

CHEM 243 ORGANIC CHEMISTRY I
Exam IV PART II, Friday-Monday, December 6-9, 2024

Guidelines for Part II (take home):

- You can use all your class notes.
- You may **not** work together, or get help from any other person.
- You may **not** access the internet, the class web pages, Google, artificial intelligence, etc.
- You may **not** use the answer key to the Study Guide, or to any class worksheets.
- The Part II take home exam should be completed in two hours.

You must return your completed Part II of EXAM IV to me in class on Monday, December 9. I will not accept the exam after 11:00 am on Monday.

I understand and agree to these conditions (signature) _____

Answer all questions in the space provided, continuing on the back if necessary. **Read each question carefully and be sure to answer all parts to each question!** This exam is worth a total of 150 points (Parts I & II are 75 points each).

An answer key to this exam will be linked to the course web page.

(21) 1. _____

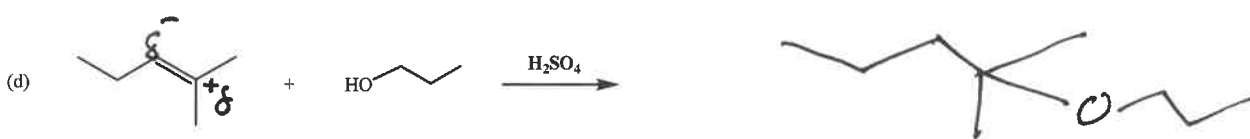
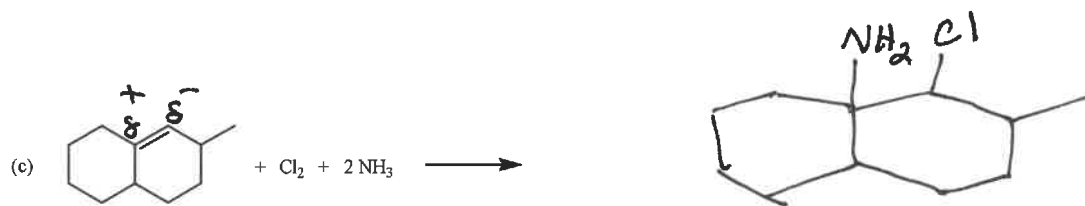
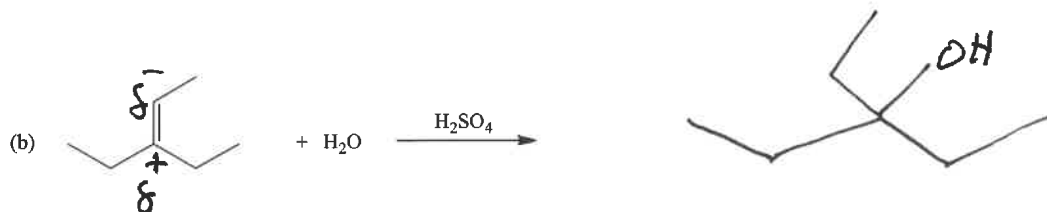
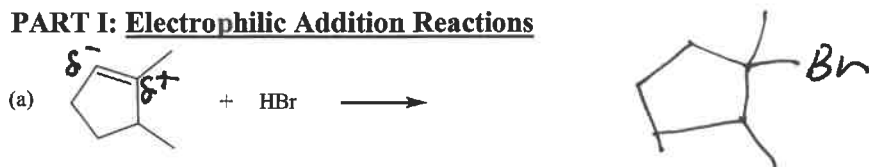
(54) 2. _____

PART II Sub-total (75) = _____

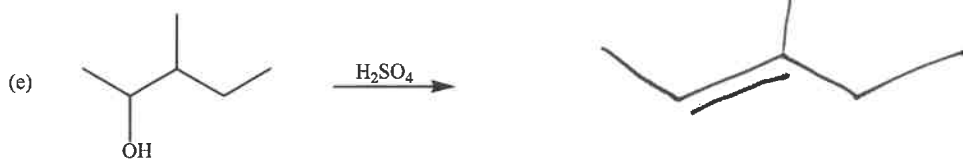
If you have any questions you can email me, but I may be delayed in replying!

1. (21 Points) Reactions. Complete the reactions below by drawing the structure of the major, neutral organic product.
 NOTES: (1) there is one organic product for each reaction, (2) it is NOT necessary to balance these reactions or write the mechanism, and (3) there are NO rearrangements, NO intramolecular reactions, and do NOT worry about stereochemistry.

PART I: Electrophilic Addition Reactions



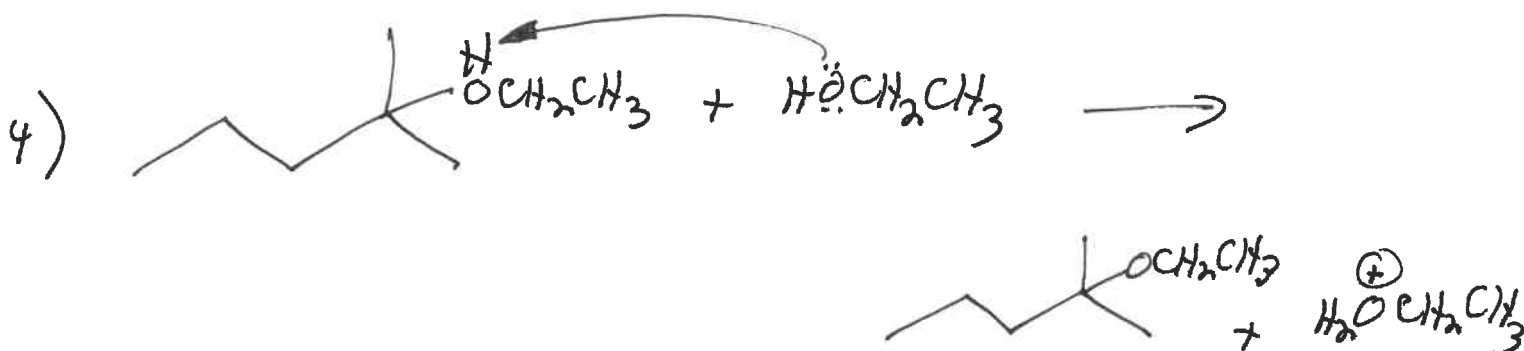
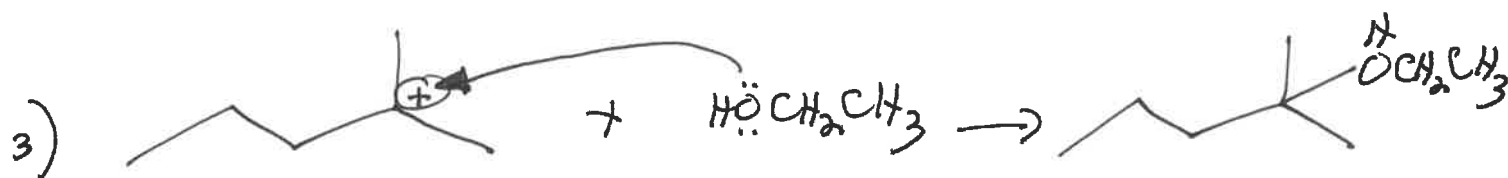
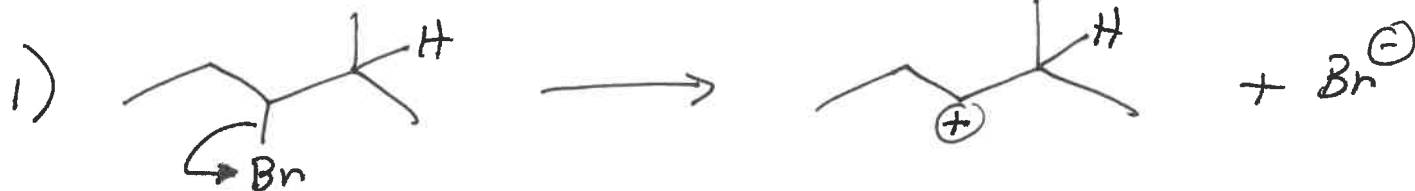
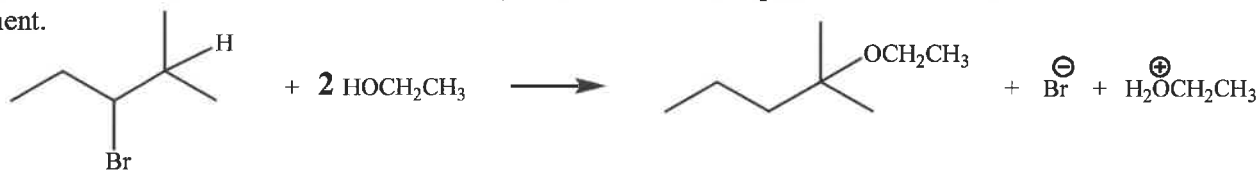
PART II: Reactions of Alcohols



2. (54 points) Mechanisms.

(a) SN1 Addition (with Rearrangement) of an Alcohol to an Alkyl Halide (4 steps).

(i) Write a complete mechanism that explains the formation of all products in the balanced net reaction shown below. Your mechanism must consist of a series of individual, balanced chemical equations, and curved arrows to show electron pair movement.



(ii) Note that there is a "2" in front of the alcohol in the balanced equation for the reaction in question above. What role(s) do the two molecules of alcohol play in this reaction? CIRCLE the best answer(s):

Nucleophile

Leaving Group

Catalyst

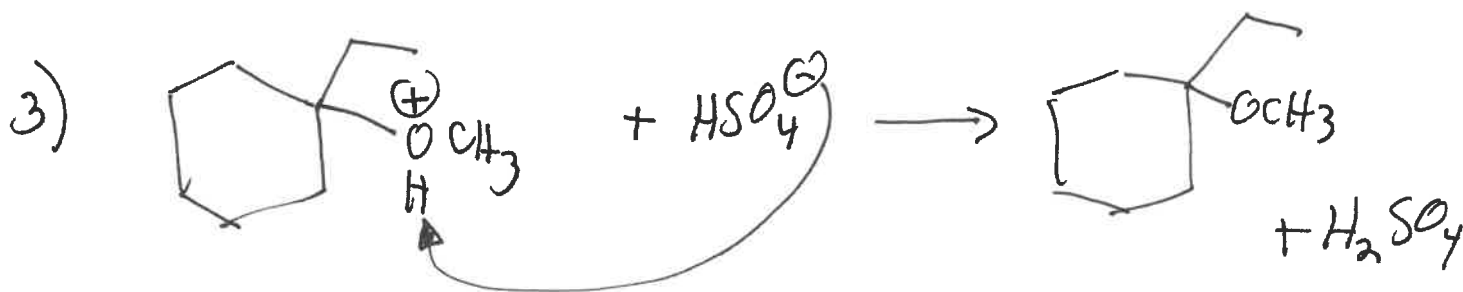
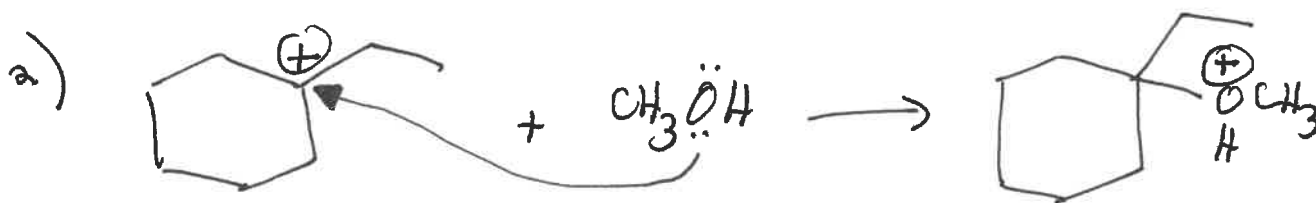
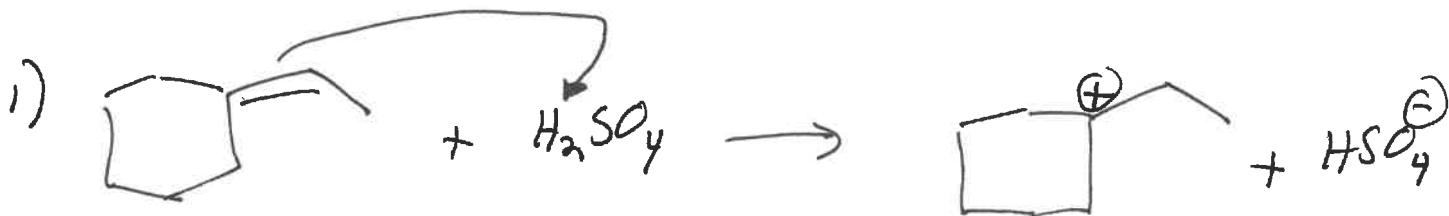
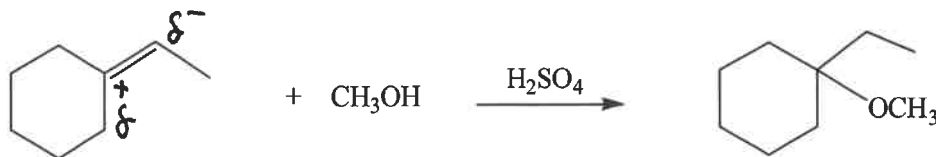
Acid

Base

provides an H⁺ electrophile

(b) Electrophilic Addition of an Alcohol to an Alkene to form an Ether (3 steps).

(i) Write a complete mechanism that explains the formation of all products in the balanced net reaction shown below. Your mechanism must consist of a series of individual, balanced chemical equations, and curved arrows to show electron pair movement.



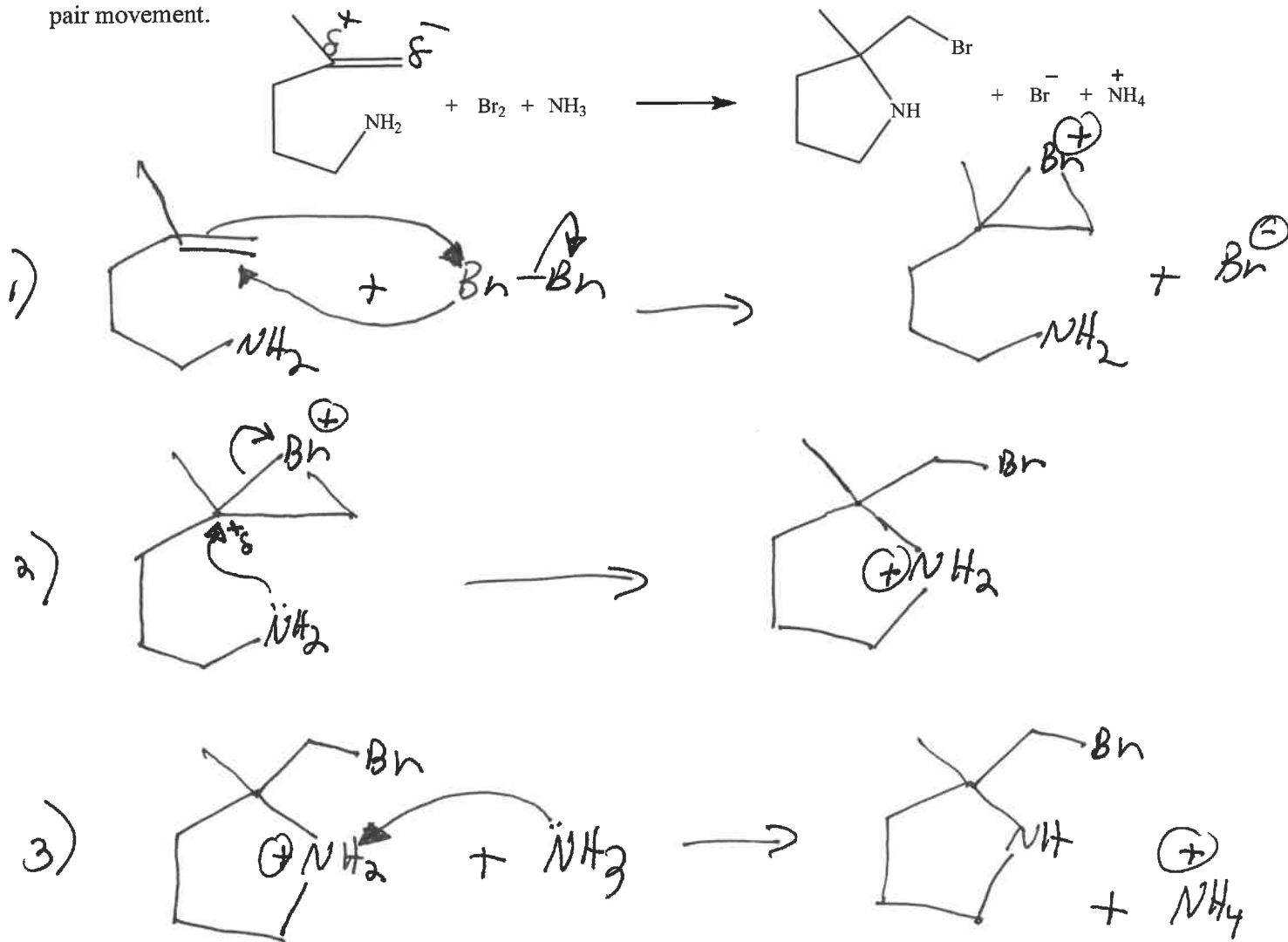
(ii) In which Step(s) is/are H_2SO_4 used in the mechanism you wrote above: step 1 only

(iii) Explain the role(s) of H_2SO_4 in your mechanism above. **Be specific!**

H_2SO_4 is an acid catalyst in step #1. It supplies the H^+ electrophile to the δ^- carbon of the alkene, forming a carbocation and HSO_4^- .

(c) Intramolecular Electrophilic Addition of Br₂ and a Nucleophile to an Alkene (3 Steps).

(i) Write a complete mechanism that explains the formation of all products in the balanced net reaction shown below. Your mechanism must consist of a series of individual, balanced chemical equations, and curved arrows to show electron pair movement.



(ii) Which of the following best describes **all roles** played by NH₃ in this reaction? Circle all that apply.

Nucleophile

Leaving Group

Catalyst

Acid

 Baseprovides an H⁺ electrophile

(iii) Explain what is happening in Step #2 of the mechanism you wrote above. Be specific!

In step #2 the R-NH₂ acts as a nucleophile, adding to the δ^+ carbon of the bromonium ion, forming a ring with the N having a \oplus charge & opening the bromonium ion ring.