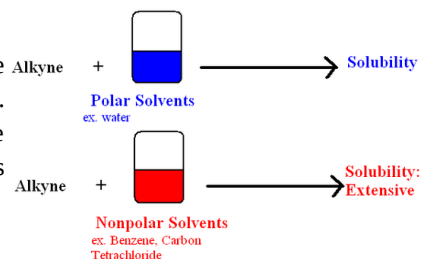


## 11.3: Physical Properties

The characteristic of the triple bond helps to explain the properties and bonding in the alkynes.

### Importance of Triple Bonds

Hybridization due to triple bonds allows the uniqueness of alkyne structure. This triple bond contributes to the nonpolar bonding strength, linear, and the acidity of alkynes. Physical Properties include nonpolar due to slight solubility in polar solvents and insoluble in water. This solubility in water and polar solvents is a characteristic feature to alkenes as well. Alkynes dissolve in organic solvents.

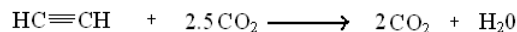


### Boiling Points

Compared to alkanes and alkenes, alkynes have a slightly higher boiling point. Ethane has a boiling point of  $-88.6^{\circ}\text{C}$ , while Ethene is  $-103.7^{\circ}\text{C}$  and Ethyne has a higher boiling point of  $-84.0^{\circ}\text{C}$ .

### Alkynes are High In Energy

Alkynes are involved in a high release of energy because of repulsion of electrons. The content of energy involved in the alkyne molecule contributes to this high amount of energy. The pi-bonds however, do not encompass a great amount of energy even though the concentration is small within the molecule. The combustion of Ethyne is a major contributor from  $\text{CO}_2$ , water, and the ethyne molecule



$\Delta H = -311 \text{ kcal/mol}$

To help understand the relative stabilities of alkyne isomers, heats of hydrogenation must be used. Hydrogenation of the least energy, results in the release of the internal alkyne. With the result of the production of butane, the stability of internal versus terminal alkynes has significant relative stability due to hyperconjugation.

### Outside links

- <http://www.ucc.ie/academic/chem/dolc...t/alkynes.html>
- <http://www.cliffsnotes.com/WileyCDA/...eId-22631.html>

### References

- Bloch, D.R. Organic chemistry demystified, New York : McGraw-Hill, 2006.
- Vollhardt. Schore, Organic Chemistry Structure and Function Fifth Edition, New York: W.H. Freeman and Company, 2007.

### Problems

- What is the carbon-carbon, carbon-hydrogen bond length for alkyne? Is it shorter or longer than alkane and alkene?
- Which is the most acidic and most stable, alkane, alkene, or alkyne? And depends on what?
- How many pi bonds and sigma bonds are involved in the structure of ethyne?
- Why is the carbon-hydrogen bond so short?
- What is the alkyne triple bond characterizes by? How is this contribute to the weakness of the pi bonds?
- How is heat of hydrogenation effects the stability of the alkyne?

### Contributors

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