**Chair Structures - More Practice - Answer Key**

I. Draw the two chair conformations for each of the following di-substituted cyclohexanes. Circle the more stable one.

a. *Cis*-1-chloro-2-methylcyclohexane

   ![Cis-1-chloro-2-methylcyclohexane](image)

   Larger methyl group is more stable in equatorial position

b. *Cis*-1-isopropyl-3-methylcyclohexane

   ![Cis-1-isopropyl-3-methylcyclohexane](image)

   Two groups equatorial more stable than two groups axial

c. *Cis*-1-ethyl-4-hydroxycyclohexane

   ![Cis-1-ethyl-4-hydroxycyclohexane](image)

   Larger group (ethyl) always more stable in equatorial position.

d. *Trans*-1-butyl-2-isopropylcyclohexane

   ![Trans-1-butyl-2-isopropylcyclohexane](image)

   Groups always more stable when equatorial

e. *Trans*-1-tert-butyl-3-methylcyclohexane

   ![Trans-1-tert-butyl-3-methylcyclohexane](image)

   Larger group (t-butyl) always more stable in equatorial position.

f. *Trans*-1-chloro-4-propylcyclohexane
II. For each of the following, do two things:
1. Draw the most stable chair form for the molecule (cis or trans, whichever is more stable) (groups in equatorial positions) and
2. Identify whether the more stable stereoisomer is cis (both up or both down) or trans (one up, one down)
   a. 1-butyl-2-methylcyclohexane
      ![Diagram of 1-butyl-2-methylcyclohexane]
      Groups always more stable when equatorial

   b. 1-tert-butyl-3-methylcyclohexane
      ![Diagram of 1-tert-butyl-3-methylcyclohexane]

   c. 1,4-diethylcyclohexane
      ![Diagram of 1,4-diethylcyclohexane]

III. For each of the following, do two things:
1. Draw the most stable chair form (largest group in equatorial positions) and
2. Identify whether the more stable chair would be the cis (both up or both down) or trans chair (one up, one down)
   a. Cis-1-chloro-2-ethylcyclohexane (largest group is ethyl, on #2)
      ![Diagram of Cis-1-chloro-2-ethylcyclohexane]
      Cis = both up or both down, ethyl bigger than Cl
      BUT
      Trans would allow both groups to be equatorial so TRANS isomer is more stable
b. Trans-1-ethyl-3-isopropylcyclohexane (largest group is isopropyl on #3)

Trans = one up, one down and shown with largest group (isopropyl) equatorial
Cis would allow both groups to be equatorial so **CIS isomer is more stable**

\[ \text{H} \quad \text{ax} \quad \text{down} \quad \text{H} \quad \text{up} \quad \text{eq} \]

\[ \text{H} \quad \text{1} \quad \text{ax} \quad \text{down} \quad \text{H} \quad \text{3} \quad \text{up} \quad \text{eq} \]


d. Trans-1-tert-butyl-4-hydroxycyclohexane (largest group is tert-butyl on #1)

Trans = one up, one down and both groups can be in equatorial position so **TRANS more stable**

\[ \text{H} \quad \text{1} \quad \text{up} \quad \text{eq} \quad \text{OH} \quad \text{4} \quad \text{eq} \quad \text{down} \quad \text{H} \]