SHORT ANSWER (15 pts each)

1. For each of the following pairs of resonance structures, circle the one that would contribute more to the overall structure (note, this is NOT a multiple choice question).

   **Bonus (+ 3 pts): use arrows to show electron movement for interconversion of each resonance structure.**

   (a) ![Resonance structures](image1)

   (b) ![Resonance structures](image2)

   (c) ![Resonance structures](image3)

2. Classify each of the following polyunsaturated compounds as either “isolated,” “conjugated,” or “cumulated.”

   ![Compounds](image4)
3. Which diene and dienophile would you employ in a synthesis of the following?

\[
\begin{align*}
\text{CO}_2\text{Me} & \quad \rightarrow \\
\text{CO}_2\text{Me} &
\end{align*}
\]

4. Show the product(s) of the following Diels-Alder reaction:

\[
\begin{align*}
\text{H}_3\text{C} & \text{NH} & \quad + & \quad \text{CO}_2\text{Et} \\
\text{C} = \text{C} & & & \rightarrow
\end{align*}
\]

MULTIPLE CHOICE (8 pts each)
5. Which of the following carbocations would be most stable?

6. A thermodynamically-controlled reaction will yield predominantly:
   (a) The more/most stable product.
   (b) The product whose formation requires the smallest free energy of activation.
   (c) The product that can be formed in the fewest steps.
   (d) The product that is formed at the fastest rate.

7. Which of the following statements about the Diels-Alder reaction is NOT true?
   (a) The reaction is a syn addition.
   (b) The diene must be in the s-cis conformation.
   (c) Generally, electron-donating groups on the diene favor the reaction.
   (d) Generally, the adduct formed most rapidly is the exo product.

8. The diene shown below does not undergo the Diels-Alder reaction because:

   (a) Ring systems cannot function as the diene component.
   (b) It cannot adopt the s-cis conformation.
   (c) It lacks electron-withdrawing groups.
   (d) It lacks strong electron-donating groups.

9. The Diels-Alder reaction is so useful in synthesis because:
   (a) It is regiospecific.
   (b) It is stereospecific.
   (c) It results in the formation of 6-membered rings.
   (d) All of the above.

**Bonus (+8 pts): Show the product of the following intramolecular Diels-Alder**
**Bonus (+5 pts): Name the “enynenynol” shown below: