Sri Chaitanya IIT Academy.,India.

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ICON Central Office - Madhapur - Hyderabad

Sec:Sr.Super60_NUCLEUS&STERLING_BT **Paper -2(Adv-2020-P2-Model)** **Date: 20-08-2023**

Time: 02.00Pm to 05.00Pm **CTA-02** **Max. Marks: 198**

20-08-2023_Sr.Super60_NUCLEUS&STERLING_BT_Jee-Adv(2020-P2)_CTA-02_Syllabus

PHYSICS : RPTA.1 TO RPTA.3 SYLLABUS

CHEMISTRY : RPTA.1 TO RPTA.3 SYLLABUS

MATHEMATICS : RPTA.1 TO RPTA.3 SYLLABUS

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

JEE-ADVANCE-2020-P2-Model

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

PHYSICS:

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

CHEMISTRY:

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

MATHEMATICS:

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

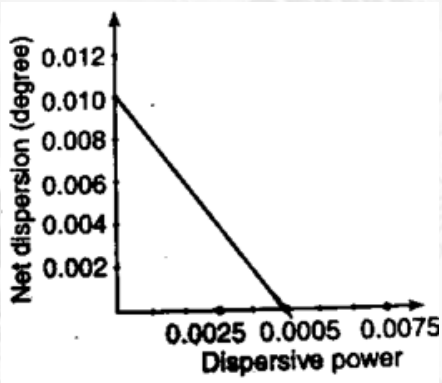
PHYSICS **Max Marks: 66**

SECTION-I
(INTEGER ANSWER TYPE)

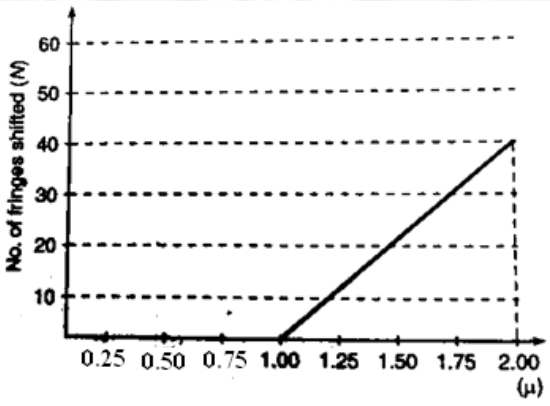
- This section contains SIX (06) questions.
- The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated **according to the following marking scheme:**

Full Marks : +3 If ONLY the correct integer is entered;
Zero Marks : 0 If the question is unanswered;
Negative Marks : -1 In all other cases

1. Two small angled prisms are coupled to yield a combination which gives only dispersion without any average deviation. The first prism is fixed, while the second prism is changed for its material and the apex angle. The graph of the net dispersion versus the dispersive power of the second prism is shown in Figure. If the light beam be passed only through the first prism, then the mean deviation will be 10n (in degree). Find n.



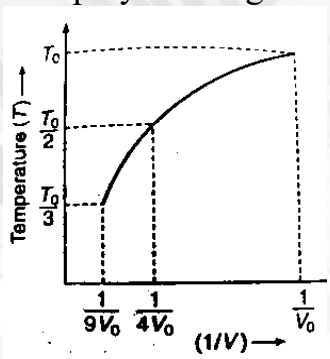
2. The slits in a double slit interference experiment are illuminated by orange light$(\lambda = 600nm)$. A thin transparent plastic of thickness t is placed in front of one of the slits. The number of fringes shifting is plotted across the refractive index μ of the plastic in Figure. The value of t is 6n (in micro meter). Find n.



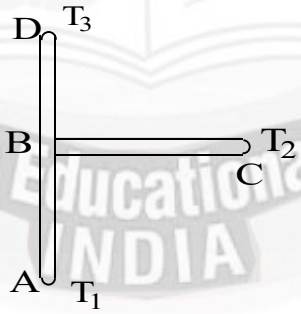
3. In a double slit experiment suppose that light emerging from the slits is intense enough to reach far off distances on the screen. Usually, the fringe width is expressed as $\frac{\lambda D}{d}$, where the symbols have their usual meanings; but this is true only if $y << D$, where y is the distance on the screen from the central bright fringe to the point of observation. If the fringe width is $p\lambda D / d$ at an angular position, $\theta = \frac{\pi}{3}$ relative to the central axis. Then find p. (Note that here y is comparable to D).

4. Four spheres A, B, C and D have their radii in arithmetic progression and the specific heat capacities of their substances are in geometric progression. If the ratio of ratios of heat capacities of D and B to that of C and A are as 8:27, the ratio of masses of B and A is: (assume same density for all spheres)

5. Figure shows the graph of T versus $\frac{1}{V}$ for a gaseous mixture of a monoatomic and a non linear polyatomic gas undergoing an adiabatic process. The ratio of the number of moles of the monoatomic and the polyatomic gas is:



6. Three rods of same cross-sectional area AB, BC and BD having thermal conductivities in the ration 1:2:3 and lengths in the ration 2:1:1 are joined as shown is Figure. The ends A, C and D are at temperatures T_1, T_2 and T_3 respectively.



The temperature of the junction B is $T = \frac{1}{d}(aT_1 + bT_2 + cT_3)$. Assume steady state. Find the value of $(a+b+c)/d$ value.

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).
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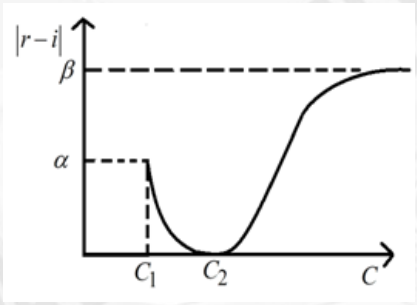
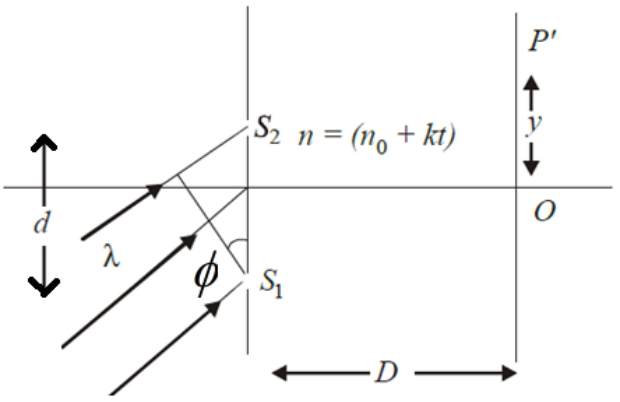
Full Marks: +4 If only (all) the correct option(s) is(are) chosen; *Partial Marks* +3 If all the four options are correct but ONLY three options are chosen;
Partial Marks: +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
Partial Marks: +1 If two or more 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.

7. A light ray is incident at an angle $i = \pi/3$ at the plane boundary separating two media. The light passes from medium 1 to medium 2. Figure shows a plot drawn showing the variation of $|r-i|$ versus $\frac{\mu_2}{\mu_1} = C$. Here r is the angle of refraction and μ_1, μ_2 the refractive indices of medium 1 and 2 respectively. Which of the following are correct?



A) $C_1 = 2/\sqrt{3}$ **B)** $\alpha = \pi/6$ **C)** $\beta = \pi/3$ **D)** $C_2 = 1$

8. For the Young's double slit experiment a monochromatic source light is used whose wavelength is λ strikes on the slits, separated by distance d as shown in the figure. In the figure n is refractive index of medium between slits and screen. Where n_0 and k are constants. (D>>d)



A) The y co-ordinate of central maxima at any time t is $\frac{D\sin\phi}{n_0 + kt}$

B) The velocity of central maxima at any time t as a function of time t is $\frac{-kD\sin\phi}{(n_0+kt)^2}$

C) If a glass plate of small thickness b is placed in front of S_1, its refractive index vary with time so that central maxima is formed at O is $n^1 = n_0 + kt + \frac{d\sin\phi}{b}$

D) Rate of change of velocity of the central maxima has no meaning as source is at large distance

9. An ideal gas has a molar heat capacity C_v at constant volume. The molar heat capacity of this gas a function of its volume, V

A) is $\left(C_v + \frac{R}{\alpha V}\right)$ if the gas undergoes the process $T = T_0 e^{\alpha V}$

B) is $\left(C_v + \frac{2R}{\alpha V}\right)$ if the gas undergoes the process $T = T_0 e^{\alpha V}$

C) is $\left\{C_v + \frac{R}{(1+\alpha V)}\right\}$ if the gas undergoes the process $P = P_0 e^{\alpha V}$

D) is $\left(C_v + \frac{R}{\alpha V}\right)$ if the gas undergoes the process $P = P_0 e^{\alpha V}$

10. An ideal gas can be expanded from an initial state to a certain volume through two different processes (i) $PV^2 =$ constant and (ii) $P = KV^2$ where K is a positive constant. Based on the given situation, choose the correct statement(s).

A) Final temperature in (ii) will be greater than in (i)

B) Final temperature in (ii) will be less than in (i)

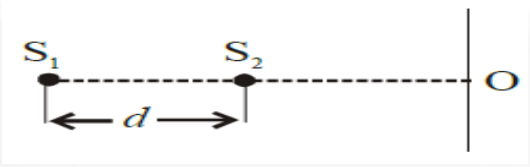
C) Total heat given to the gas in case (ii) is greater than in (i)

D) Total heat given to the gas in case (ii) is less than in (i)

11. A lens of focal length 'f' is placed in between an object and screen at a distance 'D' apart. The lens forms two real images of the object on the screen for two of its different positions, a distance 'x' apart. The two real images have magnifications m_1 and m_2 respectively $(m_1 > m_2)$.

A) $f = \frac{x}{m_1 - m_2}$ **B)** $m_1 m_2 = 1$ **C)** $f = \frac{D^2 - x^2}{4D}$ **D)** $D \geq 4f$

12. Two point monochromatic and coherent sources of light of wavelength λ are placed on the dotted line in front of an infinite screen. The source emits waves in phase with each other. The distance between S_1 and S_2 is d while their distance from the screen is much larger.



A) if d is $\frac{3\lambda}{2}$, at O minima will be observed

B) if d is $\frac{11\lambda}{6}$, then intensity at O will be $\frac{3}{4}$ of maximum

C) if d is 3λ, O will be a maxima

D) if d is $\frac{7\lambda}{6}$, the intensity at O will be $\frac{3}{4}$ of maximum intensity

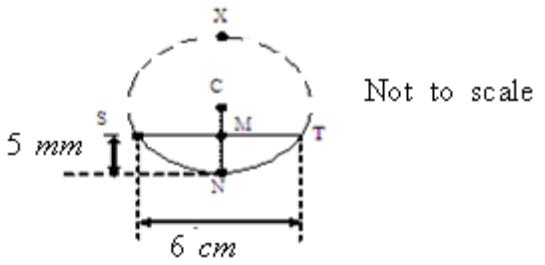
SECTION – III
(NUMERICAL VALUE TYPE)

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

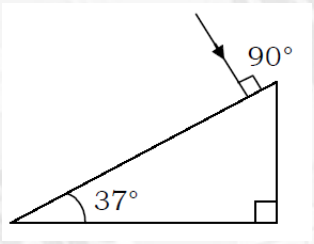
13. A hollow aluminium sphere of mass 150 kg floats on water. It is observed that, an additional mass of 30 kg is required to just submerge it at a temperature of 15^0C. How much less mass (in g) is required, in order to submerge the sphere, when the temperature is 35^0C? (Coefficient of cubical expansion of water is $1.5\times10^{-4}\ /^0C$ and linear expansivity of aluminium is $23\times10^{-6}\ /^0C$)

14. A Carnot's heat engine works with an ideal monatomic gas, and an adiabatic expansion ratio 2. Determine its efficiency (in %). (given $2^{\frac{2}{3}}=1.587$)

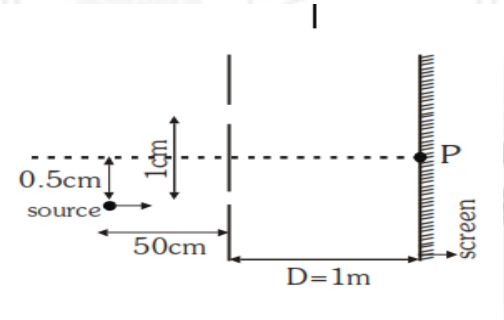
15. Diameter of a plano-convex lens of focal length 36 cm is 6 cm. It's thickness at the centre is 5 mm. The speed of light in the material of the lens is equal to $a\times10^7 ms^{-1}$. What is 'a'?



16. A ray of light is incident normally on the diagonal face of a right-angled prism $\left(\mu = \frac{5}{3}\right)$ as shown. The total deviation suffered by the ray in degrees is $\left(\sin 37^\circ = \frac{3}{5}\right)$.



17. In a typical Young's double slit experiment a point source of monochromatic light is kept as shown in the figure. If the source is given an instantaneous velocity v=1mm per second towards the screen, then the instantaneous velocity of central maxima is given as $\alpha \times 10^{-\beta} cm/s$ upward in scientific notation. Find the value of $\frac{\beta}{\alpha}$.



18. A gas mixture consists of 2.0 moles of oxygen and 4.0 moles of neon at temperature T. Neglecting all vibrational modes, the total internal energy of the system given by xRT then find x value. (Oxygen has two rotational modes).

CHEMISTRY **Max Marks: 66**

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains SIX (06) questions.
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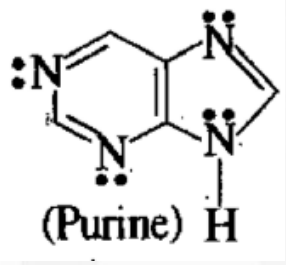
19. The purine hetrocycle occurs mainly in the structure of DNA. Identify number of 'N' atoms having localized lone pair of electron.



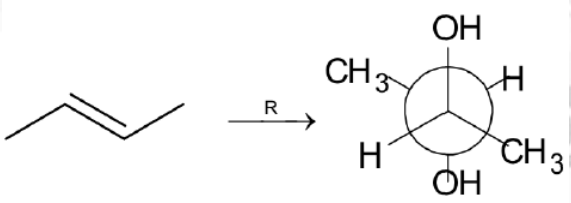
(Purine)

20. "A pair of stereoisomer might be classified in various ways depending upon their exact nature"

How many following terms could properly be applied to a pair of stereoisomers, assuming their nature permits?

(a) They might be *meso* isomers.
(b) They might be tautomers.
(c) They might be enantiomers.
(d) They might be diastereomers.
(e) They might be conformational isomers.
(f) They might be constitutional isomers.
(g) They might be configurational isomers.
(h) None of the above statements are true.

21.



How many of the following reagents are not suggestible

1) $(i)HCOOOH / (ii)H_2O$ 2) OsO_4 / H_2O_2

3) Cold alkaline MnO_4^- 4) CH_3COOH

22. How many of the following alkenes would show peroxide effect with HBr?
Ethene, propene, 1-butene, 2-butene, 2-methyl-propene, 2-methyl-2-butene, 2, 3-dimethyl -2-butene, 3-methyl-2-pentene, 3-hexene

23. How many of the following alkynes on treatment with dilute H_2SO_4 in presence of $HgSO_4$ give a methyl ketone?
$HC\equiv CH$, $CH_3C\equiv CH$, $CH_3CH_2C\equiv CH$, $CH_3C\equiv CCH_3$, $C_6H_5C\equiv CH$
$C_6H_5C\equiv CCH_3$, $CH_3CH_2C\equiv CCH_2CH_3$, $CH_3CH_2CH_2C\equiv CH$

24. How many of the following alkynes react with ammoniacal CuCl to give red precipitate of the corresponding copper alkynide?
Ethyne, propyne, 3-methyl-l-pentyne, l-butyne, 2-butyne, 2-pentyne, 3-pentyne, ethynylbenzene, cyclohexylmethylethyne

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

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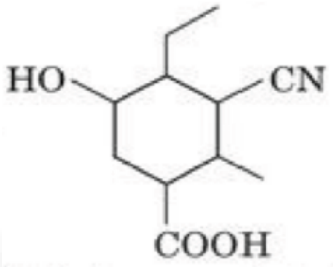
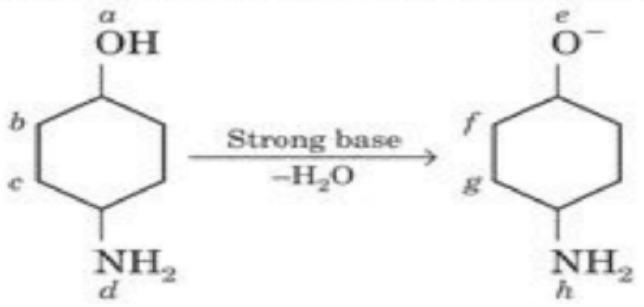
Partial Marks: +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks: 0 If none of the options is chosen (i.e. the question is unanswered);
Negative Marks: -2 In all other cases.

25. Select **correct** statement.



A) It is a homocyclic compound
B) It is having –COOH as the principal functional group
C) It is having isocyanide as one of the functional group
D) It is having ethyl at 2nd position

26. Select the correct statement about following:



A) b is more acidic than f **B)** a is less basic than e

C) a is more basic than d **D)** f is less acidic than g

27. Which of the following statement is/are correct?

A) As the resonance energy increases stability of system always decreases.

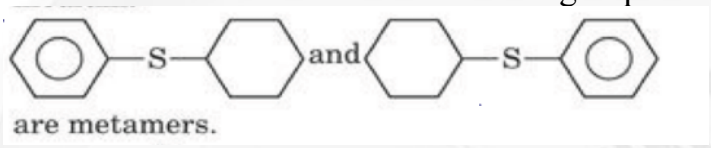
B) Homologous have same physical properties.

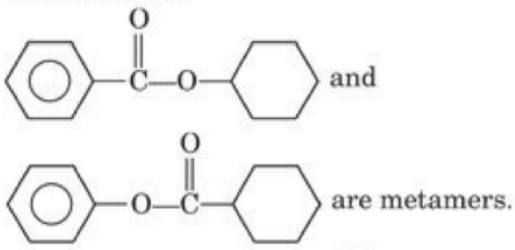
C) Inductive effect is a permanent effect.

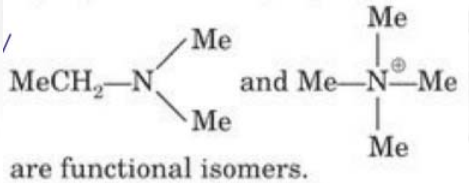
D) Ortho alkyl substituted benzoic acid is more acidic than para alkyl substituted benzoic acid.

28. Select **incorrect** statement(s).

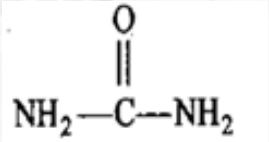
A) Metamers can have different functional groups

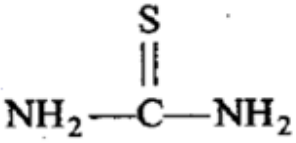
B)  are metamers.

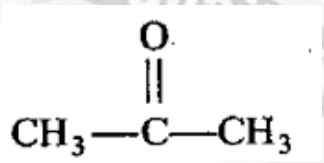
C) 

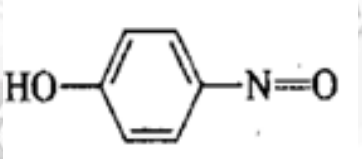
D)  are functional isomers.

29. Which of the following compounds show tautomerism?

A) 

B) 

C) 

D) 

30. Which of the following have finite dipole moment?

A) trans-2-Pentene **B)** 1-Butene

C) cis-2-Butene **D)** 1, 1-Dichloroethene

SECTION – III

(NUMERICAL VALUE TYPE)

• This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
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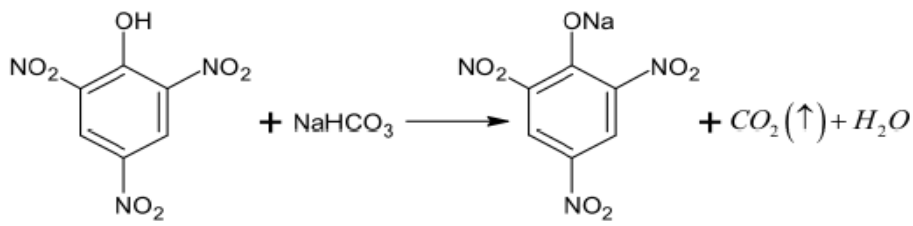
Zero Marks: 0 **In** all other cases..

31. How many of the following reactions is/are correct?

A) $CH_3COOK + CF_3COOH \rightarrow CH_3COOH + CF_3COOK$

B)

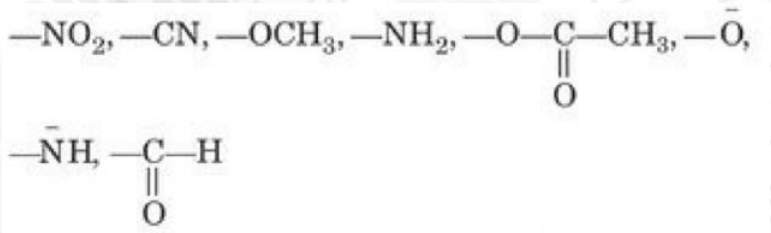


C)

D) $CH_3CH_2OH + NaHCO_3 \rightarrow CH_3CH_2ONa + H_2O + CO_2(\uparrow)$

32. If number of primary, secondary and tertiary amines possible with the molecular formula C_3H_9N respectively are X, Y, Z write XYZ as your answer.

33. Consider the following groups:



(a) How many groups can show $-M$ effect when attached to a conjugated system?

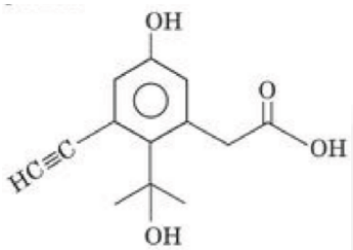
(b) How many groups can show $+M$ effect when attached to a conjugated system?

(c) How many groups can show $+I$ effect?

(d) How many groups can show $-I$ effect?

If answer of part (a) is 1, part (b) is 2, part (c) is 3 and part (d) is 4 write 1234 in answer sheet.

34. For compound



A) Number of functional group (x) (except $C=C$ and $C\equiv C$

B) Number of functional group which can react with Na (y)

C) Number of functional group which can react with NaOH(z).

D) Number of functional group which can react with $NaHCO_3(w)$.

Then $xyzw$ will be:

35. When 20 gm optically active compound is placed in a 10dm tube, in a 200ml solution rotates the PPL(plane polarized light) by $30°$:

(a) What is the angle of rotation if above solutlion is diluted to 1 litre?

(b) What is the specific angle of rotation if above solution is diluted to 1 litre?

Write answer of part (a) and (b) in the same order and present the four digit number as answer in OMR sheet. For example : If answer of (a) is 9 and (b) is 99 then fill 0999 in OMR sheet.

36. Dipole moment of a compound $X-CH_2-CH_2-X$ is $1.5D$ .IF dipole moment of its Gauche form is 6.0 D, what will be mole fraction of its anti form?

MATHEMATICS **Max Marks: 66**

SECTION-I
(INTEGER ANSWER TYPE)

- This section contains SIX (06) questions.
- The answer to each question is a SINGLE DIGIT INTEGER ranging from 0 TO 9, BOTH INCLUSIVE.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated **according to the following marking scheme:**

Full Marks: +3 If ONLY the correct integer is entered;
Zero Marks: 0 If the question is unanswered;
Negative Marks: -1 In all other cases

37. Give that f(x) is a function defined on R, satisfying f(1)=1 and for any $x \in R,\ f(x+5) \geq f(x)+5$ and $f(x+1) \leq f(x)+1$. If $g(x) = f(x)+5-x,$ then the value of $\frac{4}{5}g(2013)$ is.....

38. Let f be a twice differentiable function defined in [-3,3] such that $f(0) = -4, f'(3) = 0, f'(-3) = 12$ and $f''(x) \geq -2 \forall x \in [-3,3]$. Let $g(x) = \int_0^x f(t)dt$. If the maximum value of g(x) is M, then $\frac{M}{8}$ is _____.

39. If $f(x) = \left\| 1-x^3 \right| - \left| x^2-1 \right\| + \left| 1-x^2 \right| + \left| x^3-1 \right|,$ then the number of points of non-differentiability of f(x) is _____.

40. Let $f:[1,\infty) \to [1,\infty)$ be defined as $f(x) = x(1+lnx)$ and $g(x) = f^{-1}(x)$, then the value of $\left[\sin\left(2\left| \lim_{x\to\infty} \frac{g(x)lnx}{x} \right| \right) \right]$ (where [.] denotes greatest integer function).is

41. Let f(x) be a differentiable function on [0,8], such that $f(1)=5, f(2)=\frac{1}{2}, f(3)=6, f(4)=-3, f(5)=4, f(6)=\frac{1}{4},$ and $f(7)=-\frac{1}{5}$. If the minimum number of roots of the equation $f'(x) - f'(x)(f(x))^2 = 0$ is λ, then $\left(\frac{\lambda-1}{2}\right)$ is equal to _____.

42. Let $f(x) = \begin{cases} -2x + \log_{\frac{1}{2}}\left(K^2-6K+8\right), -2 \leq x < -1 \\ x^3+3x^2+4x+1, -1 \leq x \leq 3 \end{cases}$

The number of possible positive integer(s) in the range of k such that f(x) has the smallest value at x=-1 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.

43. Let $f(x)=\begin{cases} x^2-2x+3; x\in(-2,0) \\ x^3-x^2+2; x\in[0,2] \\ 3-2x; x\in(2,6] \end{cases}$, then

A) $f(f(x))$ is discontinuous at 4 points

B) $f(f(x))$ is discontinuous at 3 points

C) $f(f(0))=-1$

D) $f(f(2))=-9$

44. Let f, g and h be three functions defined as follows: $f(x)=\dfrac{32}{4+x^2+x^4}, g(x)=9+x^2$, and $h(x)=-x^2-3x+k$. Identify which of the following statement(s) is(are) correct?

A) number of integers in the range of f(x) is 8

B) number of integral values of K for which $h(f(x))>0$ and $h(g(x))<0 \forall x\in R$ is 20

C) number of integral values of K for which $h(f(x))>0$ and $h(g(x))<0 \forall x\in R$ is 19

D) maximum value of $g(f(x))$ is 73

45. Let $y=P(x)$ be a differentiable function $\forall x\in[0,\infty)$, such that $\dfrac{d}{dx}(P(x))+(x-1)^3\geq P(x)+1 \forall x\in[0,\infty)$. If $P(x)\leq x^3+3x+1 \forall x\in[0,\infty)$ and $P(0)=1$, then which of the following is/are CORRECT?

A) $y=P(x)$ is a strictly increasing function

B) Number of solutions of $P(P(x))=2023$ is 1

C) $\int_0^1 P(x)\,dx=2$

D) Global minimum value of $P(x)$ does not exist

46. Let $f:\left[0,\frac{1}{2}\right]\to R$, $e^{-2x}f(x)$ is twice differentiable function having local minimum at $x=\frac{1}{4}$ and $\frac{d^2}{dx^2}\left(e^{-2x}f(x)\right)>0\forall x\in\left(0,\frac{1}{2}\right)$. If $f(0)=f\left(\frac{1}{2}\right)=0$ then which of the following is/are correct?

A) $\frac{f'\left(\frac{3}{8}\right)}{f\left(\frac{3}{8}\right)}>2$ **B)** $\frac{f'\left(\frac{3}{8}\right)}{f\left(\frac{3}{8}\right)}<2$ **C)** $\frac{f'\left(\frac{1}{2023}\right)}{f\left(\frac{1}{2023}\right)}>2$ **D)** $\frac{f'\left(\frac{1}{2023}\right)}{f\left(\frac{1}{2023}\right)}<2$

47. Let $f:R\to R$ be a differentiable function satisfying $f\left(\frac{x+y}{2}\right)=\frac{f(x)+f(y)}{2}\forall x,y\in R$.

If $f(0)=1$ and $f'(0)=-1$, then which of the following is (are) correct?

A) $f(|x|)$ is discontinuous at one point

B) Number of solution(s) of the equation $f(x)=f^{-1}(x)$ is exactly one

C) $\sum_{r=0}^{10}\left(f(r)\right)^2=286$

D) $\tan^{-1}\left(f(x)\right)$ is derivable $\forall x\in R$

48. Consider $f(x)=\sin^{-1}\left(1-2\sqrt{x}\right)+\sec^{-1}\left(\frac{1}{2\sqrt{\sqrt{x}-x}}\right)+\tan^{-1}\left(\frac{\sqrt{2}-1-\sqrt{x}}{1+\sqrt{2x}-\sqrt{x}}\right)$. Identify the correct statement(s) about f(x).

A) f(x) is a decreasing function **B)** minimum value of f(x) is $-\pi/8$

C) $f'\left(\frac{1^-}{4}\right)=\frac{-24}{5}$ **D)** $f'\left(\frac{1^+}{4}\right)=\frac{-4}{5}$

SECTION – III
(NUMERICAL VALUE TYPE)

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

Full Marks: +4 If ONLY the correct numerical value is entered;

49. If $\alpha = \lim\limits_{x\to 0} \cos^{-1}\left(\dfrac{\{-x^2\}}{x^2+2x+2}\right)$ and $\beta = \lim\limits_{x\to\infty} \tan^{-1}\left(\dfrac{e^{-x^2}-e^{x}}{2e^{-x^2}+e^{x}}\right)$, then the value of $\dfrac{1}{2}\left(1-\dfrac{\tan\beta}{\cos\alpha}\right)$ is _____.({k} denotes the fractional part of k)

50. Let f(x) be a polynomial of degree 4 such that f(1)=7 and attains its local minimum value 3 at both x = 2 and x = 3. If the local maximum value of f(x) is equal to $\dfrac{p}{q}$ (where p, q are coprime), then the value of $\left(\dfrac{p+q}{10}\right)$ is _____.

51. Let f be a function defined implicitly by the equation $1-e^{f(x)} = x\left(1+e^{f(x)}\right)$ and g be the inverse of f. If $g''(\ln 3) - g'(\ln 3) = \dfrac{p}{q}$, where p and q are relative prime numbers, then $\left(\dfrac{2p+q}{5}\right)$ is _____.

52. Let $f(x) = 2\tan^{-1}x$ and $g(x)$ be a differentiable function satisfying $g\left(\dfrac{x+2y}{3}\right) = \dfrac{g(x)+2g(y)}{3}\forall x, y \in R$ and $g'(0)=1, g(0)=2$. The number of integers satisfying $f^2(g(x)) - 5f(g(x)) + 4 > 0$ where $x \in (-10,10)$ is λ. Then the value of $\dfrac{\lambda}{3}$ is _____.

53. Let $f(x) = \dfrac{\pi}{2} + \left|\text{sgn}\left(\tan^{-1}\left(\dfrac{x}{1+x^2}\right)\right)\right|\tan^{-1}x$, where $\text{sgn}(y)$ denotes the signum function of y, and g(x) is the inverse of f(x). If the complete set of values of K for which the equation $2g(x) + K(\pi - 2x) = 0$ has three distinct solutions is (a,∞), then a is equal to _____.

54. Given $f(x) = 2x^3 - 3(\lambda+1)x^2 + 6(2\lambda+1)x + \mu$, where $\mu \in R$ and $\lambda \in (-10,10)$. If f(x) has a positive point of local maxima, then the number of possible integral values of λ is _____.

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