

*CHEM 14D Midterm 1*  
October 22, 2018

**\*Full Name on Every Page\* \*Write Dark\* \*Only front pages will be scanned\***

*Key*

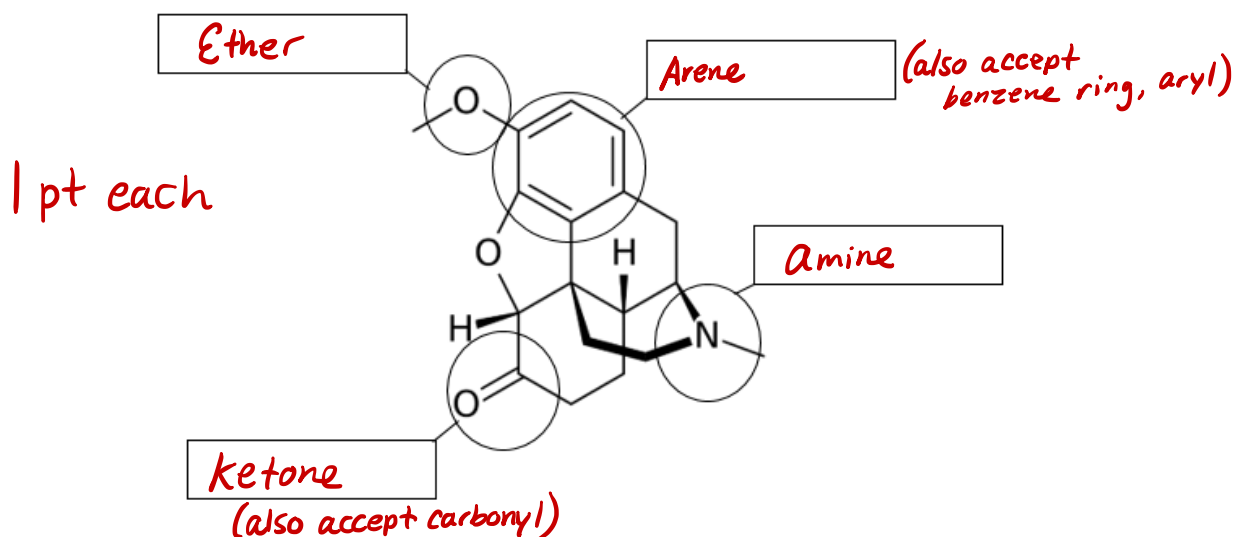
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Name (Last) \_\_\_\_\_ (First) \_\_\_\_\_ Student ID \_\_\_\_\_  
Lecture \_\_\_\_\_

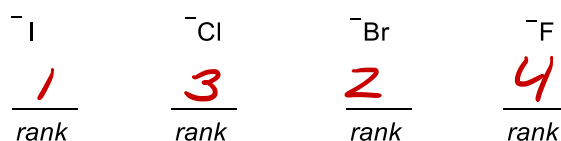
Question	1	2	3	4	5	<b>FULL Name on every page</b>	Total
Points	13	20	13	24	28	2	100

- 1. Write your full name on every page.**
- 2. Answers written on the back of the exam will not be graded.**
- 3. This is a closed book exam. The use of notes, cell phones, calculators, or other devices will not be allowed during exam.**
- 4. Where applicable, answers without a clear indication of stereochemistry will not be given any credit.**
- 5. You may use model sets brought in a clear ziplock bag.**
- 6. For full credit show your work, partial credit will be awarded.**
- 7. A periodic table will be provided to you.**
- 8. Show your student ID when turning in your exam.**

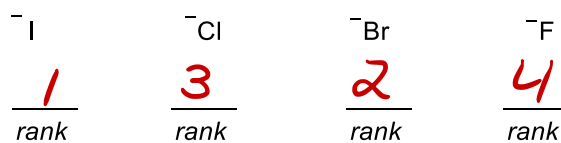
1.1 [4 Points] The structure of an addictive pharmaceutical, hydrocodone (Vicodin), is shown below. Write the names of the indicated functional groups in the boxes provided.



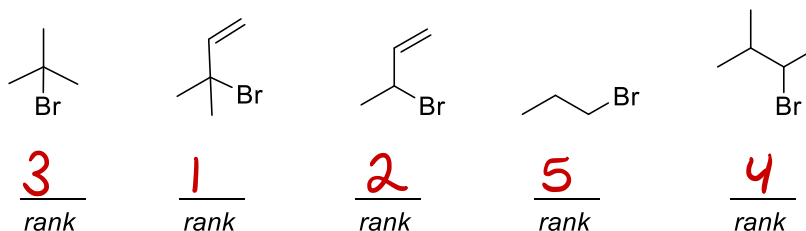
1.2 [2 Points] Rank the following leaving groups from best to worst (1 = best leaving group).



1.3 [2 Points] Rank the following nucleophiles in order of rate of  $\text{S}_{\text{N}}2$  reaction with methyl iodide (1 = best nucleophile).

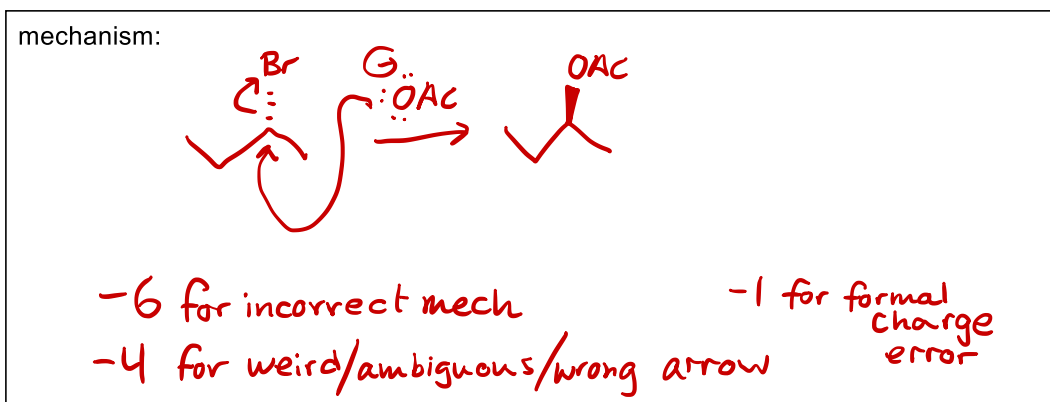
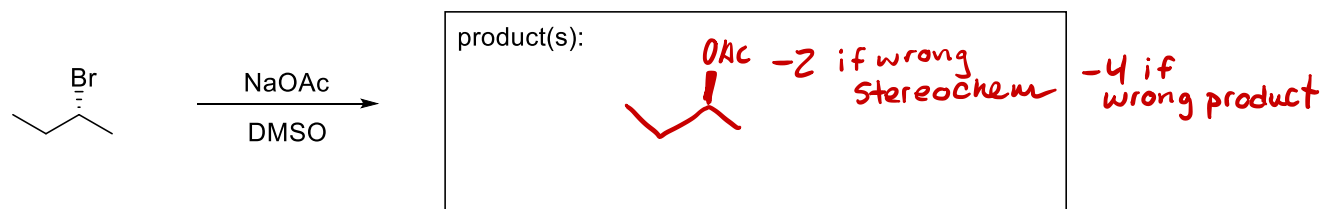
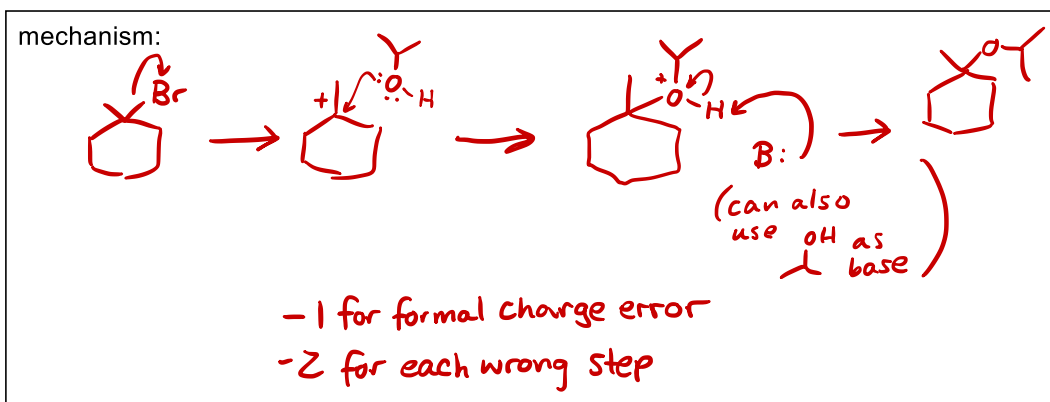
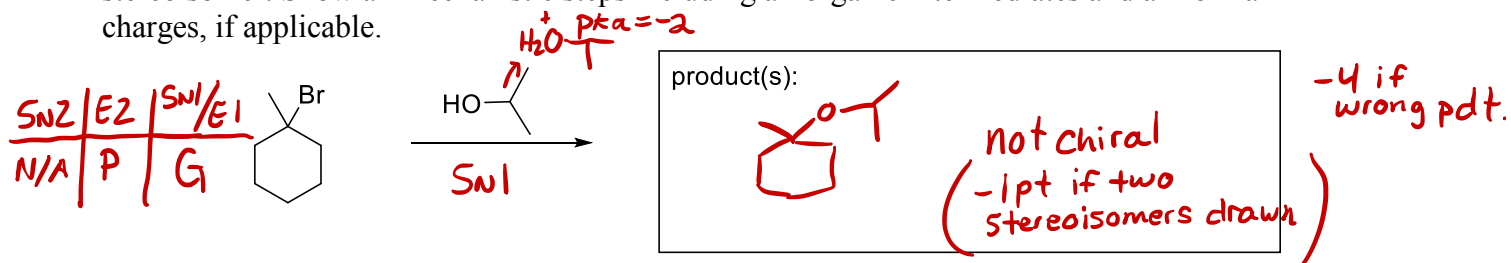


1.4 [5 Points] Rank the following substrates in order of their predicted  $\text{S}_{\text{N}}1$  reactivity (where 1 is the most reactive).

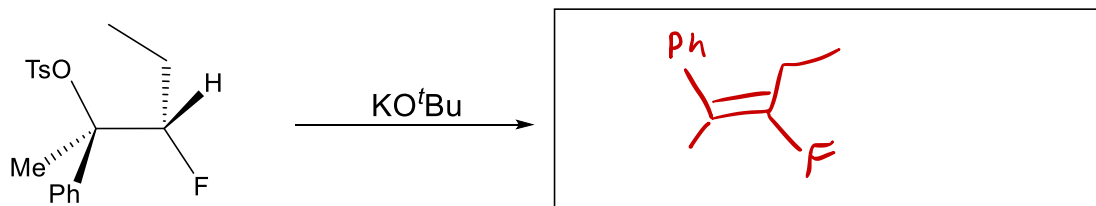


*+1 pt for correct best  
+1 pt for correct worst*

2.1 [20 Points] Predict the major organic product(s) of the following reactions and draw complete arrow-pushing mechanisms for their formation. If more than one product stereoisomer is formed, draw them all. However, you only need to show a mechanism for formation of one stereoisomer. Show all mechanistic steps including all organic intermediates and all formal charges, if applicable.



3.1 [8 Points] The following E2 reaction produces only a single major product, draw it. Show your work.



Reactive conformation:



If wrong reactive conformation, but translated correctly to alkene +2  
 If correct product shown but no work +2  
 If incorrect product but correct reactive conformation +4

3.2 [5 Points] Indicate if the following statements are either true or false by circling your answer.

a.) Grignard reagents are incompatible with polar, protic solvents.

True or  False

1 pt each

Acid/Base rxn destroys Grignard

b.)  $\text{S}_{\text{N}}2$  reactions proceed with retention of stereochemistry.

True or  False

inversion

c.) E2 requires an anti-periplanar relationship between the leaving group and  $\alpha$ -hydrogen

True or  False

$\beta$ -hydrogen

d.) Neutral charged nucleophiles are stronger than positively charged nucleophiles.

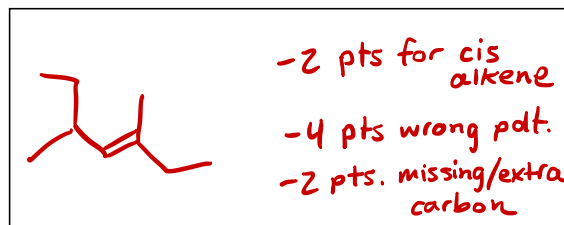
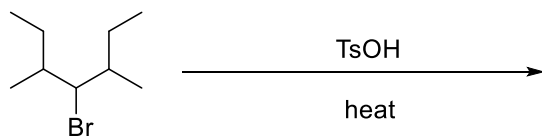
True or  False

e.) Chem 14D is a class that will improve your problem solving skills.

True or  True

4.4 [24 Points] Predict the major organic product(s) of the following reactions and select the appropriate mechanism among  $S_N1/S_N2/E1/E2$  or choose "no reaction." If multiple stereoisomers would form, draw them all.

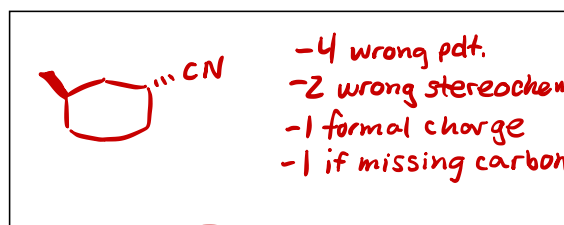
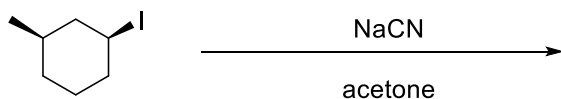
(a)



$S_N1$   $S_N2$  E2 **E1** no reaction  
2 pts

-2 pts for cis alkene  
-4 pts wrong pdt.  
-2 pts. missing/extra carbon

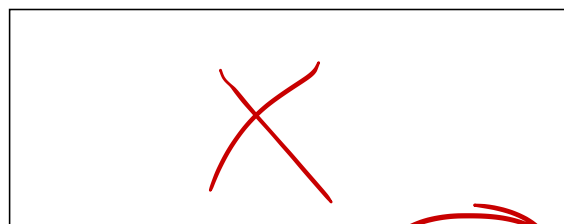
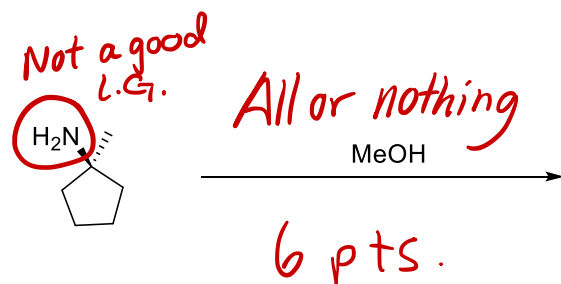
(b)



$S_N1$   **$S_N2$**  E2 E1 no reaction  
2 pts

-4 wrong pdt.  
-2 wrong stereochem  
-1 formal charge  
-1 if missing carbon

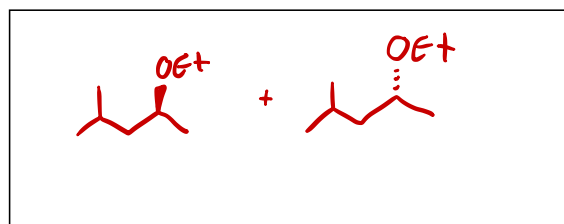
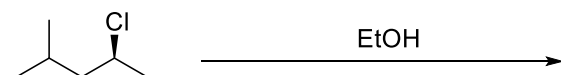
(c)



$S_N1$   $S_N2$  E2 E1 **no reaction**

Not a good L.G.  
All or nothing  
6 pts.

(d)

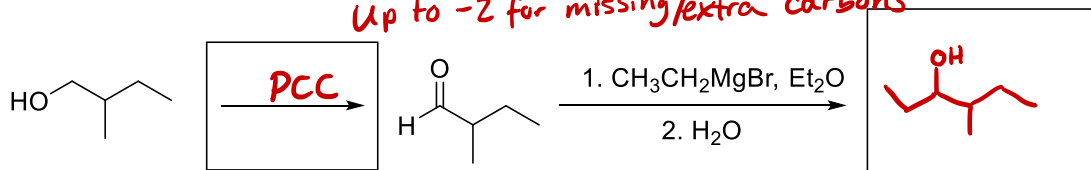


2 pts.  **$S_N1$**   $S_N2$  E2 E1 no reaction

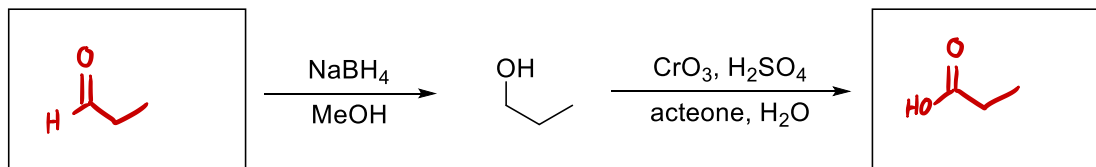
-2 did not draw both stereoisomers  
-4 wrong product  
-1 missing 1 carbon  
-1 for formal charge or protonated pdt(s)

5.1 [16 Points] Predict the missing reagents/reactants/product to complete the following transformations.

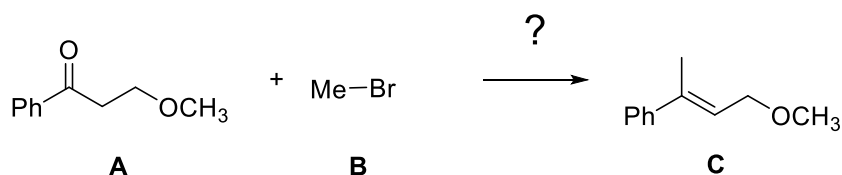
(a)



(b)

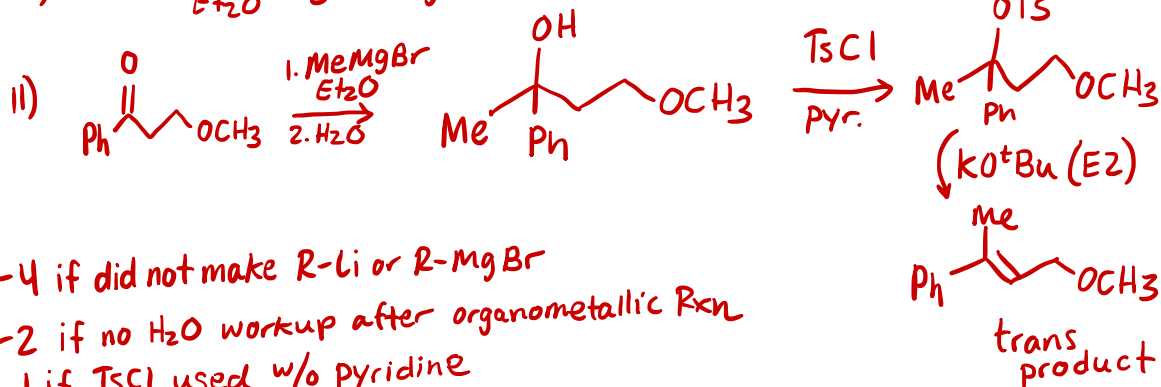
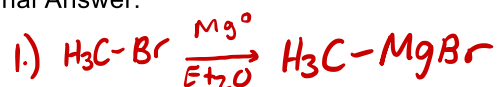


5.2 [12 points] Propose a synthesis for the following conversion (in other words, make compound C using compound A and B as the starting materials and only sources of carbon). You may use common reagents and solvents learned in class. If you use an organometallic reagent, you must show how it is made from the corresponding halide. Do not show arrow-pushing mechanisms in your answer. Use the back of this page as scratch paper if needed.



\* May be other correct syntheses, e.g. dehydration of alcohols to make alkene.

Final Answer:



-4 if did not make R-Li or R-MgBr

-2 if no H<sub>2</sub>O workup after organometallic Rxn

-1 if TsCl used w/o pyridine

-4 if no elimination step

-3 for missing/incorrect reagent but overall correct

-8 for partial plan to correct product but synthesis did not work or many missing reagents.