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Metric conversion word problems worksheet

Skip to Main ContentSkip to Navigation Math You Need > Unit Conversions > Unit Conversions Practice Problems Jump down to: Density | Scale If you do not have a list of common conversion factors in your book, you may wish to download and print this sheet of common conversion factors for the geosciences (Acrobat (PDF) 40kB Sep3 09), open the link below to use while you make your calculations. If you need a reminder of the steps, you can download and print this worksheet (Acrobat (PDF) 44kB Apr11 08) walking you through the steps for unit conversion. Finally, you can download a sheet that has all the problems (Acrobat (PDF) 48kB Jul25 09) on it so you can print it out and work them on your own. Problem 1: Imagine that you are driving your car in Canada. As you're driving along, you notice that the speed limit signs have numbers like 120 (on the highway) and 50 (in the city). As you start to speed up, you realize that the signs are in km/hour. Unfortunately, your speedometer only reads in mi/hour. Figure out how fast you're allowed to go if the sign says: 120 km/hr Hide Let's do this using the steps you learned in the previous page. Write out the units you have (when appropriate as a fraction): Hide Write out the units you want to end with: Hide Determine appropriate conversion factors (in some cases, there will be more than one conversion factor for each of the units you have): Hide Since "hours" stays the same on the bottom, you only need one conversion factor: km to mi. So, you can write 1km = 0.6214 mi Evaluate appropriate arrangement for fractions (that is, what units belong in numerator (top) of fraction? What units need to be in denominator (bottom)? Remember, units cancel when one unit is in numerator and the other is in the denominator). Remember that when you multiply fractions (as you will in step 6 below), you can cancel units ONLY when they appear in both the numerator and the denominator. Hide Since km is in the numerator in the original units, km needs to be in the denominator so that we can cancel: Set up the conversion by writing the fractions in a row with multiplication signs in between: Hide Evaluate. Do the original units cancel so that you are left with ONLY the units asked for? If not, repeat steps 3 and 4 until you are left with appropriate units: Hide We cancel km and end with mi/hr (which is what we want!) Multiply across top and bottom: Hide If necessary, reduce the fraction. Hide Evaluate your answer. Hide Is a speed limit of about 75 mph (mi/hr) a reasonable speed limit? If you got 0.75 or 75,000, would you recognize that it is not reasonable? 75 km/hr Hide Write out the units you have (when appropriate as a fraction): Hide Write out the units you want to end with: Hide Determine appropriate conversion factors (in some cases, there will be more than one conversion factor for each of the units you have): Hide Since "hours" stays the same on the bottom, you only need one conversion factor: km to mi. So, you can write 1km = 0.6214 mi Evaluate appropriate arrangement for fractions (that is, what units belong in numerator (top) of fraction? What units need to be in denominator (bottom)? Remember, units cancel when one unit is in numerator and the other is in the denominator). Remember that when you multiply fractions (as you will in step 6 below), you can cancel units ONLY when they appear in both the numerator and the denominator. Hide Since km is in the numerator in the original units, km needs to be in the denominator so that we can cancel: Set up the conversion by writing the fractions in a row with multiplication signs in between: Hide Evaluate. Do the original units cancel so that you are left with ONLY the units asked for? If not, repeat steps 3 and 4 until you are left with appropriate units: Hide We cancel km and end with mi/hr (which is what we want!) Multiply across top and bottom: Hide If necessary, reduce the fraction. Hide Evaluate your answer. Hide Is a speed limit of about 46 mph (mi/hr) a reasonable speed limit? If you got 120 or 0.075, would you recognize that it is not reasonable? You can drive approximately 45 miles per hour 50 km/hr Hide Write out the units you have (when appropriate as a fraction): Hide Write out the units you want to end with: Hide Determine appropriate conversion factors (in some cases, there will be more than one conversion factor for each of the units you have): Hide Since "hours" stays the same on the bottom, you only need one conversion factor: km to mi. So, you can write 1km = 0.6214 mi Evaluate appropriate arrangement for fractions (that is, what units belong in numerator (top) of fraction? What units need to be in denominator (bottom)? Remember, units cancel when one unit is in numerator and the other is in the denominator). Remember that when you multiply fractions (as you will in step 6 below), you can cancel units ONLY when they appear in both the numerator and the denominator. Hide Since km is in the numerator in the original units, km needs to be in the denominator so that we can cancel: Set up the conversion by writing the fractions in a row with multiplication signs in between: Hide Evaluate. Do the original units cancel so that you are left with ONLY the units asked for? If not, repeat steps 3 and 4 until you are left with appropriate units: Hide We cancel km and end with mi/hr (which is what we want!) Multiply across top and bottom: Hide If necessary, reduce the fraction. Hide Evaluate your answer. Hide Is a speed limit of about 30 mph (mi/hr) a reasonable speed limit? If you got 0.80 mph or 30,000 mph, would you recognize that it is not reasonable? You can drive about 30 mph! Density Conversions (multiple step problems) Problem 2: Geologists' observations suggest that the two most common rocks exposed at the surface of the Earth are granite (continental crust) and basalt (oceanic crust). From travel times of earthquake waves, we also know that the average density of the Earth is about 5.5 g/cm3. See if you can do some unit conversions using information given in the questions below to determine whether the whole Earth could be made of these two rock types only. As an astute observer walking around on continental crust (granite), you might decide to test the hypothesis that the Earth is made entirely of granite. You weigh a 1.00 cubic ft piece of granite on your home scale and find that it weighs 171 lbs. Thus you determine that the granite has a density of 171 lb/ft3. Convert your granite's density to g/cm3. Given the information above, could the earth be made completely of granite? Hide Let's go through this using the steps from the Unit Conversions Page. Copy the number and units as a fraction: Hide Because the block of granite is 1 cubic foot, you can put 1 on the bottom of the fraction. Write out the units you want to end with: Hide Look up the conversion factors for what you have (pounds and feet(or cubic feet)) to what you want (grams and cm (or cubic cm)). Hide pounds to grams: 1 lb = 453.3924 g feet to cm: 1 foot = 30.48 cm feet to cubic feet: 1 ft * 1 ft * 1 ft = 1 ft3 cubic feet to cubic centimeters: 1 ft3 = 30.48 cm * 30.48 cm * 30.48 cm = 28,316 cm3 Take note of what you have and what you want to end up with. Then, write out conversion factors from step 2 as fractions so that units cancel. Hide You want to be able to cancel lb (so that unit has to be on the bottom of the converting fraction) and ft3 (so that unit has to be on the top of the converting fraction): Once you have written all the conversion fractions so that the original value is being multiplied by them (see last step), evaluate. Do the original units cancel so that you end up with what the question is asking for? Hide Multiply the fractions (across the top and bottom): Hide Divide the resulting number to get an answer. Hide Is this a reasonable answer? Hide This isn't the answer we were looking for - 5.5 g/cm3. But it is within an order of magnitude. It is also a number that is greater than the density of water (which is 1 g/cm3) and we know that granite is denser than water! So it's a reasonable number. However, it shows that the Earth cannot be made completely of granite! Given that basalt seems to well up when ocean crust pulls apart at Mid-Ocean ridges, you might decide that maybe the entire Earth is made of basalt. On your bathroom scale, a 64 in 3 (4in x 4in x 4in) block of basalt weighs 116 ounces. Use this information to calculate whether the average density of the Earth (5.5 g/cm3) can be explained by an Earth made completely of basalt. Hide Let's go through this using the steps from the Unit Conversions Page. Copy the number and units as a fraction: Hide Write out the units you want to end with: Hide Look up the conversion factors for what you have (pounds and feet(or cubic feet)) to what you want (grams and cm (or cubic cm)). Hide oz to grams: 1 oz = 28.349523 g in to cm: 1 inch = 2.54 cm inches to cubic inches: 1 in * 1 in * 1 in = 1 in3 cubic in to cubic centimeters: 1 in3 = 2.54 cm * 2.54 cm * 2.54 cm = 16.4 cm3 Take note of what you have and what you want to end up with. Then, write out conversion factors from step 2 as fractions so that units cancel. Hide You want to be able to cancel oz (so that unit has to be on the bottom of the converting fraction) and in3 (so that unit has to be on the top of the converting fraction): Once you have written all the conversion fractions so that the original value is being multiplied by them (see last step), evaluate. Do the original units cancel so that you end up with what the question is asking for? Hide Multiply the fractions (across the top and bottom): Hide Divide the resulting number to get an answer. Hide Is this a reasonable answer? Hide This isn't the answer we were looking for - 5.5 g/cm3. But it is within an order of magnitude. It is also a number that is greater than the density of water (which is 1 g/cm3) and we know that basalt is denser than water (it sinks)! So it's a reasonable number. However, it shows that the Earth cannot be made completely of basalt either! So, there must be something denser down there - like the iron/nickel core! Problem 3: You are working with a map that has a fractional scale of 1:24,000 (meaning that 1 unit on the map is equal to 24,000 units on the ground - 1mm = 24,000 mm or 1 in = 24,000 in). See if you can determine solutions to the following problems that geologists face when working with maps. You are hiking to a field area and measure the length of the trail as 18.5 inches. Calculate how many miles you have to hike to get to the interesting rocks/geology? Hide This is actually a two step conversion problem. First you have to convert your map measurements to measurements on the ground. Then you can convert to units that you understand. First, think about what you have (18.5 in on the map and a scale) and what you want to know (how many miles 18.5 inches represents on the ground). It may help to think about inches on the map and inches on the ground as different units. To begin, write the fractional scale as a fraction (with the distance on the ground on top (since that is what we want to ultimately end up with)). You have just calculated how many inches you have to cover on the trail. But, that's just seems like a lot, so let's convert those inches to miles! First, let's write out the appropriate conversion factors: 1 foot = 12 inches and 1 mile = 5280 feet. Next, we have to write these conversion factors as fractions. Remember to arrange them so that units you don't want cancel and you end up with units that you do want! Then we can cancel units. Do we end up with miles? Yes! Now we multiply across the top and bottom (note that the bottom number doesn't have any units because both are canceled by others): And when we clear fractions: We find that our hike will be 7 miles! Once you get to your field area, you are going to create a geologic map of that area. You have a mechanical pencil that has a lead that is 0.3 mm thick. The smallest feature you can map will be something that is 0.3 mm wide on the map. How wide (in m) can that feature be? Hide This, like 3.1 is actually a two step conversion problem. First you have to convert your map measurements to measurements on the ground. Then you can convert to units that you understand. First, think about what you know (0.3 mm on the map and a scale) and what you want to know (how many meters 0.3 mm represents on the ground). It may help to think about mm on the map and mm on the ground as different units. To begin, write the fractional scale as a fraction (with the distance on the ground on top (since that is what we want to ultimately end up with)). You have just calculated how many millimeters thick a feature can be. But, because this is the metric system, we can modify that so that you don't have to keep a lot of zeros in your head. First, let's write out the appropriate conversion factors: Next, we have to write these conversion factors as fractions. Remember to arrange them so that units you don't want cancel and you end up with units that you do want! Finally, cancel the appropriate units (mm in this case) and multiply across the top and bottom. You can map any feature wider than 7.2 m. Hide The cool thing about the metric system is that it is based in the number 10. This means that conversions within the metric system involve moving zeros around. It also means that when doing calculations, many times you can cancel out zeros. How does this work? Zeros can only be canceled if they occur on the top and bottom of a fraction. In the problem above, you can cancel two zeros on either side of the fraction: Note that the calculation then becomes 72 divided by 10. Most of us can easily divide by 10, making this calculation much easier. In fact, when you get to that point, you may not even need a calculator. Keep this in mind as you do calculations! Now you have an idea of the size of features that can be drawn on your map. Convert your answer in problem 3.2 to feet. Hide This is a simple conversion with only one step. The conversion factor listed in the table (see link above) is 1 m = 3.281 feet. First let's set up our equation with fractions: Then cancel units and multiply top and bottom You can map a feature that is about 24 feet wide. Next Steps Okay, I am ready to try the assessment. Take me there! When you get there, remember to log in with your username and your password. Still need more practice? There are numerous websites that have practice problems for unit conversions. Several of them are listed below. Please use these links for more practice with unit conversions! « Previous Page Next Page » These conversion worksheets have problems with various levels of difficulty converting between imperial (customary) and metric unit of length using unit fractions and unit cancelling. The answer keys for these worksheets show multiple steps where required to convert between the measurement system as well as between various unit scales, so they are very useful for understanding how to cancel units when solving a conversion problem. Customary and Metric Conversion WorksheetOnce you have mastered converting between units in their own system of measurement, the next step is to learn how to convert between metric and customary units. The worksheets in this section introduce conversions between the two systems for mass, volume and distance measurements. Each of these conversions requires memorizing various constants.cm to inchesThere are exactly 2.54 centimeters in one inch. This is the basic fact that needs to be memorized for any of the distance conversions between metric and customary measurement. To convert from cm to inches, we divide the number of centimeters by 2.54 to get the result. For example, to calculate 180 cm in feet and inches, we divide 180 by 2.54 to get approximately 70.86 inches. If we divide that value by 12, we get five wholes and a remainder of 10.86, which means 180 cm is equal to 5 ft 10.86 inches. We use a similar process to convert from inches to cm, employing multiplication by the same 2.54 constant. As an example, 6 ft 2 in converted to inches is 74 inches, and that value multiplied by 2.54 is 187.96 cm. The two groups group of worksheets on this page deal with the cm to inches conversion, inches to cm conversion, inches to meters, mm to inches and other similar conversions between the two systems of measurement. The worksheets are grouped with the conversions from metric to customary, customary to metric and a mixture of both types of practice problems.

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