Name _____ Date _____ Class _____

3.1 MEASUREMENTS AND THEIR UNCERTAINTY

Section Review

Objectives

- Convert measurements to scientific notation
- Distinguish among the accuracy, precision, and error of a measurement
- Identify the number of significant figures in a measurement and in the result of a calculation

Vocabulary

- measurement
- scientific notation
- accuracy
- precision
- accepted value
- experimental value
- error
- percent error
- significant figures

Key Equations

- Error = experimental value − accepted value
- Percent error = $\frac{|\text{error}|}{\text{accepted value}} \times 100\%$

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

The __1__ of a measurement describes how close the measurement comes to the true value. The __2__ of a measurement depends on its reproducibility. An __3__ is a value measured in the lab. __4__ is calculated by subtracting the __5__ from an experimental value. Percent error is calculated by dividing the __6__ of the error by the accepted value and then multiplying by __7__.

Large and small numbers are more easily handled when expressed in __8__. Significant figures in a measurement include all of the digits that are __9__ plus a last digit that is __10__.

1. accuracy
2. precision
3. experimental value
4. error
5. accepted value
6. absolute value
7. 100%
8. scientific Notation
9. known
10. estimated

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Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

ST **11.** Scientific notation is used to express large numbers in convenient form.

AT **12.** Significant figures include all the digits that can be known accurately plus a last digit that must be estimated.

AT **13.** An answer to calculations done with scientific measurements cannot be more precise than the least precise measurement.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
b **14.** accuracy	**a.** measure of how close a series of measurements are to one another
e **15.** measurement	**b.** measure of how close a measurement comes to the actual value
a **16.** precision	**c.** digits in a measurement that are known plus one that is estimated
f **17.** scientific notation	**d.** a value determined in the laboratory
d **18.** experimental value	**e.** a quantity that has both a number and a unit
c **19.** significant figures	**f.** a method of expressing numbers as a product of a coefficient and a power of 10.

Part D Questions and Problems

Answer the following questions or solve the following problems in the space provided. Show your work.

20. Give the number of significant figures in the following measurements.

a. 3.85×10^{-3} dm — **a.** 3

b. 17.30 cm^3 — **b.** 4

c. 0.0037 mm — **c.** 2

21. Perform the following operations and give the answers in standard exponential form with the correct number of significant figures.

a. 37.2 mL + 18.0 mL + 380 mL = 4.35×10^2 mL

b. 0.57 cm × 0.86 cm × 17.1 cm = 8.4 cm^3

c. $(8.13 \times 10^4) \div (3.8 \times 10^2) = 2.1 \times 10^2$