Intermediate IUPAC Nomenclature VI

Alkenes and Alkynes

- Alkenes have at least one double bond.

- Alkynes have at least one triple bond.

- Carbons with double bonds have sp^2 hybridization; carbons with triple bonds have sp hybridization.

- Both alkenes and alkynes can be hydrocarbons (just C+H) or can contain other atoms (e.g., halogens). They can be straight or branched chains or rings.

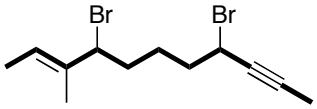
- Alkenes and alkynes are special functional groups and get higher priority than regular alkyl groups.

- IUPAC Nomenclature of alkenes and alkynes follows these steps:
  7) Find the longest chain of continuous carbons that includes **both** carbons in the *alkene* or *alkyne*. This is now the main chain. Name this chain as if it were a straight chain alkane.
     a. For alkenes drop the –ane ending and add –ene.
     b. For alkynes drop the –ane ending and add –yne.
     c. For molecules with both drop the –ane and add –enyne.
  8) Count the carbons in the main chain left to right and right to left. The direction you *first* run into a pi bond is the direction use to number the chain. Substituents no longer matter only the pi bond determines direction.
     a. If the numbers are the same go to the next nearest pi bond,
     b. If the numbers are exactly the same go to the first alkyl substituent.
     c. If the tie is between and alkene and an alkyne the alkene wins and gets low numbers (alphabetical order!)
  9) Give each substituent a number according to which carbon it's attached to. Numbers for alkenes and alkynes correspond to the lower numbered of the two carbons in the bond.
  10) List the substituents in alphabetical order in front of the main chain as you would in an alkane.
  11) Multiple substituents of the same kind are combined and given a prefix to indicate the number. (di-, tri-, tetra-) these prefixes do not count towards alphabetical order unless they are part of a branched substituent.
  12) List any relevant stereochemistry *(R,S,E,Z)* in parenthesis in front of the substituents. Stereochemistry is italicized.

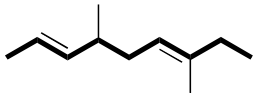
Notes:

- Alkenes as substituents are alkenyl substituents
- Alkynes as substituents are alkynyl substitutents
- Multiple bonds are always C-1 and C-2 of rings unless there is a higher priority functional group.

Examples:

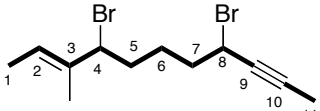


an **undecenyne**

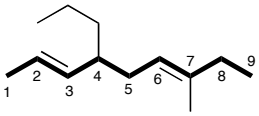


a **nonene**
(contains both alkenes)

2)

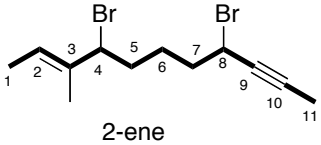


2-ene wins over 2-yne

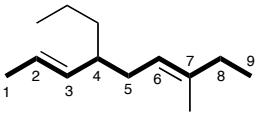


2,6 is lower than 3,7

3)



2-ene
3-methyl
4-bromo
8-bromo
9-yne



2-ene
4-propyl
6-ene
7-methyl

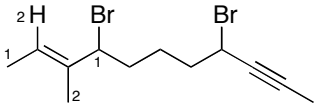
4,5) 4,8-dibromo-3-methylundec-2-en-9-yne

(internal numbers prevent confusion between which group is which number)

7-methyl-4-propyl-2,6-nonadiene
or
7-methyl-4-propylnona-2,6-diene

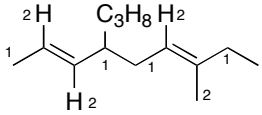
(still use di/tri/tetra for alkenes)
(numbers in front or internal are OK)

6)



E or Trans as the low priority groups are both H and opposite each other

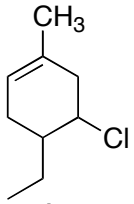
(2E)-4,8-dibromo-3-methylundec-2-en-9-yne
or
trans-4,8-dibromo-3-methylundec-2-en-9-yne



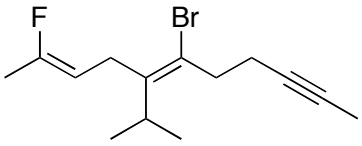
Both E as the high priority groups are on opposite sides. One alkene is trisubstituted so we do not generally mix cis/trans and E/Z.

(2E,6E)-7-methyl-4-propyl-2,6-nonadiene
or
(2E,6E)-7-methyl-4-propylnona-2,6-diene

Practice Alkene and Alkyne Nomenclature:



A



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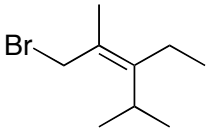

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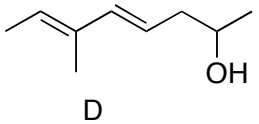

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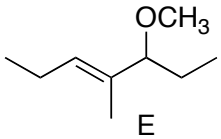

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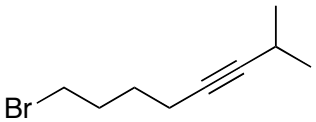

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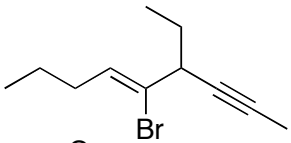

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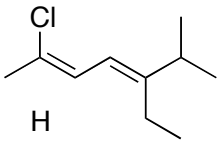

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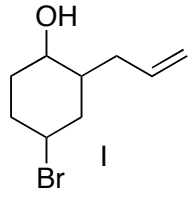

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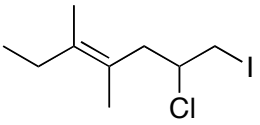

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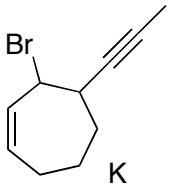

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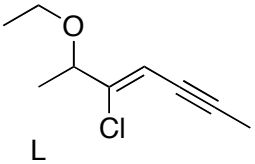

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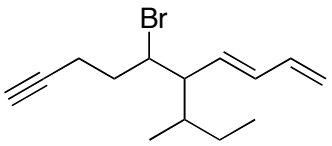

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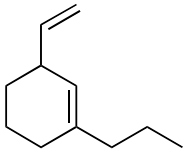

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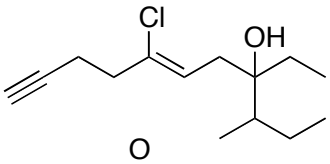

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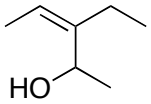

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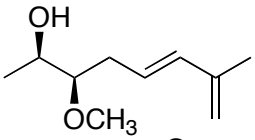

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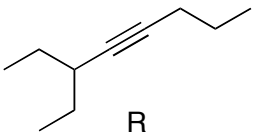

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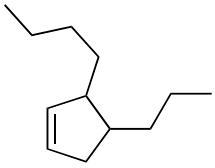

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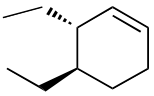

T

Practice Alkene and Alkyne Nomenclature Key:

Compound A: (1*Z)*-5-chloro-4-ethyl-1-methylcyclohexene

Compound B: *(2Z,5E)*-6-bromo-2-fluoro-5-isopropylundec-2,5-dien-9-yne or
(2Z,5E)-6-bromo-2-fluoro-5-(1-methylethyl)undec-2,5-dien-9-yne

Compound C: *(2Z)*-1-bromo-3-ethyl-2,4-dimethyl-2-pentene

Compound D: *(4E,6E)*-6-methylocta-4,6-dien-2-ol

Compound E: *(3E)*-5-methyoxy-4-methyl-3-heptene

Compound F: 8-bromo-2-methyl-3-octyne

Compound G: *(5Z)*-5-bromo-4-ethylnon-5-en-2-yne

Compound H: *(2Z,4E)*-2-chloro-5-ethyl-6-methyl-2,4-heptadiene

Compound I: 4-bromo-2-(2-propenyl)cyclohexanol

Compound J: (*3E)*-6-chloro-7-iodo-3,4-dimethyl-3-heptene

Compound K: *(1Z)*-3-bromo-4-(1-propynyl)cycloheptene

Compound L: *(4Z)*-5-chloro-6-ethoxyhept-4-en-2-yne

Compound M: *(3E)*-5-*sec*-butyl-6-bromodeca-1,3-dien-9-yne or
(3E)-6-bromo-5-(1-methylpropyl)deca-1,3-dien-9-yne

Compound N: (1Z)-3-ethenyl-1-propylcyclohexene

Compound O: *(6Z)*-7-chloro-4-ethyl-3-methylundec-6-en-10-yn-4-ol

Compound P: *(3Z)*-3-ethylpent-3-en-2-ol

Compound Q: *(2R,3R,7E)*-3-methoxy-7-methylocta-5,7-dien-2-ol

Compound R: 3-ethyl-4-octyne

Compound S: *(1Z)*-3-butyl-4-propylcyclopentene

Compound T: *(1Z,3S,4R)*-3,4-diethylcyclohexene