

FINAL EXAM PREP
CHE 3331 – Organic Chemistry

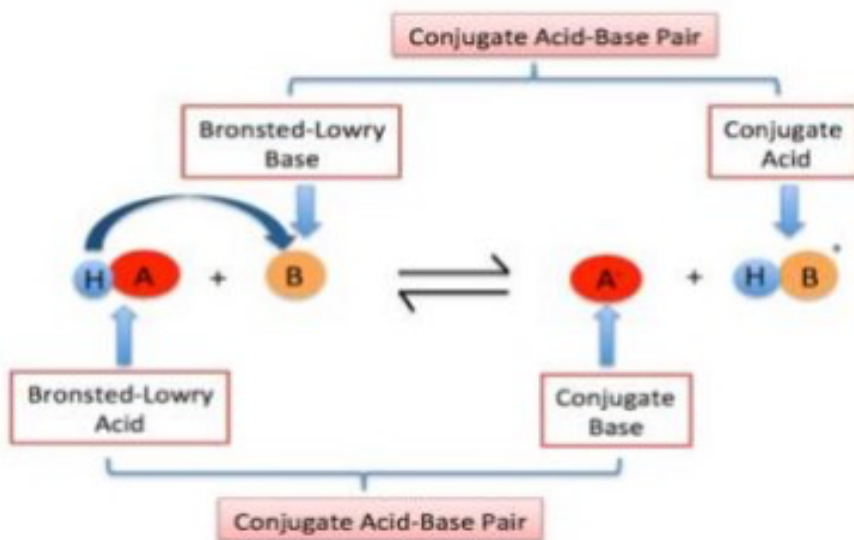
Final exam weekly resource for CHE 3331 – Organic Chemistry!

This week is the last week of class, and typically in this week (and the surrounding weeks of class) you are reviewing for the final exam. Please use the review below (as well as other resources from the semester) as a general overview of some of the key concepts taught in the course! Please take a look at all 16 weekly resources listed on our website to help you review for the final exam!

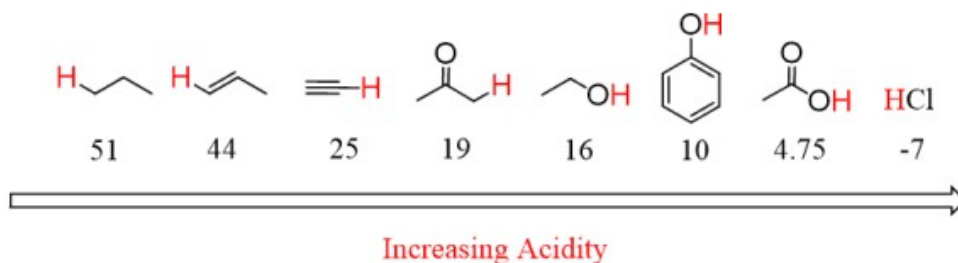
If you have any questions about these study guides, the final schedule of group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135. **The last day of tutoring in the drop in center will be the last day of class.** To learn about additional resources available during Finals Week, please visit CASE in the West Wing basement of Sid Rich! Good luck on your final exam!

HIGHLIGHT #1: Acids and Bases

- Bronsted-Lowry acids and bases
 - A Bronsted-lowry acid is a proton donor
 - A Bronsted-lowry base is a proton acceptor



- Evaluating acidity quantitatively: using pKa Values
 - The lower the pKa, the more acidic, the higher the pKa, the less acidic
- Evaluating acidity qualitatively: ARIO
 - Look at the conjugate base, and determine how stable it is. The more stable the conjugate base, the more acid the proton that was removed.
 - A: Atom bearing charge- the more electronegative and massive atoms with a charge are more stable.
 - R: Resonance stabilization- conjugate bases where the electrons participate in resonance are more stable
 - I: Induction- When super electronegative atoms are in the molecule, they can pull on the electrons making them “stick more” and be more stable
 - O: Orbitals- the more S character that the orbital has, the more stable. This is because the s orbital is closer in proximity to the + nucleus so it will hold on to the electrons tighter
 - EX:



HIGHLIGHT #2: Basic Nomenclature Rules

- Step 1: Find parent chain and name it

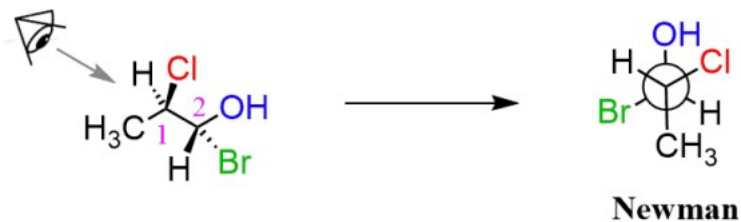
# Carbons	Parent name	Name of alkane
1	Meth	Methane
2	Eth	Ethane
3	Prop	Propane
4	But	Butane
5	Pent	Pentane
6	Hex	Hexane
7	Hept	Heptane
8	Oct	Octane
9	Non	Nonane
10	dec	Decane

- Step 2: Name Substituents using the same prefixes as in the table above and add the suffix -yl
- Step 3: number the main chain and assign numbers to substituents
- Step 4: Put the name together
 - Alphabetical order, commas between numbers, - between numbers and letters

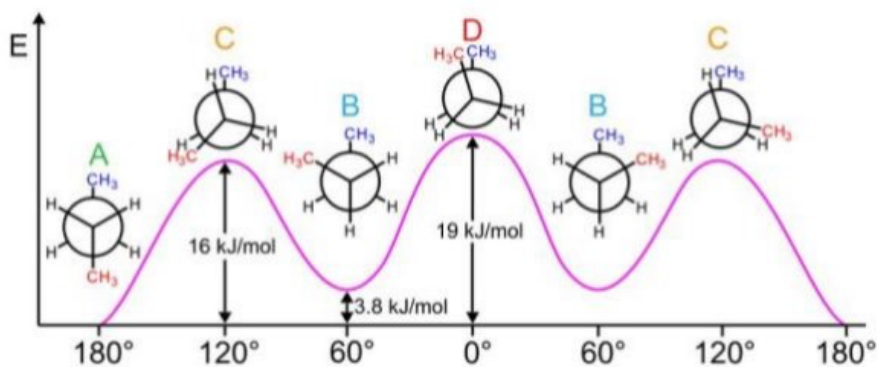
HIGHLIGHT #3: Newman Projections and Conformational Analysis

Remember that this is viewing a molecule as if you took at and rotated it 90 degrees. So, you are looking at it front to back instead of looking at the side of it.

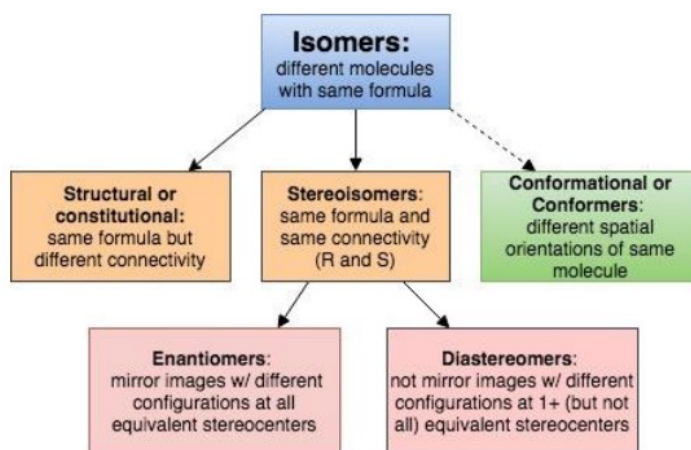
- Drawing a newman Projection



- Conformational analysis: once we draw a newman projection, we can rotate one of the carbons and see which conformation is lowest in energy, or more energetically favorable



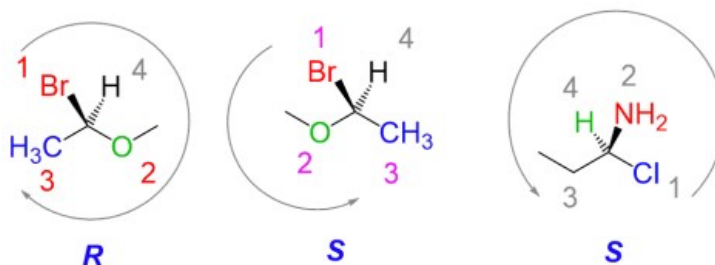
HIGHLIGHT #4: Stereoisomerism



- How to assign R and S
 - Step 1: identify all four atoms attached to the chiral carbon
 - Step 2: Assign highest priority based on the highest atomic number!
 - Remember, your lowest atomic number, hydrogen, will always receive a 4 priority If two atoms have the same

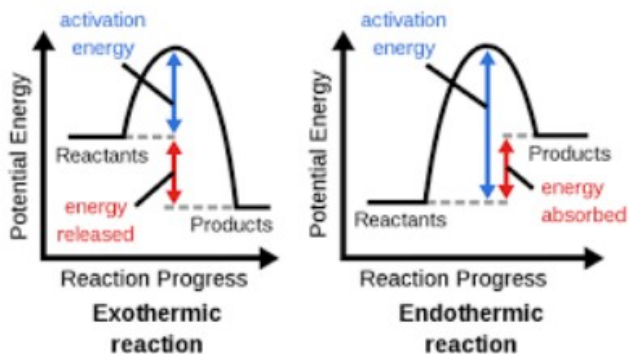
atomic number (like a chiral carbon directly attached to 2 other carbons), move away from the chiral carbon center to identify which atom will be the tie breaker

- Step 3: Your 4th priority should always be on a dash! So, if your 4th priority is on a wedge, then flip your answer.
 - For example, if your 4th priority is on a wedge and you identified it as R, then your answer will be S
 - R = clockwise
 - S = counterclockwise



HIGHLIGHT #5: Enthalpy, Entropy, and Gibbs Free Energy

- **Enthalpy:** Enthalpy is a value that is used to measure change in energy. You may remember from General Chemistry that the value for enthalpy is ΔH . $A + \Delta H$ means that the reaction is endothermic, which means that energy needs to be put into the system for that reaction to occur.
 - For example, breaking a bond is an endothermic process.
- $A - \Delta H$ means that the reaction is exothermic, which means that whatever occurred in the reaction released energy!
 - In addition to the previous example, forming a bond is an exothermic reaction.



- **Entropy:** Entropy is another value that is going to help us understand the principles that guide all thermodynamic processes. Entropy is a variable that

measures the disorder within a system or reaction and is represented by the variable ΔS .

- **Gibb's Free energy:** Gibb's free energy combines the enthalpy and entropy of a reaction to tell us if the reaction will happen spontaneously or not.
 - Equation: $\Delta H - T\Delta S$

	$\Delta H < 0$	$\Delta H > 0$
$\Delta S > 0$	Spontaneous at all T ($\Delta G < 0$)	Spontaneous at high T (when $T\Delta S$ is large)
$\Delta S < 0$	Spontaneous at low T (when $T\Delta S$ is small)	Non-spontaneous at all T ($\Delta G > 0$)

HIGHLIGHT #6: Substitution Reactions

The goal of a substitution reaction is to substitute one group for another. There are 2 different ways that this can take place

Differences between S_N1 and S_N2	
S_N1	S_N2
$\begin{array}{c} R_1 \\ \\ R_2-C-Cl \\ \\ R_3 \end{array} \xrightarrow{\text{aq. KOH}} \begin{array}{c} R_1 \\ \\ R_2-C-OH \\ \\ R_3 \end{array} + \begin{array}{c} R_1 \\ \\ HO-C-R_2 \\ \\ R_3 \end{array}$ <p>chiral-3°-alkyl halide 50% racemic mixture 50%</p>	$\begin{array}{c} R \\ \\ H-C-Cl \\ \\ D \end{array} \xrightarrow{\text{KOH}} \begin{array}{c} R \\ \\ HO-C-H \\ \\ D \end{array}$ <p>chiral 1°-alkyl halide inversion of configuration 100%</p>
1. Takes place in 3° alkyl halides	1. Takes place in 1° alkyl halide
2. Two steps	2. Only one step
3. 1 st step is slow and rate determining	3. Only one step
4. Rate is α to conc. of alkyl halide	4. Rate is α to conc. of alkyl halide and alkali
5. Unimolecular	5. Bimolecular
6. Non-concerted	6. Concerted
7. Independent of concentration of alkali	7. Dependent on concentration of both
8. Carbo-cation intermediate is formed	8. Takes place via only transition state
9. Racemic mixture is formed	9. Walden inversion takes place.
10. Favorable in protic solvents (H_2O , $HCOOH$).	10. Aprotic solvents DMSO, DMF, etc.
11. Order of reactivity: $3^\circ > 2^\circ > 1^\circ$	11. Order of reactivity: $1^\circ > 2^\circ > 3^\circ$
12. Rearrangement may takes place	12. No rearrangement takes place

HIGHLIGHT #7: Elimination Reactions

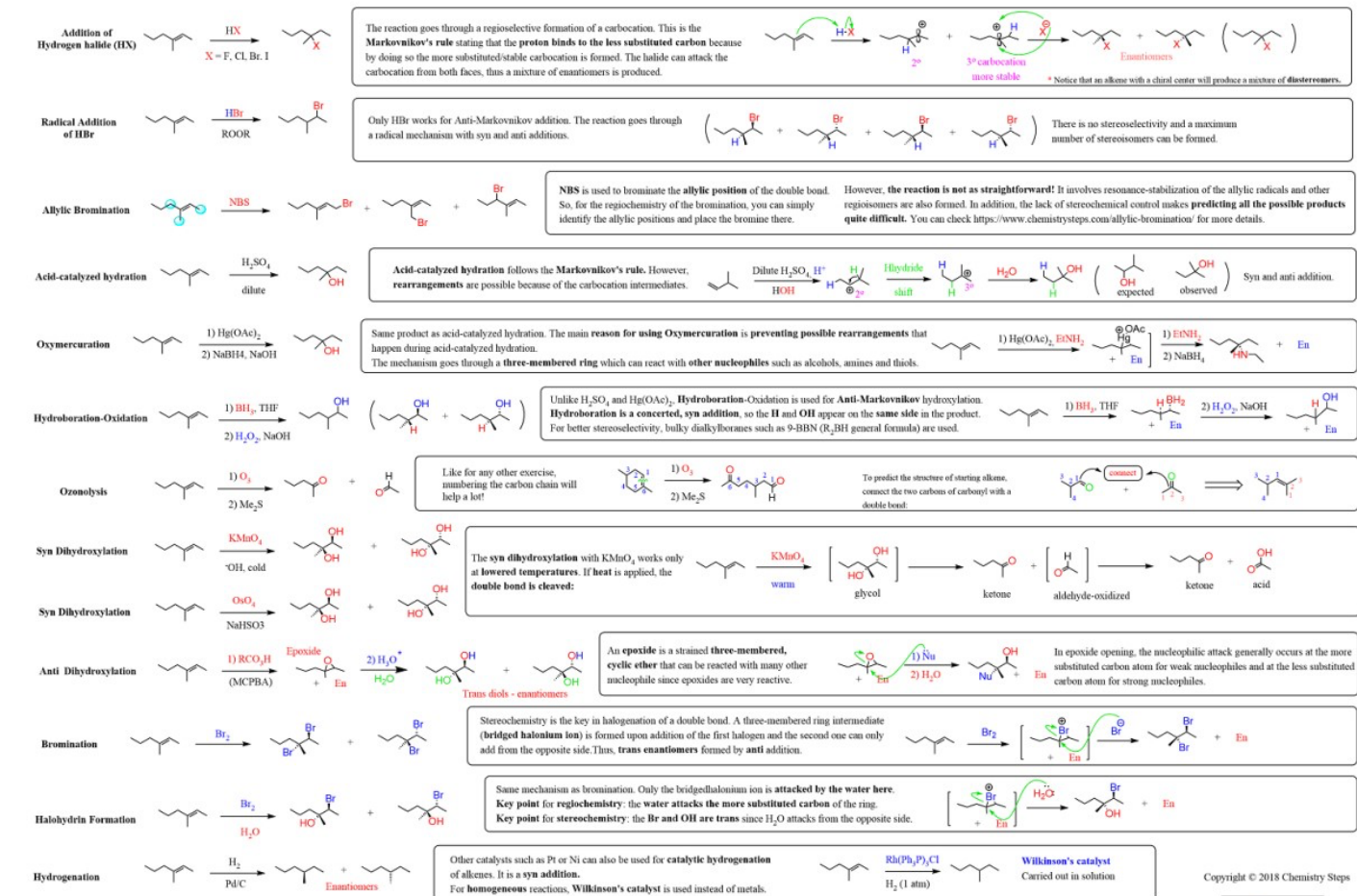
Elimination reactions are done in order to kick out a leaving group and create a double bond in the process

Comparing the E1 and E2 mechanisms

	E1	E2
Rate Law	Unimolecular (depends on concentration of substrate)	Bimolecular (depends on concentration of both substrate and base)
"Big Barrier"	Formation of carbocation $3^\circ > 2^\circ \gg 1^\circ$	None
Requires strong base?	No	Yes
Stereochemistry	No requirement	Leaving group must be <i>anti</i> to hydrogen removed

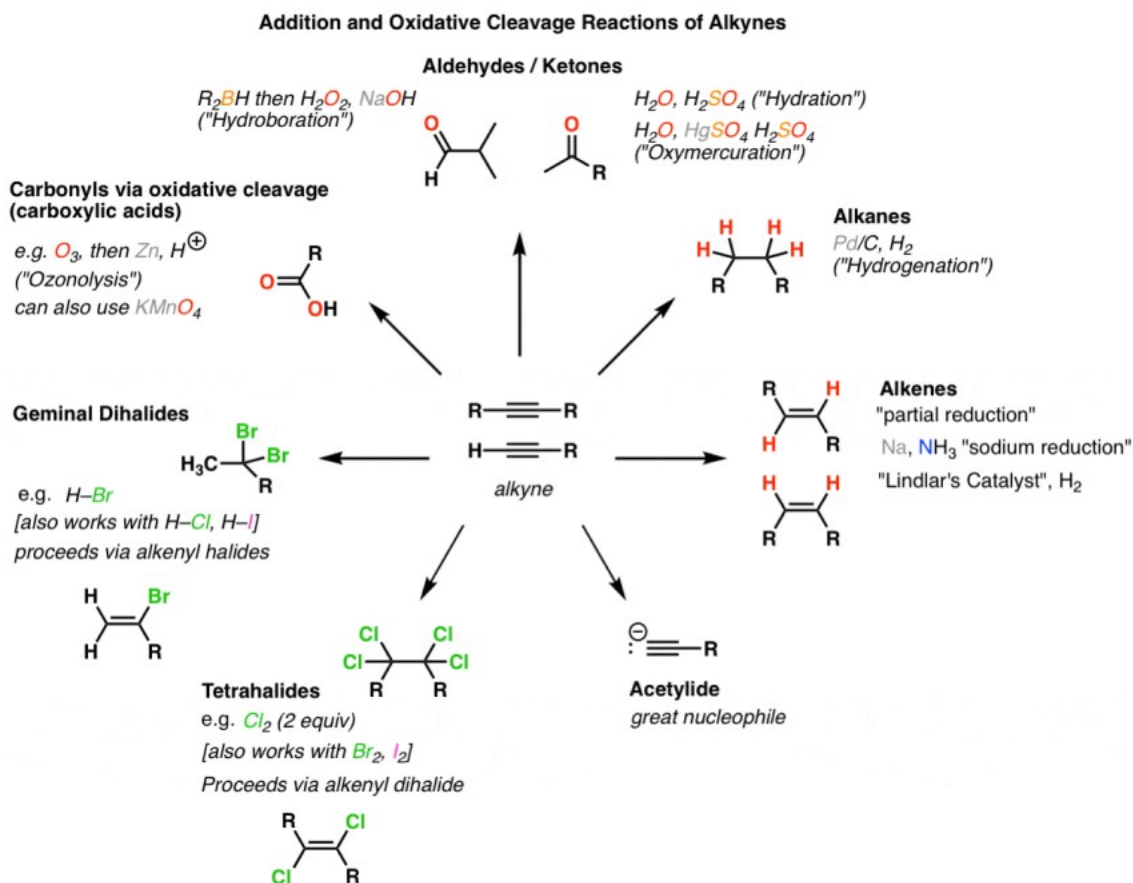
HIGHLIGHT #8: Addition to Alkenes

Addition reactions add groups across a double bond and in the process reduce a double bond to a single bond



HIGHLIGHT #9: Addition to Alkynes

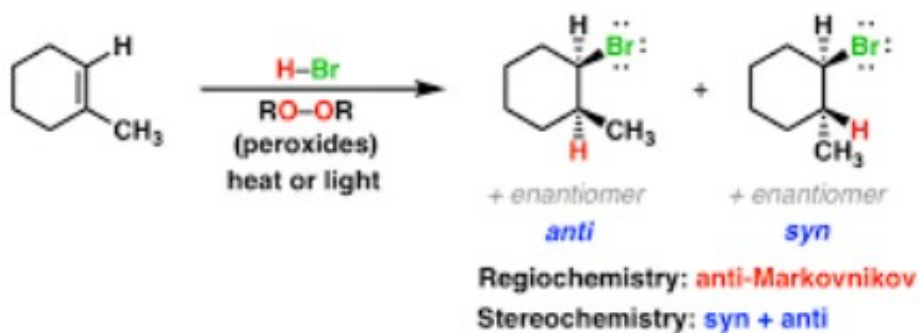
These reactions are very similar to addition to alkenes, but some of the reagents may change a little bit



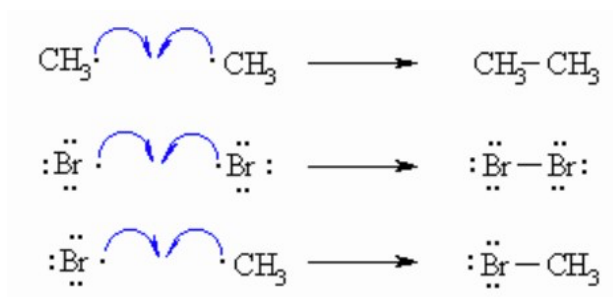
HIGHLIGHT #10: Radical Reactions

- Radical addition to Alkenes

Free-Radical Addition of H-Br To Alkenes

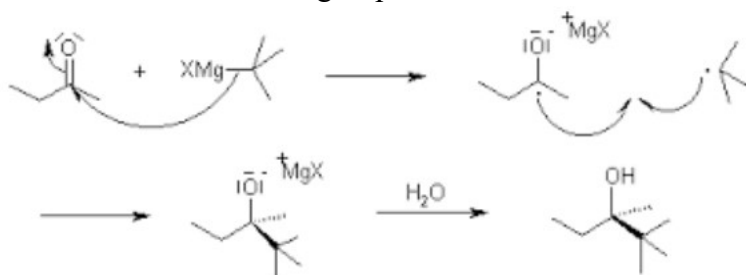


- Radical halogenation

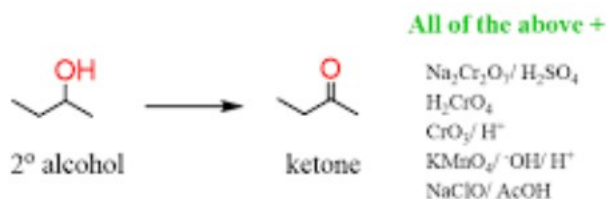
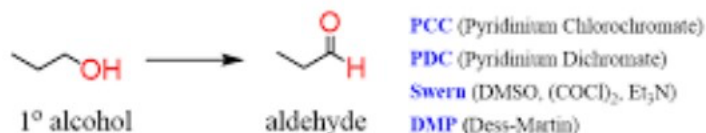


HIGHLIGHT #11: Alcohols

- Preparation of alcohols:
 - See additions reactions above such as
 - Acid catalyzed hydration
 - Oxymercuration-demercuration
 - Hydroboration oxidation
 - Anti-dihydroxylation
 - Syn-dihydroxylation
 - Gignards reagent- creates alcohol and adds R group

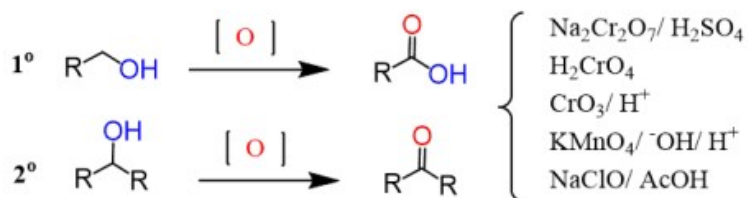


- Preparation via reduction:

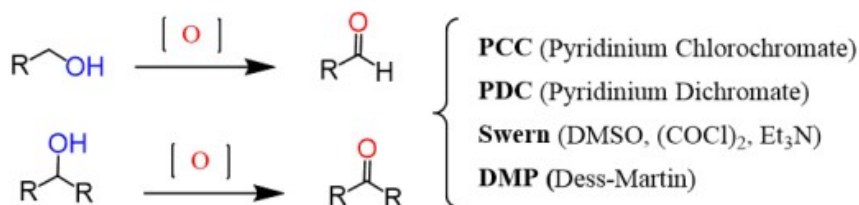


- Oxidation of alcohols:

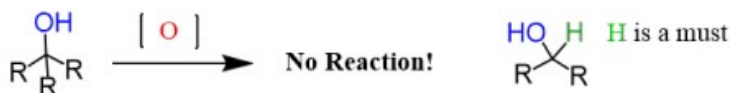
Strong Oxidizing Agents oxidize **Primary Alcohols** to **Carboxylic Acids** and **Secondary Alcohols** to **Ketones**



Some oxidizing agents can **selectively oxidize primary alcohols to aldehyde**:



Tertiary alcohols cannot be oxidized! (well, except for burning them to CO₂)



Thanks for using these resources this semester! Best wishes on your final exam!