

# Quantitative Data Integration and Uncertainty

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Interpret original fictional chemistry data cards. No measurement, laboratory work, device operation, intervention, or real-world decision is requested.

**Data cards.** Card A reports 12.1, 12.4, and 12.2 units. Card B reports  $8.0 \pm 0.5$  and  $8.7 \pm 0.5$  units. Card C gives mass  $2.50 \pm 0.05$  g and volume  $1.00 \pm 0.02$  mL. Card D gives 4.8 and 5.2 units for two labeled model groups.

1. What does a unit label communicate?

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2. Find the mean of Card A.

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3. Find the range of Card A.

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4. Why is a mean not a complete description of data?

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5. Write Card A's mean to a sensible decimal place.

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6. What does the plus/minus label on Card B mean in a model?

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7. Write Card B's first interval.

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8. Write Card B's second interval.

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9. Do the Card B intervals overlap? State the overlap if any.

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10. Does overlap alone prove the two model groups are the same?

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11. Calculate Card C's central density.

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12. Estimate Card C's relative uncertainty using addition of relative uncertainties.

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13. State Card C's density with an approximate absolute uncertainty.

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14. What condition must be shared before comparing two density cards?

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15. Find the average of Card D's two values.

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16. Find their percent difference using their average as denominator.

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17. Name one source of model uncertainty not captured by arithmetic.

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18. What would a control card help distinguish?

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19. Write one bounded observation supported by Card A.

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20. Write a two-sentence conclusion that reports a result and one limit.

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