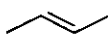

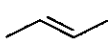
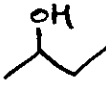
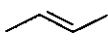
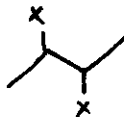
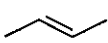
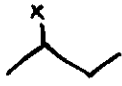


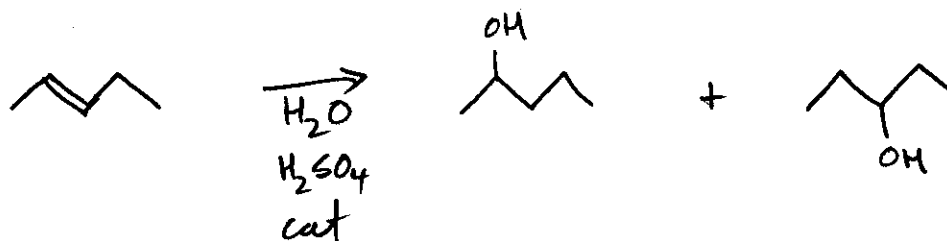
Name: _____

SCH 4U - Organic Chemistry Test #2

1. Common uses of alkenes in organic synthesis may involve addition reactions. There were four different types of addition reactions studied in this course. Using the table, list the four different types of addition reactions, provide reaction conditions and give the structure for the product that you would expect.

Name of Addition Reaction	Starting Material	Conditions	Product Material
hydrogenation		H ₂ Pt, Pd & Ni cat	
hydration		H ₂ O H ₂ SO ₄ cat	
halogenation		X ₂ H ₂ O	
hydrohalogenation		HX H ₂ O	

All of the above examples should result in only one possible product. There is however the possibility that addition reactions can lead to more than one possible product. Provide a clear example reaction that illustrates this point using a hydration addition reaction. What must be true about the alkene reactant and what must be true about the molecule being added.

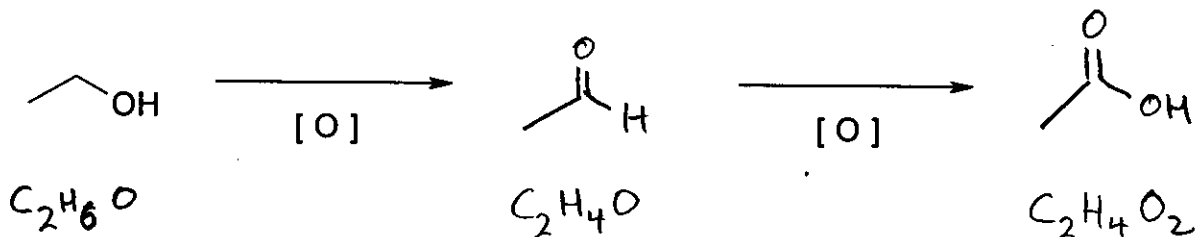


alkene must be asymmetrical
molecule added must be asymmetrical (H₂O, HX)

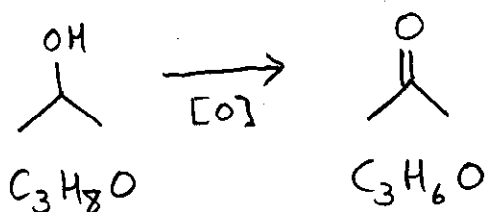
2. Oxidations and Reductions are common reactions in organic chemistry. These reactions do not involve complete loss or gain of electrons, instead the loss or gain is partial. This partial loss or gain is achieved through the shifts in electronegativity that occur when oxygen or hydrogen is added or removed. Fill in the following table with the words "added" or "removed" to indicate your knowledge of oxidation or reduction.

	oxygen	hydrogen
oxidation →	added	removed
reduction →	removed	added

Complete the reaction sequence for the oxidation of the primary two carbon alcohol to the carboxylic acid. Include the aldehyde intermediate. Write the chemical formula (i.e. $C_xH_yO_z$) underneath each structure.



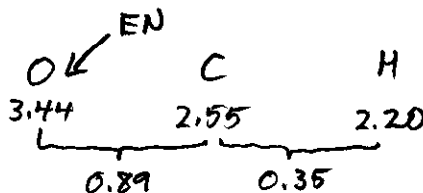
Repeat the above instructions for the oxidation of a three carbon second degree alcohol.



Do your chemical formula agree with the information you can obtain with your answers in the table? Add brief supporting statements.

yes - loss of hydrogen evident in first step of 1° alcohol and 2° alcohol
 - gain of oxygen evident in second step of 1° alcohol
 Which is of greater consideration, the role of oxygen or the role of hydrogen? Why?

- oxygen



greater difference in electronegativity causes greater partial loss or gain

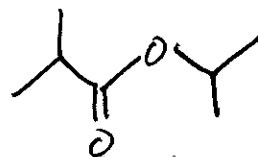
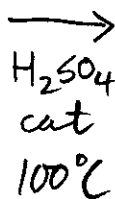
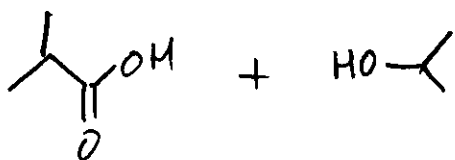
3. The six membered ring known as benzene has been described as a six carbon ring held together by "bond and halves". How does this work? Use precise terminology. Point form is perfectly acceptable. Include diagrams.



- electronic resonance causes double bonds to flip position such that the carbon bonds cannot be truly classified as either single or double (bond and a half are in the middle)
- this adds stability greatly lowering the reactivity of the "double bonds"

5

4. Write an esterification reaction for the reaction between 2-methyl propanoic acid and isopropyl alcohol. Write the name of the ester product. Include reaction conditions.

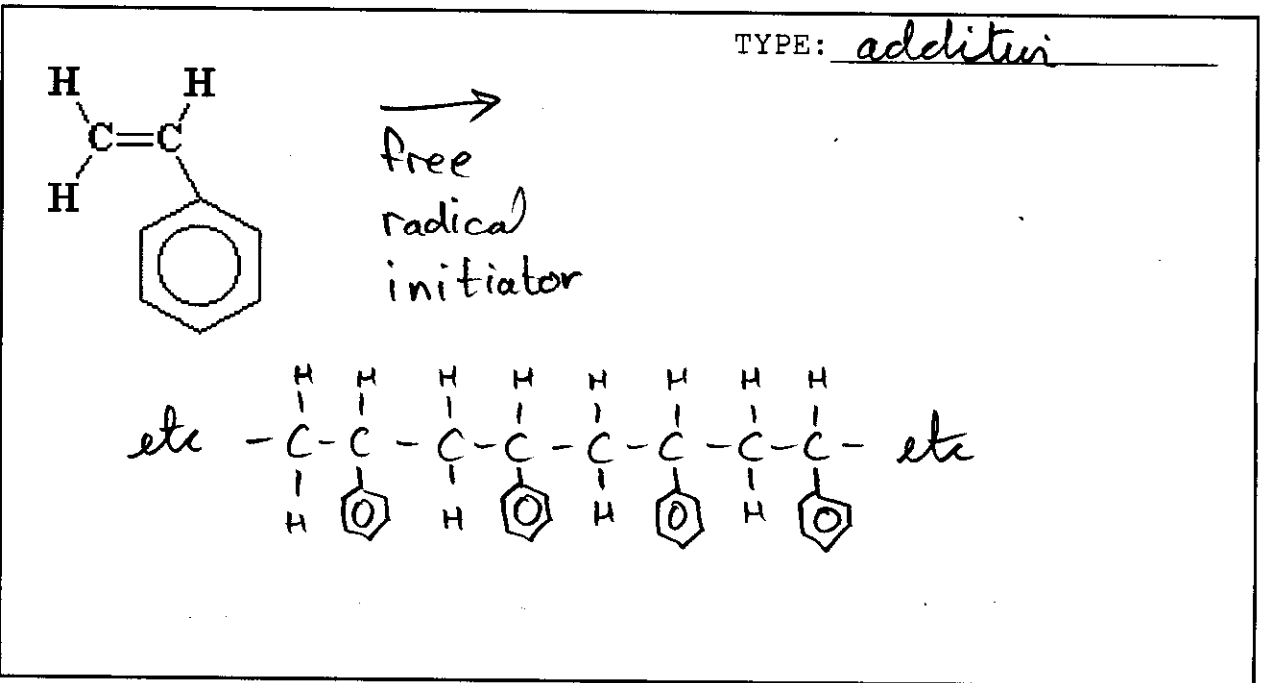
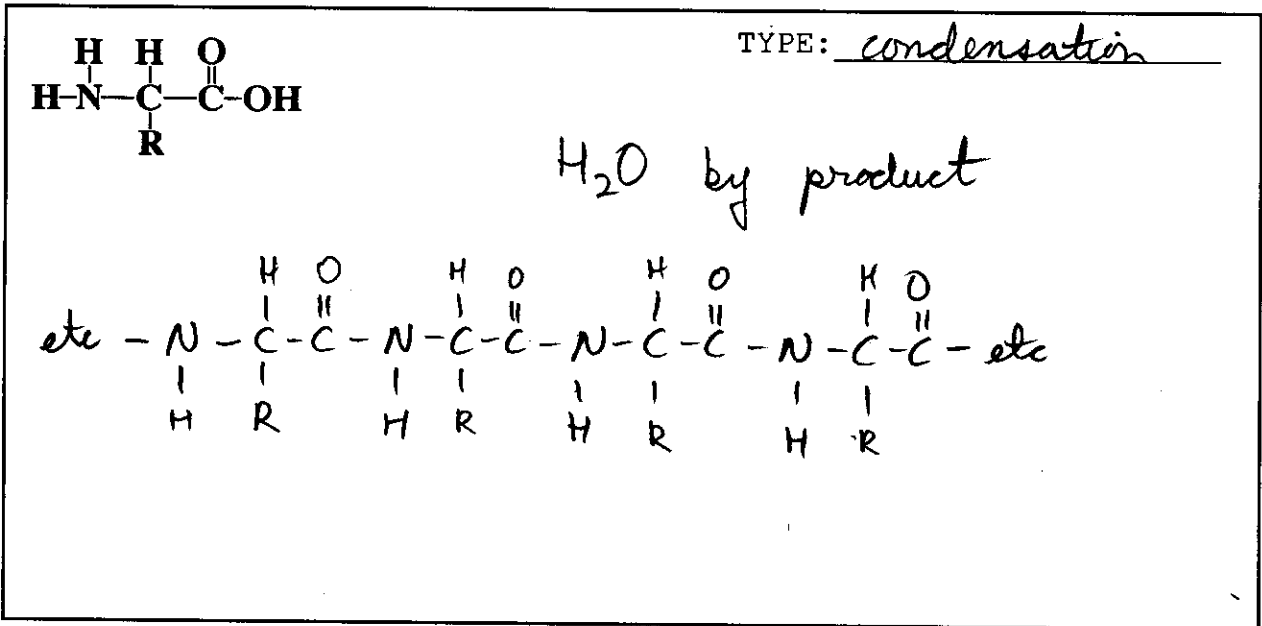


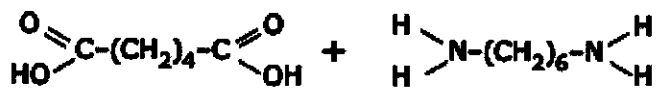
isopropyl 2-methylpropanoate

5

10

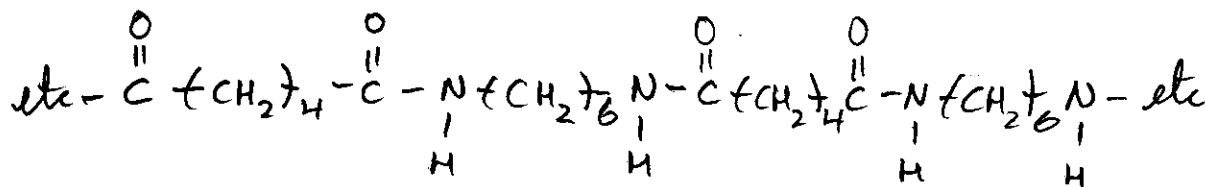
5. For each monomers undergoing a polymerization reaction, write:
- the type of polymerization reaction you would expect
 - the formula of a stable by-product if applicable
 - any special reaction conditions that are necessary to make the polymerization reaction work
 - a good diagram of the product polymer that includes four or more monomer units



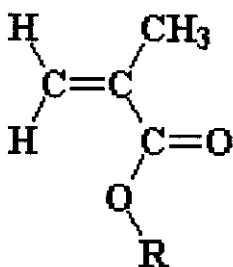


TYPE: condensation

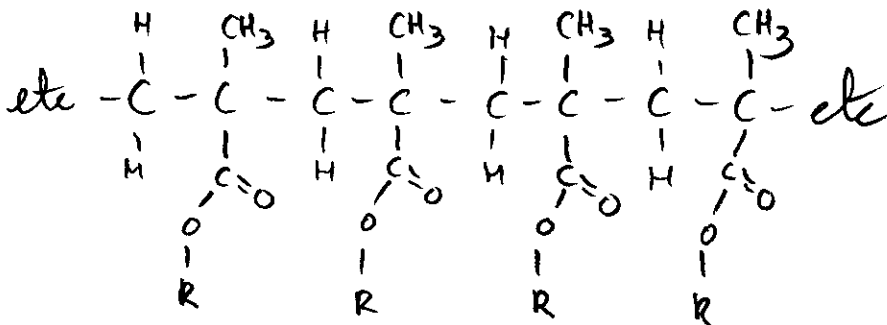
H_2O by product



4

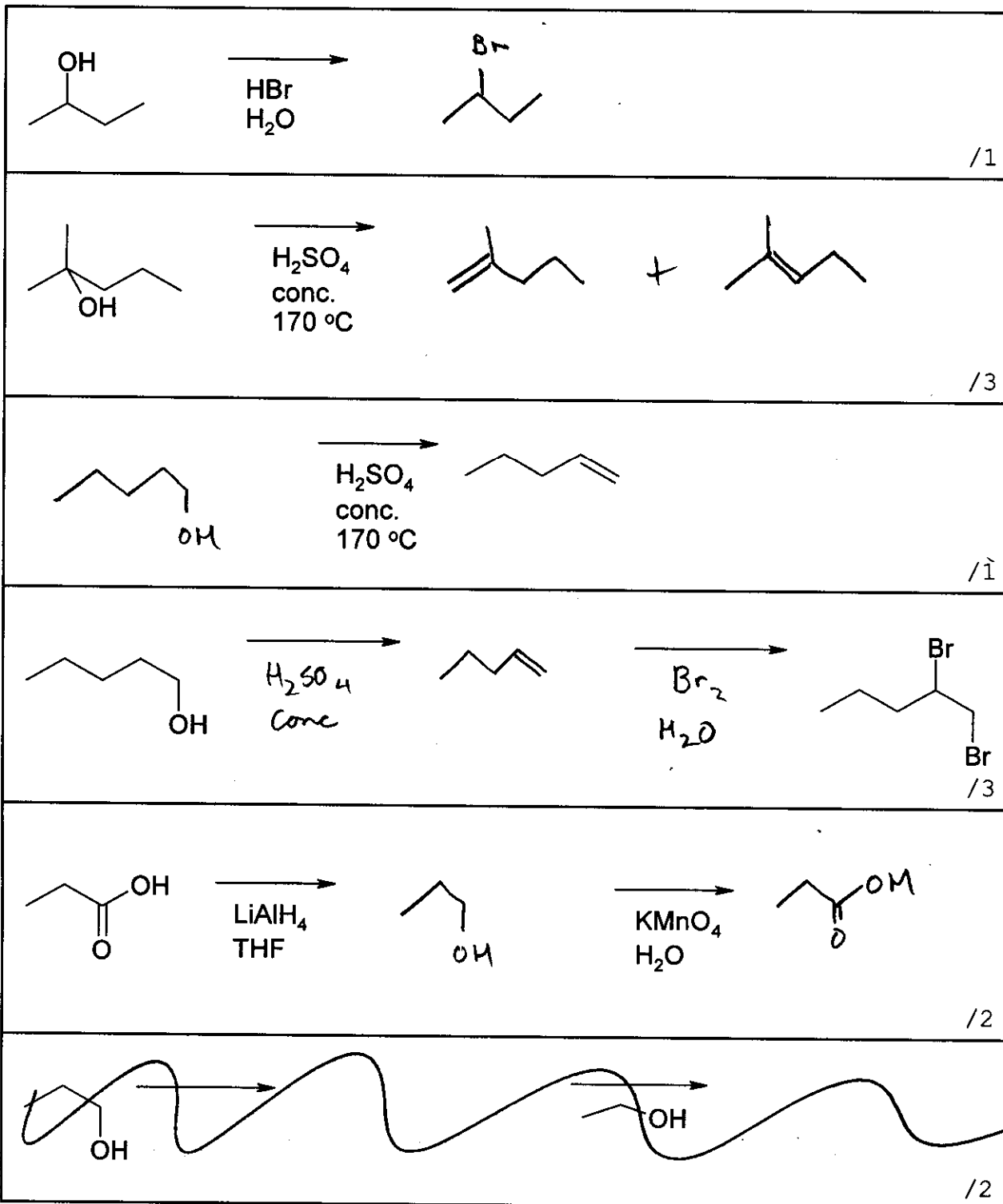


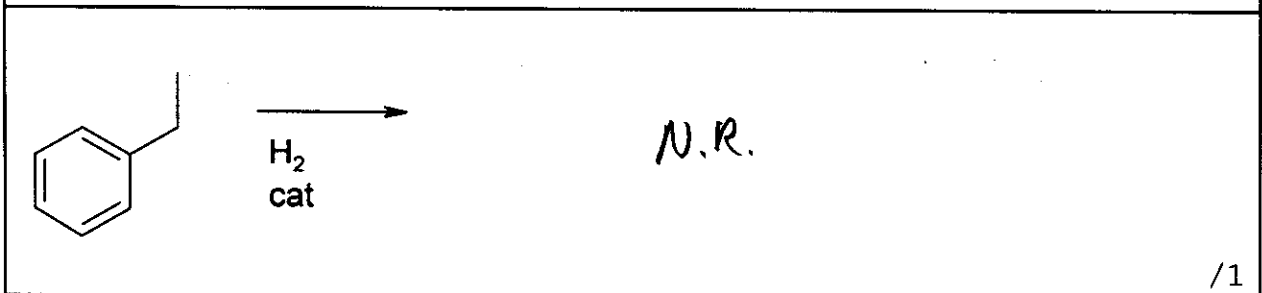
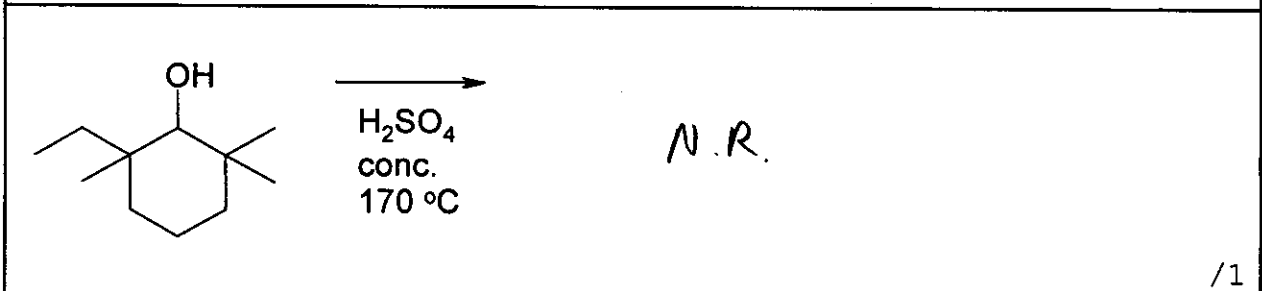
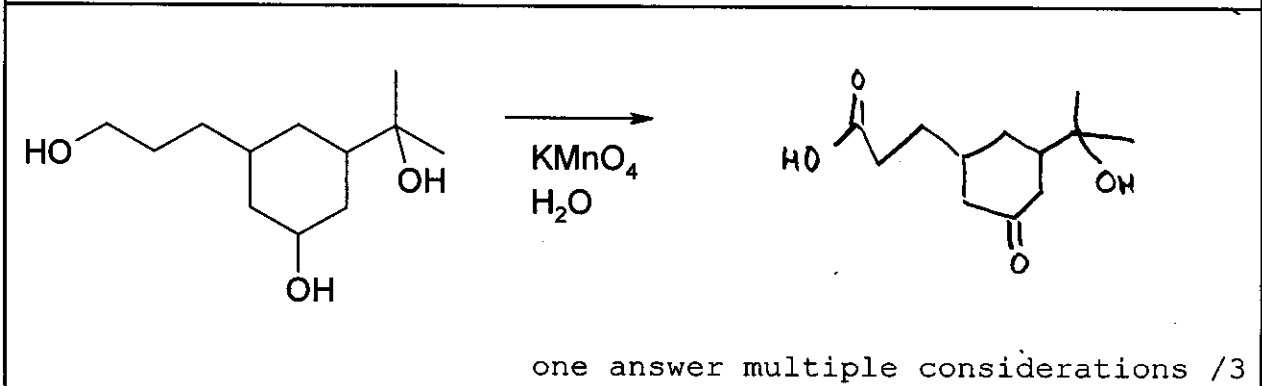
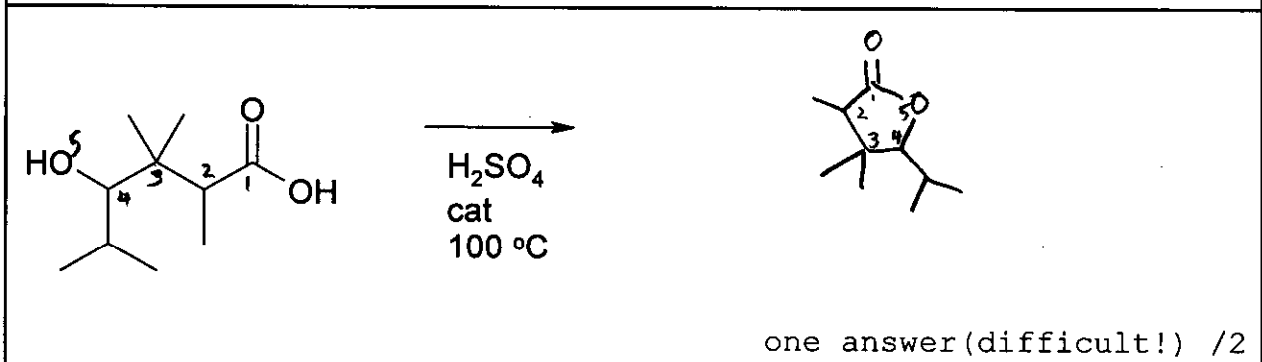
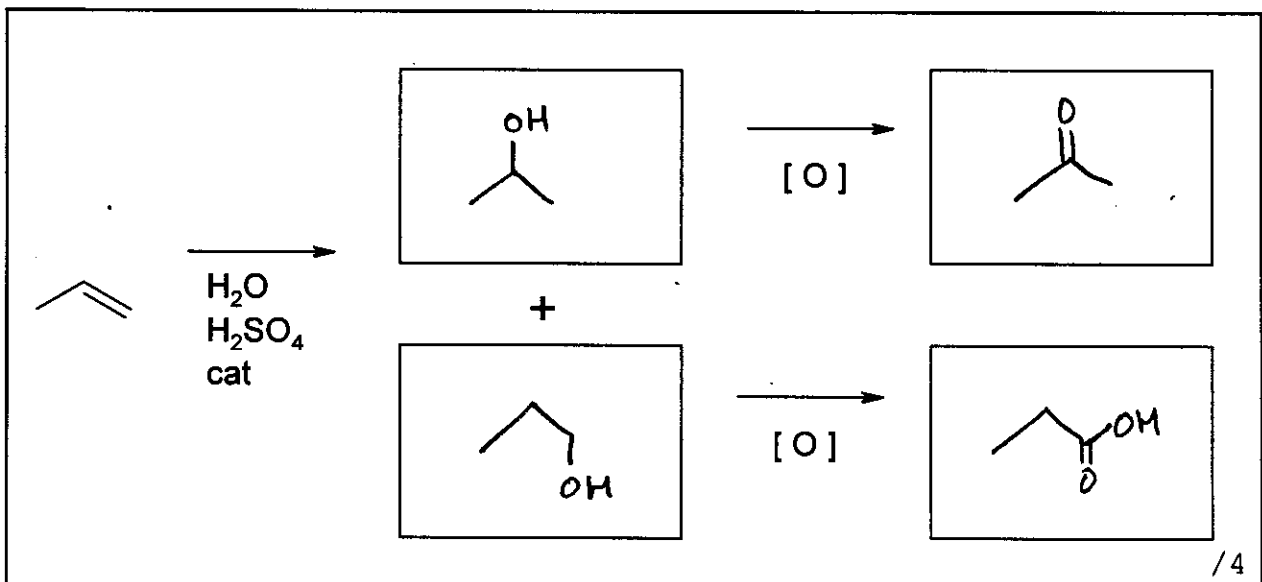
TYPE: _____



4

6. Complete each of the following reactions as fully as possible. Show products, reactants and/or reaction conditions as required. Pay attention to the possibility of multiple products or reactants. The marking scheme may be of assistance.





7. One of the primary uses for the study of organic chemistry is to make possible the synthesis of organic molecules, many of which play critical roles in maintaining our health through a wide variety of pharmaceuticals. Often the goal is to build a complicated molecule from a simple starting material through what is called a total synthesis. Many total syntheses require more than 20 reaction steps!

Design a total synthesis for the ester called ethyl ethanoate using the starting material ethene (a two carbon alkene). This can be accomplished using reactions that were studied in class. You need only show the reaction involved. No explanation is necessary. There is more than one option for how you may choose to organize your answer.

