

## Unit Cancellation

We use this method to solve many problems by using the relationship of one unit to another. For example, 12 inches = 1 foot. Since these two measurements represent the same value, the ratio (fractions) are both equal to one. When you multiply another number by the number one, you do **NOT** change its **VALUE**. However, you may change its **UNIT**.

$$\frac{12 \text{ in.}}{1 \text{ ft.}} = 1 \quad \frac{1 \text{ ft.}}{12 \text{ in.}} = 1$$

Recall that significant figures are only consider when working with measurements. Measurements are always rounded and therefore we need sig. figs. to tell us how accurate our computations using those measurement are. Remember that conversion factors and counting numbers are considered 100% accurate and do not require sig. figs. In this worksheet, we can consider the first number given to be a measurement. Therefore, write your answers to the same number of significant figures as the first measurement given.

The important thing here is to write the units. Unit Cancellation is just a method of converting numbers to different units. Let the units tell you whether you should multiply or divide by a conversion factor.

Example: Convert 2 miles to inches

$$\frac{2 \text{ miles}}{1} \times \frac{5,280 \text{ ft.}}{1 \text{ mile}} \times \frac{12 \text{ in.}}{1 \text{ ft.}} = 126,720 \text{ in.}$$

Notice that we put the first conversion factor with miles on the bottom and ft on the top so that miles would cancel out. This is how we convert miles into ft.

We always write conversion factors so that the unit we are changing **from** is on the **bottom** so they cancel out. Always show your work in this manner. You must set up your problem just like in this example. You must write the unit for every number. Do your arithmetic at the end, not in the middle of the problem.

Example: Convert 2 miles per hour to feet per second.

$$\frac{2 \text{ miles}}{1 \text{ hr.}} \times \frac{5,280 \text{ ft.}}{1 \text{ mile}} \times \frac{1 \text{ hr.}}{60 \text{ min.}} \times \frac{1 \text{ min.}}{60 \text{ sec.}} = 2.93 \frac{\text{ft}}{\text{sec.}}$$

Notice that we first changed miles into ft. Then we changed hr. into min. and then into sec. In each case, the conversion factor was written so the unit we were changing from was cancelled out.

Remember: Set up your problem like this. Always write the units. Do the arithmetic last. This is how you "show me your work". I don't want to see arithmetic problems. I want to see this setup.

Solve the following problems.

Show your setup here.

1. 3.00 hrs. = \_\_\_\_\_ sec.

2. 0.035 mg = \_\_\_\_\_ cg

3. 5.5 L = \_\_\_\_\_ cm<sup>3</sup>

4. 2.50 yds. = \_\_\_\_\_ in.

5. 14 mi. = \_\_\_\_\_ ft.

6. 63,360 ft. = \_\_\_\_\_ mi.

7. 128 mL = \_\_\_\_\_ L
8. 4924 cm<sup>3</sup> = \_\_\_\_\_ mL
9. 12.0 km / hr = \_\_\_\_\_ cm / sec
10. 116,160 ft. = \_\_\_\_\_ mi.

Word problems work the same way. They are just conversion problems with several steps. Always start with the first thing given in the problem. That number's unit is somehow related to another unit. Find it in the problem. That becomes your conversion factor.

11. A sportsman whose business is renting rowboats must buy a pair of new oars for each of his 60 boats. If the oars cost \$200 per dozen pairs, how much does he pay for the oars?
12. A summer camp having 555 boys forms basketball teams of 5 players each. Each team is supplied with 2 practice basketballs. The basketballs are purchased at \$50 per 3 basketballs. What is the cost of all the basketballs?
13. A group plans to prepare 60 signs from plywood. They can make 4 signs from one sheet of plywood. The wood costs \$32 per 5 sheets. What would be the cost of the plywood for all the signs.
14. A man raised 50 goats then entered into a series of transactions. He traded all the goats for sheep at an exchange rate of 5 goats for 7 sheep. Next he exchanged all of the sheep for hogs at a rate of 4 sheep for 2 hogs weighing 250 lbs. each. He sold all the hogs at a market price of \$55 per 100 lbs. How much money did he make from the 50 goats?
15. You are in Paris and wish to buy some peaches for lunch. The sign in the fruit stand indicates that peaches are 11.5 francs per kilogram. Given that there are approximately 5 francs to the dollar, and 2.205 lbs. per kilogram, calculate what a pound of peaches will cost in dollars. (Hint: Start with the 1.00 Lb of peaches).

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Notice that we put the first conversion factor with miles on the bottom and ft on the top so that miles would cancel out. This is how we convert miles into ft.

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Notice that we first changed miles into ft. Then we changed hr. into min. and then into sec. In each case, the conversion factor was written so the unit we were changing from was cancelled out.

Remember: Set up your problem like this. Always write the units. Do the arithmetic last. This is how you "show me your work". I don't want to see arithmetic problems. I want to see this setup.

Solve the following problems.

Show your setup here.

1. 3.00 hrs. = 10,800 sec.

$$3.00 \text{ hrs} \times \frac{60 \text{ min}}{\text{hrs}} \times \frac{60 \text{ sec}}{\text{min}} =$$

2. 0.035 mg = 0.0035 cg

$$0.035 \text{ mg} \times \frac{1 \text{ cg}}{10 \text{ mg}} =$$

3. 5.5 L = 5,500 cm<sup>3</sup>

$$5.5 \text{ L} \times \frac{1,000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ cm}^3}{1 \text{ mL}} =$$

4. 2.50 yds. = 90.0 in.

$$2.50 \text{ yds} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in.}}{1 \text{ ft}} =$$

5. 14.00 mi. = 73,920 ft.

$$14 \text{ mi} \times \frac{5,280 \text{ ft}}{1 \text{ mi}} =$$

6. 63,360 ft. = 12.00 mi.

$$63,360 \text{ ft} \times \frac{1 \text{ mi}}{5,280 \text{ ft}} = 12 \text{ mi.}$$

7.  $128 \text{ mL} = \underline{0.128} \text{ L}$      $128 \text{ mL} \times \frac{1 \text{ L}}{1,000 \text{ mL}} = 4924 \text{ cm}^3 \times \frac{1 \text{ mL}}{1 \text{ cm}^3} =$
8.  $4,924 \text{ cm}^3 = \underline{4,924} \text{ mL}$
9.  $12.0 \text{ km / hr} = \underline{333} \text{ cm / sec}$      $\frac{12.0 \text{ km}}{1 \text{ hr}} \times \frac{10^5 \text{ cm}}{1 \text{ km}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min.}}{60 \text{ sec}} =$
10.  $116,160 \text{ ft.} = \underline{22.000} \text{ mi.}$      $116,160 \text{ ft} \times \frac{1 \text{ mi}}{5,280 \text{ ft}} =$

Word problems work the same way. They are just conversion problems with several steps. Always start with the first thing given in the problem. That number's unit is somehow related to another unit. Find it in the problem. That becomes your conversion factor.

11. A sportsman whose business is renting rowboats must buy a pair of new oars for each of his 60 boats. If the oars cost \$200 per dozen pairs, how much does he pay for the oars?

$$60 \text{ boats} \times \frac{1 \text{ pair oars}}{\text{boat}} \times \frac{\$200}{12 \text{ pairs oars}} = \$1,000$$

12. A summer camp having 555 boys forms basketball teams of 5 players each. Each team is supplied with 2 practice basketballs. The basketballs are purchased at \$50 per 3 basketballs. What is the cost of all the basketballs?

$$555 \times \frac{\text{team}}{5 \text{ boys}} \times \frac{2 \text{ basketballs}}{\text{team}} \times \frac{\$50}{3 \text{ basketballs}} = \$3,700$$

13. A group plans to prepare 60 signs from plywood. They can make 4 signs from one sheet of plywood. The wood costs \$32 per 5 sheets. What would be the cost of the plywood for all the signs.

$$60 \text{ signs} \times \frac{\text{sheet}}{4 \text{ signs}} \times \frac{\$32}{5 \text{ sheets}} = \$96$$

14. A man raised 50 goats then entered into a series of transactions. He traded all the goats for sheep at an exchange rate of 5 goats for 7 sheep. Next he exchanged all of the sheep for hogs at a rate of 4 sheep for 2 hogs weighing 250 lbs. each. He sold all the hogs at a market price of \$55 per 100 lbs. How much money did he make from the 50 goats?

$$50 \text{ goats} \times \frac{7 \text{ sheep}}{5 \text{ goats}} \times \frac{2 \text{ hogs}}{4 \text{ sheep}} \times \frac{250 \text{ lbs}}{\text{hog}} \times \frac{\$55}{100 \text{ lbs}} = \$4,812.50$$

15. You are in Paris and wish to buy some peaches for lunch. The sign in the fruit stand indicates that peaches are 11.5 francs per kilogram. Given that there are approximately 5 francs to the dollar, and 2.205 lbs. per kilogram, calculate what 1.00 pound of peaches will cost in dollars. (Hint: Start with the 1.00 Lb of peaches).

$$1.00 \text{ lb (peaches)} \times \frac{1 \text{ kg}}{2.205 \text{ lbs.}} \times \frac{11.5 \text{ francs}}{1 \text{ kg}} \times \frac{\$1}{5 \text{ francs}} = \$1.04$$