

PHYSICS WEBSITE 2

Topic : Significant Figures (Part I)

Link | <https://barisciencelab.tech/Physics2.html>

2.3 Big Idea : |Measurement and Significant Figures

Tutorial: <https://youtu.be/yb094rhKYYo>

Any measurement will have a certain number of significant figures associated with it that displays how precise it is. However, you don't want to be more precise than what you started with. For example, The ball I drop on the glass. What is the mass of this ball? If I give it to my grandma, she will say 1 kilogram. Because for her, everything is 1 kilogram. However, what if I measure it using a lab scale? It reads 82 gram. However, if I measure it by NASA laser scale, it reads 82.327812 grams. Which is more correct?

Let's say we want to calculate the density of the ball. And density is,

$$d = m/V = 8247 = 1.74468085106383 = 1.7 \text{ g/cm}^3$$

Now let's use data collected by NASA lab instruments:

$$d = m/V = 82.32781247.430128 = 1.73577039 = 1.7357704$$

I called my two sons and asked them their location and here's what they have said:

Ref: I'm in the crowd

Isaac : He is near big buildings.

With this information, would I be able to precisely tell that they are at 42nd street and 8 Ave?
No.

Rules:

1. Non Zero numbers are significant , example 124 has 3 Sig Fig
2. Zero in the middle is significant , example, 203 has also 3 SigFig
3. Trailing zeros are not significant if there is no decimal, 23000, has only 2 SigFig
4. Zeros right to the decimal place significant, .00200 has actually 3 SigFig
5. Leading zeros are not significant, .00003 has only 1 SigFig

The following digits are not significant figures.

- All leading zeros. For example, 013 kg has two significant figures, 1 and 3, and the leading zero is not significant since it is not necessary to indicate the mass; $013 \text{ kg} = 13$

kg so 0 is not necessary. 0.056 m has two insignificant leading zeros since $0.056 \text{ m} = 56 \text{ mm}$ so the leading zeros are not absolutely necessary to indicate the length.

- Trailing zeros when they are merely placeholders. For example, the trailing zeros in 1500 m as a length measurement are not significant if they are just placeholders for ones and tens places as the measurement resolution is 100 m. In this case, 1500 m means the length to measure is close to 1500 m rather than saying that the length is exactly 1500 m.
- Spurious digits, introduced by calculations resulting in a number with a greater precision than the precision of the used data in the calculations, or in a measurement reported to a greater precision than the measurement resolution.

Non-zero digits within the given measurement or reporting resolution are significant.

- 91 has two significant figures (9 and 1) if they are measurement-allowed digits.

Zeros between two significant non-zero digits are significant (*significant trapped zeros*).

- 101.12003 consists of eight significant figures

Zeros to the left of the first non-zero digit (leading zeros) are not significant.

- If a length measurement gives 0.052 km, then $0.052 \text{ km} = 52 \text{ m}$ so 5 and 2 are only significant; the leading zeros appear or disappear, depending on which unit is used, so they are not absolutely necessary to indicate the measurement scale.

Zeros to the right of the last non-zero digit (trailing zeros) in a number with the decimal point are significant.

- 1.200 has four significant figures (1, 2, 0, and 0)