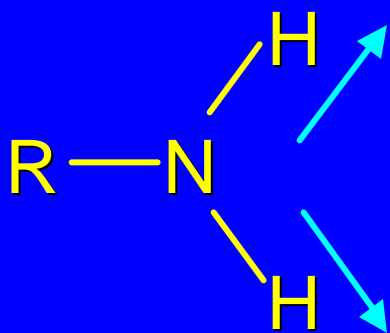


Section 22.20
Spectroscopic Analysis of Amines

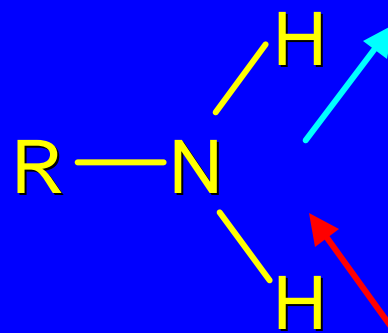
Infrared Spectroscopy

the N—H stretching band appears in the range
3000-3500 cm^{-1}

primary amines give two peaks in this region, one
for a symmetrical stretching vibration, the other for
an antisymmetrical stretch



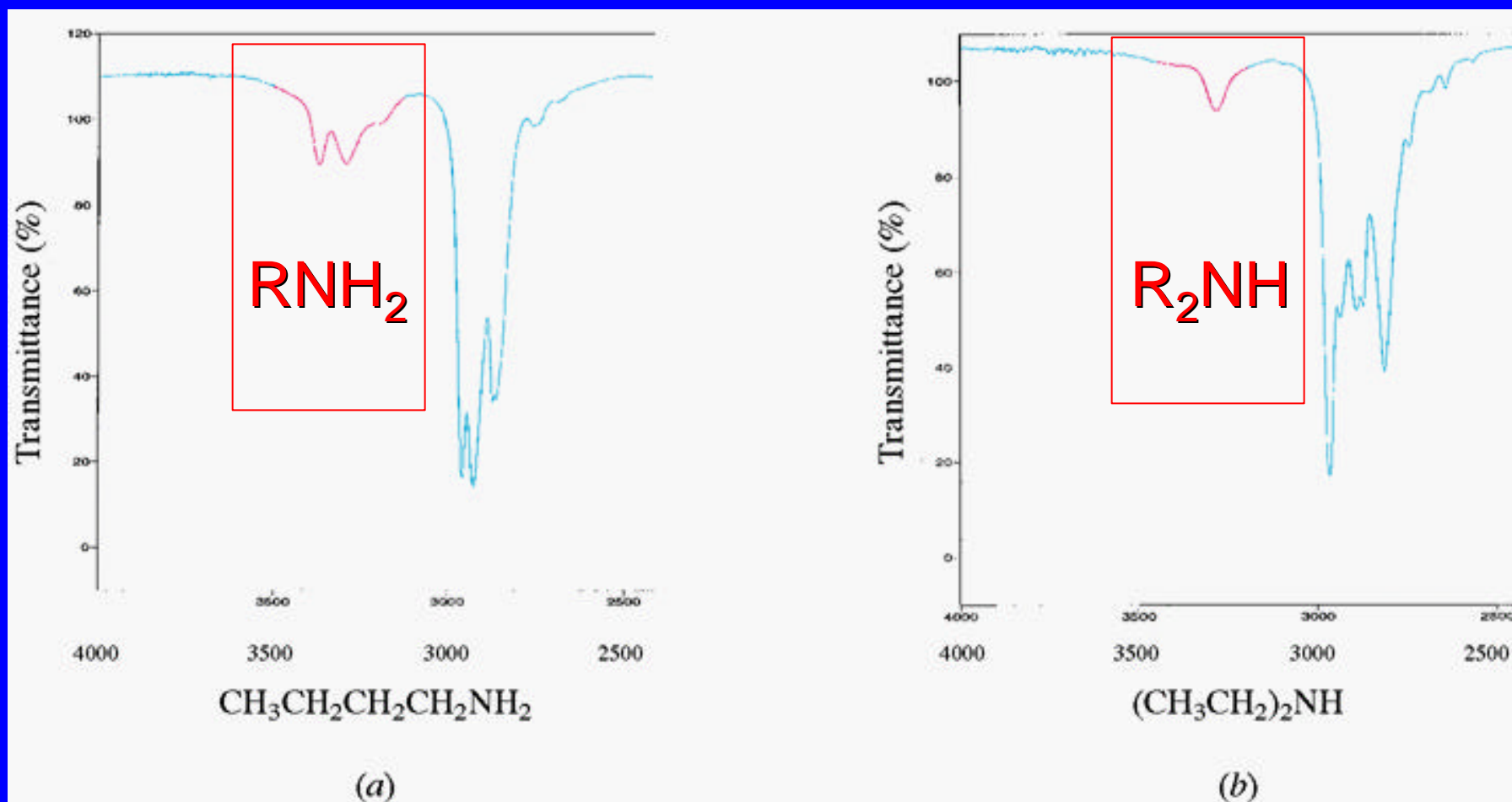
symmetric



antisymmetric

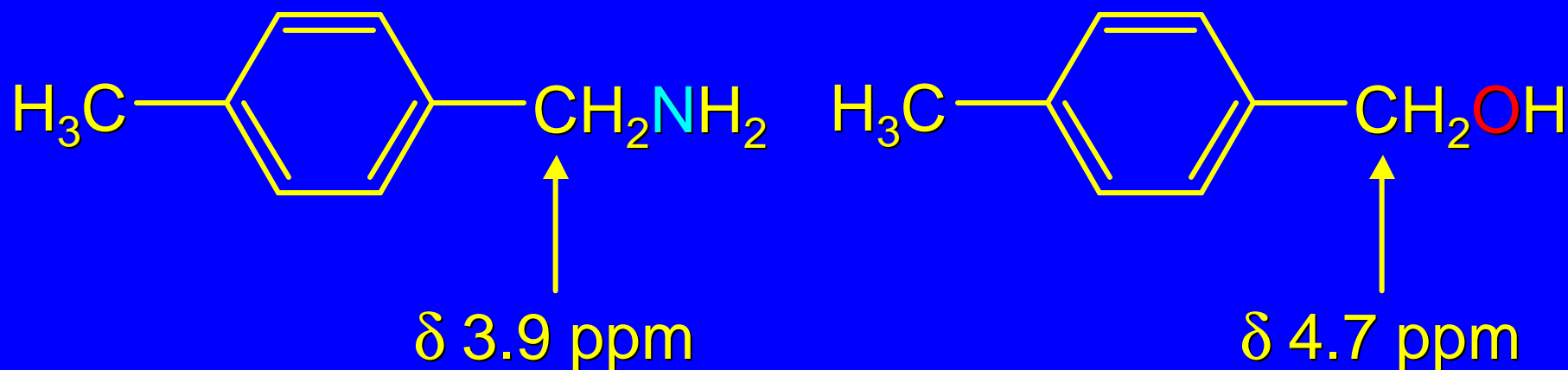
Infrared Spectroscopy

primary amines give two N—H stretching peaks,
secondary amines give one



^1H NMR

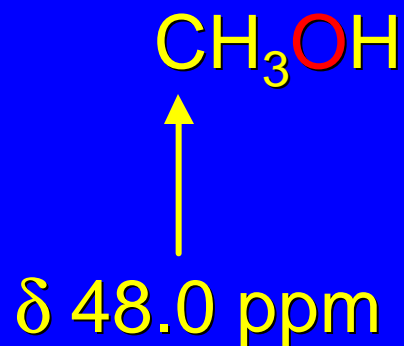
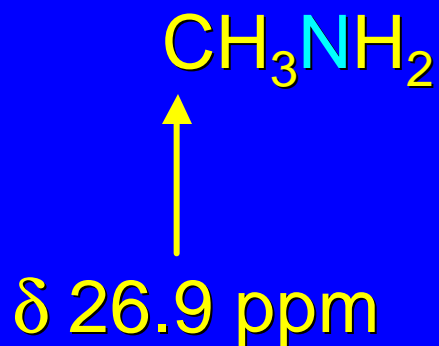
compare chemical shifts in:



$\text{N}-\text{C}-\text{H}$ is more shielded than $\text{O}-\text{C}-\text{H}$

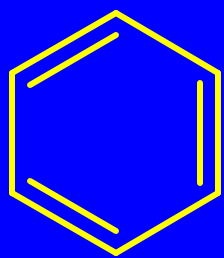
^{13}C NMR

Carbons bonded to N are more shielded than those bonded to O.



UV-VIS

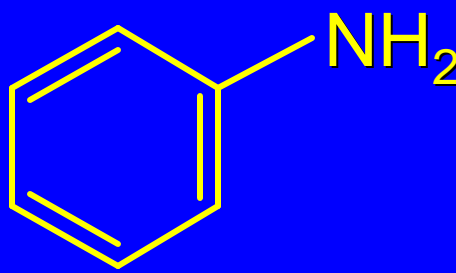
An amino group on a benzene ring shifts λ_{max} to longer wavelength. Protonation of N causes UV spectrum to resemble that of benzene.



λ_{max}

204 nm

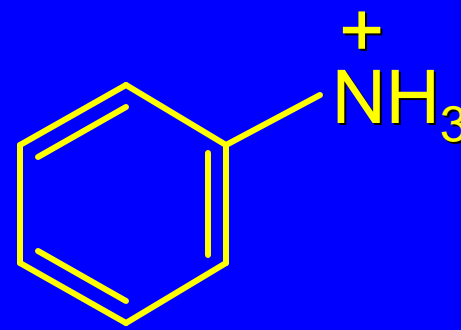
256 nm



λ_{max}

230 nm

280 nm



λ_{max}

203 nm

254 nm

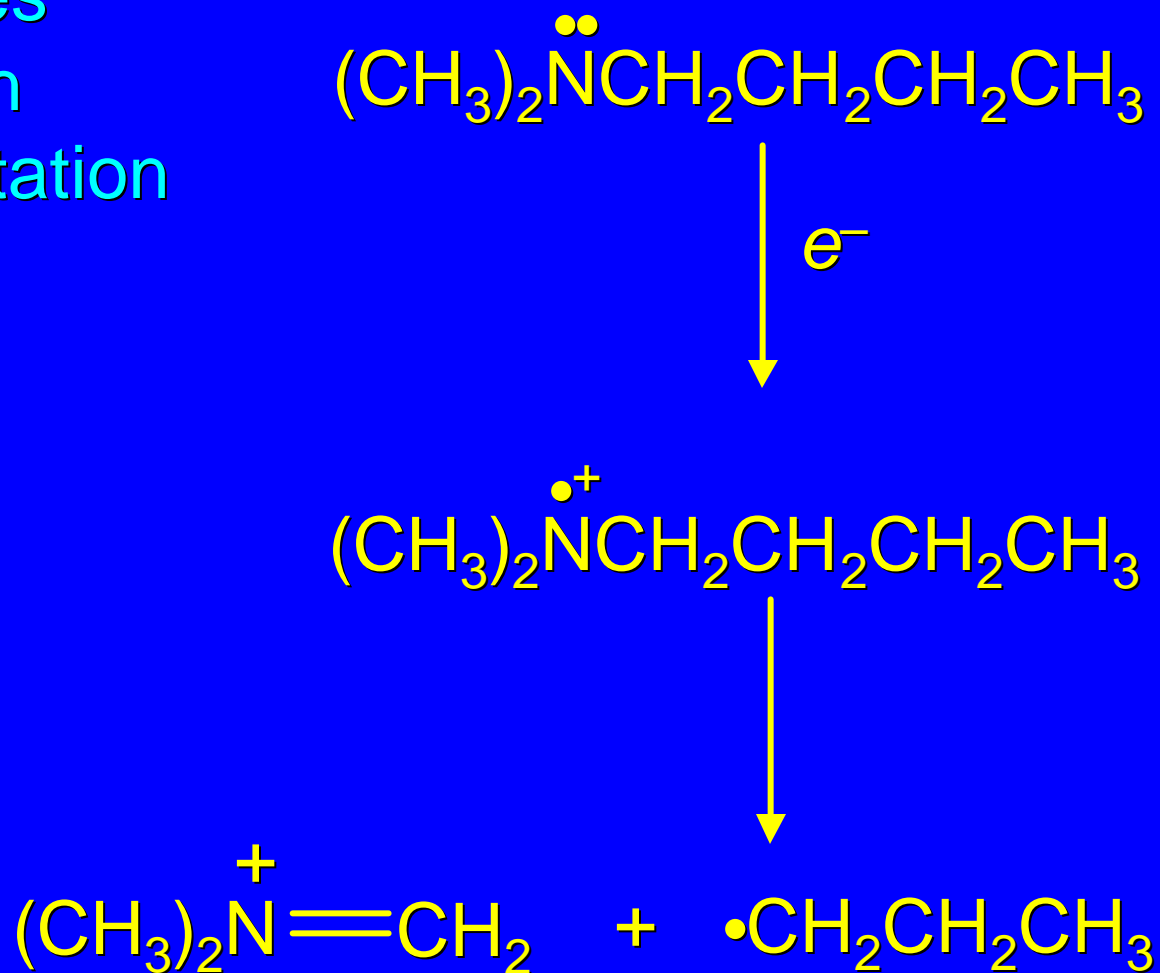
Mass Spectrometry

Compounds that contain only C, H, and O have even molecular weights. If an odd number of N atoms is present, the molecular weight is odd.

A molecular-ion peak with an odd m/z value suggests that the sample being analyzed contains N.

Mass Spectrometry

Nitrogen stabilizes carbocations, which drives the fragmentation pathways.



Mass Spectrometry

Nitrogen stabilizes carbocations, which drives the fragmentation pathways.

