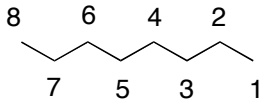
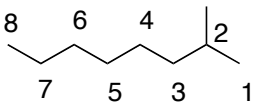
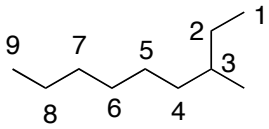
Nomenclature Refresh



Octane

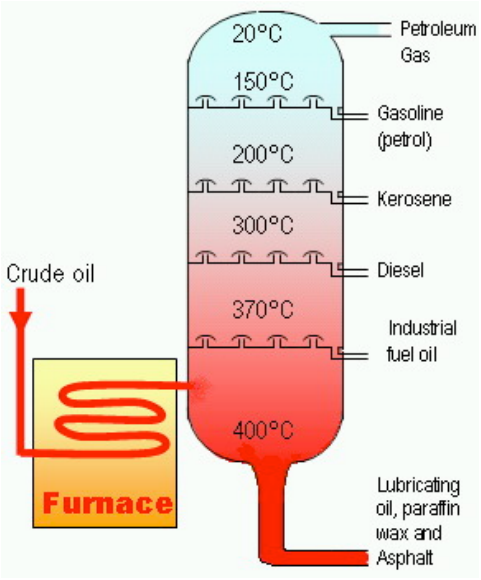


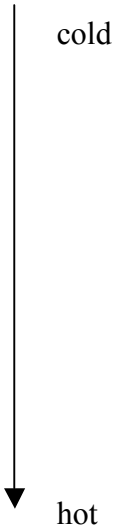
2-methyloctane



3-methylnonane

Distillation of petroleum

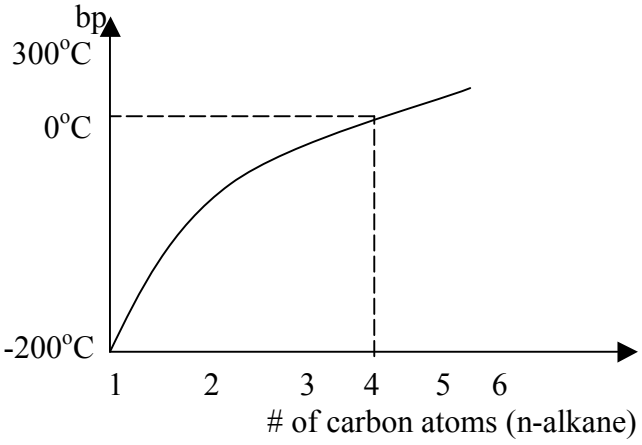




Physical Properties:

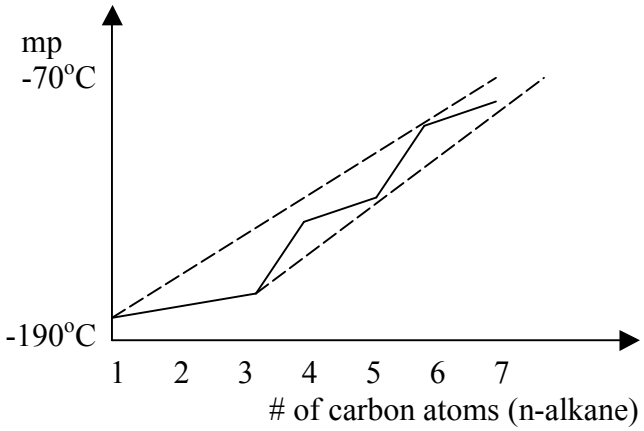
- hydrocarbons – alkanes are non-polar – H and C have similar electronegativity therefore there is no permanent dipole
- soluble in other organic solvents (like dissolves like)
- immiscible with water (not infinitely soluble in water)

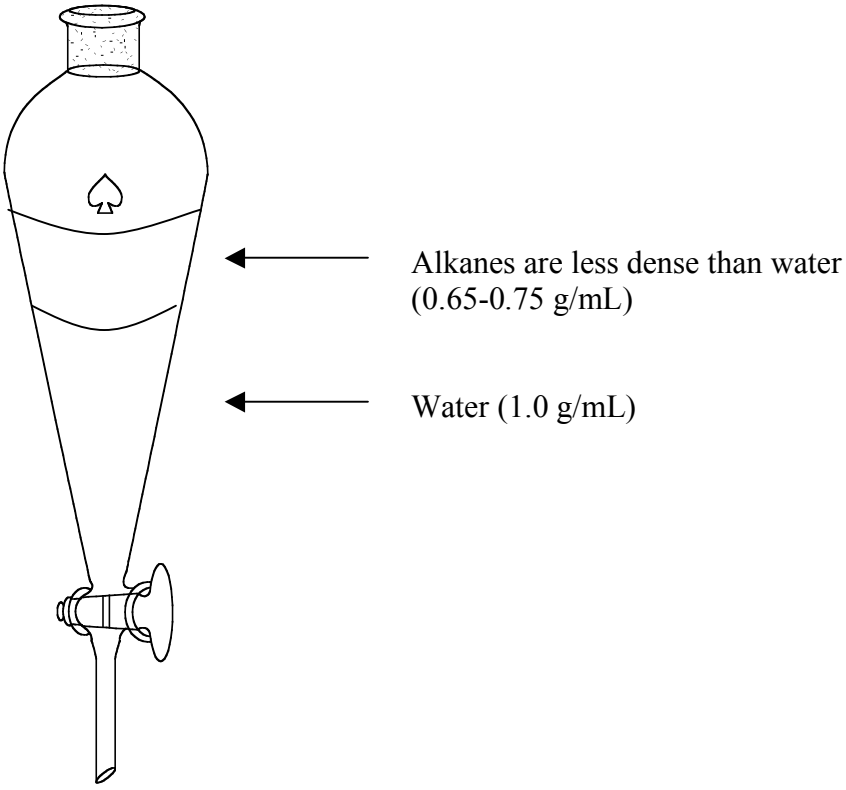
boiling point trend:



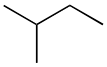
- increasing the straight chain length increases the bp. This is due to London forces (hydrophobic forces) between the adjacent molecules.

melting point trend:

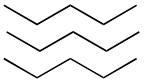


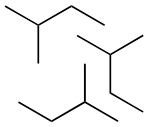


eg. pentane



mp (°C)	bp (°C)
-129	36
-160	28
-13	9





less well packed

- n-pentane has high bp due to multiple contacts of straight chains (London Forces)

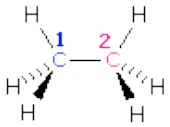
Conformations

- Different 3-D shapes a molecule can assume by rotation around single bonds.

Eg) ethane – C_2H_6

Newman projection

Less stable Eclipsed Conformation



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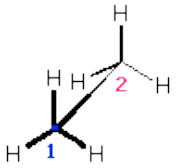

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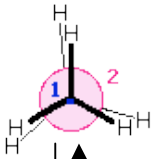
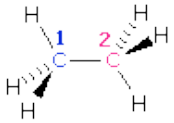


ΔG = 2.8 kcal/mol for rotation

Most stable Staggered Conformation



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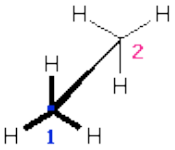

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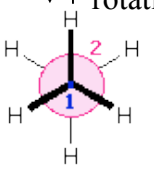
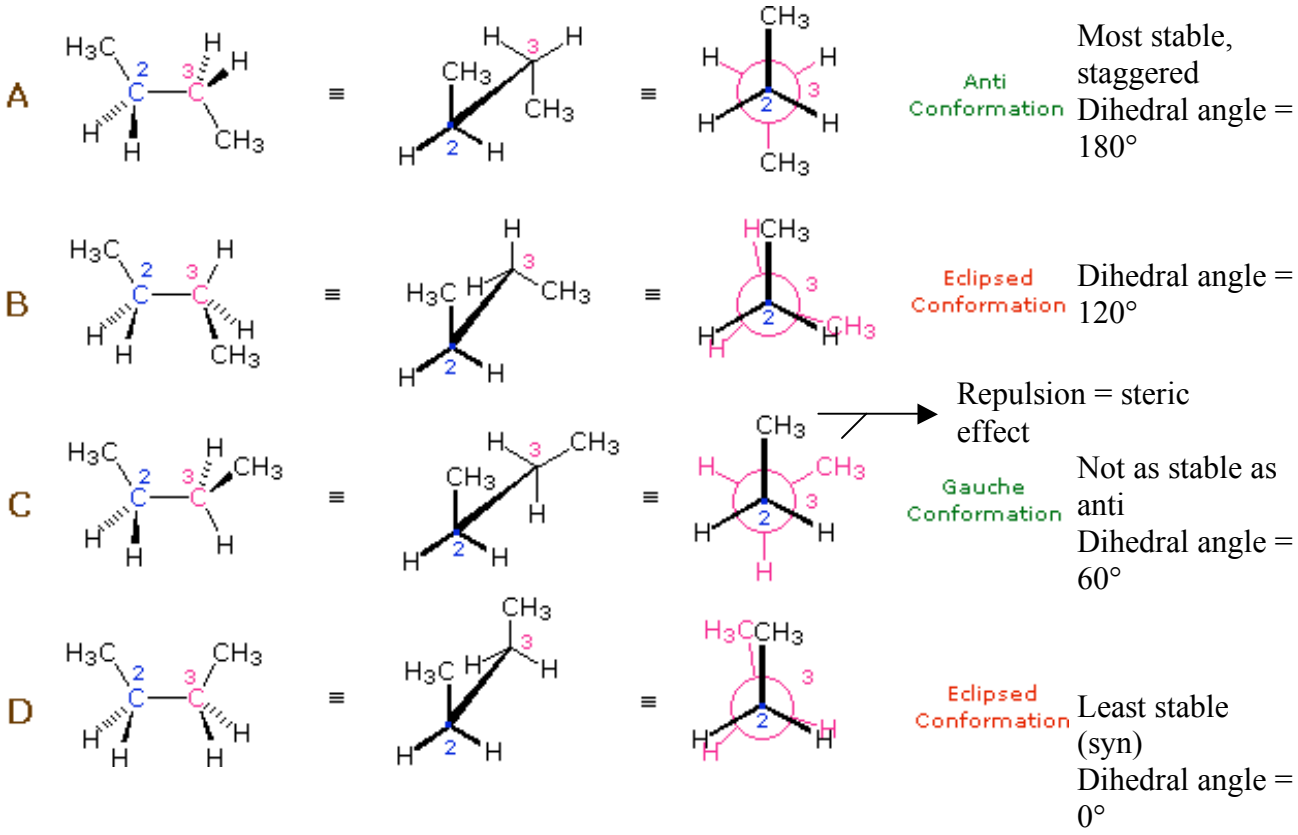


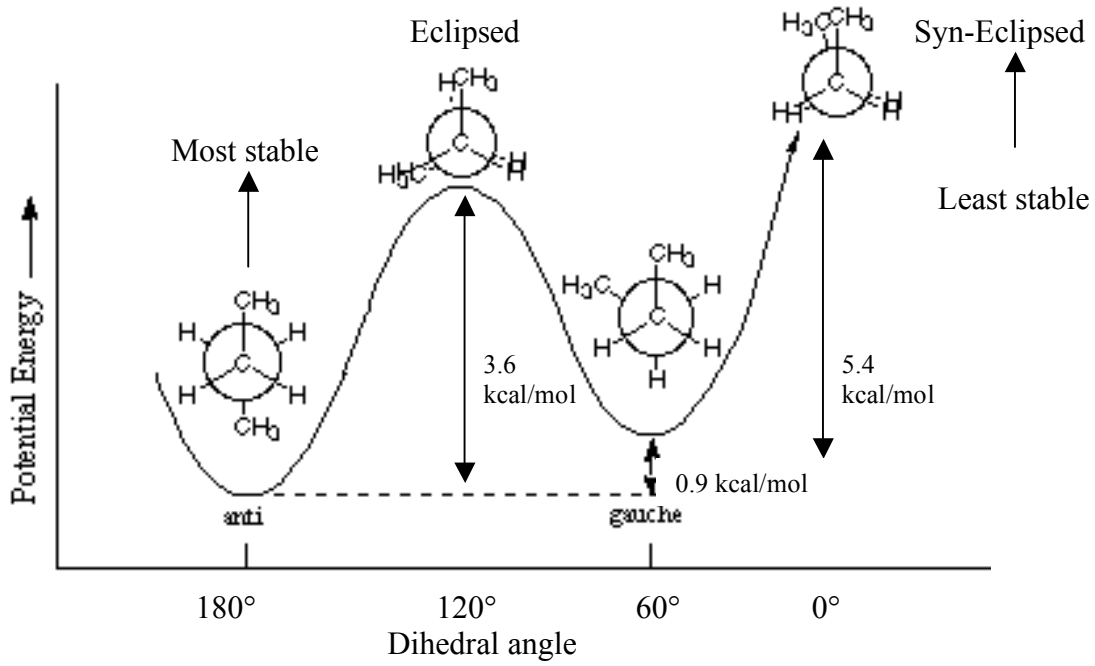
- Rotation occurs rapidly at room temperature.
- Room temperature = ~15-20 kcal/mol of energy available.

Eg) n-butane (C_4H_{10}) – rotation around all bonds still very rapid

- most stable (most populated conformation) is called anti and has groups as far away as possible

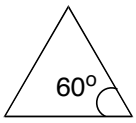


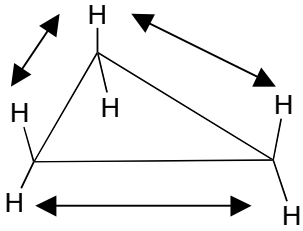
The dihedral angle in the above diagram is the angle between the two methyl groups.



Cycloalkane Conformations

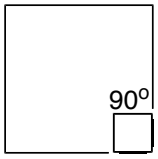
Eg) Cyclopropane –bond angle 60°



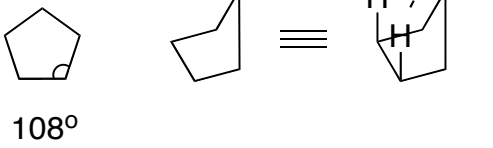


Eclipsing interactions

Eg) Cyclobutane – bond angle close to 90°

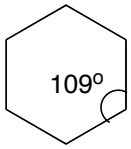


Eg) Cyclopentane – bond angles nominally 108°

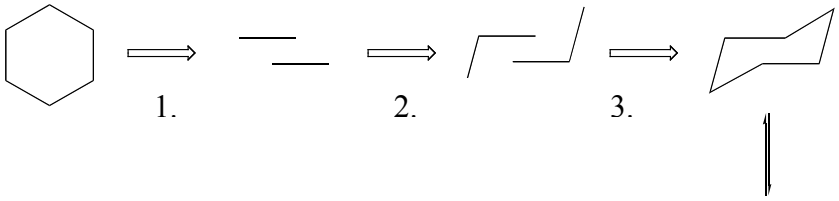


With envelope conformation there are still bad H-H interactions.

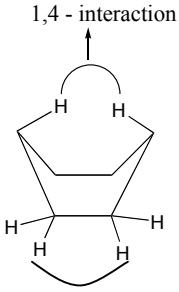
Eg) Cyclohexane – bond angles actually 109° not 120° as in flat hexagon



Cyclohexane Conformations – How to draw

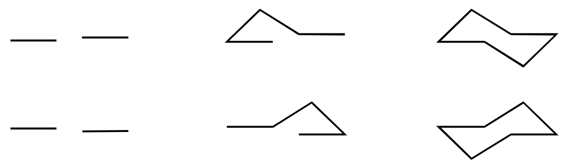


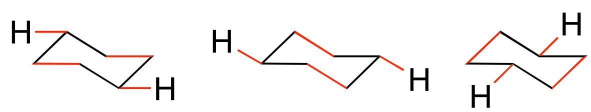
- Chair conformation (most stable)
- All adjacent hydrogen atoms are staggered



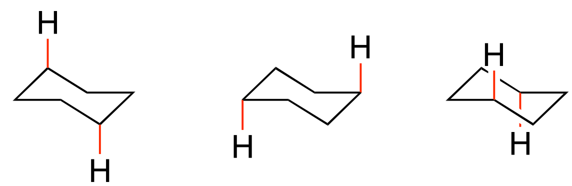
- Boat (least stable)
- many adjacent hydrogen atoms eclipsed
- 1,4 - interactions of two-hydrogens

Another way to draw cyclohexane





Parallel Lines in Equatorial Position



Vertical Lines in Axial Position