



E4t add
 (anti mark)

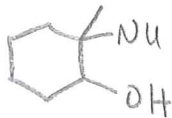
Starting Material (Substrate)	Reagents	Product	Name and Notes
$\begin{array}{c} \text{R}_1 \quad \text{R}_3 \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{H} \end{array}$	H-X	$\begin{array}{c} \text{R}_1 \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{X} \quad \text{R}_3 \end{array}$	• markovnikov • stereochemistry not controlled
$\begin{array}{c} \text{R}_1 \quad \text{R}_3 \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{H} \end{array}$	$\xrightarrow[\text{(HA, H}_2\text{O)}]{\text{H}_3\text{O}^+}$	$\begin{array}{c} \text{R}_1 \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{X} \quad \text{R}_3 \end{array}$	• markovnikov • carbocation intermediate
$\begin{array}{c} \text{R}_1 \quad \text{R}_3 \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{H} \end{array}$	$\xrightarrow{\text{X}_2}$	$\begin{array}{c} \text{R}_1 \quad \text{X} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{X} \quad \text{R}_3 \end{array}$	• anti addition
$\begin{array}{c} \text{R}_1 \quad \text{R}_3 \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{H} \end{array}$	$\xrightarrow[\text{nucleophilic solvent}]{\text{X}_2}$	$\begin{array}{c} \text{R}_1 \quad \text{X} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{Nu} \quad \text{R}_3 \end{array}$	• anti addition • markovnikov (nucleophile adds to most substituted)
$\begin{array}{c} \text{R}_1 \quad \text{R}_3 \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{H} \end{array}$	$\xrightarrow[\text{2) NaBH}_4, \text{H}_2\text{O}]{\text{1) H}_2(\text{OAc})_2, \text{HOR, THF}}$	$\begin{array}{c} \text{R}_1 \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{RO} \quad \text{R}_3 \end{array}$	• markovnikov • neither anti or syn
$\begin{array}{c} \text{R}_1 \quad \text{R}_3 \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{H} \end{array}$	$\xrightarrow[\text{2) H}_2\text{O}_2, \text{H}_2\text{O}]{\text{1) BH}_3, \text{THF}}$	$\begin{array}{c} \text{R}_1 \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}-\text{C} \\ \diagup \quad \diagdown \\ \text{R}_2 \quad \text{OH} \quad \text{R}_3 \end{array}$	• anti-mark • syn addition

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$\begin{array}{c} R_1 \quad R_3 \\ \diagdown \quad / \\ C=C \\ / \quad \diagdown \\ R_2 \quad H \end{array}$	$\xrightarrow[\text{2) aq NaHSO}_3]{\text{1) OsO}_4}$	$\begin{array}{c} OH \quad OH \\ \quad \\ R_1-CH-CH-R_3 \\ \quad \\ R_2 \quad H \end{array}$	• syn • enantiomers
$\begin{array}{c} R_1 \quad R_2 \\ \diagdown \quad / \\ C=C \\ / \quad \diagdown \\ H \quad H \end{array}$	$\xrightarrow[\text{2) Me}_2\text{S or Zn, AcOH}]{\text{1) O}_3}$	$\begin{array}{c} R_1 \\ \\ C=O \\ \\ H \end{array} + \begin{array}{c} R_2 \\ \\ O=C \\ \\ H \end{array}$	• stops at aldehyde
$\begin{array}{c} R_1 \quad H \\ \diagdown \quad / \\ C=C \\ / \quad \diagdown \\ H \quad R_2 \end{array}$	$\xrightarrow[\text{2) H}_3\text{O}^+]{\text{1) KMnO}_4, H_2O, \text{heat}}$	$\begin{array}{c} O \\ \\ R_1-C-OH \end{array} + \begin{array}{c} O \\ \\ R_2-C-OH \end{array}$	• carboxylic acid
$\diagdown \quad \diagup \\ C=C \\ \diagup \quad \diagdown$	$\xrightarrow[\text{H}_2\text{O}]{X_2}$	$\begin{array}{c} OH \\ \\ -C-C- \\ \quad \\ \quad X \end{array}$	• anti
$\diagdown \quad \diagup \\ C=C \\ \diagup \quad \diagdown$	$\xrightarrow[\text{cold}]{\text{dil. KMnO}_4, H_2O}$	$\begin{array}{c} \quad \\ -C-C- \\ \quad \\ OH \quad OH \end{array}$	• syn add
$\diagdown \quad \diagup \\ C=C \\ \diagup \quad \diagdown$	$\xrightarrow[\text{pyridine}]{\text{1) DSO}_4}$	$\begin{array}{c} \quad \\ -C-C- \\ \quad \\ OH \quad OH \end{array}$	• syn

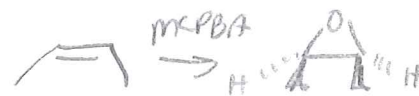
2) NaHSO₃
H₂O

don't need mech

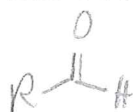
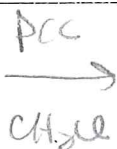
Halohydrin

Starting Material (Substrate)	Reagents	Product	Name and Notes
$R-C\equiv C-H$	X_2 (excess) $\xrightarrow{DCM}$ $X = Cl, Br, I$	$\begin{array}{c} X & Y \\ & \\ R-C & -C-H \\ & \\ X & Y \end{array}$	• adds anti 1st then proceeds to next add
$R-C\equiv C-H$	$H-X$ excess $\xrightarrow{\quad}$ $X = Cl, Br, I$	$\begin{array}{c} X & H \\ & \\ R-C & -C-H \\ & \\ X & H \end{array}$	geminal X add to same carbon
$R-C\equiv C-R'$	$1) O_3$ $\xrightarrow{2) HOAc}$	$R-CO_2H$ $R'-CO_2H$	
$R-C\equiv C-R'$	$1) KMnO_4, H_2O$ $\xrightarrow{2) H_3O^+}$	$R-CO_2H$ + $R'-CO_2H$	
	mCPBA		syn add
	H^+ $\xrightarrow{Nu}$		• trans • nucleophile attacks more substituted

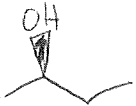
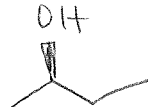
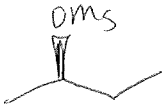
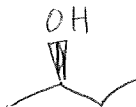
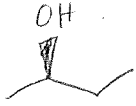
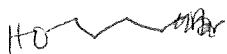
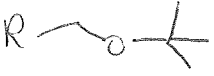
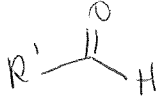
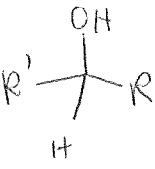
isopk
LiAlH₄

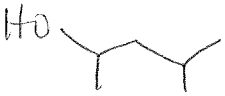


Starting Material (Substrate)	Reagents	Product	Name and Notes
	OR^-		• nucleophile <i>basic</i> attack least subs (S _N 2) <i>Bimolecular!</i>
	$\text{1) LiAlH}_4, \text{Et}_2\text{O}$ $\text{2) H}^+, \text{H}_2\text{O}$		reduces all carbonyls
	NaBH_4 H_2O		Can only reduce aldehyde/ ketone
	$\text{LiAlH}_4, \text{Et}_2\text{O}$ $\text{2) H}_2\text{O}, \text{H}^+$		Substitutes halides for H
	1) PCC, (COCl)_2 $\text{-60}^\circ\text{C}$ $\text{2) Et}_3\text{N}$		Swern oxidation
	CrO_3 H_2SO_4		1° → carbonyl <i>Jones</i> 2° → ketone 3° → NR



1° → aldehyde
2° → ketone *milder*
3° → no R

Starting Material	Reagents	Product	Name and Notes
	$\xrightarrow{\text{TsCl}}$		• good leaving group • retains Configuration
	$\xrightarrow{\text{MsCl}}$		• good leaving group • retains Configuration
	$\xrightarrow{\text{SOCl}_2}$		• inverts Stereochem
	$\xrightarrow[\text{imidazole, DmF}]{\text{TBSCl}}$		• protects -OH group • remove w/ Bu_4NF, THF or MeF
	$\xrightarrow[\text{2-methyl-2-butene}]{\text{H}_2\text{SO}_4}$		• remove w/ an acid
R-MgX			• adds twice for esters, doesn't work w/ carboxylic acids, acts as base 1st

Starting Material	Reagents	Product	Name and Notes
	1) $\text{BrMg-CH}_2\text{CH}_2\text{CH}_3$ 2) H_3O^+		• opened • opens on <u>less</u> hindered side

[illegible]