Unit Conversions

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Printed: July 18, 2012

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CONCEPT 1

Unit Conversions

Students will learn how to convert units from metric to english system and vice verse using dimensional analysis.

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Key Equations

$$1 \text{ meter} = 3.28 \text{ feet}$$
$$1 \text{ mile} = 1.61 \text{ kilometers}$$
$$1 \text{ lb. (1 pound)} = 4.45 \text{ Newtons}$$

Guidance

- The key to converting units is to multiply by a clever factor of one. You can always multiply by 1, because it does not change the number. Since 1 in. is equal to 2.54 cm, then $1 = \frac{2.54 \text{ cm}}{1 \text{ in}} = \frac{1 \text{ in}}{2.54 \text{ cm}}$. Thus, one can multiply by this form of 1 in order to cancel units (see video below).
- Write out every step and show all your units cancelling as you go.
- When converting speeds from metric to American units, remember the following rule of thumb: a speed measured in mi/hr is about double the value measured in m/s (*i.e.,* $10 \text{m}/\text{s}$ is equal to about 20 MPH). Remember that the speed itself hasn't changed, just our representation of the speed in a certain set of units.
- When you're not sure how to approach a problem, you can often get insight by considering how to obtain the units of the desired result by combining the units of the given variables. For instance, if you are given a distance (in meters) and a time (in hours), the only way to obtain units of speed (meters/hour) is to divide the distance by the time. This is a simple example of a method called *dimensional analysis*, which can be used to find equations that govern various physical situations without any knowledge of the phenomena themselves.

Example 1

Question: 20 m/s = ? mi/hr

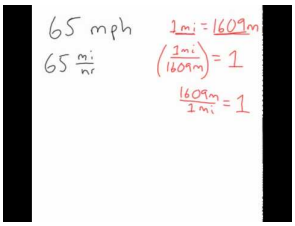
Solution:

20 m/s (1 mi/1600 m) = .0125 mi/s

.0125 mi/s (60 s/min) = .75 mi/min

.75 mi/min (60 min/hr) = 45 mi/hr

Watch this Explanation



MEDIA

Click image to the left for more content.

Time for Practice

1. Estimate or measure your height.
   a. Convert your height from feet and inches to meters.
   b. Convert your height from feet and inches to centimeters $(100\text{ cm} = 1\text{ m})$
2. Estimate or measure the amount of time that passes between breaths when you are sitting at rest.
   a. Convert the time from seconds into hours
   b. Convert the time from seconds into milliseconds (ms)
3. Convert the French speed limit of 140 km/hr into mi/hr.
4. Estimate or measure your weight.
   a. Convert your weight in pounds into a mass in kg
   b. Convert your mass from kg into μg
   c. Convert your weight into Newtons
5. Find the SI unit for pressure.
6. An English lord says he weighs 12 stone.
   a. Convert his weight into pounds (you may have to do some research online)
   b. Convert his weight in stones into a mass in kilograms
7. If the speed of your car increases by 10 mi/hr every 2 seconds, how many mi/hr is the speed increasing every second? State your answer with the units mi/hr/s.

Answers

1. a. A person of height 5 ft. 11 in. is 1.80 m tall b. The same person is 180 cm
2. a. 3 seconds $= 1/1200$ hours b. $3x10^3$ ms
3. 87.5 mi/hr
4. If the person weighs 150 lb then a. 67.9 kg (on Earth) b. 67.9 billion μg c. this is equivalent to 668 N
5. Pascals (Pa), which equals N/m^2
6. a. 168 lb.,b. 76.2 kg
7. 5 mi/hr/s