CH-005 - Isomers Cheat Sheet

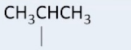
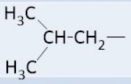
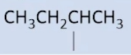
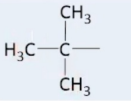
by AlexHoratio (Horatio) via cheatography.com/21127/cs/25263/

Personal Frustrations

Today I looked at my hands and I realized they are enantiomers of each other and now I'm stuck in a nightmare world where I can't escape from these things.

Help!

Basic Structural Isomers

Methyl	CH_3-	Me
Ethyl	CH_3CH_2-	Et
Propyl	$CH_3CH_2CH_2-$	Pr or *n*-Pr
iso-Propyl		*iso*-Pr or *i*-Pr
Butyl	$CH_3CH_2CH_2CH_2-$	*Bu* or *n*-Bu
iso-butyl		*iso*-Bu or *i*-Bu
sec-butyl		*sec*-Bu or *s*-Bu
tert-butyl		*tert*-Bu or *t*-Bu

These structural isomers all have fancy names. We need to learn what these are.

HOW TO FIND ALL THE ISOMERS OF A HYDRO-CARBON

This is probably not super useful, and I might be missing stuff. It's just a basic checklist for my sanity :S

1. Find all the structural isomers (lol enjoy T_T)

2. Check for any *chiral carbons*. If there are any, you need to find the S and R enantiomers. There might be several chiral carbons per molecule, and if so, you'll need to find every permutation of S- and R- carbons!

3. Check for any double-bonds. If there are any and you can assign priorities to the groups on each carbon, you need to find the E and Z isomers.

Then go through every single one until your hands fall off from writing so much :D

WHAT TYPES OF ISOMER ARE THERE?

Isomers are **DIFFERENT MOLECULES** that share the same chemical formula.

In the order they were introduced:

1. **Structural isomers**
2. **Enantiomers (S/R)**
3. **E/Z (trans/cis) isomers**

STRUCTURAL ISOMERS

Things can be 'structural isomers', meaning they have the same chemical formula, but in a completely different structure.

This is the one where you just put the bits in uniquely different places.

butane -> 2-methylpropane

(note: 2-methylpropane is also known as iso-butane! see the table to the left)

Enantiomers (S/R)

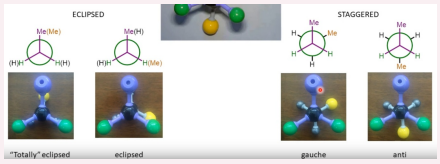
Enantiomers are mirror-images of each other.
This is the case when one of the carbon atoms is *chiral*, or when that carbon is bonded to **4** unique groups.

An enantiomer is either (S) or (R).

HOW TO FIND (S/R):

1. Assign 'priorities' -- highest priority goes to the highest atomic number. If there are multiple atoms of the same atomic number, give higher priority to the group that has the most overall stuff in it.
2. Send the lowest priority atom to the back. This is usually hydrogen.
3. Count 1->2->3, where #1 is the highest priority.
4. If counting 1->2->3 takes you clockwise, then it's **(R)**. If anti-clockwise, it's **(S)**.

Conformations?



These things are rotational conformations as viewed head-on. They can be either:

E/Z (trans/cis) Isomers

These only occur around a double-bond. A hydrocarbon with a double-bond is known as an **alkene**.

They're relatively easy to figure out, at least.

HOW TO FIND (E/Z):

1. Look at the 2 groups on each of the 2 carbons.
2. Assign priorities on each side.
3. If both carbons have their higher priorities on the *same side*, it's a cis or **(Z)** isomer. If they're on *different sides*, it's a trans or **(E)** isomer.

ECLIPSED
-> Totally eclipsed
-> Partially eclipsed
STAGGERED
-> Gauche
-> Anti

Conformations are literally just the molecule twisting around single-bonds. They're not technically isomers, just the same molecule but in different shapes.

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