

Chemistry Department

University of Alberta

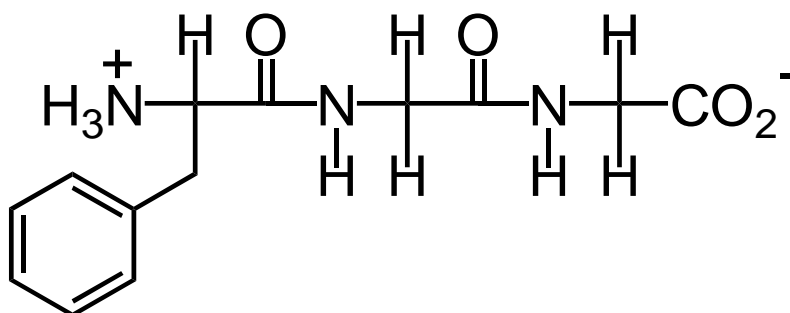
CHEM 263 B6

Final Exam

April 26, 2007

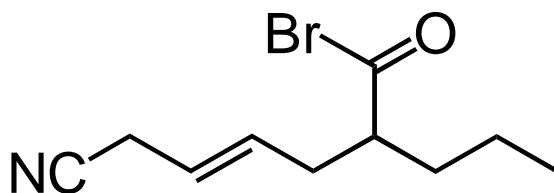
1. Name five (5) of the following structures:

a.



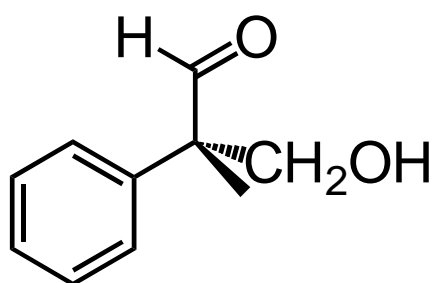
phenylalanylglycylglycine

b.



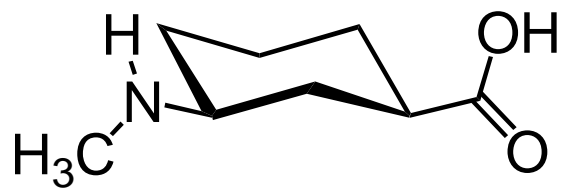
(E)-6-cyano-2-propyl-4-hexenoyl bromide

c.



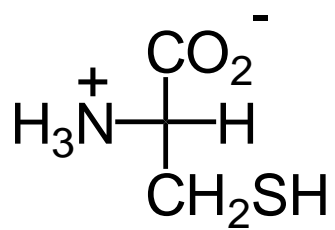
(S)-3-hydroxy-2-methyl-2-phenylpropanal

d.



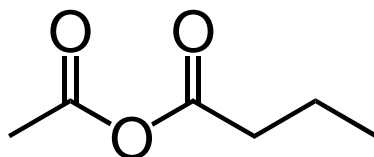
cis-3-methylaminocyclohexanecarboxylic acid

e.



(L)-cysteine

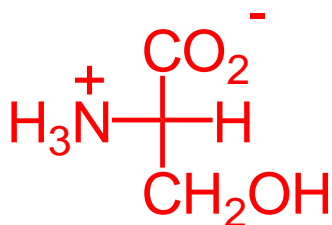
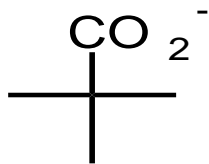
f.



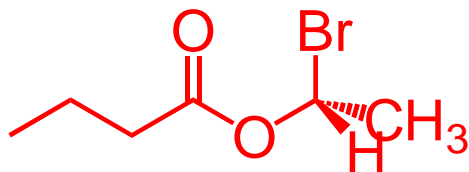
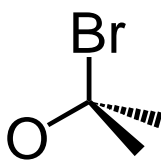
butanoic ethanoic anhydride

2. Give the structural formula of five (5) of the following compounds. Where given, complete the partial structures:

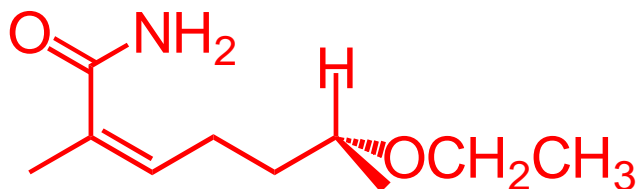
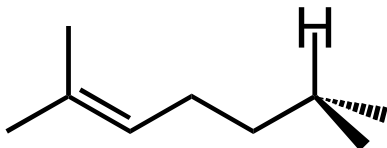
a. L-serine



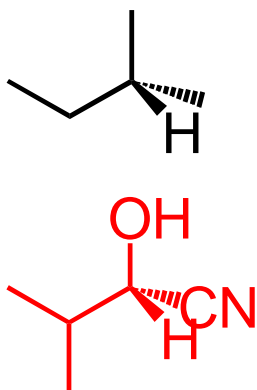
b. (R)-1-bromoethyl butanoate



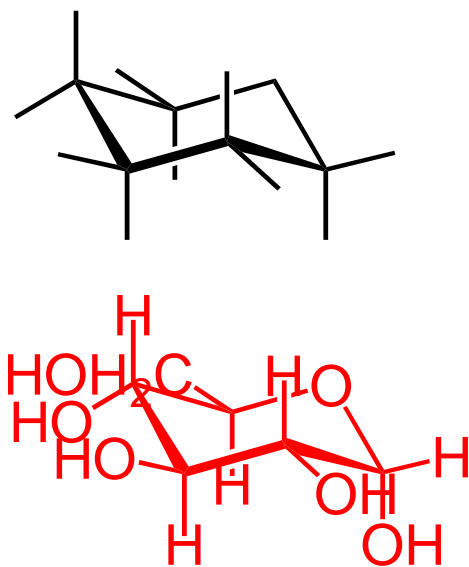
c. (2Z,6R)-6-ethoxy-2-methyl-2-heptenamide



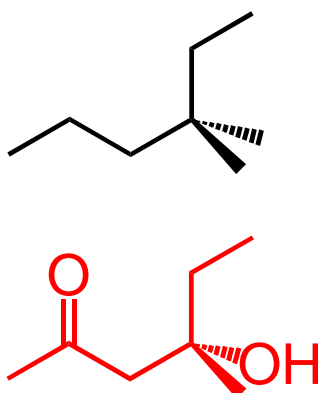
d. (S)-2-hydroxy-3-methylbutanenitrile



e. α -D-glucopyranose

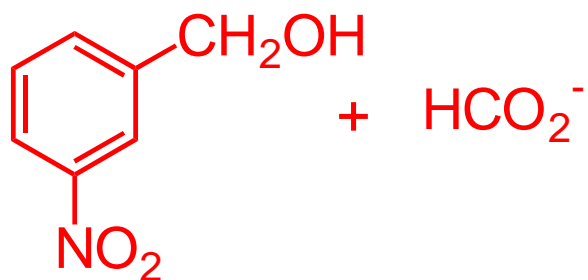
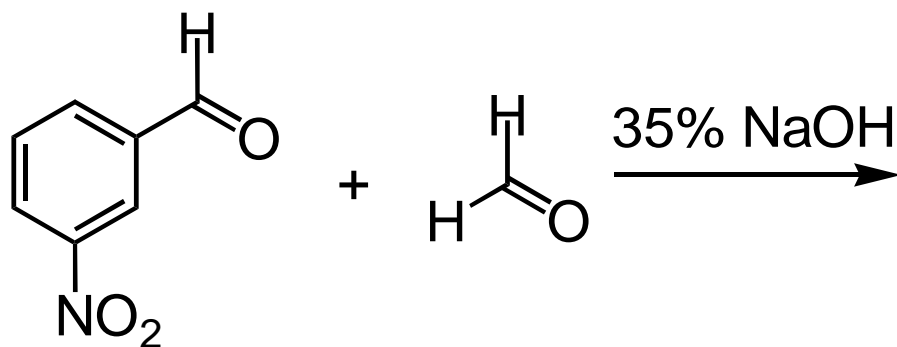


f. (S)-4-hydroxy-4-methyl-2-hexanone

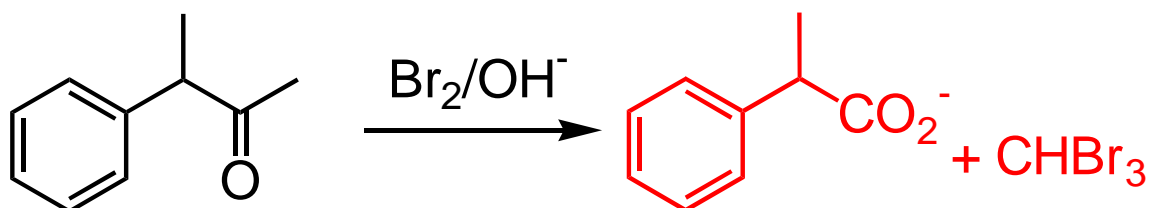


3. Give the structure(s) of the principle organic products of ten (10) of the following reactions:

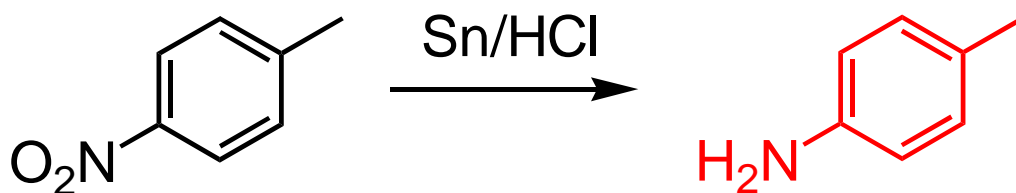
a.



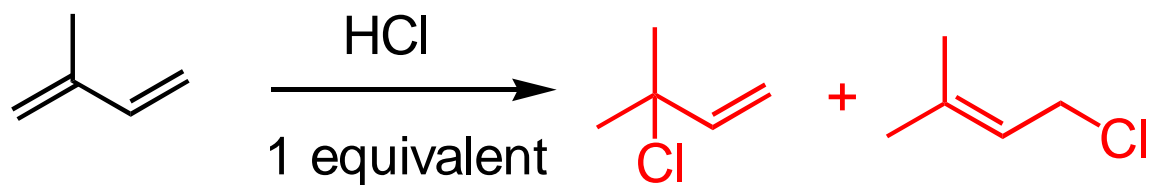
b.



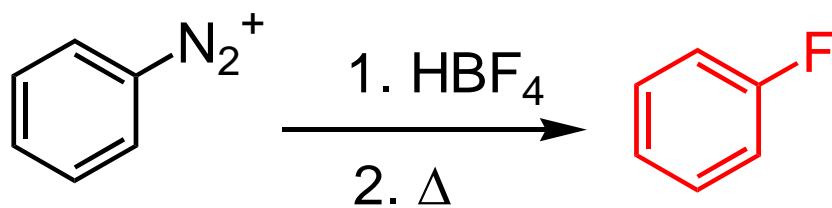
c.



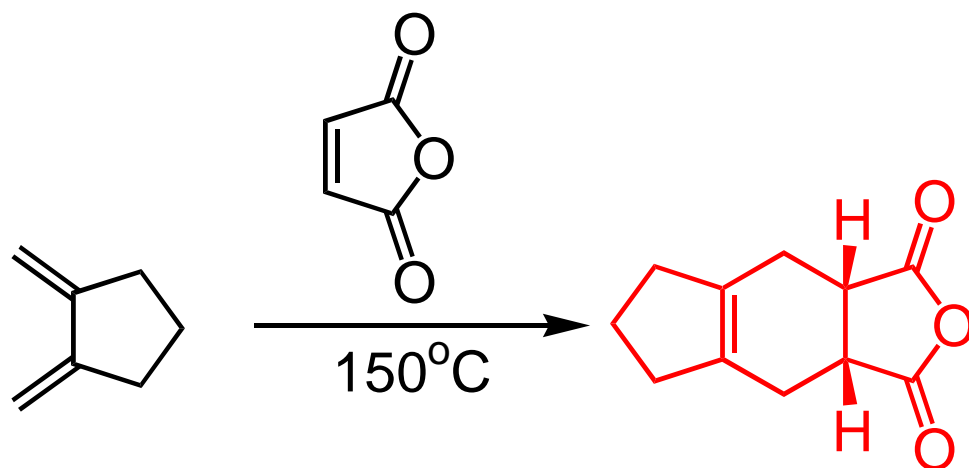
d.



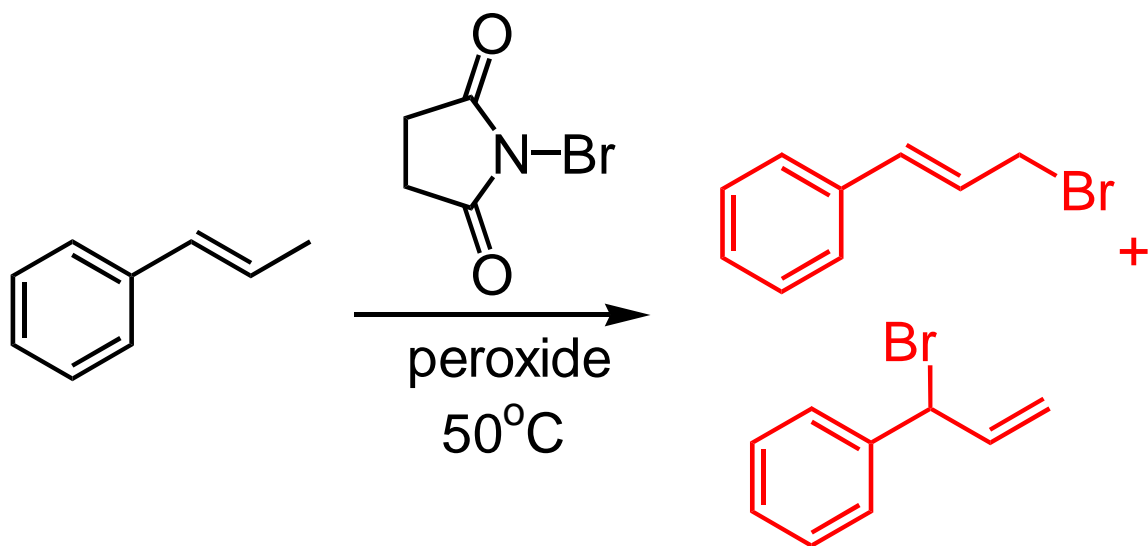
e.



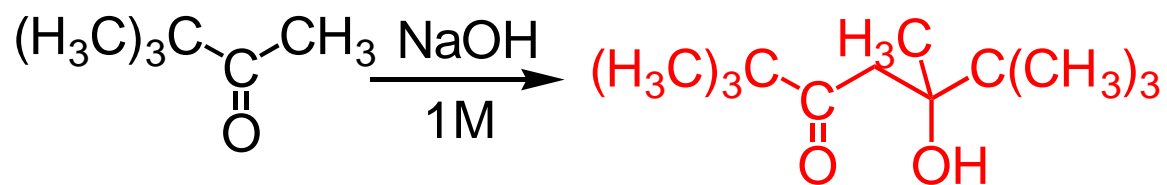
f.



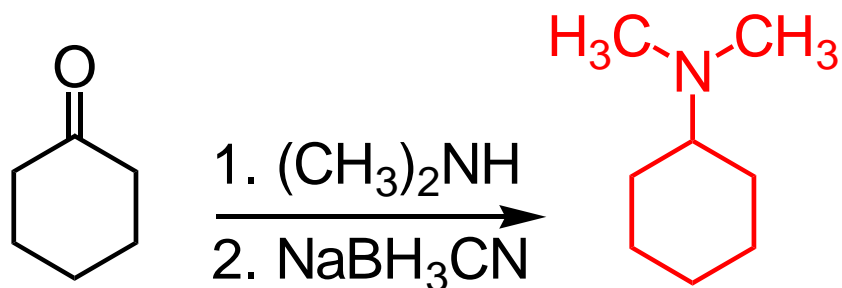
g.



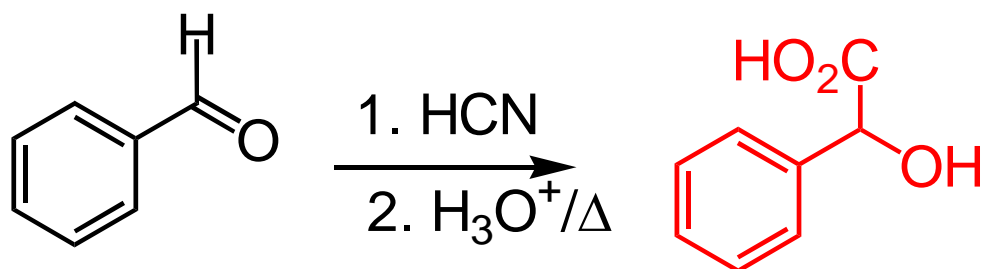
h.



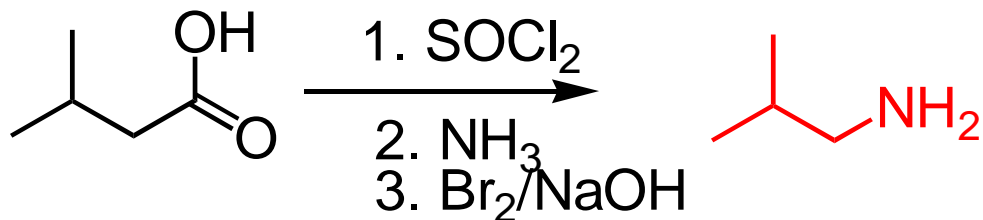
i.



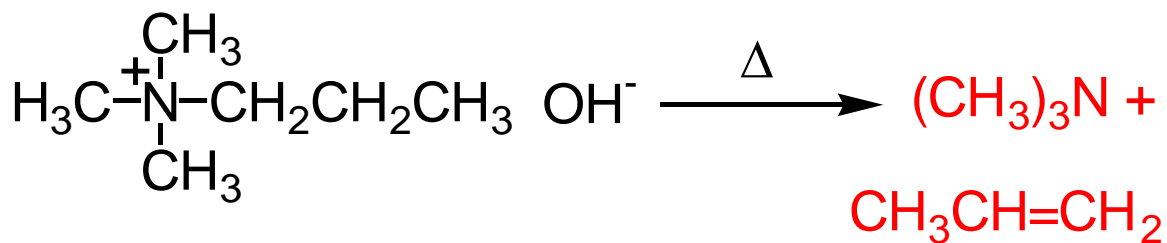
j.



k.



l.

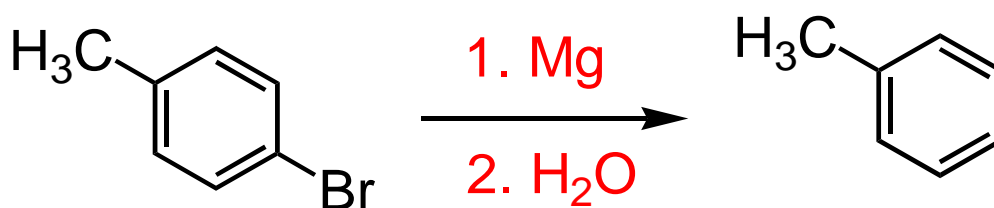


4. What reagent(s) would you use to effect ten (10) of the following conversions?

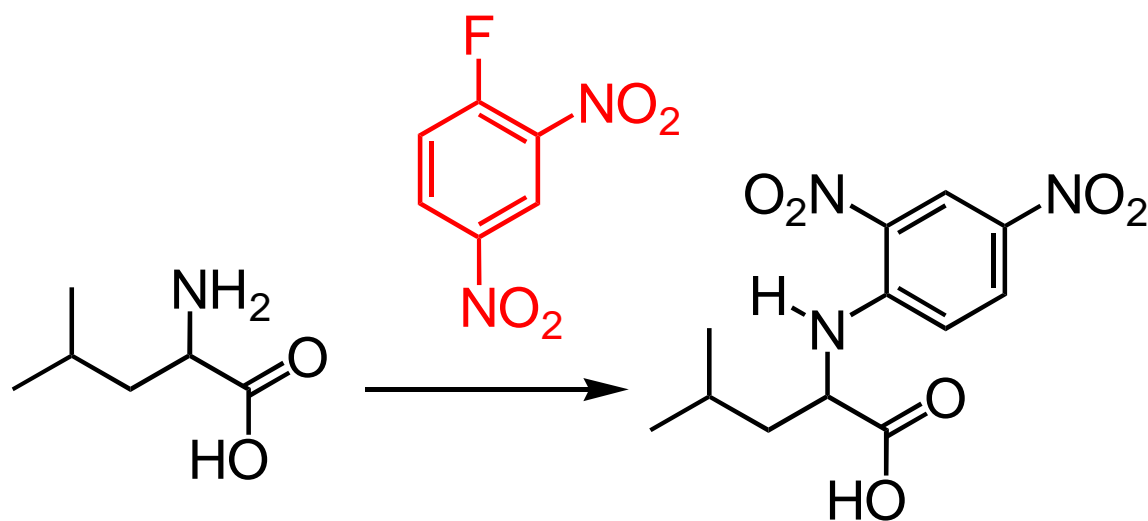
a.



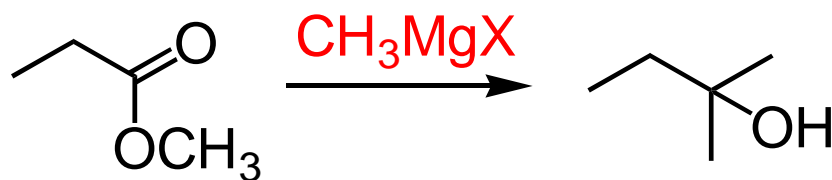
b.



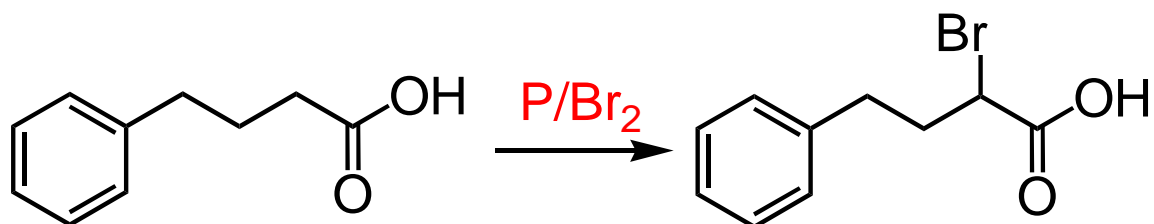
c.



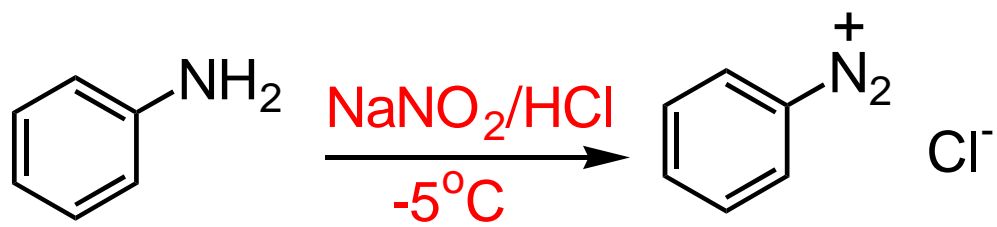
d.



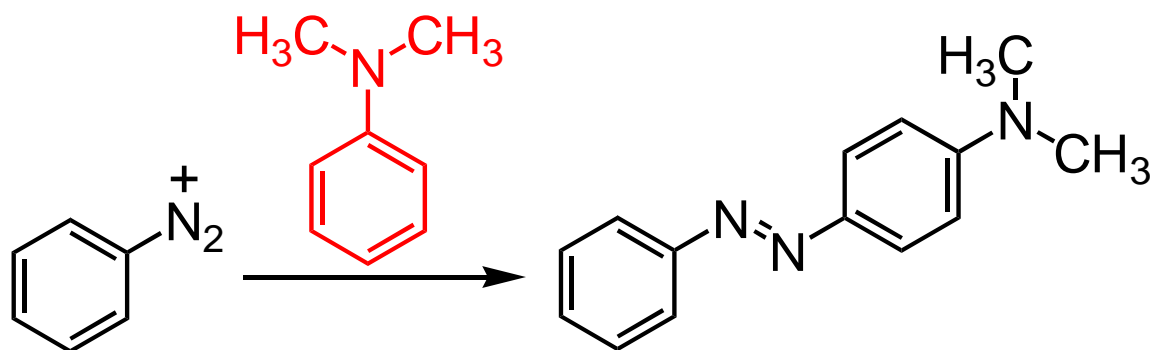
e.



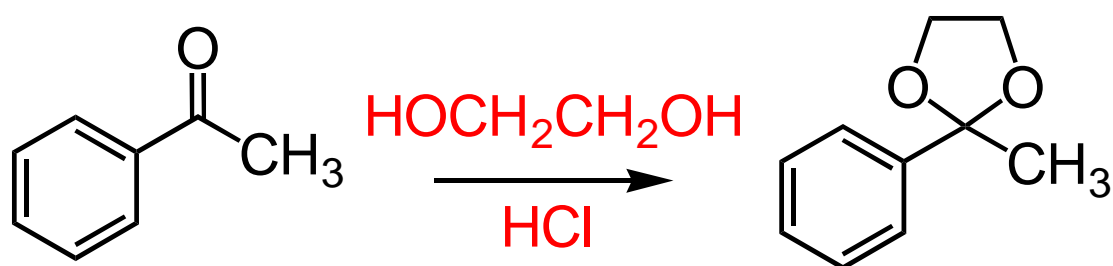
f.



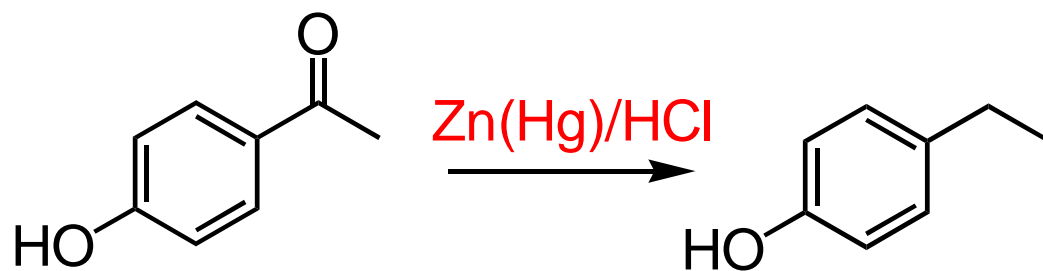
g.



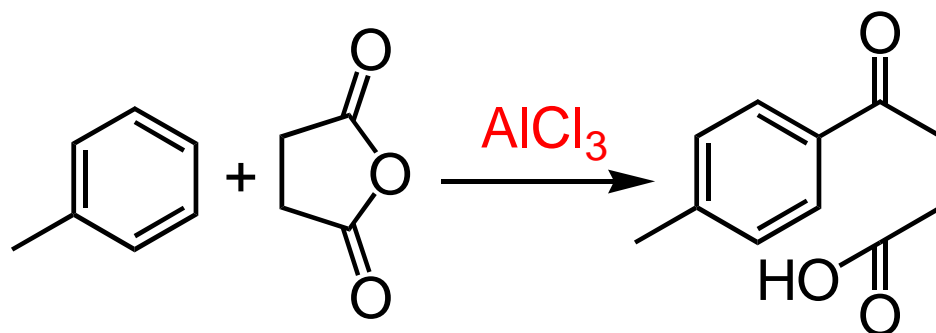
h.



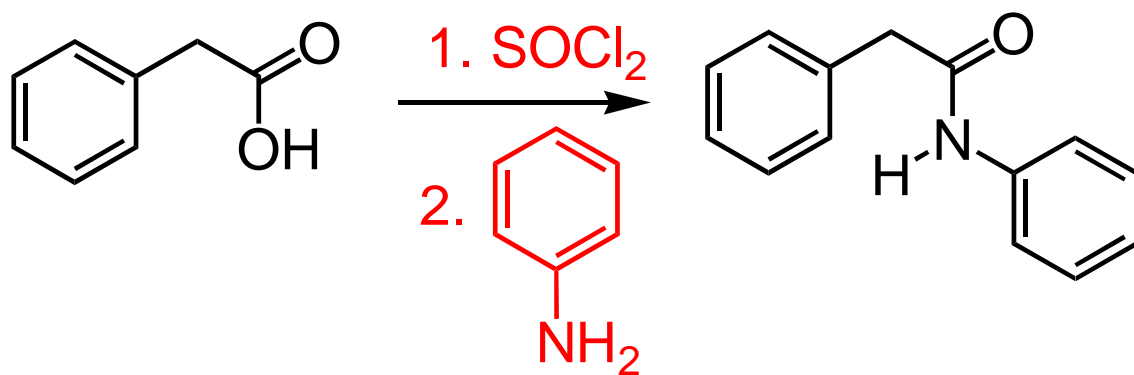
i.



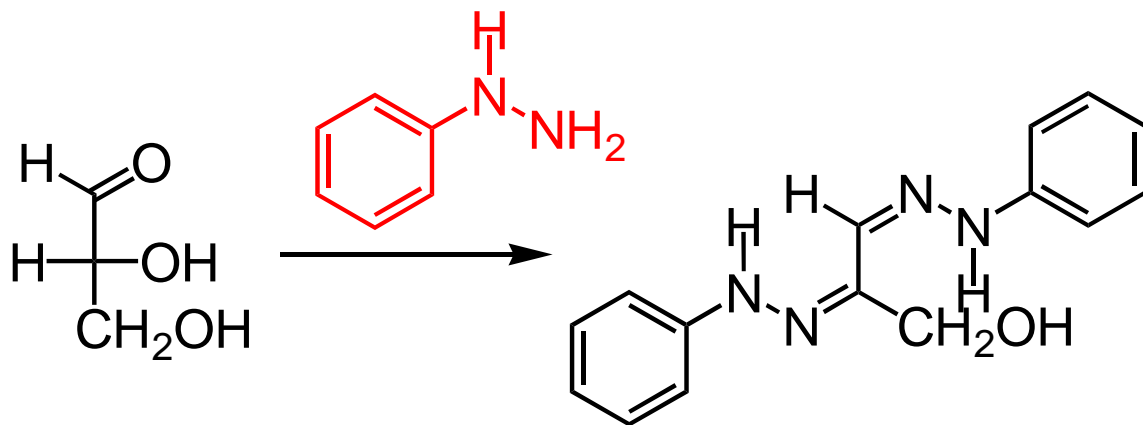
j.



k.

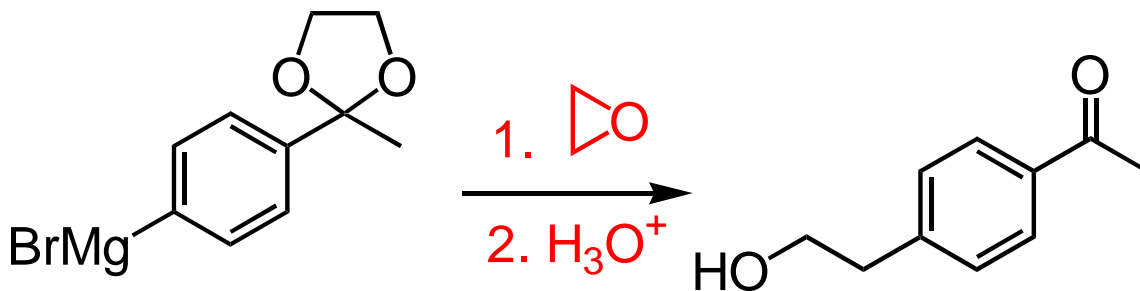
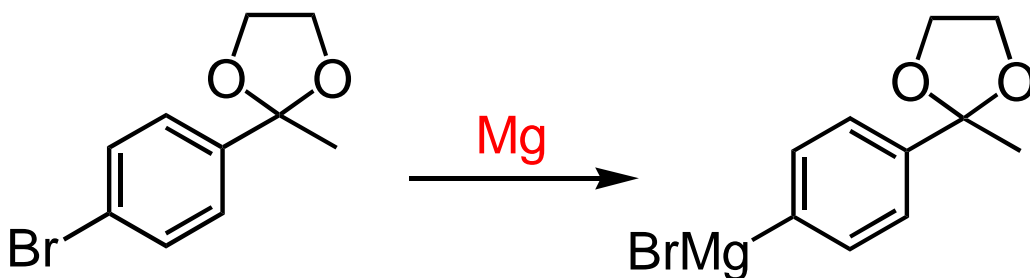
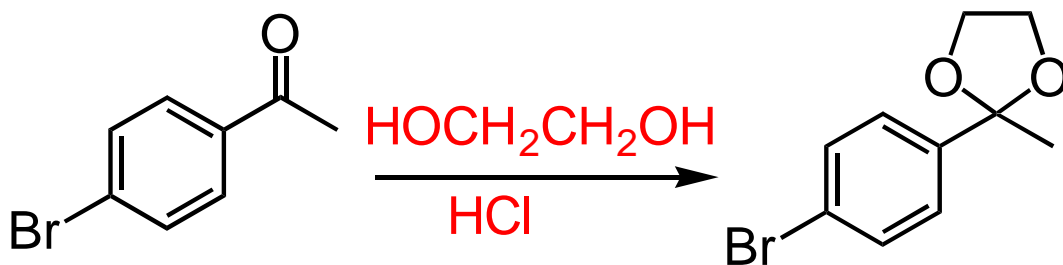
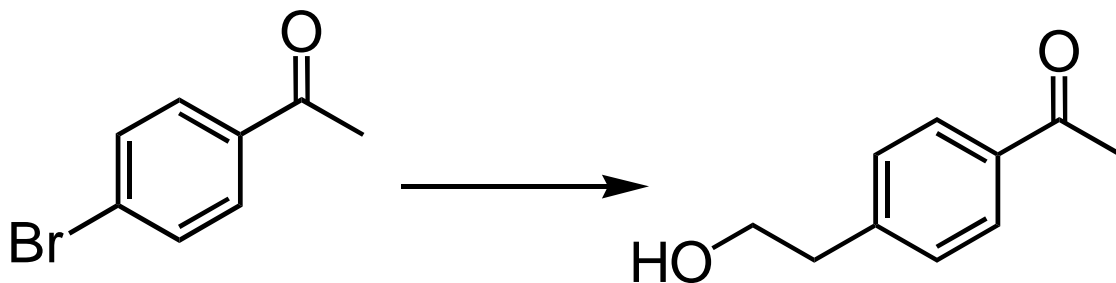


l.

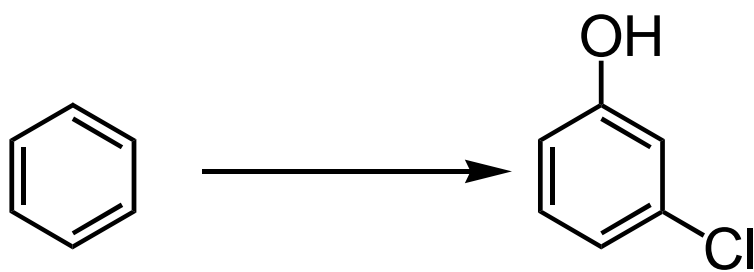


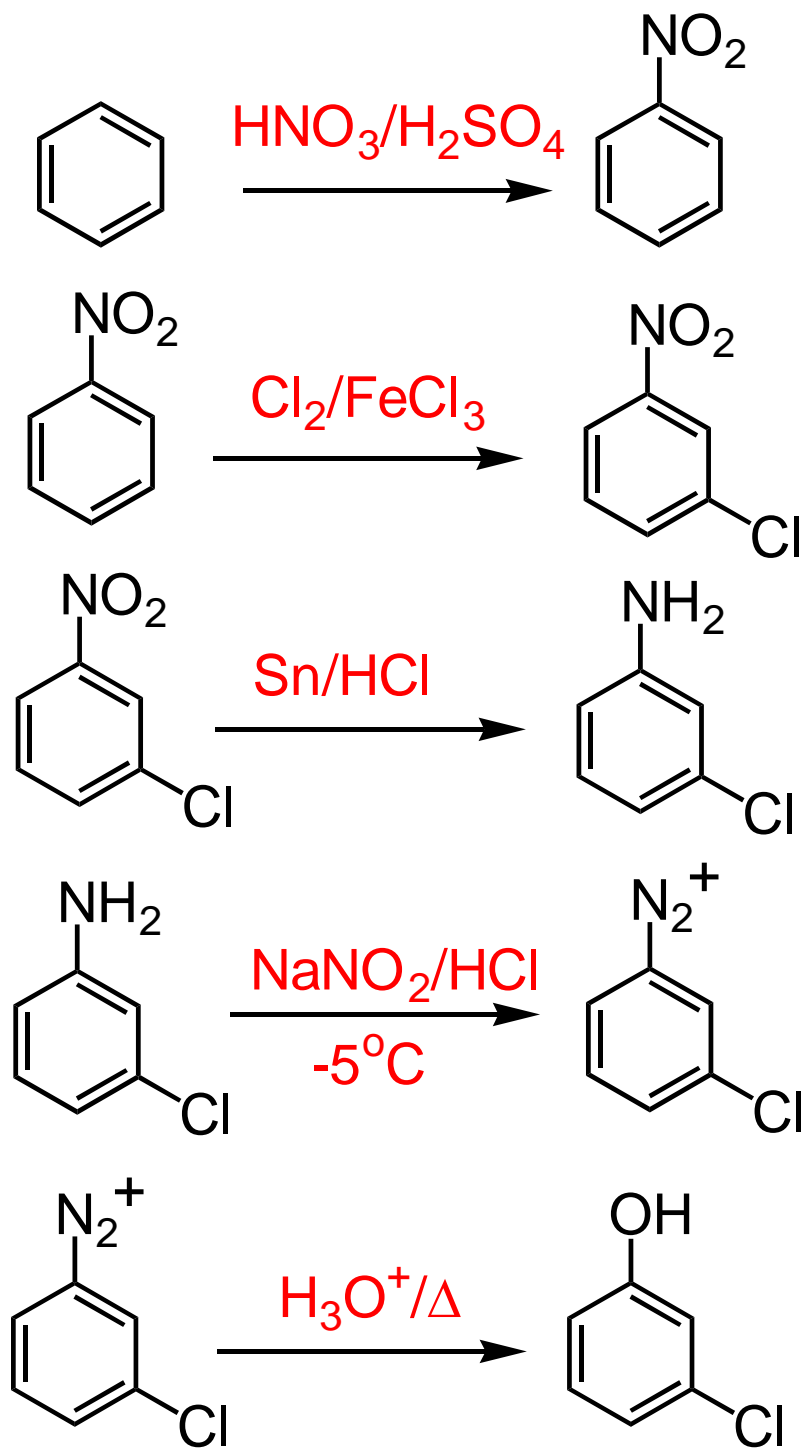
5. Provide synthetic pathways for three (3) of the following transformations:

a.

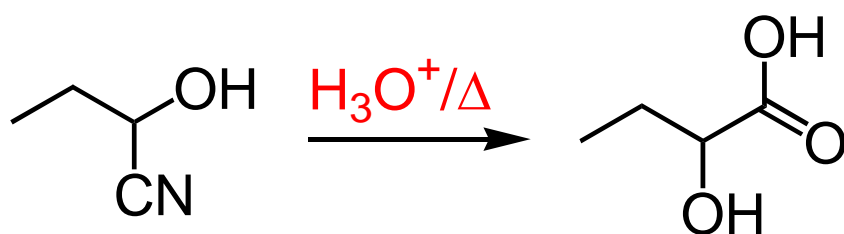
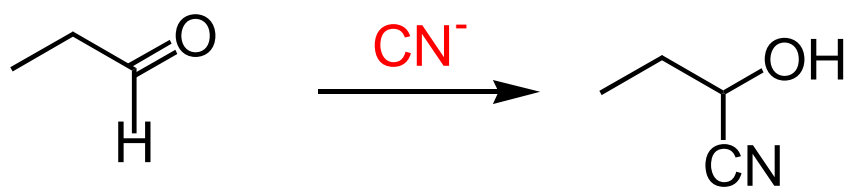
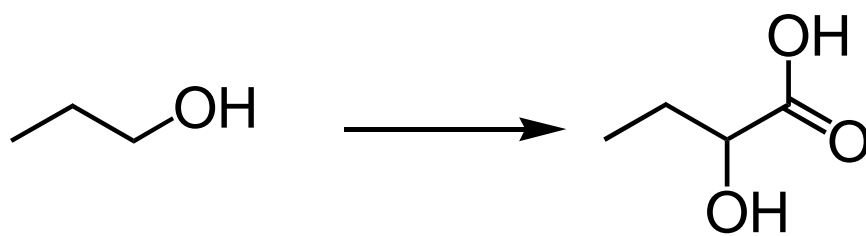


b.

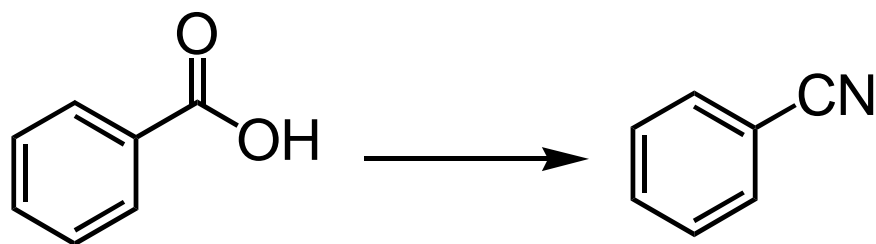


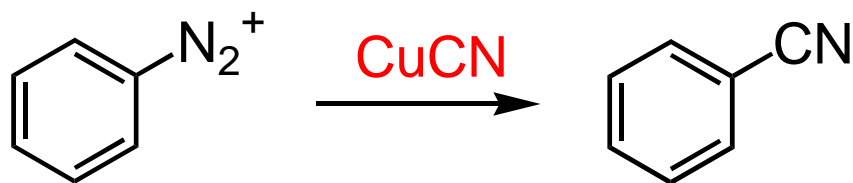
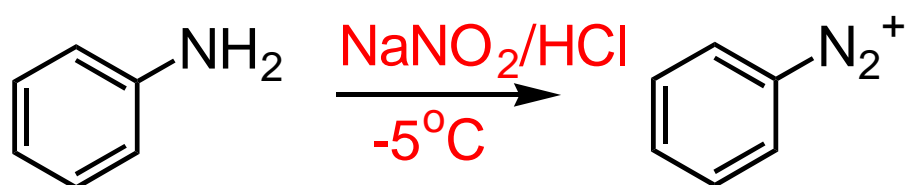
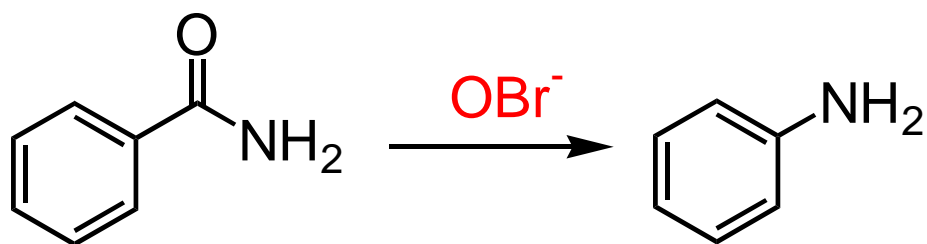
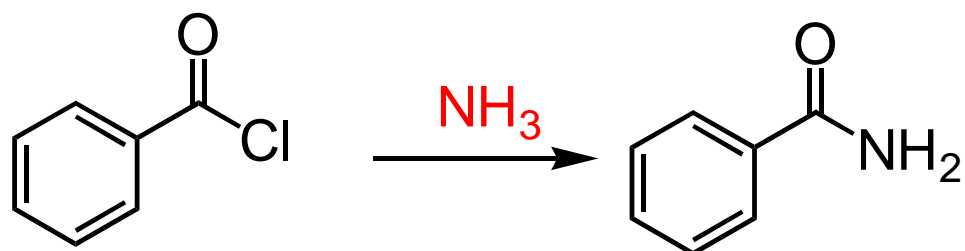
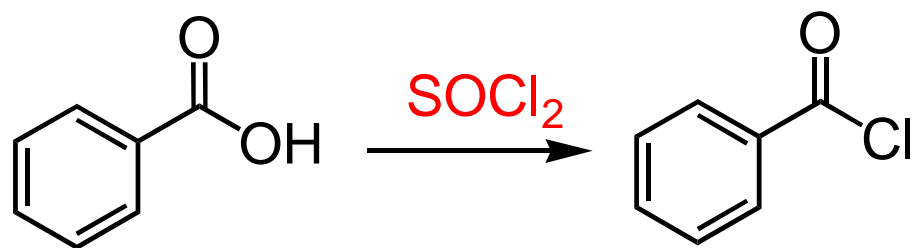


c.

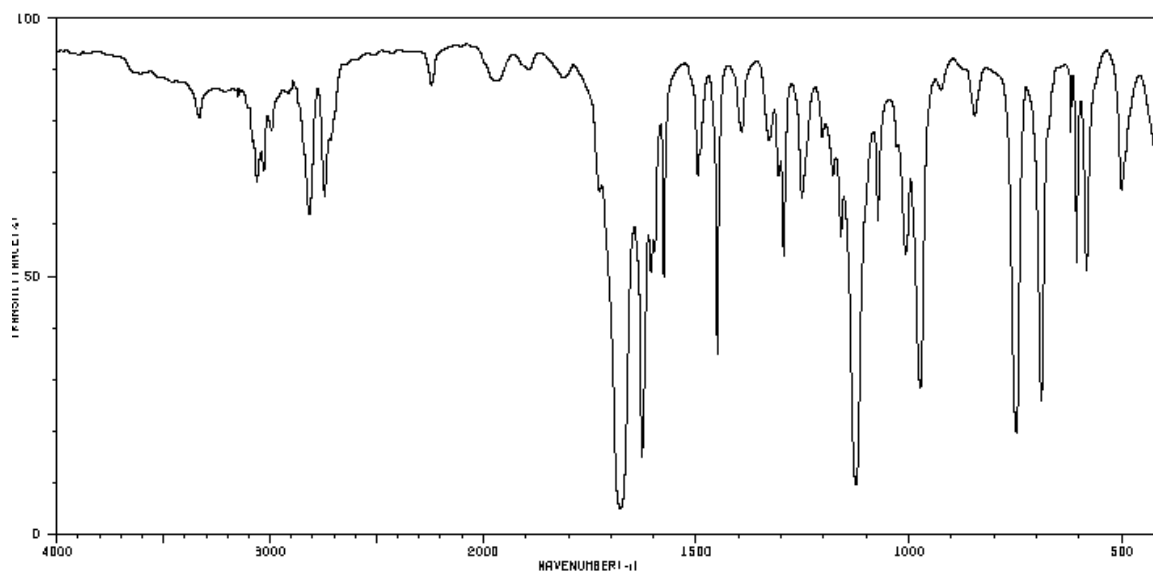


d.

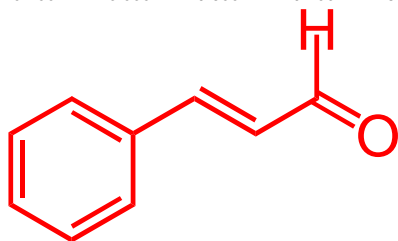
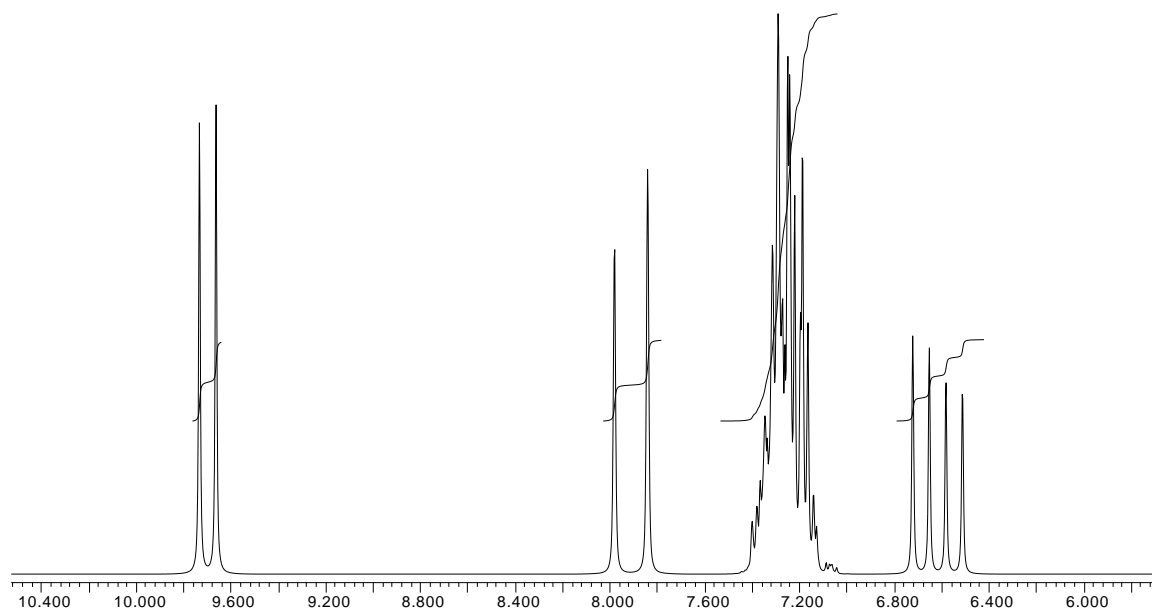




6. The IR and ^1H NMR spectra of a compound of molecular formula $\text{C}_9\text{H}_8\text{O}$ are given below. Propose a structure for this compound:



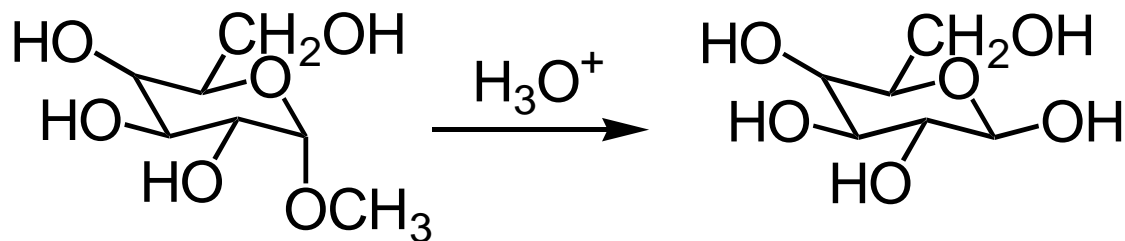
SDBSWeb: <http://www.aist.go.jp/RIODB/SDBS/> (12-04-07)



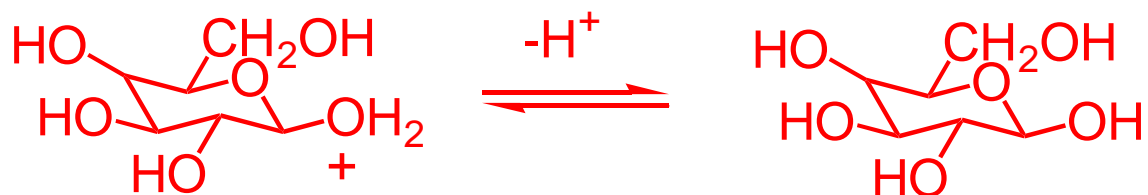
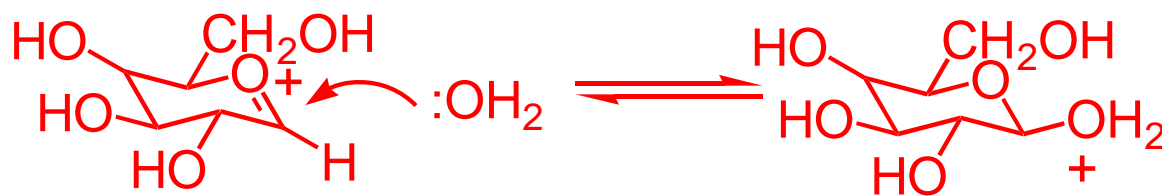
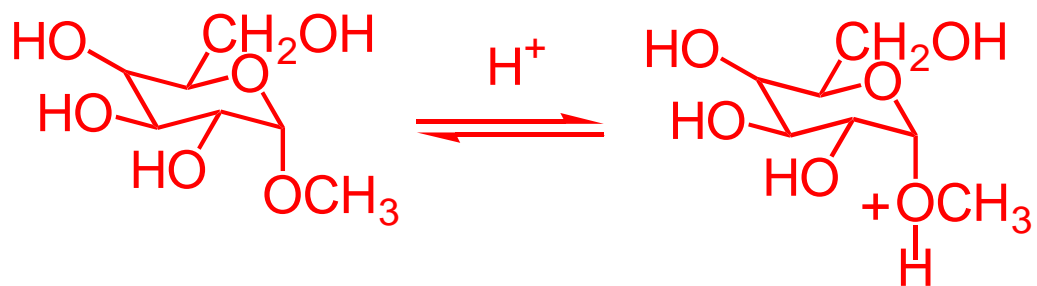
7.

a. What is meant by the term epimer?

Epimers are diastereomers that differ only at one stereocentre.

b. Methyl α -D-glucopyranoside reacts with aqueous acid to form β -D-glucose:

Propose a mechanism that accounts for this transformation.



8.

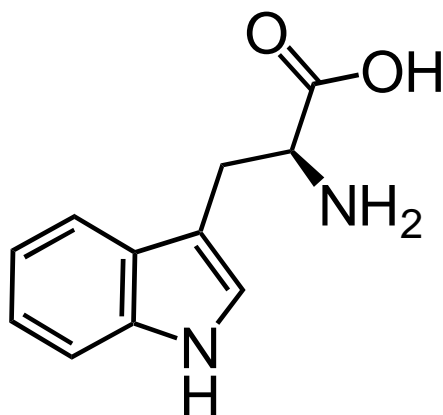
- a. Explain what is meant by the term essential amino acid.

These are the amino acids that higher animals cannot synthesize and must obtain from their diet.

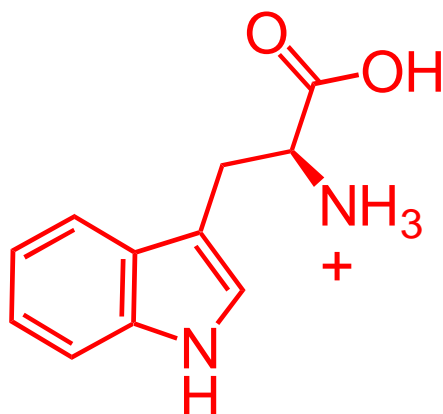
- b. Explain the term isoelectric point.

The pH at which the concentration of the zwitterion is at its maximum.

- c. The isoelectric point of tryptophan is 5.9. What is the structure of this acid at pH 2.0? (You do not need to specify any stereochemistry about C-2)



tryptophan

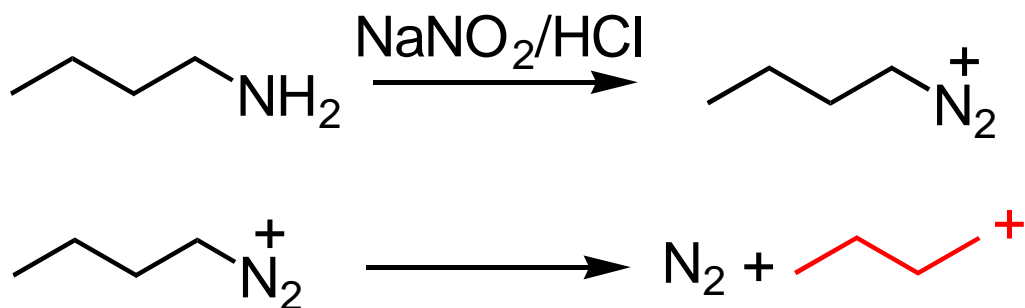


- d. In spite of having two nitrogen functions, tryptophan is a neutral amino acid. Provide an explanation.

The ring system is aromatic with the lone pair on the nitrogen contributing to the Hückel number of electrons. This nitrogen is not basic.

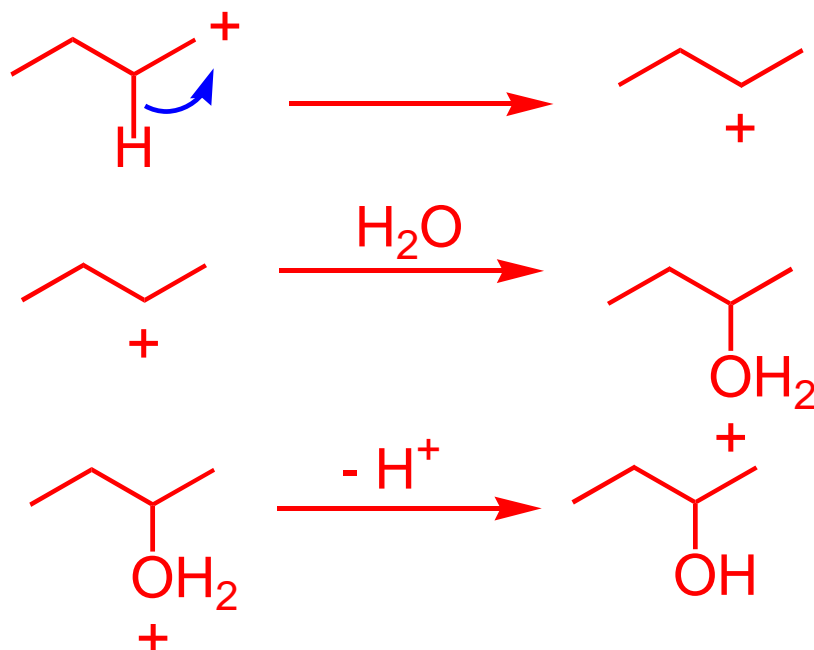
9. Butanamine reacts with sodium nitrite and hydrochloric acid to form nitrogen and the following mixture: 1-butanol (25%), 2-butanol (13%), 1-butene and 2-butene (37%), 1-chlorobutane (5%), and 2-chlorobutane (3%).

- a. What is the most likely intermediate common to all of these products? It is formed at the same time that the nitrogen is produced.

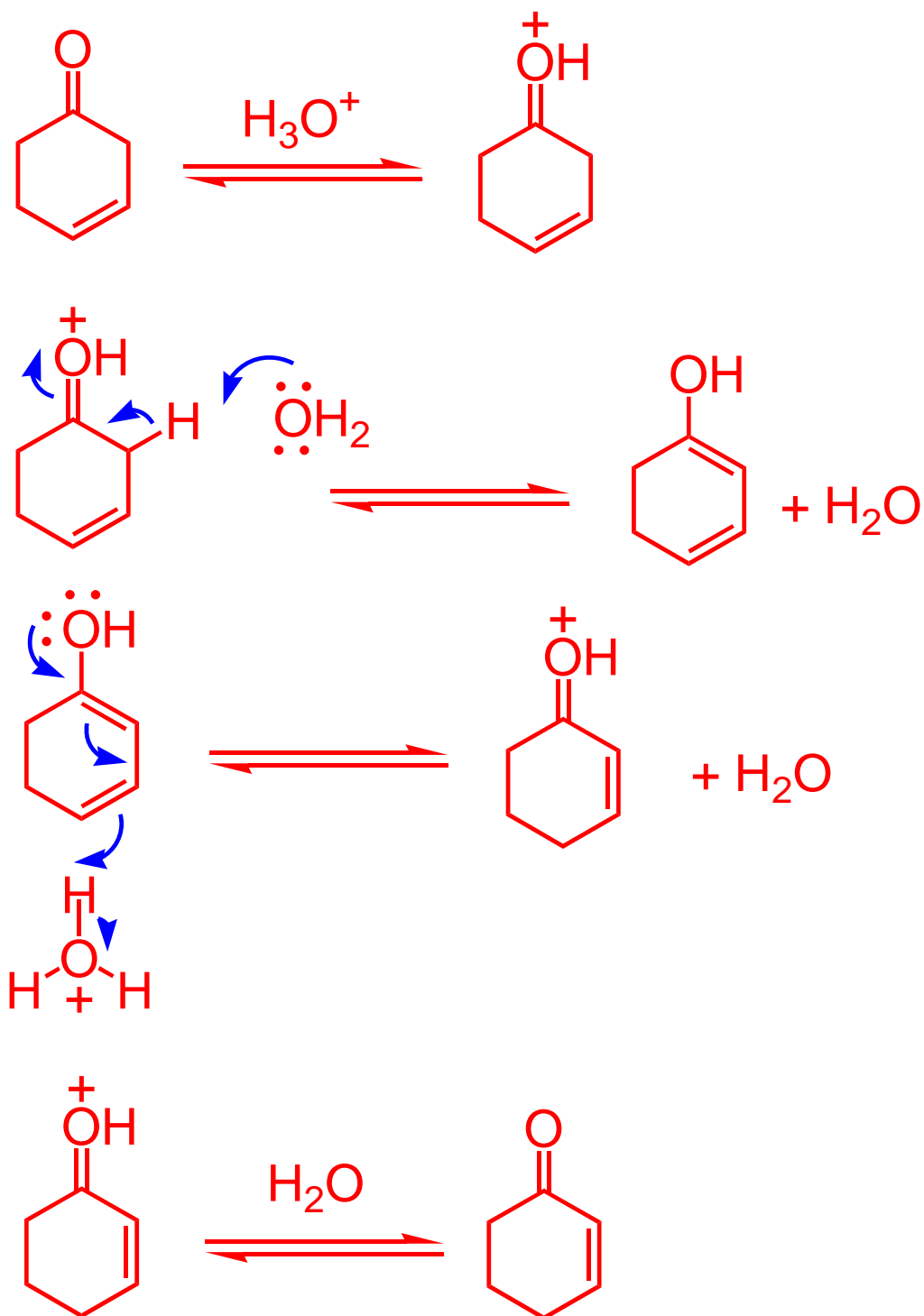


the butyl cation

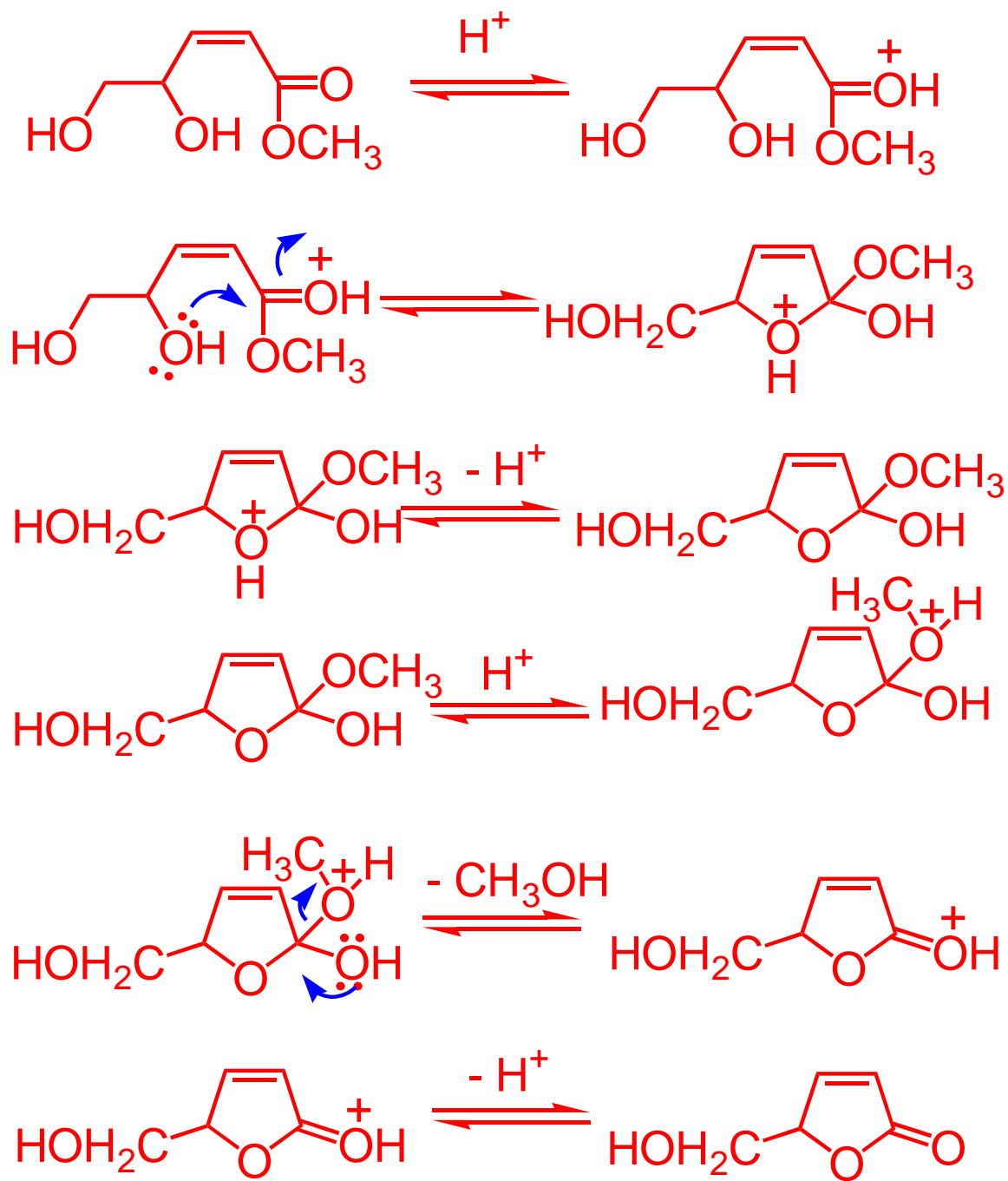
- b. Propose a mechanism that accounts for its conversion into 2-butanol.



10. 3-Cyclohexenone rapidly equilibrates with 2-cyclohexenone on treatment with dilute sulfuric acid. Propose a mechanism for the acid-catalyzed transformation of 3-cyclohexenone to form 2-cyclohexenone:



11. Propose a mechanism for the following reaction:



12. Match the pK_a values, -10, 2.9, 3.77, 4.76, 15.5, 19.3, 24, and 46 to the appropriate structure:

