Quiz - April 19, 2001

Name (PRINT) ____________________________
Answer Key
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I have neither given nor received aid on this quiz (SIGN) ____________________________
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There is 1 page and 15 pts on this quiz. Please read each question carefully before answering.

1. (9 pts) All of the following compounds absorb infrared radiation between 1600 and 1800 cm\(^{-1}\). In each case,
   (i) Show which stretching vibration between which bonds for each compound absorbs in this region.
   (ii) Circle which compound of each pair absorbs more strongly in the 1600 and 1800 cm\(^{-1}\) region.

   (a) \(\text{H} \equiv \text{CH}_2\text{CH}_3\) or \(\text{CH}_2\text{CH}_3\equiv \text{O}\)

   \(\text{C=C stretch}\)

   (b) \(\text{H} \equiv \text{CH}_2\text{CH}_3\) or \(\text{CH}_2\text{CH}_3\equiv \text{HN}\)

   \(\text{C=C stretch}\)

   (c) \(\text{H} \equiv \text{CH}_2\text{CH}_3\) or \(\text{CH}_3\equiv \text{C}\equiv \text{CH}_3\)

   \(\text{C=C stretch}\)

   (the intensity of infrared vibration is related to the change in dipole moment during the vibration)

2. (6 pts) Describe the characteristic infrared absorption frequencies that would allow you to distinguish between the following pairs of compounds.

   (a) \(\text{OH}\) and \(\text{OCH}_3\)

   The O-H peak for cyclohexanol will appear as a broad absorption around 3300 cm\(^{-1}\) and sp\(^3\) C-H absorptions between 2800 - 3000 cm\(^{-1}\), and methyl cyclopentyl ether will only have C-H absorptions between 2800 - 3000 cm\(^{-1}\).

   (b) \(\text{O}\equiv \text{H}\) and \(\text{CH}_2\text{CH}_3\equiv \text{O}\)

   The aldehyde will have two sp\(^2\) C-H stretches around 2700 and 2800 cm\(^{-1}\), while the ketone will only have sp\(^3\) C-H stretches between 2800 and 3000 cm\(^{-1}\). Both compounds will have a strong C=O stretch in the 1710 cm\(^{-1}\) range.

   (c) \(\text{H}_3\text{CH}_2\text{CH}_2\text{C}\equiv \text{H}\) and \(\text{H} \equiv \text{CH}_2\text{CH}_3\)

   The alkyne will have a triple-bond C≡C stretch around 2100 - 2200 cm\(^{-1}\), and the alkene will have a C=C stretch at 1650 cm\(^{-1}\). Since both are terminally unsaturated C-C bonds, there should be some intensity for the unsaturated C-C stretch in each case.