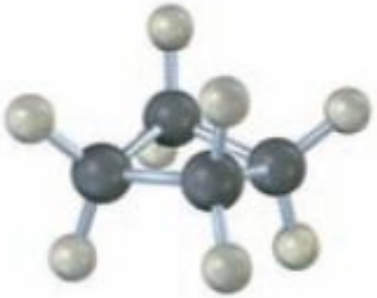
ЦИКЛОАЛКАНЫ

Номенклатура и строение

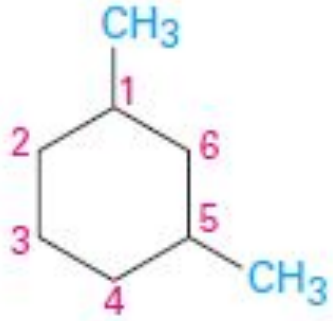
Cyclopropane

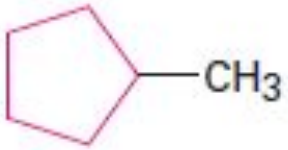


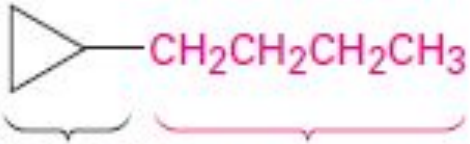
Cyclobutane

Cyclopentane

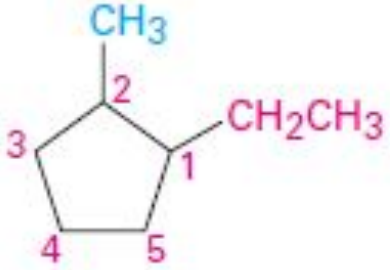
Cyclohexane

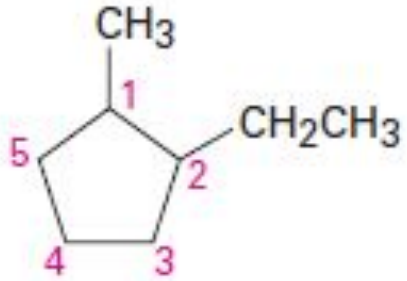






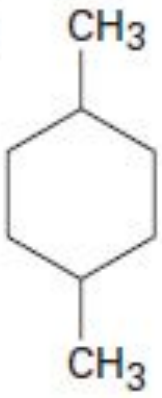
3 carbons 4 carbons



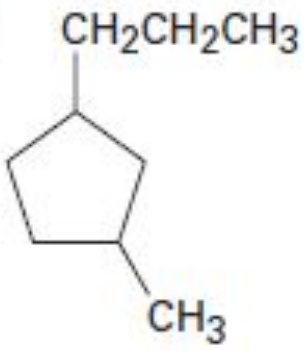


Give IUPAC names for the following cycloalkanes:

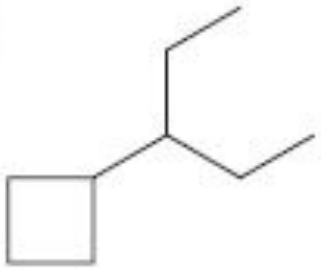
(a)



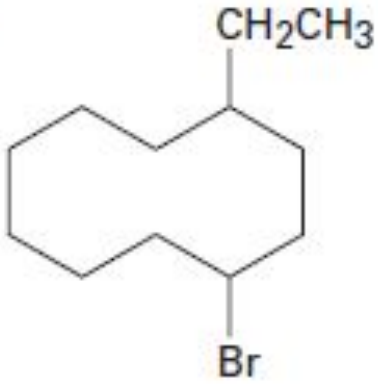
(b)



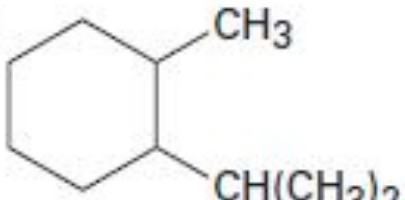
(c)



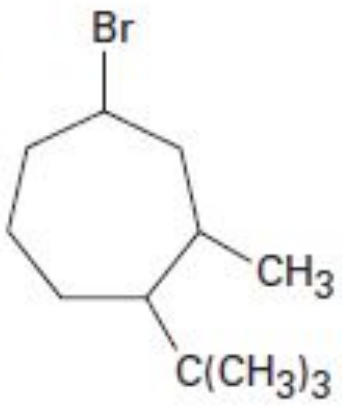
(d)

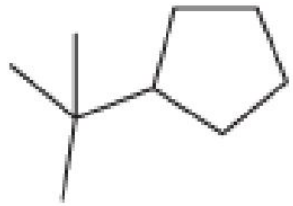


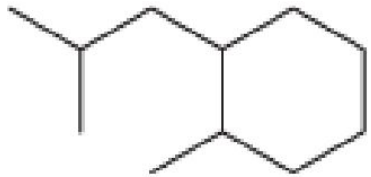
(e)

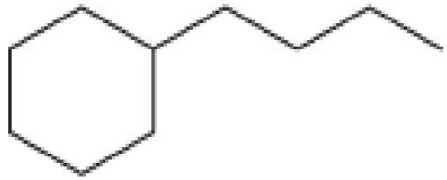


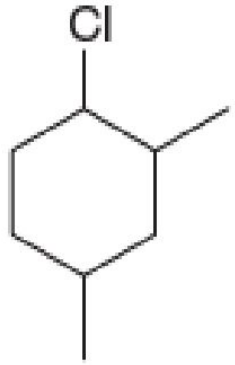
(f)

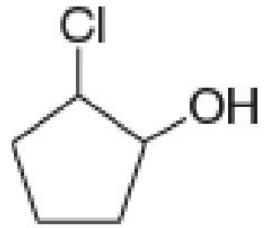


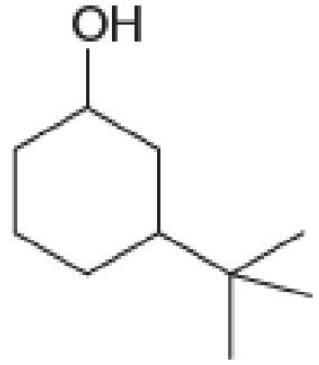
(a) 

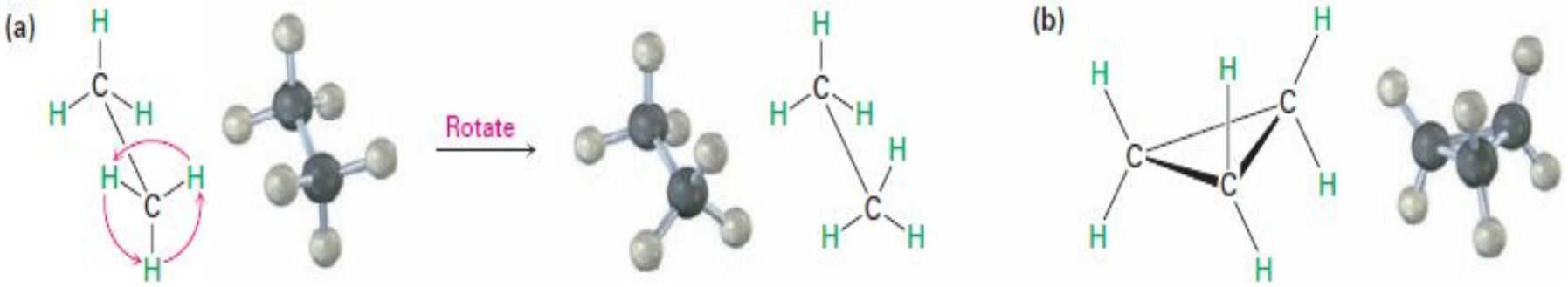
(b) 

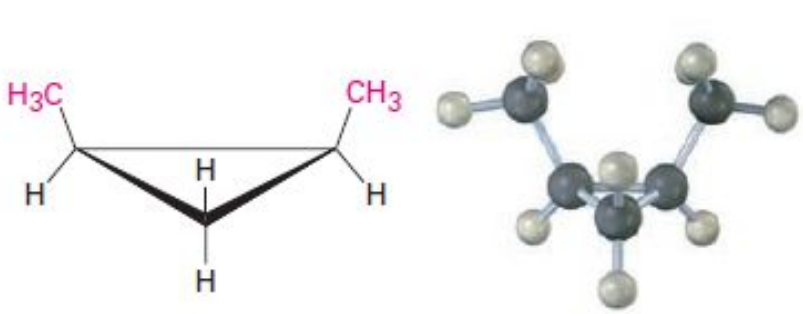
(c) 

(d) 

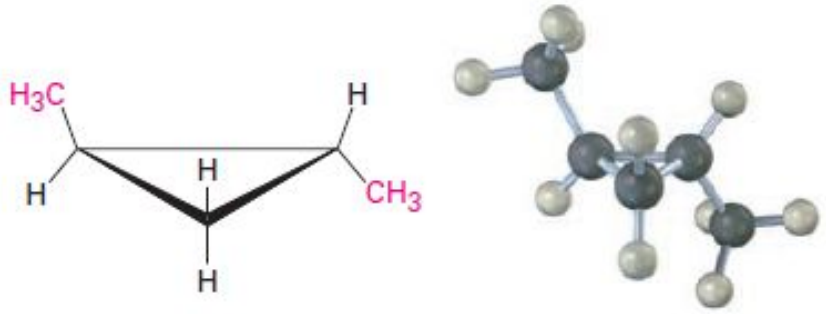
(e) 

(f) 



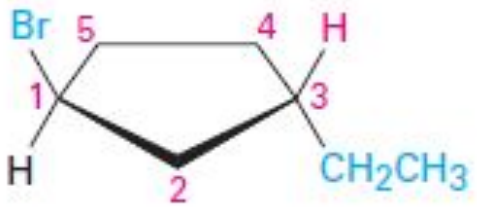


cis-1,2-Dimethylcyclopropane



trans-1,2-Dimethylcyclopropane

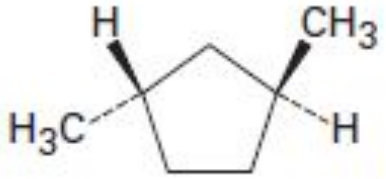
cis-1,3-Dimethylcyclobutane



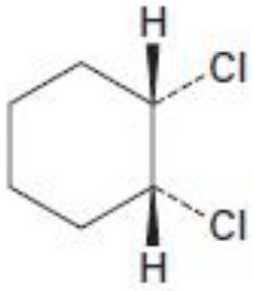
trans-1-Bromo-3-ethylcyclopentane

Name the following substances, including the *cis*- or *trans*- prefix:

(a)



(b)



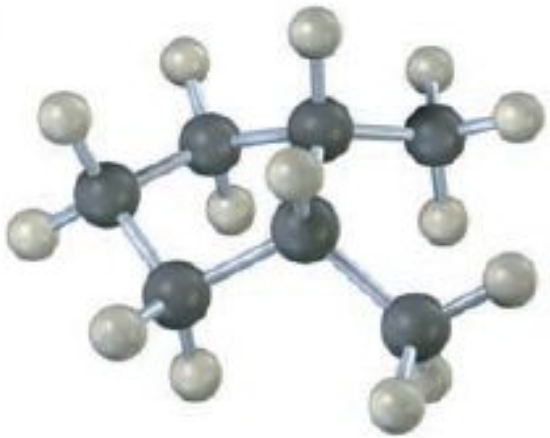
Draw the structures of the following molecules:

(a) *trans*-1-Bromo-3-methylcyclohexane **(b)** *cis*-1,2-Dimethylcyclobutane

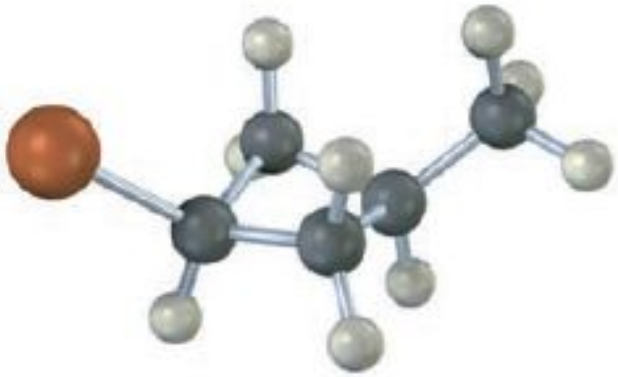
(c) *trans*-1-*tert*-Butyl-2-ethylcyclohexane

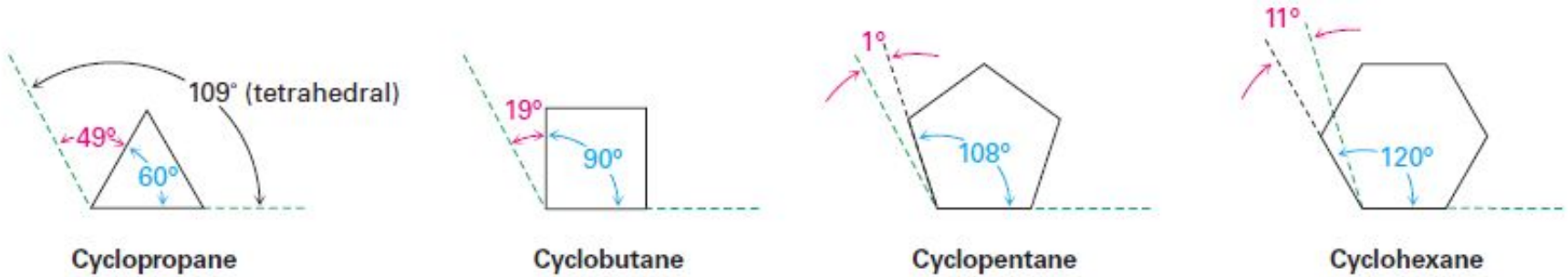
Name the following substances, including the *cis*- or *trans*- prefix (red-brown = Br):

(a)

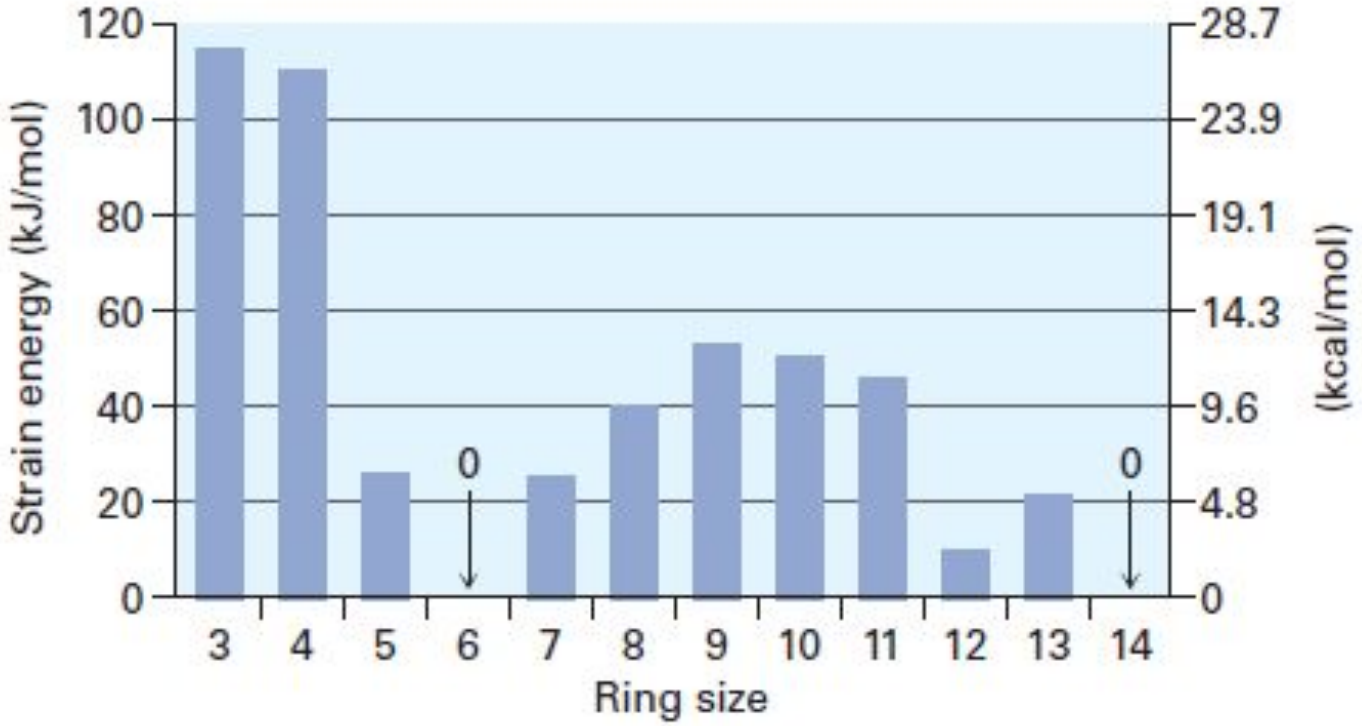


(b)



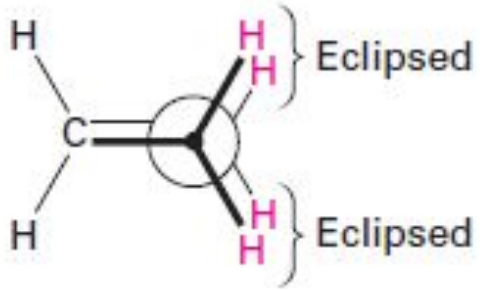


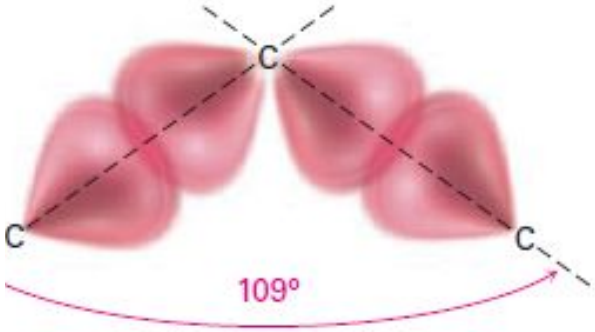
$$(CH_2)_n + 3n/2\ O_2 \longrightarrow n\ CO_2 + n\ H_2O + \text{Heat}$$



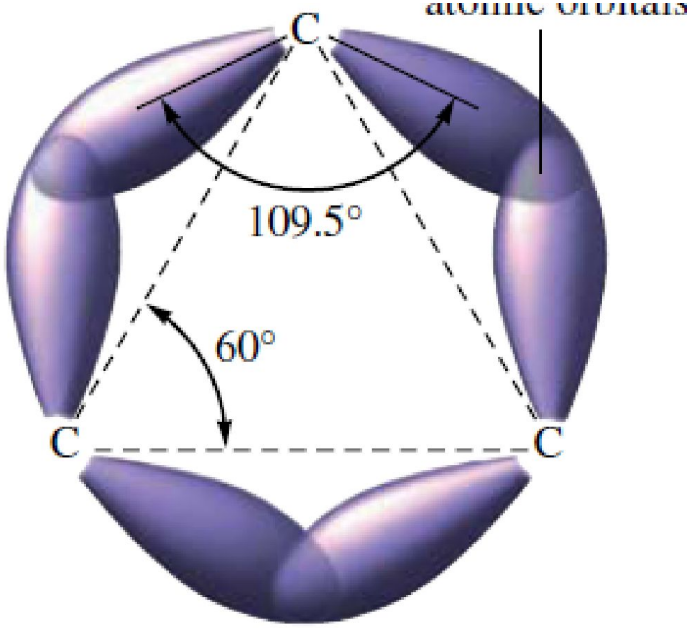
(a)

(b)



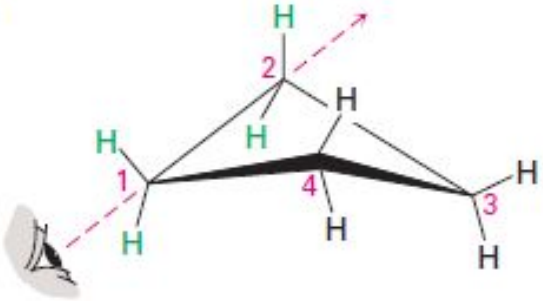


Typical alkane C–C bonds

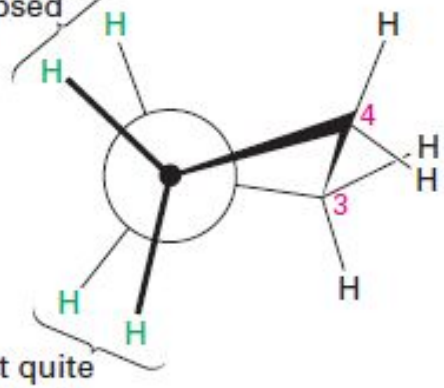


(a)

(b)



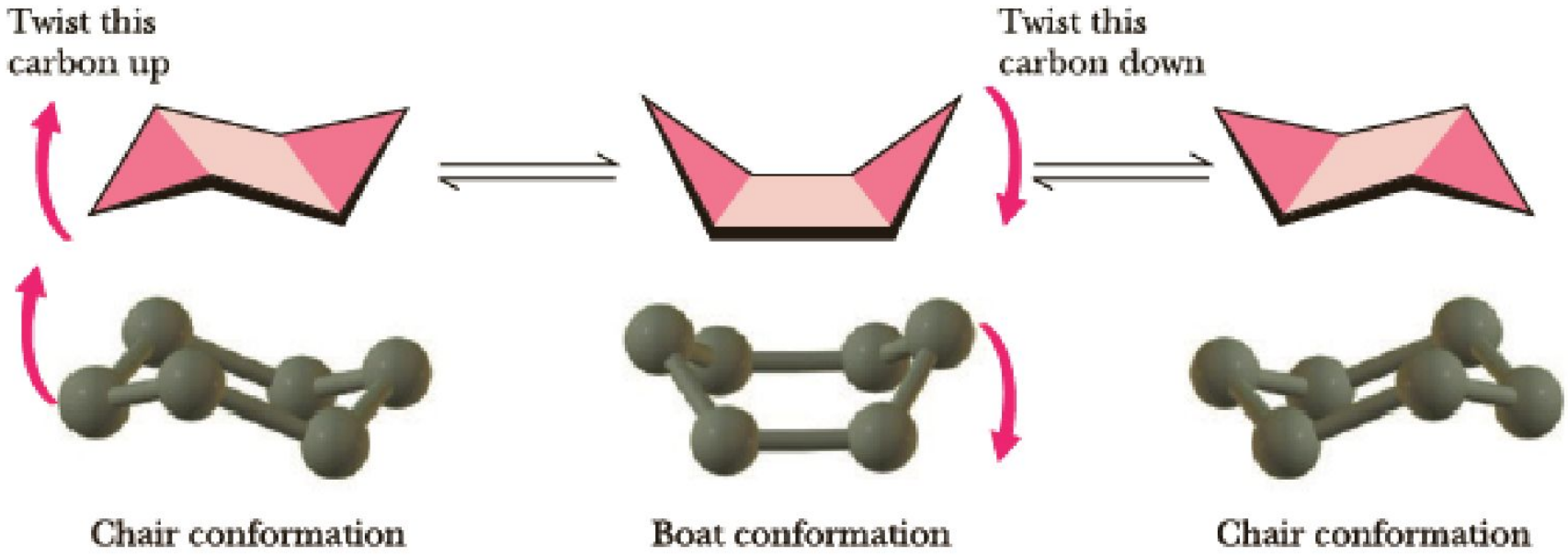
(c) Not quite eclipsed

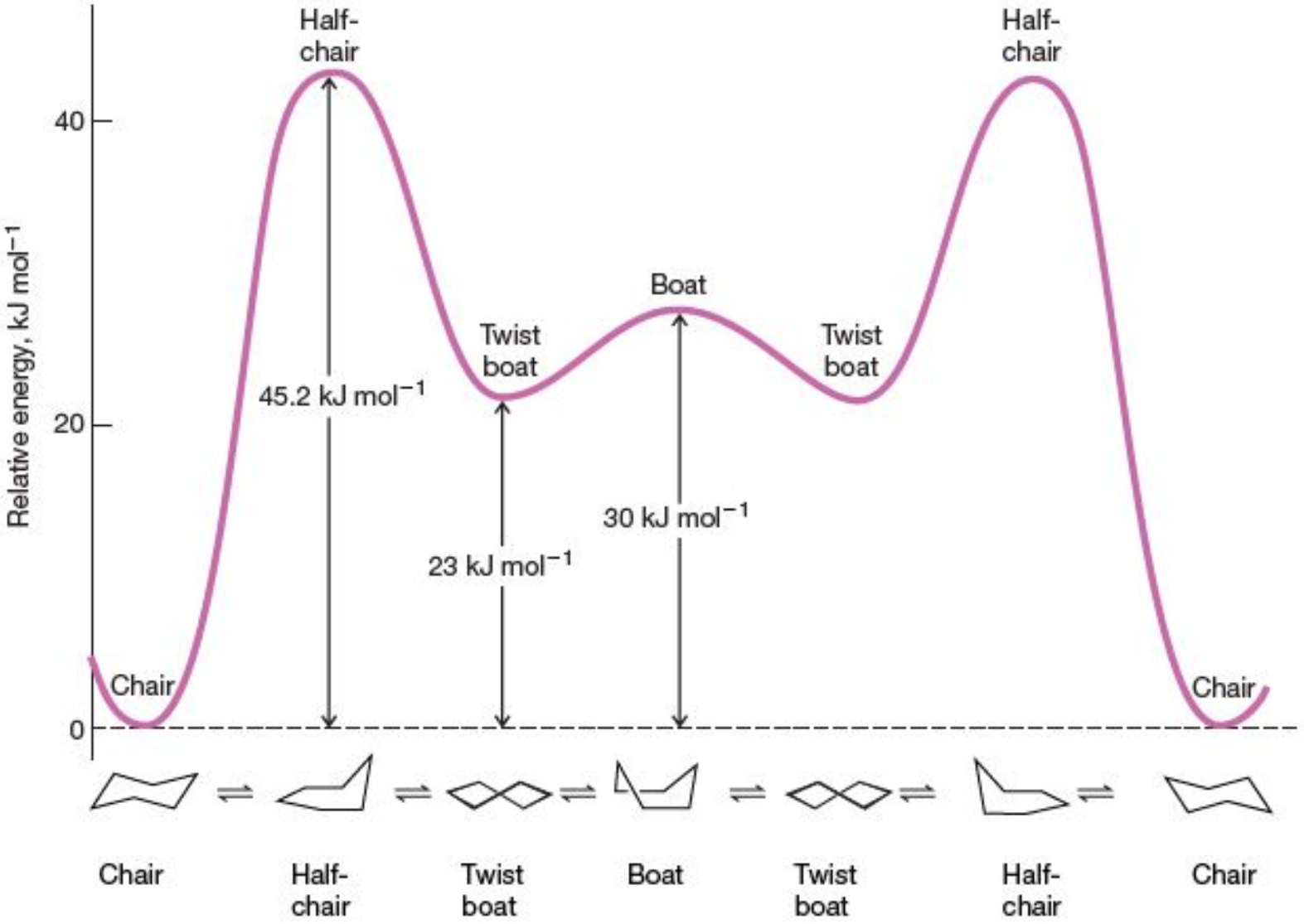


Two conformations of *cis*-1,3-dimethylcyclobutane are shown. What is the difference between them, and which do you think is likely to be more stable?

(a)

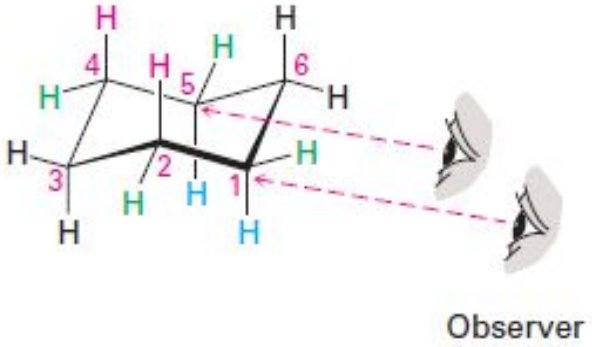
(b)


Twist this carbon up
Twist this carbon down
Chair conformation
Boat conformation
Chair conformation

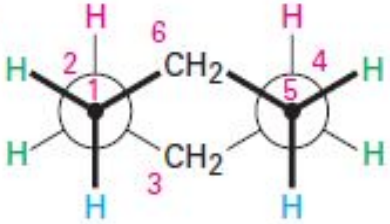

Relative energy, kJ mol⁻¹
40
20
0
Half-chair
Half-chair
Boat
Twist boat
Twist boat
45.2 kJ mol⁻¹
23 kJ mol⁻¹
30 kJ mol⁻¹
Chair
Chair
Chair
Half-chair
Twist boat
Boat
Twist boat
Half-chair
Chair

(a)

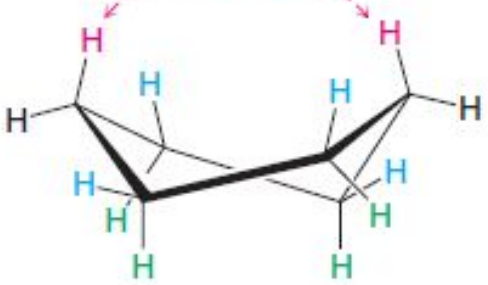
(b)



(c)

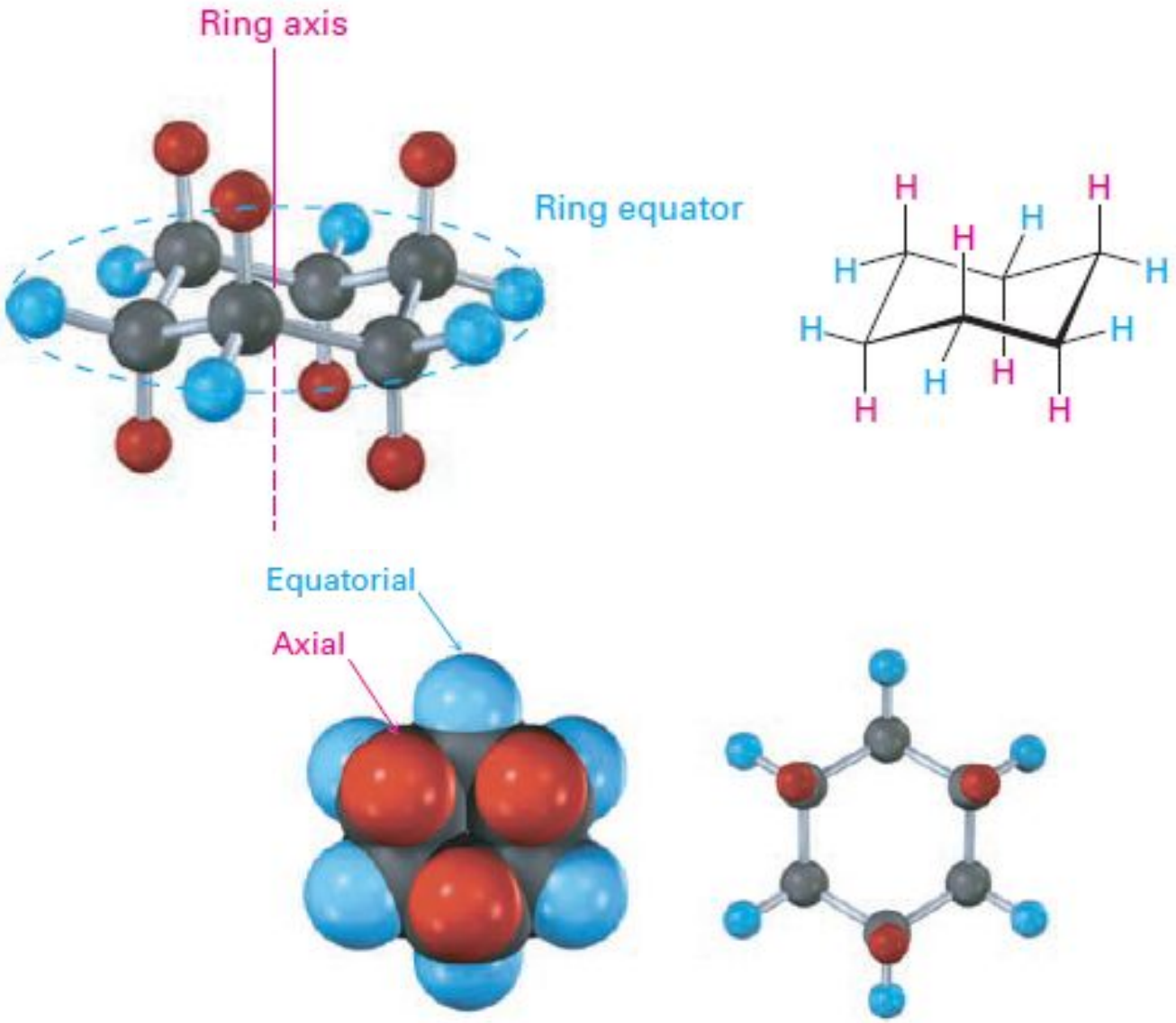


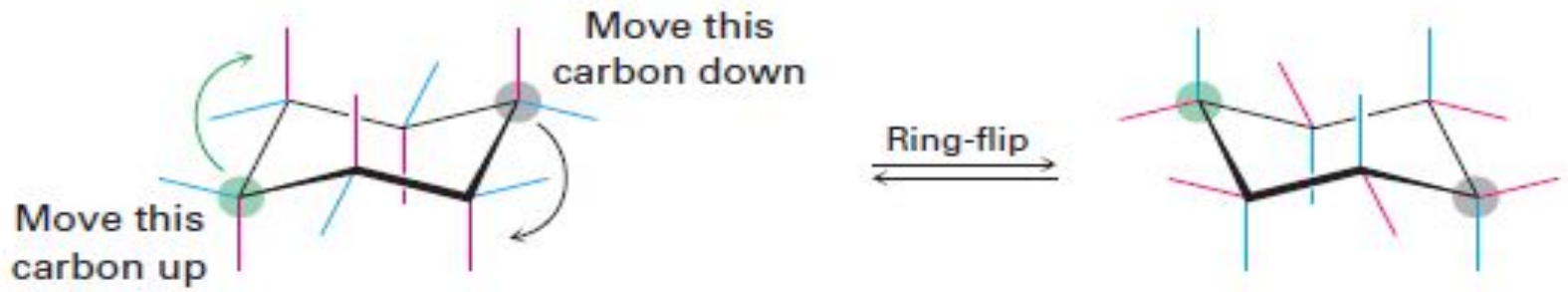
Steric strain

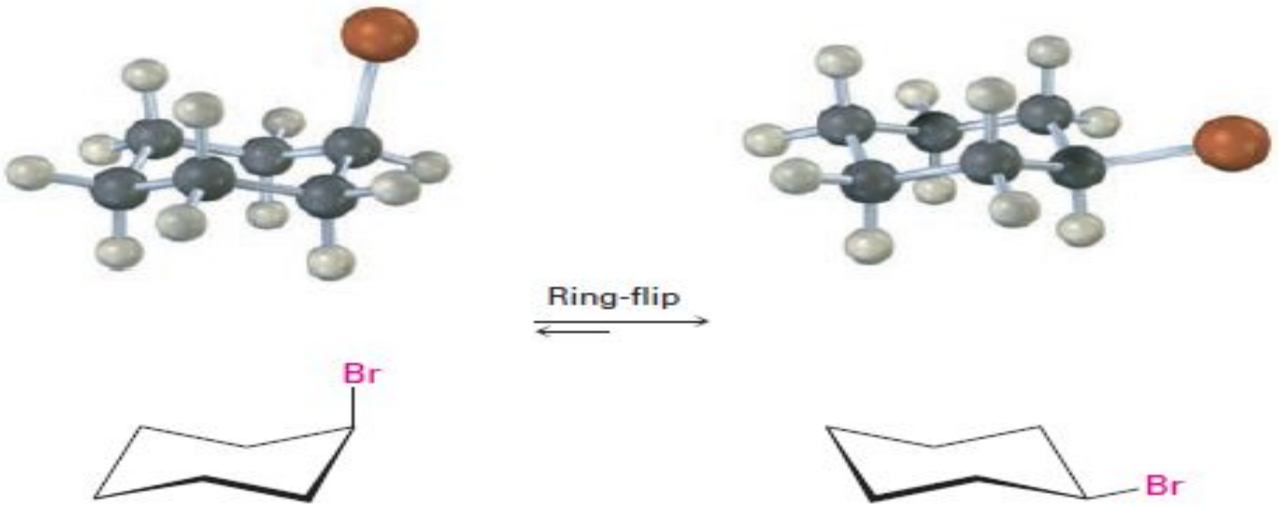


H ↔ H
H ↔ H
} Torsional strain

Twist-boat cyclohexane
(23 kJ/mol strain)


Ring axis
Ring equator
H
H
H
H
H
H
H
H
H
H
H
H
Equatorial
Axial

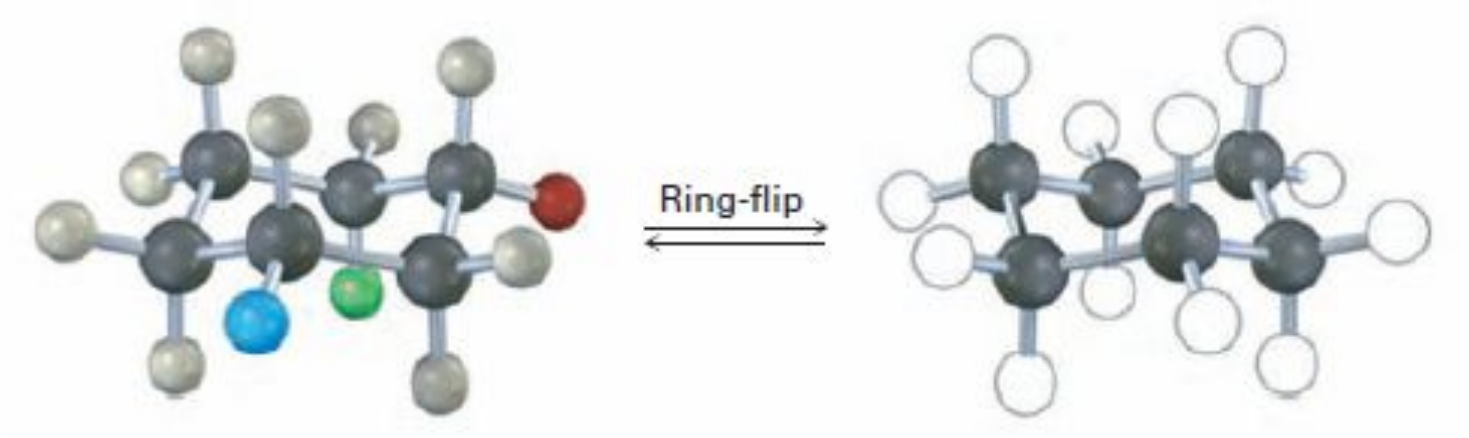


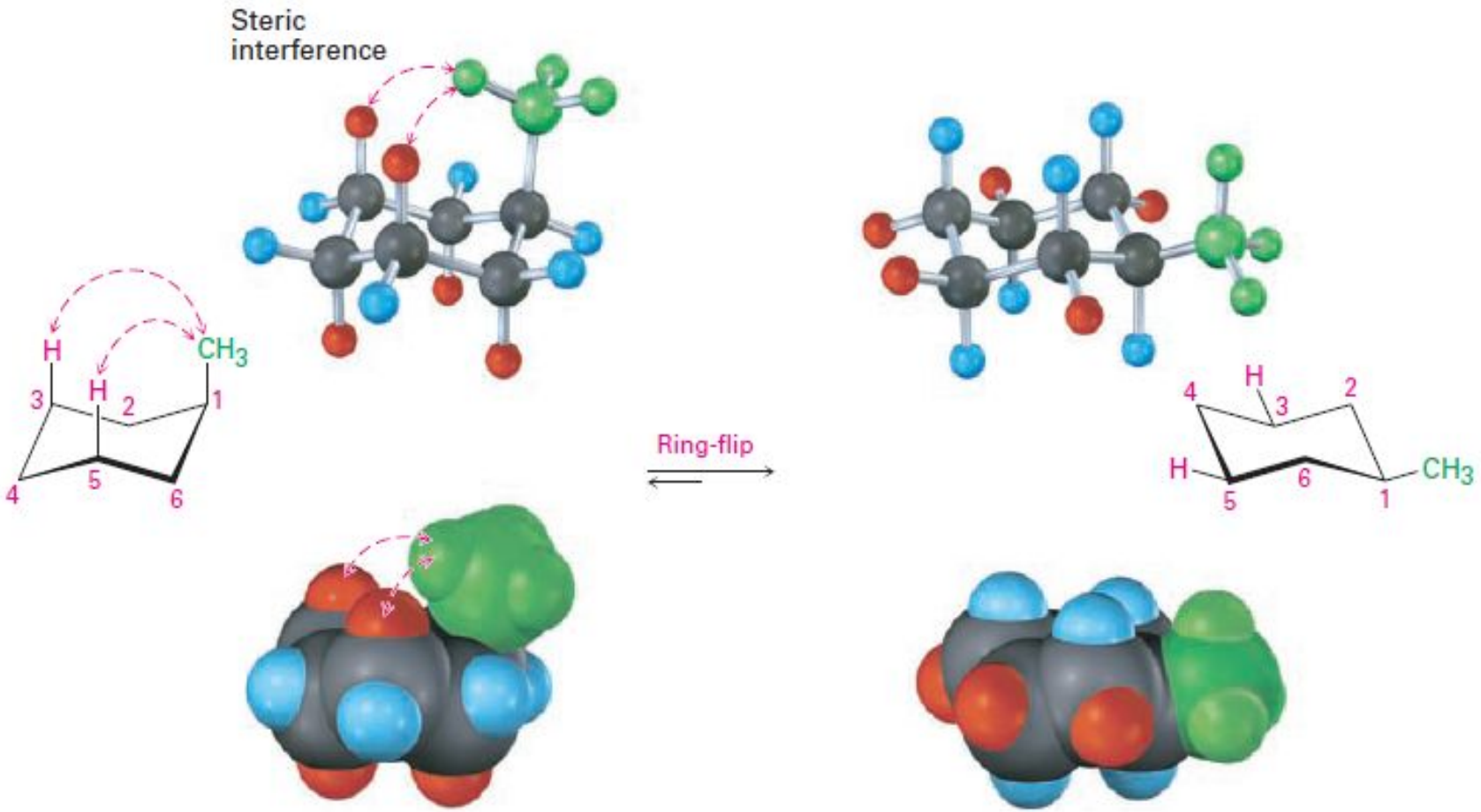


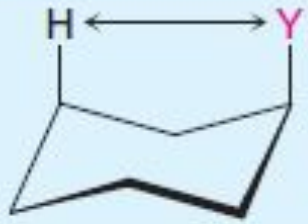
Axial bromocyclohexane

Equatorial bromocyclohexane

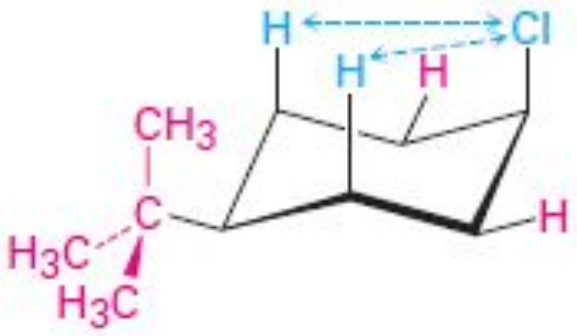
Identify each of the colored positions—red, blue, and green—as axial or equatorial. Then carry out a ring-flip, and show the new positions occupied by each color.



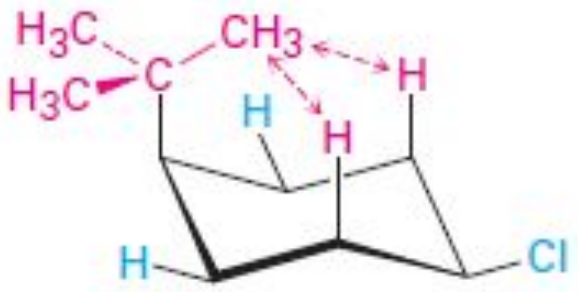

Steric
interference
H
H
CH3
3
2
1
4
5
6
Ring-flip
H
H
CH3
4
3
2
5
6
1

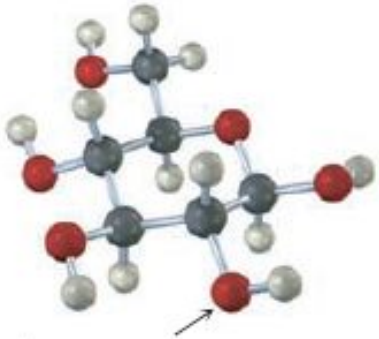


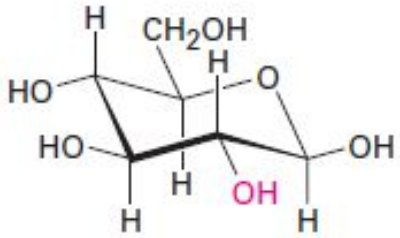
Y	1,3-Diaxial strain (kJ/mol)	1,3-Diaxial strain (kcal/mol)
F	0.5	0.12
Cl, Br	1.0	0.25
OH	2.1	0.5
CH_3	3.8	0.9
CH_2CH_3	4.0	0.95
$CH(CH_3)_2$	4.6	1.1
$C(CH_3)_3$	11.4	2.7
C_6H_5	6.3	1.5
CO_2H	2.9	0.7
CN	0.4	0.1



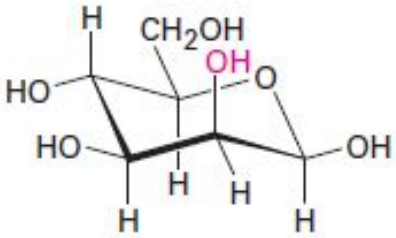
Ring-flip

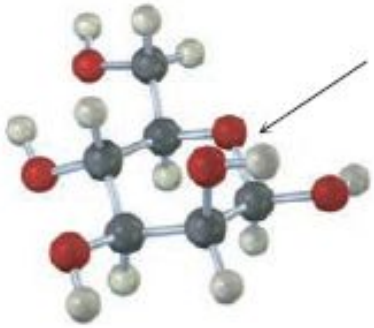






Glucose

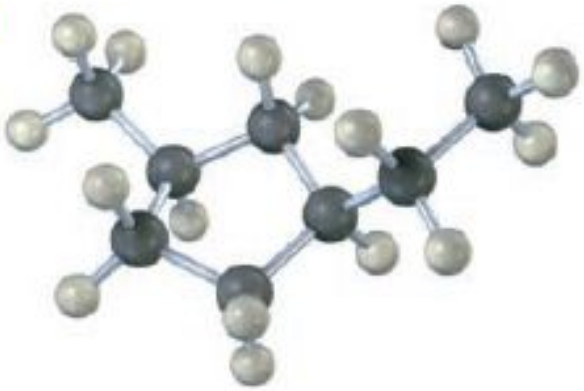




Mannose

4.22 Name the following cycloalkanes:

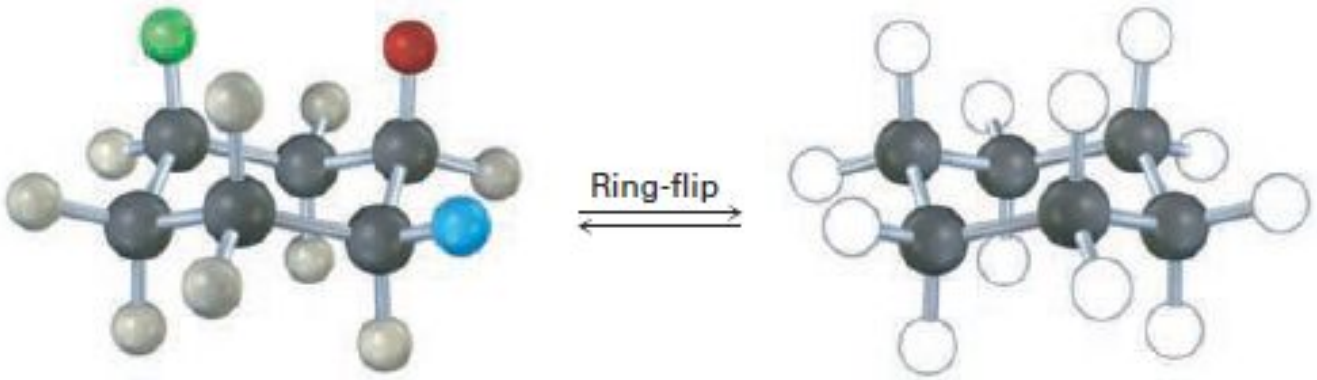
(a)



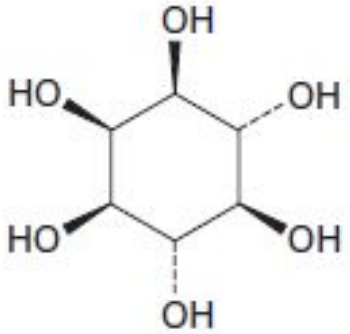
(b)

Name the following compound, identify each substituent as axial or equatorial, and tell whether the conformation shown is the more stable or less stable chair form (green = Cl):

▲ A trisubstituted cyclohexane with three substituents—red, green, and blue—undergoes a ring-flip to its alternative chair conformation. Identify each substituent as axial or equatorial, and show the positions occupied by the three substituents in the ring-flipped form.



▲ *myo*-Inositol, one of the isomers of 1,2,3,4,5,6-hexahydroxycyclohexane, acts as a growth factor in both animals and microorganisms. Draw the most stable chair conformation of *myo*-inositol.



***myo*-Inositol**

How many cis–trans stereoisomers of *myo*-inositol (Problem 4.55) are there? Draw the structure of the most stable isomer.