Significant Digits

When recording a measurement you should usually try to record 1 digit past the least count digit.

You have to make a guess as to what that digit is

↓

this last digit that you record is called an **uncertain digit**

A significant digit (figure) is one that has been measured with certainty or properly estimated.

Consider using a 30cm ruler with (mm) markings (least count) and you record the following measurement:

15.427891245 cm

(4 = least count place value; 2 = uncertain digit)

this measurement is not reasonable (too much guessing)

A more reasonable measurement would be:

15.42 cm

15.43 cm

15.44 cm ← least count is 0.1 cm or 1 mm (smallest division on the ruler)

4 significant digits →

15.44 cm

Certain digits

guess about the last digit (uncertain)

So when counting significant digits, you count all certain digits and the ONE uncertain digit.

* No matter how precise your measuring instrument, you will always have to make a guess about the last digit that you record. No measurement is exact.

Examples

20.4 cm → 4 sd (least count)
certain ↑uncertain
→ least count is 1cm

4.07 cm → 3sd (least count)
certain uncertain
→ least count is 1mm or 0.1cm

What about zeroes?

14.002cm → 5sd
60.2 cm → 3sd
A zero is always significant if it is between two non-zero digits.

29.20 cm → 4sd
certain uncertain
7.020 cm → 4sd
uncertain
A zero is significant if it is to the right of the decimal and after a non-zero digit

0.008517 cm → 4sd
leading zeroes don't count.
uncertain
↳ 8.517×10^{-3} cm
leadin zeroes are never significant

25000 m ← writing a measurement like this is confusing as we don't know what the uncertain digit is or what the least count is. could have 2,3,4 or 5sd

Using scientific notation is a better way to communicate clearly the intended number of sds.

2.5×10^4 m → 2sd (LC 1×10^4 m)
certain uncertain
2.50×10^4 m → 3sd (LC 0.1×10^4 m) (1000)
2.500×10^4 m → 4sd (LC 0.01×10^4 m) 100
2.5000×10^4 m → 5sd (LC 0.001×10^4 m) 10

25050 m → 4 or 5sd
↑choose the least

25000. → 5sd
25000.0 → 6sd