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Hello and welcome to the 6th episode of Chemistry the study of change.

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Previously in chemistry the study of change.

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We discussed the role that significant digits plays in measurement.

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We learned to express and interpret measurements using appropriate number of significant digits.

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In today's episode.

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We will introduce dimensional analysis and practice it a little.

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And we will learn how to choose our conversion factors.

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When making unit conversions, along with many other types of problems, one of the most reliable methods is dimensional analysis.

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Before setting up the problem, the first step is to choose the necessary conversion factors.

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This is actually the part that can truly be described as problem solving.

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The rest is just process.

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The most important rule is to carry the units throughout the calculation, because the units never lie, as we have said before.

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You will make sure to cancel all units except for the desired unit, the “ask” if you will.

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You may remember that we previously used dimensional analysis to determine the number of centimeters in a decimeter.

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Let's take a look at this example again.

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Step one was to choose our conversion factors.

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We found “Deci” and “Centi” in the chart.

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And we wrote down the conversion factor for each one of the prefixes along with the unit meters.

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Then we got ready to set up the frames or the boxes that we’ll use.

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We placed the given quantity at the top of the first frame.

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And we place the first conversion factor on the 2nd frame so that the unit decimeter.

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Would cancel.

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Then we canceled the units.

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We then placed the second conversion factor in the 3rd frame.

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So that the unit meters would cancel.

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And we cancelled it.

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Lastly, we multiply by the numbers in the top frames.

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And divided by the numbers in the bottom of the frames.

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And that is how we got our final answer.

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The process itself is very simple.

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As long as you know which conversion factors to use.

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However, most textbooks assume that you will take to the only challenging part of this process like a fish to water and don't really bother to explain it.

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It's a little negligent if you ask me.

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So how do you choose your conversion factors?

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Well, let's do just that.

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Notice that you have a given of 0.0833 pounds.

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And an ask of how many milligrams?

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I like to do my planning in graphic form because it comes more naturally to me.

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I start my diagram with the given and the ask.

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I place them on opposite ends of my little diagram.

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Now I look for a conversion factor that will take me directly between pounds and milligrams.

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I sadly don't find one, so I look for any conversion factor having pounds or milligrams.

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And I find one between pounds and grams.

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So I write the unit grams next to pounds.

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This arrow represents the conversion factor I found.

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1 pound is equal to 453.6 grams.

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I still have a gap between grams and milligrams.

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But because of these are SI units, I can look up the prefix milli to get a conversion factor.

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This arrow represents that conversion factor.

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1 milligram is equal to 10 to the -3 grams.

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Let me use a little shorthand to make room here.

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To draw my dimensional analysis frames.

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Notice that I again placed the given quantity at the top of the first frame.

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And my conversion factors in the second and third frames.

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So that the unit of pound cancels.

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And the unit of gram cancels

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Leaving only the units of the “ask.”

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Let me scroll down a little bit to make a little more room again.

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And we will multiply it by the top numbers.

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And divide by the bottom numbers.

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And that's our final answer.

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As far as significant digits, we need to consider all three frames.

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The given quantity obviously only has three significant digits.

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But how do we know how many significant digits our conversion factors have?

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I mean, it's not entirely obvious where those numbers came from.

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So read the fine print and your conversion table.

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There you will find the reason for the four significant digits and the exactness respectively, that’s rule #20.

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Always look under.

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Let's consider another example.

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Like all of the other problems, it has a given.

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5.2 liters.

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And an ask.

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How many cubic meters?

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In this case, there is a direct conversion in your tables between liters and cubic meters.

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So you will not really need a diagram.

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You can have one, but it would simply have one arrow going from liters to cubic meters.

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Our set of frames only has room for the given and one conversion factor.

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The given goes at the top of the first frame.

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And our one conversion factor goes on the 2nd frame.

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As always, make sure that the unit liters cancels.

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We whip out our calculator and get 5.2 * 10 to the -3 cubic meters.00:09:10

The given has two significant digits and our conversion factor is exact, so our answer will have two significant digits.

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Our next example involves liquid nitrogen.

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In this example, our given.

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Is 0.808 grams per cubic centimeter.

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And our ask is kilograms per cubic meter.

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We don't need a diagram again because we do have a direct conversion factor in our list between kilograms and grams.

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And we have another one between cubic centimeters and cubic meters.

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We will need room for the given and two conversion factors in the frames.

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As usual, we will begin by placing the given in the 1st frame.

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Notice that part of the unit goes to the lower frame.

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This will be true for any compound unit.

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Our first conversion factor goes in the 2nd frame and cancel the unit grams.

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And the second conversion factor goes in the 3rd frame to cancel the unit cubic centimeters.

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Will we pull our calculator

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And the final answer is 808 kilograms per cubic meter.

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We rounded it to three significant digits because the given quantity has three significant digits.

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And both conversion factors are exact.

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We will practice this method a little more in our next episode, so be on the lookout for that.

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And that's all there is.

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There isn't anymore.