

NAME (PRINT CLEARLY) Answer Key

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I am on my honor that I will not discuss the contents of this exam with anyone until after 6:00 pm on Monday, December 9, and will notify Dr. Brush if I am made aware of any cases of academic dishonesty.

I understand and agree to these conditions (signature) _____

CHEM 243 ORGANIC CHEMISTRY I
Exam IV PART I, Friday, December 6, 2024

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.

(32) 1. _____

(25) 2. _____

(5) 3. _____

(13) 4. _____

PART I Sub-total (75) = _____

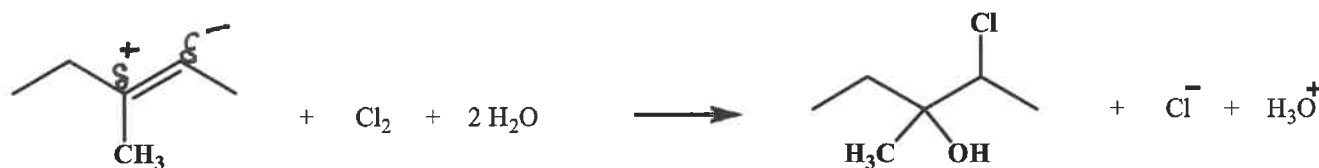
PART I _____ + PART II _____ = EXAM IV Grade _____ (150) = _____ %

IF YOU DO NOT UNDERSTAND A QUESTION, PLEASE ASK FOR AN EXPLANATION!

1. (32 Points) Answer the following questions as indicated.

(a) Indicate whether the following statements are **True** or **False**.T Rearrangements are most likely to occur in SN1 and E1 reactionsF In the addition of ^-CN to a bromonium ion, the nucleophile adds to the least substituted carbonT In electrophilic addition reactions, the electrophile has a full or partial positive chargeF In the electrophilic addition of Br_2 to an alkene, the key intermediate is called a carbocationF In electrophilic addition reactions, Na^+ is a better electrophile than H^+ T In the electrophilic addition of Cl_2 to an alkene, the two Cl atoms add to opposite sides of the double bond

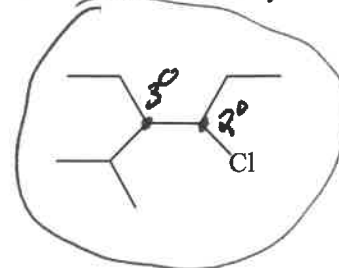
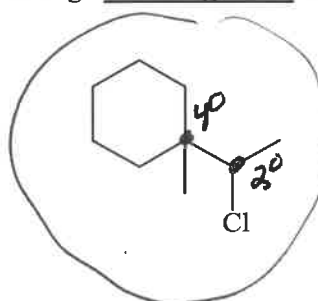
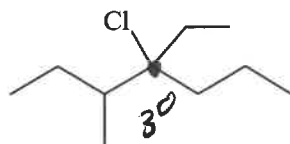
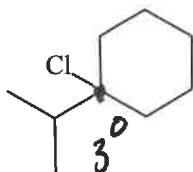
(b) Answer the following questions based on the electrophilic addition reaction drawn below:

(i) In the alkene, label the sp^2 carbons with δ^+ and δ^- (ii) (Circle the correct responses) The (H_2O , Cl^- , Cl^+) species becomes bonded to the δ^+ sp^2 carbon, and this species is referred to as the (nucleophile, electrophile, acid, base).(iii) (Circle the correct responses) The (H_2O , Cl^- , Cl^+) species becomes bonded to the δ^- sp^2 carbon, and this species is referred to as the (nucleophile, electrophile, acid, base).(iv) Which of the following best describes **all** roles played by H_2O in this reaction? Circle all that apply.Nucleophile

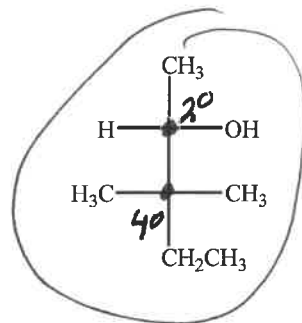
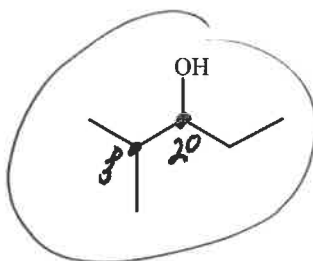
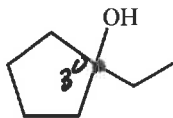
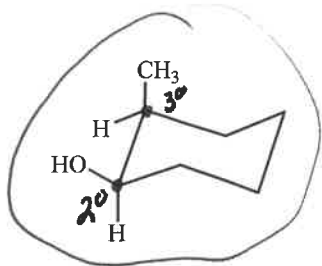
Leaving Group

Catalyst

Acid

Baseprovides the H^+ electrophile(c) Which of the following molecules will be most likely to undergo **rearrangement** in an SN1 reaction? Circle your choice(s).

(d) Which of the following alcohols will most likely undergo rearrangement upon **E1 dehydration** with H_2SO_4 ? Circle your choice(s).



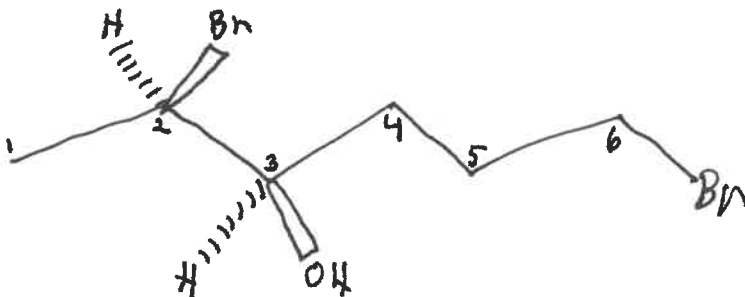
(e) Explain your reasoning to question (d) above.

Rearrangements are likely to occur when a 2° carbocation is formed adjacent to a 3° or 4° carbon. The shift of an "H" or "CH₃" will produce a more stable 3° carbocation.

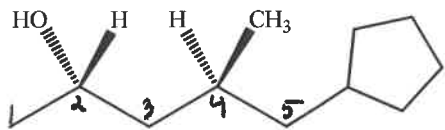
2. (25 Points) Alcohol Nomenclature.

- If a name is given draw an accurate zig-zag structure (use wedge and dash bonds for all chiral carbons).
- If a structure is drawn, give an accurate IUPAC name (assign configurations using the R/S prefix).

(a) (2R, 3R)-2,6-dibromo-3-hexanol

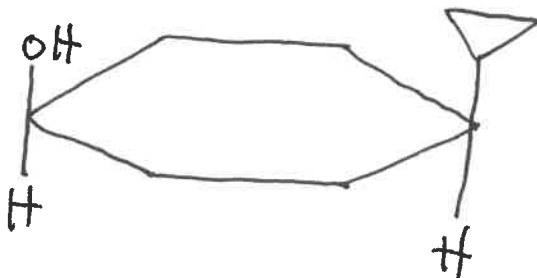


(b)



(2S, 4S) - 5-cyclopentyl - 4-methyl - 2-pentanol

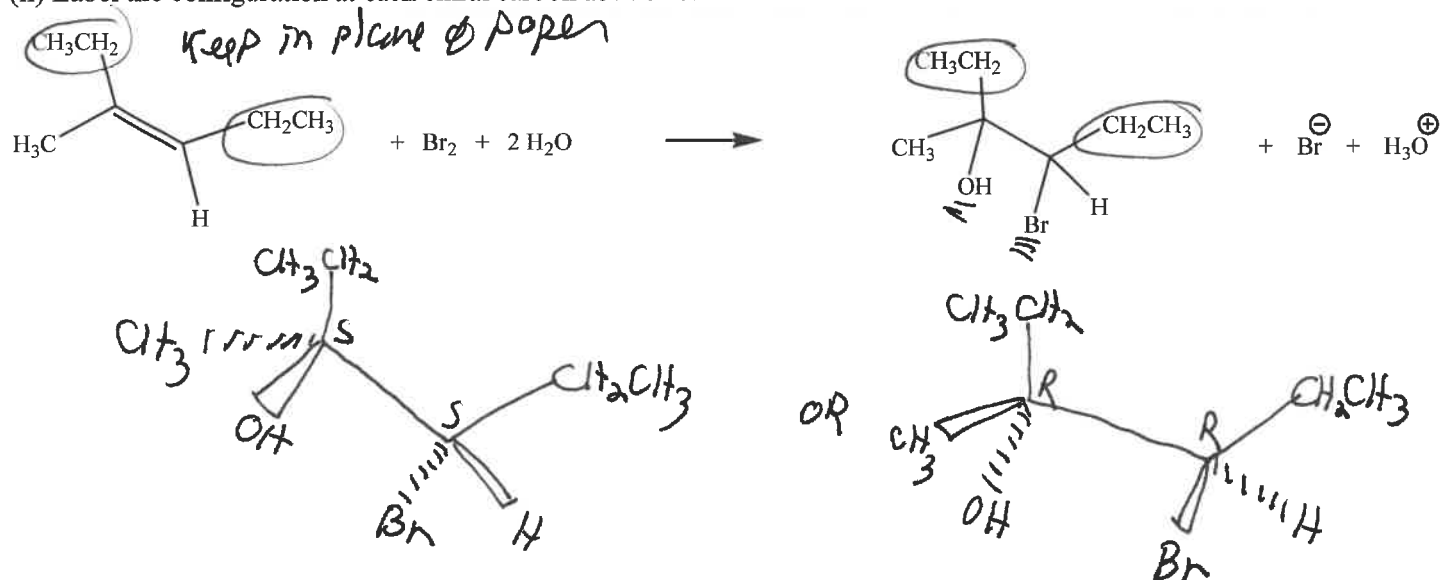
(c) cis-4-cyclopropyl cyclohexanol



3. (5 Points) Stereochemistry in the Electrophilic Addition of Br₂ and a Nucleophile.

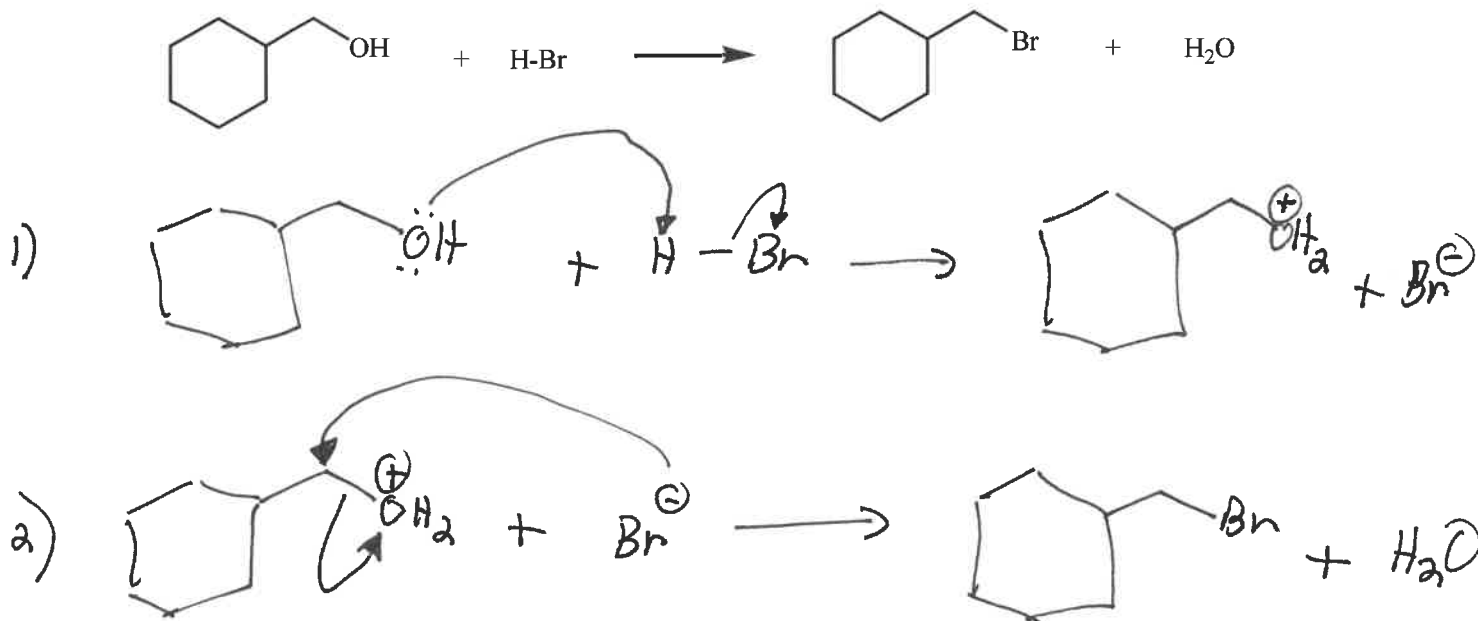
(i) Draw the 3D structure of any ONE of the two enantiomer products of the reaction shown below. Use proper wedge and dash bonds.

(ii) Label the configuration at each chiral carbon as R or S.



4. (13 points) Mechanisms.

(a) **SN2 Addition of HBr to an Alcohol (2 steps).** Write a complete mechanism that explains the formation of all products in the balanced Net Equation shown below. Your mechanism must consist of a series of individual, balanced chemical equations, and curved arrows to show electron pair movement.



(b) In the reaction given above, what roles are played by the **H-Br** ions? CIRCLE all the best answer(s):

Nucleophile

Leaving Group

Catalyst

Acid

Base

provides an H⁺ electrophile