

CHEM 310 Exam 3

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April 13, 2007

Honor Pledge:

In Part V of the Winthrop University Student Conduct Code, it is stated that "A fundamental tenet of all institutions of higher learning is academic honesty. ... Misrepresentation of someone else's work as one's own is a most serious offense in any academic setting. ... Academic misconduct includes but is not limited to providing or receiving assistance in a manner not authorized by the professor in the creation of work to be submitted for academic evaluation including papers, projects, and examinations ..."

By my signature below, I pledge that I did not commit academic misconduct (cheat) on this examination.

KEY

Printed Name _____

Signature _____

Part 1 _____/20

Part 2 _____/30

Part 3 _____/20

Part 4 _____/10

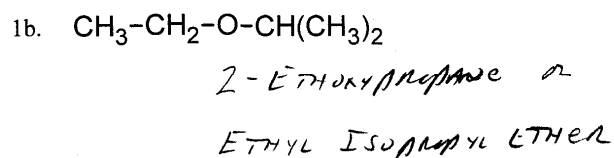
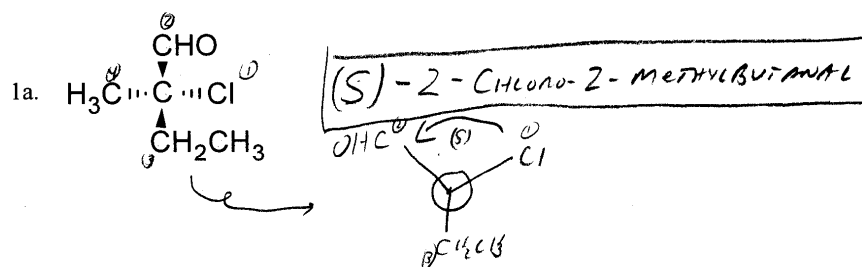
Part 5 _____/20

Total _____/100

1248-1255
1.04-2.04
(21/11-)

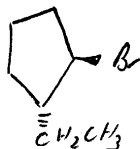
Part 1: Nomenclature (20 pts)

Write IUPAC names for the following compounds (indicate stereochemistry where required):

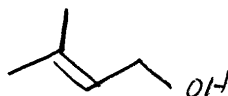


Draw structures corresponding to the following IUPAC names:

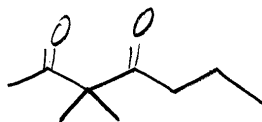
1c. *trans*-1-Bromo-2-ethylcyclopentane



1d. 3-Methyl-2-buten-1-ol

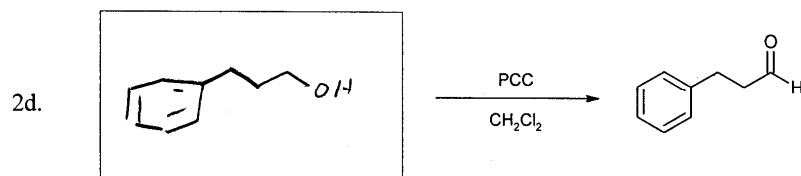
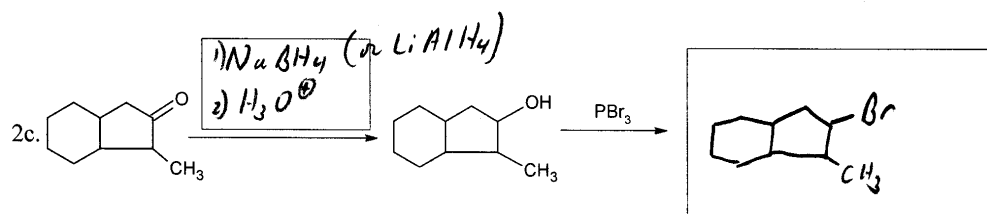
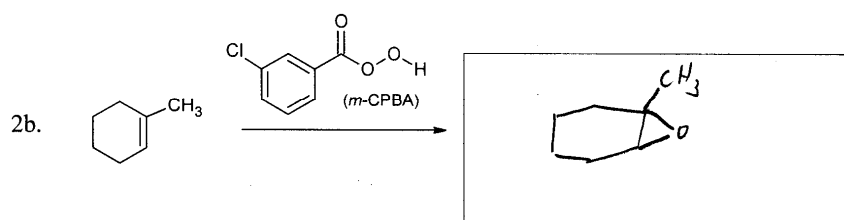
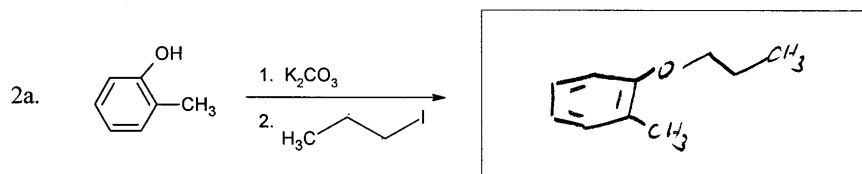


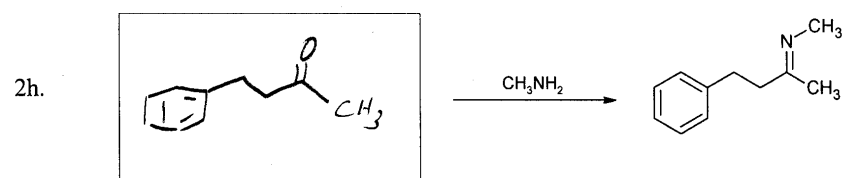
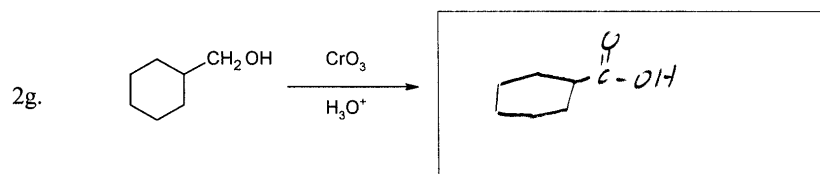
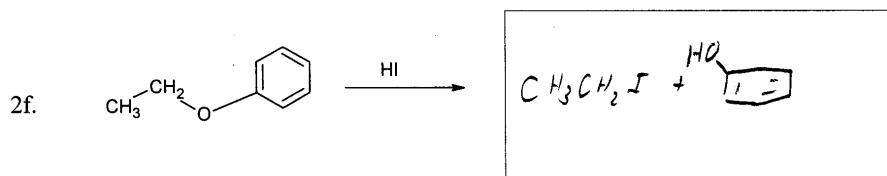
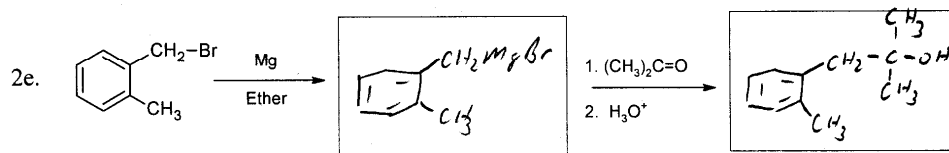
1e. 3,3-Dimethylheptan-2,4-dione



Part 2: Provide the Starting Material, Reagent, or Product (30 pts):

Provide the missing piece (starting material, reagent(s), or product(s)) in the box provided.

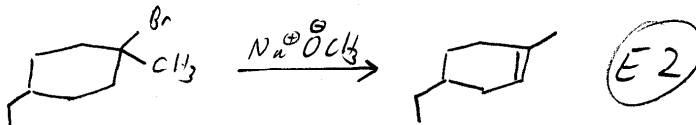




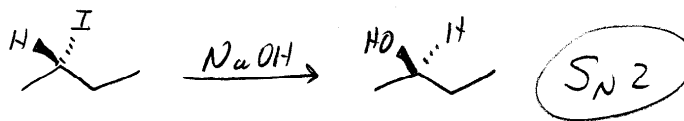
Part 3: Mechanisms (20 pts)

Draw the chemical equations (with structures) described below and indicate whether the mechanism of the reaction is S_N2 , S_N1 , E2 or E1.

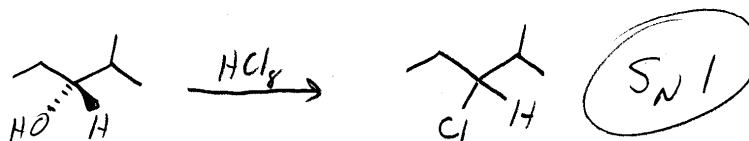
- 3a. 1-Bromo-4-ethyl-1-methylcyclohexane reacts with sodium methoxide ($\text{Na}^+ \text{OCH}_3^-$) to give 4-ethyl-1-methylcyclohexene



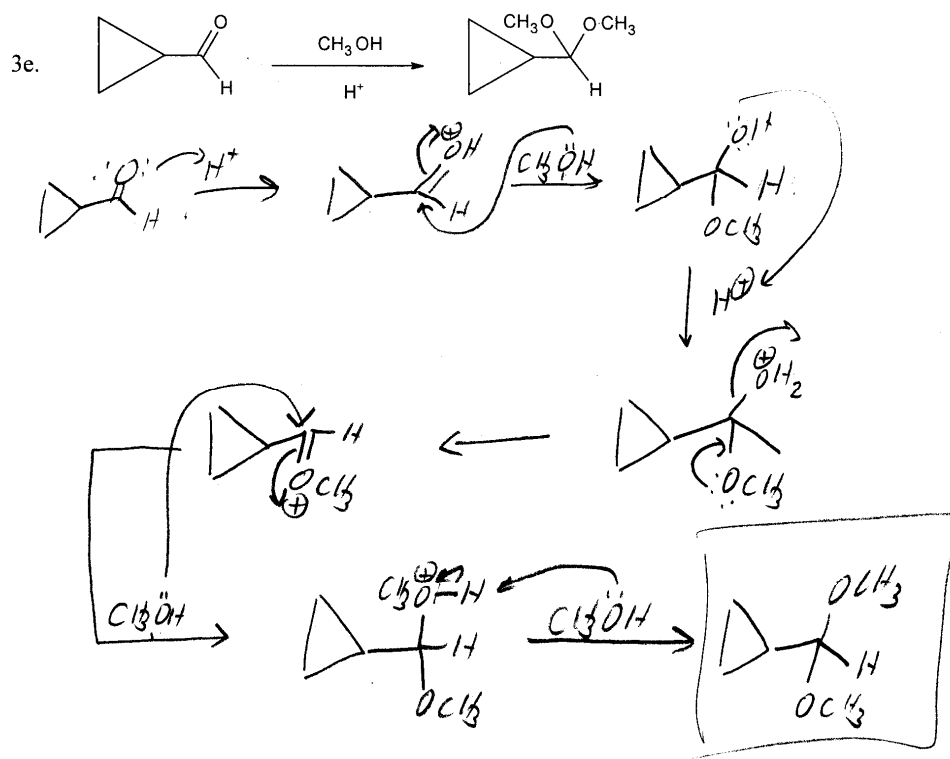
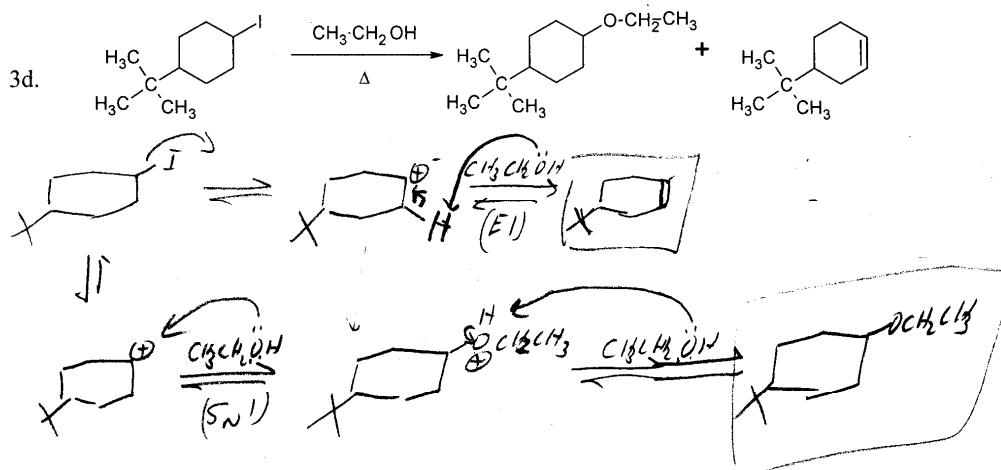
- 3b. (S)-2-Iodobutane reacts with sodium hydroxide to give (R)-butan-2-ol.



- 3c. (R)-2-Methylpentan-3-ol reacts with dry $\text{HCl}_{(g)}$ to give racemic 3-chloro-2-methylpentane

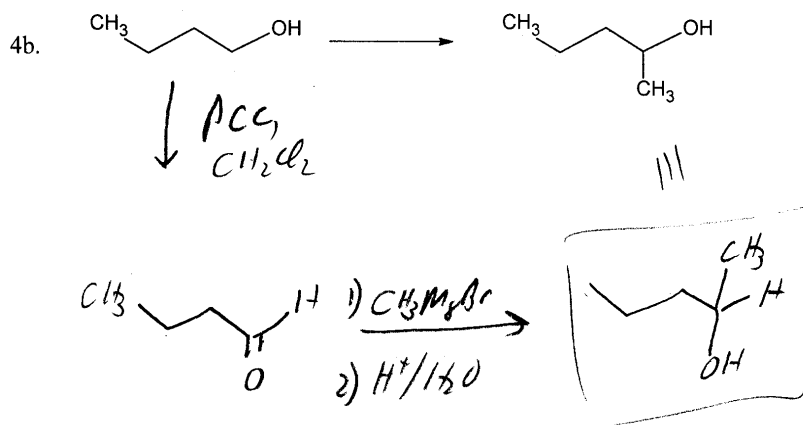
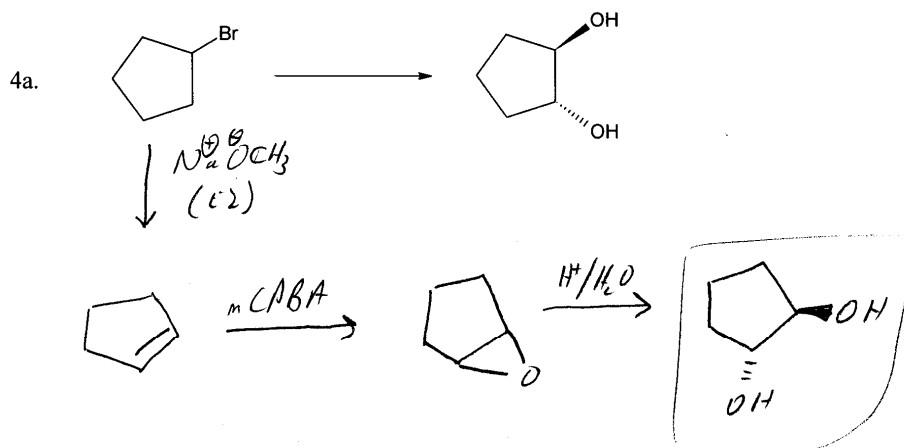


Provide complete arrow-pushing mechanisms for the following transformations:



Part 4: Synthesis (10 pts)

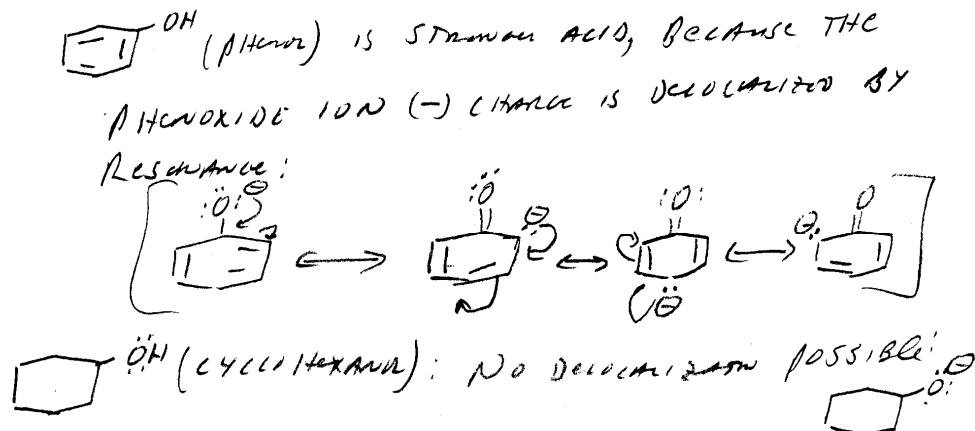
Provide a synthesis of each of the following compounds starting from the indicated compound and any other reagents you need:



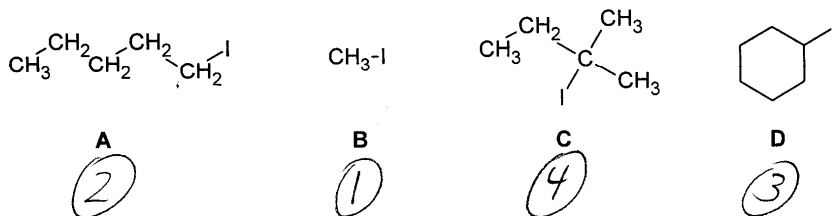
Part 5: General Questions (20 pts)

Provide answers to the following questions. Where applicable, draw structures to support your answers.

- 5a. The pK_a of cyclohexanol is approximately 16, while the pK_a of phenol is approximately 10. Indicate which compound is the stronger acid, and explain the reason for the difference in acidity.

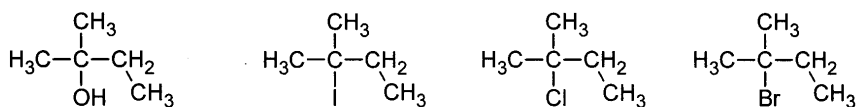


- 5b. Rank the following compounds in order of S_N2 reactivity (1 = fastest, 4 = slowest). Explain your answer.



S_N2 REACTIONS REQUIRE ATTACK OF NUCLEOPHILE FROM THE BACKSIDE OF THE LEAVING GROUP, SO MORE SUBSTITUTION ON CARBON BEARING THE LEAVING GROUP \Rightarrow SLOWER RXN

5c. Rank the following compounds in order of S_N1 reactivity. (1 = fastest, 4 = slowest). Explain your answer.



A
④

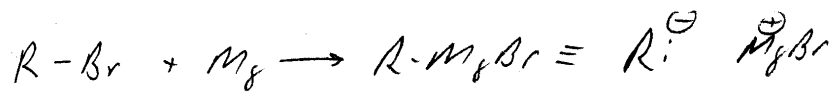
B
①

C
③

D
②

I > Br > Cl >> OH in LEAVING GROUP ABILITY.

5d. Explain why a Grignard reagent cannot be prepared in the presence of water or alcohols.



R^- is a very STRONG BASE & WILL REACT VERY FAST WITH PROTONIC SOLVENTS LIKE H_2O & ROH TO GIVE $\text{R}-\text{H}$