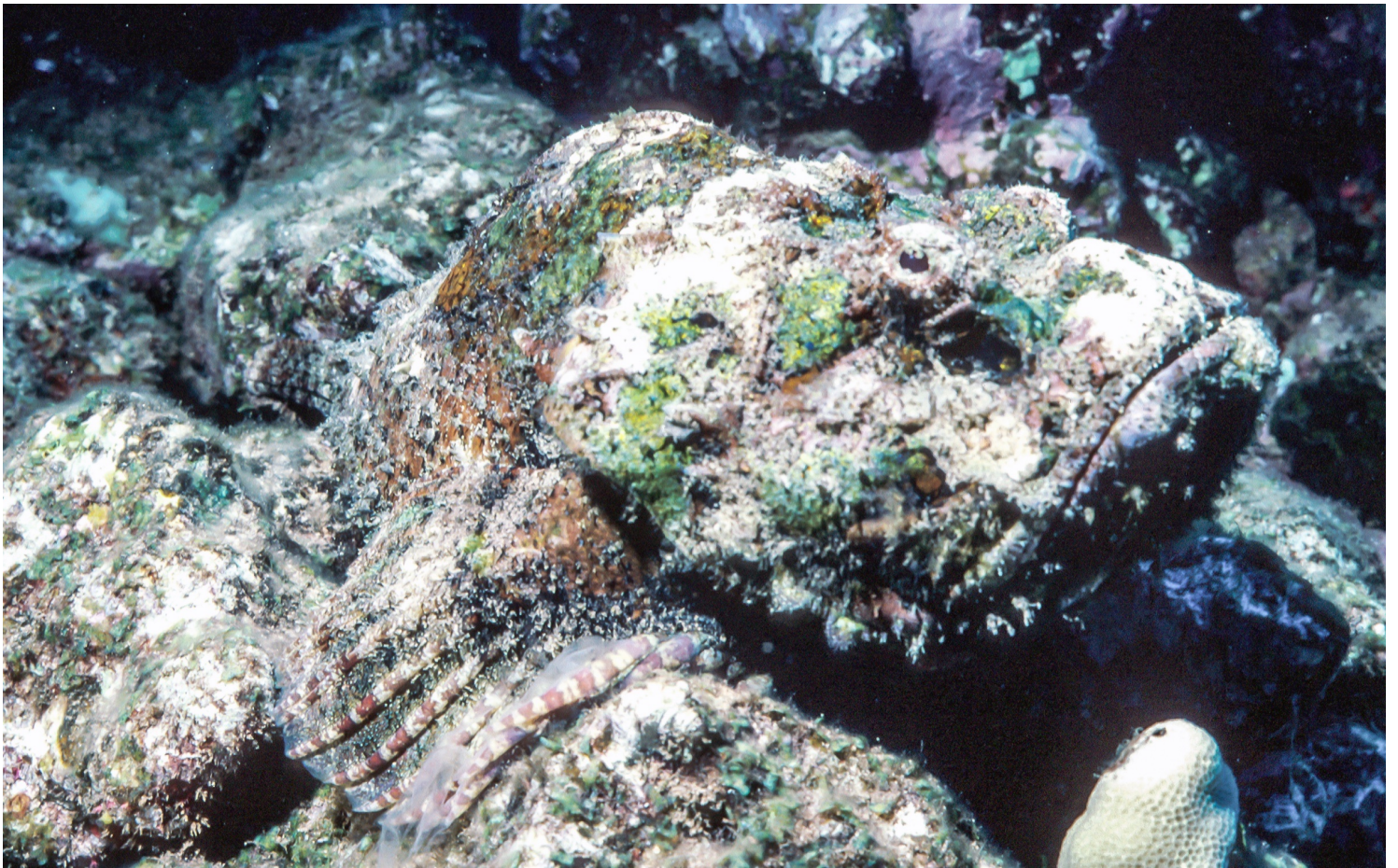
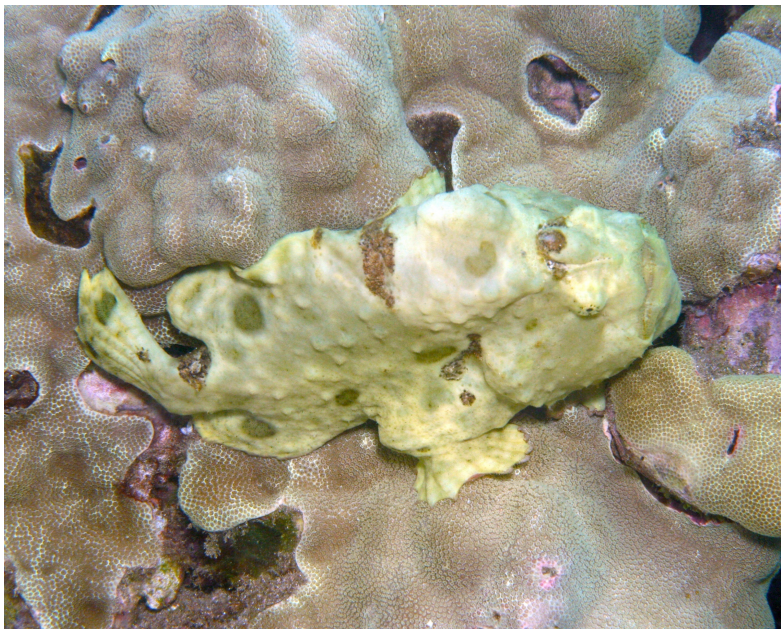






JANUARY 22, 2020

How Toxic is the Stonefish?

Meet the stonefish, the world's most venomous fish

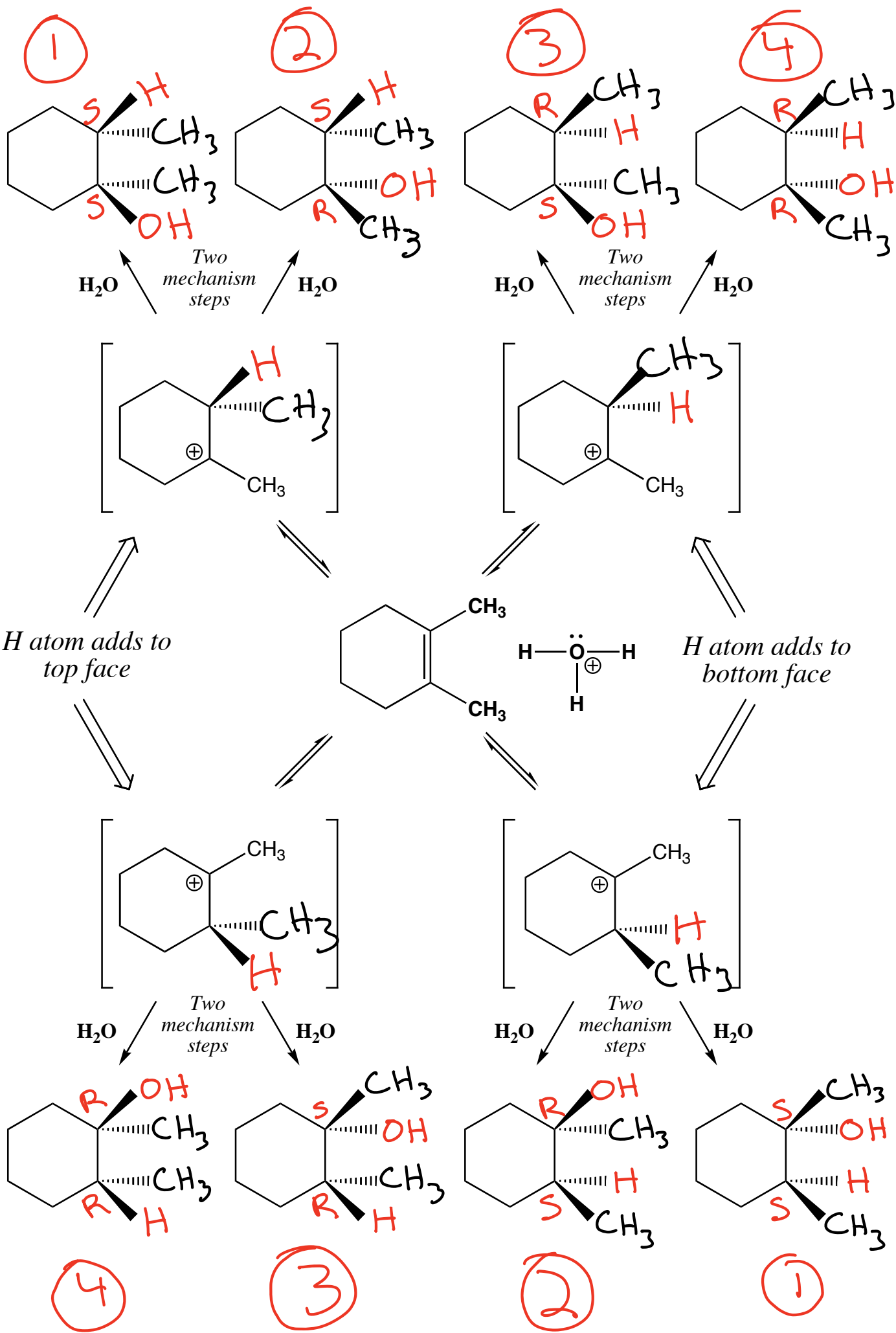
Erin Spencer
Former Senior Digital Strategist

3 Minute Read

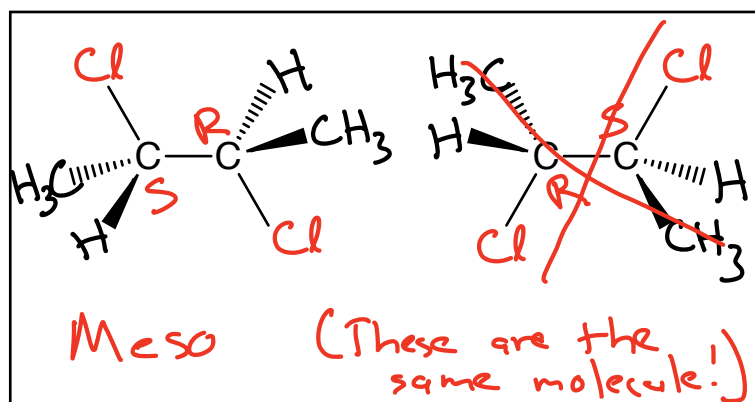
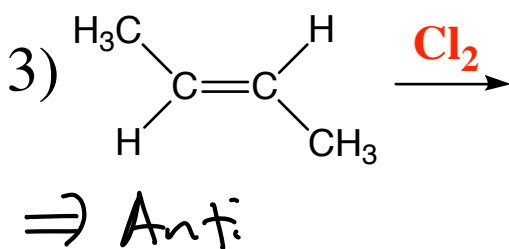
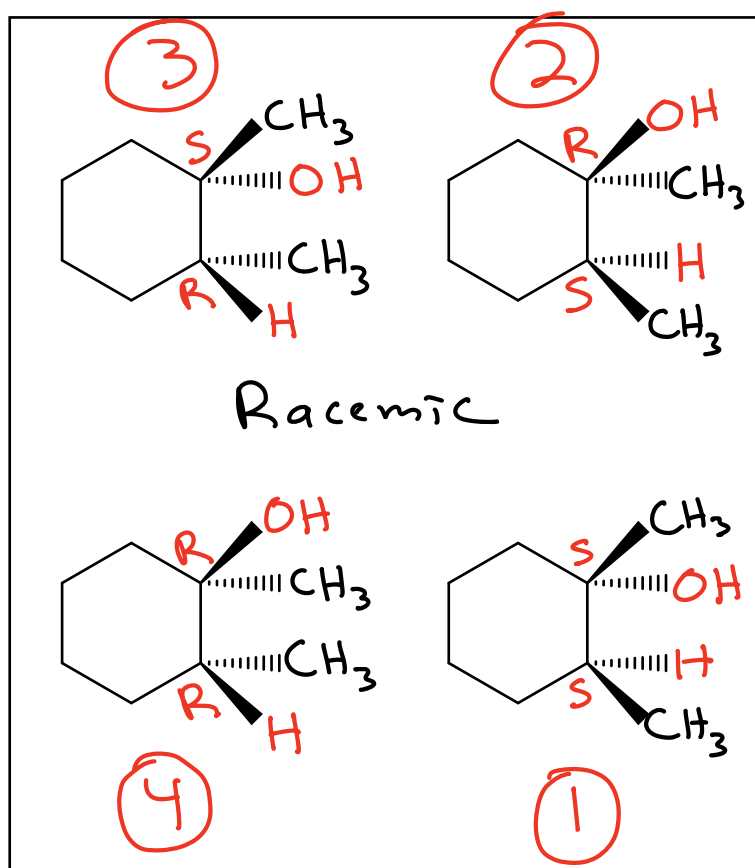
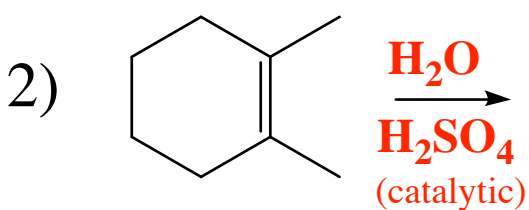
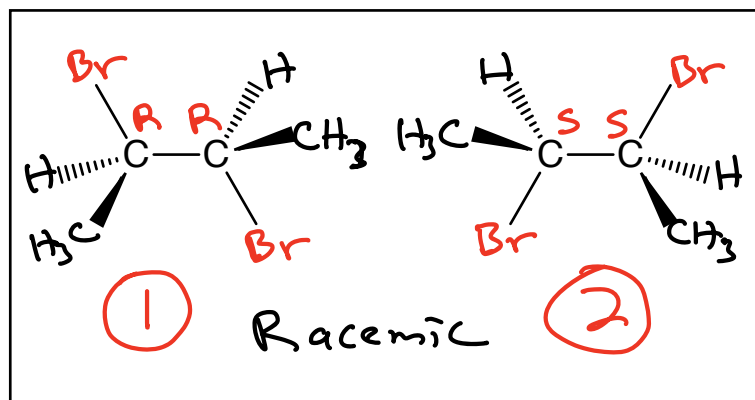
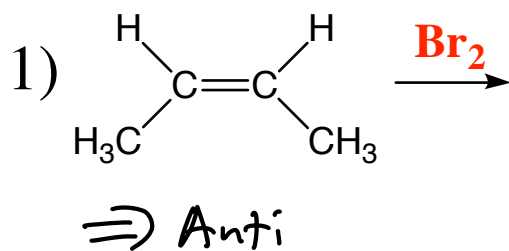
Now, you might be thinking ... *"I don't love the idea of being next to the most venomous fish in the world and not know it."* And you're right! You definitely don't want to be surprised by this guy. The good news is that stonefish use their spines defensively, NOT offensively, so the fish won't go out of its way to attack you.

If you step on the fish however, it's a different story. Stonefish have 13 spines lining its back that release venom under pressure. If you inadvertently step on a stonefish thinking it's a harmless rock, it will pop up its dorsal spines and release venom from two sacs at the base of each spine. Unsurprisingly, the more venom that is injected, the worse it is for you. Stings result in terrible pain, swelling, necrosis (tissue death) and even death. One victim wrote online (which was later reported by [**ABC News**](#)) that after being stung on the finger, it was like "having each knuckle, then the wrist, elbow and shoulder being hit in turn with a sledgehammer over the course of about an hour."

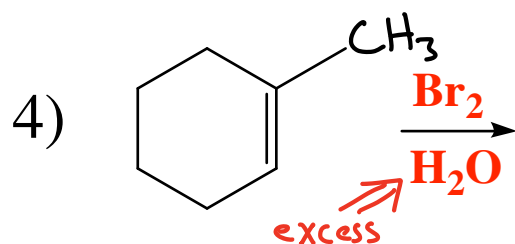
1. Wear water shoes
2. Always look where you walk
3. Shuffle your feet along the bottom to avoid stepping directly on the fish. This shuffle also helps scare away stingrays, which you don't want to step on either.



Examples

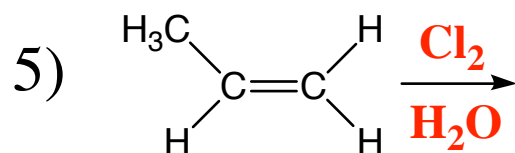
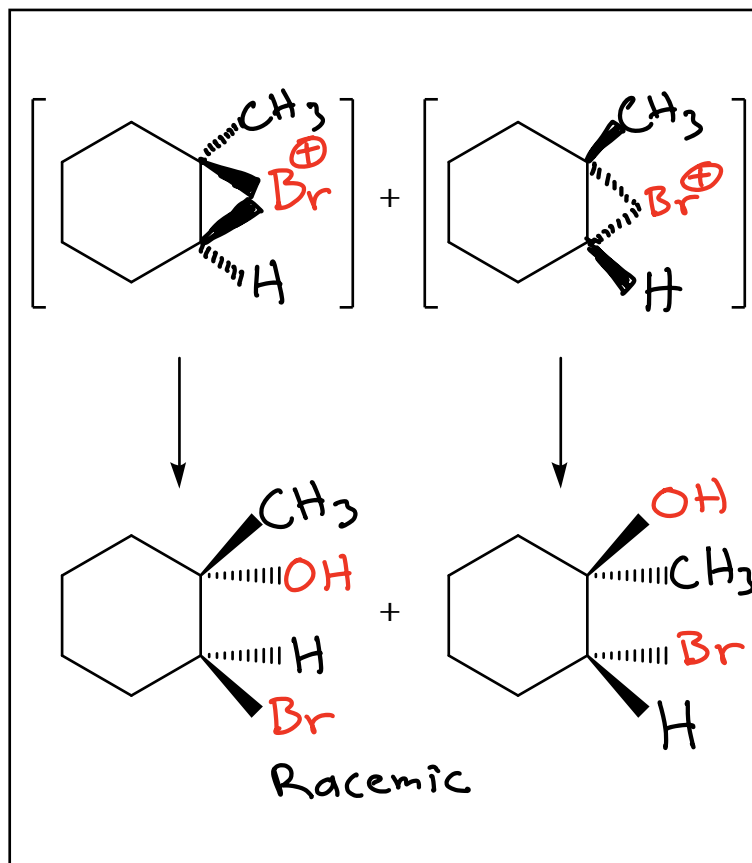


More Examples



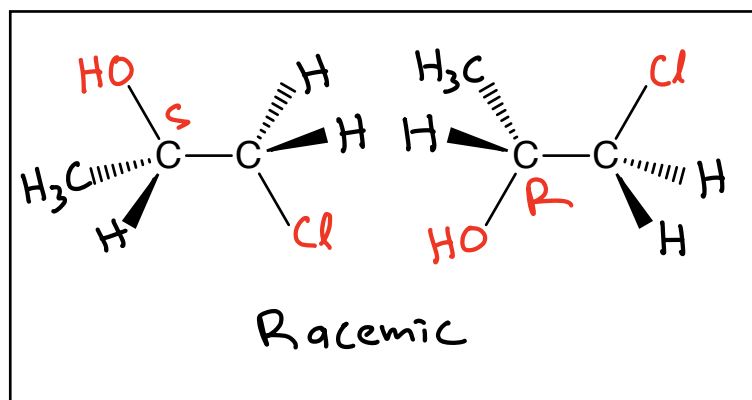
$\Rightarrow$ Markovnikov

$\Rightarrow$ Anti



$\Rightarrow$ Mixed

$\Rightarrow$ Markovnikov



Who do you call when you need help?

Nurse

[nɜːs] noun

lifesaving superhero, patient,
smile bringing, kind, lives to heal.
Kind of a big deal.

nurse

[nɜːs] *noun*

the first person you see after saying, "hold my beer and watch this!"

When studying OChem $\rightarrow$ Call a NIRRS
Learn each of these things for every
reaction $\rightarrow$ then you will be able to
predict mechanisms and therefore products

Nature of the reaction; what is the starting material/product? (i.e. alkene converted to an alcohol)

Intermediate (or "Important transition state" if applicable) of the reaction, the key to the mechanism (carbocation, halonium ion, etc.)

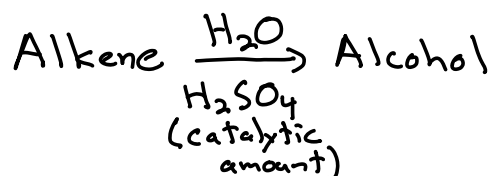
Reagents Learn the exact way to designate the reagents for each reaction

Regiochemistry What is the regiochemistry of addition? (Markovnikov, non-Markovnikov, etc.)

Stereochemistry of addition (anti, syn or mixed)



Carbocation
Markovnikov
Mixed



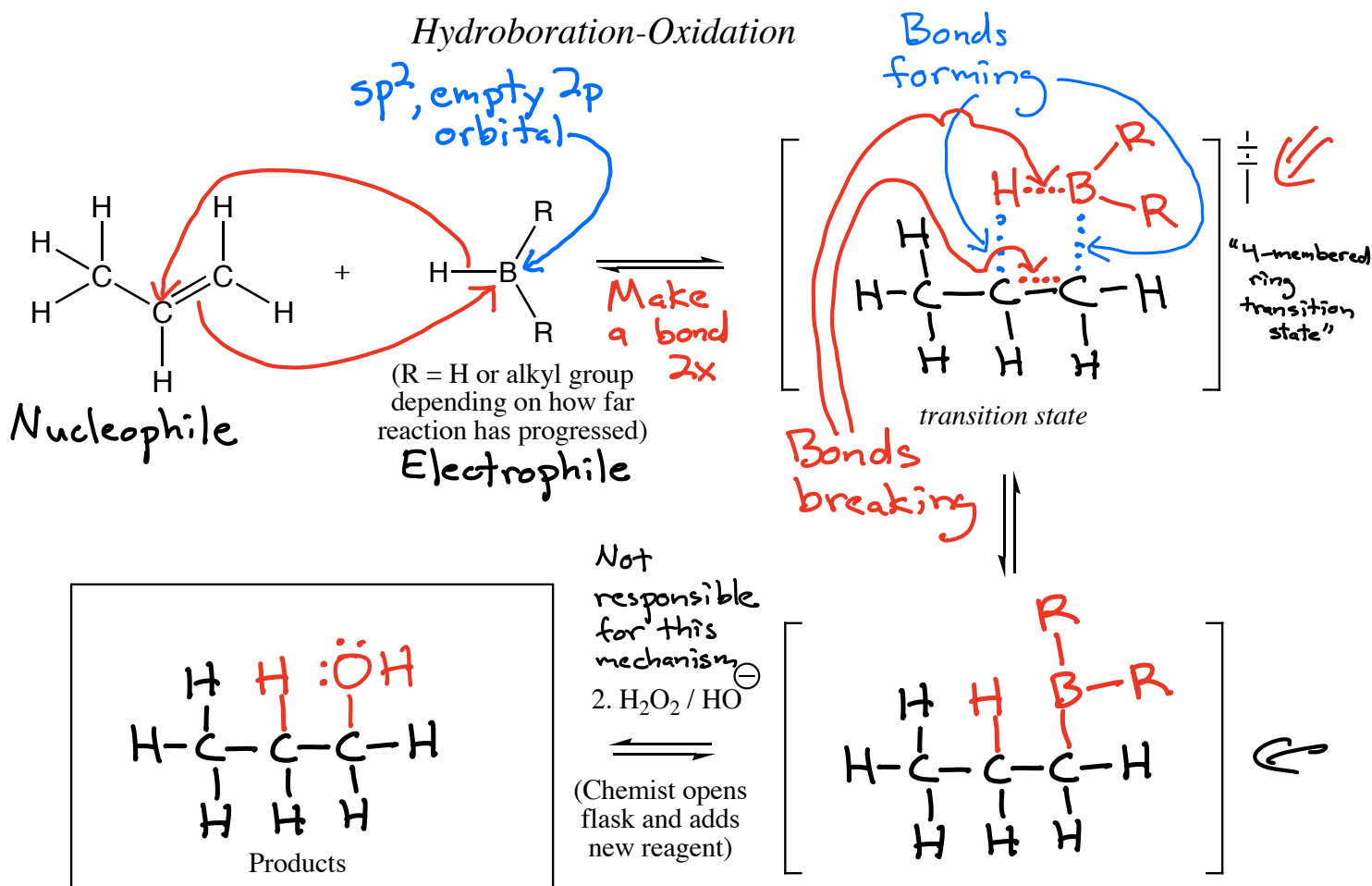
Carbocation
Markovnikov
Mixed

When you see

BH_3 think

4-membered
ring transition
state

Hydroboration-Oxidation



H → More substituted C atom
 OH → Less substituted C atom
 } Steric strain in the first transition state

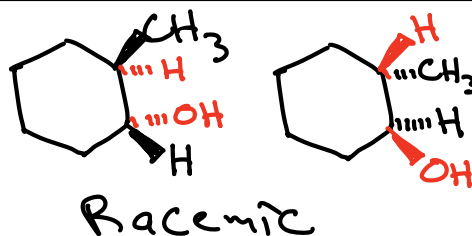
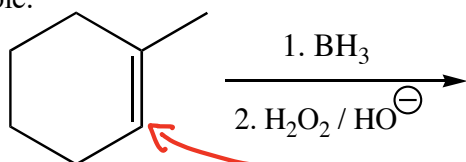
H and OH are syn

Summary: The π bond of the alkene attacks the Lewis acid (electrophile) B atom at the same time a new bond forms between C and H. In 2nd step OH replaces $\text{B}(\text{R})_2$. "4-membered ring transition state"

Regiochemistry: Non-Markovnikov

Stereochemistry: Syn

Example:



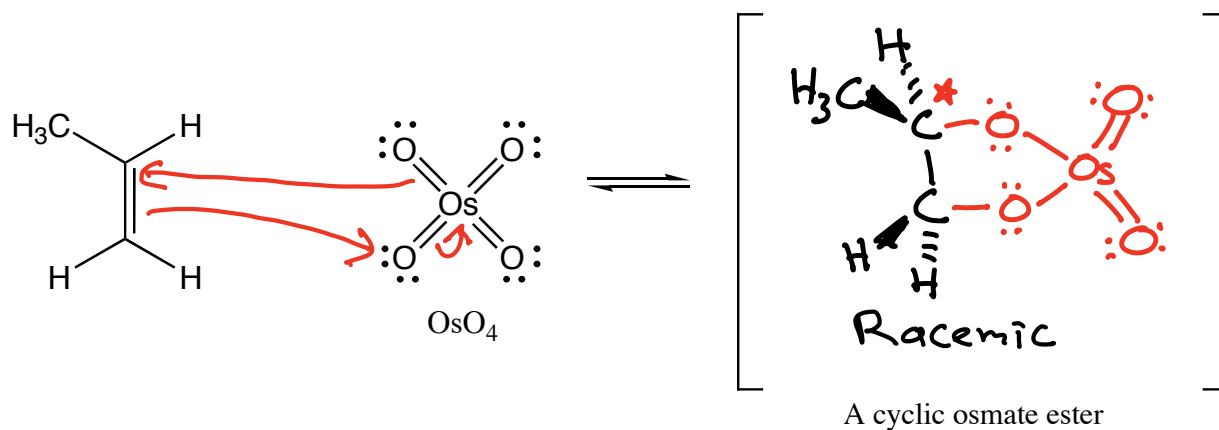
Less substituted C atom
 (pointing to the methyl group on the cyclohexene ring)

Ozzy Osbourne

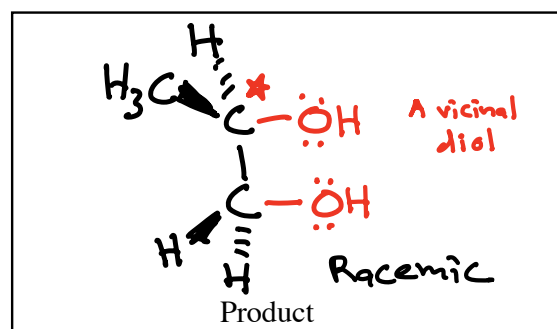


Ozzy Osborne Reaction → "Sin" (Syn)

OsO_4 Partial Mechanism



2. $\text{NaHSO}_3 / \text{H}_2\text{O}$
(Chemist opens up flask) $\parallel$ Not responsible for mechanism



Summary:

The mechanism involves a cyclic osmate ester, explaining the syn (sin!) stereochemistry of addition.

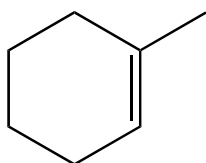
Regiochemistry:

N/A

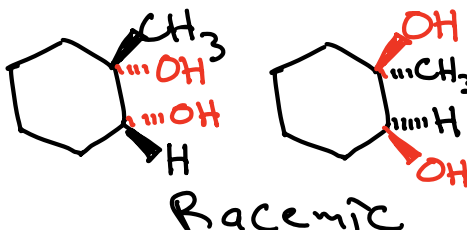
Stereochemistry:

Syn (Sin!)

Example:

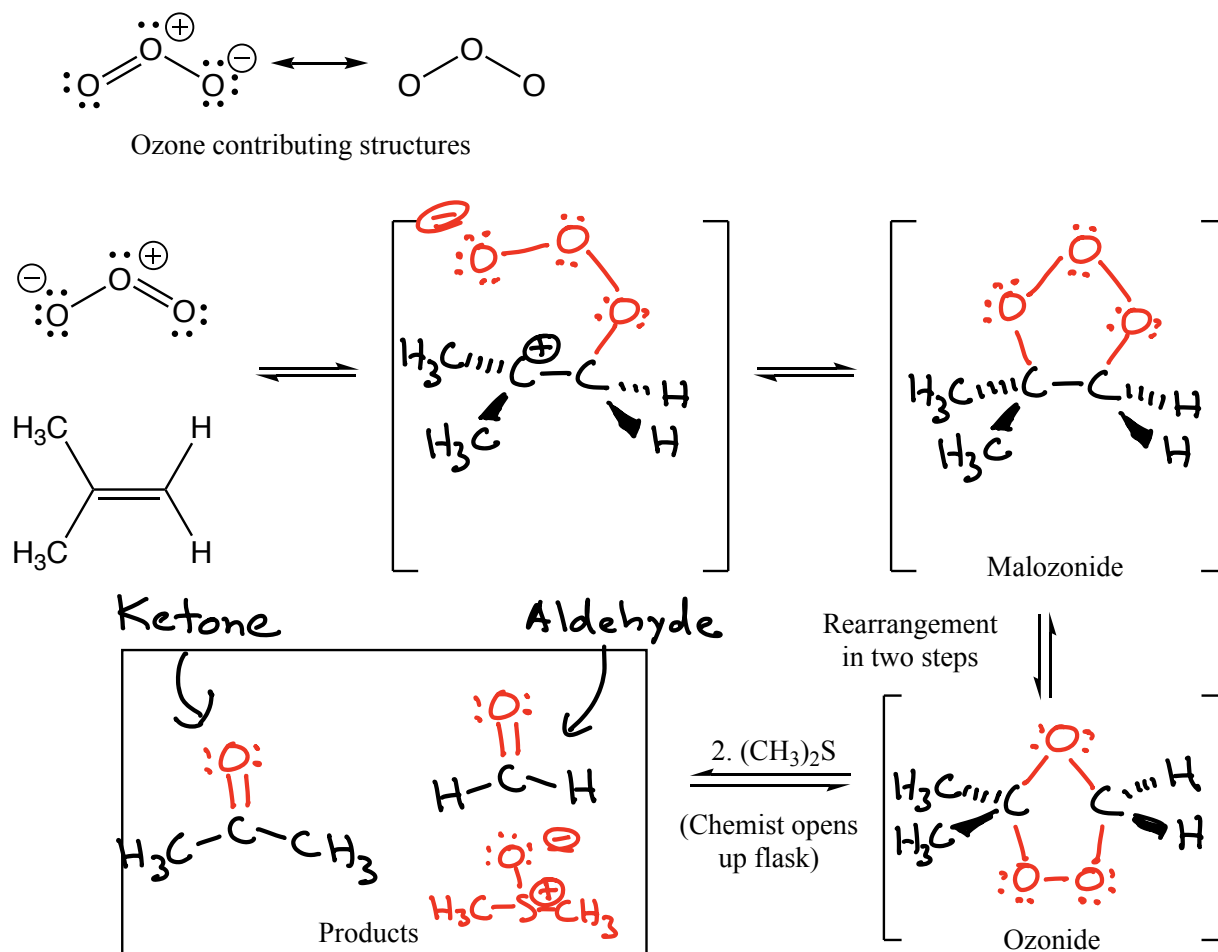


1. OsO_4
2. $\text{NaHSO}_3 / \text{H}_2\text{O}$



This reaction breaks a C=C bond!

Ozonolysis Partial Mechanism



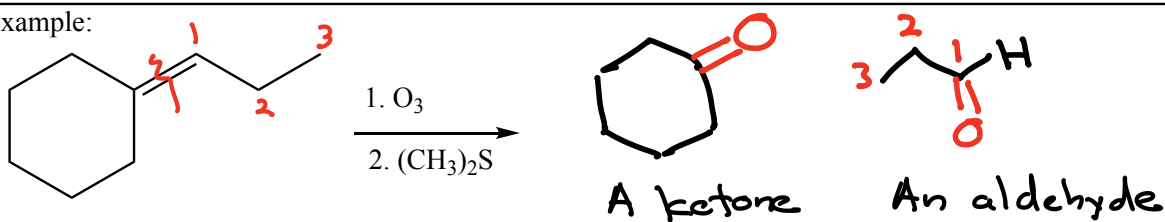
Summary:

Reaction of an alkene with O_3 gives a malozonide then an ozonide intermediate (the C=C pi bond then C-C sigma bond is broken). Adding $(\text{CH}_3)_2\text{S}$ decomposes the ozonide into ketone and aldehyde products. **Breaks C=C bond!**

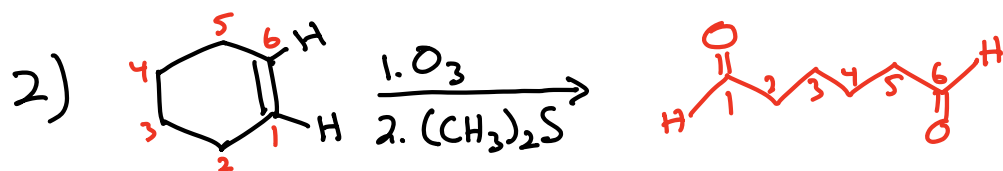
Regiochemistry: N/A

Stereochemistry: N/A

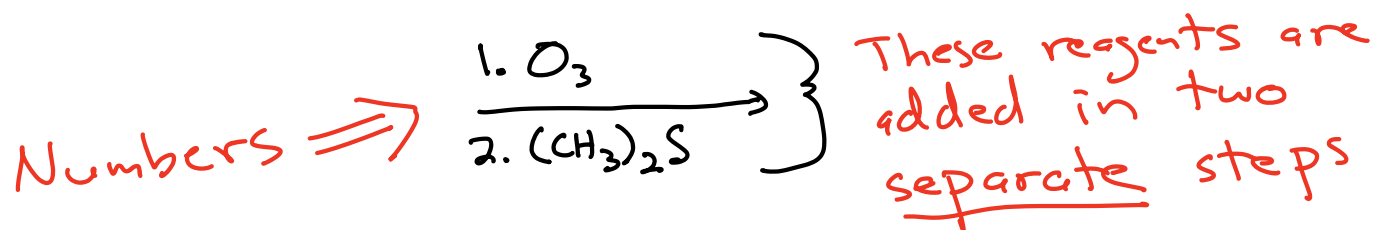
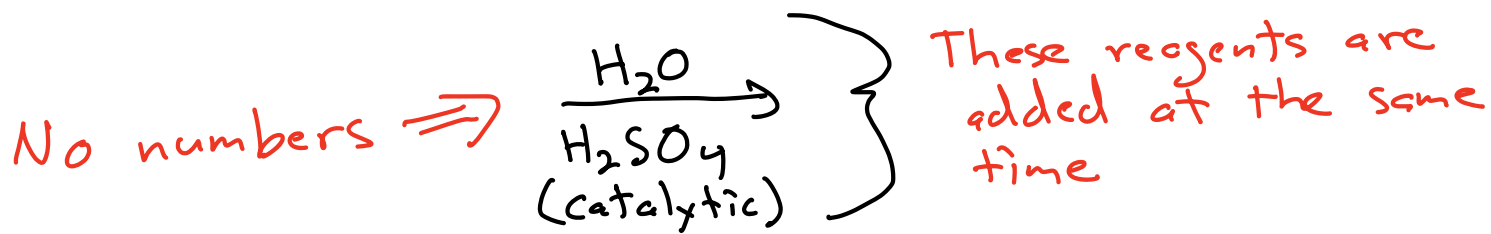
Example:



Ozonolysis is the only reaction that breaks C=C bonds!

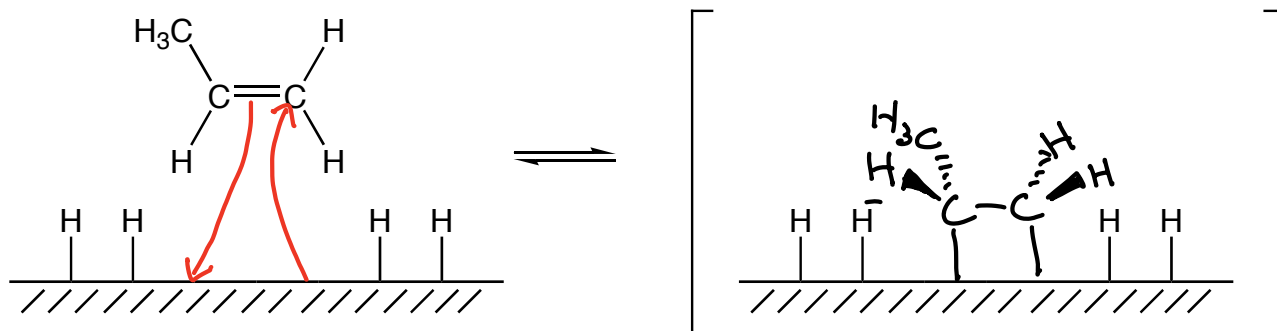
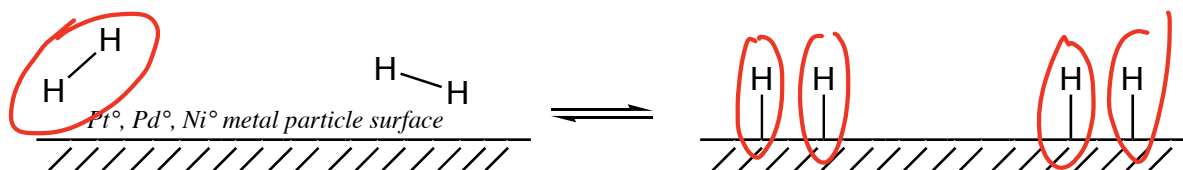


Notice the numbers!

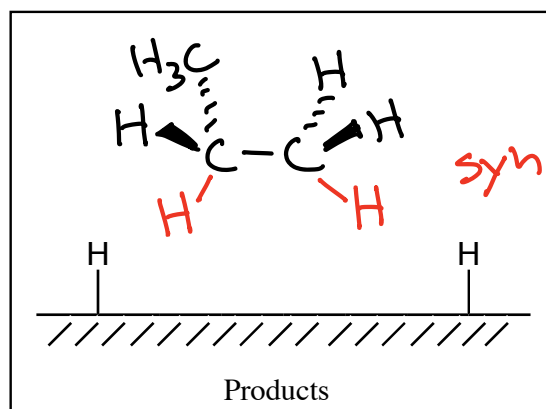


Hydrogenation: H_2 with Pt^0 , Pd^0 , Ni^0

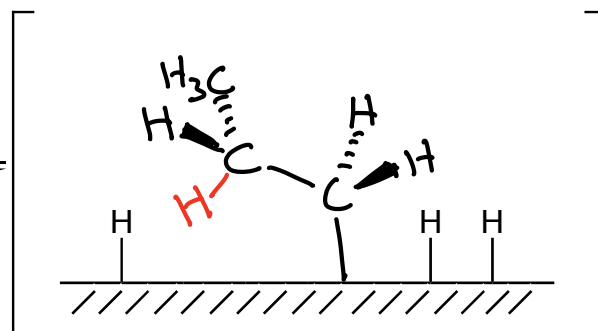
"In the elemental state - a metal"



Very fast



Very fast



Summary: H_2 adsorbs onto the metal surface.
The alkene adsorbs onto the metal surface.
H atoms transfer to both C atoms $\rightarrow$
on the same face $\rightarrow$ before the C-C bond rotates

Regiochemistry: N/A

Stereochemistry: Syn

Example:

