

Useful Spectroscopy Information for both the Chem 420 and 421 Lab Exams

- IR
- ≈ 3400 cm^{-1} : O-H and N-H stretch
 - ≈ 3100 cm^{-1} : sp and sp^2 C-H stretch
 - ≈ 2900 cm^{-1} : sp^3 C-H stretch
 - ≈ 2700 cm^{-1} : aldehyde C-H stretch (fangs)
 - ≈ 2200 cm^{-1} : $\text{C}\equiv\text{C}$ & $\text{C}\equiv\text{N}$ stretch (primarily for terminal $\text{C}\equiv\text{C}$)
 - ≈ 1700 cm^{-1} : C=O stretch
 - ≈ 1600 cm^{-1} : C=C stretch (primarily for terminal C=C)
 - ≈ 1200 cm^{-1} : C-O stretch

^1H NMR

- 0.5 – 1.5 ppm: simple alkanes
- 2.0 – 3.0 ppm: H's on C's that are adjacent to mildly electronegative groups (carbonyls, halogens, benzene rings)
- 3.0 – 4.5 ppm: H's on C's that are adjacent to strongly electronegative groups (oxygen, multiple halogens, multiple carbonyls)
- 5.0 – 6.5 ppm: alkene H's
- 7.0 – 8.5 ppm: arene H's (H's on benzene rings)
- 9.0 – 10 ppm: aldehyde C-H
- 11-12 ppm: carboxylic acid O-H

^{13}C NMR

- 10 – 30 ppm: simple alkanes
- 40 – 70 ppm: C's that are adjacent to electronegative groups
- 120 – 150 ppm: C's in aromatic rings
- 160 – 185 ppm: C's in the carbonyl group of carboxylic acid and its derivatives (esters, amides, acid chlorides, and anhydrides).
- 190 – 210 ppm: C's in the carbonyl group of aldehydes and ketones