Laboratory Measurement, Precision & Error

INSTRUCTOR / SELF-STUDY ANSWER KEY

Answers and reasoning appear in red. Use these to discuss why incorrect choices are incorrect.

Part A — Concept checks

1. **Measurements clustered together but far from a reference are…**

   Answer: B. precise but inaccurate — Repeatability can be high despite systematic bias.

2. **What is percent error when measured = 9.0 and accepted = 10.0?**

   Answer: C. 10% — $|9 - 10|/10 \times 100\% = 10\%$.

3. **Which is an example of systematic error?**

   Answer: B. consistent zero offset in a balance — A systematic offset creates repeatable bias.

4. **Which record best preserves an electronic balance display of 2.340 g?**

   Answer: D. 2.340 g — Record the digits actually displayed, when the reading is stable.

5. **Which is a measure of repeatability?**

   Answer: A. precision — Precision concerns the spread of repeated measurements.

6. **Why should raw laboratory data be preserved?**

   Answer: B. to permit transparent analysis and correction — Traceable raw data support reproducible evaluation.

Part B — Application and explanation

7. A measured density is 0.980 g/mL and the accepted value is 1.000 g/mL. Find percent error.

   Model solution: Percent error = $|0.980 - 1.000| / 1.000 \times 100\% = 2.0\%$. Final answer: 2.0%

8. Explain why this guideline matters, with an example of what could go wrong if you ignore it: Do not confuse uncertainty with an excuse to edit observations. Always preserve raw readings and document any correction.

   Model explanation: Do not confuse uncertainty with an excuse to edit observations. Always preserve raw readings and document any correction. Example/check: Record all certain digits plus one estimated digit for an analog scale when appropriate. Digital displays report the instrument resolution.

REFERENCE RELATIONSHIP

percent error = $|\text{experimental} - \text{accepted}| / |\text{accepted}| \times 100\%$