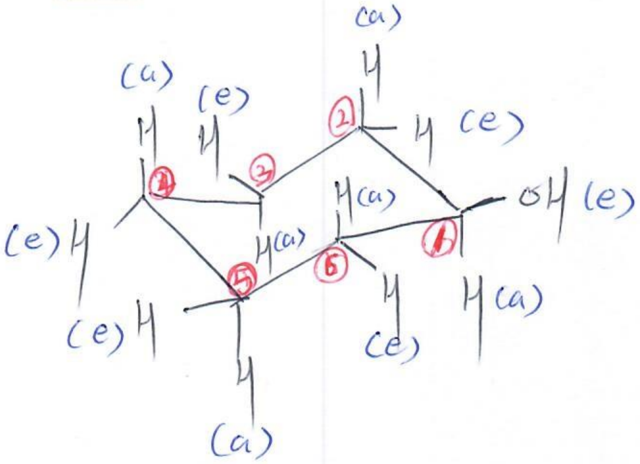
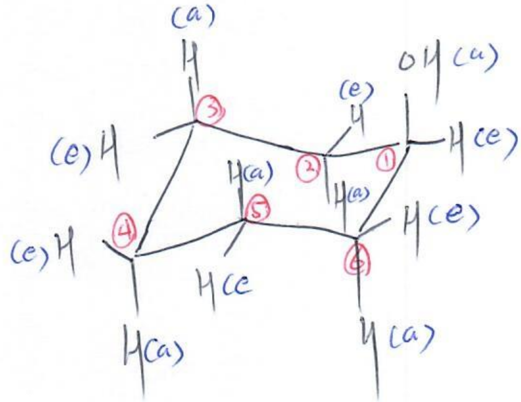
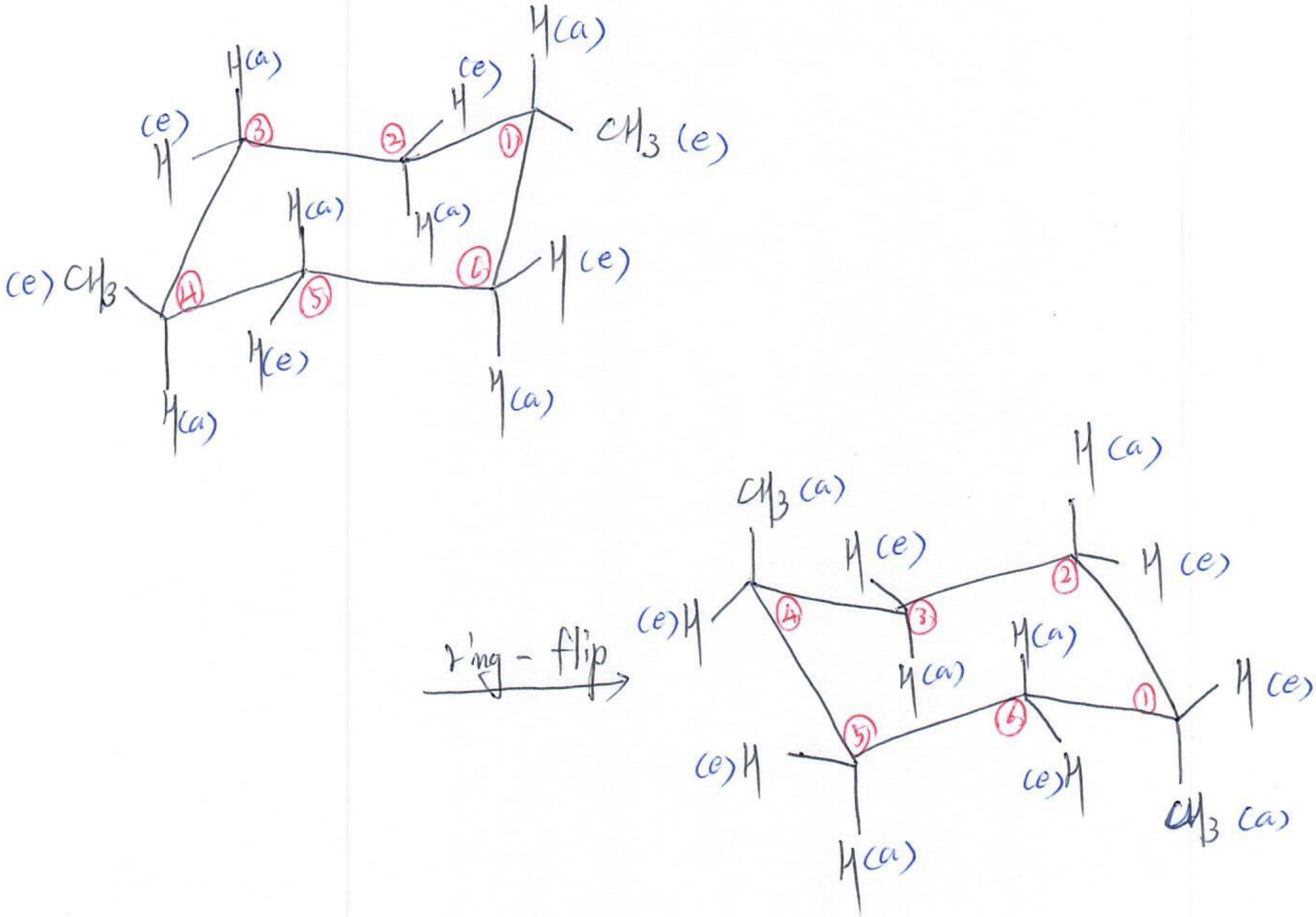
Problem 4-12.



$\xrightarrow{\text{ring-flip.}}$

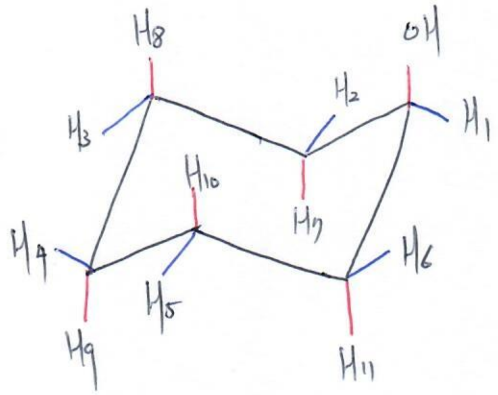


Problem 4-13



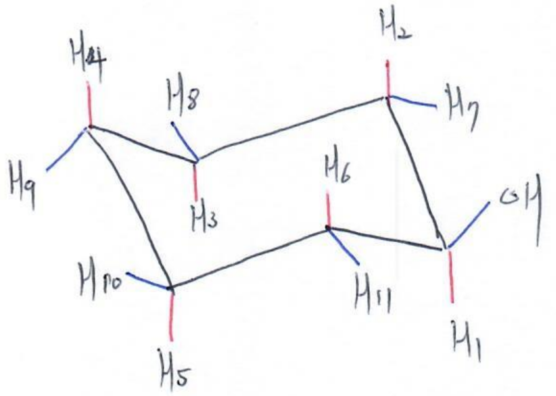
Problem 4-15

(I)



↓ ring-flip.

(II)



In case (I), OH is interacted with H8 and H10 (Diaxial interaction).

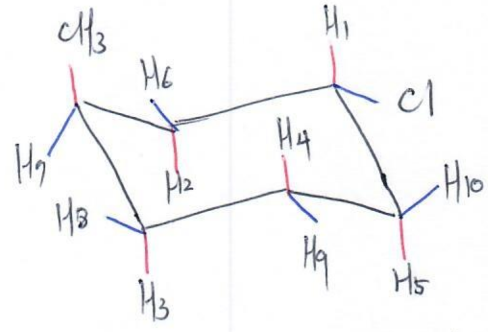
In case (II), OH does not have "Diaxial Interaction".

(II) is more stable than (I).

Problem 4-18-1

(a)

(I)



trans-1-chloro-3-methyl hexane.

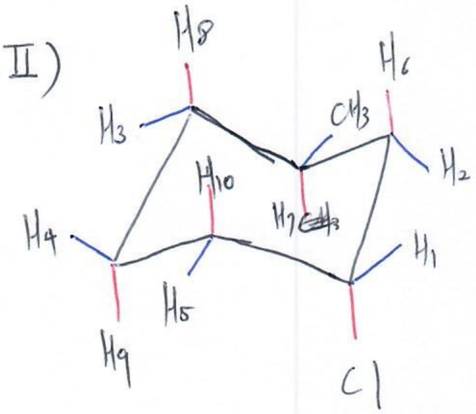
CH_3 is interacted with H_1 and H_4

The steric strain Energy is

$3.8\ kJ/mol\ (CH_3 \leftrightarrow H) \times 2$

$= 7.6\ kJ/mol$

(II)



Cl is interacted with H_7 and H_9.

The steric strain Energy ($Cl \leftrightarrow H$) is

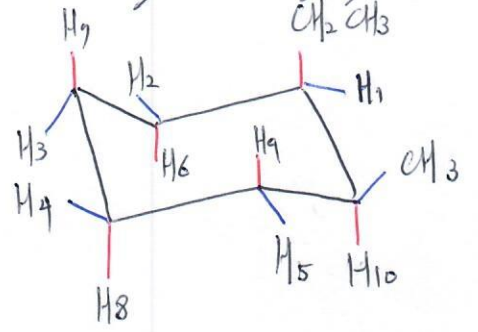
$1.0\ kJ/mol \times 2 = 2.0\ kJ/mol$.

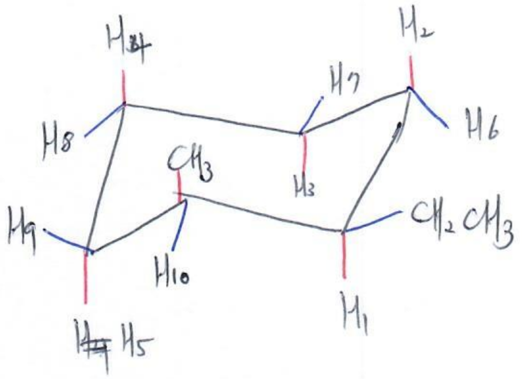
∴ The (II) conformation of "trans-1-chloro-3-methyl cyclohexane" is stable.

Problem 4-18-2

cis-1-Ethyl-2-methylcyclohexane.

(b).





$CH_2CH_3 \leftrightarrow H_7 = 4$ kJ/mol

$CH_2CH_3 \leftrightarrow H_9 = 4$ kJ/mol

$CH_2CH_3 \leftrightarrow CH_3 = 3.8$ kJ/mol

11.8 kJ/mol

$CH_3 \leftrightarrow H_2 = 3.8$ kJ/mol

$CH_3 \leftrightarrow H_4 = 3.8$ kJ/mol

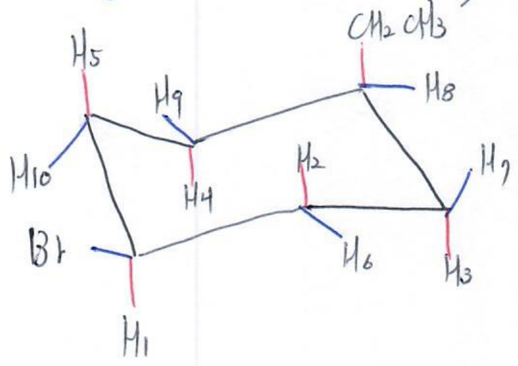
$CH_3 \leftrightarrow CH_2CH_3 = 3.8$ kJ/mol

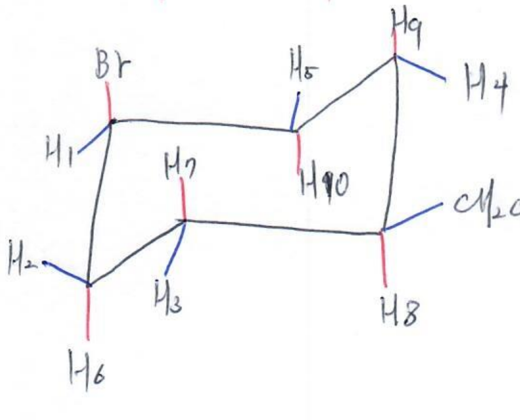
11.4 kJ/mol

more stable.

cis-1-Bromo-4-ethylcyclohexane

(c)





$CH_2CH_3 \leftrightarrow H_2 = 4$ kJ/mol

$CH_2CH_3 \leftrightarrow H_5 = 4$ kJ/mol

---

8 kJ/mol

$Br \leftrightarrow H_7 = 1$ kJ/mol

$Br \leftrightarrow H_9 = 1$ kJ/mol

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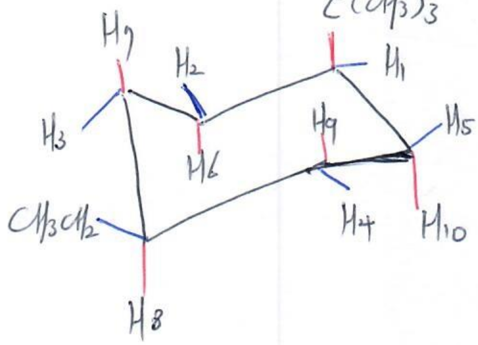
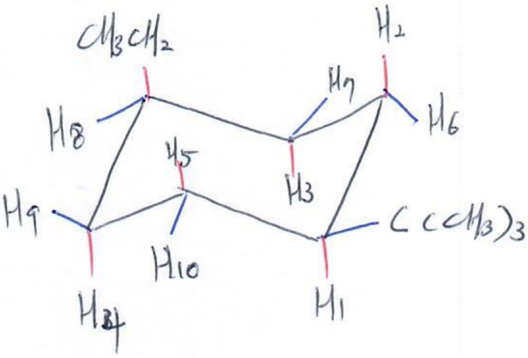
2 kJ/mol

more stable.

Problem 4-18-3

(d) cis-1-tert-butyl-4-ethylcyclohexane.





$C(CH_3)_3 \leftrightarrow H_7 = 11.4\,kJ/mol$

$C(CH_3)_3 \leftrightarrow H_9 = 11.4\,kJ/mol$

22.8 kJ/mol

$CH_2CH_3 \leftrightarrow H_2 = 4\,kJ/mol$

$CH_2CH_3 \leftrightarrow H_5 = 4\,kJ/mol$

8 kJ/mol

more stable.