

Dimensional Analysis

Conversions:

$$1 \text{ foot} = 12 \text{ inches}$$

$$3 \text{ ft} = 1 \text{ yard}$$

$$5280 \text{ ft} = 1 \text{ mile}$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ km} = 0.62 \text{ miles}$$

$$1000 \text{ mm} = 1 \text{ m}$$

$$100 \text{ cm} = 1 \text{ m}$$

$$10 \text{ mm} = 1 \text{ cm}$$

$$1 \text{ km} = 1000 \text{ m}$$

$$60 \text{ sec} = 1 \text{ min}$$

$$60 \text{ min} = 1 \text{ hr}$$

$$24 \text{ hr} = 1 \text{ day}$$








$$365 \text{ days} = 1 \text{ yr}$$

Using the above conversion factors, make the following conversions.

1. Convert 100 mm into inches.
2. Convert 32 years into hours.
3. Convert 12,345 mm into km.
4. Convert 12,345 seconds into years.
5. Convert 35 inches into meters.
6. Convert 1234 mm into feet.
7. Convert 27 km/hr into m/s.
8. Convert 35 miles/hr into ft/sec.
9. Convert 120 ft/min into km/hr.
10. Convert 420 ft/sec into miles/hr.

Converting Units: Currency Exchange

A great example of simple dimensional analysis involves converting from one unit of currency to another. Consider, for example, the table of values below, using data current on 12 September 2011 rounded to the second decimal place.

	 USD	 GBP
	1	1.58762
	0.62987	1
	1.00088	1.58902
	0.732279	1.16258
	0.968439	1.53752

Monday, September 12, 2011

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The table shows us, for example, that \$1.00 = £0.63 British pounds = € 0.73 (euros) rounded to two decimal places.

Suppose, for example, while traveling through France you find an mp3 player priced at € 89.99. What is the equivalent number of US Dollars?

1. Start with what is given: € 89.99
2. Write the conversion that \$1.00 = € 0.73, and multiply it by what is given so that the units you start with cancel out.

$$€ 89.99 \times \frac{\$1.00}{€ 0.73} = \$123.27$$

Now, answer these questions in a similar manner.

1. How much does the mp3 player cost in Canadian dollars?
2. Which currency listed is closest to the value of the US dollar? Which is the most “valuable” on a one to one comparison?
3. While visiting an international bazaar, you find three ice cream vendors side by side. One sells ice cream cones for \$2.49, one sells the identical product for £1.19, and the third sells them for 1.99 Australian dollars. Which is the most expensive? Which is the cheapest? Show your work.

Using the above conversion factors, make the following conversions.

1. Convert 100 mm into inches.

$$100 \text{ mm} \times \frac{1 \text{ cm}}{10 \text{ mm}} \times \frac{1 \text{ inch}}{2.54 \text{ cm}} = 3.94 \text{ inches}$$

2. Convert 32 years into hours.

$$32 \text{ yrs} \times \frac{365 \text{ days}}{1 \text{ yr}} \times \frac{24 \text{ hrs}}{1 \text{ day}} = 280,320 \text{ hrs} = 2.80 \times 10^5 \text{ hrs}$$

3. Convert 12,345 mm into km.

$$12,345 \text{ mm} \times \frac{1 \text{ m}}{1000 \text{ mm}} \times \frac{1 \text{ km}}{1000 \text{ m}} = 0.012 \text{ km}$$

4. Convert 12,345 seconds into years.

$$12,345 \text{ sec} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ yr}}{365 \text{ day}} = 0.00039 \text{ yrs}$$

5. Convert 35 inches into meters.

$$35 \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} \times \frac{1 \text{ m}}{100 \text{ cm}} = 0.889 \text{ m}$$

6. Convert 1234 mm into feet.

$$1234 \text{ mm} \times \frac{1 \text{ cm}}{10 \text{ mm}} \times \frac{1 \text{ inch}}{2.54 \text{ in}} \times \frac{1 \text{ ft}}{12 \text{ in}} = 4.05 \text{ ft}$$

7. Convert 27 km/hr into m/s.

$$\frac{27 \text{ km}}{\text{hr}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} = \frac{7.5 \text{ m}}{\text{sec}}$$

8. Convert 35 miles/hr into ft/sec.

$$\frac{35 \text{ miles}}{\text{hr}} \times \frac{5280 \text{ ft}}{1 \text{ mile}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} = \frac{51.33 \text{ ft}}{\text{sec}}$$

9. Convert 120 ft/min into km/hr.

$$\frac{120 \text{ ft}}{\text{min}} \times \frac{1 \text{ mile}}{5280 \text{ ft}} \times \frac{1 \text{ km}}{0.62 \text{ mile}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \frac{2.20 \text{ km}}{\text{hr}}$$

10. Convert 420 ft/sec into miles/hr.

$$\frac{420 \text{ ft}}{\text{sec}} \times \frac{1 \text{ mile}}{5280 \text{ ft}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \frac{283.36 \text{ miles}}{\text{hr}}$$