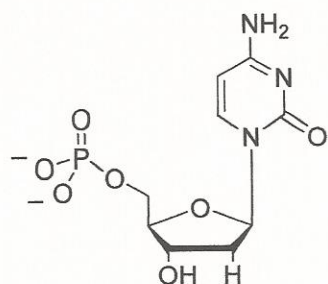
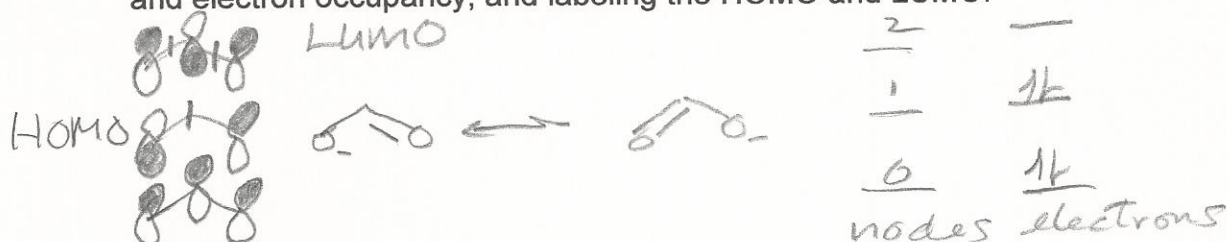


20. (9 pts) Name the nucleotide drawn below. Is the compound drawn below a purine nucleotide? Is the nucleobase in the syn or anti conformation?

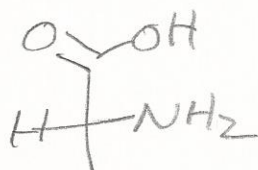


5'-monophosphate-2'-deoxycytidine  
pyrimidine not purine  
anti conformation

21. (6 pts) Draw the molecular orbital diagram for carboxylate anion, including nodes and electron occupancy, and labeling the HOMO and LUMO.



22. (5 pts) Draw d-alanine as a Fischer projection



23. (10 pts) List six of the nine functional groups present in the 20 common alpha-amino acids.

- Any six of the following?
1. Alkyl or Alkane
  2. Aromatic
  3. Heterocycle
  4. Alcohols
  5. Sulfur (Thiol + sulfide)
  6. Acids or Carboxylate
  7. Amides
  8. Bases
  9. Cyclic (proline)

24. (5 pts) Histidine plays an essential role in many protease enzymes. The role of the histidine in these enzymes is to:

- a. Add as a nucleophile to the amide carbonyl of a protein
- b. Act as a base to abstract the proton from an enzyme active site histidine
- c. Facilitate the addition of an aspartate side chain to cleave a protein
- ☒ d. Act as an acid to protonate the covalent catalysis ester intermediate
- e. a. and c.
- f. b. and d
- g. all of the above

25. (5 pts) Mutarotation is:

- a. a spontaneous process that occurs only in ketose sugars
- b. fast in nucleosides
- ☒ c. interconversion of hemi-acetal isomers of sugars
- d. part of the Monsanto acetic acid process
- e. all of the above

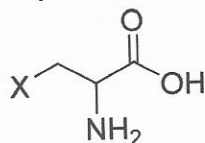
26. (5 points) The ligand on Pd used in the Carboxyamidation reaction is a triphenylphosphine. This ligand is an example of:

- a. pi-donor ligand with sigma acceptor response
- b. Lewis acid ligand
- ☒ c. Sigma donor ligand
- d. a. and c
- e. a and b

27. (8 pts) The DNA helix can be B-form or A-form depending on the solution. For B-form DNA helix:

- a. The nucleobases are in the syn conformation and the deoxyribose is in the C2'-endo conformation
- b. The nucleobases are in the anti conformation and the deoxyribose is in the C3'-endo conformation
- c. The phosphodiester bond determines the number of nucleobases per helix turn and form of the double helix
- d. All of the above
- ☒ e. None of the above

28. (5 pts) For the amino acid drawn below and group as discussed in class the range of pI values is:



- ☒ a. Approximately 6 when X = isopropyl
- ☐ b. Approximately 8 when X = carboxylic acid
- ☐ c. Of the same order of magnitude as acetic acid when X = H
- ☐ d. All of the above

29. (5 pts) In an electrophilic aromatic substitution reaction:

- ☐ a. The aromatic pi-system is the electrophile
- ☒ b. The aromatic pi-system is the nucleophile
- ☐ c. Both a. and b. are possible
- ☐ d. Only radical intermediates are involved

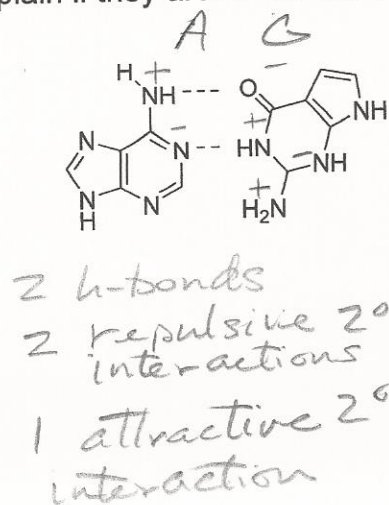
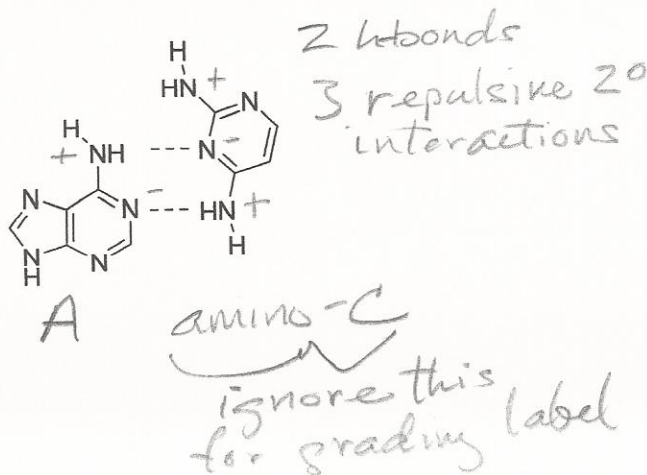
30. (5 pts) Glucose and Fructose can be interconverted by:

- ☐ a. Base catalyzed mutarotation
- ☒ b. Acid catalyzed enolization
- ☐ c. Nucleophilic substitution
- ☐ d. Radical elimination plus addition
- ☐ e. None of the above

31. (5 pts) The nitrogen in aniline is:

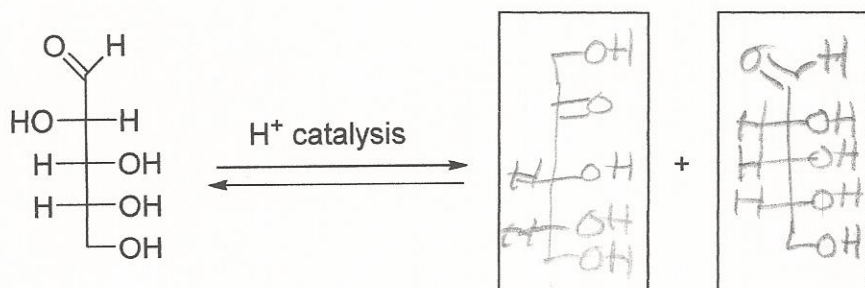
- ☐ a. Sp<sup>2</sup> hybridized
- ☐ b. Sp hybridized
- ☒ c. Sp<sup>3</sup> hybridized
- ☐ d. None of the above

32. (8 pts) For the base pairs drawn below label the nucleobases from the choices A, C, G, or U. For these two hydrogen bonded base pairs explain if they are of the same stability or if one pair is predicted to be more stable.

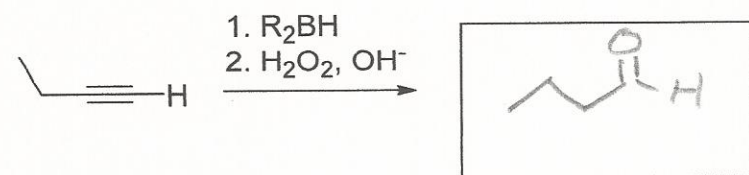
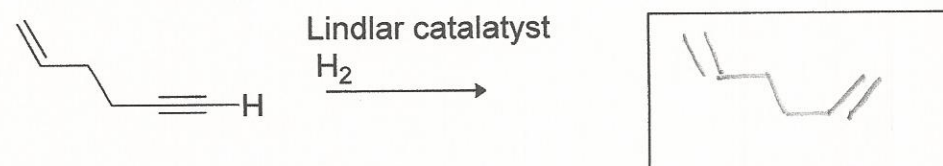
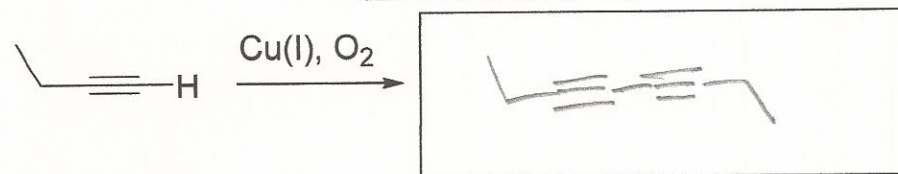
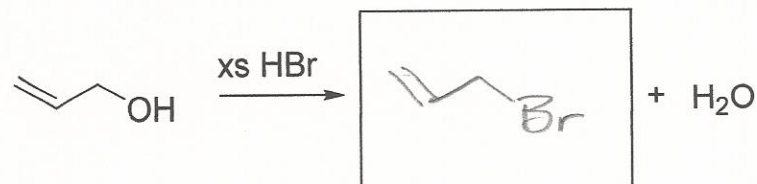
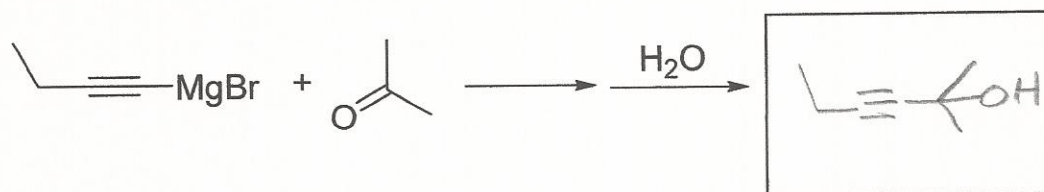


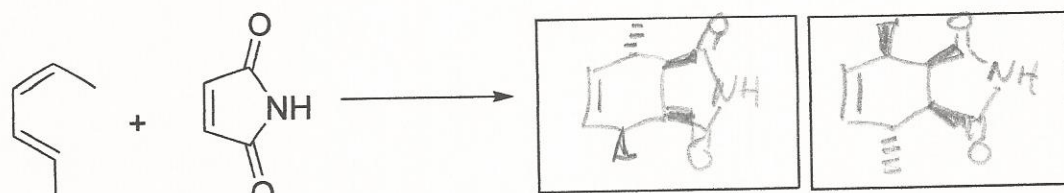


33. (126 pts, 3 points per box) for the reactions shown below fill in the box to complete the chemical equation. In equations where there are inorganic by-products you can ignore these in your answer.

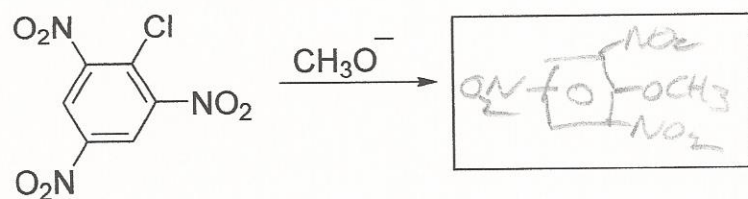
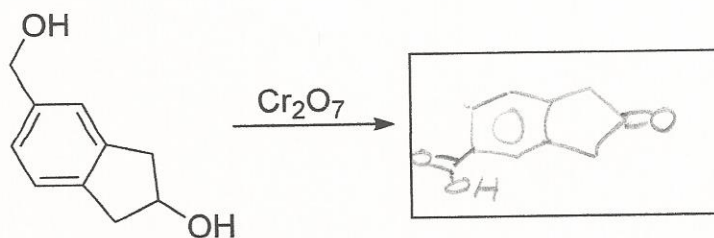
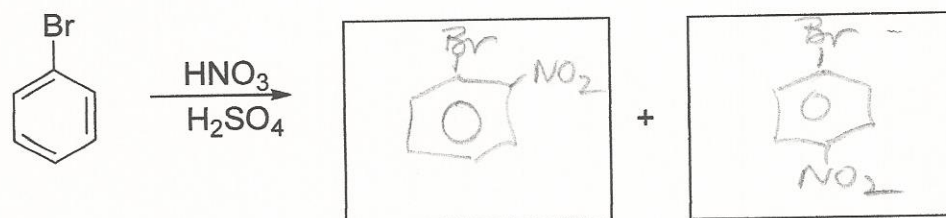
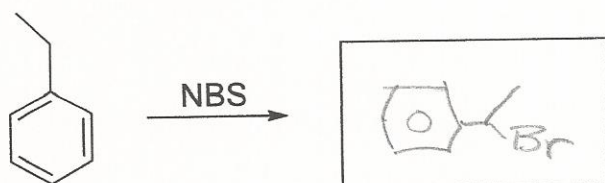


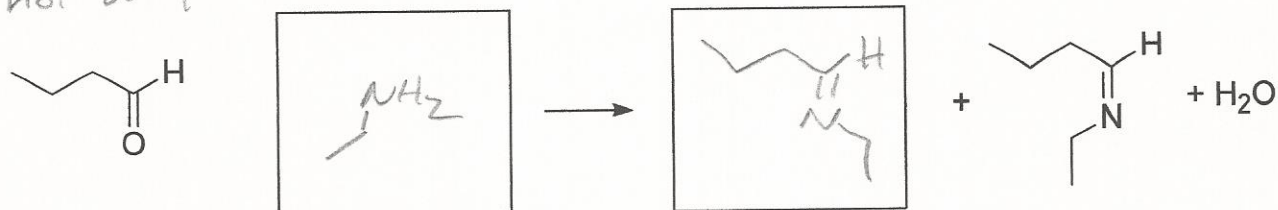
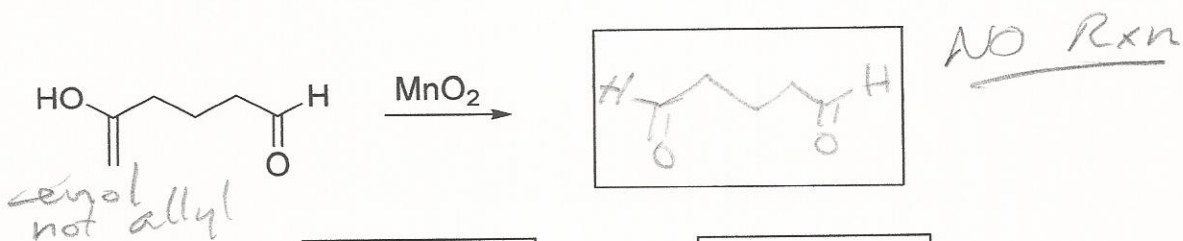
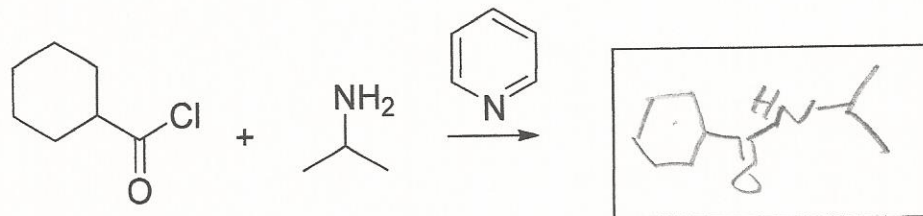
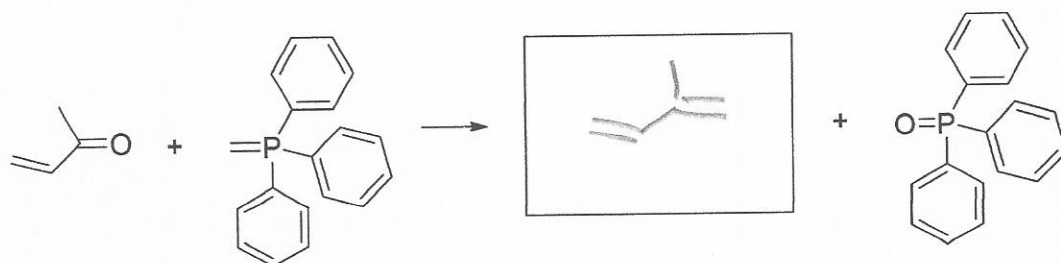
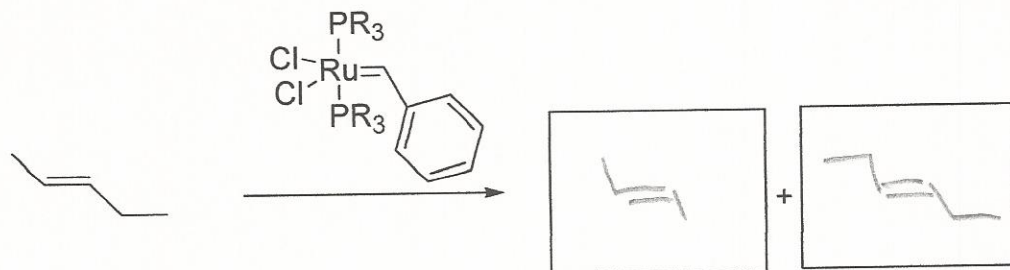
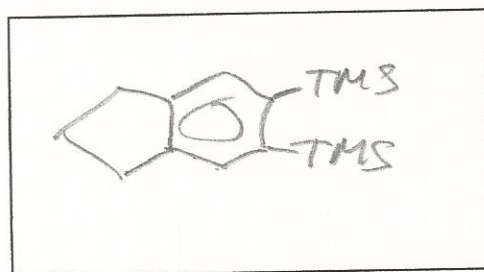
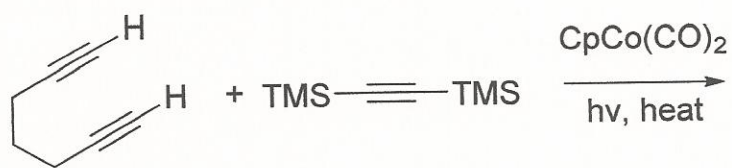
Draw the products as Fischer projections

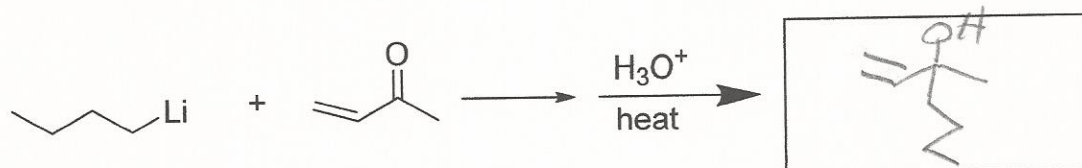
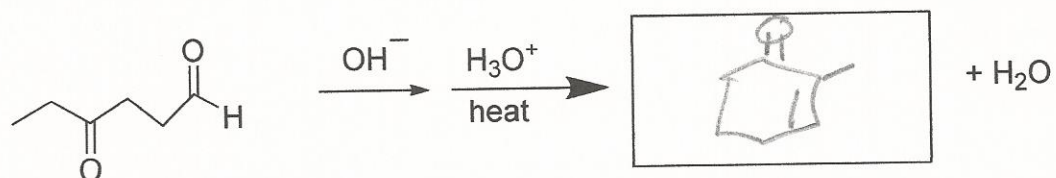
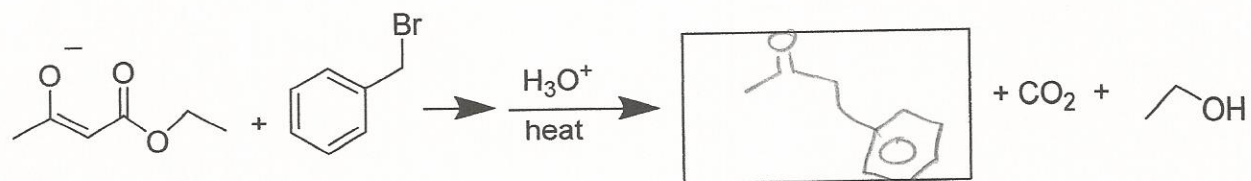
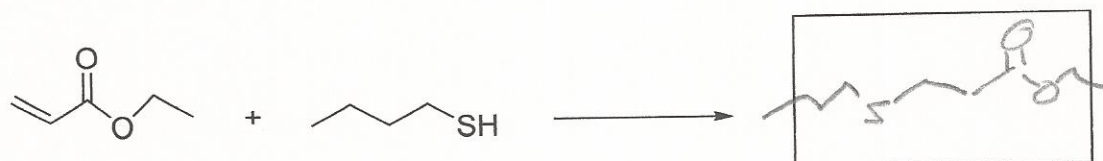
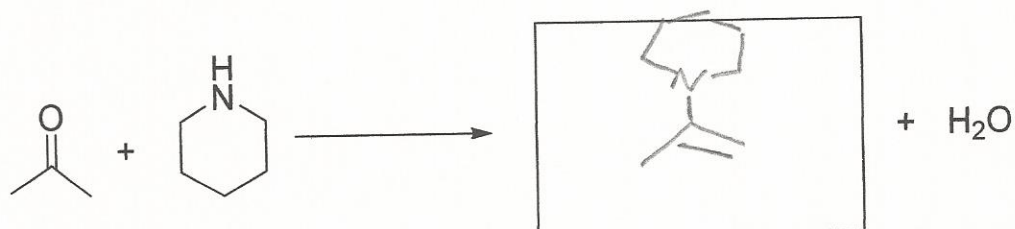
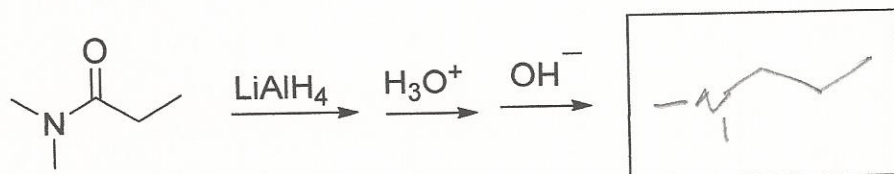
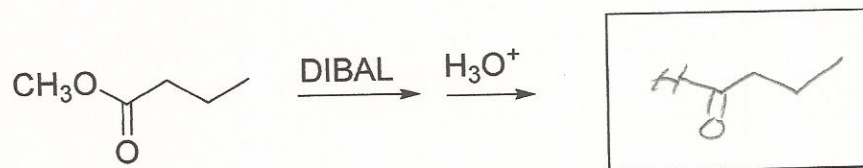
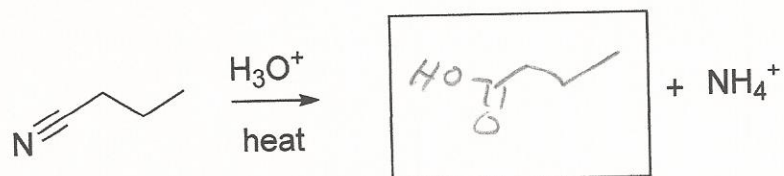


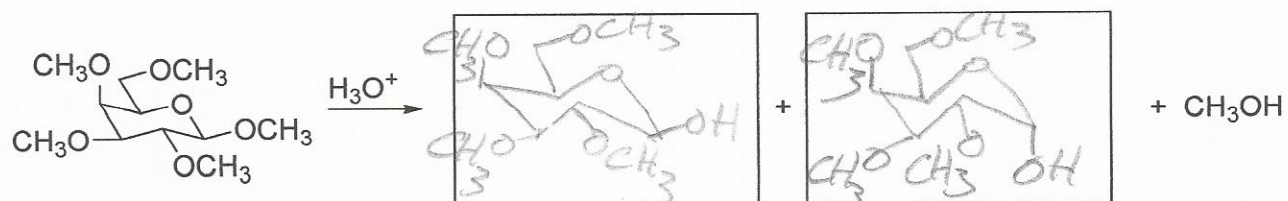
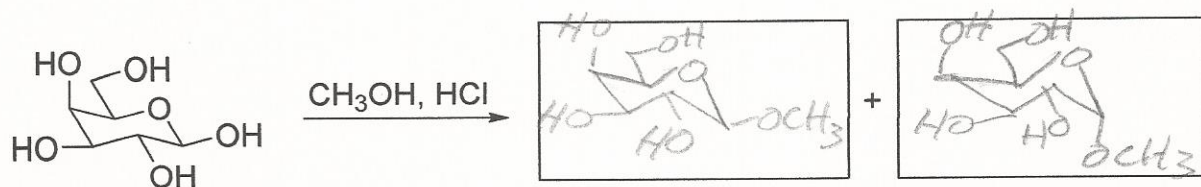
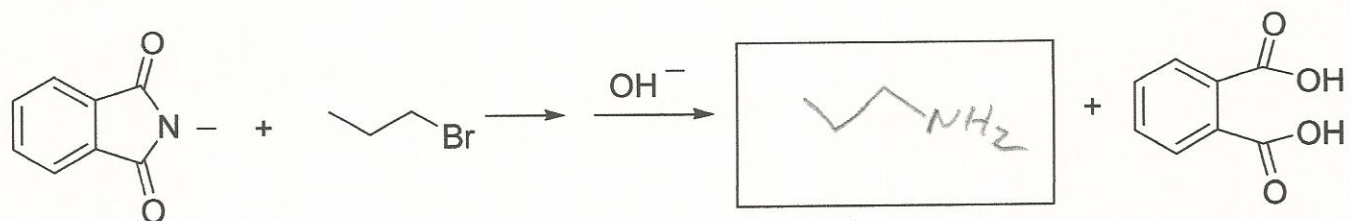
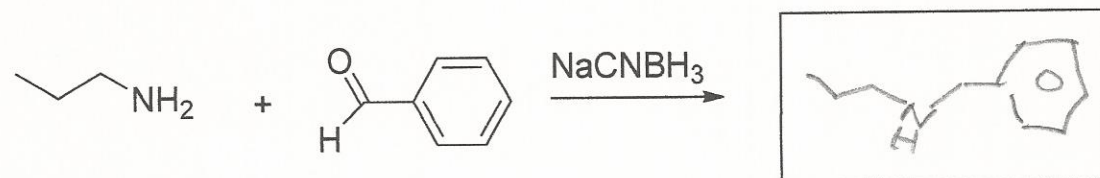
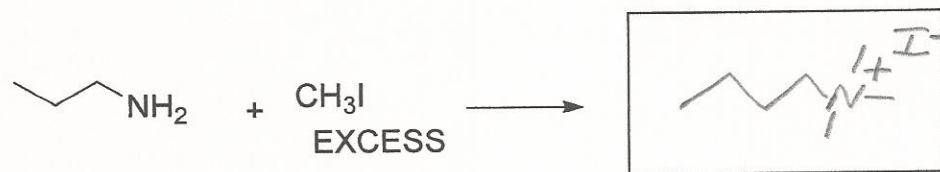
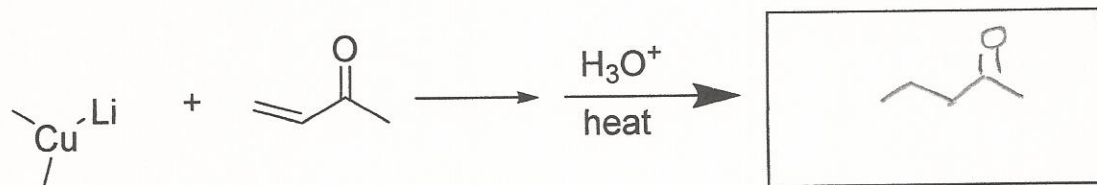


(2 pts) Can you label the products as coming from the endo and exo transition states?

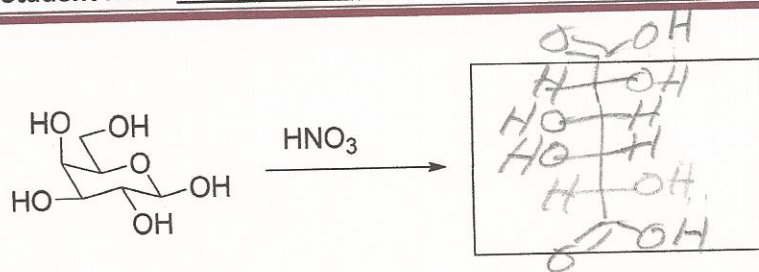




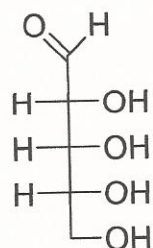




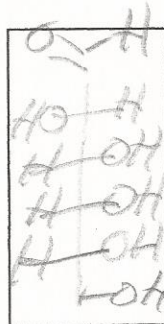
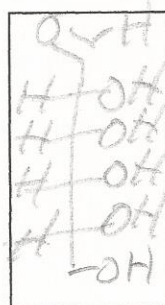




give partial credit for aldonic (mono) acid

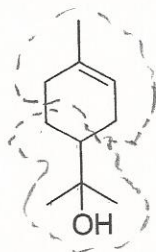


1. HCN
2. Pd/C BaSO<sub>4</sub>, H<sub>2</sub>
3. H<sub>3</sub>O<sup>+</sup>



Draw the products as Fischer projections

34. (5 pts) For the terpene alcohol drawn below identify the isoprene units by outlining the carbons in each unit and classify the terpene as a mono, di, etc.



10 carbons = 2 isoprene units = monoterpene