3. The axial $H$ bonds are weaker, so the cis form is preferred.

Cis: 4 axial $H$, 4 equatorial $H$

Trans: 8 axial $H$, 0 equatorial $H$

Expected: $E_{\text{rel}}$ in cis $\approx 4 \times (0.9) = 3.6$ kcal/mol, in trans $\approx 8 \times (2.79) = 22.3$ kcal/mol

Therefore, cis is more stable.

4. The cis-diaxial interaction is due to the steric repulsion between the axial $H$ and the equatorial $H$.

**Problem:** How does this interaction affect the stability of the cis form?
1. 1,2- dimethylcyclohexane: chiral
   (R,S)
   achiral

1,3- dimethylcyclohexane:
   achiral (R,S)
   chiral (R,S)
   chiral (R,S)

Both stereoisomers of 1,4- dimethylcyclohexane are achiral because you can draw a mirror plane that goes through both methyl groups.

2. You know what to do...

3. Hexahelicene cannot be planar because the two terminal rings would occupy some of the same space. As a result, there are two enantiomerically helical conformations that cannot interconvert.

Build a model if it helps!
1. Radicals are electron-deficient alkyl groups can donate electron density in two ways:

   ![Inductive donation and hyperconjugation](image)

2. Delocalization = stabilization, and the most stable radical will form fastest.

   ![Delocalization example](image)

   This product would have to result from formation of an $sp^2$ ("vinyl") radical. This is bad because $sp^2$ orbitals are more electronegative than $sp^3$; much less happy to have less than an octet!

3. On the next page...

4. ![Structures with labels](image)
3. **Initiation**: 
\[
\text{Br}_2 \xrightarrow{hv} \text{Br}^- + \text{Br}^-
\]

**Propagation**: 

1. \[
\text{Br}^- + \text{H}_2\text{C} = \text{C} - \text{H} \xrightarrow{hv} \text{H-Br} + \text{C} = \text{C}^-\text{H}^-
\]

2. \[
\text{C} = \text{C} - \text{H} + \text{Br}^- \xrightarrow{hv} \text{C} = \text{C} - \text{Br} + \text{Br}^-
\]

**Termination**: 

\[
\text{Br}^+ + \text{Br}^- \rightarrow \text{Br}_2
\]

\[
\text{Br}^- + \text{C} = \text{C} \rightarrow \text{C} = \text{C}^-\text{Br}
\]

\[
\text{C} = \text{C} - \text{H} + \text{Br}^- \rightarrow \text{C} = \text{C} - \text{Br}
\]

---

**Energy Calculations**

<table>
<thead>
<tr>
<th>Reaction</th>
<th>( \Delta H )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make H-Br</td>
<td>-88 kcal/mol</td>
</tr>
<tr>
<td>Break benzene (-H)</td>
<td>+85 kcal/mol</td>
</tr>
<tr>
<td>Overall</td>
<td>(-3) kcal/mol</td>
</tr>
</tbody>
</table>

**Additional Notes**

- Make sure you always label your reaction energy diagrams very thoroughly!