ALKYNES

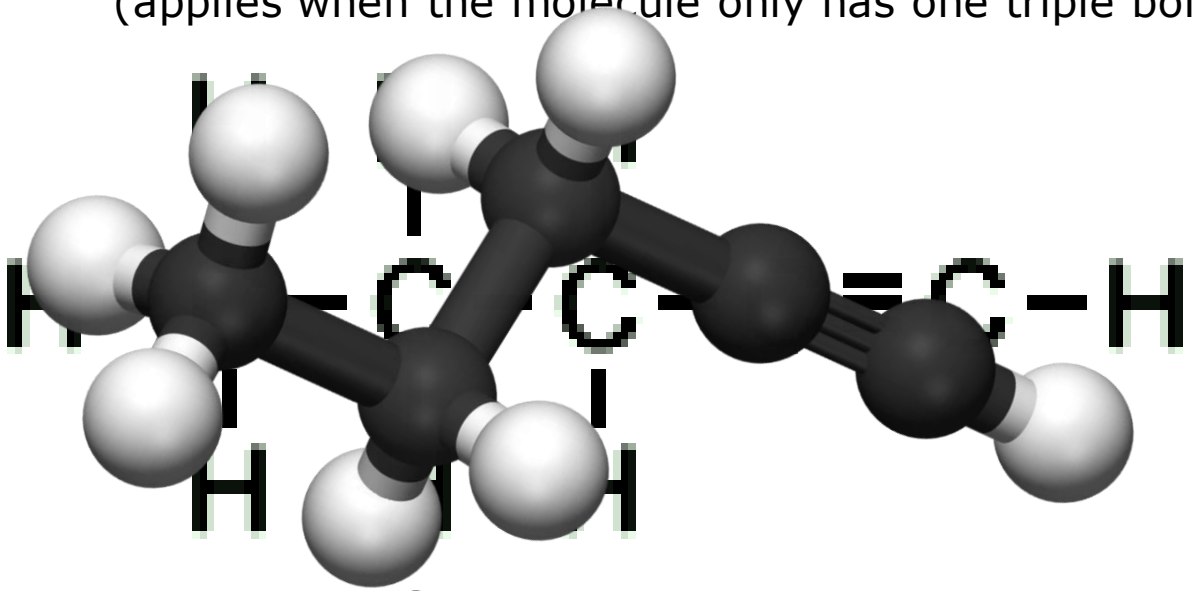
ALKYNES

-Characterized by C≡C triple bond(s)

-Classified as *unsaturated hydrocarbons*

-empirical formula = C_nH_{2n-2}

(applies when the molecule only has one triple bond)



→ C_nH_{2n-2}, n=5

= C_5H_8

ALKYNES

Properties:

-Are hydrophobic like all hydrocarbons

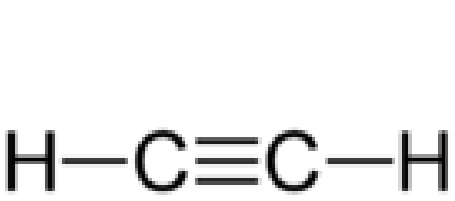
-Have higher boiling points than alkanes and alkenes due to their ability to stack

Name	Formula	B.p. °C
Acetylene	$HC{\equiv}CH$	−75
Propyne	$HC{\equiv}CCH_3$	−23
1-Butyne	$HC{\equiv}CCH_2CH_3$	9
1-Pentyne	$HC{\equiv}C(CH_2)_2CH_3$	40
1-Hexyne	$HC{\equiv}C(CH_2)_3CH_3$	72
1-Heptyne	$HC{\equiv}C(CH_2)_4CH_3$	100
1-Octyne	$HC{\equiv}C(CH_2)_5CH_3$	126
1-Nonyne	$HC{\equiv}C(CH_2)_6CH_3$	151
1-Decyne	$HC{\equiv}C(CH_2)_7CH_3$	182
2-Butyne	$CH_3C{\equiv}CCH_3$	27
2-Pentyne	$CH_3C{\equiv}CCH_2CH_3$	55
2-Hexyne	$CH_3C{\equiv}C(CH_2)_2CH_3$	84
3-Hexyne	$CH_3CH_2C{\equiv}CCH_2CH_3$	81
4-Octyne	$CH_3(CH_2)_2C{\equiv}C(CH_2)_2CH_3$	131
5-Decyne	$CH_3(CH_2)_3C{\equiv}C(CH_2)_3CH_3$	175

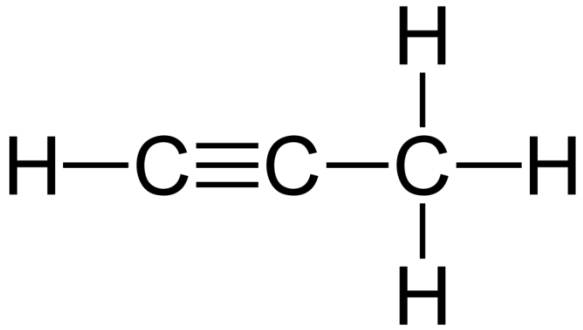
ethane	$C_2H_{6(g)}$	**-88**
propane	$C_3H_{8(g)}$	**-42**
butane	$C_4H_{10(g)}$	**0**
pentane	$C_5H_{12(l)}$	**+36**
hexane	$C_6H_{14(l)}$	**+68**
heptane	$C_7H_{16(l)}$	**+98**
octane	$C_8H_{18(l)}$	**+126**

ALKYNES

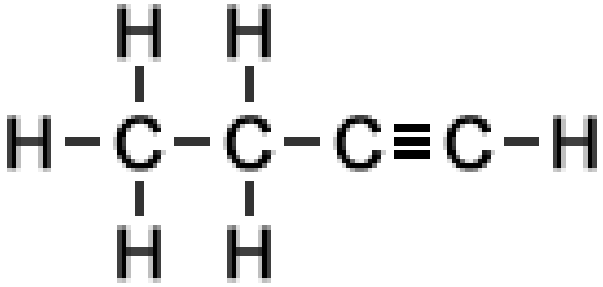
Some IUPAC names of alkynes:



ethyne



propyne

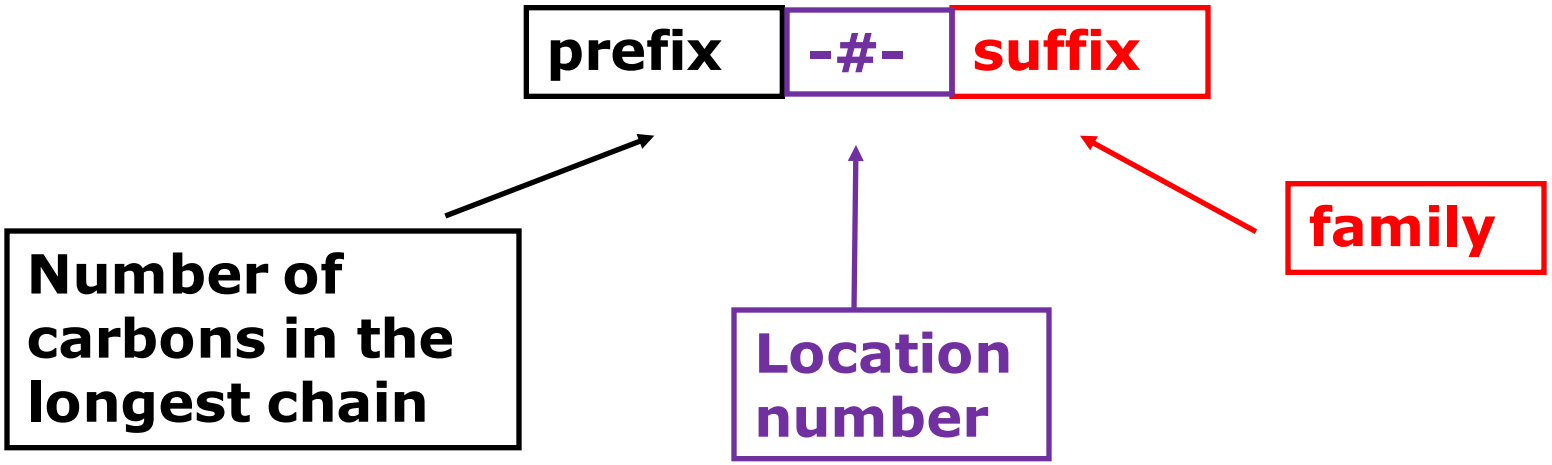


but-1-yne

All alkynes have the suffix “yne”

ALKyNES

IUPAC naming system:

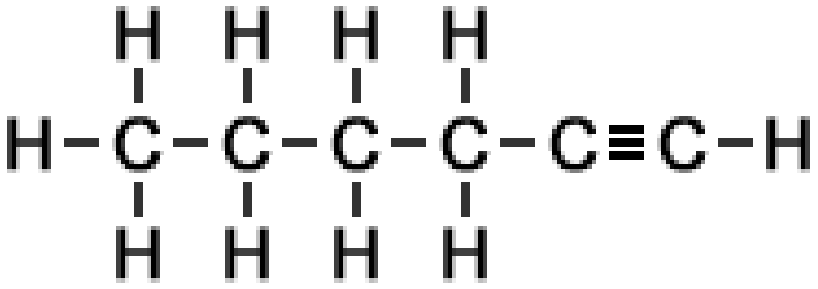


Ex: **but-1-yne**

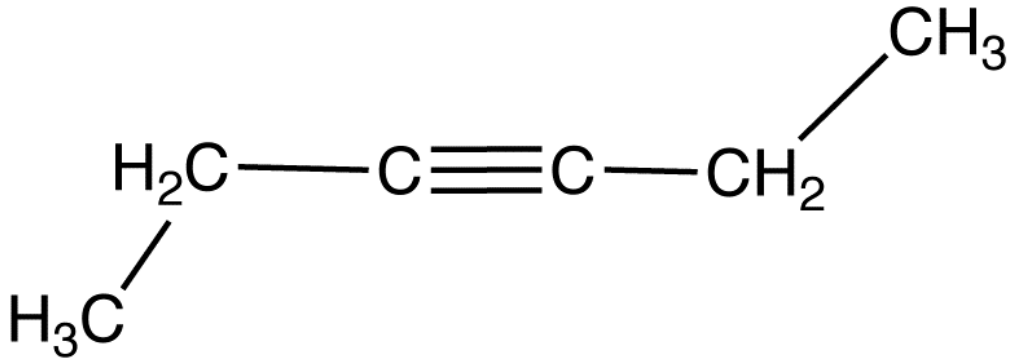
ALKYNES

IUPAC naming system:

Name the following alkynes:



hex-1-yne

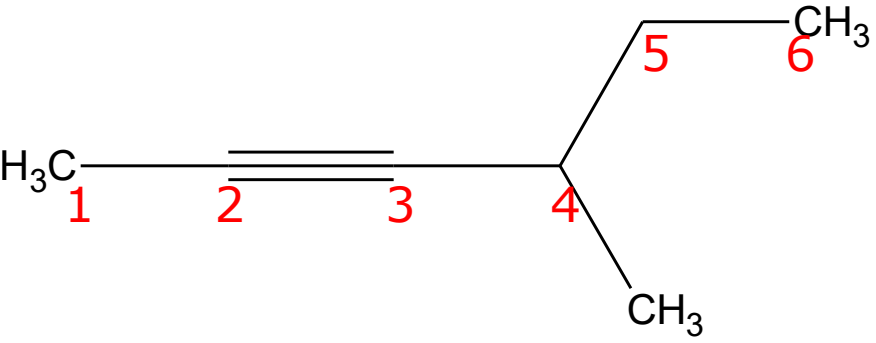


hex-3-yne

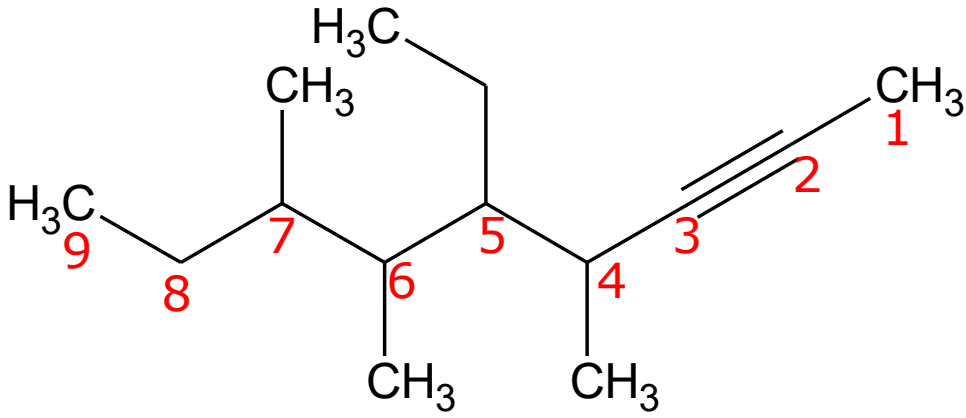
ALKYNES

IUPAC naming system:

Name the following alkynes:



4-methylhex-2-yne



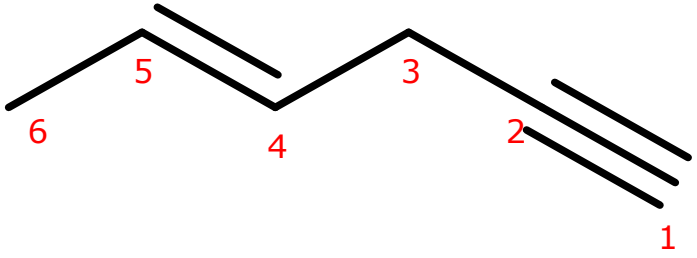
5-ethyl-4,6,7-trimethylnon-2-yne

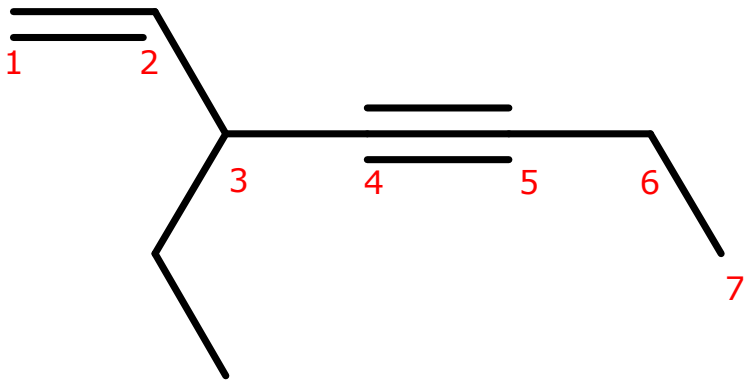
The triple bond has a higher numbering priority than the alkyl and halide substituents

ALKYNES

IUPAC naming system:

Name the following alkynes:





(4*E*)-hex-4-en-1-yne

3-ethylhept-1-en-4-yne

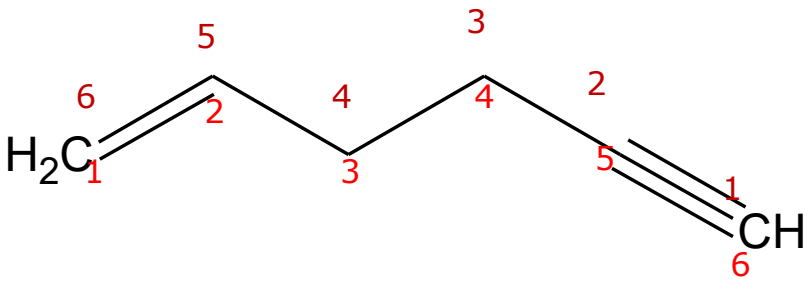
Alkenes are ordered first in the name, and the "e" ending is dropped.

Generally, double bonds and triple bonds have equal numbering priority (aim to get the lowest numbers).*

ALKYNES

IUPAC naming system:

Name the following alkynes:



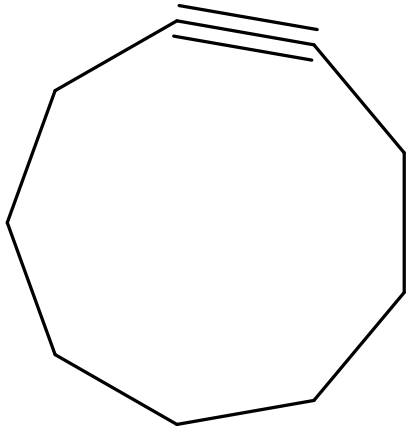
hex-1-en-5-yne or hex-5-en-1-yne

**Double bonds have higher priority than triple bonds whenever there is ambiguity in their numbers.*

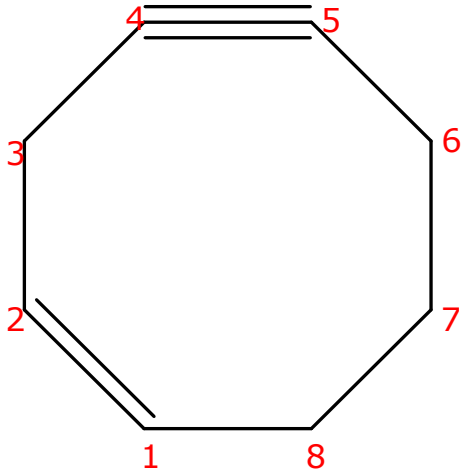
ALKYNES

IUPAC naming system:

Name the following alkynes:



cyclononyne



(1*Z*)-cyclooct-1-en-4-yne

Why does this cycloalkene have a (*Z*)-?

CYCLOALKENE *E* AND *Z*

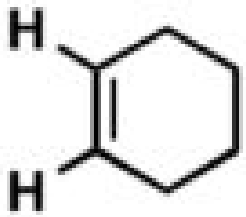
Why do cycloalkenes sometimes have a (*Z*)-?

For smaller rings…

Double bonds in cycloalkenes of 7 or fewer carbons are exclusively *cis*

The *trans* isomers are too strained to stable under ordinary conditions

Cis



Trans

(extremely unstable due to ring strain)

For this reason, we can omit the *cis*- or (*Z*)- when naming a "cycloheptene"

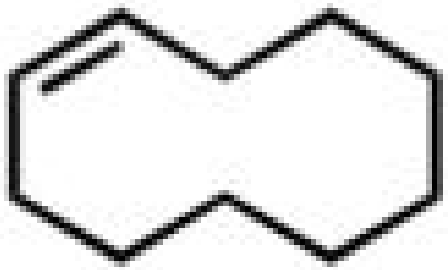
CYCLOALKENE *E* AND *Z*

Why do cycloalkenes sometimes have a (*Z*)-?

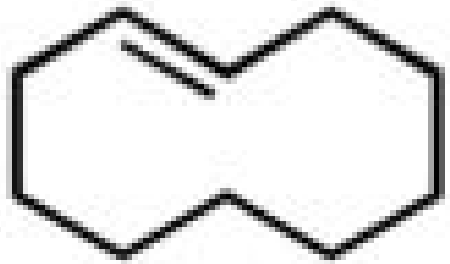
For larger rings...

The *trans*- or (*E*)- isomer is possible.

For cycloalkenes containing 8 or more carbons, a non-ambiguous name should indicate the alkene stereochemistry



(*Z*)-cyclodecene

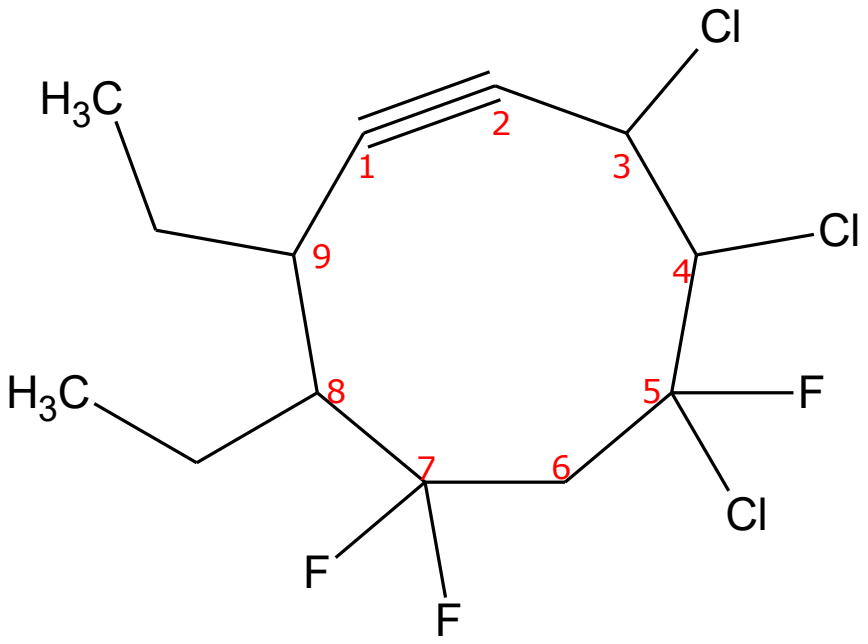


(*E*)-cyclodecene

ALKYNES

IUPAC naming system:

Name the following alkyne:



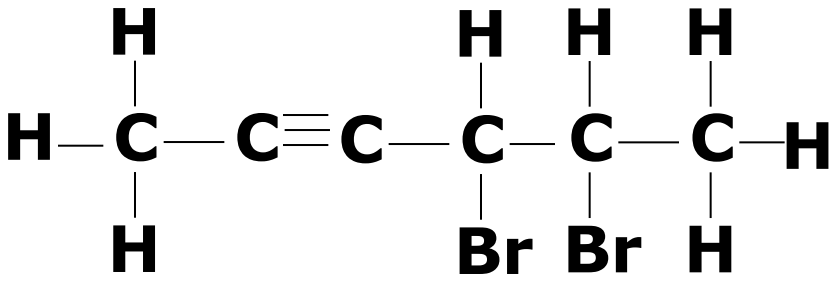
3,4,5-trichloro-8,9-diethyl-5,7,7-trifluorocyclononyne

ALKYNES

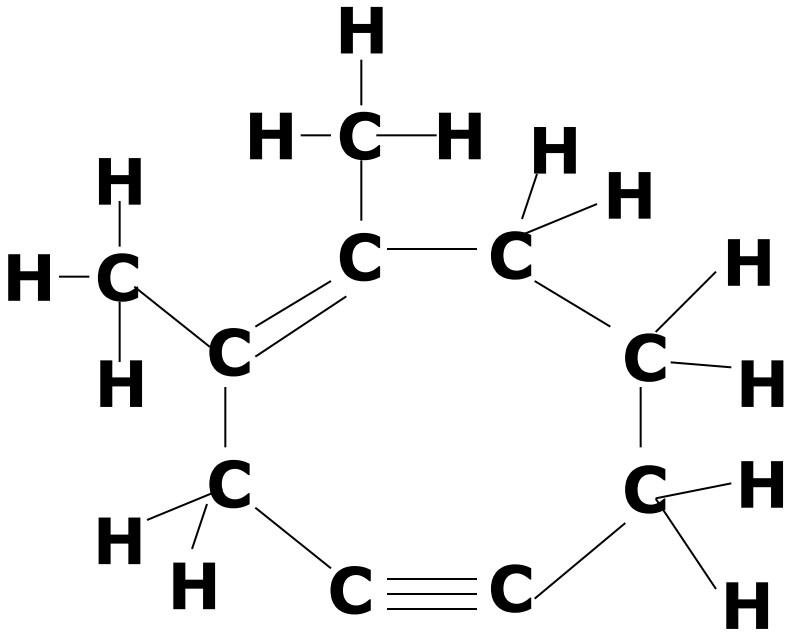
Drawing alkynes:

Draw the following alkynes using structural diagrams

4,5-dibromohex-2-yne



(1*Z*)-1,2-dimethylcyclooct-1-en-4-yne

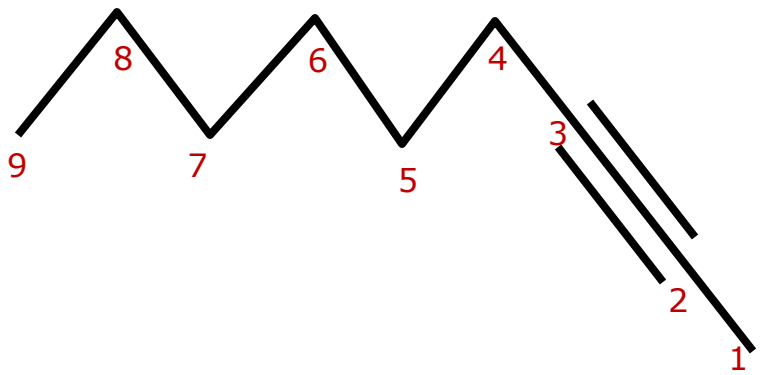


ALKYNES

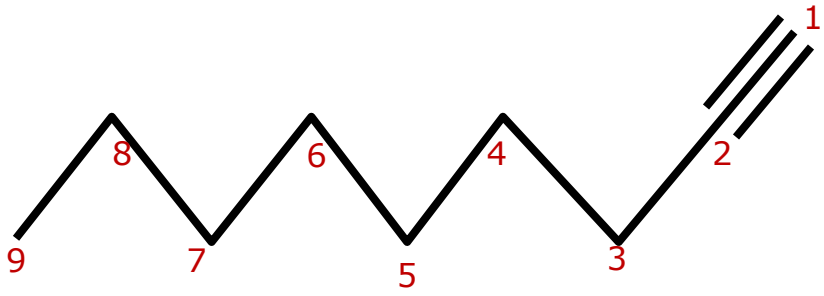
Drawing alkynes:

Draw the following alkynes using line diagrams

non-2-yne



non-1-yne



The triple bond cannot bend, so the bonds adjacent to a triple bond must be straight.