1. With the aid of three-dimensional drawings, provide a clear rationale for the products that are observed in the following transformations. Your rationale must include the mechanism for each transformation. Hint: Think cyclohexane chair!

![Three-dimensional drawings](image1)

2. Please provide a detailed mechanism for the illustrated transformation.

![Three-dimensional drawings](image2)

3. Please provide a detailed mechanism that accounts for the formation of all three of the observed products. Hint: Think Beckmann rearrangement.

![Three-dimensional drawings](image3)
4. a) Please provide a rationale for the illustrated rate data.

Relative Rate

\[ \text{Relative Rate} \]

\[ 7 \times 10^7 \]

b) Please provide a mechanism to account for the formation of the products illustrated below. In addition, explain why no other stereoisomers are generated in the reaction.

5. Please provide a detailed mechanism for the illustrated transformation.

6. In the reaction illustrated below, the desired product from a simple Friedel–Crafts acylation (A) was not observed. Instead, and isomeric product (B) was generated through a more complex route that also involves Friedel–Crafts chemistry. Please provide a detailed mechanism for this unexpected process.