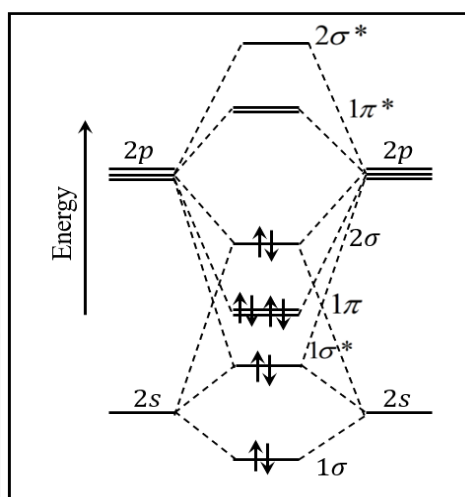
Negative Marks : -1 In all other cases

51. The correct molecular orbital diagram of N_2 in ground state is

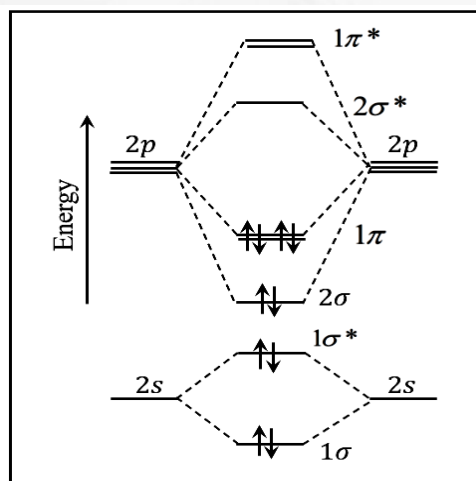
A)



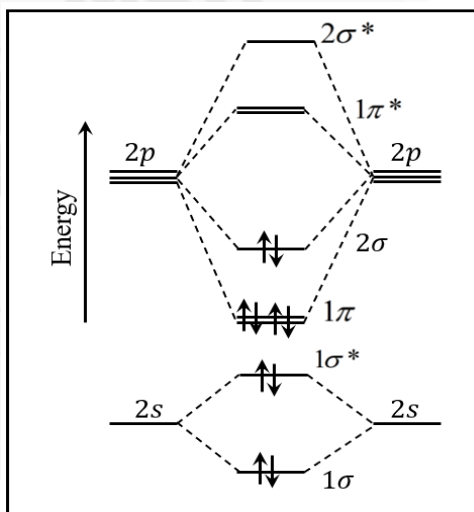
B)



C)



D)



52. In this question, each option has two statements, **S-I** and **S-II**. **S-II** is a statement related to **S-I**. Choose the option in which **S-II** is INCORRECT explanation of **S-I**.

A) **S-I** : Ethyl amine is soluble in water whereas aniline is not.

S-II: The hydrophobic part of aniline is larger than that of ethyl amine.

B) **S-I** : Methyl amine in water reacts with ferric chloride to precipitate hydrated ferric oxide.

S-II: Methylamine acts as a Bronsted base in water.

C) **S-I** : Although amino group is *o*- and *p*- directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of *m*-nitroaniline.

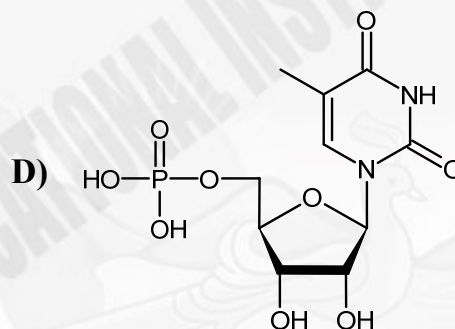
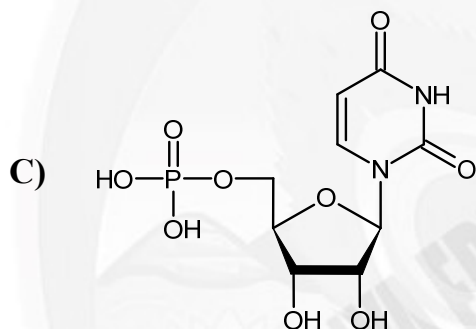
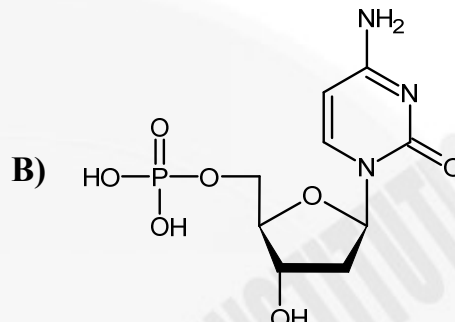
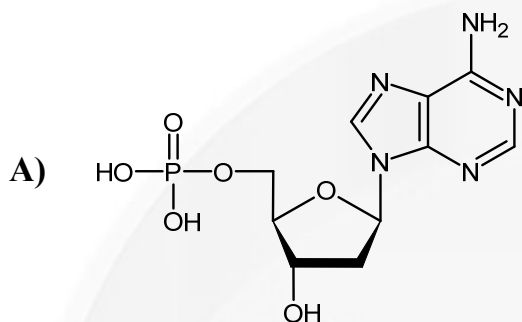
S-II: Aniline undergoes protonation in acidic medium to become anilinium ion.

D) **S-I** : Me_3N is more basic than Me_2NH in vapour phase while reverse is true in aqueous solution.

S-II: Inductive effect dominates over hydrogen bonding in aqueous solution.



53. Which of the following gives a chiral product on reductive ozonolysis?
A) *cis*-1,4-polyisoprene B) *trans*-1,4-polyisoprene
C) Neoprene D) Butadiene – styrene copolymer
54. Which of the following is a nucleotide in *m*-RNA?



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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
All India
Category Ranks
Count

699

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