An Extra Note about Dimensions

The responses from a couple of students about their table measurements points out an aspect about dimensions and units that needs clarification.

When you measure your table and get, for example, that its top is 180 cm long, 120 cm wide, and 80 cm high, you might write that information as 180 cm x 120 cm x 80 cm. The x's here are read as "by"; 180 cm long by 120 cm wide by 80 cm high.

If you were to consider that table a box and you wanted its volume, you would interpret those x's as multiplication signs: table volume = 180 cm multiplied by 120 cm multiplied by 80 cm = 1728000 cm^3. Let me write this in a more careful mathematical manner using centered dots to signify multiplication and using parentheses to show how the numbers and their units are grouped:

$$V=(180\text{ cm})\cdot(120\text{ cm})\cdot(80\text{ cm})=(180\cdot 120\cdot 80)\cdot(\text{cm}\cdot\text{cm}\cdot\text{cm})=1728000\text{ cm}^3$$

Here, you can see that both the numbers and units get multiplied together. When the numbers are multiplied together we get 1728000, and when cm is multiplied by cm and again multiplied by cm, we end up with cm^3, cm cubed. So the volume is 1728000 cm^3.

Similarly, the area of the top of the desk is area = 180 cm multiplied by 120 cm = 21600 cm^2 , and we end up with

$$A=(180\text{ cm})\cdot(120\text{ cm})=(180\cdot 120)\cdot(\text{cm}\cdot\text{cm})=21600\text{ cm}^2$$

Because the length, width and height were measured in cm, the volume automatically became cm^3 and the area automatically became cm^2.

If the length, width, and height were measured in meters, the volume would be

$$V=(1.80\text{ m})\cdot(1.20\text{ m})\cdot(0.80\text{ m})=(1.80\cdot 1.20\cdot 0.80)\cdot(\text{m}\cdot\text{m}\cdot\text{m})=1.728\text{ m}^3$$

and the area would be

$$A=(1.80\text{ m})\cdot(1.20\text{ m})=(1.80\cdot 1.20)\cdot(\text{m}\cdot\text{m})=2.16\text{ m}^2$$

If the length, width, and height were (ugg!!) measured in inches, the volume would be

$$V=(70.8661\text{ in})\cdot(47.2441\text{ in})\cdot(31.4961\text{ in})=(70.8661\cdot 47.2441\cdot 31.4961)\cdot(\text{in}\cdot\text{in}\cdot\text{in})=105449\text{ in}^3$$

To convert this to cm^3, we need to multiply by $(2.54\text{ cm/in})^3 = 16.3871\text{ cm}^3/\text{in}^3$.

$$(105449\,\text{in}^3)\cdot(16.3871\,\text{cm}^3/\text{in}^3)=1728000\,\text{cm}^3$$

Here, the in^3 on the top cancels the in^3 on the bottom and we are left with cm^3 for the answer's units.

In this class, and in science in general, we don't mess with inches. We just measure in mm, cm, m, etc., and only need to adjust the powers of 10 to convert between the different sizes of units. Metric units make life much easier and less error prone.

The only time powers of 10 don't work in science, is if we talk about time in terms of minutes, hours, days, and years. If we just stick with seconds and use scientific notation for large or small numbers, our work is easier.