



JEE(Advanced) : MOCK TEST-01

PAPER-1

BEWARE OF NEGATIVE MARKING

PART-1 : PHYSICS

SECTION-I (i) : (Maximum Marks: 12)

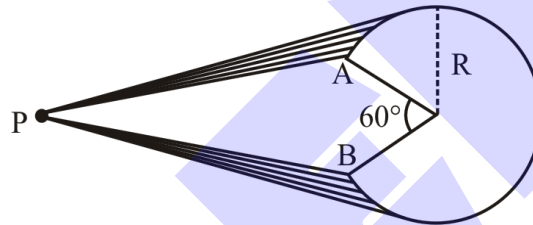
- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the 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)

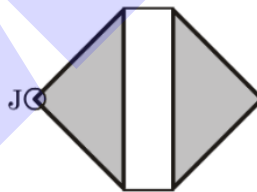
Negative Marks : -1 In all other cases

1. A nonconducting hollow cone has charge density $12\epsilon_0 C/m^2$. A part ABP is cut and removed from the cone. The radius of the base of the cone is 1m. The potential due to the remaining portion of the cone at point 'P' is



- (A) 5V (B) 6V (C) 8V (D) 10V

2. A square of side length a and mass $2m$ is cut across its diagonal. Two ideal light rods of negligible length are rigidly attached to the two corners that were cut. A tangential impulse J (into the page) is applied to the outermost corner of the square. What is the tension developed in each rod?



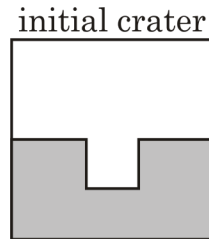
(A) $\frac{9(2 - \sqrt{2})J^2}{ma}$

(B) $\frac{27(2 - \sqrt{2})J^2}{ma}$

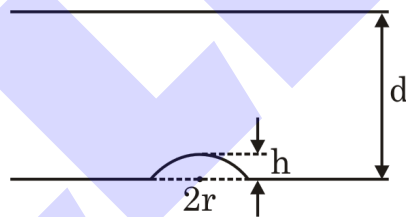
(C) $\frac{3J^2}{\sqrt{2}ma}$

(D) $\frac{3J^2}{2\sqrt{2}ma}$

3. A meteor hits the moon and creates a crater within the ground. The crater can be modelled as a cubic hole of length L , created when the material originally within it is ejected out after the collision. Assume that energy is not lost during the collision, and kinetic energy of meteor gets converted to gravitational potential energy of the ejected mass. If a meteor of twice the mass of the initial meteor hits the moon at the same velocity, how much larger is the volume of the crater compared to the initial one? Assume everything on the moon are of the same density.



- (A) 16
 (B) 4
 (C) 2
 (D) $2^{3/4}$
4. On one of the plates of the capacitors has a small hole of radius r , covered with a soap film. The surface tension of the film is σ . The capacitor is charged to a potential V . Distance d between the plates is small compared to linear dimensions of the plates. Value of h ($\ll r$) is equal to :-



- (A) $\frac{\epsilon_0 V^2 r^2}{8\sigma d^2}$
 (B) $\frac{\epsilon_0 V^2 r^2}{4\sigma d^2}$
 (C) $\frac{\epsilon_0 V^2 r^2}{16\sigma d^2}$
 (D) $\frac{\epsilon_0 V^2 r^2}{\sigma d^2}$

SECTION-I (ii) : (Maximum Marks: 12)

- This section contains **THREE (03)** 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 and both of which are correct.

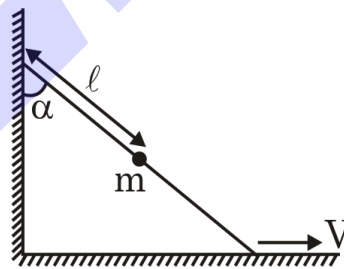
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

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

Negative Marks : -2 In all other cases.

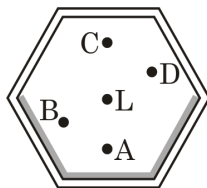
- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

5. The length of a weightless rod is 2ℓ . A small sphere of mass m is fixed at a distance ℓ from its upper end. The rod rests with its one end against the wall and the other against the floor. The end that rests on the floor is being moved with a constant velocity V away from the wall :-



- (A) The force with which the sphere affects the rod at the moment when $\alpha = 45^\circ$ is $m \left(g - \frac{V^2}{\sqrt{2}\ell} \right)$.
- (B) The force with which the sphere affects the rod at the moment when $\alpha = 45^\circ$ is $m \left(g - \frac{V^2}{2\sqrt{2}\ell} \right)$.
- (C) Vertical acceleration of m when $\alpha = 60^\circ$ is $\frac{2V^2}{\ell}$.
- (D) Horizontal acceleration of m when $\alpha = 60^\circ$ is $\frac{V^2}{\ell}$.

6. Three adjacent walls of a regular hexagon-shaped room are covered with flat mirror (see the figure). A lamp is lit at the centre of the room.



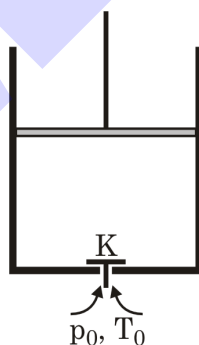
- (A) The number of images seen by an observer at A is 4.
 (B) The number of images seen by an observer at B is 4.
 (C) The number of images seen by an observer at C is 5.
 (D) The number of images seen by an observer at D is 5.

7. At the end of the thermally insulated cylinder with the piston there is a valve (figure) that covers a small hole, which opens and begins to let air from outside into the cylinder at a pressure difference $\Delta P = P_0/3$ (P_0 is atmospheric pressure). The valve does not allow air to escape from the cylinder to the outside. At the initial moment of time, the piston is pressed against the end of the cylinder, there is no air inside.

In the first case, the cylinder is filled with air to volume V_0 , slowly moving the piston, after which it is stopped, and then the piston is released.

In the second case, the piston is abruptly moved to a position in which the volume under the piston is equal to V_0 , so that the air does not have time to penetrate through the valve into the cylinder. In this position, fix the piston, wait until the cylinder is filled with air, just as in the first case, release the piston.

Outside the cylinder is air at atmospheric pressure P_0 and temperature T_0 . The friction of the piston against the walls, the mass of the piston, as well as the heat exchange of air with the piston and the cylinder walls can be neglected. Air can be considered a diatomic ideal gas. After the piston is released, the valve remains closed all the time.



- (A) For first case the temperature of air inside the cylinder at the moment the piston is stopped at volume V_0 is T_0 .
 (B) For first case, the temperature of air inside the cylinder when the piston stops movement is $\frac{8}{7}T_0$.
 (C) For second case, the temperature of air in the cylinder after stopping of piston and filling with air is $\frac{7}{5}T_0$.
 (D) For second case, the temperature of air after piston is released and it stops movement is $\frac{9}{5}T_0$.

SECTION-I (iii) : (Maximum Marks: 12)

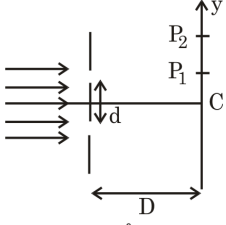
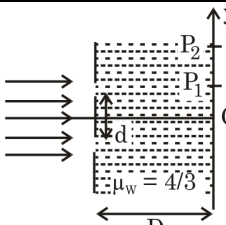
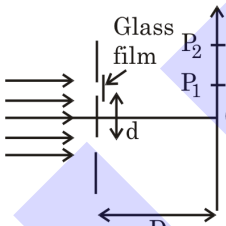
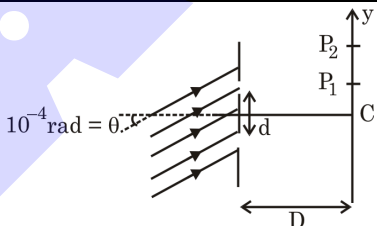
- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists : **List-I** and **List-II**.
- **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 **ONLY** if the option corresponding to the correct combination 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.

8. List-I contains four different YDSE systems and List-II contains intensity measured at some points on the screen. Do the correct match (es) in List-I and List-II, ($CP_1 = 0.3 \text{ mm}$ and $CP_2 = 1.2 \text{ mm}$)

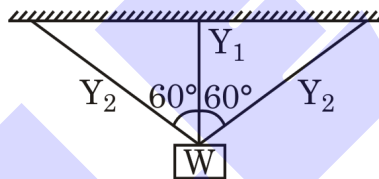
	List-I	List-II
(P)	 <p>$\lambda = 4000 \text{ \AA}$ in air $d = 1 \text{ mm}, D = 1 \text{ m}$ Intensity due to each slit = I_0</p>	(1) $I_C = 4I_0$
(Q)	 <p>$\lambda = 4000 \text{ \AA}$ in air $d = 1 \text{ mm}, D = 1 \text{ m}$ Intensity due to each slit = I_0 and no absorption of light by water ($\mu_w = 4/3$)</p>	(2) $I_{P_1} = 2I_0$
(R)	 <p>$\lambda = 4000 \text{ \AA}$ in air $d = 1 \text{ mm}, D = 1 \text{ m}$ Film thickness $t = 0.8 \text{ \mu m}$, refractive index of film = $3/2$ Intensity due to each slit = I_0 and no absorption of light by glass</p>	(3) $I_{P_1} = 4I_0$
(S)	 <p>$10^{-4} \text{ rad} = \theta$ $\lambda = 4000 \text{ \AA}$ in air $d = 1 \text{ mm}, D = 1 \text{ m}$ Intensity due to each slit = I_0</p>	(4) $I_{P_1} = 0$
		(5) $I_{P_2} = 2I_0$

- (A) $P \rightarrow 1,2; Q \rightarrow 1,3; R \rightarrow 2; S \rightarrow 4,5$ (B) $P \rightarrow 1,2; Q \rightarrow 1,3; R \rightarrow 2,5; S \rightarrow 4,5$
 (C) $P \rightarrow 2; Q \rightarrow 3; R \rightarrow 2,5; S \rightarrow 1,2$ (D) $P \rightarrow 1,2; Q \rightarrow 1,3; R \rightarrow 1,2; S \rightarrow 4,5$

9. An electron in a hydrogen atom makes a transition $n_1 \rightarrow n_2$, where n_1 and n_2 are the principal quantum numbers of the two states. Assume Bohr model to be valid.

	List-I		List-II
(P)	The electron emits an energy of 2.55 eV	(1)	$n_1 = 2, n_2 = 1$
(Q)	Time period of the electron in the initial state is eight times that in the final state.	(2)	$n_1 = 4, n_2 = 2$
(R)	Speed of electron become two times	(3)	$n_1 = 5, n_2 = 3$
(S)	Radius of orbit of electron becomes 4.77 \AA	(4)	$n_1 = 6, n_2 = 3$
		(5)	$n_1 = 8, n_2 = 4$

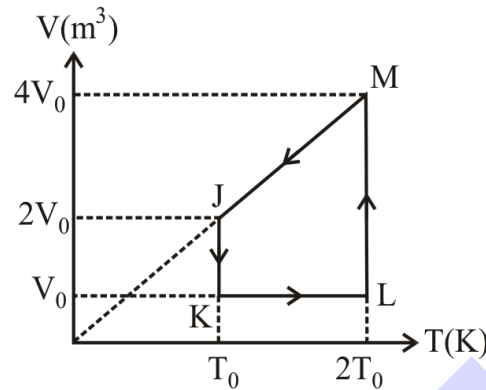
- (A) $P \rightarrow 2; Q \rightarrow 1,2; R \rightarrow 1,2; S \rightarrow 3$
 (B) $P \rightarrow 2; Q \rightarrow 1,2,4; R \rightarrow 1,3,4; S \rightarrow 4$
 (C) $P \rightarrow 2; Q \rightarrow 1,2,4,5; R \rightarrow 1,2,4,5; S \rightarrow 3,4$
 (D) $P \rightarrow 2; Q \rightarrow 1,2,3,4,5; R \rightarrow 1,2,3,4,5; S \rightarrow 4$
10. A load is supported using three wires of same cross section area as shown.



	List-I		List-II
(P)	Equal tensile stress in all wires	(1)	$Y_2 = 2Y_1$
(Q)	Equal tension in all wires	(2)	$Y_2 = 4Y_1$
(R)	Equal elastic potential energy in all wires	(3)	$Y_2 = 8Y_1$
(S)	Equal elastic potential energy per unit volume in all wires	(4)	$Y_2 = 16Y_1$
		(5)	Does not depend on ratio of $\frac{Y_1}{Y_2}$

- (A) $P \rightarrow 2; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 4$
 (B) $P \rightarrow 2; Q \rightarrow 3; R \rightarrow 2; S \rightarrow 4$
 (C) $P \rightarrow 4; Q \rightarrow 5; R \rightarrow 3; S \rightarrow 1$
 (D) $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 5; S \rightarrow 4$

11. V–T graph of a thermodynamic process is shown in figure. If heat given to process is taken to be positive :- (ΔQ is heat given to the gas in the process, ΔU is change in internal energy in the process, ΔW is the work done by the gas in the process).



	List-I		List-II
(P)	JK	(1)	$\Delta W \geq 0$
(Q)	KL	(2)	$\Delta Q < 0$
(R)	LM	(3)	$\Delta W < 0$
(S)	MJ	(4)	$\Delta Q > 0$
		(5)	$\Delta U = 0$

- (A) P → 2,3,5; Q → 4; R → 1,4,5; S → 2,3
 (B) P → 1,3,5; Q → 4; R → 1,4,5; S → 2,5
 (C) P → 2,3,5; Q → 1,4; R → 1,4,5; S → 2,3
 (D) P → 1,4; Q → 2,4; R → 1,3,5; S → 2,3

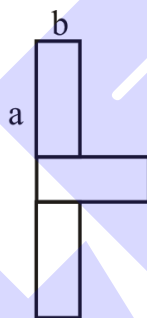
SECTION-II : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**
- For each question, enter the correct integer value of the answer in the place designated to enter the answer.
- For each question, marks will be awarded in one of the following categories :

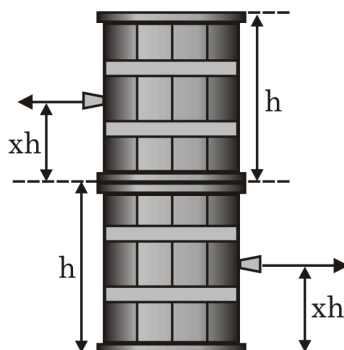
Full Marks : +4 If only the correct answer is given.

Zero Marks : 0 In all other cases.

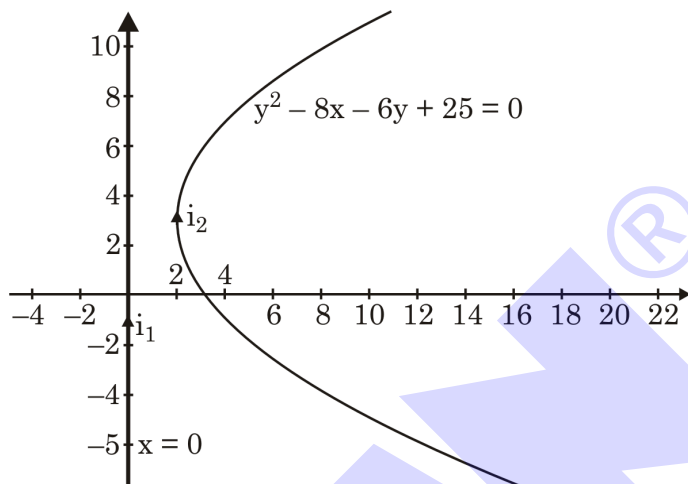
1. The pitch of a screw gauge is 1 mm and its cap is divided into 100 divisions. When nothing is placed between its studs, the zero of the circular scale lies 6 divisions below the reference line and zero of main scale is just visible. When a wire is placed between its studs, the main scale reading is 4 mm and 56th division of circular scale coincides with the reference line. The length of the wire is 4.20 cm. If the curved surface area (in cm^2) comes out to be x , then find the value of $100x$. $\left(\pi = \frac{22}{7}\right)$
2. A tower is glued together from three identical wooden blocks of edge lengths a and b as in the figure below. What is the largest ratio a/b such that the tower would still be stable?



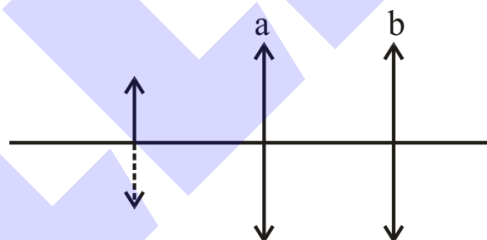
3. I placed 2 identical cylinder-shaped barrels, having the same height h , on the horizontal ground, one on the top of the other (see the figure). Both were nearly fully filled with water. Your task is to drill a hole perpendicularly to the wall of each of the barrels at the same xh height measured from the bottom of each barrel. The value of the dimensionless factor x , in order that the impact points of the water rays fall as far apart as possible. The value of $\frac{1}{x}$ is :-



4. Two infinitely long current carrying wires carry constant current i_1 and i_2 as shown in the diagram. The equations of the wire curvatures are $y^2 - 8x - 6y + 25 = 0$ and $x = 0$. The magnitude of force acting on one of the wires due to the other is $\frac{\mu_0 i_1 i_2}{\beta}$. The value of β is (The current-carrying wires are rigidly fixed. The units for distances on the graph should be taken in meters.)



5. Consider two convex lens with focal length f_a and f_b respectively. If placed appropriately, a small object perpendicular to the optic axis can create an inverted image, the size and position of which matches the size and position of object as shown in the figure. The distance between the lens is d and distance between the object and the left lens is u . The ratio $\frac{u}{d}$ is (Take : $f_a = 1$ cm, $f_b = 4$ cm)



6. A capacitor of value 1.0 F discharges through a device whose resistance R varies linearly with applied potential difference, V , so that $R = AV + B$, where A and B are constants. The resistance of the device has a value of 10.0Ω when $V = 6.0$ V, and 4.0Ω when $V = 0.06$ V. The capacitor is initially charged to a potential of 6.0 V. Determine how long (in sec) takes for the capacitor to discharge to 1% of this initial value. (Take : $\ln 10 = 2$)

PART-2 : CHEMISTRY
SECTION-I (i) : (Maximum Marks: 12)

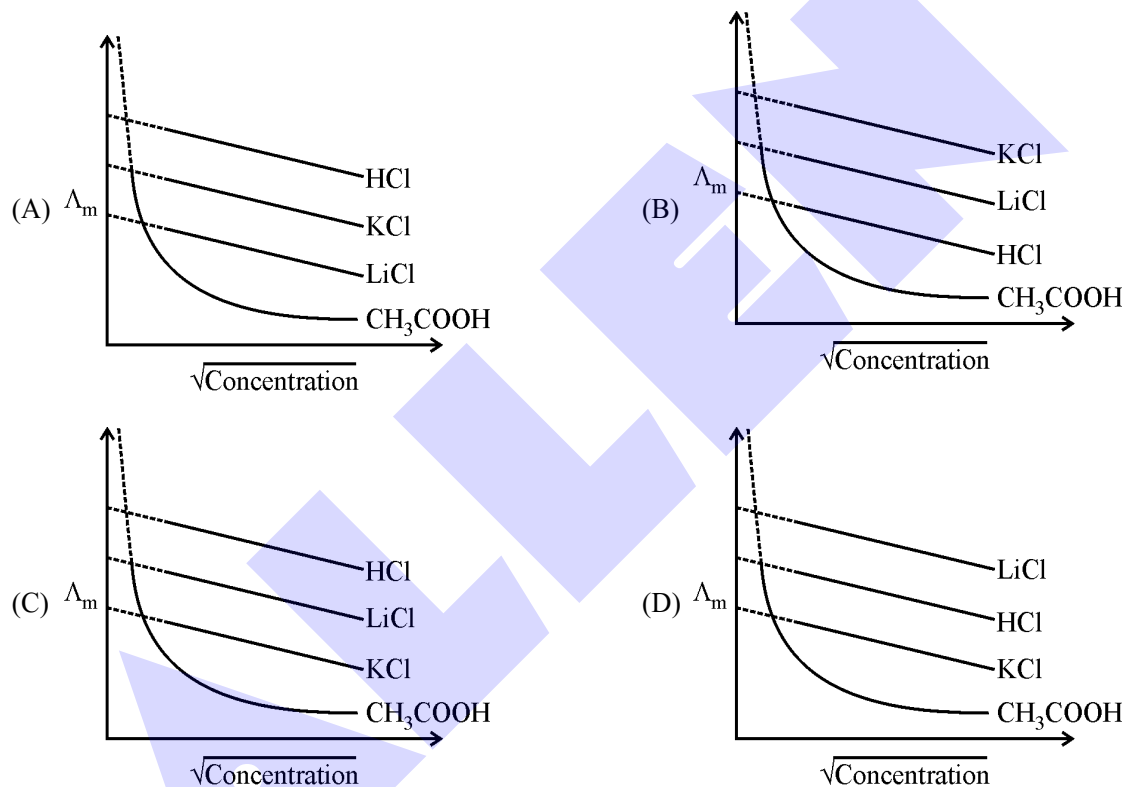
- This section contains **FOUR (04)** questions.
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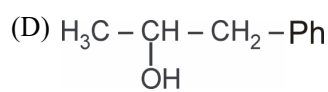
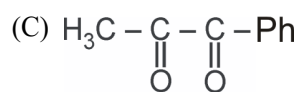
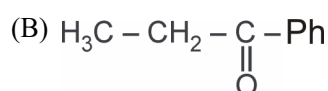
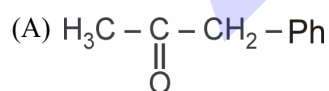
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered)

Negative Marks : -1 In all other cases

1. Select the correct option for following aqueous solutions :



2. $\text{H}_3\text{C} - \text{C} \equiv \text{C} - \text{Ph} \xrightarrow{\text{Hg}^{2+}/\text{H}^+/\text{H}_2\text{O}} \text{P}$, P is :



3. Alkaline solution of (X) $\xrightarrow{\text{NaBO}_3}$ Canary yellow colored solution

Acidic solution of (Y) $\xrightarrow{\text{NaBiO}_3}$ Lilac colored solution

(X) & (Y) are respectively :-

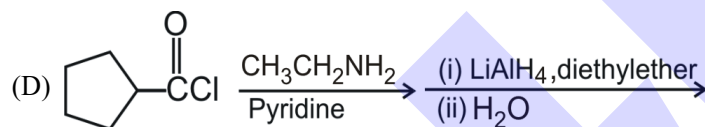
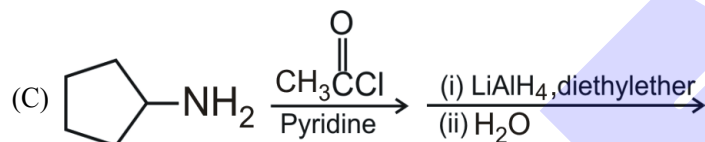
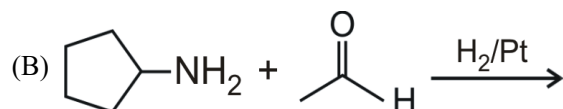
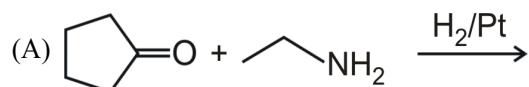
(A) $\text{Fe}(\text{OH})_3$, $\text{Mn}(\text{OH})_2$

(B) $\text{Cr}(\text{OH})_3$, $\text{Pb}(\text{OH})_2$

(C) $\text{Fe}(\text{OH})_3$, $\text{Zn}(\text{OH})_2$

(D) $\text{Cr}(\text{OH})_3$, $\text{Mn}(\text{OH})_2$

4. Among the following, which reaction will not give N-ethylcyclopentylamine as major product?



SECTION-I (ii) : (Maximum Marks: 12)

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- 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 and 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.

- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

5. Consider two liquids A and B having pure vapour pressures P_A° & P_B° forming an ideal solution. The plot of $\frac{1}{X_A}$ v/s $\frac{1}{Y_A}$ (where X_A and Y_A are the mole fraction of liquid A in liquid and vapour phase respectively) is linear with slope and Y intercepts respectively :

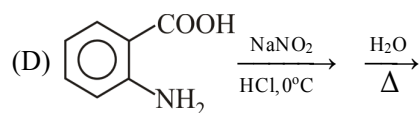
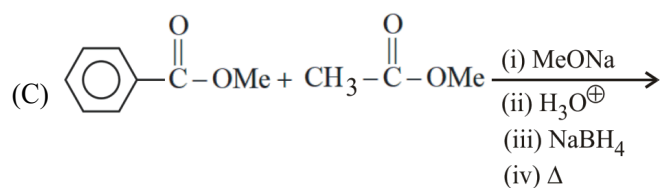
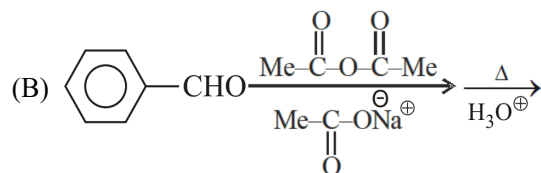
(A) Intercept = $\frac{P_A^\circ - P_B^\circ}{P_B^\circ}$

(B) Intercept = $\frac{P_B^\circ - P_A^\circ}{P_B^\circ}$

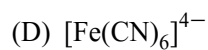
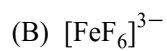
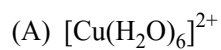
(C) Slope = $\frac{P_A^\circ}{P_B^\circ}$

(D) Slope = $\frac{P_B^\circ}{P_A^\circ}$

6. In which of the following reactions cinnamic acid is one of the major organic product ?



7. The complex(es) with distorted octahedron structure is/are :-



SECTION-I (iii) : (Maximum Marks: 12)

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists : **List-I** and **List-II**.
- **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 **ONLY** if the option corresponding to the correct combination 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.

8. Four different gases and their Vander Waal's constant are given below : ($R = 0.08 \text{ L-atm/K-mol}$)

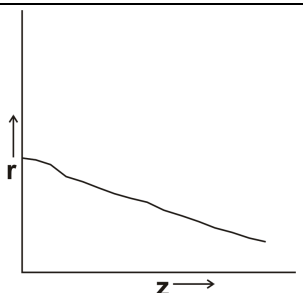
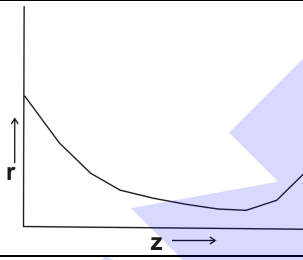
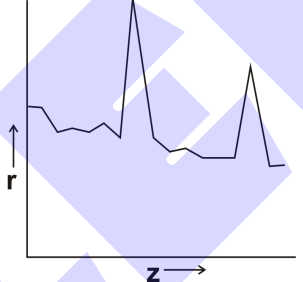
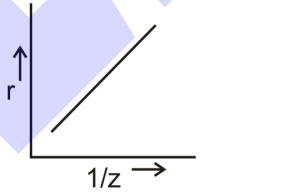
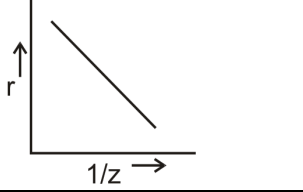
Gas	a (in $\text{atm L}^2 / \text{mol}^2$)	b (in L/mol)
W	1.5	0.05
X	2.0	0.08
Y	4.2	0.025
Z	5.0	0.10

List - I		List - II	
(P)	W	(1)	Gas having highest intermolecular force of attraction.
(Q)	X	(2)	Gas having smallest size of molecules.
(R)	Y	(3)	Gas that can be liquefied at 85 K
(S)	Z	(4)	Gas resembles with ideal gas at nearly boiling point of water
		(5)	Gas with highest boyle's temperature.

Codes :

- (A) $P \rightarrow 3,4,5; Q \rightarrow 1,5; R \rightarrow 2,4; S \rightarrow 5$
 (B) $P \rightarrow 1,2; Q \rightarrow 4,5; R \rightarrow 3,4; S \rightarrow 2$
 (C) $P \rightarrow 4; Q \rightarrow 3; R \rightarrow 2,5; S \rightarrow 1$
 (D) $P \rightarrow 1,4; Q \rightarrow 3,4; R \rightarrow 5; S \rightarrow 1,2,3$

11.

List-I (Element in periodic table)		List-II [Graphical change in radius (r) with atomic number (Z)]	
(P)	Halogens	(1)	
(Q)	M ⁺³ ions of Lanthanides	(2)	
(R)	M atoms of Lanthanides	(3)	
(S)	Size of 3d series metal (covalent radius)	(4)	
		(5)	

Select **CORRECT** code :-

- (A) P → 4; Q → 5; R → 1; S → 2
- (B) P → 5; Q → 1; R → 3; S → 2
- (C) P → 4; Q → 3; R → 1; S → 2
- (D) P → 5; Q → 1; R → 2; S → 3

SECTION-II : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**
- For each question, enter the correct integer value of the answer in the place designated to enter the answer.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +4 If only the correct answer is given.

Zero Marks : 0 In all other cases.

1. Identify correct number of statements :

Statement - 1 : Entropy of system increases in dissociation of ammonia gas into N_2 and H_2 gases.

Statement - 2 : Entropy of system increases in polymerization process of ethene to form polythene.

Statement - 3 : Entropy of system increases in adiabatic irreversible compression of an ideal gas.

Statement - 4 : Entropy of system increases in condensation of H_2O (vapour).

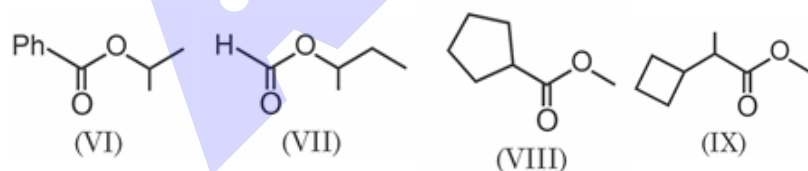
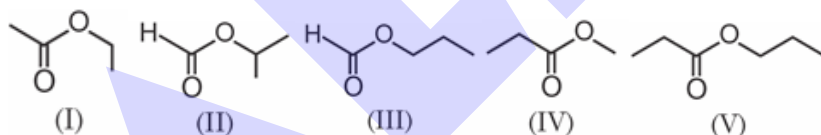
Statement - 5 : Entropy of system increases in isothermal free expansion of ideal gas.

Statement - 6 : Entropy of system always increases in a spontaneous process.

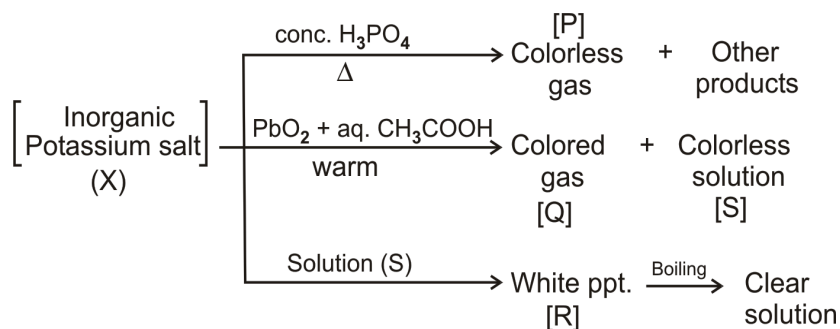
Statement - 7 : Adiabatic process whether reversible or irreversible will not cause any change in entropy of the surroundings.

Statement - 8 : At absolute zero, entropy of any substance becomes zero.

2. 1.2 gram of carbon is burnt completely with 2.56 gram of oxygen to produce $CO(g)$ and $CO_2(g)$. None of the reactant remaining after reaction. Produced mixture of gases is treated with solid I_2O_5 (to know the amount of $CO(g)$ produced). The liberated iodine required x mL of 0.1 M hypo solution for complete titration. The value of x is _____
3. An organic compound reacts with excess $MeMgBr$ followed by H_2O to give two organic product of which one reacts with $NaOI$ to give yellow precipitate and OTHER DOES NOT. How many of the following compounds can satisfy this condition ?



4. Consider the following reactions and write molecular weight of **white precipitate (Y)**.
 (Given atomic mass : H = 1, O = 16, C = 12, F = 19, N = 14, S = 32, P = 31, Cl = 35.5, Br = 80, I = 127, K = 39, Na = 23, Pb = 207, Al = 27, Si = 28, Mn = 55, Cr = 52)



Colored gas [Q] is identified by its staining of starch paper orange red

Phenol + [Q] in water \rightarrow **White precipitate (Y)** + other product

5. Find the Mo—Mo bond order in $[(\eta^5\text{-C}_5\text{H}_5)\text{Mo}(\text{CO})_2]_2$
 (Given that both the Mo have 18 valence electrons in given complex)
 [Atomic number of Mo = 42]
6. Consider all possible isomeric ketones including stereoisomers of MW = 86, All these isomers are independently reacted with NaBH_4 (NOTE : stereoisomers are also reacted separately).
 The total number of ketones that give a racemic product(s) is/are.

PART-3 : MATHEMATICS
SECTION-I (i) : (Maximum Marks: 12)

- 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

1. If $I = \int_{\frac{1}{4}}^4 \frac{\tan^{-1}x}{x} dx$, then the value of $2[I]$ is equal to - (where $[.]$ denotes greatest integer function and $e^{0.693} \simeq 2$)
- (A) 6 (B) 4
(C) 2 (D) 8
2. If $\int_0^1 x f(x^2) dx = \frac{1}{2}$, then $\int_1^2 f^{-1}(x) dx$ is equal to (where $f(0) = 1$, $f(1) = 2$ & f is strictly increasing in its domain)
- (A) 0 (B) 2
(C) 1 (D) 3
3. Number of solutions of $\sqrt{\tan \theta} = 2 \sin \theta$, $\theta \in [0, 2\pi]$ is equal to
- (A) 2 (B) 4
(C) 5 (D) 7
4. Value of $\lim_{n \rightarrow \infty} n \int_{0^+}^{\pi/2} (1 - \sqrt[n]{\sin x}) dx$ is
- (A) $\ln 2$
(B) $-\ln 2$
(C) $\frac{\pi}{2} \ln 2$
(D) $-\frac{\pi}{2} \ln 2$

SECTION-I (ii) : (Maximum Marks: 12)

- This section contains **THREE (03)** 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 and 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.

- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

5. If A_i is the area bounded by $|x - a_i| + |y| = b_i$, $i \in \mathbb{N}$, where $a_{i+1} = a_i + \frac{3}{2}b_i$ & $b_{i+1} = \frac{b_i}{2}$, $a_1 = 0$, $b_1 = 32$, then

(A) $A_3 = 128$

(B) $A_3 = 256$

(C) $\lim_{n \rightarrow \infty} \sum_{i=1}^n A_i = \frac{8}{3}(32)^2$

(D) $\lim_{n \rightarrow \infty} \sum_{i=1}^n A_i = \frac{4}{3}(16)^2$

6. A circle S having centre (α, β) intersect a parabola $y^2 = 4x$ at three points A, B and C such that normals at these points are concurrent at $(9, 6)$, where O is origin. The slope of normals at A & B are positive, then

(A) Sum of modulus of slopes of normals at points A, B and C is 6

(B) $|\alpha - \beta| = 4$

(C) point of intersection of tangents at A & B will be $(2, -3)$

(D) Circle S also passes through O

7. If $P = \sum_{r=3n}^{r=4n-1} \left[\frac{r^2 + 13n^2 - 7rn}{n^3} \right]$ & $Q = \sum_{r=3n+1}^{r=4n} \left[\frac{r^2 + 13n^2 - 7rn}{n^3} \right]$, then

(A) $P > \frac{5}{6}$

(B) $Q < \frac{5}{6}$

(C) $Q > \frac{5}{6}$

(D) $P < \frac{5}{6}$

SECTION-I (iii) : (Maximum Marks: 12)

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists : **List-I** and **List-II**.
- **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 **ONLY** if the option corresponding to the correct combination 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.

8. Match List-I with List-II and select the correct answer using the code given below the list.

List-I		List-II	
(P)	Given all terms of an A.P. are positive integers, third term is 8 and sum of first 15 terms lies between 191 and 196, then first term is	(1)	1
(Q)	Suppose that for some angles x and y the equation $\cos 2y - \cos 2x = 3a - 2$ and $\cos^2 x + \sin^2 y = \frac{a^2}{2}$ hold simultaneously, then number of possible values of a is/are	(2)	4
(R)	Number of solution(s) of the equation $\sin^{-1} \frac{2x}{1+x^2} = \frac{\pi}{2} + \cos^{-1} x$	(3)	6
(S)	In ΔABC , minimum value of $\frac{1}{\Delta} \sqrt{abc(a+b+c)}$ is, (all symbols have their standard meaning)	(4)	0
		(5)	5

- (A) P → 1; Q → 1; R → 1; S → 2
 (B) P → 3; Q → 5; R → 2; S → 3
 (C) P → 3; Q → 1; R → 2; S → 1
 (D) P → 3; Q → 1; R → 1; S → 2

9. Match List-I with List-II and select the correct answer using the code given below the list.

List-I		List-II	
(P)	Given $\int_{-2}^2 f(\{x\}) dx = 0$ and $\int_{-2}^6 f(\{x\}) dx = -2$ then value of $\int_6^2 f(\{x\}) dx$ is equal to (Here $\{.\}$ denotes fractional part of function)	(1)	2
(Q)	If $ \vec{a} - \vec{b} = 8$, $ \vec{b} = \sqrt{57}$ and $ \vec{a} + \vec{b} = 10$, then value of $ \vec{a} $ is equal to	(2)	3
(R)	$\int_{-\pi}^{\pi} \frac{ \operatorname{sgn}(\cot x) + \operatorname{sgn}(\tan x) dx}{\pi}$ is	(3)	4
(S)	Let $A = \begin{bmatrix} 1 & \frac{1}{2} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & \frac{1}{2^2} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & \frac{1}{2^3} \\ 0 & 1 \end{bmatrix} \dots \infty$ times, then sum of all elements of matrix A is	(4)	5
		(5)	6

(A) $P \rightarrow 5; Q \rightarrow 4; R \rightarrow 3; S \rightarrow 2$

(B) $P \rightarrow 1; Q \rightarrow 4; R \rightarrow 3; S \rightarrow 2$

(C) $P \rightarrow 1; Q \rightarrow 4; R \rightarrow 2; S \rightarrow 2$

(D) $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 2$

10. Suppose n people ($n > 6$) are asked a question successively in a random order and exactly 3 out of 'n' people know the answer. Let P_r denote the probability that r^{th} person asked, is the first to know the answer, then

List-I		List-II	
(P)	Probability that first four do not know the answer	(1)	$\frac{3(n-3)}{n(n-1)}$
(Q)	P_2	(2)	$\frac{(n-4)(n-5)(n-6)}{n(n-1)(n-2)}$
(R)	P_{n-2}	(3)	$\frac{6}{n(n-1)(n-2)}$
(S)	P_r	(4)	$\frac{3(n-r)(n-r-1)}{n(n-1)(n-2)}$
		(5)	$\frac{6(n-r)(n-r-1)}{n(n-1)(n-2)}$

- (A) $P \rightarrow 2; Q \rightarrow 1; R \rightarrow 3; S \rightarrow 4$
 (B) $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 4$
 (C) $P \rightarrow 2; Q \rightarrow 1; R \rightarrow 3; S \rightarrow 5$
 (D) $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 4; S \rightarrow 3$

11.

List-I		List-II	
(P)	$\lim_{x \rightarrow 0} \left[(\min(y^2 + 2y + 4)) \frac{\sin x}{x} \right]$ is equal to, where [.] denotes G.I.F.	(1)	2
(Q)	$\lim_{x \rightarrow 0} \frac{1}{x} \cdot \sin^{-1} \left(\frac{2x}{1+x^2} \right) =$	(2)	3
(R)	The number of points in the domain of the function $f(x) = \frac{1}{\ln x-4 }$ is discontinuous are	(3)	6
(S)	Number of critical points of $f(x) = \min(\sin x, \cos x)$, in $x \in [0, 2\pi)$, is	(4)	0
		(5)	5

- (A) $P \rightarrow 1; Q \rightarrow 1; R \rightarrow 2; S \rightarrow 5$
 (B) $P \rightarrow 1; Q \rightarrow 1; R \rightarrow 4; S \rightarrow 5$
 (C) $P \rightarrow 2; Q \rightarrow 4; R \rightarrow 5; S \rightarrow 2$
 (D) $P \rightarrow 2; Q \rightarrow 4; R \rightarrow 1; S \rightarrow 3$

SECTION-II : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**
- For each question, enter the correct integer value of the answer in the place designated to enter the answer.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +4 If only the correct answer is given.

Zero Marks : 0 In all other cases.

1. If 4-horses participate in race. The number of ways in which they can go through finish line is α (Dead heat is possible), then value of α is (Two or more horses can finish race exactly at same time)
2. A line $3x + y = 8$ touches a hyperbola $H = 0$ at $P(1, 5)$ meets its asymptotes at A and B. If $AB = 2\sqrt{10}$, $C(1, 1)$ be the centre of hyperbola, e and ℓ are eccentricity and latus rectum, (here length of conjugate axis < length of transverse axis), then value of $[e^2 + \ell^2]$ is (Where $[.]$ Greatest Integer Function)
3. Lines $L_1 : \frac{x-6}{3} = \frac{y-4}{2} = \frac{z-2}{0}$ and $L_2 : \frac{x-8}{4} = \frac{y-2}{0} = \frac{z-4}{2}$ meets the plane $\pi : \vec{r} \cdot (2\hat{i} + \hat{j} - \hat{k}) = 6$ at point A and B respectively. Area of the triangle formed by the lines L_1, L_2 and AB is
4. Let A and B are non-singular matrices of order 3 such that $\det(A) = 5$ and $A^{-1}B^2 + AB = O$. If value of $\det(A^6 - 2A^4B + A^2B^2)$ is equal to 10^n , then value of n is

5. Let ω be the complex number representing the point $M\left(\frac{-1}{2}, \frac{\sqrt{3}}{2}\right)$, then number of distinct complex numbers z satisfying the equation $(z+1) \begin{vmatrix} z+\omega^2 & 1 \\ 1 & z+\omega \end{vmatrix} + \omega \begin{vmatrix} 1 & \omega \\ z+\omega & \omega^2 \end{vmatrix} + \omega^2 \begin{vmatrix} \omega & z+\omega^2 \\ \omega^2 & 1 \end{vmatrix} = 0$ is equal to :
6. Let $f(x)$ be a twice differentiable function defined on $(-\infty, \infty)$ such that $f(x) = f(2-x)$. Then value of $\int_{-1}^1 f'(1+x)x^2 e^{x^2} dx$ is equal to