Code No - 56898

①

Q. No. **Q1 A. Select the correct option and complete the following**

i) b) rate of reaction is independent of the concentration of the reacting species

ii) c) 1

iii) c) independent of initial concentration

iv) c) Addition of chemicals reduces the surface tension of a liquid

v) b) surface tension

vi) c) $2\pi r\gamma = mg$

vii) b) Phosphorous

viii) b) sp^2

ix) b) Boron-Silicon

x) a) Na_2CO_3

xi) b) p-block

xii) c) non availability of the d-orbitals

xiii) a) Meso

xiv) b) 2

xv) a) Eclipsed

xvi) a) 2

xvii) a) Inactive

xviii) b) Enantiomers

56898

②

Q. No. Q.1.(B) State whether true or false

i. True

ii. False

iii. True

iv. False

v. False

vi. True

Q.1.(C) Match the following

Column B

i) e) mole^{-1} litre s^{-1}

ii) d) $\frac{(n^2-1)}{(n^2+2)} \times \frac{M}{d}$

iii) h) CO_2

iv) f) 1

v) a) clockwise

vi) b) Similar groups on the same side

vii)

Q.2 (A) Derive an expression for the rate constant of a second order reaction of reactants having equal concentration .

Second order reaction is when the rate of the reaction is proportional to the second power of the concentration of the reactant. The rate is influenced by the concentration of two reactants

$$2\,A \longrightarrow \text{products}$$

$$\text{Rate} = k\,[A]^2$$

1 mark

Let 'a' mol/dm^3 be the initial concentration of the reactant at time

x' mol/dm^3 of the reactant react at time t and get converted to products

(a-x) mol/dm^3 will be the concentration of reactant at time t

Rate $dx/dt = k\,(a-x)^2$ where 'k' is the rate constant

1 mark

$$\int_{x=0}^{x=x} dx/(a-x)^2 = k\int_{t=0}^{t=t} dt$$

$1/(a-x)$ + constant $= kt$ ………………. eq (1)

when t=o …. x=o …..substituting in eq (1)

∴ constant $= -1/a$

Substituting $-1/a$ in constant in eq (1)

$$1/(a-x) - 1/a = kt$$

$$k = \frac{x}{a\,(a-x)} \times \frac{1}{t}$$

3 marks

Q.2. (C) i) Half life time : Half life time is the time it takes for the concentration of a reactant to fall to half of its original value

1 mark

ii) Half life time method for the determination:

4 marks

The time at which one-half of the substance has disappeared is determined and the experiment is repeated with different initial concentrations of the reactants. The order (n) is then determined where 'a' is the initial concentration

$(t_{1/2})_1 \propto 1/\ a^{n-1}$

$\therefore\ t_{1/2} \propto a^{1-n} \qquad \therefore\ t_{1/2} = k\ a^{1-n} \qquad \therefore\ \log t_{1/2} = \log k + (1-n)\,a$

A plot of graph of *log* $t_{1/2}$ *vs log a* gives a straight line with a *slope* $(1-n)$.
From the slope the order (n) of the reaction can be determined.
If half life at different concentration is given i.e $(t_{1/2})_1$ and $(t_{1/2})_2$ then

$(t_{1/2})_1 \propto 1/\ a_1^{\,n-1}$ and $(t_{1/2})_2 \propto 1/\ a_2^{\,n-1}$ then

$$\frac{(t_{1/2})_1}{(t_{1/2})_2} = \frac{a_2^{\,n-1}}{a_1^{\,n-1}}$$

∴ Order of Reaction (n) is

$$n = 1 + \frac{(\log t_{1/2})_1 - (\log t_{1/2})_2}{\log a_2 - \log a_1}$$

Q.2.B Given

Time (min)	9.82	59.6	93.8	142.9
% remaining	96.5	80.3	71.0	59.2

To determine order:

Solve: $k = \frac{2.303}{t} \log \frac{a}{(a-x)}$

1 mark

i) For a=100 a-x = 96.5 t = 9.82
$k = \frac{2.303}{9.82} \log(100/96.5) = 3.628 \times 10^{-3}\ \text{min}^{-1}$

ii) For a=100 a-x = 80.3 t = 59.6
$k = \frac{2.303}{59.6} \log(100/80.3) = 3.681 \times 10^{-3}\ \text{min}^{-1}$

iii) For a=100 a-x = 71.0 t = 93.8
$k = \frac{2.303}{93.8} \log(100/71.0) = 3.652 \times 10^{-3}\ \text{min}^{-1}$

iv) For a=100 a-x = 59.2 t = 142.9
$k = \frac{2.303}{142.9} \log(100/59.2) = 3.669 \times 10^{-3}\ \text{min}^{-1}$

2 marks

- The order is equal to 1

1 mark

- The mean rate constant $= \frac{(3.628 + 3.681 + 3.652 + 3.669)}{4} \times 10^{-3}$

$= 3.657 \times 10^{-3}\ \text{min}^{-1}$

1 mark

Set - V.

56898

⑤

M.U.P./J.Exam.2063-40,000x8pp.-2-14

Questions should be —

WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK

SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK.

so as to avoid mistakes in the printed question papers

Duration .... Hours. Total Marks assigned to the paper ....

Q. No.		Marks
	N.B. :	

2.(D) Definition - 1 Mark
Equation - 1 Mark
Diagram- 1 Mark
Procedure- 2 Marks

Surface tension is defined as the force in (Newton) acting along the surface of liquid at right angles to any line of unit length (1 m)

Procedure

i) Clean the stalagmometer with chromic acid mixture, wash with water and dry it.

ii) Attach a small piece of rubber tube having a screw pinch cock at the upper end of the stalagmometer.

iii) Immerse the lower end of the stalagmometer in distilled water and suck the water 1-2 cm above mark 'A'. Adjust the pinch cock so that 10-15 drops fall per minute.

iv) Clamp the stalagmometer, allow the water drops to fall and start counting the number of drops, when the meniscus crosses the upper mark 'A' and stop counting when the meniscus passes mark 'B;.

v) Repeat the exercise to take three to four readings.

vi) Rinse the satalagmometer with alcohol and dry it.

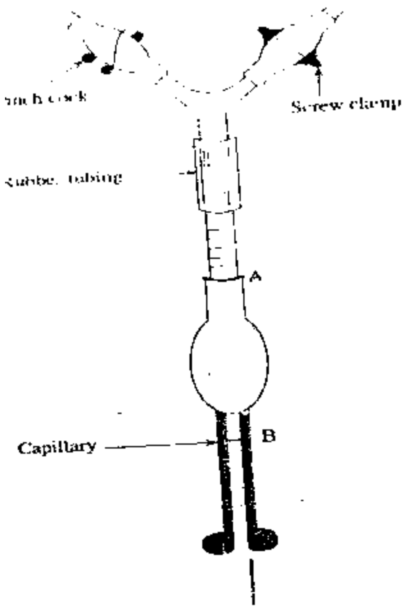
vii) Suck the given liquid in the satalagmometer and count the drops as in case of water.

viii) Let n_1 be the number of drops formed by the given liquid with density d_1 and surface tension γ_1.

ix) Let n_2 be the number of drops, d_2 density and γ_2 surface tension of the reference liquid. Then,

$$\gamma_1/\gamma_2 = n_2d_1/n_1d_2$$

x) Knowing the densities of two liquids and the value of surface tension of one of the liquids, surface tension of other liquid can be calculated.



Set - V

⑥

Q. No. Marks

(E) Refractive Index - The refractive index of a medium is defined as the ratio of velocity of light in vaccum to that in the medium. → 1 mark.

Solution -

Given, $n = 1.6$, $d = 0.87\ g\ cm^3$.

$MW = 78$.

Molar refraction

$$R_M = \frac{n^2 - 1}{n^2 + 2} \times \frac{M}{d} \longrightarrow 1 \text{ Mark}$$

$$\left.\begin{aligned} &= \frac{(1.6)^2 - 1}{(1.6)^2 + 2} \times \frac{78}{0.87} \\ &= 0.3421 \times 89.6551 \end{aligned}\right\} \rightarrow 2 \text{ Marks}$$

Molar refaction $= 30.6710\ Cm^3\ mol^{-1}$ → 1 Mark.

Set - V

56898

Q. No.

2 (F)

Definition of liquid Crystal-1 mark

Naming of different Classes- 1 mark

Explanation of each class with example- 3 marks

Liquid Crystals- A substance which flows like a liquid but has some degree of ordering in the arrangement of its molecules is called liquid crystals.

Liquid crystals are classified in to three catagories-

i. Smectic liquid crystals- Flow in layers in different planes and sheets giiding over each other.It has non-Newtonian motion. Examples- ethyl-azoxy benzoate, ethyl-p-azoxy cinnamate.

ii. Nematic liquid crystals- They flow more readily. Their flow is Newtonian. They have thread like structure. Examples- p-azoxy anisole, p-methoxy cinnamic acid.

iii. Chloesteric liquid crystals- These have some nematic and smectic characteristics. They have high non-Newtonian flow. Example- Chloesteryl benzoate.

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(05)

Q3 (8)

(A) Metallic and non-metallic nature of an element is defined by its electropositive character. It is tendency of an element in its gaseous state to lose one or more electrons to form gaseous cations. Higher the value of electropositive character higher is metallic tendency. As the ionization energy decreases electropositive character increases and hence metallic character also increases.

gp I Li → Cs ionization energy decreases hence metallic character increases.

gp 2 Be → Ba ionization energy ~~an~~ is higher than corresponding alkali metals hence less electropositive than alkali metals metallic properties increases down the group.

gp 13 B to Al metallic character increases. But from Al to Tl is almost same because the difference in their ionization energy is small

gp 14 Two elements carbon and silicon are distinctly non metal, germanium is metalloid Sn and Pb are metals with the increase in electropositive ~~metallic~~ character from

gp 15 N to Bi metallic character increases.

gp 16 The non-metallic character is stronger with oxygen and sulphur and weaker with selenium and tellurium. The last element Po is distinctly metal.

gp 17 elements are halogen they are least basic in nature from fluorine to iodine electropositive and metallic character increases. Fluorine shows highest electronegativity of 4

(01) m

(B) The reluctance of ns electron pair from taking part in bonding is called inert pair effect. which is observ
elements, The stability of lower oxidation sta
oxidation state

decreases down the group. have ns^2np^3 configuration ⓪② marks

3) The elements of group 15 The hence oxidation states are +3, +5 and -3. The stability of +3 O.S increases ~~w~~ and +5 decreases from N to Bi due to inert pair effect. N donot form compound with +5 oxidation state because of absence of d orbitals. In -3 oxidation state, the elements have the tendency to act as election pair donors.

The elements of group 16 have ns^2np^4, hence ⓪② marks oxidation states are -2, +2, +4 and +6. Since elements have 6 valence electrons they tend to gain or share 2 electrons to attain stable octet. Oxygen is most electro negative shows tendency to gain 2 electrons exhibits -2 O.S. Oxygen is different from other elements due to (a) small size (b) high ionization potential (c) more electronegativity (d) non-availability of d-orbital (e) exhibits -2 oxidation state. The last element Po is most electropositive hence does not show -2 oxidation state

Nitrides are binary compounds of nitrogen with an element which is more electropositive or less electronegative than nitrogen.

(C) Types of nitrides (1) Ionic nitrides (2) covalent (3) interstitial nitrides (explanation is expected) → ⓪③ marks

Alkali and alkaline earth metals form ionic nitrides

Alkali metals donot combine directly with nitrogen — ⓪① to form nitrides first azide (MN_3) is formed then converted to nitrides

$MNH_2 + N_2O \rightarrow MN_3 + H_2O$

$8M + MN_3 \rightarrow 3M_3N$

Only lithium combines directly with nitrogen to ⓪① form Li_3N

Alkaline earth metals burn in N_2 atmosphere & form nitrides $3M + N_2 \rightarrow M_3N_2$ (M = Mg, Ca, Sr, Ba)

is formed by the action of NH_3

56898

D. ⑩ Boron belongs to group 13 the unusual characteristics as compared to other group elements are because of
(i) small ionic radius
(ii) compounds act as strong Lewis acids
(iii) Boron shows maximum covalency 4
(iv) does not show inert pair effect

E. Method of preparation of Caustic soda (anyone) (01) mark
Chemical properties (any two) (02) mark
Uses (any Two) (02) mark

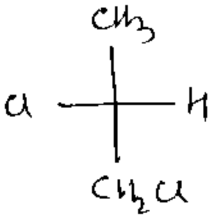
(02) marks

F. Sulphuric acid droplets and sulphate compounds, formed by SO_2 affect visibility, causes nose, eye, lung irritations. Sulphur aerosols penerate inner most passage of lungs they cause broncho-constriction. (03) marks
Nitric oxide do not have adverse effect on human health. Hemoglobin has high affinity for NO. NO_2 is highly toxic and type of pollutant NO_2 forms nitrous and nitric acids which attacks the mucous inner lining of the lungs. The acute symptoms are emphysema (pulmonary fibrosis) Those regularly exposed to levels of 10-40 ppm of NO_2 are most effected. The exposure to lower concentration of 0.11 – 0.2 ppm for one hour produces changes in airways resistance in asthmatic patients. The lower concentration of NO_2 causes ~~[illegible]~~ irritation of eyes, throat and lungs.

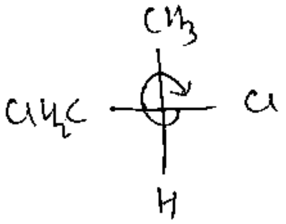
(1)

A i Assign R or S

a)

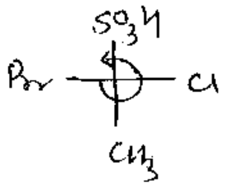


Cl	CH_2Cl	CH_3	H	1 M
17	6(17,1,1)	6(1,1,1)	1	



'R' configuration 1 M

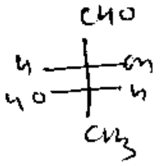
b)



Br	Cl	SO_3H	CH_3	1 M
35	17	16	6	

'S' configuration 1 M

ii Threo Isomer - If two similar groups are on the opposite side then the isomer is called threo isomer ½ M

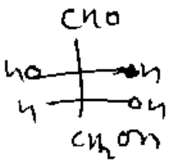


or any example ½ M

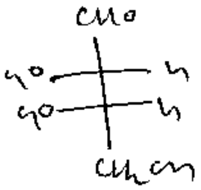
B i) Chiral molecules 1M each

a) Chiral b) achiral c) Chiral

ii) 1M each



D Threose



L Erythrose

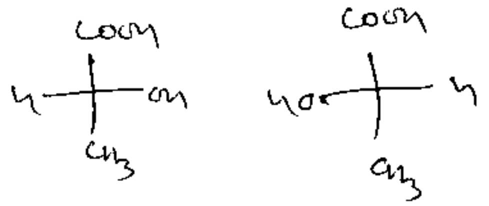
c (12) Enantiomers –

1 Enantiomers are optical isomers which are nonsuperimposable mirror images of each other

2 They rotate the plane of plane polarised light to the same extent but opposite direction

3 One enantiomer is dextro rotatory and other is laevo rotatory

4 Identical physical properties ie MP, B.P, density etc



each point 1
example ½ M
3 points = 2½ M

Racemic form

1 Mixture containing equal quantities of d & l forms of an optically active compound 1M

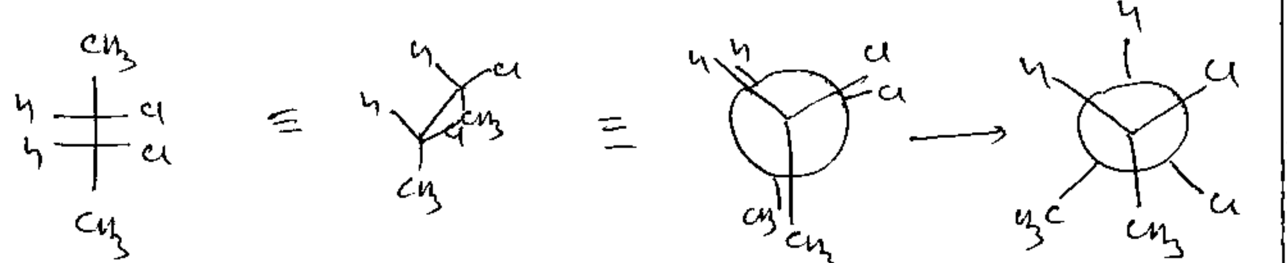
2 Racemic form is a mixture of 2 isomers and ½M optically inactive due to external compensation

3) It is represented as (dl) or (±) ½M

4) eg. Mixture of d & l lactic acid ½M

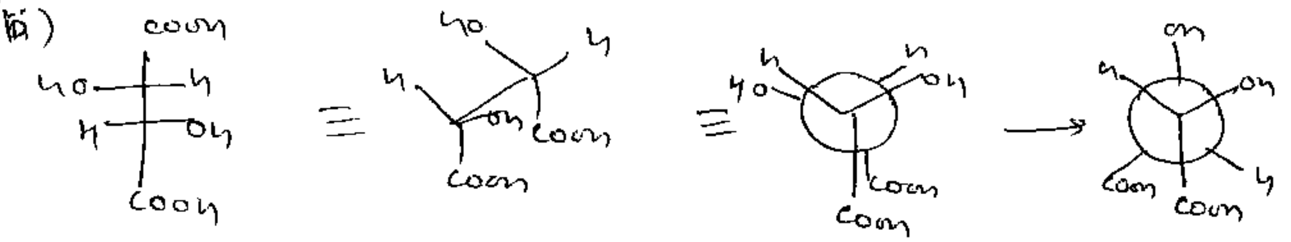
3pts = 2½ M

D i)



2½M

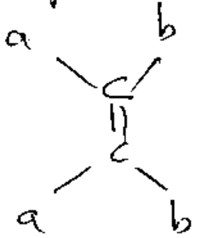
ii)



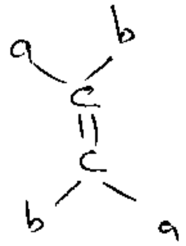
2½M

E (13) Unsaturated compounds and cyclic compounds show geometrical isomerism. Compounds having same structure but different spatial arrangement of groups. 1M

1M



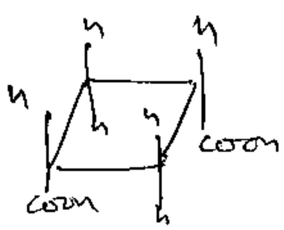
Cis



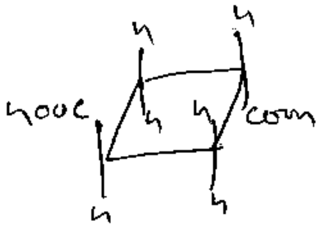
trans

No of geometrical isomers = 2^n

Cyclic compounds show geometrical isomerism due to the rigidity of the ring. The rotation of C–C bond is restricted 1M



cis 1,3 cyclobutane dicarbonylic acid



trans 1, 3 cyclobutane dicarbonylic acid

Cis 1M

Trans 1M

F a) ~~Stereogenic centre~~ Specific Rotation – It is defined as the angle of rotation produced by a solution of unit concentration (1g/ml) which is placed in a polarimeter tube of unit length (1dm). 1M

It is denoted as α. It is dependent upon the nature of substance, Temperature and wavelength of light 1M

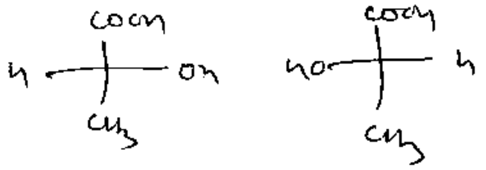
) Optical isomerism :-

Two or more molecules having same structure but differ in their action on the plane of polarised light. this phenomenon is called optical isomerism 1M

The molecules rotate the plane of plane polarised light in clockwise direction is dextro rotatory and that which rotates plane of plane polarised light in anticlockwise direction is laevorotatory ½M

) Chirality - Chirality is a property by which a molecule cannot be superimposed on its own mirror image 1M

eg. Due to chirality a molecule exists as two enantiomers ie dextro & laevo ½M



5

56898

5

Q.5. (A) Given $k = 6 \times 10^{-2}\ s^{-1}$

Let initial concentration = a   Final concentration $(a-x) = (1/10) \times a$

To determine : t and $t_{1/2}$

Solve: $k = \frac{2.303}{t} \log \frac{a}{(a-x)}$ **1 mark**

i) To determine time **2 marks**

$6 \times 10^{-2} = \frac{2.303}{t} \log [a / (1/10 \times a)]$

$t = 2.303 \times \log 10 / (6 \times 10^{-2})$ = **3. 84 seconds**

ii) $t_{1/2} = 0.693 / k$ **1 mark**

$= 0.693 / (6 \times 10^{-2})$ = **1.15 seconds** **1 mark** c B). i) Coefficient of Viscosity - It may be defined as the force per unit area required to maintain a unit difference of velocity between two consecutive parallel layers of the liquid 1 cm apart. → 1 mark

ii) Relative Viscosity - The term η/η_0 is known as relative viscosity. (η_r). → 1 mark

iii) Specific viscosity (η_{sp}) - It is relative increase in viscosity and mathematically, may be represented as, → 2 Marks

$$\eta_{sp} = \frac{\eta - \eta_0}{\eta_0} = \frac{\eta}{\eta_0} - 1 = \eta_r - 1.$$

iv) Reduced viscosity - The ratio of η_{sp}/c ie, increase in specific viscosity per unit concentration of the solution is known as the reduced viscosity. → 1 Mark

Q5 (17)

C. The two important gaseous inorganic pollutants of carbon are (i) CO_2 (ii) CO (01) mark

Sources of carbon monoxide (any two) (01) mark

(i) Interaction of CO_2 with coke at higher temp in blast furnace. $CO_2 + C \rightarrow 2CO$

(ii) Incomplete combustion of carbonaceous matter in automobile engines, agricultural and slash matter, petroleum refineries

$$2C + O_2 \rightarrow 2CO$$

(01) mark.

Control Techniques (any two)

(1) By changing the fuel or the energy source.

(2) longer duration of circulation of the fuel gas in the combustion chamber

(01) mark.

Sources of carbon di oxide (any two)

(i) Volcanic activities

(ii) complete combustion of carbon compounds

$C + O_2 \rightarrow CO_2\uparrow$

$CaCO_3 \rightarrow CaO + CO_2\uparrow$

Control Techniques

(i) By reducing release from industrial process.

(ii) By increased rate of photosynthesis from increasing forest cover

5.D. Carbides are binary compounds of carbon with an element which is more electropositive or less electronegative than carbon. (01) mark.

characteristics of ionic carbides (02) marks

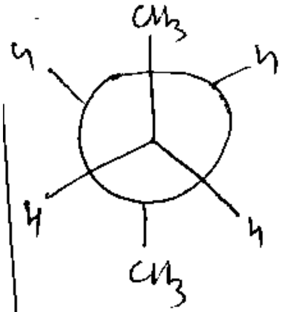
(1) Acetylides (C_2^{2-} groups) gives acetylene on hydrolysis, they are derivatives of ($HC\equiv CH$) eg MgC_2

$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$

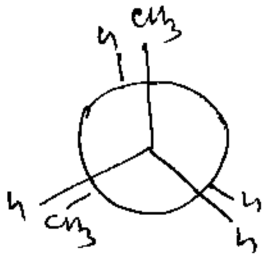
structure $:\bar{C}\equiv\bar{C}:$ or $[:C\equiv C:]^{2-}$ (02) marks.

(ii) Allylides (C_3^{4-} groups) :- gives allylene ($H_2C=C=CH_2$) on hydrolysis, they are derivative of allylene are called allylides $Mg_4(C_3)_2$ or Mg_2C_3. $Mg_2C_3 + 4H_2O \rightarrow 2Mg(OH)_2 + C_3H_4$

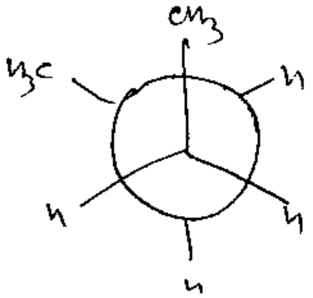
⑱ Conformational Analysis
study of relative stabilities of various conformations and relating the properties of the molecule to the stability is Called Contromational Analysis 1M



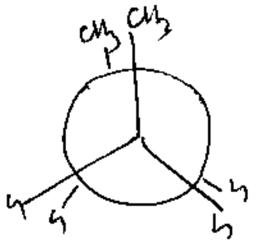
Antiperiplanar
I



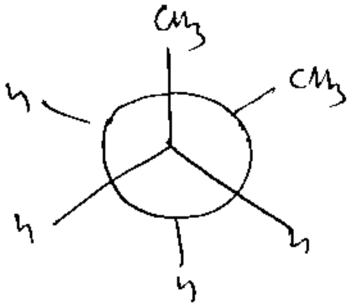
Anticlinal
II



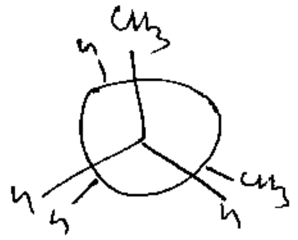
Synclinal (Gauche)
III



Synperiplanar
IV



Synclinal
V



Anticlinal
VI

$\frac{1}{2}$M each conformat 3M

Eclipsed conformations – II IV VI
Staggered conformations I III V

Most stable – Antiperiplanar
Most Unstable Synperiplanar
order of stability 1M
Antiperiplanar > Synclinal > Anticlinal > ~~Anti~~ synperiplanar

56898

⑲

i) a Z isomer 1M

b E isomer 1M

Pair of enantromers -

~~I & III~~ ~~1½M~~

~~III & IV~~ ~~1½M~~

a & b 1½M

c & d 1½M