

University of California, Los Angeles
Chem 14D – TaH Exam #1
Fall 2020 – 10/23/20

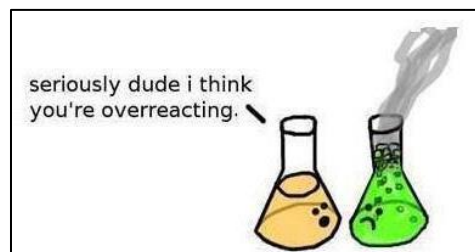
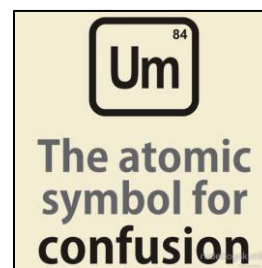
I hereby state that **I have neither given nor received aid to or from other people during this exam** (including external websites and programs). **I vouch for the honesty and integrity of each and every answer given.**

Signature _____ ID# _____

Circle your TA's name: Dominick Garrett Yiyi Eun Bin
 Brennan Shuaijing Tony

Use scratch paper first before inputting the answers onto the test for clearer scans onto Gradescope.

| | Possible | Your score |
|-----------------------------|----------|------------|
| I. This, That, or the Other | 10 | |
| II. Order in the Lab | 6 | |
| III. What Are We Making? | 24 | |
| IV. Show Me the Way | 11 | |
| Bonus | 0 (2) | |
| Total | 50* | |



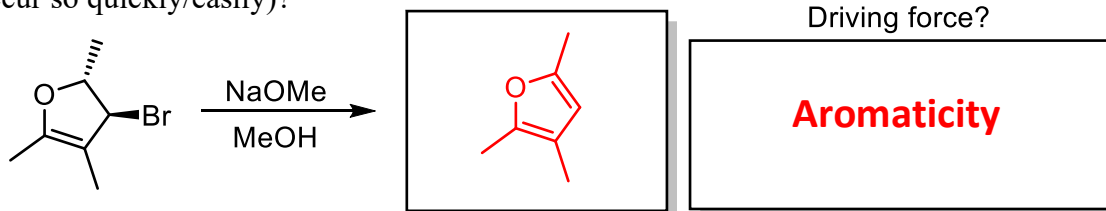
*The actual total is 51 (before bonus). Think of it as 1 extra extra credit point. Good luck!

****Bonus:** Answer these questions for some extra credit points. These are *strictly extra points*, meaning that missing these will not be detrimental to your grade. Each question is **all or nothing**.

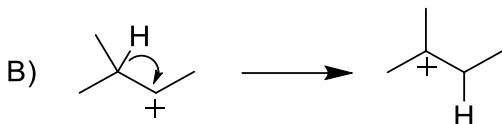
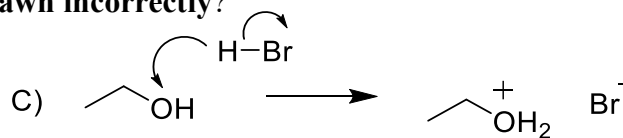
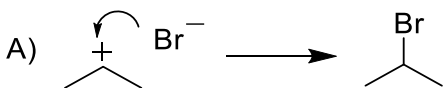
a) (1 pt) How fortunate that today is your first exam! What is the **chemical significance of today**?

Happy Mole Day!

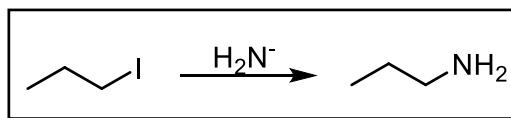
b) (1 pt) The following reaction occurs rapidly upon mild heating to produce a certain product. **What is that product**, and what is the **driving force** of the reaction (i.e. what makes the reaction occur so quickly/easily)?

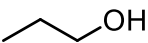
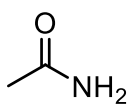
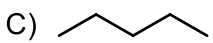
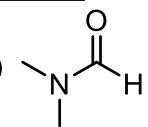


I. This, That, or the Other (10 pts; 1 pts each) Answer the following questions by **inputting the correct answer into the boxes** provided next to each question.

Ca) Which of the following mechanistic steps is **drawn incorrectly**?

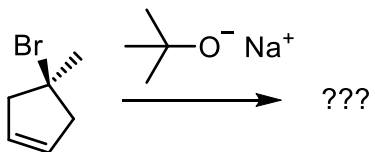
D) These steps are all drawn correctly

Db) Which of the following would be the **best solvent** for this reaction?

- A)  B)  C)  D)  E) None of these would work

Ac) Which of the following statements refers to the **regioselective** outcome of a reaction?

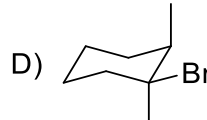
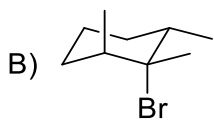
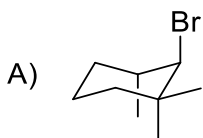
- A) The Zaitsev product is formed preferentially in an elimination reaction
 B) A carbocation is planar and can be attacked from either side
 C) An S_N2 mechanism involves the backside attack of a tetrahedral carbon
 D) In an $E1$ mech, a trans-alkene would be preferentially formed over a cis-alkene
 E) There is more than one statement that refers to the regioselective outcome

Ed) Choose the **incorrect statement** about the following reaction:

- A) The reaction is an elimination
 B) The product will be the Zaitsev product
 C) The mechanism is $E1$
 D) The alkyl halide is tertiary
 E) There is more than one incorrect statement

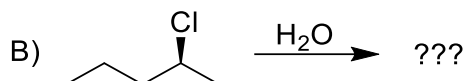
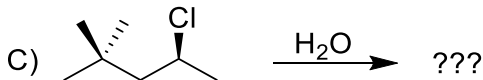
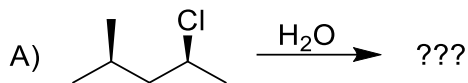
De) Choose the statement the **best completes** this sentence: *On **any** reaction coordinate diagram...*

- A) ...the rate-determining step is always the first step
 B) ...there is an intermediate formed
 C) ...the products will be lower in energy than the reactants
 D) ...the step with the highest activation barrier will take the longest
 E) ...the transition states consist of two molecules

Bf) Which of the following cyclohexanes are in the **proper conformation** for an **$E2$ elimination** to occur?

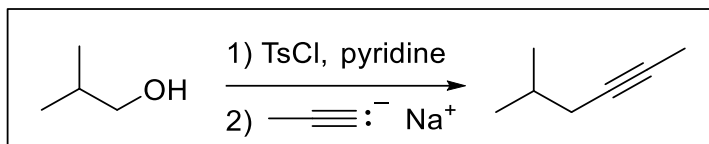
E) None of these conformations would work

D g) Which reaction would result in a **racemic mixture**?



D) These would all result in a racemic mixture

A h) In the following two-step reaction, what is the purpose of the **first step**?



A) To create a better leaving group C) To reduce steric hindrance

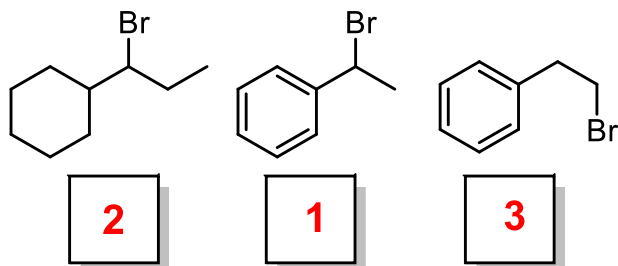
B) To create a stronger nucleophile D) To protonate the alcohol

F i) True or False: Both S_N2 and $E2$ mechanisms occur in **one mechanistic step**, so their rates are inherently **faster than two-step mechanisms** like S_N1 and $E1$.

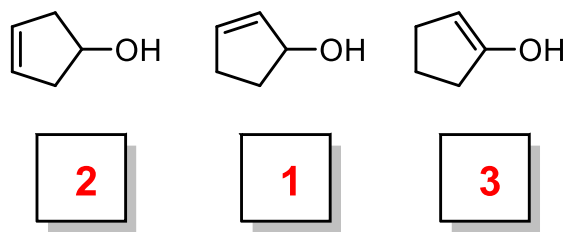
F j) True or False: The **most stable products are always formed** in elimination and nucleophilic substitution reactions, regardless of what mechanism is occurring.

II. Order in the Lab (6 pts, 1.5 pts each) Rank the following compounds by **inputting the correct numbers (1-3)** into the boxes provided. (*1 = most reactive, 3 = least reactive*).

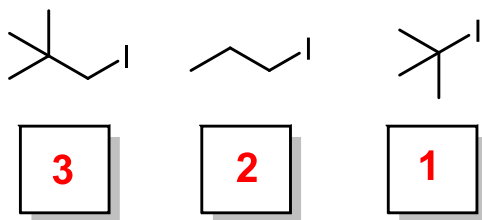
a) ...in order of S_N1 reactivity with MeOH



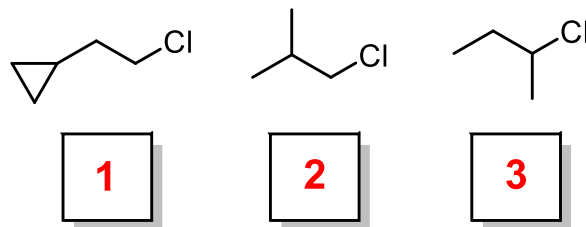
b) ...in order of $E1$ reactivity with $\text{H}_2\text{SO}_4, \Delta$



c) ...in order of $E2$ reactivity with NaOMe



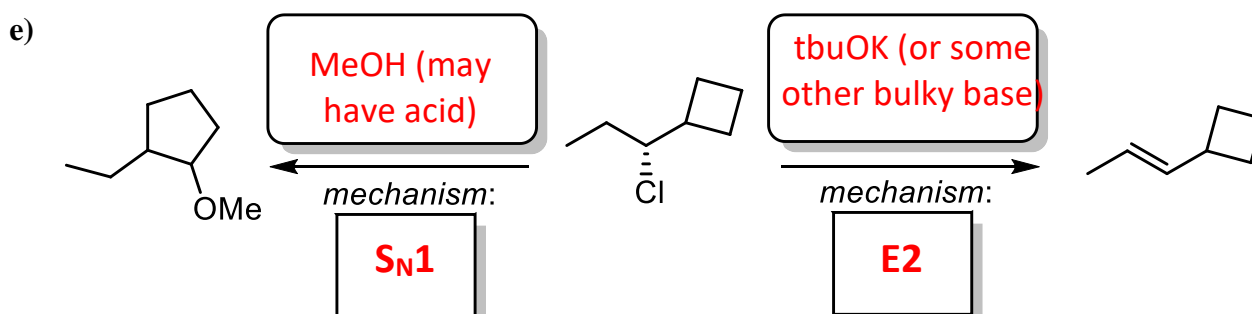
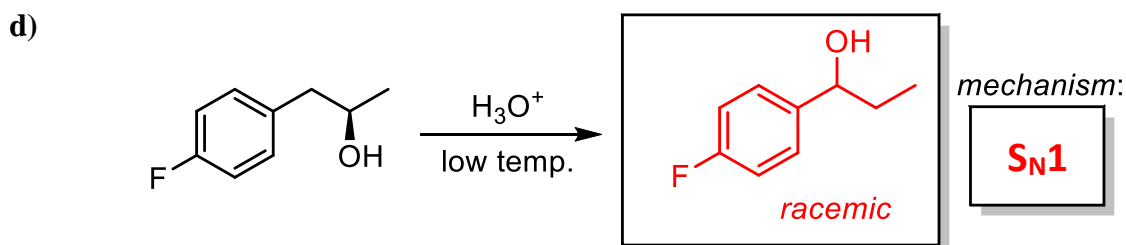
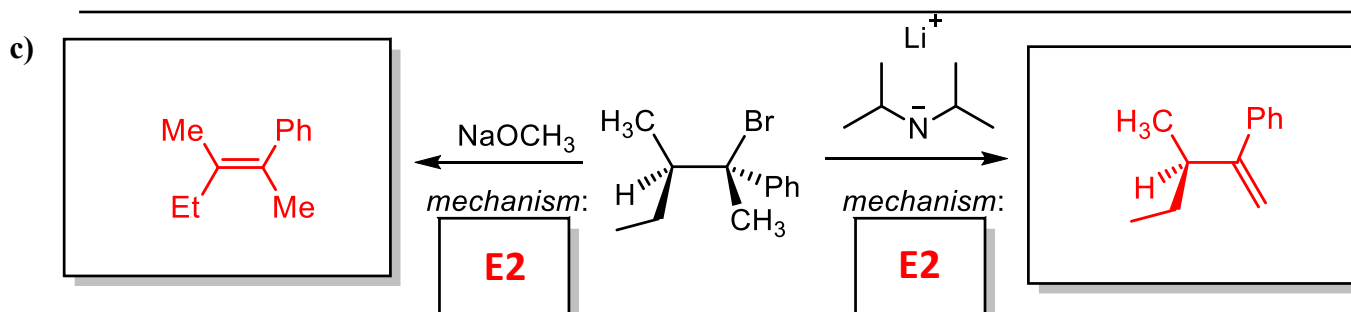
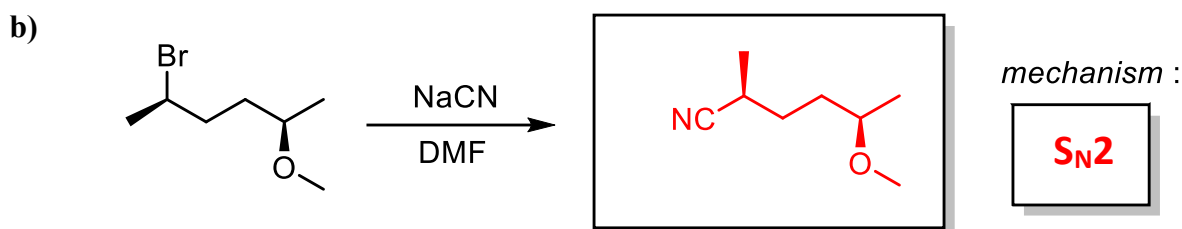
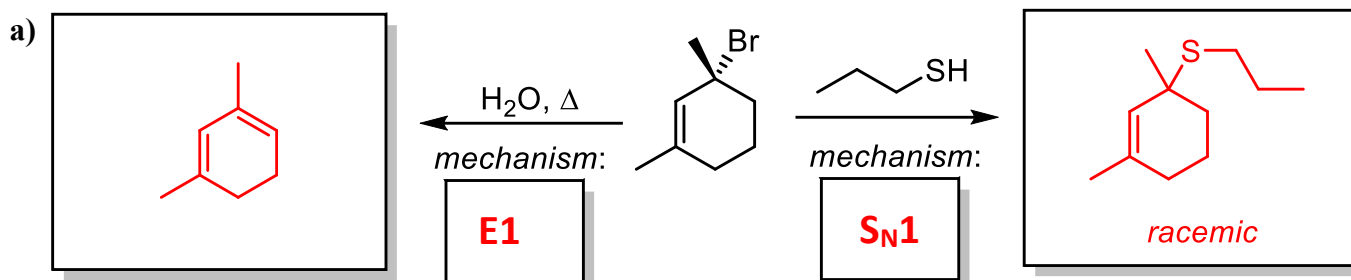
d) ...in order of S_N2 reactivity with NaN_3



III. What Are We Making? (24 pts; 2pts/molecule or reagent, 1pt/mechanism) Complete the following reactions by **drawing clear structures** for the *major* organic products; for reagents, you may either draw or write them out. Then **state the mechanism** under which the reaction occurs when appropriate.

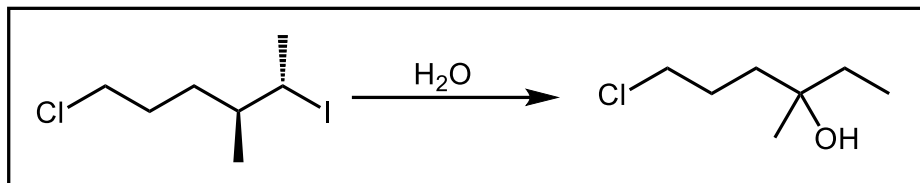
Note on stereochemistry:

- If the answer is a **single compound**, give its structure clearly.
- If the answer is a **racemic mixture**, you may give one enantiomer's structure clearly and write "racemic" or (\pm) under the answer.
- If the answer is a **mixture of diastereomers**, you must clearly give the individual structure of each product.



IV. Show Me the Way (11 pts) – The reactions below proceed through mechanisms we have seen in class. Answer the following questions, then provide complete **arrow-pushing mechanisms** for both reactions. Show **every step** clearly; messiness may result in lost points. *Note: Other products may also be formed in small quantities, but you **only have to show the mechanism to form the product shown.***

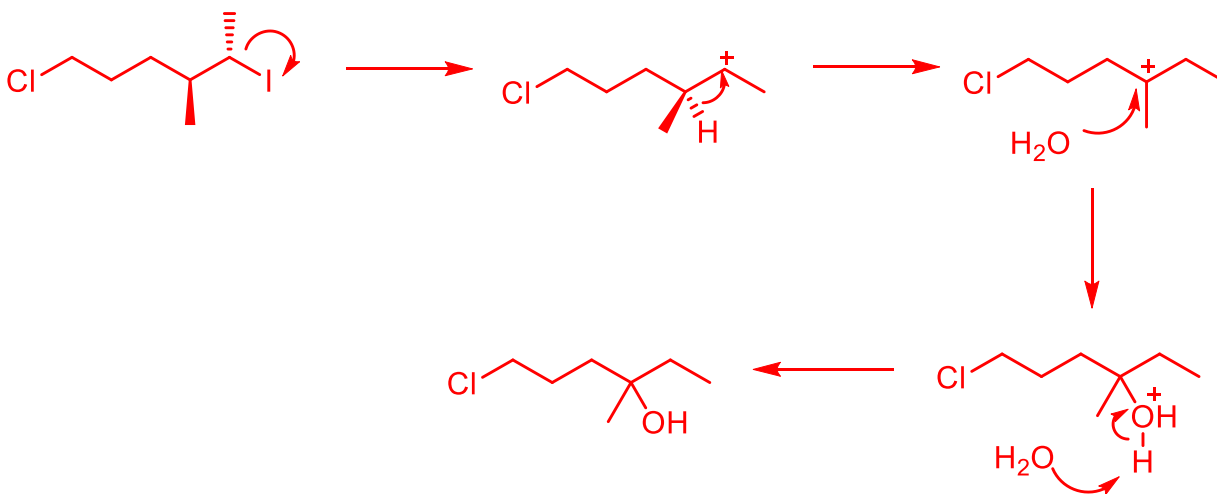
a) (6 pts) The alkyl dihalide below can react with water to form the alcohol shown.



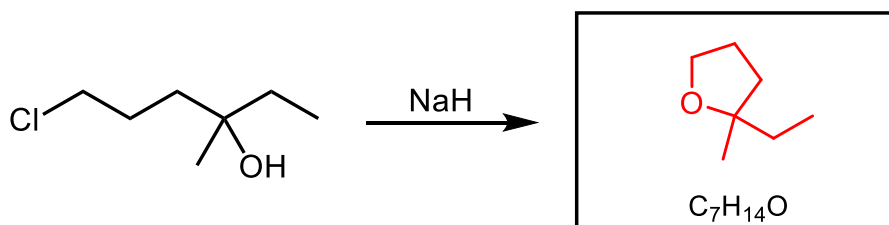
Which mechanism is likely occurring? **Circle one.**

S_N1 **S_N2**
 E1 **E2**

Mechanism:



b) (5 pts) The resulting alcohol from above can participate in an **intramolecular** reaction when subjected to sodium hydride. Predict the **product**, then provide the **mechanism** below.



Which mechanism is likely occurring? **Circle one.**

S_N1 **S_N2**
 E1 **E2**

Mechanism:

