Significant Digits

Precision is the degree of exactness to which a measured value can be reproduced.

Accuracy is the extent to which a measured value agrees with the standard value of a quantity.

Low Precision / Low Accuracy

High Precision / Low Accuracy

Low Precision / High Accuracy

High Precision / High Accuracy

- ALL devices have limits to their precision.
- The last digit recorded in any measurement in science is an estimate and is uncertain.
- The last digit is the only uncertain digit in your measurement
- Precision is limited to a half of the smallest interval
- Anytime a measurement is recorded, it can include all digits that are certain ***plus*** one uncertain digit.
- The more significant digits in a recorded measurement, the more precise the measurement.

Draw a picture explaining why.

Use the following rules to determine the number of significant digits in a recorded measurement.

1. **Digits other than zeroes are always significant.**

967 has ____ significant digits

96.7 has ____ significant digits

9.6 has ____ significant digits

2. **Zeroes between two other significant digits are always significant.**

9.067 has ____ significant digits

9.007 has ____ significant digits

3. **Zeroes at the beginning of a number are never significant. They merely indicate the position of the decimal point.**

0.02 has ____ significant digits

0.00026 has ____ significant digits

0.000204 has ____ significant digits

4. **When a number ends in zeroes before the decimal point, the zeroes are non-significant.**

150 000 000 has ____ significant digits

130 has ____ significant digits

800. has ____ significant digits

5. **Zeroes that fall at the end of a number and after the decimal point are always significant.**

0.200 has ____ significant digits

3.0 has ____ significant digits

0.20030 has ____ significant digits

Write the number of significant digits beside each value

6340000	2 940	0.000 076 s
12 300	0.332	104.080 J
67.1	6.310	0.80 kg
713	104	301.5 kg
91	5 240	789 mm
400.0	0.000 051	$5.60 \times 10^2\ m/s^2$
11.400	3.95	56.02 m
7600	104	$4.24 \times 10^3\ m$
0.000967	8.000	5.00 cm
0.00005810	132	0.050 m
8.14	52 401 100	$2.999 \times 10^6\ m/s$
48	37.2 m	$9.7 \times 10^{-10}\ m$
400	56 cm	0.00015

Round down if below 5, up if above 5.

0.643876 with 2 significant digits gets rounded to _____

0.469436 with 2 significant digits gets rounded to _____

Round off each of the following to the number of significant figures (s.f.) indicated:

$$34.9255 \; to \; 3 \; significant \; figures.$$

$$0.09\,31 \; to \; 2 \; significant \; figures.$$

$$4.6039 \; to \; 3 \; significant \; figures.$$

$$52\,196.92 \; to \; 2 \; significant \; figures.$$

$$0.00043900 \; to \; 4 \; significant \; figures.$$

$$3394.2 \; to \; 1 \; significant \; figures.$$

$$93000 \; to \; 3 \; significant \; figures.$$

$$1999.99 \; to \; 2 \; significant \; figures.$$

Addition and Subtraction:

The sum or difference has as many significant figures as the measurement that is the least precise. This is the measurement that has the smallest number of significant digits.

Perform each of the following mathematical operations, expressing the answers to the correct number of significant digits.

$76.0\ m - 56.72\ m$

$4005.34\ -\ 325.2600$

$15.91\ +\ 9.2$

$0.00076\ -\ 0.00060000$

$79.3\ -\ 9.094$

$362.66\ -\ 29.2$

$12.03\ -\ 0.0264$

$4005.34\ -\ 325.2600$

$0.0190\ +\ 0.0010$

$0.000\,76\ -\ 0.000\,600$

$10.03\ +\ 9.128\ +\ 72.4$

$14.65\ g\ +\ 256.5\ g\ +\ 0.645\ g$

$18.77\ +\ 8.75\ -\ 20$

$37.2\ +\ 0.12\ +\ 363.55$

$362.66\ -\ 29.2$

Multiplication and Division:

The product or quotient(**multiplication** or **division**) has as many significant figures as the measurement that is least precise . This is the measurement that has the smallest number of significant digits.

Perform each of the following mathematical operations, expressing the answers to the correct number of significant digits.

2.4×6.0

$0.23 \times 0.350 \times 4$

$55 \times 0.540 \times 326$

$(55)(0.54)(326)$

$(0.0060)(55.1)(26)$

0.025×0.82

9000×15.62

$3\,kg \times 6\,m/s$

$0.24\,A \times 3.56\,V$

$2.6\,N \times 0.43$

$40.0 \div 8.02$

$16.55 \div 4$

$10.30 / 4.2571$

$\frac{750}{3.0}$

$\frac{0.452}{0.014}$

$\frac{0.094 \times 720}{4.4}$

$\frac{((6.21)(0.45))}{5.0}$

$\frac{((0.94)(720))}{4.4} \cdot 2.52$

$\frac{4.91}{2}$

$3.12 + \frac{9.651}{2}$

$\frac{4.251}{2} - \frac{2.11}{2}$

$0.000\,0400 \times 5.00 \times 90.0$

$(1.002 \times 10^{13}) - (9.997 \times 10^{12})$