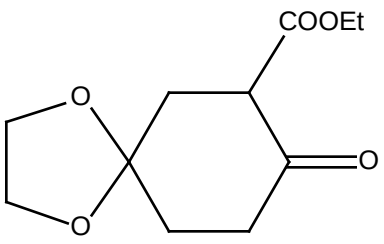
**GTQ on Claisen and Dieckmann Condensations.** (40 points, synthesis, disconnection)

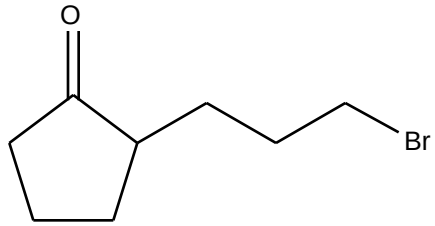
**(a)** The Dieckmann reaction is the intramolecular version of the Claisen condensation and it works for the formation of 5- and 6-membered rings. Show the overall reaction product formed from diethyl heptanedioate in the Dieckmann reaction. Name the product and write down what general class of compounds it does belong to. Provide the mechanism of the reaction.

| Starting Material | Reaction Conditions | Dieckmann Product (structure, name, class) |
|---|---|---|
| Mechanism | | |

**(b)** Suggest a synthesis of the cyclic compound shown via a Dieckmann condensation. Notice that the Dieckmann reaction conditions do not interfere with the acetal.



**(c)** The ketone shown was synthesized from a pentanoic acid derivative via Dieckmann condensation. Show the complete synthesis and specify reagents for every step.




**(d)** The so-called **double Claisen condensation** involves the reaction of a diester (with enolizable methylene group) with an oxalate (no enolizable methylene group). This is essentially a mixed Claisen condensation in which the non-enolizable oxalate acts as the carbonyl compound to which the diester enolate will add. This mixed Claisen condensation simply happens twice and a symmetric ring structure is formed. Using **diethyl oxalate** and **diethyl pentanedioate**, show the products of the first mixed Claisen condensation and of the second mixed Claisen condensation.

| diethyl oxalate | diethyl pentanedioate |
|---|---|
| product from first mixed Claisen | product from second mixed Claisen |