Chapter 17
Conjugated Pi Systems and Pericyclic Reactions

Review of Concepts
Fill in the blanks below. To verify that your answers are correct, look in your textbook at the end of Chapter 17. Each of the sentences below appears verbatim in the section entitled Review of Concepts and Vocabulary.

• Conjugated dienes experience free-rotation about the C2-C3 bond, giving rise to two important conformations: s-____ and s-____. The s-trans conformation is lower in energy.
• The HOMO and LUMO are referred to as ___________ orbitals, and the reactivity of conjugated polyenes can be explained with frontier orbital theory.
• An _______ state is produced when a π electron in the HOMO absorbs a photon of light bearing the appropriate energy necessary to promote the electron to a higher energy orbital.
• Reactions induced by light are called ___________ reactions.
• When butadiene is treated with HBr, two major products are observed, resulting from ______-addition and ______-addition.
• Conjugated dienes that undergo addition at low temperature are said to be under __________ control. Conjugated dienes that undergo addition at elevated temperature are said to be under __________ control.
• __________ reactions proceed via a concerted process with a cyclic transition state, and they are classified as cycloaddition reactions, __________ reactions, and sigmatropic rearrangements.
• The Diels–Alder reaction is a [ _______ ] cycloaddition in which two C-C bonds are formed simultaneously.
• High temperatures can often be used to achieve the reverse of a Diels–Alder reaction, called a ______ Diels–Alder.
• The starting materials for a Diels–Alder reaction are a diene, and a __________.
• The Diels–Alder reaction only occurs when the diene is in an ___ conformation.
• When cyclopentadiene is used as the starting diene, a bridged bicyclic compound is obtained, and the _____ cycloadduct is favored over the _____ cycloadduct.
• Conservation of orbital symmetry determines whether an electrocyclic reaction occurs in a __________ fashion or a __________ fashion.
• A [ _______ ] sigmatropic rearrangement is called a Cope rearrangement when all six atoms of the cyclic transition state are carbon atoms.
• Compounds that possess a conjugated π system will absorb UV or visible light to promote an electronic excitation called a __________ transition.
• The most important feature of the absorption spectrum is the ________, which indicates the wavelength of maximum absorption.
• When a compound exhibits a $\lambda_{\text{max}}$ above 400 nm, the compound will absorb ________ light, rather than UV light.
Review of Skills
Fill in the blanks and empty boxes below. To verify that your answers are correct, look in your textbook at the end of Chapter 17. The answers appear in the section entitled "SkillBuilder Review."

17.1 Proposing the Mechanism and Predicting the Products of Electrophilic Addition to Conjugated Dienes

In the space provided, draw the mechanism of the reaction that is expected to occur when the following compound is treated with HBr. Make sure to draw all possible products.

\[
\text{Ph} \quad \text{Ph} \quad \overset{\text{hv}}{\text{Ph}} \quad \overset{\text{Ph}}{\text{Ph}}
\]

17.2 Predicting the Major Product of an Electrophilic Addition to Conjugated Dienes

Draw the major products of the following reaction:

\[
\text{HBr} \quad \overset{0^\circ\text{C}}{\text{Ph}} \quad \text{Ph}
\]

17.3 Predicting the Product of a Diels–Alder Reaction

Draw the major products of the following reaction:

\[
\overset{\text{N}}{\text{N}} \quad \overset{\text{N}}{\text{N}}
\]

17.4 Predicting the Product of an Electrocyclic Reaction

Draw the major products of the following reaction:

\[
\overset{\text{Ph}}{\text{Ph}} \quad \overset{\text{hv}}{\text{Ph}} \quad \overset{\text{Ph}}{\text{Ph}}
\]
17.5 Using Woodward–Fieser Rules to Estimate $\lambda_{\text{max}}$

<table>
<thead>
<tr>
<th>USE WOODWARD-FIESER RULES TO ESTIMATE $\lambda_{\text{max}}$ FOR THE FOLLOWING COMPOUND:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BASE VALUE</strong> =</td>
</tr>
<tr>
<td><strong>ADDITIONAL DOUBLE BONDS</strong> =</td>
</tr>
<tr>
<td><strong>AUXOCHROMIC ALKYL GROUPS</strong> =</td>
</tr>
<tr>
<td><strong>EXOCYCLIC DOUBLE BOND</strong> =</td>
</tr>
<tr>
<td><strong>HOMOANNULAR DIENE</strong> =</td>
</tr>
<tr>
<td><strong>TOTAL</strong> =</td>
</tr>
</tbody>
</table>

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**Review of Reactions**

Predict the Products for each of the following transformations. To verify that your answers are correct, look in your textbook at the end of Chapter 17. The answers appear in the section entitled **Review of Reactions**.

**Preparation of Dienes**

\[
\begin{align*}
\text{Br} & \quad \longrightarrow & \quad t\text{-BuOK} \\
\text{Br} & \quad \longrightarrow & \quad t\text{-BuOK} \\
\text{Br} & \quad \longrightarrow & \quad t\text{-BuOK}
\end{align*}
\]

**Electrophilic Addition**

\[
\begin{align*}
\text{Br} & \quad \longrightarrow & \quad H\text{--Br} \\
\text{Br} & \quad \longrightarrow & \quad Br_2
\end{align*}
\]

**Diels–Alder Reaction**

\[
\begin{align*}
\text{Diels-Alder} \\
\text{Retro Diels-Alder} \\
(\text{very high temperature})
\end{align*}
\]
**Electrocyclic Reactions**

\[
\text{CH}_3 + \text{CH}_3 \rightarrow \text{CH}_3
\]

**Sigmatropic Rearrangements**

**Cope Rearrangement**

\[
\text{CH}_3 \rightarrow \text{CH}_3
\]

**Claisen Rearrangement**

\[
\text{CH}_3 \rightarrow \text{CH}_3
\]
Solutions

17.1.

a) [Diagram showing HO...OH with conjugated structure]

b) [Diagram showing isolated and conjugated structures]

c) [Diagram showing isolated and conjugated structures]

d) [Diagram showing isolated and conjugated structures]
17.2. 
\[ \text{Br}_2 \xrightarrow{hv} \text{Br}_2 \xrightarrow{NaOEt} \text{Br}_2 \xrightarrow{t\text{-BuOK}} \text{Br} \]

17.3.

\begin{align*}
\text{Bond Length} & \\
\text{C1-C2} & \text{C2-C3} & \text{C3-C4} \\
\end{align*}

17.4.

a) 
The conjugated diene will liberate the least heat because it is the most stable of the three compounds.

b) 
This isolated diene will liberate more heat than the other isolated diene, because the π bonds in this compound are not highly substituted (one π bond is monosubstituted and the other is disubstituted). In the other isolated diene, the π bonds are disubstituted and trisubstituted (and therefore more stable).

17.5. In the compound below, all three π bonds are conjugated:
17.6.

**GROUND STATE**

- $\psi_8$
- $\psi_7$
- $\psi_6$
- $\psi_5$ (LUMO)
- $\psi_4$ (HOMO)
- $\psi_3$
- $\psi_2$
- $\psi_1$

**EXCITED STATE**

- $\psi_8$
- $\psi_7$
- $\psi_6$ (LUMO)
- $\psi_5$ (HOMO)
- $\psi_4$
- $\psi_3$
- $\psi_2$
- $\psi_1$
17.7.

a) 

\[
\text{HCl} \quad \text{HCl} \\
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
(\text{racemic}) \quad (\text{racemic})
\]

\[
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
(\text{racemic}) \quad (\text{racemic})
\]

\[
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
(\text{racemic}) \quad (\text{racemic})
\]

b) 

\[
\text{HCl} \quad \text{HCl} \\
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
(\text{racemic}) \quad (\text{racemic})
\]

\[
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
(\text{racemic}) \quad (\text{racemic})
\]

\[
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl} \\
(\text{racemic}) \quad (\text{racemic})
\]
c)

\[
\begin{align*}
\text{HCl} & \quad \text{Cl} \\
\text{Cl} & \quad \text{Cl}
\end{align*}
\]

\[
\begin{align*}
\text{(racemic)} & \quad + \\
\text{(racemic)} & \quad +
\end{align*}
\]

d)

\[
\begin{align*}
\text{HBr} & \quad \text{Br} \\
\text{Br} & \quad \text{Br}
\end{align*}
\]

\[
\begin{align*}
\text{(racemic)} & \quad + \\
\text{(racemic)} & \quad +
\end{align*}
\]
e) 

\[ \text{HBr} \rightarrow \text{Br}^- \]

\[ \text{Br}^- \]

\[ \text{racemic} \]

\[ \text{Br} \] 

\[ \text{racemic} \]

\[ \text{f) } \]

\[ \text{Br}^- \]

\[ \text{Br}^- \]

\[ \text{racemic} \]

\[ \text{racemic} \]
17.8. The first diene can be protonated either at C1 or at C4. Each of these pathways produces a resonance stabilized carbocation. And each of these carbocations can be attacked in two positions, giving rise to four possible products. In contrast, the second diene yields the same carbocation regardless of whether protonation occurs at C1 or at C4. This resonance-stabilized carbocation can be attacked in two positions, giving rise to two products.

17.9.

\[ \text{HBr} \rightarrow \text{Br} \]

17.10.

a)

\[ \text{HBr} \rightarrow \text{Br} \]

b)

\[ \text{HCl} \rightarrow \text{Cl} \]

c)

17.11. In this case, the \( \pi \) bond in the 1,2-adduct is more substituted than the \( \pi \) bond in the 1,4-adduct (trisubstituted rather than disubstituted). As a result, the 1,2-adduct predominates at either low temperature or high temperature.
17.12. In this case, 1,2-addition and 1,4-addition yield the same product.

\[
\text{HBr} \quad \text{Br} \quad \text{Br} \quad \text{(racemic)}
\]

17.13.

a) 

b) 

17.14.

a) 

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

b) 

\[
\text{C=C} + \text{COOH} \quad \rightarrow \quad \text{OH} + \text{OH} \quad \text{(meso)}
\]

c) 

\[
\text{C=C} + \text{C=O} \quad \rightarrow \quad \text{C=C} + \text{En}
\]

d) 

\[
\text{C=C} + \text{C=O} \quad \rightarrow \quad \text{C=C}
\]
e) 
\[
\text{+ } \text{meso} 
\]

f) 
\[
\text{+ En} 
\]

h) 
\[
\text{+ En} 
\]

17.15. 
\[
\text{(excess)} 
\]
17.16.

\[
\text{[Image of chemical structure]} \quad \Rightarrow \quad \text{[Another image of chemical structure]}
\]

17.17. The \(2E,4E\) isomer is expected to react more rapidly as a diene in a Diels–Alder reaction, because it can readily adopt an \textit{s-trans} conformation.

\[
\text{(2E,4E)-hexadiene} \quad \Rightarrow \quad \text{[Image of reaction product]}
\]

In contrast, the \(2Z,4Z\) isomer is expected to react more slowly as a diene in a Diels–Alder reaction, because it cannot readily adopt an \textit{s-trans} conformation, as a result of steric hinderance.

\[
\text{(2Z,4Z)-hexadiene} \quad \Rightarrow \quad \text{[Image of reaction product]}
\]

17.18. Reactivity in Diels-Alder reactions

\[
\begin{align*}
\text{[Image of cyclopentadiene]} & \quad \text{[Image of diene]} & \quad \text{[Image of cyclohexadiene]} \\
\text{locked in an } & \quad \text{locked in an } & \\
\text{s-cis } & \quad \text{s-trans } & \\
\text{conformation} & \quad \text{conformation}
\end{align*}
\]

17.19. 

a) \[
\text{[Image of cyclopentadiene]} + \quad \text{[Image of diene]} \quad \Rightarrow \quad \text{[Image of product]} \quad \text{(meso)}
\]

b) \[
\text{[Image of diene]} + \quad \text{[Image of diene]} \quad \Rightarrow \quad \text{[Image of product]} \quad + \quad \text{En}
\]
17.20. We first consider the HOMO of one molecule of butadiene and the LUMO of another molecule of butadiene. The phases of these MOs do not align, so a thermal reaction is symmetry-forbidden. However, if one molecule is photochemically excited, the HOMO and LUMO of that molecule are redefined. The phases of the frontier orbitals will align under these conditions, so the reaction is expected to occur photochemically.
17.21.

a) 

\[
\begin{align*}
\text{heat} & \quad \rightarrow \\
\text{(meso)}
\end{align*}
\]

b) 

\[
\begin{align*}
\text{heat} & \quad \rightarrow 
\end{align*}
\]

c) 

\[
\begin{align*}
\text{heat} & \quad \rightarrow 
\end{align*}
\]

17.22.

a) 

\[
\begin{align*}
\text{light} & \quad \rightarrow \\
+ \text{En}
\end{align*}
\]

b) 

\[
\begin{align*}
\text{light} & \quad \rightarrow 
\end{align*}
\]

c) 

\[
\begin{align*}
\text{heat} & \quad \rightarrow \\
+ \text{En}
\end{align*}
\]
17.23.

a) 

\[
\begin{array}{c}
\text{Et} \\
\text{Et}
\end{array} & \xrightarrow{\text{heat}} & 
\begin{array}{c}
\text{Et} \\
\text{Et}
\end{array}
\]

b) 

\[
\begin{array}{c}
\text{Et} \\
\text{Et}
\end{array} & \xrightarrow{\text{light}} & 
\begin{array}{c}
\text{Et} \\
\text{Et}
\end{array} + 
\begin{array}{c}
\text{Et} \\
\text{Et}
\end{array}
\]

Not formed
Ethyl groups are too crowded

17.24.

a) a meso compound
b) a pair of enantiomers
c) a pair of enantiomers

17.25.

a) 

\[
\begin{array}{c}
\text{O} \\
\text{C}
\end{array} & \xrightarrow{\text{heat}} & 
\begin{array}{c}
\text{O} \\
\text{C}
\end{array}
\]

[3,3] Sigmatropic rearrangement

b) 

\[
\begin{array}{c}
\text{C} \\
\text{H}
\end{array} & \xrightarrow{\text{heat}} & 
\begin{array}{c}
\text{C} \\
\text{H}
\end{array}
\]

[1,5] Sigmatropic rearrangement

17.26.

a) 

\[
\begin{array}{c}
\text{C}
\end{array} & \xrightarrow{\text{heat}} & 
\begin{array}{c}
\text{C}
\end{array}
\]

b) [3,3] Sigmatropic rearrangement

c) The ring strain associated with the three-membered ring is alleviated. The reverse process would involve forming a high-energy, three-membered ring. The equilibrium disfavors the reverse process.
17.27. 

a) 

\[ \text{heat} \]

b) 

\[ \text{heat} \]

c) 

\[ \text{heat} \]

d) 

\[ \text{heat} \] \[ \text{taut.} \]

17.28. 

\[ \text{heat} \] \[ \text{heat} \] 

17.29. 

a) 

Base = 217  
Additional double bonds = 0  
Auxochromic alkyl groups = +25  
Exocyclic double bond = +5  
Homoannular diene = 0  
Total = 247 nm
b)  
Base = 217  
Additional double bonds = +30  
Auxochromic alkyl groups = +25  
Exocyclic double bond = +5  
Homoannular diene = 0  
Total = 277 nm

c)  
Base = 217  
Additional double bonds = +30  
Auxochromic alkyl groups = +30  
Exocyclic double bonds = +15  
Homoannular diene = 0  
Total = 292 nm

d)  
Base = 217  
Additional double bonds = +30  
Auxochromic alkyl groups = +35  
Exocyclic double bonds = +5  
Homoannular diene = +39  
Total = 326 nm

17.30  

17.31.  
a) Blue.  
b) Red-Orange.  
c) Blue-violet.

17.32.  
a) b)  
c) d)  
e)
17.33.

17.34.

a) These drawings represent two different conformations of the same compound: the s-cis conformation and the s-trans conformation. These two conformations are in equilibrium at room temperature.

b) These drawings represent two different compounds: (Z)-1,3,5-hexatriene and (E)-1,3,5-hexatriene. These compounds are diastereomers and can be isolated from one another.

c) These drawings represent two different conformations of the same compound: the s-cis conformation and the s-trans conformation. These two conformations are in equilibrium at room temperature.

17.35.

\[ \text{cyclohexane} + \text{HBr} \rightarrow \text{cyclohexyl bromide} \]

(racemic)

17.36.

\[ \text{propene} + \text{HBr} \rightarrow \text{(racemic propene bromide)} \]
17.37. An increase in temperature allowed the system to reach equilibrium concentrations, which are determined by the relative stability of each product. Under these conditions, the 1,4-adducts predominate. Once at equilibrium, lowering the temperature will not cause a decrease in the concentration of the 1,4-adducts.
17.40.  

a) The tert-butyl groups provide significant steric hinderance that prevents the compound from adopting an \( s\)-\( cis \) conformation.

b) This diene is not conjugated.

c) The methyl groups provide significant steric hinderance that prevents the compound from adopting an \( s\)-\( cis \) conformation.

d) This diene cannot adopt an \( s\)-\( cis \) conformation

17.41.

Reactivity in Diels-Alder reactions

17.42. The \( \pi \) bonds in 1,2-butadiene are not conjugated, and \( \lambda_{\text{max}} \) is therefore lower than 217 nm. In fact, it is below 200 nm, which is beyond the range used by most UV-VIS spectrometers.

17.43.

a) 

\[
\text{HOOC} + \text{HOOC} \rightarrow \text{COOH} + \text{COOH} + \text{En}
\]

b) 

\[
\text{CN} + \text{CN} \rightarrow \text{CN} + \text{CN} + \text{En}
\]

c) 

\[
\text{O} + \text{O} \rightarrow \text{O} + \text{O} + \text{En}
\]
d) 
\[ \text{S} + \text{O} \rightarrow \text{(meso)} \]

e) 
\[ \text{MeO} + \text{CN} \rightarrow \text{CN} \]

f) 
\[ \text{MeO} + \text{CO}_2\text{Me} \rightarrow \text{CO}_2\text{Me} \]

17.44. 

a) 
\[ \text{C} + \text{COOH} \rightarrow \text{COOH} \]

b) 
\[ \text{C} + \text{CN} \rightarrow \text{CN} \]

c) 
\[ \text{C} + \text{CHO} \rightarrow \text{CHO} \]

d) 
\[ \text{C} + \text{O} \rightarrow \text{O} \]
e) 
\[ \text{H} + \text{O} \rightarrow \text{H} \]

f) 
\[ \text{H} + \text{O} \rightarrow \text{H} \]

g) 
\[ \text{HOOC} + \text{COOH} \rightarrow \text{COOH} + \text{En} \]

h) 
\[ \text{H} + \text{O} \rightarrow \text{H} \]

17.45. 
\[ \text{HBr} \xrightarrow{40 \degree C} \text{Br} \xrightarrow{1) \text{NaOH}} \xrightarrow{2) \text{PCC}} \text{H} + \text{En} \]

17.46. 
\[ + \text{COOH} \rightarrow \text{COOH} \rightarrow \text{COOH} \rightarrow \text{COOH} \rightarrow \text{COOH} \rightarrow \text{COOH} \]
17.47.

\[
\begin{array}{c}
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\end{array}
\rightarrow
\begin{array}{c}
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{H} \\
\end{array}
\]

\text{chlorodane}

17.48. The two ends of the conjugated system are much farther apart in a seven-membered ring than they are in a five-membered ring.

17.49.

\[
\begin{array}{c}
\text{CH}_2=CH\text{CH}_2\text{CH}=	ext{CH}_2 \\
\text{CH}_2=CH\text{CH}=	ext{CH}_2 \\
\end{array}
\]

17.50.

Increasing \(\lambda_{\text{max}}\)

\[
\begin{array}{c}
\text{CH}_2=CH\text{CH}=	ext{CH}_2 \\
\text{CH}_2=CH\text{CH}=	ext{CH}_2 \\
\text{CH}_2=CH\text{CH}=	ext{CH}_2 \\
\end{array}
\]

17.51. Two of the \(\pi\) bonds are homoannular in this compound, which adds +39 nm according to Woodward-Fieser rules.

17.52.

\begin{align*}
\text{Base} & = 217 \\
\text{Additional double bonds} & = +60 \\
\text{Auxochromic alkyl groups} & = +35 \\
\text{Exocyclic double bonds} & = +5 \\
\text{Homoannular diene} & = +39 \\
\text{Total} & = 356 \text{ nm}
\end{align*}

17.53. Each of these transformations can be explained with a [1,5] sigmatropic rearrangement:

\[
\begin{array}{c}
\text{Me} \\
\text{D} \\
\end{array}
\leftrightarrow 25^\circ \text{C}
\begin{array}{c}
\text{Me} \\
\text{D} \\
\end{array}
\leftrightarrow 25^\circ \text{C}
\begin{array}{c}
\text{Me} \\
\text{D} \\
\end{array}
\]
17.54. This transformation can be explained with a [1,5] sigmatropic rearrangement:

\[
\text{heat} \quad \begin{array}{c}
\text{D} \\
\text{D} \\
\text{D}
\end{array} 
\quad \overset{\text{heat}}{\longrightarrow} 
\begin{array}{c}
\text{D} \\
\text{D}
\end{array}
\]

17.55.

\[
\text{heat} \quad \longrightarrow 
\quad \text{light} 
\]

17.56.

a) \[
\text{heat} \quad \rightarrow 
\begin{array}{c}
\text{meso}
\end{array}
\]

b) \[
\text{hv} \quad \rightarrow 
\begin{array}{c}
\text{En}
\end{array}
\]

c) \[
\text{heat} \quad \rightarrow 
\begin{array}{c}
\text{En}
\end{array}
\]

d) \[
\text{hv} \quad \rightarrow 
\begin{array}{c}
\text{meso}
\end{array}
\]

17.57. The compound on the right has a \(\pi\) bond in conjugation with the aromatic ring, while the compound on the left does not. Therefore, the compound on the right side of the equilibrium is expected to be more stable, and the equilibrium will favor the compound that is lower in energy.
17.58.

\[ \text{Not formed} \]

Methyl groups are too crowded

17.59.

a) \[ \text{heat} \]

b) \[ \text{heat} \]

c) \[ \text{heat} \]

17.60.

a) \( \alpha \)-Terpinene has two double bonds.

b) \( \alpha \)-terpinene

\[ \text{1) O}_3 \quad \text{2) DMS} \]

\[ \text{H}_2 \quad \text{Pt} \]

\[ \text{Base} = 217 \]
\[ \text{Additional double bonds} = 0 \]
\[ \text{Auxochromic alkyl groups} = +20 \]
\[ \text{Exocyclic double bonds} = 0 \]
\[ \text{Homoannular diene} = +39 \]
\[ \text{Total} = 276 \text{ nm} \]
17.61.

\[ \text{Et} - \text{Me} - \text{Et} \]

17.62.

\[ \text{Br} \quad \text{t-BuOK} \quad \text{Et} \]

17.63. In each case, the non-conjugated isomer will be higher in energy:

a) \[ \text{cyclic structure} \]

b) \[ \text{linear structure} \]

17.64. Nitroethylene should be more reactive than ethylene in a Diels–Alder reaction, because the nitro group is electron-withdrawing, via resonance:

\[
\begin{array}{c}
\text{N} \text{O} \\
\text{N} \text{O}
\end{array}
\]
17.65. \[ \text{AcO} \quad \overset{\text{heat}}{\longrightarrow} \quad \text{AcO} \]

17.66. The diene is electron-rich in one specific location, as seen in the second resonance structure below:

\[ \text{MeO} \quad \text{MeO} \]

The dienophile is electron-poor in one specific location, as seen in the third resonance structure below:

\[ \text{The dienophile is electron poor in this location} \]

These two compounds will join in such a way that the electron-poor center lines up with the electron-rich center:

17.67. \[ \text{MeO} \quad \overset{\text{heat}}{\longrightarrow} \quad \text{MeO} \]
17.68. The nitrogen atom in divinyl amine is $sp^2$ hybridized. The lone pair is delocalized, and joins the two neighboring $\pi$ bonds into one conjugated system. As such, the compound absorbs light above 200 nm (UV light). In contrast, 1,4-pentadiene has two isolated double bonds and therefore does not absorb UV light in the region between 200 and 400 nm.