

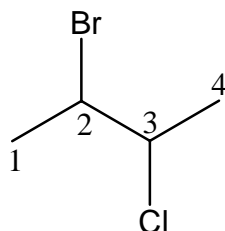
Chem3322, Sections 9.6 and 9.7

9.6 Diastereomers

A compound with n stereocentres (chiral centres, asymmetric centres, stereogenic centres) can have 2^n stereoisomers. For example, if a compound has 1 stereocentre then it will have $2^1 = 2$ stereoisomers. If a compound has 2 stereocentres, then it will have $2^2 = 4$ stereoisomers.

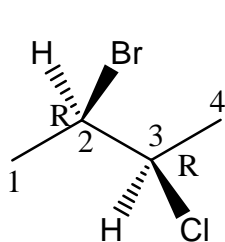
Compounds with two stereocentres that are not identically substituted:

Example: 2-bromo-3-chlorobutane



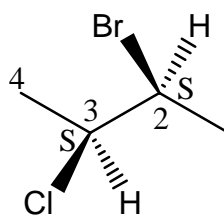
This compound has two stereocentres, therefore it has a total of $2^2 = 4$ stereoisomers. They are A, B, C, and D as shown below.

Mirror Plane



A

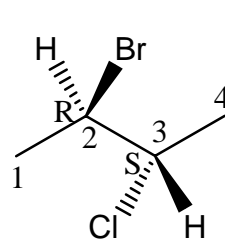
(2R,3R)-2-bromo-3-chlorobutane



B

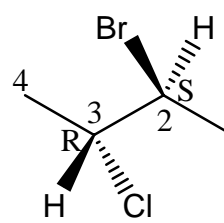
(2S,3S)-2-bromo-3-chlorobutane

Mirror Plane



C

(2R,3S)-2-bromo-3-chlorobutane



D

(2S,3R)-2-bromo-3-chlorobutane

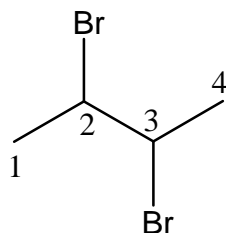
Enantiomers: nonsuperimposable mirror images. They have opposite configurations at all stereocentres. Diastereomers: not mirror images. They have the same configuration at one stereocentre but the opposite at the other.

A and B: *enantiomers*, B and C: *enantiomers*. A and C, A and D, B and C, B and D: *diastereomers*

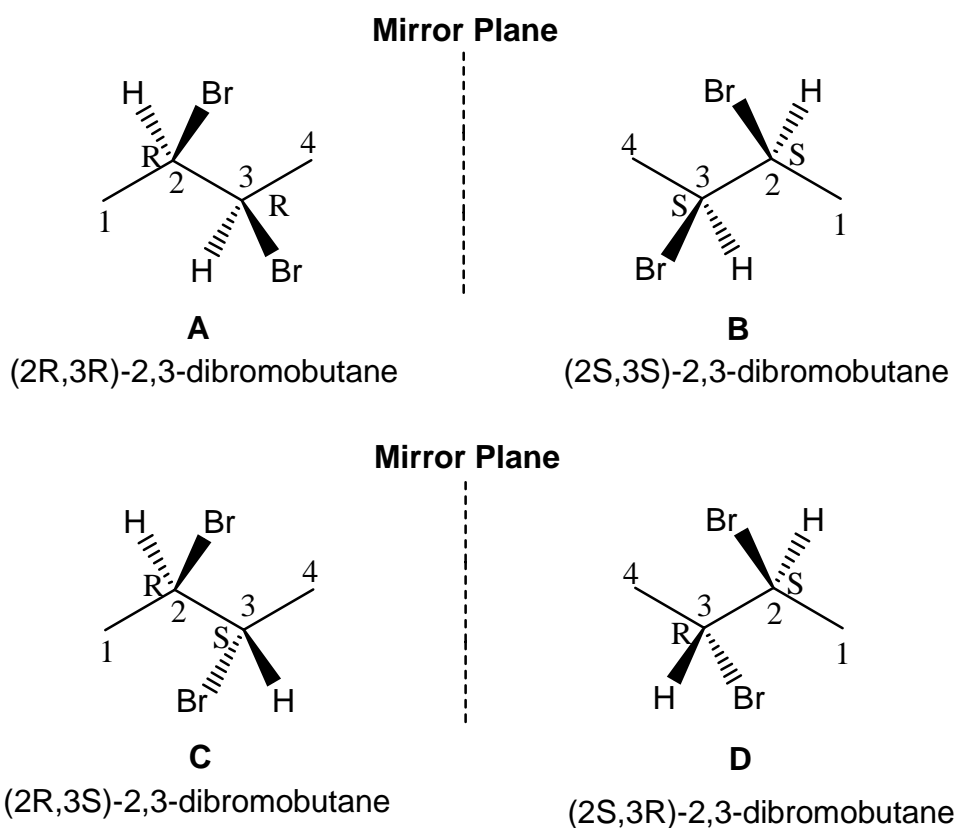
9.7 Meso Compounds

Compounds with stereocentres that are identically substituted:

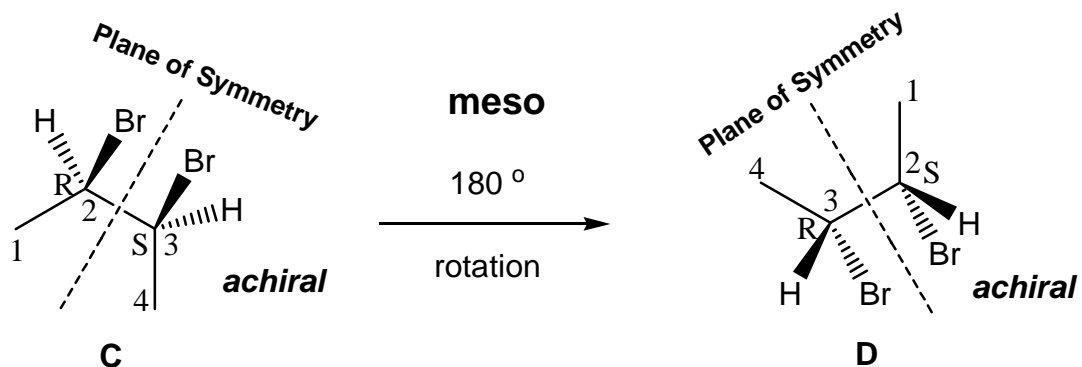
Example: 2,3-dibromobutane



This compound has two stereocentres, therefore it will have a total of $2^2 = 4$ stereoisomers. They are A, B, C, and D as shown below. The story is not finished yet!



Clearly, A and B are enantiomers. A careful look at C reveals that it has a plane of symmetry:

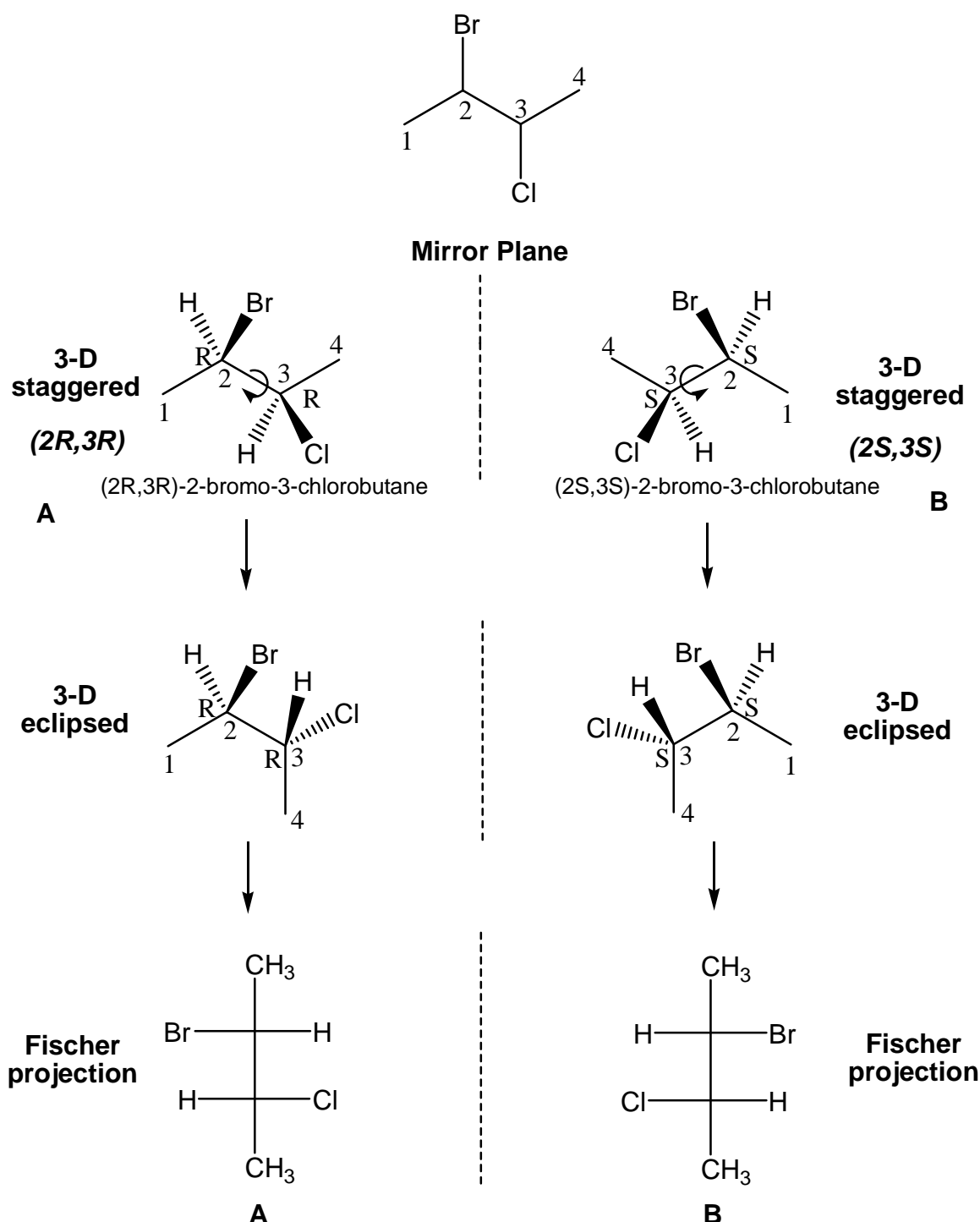


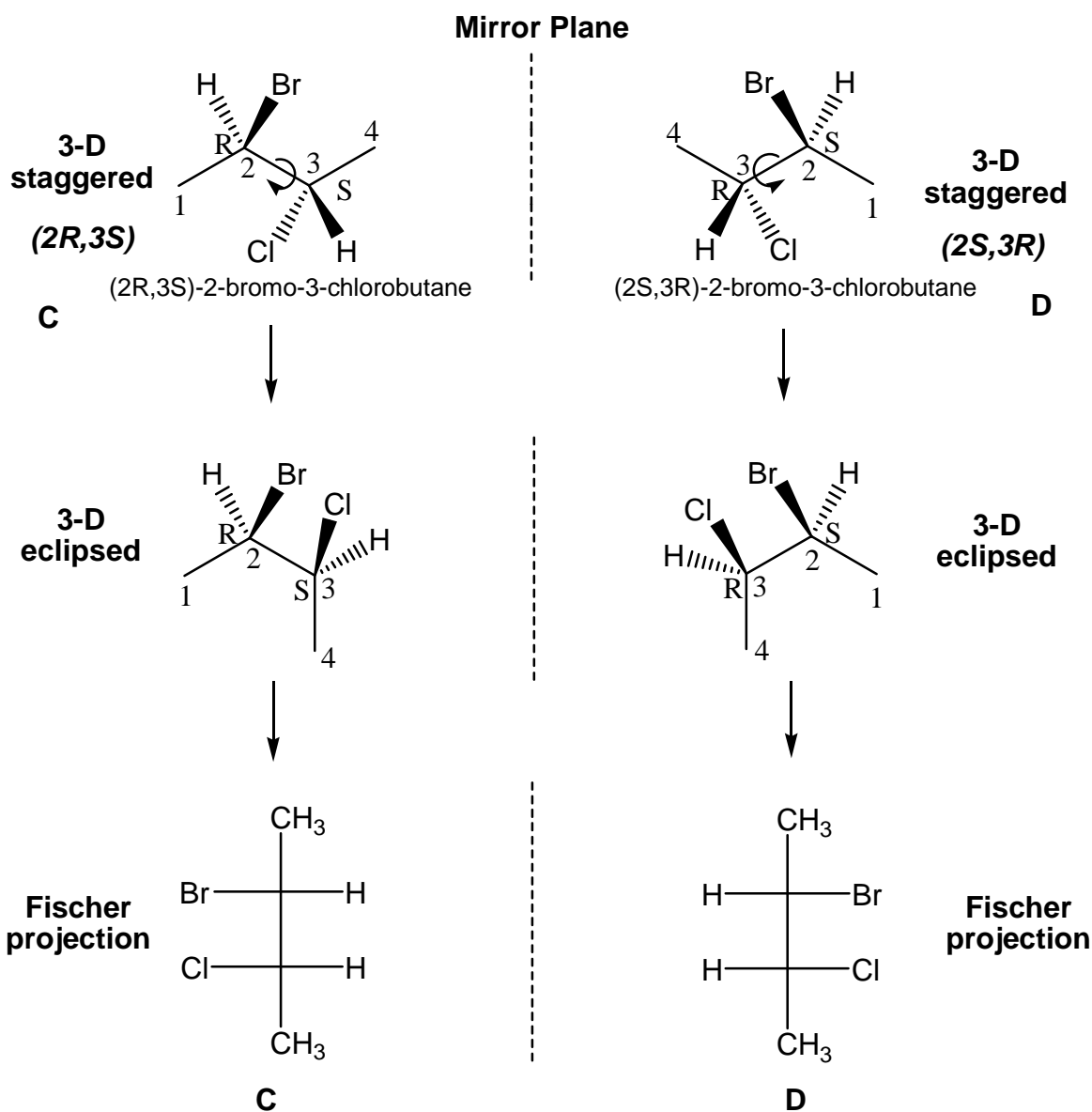
C and D are identical structures. Both have a plane of symmetry and thus achiral. This compound is called **meso**. Therefore, in this case there are **3 stereoisomers only**. A pair of enantiomers, A and B and a meso compound C.

9.6 using Fischer projections

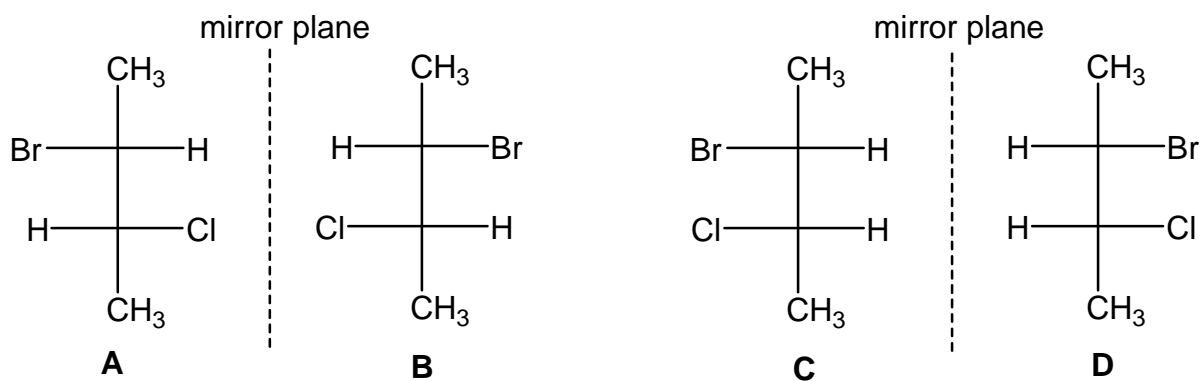
In Fischer projections, horizontal lines are bonds directed toward the viewer. Therefore, a Fischer projection is a representation of a molecule in an eclipsed conformation. Accordingly, to convert a wedged-dashed 3-D drawing (staggered) into a Fischer projection, the staggered representation must be rotated to get an eclipsed representation which can then be converted into a Fischer projection.

For 2-bromo-3-chlorobutane:





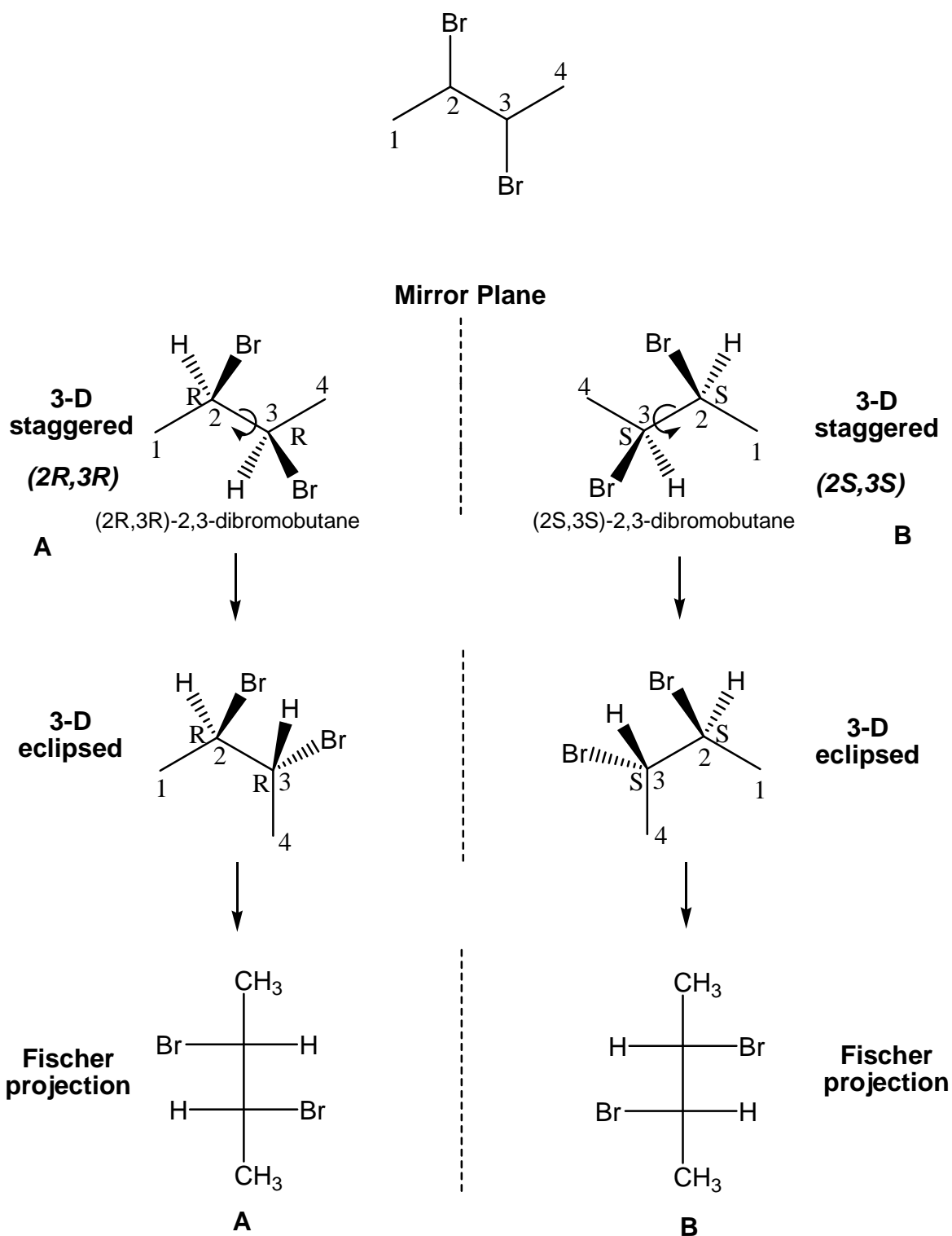
Overall: *Four stereoisomers*

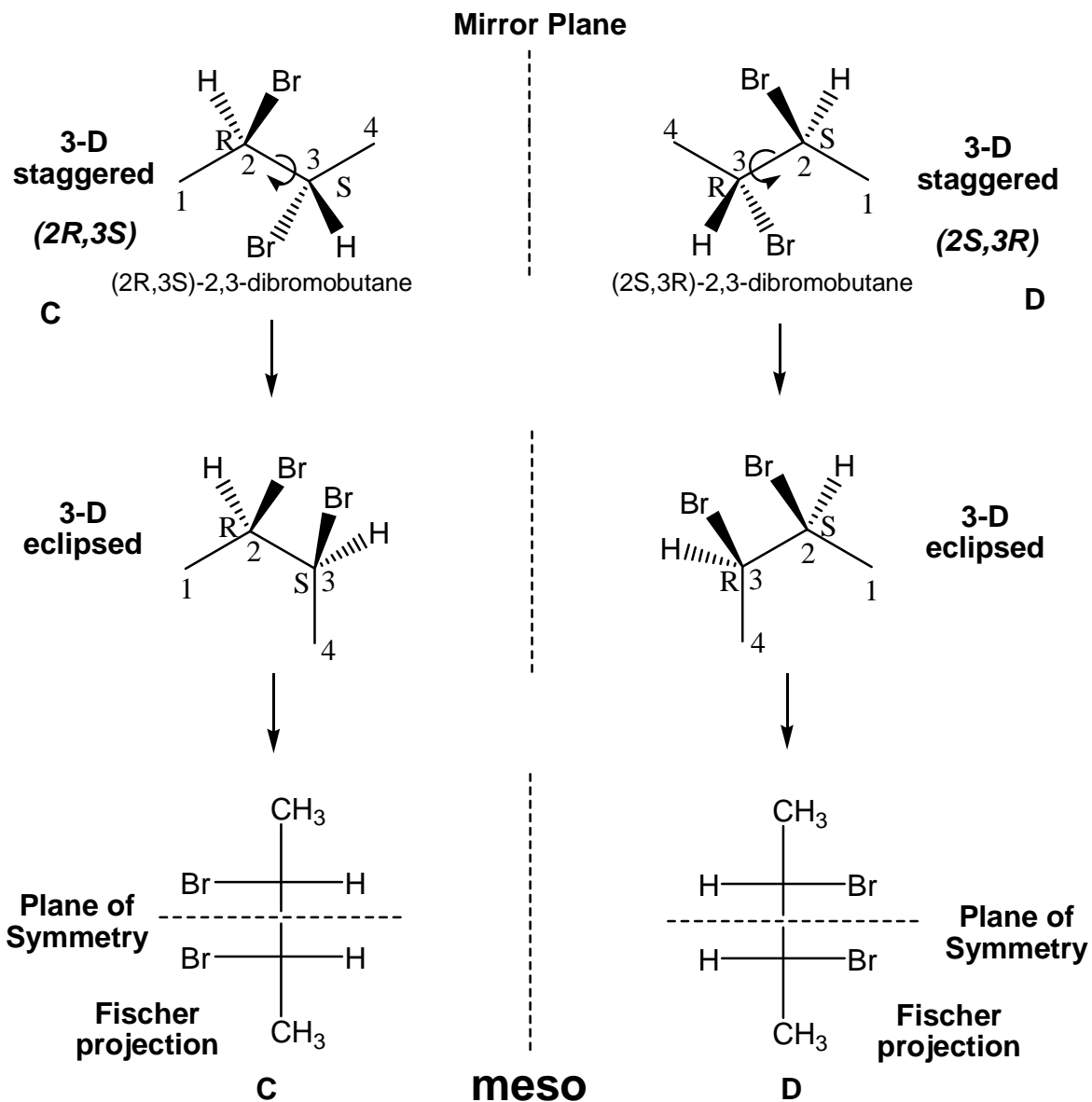


A and B: enantiomers, C and D: enantiomers. A and C: diastereomers, A and D: diastereomers, B and C: diastereomers, B and D: diastereomers. All optically active and chiral

9.7 using Fischer projections

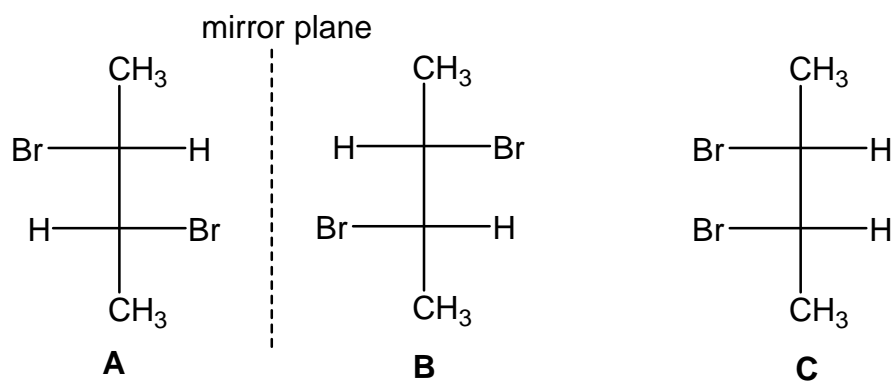
For 2,3-dibromobutane:





Overall:

Three stereoisomers; a pair of enantiomers and a meso compound



A and B: enantiomers (optically active, chiral), C: meso (optically inactive, achiral)

A and C: diastereomers (optically active, chiral), B and C: diastereomers (optically active, chiral)