If you do not want your graded quiz placed in the box outside my office, then please tick here.

Answer all the questions.

1) (6pts) Assign (R) or (S) to all the chiral centers in the following molecules.

(a) \[
\text{HO} \\
\text{F} \quad \text{Cl} \\
\text{CH}_3
\]

(b) \[
\text{CF}_3 \\
\text{H} \quad \text{Br} \\
\text{Cl} \quad \text{Cl} \\
\text{CF}_3
\]

(c) \[
\text{F} \quad \text{F} \\
\text{H} \quad \text{O}
\]

2) (3pts) Also indicate whether each molecule is chiral or achiral.

(a)

(b)

(c)

3) (1pt) True or False? A molecule can be chiral even though it has a mirror plane of symmetry.
4) (12pts) 2-Butene can exist as two geometric isomers, and one is of lower energy than the other.

(i) draw the two isomers

(ii) identify which is cis and which is trans

(iii) assign Z or E to each isomer

(iv) explain why one is more stable than the other.
5) (5pts) Name this compound in IUPAC form.

\[
\text{Br} \quad \text{Br}
\]

6) (10pts) For each pair of molecules, circle the one which will undergo S_N1 type reactions the quickest, and write a sentence to explain your answer/guess.

(a) \( \text{F} - \text{C}_8\text{H}_8 \) \( \text{Cl} - \text{C}_8\text{H}_8 \)

(b) \( \text{Br} - \text{C}_8\text{H}_8 \) \( \text{Br} - \text{C}_8\text{H}_8 \)

(c) \( \text{C}_8\text{H}_8 - \text{I} \) \( \text{C}_8\text{H}_8 - \text{CH}_2\text{I} \)

(d) \( \text{Br} - \text{C}_8\text{H}_8 = \text{C}_8\text{H}_8 \) \( \text{Br} - \text{C}_8\text{H}_8 = \text{C}_8\text{H}_8 \)

(e) \( \text{C}_8\text{H}_8 - \text{CH}_2\text{F} \) \( \text{C}_8\text{H}_8 - \text{F} \)

7) (6pts) Draw \text{trans}-1,2-dibromo-1-ethylocyclopentane.
8) (18pts) The molecule below can form three different elimination products when it reacts with potassium t-butoxide via the E1 mechanism.

(i) Draw the three different products

(ii) Provide a mechanism for the formation of each product

(iii) Two of the products are formed in much larger amounts than the third. Indicate which is the minor product.
9) (7pts) The below enantiomer undergoes $S_N2$ reaction with sodium methoxide.

\[
\text{CH}_3\text{Br} + \text{CH}_3\text{O}^-\text{Na} \rightarrow \text{CH}_3\text{O}^-\text{Na} \quad (S)
\]

(i) Draw the product or products.

(ii) Will the product of this reaction be totally (R), totally (S) or a mixture of both?

(iii) Is this an example of a stereospecific or non-stereospecific reaction?

(iv) Justify your answer to (iii)
10) (22pts) Write above the arrow the best reagents to use for each of the following transformations.

(a) \[ \begin{array}{c}
\text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2 \\
\text{H} \quad \text{CH}_3
\end{array} \quad \text{H} \quad \begin{array}{c}
\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \\
\text{H}_3\text{C} \quad \text{H}
\end{array} \]

(b) \[ \begin{array}{c}
\text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2 \\
\text{H} \quad \text{CH}_3
\end{array} \quad \text{H} \quad \begin{array}{c}
\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \\
\text{H}_3\text{C} \quad \text{Br}
\end{array} \]

(c) \[ \begin{array}{c}
\text{CH}_3\text{CH} = \text{CH}_2 \\
\text{CH}_3 \quad \text{CH}_3
\end{array} \quad \text{H} \quad \begin{array}{c}
\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \\
\text{CH}_3\text{CH}_2 \quad \text{HO}
\end{array} \]

(d) \[ \begin{array}{c}
\text{CH}_3\text{CH} = \text{CH}_2 \\
\text{CH}_3 \quad \text{CH}_3
\end{array} \quad \text{H} \quad \begin{array}{c}
\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \\
\text{CH}_3\text{CH}_2 \quad \text{HO}
\end{array} \]

(e) \[ \begin{array}{c}
\text{C}_5\text{H}_8 \\
\text{C}_5\text{H}_8
\end{array} \quad \text{C}_5\text{H}_8 \quad \text{C}_5\text{H}_8 \quad \text{C}_5\text{H}_8\]
(iii) circle any anti Markovnikov products on the previous six reactions.

(iv) Provide an alternative method for part (d)

11) (10pts) Write the mechanism for any one of the Anti-Markovnikov additions in (10).
Fall 99 Exam 2. Chapters 5-8

Name: I K A N  H E A R U

If you do not want your graded quiz placed in the box outside my office, then please tick here ______

Answer all the questions.

1) (6pts) Assign (R) or (S) to all the chiral centers in the following molecules.

(a)

(b)

(c)

-1 if 'extra' chiral center

2) (3pts) Also indicate whether each molecule is chiral or achiral.

(a) Chiral

(b) Chiral

(c) Chiral

3) (1pt) True or False? A molecule can be chiral even though it has a mirror plane of symmetry.

FALSE
4) (12pts) 2-Butene can exist as two geometric isomers, and one is of lower energy than the other.

(i) draw the two isomers

(ii) identify which is cis and which is trans

(iii) assign Z or E to each isomer

(iv) explain why one is more stable than the other.

The trans is more stable due to less steric hindrance. The bulky groups are further away from one another in space, and thus produce the least amount of e-/e-repulsions.
5) (5pts) Name this compound in IUPAC form.

5-bromo-(2E, 4E)-heptadiene

6) (10pts) For each pair of molecules, circle the one which will undergo Sn1 type reactions the quickest, and write a sentence to explain your answer/guess.

(a) F-\text{cyclohexane} \quad \text{Cl-\text{cyclohexane}}

Cl better leaving group than F

(b) \text{Br-\text{cyclohexane}} \quad \text{Br-\text{cyclohexane}}

Tertiary carbocation more stable than secondary
cation

(c) \text{I-\text{cyclohexane}} \quad \text{CH}_2\text{I-\text{cyclohexane}}

Secondary carbocation more stable than primary carbocation.

(d) \text{Br-\text{allyl}} \quad \text{Br-\text{allyl}}

Allylic carbocation has resonance stabilization

(e) \text{CH}_2\text{F-phenyl} \quad \text{F-phenyl}

Benzylic carbon has resonance stabilization

7) (6pts) Draw trans-1,2-dibromo-1-ethylcyclopentane.
8) (18pts) The molecule below can form three different elimination products when it reacts with potassium t-butoxide via the E1 mechanism.

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{Br} \\
\text{CH}_3 & \quad \text{K}^+\text{O}^-'\text{Bu}
\end{align*}
\]

(i) Draw the three different products

(ii) Provide a mechanism for the formation of each product

(iii) Two of the products are formed in much larger amounts than the third. Indicate which is the minor product.
(iv) Justify your answer to (iii)

The minor product is the least substituted alkene product, the disubstituted alkene is less stable than the other 2 tri-substituted alkenes. This is Slatzeyff's rule.

9) (7pts) The below enantiomer undergoes $S_N2$ reaction with sodium methoxide.

(i) Draw the product or products.

(ii) Will the product of this reaction be totally (R), totally (S) or a mixture of both?

Totally R

(iii) Is this an example of a stereospecific or non-stereospecific reaction?

Stereo specific
10) (22pts) Write above the arrow the best reagents to use for each of the following transformations.

(a) \[ \text{H-Br} \]

(b) \[ \text{H-Br, Peroxides} \]

(c) \[ \text{BH}_3, \text{H}_2\text{O}_2 \]

(d) \[ \text{H}_2\text{O}/\text{H}^+ \] or \[ \text{CH}_3\text{SO}_4 \text{H}^+ \text{ then H}_2\text{O} \] or \[ \text{Hg(OAc)}_2 \text{ and H}_2\text{O} \] then \[ \text{NaBH}_4 \] or \[ \text{OsO}_4, \text{H}_2\text{O}_2 \] or \[ \text{KMnO}_4, \text{NaOH}, \text{H}_2\text{O} \]
(iii) circle any anti Markovnikov products on the previous six reactions.

(iv) Provide an alternative method for part (d)

11) (10 pts) Write the mechanism for any one of the Anti-Markovnikov additions in (10).