

The Importance of Units

Units are incredibly important to physics. Two of the most important reasons are the following: (1) they help us to avoid making mistakes in computation, and (2) they serve as a check on computations once they are completed.

In the first case, you can avoid adding $3m$ and $25cm$ and coming up with the wrong answer. If one merely adds 3 and 25, one gets 28. But answer this question, “28 what?” One cannot add apples and oranges – so to speak – and get a meaningful answer. Before adding, units should be in common to the two terms. To add $3m$ to $25cm$, convert both to either meters or centimeter and then add:

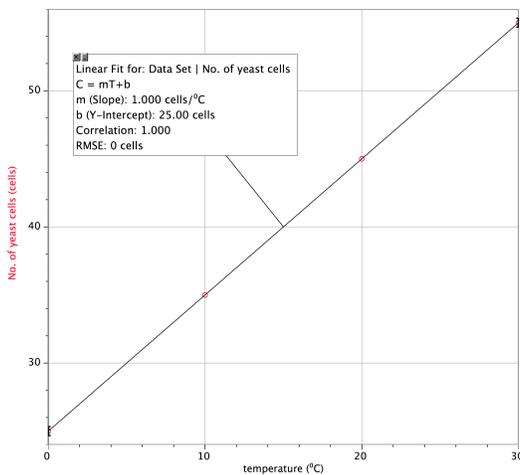
$$3m + 25cm = 300cm + 25cm = 325cm \quad \text{OR} \quad 3m + 25cm = 3m + 0.25m = 3.25m$$

Note that $325cm$ and $3.25m$ (both the same distance) don’t look anything like 28 “something”.

In the second case, one might be looking for a speed expressed in m/s . Speed can be found using the equation, $\Delta x = \bar{v}t$. What if someone solves the equation incorrectly and gets the following where $t = 3.5s$ and Δx is $62.5m$?

$$\bar{v} = \frac{t}{\Delta x} = \frac{3.50s}{62.5m} = 0.0560 \frac{s}{m}$$

Clearly speed is not measured in s/m ; rather, it is commonly measured in m/s . On a multiple-choice test in a question asking for speed in m/s , the correct answer would be 17.9. Having found 0.0560 with the use of a calculator (and ignoring units), the student might be lured into a trap of selecting the wrong answer if 0.0560 is among them.



Consider, too, the importance of units in graphing as in the example here. Let’s say that students use the regression formula shown on the graph to write the relationship between variables as follows:

$$N = T + 25$$

The equation states, in effect, that the cell number, N , equals the temperature, T , plus 25. This makes no sense. If a temperature of 34°C is input into the formula, one gets

$$N = 34^\circ\text{C} + 25$$

How does one add 34°C to 25, a pure number? It’s like adding apples and oranges in the above example. And what happens if someone enters the temperature, T , in $^\circ\text{F}$ or K (Kelvins) instead of

$^\circ\text{C}$? An entirely incorrect answer will result!

Properly written with units, the relationship between the variables shown in the above graph is as follows:

$$N = (1 \text{ cells} / ^\circ\text{C}) * T + 25 \text{ cells}$$

And solving the formula for $T = 34^\circ\text{C}$, one gets the following correct answer:

$$N = (1 \text{ cells} / ^\circ\text{C}) * 34^\circ\text{C} + 25 \text{ cells}$$

$$N = \frac{34^\circ\text{C} * \text{cells}}{^\circ\text{C}} + 25 \text{ cells}$$

$$N = 34 \text{ cells} + 25 \text{ cells}$$

$$N = 59 \text{ cells}$$

Avoid doing numerical calculations using a calculator and then slapping units on at the end without having worked them out. This will serve as a check on your work.

Lastly, treat units like any other number. They multiply and divide just like numbers. When adding or subtracting, be certain that the units are the same so you can avoid mixing apples with oranges so to speak.