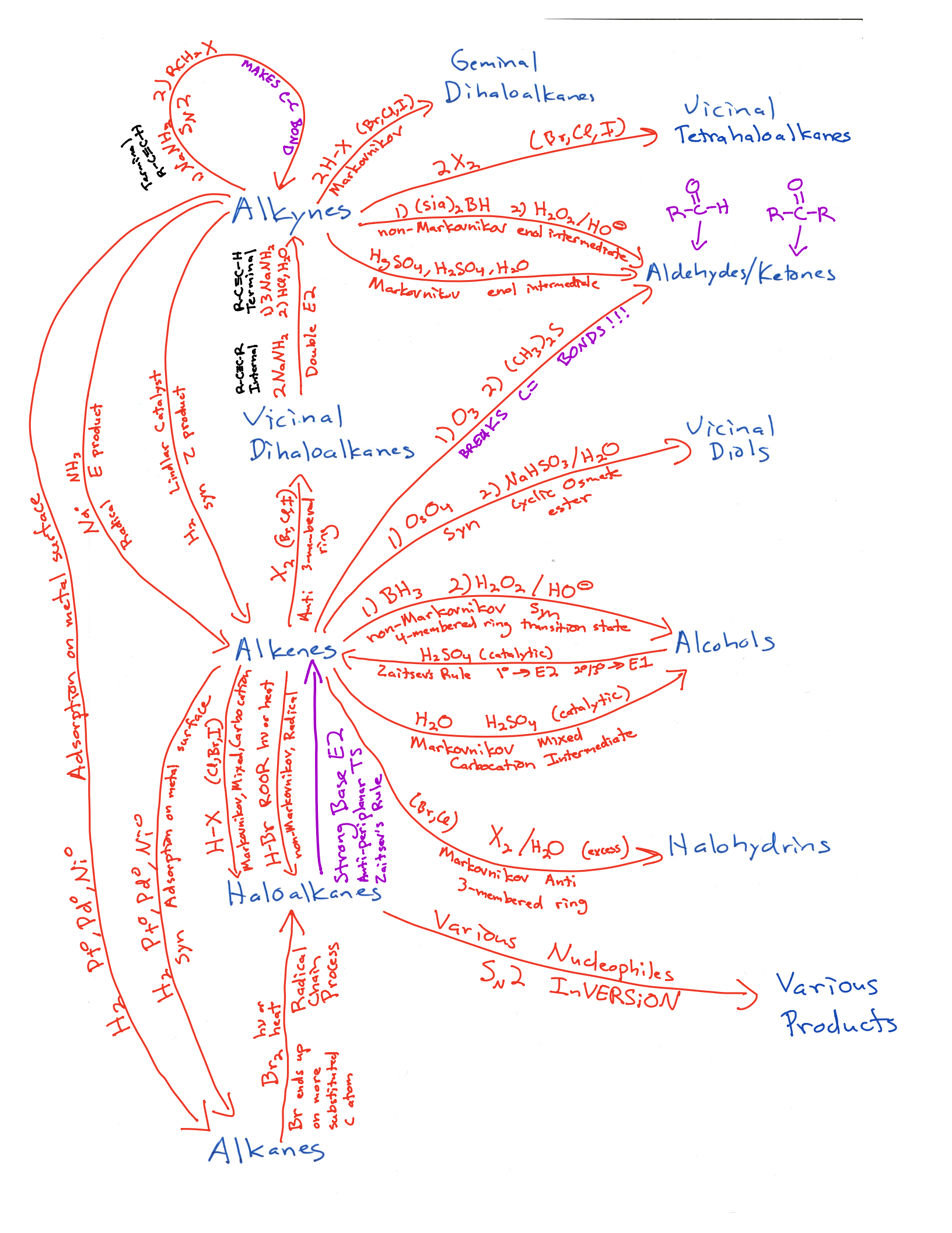

Geminal Dihaloalkanes
Vicinal Tetrahaloalkanes
Alkynes
Aldehydes/Ketones
Vicinal Dihaloalkanes
Vicinal Diols
Alkenes
Alcohols
Haloalkanes
Halohydrins
Alkanes
Various Products
Terminal RC≡CH
Internal R-C≡C-R
MAKES C-C
Double E2
Linear Catalyst
Z product
syn
Radical
E product
Adsorption on metal surface
Anti 3-membered ring
BREAKS C= BONDS!!!
Syn
cyclic Osmate ester
non-Markovnikov
4-membered ring
transition state
Zaitsev's Rule
Markovnikov, Mixed Carbocation
non-Markovnikov, Radical
Strong Base E2
Anti-periplanar TS
Markovnikov
Mixed Carbocation Intermediate
Markovnikov Anti
3-membered ring
Radical Chain Process
Br ends up on more substituted C atom
Nucleophiles
INVERSION

Geminal Dihaloalkanes

Vicinal Tetrahaloalkanes

Alkynes (DFW)

Carboxylic Acids

Aldehydes Ketones

Vicinal Diols

Vicinal or Geminal Dihaloalkanes (Waco)

Epoxides

Alkenes (Austin)

Alcohols

Halohydrins

Allylic Halides

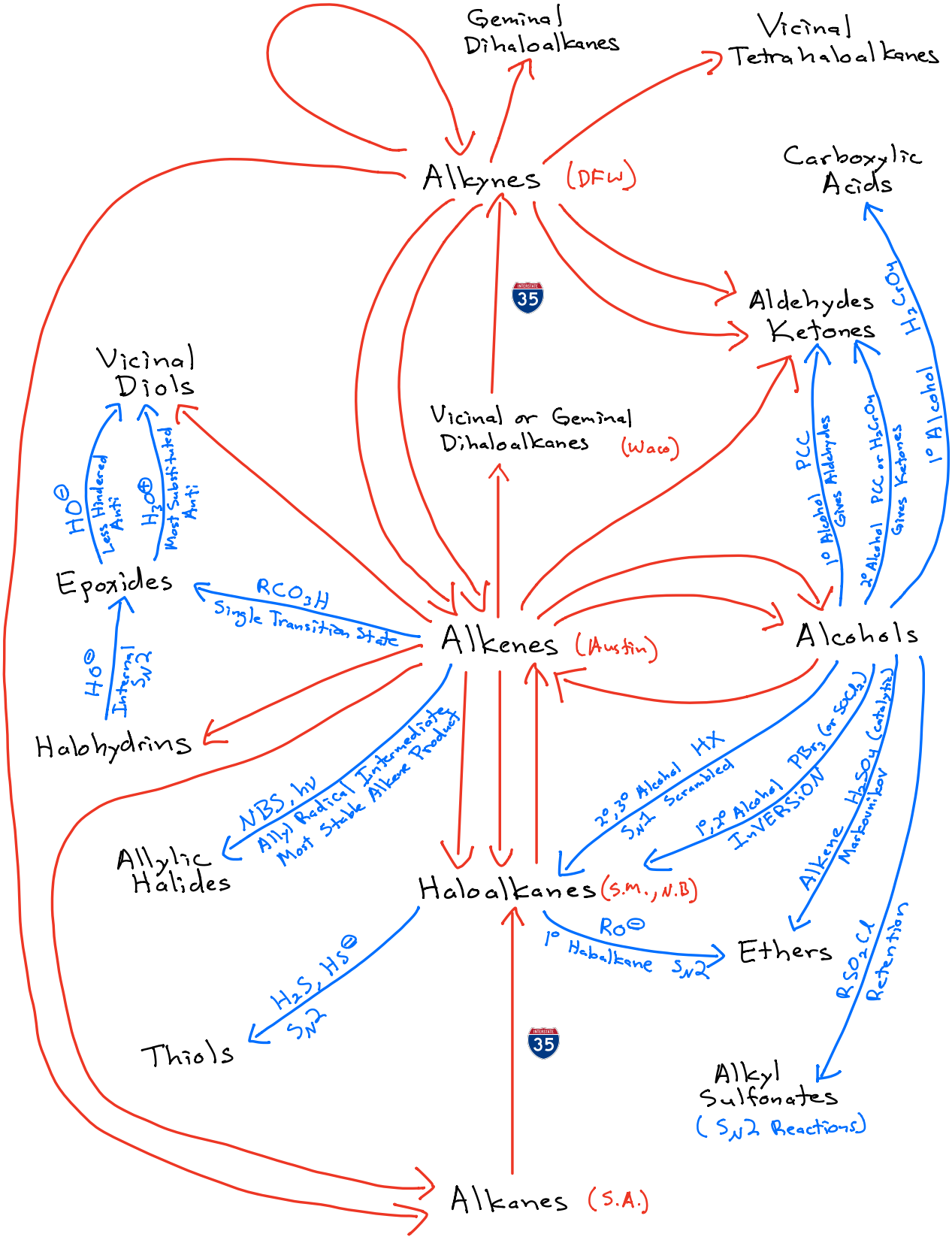
Haloalkanes (S.M., N.B)

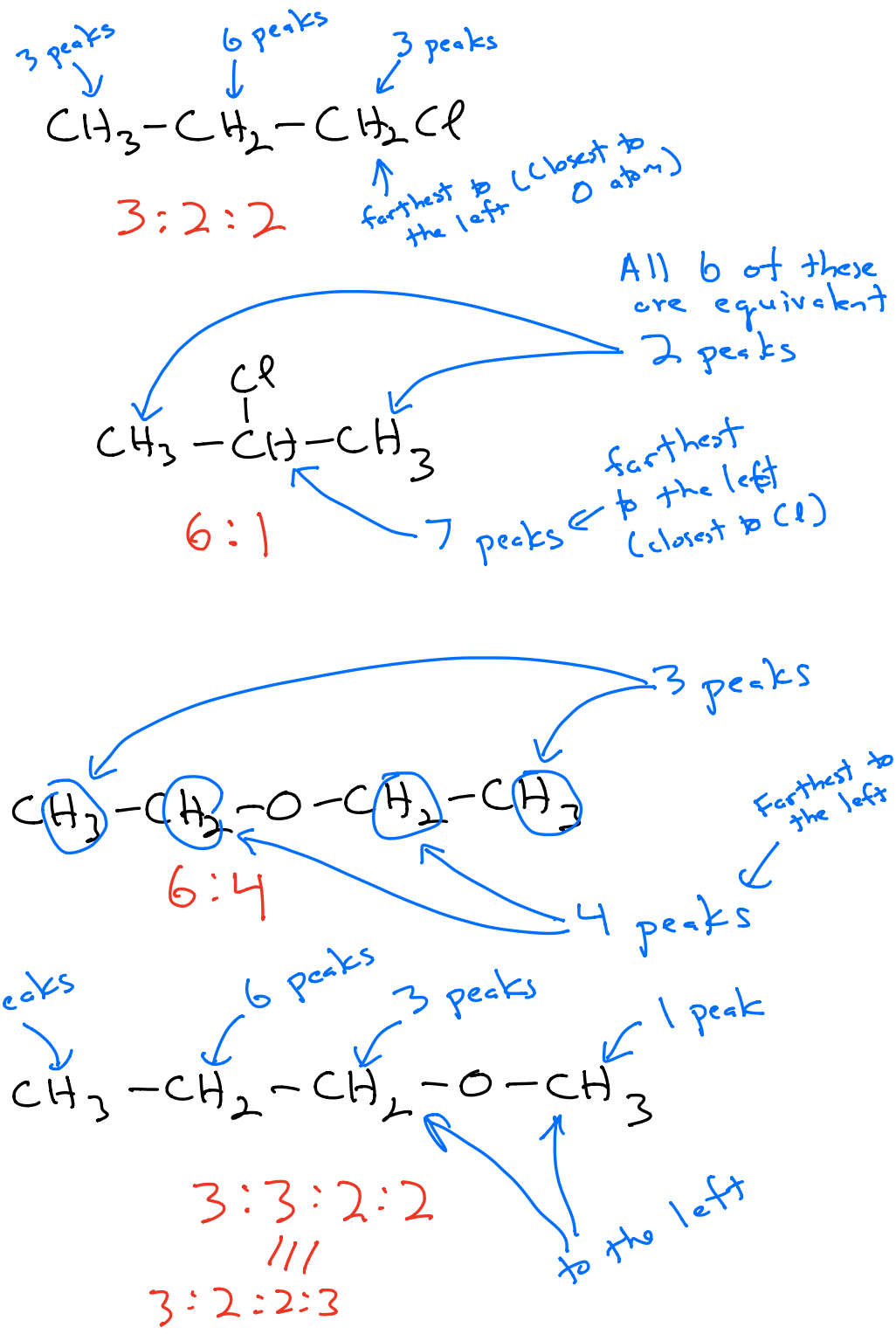
Ethers

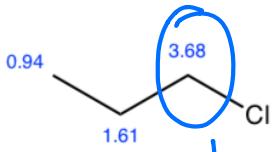
Thiols

Alkyl Sulfonates

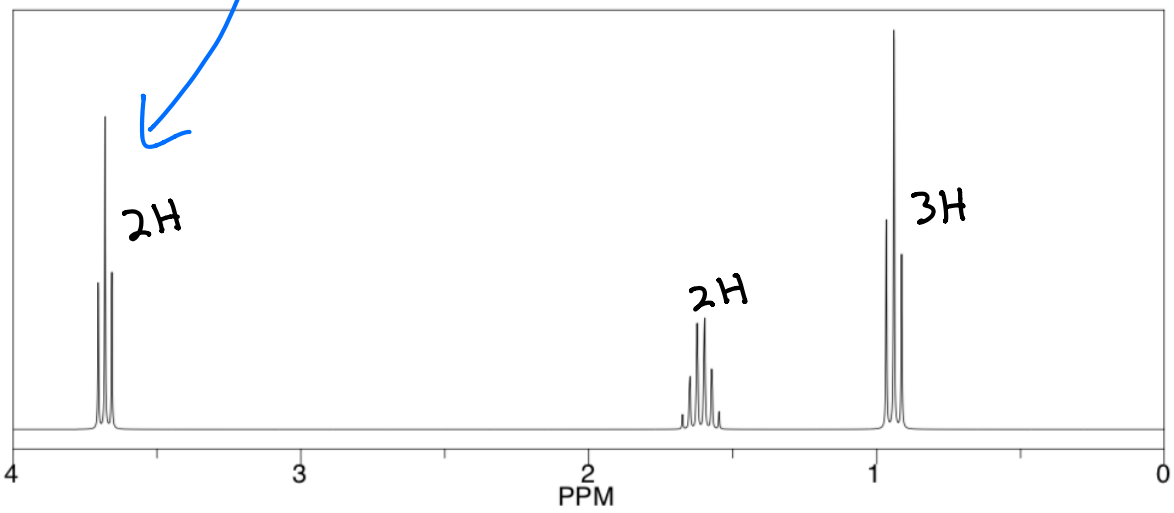
Alkanes (S.A.)

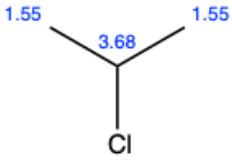

Geminal Dihaloalkanes
Vicinal Tetrahaloalkanes
Alkynes (DFW)
Carboxylic Acids
Aldehydes Ketones
Vicinal Diols
Vicinal or Geminal Dihaloalkanes (Waco)
PCC
1° Alcohol Gives Aldehydes
2° Alcohol PCC or H2CrO4 Gives Ketones
H2CrO4
1° Alcohol
HO⊖ Less Hindered Anti
H3O⊕ Most Substituted Anti
Epoxides
RCO3H Single Transition State
Alkenes (Austin)
Alcohols
HO⊖ Internal SN2
Halohydrins
NBS, hv Allyl Radical Intermediate Most Stable Alkene Product
2°,3° Alcohol HX SN1 Scrambled
1°,2° Alcohol PBr3 (or SOCl2) INVERSION
Alkene H2SO4 (catalytic) Markovnikov
Allylic Halides
Haloalkanes (S.M., N.B)
H2S, HS⊖ SN2
RO⊖ 1° Haloalkane SN2
Ethers
RSO2Cl Retention
Thiols
Alkyl Sulfonates (SN2 Reactions)
Alkanes (S.A.)


3 peaks
6 peaks
3 peaks
CH3-CH2-CH2Cl
3:2:2
farthest to the left (closest to O atom)
All 6 of these are equivalent
2 peaks
Cl
CH3-CH-CH3
6:1
7 peaks
farthest to the left (closest to Cl)
3 peaks
CH3-CH2-O-CH2-CH3
6:4
4 peaks
farthest to the left
3 peaks
6 peaks
3 peaks
1 peak
CH3-CH2-CH2-O-CH3
3:3:2:2
///
3:2:2:3
to the left

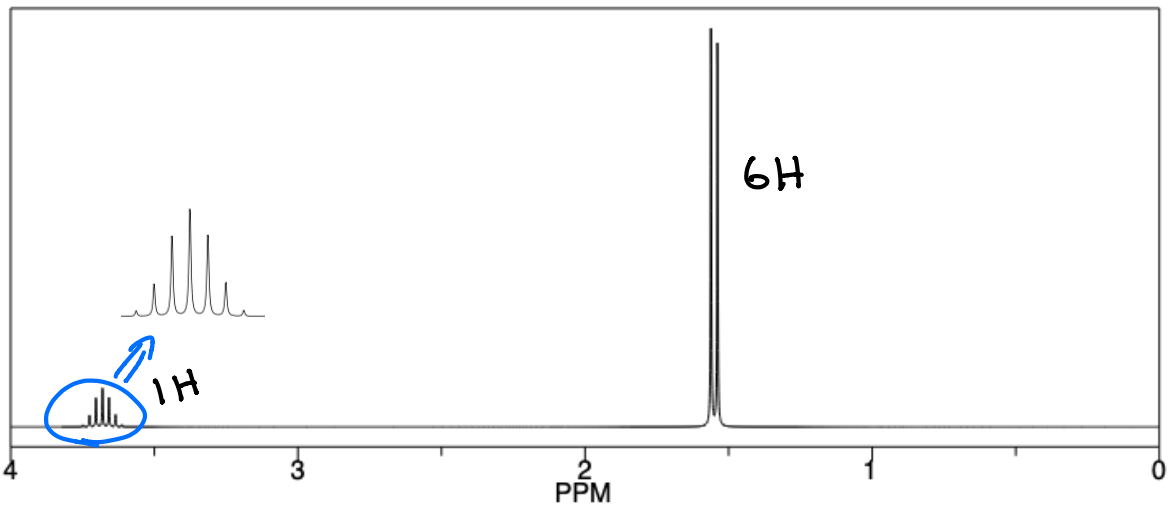


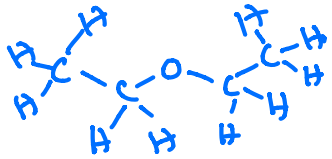
Estimation quality is indicated by color: good, medium, rough



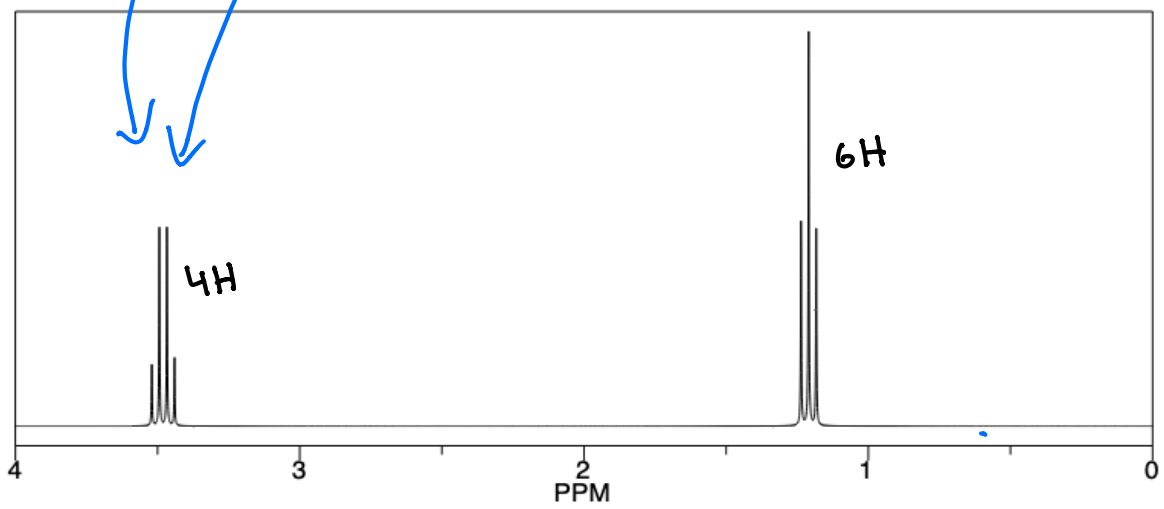


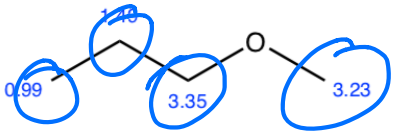
Estimation quality is indicated by color: good, medium, rough



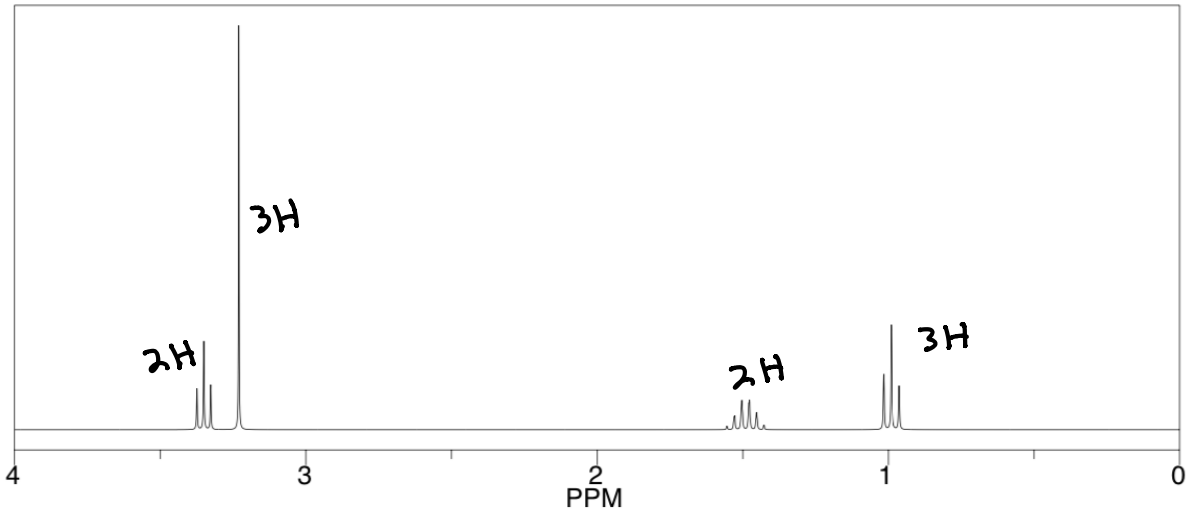


Estimation quality is indicated by color: good, medium, rough



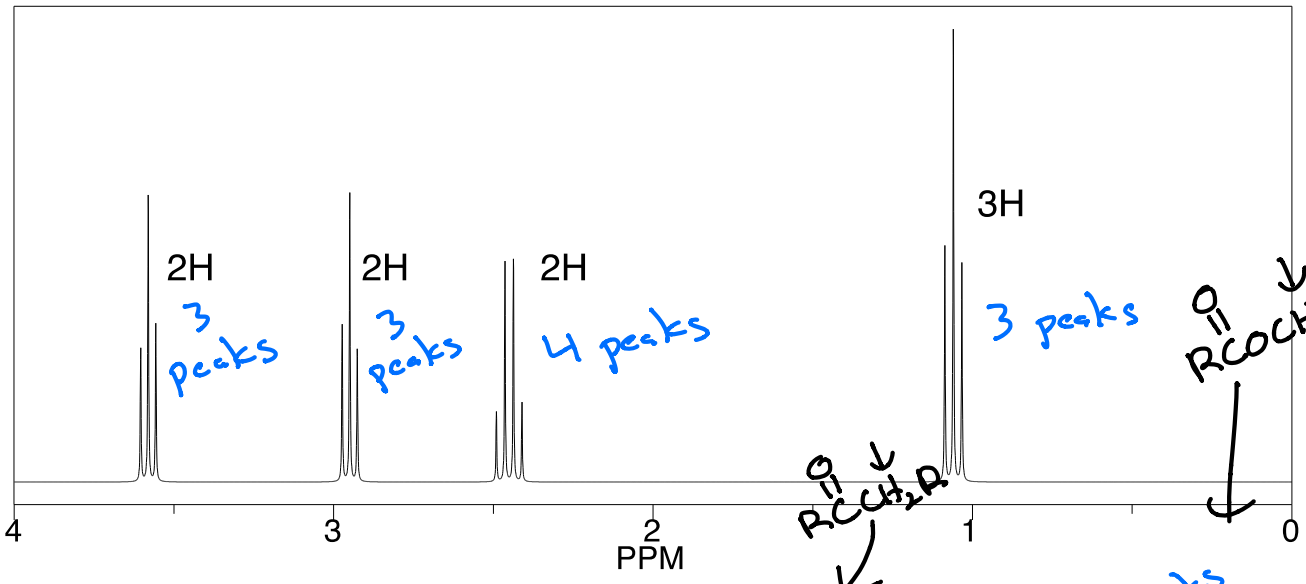


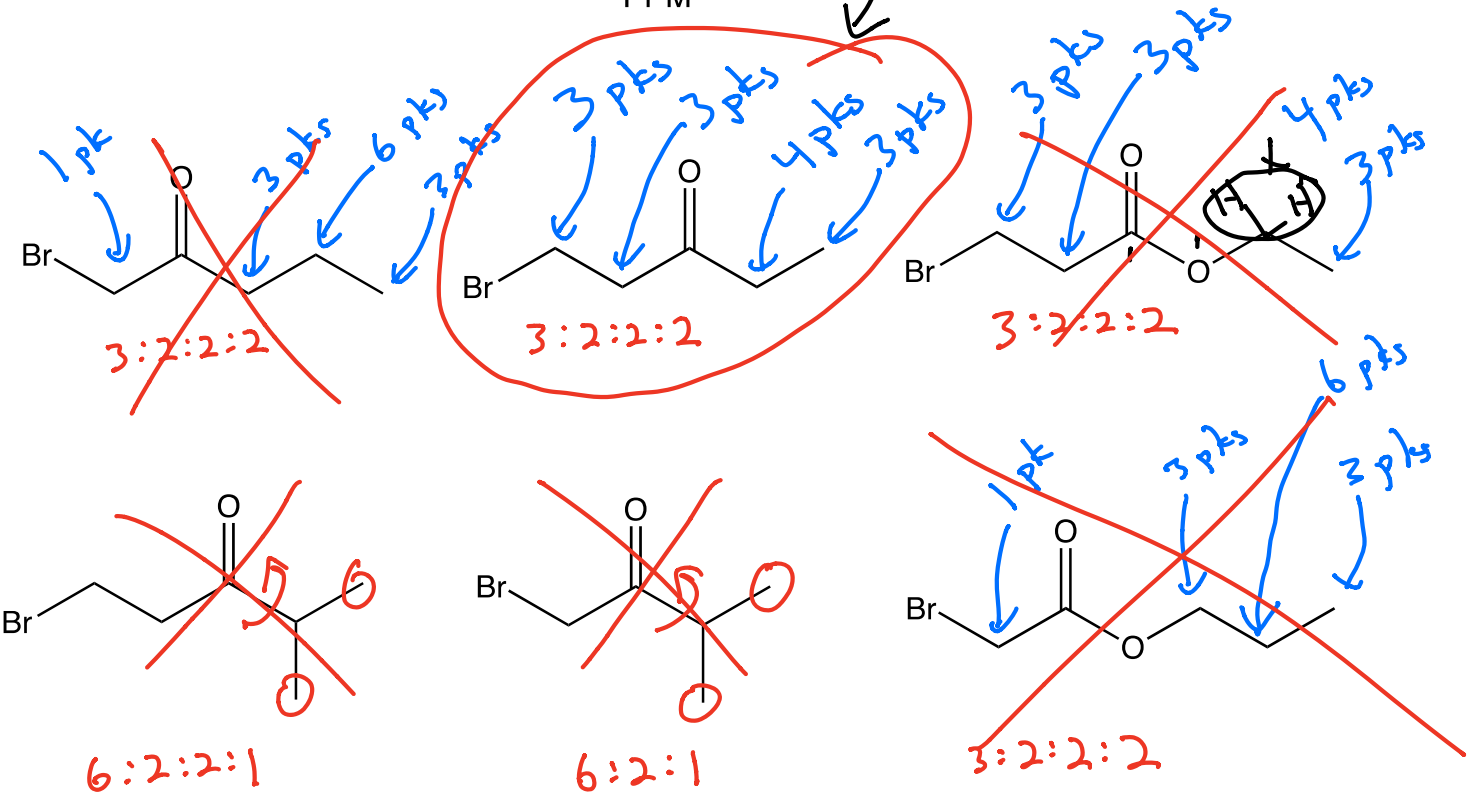
Estimation quality is indicated by color: good, medium, rough



V. When solving NMR spectra problems:

1) Determine number and relative integrations of signals predicted for a given structure
2) Make sure the splitting pattern matches with the spectrum for each signal and
3) If the number and relative integrations as well as splitting patterns match with the spectra, compare expected chemical shifts with those of the signals in the spectra.





Type of Hydrogen (R = alkyl, Ar = aryl)	Chemical Shift (δ)*	Type of Hydrogen (R = alkyl, Ar = aryl)	Chemical Shift (δ)*
		RCH_2OH	3.4-4.0
R_2NH	0.5-5.0	RCH_2Br	3.4-3.6
ROH	0.5-6.0	RCH_2Cl	3.6-3.8
RCH_3	0.8-1.0	$RCOCH_3$	3.7-3.9
RCH_2R	1.2-1.4	$RCOCH_2R$	4.1-4.7
R_3CH	1.4-1.7	RCH_2F	4.4-4.5
$R_2C{=}CRCHR_2$	1.6-2.6	$ArOH$	4.5-4.7
$RC{\equiv}CH$	2.0-3.0	$R_2C{=}CH_2$	4.6-5.0
$RCCH_3$	2.1-2.3	$R_2C{=}CHR$	5.0-5.7
$RCCH_2R$	2.2-2.6	$H_2C{-}CH_2$	3.3-4.0
$ArCH_3$	2.2-2.5	RCH	9.5-10.1
RCH_2NR_2	2.3-2.8	$RCOH$	10-13
RCH_2I	3.1-3.3		
RCH_2OR	3.3-4.0		

* Values are relative to tetramethylsilane. Other atoms within the molecule may cause the signal to appear outside these ranges.

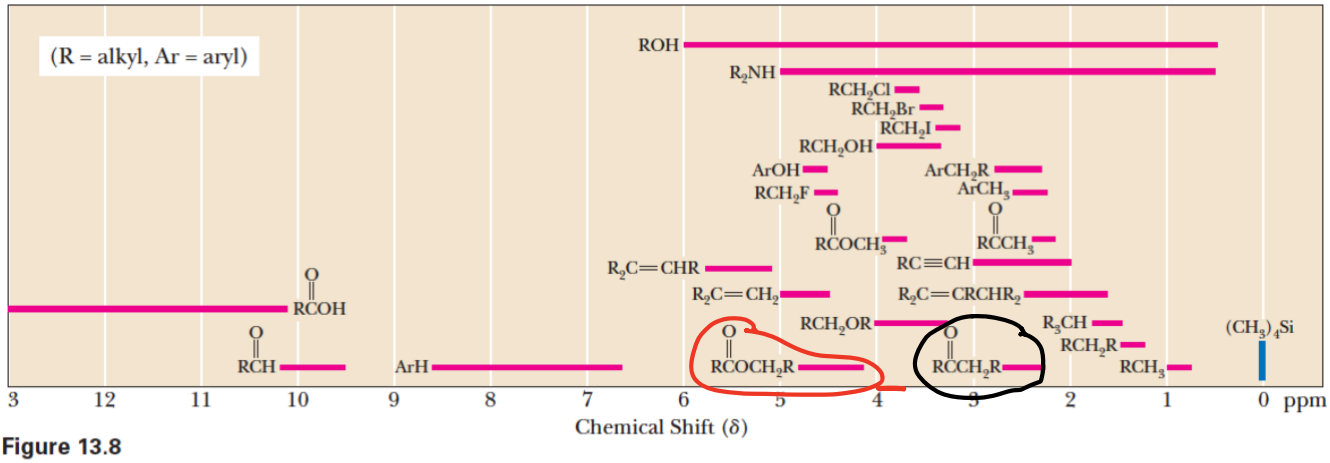
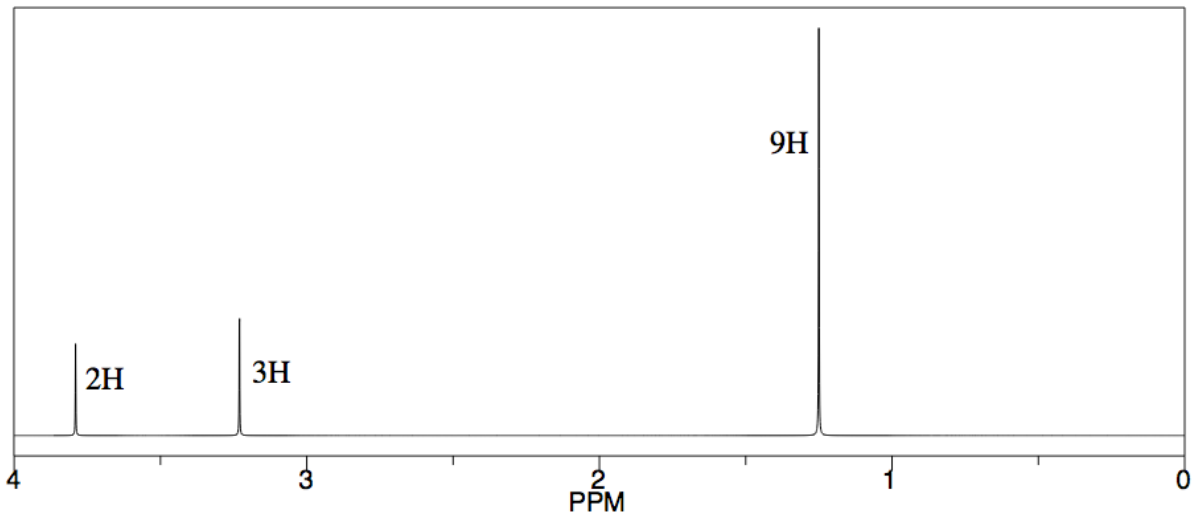
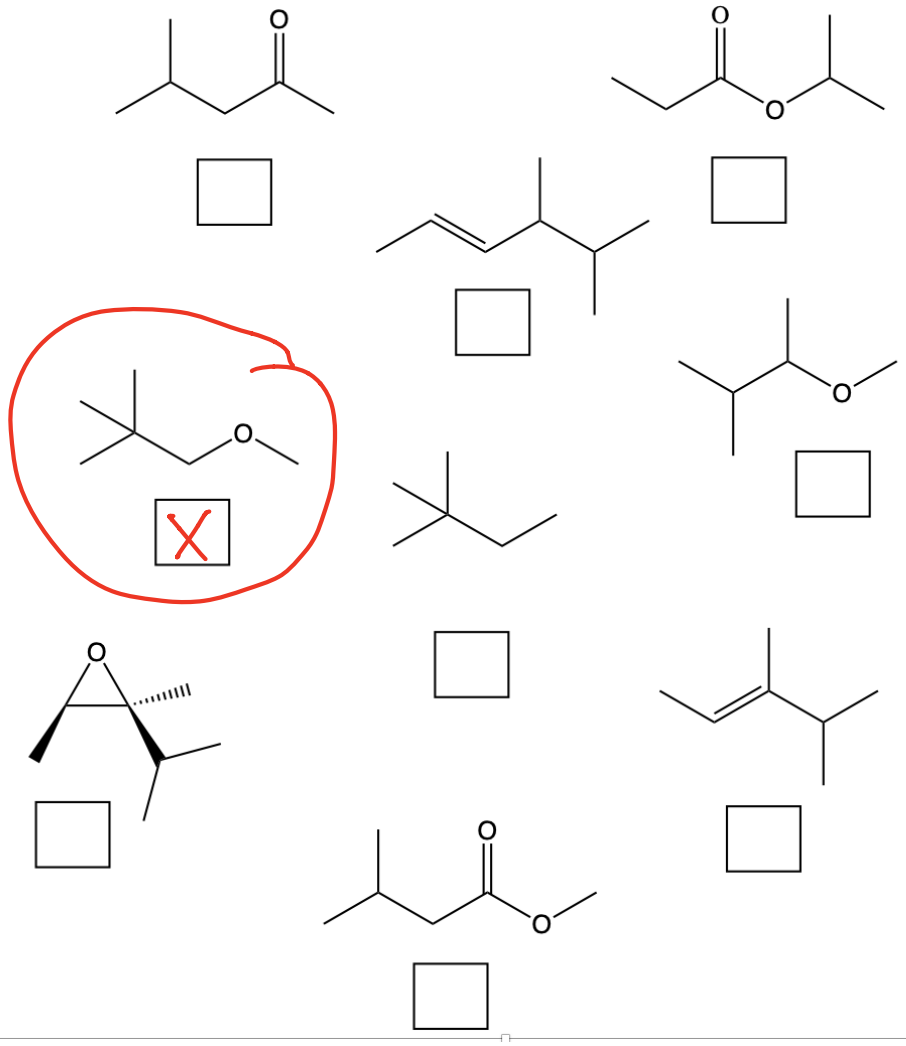
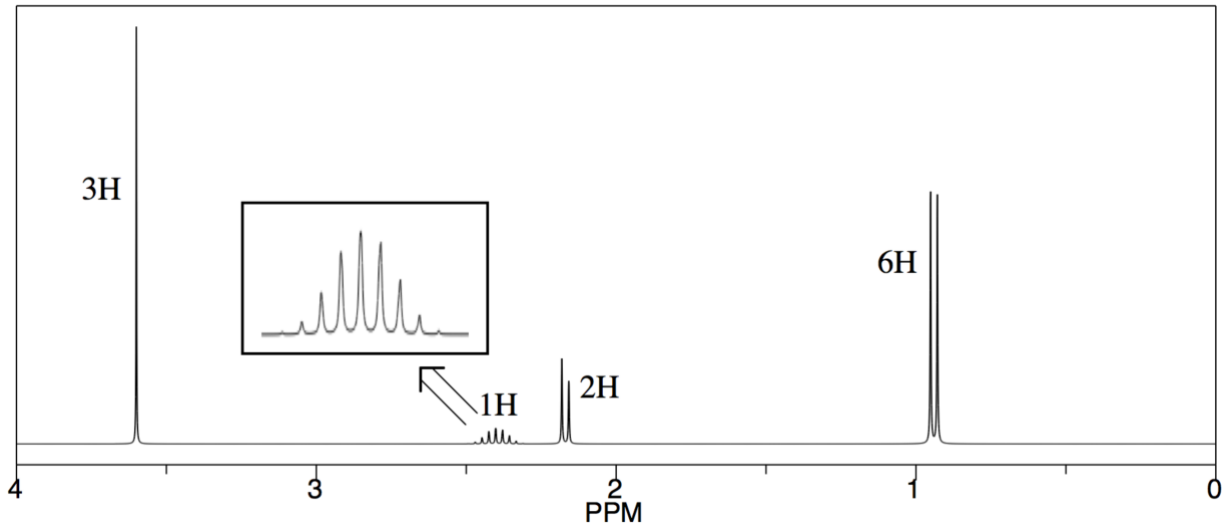
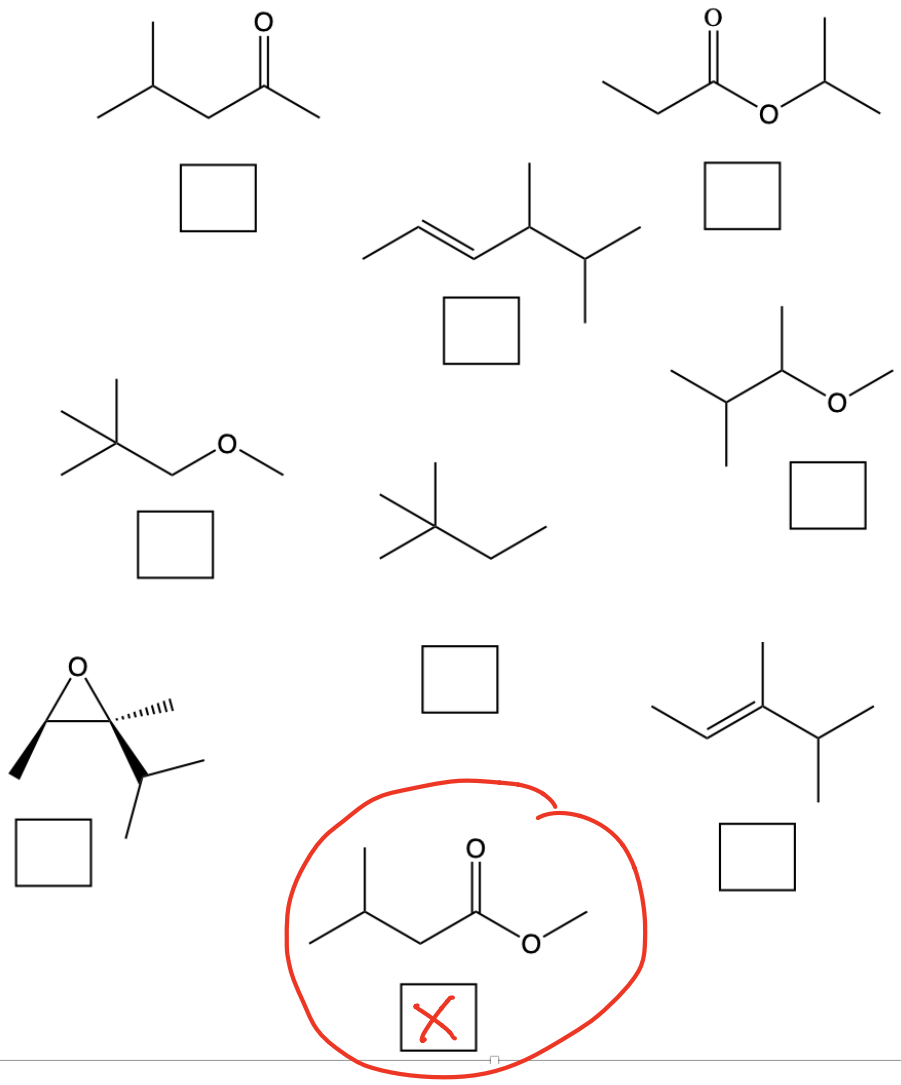


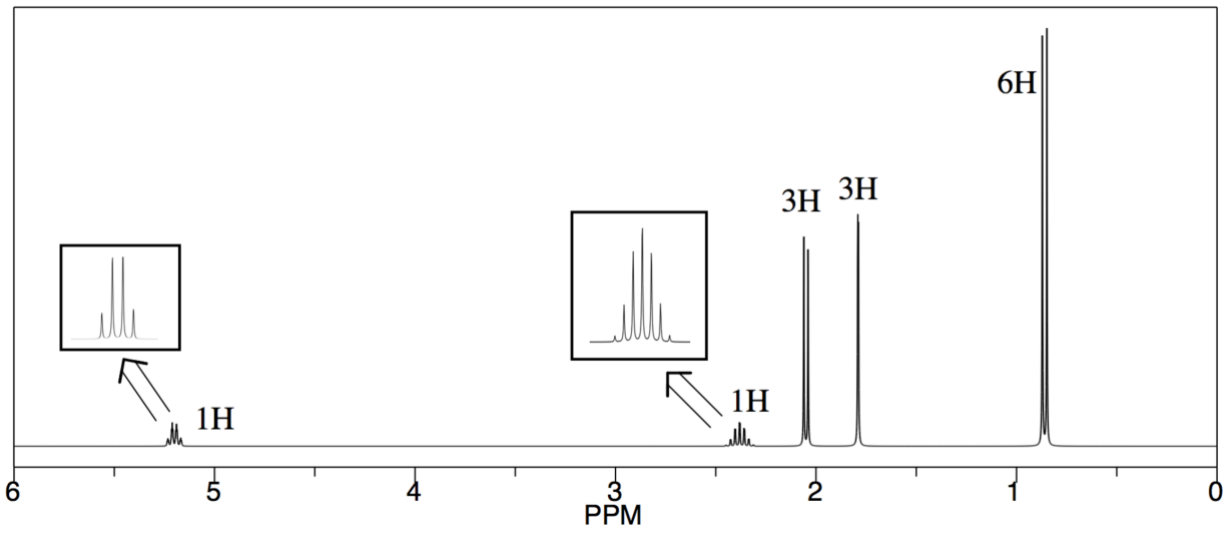
Figure 13.8
Average values of chemical shifts of representative types of hydrogens. These values are approximate. Other atoms or groups in the molecules may cause signals to appear outside of these ranges.

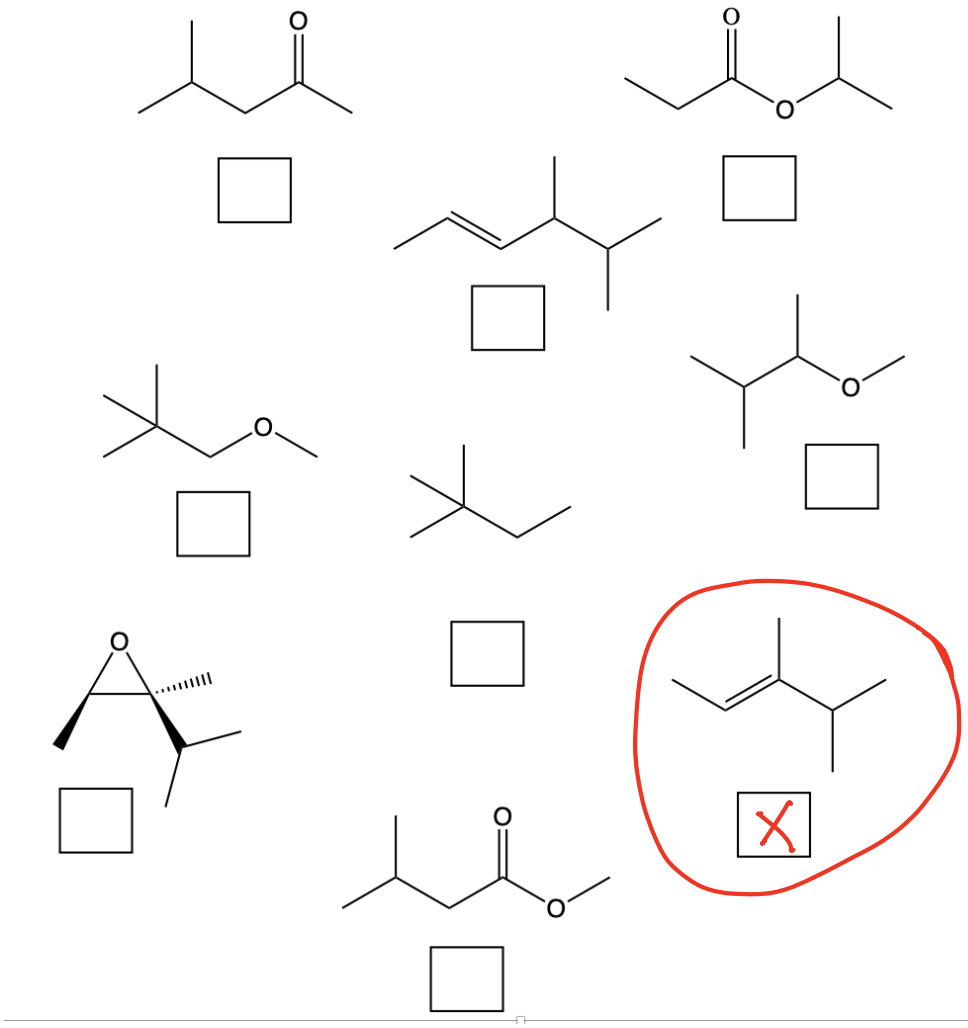

9H
2H
3H
4
3
2
PPM
1
0


O
O
O
O
O
O
O


3H
1H
2H
6H
4
3
2
1
0
PPM


O
O
O
O
O
O
O
O


6H
3H
3H
1H
1H
6
5
4
3
2
1
0
PPM


O
O
O
O
O
O
O
O