Assigning Stereochemistry VI

**E and Z in Alkenes**

- Alkenes can have multiple geometric isomers (non-superimposable, non-mirror images)

- If there are exactly two substituents and two hydrogens attached an alkene the isomer may be labeled as *cis*- or *trans*.

  ![Diagram of trans and cis alkenes](image)

- If there are two or more substituents attached to an alkene the isomer may be labeled as *E* or *Z*
  - All *cis*- molecules are *Z*, but not all *Z* molecules are *cis*; all *trans-* molecules are *E*, but not all *E* molecules are *trans*. *Cis* and *trans* are accepted when appropriate, but *E* and *Z* work for all asymmetrical alkenes.

- Assigning Relative Configuration: *E* vs. *Z*
  - For each sp\(^2\) carbon in the alkene identify the two substituents and prioritize them 1 and 2 using the Cahn-Ingold-Prelog Rules.
    - See Assigning Stereochemistry II
  - If both high priority groups are on the same side of the alkene the molecule is *Z*. (similar to a *cis*)
    - This can be remembered by *Z* is on the Zame Zide.
  - If the high priority groups are on opposite sides of the alkene the molecule is *E*. (similar to *trans*)
  - If the there is no difference between the groups then the molecule is symmetrical and thus *E/Z* is unnecessary. (e.g. monosubstituted alkenes)

  ![Diagram of E and Z alkenes](image)
Examples:

Compound A:

\[ \text{assign priority} \quad \rightarrow \quad \text{High priority on the same side} \quad (3Z)-4\text{-bromo-3\text{-pentenal}} \]

Compound B:

\[ \text{assign priority} \quad \rightarrow \quad \text{High priority on opposite sides} \quad (3E)-3\text{-methyl-3\text{-hexene}} \]

Compound C:

\[ \text{assign priority} \quad \rightarrow \quad \text{High priority on opposite sides} \quad (3E)-1\text{-chloro-4\text{-ethyl-5\text{-methyl-3\text{-hexene}}}} \]

Compound D:

\[ \text{assign priority} \quad \rightarrow \quad \text{High priority on the same side} \quad (2Z)-2\text{-bromo-3\text{-butenoic acid}} \]

Compound E:

\[ \text{assign priority} \quad \rightarrow \quad (2Z,4E)-2,4\text{-heptadiene or cis,trans-2,4-heptadiene} \]
Practice Examples:

Assign E or Z to each molecule.

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X
Practice Examples Key:

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X