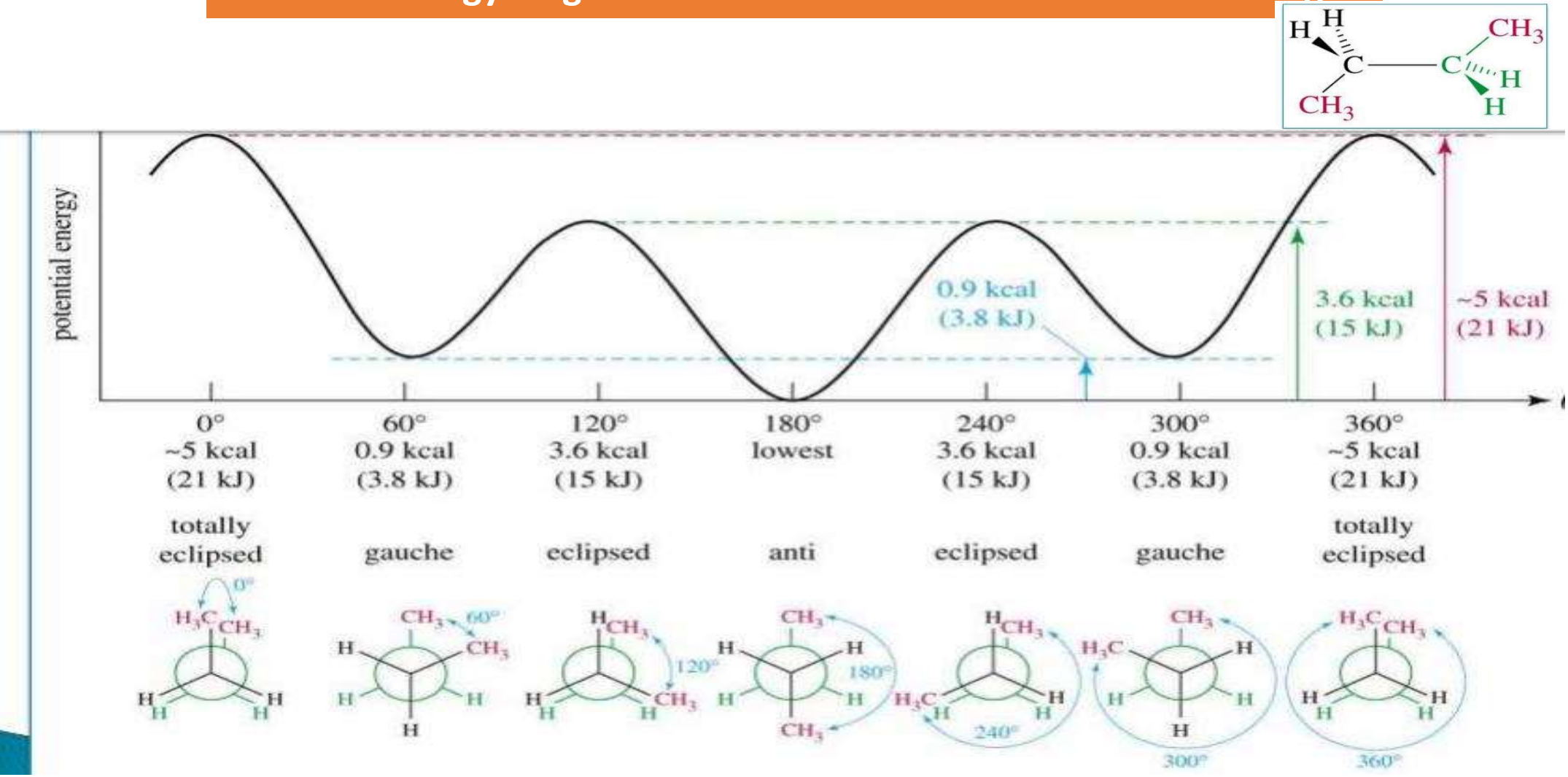
Potential energy diagram of butane as a function of dihedral angle



CONFORMATIONAL ISOMERS OF CYCLOALKANES

The bond angel is of 109˚ 28' (or 109.5˚) for carbon atom in tetrahedral geometry

Ring Strain

Baeyer Strain Theory

Baeyer proposed “any deviation of bond angle from ideal bond angle value (109.5˚) will produce a strain in molecule.

The strain is also called as **angle strain**

Cyclopentane

planar conformation is strain free according to Baeyer; however, there is considerable torsional strain (10 H-H eclipsing interactions)

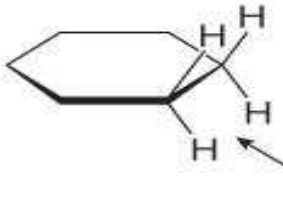
Envelope and half-chair conformations relieve much of the torsional strain

Cyclohexane

If a cyclohexane ring were flat....

angle strain

The internal bond angle is >109.5°.



All H's are aligned.

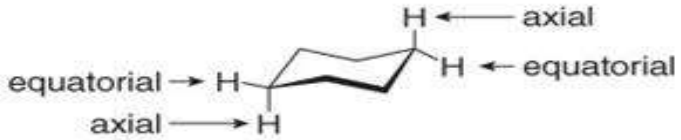
torsional strain

In reality, cyclohexane adopts a puckered "chair" conformation, which is more stable than any possible other conformation.

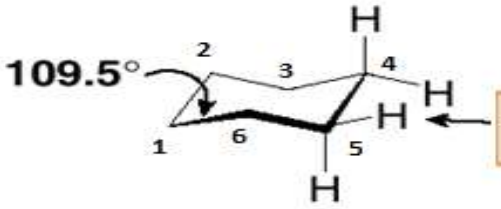
3 *up* C's and 3 *down* C's

● = *up* C ○ = *down* C

Two kinds of H's



The chair conformation is so stable because it eliminates angle strain (all C—C—C angles are 109.5°), and torsional strain (all hydrogens on adjacent C atoms are staggere



All H's are **staggered.**