Chemistry 334

Examination #2

October 29, 2012                  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 structure of the expected major organic product for each of the following five (5) questions. Specify stereochemistry, if relevant.

A.

\[ \text{H}_3\text{C} - \text{C} = \text{C} - \text{H} \]

\[ \xrightarrow{\text{a.) (Si)}_2\text{BH}} \]

\[ \xrightarrow{\text{b.) aq. NaOH, H}_2\text{O}_2} \]

B.

\[ \text{product 1A} \xrightarrow{\text{Ph}_3\text{PCHCH}_3} \]

"salt-free" conditions

C.

\[ \text{H}_3\text{CO}_2\text{C} - \text{CH}_3 \]

\[ \xrightarrow{\text{C}} \]

D.

\[ \text{H}_3\text{C} - \text{O} \]

\[ \xrightarrow{\text{1.) SOCl}_2} \]

\[ \xrightarrow{\text{2.) H}_3\text{CCO}_2\text{Na}} \]

E.

\[ \text{H}_3\text{C} - \text{CH}_3 \]

\[ \xrightarrow{\text{a.) O}_3} \]

\[ \xrightarrow{\text{b.) H}_3\text{CSCH}_3} \]
2. (25 points)

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

A. The reaction of phenylmagnesium bromide with heptan-3-one affords
   1. an achiral product
   2. an optically active product
   3. a racemic mixture

B. Lithium aluminum hydride reduction of \( N,N \)-diethyldecanamide yields an
   1. aldehyde
   2. imine
   3. amine

C. Which of the following carboxylic acid derivatives is hydrolyzed most easily?
   1. butanoyl bromide
   2. ethyl butanoate
   3. butanoic propanoic anhydride

D. Which of the following compounds has a proton that is most easily exchanged with \( D_2\)O?
   1. 3-methylpentanoic acid
   2. 3-methylpentanal
   3. 3-methylpentanenitrile

E. What reagents bond to the carbonyl carbon of ketones?
   1. electrophiles
   2. nucleophiles
   3. both electrophiles and nucleophiles
3. (30 points)

Draw the mechanism of the following reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates and denote all unshared electrons, formal charges, and countercharges where appropriate.

\[
\begin{align*}
\text{H}_3\text{C} &\quad \rightarrow \quad \text{H}_3\text{C} \\
| & \quad \text{Ph} \\
\text{aq. HCl} & \quad \rightarrow \\
\text{H}_3\text{C} &\quad \rightarrow \quad \text{H}_3\text{C} \\
| & \quad \text{Ph} \\
+ & \quad \text{NH}_4^+ \quad \text{Cl}^-
\end{align*}
\]
4. (20 points)

Answer the following two (2) questions precisely, succinctly, and with correct grammar.

A. What is the range of numerical values for the Bürgi-Dunitz angle? What is the relevance of the Bürgi-Dunitz angle to the reactions of carbonyl compounds?

B. Why is the pKₐ of 2-fluorohexanoic acid less than the corresponding value for 3-fluorohexanoic acid?