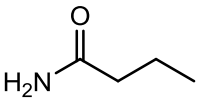
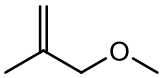
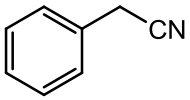
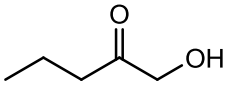
In an IR spectrum the absorbance of energy at characteristic frequencies and with characteristic intensity can be used to determine the presence of functional groups that absorb energy at that frequency. IR analysis will therefore require you to combine your knowledge of the bonds in various functional groups with an understanding of where these absorptions appear in the IR spectrum.

1. a) For each of the following compounds, draw a structural isomer that changes the functional groups in the molecule. b) Name all the functional groups in each isomer. c) Indicate the major absorbances you would expect to find in the IR spectrum for each isomer, and highlight how you could use IR to tell them apart.



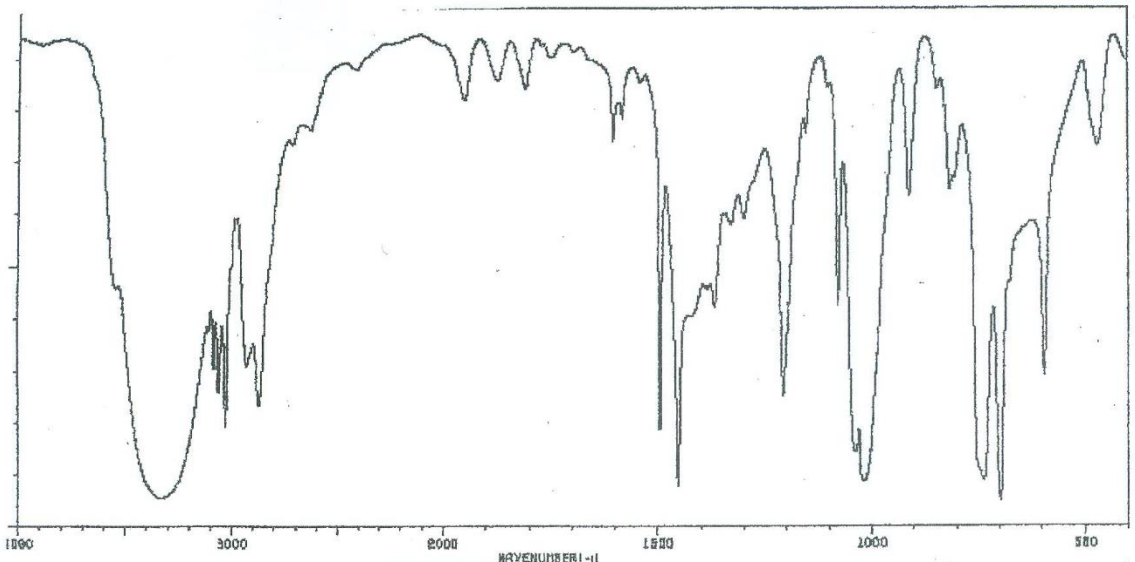


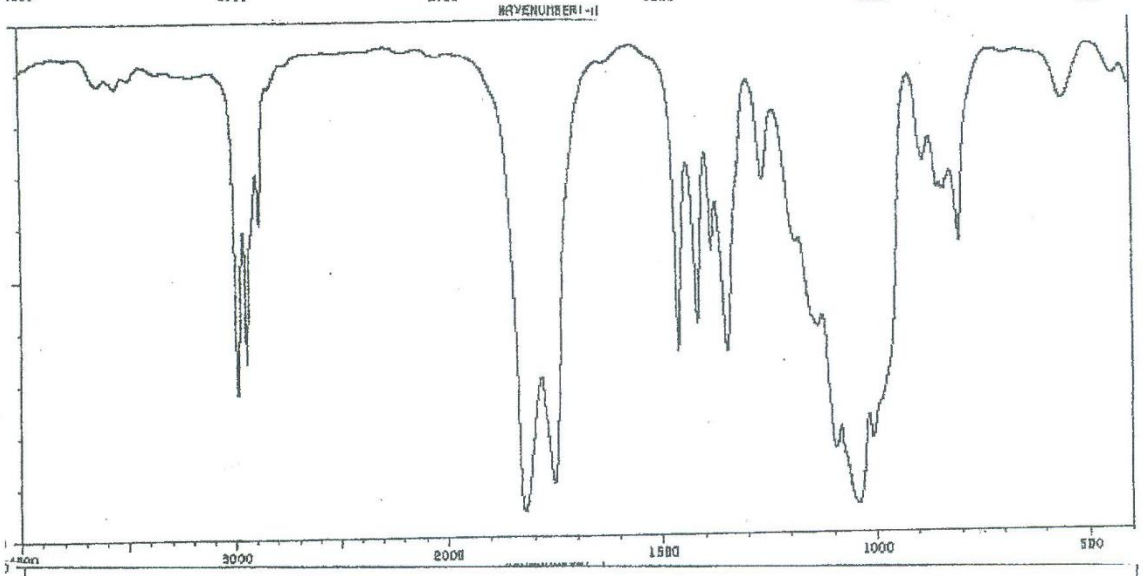


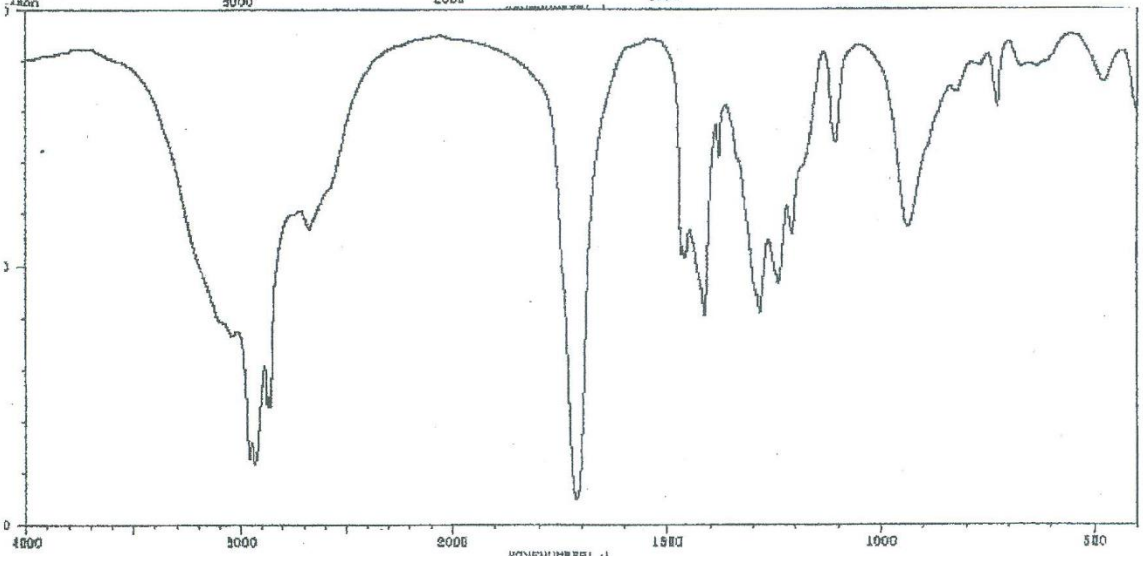


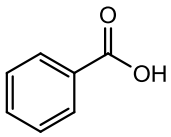
2. You find a bottle on the shelf only labeled C_3H_6O. You take an IR spectrum of the compound and find major peaks at 2950, 1720, and 1400 cm^{-1}. Draw a structure for the molecule that might be the compound in the bottle.

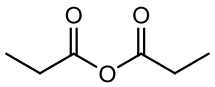
3. Match the IR spectra below with one of the compounds to the right. Label 3 peaks (in each spectrum) that helped you derive your answer. Don't forget to label each peak as a stretch or bend, the bond the peak corresponds to, and the functional group.

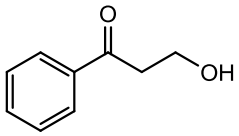


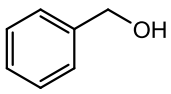


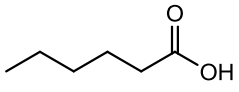


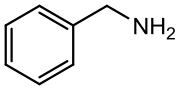






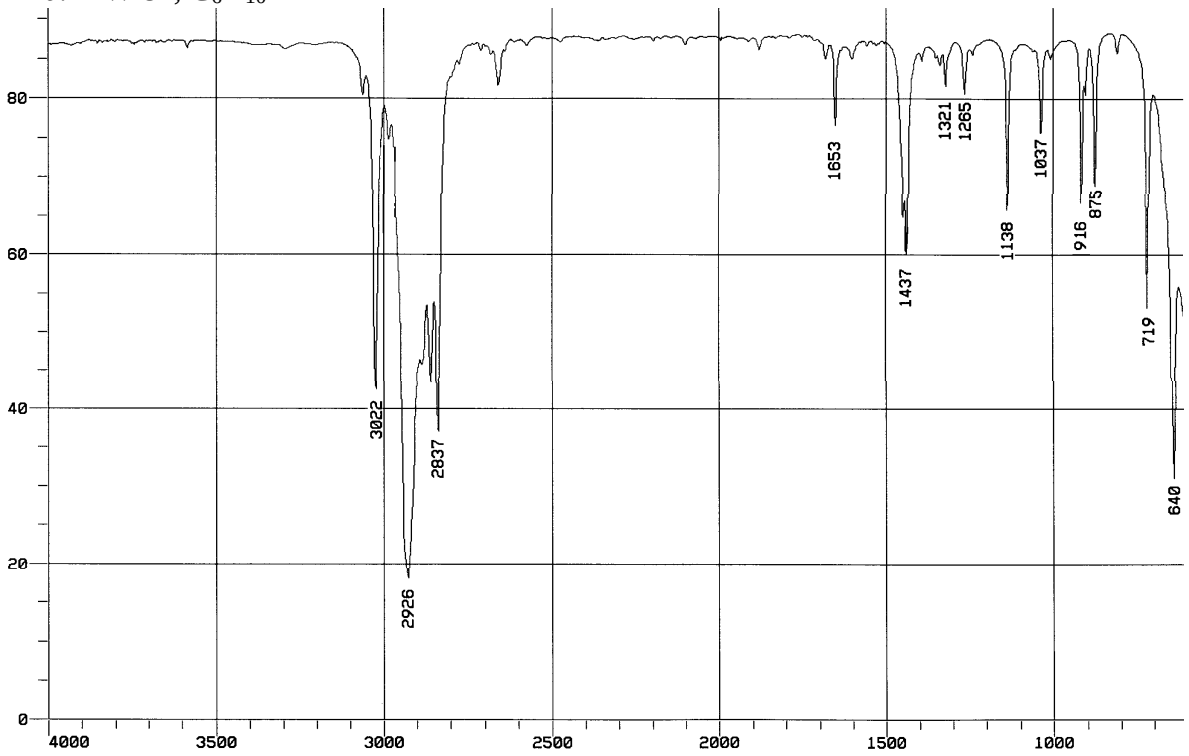




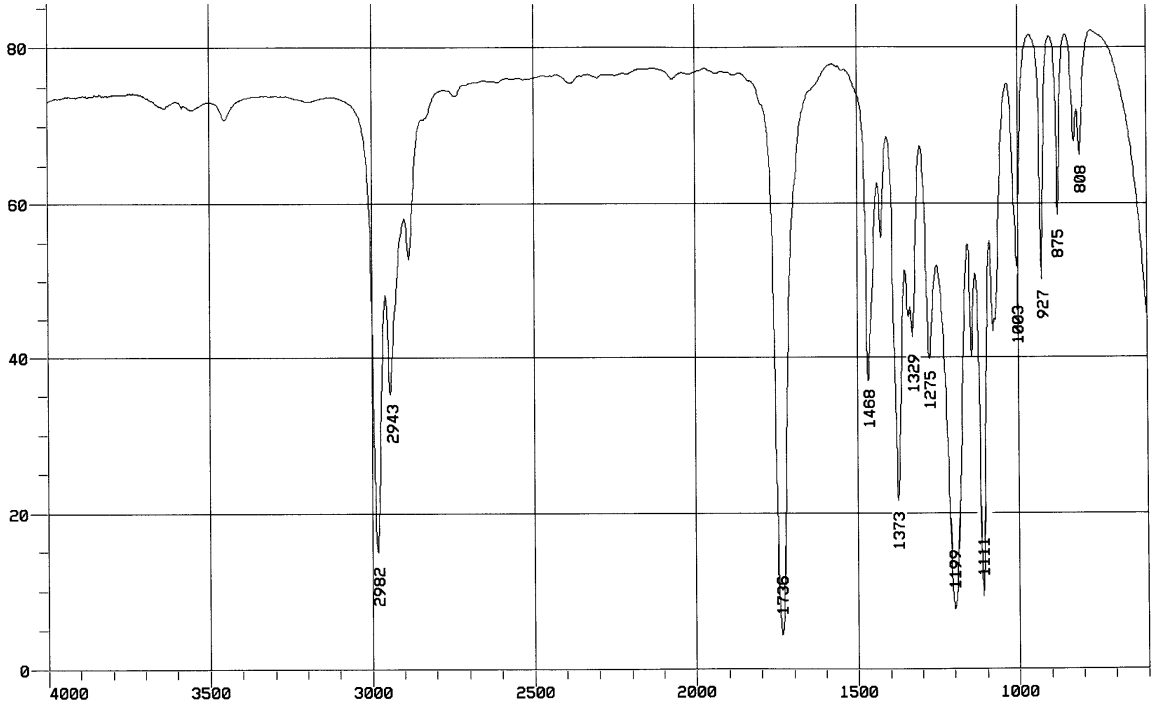


4. For each example below, draw at least one possible isomer that is consistent with the molecular formula and the associated IR spectrum.

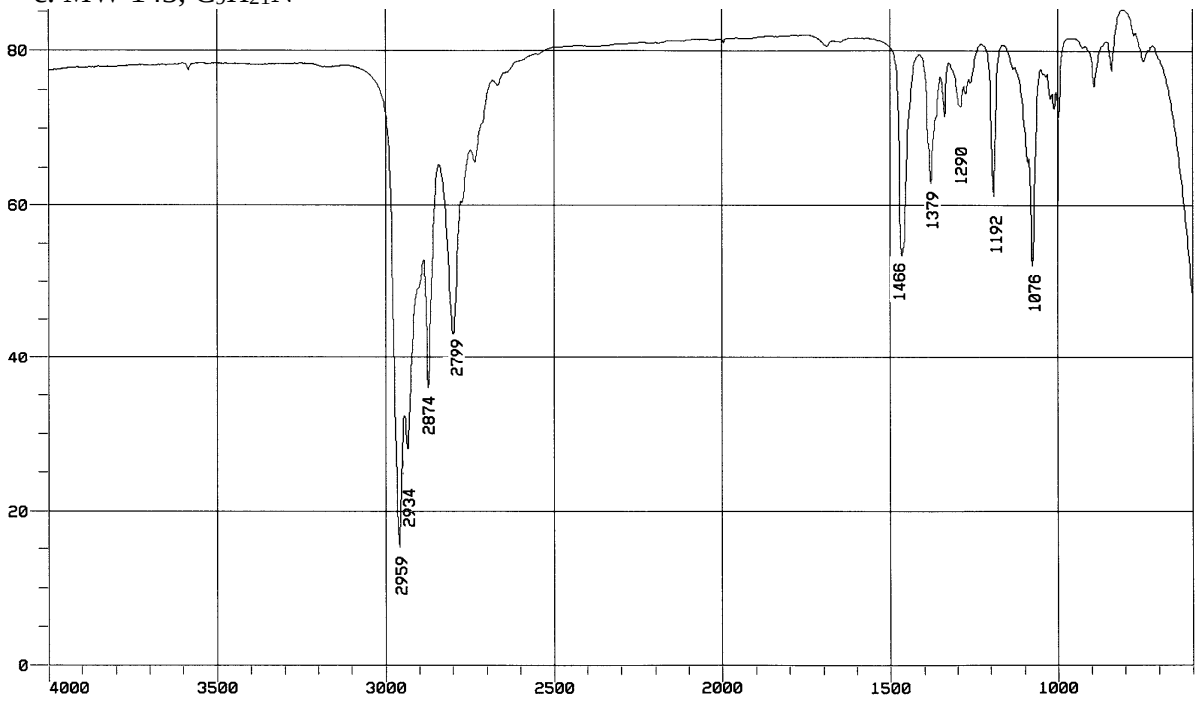
a. MW 82, C_6H_{10}



b. MW 116, $C_6H_{12}O_2$



c. MW 143, $C_9H_{21}N$



5. The product of the reaction below gives the IR spectrum shown. Although you are unfamiliar with the reaction, use your knowledge of IR spectroscopy to predict a likely product. (Note: the number of carbon atoms in the product is the same as in the starting material.)