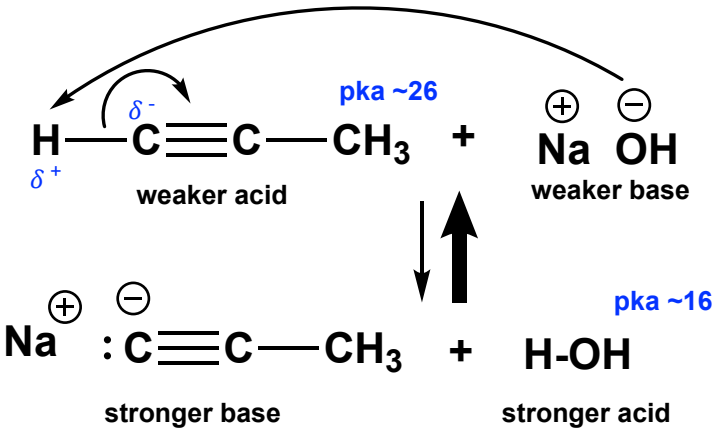
Upcoming Topics:
1. Alkyne Reactions
2. Radical Additions to Alkenes
3. Polymers
4. Alcohol & Sugars: Structure + Nomenclature

Review
:Base picks up a proton (H^+) very fast, may be negatively charged
:Nucleophile attaches other atoms (like carbon)

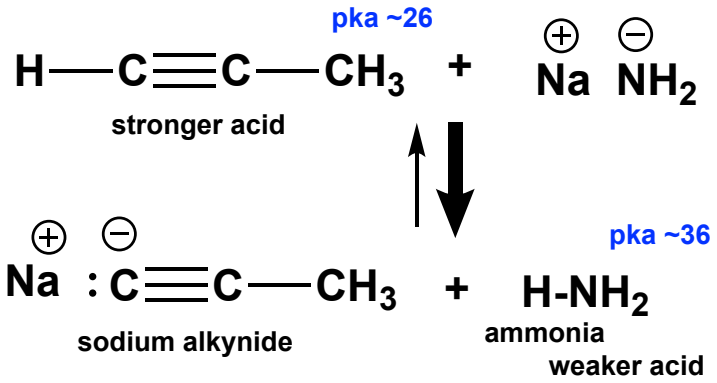
Reactions of Terminal Alkynes – Alkylation

Example 1



The stronger acid and stronger base are always on the same side. As such, the reaction is driven towards the opposite side.

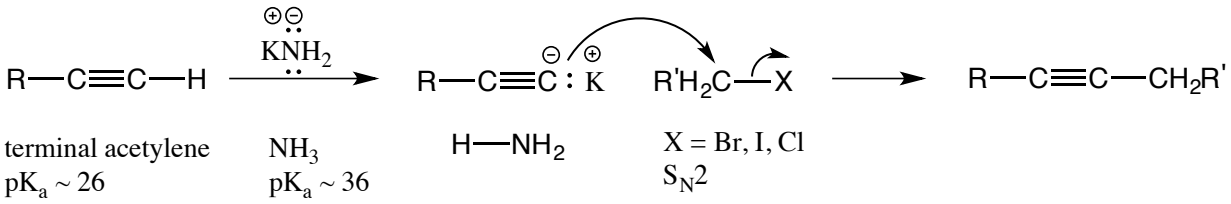
Example 2



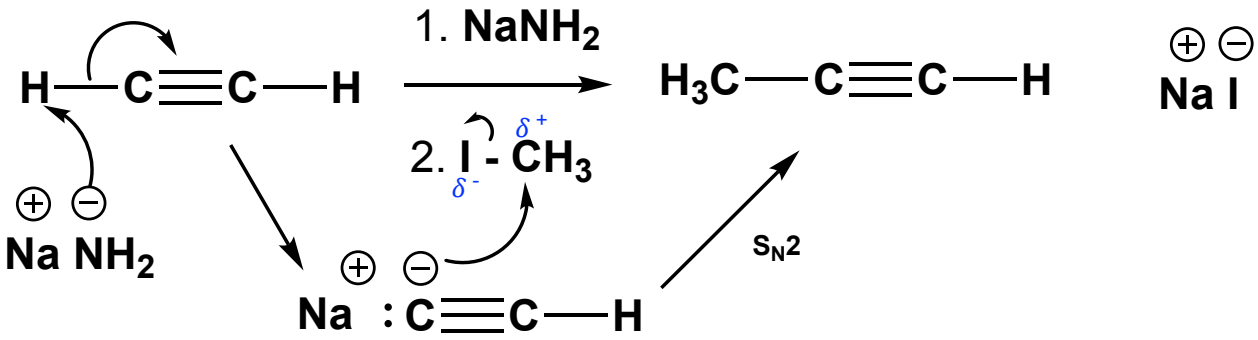
How can this terminal anion be used to form useful compounds?

Terminal alkynes/acetylenes can be deprotonated and then reacted with alkyl halides to form new carbon-carbon bonds.

General Scheme

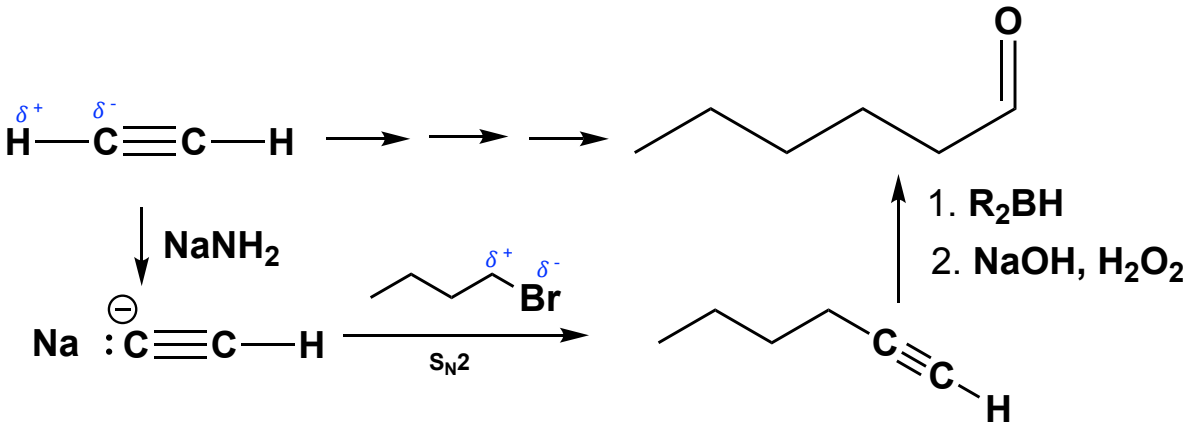


Example 1



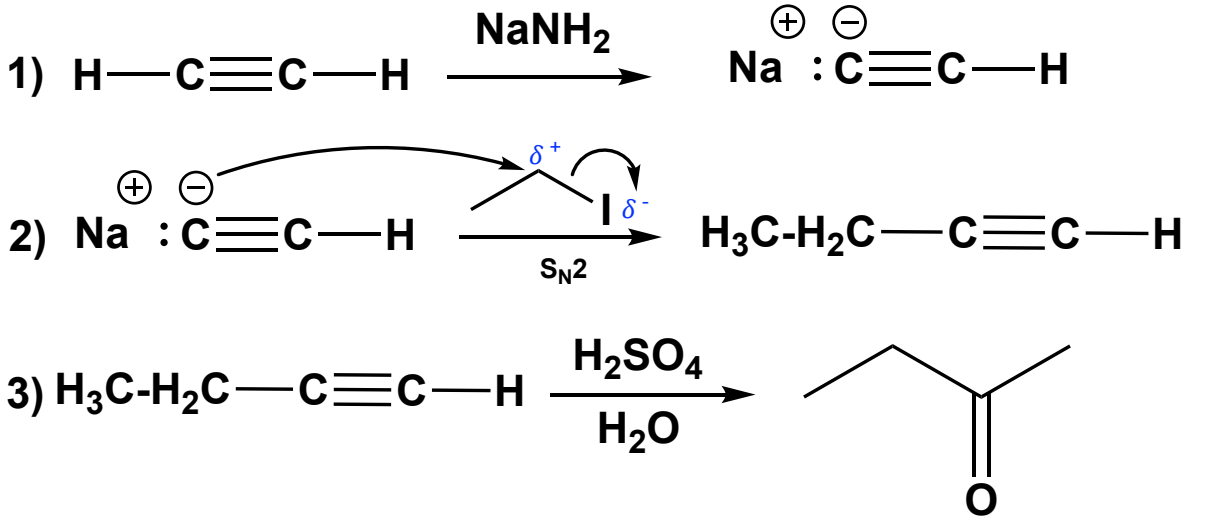
Example 2

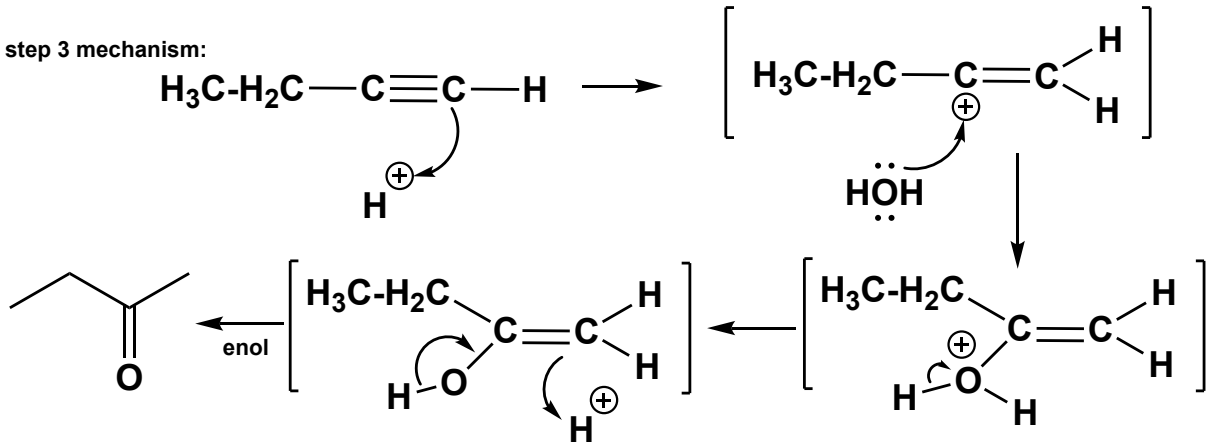
What reactions could be used to create this aldehyde?



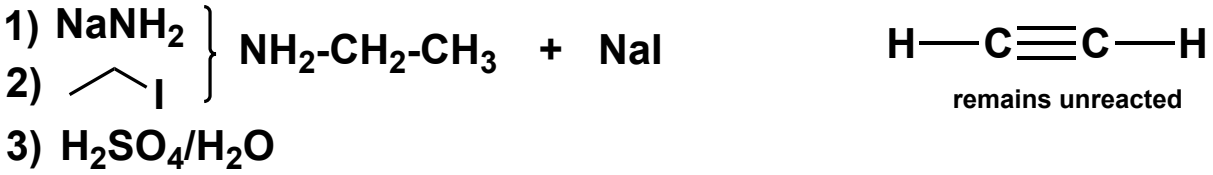
Example 3

What about this ketone?

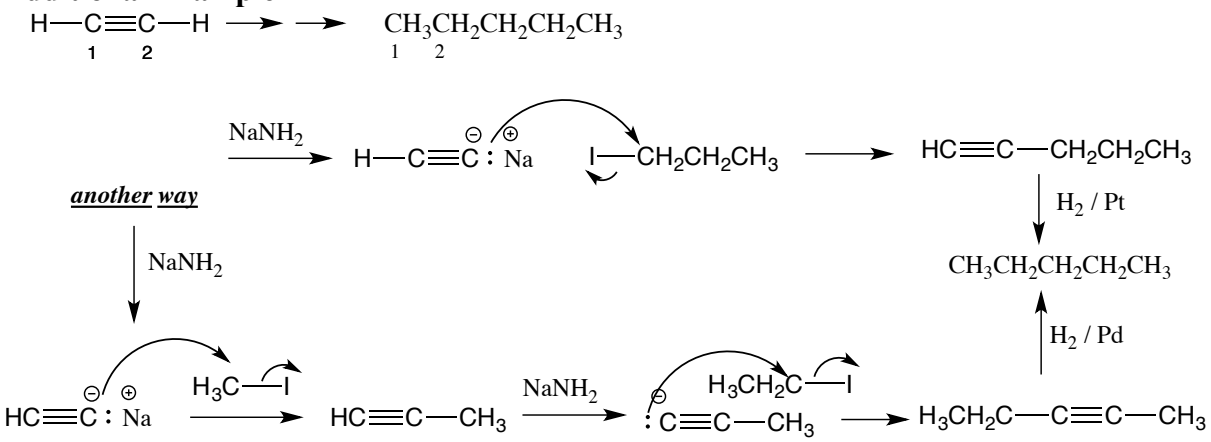




Can you add everything together at once? No. The sodium amide will react with the alkyl halide and form a byproduct amine instead of the desired ketone.

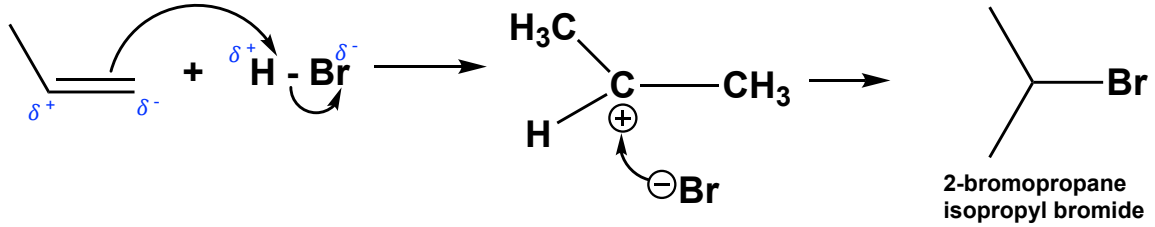


Additional Example

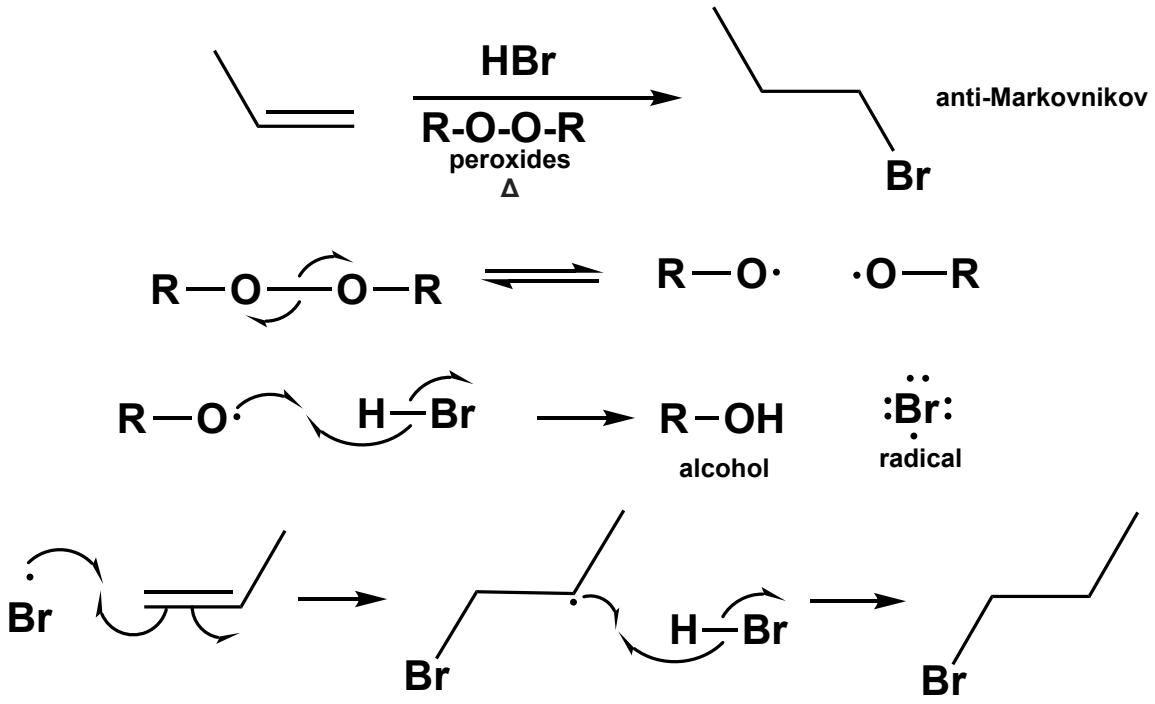


Radical Addition to Alkenes

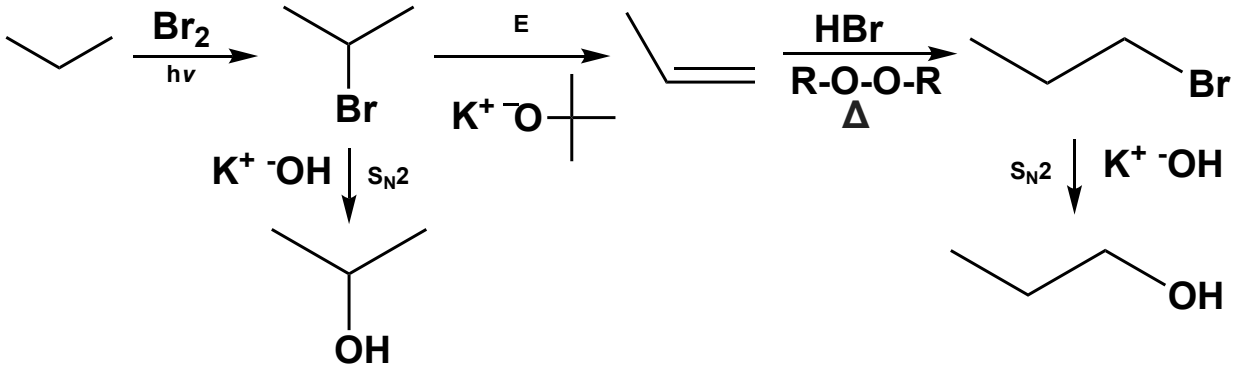
Recall the addition of a hydrogen halide:



By adding peroxide and heat, the following can occur via a radical mechanism.



Now, you can combine all the different types of reactions you have learned to create your desired compound from simple starting material. For example, using propane, several compounds can be created:



Polymers

poly – many, meros – parts

Natural Polymers:

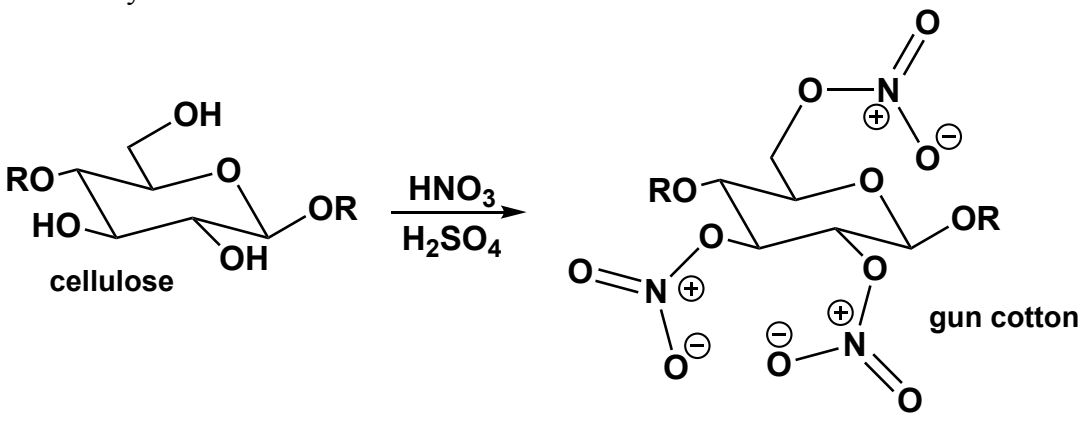
- Nucleic acids (DNA, RNA)
- Proteins and peptides (amino acid polymers)
- Polysaccharides (cellulose)
- Fats, polyketides (polymers of acetic acid)

Human-Made Polymers

- Christian Schönbein, 1826 professor in Basel
  - Mopped up a spill of H_2SO_4 and HNO_3 with an apron made of cotton (cellulose, a polymer of glucose),
  - He washed the apron and hung it up to dry
    - The apron exploded → He had created gun cotton!

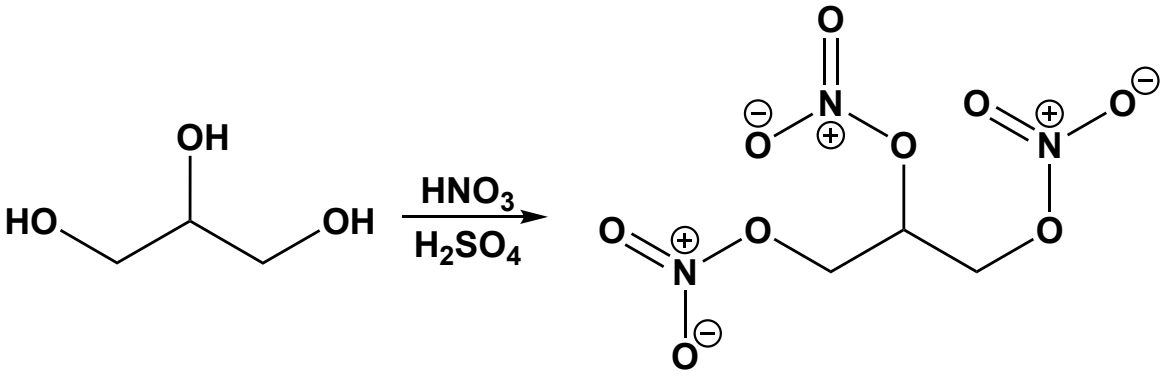
How did this happen?

In the presence of H_2SO_4 and HNO_2, the free hydroxyl groups form a material that spontaneously combusts.



Another example: **glycerol**

Under the same conditions, glycerol will form nitroglycerine

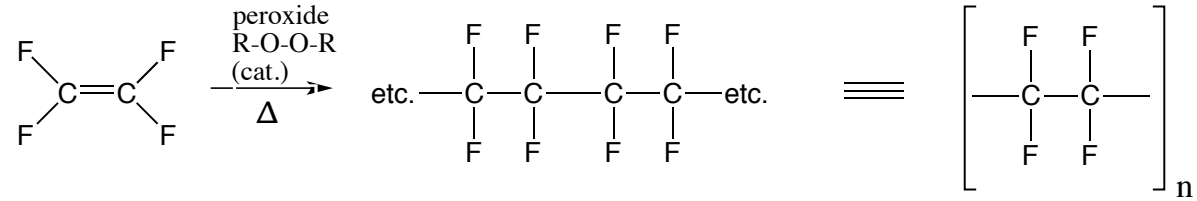


2 to 5 % of nitroglycerine was combined with diatomaceous earth → dynamite!

Who did this reaction? Alfred Nobel, the founder of the Nobel Prize!

- *Wallace Carothers* 1896-1937 DuPont
  - Nylon (polyamide)
  - Dacron (polyester)
- Roy Plunkett 1938 DuPont
  - Teflon (created from tetraflyoroethylene, a toxic gas)

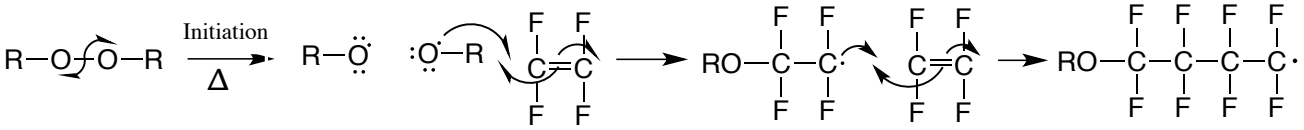
Teflon: Polytetrafluoroethylene



tetrafluoroethylene
toxic gas

Teflon
MW > 1 million

Polymerization Mechanism of Teflon



repeat to form long chains