Chemistry 334

Examination #1

September 30, 2014

Professor Charonnat

Name: _____________________________

Be certain that your examination has five (5) pages including this one.

Put your name on each page of this examination booklet.

By putting your name on this examination booklet you agree to abide by California State University, Northridge policies of academic honesty and integrity.

Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.
1. (25 points)

Draw the specific reagent(s) necessary to effect the following three (3) transformations. If more than one reaction is involved in an answer, be certain to distinguish the individual steps clearly.

A. 

\[ \text{H}_3\text{C}-\text{CH} = \text{CH}-\text{CH}_3 \rightarrow \text{CH}_3\text{C} = \text{CH}_2-\text{OH} \]

(racemic)

B. 

\[ \text{CH}_3-\text{CH}_2 = \text{CH}_3 \rightarrow \text{CH}_3-\text{CH}_2\text{S}-\text{CH}_3 \]

C. 

\[ \text{H}_3\text{C}-\text{CH} = \text{CH}-\text{I} \rightarrow \text{H}_3\text{C}-\text{CH} = \text{CH}-\text{CH}_3 \]
2. (25 points)

Circle the number that corresponds to the correct answer for each of the following five (5) questions.

A. The sulfonium salt, S-adenosylmethionine (SAM), acts biochemically as
   1. an alkylating agent
   2. a reducing agent
   3. an oxidizing agent

B. The electrophilic aromatic nitration of toluene with sulfuric acid/nitric acid primarily affords
   1. the meta substitution product
   2. the ortho and para substitution products
   3. roughly equal amounts of the ortho, meta, and para substitution products

C. Which of the following compounds has the largest ultraviolet $\lambda_{\text{max}}$?
   1. (3E,5E)-nona-1,3,5,8-tetraene
   2. (3E,6E)-nona-1,3,6,8-tetraene
   3. (3E,5E,7E)-nona-1,3,5,7-tetraene

D. Which of the following compounds is most likely to react with sodium ethoxide to form an ether?
   1. bromobenzene
   2. 3-bromoprop-1-ene
   3. 2-bromo-2-methylbutane

E. Which of the following compounds is aromatic?
   1.
   \[ \text{Diagram} \]
   2.
   \[ \text{Diagram} \]
   3.
   \[ \text{Diagram} \]
3. (10 points)

Use IUPAC nomenclature to write the systematic name of the following epoxide.

![Epoxide structure]

4. (25 points)

Draw the mechanism of the following reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates. Denote all unshared electrons, nonzero formal charges, countercharges, and reversibility or irreversibility. Draw all important resonance contributors for intermediates. Finally, explain why racemic, not optically-active products are obtained.

![Reaction mechanism]

\[ \text{H}_3\text{C} - \text{C} - \text{CH}_3 \quad \overset{\text{excess HBr}^+}{\longrightarrow} \quad \text{H}_3\text{C} - \text{C} - \text{CH}_3 + \text{H}^+ - \text{OH}_2 - \text{Br}^- \]

(racemic)
5. (15 points)

Use letters to label all the sets of chemically equivalent protons for the following aromatic compound. Then draw an annotated tree diagram for proton $H_a$. Specify and estimate quantitatively all the coupling constants for $H_a$ in the tree diagram.

![Aromatic Compound Diagram](attachment:image.png)

Congratulations!

1. /25
2. /25
3. /10
4. /25
5. /15
Total: /100