Significant Digit Rules

A measurement can only be as accurate and precise as the instrument that produced it. Significant digits indicate how precise a measurement has been made. The more significant digits a measurement has, the less uncertainty there is. How many significant digits a particular measurement has depends on the measuring instrument used.

Example: A scale that measures to a tenth of a gram is more precise than one measuring to the nearest gram. (12.3g vs 12g)

- **Rules:**
  1. All non-zero digits (1 - 9) are significant.

     2 → 1 sd 23 → 2 sd

  2. Zero(es) located between two non-zero digits are significant.

     101 → 3 1001 → 4 10.001 → 5

  3. Zeroes in front of a non-zero digit are not significant (place holders).

     02 → 1 sd 0.2 → 1 sd 0.002 → 1 sd

  4. Trailing zeros are significant **only** if a decimal point is included in the measurement.

     2.0 → 2 sd 2.00 → 3 sd 0.0200 → 3 sd

1. Determine the number of significant figures in each of the following:

a) 4 75.02mm d) 2 0.0049 g

b) 4 18.90 mL e) 2 150 cm

c) 2 12 test tubes f) 3 150. cm

2. Re-write the quantity 827 000 000 000 000 picoseconds to show:

a) 1 sig. fig. 800 000 000 000 000 OR 8×10^{14}

b) 2 sig. figs. 830 000 000 000 000 OR 8.3×10^{14}

c) 3 sig. figs. 827 000 000 000 000 OR 8.27×10^{14}

d) 4 sig. figs. 8.270×10^{14}

e) 5 sig. figs. 8.2700×10^{14}

3. Rewrite the quantity 0.0031904 kg to show:

a) 1 sig. fig. 0.003 OR 3×10^{-3}

b) 2 sig. figs. 0.0032 OR 3.2×10^{-3}

c) 3 sig. figs. 0.00319 OR 3.19×10^{-3}

4. Round each of the following to 3 significant figures:

a) 16.8477 L 16.8

b) 5.6732 5.67

c) 0.14936 L 0.150

d) 86185 862

e) 4.206×10^{4} km 4.21×10^{4}

f) 5.0931×10^{-3} 5.10×10^{-3}

g) 0.00318756 m 0.00319 → 3.19×10^{-3}

h) 0.09025011 0.0903

- **Calculations with Significant Figures:**
  1. When **ADDING OR SUBTRACTING**, the number of decimal places found in each measurement is important. **AFTER** performing your calculations, round the answer to the **LEAST** number of **DECIMAL PLACES.**

$123.25 + 46.0 + 86.257 = 255.507 \rightarrow 255.5$

$2.01 + 32.50 + 2.567 = 37.077 \rightarrow 37.08$

  2. When **MULTIPLYING OR DIVIDING**, the number of significant figures found in each measurement is important. **AFTER** factoring, round your answer to the least number of **SIGNIFICANT DIGITS.**

$23.0 \times 432 \times 19 = 188\,784 \rightarrow 190\,000$

$\rightarrow 1.9 \times 10^{5}$

CALCULATIONS USING SIGNIFICANT FIGURES

Name _____

When multiplying and dividing, limit and round to the least number of significant figures in any of the factors.

> **Example 1:** 23.0 cm x 432 cm x 19 cm = 188,784 cm^3
> The answer is expressed as 190,000 cm^3 since 19 cm has only two significant figures.

When adding and subtracting, limit and round your answer to the least number of decimal places in any of the numbers that make up your answer.

> **Example 2:** 123.25 mL + 46.0 mL + 86.257 mL = 255.507 mL
> The answer is expressed as 255.5 mL since 46.0 mL has only one decimal place.

Perform the following operations expressing the answer in the correct number of significant figures.

1. 1.35 m x 2.467 m = 3.33045 m^2 → 3.33 m^2
2. 1,035 m^2 ÷ 42 m = 24.642857 → 25 m
3. 12.01 mL + 35.2 mL + 6 mL = _____
4. 55.46 g − 28.9 g = _____
5. .021 cm x 3.2 cm x 100.1 cm = _____
6. 0.15 cm + 1.15 cm + 2.051 cm = _____
7. 150 L^3 ÷ 4 L = _____
8. 505 kg − 450.25 kg = _____
9. 1.252 mm x 0.115 mm x 0.012 mm = _____
10. 1.278 x 10^3 m^2 ÷ 1.4267 x 10^2 m = _____