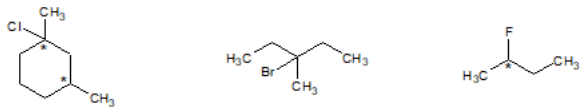
6.15: SOLUTIONS TO ADDITIONAL EXERCISES

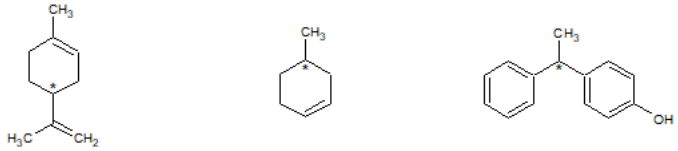
CHIRALITY

6-1

(a) (b) (c)

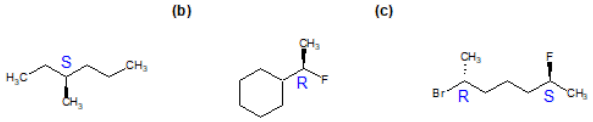


(d) (e) (f)

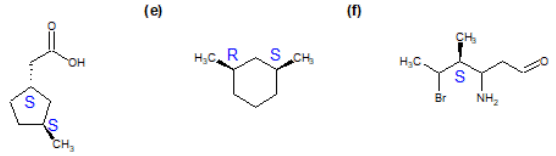


6-2

(a) (b) (c)

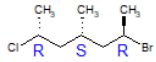


(d) (e) (f)

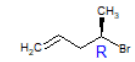


6-3

(a) (b)



(2*R*,4*S*,6*R*)-2-bromo-6-chloro-4-methylheptane



(4*R*)-4-bromopent-1-ene

(c) (d)

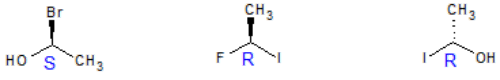
(1*R*,2*R*,3*S*)-1-fluoro-2,3-dimethylcyclohexane

(3*S*)-3-methylcyclopent-1-ene

(R) AND (S) NOMENCLATURE OF ASYMMETRIC CARBON ATOMS

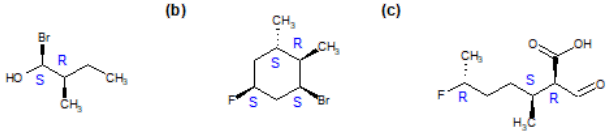
6-4

(a) (b) (c)

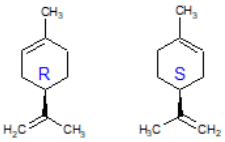


6-5

(a) (b) (c)



6-6



CHIRAL COMPOUNDS WITHOUT ASYMMETRIC ATOMS

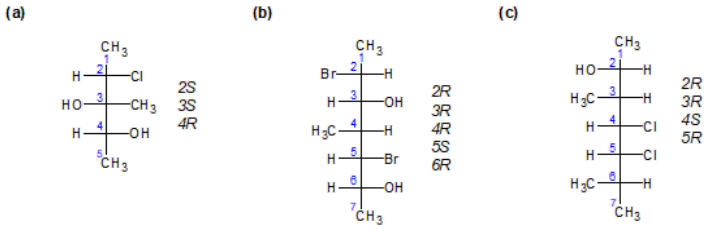
6-7 Though the molecule does not contain a chiral carbon, it is chiral as it is non-superimposable on its mirror image due to its twisted nature (the twist comes from the structure of the double bonds needing to be at 90° angles to each other, preventing the molecule from being planar). This allows it to be optically active.

6-8 The molecule does not contain a chiral center; however, it is a chiral molecule as it is non-superimposable on its mirror image.

6-9 In the case of this biaryl molecule, the large bulky substituents, located at the ortho positions relative to the sigma bond in the middle, experience enough steric interference with each other to create a large energy barrier to free rotation around the C-C sigma bond. Thus, the molecule cannot freely rotate to its other conformations and is non-superimposable on its mirror image.

FISCHER PROJECTIONS AND DIASTEREOMERS

6-10



6-11

a) Enantiomers

b) Diastereomers

c) Diastereomers

d) Same compound

6-12

a) Enantiomers

b) Diastereomers

c) Diastereomers

MESO COMPOUNDS

6-13

a) Meso

b) Not meso

c) Meso

d) Meso

e) Meso

f) Not meso

6-14 Meso compounds are not optically active as they can be superimposed on their mirror images, making them achiral (which are not optically active). The stereocenters on one half of the molecule will rotate light one direction, while the other half of the molecule will rotate light the opposite direction, giving a net rotation of zero and making the molecule optically inactive.

6-15 The compound is meso, since the opposing stereocenters have opposite absolute configurations and if the molecule is rotated about the sigma bond in the middle, you can see that the two halves of the compound are mirror images of each other.