Unit Conversions

Physics 6A
Units are very important when dealing with physical quantities. Here are a couple of examples for practice:
The speed of light is $3.00 \times 10^8$ m/s.

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1 mile = 1609 meters

Now we can do some simple multiplying to do the conversions:
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\left(\frac{3.00 \times 10^8 \text{ m}}{1 \text{ s}}\right) \left(\frac{1 \text{ mile}}{1609 \text{ m}}\right) \left(\frac{60 \text{ s}}{1 \text{ min}}\right) \left(\frac{60 \text{ min}}{1 \text{ hr}}\right) = 671224362.958 \frac{\text{ miles}}{\text{ hr}}
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\left( \frac{3.00 \cdot 10^8 \text{m}}{1\text{s}} \right) \left( \frac{1\text{mile}}{1609\text{m}} \right) \left( \frac{60\text{s}}{1\text{min}} \right) \left( \frac{60\text{min}}{1\text{hr}} \right) = 671224362.958 \frac{\text{miles}}{\text{hr}}
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Of course that answer is very cumbersome to work with and it has the wrong number of significant digits. A better answer would be rounded off and be placed in scientific notation:

$$6.71 \cdot 10^8 \frac{\text{miles}}{\text{hr}}$$
A beaker has a radius of 5 cm and is filled with water to a depth of 10 cm. Suppose that a water molecule can be modeled as a cube with side length 0.1 nm. Approximately how many water molecules are in the beaker?
This is a question about volumes. We need to be careful with our units and make sure they all match up. One way to do this is to convert everything to the same units (meters are convenient here).
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What is the volume of the beaker?

It is a cylinder, so the volume is \( \pi \times (\text{radius})^2 \times (\text{height}) \).
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$V_{\text{beaker}} = \pi \cdot (0.05\text{m})^2 \cdot (0.10\text{m}) \approx 7.85 \cdot 10^{-4}\text{m}^3$
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$$\# \text{molecules} = \frac{7.85 \times 10^{-4}\text{m}^3}{1 \times 10^{-30}\text{m}^3/\text{molecule}} = 7.85 \times 10^{26}\text{molecules}$$