

LEC ⑨ CHEM 30A

①
Oct 20th

- ① PROPERTIES OF ALKANES
- ② REACTIONS/SOURCES/IMPORTANCE

CHAPTER 3

- ③ STEREOCHEMISTRY
- ④ CHIRALITY

Reading 2.9 - 3.4

Hmk 2.16, 2.46 - 2.61, 3.1 - 3.5, 3.10 - 3.23
(Ch2 Probs on FRIDAY)

① 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

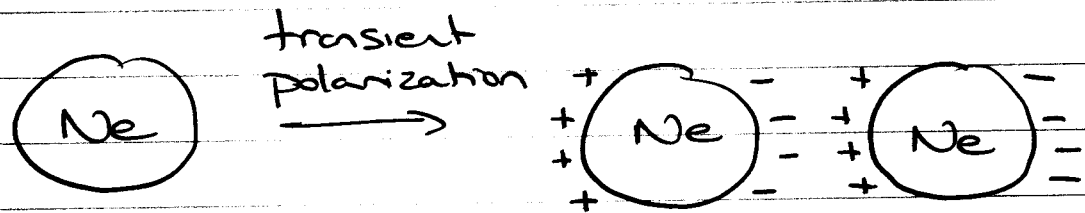
↳ DISPERSION FORCES / LONDON FORCES

The fact that low MW nonpolar substances can be LIQUEFIED

⇒ DISPERSION FORCES

e.g. He 4K
Ne 27K

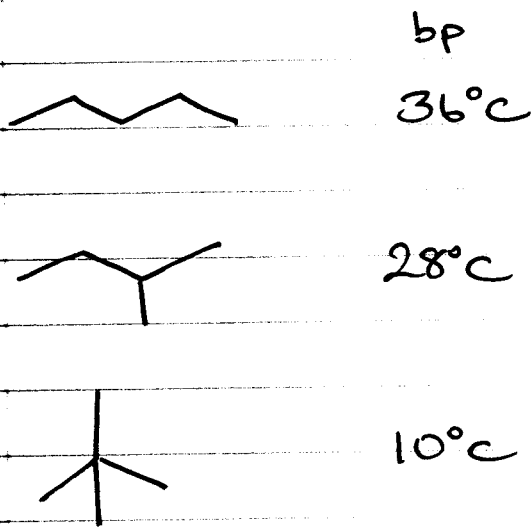
Bigger electron clouds, stronger forces



Symmetrical electron density distribution

temporary electrostatic attraction

- Consider



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

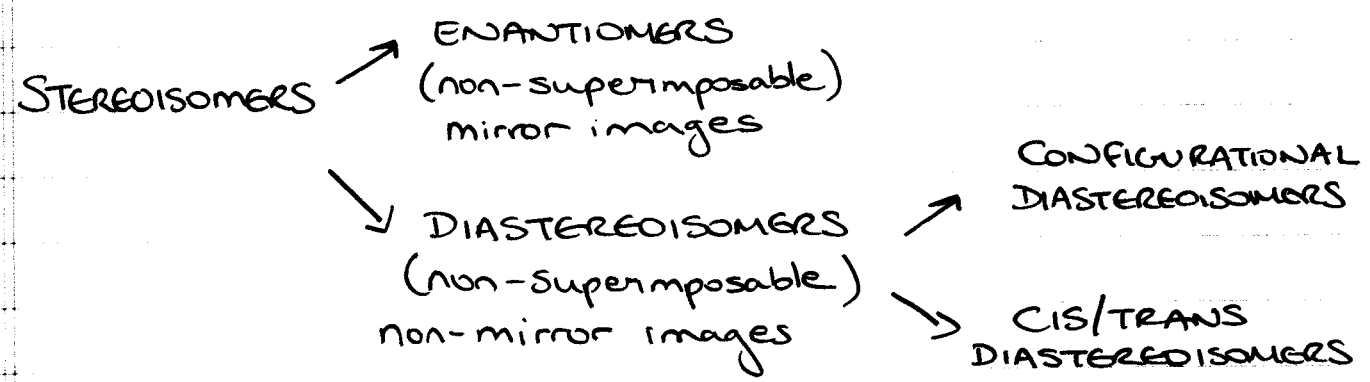
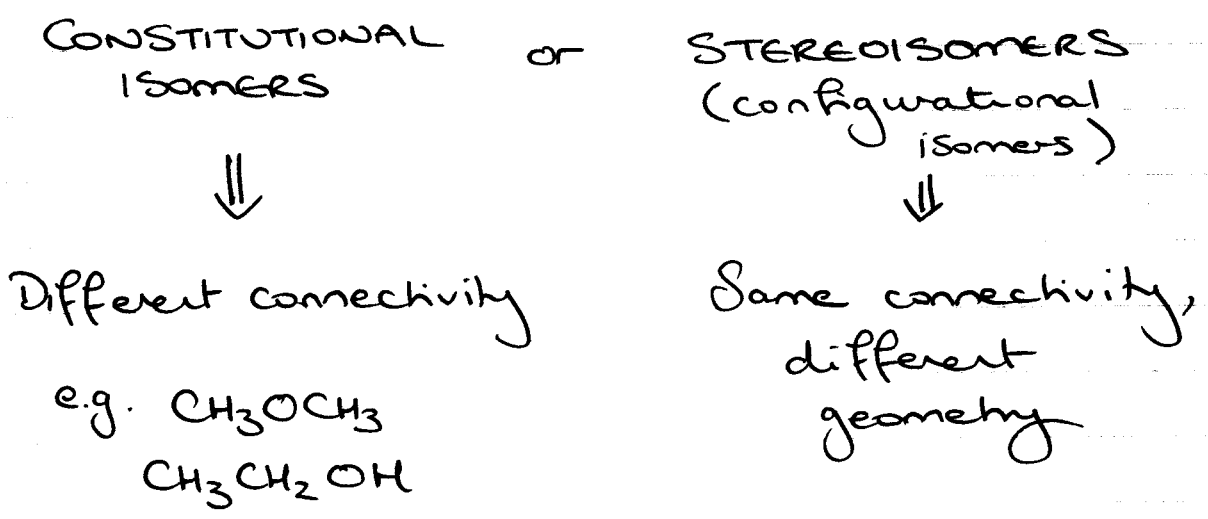
ISOMERS

② Reactions/Sources/Importance

↳ Read sections 2.9/2.10 and answer questions

③ STEREOCHEMISTRY

ISOMERS → different compounds with the same molecular formula



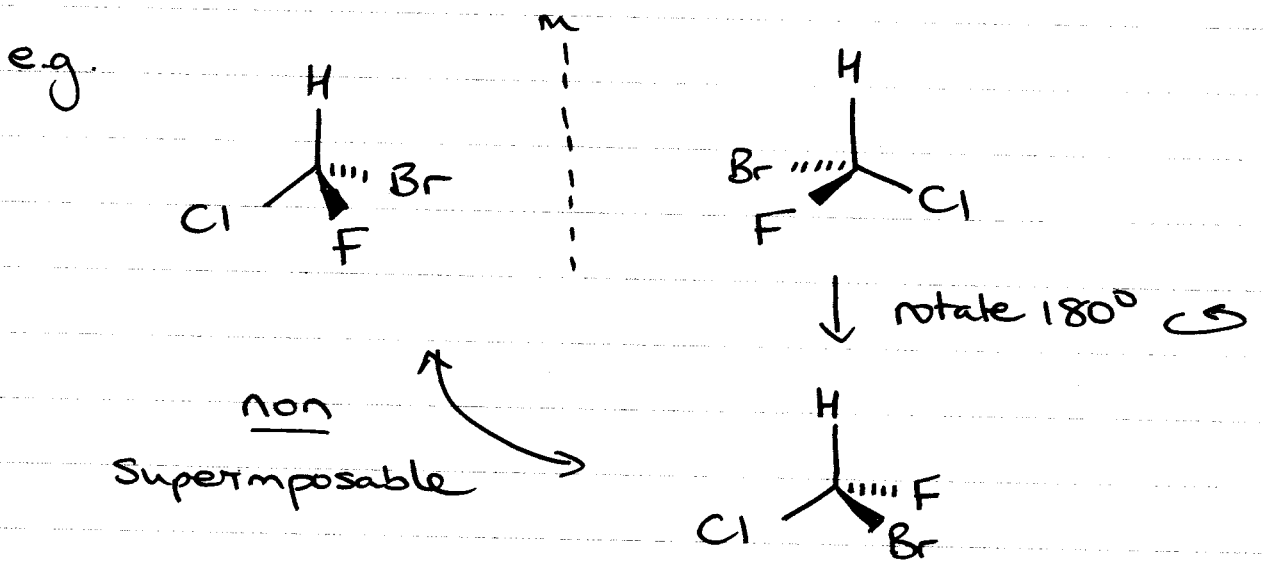
④ CHIRALITY

An object that is not superimposable on its

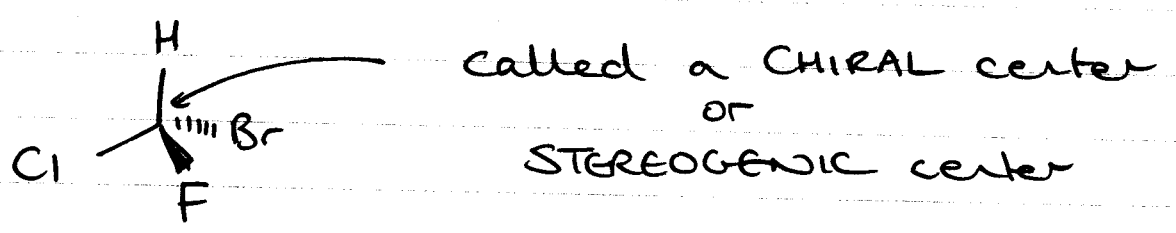
mirror image is said to be CHIRAL

from greek cheir meaning hand

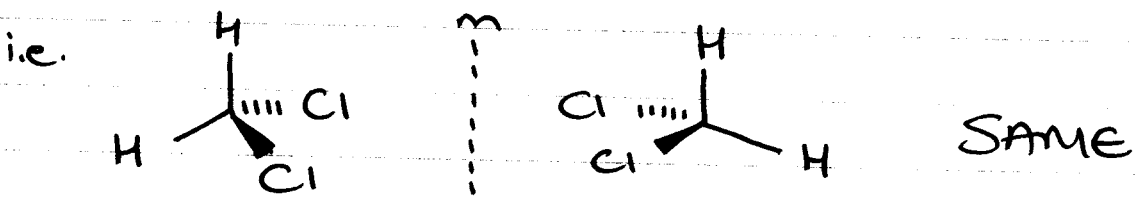
So, a molecule is an object \rightarrow



So both of these molecules are chiral, and they are ENANTIOMERS

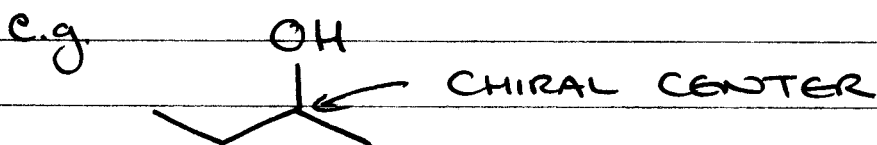


IF an OBJECT or MOLECULE is not CHIRAL, it is referred to as ACHIRAL



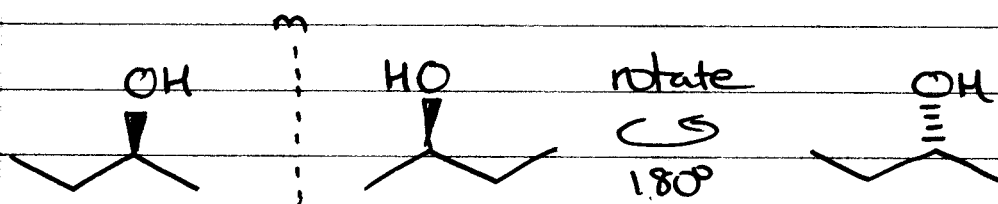
(5)

One of the most common causes of chirality in organic molecules is a TETRAHEDRAL atom (usually C) bonded to four different groups

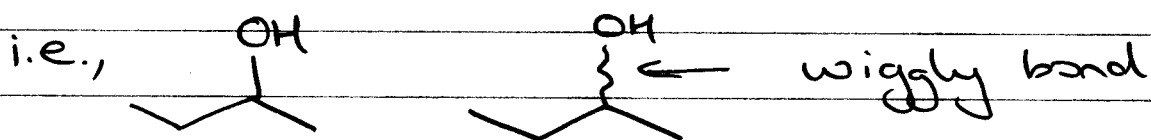


THIS IS A CHIRAL molecule

ENANTIOMERS ALWAYS COME IN PAIRS



IF no stereochemistry is indicated in a structure



MEANS ONE OF TWO THINGS

- ① We have an equal mixture of enantiomers (RACEMIC MIXTURE or RACEMATE)
- ② We have a single enantiomer, but of UNKNOWN stereochemistry.

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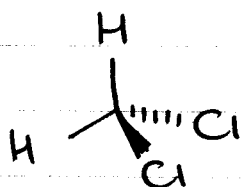
TIPS FOR IDENTIFYING CHIRAL OBJECTS

If a molecule can be drawn with

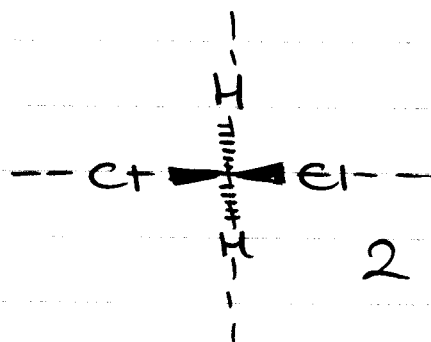
- (i) a PLANE of symmetry or
- (ii) an inversion center

IT IS ACHIRAL

eg. (i)



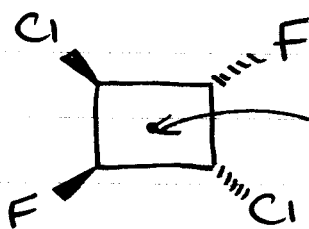
ACHIRAL



2 PLANES!

You will SEE THIS MORE THAN:

(ii)



center of inversion

NO PLANE

ACHIRAL

Centre of inversion \rightarrow identical groups lie equidistant of a point, on opposite sides of that point

Distinguishing ENANTIOMERS

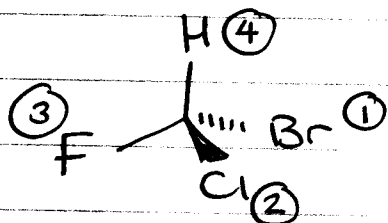
7



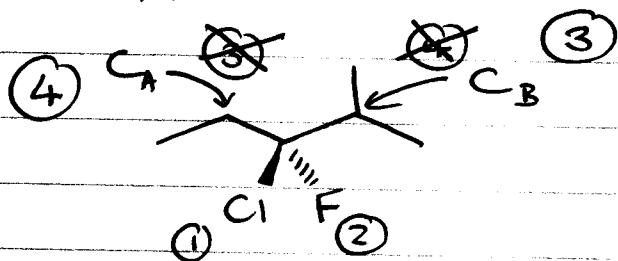
R,S designation

① Assigning priority

(i) ATOMIC WEIGHT of atoms attached to stereocenter



(ii) KEEP going until the first point of difference



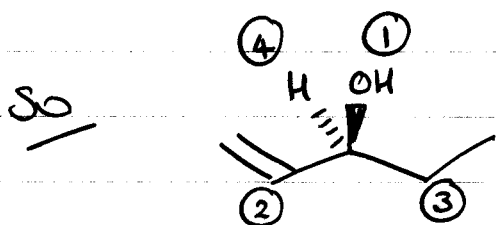
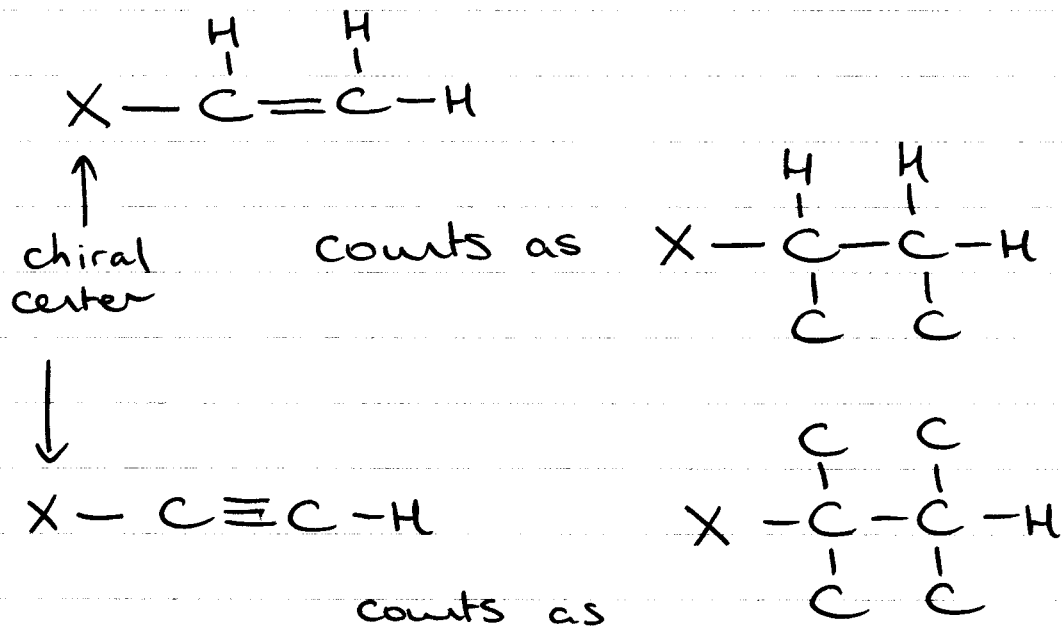
Attached to C_A C, H, H
Attached to C_B C, C, H

so ~~③ ④~~
~~④ ③~~

WRONG

8

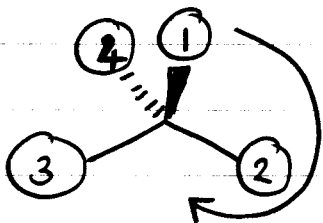
(iii) MULTIPLE BONDED ATOMS count as the equivalent number of singly bonded atoms, i.e.,



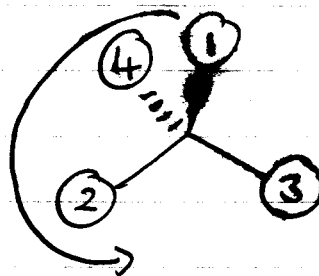
② Arrange in the following orientation:

- PUT ④ in the back, pointing away from you, so you get either

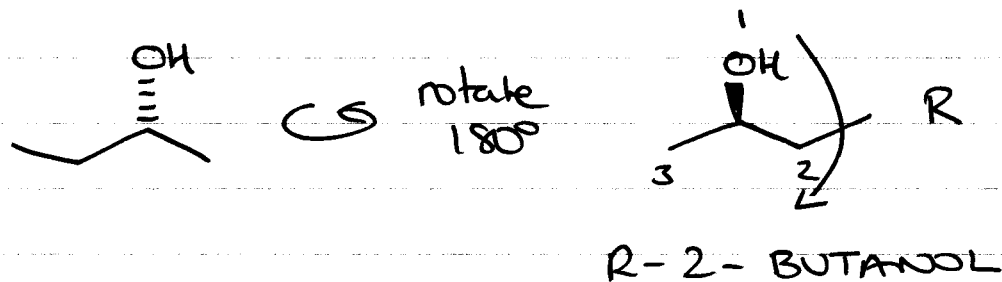
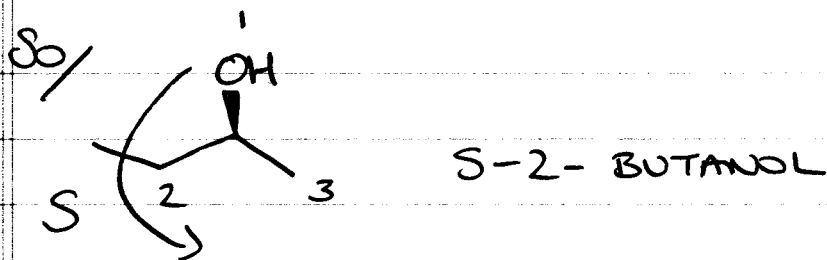
CLOCKWISE
(R)



OR



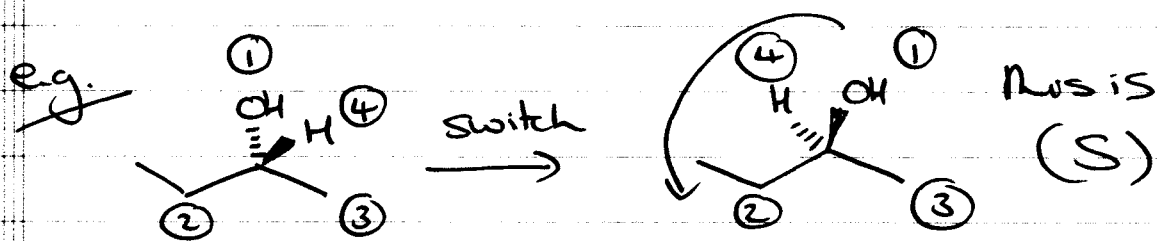
COUNTER-
CLOCKWISE
(S)



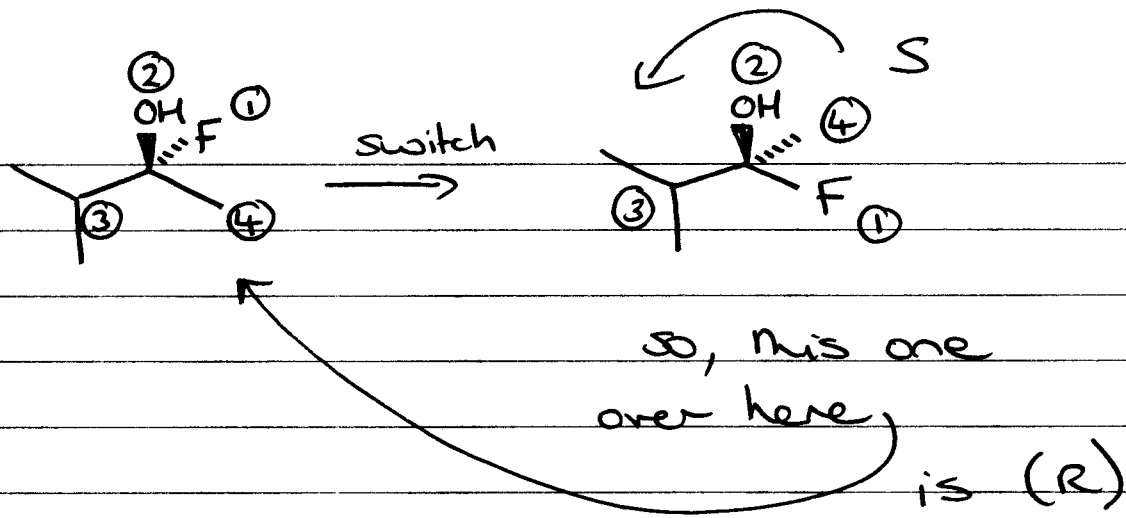
or
IF you have trouble rotating molecules

TRICK

- Switch the (4) group with whatever group is in the back
- assign stereochemistry R or S
- switch the stereochemistry

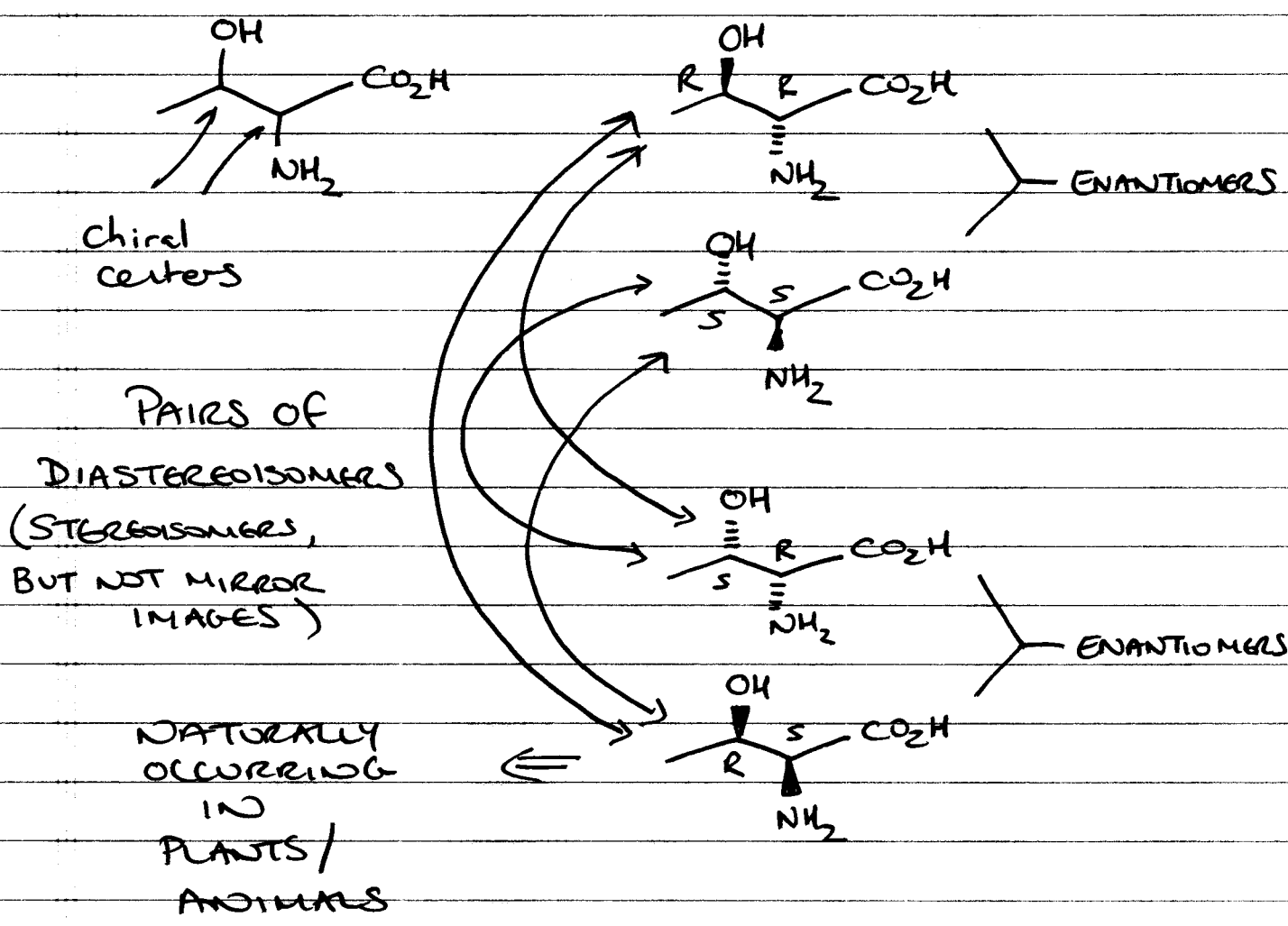


So original compd was (R)

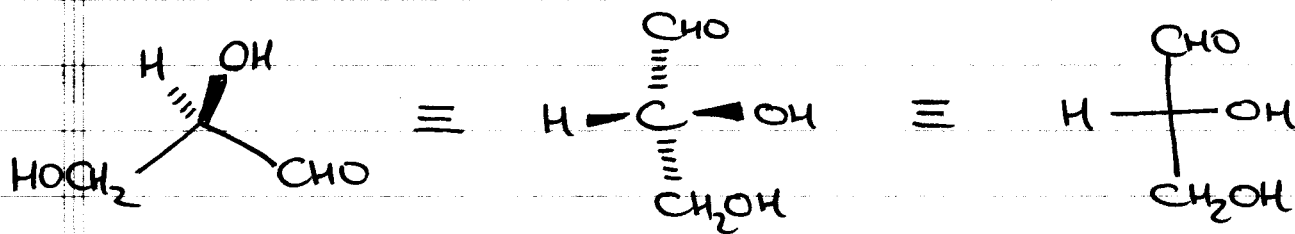


- More than ~~one~~ ONE STEREOCENTER

amino acid THREONINE

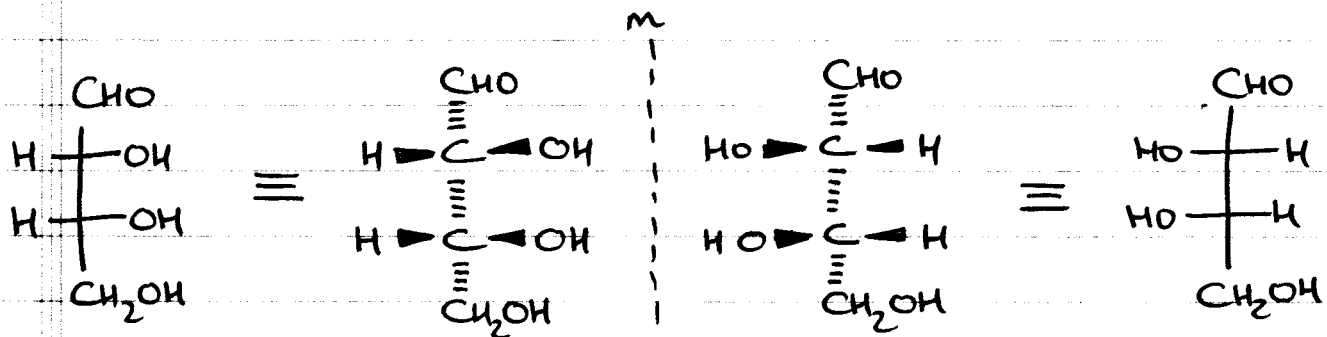
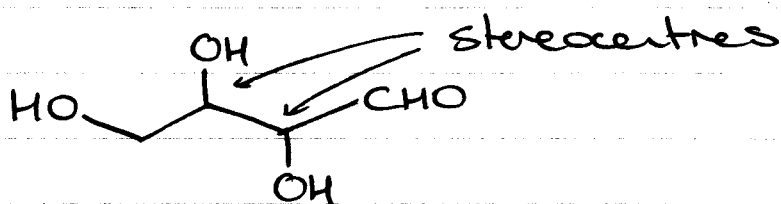


FISCHER PROJECTIONS

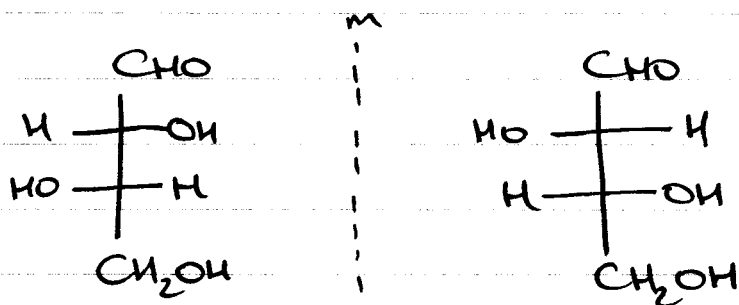


Glyceraldehyde

2,3,4 Trihydroxybutanal



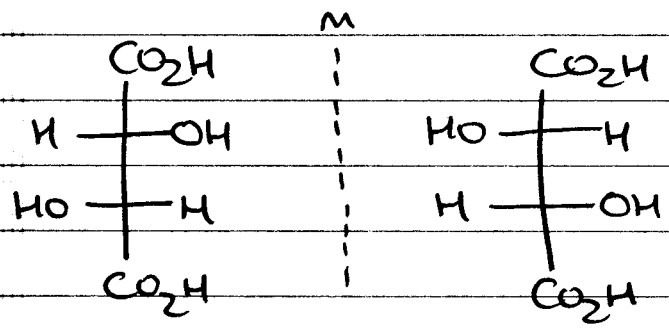
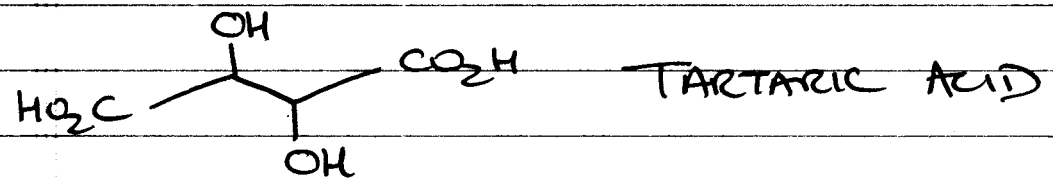
ENANTIOMERS



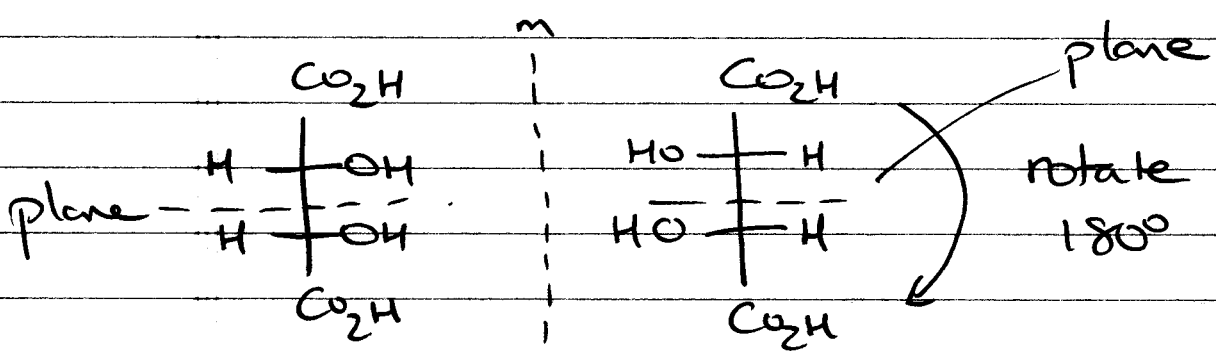
ANOTHER PAIR OF ENANTIOMERS

A molecule with n chiral centers can have a max number of stereoisomers = 2^n

- MESO COMPOUNDS



ENANTIOMERS



↔
SAME

So - compd with stereocenters, but is achiral \Rightarrow MESO