CHEM 2312
E5 practice iii

1. (32 points) Circle the letter on the right which corresponds to the answer to each question. There is only one correct answer for each question.

(i) Which of the following could be prepared by a malonic ester synthesis?

- A. \( \text{Ph-CH(OH)CO}_2 \)
- B. \( \text{Ph-CH(OH)CO}_2 \)
- C. \( \text{Ph-CH(OH)CO}_2 \)
- D. \( \text{Ph-CH(OH)CO}_2 \)

(ii) Which of the following has the lowest pKₐ?

- E. methanol
- F. 2,4-pentanedione
- G. ethyl acetate
- H. ammonia

(iii) Which of the following is most acidic?

- I. \( \text{CH}_2=\text{CH-CH(OH)CO}_2 \)
- J. \( \text{CH}_2=\text{CH-CH(OH)CO}_2 \)
- K. \( \text{Ph-CH(OH)CO}_2 \)
- L. \( \text{Ph-CH(OH)CO}_2 \)

(iv) Which of the following undergoes the most rapid thermal decarboxylation?

- M. \( \text{CH}_3\text{COCHCH}_2\text{CO}_2\text{H} \)
- N. \( \text{CH}_3\text{COCH}_2\text{COCH}_3 \)
- O. \( \text{CH}_3\text{COCH(Ph)CO}_2\text{H} \)
- P. \( \text{CH}_3\text{CH}_2\text{OCHCH}_2\text{OH} \)

(v) Which of the following is the thermodynamic enolate of 2-methylcyclohexanone?

- Q. \( \text{Q} \)
- R. \( \text{R} \)
- S. \( \text{S} \)
- T. \( \text{T} \)

(vi) Which of the following is not an intermediate or product in the iodoform reaction of acetophenone, \( \text{PhCOCH}_3 \) (i.e., reaction of acetophenone with \( \text{I}_2 \) and \( \text{NaOH} \))? 

- U. an enolate
- V. triiodomethyl anion
- W. benzoate anion
- X. formaldehyde

(vii) Which of the following acts as a nucleophile in the base-catalyzed aldol reaction of butanal?

- Y. an enolate
- Z. an alkoxide
- AA. an enol
- BB. an aldol

(viii) Which of the following has the greatest equilibrium constant for enolization?

- CC. ethyl acetate
- DD. ethyl acetoacetate
- EE. benzaldehyde
- FF. acetic acid
2. (38 points) (a) Provide the structure of the major organic product obtained from each of the following reactions.

2. (38 points) (a) Provide the structure of the major organic product obtained from each of the following reactions.

(b) Alkenes normally do not undergo rapid isomerization. However, the reaction shown at right is relatively rapid. Provide a detailed mechanism for this transformation.
3. (30 points) The following transformations cannot be completed in a single step. Provide a sequence of reactions to perform each transformation, showing the reagents and structures of all isolated synthetic intermediates. The synthesis must use the given starting materials; you may also use any other starting materials with 3 or fewer carbon atoms. You may use any reagents. Do not show mechanisms or the structures of reactive intermediates. Shorter, more efficient syntheses are preferred; overly long or inefficient sequences will lose some credit.

$\text{EtO} \quad \text{OEt}$

1,4-pentanediol

$\text{OEt} \quad \text{EtO}$

1,5-hexanediol

1-butanol

2-ethyl-1-hexanol