1. (10 points) Number the following protons in (+)-jasplakinolide from 1 to 5 in terms of acidity, where 1 is the most acidic proton and 5 is the least acidic proton.

2. (15 points) Using frontier molecular orbital theory, explain the difference in diastereoselectivity for following two [4+2] cycloaddition reactions. Be sure that your answer includes a detailed analysis the transition states that lead to each product.

3. (15 points) Provide the transition state that leads to the enolate isomer for each of the following deprotonations.

4. (10 points) Provide a reasonable mechanism for the reaction below.

5. (10 points) For the reaction given below provide: a) an electron-pushing mechanism; b) the transition
state for the transformation; c) the frontier molecular orbital interaction that forms the new sigma bond.

\[ \text{Et} \quad \text{Et} \quad \text{Et} \quad \text{Et} \quad 100^\circ C \quad \text{Et} \quad \text{Et} \]

8. (10 points) Provide a reasonable mechanism for the DCC coupling reaction given below.

\[ \text{EtO} \quad \text{NH}_2 \quad + \quad \text{HO} \quad \text{N} \quad \text{Ot-Bu} \quad \text{EtO} \quad \text{N} \quad \text{MeS} \quad \text{O} \quad \text{t-Bu} \]

9. (10 points) Provide a reasonable mechanism for the PLP co-factor mediated amino acid decarboxylation illustrated below.

\[ \text{EtO} \quad \text{NH}_2 \quad + \quad \text{HO} \quad \text{N} \quad \text{Ot-Bu} \quad \text{EtO} \quad \text{N} \quad \text{MeS} \quad \text{O} \quad \text{t-Bu} \]

10. (20 points) a) Illustrate a three unit single strand of DNA with the follow nucleotide base pairs: guanine, thymine, and adenine. b) Separately, illustrate the hydrogen-bonding between adenine and thymine, and cytosine and guanine that is responsible for the ladder structure of DNA. Note: The nucleotide base pairs are illustrated below for your reference but you are required to know, which ones are capable of hydrogen-bonding and, which ones are present in DNA.

\[ \text{G} \quad \text{T} \quad \text{A} \quad \text{C} \quad \text{G} \quad \text{T} \quad \text{A} \quad \text{C} \quad \text{G} \quad \text{T} \]