Multiple Choice Questions. 60 points Select the best answer to each of the questions.

1. Choose the order that has the following amines arranged correctly with respect to increasing basicity (most basic on right).

   ![Amines](image)

   (a) A < B < C  
   (b) B < A < C  
   (c) C < B < A  
   (d) A < C < B  
   (e) B < C < A

2. Choose the reaction that is incorrectly shown.

   ![Reactions](image)

3. Choose the kinetic product formed in the following reaction.

   ![Reaction](image)

4. Choose the reactants that would give the following Diels-Alder product.

   ![Diels-Alder](image)
5. Choose the order that has the following reactants correctly arranged with respect to increasing reactivity in the Diels-Alder reaction (most reactive on right).

\[ \text{R = H, OCH}_3 \text{ or CO}_2\text{CH}_3 \]

\[ \text{OCH}_3 \]

\[ \text{OCH}_3 \]

\[ \text{Diels-Alder reaction} \]

\[ \text{R = H, OCH}_3 \text{ or CO}_2\text{CH}_3 \]

\[ \text{O}_3\text{CO} \]

\[ \text{OCH}_3 \]

\[ \text{A} \]

\[ \text{B} \]

\[ \text{C} \]

(a) \( A < B < C \)  
(b) \( B < A < C \)  
(c) \( C < B < A \)

(d) \( A < C < B \)  
(e) \( B < C < A \)

6. Choose the worst method for the preparation of benzylamine (\( \text{PhCH}_2\text{NH}_2 \)).

\[ \text{O}_3\text{NH}_2 \]

\[ \text{Br} \]

\[ \text{H}_3\text{N} \]

\[ \text{NH}_3 \]

\[ \text{1. LiAlH}_4 \]

\[ \text{2. H}_2\text{O} \]

\[ \text{1.0 equivalents} \]

\[ \text{1. NH}_3 \]

\[ \text{2. } \text{H}_2 / \text{Ni} \]

\[ \text{N}_3 \]

\[ \text{1. } \text{LiAlH}_4 \]

\[ \text{2. } \text{H}_2\text{O} \]

(a) \( \text{O}_3\text{NH}_2 \)

(b) \( \text{Br} \)

(c) \( \text{O}_3\text{NH}_2 \)

(d) \( \text{O}_3\text{NH}_2 \)

(e) \( \text{O}_3\text{NH}_2 \)

7. Choose the order that has the following dienes arranged correctly with respect to increasing stability (the most stable on the right).

\[ \text{A} \]

\[ \text{B} \]

\[ \text{C} \]

(a) \( A < B < C \)  
(b) \( B < A < C \)  
(c) \( C < B < A \)

(d) \( A < C < B \)  
(e) \( B < C < A \)

8. Choose the order that has the following compounds correctly arranged with respect to increasing wavelength of their UV-visible absorption (the longest wavelength absorber on the right).

\[ \text{A} \]

\[ \text{B} \]

\[ \text{C} \]

(a) \( A < B < C \)  
(b) \( B < A < C \)  
(c) \( C < B < A \)

(d) \( A < C < B \)  
(e) \( B < C < A \)
9. Choose the major product of the following Cope rearrangement.

![Cope rearrangement diagram]

10. Choose the reactant(s) that would give the following Diels-Alder product.

![Diels-Alder product diagram]

11. Choose the statement that is true about A, B and C in the following separation scheme.

(a) A = tetrahydroisoquinoline, B = naphthalene and C = inorganic ions such as Na\(^+\) and Cl\(^-\).
(b) A = naphthalene, B = tetrahydroisoquinoline and C = inorganic ions such as Na\(^+\) and Cl\(^-\).
(c) A = inorganic ions such as Na\(^+\) and Cl\(^-\), B = tetrahydroisoquinoline and C = naphthalene.
(d) A = inorganic ions such as Na\(^+\) and Cl\(^-\), B = naphthalene and C = tetrahydroisoquinoline.
(e) A = naphthalene, B = inorganic ions such as Na\(^+\) and Cl\(^-\) and C = tetrahydroisoquinoline.

12. Choose the best method for the preparation of the following compound.

![Preparation method diagram]
Short Answer Questions. 40 points.

13. (a) Using atomic p-orbitals sketch the four molecular orbitals of a diene and the two molecular orbitals of an alkene. Clearly show the proper phase relationships by using your pencil to partially shade the orbitals.

(b) Circle the one molecular orbital of the diene and the one molecular orbital of the dienophile most involved in the following Diels-Alder reaction.

\[
\text{\( \text{C} = \text{C} + \text{C} = \text{O} \rightarrow \text{C} = \text{C} - \text{O} \)}
\]

14. (a) Give an acceptable structure for 1-phenyl-2-propanamine.

(b) Give an acceptable name for the following amine

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

15. A synthesis of cycrimine is given below. Using the curved arrow formalism, postulate reaction mechanisms for the conversion of A to B and B to cycrimine.

16. Propose a synthesis of cycrimine using the retrosynthetic analysis and reactants shown.