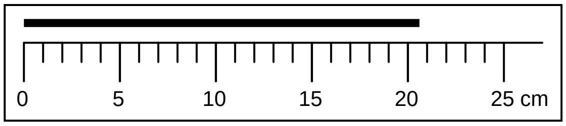
SIGNIFICANT DIGITS



The length of the line is approx. 20.7 cm.
The 2 and 0 are certain, the 7 is uncertain.
All three digits are significant.

Summary: associated with every measurement made is some degree of uncertainty. For instance, you might measure the length of the dark line shown in the diagram as 20.7 cm. The digits 2 and 0 are certain - there is no doubt that the length is "20 point something" cm. The 7 is uncertain - it might be a little less or a little more. The number of 'significant digits' indicates the certainty of our measurement. There are three significant digits in this case (20.7). Thus, significant digits in a measurement or calculation consist of all those digits that are certain, plus one uncertain digit. Although your calculator may give you an answer to eight decimal places or more, you should not include all of these digits in your answer.

Rules For Determining The Number Of Significant Digits

If you have trouble determining the number of significant digits, follow these steps.

1. All digits from 1 to 9 (non-zero digits) are considered to be significant.

Example	Number of significant digits
1.23 g	3

2. Zeros between non-zero digits are always significant

1.03 g	3

3. Zeros to the left of non zero digits, serve only to locate the decimal point; they are not significant.

0.00123 g	3; zeros to the left of the 1 simply locate the decimal point. To avoid confusion you can write numbers in scientific notation. I.e. 0.00123 = 1.23×10^{-3}

4. Any zero printed to the right of a non-zero digit is significant if it is also to the right of the decimal point.

2.0 g and 0.020 g	2 for both; all zeros that are right of both a non-zero digit and the decimal point are significant.

5. Any zero printed to the right of a non-zero digit may or may not be significant if there is no decimal point indicated. For example, if someone tells you that a mountain is 3600 m high they are probably certain of the 3, and uncertain of the 6. In other words, there are likely 2 significant digits. However 3600 m may also have 3 significant digits (if the measurement was taken to the nearest 10 m) or 4 significant digits if the measurement was taken to the nearest 1 m).

100 g	1, 2, or 3; in numbers that do not contain a decimal point, "trailing" zeros may or may not be significant. To eliminate possible confusion, one practice is to underline the last significant digit. Thus, 1<u>0</u>0 has two significant digits, whereas 10<u>0</u> has three. Ideally, we write the number in scientific notation: for example 1.0×10^{-2} has two significant digits and 1.00×10^{-2} has three significant digits. Notice that for numbers written in scientific notation, all digits are significant.

6. Any number that is counted instead of measured has an infinite number of significant digits.

3 test tubes	Infinite; exact numbers, for example, the number of meters in a kilometer or numbers obtained by counting (4 people, 5 beakers), are said to have an infinite number of significant digits.

A) How many significant digits do the following measured quantities have?

i) 2.83 cm	iii) 14.0 g	v) 0.02 mL	vii) 2.350×10^{-2} L	ix) 3 fingers
ii) 36.77 mm	iv) 0.0033 kg	vi) 0.2410 km	viii) 1.00009 L	x) 0.0056040 g

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B) i) 83.25 – 0.1075 ii) 4.02 + 0.001 iii) 0.2983 + 1.52

C) i) 7.255 ÷ 81.334 ii) 1.142 x 0.002 iii) 31.22 x 9.8

D) Solve the following (do one step at a time, according to BEDMAS): i) 6.12 x 3.734 + 16.1 ÷ 2.3
ii) 0.0030 + 0.02 iii) $1.70 \times 10^{3} + 1.34 \times 10^{5}$ iv) (33.4 + 112.7 + 0.032)/(6.487)

E) Convert these measurements: i) 1.0 cm = ______ m, ii) 0.0390 kg = ______ g, iii) 1.7 m = _____ mm