

Significant Figures

- A **Significant Figure** is:
 - Any digit in a measurement that is known with certainty plus one final digit, which is somewhat uncertain or estimated.
 - Example: You measure a mass and the scale shows 15.45 grams, however, the tenths pointer on the scale is halfway between .45 and .46. The uncertain digit here would be 5 one thousandths.
 - Significant Figure is: 15.45**5** grams

Rules for Determining Significant Zeros

Rule 1: Zeros appearing between nonzero digits are significant.

Examples:

40.7 L has three significant figures.

87.009 km has five significant figures.

Rule 2 : Zeros appearing in front of nonzero digits are not significant.

Examples:

0.0095 87 m has four significant figures.

0.0009 kg has one significant figure.

Rule 3: Zeros at the end of a number and to the right of a decimal point are significant.

Examples:

85.00 g has four significant figures.

9.070 000 000 has ten significant figures.

Rule 4: Zeros at the end of a number with no decimal point may or may not be significant.

If such a zero has been measured or estimated, it is significant.

If a zero has not been measured or estimated and is just a place holder, it is not significant.

A decimal point placed after zeros indicates that they are all significant.

Rule 4

Example 1:

2000 m may contain from one to four significant figures, depending on how many zeros are place holders.

In this text, if the value does not contain a decimal point, assume that none of the zeros at the end of a measurement are significant.

Rule 4

Example 2:

2000.0 m has five significant figures,
indicated by the decimal point.

Rules for Using Significant Figures in Calculations.

Multiplication and Division:

The answer can have not more significant figures than there are in the measurement with the smallest number of significant figures.

Multiplication and Division

Example 1

12.257 — has five significant figures.

x 1.162 — has four significant figures.

14.2426234 — round off to 14.24

Multiplication

Example 2

$$\begin{array}{r} 12.65 \text{ m} \\ \times 42.1 \text{ m} \\ \hline \end{array}$$

532.565

Round off to Significant figures.

Answer: ?

$$\begin{array}{r} 12.65 \text{ m} \\ \times \underline{42.1 \text{ m}} \end{array}$$

532.565

Answer = 533

Multiplication

Example 3

$$3.02 \text{ cm} \times 6.3 \text{ cm} \times 8.225 \text{ cm} =$$
$$156.48885 \text{ cm}$$

Round off to Significant figures.

Answer: ?

$$3.02 \text{ cm} \times 6.3 \text{ cm} \times 8.225 \text{ cm} = 156.48885 \text{ cm}$$

Round off to Significant figures.

Answer: ?

Answer: 160 cm

Multiplication

Example 2

$$\begin{array}{r} 6.35 \text{ m} \\ \times \underline{.012 \text{ m}} \\ \hline ? \end{array}$$

Multiplication

Example 2

6.35 m

x .012 m

0.0762 m

Answer = 0.076 m

Addition and Subtraction:

The answer can have **no more digits to the right of the decimal point** than there are in the measurement with the **smallest number of digits to the right of the decimal point.**

Addition

Example:

3.95

2.879

+ 213.6 — only one digit to the right of the decimal

220.429 — round off to 220.4

Addition

Example 2

20.34 km²

18.0 km²

+ 25.333 km²

63.673 km²

Answer ?

Addition

Example 2

20.34 km²

18.0 km²

+ 25.333 km²

63.673 km²

Answer: 63.7 km²

Subtraction

Example 1

$$\begin{array}{r} 1615 \text{ km} \\ - \underline{1453 \text{ km}} \\ \hline 162 \text{ km} \end{array}$$

Subtraction

Example 2

4 350 000 000 km

- 40 200 000 km

4 310 000 000 km

OR

Subtraction

Example 2

$$4.35 \times 10^9 \text{ km}$$

$$\underline{- 4.02 \times 10^7 \text{ km}}$$

$$4.31 \times 10^9 \text{ km}$$