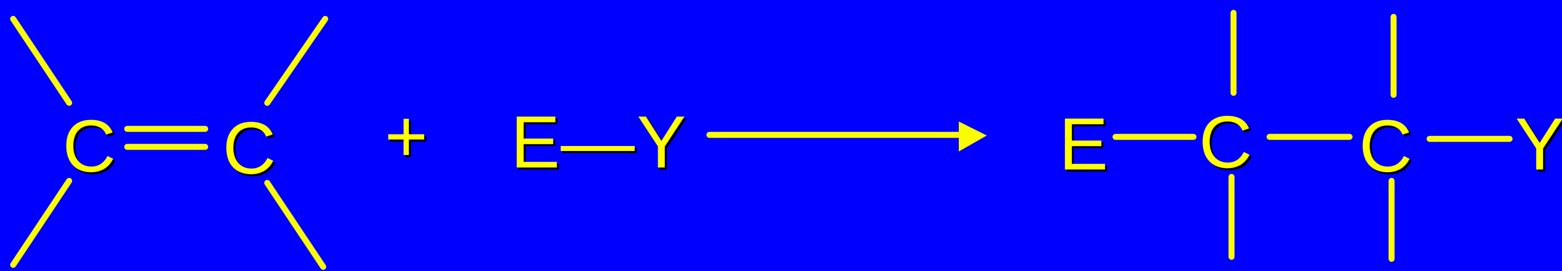
# 7.13

# Chemical Reactions That Produce Diastereomers

## *Stereochemistry of Addition to Alkenes*

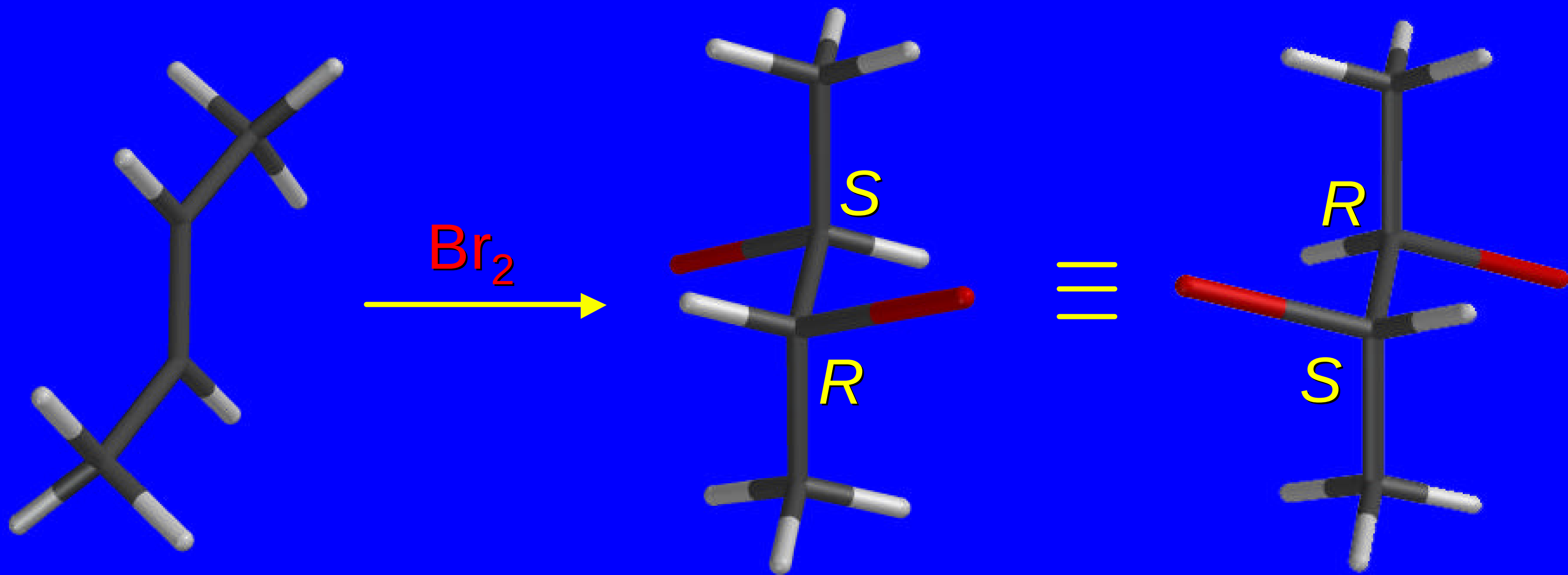



*In order to know understand stereochemistry of product, you need to know two things:*

(1) stereochemistry of alkene (cis or trans; Z or E)

(2) stereochemistry of mechanism (syn or anti)

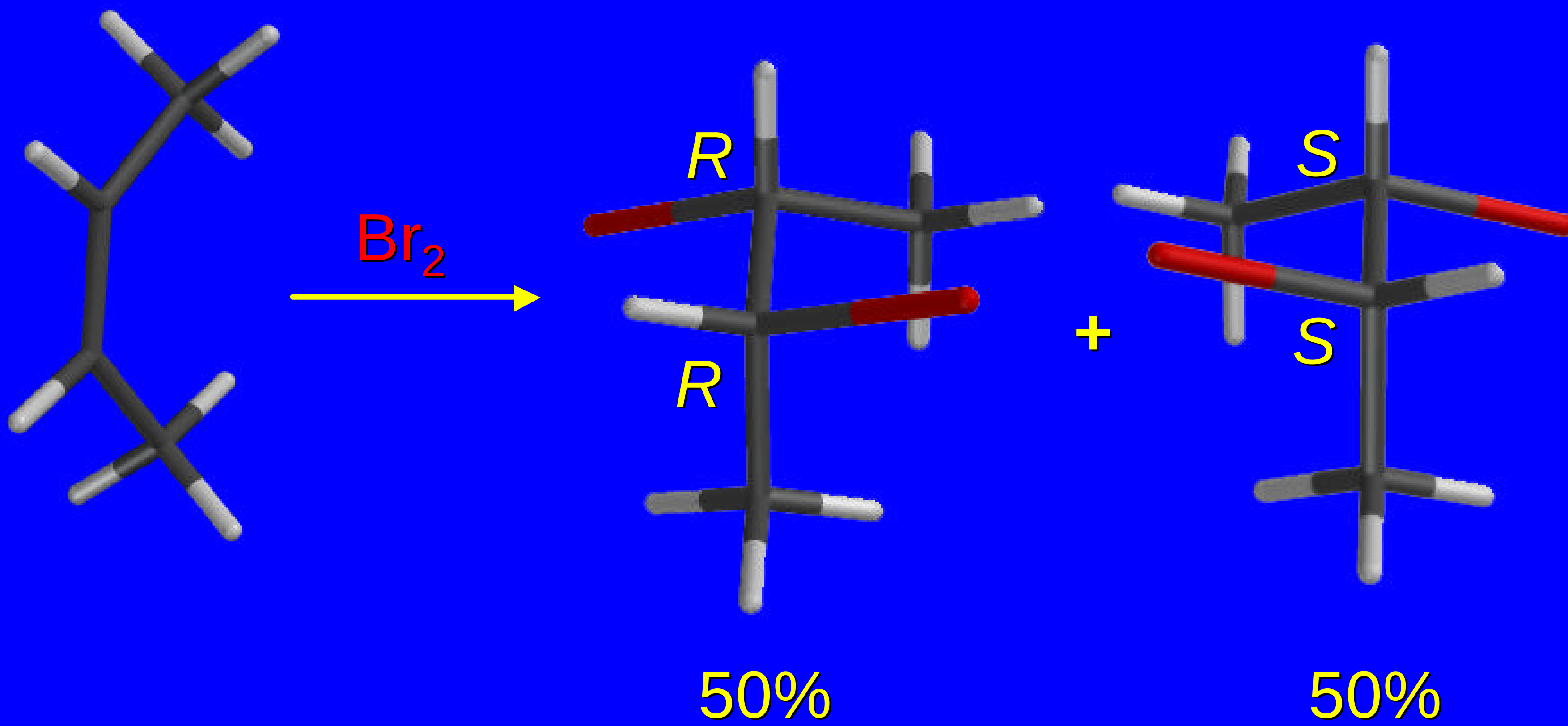
# *Bromine Addition to trans-2-Butene*
# *Fig. 7.14 (p 284)*




meso

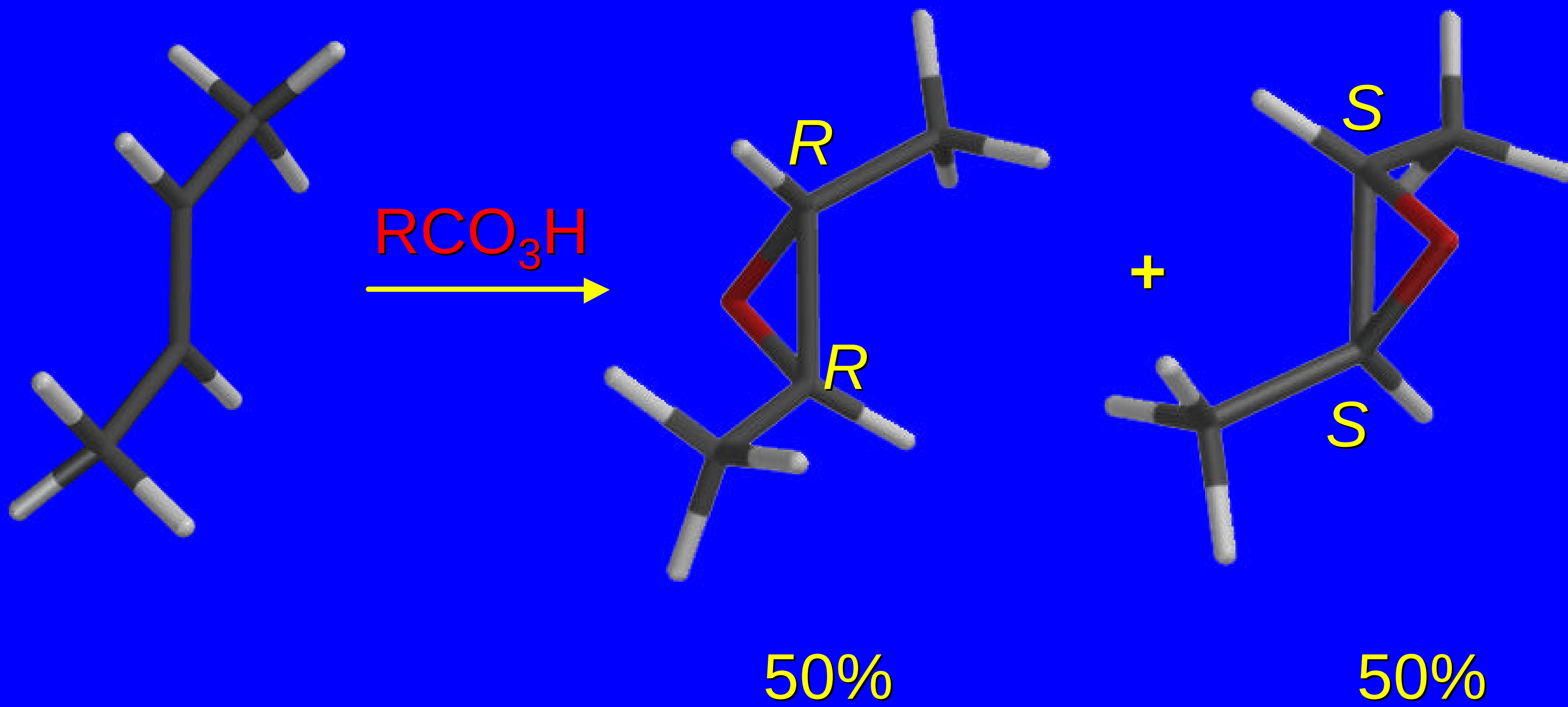
anti addition to *trans*-2-butene gives meso diastereomer

# *Bromine Addition to cis-2-Butene*
## *Fig. 7.15 (p 285)*



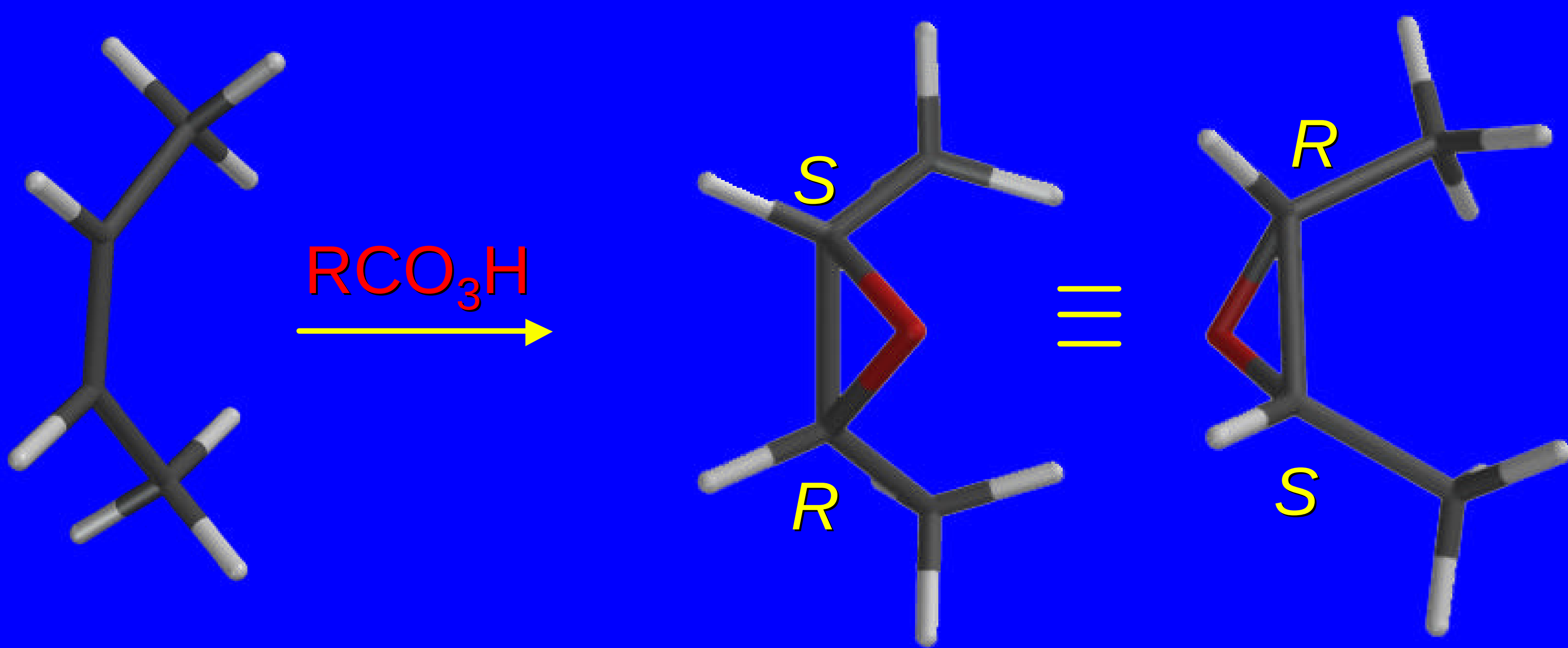

anti addition to *cis*-2-butene gives racemic mixture of chiral diastereomer

## *Epoxidation of trans-2-Butene*
## *Problem 7.17 (p 285)*




syn addition to *trans*-2-butene gives racemic mixture of chiral diastereomer

# *Epoxidation of cis-2-Butene*
# *Problem 7.17 (p 285)*




meso

syn addition to *cis*-2-butene gives meso diastereomer

## *Stereospecific reaction*

of two stereoisomers of a particular starting material, each one gives different stereoisomeric forms of the product

related to mechanism: terms such as syn addition and anti addition refer to stereospecificity

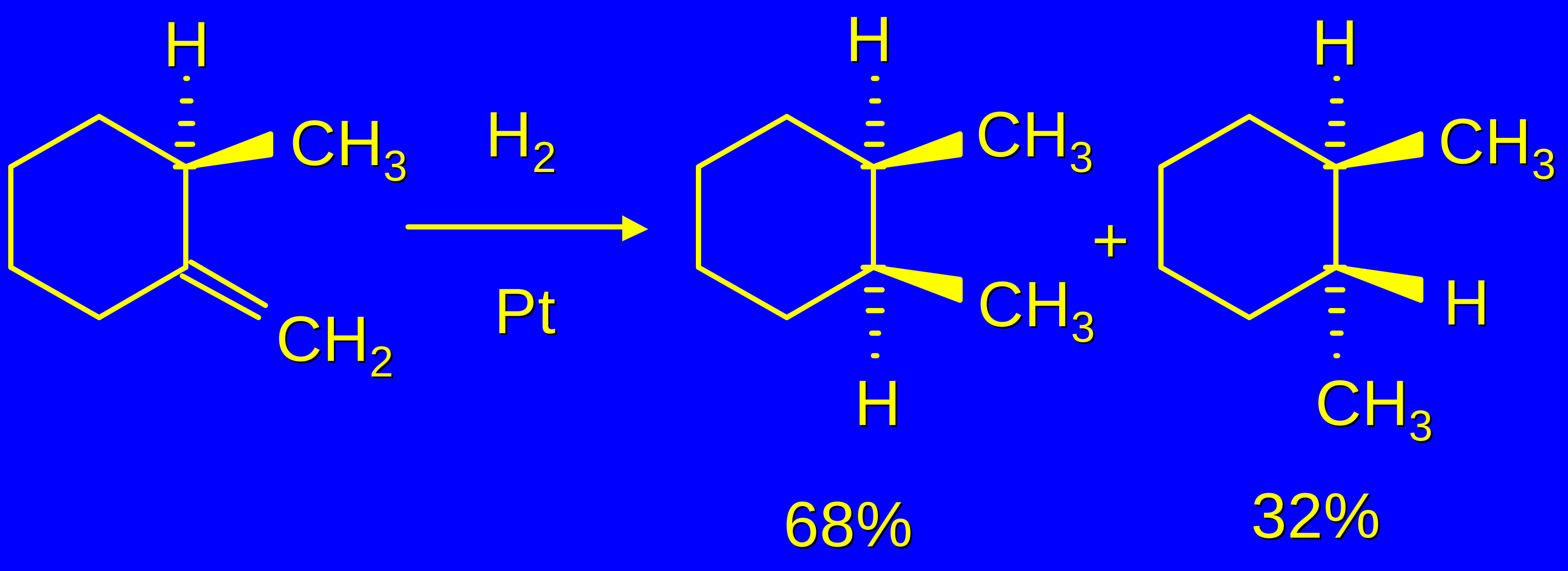
| | | | |
|---|---|---|---|
| *cis*-2-butene | bromination | anti | 2*R*,3*R* + 2*S*,3*S* |
| *trans*-2-butene | bromination | anti | meso |

*Stereospecific reaction*

| | | | |
|---|---|---|---|
| *cis*-2-butene | epoxidation | syn | meso |
| *trans*-2-butene | epoxidation | syn | 2*R*,3*R* + 2*S*,3*S* |

## *Stereoselective reaction*

a single starting material can give two or more stereoisomeric products, but gives one of them in greater amounts than any other



## 7.14

## Resolution of Enantiomers

separation of a racemic mixture into its two enantiomeric forms

## *Strategy*

enantiomers

| C(+) | C(-) |
|---|---|

# *Strategy*

enantiomers

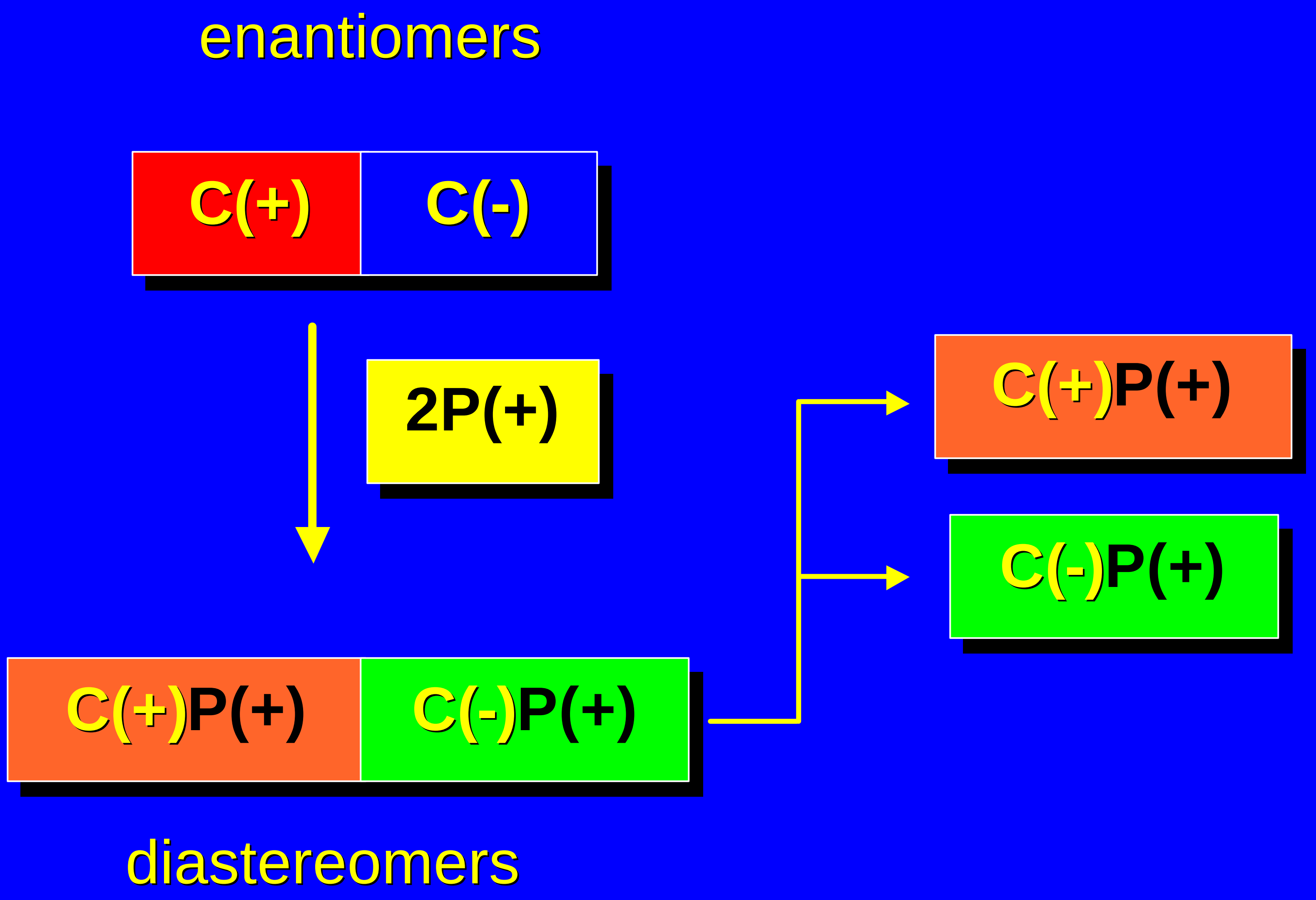
C(+) | C(-)

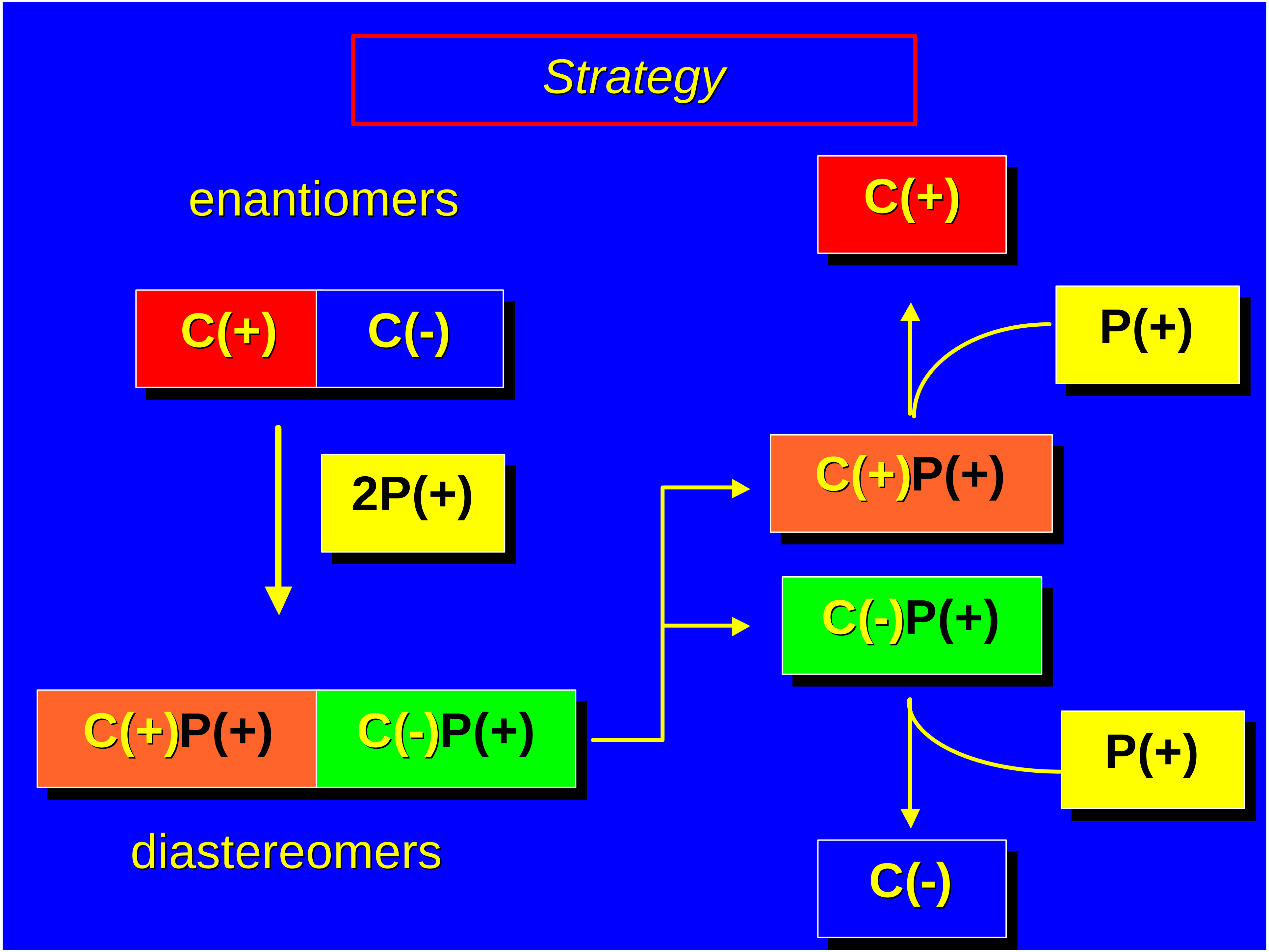
2P(+)

C(+)P(+) | C(-)P(+)

diastereomers

# *Strategy*




Strategy
enantiomers
C(+)
C(-)
2P(+)
C(+)P(+)
C(-)P(+)
diastereomers
C(+)
P(+)
C(+)P(+)
C(-)P(+)
P(+)
C(-)

# 7.15

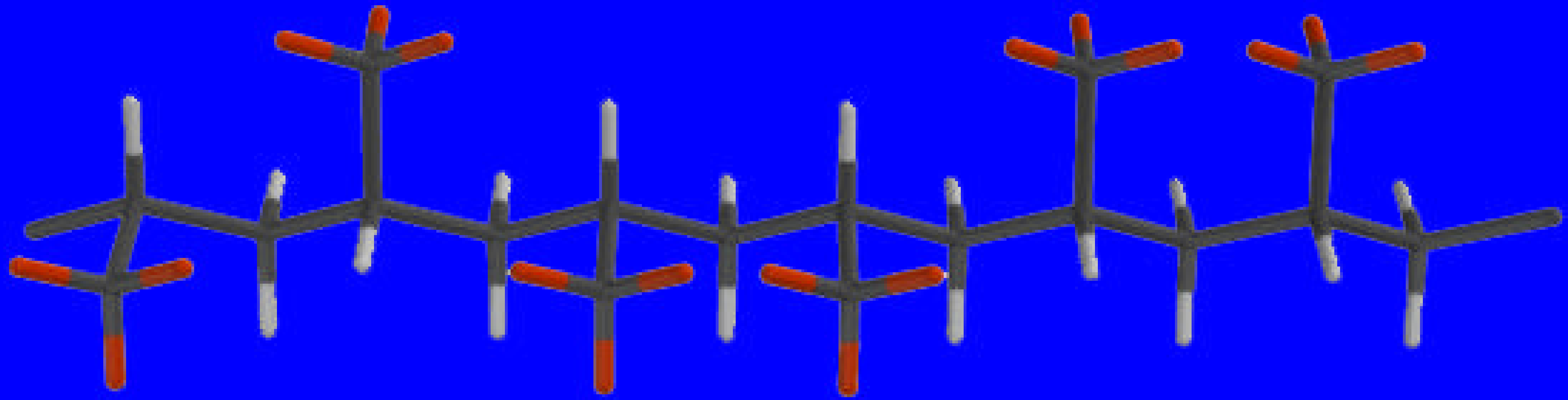
# Stereoregular Polymers

atactic

isotactic

syndiotactic

# *Atactic Polypropylene*

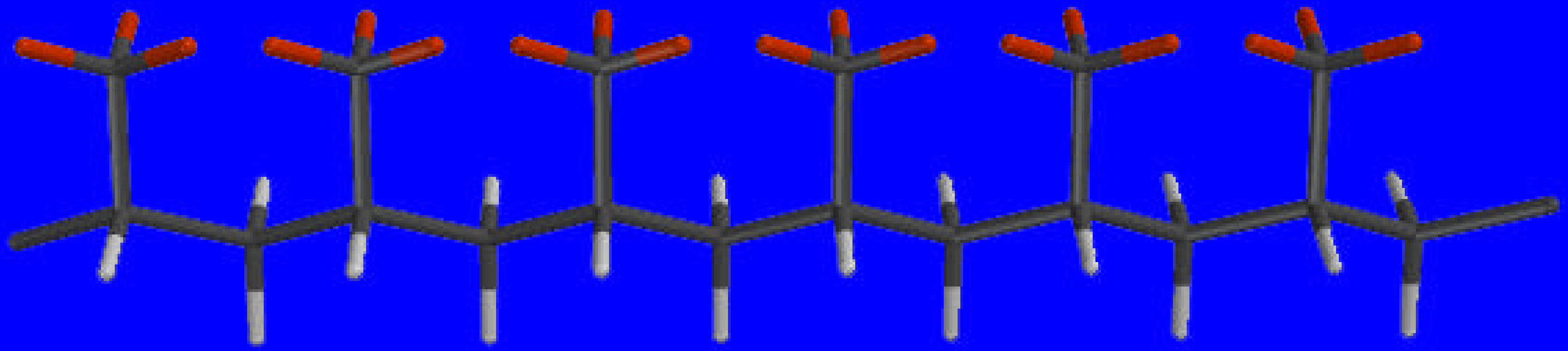


random stereochemistry of methyl groups attached to main chain (stereorandom)

properties not very useful for fibers etc.

formed by free-radical polymerization

# *Isotactic Polypropylene*

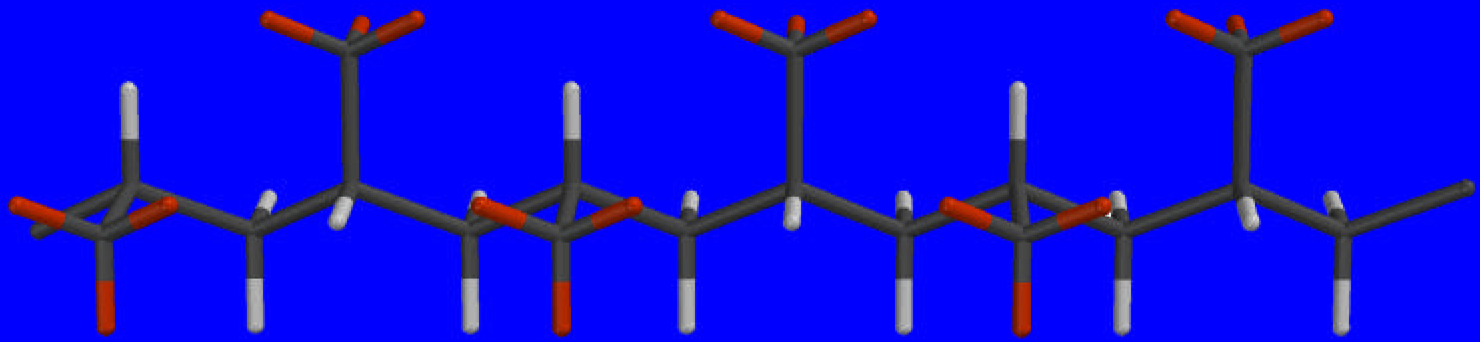


stereoregular polymer; all methyl groups on same side of main chain

useful properties

prepared by coordination polymerization under Ziegler-Natta conditions

# *Syndiotactic Polypropylene*



stereoregular polymer; methyl groups alternate side-to-side on main chain

useful properties

prepared by coordination polymerization under Ziegler-Natta conditions

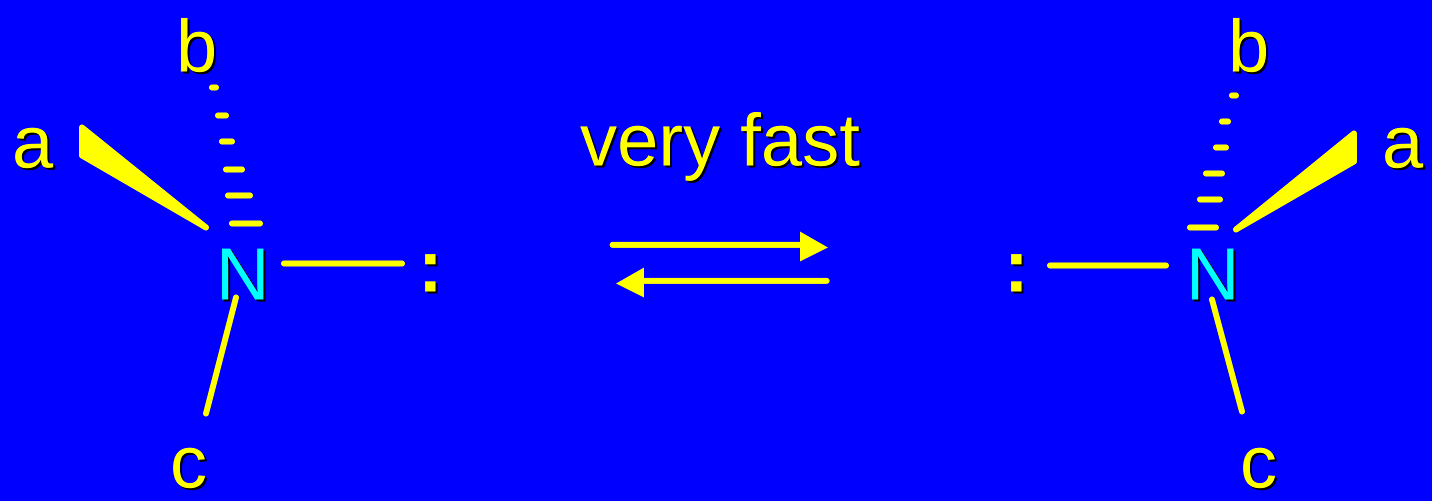
# 7.16

# Stereogenic Centers Other Than Carbon

# *Silicon*

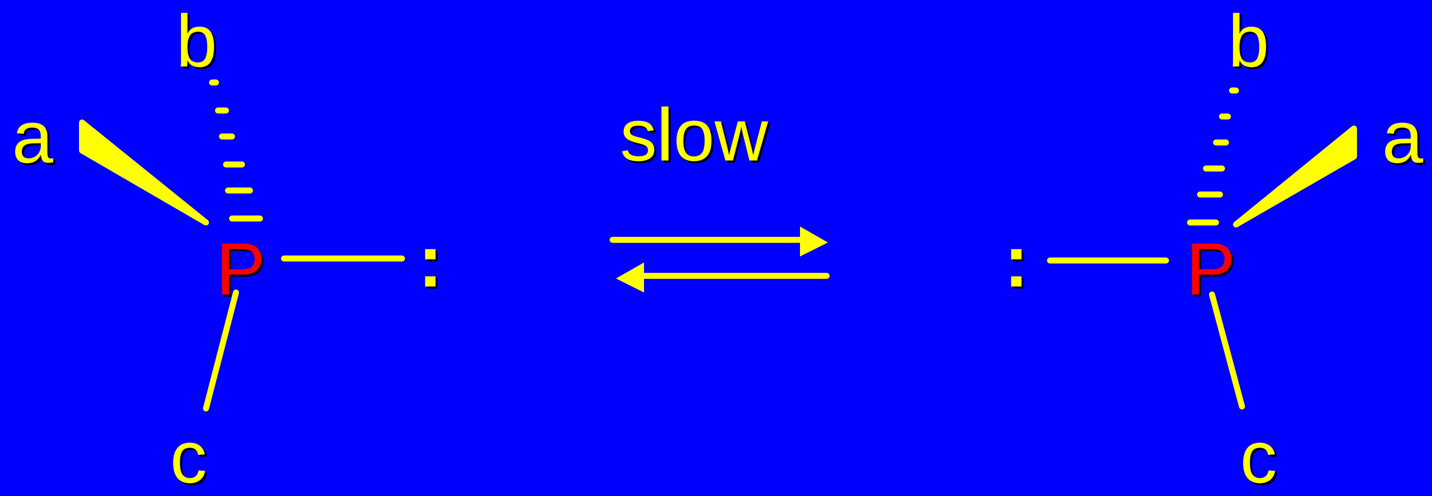

silicon, like carbon, forms four bonds in its stable compounds and many chiral silicon compounds have been resolved

*Nitrogen in amines*



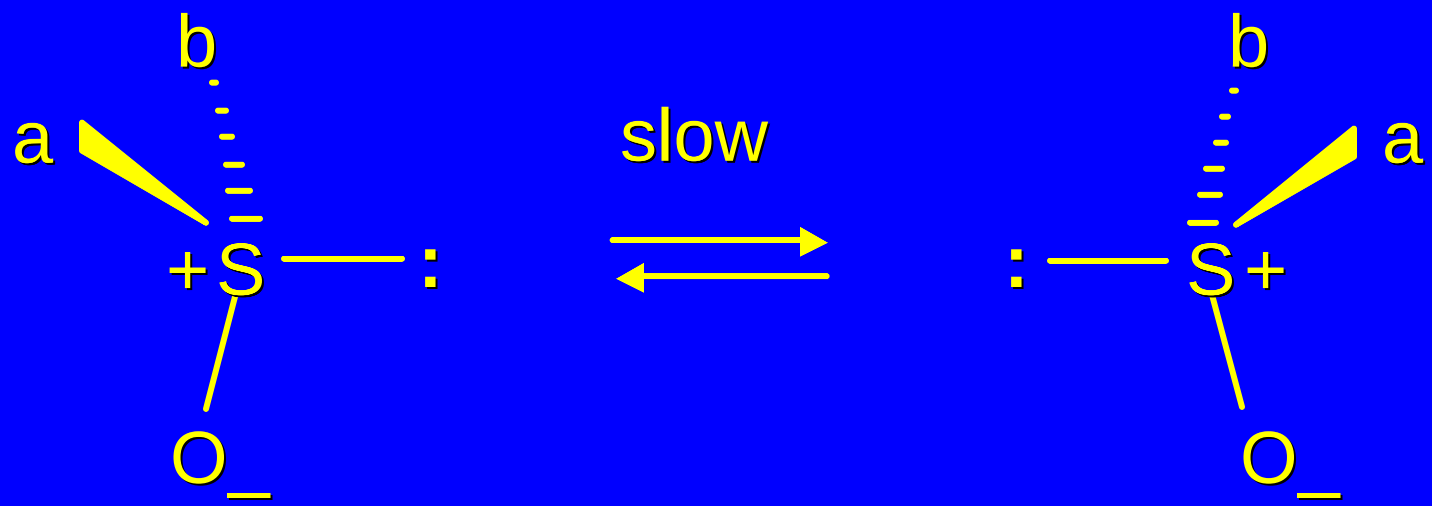

pyramidal geometry at nitrogen can produce a chiral structure, but enantiomers equilibrate too rapidly to be resolved

## *Phosphorus in phosphines*




pyramidal geometry at phosphorus can produce a chiral structure; pyramidal inversion slower than for amines and compounds of the type shown have been resolved

*Sulfur in sulfoxides*




pyramidal geometry at sulfur can produce a chiral structure; pyramidal inversion is slow and compounds of the type shown have been resolved