

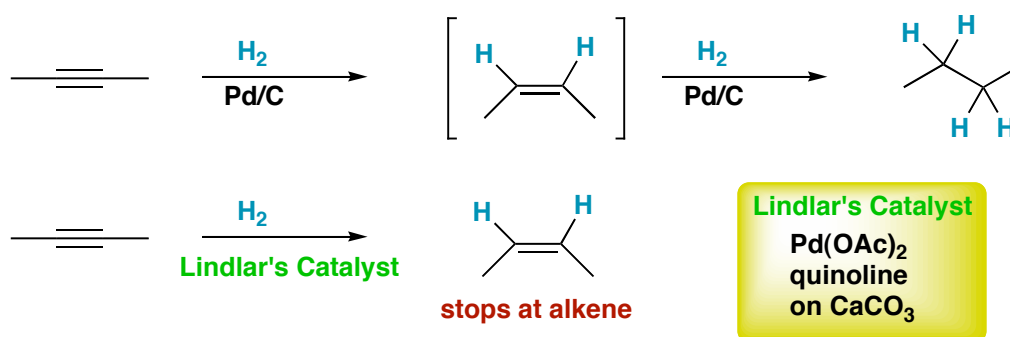
# Chem 341 • Organic Chemistry I

Lecture Summary 24 • October 22, 2007

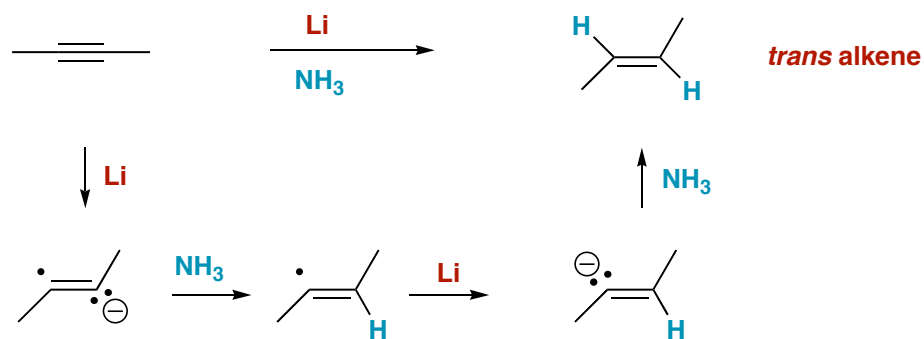
## Chapter 8 - Alkynes: An Introduction to Organic Synthesis

### Hydrogenation of Alkynes

Alkynes can be hydrogenated just like alkenes all the way to the alkane with Pd/C catalysis. In order to stop the reaction after the first addition of hydrogen, you need a 'poisoned', or less reactive catalyst. Lindlar's catalysts foots the bill here. This is a Pd catalyst whose reactivity has been tempered by the addition of quinoline.

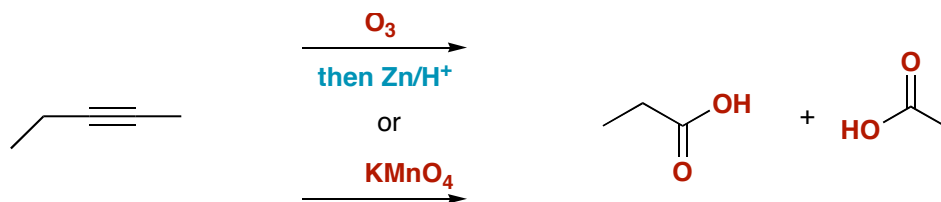


Catalytic hydrogenation with hydrogen gas using Lindlar's catalyst is specific for generating the cis alkene. Trans alkenes can be prepared by reduction of alkynes using lithium metal in ammonia. This reaction proceeds via two successive one-electron reductions and proton transfers from the ammonia. The carbanion intermediates place the substituents in the more stable trans positions prior to protonation.



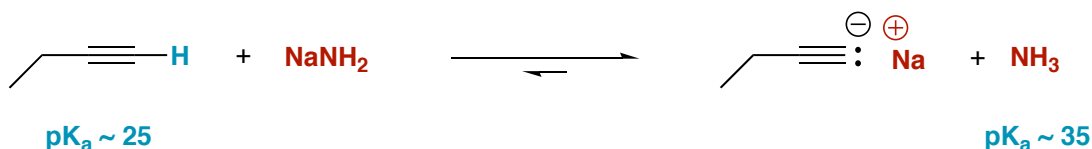
### Oxidation of Alkynes

Because of the additional pi-bond, ozone will cleave an alkyne to provide a carboxylic acid. The same product is produced using potassium permanganate.



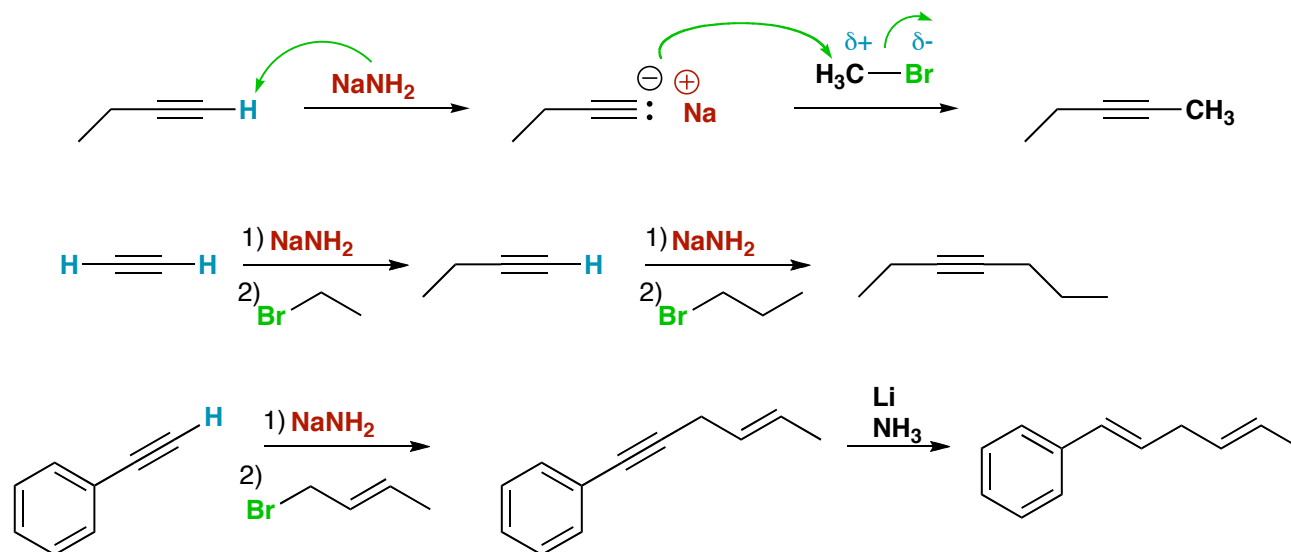
## Acidity of Alkynes

Due to the nature of the sp-orbital on the end of an alkyne (it has 50% s character) it can accommodate a lone pair of electrons more readily than an sp<sup>2</sup> or sp<sup>3</sup> orbital. Thus, terminal alkynes are readily deprotonated with a strong base like sodium amide.

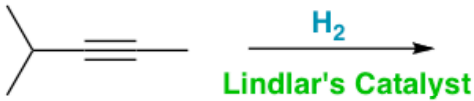
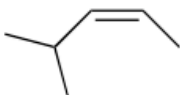
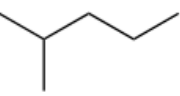
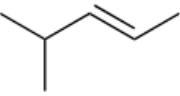


## Alkylation of Alkynes

Alkyne anions will participate in substitution reactions with carbon-based electrophiles like alkyl halides. Thus, it is relatively straightforward to build up carbon chains by alkylating alkynes. This works best with primary alkyl halides and methyl halides. While secondary halides may work, they do suffer from side reactions (elimination reactions) and are not ideal. Tertiary halides will not participate in this reaction as they are too hindered for the acetylide to attack it. Here are some examples used in synthesis.



Quiz of the day

<p><b>Q:</b> Which of the compounds on the right would be produced by the reduction reaction shown below?</p>  <p>Reaction scheme: 2-methylbut-1-yne <math>\xrightarrow[\text{Lindlar's Catalyst}]{\text{H}_2}</math> 2-methylbut-2-ene</p>	<input checked="" type="checkbox"/> <b>1:</b>	
<input type="checkbox"/> <b>2:</b>		
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