We saw in class a way to synthesize acid chlorides from acids. Here is another. Provide a mechanism.

Although this is a nice way to make acid chlorides, the reaction can be rather slow requiring 12 hours or more. It has been found that the addition of a catalytic amount of DMF catalyzes this reaction by several orders of magnitude, such that it will generally be done in less than 15 min.

The DMF first reacts with the oxalyl chloride to produce:

a. Write a plausible mechanism for this transformation.

In the second part of the reaction, the following reaction occurs, and the DMF is regenerated:

b. Write a plausible mechanism for this transformation.
2. You are now ready for the first part of the Swern oxidation. Provide a mechanism for the following reaction:

\[
\begin{align*}
\text{Cl} & \quad \text{Cl} \\
\text{CO}_2 & \quad \text{CO}
\end{align*}
\]

3. Propose a synthesis to accomplish the following transformation.

\[
\begin{align*}
\text{EtO} & \quad \text{OEt} \\
\text{O} & \quad \text{O}
\end{align*}
\]

4. Propose a synthesis of the following β-ketoester from the illustrated dinitrile.

\[
\begin{align*}
\text{NC} & \quad \text{CN} \\
\text{Me} & \quad \text{H} \quad \text{Me} \quad \text{H}
\end{align*}
\]

5. Predict the major product of the following reaction sequence:

\[
\begin{align*}
\text{CO}_2 & \quad \text{Me} \\
\text{Me} & \quad \text{H} \quad \text{Me} \quad \text{H}
\end{align*}
\]

6. It has been observed that the illustrated carboxylic acid can undergo racemization during DCC-mediated amide synthesis:

\[
\begin{align*}
\text{Me} & \quad \text{H} \quad \text{O} \quad \text{Me} \\
\text{N} & \quad \text{C} \quad \text{H} \quad \text{Me}
\end{align*}
\]

\[
\begin{align*}
\text{H}_2\text{NMe} & \quad \text{H}_2\text{NMe} \\
\text{Me} & \quad \text{Me}
\end{align*}
\]

Enantiomerically pure

It has been established that the carboxylic acid and the DCC react to form an azlactone, and that it is the azlactone which undergoes racemization:

\[
\begin{align*}
\text{Me} & \quad \text{H} \quad \text{O} \quad \text{Me} \\
\text{N} & \quad \text{C} \quad \text{H} \quad \text{Me}
\end{align*}
\]

\[
\begin{align*}
\text{H}_2\text{NMe} & \quad \text{H}_2\text{NMe} \\
\text{Me} & \quad \text{Me}
\end{align*}
\]

Provide a mechanism for the formation of the azlactone, and then for the reaction of the azlactone with the methylamine to give the final amide product.

For even more fun, write a mechanism for the racemization process (the amine is necessary!), and provide an explanation as to why the racemization is so fast with the azlactone.