

OBSERVATION

PUDDLES AND WORMS...

IT MUST HAVE RAINED.

INFERENCE

AN IR BAND OF THIS SIZE AND SHAPE...

INFERENCE

PROBABLY THAT FUNCTIONAL GROUP.

ALL IR BANDS ARE EQUAL, BUT SOME ARE MORE EQUAL THAN OTHERS.

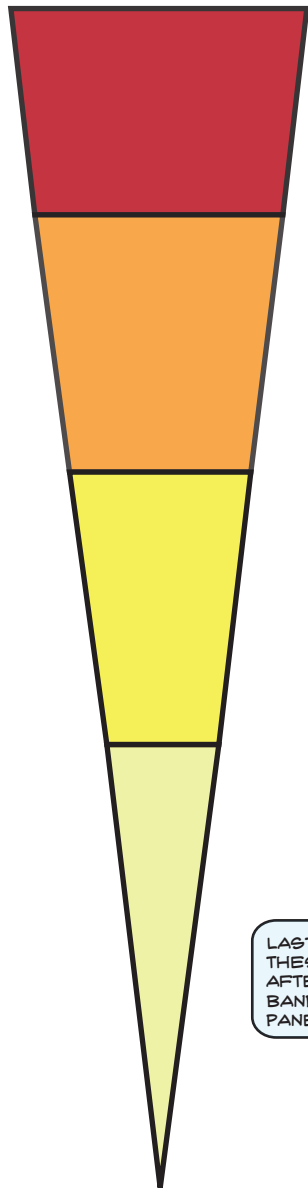
Alkyne (stretch)	ca. 3300	ca. 3.45
Aldehyde	2900-2800	3.45
	2800-2700	3.57
Alkane	not interpretatively useful	
Alkene	1680-1600	5.95
Aromatic	1600 and 1475	6.25
Alkyne	2250-2100	4.44
Aldehyde	1740-1720	5.75
Ketone	1725-1705	5.80
Carboxylic Acid	1725-1700	5.80
Ester	1750-1730	5.71
Amide	1670-1640	6.00
Anhydride	1810 and 1760	5.52
Acid Chloride	1800	5.56
Alcohols, Ethers, Esters, Carboxylic Acids, Anhydrides	1300-1000	7.69
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MOVING DOWN THE CHART ONE AT A TIME, MATCHING BANDS AS YOU GO, IS NOT A USEFUL STRATEGY.

INSTEAD, LET'S ARRANGE THEM BY THEIR INTERPRETIVE POWER.

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Aldehyde	2900-2800	
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Alkane	not interpretatively useful	
Alkene	1680-1600	
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Aldehyde	1740-1720	
Ketone	1725-1705	
Carboxylic Acid	1725-1700	
Ester	1750-1730	
Amide	1670-1640	
Acid Chloride	1800	
Alcohols, Ethers, Esters, Carboxylic Acids, Anhydrides	1300-1000	
Alcohols, Phenols	1300-1000	

GREAT INTERPRETIVE POWER



THIS IS THE FIRST REGION YOU SHOULD LOOK AT, AND THERE ARE 4 DIFFERENT SHAPES OF BANDS THAT YOU MAY SEE HERE.

...AND IF YOU DON'T SEE ANY BAND HERE, YOU MOST LIKELY DON'T HAVE ANY OF THESE FUNCTIONAL GROUPS (FG)

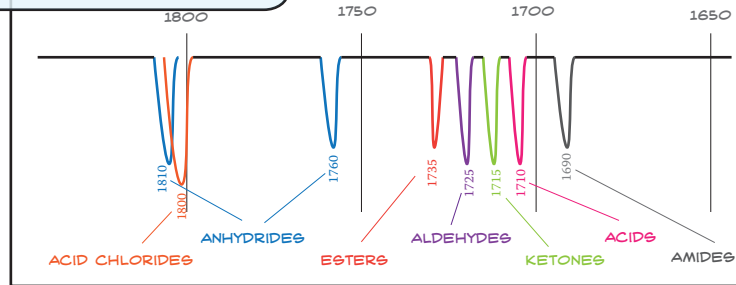
A SMOOTH TONGUE MEANS AN ALCOHOL. -O-H

VAMPIRE FANGS MEANS A PRIMARY AMINE... -N-H

ONE KNOCK-OUT FANG MEANS A 2° AMINE, OR A TERMINAL ALKYNE. -C≡C-H

HAIRY BEARD IS A SIGN FOR A CARBOXYLIC ACID. -COO-H

IN THE C=O REGION, IT'S NOT THE SHAPE, BUT THE EXACT LOCATION THAT REVEALS THE IDENTITY OF THE FG.



NOTE THAT THE EXACT POSITION DEPENDS ON THE SURROUNDING ENVIRONMENT:

$+30\text{CM}^{-1}$ STRAIN, OR CONJUGATED AT -O-

-30CM^{-1} CONJUGATED AT C=O

AT $\sim 2200\text{CM}^{-1}$, WE FIND TRIPLE BONDS: C≡C, AND C≡N

USUALLY SHARP (CAN BE SMALLISH)

HINT: USE 3300CM^{-1} TO DISTINGUISH TERMINAL AND INTERNAL ALKYNES.

Interpreting IR spectra

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LASTLY, YOU SHOULD LOOK AT THESE FEATURES (BUT ONLY AFTER ANALYSING THE MAJOR BANDS IN THE PREVIOUS PAGES)

UNSATURATED C-H STRETCH

SATURATED C-H STRETCH

3000CM^{-1}

MONO ORTHO META PARA

700, 690 ~ 750 890, 780, 690 ~ 825

ALKENE/AROMATIC SUBSTITUTION PATTERN CAN BE SEEN IN THE C-H BEND REGIONS.

STRONG 990, 910 ~ 900 (STRONG) (WEAK) ~ 700 ~ 970 (STRONG)

MONO GEM (1,1-) DI-SUBSTITUTED CIS- TRANS-

LASTLY, A PEAK AT 2700CM^{-1} , TOGETHER WITH A C=O, IS INDICATIVE OF AN ALDEHYDE.

C-H STRETCH

2700CM^{-1}

C=O STRETCH

R-C(=O)-H

SATURATED AND UNSATURATED C-H CAN BE PRESENT AT THE SAME TIME.

KETONES HAVE NO C-H IN THEM AND CAN HAVE NO 2700CM^{-1} C-H STRETCH PEAKS.

NOTES

** IF YOU'RE NOT SURE WHAT THE DIFFERENCE BETWEEN AN ACID AND AN ALCOHOL IS, DO THE QUICK "FUNCTIONAL GROUP IDENTIFICATION" EXERCISE.

** ...IF YOU HAVE ONE FG. TWO 2° AMINE WOULD LOOK LIKE A 1 AMINE.

WE LOOKED AT THESE LAST BECAUSE THEY CAN BE AMBIGUOUS TO INTERPRET, OR THEY HAVE ONLY A NARROW NICHE OF USEFULNESS.