**Question 1.** Please propose a synthesis of the butenolide shown from the indicated starting material.

![Butenolide Synthesis](image1.png)

**Question 2.** Provide a concise mechanism for the indicated reaction in the space below.

![Mechanism](image2.png)

For the first years, from the practice exam

**Question 4.** *JACS, 2002, 2456.*

In 2002, Jacobsen and Movassaghi designed a method to directly convert epoxides into butenolides. This method utilizes Ynamine E as an equivalent for an ester enolate. E is synthesized from morpholine according to the synthetic sequence shown below. Please provide a mechanism for the conversion of compound C to compound D, using nBuLi.

*Also, provide the mechanism of B to C*

![Synthetic Sequence](image3.png)