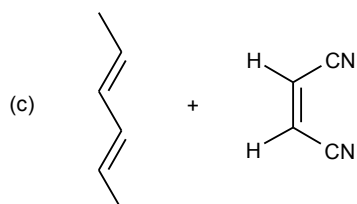
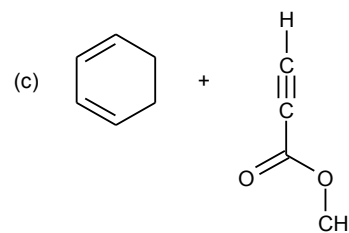
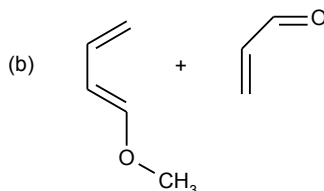
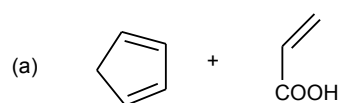


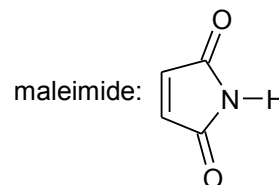
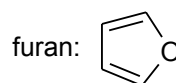
## Practice Problems on Diels-Alder Reactions

1. Predict the product of the following Diels-Alder reactions; under kinetic control. Include the stereochemistry where appropriate.



2. Furan and maleimide, shown below, react to produce and adduct via a Diels-Alder reaction. At 25°C the isomer produced is the *endo* product, however at 90°C the *exo* isomer predominates. Additional studies have shown that at 90°C the equilibrium between the *endo* and *exo* products favors the *exo* isomer.

- a) Draw each isomeric product, *endo* and *exo*.

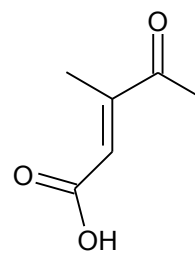


- b) Which isomer would you expect to usually form in this reaction? Why is that isomer usually preferred?

- c) Is your answer to question 4(b) dependent on a kinetically or thermodynamically controlled reaction?

- d) Explain why the *endo* isomer predominates when the reaction takes place at 25°C and why the *exo* isomer at 90°C.

3. When 1,3-butadiene reacts with compound **D** two products are formed. Draw the structures of each.



**D**

4. Compound **A**,  $C_4H_6$ , reacts with one of the diastereomers, **B**, of  $CH_3O_2CCH=CHCO_2CH_3$  to form 2 enantiomeric products, **C** & **D**. On the other hand when **B'** (the other diastereomer) reacts with **A** only one product is formed, **E**. Determine the identity of compounds **A** through **E**.

5. Which diene and dienophile could be used in the synthesis of each of the following.

