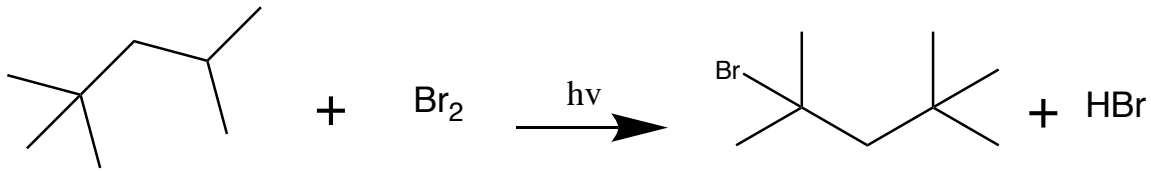
REVIEW:

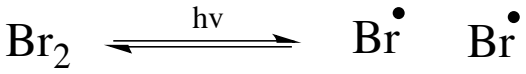
Stability of radicals:

- Increases with alkyl substitution.
- Alkyl groups are polarizable and donate electron density (negative charge) to electron deficient sites (e.g. radicals or cations).
- Inductive effect: through single bonds: can be donating (alkyl groups) or withdrawing

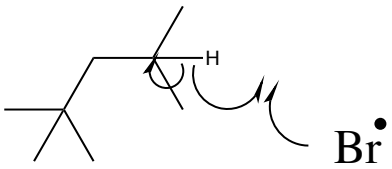
$\cdot CH_3$	<	$\cdot CH_2R$	<	$\cdot CHR_2$	<	$\cdot CR_3$
methyl radical (least stable)		primary radical		secondary radical		tertiary radical (most stable)



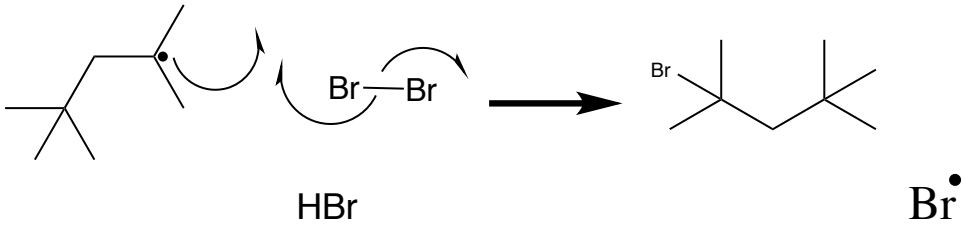
Initiation:



First propagation step:



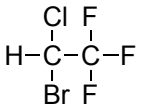
Second propagation step:



Physical Properties of Alkyl Halides:

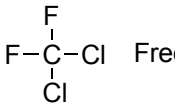
- Governed primarily by dipole-dipole interactions. "Non-polar", but more polar than hydrocarbons.
- High MP and BP relative to hydrocarbons of similar molecular weight
- Good solvents for organic compounds e.g. methylene chloride (CH_2Cl_2) and chloroform ($CHCl_3$)
- Density = ρ (rho) = 1.0 g/cm^3 for water
- If % composition > 65% halogen by weight, then more dense than water (ρ > 1.0)
- Immiscible (insoluble) in H_2O. H_2O floats on top.

Example: Halothane – general anesthetic

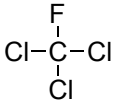


1,1,1-trifluoro-2-bromo-2-chloroethane

Example: Refrigerants



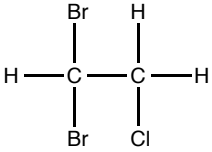
Freon 12



Freon 11

How would you synthesize Freon 11? Fluorinate or chlorinate first? You would chlorinate first. Fluorine is more reactive and it would be difficult to get monofluorinated products.

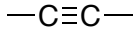
Another Example:



1,1-dibromo-2-chloroethane

Potential Male contraceptive – Sperm count for a healthy male is typically 100 million per mL. This compound can reduce that to 0.

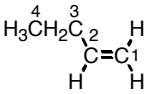
ALKENES AND ALKYNE NOMENCLATURE



Alkene (olefin)	Alkyne (acetylene)
- sp^2 hybridized	- sp hybridized
- 120°, planar	- 180°, linear

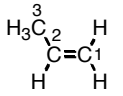
Alkenes – Structure and Nomenclature

ethylene (common name)
ethene (systematic name)
replace "ane" of corresponding alkane name with "ene"



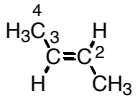
1-butene

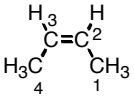
- to name find longest chain containing maximum number of C=C with both multiply bonded carbons in chain



propylene (common name)
or propene(systematic name)

- number from end to give 1st carbon of C=C lowest number, prefix with number to indicate position of first double bonded carbon





- cis = two large groups on same side
- trans = two large groups on opposite side

trans-2-butene

cis-2-butene

These 2-butenes are structural isomers with respect to the 1-butene above

Stereoisomers (Diastereomers)

Another example:

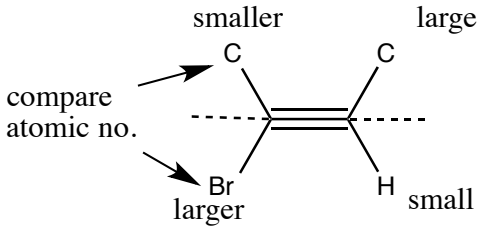
2-bromo-2-butene

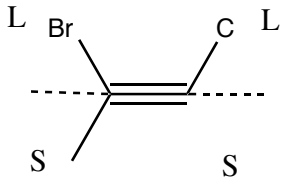
2-bromo-2-butene

(methyls same side of double bond)

(methyls opposite sides of double bond)

E-Z Nomenclature



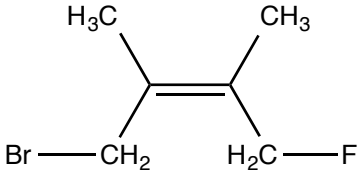


Large groups are on opposite sides on the C=C --> E

E-2-bromo-2-butene

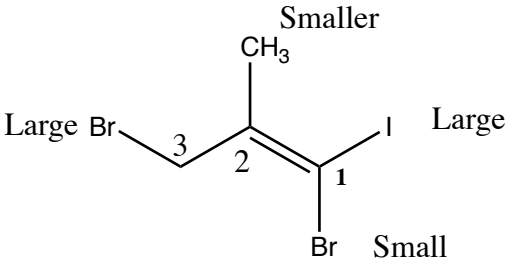
Z-2-bromo-2-butene

If you canno decide on basis of atomic number of atoms directly attached to double bond, go to the next set of atoms until a higher atomic number is found

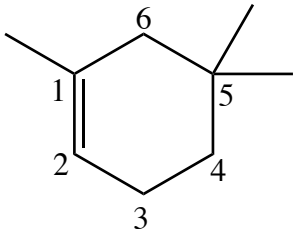


Z-1-bromo-2,3-dimethyl-4-fluoro-2-butene

Other examples:



(E)-1,3-Dibromo-1-iodo-2-methyl-1-propene



1,5,5-trimethyl-1-cyclohexane

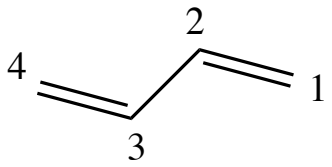
Multiple C=C

2 Diene

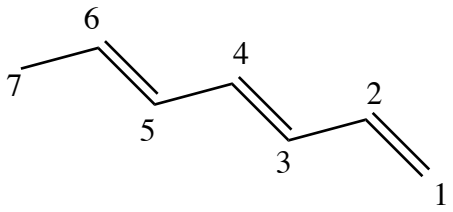
3 Triene

4 Tetraene

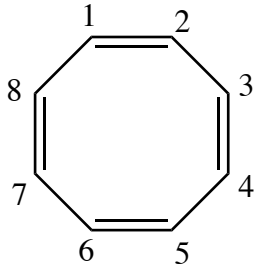
…etc



Buta-1,3-Diene
1,3-Butadiene



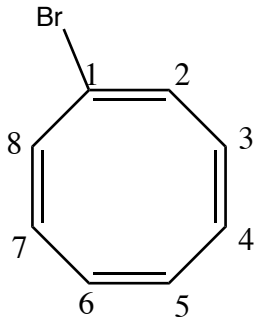
1,3,5-triene
(3E,5E)-1,3,5-Heptatriene
1,3E,5E-Heptatriene

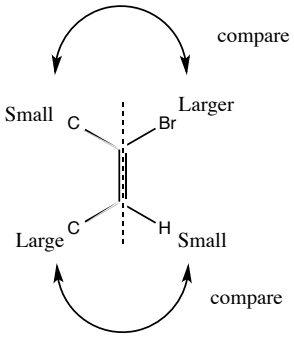


1,3,5,7-Cycloctatetraene
COT

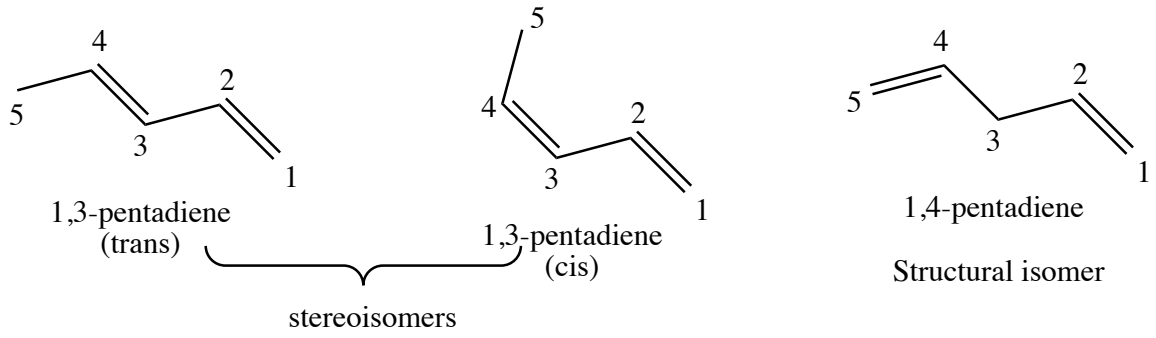
(all Z double bonds)

Another examples:

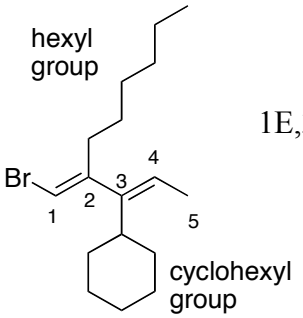




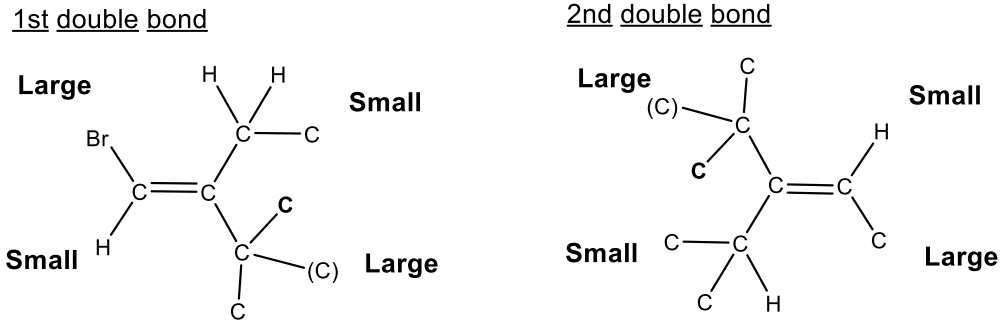
1-Bromo-1,3,5,7-cycloctatraene - the double bond at 1-2 is E



Example



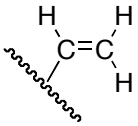
1E,3E-1-bromo-3-cyclohexyl-2-hexyl-1,3-pentadiene



Note: Carbons attached to double and triple bonds are depicted as additional carbon-carbon bonds in the representations above.

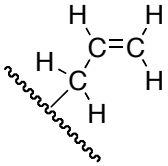
Special Nomenclature of common groups:

Different groups

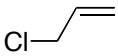


Vinyl group

Vinyl chloride
1-chloroethene



Allyl group



Allyl chloride
3-chloropropene