1. (10 points) Draw an arrow-pushing mechanisms for the following transformation.

\[
\text{O} \quad \xrightarrow{\text{NH}_4\text{OAc}} \quad \xrightarrow{\Delta} \quad \text{N}
\]

2. (10 points) Draw an arrow-pushing mechanisms for the following transformation.

\[
\begin{align*}
\text{O} & \quad \xrightarrow{\text{H}^+} \quad \text{O} \\
\text{O} & \quad \xrightarrow{\text{H}^+} \quad \text{O}
\end{align*}
\]

3. (10 points) Deduce the structure of E, and draw and arrow-pushing mechanism for its formation. Be careful with the IHD - we are now dealing with nitro groups - NO₂ counts as halogen!

\[
\text{Cl} \quad \xrightarrow{\text{NaH}} \quad \text{E} \\
\text{NO}_2 \quad \xrightarrow{\text{NaH}} \quad \text{F}
\]

IR: 3080, 2989, 2457, 1928, 1721, 1596, 1530, 1463, 1342, 1248, 1094, 1014, 858 cm⁻¹

\[\text{^1H NMR:}\]
- 8.10 4H, d, J=8.9 Hz
- 7.33 4H, d, J=8.9 Hz
- 4.19 2H, q, J=7.1Hz
- 1.93 3H, s
- 1.16 3H, t, J=7.1 Hz

\[\text{^13C NMR:}\]
- 173.2, s
- 150.9, s (2)
- 147.3, s (2)
- 129.4, d (4)
- 123.9, d (4)
- 62.8, t
- 57.2, s
- 27.0, q
- 14.3, q