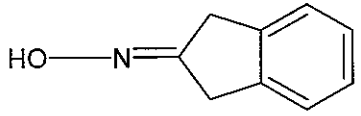
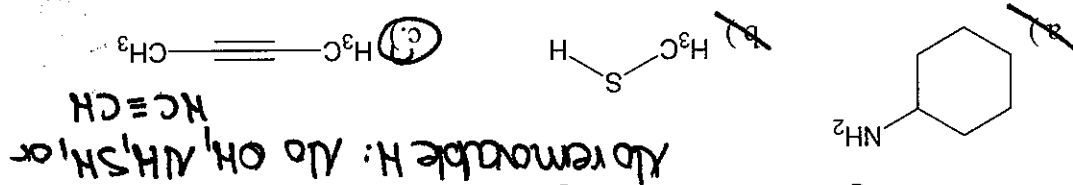


Key

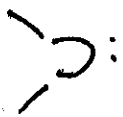
- 1.) Which of the following **best** accounts for the following statement? Alcohols have higher boiling points and higher water solubility than alkanes of similar molecular weight.
- ~~a.)~~ The bond angle around the oxygen of an alcohol is $< 109.5^\circ$.
 - ~~b.)~~ Alcohols contain a polar covalent bond that an alkane does not have.
 - c.)** The strongest intermolecular force present in an alcohol is hydrogen bonding while the strongest intermolecular force present in alkanes is London dispersion.
 - ~~d.)~~ Alcohols always have a higher molecular weight than alkanes.
- 2.) Which of the following would yield a secondary alcohol after the indicated reaction, following hydrolysis if necessary?
- ~~a.)~~ LiAlH_4 and a Ketone **T**
 - ~~b.)~~ $\text{CH}_3\text{CH}_2\text{MgBr}$ and an Aldehyde **T**
 - ~~c.)~~ 2-butene and $\text{Hg}(\text{OAc})_2, \text{H}_2\text{O}$ followed by NaBH_4 **T**
 - d.)** All of these.
- 3.) Which of the following terms best describes the reactive nature of the Grignard reagent?
- ~~a.)~~ Carbocation
 - ~~d.)~~ Free Radical
 - b.)** Electrophile **(e.)** Nucleophile
 - ~~e.)~~ Carbene
- 4.) The compound shown below is best classified as:
- 
O=C1N(O)CC2=CC=CC=C12
- ~~a.)~~ Carbimolamine
 - ~~e.)~~ Enamine
 - b.)** Oxime **(B.)** Hydrazone
- 5.) Through what mechanism is a tertiary alcohol converted to a tertiary alkyl halide?
- ~~a.)~~ $\text{S}_{\text{N}}2$
 - b.)** $\text{S}_{\text{N}}1$ **(b.)** $\text{S}_{\text{N}}1$
 - ~~c.)~~ $\text{E}1$
 - ~~d.)~~ $\text{E}2$
 - ~~e.)~~ This reaction is not possible.

6.) Which of the following could be used in the presence of a Grignard reagent?



Also remember H: $\text{AlO OH, AlH}_3\text{SH, or HC}\equiv\text{CH}$

7.) A carbene carbon is sp² hybridized and the lone pair of electrons resides



in an sp² orbital.

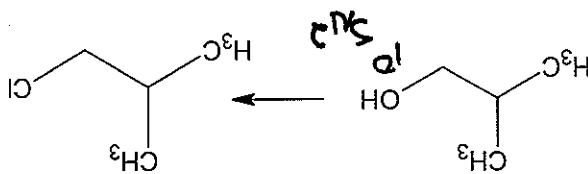
- ~~a) sp³ : sp³~~
~~b) sp³ : p~~
~~c) sp² : sp²~~
~~d) sp² : p~~
~~e) sp : p~~

8.) Which of the following does not undergo oxidation with CrO_3 and H_3O^+ ?

- ~~a) Butylalcohol~~
~~b) sec-butylalcohol~~
~~c) tert-butylalcohol~~
~~d) tert-butylalcohol~~

Also ox. of 3° ROH

9.) What is the best choice of reagents to achieve the following transformation?



- ~~a) HCl/ether~~
~~b) Cl_2/hv~~
~~c) $\text{SOCl}_2/\text{pyridine}$~~
~~d) $\text{Cl}_2/\text{H}_2\text{O}$~~

10.) Which of the following statements is not true?

- ~~a) The carbon atom of a carbonyl group is electrophilic.~~
~~b) In general, aldehydes are more reactive than ketones.~~
~~c) Nucleophilic addition to carbonyl groups can be catalyzed by acid or base.~~
~~d) Addition of a nucleophile to a carbonyl group changes the hybridization of the carbonyl carbon from sp² to sp³.~~

11.) What type of reaction takes place upon treatment of a ketone with HCN to form a cyanohydrin?

a) nucleophilic addition b) electrophilic addition

c) nucleophilic substitution d) electrophilic substitution

12.) Acid catalyzed dehydration of an alcohol proceeds through what mechanism?

a) S_N1 b) S_N2 c) E1 d) E2 e) This reaction is not possible.

13.) Which of the following statements about imine and enamine formation is false? (choose all that apply)

a) Reacting a ketone or an aldehyde with a primary amine will yield an imine. **T**

b) Reacting a ketone or an aldehyde with a secondary amine will yield an enamine. **T**

c) Imine and enamine formation should be carried out in highly acidic conditions. **F**

d) Imines can be reduced to primary amines. **F**

e) Enamines can be reduced to secondary amines. **F**

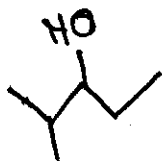
14.) During a Tollen's test, the _____ is oxidized and the _____ is reduced.

a) silver: aldehyde b) aldehyde: silver

15.) 2-methyl-3-pentanol is classified as a _____.

a) primary alcohol c) secondary alcohol

b) tertiary alcohol d) none of the above

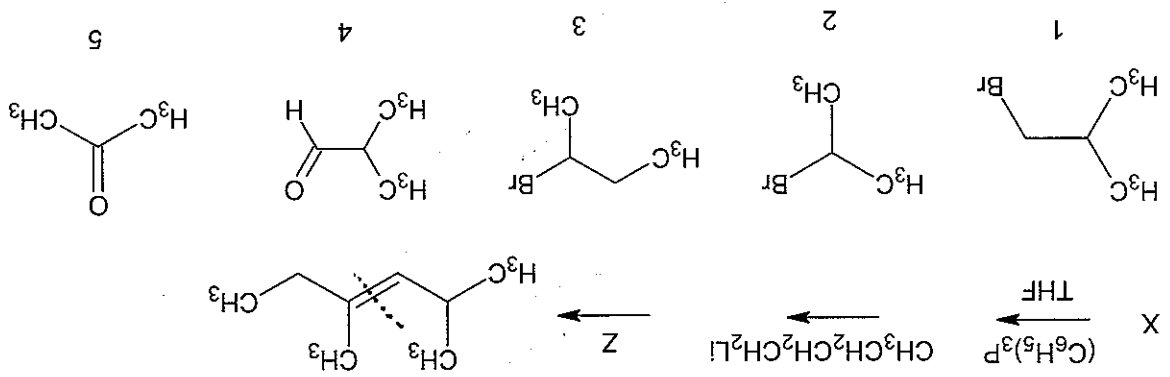


16.) The substance formed on addition of water to an aldehyde or ketone is called a hydrate or a:

a) vicinal diol c) geminal diol e) acetal

b) ketal d) none of the above

17.) Which of the following compounds could serve as the reagents X and Z in the following sequence?

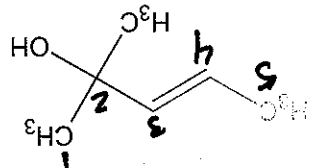


	X	Z
A	1	5
B	1	4
C	2	4
D	2	5
B	3	4

18.) When the carbonyl group of a neutral ketone is protonated:

- a) the resulting species becomes more electrophilic. **T**
- b) the resulting species is activated toward nucleophilic attack. **T**
- c) subsequent nucleophilic attack on the resulting species is said to occur under acid-catalyzed conditions. **T**
- d) the resulting species has a positive charge. **T**
- e.) All of the above.

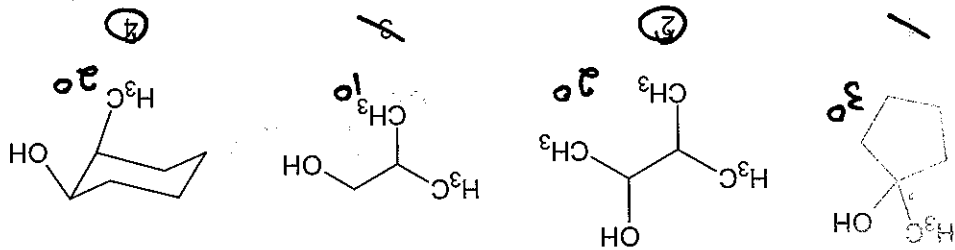
19) What is the IUPAC name of the following compound?



a. (E)-2-methyl-3-penten-2-ol b. (Z)-2-methyl-3-penten-2-ol

c. (E)-4-methyl-2-penten-4-ol d. (Z)-2-methyl-4-penten-2-ol

20) Which of the following is/are secondary alcohols?



a. only one b. only three c. two and four d. one, two, three, and four

21) Secondary alcohols can be made by the reaction of Grignard reagents with:

a. formaldehyde b. ethylene oxide

c. ketones d. aldehydes other than formaldehyde

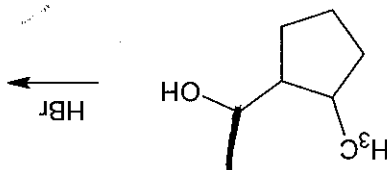
22) The lower the pK_a , the stronger the acid.

23) The nucleophile in the reduction of carbonyl compounds by $LiAlH_4$ and $NABH_4$ is Hydride (H^-).

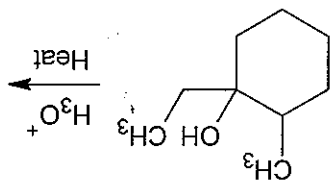
24) Aldehydes are generally more reactive toward nucleophiles than ketones. Provide two reasons that explain this observation.

Steric: Aldehydes are less sterically hindered (one less C)
 Electronic: Aldehydes are less stabilized by induction (one less C)

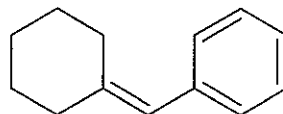
25.) Predict the product for the following reaction. Show the mechanism including electron movement with arrows and all intermediates that accounts for the formation of the product.



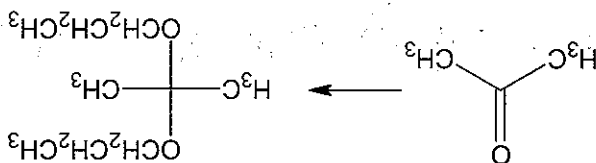
26.) Predict the products for the following reaction. Show the mechanism including electron movement with arrows and all intermediates that accounts for the formation of each possible product. Determine which products are major and minor and explain your choices.



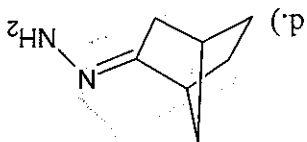
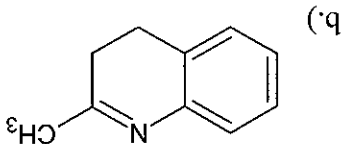
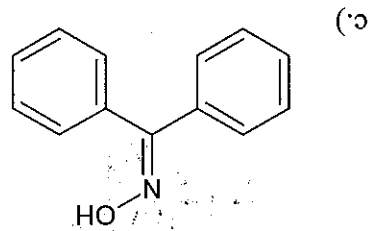
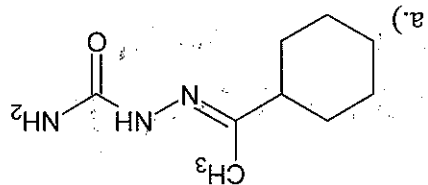
27.) Outline a Wittig synthesis of the following molecule starting with a ketone and an alkyl halide. List all necessary reagents and show the complete mechanism.



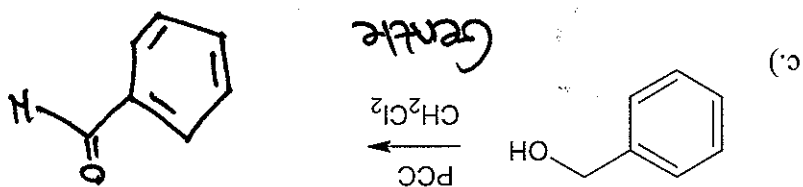
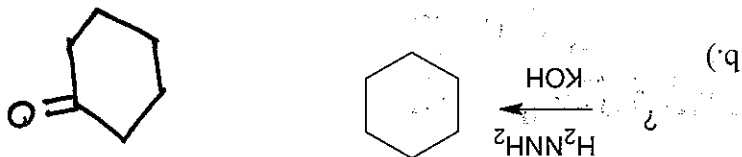
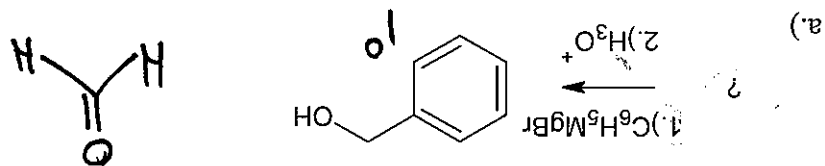
28.) Give the reagents that are responsible for the following transformation. Show the mechanism that accounts for the product.

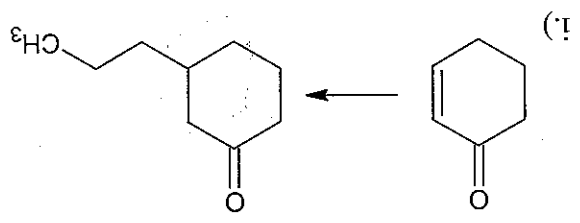
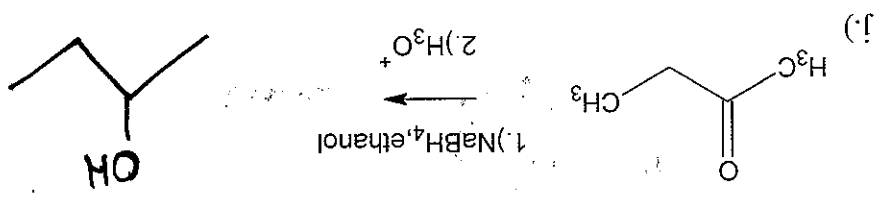


30.) Show what amines and carbonyl compounds combine to give the following compounds.

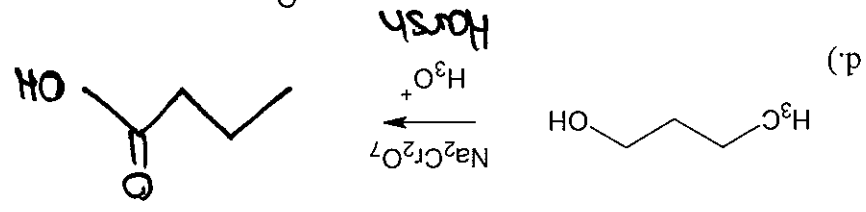
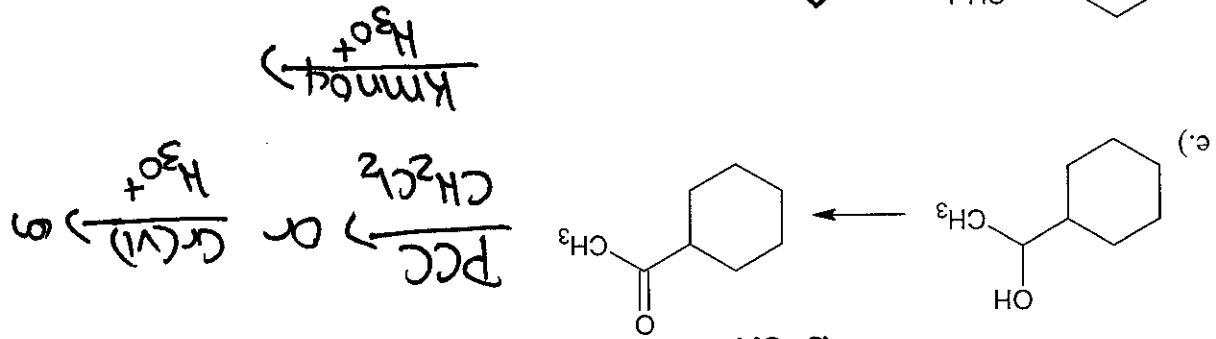
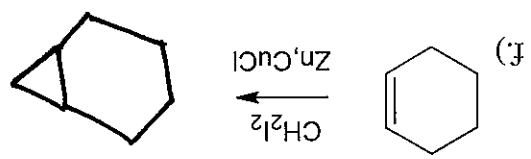
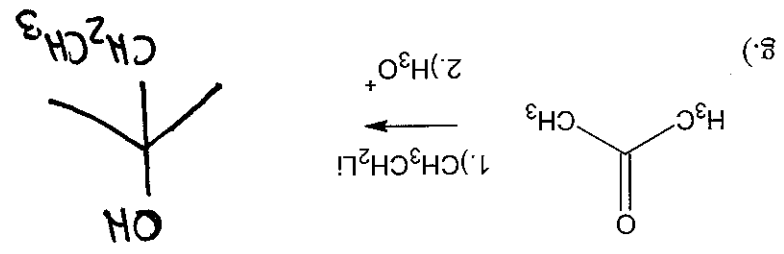
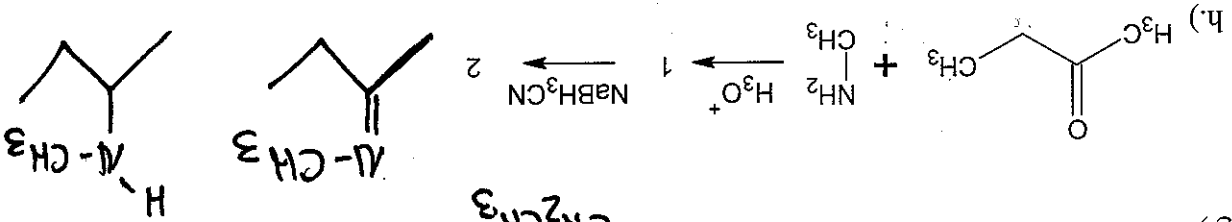


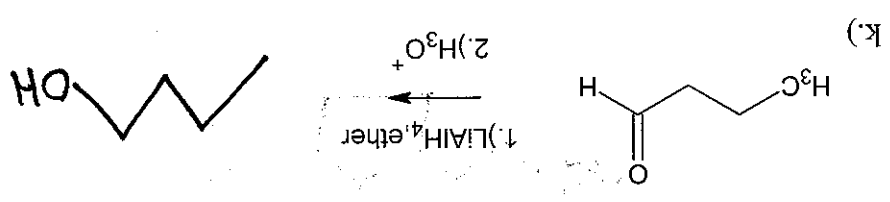
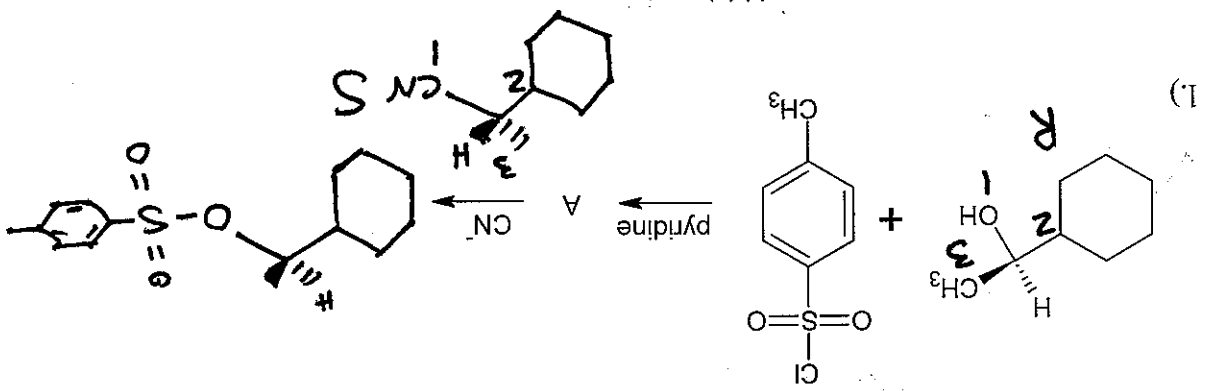
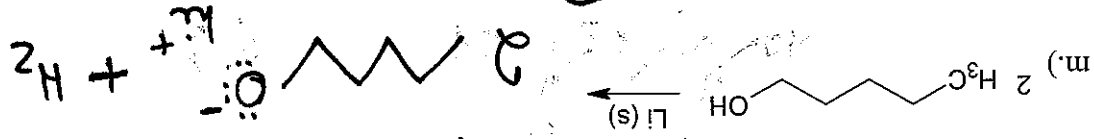
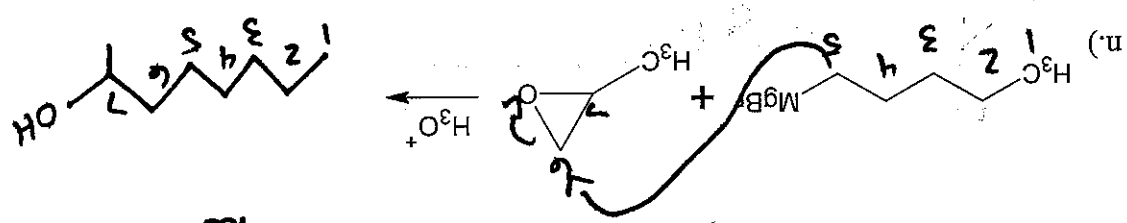
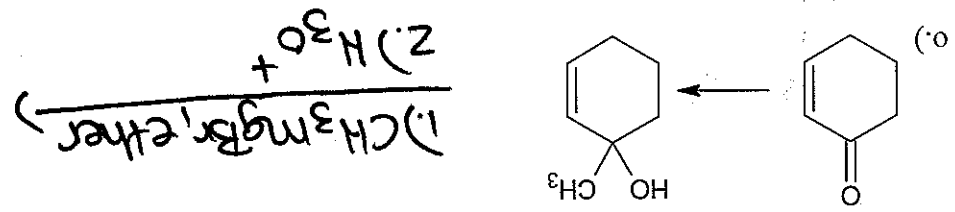
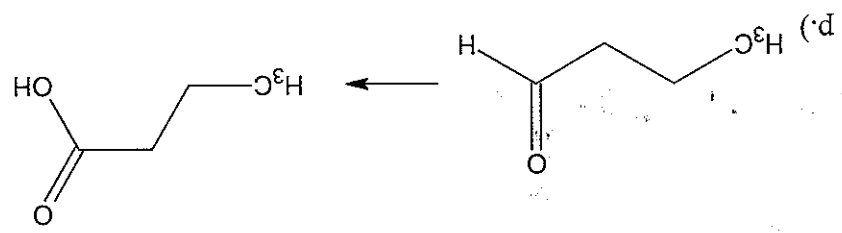
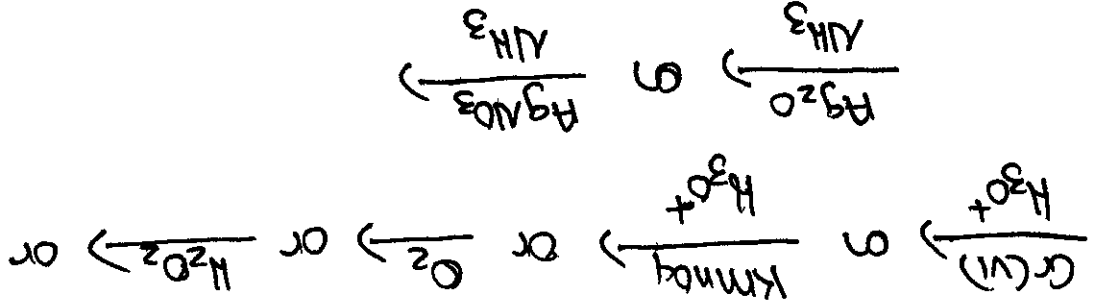
31.) For each of the following reactions, provide the structure of the missing reagents, reactants, or products.



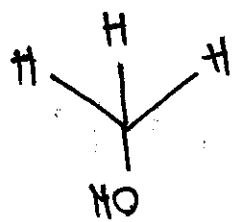
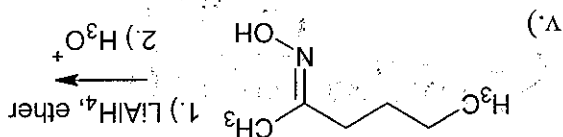
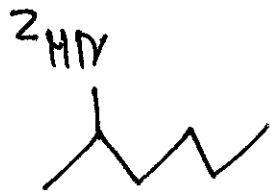
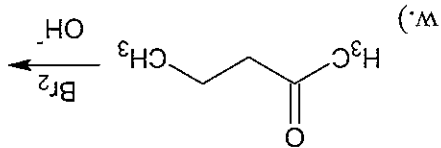
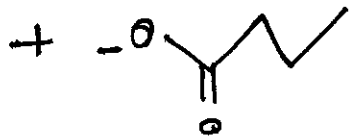


1.) $(CH_3CH_2CH_2)_2CuLi$, ether
2.) H_3O^+

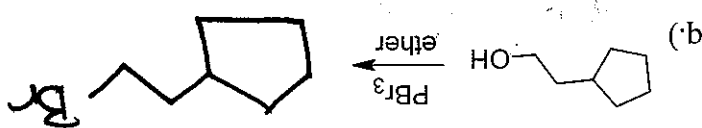
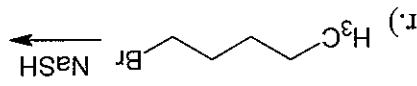
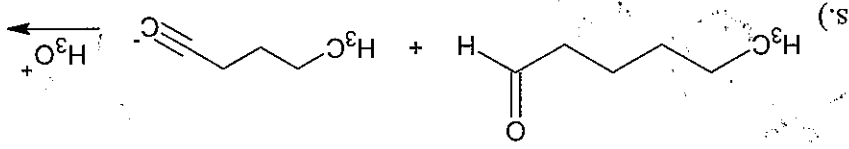
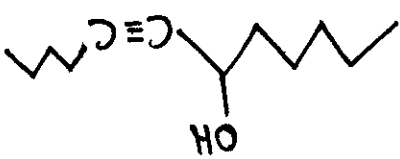
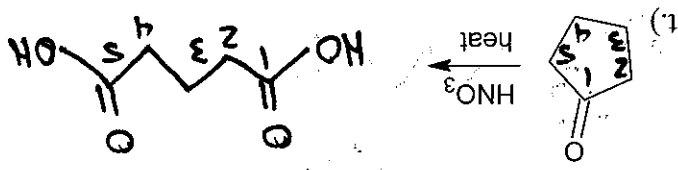
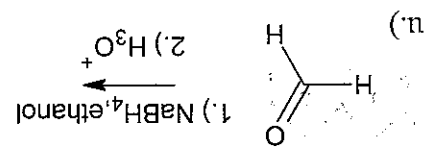




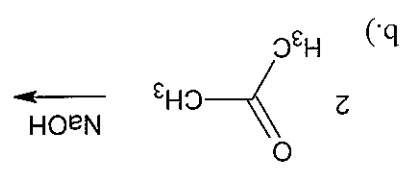
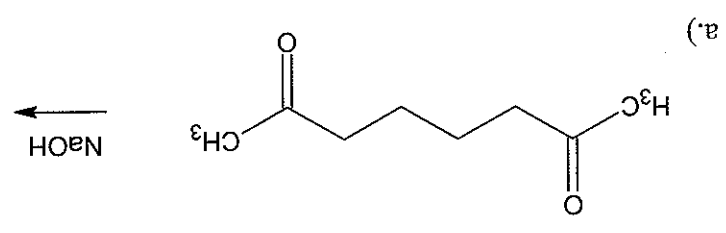
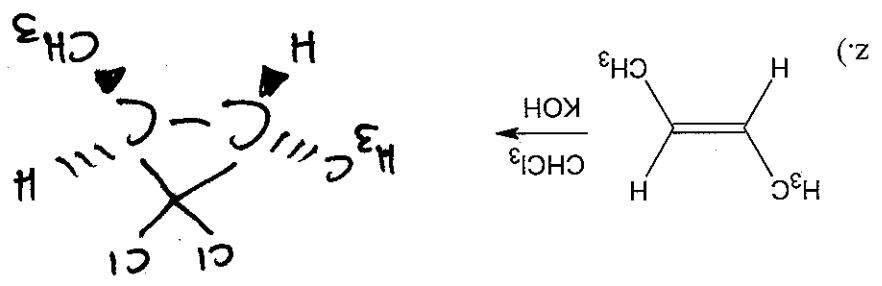
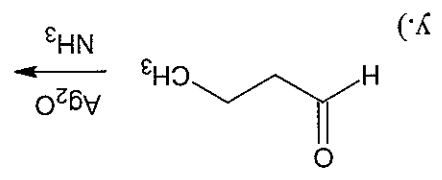
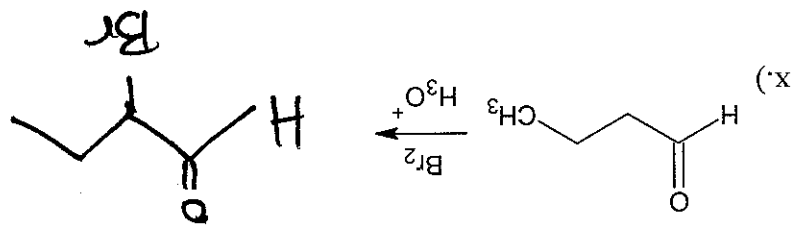
CBr_3H



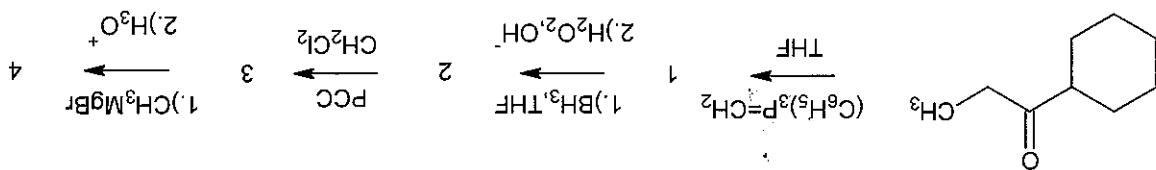
CH_3OH



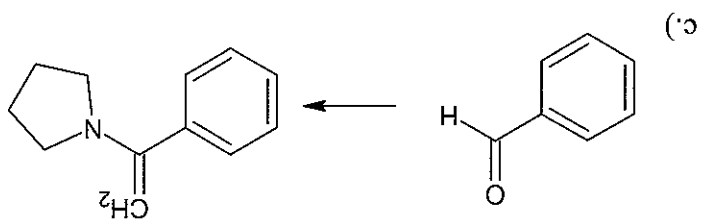
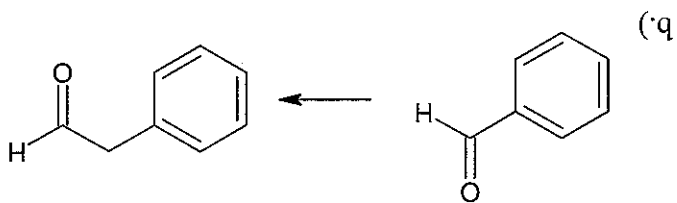
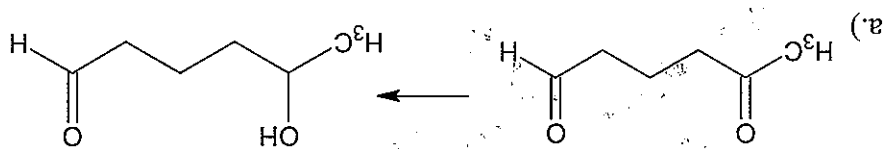
32.) Determine the products of the following reactions. Show the mechanism.

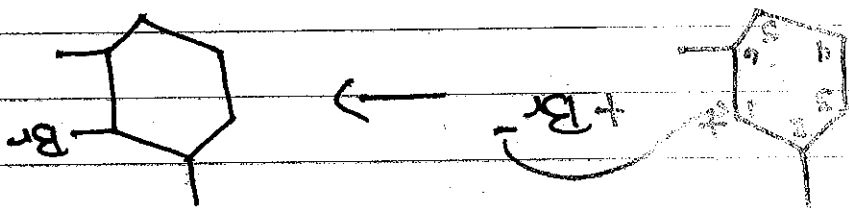


33.) Identify the missing products in the synthesis shown below.

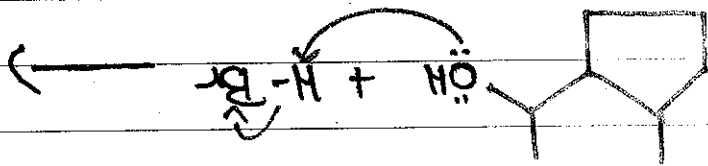
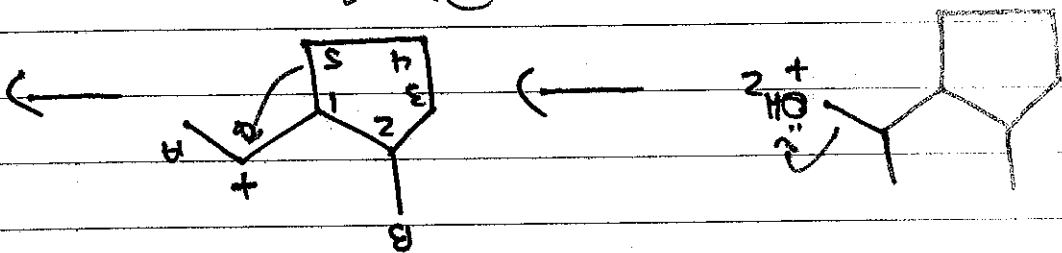


34.) Complete the following synthesis problems. Show all reagents, reaction conditions, and intermediate products.

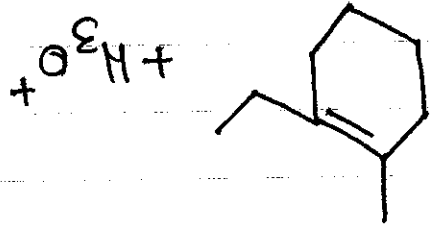




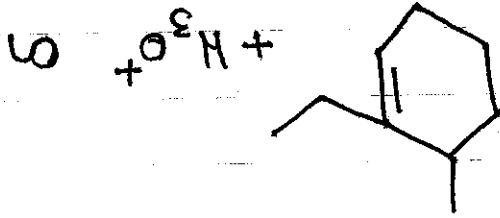
Ring Expansion



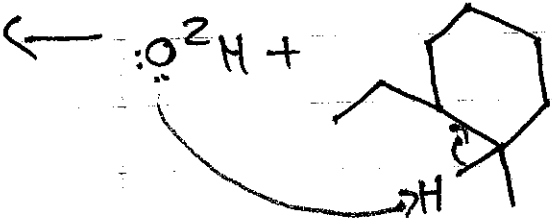
major



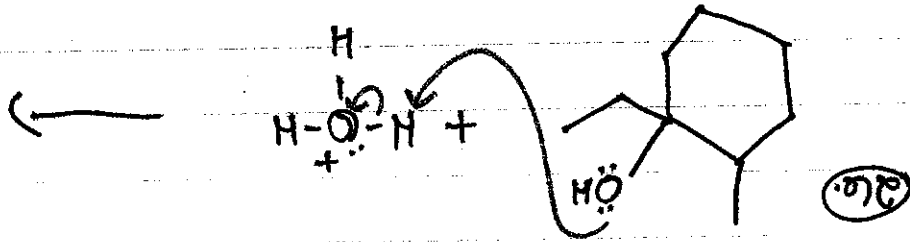
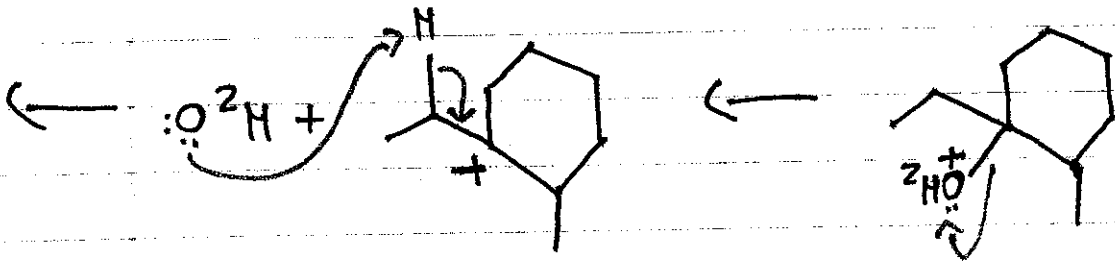
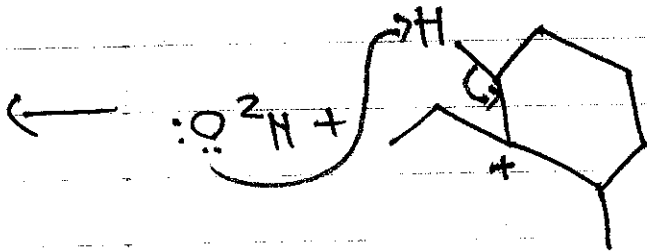
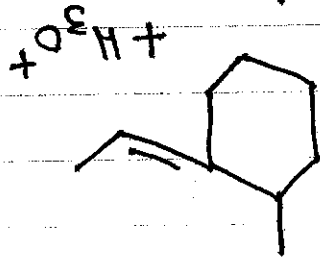
between



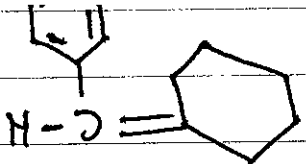
Markovnikov's Rule:
 more substituted C=C
 is more stable



minor

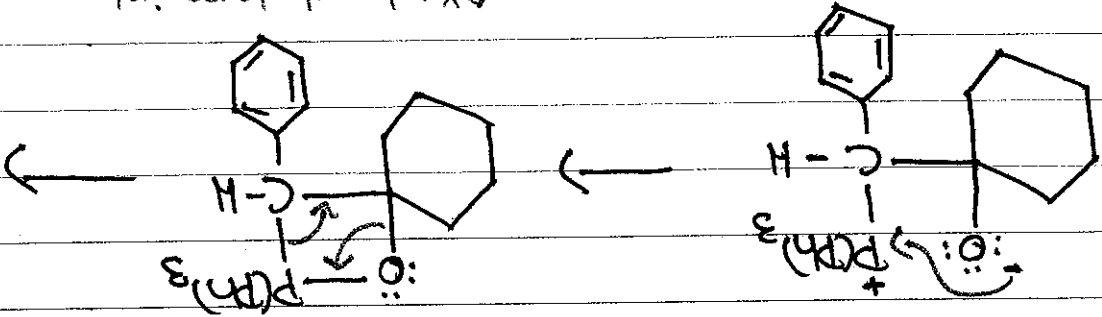


(26)

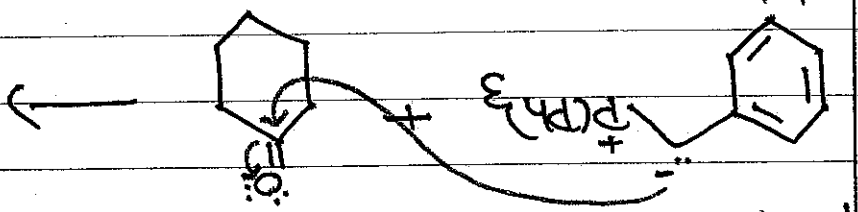


Redline int.

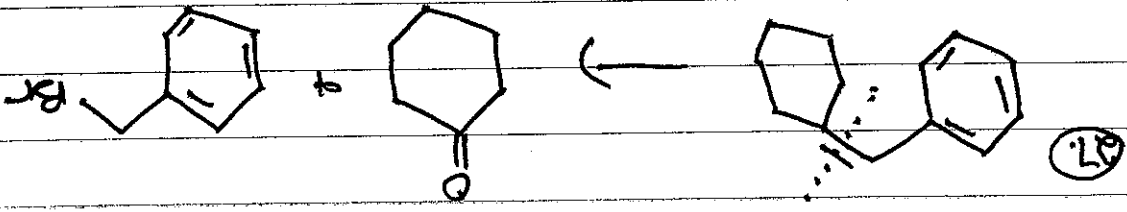
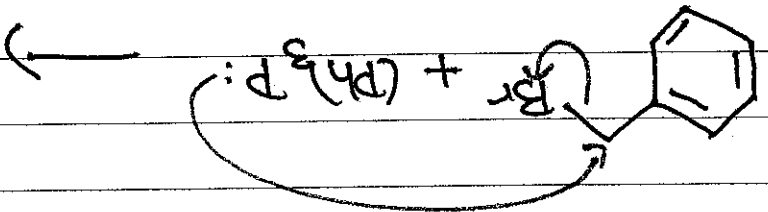
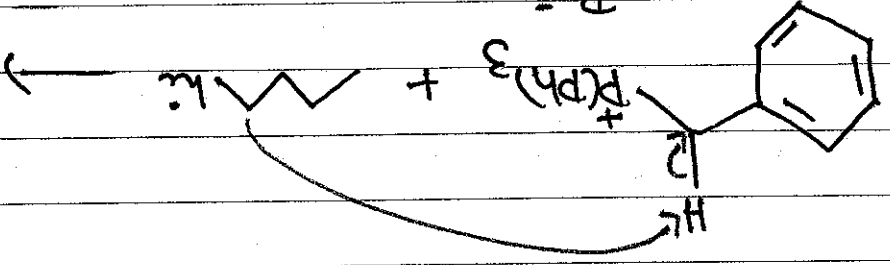
Oxaphosphorane int.



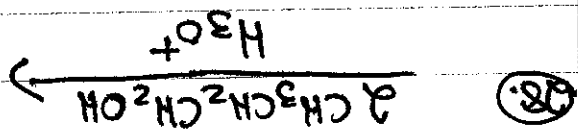
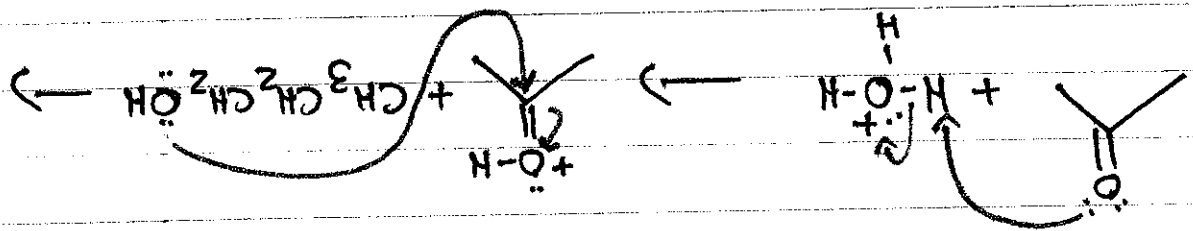
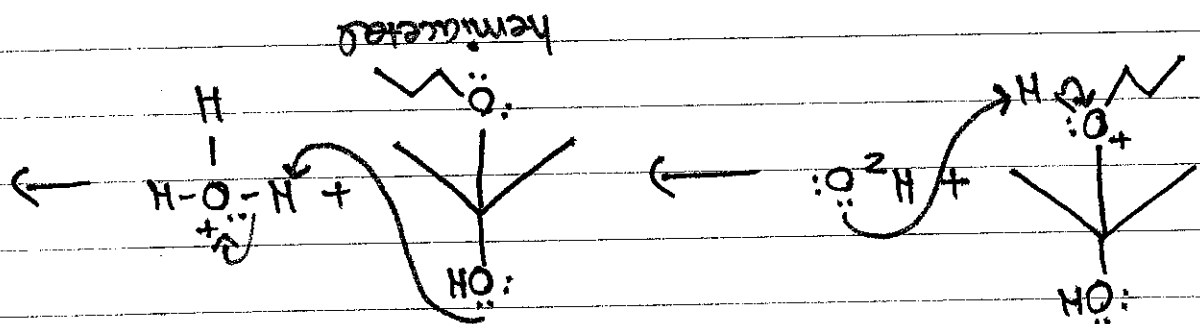
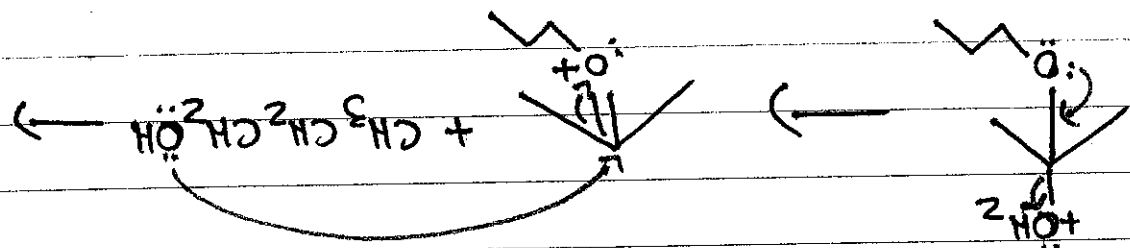
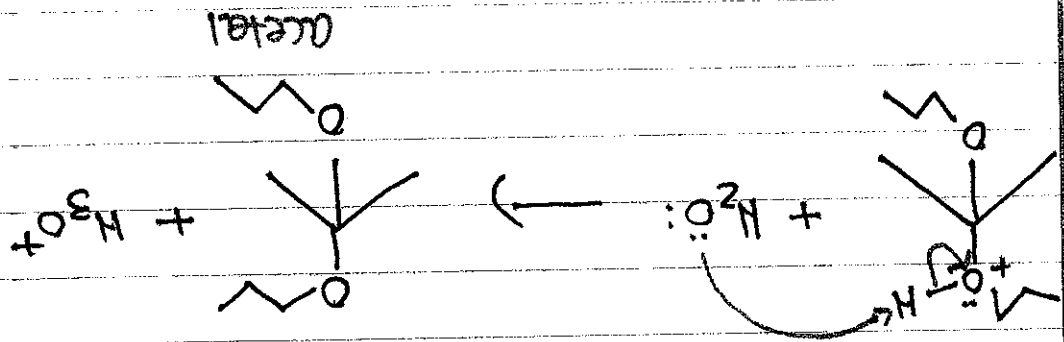
ylide

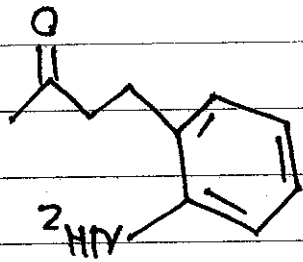


Phosphonium salt
Br⁻

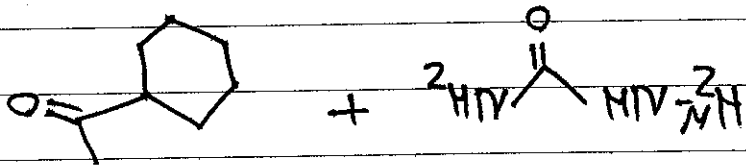
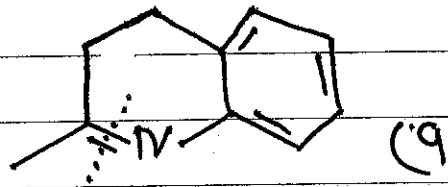


27.

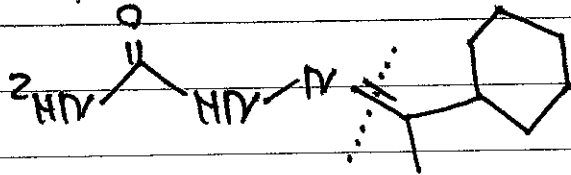




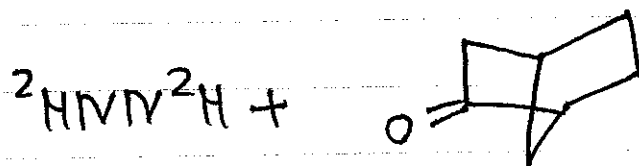
imine \rightarrow 1° amine + ketone or aldehyde



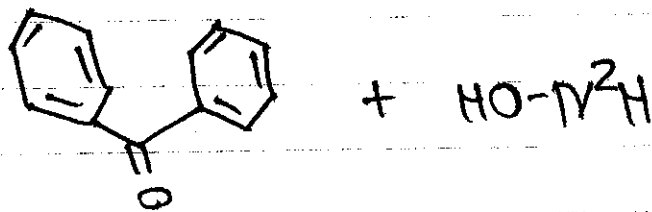
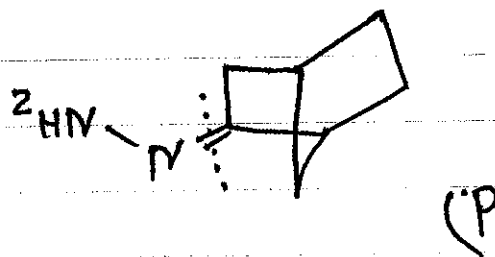
Semicarbazone \rightarrow semicarbazide + ketone or aldehyde



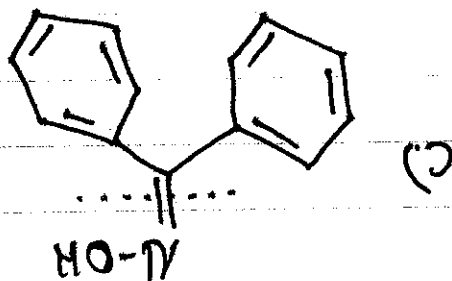
(30) (1)



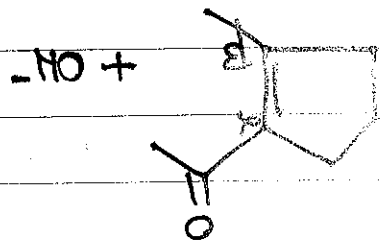
hydroxime + aldehyde or ketone



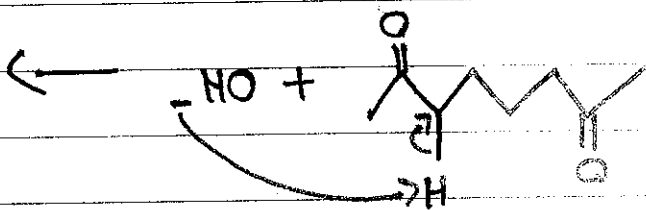
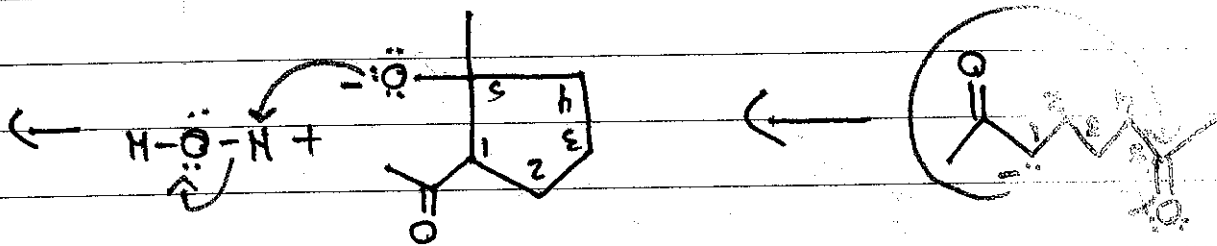
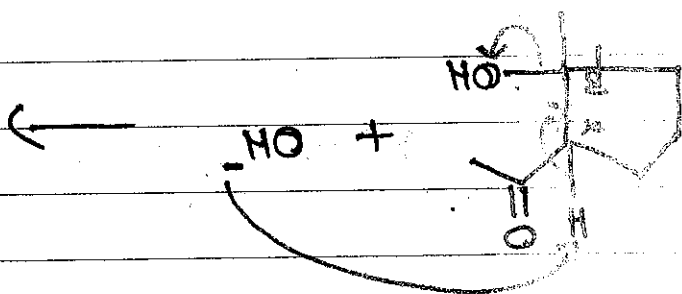
oxime + aldehyde or ketone



α,β -unsaturated ketone

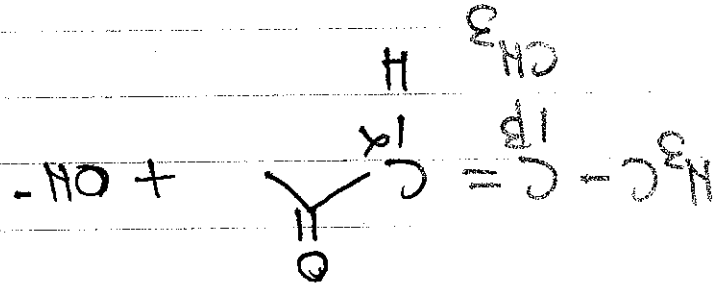


β -keto ketone

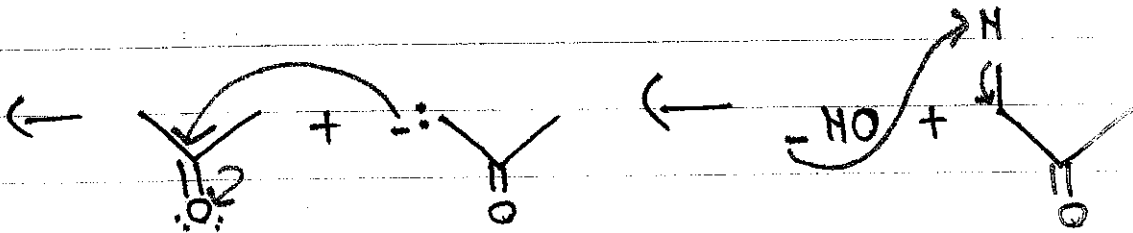
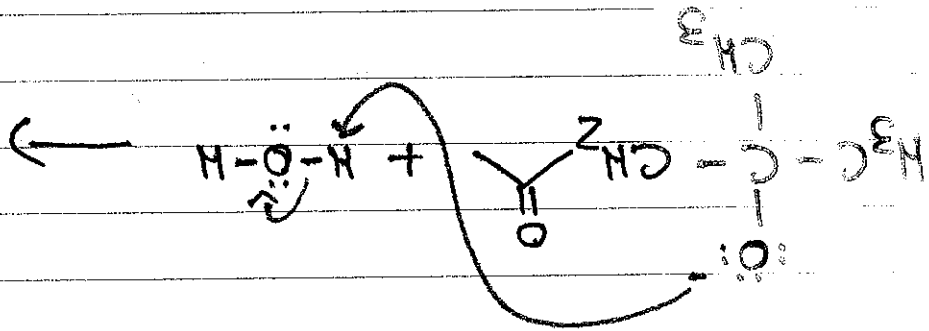
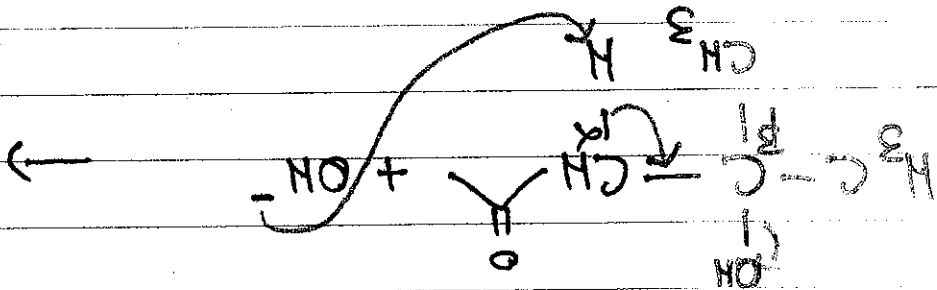


(2) (2)

of β -unsaturated ketone



β -hydroxy ketone



b)

