

Name: _____

Unit Conversion Sheet

EXAMPLE

Which is faster, going 80 miles an hour or going 40 meters per second?

Okay, I need to convert from "miles" to "meters" and from "hours" to "seconds". I find the following conversion factors useful:

60 seconds : 1 minute
60 minutes : 1 hour
1 mile : 5280 feet
1 mile : 1.61 km
1 foot : 12 inches
2.54 centimeters : 1 inch
100 centimeters : 1 meter
1000 meters : 1 kilometer
1000 grams : 1 kilogram

To compare these two rates of speed, I need them to be in the same units. I decide that I'll convert the "80 miles per hour" to "meters per second". I need to start setting things up so the units will cancel:

$$\frac{80 \text{ miles}}{\text{hour}} \cdot \frac{1 \text{ hour}}{60 \text{ mins}} \cdot \frac{1 \text{ min}}{60 \text{ secs}}$$

Why did I put "1 hour" on top and "60 min" underneath? Because I started with "80 miles per hour", so "hours" was underneath. I want "hours" to cancel off, so the conversion factor for hours and minutes needed to have "hours" on top. That meant that "60 min" had to be underneath. And that dictated the orientation of the next factor: since "60 min" was underneath and since I'd need "minutes" to cancel at some point, then the "1 min" (from the conversion factor for minutes and seconds) had to be on top; this in turn meant that "60 sec" had to be underneath. And since I'm wanting a final answer of "per seconds", I *want* the seconds underneath, so this works out just right.

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$$\frac{80 \text{ miles}}{\text{hour}} \cdot \frac{1 \text{ hour}}{60 \text{ mins}} \cdot \frac{1 \text{ min}}{60 \text{ secs}} \cdot \frac{5280 \text{ ft}}{1 \text{ mile}} \cdot \frac{12 \text{ in}}{1 \text{ ft}} \cdot \frac{2.54 \text{ cm}}{1 \text{ inch}} \cdot \frac{1 \text{ meter}}{100 \text{ cm}}$$

Cancel off the units:

$$\frac{80 \cancel{\text{ miles}}}{\cancel{\text{ hour}}} \cdot \frac{1 \cancel{\text{ hour}}}{60 \cancel{\text{ mins}}} \cdot \frac{1 \cancel{\text{ min}}}{60 \text{ secs}} \cdot \frac{5280 \cancel{\text{ ft}}}{1 \cancel{\text{ mile}}} \cdot \frac{12 \cancel{\text{ in}}}{1 \cancel{\text{ ft}}} \cdot \frac{2.54 \cancel{\text{ cm}}}{1 \cancel{\text{ inch}}} \cdot \frac{1 \text{ meter}}{100 \cancel{\text{ cm}}}$$

Since the units cancel, leaving me with the "meters per second" that I need, I know the numbers must then be in the right places. So to get my answer, all I have to do is grab a calculator and simplify:

$$\frac{80}{1} \cdot \frac{1}{60} \cdot \frac{1}{60} \cdot \frac{5280}{1} \cdot \frac{12}{1} \cdot \frac{2.54}{1} \cdot \frac{1}{100} \approx 35.7632$$

This says that 80 miles per hour is equivalent to just under 36 meters per second, so:

40 meters per second is faster than 80 miles per hour.

Canceling units (also known as "factor label") is based on the principal that multiplying something by "1" doesn't change the value, and that any value divided by the same value equals "1".

Convert the following: (Show all work for full credit)

1. 600 sec to hours

2. 30 miles to meters

3. 5400 km to centimeters

4. 50 miles/hr to km/hr

5. 25 km/hr to m/s

6. 70 miles/hr to m/s

7. 5 feet to meters

8. 10 m/s to miles/hr