1. Indicate which of the following molecules can function as dienes in a Diels-Alder reaction.

![Diels-Alder reaction molecules](image)

2. Which of the following molecules can be synthesized via a Diels-Alder reaction? If they can, indicate what the reactants would be. If not, explain why.

![Diels-Alder reaction products](image)

3. Draw the products of the following Diels-Alder reactions. Be sure and indicate correct stereochemistry where necessary.

![Diels-Alder reaction products](image)
3. Continued.

\[ \text{e) } \text{H} + \text{H} \]

\[ \text{f) } \text{H}_{3}\text{CO} + \text{HOOC} \]

\[ \text{g) } \text{H}_{3}\text{CO} + \text{HOOC} \]

\[ \text{h) } \text{H}_{3}\text{CO} + \text{HOOC} \]

4. What diene and dienophile were used to synthesize the following compounds?

\[ \text{a) } \text{b) } \text{c) } \text{d) } \]

5. A look ahead to chapter 15. You will need to read the chapter and look at the lecture notes for this question.

   a) Using the notes and figure 15.10, draw the six molecular orbitals for benzene, and arrange from lowest to highest energy.

   b) Indicate which orbital will hold electrons.

   c) Benzene has degenerate molecular orbitals. What does this mean?

   d) Benzene is extremely stable. It does not undergo electrophilic addition reactions in the same way alkenes do. Provide two reasons for this observation.

   e) Anthracene, shown below, unlike benzene, does undergo Diels-Alder reactions. Explain this observation.

   f) Phenanthrene unlike benzene undergoes electrophilic addition reactions as seen in the equation below. Explain this observation.