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_STERLING_BT **Paper -2(Adv-2020-P2-Model)** **Date: 01-10-2023**

Time: 02.00Pm to 05.00Pm **CTA-08** **Max. Marks: 198**

01-10-2023_Sr.Super60_STERLING_BT_Jee-Adv(2020-P2)_CTA-08_Syllabus

PHYSICS : CTA-8 (RPTA.1 TO RPTA.9 SYLLABUS)
Thermal physics, Geometrical optics, Wave optics, General Physics, Kinematics, NLM, Friction, Circular motion, WPE, COM & Collisions, Rigid body Dynamics 1, Rigid body Dynamics 2, Fluid statics & Dynamics

CHEMISTRY : CTA-8 (RPTA.1 TO RPTA.9 SYLLABUS)
Nomenclature, Isomerism, GOC, Alkanes, Alkene & Alkyne, Benzene, Alkyl Halides & Aryl Halides, Alcohols, Phenols , Ethers & Amines, Aldehydes & Ketones, Carboxylic acid & Derivatives, Biomolecules, Polymers, Chemistry in Everyday Life & POC, 1.Classification of Elements and Periodicity in Properties, 2.Chemical bonding and Molecular Structure, 3.Hydrogen, 1.s-Block Elements, 2.Group-13, 3.Group 14

MATHEMATICS : CTA-8 (RPTA.1 TO RPTA.9 SYLLABUS)
Functions & LCD, Application of Differentiation (AOD), TOTAL DIFFERENTIAL CALCULUS, Indefinite Integration, Definite Integration, Areas & Differential Equations , Total Integral Calculus, Vectors & 3D-Geometry, Matrices & Determinants

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

JEE-ADVANCE-2020-P2-Model

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

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**

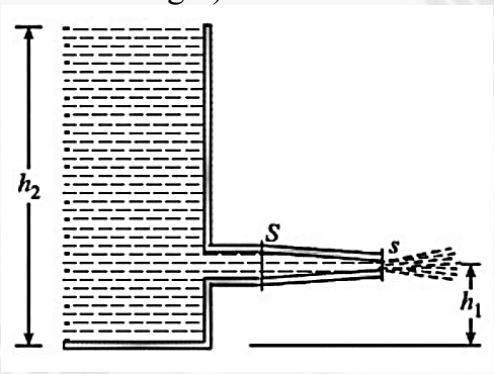
PHYSICS **Max Marks: 66**

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:**

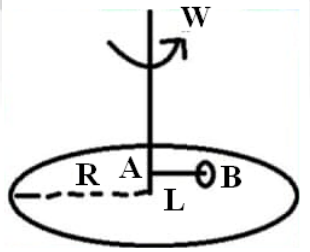
Full Marks: +3 If ONLY the correct integer is entered;
Zero Marks: 0 If the question is unanswered;
Negative Marks: -1 In all other cases

01. A side wall of a wide open tank is provided with a narrowing tube through which water flows out. The cross sectional area of the tube decreases from S=3.0 cm^2 to s=1.0 cm^2. The water level in the tank is h = 4.6 m higher than in the tube. Neglecting the viscosity of water, find the horizontal component of the force tending to pull the tube out of the tank. (Communicate the nearest integer).



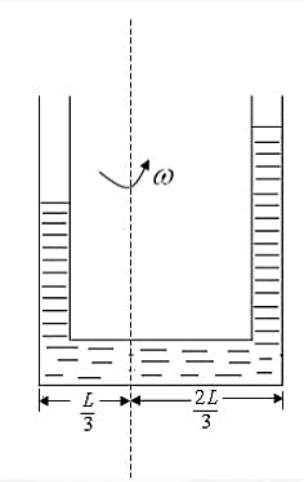
02. A uniform disc of mass M and radius R is rotating freely about its stationary smooth central vertical axis with angular speed ω_0 .Another disc of mass m and radius r is free to rotate about a horizontal rod AB. Length of the rod AB is L (<R). And its end A is rigidly attached to the vertical axis of the first disc. The disc of mass m, initially at rest, is placed gently on the disc of mass M as shown in the figure. Find the time in seconds after which the slipping between the two discs will cease. Assume that normal reaction between the two disc is equal to mg, coefficient of friction between the two discs is μ given

$M = 1kg, m = 1kg$, L = 0.5 m, $\mu = 0.1, \omega_0 = 5rad/\sec$



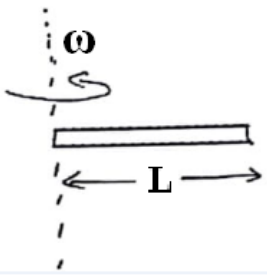
03. Two identical calorimeters A and B contain equal quantity of water at 20^0C . A 5 gm piece of metal X of specific heat $0.2cal\,g^{-1}\left(C^0\right)^{-1}$ is dropped into A and a 5 gm piece of metal Y into B. The equilibrium temperature in A is 22^0C and in B is 23^0C . The initial temperature of both the metals is 40^0C . The specific heat of metal Y in $cal\,g^{-1}\left(C^0\right)^{-1}$ is $\frac{27}{17x}$ .Find x.

04. A uniform U – Tube containing a liquid of uniform density ρ ,rotates about a vertical axis with constant angular velocity ω,as shown in the figure.



Length of the horizontal section is L. Difference in height of the liquid columns in the two vertical sections of the tube is $\Delta h = \frac{\omega^2 L^2}{xg}$ .Find x.

05. A uniform rod of mass m and L is rotated uniformly at angular velocity ω about an axis passing through its end perpendicular to tis length. The net force on the left half of the rod at the instant shown in the diagram is found to be $\frac{n}{8}mL\omega^2$. What is the value of n?



06. Let $S_1 \& S_2$ be the two slits in YDSE. If central maxima is observed at ρ and angle $S_1\rho S_2 = \theta$ (θ is small), the Y- coordinate of 3^{rd} minima assuming the origin at the central maxima is $\pm\frac{K\lambda}{2\theta}$. Find 'K' ($\lambda$: wave length of mono chromatic light used).

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.

07. The pitch of screw gauge is 1mm and its circular scale is divided into 100 divisions. When nothing is put between the zero of main scale is not seen, but when circular scale is rotated by 450^o the zero of main scale is seen and zero of main scale coincide with the zero of circular scale. When a glass plate is placed between the studs, the circular scale lies between 18^{th} to 19^{th} division of main scale and circular scale reds 34 division. Then,

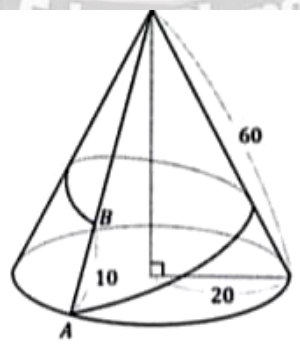
A) Error is positive zero error and its magnitude is 1.25 mm.

B) Error is negative zero error and its magnitude is 1.25 mm

C) The thickness of the glass plate is 19.59 mm.

D) The thickness of the glass plate is 17.09 mm.

08. The diagram illustrates a right circular cone-shaped hypothetical mountain, of apex 'O'. If you build a shortest distance track for a sightseeing train around the mountain, in which the track starts at point A and ends at point B, the track will first go uphill, but then it will go downhill. AB=10km, radius of cone=20 km. Slant height of the cone=60km. The speed of train (consider it a particle) is set at a constant 20 kmph. Mark the **CORRECT** statements(s).



A) At the instant of shortest distance from 'O' the angular velocity of train about 'O' is maximum

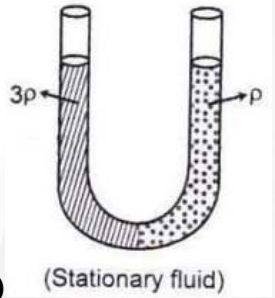
B) The journey time of the train is $\frac{\sqrt{91}}{2}$ hr

C) The length of the downhill part of the journey is $\frac{200}{\sqrt{91}}$km

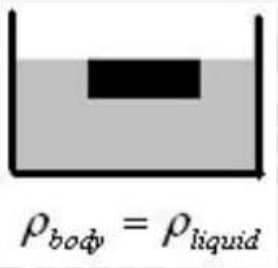
D) The velocity of the train is always perpendicular to the line joining 'O' to the train

09. Which of the following is/are not possible equilibrium conditions?

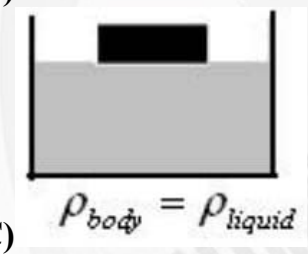
A)



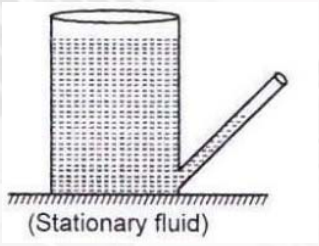
B)



C)



D)



10. Which one of the following statements is (are) **FALSE?**

A) Temperature differing by 25^o on the Fahrenheit scale must differ by 45^o on the Celsius scale (Centigrade scale)

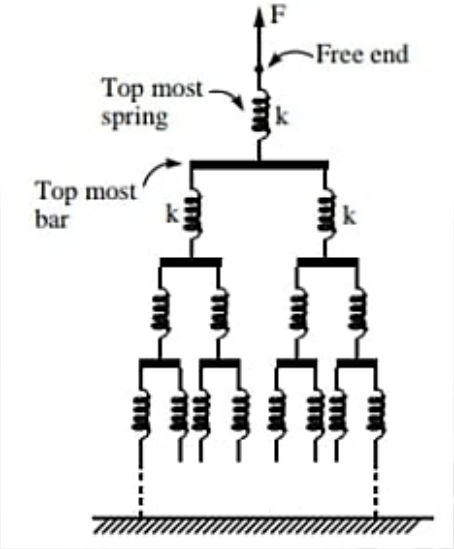
B) Temperature which differ by 10^o on the Celsius scale (Centigrade scale) must differ by 18^o on the Fahrenheit scale

C) Water at 90^oC is warmer than water at 202^oF

D) 0^oF corresponds to -32^oC

11. There is an infinite array of ideal springs as shown in figure, whose base row is attached to a fixed support. All the springs are identical and their spring constants are k each. Initially all the springs are unstretched. Then a constant force F is applied on the free end of topmost spring along it's length. (Assume all the bars to be of negligible mass).Number of springs rows are increasing in GP, from top to bottom.

When the system is in equilibrium, choose the CORRECT option(s).



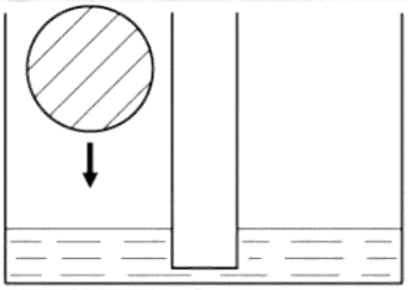
A) Displacement of free end is 2F/K

B)Displacement of free end is F/2K

C) Displacement of topmost bar is F/K

D) Displacement of topmost bar is F/4K

12. In two identical communicating vessel we poured water (see picture). In one of them we put an ice ball of volume $V = 100cm^3$ which gets exactly half immersed in the water. The density of water $\rho_w = 1000\ kg\ /\ m^3$,the density of ice $\rho_i = 900kg\ /\ m^3$.



Select the correct statement(s). Soon after placing the ice ball in left vessel.

A) The volume of water flowing to the right vessel is 25cc.

B) The volume of water flowing to the right vessel is 50cc.

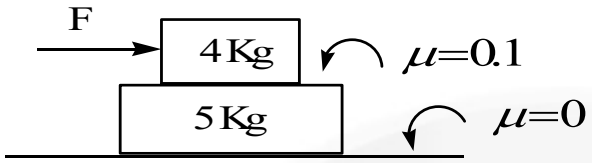
C) The ice ball is resting on the bottom of vessel.

D) The ice ball is floating on the water surface.

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..

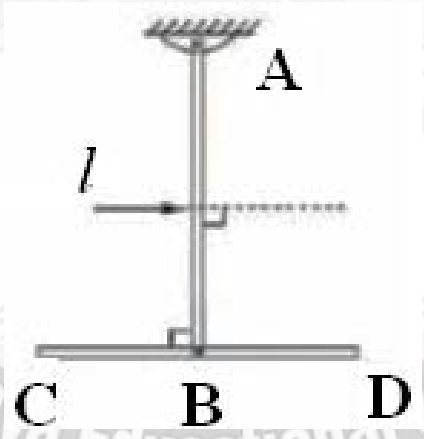
13.



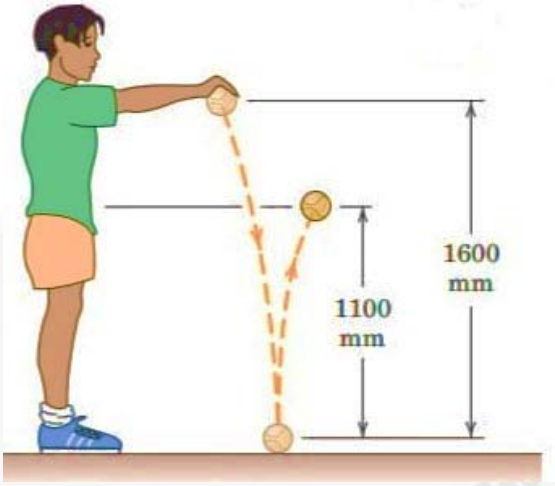
Maximum force a to move these blocks together is ___N if g=10m/s^2

14. A light ray incident along $2\bar{i}+4\bar{j}+\sqrt{5}\bar{k}$ strikes on x-z plane from medium 1 of refractive index $\sqrt{3}$ and enters in to medium 2 of refractive index μ_2. The value of μ_2 for which the value of angle of refraction becomes 90°, is _____ $\left(\sqrt{3}=1.73\right)$

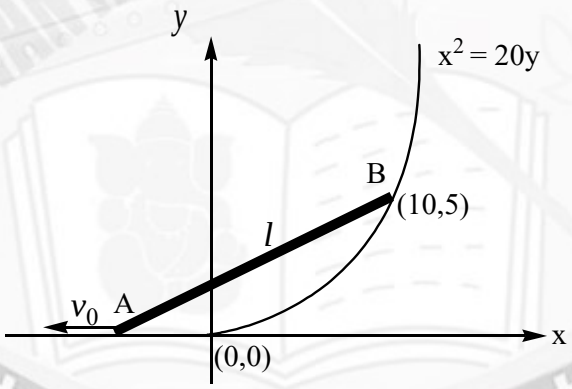
15. A T-shaped system is made by using two identical rods AB and CD each of mass m and length '*l*'. A liner impulse J is imparted to the system at midpoint of rod AB. Just after impulse, angular speed of rod AB is (1) ω_1 if midpoint of rod CD is connected to end B by a pin support so that rod CD can rotate freely about hinge at end B and (2) ω_2 if midpoint of CD is rigidly connected to end B. Find $\frac{4\omega_1}{\omega_2}$



16. Tennis balls are usually rejected if they fail to rebound to waist level when dropped from shoulder level. If a ball just passes the test as indicated in the figure, determine the coefficient of restitution *e*.



17. A uniform rod has mass $m=1kg$ and length $l=13m$. One end of the rod is pulled with a constant velocity of $v_0=1m/s$ along a frictionless horizontal floor in the negative x direction. The other end is moving along a parabolic fixed curve. The equation of the parabola is $x^2=20y$. If the angular velocity of the rod (in minutes/s) when the end point 'B' is at $(10, 5)$ is ω. Find $\frac{\omega}{10}$



18. A sphere of mass m is moving with a velocity $4\hat{i}-\hat{j}$ when it hits a smooth wall and rebounds with velocity $\hat{i}+3\hat{j}$. Find the coefficient of restitution between the sphere and the wall.

CHEMISTRY **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:**

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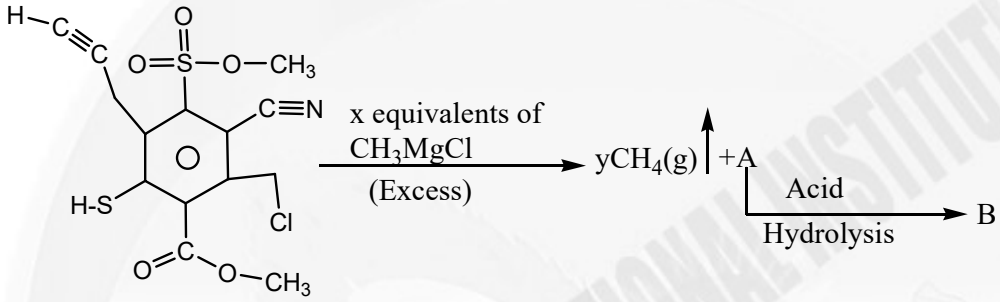
Zero Marks: 0 If the question is unanswered;
Negative Marks: -1 In all other cases

19.



(Note: No Hydration across alkyne from A to B)

How many of the following are correct statements regarding above conversion

A) x + y = 9

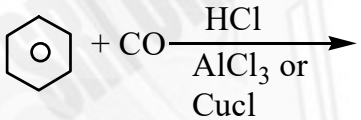
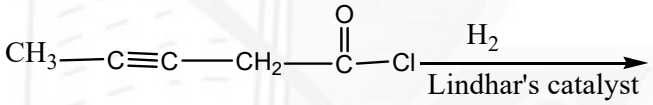
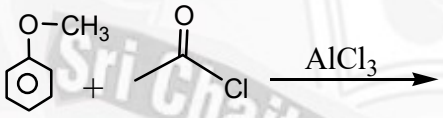
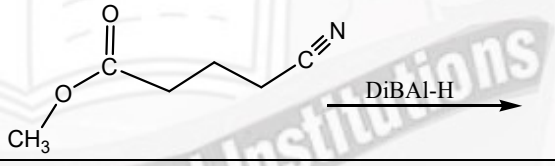
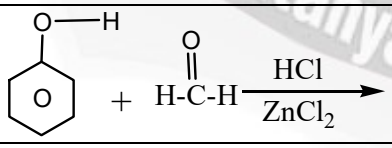
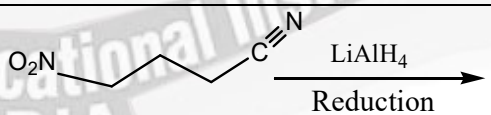
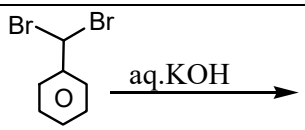
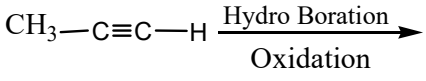
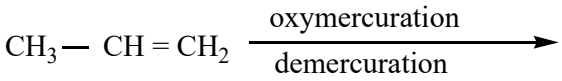
B) B consumes 6 mole NaOH for Acid – Base neutralization

C) B gives silver mirror test

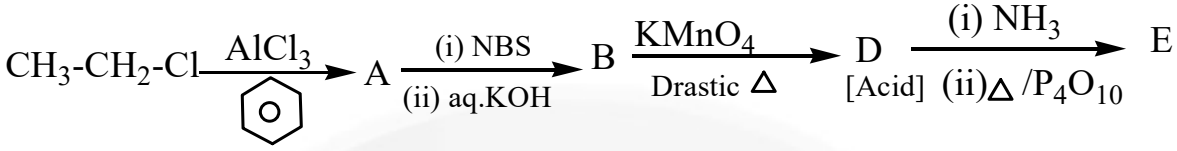
D) One mole of B with excess Na liberates 2 moles of H_2 gas

E) B gives turbidity immediately with lucas reagent.

20. How many of the following reactions produce carbonyl compound as one of the products.

A		**F**	
B		**G**	
C		**H**	
D		**I**	
E		**J**	

21.



How many of the following mechanisms are as principle mechanisms involved in above conversions; during formation of major product in respective reaction / step

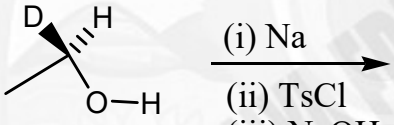
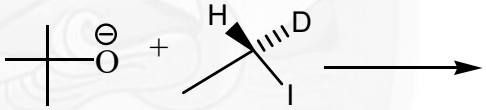
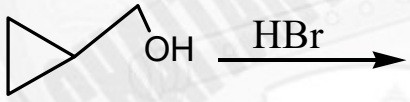
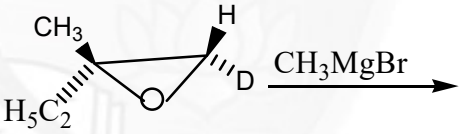
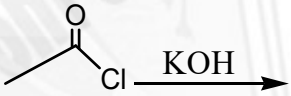
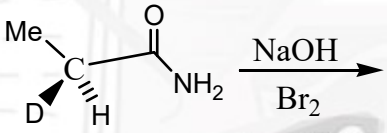
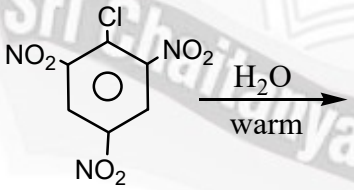
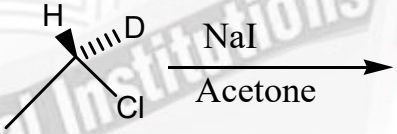
A) Electrophilic aromatic substitution [EAS] B) Electrophilic Addition

C) Free radical substitution D) Free radical addition

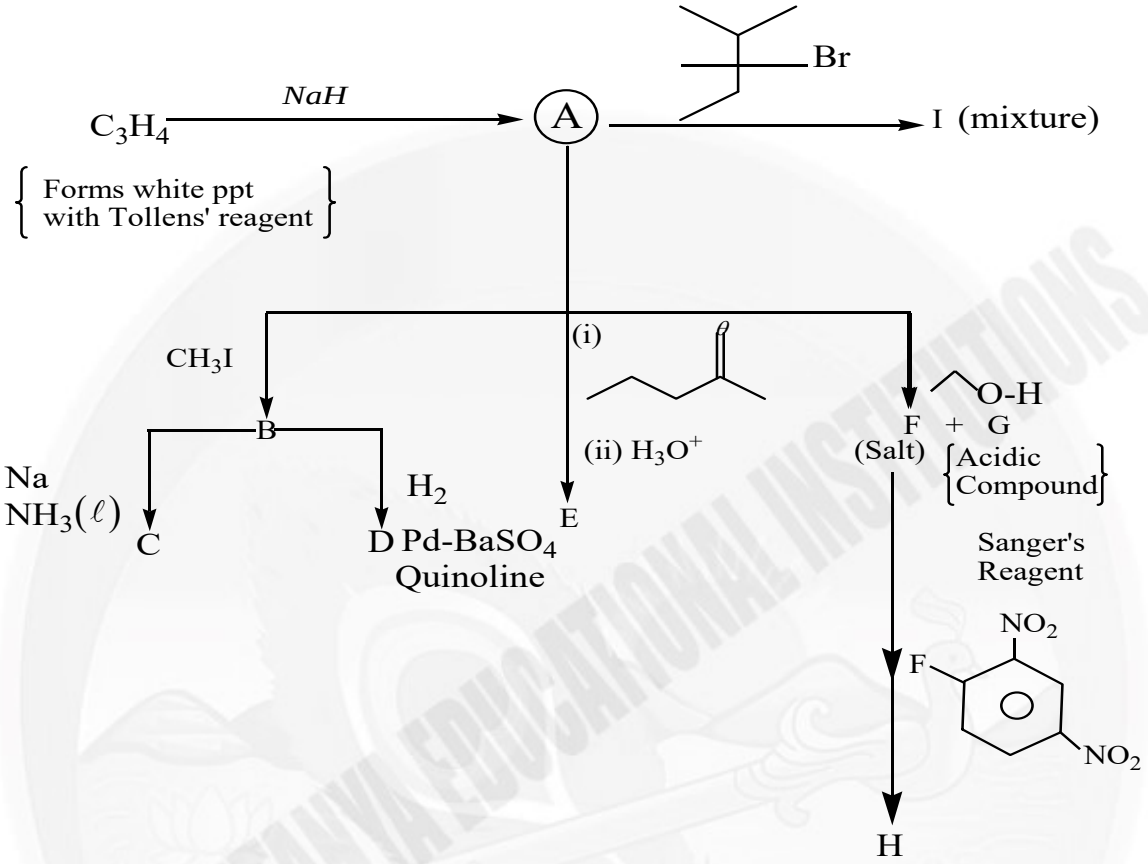
F) Nucleophile substitution G) Nucleophilic Addition

H) Elimination of water I) dehydro halogenation

22. In how many of the following reactions, the product has inversion in configuration when compared with reactant at reaction center. [In formation of major product.]

A		F	
B		G	
C		H	
D		I	
E			

23.



Pick up correct statements about A to I in above conversions.

(1) A is $CH_3 - CH = CH_2$

(2) B is non terminal (internal) alkyne

(3) C& D are diastereomers

(4) E is Racemic mixture of 4-Methy Hept-2-yn-4-ol

(5) F is ethoxide

(6) G decolourises Baeyer's reagent

(7) H is Aryl Alkyl ether

(8) There are 4 possible isomeric Alkenes in the mixture I.

24. Gly-Lys-Pro-Glu- His

Regarding above pentapeptide, chain, pick up the number of correct statements given below.

A) It is also represented as GKPGH

B) On complete hydrolysis gives 2 essential amino acids

C) On complete hydrolysis gives one Acidic Amino acid & Two Basic Amino acid

D) At one place of chain; Nitrogen atoms are arranged similar to Nitrogen atoms in Guanidine [Guanidyl group of Nitrogen atoms]

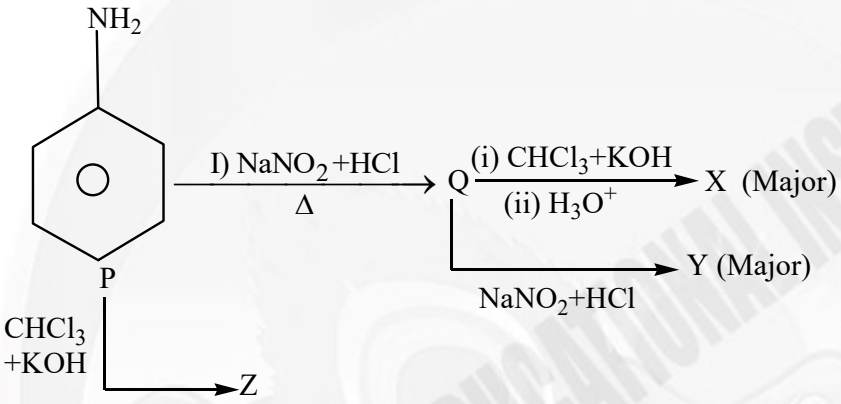
E) Glycine end of chain is called as c-terminal

F) On complete hydrolysis gives four primary Amino acids & one secondary amino acid.

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.

25.



Pick up correct Statements about P;Q;X;Y;Z

A) The electrophiles Involved in P to Q and P to Z respectively are $\overset{\oplus}{N}=0$ & $:CCl_2$

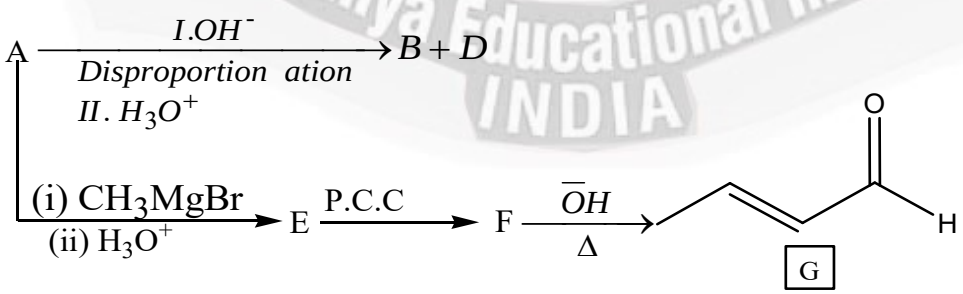
B) $Q \xrightarrow[(iii)AC_2O]{(i)NaOH/CO_2 \\ (ii)H_3O^+} Asprin\ (Major)$

C) $P \xrightarrow[H^+]{PhN_2^{\oplus}Cl^{\Theta}}$ yellow dye

$Q \xrightarrow[OH^-]{PhN_2^{\oplus}Cl^{\Theta}}$ Orange dye

D) Both P & Q form white PPT with Bromine water.

26.



Pick up correct statements among following.

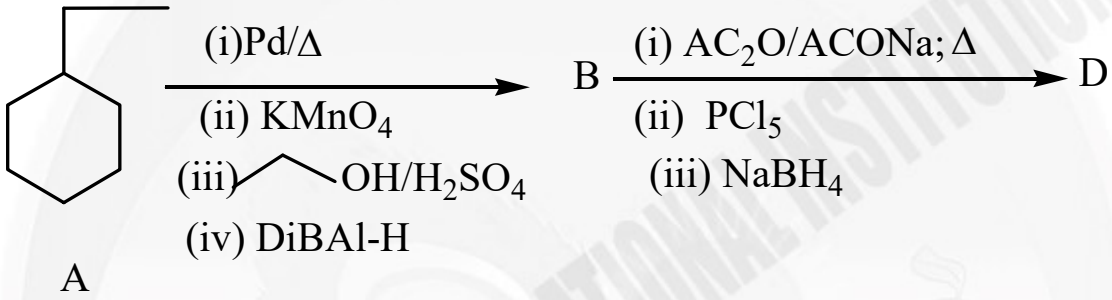
A) Among A, B, D,E & F only 3 compounds give Cu_2O with Fehling's solution

B) When A,B,D,E & F are treated separately with KOI / $I_2 + KOH$ then only 2 compounds form CHI_3.

C) $G \xrightarrow{HBr} X$ Formation of X is nucleophile addition at alkene.

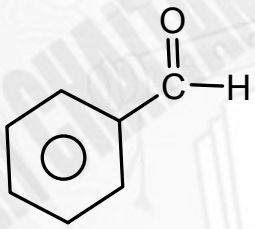
D) Cannizzaro & Aldol condensation reactions are involved in above conversion

27.



Pick up correct statements about A ; B; & D

A) B is 

B) D is 

C) $A \xrightarrow[h\upsilon]{Cl_2}$ 6 Mono chloro derivatives will be formed [excluding stereo Isomers]

D) B to D Involves PERKIN reaction in one of the steps.

28. The following observations are recorded about 3 isomers of C_3H_9N.

$\Rightarrow$ Isomer X is prepared by Gabriel phthalimide synthesis with higher rate than other 1° amine isomer Y

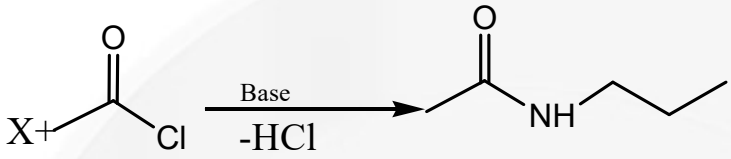
$\Rightarrow$ Isomer Z reacts with Hinsberg's reagent and the product formed is insoluble in alkali

$\Rightarrow$ Pick up correct statements about X;Y & Z

A) Butanamide $\xrightarrow[NaOH]{Br_2} X + NaBr + H_2O + Na_2CO_3$

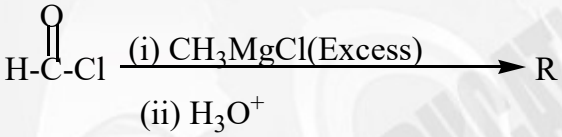
B) Y is isopropyl amine

C) Z is N-Methyl Ethanamine

D) 

29. Decreasing order of boiling points of 4 isomeric BUTYL ALCOHOLS is
P > Q > R> S
Pick up correct statements about P,Q,R,S

A) Compound P is 1-Butanol

B) 

C) In Lucas test; "P" isomer gives red turbidity immediately

D) Formation of ether by bimolecular reaction is most suitable for isomer P; when P is treated with H_2SO_4 with suitable temperature to form ether

30. How many of the following are correct [consider Neutral forms of molecules].

A) Oxime of Acetaldehyde exhibit Geometrical isomerism

B) Semicarbazone of Acetone has 5 lone pairs

C) Cyanohydrine of butanone is chiral molecule

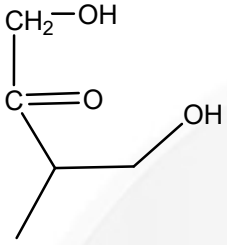
D) Sodium Bisulphite adduct of propanal is chiral molecule

SECTION – III
(NUMERICAL VALUE TYPE)

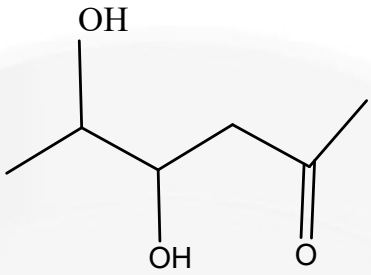
• This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE.**
• For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual Numeric keypad in the place designated to enter the answer. If the numerical value has more 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..

31. How many of the following can be oxidized by Tollen's reagent.

A) Glucose; **B)** Fructose; **C)** Propene; **D)**Mannose;



E) ; **F)**



G) But –2-yne **H)** Ribose **I)** 2-deoxy Ribose

32. The sum of Bond orders in all the following combinedly is ____ (Rounding to the nearest natural number)

SiO_4^{4-} $C\ell O_4^-$ PO_4^{3-} O_2^-

N_2^+ SiO_3^{2-} $C\ell O_3^-$

33. 2 Liter 56 volume H_2O_2 can oxidise ____mole $KMnO_4$ in H_2SO_4

34. How many of the following ionic hydrides liberate hydrogen gas on addition to water.

$NaH; B_2H_6; CaF_2; CaH_2; CH_4; SiH_4; Al_4C_3; CaC_2$

35. (i) Number of electron deficient species among following is 'x'

$B_2H_6; BF_3; SiC\ell_4; CCl_2; AlCl_3$

(ii) Number of chemical species that can get partial or complete hydrolyzed among following is y[in any medium) $SiF_4; SiC\ell_4; BCl_3; BF_3$ Determine $x+y$

36. In long form of periodic table with 7 periods & 18 groups [Numbered 1 to 18 from left); Calculate sum of group number of metal ions present in Gilman reagent & Grignard's Reagent

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. If $\int \frac{(2-x^2)e^x}{(1-x)\sqrt{1-x^2}}dx = \mu e^x\left(\frac{1+x}{1-x}\right)^{\lambda} + C$ then $2(\lambda+\mu)$ is equal to .....

38. If $\lim\limits_{n\to\infty}\sum\limits_{k=0}^{n}\frac{{}^nC_K}{n^K(K+3)} = e - l$. Then l is

39. Let S denotes the sum of all the values of λ for which the system of equations

$$(1+\lambda)x_1 + x_2 + x_3 = 1$$
$$x_1 + (1+\lambda)x_2 + x_3 = \lambda$$
$$x_1 + x_2 + (1+\lambda)x_3 = \lambda^2$$

is inconsistent. Find $|S|$.

40. If a, b, c are three complex numbers such that $a^2+b^2+c^2=0$ and

$$\Delta = \begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix} = ka^2b^2c^2,$$ then value of k is

41. A circle is inscribed in an n-sided regular polygon $A_1, A_2 ..., A_n$ having each side a unit for any arbitrary point P on the circle.

If $\sum\limits_{i=1}^{n}(PA_i)^2 = n\frac{a^2}{k}\left(\frac{\lambda+\cos^2\pi/n}{\sin^2\pi/n}\right)$. Then the value of $\left[\frac{k+\lambda}{2}\right]$ is (where$[x]$ is the greatest integer less than equal to x).

42. Let PM be the perpendicular from the point *P (1, 2, 3)* to XY-plane. If OP makes an angle θ with the positive direction of the Z-axis and OM makes an angle ϕ with the positive direction of X-axis, where O is the origin, then $3\sqrt{5}\tan\theta + \tan\phi$ is _____.

SECTION – II
(ONE OR MORE CORRECT ANSWER TYPE)

•This section contains SIX (06) questions.
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Negative Marks: -2 In all other cases.

43. If $\int x\log(1+x^2)dx = \phi(x)\log(1+x^2) + x\,\psi(x) + C$, then, which of the following option(s) is/are correct?

A) $\phi(x) = \dfrac{1+x^2}{2}$ **B)** $\psi(1) = \dfrac{-1}{2}$ **C)** $\psi(x) = \dfrac{-\left(1+x^2\right)}{2}$ **D)** $\phi(3) = 5$

44. If S be the area of the region enclosed by $y = e^{-x^2}, y = 0, x = 0$ and $x = 1$. Then, which of the following option(s) is/are correct?

A) $S \geq \dfrac{1}{e}$ **B)** $S \geq 1 - \dfrac{1}{e}$ **C)** $S \leq \dfrac{1}{4}\left(1 + \dfrac{1}{\sqrt{e}}\right)$ **D)** $S \leq \dfrac{1}{\sqrt{2}} + \dfrac{1}{\sqrt{e}}\left(1 - \dfrac{1}{\sqrt{2}}\right)$

45. A curve $y=f(x)$ has the property that the perpendicular distance of the origin from the normal at any point P of the curve is equal to the distance of the point P from the x-axis. Then the differential equation of the curve

A) is homogeneous
B) Can be converted into linear differential equation with some suitable substitution
C) is the family of circles touching the x-axis at the origin
D) The family of circles touching the y-axis at the origin

46. If $2f(x) + xf\left(\dfrac{1}{x}\right) - 2f\left(\left|\sqrt{2}\sin\pi\left(x + \dfrac{1}{4}\right)\right|\right)$

$= 4\cos^2\left(\dfrac{\pi x}{2}\right) + x\cos\left(\dfrac{\pi}{x}\right), \forall x \in R - \{0\}$, which of the following statement(s) is/are true?

A) $f(2) + f\left(\dfrac{1}{2}\right) = 1$ **B)** $f(2) + f(1) = 0$

C) $f(2) + f(1) = f\left(\dfrac{1}{2}\right)$ **D)** $f(1).f\left(\dfrac{1}{2}\right).f(2) = 1$

47. **a, b** and **c** are three vectors such that $\mathbf{a}.\mathbf{a} = \mathbf{b}.\mathbf{b} = \mathbf{c}.\mathbf{c} = 3$ and

$|\mathbf{a} - \mathbf{b}|^2 + |\mathbf{b} - \mathbf{c}|^2 + |\mathbf{c} - \mathbf{a}|^2 = 27$, then which of the following option(s) is/are correct?

A) a, b and **c** are necessarily coplanar.
B) a, b and **c** represent sides of a triangle in magnitude and direction

C) $\mathbf{a}.\mathbf{b}+\mathbf{b}.\mathbf{c}+\mathbf{c}.\mathbf{a}$ has the least value -9/2

D) **a, b** and **c** represent orthogonal triad of vectors

48. If **a, b, c** and **d** are the unit vectors such that $(\mathbf{a}\times\mathbf{b}).(\mathbf{c}\times\mathbf{d})=1$ and $\mathbf{a}.\mathbf{c}=\frac{1}{2}$, then which of the following option(s) is/are correct?

A) **a, b, c** are non-coplanar **B)** **a, b, d** are non-coplanar

C) **b, d** are non-parallel **D)** **a, d** are parallel and **b, c** are parallel

SECTION – III
(NUMERICAL VALUE TYPE)

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49. If $I=\int_0^{\sqrt{3}}\frac{1}{1+x^2}.\sin^{-1}\left(\frac{2x}{1+x^2}\right)dx$. Then $\frac{72I}{\pi^2}$ is _____

50. For positive integers K=1, 2, 3, ……,n. Let S_k denotes the area of ΔOAB_K (where 'O' is the origin) such that $\angle AOB_K=\frac{K\pi}{2n}, OA=1$ and $OB_K=K$. The value of the

$\lim_{n\to\infty}\frac{\pi^2}{n^2}.\sum_{K=1}^{n}\frac{S_K}{10}$ is

51. Let $f:R\to R$ is a function which satisfies condition $f\left(x+y^3\right)=f(x)+\left[f(y)\right]^3$ for all $x,y\in R$. If $f'(0)>0$, then $\frac{1}{1000}f(100)$ is ____

52. Let $f(x)=\begin{vmatrix}\sec x & \cos x & \sec^2 x+\cot x\cos ecx\\ \cos^2 x & \cos^2 x & \cos ec^2 x\\ 1 & \cos^2 x & \cos ec^2 x\end{vmatrix}$ and $I=\int_{\pi/4}^{\pi/2}f(x)dx$. The value of $I+\frac{\pi}{8}+\frac{1}{6\sqrt{2}}$ is ___

53. Let **a, b** and **c** be vectors with magnitudes 3, 4 and 5, respectively and **a**+**b**+**c**=0, then the values of $|\mathbf{a}.\mathbf{b}+\mathbf{b}.\mathbf{c}+\mathbf{c}.\mathbf{a}|$ is

54. The distance between the plane $Ax-2y+z=d$ and the plane containing the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is $\sqrt{6}$, then $|d|$ is equal to …

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RANK 23
SHAIK SAHIL CHANDA
HT.No. 236132870

RANK 26
SONI MAYANK
HT.No. 232097025 (SVF)

RANK 33
GOYAL NAMAN
HT.No. 232029345 (SVF)

RANK 37
SUMEDH SS
HT.No. 231029088 (SVF)

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V DEERAJ SATHVIK REDDY
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HT.No. 231004058 (SVF)

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BELOW 1000 All India Open Category Ranks » 181

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