CHEM 3311
Fall 2001
Exam II (October 25)

A. Attachments

Periodic Table

B. Special Instructions

This is a "Closed Book" exam. You are permitted to use molecular models. Answers should be written clearly to receive partial credit. Additional scratch paper will not be graded or collected. You have an hour and thirty minutes to complete the exam.

1. (25 points) Multiple Choice: Circle the **best** possible answer.

(i) Select the correct IUPAC name for the compound incorrectly labeled as 2-ethyl-2-pentene.

(A) 3-Methyl-3-pentene (B) 4-Methyl-3-pentene
(C) 3-Methyl-3-hexene (D) 3-Heptene

(ii) What is the slow, rate-determining step in the acid-catalyzed dehydration of 2-methyl-2-propanol

(A) The simultaneous loss of a b-hydrogen and water from the oxonium ion.
(B) Protonation of the alcohol to form an oxonium ion.
(C) Loss of water from the oxonium ion to form a carbocation.
(D) Loss of a beta-hydrogen from the carbocation to form an alkene.

(iii) Select the alkene that is thermodynamically the most stable.

(A) trans-3-hexene (B) cis-3-hexene
(C) 1-hexene (D) 2-methyl-2-pentene

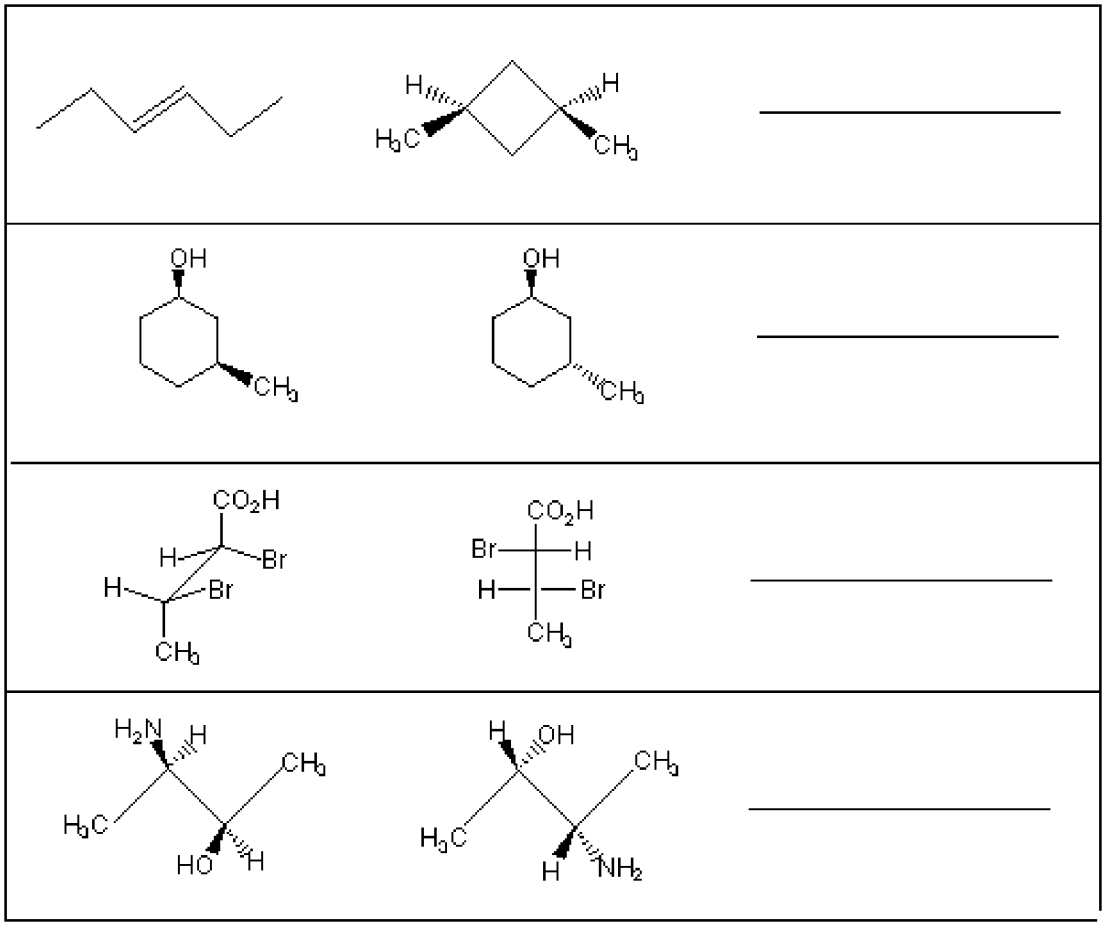
(iv) The reaction of 1-butene with bromine, Br_2, in aqueous solution gives primarily 1-bromo-2-butanol. The nucleophilic species that leads to the above product is:

(A) Br_2 (B) Br^-
(C) H_2O (D) OH^-

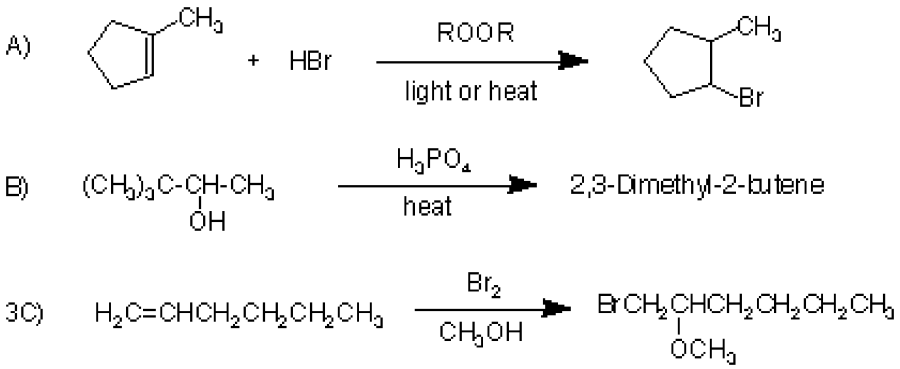
(v) Compound X, $C_5H_{10}O$, is optically active. The compound consumes one equivalent of H_2 to form $C_5H_{12}O$. The hydrogenation product is also optically active. The structure of compound X is most likely to be:

(A) $H_2C{=}CHCH_2CH_2CH_2OH$ (B) *trans*-$CH_3CH{=}CHCH_2CH_2OH$
(C) $CH_3CH_2CH(OH)CH{=}CH_2$ (D) $CH_3CH(OH)CH_2CH{=}CH_2$

2. (20 points) Label each of the following pairs of structures as conformers, constitutional (or structural) isomers, diastereomers, enantiomers, or the same.



3. (20 points) Write an arrow pushing mechanism for **ANY TWO** of the following transformations. Be sure to show all intermediates in the pathway from starting material to product, but do not show transition states. All structures should have proper valence bond structures with correct formal charges and lone pairs as necessary. If you attempt all three, be sure to CROSS OUT the one that SHOULD NOT BE GRADED. If you do not follow the guidelines, only the first two mechanisms will be graded.

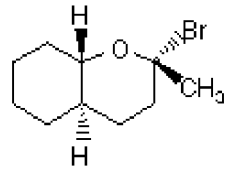


4. (10 points) 5-Bromononane on treatment with potassium ethoxide in ethanol produces a mixture of *cis*-4-nonene (23%) and *trans*-4-nonene (77%). Draw Newman projections of 5-bromononane, **looking down the C5-C6 bond**, showing the conformations that lead to *cis*-4-nonene and *trans*-4-nonene, respectively. Assume that C5 is closest to you and C6 is pointing away from you.

Conformation leading to *cis*-4-nonene	Conformation leading to *trans*-4-nonene

Based on your conformations, explain in one or two sentences, why the *trans*-alkene is the major product.

5. (25 points) Write the structure of the single major product of each of the following reactions. If two or more major products are formed, write the structures of both. Show the stereochemistry, where appropriate, using wedges and dashes.

A) 

$CH_3O^-Na^+$, CH_3OH → E2

B) (E)-2-butene (Draw structure) → (Br_2, H_2O)

C) 1,5,5-Trimethylcyclopentene (Draw structure) → (1) B_2H_6, THF; (2) H_2O_2, OH^-

D) 2-methyl-2-butene + CH_3COOH (Draw structure) →

E) $HOH_2C\text{-}CH_2\text{-}CH{=}CH_2$ (Write correct name for 3 bonus points) → (50% H_2SO_4/H_2O)