Answers to Problem 81, Chemistry 301X - 2006

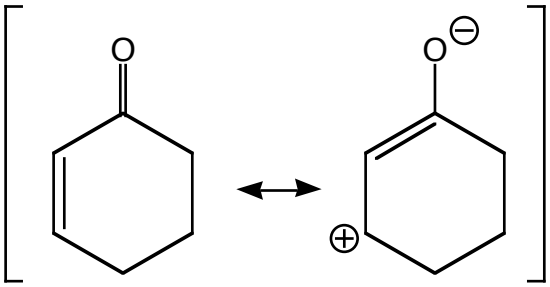
(a) There will be 7 signals for the cis molecule and 10 for the trans compound.

(b) You can't. In particular, there is no visible *J* between equivalent hydrogens!

(c) Cyclopropane can be distinguished from the others by its high-field (ca. 0- 1 ppm) chemical shift, but there is no easy way to tell cyclobutane from cyclopentane. These compounds will all show singlets in the hydrogen NMR, by the way.

(d) The vinyl hydrogen adjacent to the C=O will be a doublet in the conjugated molecule (there may be additional very small allylic coupling). Both vinyl hydrogens in the unconjugated molecule will be much more complex multiplets.

(e) In the conjugated molecule, the β vinyl hydrogen will be far downfield (see the polar resonance form).



(f) A conjugated carbonyl will be at lower frequency (1691 cm^{-1} for cyclohexenone) than the unconjugated carbonyl (ca. 1720 cm^{-1}).