

Spectroscopy as a Measurement Model

g11_u06_w22

Purpose and boundary

Use original fictional paper spectra and calibration data only. No instruments, samples, light sources, chemicals, or identification/health decisions are requested.

Targets: I can read a stated absorbance model, calculate a concentration estimate, compare peak evidence, and name ambiguity. **Vocabulary:** absorbance, wavelength, calibration, peak, spectral feature, ambiguity.

Prerequisites: linear models, graphs, units, evidence limits.

For items 4–11 use the fictional model $A = 0.400C + 0.020$, where A is absorbance units and C is mg L^{-1} , at one stated wavelength. This is a calculation model only.

1. Define absorbance as a measurement-model quantity, not a substance identity.

2. What does a wavelength label describe?

3. Why can two different materials share a similar spectral feature?

4. Find A for $C = 2.00 \text{ mg L}^{-1}$.

5. Find C for $A = 0.620$.

6. What does the 0.020 intercept represent in the stated model?

7. A blank has $A = 0.023$. Compare it to the modeled intercept.

8. An unknown has $A = 0.300$. Find its model estimate.

9. A card reports a calibration range of 0.00 to 2.00 mg L^{-1} . Is item 5 interpolated or extrapolated?

10. A card has $A = 1.00$. Find its model estimate and label the limitation.

11. A fictional spectrum has peaks at 430 and 610 nm; a reference card has peaks at 430 and 620 nm. State one supported comparison and one unsupported identity claim.

12. Why is peak position alone weaker evidence than several matched features under stated conditions?

13. Two repeated cards estimate 1.40 and 1.60 mg L⁻¹. Find their mean and half-range.

14. Explain why half-range is not a complete uncertainty analysis.

15. A student says larger absorbance always means a more concentrated unknown. Name one stated-model condition required before accepting that claim.

16. A calibration line fits one wavelength. Why might it not transfer to another wavelength?

17. Identify one missing comparison that limits a claim based on one peak.

18. A card says a feature is consistent with a reference. Translate that phrase into a careful evidence statement.

19. Explain why a model concentration estimate is not a diagnosis, compliance, or safety conclusion.

20. Write a two-sentence bounded conclusion from a fictional absorbance estimate and a stated spectral limitation.
