Introduction: RELAX!! You will have an entire 1.5 hour period in which to do this exam. As always, do the ones which come easily first, then go back and puzzle over the more difficult ones. Please be sure your mechanistic arrows are clear, and show exactly what you want them to show, and that your syntheses yield the desired product in as high a yield as possible. Show all work for partial credit. Good luck!

1) Account for the following observation with a good mechanism (arrow formalism):

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

2) The molecule shown below is the only product formed upon ozonolysis and oxidative work-up of compound A. Suggest a structure for the starting material A. What product would A yield upon treatment with H₂/Pd/C? Upon treatment with BH₃, followed by H₂O₂/OH⁻?

\[
\begin{align*}
\text{O} & \quad \text{O} \\
\text{HO} & \quad \text{K} \\
\end{align*}
\]

3) Starting with organic compounds of four (4) or fewer carbons, and any inorganic reagents you need, propose a synthesis of cis-1-(n-butyl)-2-methylcyclopropane

4) The reaction of CH₃CH=CHCF₃ with HCl could, in theory, lead to two addition products; however, only one is formed. Draw both possible isomers and identify the one that is actually formed. Justify your logic.

5) (+) 3-Carene is a readily available, optically active natural product that is often used as a “chiral building block” in organic synthesis. Using 3-carene as your starting material, provide synthetic routes to the following compounds: (Scheme shown overleaf.)