Significant Digits

When are digits significant (important)?

1. Non-zero digits are always significant. 44, 36.1

2. Zeroes to the right of a decimal and before significant digits **are not** significant. 0.00032 has 2 significant digits.

3. Zeroes placed between other digits are significant. 30004 has 5 significant digits.

4. Zeroes placed after other digits behind a decimal are always significant. 3.4600 has 5 significant digits.

5. Zeroes at the end of a number and to the left of a decimal may or may not be significant. 7800 may have 2, 3, or 4 significant digits. In these cases use scientific notation. 7.8×10^3 has 2 significant digits, 7.800×10^3 has 4.

Significant Digits

Determine the number of significant digits in each of the following measurements:

0.0<u>2400</u> meters

has 4 significant digits

40.5 kilograms

has 3 significant digits

2.70×10^{7}

has 3 significant digits

Significant Digits

Example 1

Marcus combines 4.32 grams of salt with 5.746 grams of salt. What is the total weight in grams with the correct number of significant digits?

Step 1

Add the two amounts.

$$4.32 + 5.746 = 10.066$$

Step 2

Determine the correct number of significant digits.

Step 3

Round to two decimal places.

10.066 rounds to 10.07

Significant Digits

A sprinter runs 100.00 meters in 12.14 seconds. To find the sprinter's average speed (in meters per second), divide the distance she traveled by the time it took. What is the sprinter's average speed with the correct number of significant digits?

THINKING IT THROUGH

How many significant digits does 100.00 have?_____

How many significant digits does 12.14 have? _____

Divide 100.00 by 12.14. Round to 8 decimal places.

How many significant digits should the final answer have? Why?

Round the answer to the appropriate number of significant digits.

The sprinter's average speed is_____

Measurement Error and Units

No measuring tool is perfect. There will always be a difference between the measured quantity and its true value. This is called **measurement error.**

There are two types of measurement error:
absolute error and **relative error**.

Absolute error: the absolute value of the difference between the measured value and the true value in terms of the units of measurement. (inches, feet, pounds, etc.)

Relative error: measures the same difference as a %

Measurement Error and Units

For example, a measurement might be given as 8 cm $\pm$ 0.5 cm. This **does not** mean that the measurement **is** off by 0.5 cm, only that it **could** be. The range of possible measurements is 7.5 cm to 8.5 cm.

To find relative error, divide the absolute error by the initial measurement and multiply by 100.

In this example, $\frac{0.5}{8} \times 100 = 0.0625 \times 100 = 6.25\%$

Measurement Error and Units

Example 1

Eli weighs a bag of flour. The bag weighs 4.8 kg and Eli estimates the absolute error to be 0.4 kg. Give a range of possible weights for the bag and calculate the relative error.

Step 1

Calculate the range.

Measurement Error and Units

Measurement Error and Units