



# Sri Chaitanya IIT Academy.,India.

✪ A.P ✪ T.S ✪ KARNATAKA ✪ TAMILNADU ✪ MAHARASTRA ✪ DELHI ✪ RANCHI

*A right Choice for the Real Aspirant*

ICON Central Office - Madhapur - Hyderabad

Sec: **Sr.Super60\_NUCLEUS&STERLING\_BT Paper -2(Adv-2022-P2-Model)**

Date: 13-08-2023

Time: 02.00Pm to 05.00Pm

CTA-01

Max. Marks: 180

13-08-2023\_Sr.Super60\_NUCLEUS&STERLING\_BT\_Jee-Adv(2022-P2)\_CTA-01\_Syllabus

**PHYSICS** : RPTA.1 TO RPTA.2 SYLLABUS

**CHEMISTRY** : RPTA.1 TO RPTA.2 SYLLABUS

**MATHEMATICS** : RPTA.1 TO RPTA.2 SYLLABUS

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
<b>Total</b>				<b>18</b>	<b>60</b>

**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
<b>Total</b>				<b>18</b>	<b>60</b>

**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
<b>Total</b>				<b>18</b>	<b>60</b>

Sec: Sr.Super60\_ NUCLEUS&amp;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 2023**  
SINGARAJU  
VENKAT KOUNDINNYA  
RANK 1  
300  
300

**1**

**JEE Advanced 2023**  
VAVILALA  
CHIDVILAS REDDY  
RANK 1  
341  
360

**1**

**NEET 2023**  
BORA VARUN  
CHAKRAVARTHI  
RANK 1  
720  
720

**1**

**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

- Suppose real numbers  $x, y$  satisfy  $x = 2\sqrt{x-y} + 4\sqrt{y}$ , the range of  $x$  is  $\{0\} \cup [p, q]$  then  $q - 3p$  is equal to \_\_\_\_\_
- The number of real roots of the equation  $x^3 - 3x = \sqrt{x+2}$  is/are \_\_\_\_\_
- The least possible positive integral value of 'a' such that the equation  $x^2 + 2ax + a - \sqrt{a^2 + x} - \frac{1}{16} + \frac{1}{16} = 0, x \geq -a$ , has two distinct real roots is \_\_\_\_\_
- If  $6 + f''(x) + f'(x) = x^2 + f^2(x)$  be the differential equation of a curve and let P be the point of minima of this curve, then the number of tangents which can be drawn from P to the circle  $x^2 + y^2 = 4$  is \_\_\_\_\_.
- Let  $f(x) = \begin{cases} 4x-2; & 0 \leq x \leq 1 \\ -x^2-2x; & -2 \leq x < 0 \end{cases}$  the number of solution(s) of the equation  $f(f(x)) = \frac{3}{4}$  is \_\_\_\_\_
- Let  $f$  be a differentiable function on  $(0, \infty)$   
If  $\lim_{x \rightarrow \infty} \left( \sin\left(\frac{\pi}{10}\right) \cdot f(x) + f'(x) \right) = \sec\left(\frac{\pi}{5}\right)$ , then  $\lim_{x \rightarrow \infty} f(x)$  equals \_\_\_\_\_
- If  $L = \lim_{n \rightarrow \infty} \sum_{r=0}^n \frac{2^r}{5^{2^r} + 1}$ , then the value of  $(40L - 1)$  equals \_\_\_\_\_
- The number of solution(s) of the equation  $(x-2) + 2 \log_2(2^x + 3x) = 2^x$  in  $(-\infty, 3)$  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  $\alpha = \sum_{k=1}^{\infty} \cos^{2k} \left( \frac{\pi}{3} \right)$ . Let  $g : [0, 1] \rightarrow R$  be the function defined by  $g(x) = 2^{\alpha x} + 2^{\alpha(1-x)}$ .

Then, which of the following statements is/are **TRUE**?

- A) The minimum value of  $g(x)$  is  $2^{\frac{7}{6}}$
- B) The maximum value of  $g(x)$  is  $1 + 2^{\frac{1}{3}}$
- C) The function  $g(x)$  attains its maximum at only one point
- D) The function  $g(x)$  attains its minimum at more than one point
10. Let  $f : [0, 8] \rightarrow R$  be twice differentiable function such that  $f(0) = 0, f(4) = 1, f(8) = 1$  then identify the **CORRECT** statement(s).
- A) There exist some  $c_1 \in (0, 8)$  where  $f'(c_1) = \frac{1}{4}$
- B) There exist some  $c \in (0, 8)$  where  $f'(c) = \frac{1}{3}$
- C) There exist  $c_1, c_2 \in [0, 8]$  where  $8f'(c_1)f'(c_2) = 1$
- D) There exist some  $\alpha, \beta \in (0, 2)$  such that  $\int_0^8 f(t) dt = 3(\alpha^2 f(\alpha^3) + \beta^2 f(\beta^3))$
11.  $f : [0, 1] \rightarrow R$  is a differentiable function such that  $f(0) = 0$  and  $|f'(x)| \leq K|f(x)|$  for all  $x \in [0, 1]$  ( $K > 0$ ) then which of the following is/are always **TRUE**?
- A)  $f(x) = 0 \forall x \in R$
- B)  $f(x) = 0 \forall x \in [0, 1]$
- C) Number of solutions of  $2^x - x^2 = f(x)$  in  $[0, 1]$  is 2
- D) Number of solutions of  $e^x - x^2 = f(x)$  in  $[0, 1]$  is 1





12. Let  $f$  be a function defined by  $f(k) = \int_0^{\frac{\pi}{2}} |k - 2 \sin t| \cos t \, dt$  where  $k$  is any real number,

then which of the following statement(s) is/are **CORRECT** ?

- A)  $f(k)$  is continuous  $\forall k$  but not differentiable at two values of  $k$   
 B)  $f(k)$  is differentiable  $\forall k$   
 C)  $f(k) = k - 1 \forall k \geq 2$   
 D)  $f(k) = 1 - k \forall k \leq 0$
13. Let  $f: [0, 1] \rightarrow R$  be a continuous function. If  $f(x)$  is differentiable on  $(0, 1)$  and

$\int_0^1 f(x) dx = 0$ , then which option(s) is/are **CORRECT**:

- A)  $\int_0^c f(x) dx = f(c)$ , for at least one  $c$  in  $(0, 1)$   
 B)  $\int_0^c f(x) dx = -f(c)$ , for at least one  $c$  in  $(0, 1)$   
 C)  $\int_0^c f(x) dx = \left(\frac{1-c}{c}\right) f(c)$ , for at least one  $c$  in  $(0, 1)$   
 D)  $\int_0^c f(x) dx = -\left(\frac{1-c}{c}\right) f(c)$ , for at least one  $c \in (0, 1)$

14. A rectangular sheet of fixed perimeter with sides having their length in the ratio 5 : 8 is converted into an open rectangular box by folding, after removing squares of equal areas from all four corners. If the total area of removed squares is 4, the resulting box has maximum volume. If the length of sides of rectangular sheet are  $a$  and  $b$ , then which of the following is/are **TRUE**? ([.] is GIF,  $a > b$ )

- A)  $[b] = 4$       B)  $[a] = 8$       C)  $[b] = 5$       D)  $[a] = 9$





### 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. Let  $P(x) = 0$  be a  $50^{\text{th}}$  degree polynomial with 50 real and distinct roots say  $\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_{50}$ . Then  $P(x) = A(x - \alpha_1)(x - \alpha_2)(x - \alpha_3) \dots (x - \alpha_{50})$ , where  $A \in \mathbb{R} - \{0\}$  and  $\alpha_i \neq 0 \forall i \in [1, 50]$ . The roots of the equation  $50p(x)p'(x) = 49(p'(x))^2$  are
- A) All real and distinct                      B) All imaginary  
C) All real but not all distinct              D) Atleast two real roots
16. The minimum value of  $\left[ (\tan A - \cos B)^2 + (4 \cot A - \sin B)^2 \right]^{1/2}$ , where A and B are independent defined variables, is of the form  $b\sqrt{c} - a$ , where a, b, c are natural numbers and c is prime. The value of  $a + b + c$  is equal to
- A) 15                      B) 5                      C) 4                      D) 7
17. Let a function 'f' satisfies  $f(-x) = f(x)$  and  $f(3+x) = f(1-x) \forall x \in \mathbb{R}$  and  $f(x) = \begin{cases} x & ; 0 \leq x \leq 1 \\ 1-2x & ; 1 < x \leq 2 \end{cases}$ . The number of points where function  $f(x)$  is discontinuous in  $[0, 100]$  is equal to D and value of  $\int_0^{100} f(x) dx$  is equal to
- I. The value of  $2D - I$  is equal to
- A) 100                      B) 125                      C) 150                      D) 175
18. If  $f(x)$  is differentiable function wherever it is continuous and  $f'(c_1) = f'(c_2) = 0, f''(c_1) \cdot f''(c_2) < 0, f(c_1) = 5, f(c_2) = 0$  and  $(c_1 < c_2)$ . If  $f(x)$  is continuous in  $[c_1, c_2]$  and  $f''(c_1) - f''(c_2) > 0$ , then minimum number of roots of  $f'(x) = 0$  in  $[c_1 - 1, c_2 + 1]$  is
- A) 2                      B) 3                      C) 4                      D) 5







## PHYSICS

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.
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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

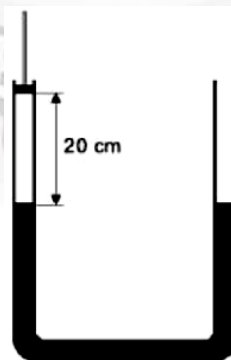
19. The cylindrical vessel shown in the figure has two pistons in it. The piston on the left touches a spring attached to the wall of the vessel. The wall has a hole in it. The volume of the air between the pistons is  $2000 \text{ cm}^3$  and its pressure is initially equal to the external atmospheric pressure of  $10^5 \text{ N/m}^2$ . The piston on the right is slowly pressed inwards, maintaining constant temperature, until its inner surface is at the position where the inner surface of the piston on the left was initially. What will be the final volume of the air between the pistons?

The cross-sectional area of the cylinder is  $100 \text{ cm}^2$ , and a force of 10 N compresses the spring by 1 cm.

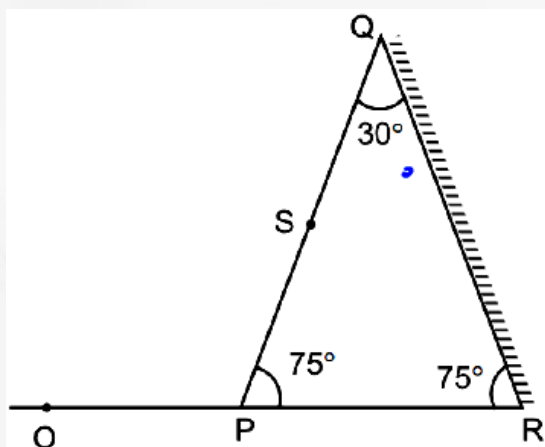
If  $V = x \times 10^{-4} \text{ m}^3$  find  $\frac{x}{6}$  (nearest integer)



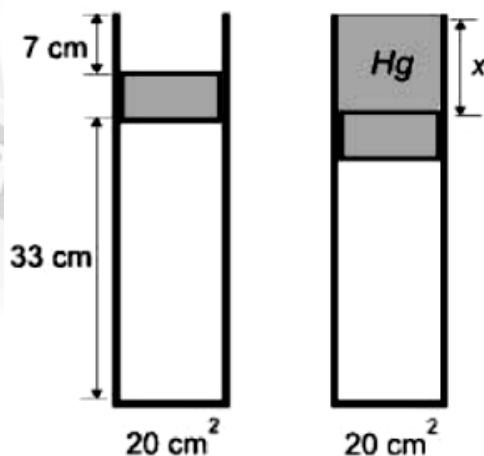
20. One arm of a communicating vessel containing mercury is closed by a piston 20 cm above the mercury. The other arm is open. The mercury level is the same in both arms, whose cross-sectional areas are  $2 \text{ cm}^2$ . In an isothermal process the piston is pushed down by 10 cm. Find the change in height (x cm) of right arm (Nearest integer)



21. PQR is an isosceles prism in which point 'S' is the mid point of the face PQ. The refractive index of the prism is  $\sqrt{3}$  and its face QR is silvered. 'O' is a point source. A light ray has been sent from the source 'O' to point 'S' in such a way that it comes back to point 'O'. It is given that  $PR = \frac{20}{\sqrt{3} + 1} \text{ cm}$ . Find the distance (in cm) of the source 'O' from the point 'P'.



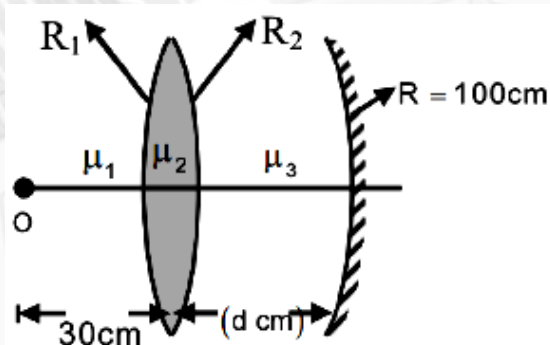
22. In a cylinder, whose cross-sectional area is  $20 \text{ cm}^2$ , a frictionless piston of mass  $7.2 \text{ kg}$  encloses a  $33 \text{ cm}$  high air column at  $0^\circ \text{C}$  so that there is a  $7 \text{ cm}$  high empty part above the piston as shown. The atmospheric pressure is  $10 \text{ N/cm}^2$ , the densities of mercury and air in its initial state are  $13.6 \text{ g/cm}^3$  and  $1.8 \text{ g/dm}^3$  respectively, the specific heat of the air at constant volume is  $0.7 \text{ J/(g K)}$ . Use  $g = 10 \text{ m/s}^2$ . Mercury is poured into the empty part above the piston until the cylinder is full. (Assume constant temperature). If length of mercury column is  $x \text{ cm}$ . Find  $x/10 = ?$







23. For a given amount of nitrogen gas the initial, minimum temperature is  $T_0$ , while the maximum temperature is  $4T_0$ . The gas is first heated at constant volume, then it is allowed to expand at constant pressure. Then it is cooled at constant volume and finally it is compressed at constant pressure. This way the gas returns to its initial state. Find the maximum possible efficiency of the cyclic process. If it is  $n$ , find  $10n$  \_\_\_\_\_ ( $n$  is a fraction not percentage) (nearest integer)
24. Consider two semi-infinite plane mirrors with their finite ends placed together. The angle subtended by the two mirrors is  $\alpha$ . A ray, that is parallel to mirror 2, is incident on mirror 1 and after 8 reflections, it emerges parallel to mirror 1 (after a final reflection from mirror 2) Determine  $\alpha$ . If  $\alpha = \frac{\pi}{n}$ , Find  $n = ?$
25. A spherical planet of radius  $r$ , painted black, travels around the sun in a circular orbit at a distance  $D$  from its centre ( $r \ll D$ ). The sun, a sphere of radius  $R$ , radiates as a blackbody at a temperature  $T_0 = 6000K$  and subtends an angle  $0.01$  rad as seen from the planet. The equilibrium temperature  $T$  of the planet is  $x \times 100$ . Find  $x$ .
26. The given thin lenses have  $R_1 = R_2 = 10cm$  and  $\mu_1 = 1, \mu_2 = 2$  and  $\mu_3 = 4$ . If final image formed at object and value of ' $d$ ' is  $x \times 10cm$ . Find ' $x$ '.



### 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;

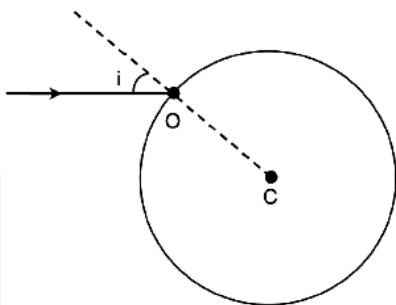
**Partial Marks:** +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

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

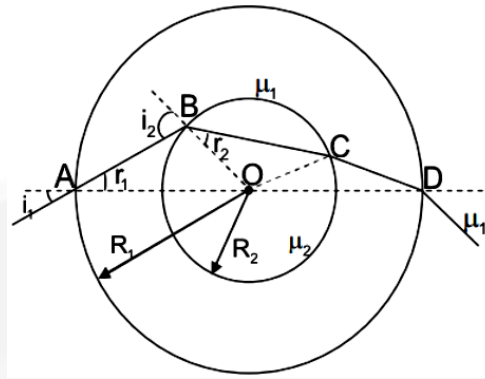
**Negative Marks:** -2 In all other cases.

27. A spherical transparent medium of refractive index  $n$  is placed in air. A thin parallel beam of light of monochromatic wavelength  $\lambda$  is incident at a point  $O$  of the sphere at an angle of incident  $i$ . Then which of the following statements will be true for this optic system ?



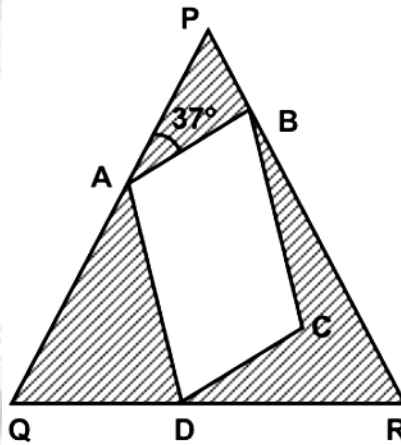


- A) For the ray to come out of the sphere after refraction through it, the incident angle  $i$  should be less than the critical angle  $C$  for the medium of the sphere.
- B) The angle of emergence  $\theta$  (made with the normal) for the ray will be equal to the incident angle  $i$  for all values of  $i$ .
- C) If the angle  $i = 90^\circ$  (grazing incidence) the emergent ray will come out grazing the surface.
- D) If the angle of incident  $i$  such that the angle of refraction at  $O$  is equal to the critical angle  $C$  for the medium of sphere, the emergent ray will be parallel to the incident ray.
28. A lens forms 3 times magnified image of an object on screen. When the distance between the screen and the lens is increased by 10 cm and object is also moved to get 5 times magnified image again on the screen. Then
- A) Focal length of the lens is 5 cm
- B) Focal length of the lens is -5 cm
- C) The displacement of the object is  $\frac{2}{3}$  cm towards the lens
- D) The displacement of the object is  $\frac{2}{3}$  cm away the lens
29. There is a spherical glass ball of refractive index  $\mu_1$  and another glass ball of refractive index  $\mu_2$  inside it as shown in figure. The radius of the outer ball is  $R_1$  and that of inner ball is  $R_2$ . A ray is incident on the outer surface of the ball at an angle  $i_1$ . Mark the correct options.



- A) The value of  $r_1$  is  $\sin^{-1}\left(\frac{\sin i_1}{\mu_1}\right)$       B) The value of  $r_2$  is  $\sin^{-1}\left(\frac{R_1}{\mu_2 R_2} \sin i_1\right)$
- C) The value of  $r_1$  is  $\sin^{-1}\left(\frac{\sin i_2}{\mu_2}\right)$       D) The value of  $r_2$  is  $\sin^{-1}\left(\frac{R_2}{\mu_2 R_1} \sin i_1\right)$

30. A rectangular cavity ABCD is carved inside an equilateral prism PQR of refractive index  $\left(\frac{8}{5}\right)$  as shown in figure. If  $\delta_{\min}$  is the deviation in a ray entering at face PQ and emerging at face PR, without passing through AB or CD, then which of the following is/are correct.

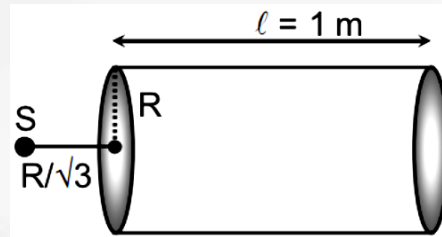


- A) There is no effect of cavity of the value of  $\delta_{\min}$ .
- B) The minimum deviation  $\delta_{\min} = 46^\circ$ .
- C) If the cavity is filled with water ( $\mu_w = 4/3$ ), the  $\delta_{\min} = 46^\circ$ .
- D) If the cavity is filled with a liquid of refractive index  $\mu = 2$ , then  $\delta_{\min} = 23^\circ$ .

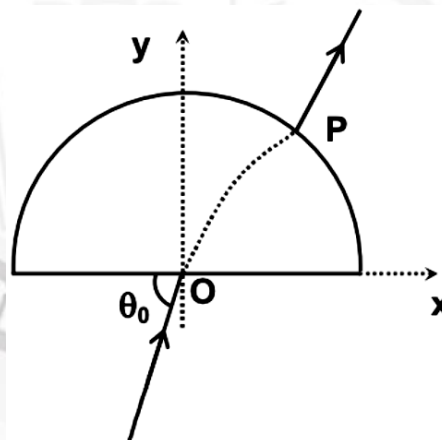




31. A conducting cylinder has curved surface covered with insulated layer. Flat surfaces are perfect absorbers. Flat surface area is  $\frac{3}{17}m^2$ . A point light source placed at some distance from left face. Temperature of surrounding is 0 K. In steady state temperature of left face is 200 K and right face 100 K. Then (Stefan's constant  $= \frac{17}{3} \times 10^{-8} W / m^2 k^4$ )



- A) Power emitted by source is 68W  
 B) Power emitted by source is 18W  
 C) Thermal conductivity of cylinder is 0.057 W/mK  
 D) Thermal conductivity of cylinder is 0.023 W/mK
32. A hemisphere made of a transparent material of variable refractive index has radius 12 cm and centre at origin O. The refractive index of the material of the sphere varies as  $\mu = \frac{24}{24 - x}$ , where x is in cm. A ray of light is incident at the point O at an angle  $\theta_0$  with the x-axis and comes out through a point P on its curved surface. Given  $\theta_0 \approx 90^\circ$ , then



- A) Path of the ray inside the sphere is parabolic  
 B) Path of the ray inside the sphere is circular  
 C) x-coordinate of point P is 3 cm  
 D) x-coordinate of point P is 1.50 cm





### SECTION – III (SINGLE CORRECT ANSWER TYPE)

This section contains **FOUR (04)** questions.

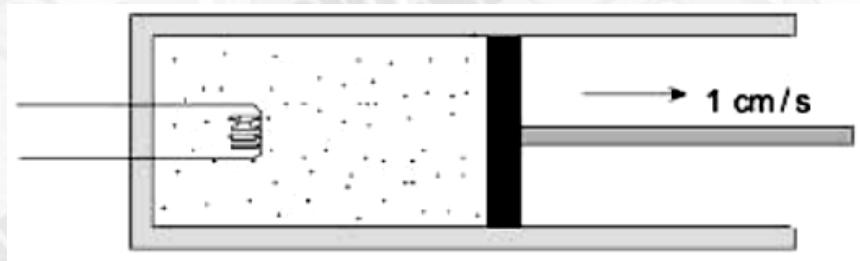
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

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

33. Ideal gas at pressure  $10^5 \text{ Pa}$  and volume  $1 \text{ m}^3$  is enclosed by a piston in a cylinder. We start to move the piston outwards at a constant velocity of  $1 \text{ cm/s}$ . The cross-sectional area of the piston is  $0.1 \text{ m}^2$ . While the piston is moving we can deliver heat to the gas through a heating filament. How should the heating power change as a function of time if we keep the temperature of the gas constant? (Apart from the heat transfer between the gas and the heating filament all other heat exchange can be neglected).

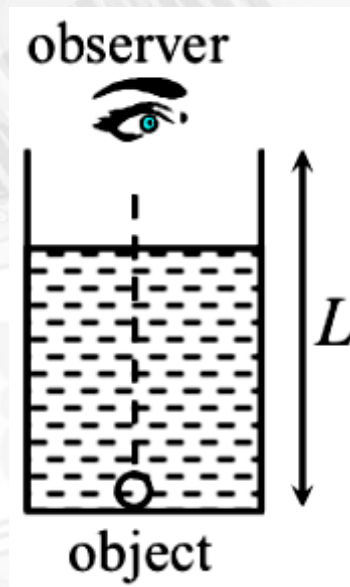


- A)  $P = \frac{100}{1 + 10^{-3}t}$       B)  $P = 100 + 10^{-3}t$
- C)  $P = \frac{100}{1 + 10^{-3}t^2}$       D) None of these
34. It is known that the temperature in the room is  $+20^\circ\text{C}$  when the outdoor temperature is  $-20^\circ\text{C}$ , and  $+10^\circ\text{C}$  when the outdoor temperature is  $-40^\circ\text{C}$ . Then the temperature  $T$  of the radiator heating the room is (Assuming that radiated by the heater is proportional to the temperature difference with the room)
- A)  $40^\circ\text{C}$       B)  $60^\circ\text{C}$       C)  $30^\circ\text{C}$       D)  $20^\circ\text{C}$





35. There is a very small hole in a totally enclosed heated furnace. Outside the furnace, the air temperature is  $0^{\circ}\text{C}$  and the air pressure is 100 kPa. The air inside the furnace is kept at a constant temperature of  $57^{\circ}\text{C}$  by the controlled heating system, and after a sufficiently long time its pressure also becomes stationary. Calculate (to the nearest integer) the magnitude of this stationary pressure.
- A) 105 kPa      B) 120 kPa      C) 110 kPa      D) 124 kPa
36. A cylinder is filled with a liquid of refractive index  $\mu$ . The radius of the cylinder is decreasing at a constant rate  $K$ . The volume of the liquid inside the container remains constant at  $V$ . The observer and the object  $O$  are in a state of rest and at a distance  $L$  from each other. The apparent velocity of the object as seen by the observer, (when radius of cylinder is  $r$ )



- A)  $\frac{(1-\mu)2KV}{(\pi\mu r^3)}$       B)  $\frac{(1-\mu)2KV}{(\pi\mu Lr^2)}$       C)  $\frac{(1-\mu)2K}{\mu}$       D)  $\frac{(1-\mu)K}{2\mu}$







## CHEMISTRY

Max Marks: 60

SECTION-I  
(INTEGER ANSWER TYPE)

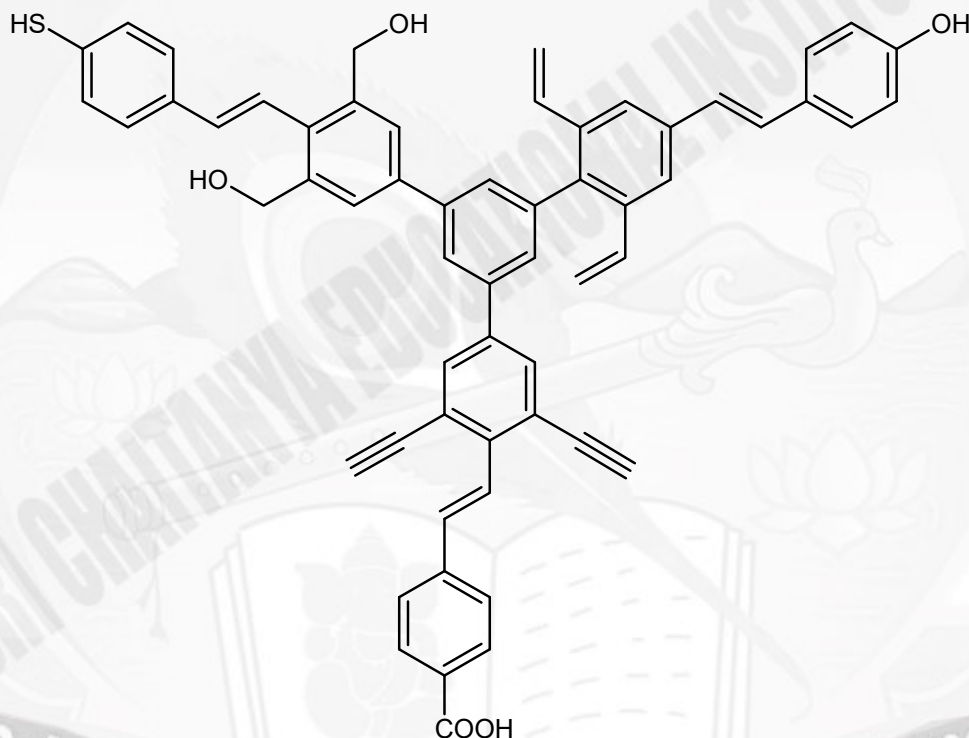
- This section contains EIGHT (08) questions.
- The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter 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;

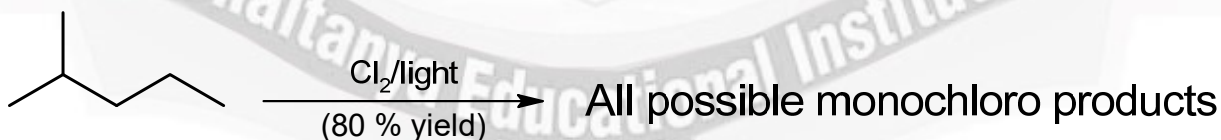
Zero Marks: 0 If the question is unanswered;

Negative Marks: -1 In all other cases

37. The number of moles of  $CH_4$  produced when 1 mole of the following compound is treated with excess methyl magnesium bromide ( $CH_3MgBr$ ) is \_\_\_\_\_.



38. Consider the following reaction:

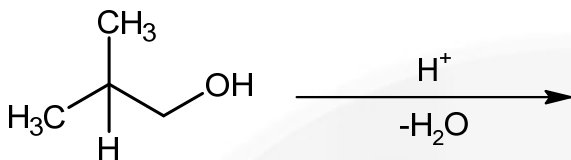


After the reaction, the reaction mixture is subjected to fractional distillation. Assuming that there are no other organic products/byproducts formed, the number of fractions obtained during fractional distillation is \_\_\_\_\_.

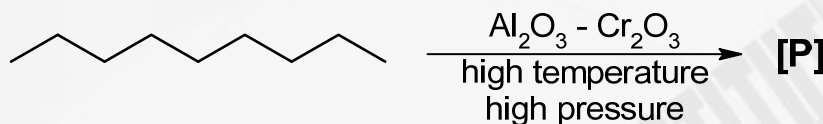




39. The number of hyperconjugation structures of the chief carbocation formed in the following reaction is

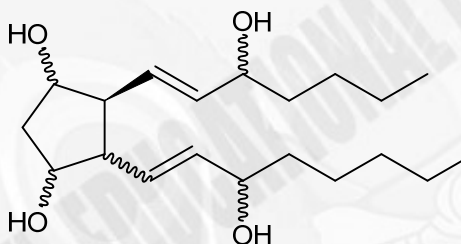


40. The number of  $sp^3$  carbon atoms in the product [P] in the following reaction is



41. The number of distinct tautomeric keto form(s) of phenol is \_\_\_\_\_.

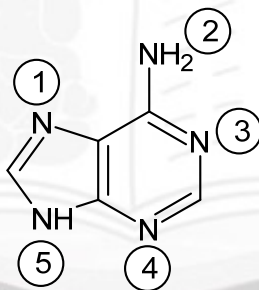
42. For the given compound X, the total number of optically inactive stereoisomers is



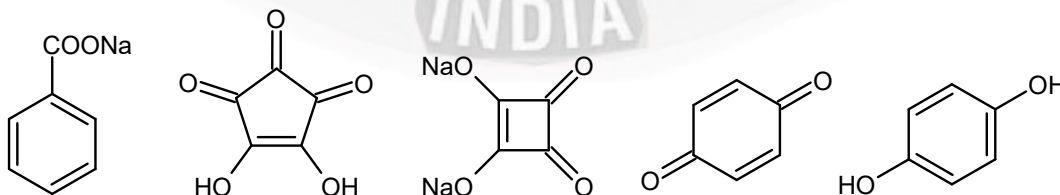
— This type of bond indicates that the configuration at the specific carbon and the geometry of the double is fixed.

~~~~ This type of bond indicates that the configuration at the specific carbon and the geometry of the double is not fixed.

43. The least favourable site for protonation in the following compound is \_\_\_\_\_.



44. The number of compounds in which all carbon – oxygen bonds are of equal length 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;

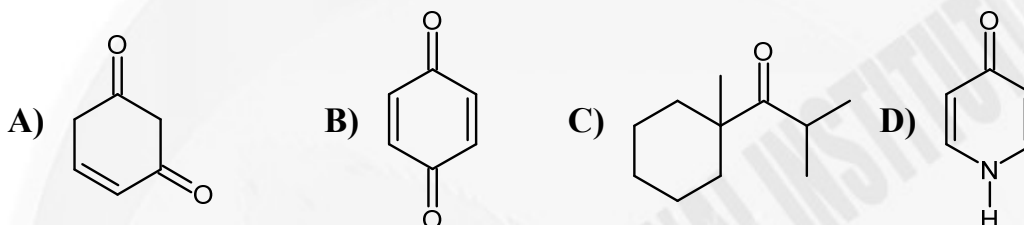
**Partial Marks:** +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct;

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

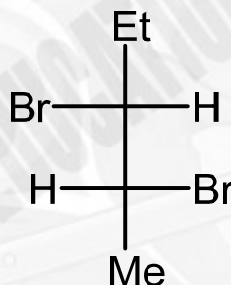
**Zero Marks:** 0 If none of the options is chosen (i.e. the question is unanswered);

**Negative Marks:** -2 In all other cases.

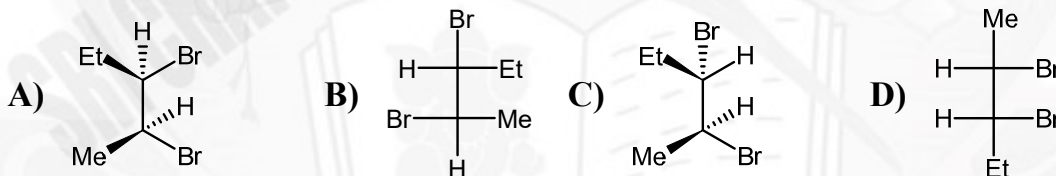
45. Tautomerism is exhibited by



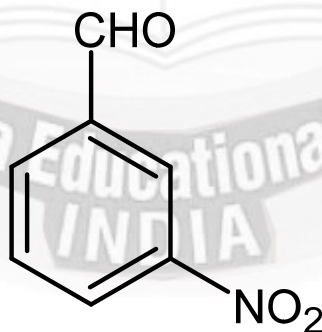
46. Given below is one of the *threo*-isomer of 2,3-dibromopentane:



Choose the structure(s) of its diastereomer(s):



47. IUPAC name(s) of the following compound is(are)



A) 3-nitrobenzaldehyde

B) 3-nitrobenzenecarbaldehyde

C) (3-nitrophenyl)methanal

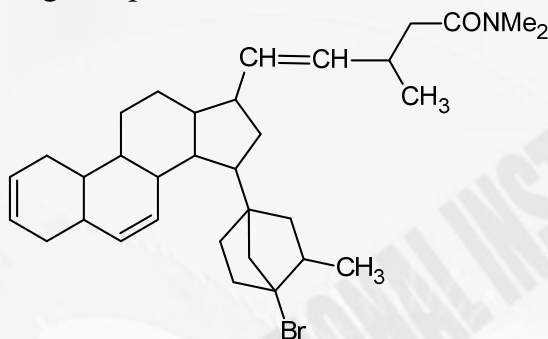
D) 1-formyl-3-nitrobenzene

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RANK 1  
341  
360**RANK****1****NEET****2023**BORA VARUN  
CHAKRAVARTHI  
RANK 1  
720  
720**RANK****1**



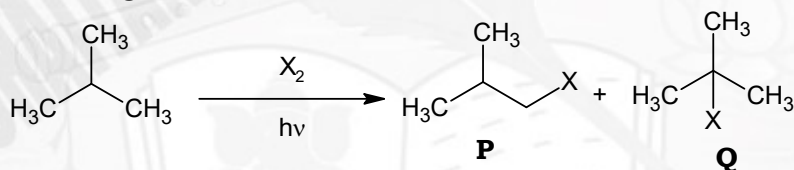


48. Which of the following is(are) explained by hydrogen bonding?
- A) *o*-nitrophenol is less acidic than *p*-nitrophenol.
- B)  $\text{Me}_2\text{NH}$  is more basic than  $\text{Me}_3\text{N}$  in aqueous solutions.
- C)  $pK_{\text{al}}$  of *cis* isomer of but-2-enedioic acid is less than that of the *trans* isomer.
- D) *o*-nitrobenzoic acid is more acidic than *p*-nitrobenzoic acid.
49. Considering the following compound,



Choose the correct statement(s):

- A) All of its stereoisomers are optically active.
- B) It exhibits tautomerism.
- C) It has 14 stereogenic atoms.
- D) The degree of unsaturation of this compound is 10.
50. Consider the following reaction:



Choose the correct statement(s) from amongst the following:

- A) When  $\text{X} = \text{F}$ , **P** and **Q** will be formed in equal proportions as F is equally reactive with primary as well as secondary hydrogen atoms.
- B) When  $\text{X} = \text{Cl}$ , **P** is the major product.
- C) When  $\text{X} = \text{Br}$ , **Q** is the major product.
- D) When  $\text{X} = \text{I}$ , the reaction does not succeed.

### 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:

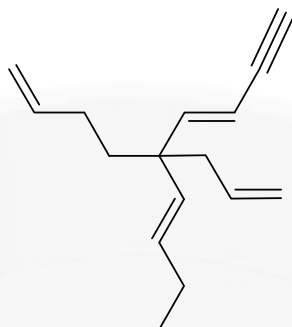
Full Marks : +3 If **ONLY** the correct option is chosen;

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

Negative Marks : -1 In all other cases



51. IUPAC name of the following compound is

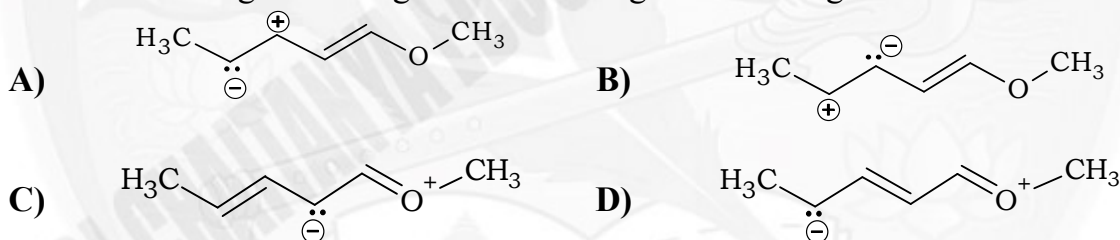


- A) 5-(but-3-enyl)-5-(prop-2-enyl)nona-3,6-dien-1-yne  
 B) 5-(but-1-enyl)-5-(prop-2-enyl)nona-3,8-dien-1-yne  
 C) 5-(but-3-enyl)-5-(prop-2-enyl)nona-,6-dien-8-yne  
 D) 5-(but-1-enyl)-5-(prop-2-enyl)nona-1,6-dien-7-yne

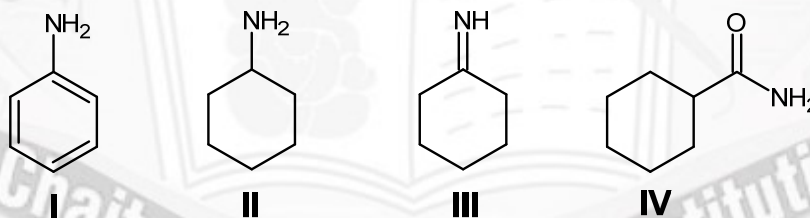
52. Alkane which releases the highest amount of heat per mol, on complete combustion is



53. Least contributing resonating structure among the following is



54. Choose the correct order of basic character of the following compounds



- A) I>II>IV>III B) II>I>III>IV C) II>III>I>IV D) II>I>IV>III





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