

LEC (9)

CHEM 30A

Jan 28<sup>th</sup>

- ① CYCLOALKANES cont
- ② PROPERTIES OF ALKANES
- ③ REACTIONS/SOURCES/IMPORTANCE

CHAPTER 3

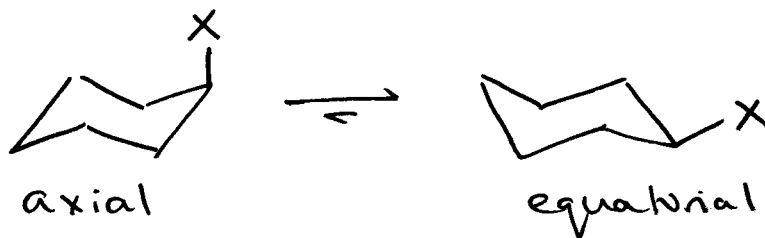
- ④ STEREOCHEMISTRY
- ⑤ CHIRALITY

MMK: Reading 2.9-3.4

Problems 2.16, 2.46-2.61, 3.1-3.5, 3.10-3.23

① CYCLOALKANES

A values = -ΔG for:

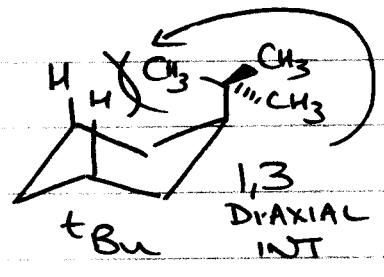
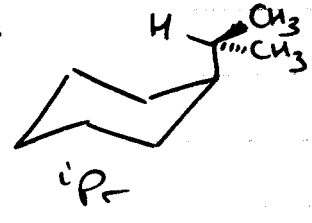
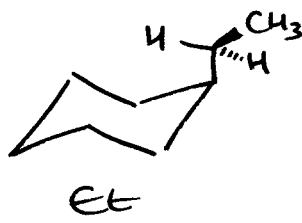
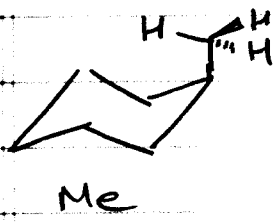


So, VALUES ARE +VE

Larger the value, the stronger the preference for the EQUATORIAL position

-CH <sub>3</sub>	-CH <sub>2</sub> CH <sub>3</sub>	-CH(CH <sub>3</sub> ) <sub>2</sub>	-C(CH <sub>3</sub> ) <sub>3</sub>
1.74	1.75	2.15	>5

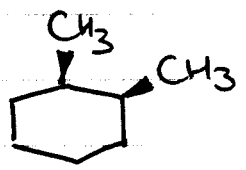
Note: small changes for Me, Et, *i*Pr → why?



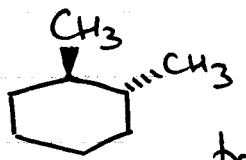
*t*Bu ⇒ LOCKING GROUP  
OVERWHELMING PREFERENCE  
FOR THE EQUATORIAL POSITION



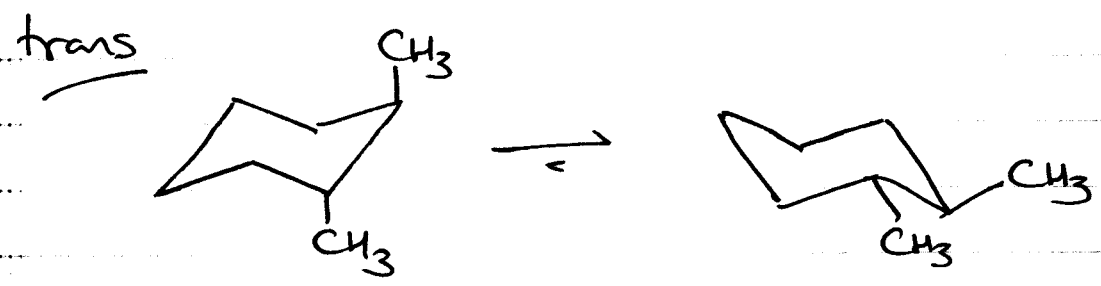
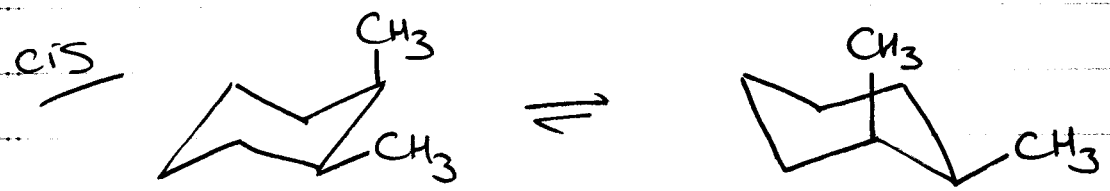
### DISUBSTITUTED CYCLOHEXANES



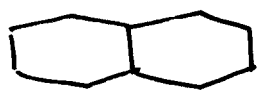
same side cis  
cis-1,2-dimethylcyclohexane



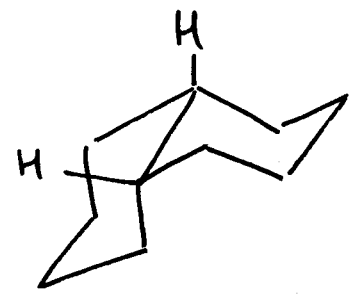
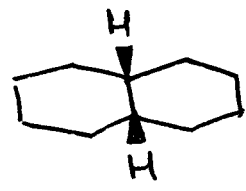
opposite side trans  
trans-1,2-dimethylcyclohexane



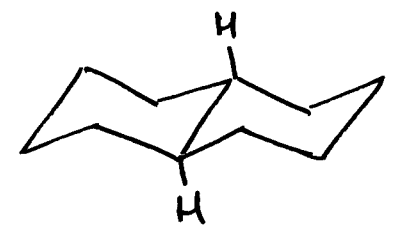
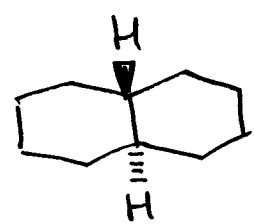
— DECALIN



cis Decalin



trans Decalin



## ② PROPERTIES OF ALKANES

as MW increases, mp & bp increase

Intermolecular Interactions

- Ionic interactions
- Hydrogen Bonding
- Dipole - dipole
- Dipole - induced dipole
- Induced Dipole - Induced Dipole

Decreasing Strength ↓

↳ DISPERSION FORCES / LONDON FORCES ↘

low mw nonpolar substances can be liquefied

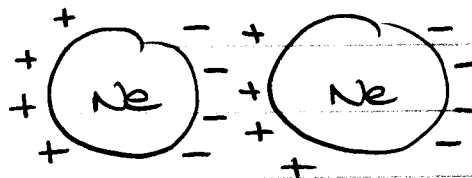
He 4K

Ne 27K

Bigger e<sup>-</sup> clouds, stronger forces



transient polarization →



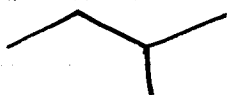
Symmetrical electron density distribution

↑  
temporary electrostatic attraction

- consider



bp  
36°C



28°C



10°C

Constitutional isomers

more branching  
↓  
more compact shape  
↓  
less surface area  
↓  
less molecule / molecule contact  
fewer DISPERSION interactions

### ③ Reactions / Sources / Importance

↳ Read sections 2.9/2.10  
and look over associated questions

# 4) STEREOCHEMISTRY

ISOMERS → different compounds with the same molecular formula

CONSTITUTIONAL ISOMERS

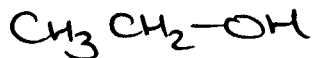
or

STEREISOMERS (configurational isomers)



Different connectivity

Same connectivity, different geometry



STEREISOMERS → ENANTIOMERS

(non-superimposable mirror images)



DIASTEREISOMERS

(non-superimposable non-mirror images)

CONFIGURATIONAL DIASTEREISOMERS

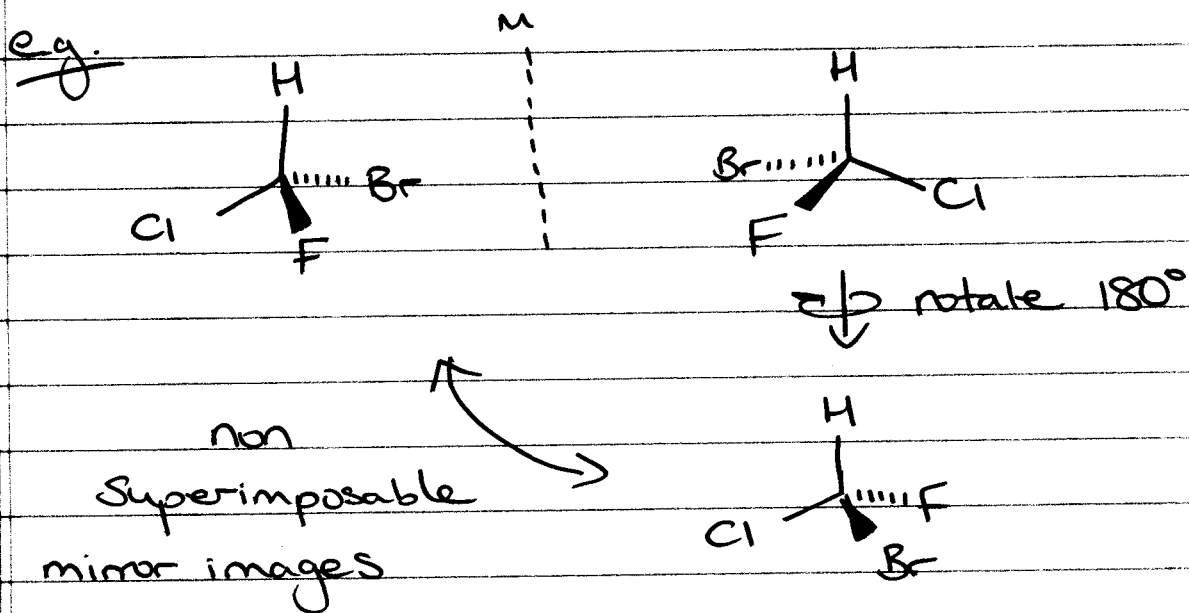
CIS/TRANS DIASTEREISOMERS

# 5) CHIRALITY

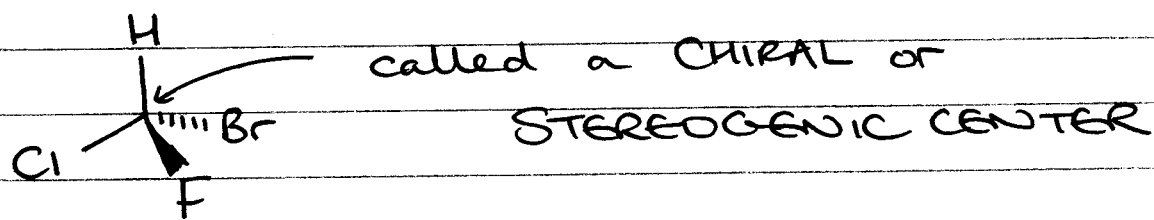
An object (molecule) that is NOT superimposable on its mirror image is said to be CHIRAL

6

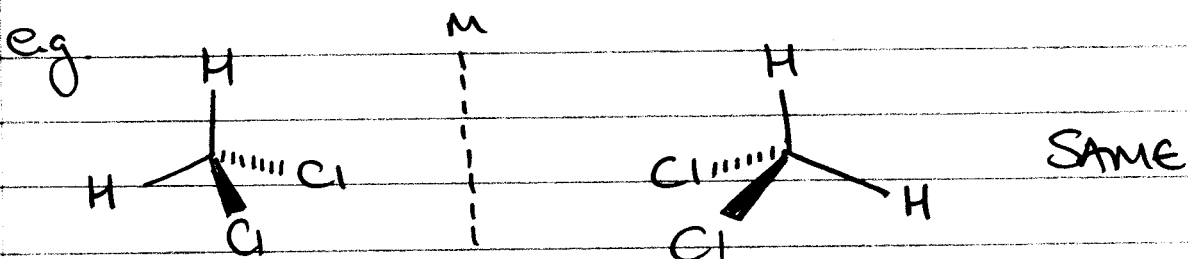
from Greek cheir meaning hand



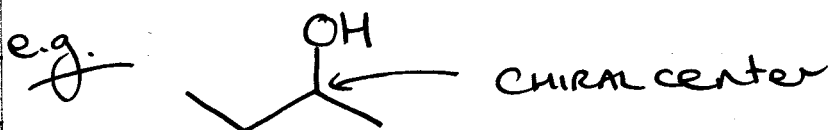
So, each of these molecules is CHIRAL and they are ENANTIOMERS



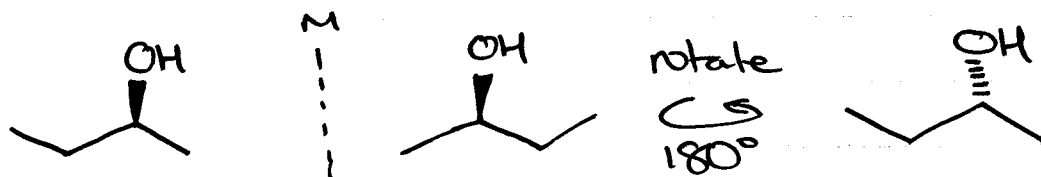
If an OBJECT (or molecule) is not CHIRAL, it is referred to as ACHIRAL



One of the most common causes of chirality in organic molecules is a TETRAHEDRAL atom (usually C) bonded to FOUR DIFFERENT GROUPS



ENANTIOMERS come in pairs

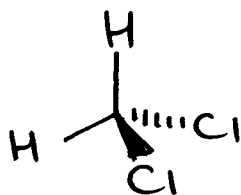


### IDENTIFYING CHIRAL OBJECTS

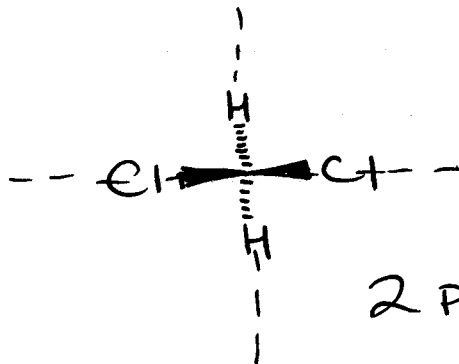
If a molecule can be drawn with  
(i) a PLANE of symmetry or  
(ii) an INVERSION center

⇒ IT IS ACHIRAL

e.g. (i)

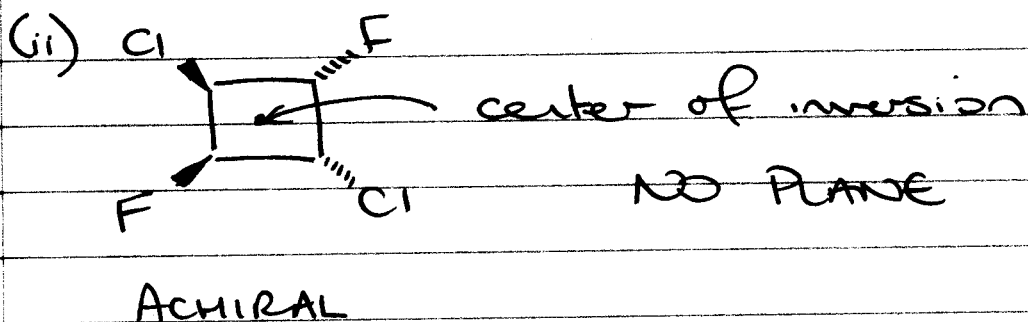


ACHIRAL



2 PLANES!

- You will see THIS MORE THAN:



centre of inversion  $\Rightarrow$  identical groups lie equidistant of a point, on opposite sides of that point.

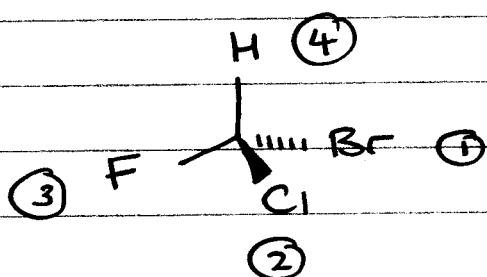
- DISTINGUISHING ENANTIOMERS



R, S designation

① Assigning Priority

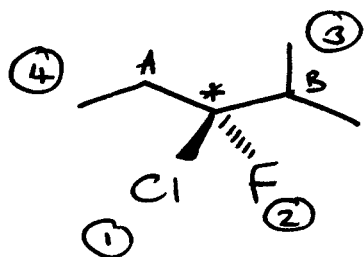
(i) ATOMIC WEIGHT of atoms attached to the stereocenter





9

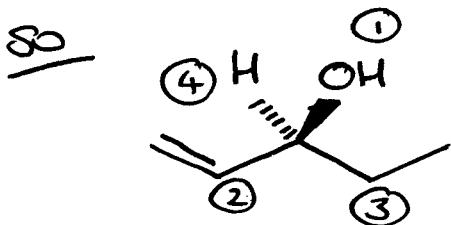
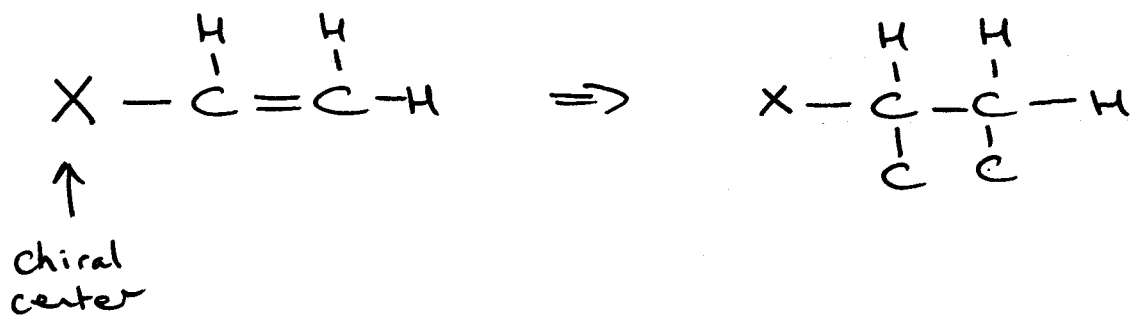
(ii) Keep going until the first point of difference



$C_A$  attached to C, H, H (4)

$C_B$  attached to C, C, H (3)

(iii) MULTIPLE BONDED ATOMS count as the equivalent number of singly bonded atoms



Use 1,2,3,4 to set R or S