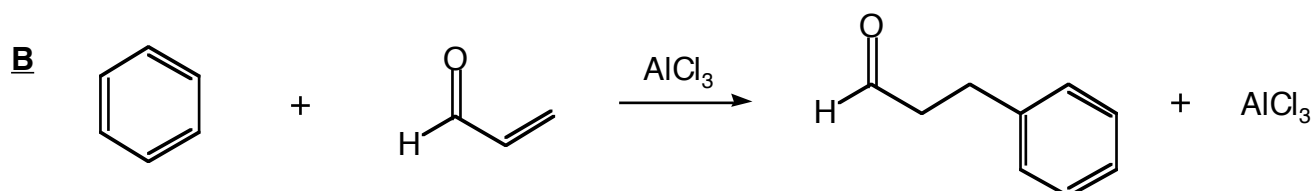
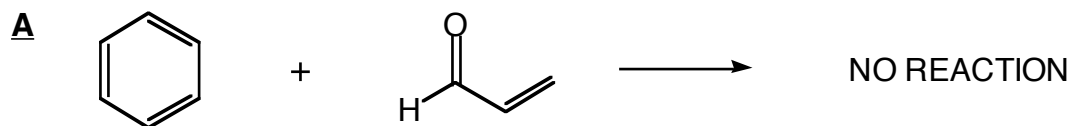
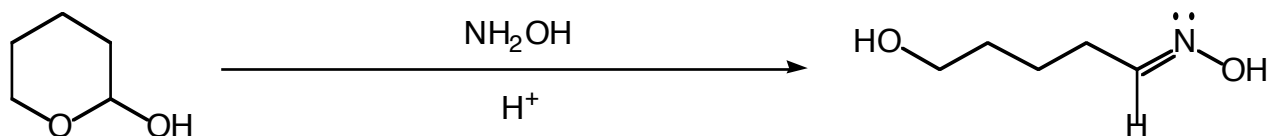


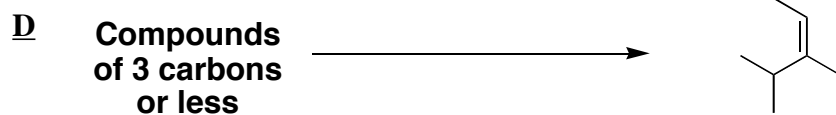
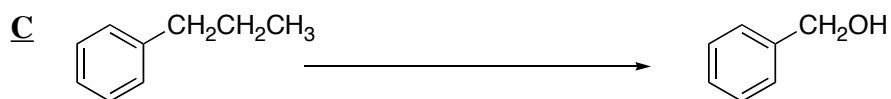
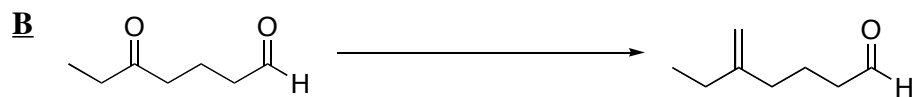
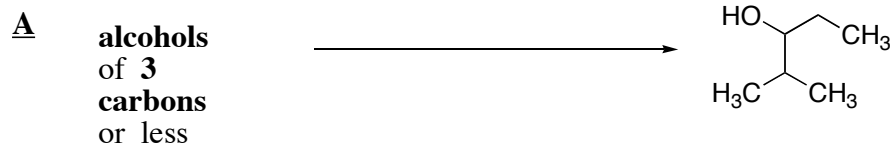
- 1) When benzene and propenal are mixed together, no appreciable reaction occurs (as shown in **A**). However, when aluminum chloride is added to the reaction, the product shown in **B** is obtained. Propose a mechanism for reaction **B** and explain why the reaction proceeds in **B** but not in **A**.



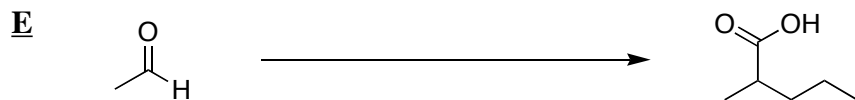
- 2) Propose a mechanism for the following reaction. For full credit, be sure to show all intermediates, charges, and lone pairs of electrons.



3) Complete the following syntheses. For full credit, be sure to show all intermediary products, reagents, and solvents.



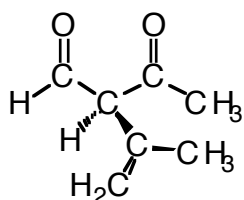
(your reagents can have > 3 carbons as long as they don't end up being part of your final product)



4) A group of students taking organic chemistry reported the following results for their multi-week laboratory experiment. Look over the results *carefully & critically* (pretend you are the instructor grading this report). Then see the following page for instructions regarding this problem.

“Procedure: In examining potential drugs in local plants, we collected leaves from a snuffaluffagus tree, ground them up, and placed them in 50 mL of ethanol to dehydrate them. After filtration, the remaining plant bits were extracted with CH_2Cl_2 . Column chromatography was performed on the extracts and one of the fractions was shown by GC to be 99.9% pure.

Results: We have identified the compound as...



Compound A

This is supported by the following spectral data:

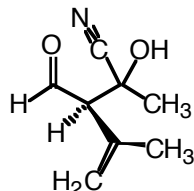
IR: We saw alkene peaks at 3030 cm^{-1} , alkane peaks at 2980 cm^{-1} , and the only other significant ones were two large peaks at 1760 cm^{-1} and 1750 cm^{-1} , showing that we have two carbonyl groups (an aldehyde C-H stretch was seen at 2835 cm^{-1}).

NMR: ^{13}C NMR showed 7 peaks at 210, 205, 135, 127, 56, 24, and 21ppm.

MS: Showed an M^+ peak at 126. An $[\text{M}-15]$ peak at 111 indicates loss of CH_3 . An $[\text{M}-41]$ peak indicates loss of $\text{CH}_3\text{-C}=\text{CH}_2$.

Derivative studies: We wanted to further verify that our compound was indeed the structure shown above. After some literature searching, we found several similar compounds with published physical constants. We then proceeded to synthesize these compounds from our natural product (A) to compare physical constants of the published compounds to the derivatives that we synthesized.

Derivative #1



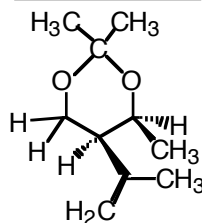
m.p. = $122\text{ }^\circ\text{C}$

Source = Merck Index

This derivative was made by refluxing compound A in 10% HCN followed by filtration to collect the solid. The product was recrystallized with methanol, vacuum filtered, and allowed to dry overnight.

The derivative that we synthesized had a melting point of $116\text{ }^\circ\text{C}$. This is only 8 degrees from the literature value, and we attribute the difference to impurities or moisture in the sample.

Derivative #2



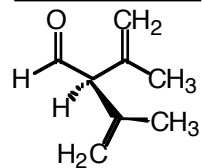
m.p. = $72\text{ }^\circ\text{C}$

Source = Merck Index

This derivative was made by first reducing compound A with excess NaBH_4 in EtOH. This gave us a diol which we proceeded to react with acetone and dilute sulfuric acid. This gave derivative #2 in 80% yield after recrystallization with toluene.

The derivative that we synthesized had a melting point of $77\text{ }^\circ\text{C}$. We attribute the higher melting point (only 5 ° above the literature value) to increasing the heat too rapidly.

Derivative #3



m.p. = $90\text{ }^\circ\text{C}$

Source = Merck Index

We made this derivative by protecting the aldehyde with and $\text{HOCH}_2\text{CH}_2\text{OH} / \text{H}^+$ then doing a Wittig reaction on the protected compound A. We then removed the protecting group with H^+ in excess H_2O . Recrystallization with toluene gave derivative #3 in 57% yield.

The derivative that we synthesized had a melting range of $87\text{-}89\text{ }^\circ\text{C}$. We even put our molecule in a polarimeter and got an optical rotation of $(+)\text{ }65^\circ$. However, no literature value was available.”

4) There are several fundamental mistakes (at least 4) in the students' reasoning and analysis. In fact **compound A** cannot possibly be the structure that they suggest! As an experienced organic chemistry student, point out at least 3 of them. *Note: there are no errors in their procedure, just the data that they report and/or their interpretation of it.*