

Sampling, Standards, Blanks, and Calibration

g11_u06_w21

Purpose and boundary

Use original fictional paper data only. No sample collection, chemical handling, calibration, instrument operation, or environmental/health determination is requested.

Targets: I can identify a blank, standard, and sampling limit; use a stated calibration line; and limit a conclusion to the supplied data. **Vocabulary:** analyte, blank, standard, calibration, residual, sampling bias. **Prerequisites:** linear graphs, slope, units, uncertainty.

For items 5–12 use the fictional calibration model $S = 2.50C + 0.10$, where S is signal units and C is mg L^{-1} . It is a paper model, not an operating instruction.

1. Define an analyte in a measurement-model context.

2. What question can a blank help ask about a listed signal?

3. What role does a standard play in a calibration model?

4. Distinguish a random sample from a representative sample.

5. Find S for $C = 1.20 \text{ mg L}^{-1}$.

6. Find S for $C = 0.00 \text{ mg L}^{-1}$. What model feature does this show?

7. A fictional unknown card lists $S = 3.10$. Solve for C .

8. A blank card lists $S = 0.12$. Compare it with the modeled zero-concentration signal.

9. A standard card has $C = 2.00 \text{ mg L}^{-1}$ and observed $S = 5.00$. Find its residual, observed minus modeled.

10. Explain why one residual cannot prove the calibration model is universally correct.

11. A card is outside the stated calibration range 0.00 to 2.00 mg L⁻¹. Why is a direct linear extrapolation limited?
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12. A listed signal is 6.35. Compute the model estimate and label it extrapolated.
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13. Two fictional subsamples have estimates 0.80 and 1.20 mg L⁻¹. Find their mean.
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14. Name one sampling feature that could make that mean unrepresentative of a broader source.
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15. A student says a nonzero blank proves analyte is present. Correct the claim.
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16. A paper plan includes standards but no blank. What measurement question remains weakly checked?
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17. A paper plan includes a blank but only one standard. What model question remains weakly checked?
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18. Give one supported and one unsupported claim from a fictional estimate of 1.20 mg L⁻¹.
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19. Explain why signal units and concentration units must remain distinct in the equation.
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20. Write a two-sentence bounded conclusion using a calibration estimate and one stated limitation.
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