Name: _____ Date: _____

# Dimensional Analysis

READ

Dimensional analysis is used to solve problems that involve converting between different units of measurement.

PRACTICE

1. Circle the conversion factor you would choose to solve the following problems.
   a. How many inches are in 6 meters?

   $$\frac{1 \text{ meter}}{39.4 \text{ inches}} \text{ OR } \frac{39.4 \text{ inches}}{1 \text{ meter}}$$

   b. How many liters are in 10 U.S. gallons?

   $$\frac{1 \text{ gallon}}{3.79 \text{ liters}} \text{ OR } \frac{3.79 \text{ liters}}{1 \text{ gallon}}$$

   c. 100 kilometers is equal to how many miles?

   $$\frac{1 \text{ kilometer}}{0.624 \text{ miles}} \text{ OR } \frac{0.624 \text{ miles}}{1 \text{ kilometer}}$$

   d. 1,000,000 grams is equal to how many kilograms?

   $$\frac{0.001 \text{ kilogram}}{1 \text{ gram}} \text{ OR } \frac{1 \text{ gram}}{0.001 \text{ kilogram}}$$

2. A grocery store just received a shipment of 200 cartons of eggs. Each carton holds one dozen eggs. If 12 eggs = 1 dozen, how many eggs did the store receive?

3. A marathon is 26.2 miles long. How many kilometers is a marathon? (1 mile = 1.61 km)

4. The speed limit on many interstate highways in the United States is 65 miles per hour. How many kilometers per hour is that? (1 mile = 1.61 km)

5. Ashley is going on a trip to London. She has saved $100.00 in spending money. When she arrives in England, she goes to a bank to change her money into pounds. She is told that the exchange rate is 1 British pound = 1.43 American dollars. The bank charges a fee of 4 pounds to change the money from dollars to pounds. How much money, in British pounds, will Ashley have if she changes all of her dollars to pounds?

6. Although it is widely believed that Germany's Autobahn highway has no speed limit whatsoever, much of the highway has regulated speed limits of 130 km/hr or less, and in some places speed is limited to just 60 km/hr.
   a. How many miles per hour is 130 km/hr? (1 mile = 1.61 km)
   b. How many miles per hour is 60 km/hr?

7. In England, a person's weight is commonly given in stones. One English stone is equal to 14 pounds. If an English friend tells you he weighs eleven stones, what is his weight in pounds?

Name: _____ Date: _____

# Working with Quantities and Rates

**READ**

- A quantity describes an amount of something. It has two parts: a number and a unit. The number tells "how many." The unit tells "of what." For example, 10 apples is a quantity. **10** is the number, **apples** is the unit.
- You cannot combine quantities unless they have the same unit. For example, 5 apples + 5 pears can't be combined, but 5 apples + 5 apples can be combined to make 10 apples.
- When you multiply or divide quantities, the units get multiplied or divided too. For example, 10 cm ÷ 10 cm = 100 cm ÷cm, or 100 $cm^2$.
- A rate describes a relationship between two quantities. Rates are commonly described as something "per" something, like "50 miles *per* hour." *Per* means "for every" or "for each." In science, we often use a fraction bar or slash to represent the word per, as in 10 cookies/dollar. Rates are usually written in the fraction's lowest terms. For example, if you received $100 for working 10 hours, you could write:

$$\frac{100 \text{ dollars}}{10 \text{ hours}} = \frac{10 \text{ dollars}}{1 \text{ hour}}$$

- Sometimes you will be asked to multiply two rates. This is often done to change one unit to another. For example, if you wanted to know how much you were paid per minute, you could set up a problem like this:

$$\frac{10 \text{ dollars}}{1 \text{ hour}} \times \frac{1 \text{ hour}}{60 \text{ minutes}} = \frac{10 \text{ dollars}}{60 \text{ minutes}} = \frac{0.17 \text{ dollar}}{1 \text{ minute}}$$

Notice that the rules for multiplying fractions apply to units, too. Since "hour" appears in the numerator and the denominator, the "hour" unit is cancelled

**PRACTICE**

1. Practice your skills with quantities in the problems below. Make sure that you include units in your answer. If the quantities can't be combined, write "cannot combine" as your answer.

   a. 5 inches × 4 inches =

   b. 12 cookies – 5 cookies =

   c. 12 eggs + 12 eggs =

   d. 120 erasers ÷ 10 boxes =

   e. 12 cookies – 5 candy bars =

   f. 120 erasers ÷ 12 erasers =

Practice your skills with rates in the problems below. Some of the units you will see are real (like seconds) and some are made up (like blinks). Even with made up units, the rules for algebra and arithmetic still apply. Make sure that you reduce fractions to their lowest terms and include units in your answer.

2. $\frac{\$36}{3 \text{ hours}} =$

3. $\frac{48 \text{ students}}{2 \text{ classrooms}} =$

4. $\frac{10 \text{ meters}}{\text{second}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} =$

5. $\frac{15 \text{ winks}}{5 \text{ clinks}} \times \frac{10 \text{ blinks}}{5 \text{ winks}} =$


In the space provided, write the unit that should go in the parentheses so that each side of the equation is equal. Use the example to help you get started. Note that singular and plural units do cancel one another.

**Problem:** $\frac{\text{miles}}{(\quad)} \times \text{hours} = \text{miles}$ **Answer:** $\frac{\text{miles}}{(\text{hour})} \times \text{hours} = \text{miles}$

6. $\frac{\text{cm}}{\text{second}} \times \text{seconds} = (\quad)$

7. $\frac{\text{commercials}}{(\quad)} \times \text{program} = \text{commercials}$

8. $\frac{(\quad)}{\text{pound}} \times \text{pound} = \text{shrimp}$

9. $\text{seconds} \times (\quad) = \text{seconds}^2$

10. $\text{cm}^2 \times (\quad) = \text{cm}^3$

11. $\frac{(\quad)}{(\quad)} \times \text{pencils} = \text{boxes}$

12. $\frac{(\text{kg} \times \text{m})}{\text{s}^2} \times (\quad) = \text{m}$

13. $(\text{clinks})(\text{winks}) \times \frac{1}{\text{blinks}} = (\quad)$

14. $\frac{\text{miles}}{\text{hours}} \times \frac{\text{hours}}{\text{minute}} \times \frac{\text{minutes}}{\text{second}} = (\quad)$

15. $\frac{\text{centimeter}}{\text{hour}} \times \frac{\text{millimeter}}{\text{centimeter}} = (\quad)$

16. $(\quad) \times \frac{\text{pizzas}}{\text{person}} \times \frac{\text{dollars}}{\text{pizza}} = \text{dollars}$

17. $\frac{\text{calories}}{\text{minute}} \times \frac{\text{minute}}{\text{hour}} \times (\quad) = \text{calories}$

18. $\frac{\text{games}}{\text{year}} \times \frac{\$}{(\quad)} \times \text{years} = \$$

19. $\frac{\text{heartbeats}}{\text{minute}} \times \frac{\text{minute}}{(\quad)} \times \frac{\text{hour}}{\text{day}} \times \text{days} = \text{heartbeats}$

20. $\frac{\text{centimeters}}{\text{second}} \times \frac{\text{second}}{\text{hour}} \times \frac{\text{meter}}{(\quad)} \times \frac{\text{kilometer}}{\text{meter}} \times \frac{\text{miles}}{\text{kilometer}} = \frac{\text{miles}}{\text{hour}}$

# Unit Conversion Worksheet

**Conversions**

| | | |
|---|---|---|
| 1 hour = 3600 seconds | 1 mile = 5280 feet | 1 yard = 3 feet |
| 1 meter = 3.28 feet | 1 km = 0.62 miles | 1 light second = 300,000,000 meters |
| 1 kg = 2.2 lbs | 1 lb = 0.45 kg | 1 quart = 0.946 liters |
| 1 m/s = 2.2 miles/hour | 1 foot = 12 inches | 1 inch = 2.54 cm = 25.4 mm |

**Convert the following quantities.**

565,900 seconds into days

17 years into minutes

43 miles into feet

165 pounds into kilograms

100 yards into meters

22,647 inches into miles

2678 cm into feet

60 miles per hour into meters per second

130 meters per second into miles per hour

1100 feet per second into miles per hour

53 yards per hour into inches per week

721 lbs per week into kg per second

88 inches per second into miles per day

12080 gallons per month into liters per hour

27 miles per gallon into kilometers per liter

186,282 miles per second into meters per second

Name_____

**Jabberwocky**

Nonsense words taken from the poem *Jabberwocky* (from Lewis Carroll's *Through the Looking Glass*)

There are 20 tumtum trees in the tulgey wood.

In each tulgey wood is one frumious Bandersnatch.

There are 5 slithy toves in 2 borogoves.

There are 2 mome raths per Jabberwock.

There are 2 Jubjub birds in 200 tumtum trees.

There are 200 mome raths in each borogove.

There are 5 Jubjub birds per slithy tove.

**If there are 5 frumious Bandersnatches, how many Jabberwocks should there be?**

***HINT: What is your "given" info (other than conversion factors)? Use this to start the set up. Show your work.***

**After** you finish the problem above _____ , try this one:

A spaceship from another planet travels at a speed of 4.27 googs per mulm. There are 256 googs in a plotz and 12.3 plotz in a wraslm. If 3.4 tpocks equal one mulm, what is the ship's speed in wraslm per tpock? Show your work. In this case, assume numbers with decimal places are measured but whole numbers are exact (we'll pretend that "googs" are creatures!)