

IR Spectroscopy — Answer Key

Ten carefully checked problems • Spectroscopy • Instructor copy

INSTRUCTOR ANSWER KEY — Correct answers and explanations appear in red.

1. Where is the wavenumber axis usually highest on a standard IR plot?

Answer: At the left edge; IR plots commonly run ~ 4000 to 400 cm^{-1} from left to right.

2. What structural feature frequently gives a strong band near 1715 cm^{-1} ?

Answer: A carbonyl ($\text{C}=\text{O}$) stretch; exact position depends on conjugation and functional group.

3. What group may give a broad peak centered around 3400 cm^{-1} ?

Answer: An O–H stretch in an alcohol or phenol; N–H may also occur there but is often sharper.

4. What combination strongly suggests a carboxylic acid?

Answer: Very broad acid O–H absorption $\sim 2500\text{--}3300\text{ cm}^{-1}$ plus a strong $\text{C}=\text{O}$ band.

5. What bond commonly absorbs near 2250 cm^{-1} ?

Answer: $\text{C}\equiv\text{N}$ (nitrile), often a relatively sharp absorption.

6. What does a downward feature mean on a % transmittance IR graph?

Answer: Less light transmitted: the sample absorbs at that wavenumber.

7. Give the approximate range of the fingerprint region.

Answer: Approximately below 1500 cm^{-1} .

8. Why might an O–H peak be broad?

Answer: Intermolecular hydrogen bonding broadens the range of O–H stretching frequencies.

9. Can IR by itself always distinguish two closely related isomers?

Answer: No; use the full spectral fingerprint and complementary evidence such as NMR or GC.

10. What additional feature could help distinguish an aldehyde from a ketone?

Answer: Aldehydic C–H bands often appear near ~ 2720 and $\sim 2820\text{ cm}^{-1}$, although they may be weak or obscured.