Answer Key

Chemistry 531
Stereochemistry Practice Problems

The majority of these problems are taken from sophomore organic chemistry. Some of the problems near the end of the set are a bit more advanced.

1) For each compound below, identify all chirality (asymmetric) centers with an asterisk (*).
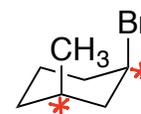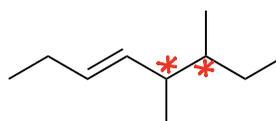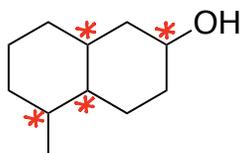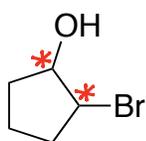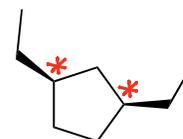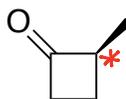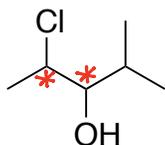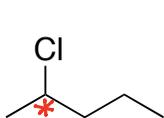
→ either draw the mirror image or invert all chiral centers

2) Draw the enantiomer of each compound below.
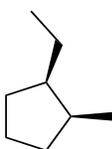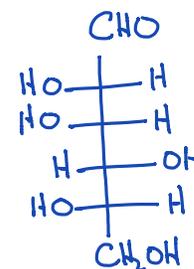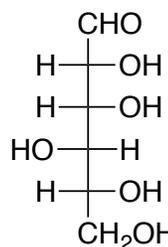
here I just inverted all chiral centers
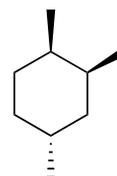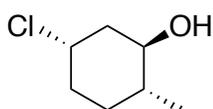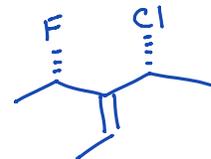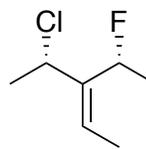
3) Assign an R/S configuration to each chiral center in the compounds below.

S   R   R

S   Trick: looks like R, but "4" group is pointing out so it is actually S

S
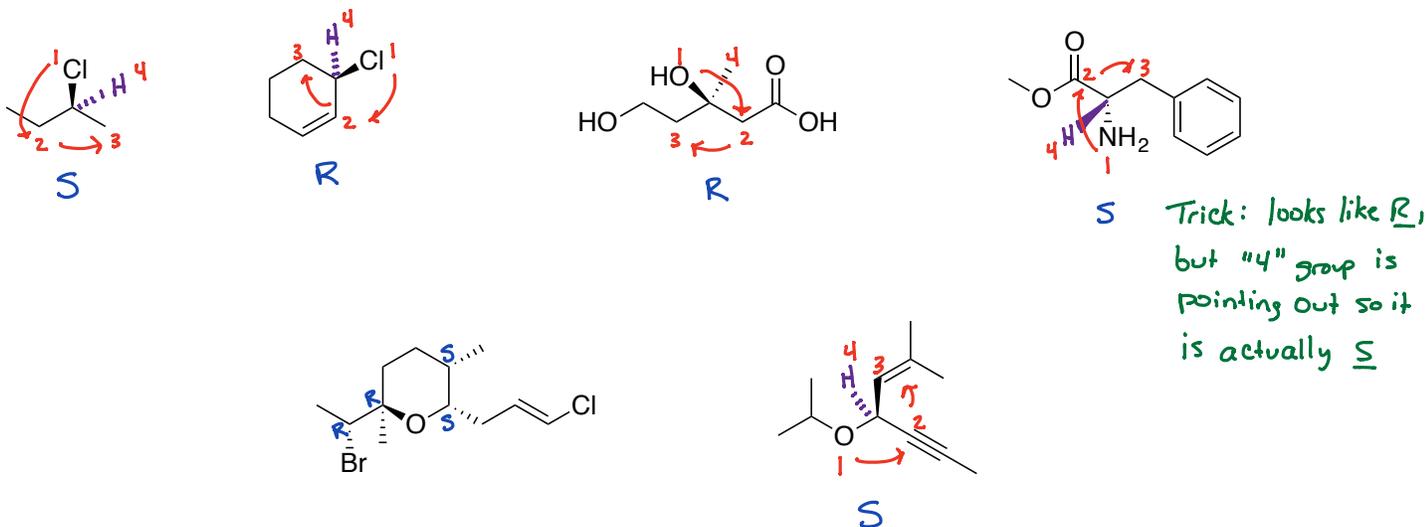
4) Identify all asymmetric centers in the molecules below and classify the molecule as chiral or achiral.
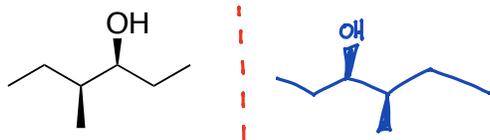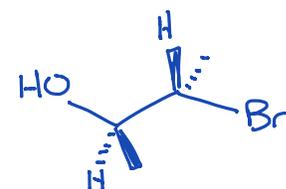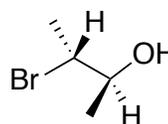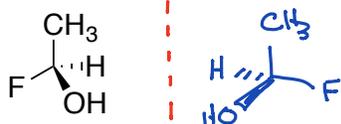
Chiral   Chiral   achiral   achiral   achiral (meso)   Chiral

achiral (meso)   achiral (meso)   achiral (meso)   Stereocenters achiral   Chiral

Chiral   Stereocenters achiral   achiral   Chiral
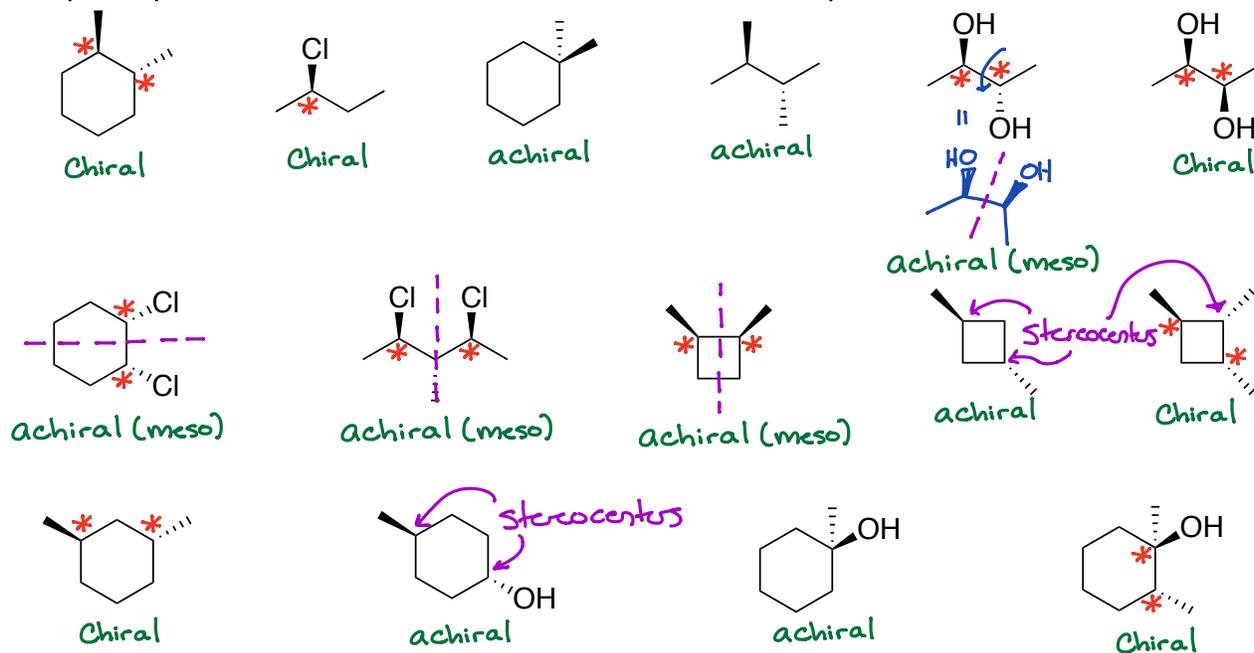
5) Label each of the following as chiral or achiral.

achiral   Chiral   achiral (meso)   achiral

Chiral   achiral (meso)   achiral (meso)   Chiral
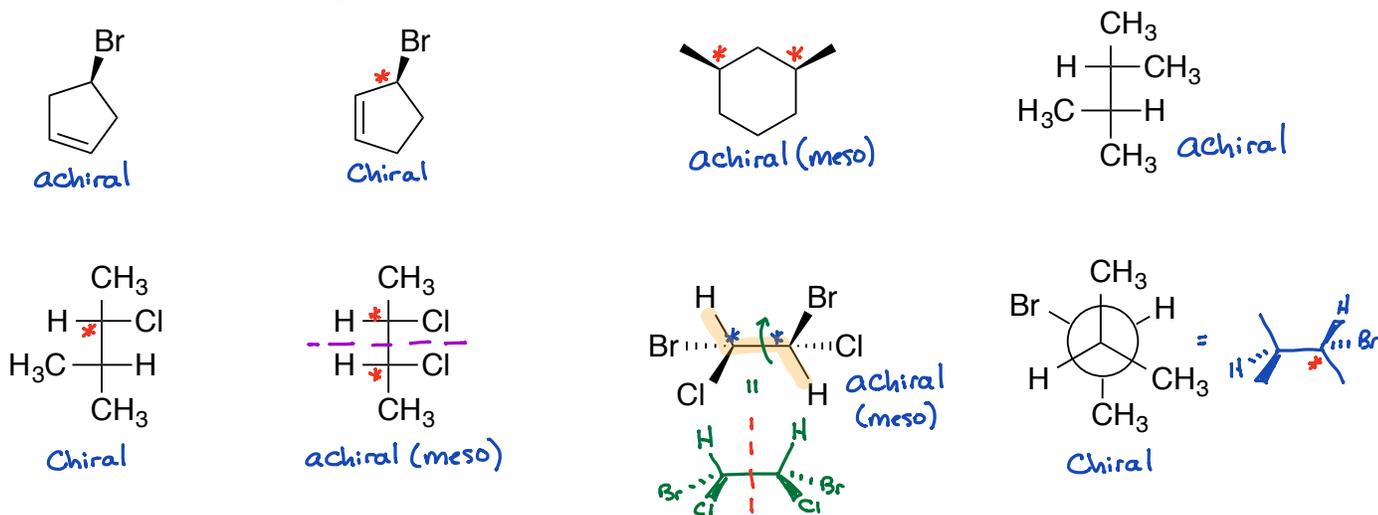
6) Indicate the relationship between each of the compound pairs below. Are they enantiomers, diastereomers, constitutional isomers, or identical compounds?

diastereomers

enantiomers

identical

identical

diastereomers

diastereomers

diastereomers

enantiomers

diastereomers

enantiomers

diastereomers

enantiomers
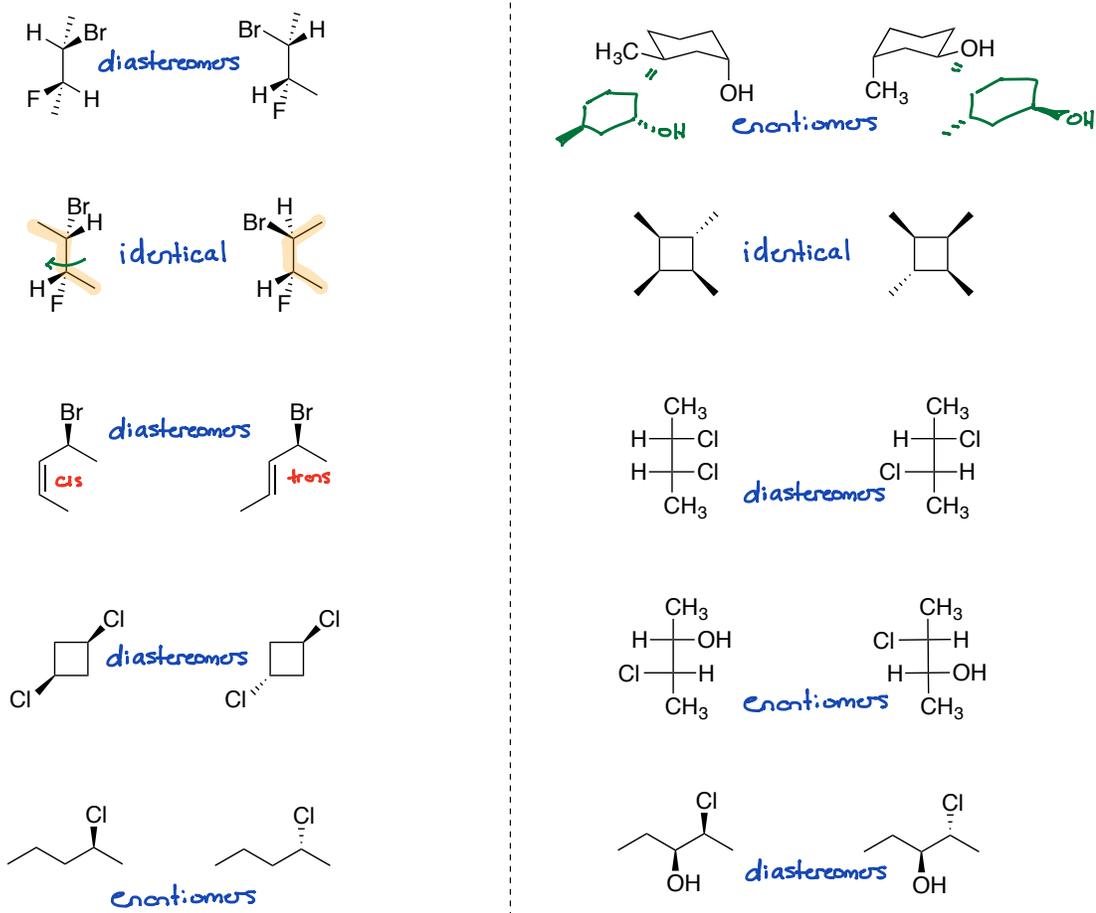
7) Identify the indicated protons or groups in each molecule as homotopic, enantiotopic, diastereotopic, or heterotopic.

enantiotopic

enantiotopic

homotopic

diastereotopic

enantiotopic

diastereotopic

homotopic

diastereotopic

enantiotopic

diastereotopic

diastereotopic

diastereotopic

diastereotopic

homotopic
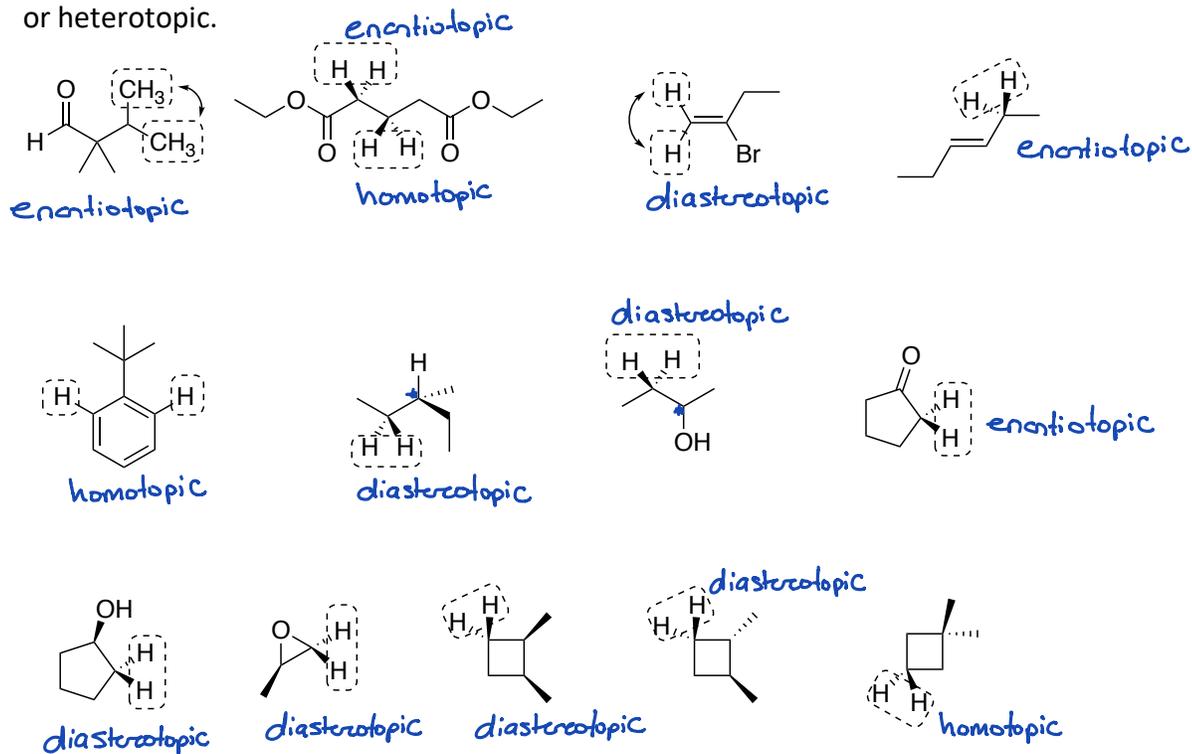
8) Is the following molecule chiral or achiral?
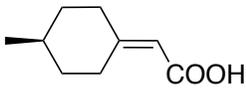
Chiral
└ it is non-superimposable on its mirror image

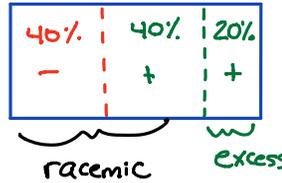9) Pure taxol has a specific rotation of -120°. If a mixture of its two enantiomers has a specific rotation of +24°, what percentage of each enantiomer is present.

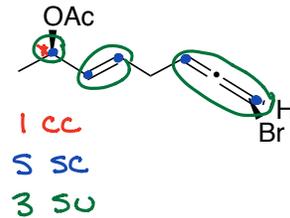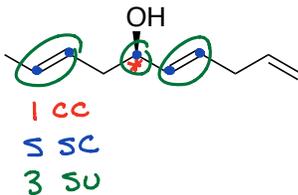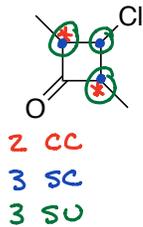$$ee = \frac{\alpha_{obs}}{\alpha_{pure}} \times 100 = \frac{24}{120} \times 100 = 20\% \; ee$$
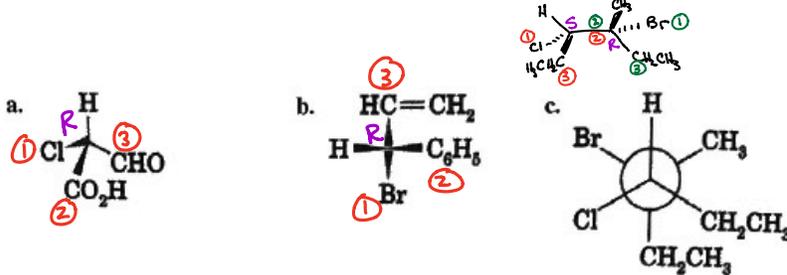
excess of
+ enantiomer

40%	40%	20%
–	+	+

racemic   excess

=> 60% + en
   40% - en

10) In each compound below, identify the number of chiral centers, the number of stereocenters, and the number of stereogenic units.

     CC   SC
SU

2 CC
3 SC
3 SU

1 CC
5 SC
3 SU

1 CC
5 SC
3 SU

11) Give each of the following R, S, M, or P designations as appropriate.

a.

b.

c.

* Note: the author of this problem uses

 to represent

d.

e.

f.

g.

h.

i.

j.

k.

l.