

Model Answer

For

B. Sc. (Hon's) (Second Semester) Examination, 2013

CHEMISTRY

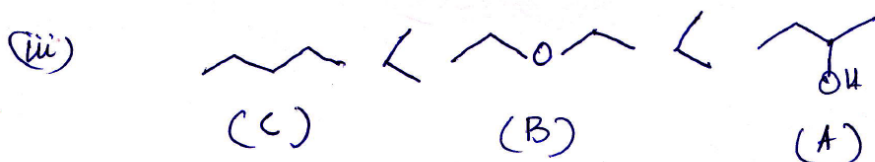
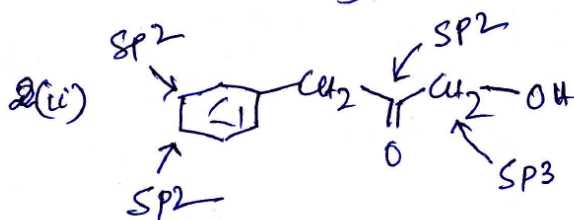
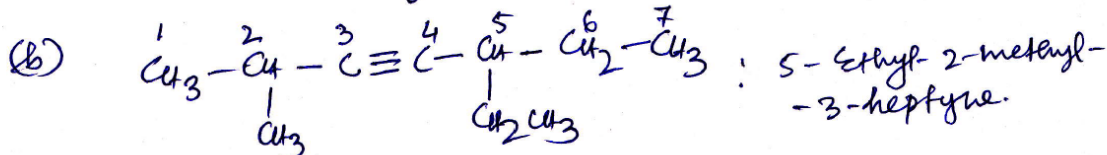
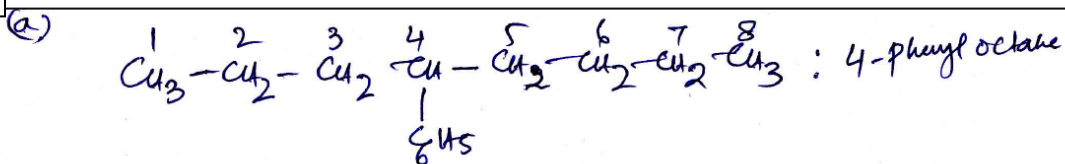
Paper: CBT: 201

(ORGANIC CHEMISTRY – 1)

AR-7770

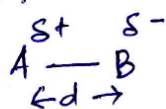
Section – A
(Short Answer Type Questions)

1.



Reason: A : -OH functional group present forms H-bonding
B and C, OH group absent, H-bonding is absent and have lower b.p than A.

(iii) Dipole moment :- dipole moment can be defined as the product of magnitude of charge and the distance of separation between the charges.



expressed as

$$\text{Dipole moment } (\mu) = \delta \times d$$

where d = distance between the charges
 δ = charge

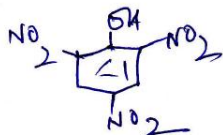
Unit of dipole moment.

The dipole moment is commonly measured in "Debye" and represented by symbol is "D"

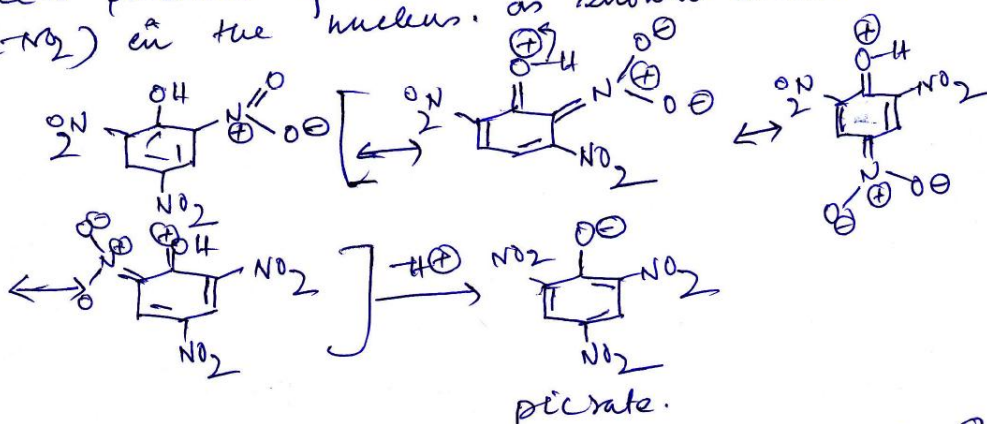
Section – A (Short Answer Type Questions)

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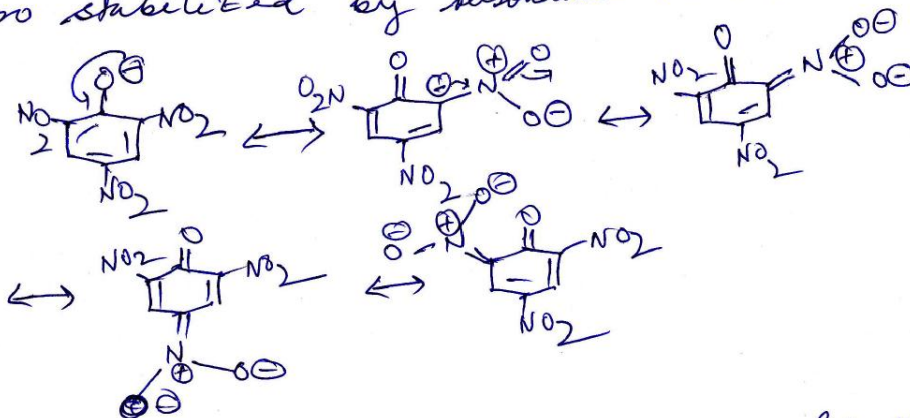
Q) Picric acid is 2,4,6-trinitrophenol (1).



We know that phenols are acidic in nature due to resonance, the high acidity of picric acid can be explained on the basis of extended resonance structures due to presence of three electron-withdrawing groups $-(NO_2)$ in the nucleus, as shown below.



The picrate ion formed after removal of H^+ is also stabilized by resonance as shown below.



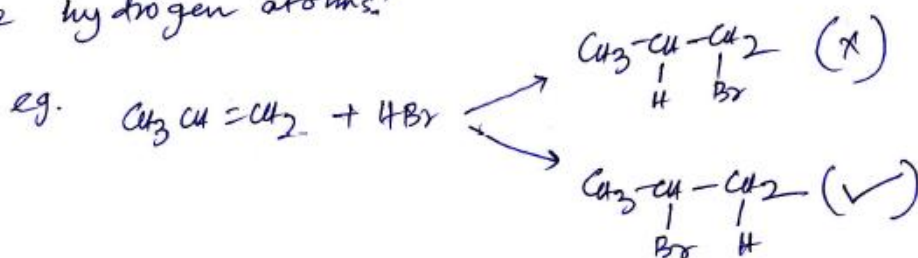
vi Homolytic cleavage :- The process by which the shared pair of covalently bonded electrons are equally divided between two atoms leading to generation of two free radicals.
example $A \overset{\cdot}{\text{B}} \rightarrow A^{\cdot} + B^{\cdot}$; $Cl_2 \xrightarrow{h\nu} Cl^{\cdot} + Cl^{\cdot}$
free radicals.

Section – A (Short Answer Type Questions)

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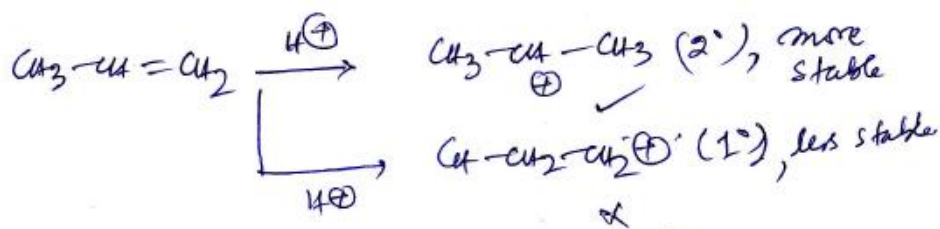
vii) Markovnikov's Rule:—

In organic chemistry, Markovnikov's rule describes the some addition reaction in organic chemistry. The rule states that 'when a polar molecule (eg HBr) adds to a unsymmetrical alkene (eg. propene) positive part of the addendum (H⁺) will add to carbon attached to double bond which contain more hydrogen atoms.'

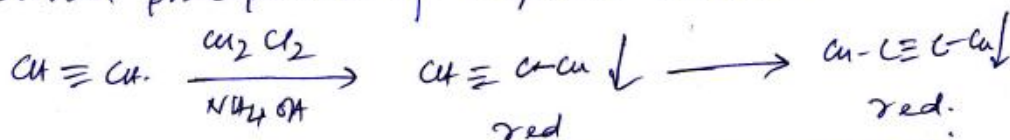


2-bromopropane.

The chemical basis of the rule is the formation of more stable carbocation as shown below.



viii) When ammoniacal solution of cuprous chloride ~~was~~ is treated with acetylene gas red coloured precipitate of cuprous acetylide is formed

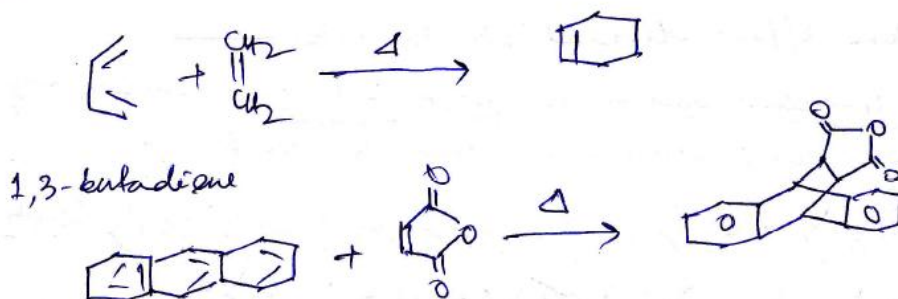


This reaction proves that acetylene is acidic in nature.

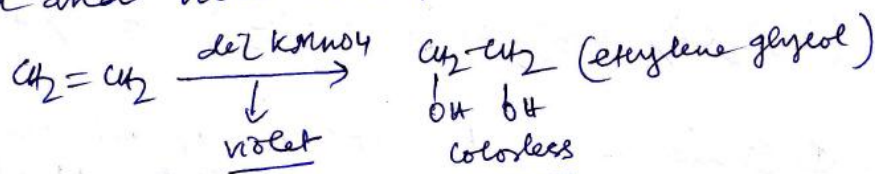
Section – A (Short Answer Type Questions)

4

(X) example of Diels-Alder reaction:



(X) when ethylene gas is passed through a dilute solution of $KMnO_4$ (pink/violet), ethylene glycol is formed and violet color of $KMnO_4$ is become colorless.



Section – B (Long Answer Type Questions)

2. Inductive effect:-

The polarisation of a σ -bond due to electron withdrawing or electron donating effect of adjacent groups or atoms is called inductive effect.

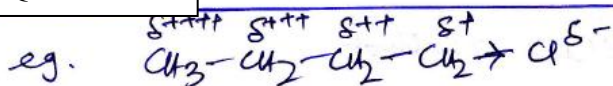
- Features :-
- (i) It arises due to difference in electronegativity.
 - (ii) transmitted through σ -bonds.
 - (iii) The magnitude of effect decreases rapidly with distance.
 - (iv) it is permanent effect,
 - (v) it influences chemical and physical properties.

P.T.O

Section – B (Long Answer Type Questions)

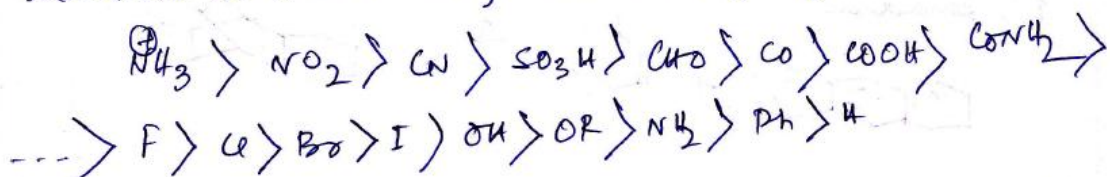
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Q. 2. Contd...

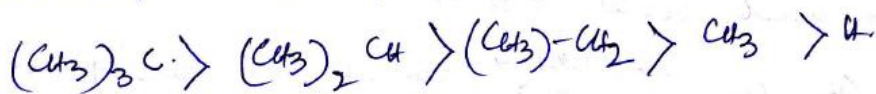


Inductive effect divided into two types —

① Negative inductive effect (-I): — caused by electron withdrawing atom or groups.



② Positive inductive effect (+I): — refers to electron releasing nature of a atom or group.



* Inductive effect helps to explain the acidity and basicity of organic compounds. +I effect increase the basicity while -I effect increase the acidity of a compound.

Structure of five isomers of hexanes

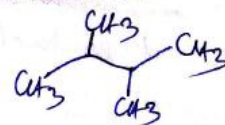
(a) Hexane,



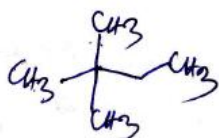
(b) 2-methylpentane



(c) 2,3-dimethylbutane



(d)



, 2,2-dimethylbutane

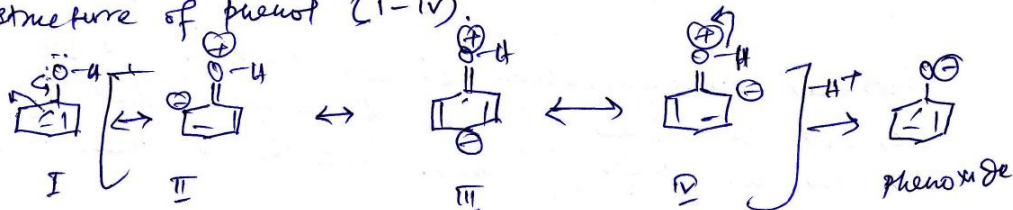
Section – B (Long Answer Type Questions)

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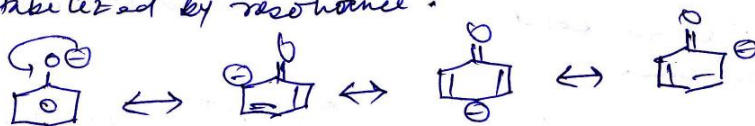
3 (a) Phenols are acidic but alcohols are neutral in nature. Phenol reacts with NaOH to form sodium phenoxide. This can be explained by considering resonance.



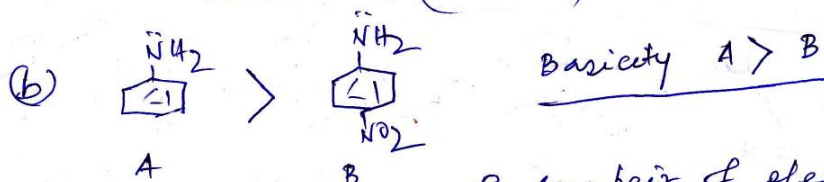
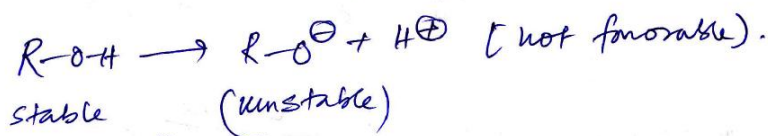
Structure of phenol (I-IV)



From the structures I-IV of phenol indicated that the three structures contains a charge on oxygen atom, which weakens the O-H bond and releases H^+ easily. After H^+ release phenoxide ion is formed, which is stabilized by resonance.



On the other hand, in alcohol -OH group attached to an alkyl group (R), which has a +I effect and destabilizes the alkoxide ion (RO^-).



due to the presence of a lone pair of electrons on the N-atom of NH_2 , both compounds are basic in nature. However, aniline (A) is more basic than 4-nitroaniline (B), due to the extended resonance structure and delocalization of the lone pair of electrons into the ring.

Section – B (Long Answer Type Questions)

7 Q. 3 (b) Contd...

due to presence of NO_2 group at para position -

Further delocalization of lone pair of electron does not take place in case of aniline. Thus, ⁱⁿ aniline the lone pair of electron is more localized than in 4-nitroaniline.

Q4. definition of conformation:-

Structures that can be interconverted simply by rotation about a single bond are known as conformations of the same molecule.

example.

Possible isomers of n-butane

Staggered form $\theta = 180^\circ$

$\theta = 0^\circ$ (Eclipsed)

$\theta = 60^\circ$ (gauche)

$\theta = 120^\circ$ (eclipsed)

$\theta = 240^\circ$

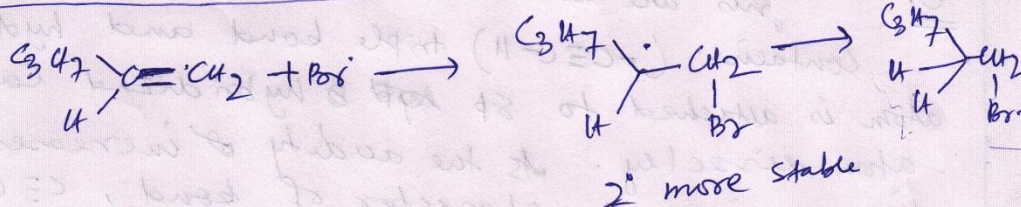
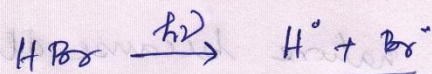
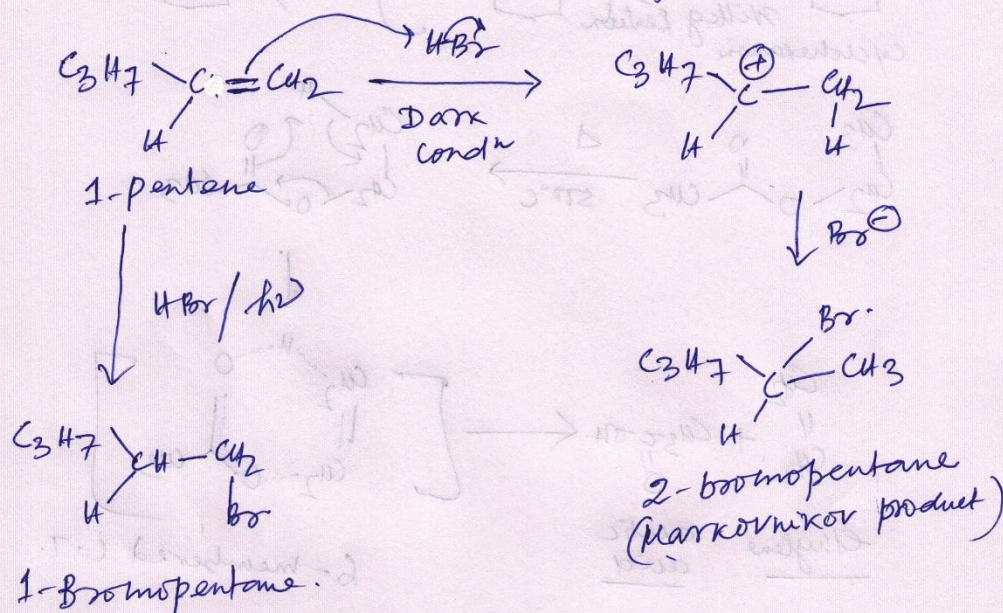
$\theta = 300^\circ$ gauche form

Draw energy profile diagram and show the stability of the different conformers.

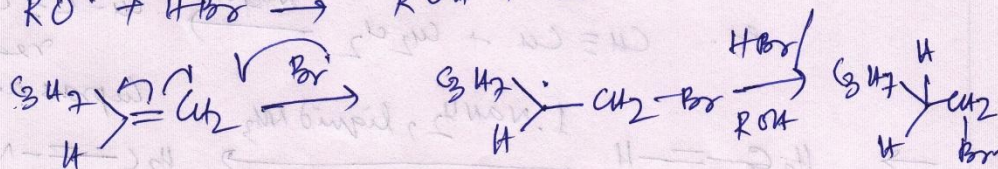
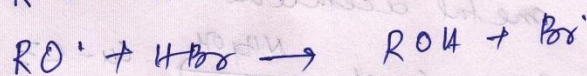
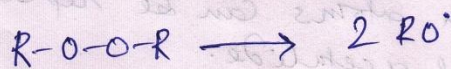
Section – B (Long Answer Type Questions)

8

5 (a) mechanism for the addition of HBr to 1-pentene.

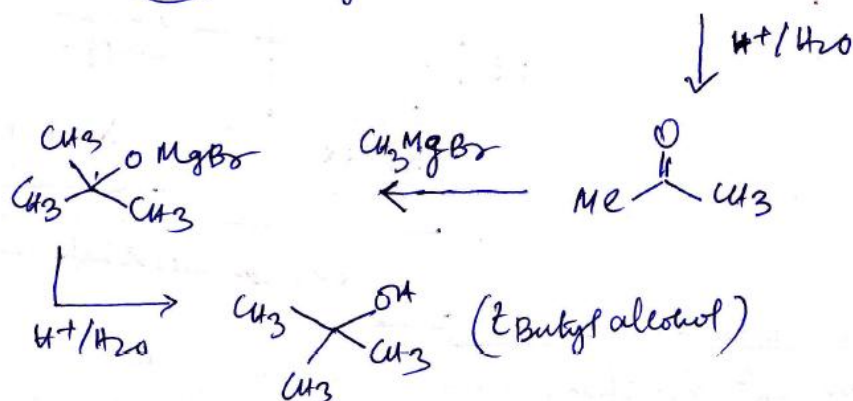
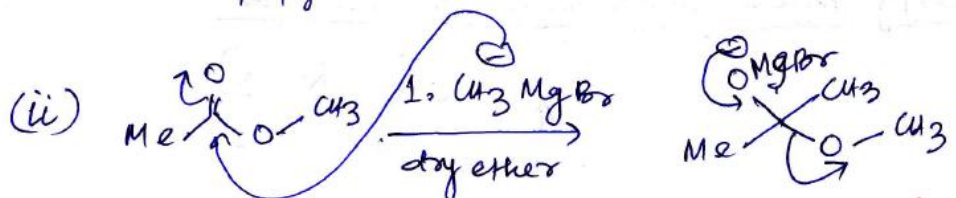
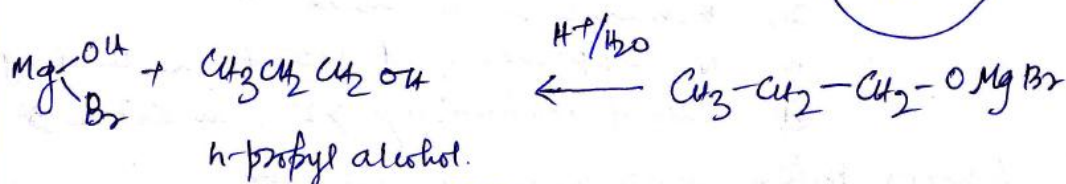
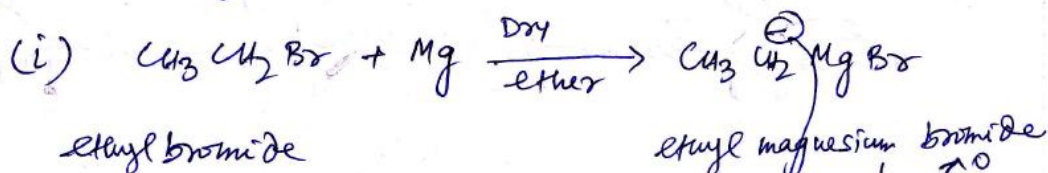


In presence of peroxide:



Section – B (Long Answer Type Questions)

Q.7. Identify the products [A] to [D]



Q.8. Discuss $\text{S}_\text{N}2$ reaction:

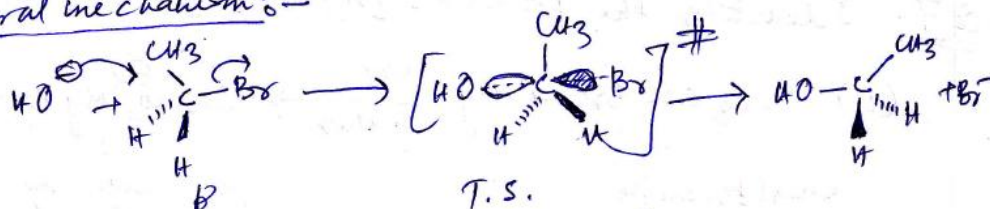
The $\text{S}_\text{N}2$ (known as bimolecular nucleophilic substitution) type of nucleophilic substitution reaction, where a nucleophile (Nu^-) attacks an electron deficient electrophilic center and bonds to it, expelling another group called a leaving group in one step. Because two reactive species involved in one step, so it named as bimolecular.

P.T.O.-

Section – B (Long Answer Type Questions)

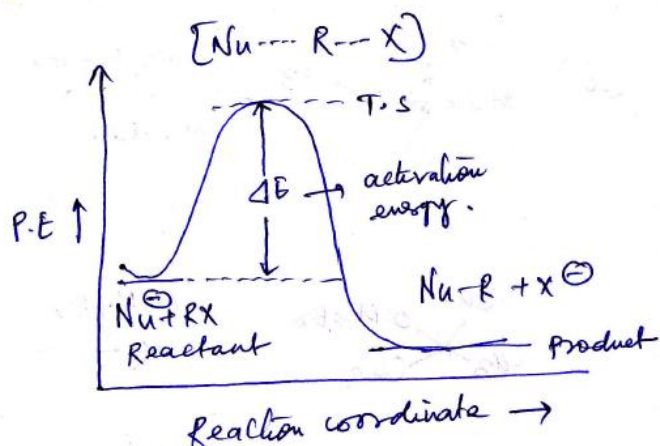
11 Q. 8. Contd...

Q.8 General mechanism –



- Features:
- (i) one step process / via a T.S.
 - (ii) bimolecular in nature
 - (iii) Nu approaches at 180° to the leaving group
 - (iv) rate of reaction: $(\text{CH}_3)^\circ > 2^\circ$, no SN^2 in 3°

Energy profile diagram for SN^2 reaction



Stereochemical outcome –

In SN^2 reaction, when nucleophile attacks a chiral substrate, an inversion of configuration of stereochemistry was observed. This phenomenon is called "Walden inversion". Because the Nu attack at 180° from the side opposite to leaving group, resulting inversion of tetrahedron, much like an umbrella turning inside out in the wind. If the starting material is in (R)-configuration, the product will be in (S)-configuration –