

Uncertainty, Precision, Accuracy, and Propagation

Student Worksheet | g11_u01_w02

Scope: Use only these original fictional data cards. No measurement or chemical handling is requested. Report a reasonable result and explain the model limit.

1. Readings are 14.2, 14.4, and 14.3 mL. Find mean, range, and half-range.

2. Report item 1 as a mean with simple half-range uncertainty.

3. A reference is 14.00 mL. Is item 1's mean accurate within its simple uncertainty? Defend your answer.

4. Set A is 5.01, 5.02, 5.00 g; set B is 4.80, 4.81, 4.79 g against a 5.00 g reference. Which is more precise and which is more accurate?

5. Compute $x + y$ for $x = 12.4 \pm 0.1$ cm and $y = 3.2 \pm 0.1$ cm using a conservative absolute-uncertainty addition rule.

6. Compute $x - y$ for the same values and rule.

7. A model uses $m = 2.50 \pm 0.03$ g and $V = 1.20 \pm 0.02$ mL. Calculate m/V .

8. Calculate the relative uncertainties for m and V in item 7.

9. For a conservative product/quotient estimate, add item 8's relative uncertainties and report density uncertainty.

10. Why is the uncertainty in item 9 a model estimate rather than a complete probability statement?

11. Calculate $A = 3.0 \text{ cm} \times 4.0 \text{ cm}$ and state the limiting displayed precision.

12. A calibration line is $y = 0.080x + 0.010$ and a signal is 0.250 ± 0.005 . Solve for x .

13. Use signal-only propagation for item 12: $\Delta x = \Delta y / 0.080$.

14. Explain why uncertainty in slope/intercept would matter before treating item 13 as final.

15. Two repeated model readings have the same mean but ranges 0.02 and 0.20 units. What conclusion is justified?

16. A result changes from 2.00 to 2.04 when an input changes by 0.02. State a local sensitivity estimate.

17. A report says $6.000 \pm 0.001 \text{ g}$, but its only input is 6.0 g. Diagnose the mismatch.

18. Compare random variation and a systematic offset in one sentence each.

19. A value is outside a reference interval. List two non-blaming checks before discarding it.

20. Write a conclusion for a fictional data card that includes a result, uncertainty, and boundary without claiming a cause.
