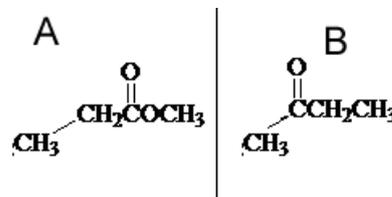


Friday Worksheet
IR spectroscopy

Name:

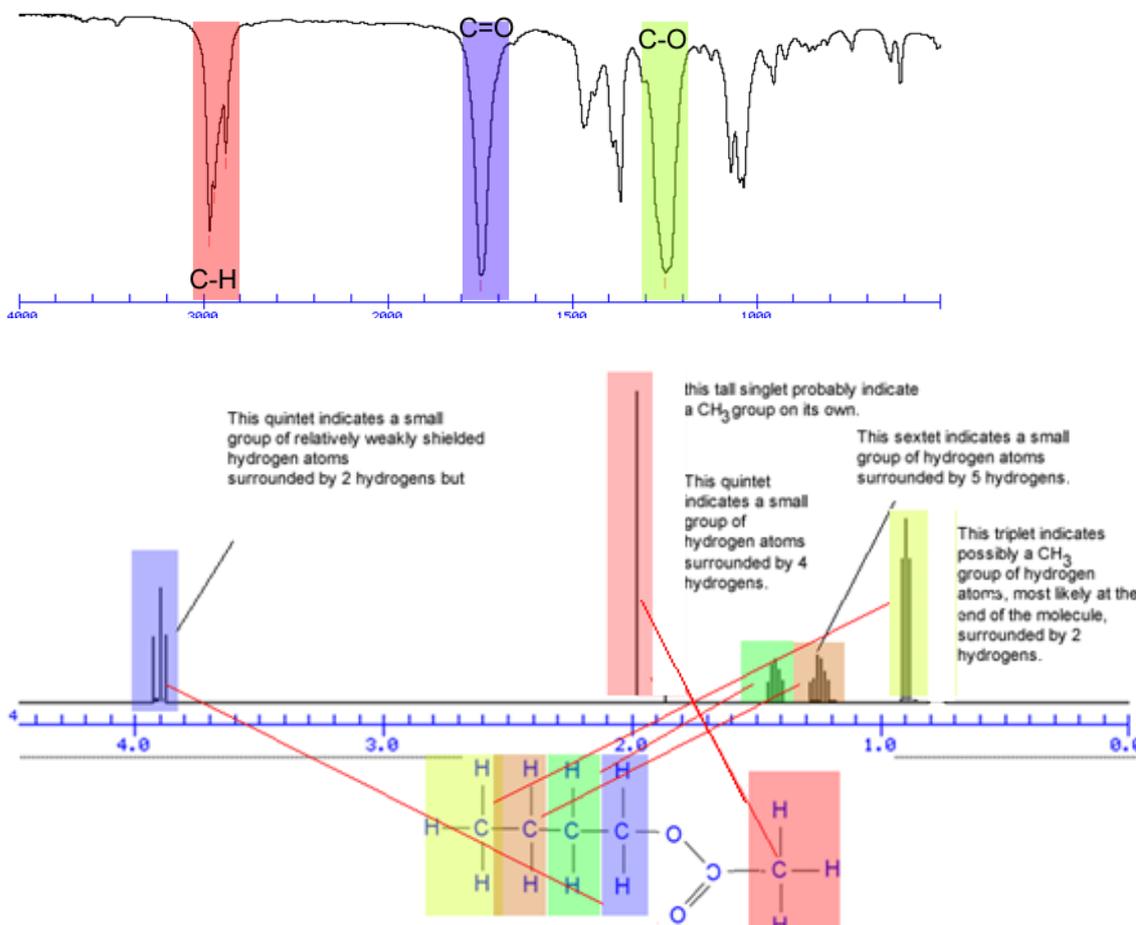
- 1) Consider the following statements.
 - i. Valence electrons in metal atoms absorb energy and are excited to higher energy levels.
 - ii. Valence electrons in metal atoms release energy as they return from high energy levels to low energy levels.
 - iii. Nucleons absorb radio waves and are excited to higher energy spin states.
 - iv. Bonds present in a molecule stretch or bend by absorbing energy of specific wavelength.
 - v. Bonding and non-bonding valence electrons only absorb energy and are promoted to a higher energy state.
 - vi. The energy absorbed depends on the mass of the atoms forming a bond.
 - a) Which of the statements above relate to IR spectroscopy ? *iv, v*
 - b) Which of the statements above relate to NMR spectroscopy ? *iii*
 - c) Which of the statements above relate to UV-visible spectroscopy ? *vi*

- 2) How can IR spectroscopy be used to distinguish between compounds "A" and "B" shown on the right?



The IR spectrum for "A" will have a strong absorbance at 1000 -1300 indicating an C-O bond and "B" should not.

- 3) A compound has the molecular formula C₆H₁₂O₂. Its IR and ¹HNMR spectra are shown below.



a) Identify the bonds present in the molecule?

Strong absorption around 3000 indicates C-H bonds while strong absorption at 1750 indicates a C=O bond. Another strong absorption at 1250 should indicate the presence of possibly a C-O bond.

The fact that we have no absorption in the region 2500 – 3300 (O-H of acid) indicates that this is not an organic acid.

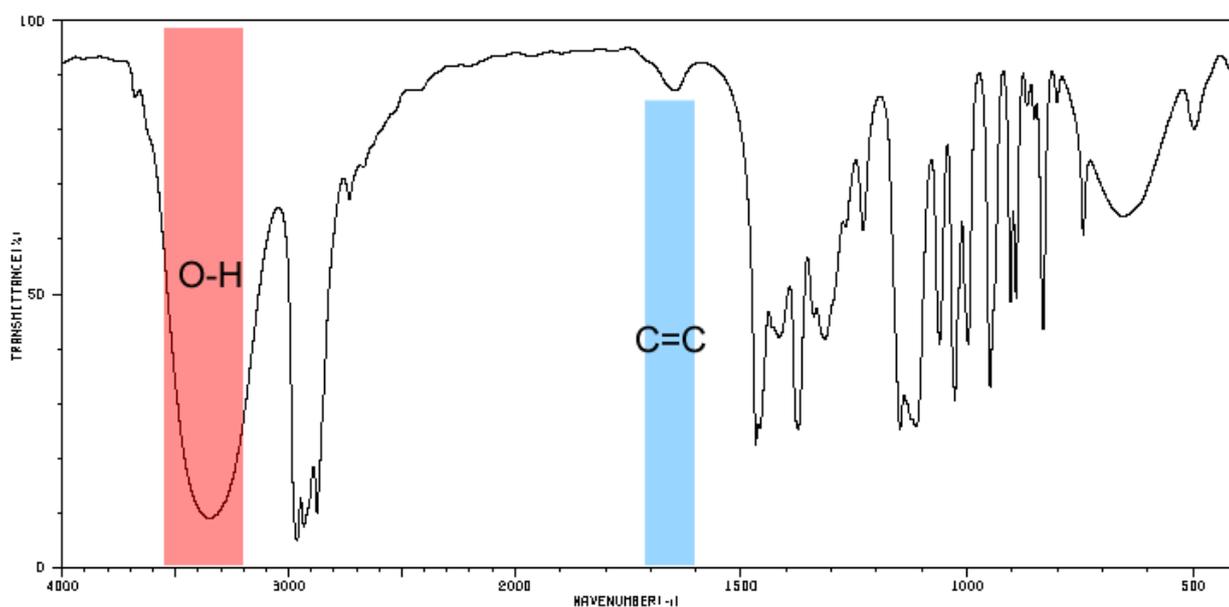
So from the IR spectrum we can deduce that it is possibly some kind of ester. The structure of which should be easily derived from the ^1H NMR spectrum.

From the ^1H NMR spectrum we see 5 hydrogen environments.

b) Give a possible structural formula for the compound

Shown above

4) Below is the IR spectrum of an organic molecule.



A scientist suspects that it belongs to either of three molecules

- i) $\text{CH}_3\text{CHOHCH}_2\text{CH}_2\text{CH}_3$
- ii) $\text{CH}_3\text{CHCHCH}_2\text{CH}_2\text{OH}$
- iii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$

Which molecule is likely to form the IR spectrum above? Discuss with reference to the IR spectrum.

Looking at the IR spectrum we see a broad absorption band at wavelength 2200 – 2550 indicating an O-H

We also see no strong absorption in the region of 1610 - 1680 to indicate C=C bonds.

There is also no strong absorption in the region 1670 -1750 to indicate a C=O bond.

The spectrum is of pentan-2-ol (option i)