The exam consists of 8 questions worth 100 pts.

1. _____/10
2. _____/10
3. _____/20
4. _____/20
5. _____/6
6. _____/10
7. _____/12
8. _____/12

Regrading: All requests for regrades must be submitted in writing within 48 hours of the return of the exam. You must explicitly state what has been misgraded and why it is an error. The entire exam will be regraded, which could result in points being added or deducted overall.
1. (10 pts) Provide a mechanism to account for the following reaction.

\[
\text{OH} \xrightarrow{\text{H}_2\text{SO}_4} \]

Draw the structure of a minor product you would expect from the reaction above:
2. (10pts) Provide an explanation for the stereochemistry observed in the following two step reaction:

What reagents would be necessary to make the product with this stereochemistry?
3. (20 pts) Provide all the necessary reagents for the following transformations. Choose four out of the following five problems. If you do not clearly mark the problem you do not want corrected, the first four will be graded.

A. 

B. 

C. 

D. 

E. 

(E)-2,3-dichloro-2-butene
4. (20pts) Predict the products of the following reactions, including proper stereochemistry. Choose four out of the following five problems. If you do not clearly mark the problem you do not want corrected, the first four will be graded.

- **Problem 1:**
  \[
  \text{H}_3\text{C} = \text{C} - \text{H}_3 \xrightarrow{\text{HCl}} \text{H}_3\text{C} = \text{C} - \text{H}_3
  \]

- **Problem 2:**
  \[
  \text{H}_2\text{O}
  \]

- **Problem 3:**
  \[
  \text{2-pentanol} \xrightarrow{\text{POCl}_3, \text{pyr}} \text{H}_3\text{C} = \text{C} - \text{H}_3
  \]

- **Problem 4:**
  \[
  \text{excess HCl} \xrightarrow{} \text{H}_3\text{C} = \text{C} - \text{H}_3
  \]

- **Problem 5:**
  \[
  \text{(Z)-2-butene} \xrightarrow{\text{Br}_2} \text{H}_3\text{C} = \text{C} - \text{H}_3
  \]

- **Problem 6:**
  \[
  \text{H}_3\text{C} = \text{C} - \text{H}_3 \xrightarrow{1. \text{OCH}_3, 2. \text{H}_2\text{O}} \text{H}_3\text{C} = \text{C} - \text{H}_3
  \]
5. (6 pts) Explain why different constitutional isomers are formed when these two different sets of reagents are used.

6. (10pts) Provide a mechanism to account for the formation of both the bromides.
7. (12pts) Provide a mechanism to account for the observed product.

In one sentence, describe how this mechanism explains the **stereochemistry** of the reaction:

In one sentence, describe how this mechanism explains the **regiochemistry** of the reaction:
8. (12pts) Provide all reagents needed for these multi-step syntheses. Choose three out of the following four problems. If you do not clearly mark the problem you do not want corrected, the first four will be graded.

A. 

B. 

C. 

D. 