



Exam Preview

20 questions

Lewis structures/
Contributing structures

68 pts.

Molecular dipoles

23 pts.

Bonding theory

55 pts.

Nomenclature

34 pts.

Chirality

54 pts.

Conformations/Strain

44 pts.

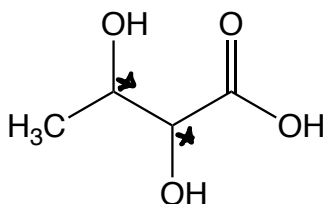
MCAT question

20 pts.

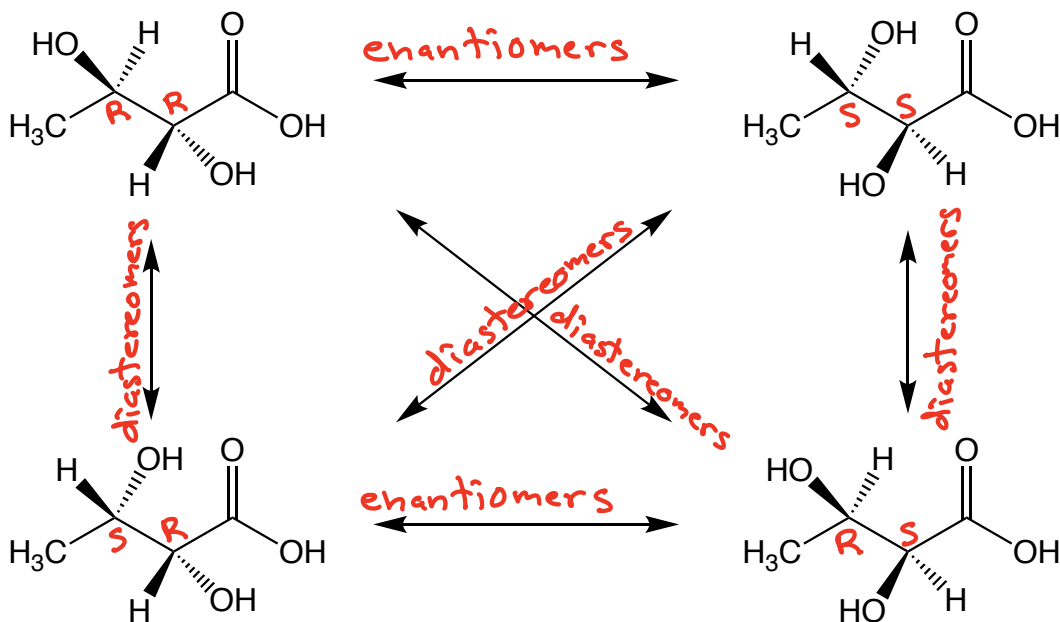
Molecules With 2 Chiral Centers

- 1) If a molecule contains n chiral centers there are 2^n possible stereoisomers $\rightarrow$ fewer if symmetry is present (see "meso")
- 2) R,R and S,S are enantiomers
 R,S and S,R are enantiomers
All other pairs are diastereomers (Ex. R,R and R,S)
- 3) To identify stereoisomer relationships $\rightarrow$ assign R and S to each chiral center and see Rule 2) above

$2^2 = 4$
stereoisomers

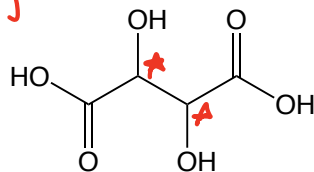


2 chiral centers $\rightarrow$
no overall symmetry

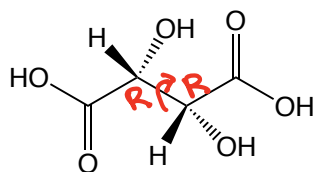
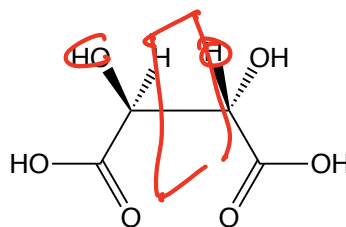
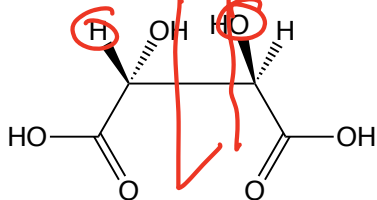


4) A meso compound has chiral centers but is not chiral due to symmetry (plane of symmetry)

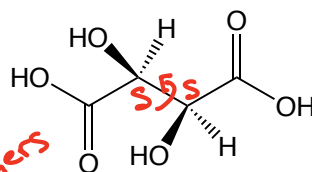
You need to draw the molecule in the most symmetric possible conformation to look for symmetry $\rightarrow$ eclipsed is OK



2 chiral centers $\rightarrow$ symmetry $\rightarrow$ both chiral centers have the same four groups



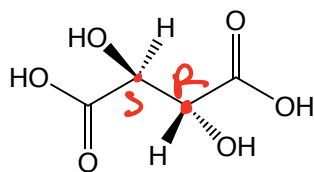
enantiomers



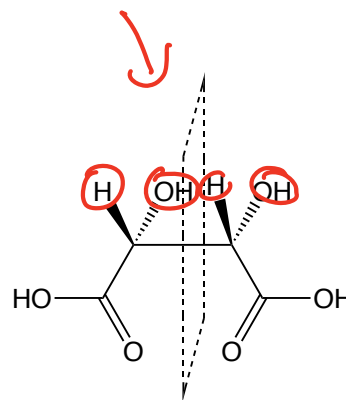
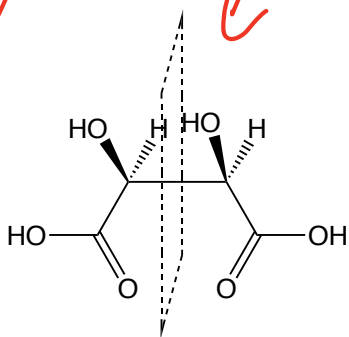
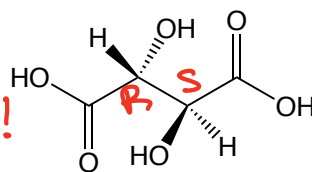
diastereomers

diastereomers

diastereomers



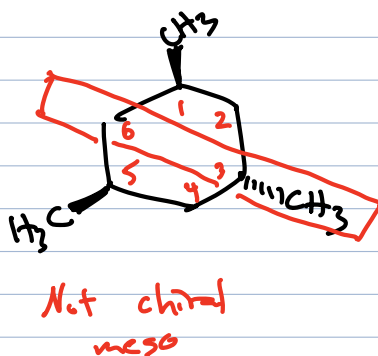
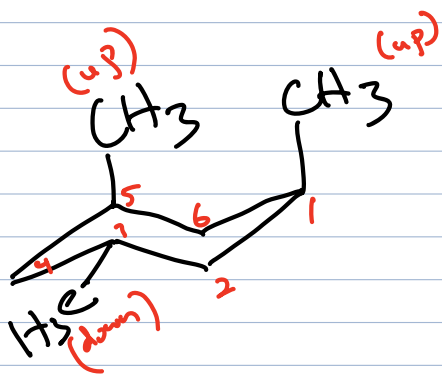
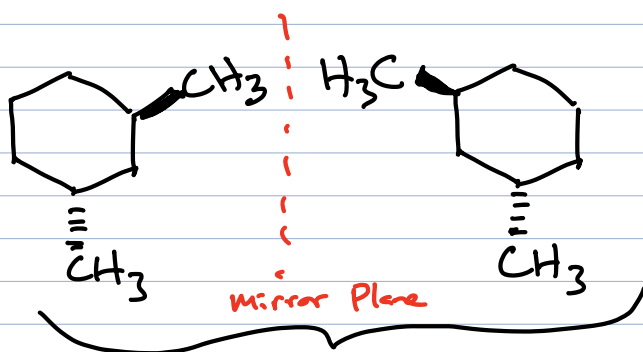
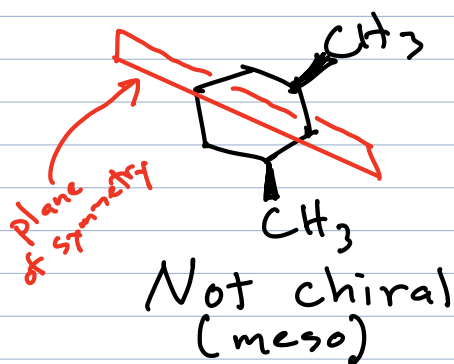
SAME MOLECULE!



This molecule has only three stereoisomers!!

5) Meso compounds will always be the R,S = S,R stereoisomer if both chiral centers have the same four groups

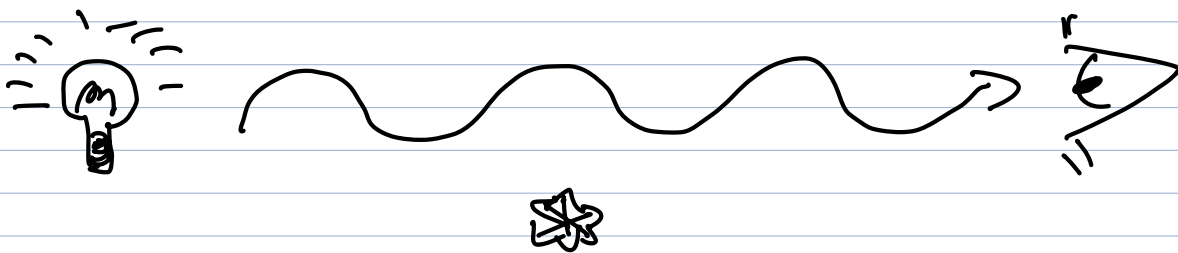
Pro tip → Use flat cyclohexanes to look for planes of symmetry



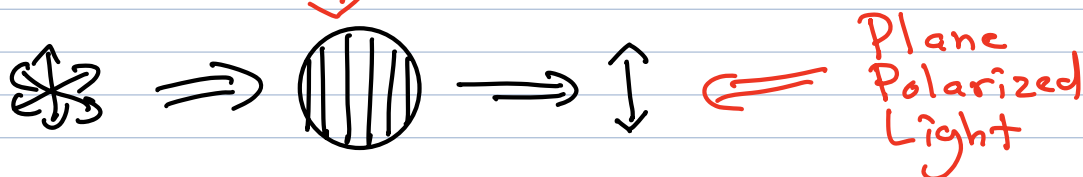
Enantiomers → identical physical properties
m.p., b.p., density...

Diastereomers → DIFFERENT physical properties
m.p., b.p., density...

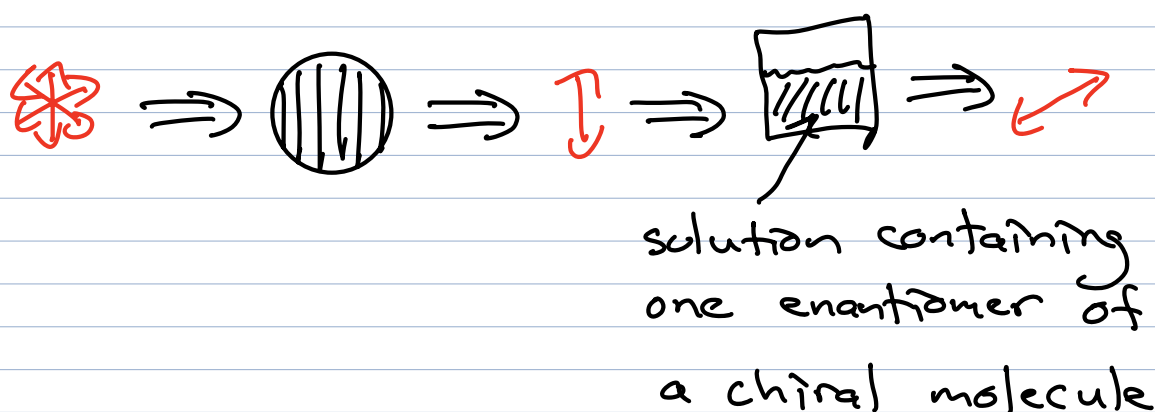
→ Can be distinguished if measured
in a chiral way!



Polarizing filter $\rightarrow$ makes it so only light in a single plane gets through



A sample of a chiral molecule will rotate the plane of plane polarized light an amount and direction that is characteristic for that molecule $\rightarrow$ Its enantiomer will rotate the plane of plane polarized light by the same amount but in the OPPOSITE direction!

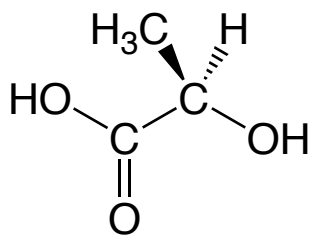


Clockwise rotation $\rightarrow$ "+"

Counterclockwise rotation "-"

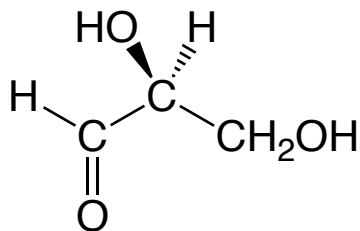


There is no direct connection between R and S and "+" and "-". Sometimes R is "+" and sometimes S is "+". Sometimes R is "-" and sometimes S is "-".



R-(-)-lactic acid

Both are "-"
but one is R
and one is S



S-(-)-glyceraldehyde



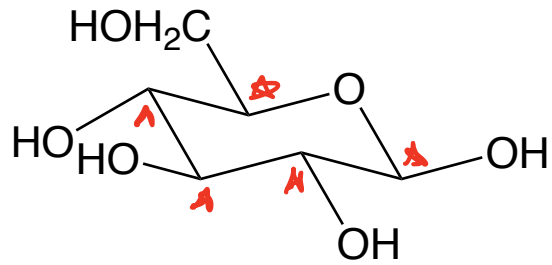
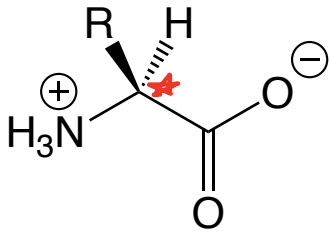


New definition $\rightarrow$ Racemic Mixture

1:1 mixture of two
enantiomers

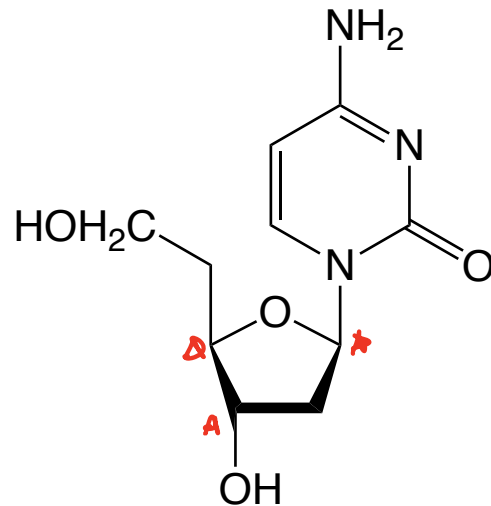
Does not rotate the plane of
plane polarized light $\Rightarrow$
the directions cancel

A meso compound does not rotate
 $\searrow$ the plane of plane polarized light
Not Chiral



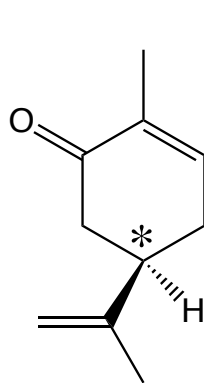
R = 20 different things

Amino Acids

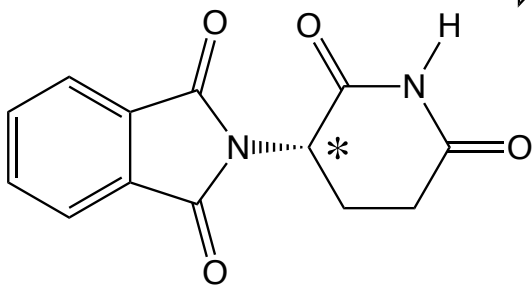
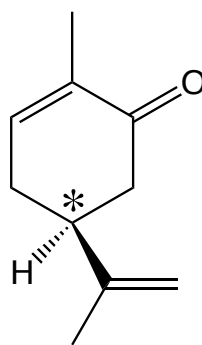


These are our molecular building blocks → they are present as single enantiomers in living things → We and all life on this planet is chiral!

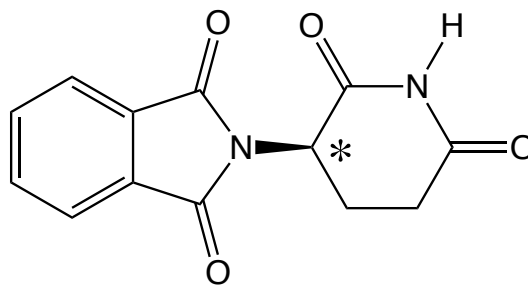
R-Carvone
Spear-mint



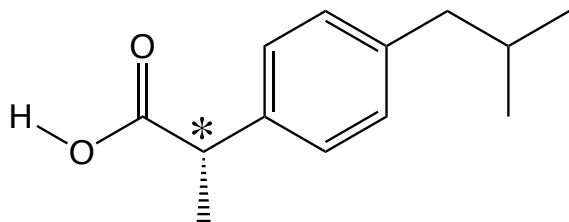
S-Carvone
Major component
of caraway seeds



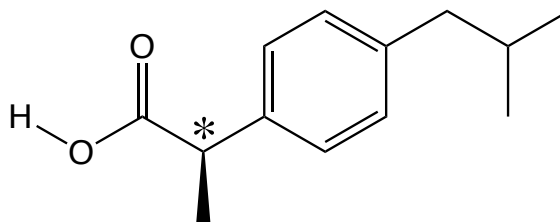
S-Thalidomide (Relieves morning sickness)



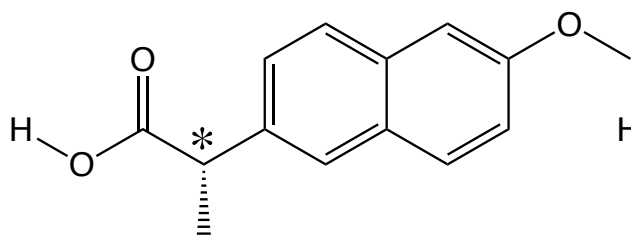
R-Thalidomide (Causes birth defects)



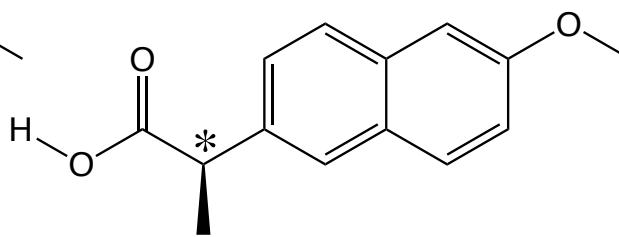
S-Ibuprofen (Advil, Motrin)



R-Ibuprofen (Inactive and relatively harmless)



S-Naproxen (Aleve)



R-Naproxen (liver toxin)

Organic Chemistry is the study of carbon-containing molecules.

This class has two points.

The first point of the class is to understand the organic chemistry of living systems. We will teach you how to think about and understand the most amazing things on the planet!!

Water is essential for life, you will learn why water has such special properties. 8/27/25

You will learn the secret structural reason proteins, the most important molecular machines in our bodies, can support the chemistry of life. 9/10/25

You will learn why when you take Advil for pain, exactly half of what you take works, and the other half does nothing. 9/24/25

You will learn how toothpaste works.

You will learn how a single chlorofluorocarbon refrigerant molecule released into the atmosphere can destroy many, many ozone molecules, leading to an enlargement of the ozone hole.

You will learn how medicines like Benadryl, Seldane, and Lipitor work.

You will learn how Naloxone is an antidote for an opioid overdose.

You will learn why Magic Johnson is still alive, decades after contracting HIV.

You will learn how MRI scans work.

The second point of organic chemistry is the synthesis of complex molecules from simpler ones by making and breaking specific bonds.

You will learn how to understand movies of reaction mechanisms like alkene hydration.

You will learn reactions that once begun, will continue reacting such that each product molecule created starts a new reaction until all the starting material is used up.

You will learn reactions that can make antifreeze from vodka.

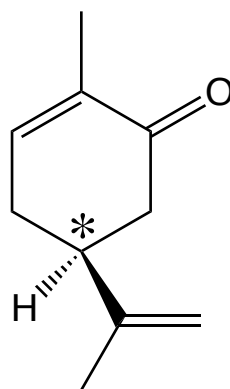
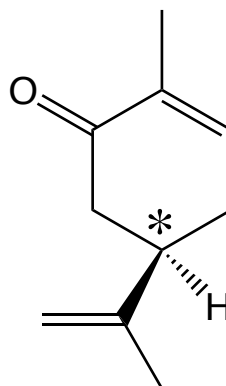
You will learn a reaction that can make nail polish remover from rubbing alcohol.

You will learn how to look at a molecule and accurately predict which atoms will react to make new bonds, and which bonds will break during reactions.

You will learn how to analyze a complex molecule's structure so that you can predict ways to make it via multiple reactions starting with less complex starting molecules.

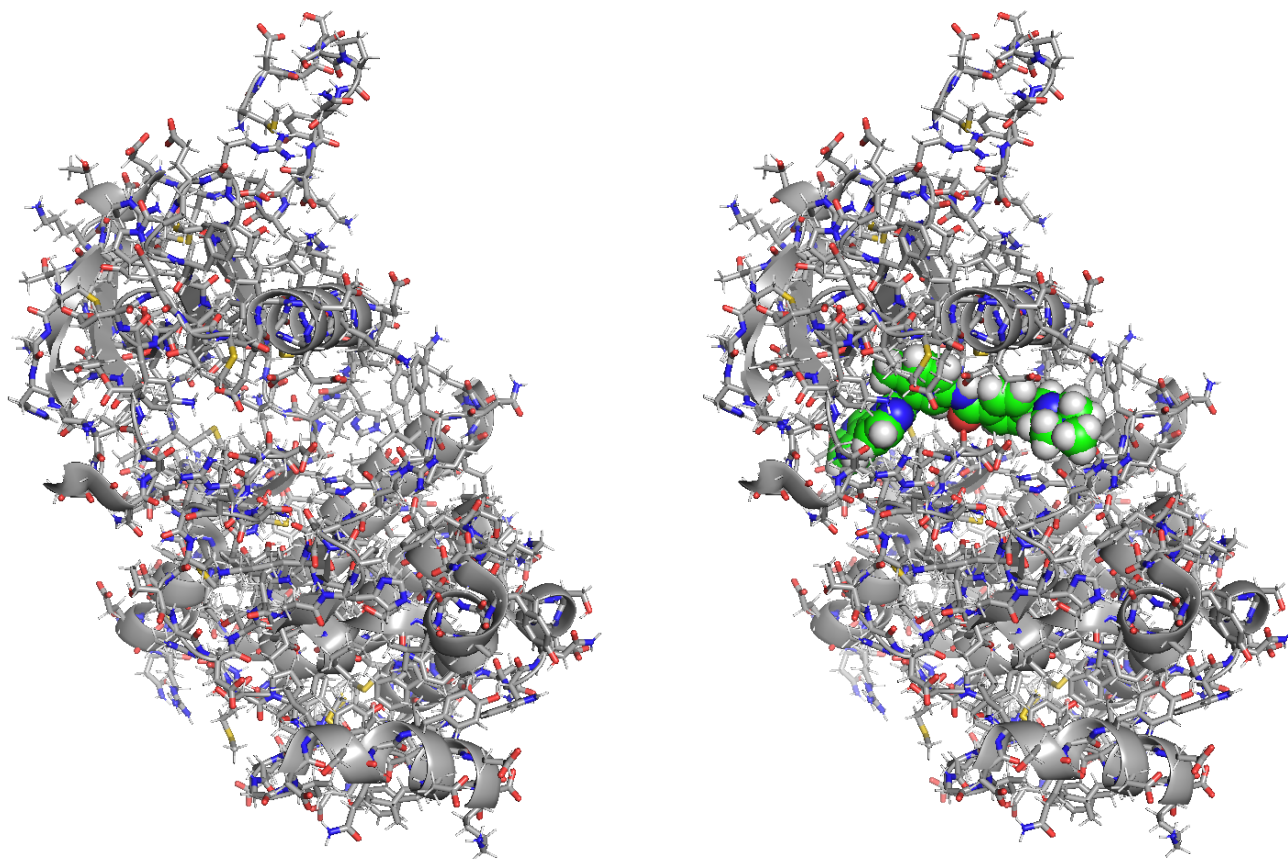


R-Carvone
Spearmint



S-Carvone
Major component
of caraway seeds





The drug Gleevec (green) bound to its target protein, the ABL kinase.

