

Significant Figures in Calculations Rules

When doing **multiplication or division** with measured values, the answer should have ***the same number of significant figures*** as the measured value with the least number of significant figures.

• Procedure to determine significant figures after multiplication or division:

1. Multiply or divide the numbers using your calculator.
2. Round the result to have ***the same number of significant figures as the measured value with the least number of significant figures.***

- Below are two examples.

A) Write the product of 2.10×0.5896 with the correct number of significant figures.

Step 1) $2.10 \times 0.5896 = 1.23816$

Step 2) $1.23816 = 1.24$ (three sig. figs because 2.10 has three)

The answer is 1.24

B) Write the quotient of $16.15 / 2.7$ with the correct number of significant figures.

Step 1) $16.15 / 2.7 = 5.98148148$

Step 2) $5.98148148 = 6.0$ (two sig. figs because 2.7 has two)

The answer is 6.0

When doing **addition or subtraction** with measured values, the answer should have the same ***precision*** as the least precise measurement (value) used in the calculation.

• Procedure to determine significant figures after adding or subtracting:

1. Add or subtract the numbers on your calculator (or by hand).
2. Round the result to the ***same number of decimal places*** as the least precise value.

- Below are two examples.

A) Write the sum of $1.586 + 2.31$ with the correct number of significant figures.

Step 1) $1.586 + 2.31 = 3.896$

Step 2) $3.896 = 3.90$ (two decimal places because 2.31 has two decimal places)

The answer is 3.90

B) Write the difference of $0.954 - 0.3109$ with the correct number of significant figures.

Step 1) $0.954 - 0.3109 = 0.6431$

Step 2) $0.6431 = 0.643$ (three decimal places; 0.954 has three decimal places)

The answer is 0.643

Significant Figures with Mixed Operations

When doing a calculation that involves **only** multiplication and/or division, you can do the entire calculation then round the answer to the correct number of significant figures at the end. The same is true for a calculation that involves **only** addition and/or subtraction.

But what about a calculation that involves mixed operations: **both** multiplication or division **and** addition or subtraction?

When doing calculations that involve **both** multiplication or division **and** addition or subtraction, first do a calculation for the operation *shown in parenthesis* and round that value to the correct number of significant figures, **then** use the rounded number to carry out the next operation.

Significant Figures with Log Values (Chapter 9)

Procedure to determine significant figures after performing a **logarithm**:

(We will not need this until chapter 9 when we do pH)

1. Calculate the logarithm of the number.
2. Round the result to keep the same **number of decimal places** as there were **significant figures** in the original number.

$$\text{Examples: } \log(4.500 \times 10^3) = 3.6532125 = 3.6532 \quad (4 \text{ decimal places})$$

$$\log(4.50 \times 10^3) = 3.6532125 = 3.653 \quad (3 \text{ decimal places})$$

$$\log(4.5 \times 10^3) = 3.6532125 = 3.65 \quad (2 \text{ decimal places})$$

The rules for expressing significant figures with logarithms will only rarely be encountered in introductory chemistry. The main context for this rule will be the calculation of pH, encountered in acid-base chemistry. Often, pH is reported with one decimal place corresponding to a concentration measurement with a precision of one significant figure.