1) (15 points) Write a mechanism for the following acid catalyzed aldol condensation using the curved arrow formalism.

\[
\text{EtOH} \quad \text{HCl} \quad \text{EtOH} \quad \text{HCl}
\]

\[
\begin{align*}
\text{Cyclic ketone} + \text{PhCHO} & \quad \xrightarrow{\text{EtOH}, \text{HCl}} \quad \text{Cyclic enone} + \text{H}_2\text{O} \\
\end{align*}
\]

2) (10 points) For the following Diels-Alder reaction, the endo product is the kinetic product and the exo product is the thermodynamic product. Construct a reaction co-ordinate diagram to explain this result. Label axes, starting materials, exo product, endo product, transition states, intermediates, \( \Delta G^0 \), and \( \Delta G^\ddagger \).

\[
\begin{align*}
\text{Cyclopentadiene} + \text{Maleimide} & \quad \xrightarrow{\text{endo}} \quad \text{Cyclopentadiene adduct} + \text{Maleimide adduct} \\
\end{align*}
\]