# **Objectives for Chapter 3 – Infrared Spectroscopy**

## I. Introduction to Spectroscopy

#### Characterizing compounds

1. Explain what it means to characterize a compound, and give examples of when this would be needed.

2. Distinguish between using physical properties, chemical reactivity, and spectroscopy to characterize a compound.

3. List the types of spectroscopy used in organic chemistry, and what kind of information they provide.

# The Electromagnetic Spectrum

1. List the types of light found in the electromagnetic spectrum, and how they affect atoms and molecules.

2. Explain how wavenumbers are used to give the frequency of infrared light, and what range is used for IR spectroscopy.

### The IR Spectrometer and the IR Spectrum

1. Explain the basic components of an IR spectrometer.

- 2. Explain what FTIR means.
- 3. List the methods of taking an IR of a solid or liquid compound.

4. Sketch a sample IR spectrum, labeling the axes and explaining what causes a band to appear.

### **II. Molecular Vibrations**

### Types of Vibrations

- 1. Explain what causes organic molecules to absorb IR light.
- 2. Explain the difference between a stretching and a bending vibration.
- 3. Demonstrate the four bending vibrations of a  $CH_2$  group.

### Factors which affect a band

1. Explain how dipole moment and number of bonds will affect the amount of light absorbed by a bond vibration.

2. Explain why some bonds do not absorb IR light.

3. Explain how the size of the atoms in the bond, the bond order, and the type of vibration affect the frequency of light absorbed by a bond vibration.

#### Regions of the IR Spectrum

1. Explain what the functional group and fingerprint region of the spectrum are, and what they are useful for.

## **III. Identifying Functional Groups**

- 1. Recognize which bonds give useful bands on an IR spectrum.
- 2. List the bands that you should look for in the spectrum of each functional group.
- 3. Identify the area of the spectrum where you should look for a particular band.
- 4. Identify the important bands and functional group of the spectrum of an unknown compound.

# IV. Interpreting an IR Spectrum

- 1. Identify important differences between spectra of compounds with different functional groups.
- 2. Use IR spectra to evaluate the success of a reaction.