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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_STERLING BT

RPTA-01

Date: 10-08-2025

Time: 09:00AM to 12:00PM

JEE-ADV(2021-P1)

Max. Marks: 180

10-08-2025_Sr.Super60_STERLING BT_Jee-Adv(2021-P1)_RPTA-01_Syllabus

PHYSICS

: Thermal physics: Thermal expansion of solids, liquids and gases, Calorimetry, latent heat, Ideal gas laws, Specific heats (C_v and C_p for monoatomic and diatomic gases), Isothermal and adiabatic processes, bulk modulus of gases, Equivalence of heat and work, First law of thermodynamics and its applications (only for ideal gases), Mean free path
Experiments: Plotting a cooling curve for the relationship between the temperature of a hot body and time, Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures, Specific heat of a liquid using calorimeter

CHEMISTRY

: Nomenclature, Isomerism: Structural, Stereo, Hybridisation of carbon, bonds, shapes of simple organic molecules, structural and geometrical isomerism, Optical isomerism of compounds containing upto two asymmetric centres, (R, S and E, Z nomenclature excluded) IUPAC nomenclature of simple organic compounds (only hydrocarbons, monofunctional and bi-functional compounds) Conformations of ethane and butane (Newman projections

MATHEMATICS

: Functions and Inverse Trigonometric Function

Name of the Student: _____

H.T. NO:

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**JEE-ADVANCE-2021-P1-Model**

Time:3Hr's

IMPORTANT INSTRUCTIONS

Max Marks: 180

PHYSICS:

Section	Question Type	+Ve Mark	- Ve Mark	No.of Qs	Total marks
Sec – I(Q.N : 1 – 4)	Questions with Single Correct Choice!	+3	-1	4	12
Sec – II(Q.N : 5 – 10)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 11 – 16)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 17 – 19)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 20 – 23)	Questions with Single Correct Choice	+3	-1	4	12
Sec – II(Q.N : 24 – 29)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 30 – 35)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 36– 38)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 39 – 42)	Questions with Single Correct Choice	+3	-1	4	12
Sec – II(Q.N : 43 – 48)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 49 – 54)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 55 – 57)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

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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
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300****RANK
1****JEE Advanced
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Bachchan Class**341
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1****NEET
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Bachchan Class**720
720****RANK
1**



PHYSICS

Max Marks: 60

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 4 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.

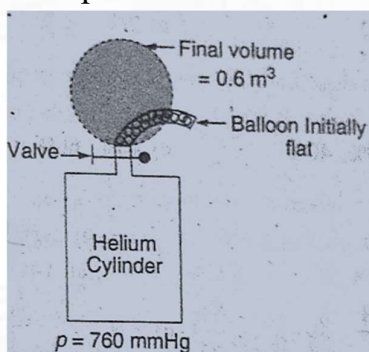
Marking scheme: +3 for correct answer, 0 if not attempted and –1 in all other cases. Section 1 (Max Marks: 12)

- Section 1 contains Four questions
- Each Question has Four Options and Only One of these four will be the correct answer.
- For each question, choose the option corresponding to the correct answer
- The Marking scheme to evaluate Answer to each question will be :
- Full Marks: +3 (If the answer is correct)
- Zero Marks: 0 (If the question is unanswered)
- Negative Marks: -1 (In all other cases)

1. The radius of a metal sphere at room temperature 'T' is 'R' and the coefficient of linear expansion of the metal is ' α '. The sphere is heated a little by a temperature ' ΔT '. So that its new temperature is $(T + \Delta T)$. The increase in the volume of the sphere is approximately

A) $2\pi R \alpha \Delta T$ B) $\pi R^2 \alpha \Delta T$ C) $\frac{4\pi R^3 \alpha \Delta T}{3}$ D) $4\pi R^3 \alpha \Delta T$

2. A cylinder contains compressed helium, is used to inflate in an elastic flexible balloon originally completely flat, to a volume of 0.6 m^3 If barometer reads 760 mm of Hg. Then the work done by the atmosphere on the balloon is



- A) 60.8 kJ B) -60.8 kJ C) 0 D) 60.8 J
3. The pressure of one mole of an ideal gas varies according to the law $P = P_0 - \alpha V^2$ where p_0 and α are positive constants. The highest temperature that, the gas may attain is

A) $\frac{2p_0}{3R} \left(\frac{p_0}{3\alpha} \right)^{1/2}$ B) $\frac{3p_0}{2R} \left(\frac{p_0}{3\alpha} \right)^{1/2}$ C) $\frac{p_0}{R} \left(\frac{p_0}{3\alpha} \right)^{1/2}$ D) $\frac{p_0}{R} \left(\frac{p_0}{\alpha} \right)^{1/2}$

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Page 3

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4. Heat is supplied to a diatomic gas at constant pressure. The ratio of $\Delta Q : \Delta U : \Delta W$ is:
- A) 5:3:2 B) 5:2:3 C) 7:5:2 D) 7:2:5

SECTION-II
(PARAGRAPH WITH NUMERICAL VALUE TYPE)

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

Question Stem for Question Nos. 5 and 6

Question Stem

To find the expansion of the length (ΔL) of a rail track one can use the formula:

$$\Delta L = L\alpha\Delta T$$

Here

L : original length

α : coefficient of linear expansion

ΔT : Rise in temperature

Consider a rail track of length 20 m at 10^0C having coefficient of linear expansion $\alpha = 12 \times 10^{-6} / ^0\text{C}$. When the wheels of train cross the gap between the two such rail tracks, we hear rhythmic sound (thak, thak) and distance between the two consecutive wheels along the rail track is also is 20m. Suppose we find that wheels are making 75 clicks (rhythmic sound) in a minute

5. Estimate the speed of train (in km/hr).
6. Find the magnitude of change in length of rail track when temperature rises to 60^0C (in mm)

Question Stem for Question Nos. 7 and 8

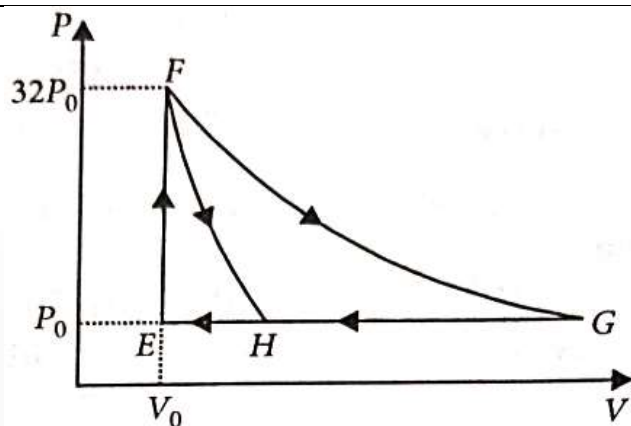
Question Stem

One mole of a monatomic ideal gas is taken along two cyclic processes

$E \rightarrow F \rightarrow G \rightarrow E$ and $E \rightarrow F \rightarrow H \rightarrow E$ as shown in the PV diagram.

The processes involved are purely isochoric, isobaric, isothermal or adiabatic.



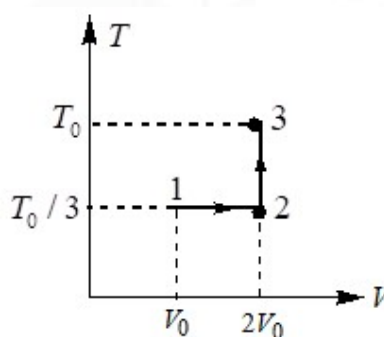


7. Magnitude of work done in process $G \rightarrow E$ is _____ p_0V_0
8. Magnitude of work done in process $F \rightarrow H$ is _____ p_0V_0

Question Stem for Question Nos. 9 and 10

Question Stem

In a thermodynamic process on an ideal monatomic gas, the infinitesimal heat absorbed by the gas is given by $T\Delta X$, where T is temperature of the system and ΔX is the infinitesimal change in a thermodynamic quantity X of the system. For a mole of monatomic ideal gas $X = \frac{3}{2}R\ln\left(\frac{T}{T_A}\right) + R\ln\left(\frac{V}{V_A}\right)$. Here, R is gas constant, V is volume of gas, T_A and V_A are constants. If the process on the mole of monatomic ideal gas is as shown in the TV-diagram with $P_0V_0 = \frac{1}{3}RT_0$,



9. Work done by the system in process $1 \rightarrow 2 \rightarrow 3$ is $\frac{1}{x}RT_0\ln 2$ then x is _____
10. Change in internal energy in process $1 \rightarrow 2 \rightarrow 3$ is yRT_0 then y is _____

SECTION-III

(ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) 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 unanswered;
- **Negative Marks: -2** In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to the correct answer, then
Choosing **ONLY** (A), (B) and (D) will get +4 marks;
Choosing **ONLY** (A), will get +1 mark;
Choosing **ONLY** (B), will get +1 mark;
Choosing **ONLY** (D), will get +1 mark;
Choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
Choosing any other option(s) will get -2 marks.

11. A bimetallic strip is formed out of two identical strips one of copper and the other of brass. The coefficients of linear expansion of the two metals are α_C and α_B . On heating, the temperature of the strip goes up by ΔT and the strip bends to form an arc of radius of curvature R . Then R is
 - A) proportional to ΔT
 - B) inversely proportional to ΔT
 - C) proportional to $|\alpha_B - \alpha_C|$
 - D) inversely proportional to $|\alpha_B - \alpha_C|$
12. C_V and C_p denote the molar specific heat capacities of a gas at constant volume and constant pressure, respectively. Then
 - A) $C_V - C_p$ is larger for a diatomic ideal gas than for a monoatomic ideal gas
 - B) $C_p + C_V$ is larger for a diatomic ideal gas than for a monoatomic ideal gas
 - C) C_p / C_V is larger for a diatomic ideal gas than for a monoatomic ideal gas
 - D) $C_p \cdot C_V$ is larger for a diatomic ideal gas than for a monoatomic ideal gas
13. A container of fixed volume has a mixture of one mole of hydrogen and one mole of helium in equilibrium at temperature T . Assuming the gases are ideal, the correct statement(s) is (are)
 - A) The average energy per mole of the gas mixture is $2 RT$.
 - B) The ratio of speed of sound in the gas mixture to that in helium gas is $\sqrt{6/5}$.
 - C) The ratio of the rms speed of helium atoms to that of hydrogen molecules is $1/2$
 - D) The ratio of the rms speed of helium atoms to that of hydrogen molecules is $1/\sqrt{2}$

14. A bubble has surface tension S . The ideal gas inside the bubble has ratio of specific heats $\gamma = 5/3$. The bubble is exposed to the atmosphere and it always retains its spherical shape. When the atmospheric pressure is P_{a1} , the radius of the bubble is found to be r_1 and the temperature of the enclosed gas is T_1 . When the atmospheric pressure is P_{a2} , the radius of the bubble and the temperature of the enclosed gas are r_2 and T_2 , respectively. Which of the following statement (s) are correct

A) If the surface of the bubble is a perfect heat insulator, then
$$\left(\frac{r_1}{r_2}\right)^5 = \frac{P_{a2} + \frac{2S}{r_2}}{P_{a1} + \frac{2S}{r_1}}$$

B) If the surface of the bubble is a perfect heat insulator, then the total internal energy of the bubble including its surface energy does not change with the external atmospheric pressure

C) If the surface of the bubble is a perfect heat conductor and the change in atmospheric

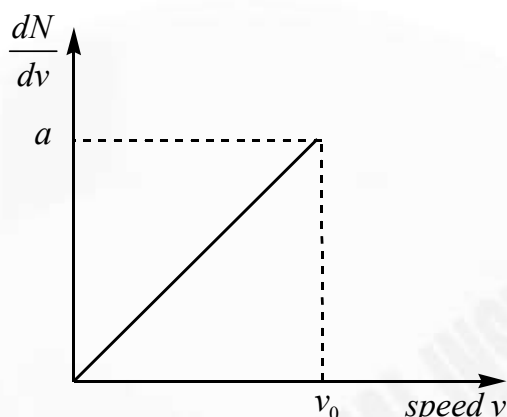
temperature is negligible, then
$$\left(\frac{r_1}{r_2}\right)^3 = \frac{P_{a2} + \frac{4S}{r_2}}{P_{a1} + \frac{4S}{r_1}}$$

D) If the surface of the bubble is a perfect heat insulator, then
$$\left(\frac{T_2}{T_1}\right)^{\frac{5}{2}} = \frac{P_{a2} + \frac{4S}{r_2}}{P_{a1} + \frac{4S}{r_1}}$$



15. Graph shows a hypothetical speed distribution for a sample of N gas particles

(for $v > v_0$; $\frac{dN}{dv} = 0$)



- A) The value of v_0 is $\frac{2N}{a}$ B) The ratio $\frac{v_{avg}}{v_0} = \frac{2}{3}$
- C) The ratio $\frac{v_{rms}}{v_0} = \frac{1}{\sqrt{2}}$
- D) Three fourth of the total particle has speed between $0.5v_0$ and v_0
16. An ideal gas whose adiabatic exponent equals γ is expanded so that the amount of heat transferred to the gas is equal to the decrease of its internal energy
- A) The molar heat capacity of the gas in this process is $C = \frac{-R}{\gamma - 1}$
- B) The equation of the process in the variables T, V is $TV^{\frac{\gamma-1}{2}} = \text{constant}$
- C) The work performed by one mole of the gas when its volume increases η times if the initial temperature of the gas is T_0 , $W = \frac{2RT_0}{\gamma - 1} \left(1 - \eta^{\frac{1-\gamma}{2}} \right)$
- D) The work performed by one mole of the gas when its volume increases η times if the initial temperature of the gas is T_0 , $W = \frac{RT_0}{\gamma - 1} \left(1 - \eta^{\frac{1-\gamma}{2}} \right)$

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SECTION-IV (INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks** : +4 If ONLY the correct integer is entered;
- **Zero Marks** : 0 In all other cases.

17. The volume of the bulb of mercury thermometer at 0°C is V_0 and cross -section of capillary is A_0 . Coefficient of linear expansion of glass is α_g . The cubical expansion of mercury is γ_g . If the mercury just fills the bulb at 0°C . Then the length of the mercury column at $t^\circ\text{C}$ is $\frac{V_0 t (\gamma_R - a \alpha_g)}{A_0 (1 + b \alpha_g t)}$. the sum of a + b is _____
18. A liquid at 30°C is poured very slowly into a Calorimeter that is at temperature of 110°C the boiling temperature of the liquid is 80°C . It is found that the first 5 gm of the liquid completely evaporates. After pouring another 80 gm of liquid the equilibrium temperature is found to be 50°C . The ratio of the latent heat of the liquid to its specific heat will be $X \times 10^0$. Then X is [Neglect the heat exchange with surrounding]
19. 2 kg of ice at -20°C is mixed with 5 kg of water at 20°C in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container is _____ Kg. It is given that the specific heats of water and ice are $1 \text{ Kcal/kg}^\circ\text{C}$ and $0.5 \text{ kcal/kg}^\circ\text{C}$ while the latent heat of fusion of ice is 80 Kcal/kg .

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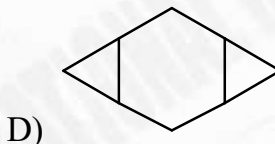
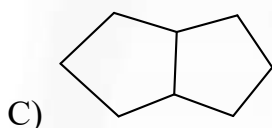
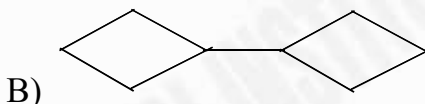
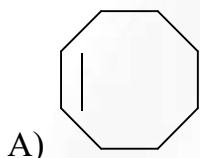
CHEMISTRY

Max. Marks: 60

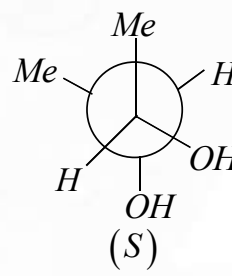
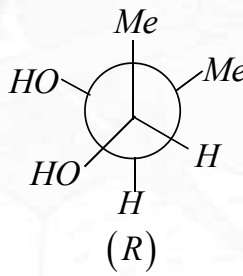
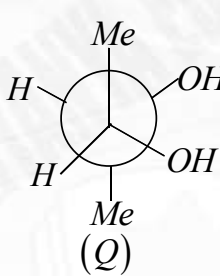
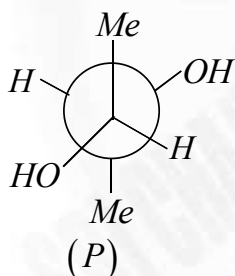
SECTION-I
(SINGLE CORRECT ANSWER TYPE)

- 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 the none of the options is chosen (i.e. the question is unanswered);
- Negative Marks : -1 In all other cases.

20. Which one of the compounds shown below, is not an isomer of the others?

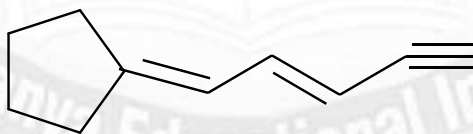


21. Among the following the Newmann projections of meso-2,3-butanediol are :



- A) P, Q B) P, R C) R, S D) Q, S

22. The number of cis-trans isomers possible for the following compound is



- A) 2 B) 4 C) 6 D) 8

23. A pure enantiomer of an organic compound has a specific rotation of $+8.4^\circ$. A sample of the same compound has a specific rotation of $+3.2^\circ$. The percentage of (-) isomer is

- A) 61% B) 31% C) 26% D) 50%



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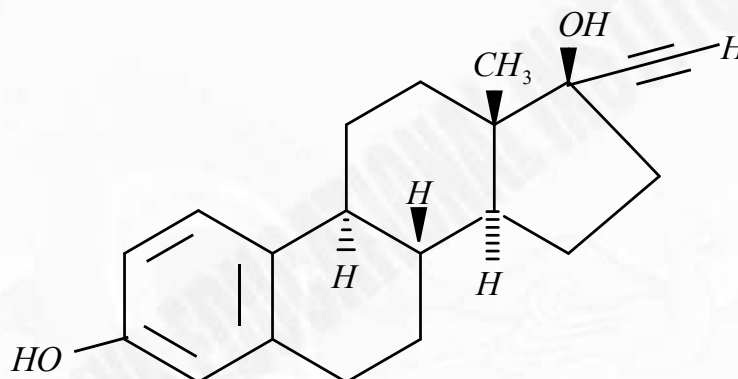
SECTION-II

(PARAGRAPH WITH NUMERICAL VALUE TYPE)

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

Question Stem for Question Nos. 24 and 25

Question Stem



Ethynylestradiol (1)

The synthetic steroid ethynylestradiol (1) is compound used in the birth control pill.

- How many asymmetric (steriogenic) centres are present in compound (1)?
- How many sp^3 hybridized carbon atoms are present in compound (1) ?

Question Stem for Question Nos. 26 and 27

Question Stem

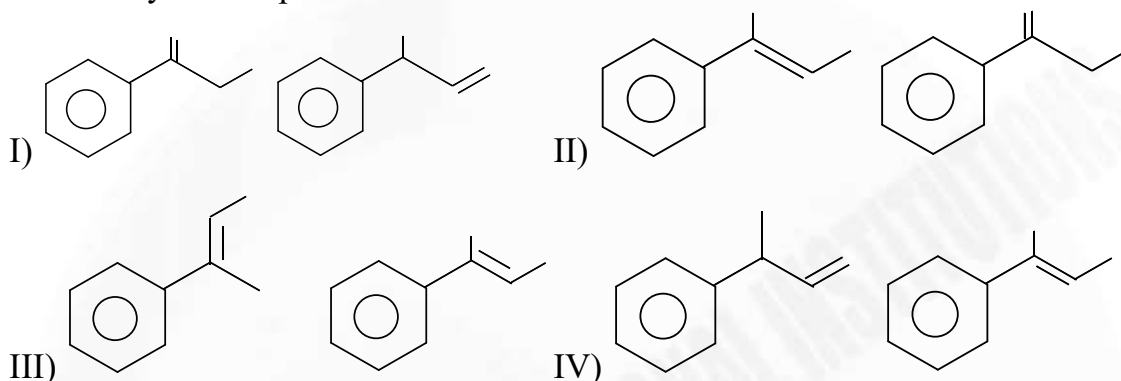
A number of unsaturated hydrocarbons have the same molecular formula $C_{11}H_{22}$. All of these hydrocarbons on catalytic hydrogenation gives the same 3, 4, 6- trimethyloctane.

- How many of the above unsaturated hydrocarbons (show geometrical isomerism) gives 3, 4, 6- trimethyloctane
- If the product is 3, 6-dimethyl octane, how many different isomers (structural+geometrical only) of alkenes can given this product?

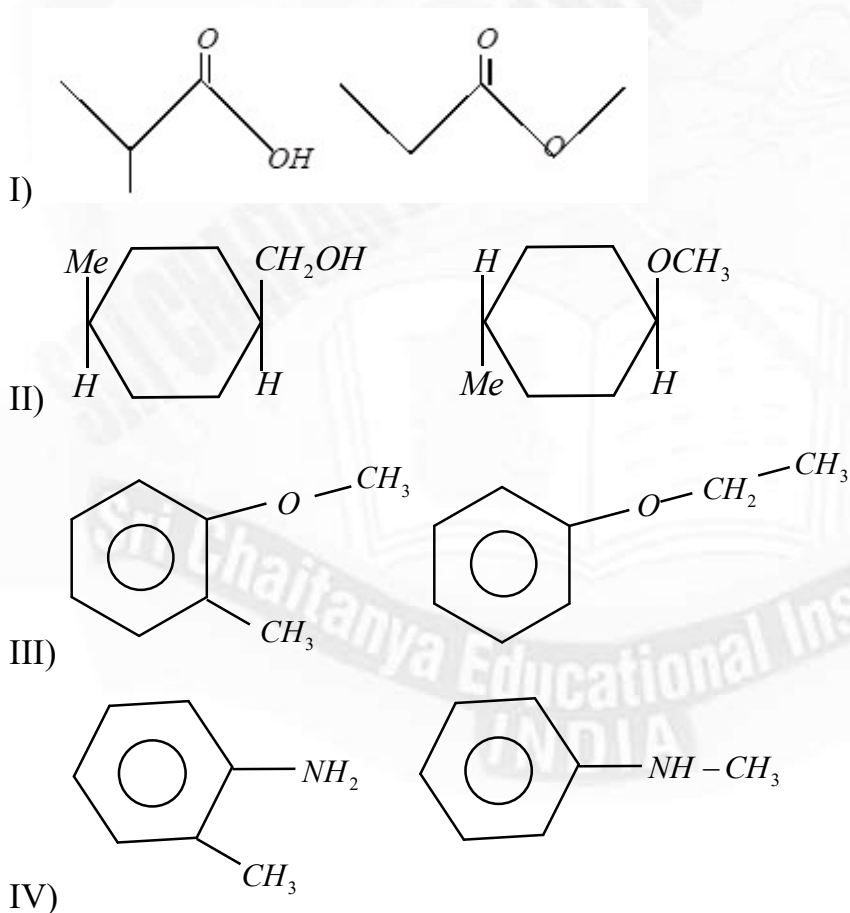
**Question Stem for Question Nos. 28 and 29****Question Stem**

Structural isomerism for any compound may be chain, position, functional metamerism & tautomerism

28. How many are not positional isomer of each other



29. How many sets are functional isomers

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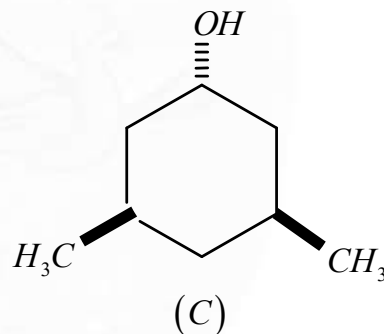
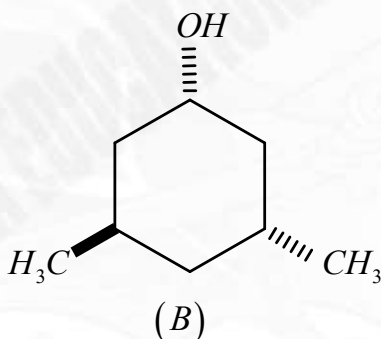
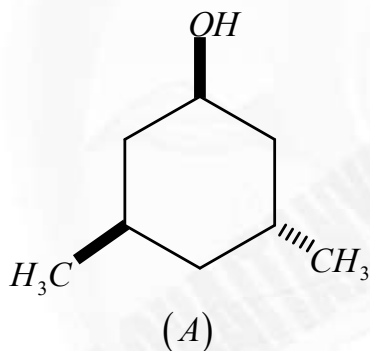


SECTION-III

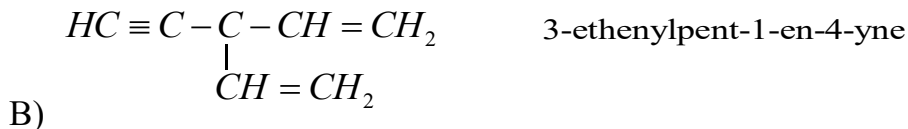
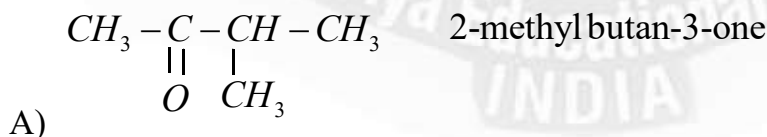
(ONE OR MORE CORRECT ANSWER TYPE)

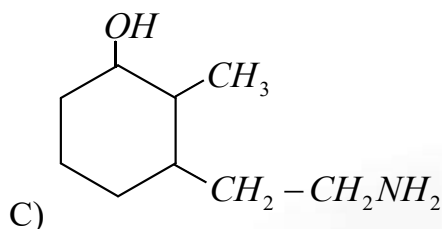
- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will 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 unanswered;
- Negative Marks: -2** In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to the correct answer, then
 Choosing **ONLY** (A), (B) and (D) will get +4 marks;
 Choosing **ONLY** (A), will get +1 mark;
 Choosing **ONLY** (B), will get +1 mark;
 Choosing **ONLY** (D), will get +1 mark;
 Choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
 Choosing any other option(s) will get -2 marks.

30. What is the relationship between the three compounds below

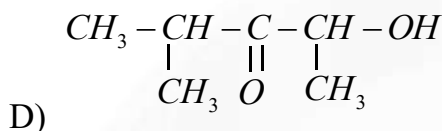


- A) A & B are diastereomers; B & C are diastereomers
 B) A & B are identical; B & C are diastereomers
 C) A & B are identical; A & C are also diastereomers
 D) A & B are enantiomers; B & C are diastereomers
31. Which of the following is/are incorrect IUPAC name/s

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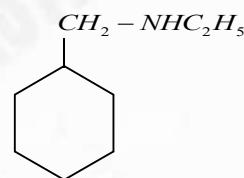
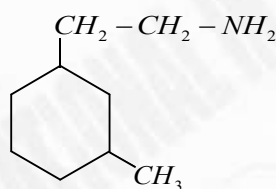
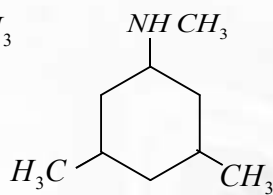
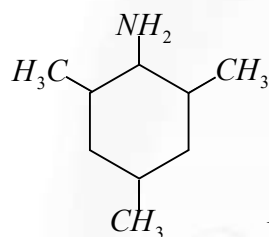


3-(2-aminoethyl)-2-methylcyclohexan-1-ol



4-methyl-3-oxo-pentan-2-ol

32. Which of the following is the correct relationship?



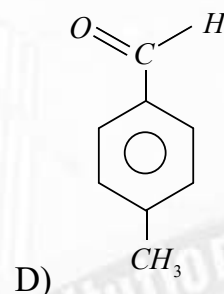
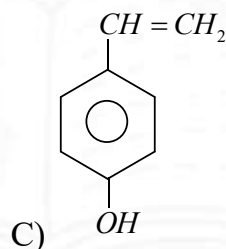
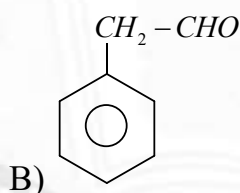
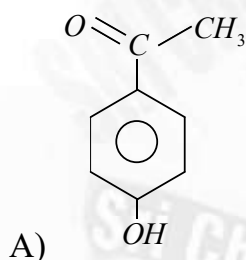
A) I & II are functional isomers

B) II & IV are metamers

C) I & IV are position isomers

D) I & III are structural isomers

33. Which of the following can be the isomers of C_8H_8O



34. Identify compound(s) in which gauche conformer is more stable than staggered

A) 1, 2-difluoroethane

B) chloropropane (C_1 - C_2 rotation)

C) Ethylene glycol

D) succinic acid



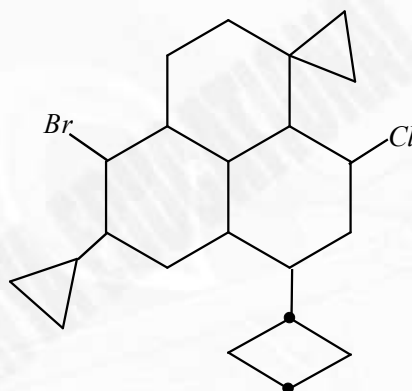
35. Which of the following molecule/s does not show stereo isomerism?

- A) 3-ethyl-4-methylhex-3-ene B) 3-methyl hex-1-ene
C) 3-ethyl hex-3-ene D) 4-methyl pent-1-ene

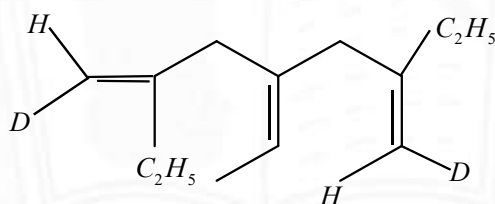
SECTION-IV
(INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks** : +4 If ONLY the correct integer is entered;
- **Zero Marks** : 0 In all other cases.

36. Total number of 2^0 -carbon present in given compound is _____



37. Number of geometrical isomers possible for the given structure is _____



38. How many structurally isomeric carbonyl compounds are possible with molecular formula $C_5H_{10}O$

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**MATHEMATICS****Max. Marks: 60****SECTION-I**
(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 the none of the options is chosen (i.e. the question is unanswered);
- Negative Marks : -1** In all other cases.

39. Let $f(30+x) = f(30-x) \forall x \in R$. If $f(x) = 0$ has exactly three real roots α, β, γ then $\alpha + \beta + \gamma$ is
- A) 30 B) 60 C) 90 D) 100
40. The domain of the function $f(x) = \frac{1}{\sqrt{[\![x]\!]-1}}$, when $[\cdot]$ denotes the greatest integer function, is
- A) $(-\infty, 7)$ B) $(-\infty, -7] \cup [7, \infty)$ C) $(-7, 7)$ D) R
41. Domain of $f(x) = [x] \sin\left(\frac{\pi}{[x+1]}\right)$, where $[\cdot]$ denote the GIF is
- A) $R - [-1, 0)$ B) $[-1, 0)$ C) $[-1, 0]$ D) $R - [-1, 0]$
42. Range of the function $f(x) = \cos^{-1}x + \operatorname{cosec}^{-1}x$ is
- A) $[0, \pi]$ B) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$ C) $\left\{-\frac{\pi}{2}\right\}$ D) $\left\{\frac{\pi}{2}\right\}$

SECTION-II
(PARAGRAPH WITH NUMERICAL VALUE TYPE)

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

SEC: Sr.Super60_STERLING BT**Space for rough work****Page 16****Sri Chaitanya**
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**Question Stem for Question Nos. 43 and 44****Question Stem**

$f: R \setminus \{0,1\} \rightarrow R$ such that $f(x) + 2f\left(\frac{1}{x}\right) + 3f\left(\frac{x}{x-1}\right) = x$, then

43. $16f(4) =$

44. $24f(2) =$

Question Stem for Question Nos. 45 and 46**Question Stem**

If $\sum_{r=1}^{10} \tan^{-1}\left(\frac{3}{9r^2 + 3r - 1}\right) = \cot^{-1} \frac{m}{n}$ (where m and n are coprime), then

45. $m =$

46. $n =$

Question Stem for Question Nos. 47 and 48**Question Stem**

Number of solutions of the equation $\sin^{-1}(\sin x) = -x^2 + 1$ is p and number of positive solutions is q then

47. $p =$

48. $p + 2023q =$

SECTION-III**(ONE OR MORE CORRECT ANSWER TYPE)**

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) 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 unanswered;
- **Negative Marks** : -2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to the correct answer, then
 Choosing **ONLY** (A), (B) and (D) will get +4 marks;
 Choosing **ONLY** (A), will get +1 mark;
 Choosing **ONLY** (B), will get +1 mark;
 Choosing **ONLY** (D), will get +1 mark;
 Choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
 Choosing any other option(s) will get -2 marks.

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49. Which one of the following is / are positive?
- A) $\cos(\tan^{-1}(\tan 4))$ B) $\sin(\cot^{-1}(\cot 4))$
 C) $\tan(\cos^{-1}(\cos 5))$ D) $\cot(\sin^{-1}(\sin 4))$
50. $f: R \rightarrow R$ and $f(f(x)) = x^3 + 3x$. then which of the following is/are correct?
- A) f is an one to one function B) f can be many to one function
 C) f is an onto function D) f is an into function
51. Let $f(x) = \sqrt{\sin(\sin x)} + \sqrt{\sin(\cos x)}$, Then which of the following is/are correct?
- A) Range of f is $\left[\sqrt{\sin 1}, 2\sqrt{\sin \frac{1}{\sqrt{2}}} \right]$
 B) Domain of f is $\bigcup_{n \in \mathbb{Z}} \left[2n\pi, 2n\pi + \frac{\pi}{2} \right]$
 C) Period of the function is 2π
 D) f is a many to one function
52. Let $f(x) = \frac{x^2 + 4x + 3}{x^2 + 7x + 14}$, $g(x) = \frac{x^2 - 5x + 10}{x^2 + 5x + 20}$. Then which of the following is/are correct?
- A) Max of $f(x)$ is 2 B) Max of $g(x)^{f(x)}$ is 9
 C) $g(x)^{f(x)}$ has maximum at $x = -1$ D) $g(x)^{f(x)}$ has maximum at $x = -5$
53. If a function $f: [a, \infty) \rightarrow [a, \infty)$ is defined by $f(x) = x^2 - 2ax + a(a+1)$ and if one of the solution of the equation $f(x) = f^{-1}(x)$ is 5044, then the other may be
- A) 5043 B) 5042 C) 5045 D) 5046

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54. $\tan^{-1} x + \cos^{-1} \frac{y}{\sqrt{1+y^2}} = \sin^{-1} \left(\frac{3}{\sqrt{10}} \right)$ $x, y > 0, x, y \in I$ then which of the following is/are correct?

A) $x \in (0, 2), y \in (1, 7)$

B) $x \in (1, 3), y \in (3, 8)$

C) $x \in (0, 4), y \in (3, 7)$

D) $x \in (2, 3), y \in (3, 8)$

SECTION-IV (INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- Full Marks** : +4 If ONLY the correct integer is entered;
- Zero Marks** : 0 In all other cases.

55. $f : N \rightarrow R - \{0\}$, such that

$$f(1) + f(2) + \dots + f(n) = f(n) \cdot f(n+1), \forall n \in N. \text{ Let } f(2) + f(4) + f(6) + \dots + f(100) = a$$

and $S(n)$ denote the sum of digits of n then $S(S(a))$ is

56. If $f(x) = [x] + \sum_{r=1}^{2008} \frac{x+r-[x+r]}{2008}$, then $f(3) = \dots$ (where $[.]$ is G.I.F)

57. Let $f(0) = f(1) = 0$ and $f(n+2) = 4^{n+2} f(n+1) - 16^{n+1} f(n) + n \cdot 2^{n^2}$, $n = 0, 1, 2, 3, \dots$ then the remainder on dividing $f(1990)$ by 13 is



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