

10. Diet Coke contains approximately 31 milligrams of caffeine per cup. Determine how many milligrams per fluid ounce this is.
11. Barbecue potato chips contain 150 calories per ounce. Determine how many calories per pound this is.
12. All-purpose flour costs \$0.99 per pound. What is the price of flour per kilogram?
13. A hardware store loans out toolsets at a rate of \$5 per hour. Determine how much tool rental costs per day.
14. A water faucet left running can use 900 liters of water per hour. Determine how many gallons per hour this is.
15. A machine uses 0.5 gallons of fuel per hour. Determine how many liters per hour this is.
16. A road sign indicates that the speed is 50 miles per hour. What is the speed in kilometers per hour?
17. A road sign indicates that the speed is 100 kilometers per hour. What is the speed in miles per hour?
18. Hair grows at an average rate of 0.5 inches per month. What is the average growth rate of hair in centimeters per month?
19. For the first 30 years of its lifespan, a dawn redwood tree grows an average of 1.22 meters per year. Determine the growth rate of the tree in centimeters per year.
20. Guidelines recommend that paper lawn bags contain no more than 50 pounds of material per bag. Determine the recommended capacity in kilograms per bag.
21. According to an EPA study, the average American produces 4.5 pounds of trash per day. How many ounces of trash per day does the average American produce?
22. A motorcycle gets an average fuel efficiency of 25 km/L. Determine the fuel efficiency in miles per gallon.
23. An SUV gets an average fuel efficiency of 14 mi/gal. Determine the fuel efficiency in kilometers per liter.
24. The maximum speed of a housefly is 5 miles per hour. Determine the speed in kilometers per minute.
25. The average speed of a tree swallow is 20 miles per hour. Determine the speed in kilometers per minute.

26. Lumber varies in weight depending on the type of tree it is made from. A 2 x 6 Sitka Spruce lumber has a weight of 1.6 pounds per linear foot. Determine the weight in ounces per yard.
27. A pool is losing water at a rate of 3 fluid ounces per hour. Determine the rate of water loss in cups per day.
28. A small mill can process wood chips into sawdust at a rate of 75 kilograms per hour. Determine the rate in pounds per day.
29. A water faucet left running can use 240 gallons of water per hour. Determine this rate in liters per minute.
30. A pedometer is a device that records the number of steps taken, and many watches can measure this as well. Assuming a consistent walking pace, convert the following into steps per minute.
- Walking 4 miles per hour with a stride length of 2100 steps in a mile
 - Walking 2.75 miles per hour with a stride length of 1920 steps in a mile
 - Walking 3.25 miles per hour with a stride length of 2005 steps in a mile
31. Tenisha makes jewelry and sells it via an online craft site. For each of the following scenarios, express Tenisha's earnings in dollars per hour.
- Making 3 bracelets in 50 minutes and selling them for \$15 each.
 - Making 2 necklaces in 105 minutes and selling them for \$22 each.
 - Making 1 pair of earrings in 17 minutes and selling them for \$13 each.
32. Convert the following fuel consumption measurements from miles per gallon to kilometers per liter. Use 1 mile is approximately 1.609 kilometers and 1 gallon is approximately 3.785 liters.
- 28 miles per gallon
 - 21 miles per gallon
 - 32.5 miles per gallon
33. Recall from Example 4.4.4 that the drip factor for a liquid administered through an IV is given in gtt/mL. The flow rate of an IV is measured in gtt/min. For each of the following situations, determine how many drops per minute (in whole numbers) should be given.
- 300 mL given over 2 hours with a drip factor of 20 gtt/mL
 - 90 mL given over 0.5 hours with a drip factor of 15 gtt/mL
 - 1200 mL given over 10 hours with a drip factor of 20 gtt/mL
34. In 1628 the Swedish warship Vasa sank less than a mile into its first voyage. One factor may have been the use of different rulers during construction, with some calibrated to Swedish feet which had 12 inches and some calibrated to Amsterdam feet which had 11 inches. If the Vasa was 69 meters long, find the ship's length in Swedish feet and Amsterdam feet. Let 1 meter equal 39.37 inches.

35. After NASA's Hubble telescope first launched in 1990, the pictures it took were fuzzier than expected. The cause was an error in the shape of the telescope's main mirror: it was 2.2 microns too flat. If a micron is $1/1000$ of a millimeter and 1 millimeter is approximately 0.03937 inches, how large was the error in inches?
36. The day before the start of the 2014 Sochi Winter Olympics, an error was discovered in the biathlon track. The loop was supposed to be 2.5 kilometers but was 40 meters too short. If an athlete completed 3 loops on the erroneous track, how many feet short was their distance? Use 1 meter is approximately 3.281 feet.

4.4 PROJECT

LITERS, GALLONS, AND FUEL EFFICIENCY

According to a 2019 report produced by the United Nations, fossil fuel emissions from energy use grew 2.0% in 2018. These emissions reached a record high of 37.5 gigatons of equivalent CO_2 per year. In order to try to alleviate the issue, many countries are working on requiring that cars become more fuel efficient.

In this activity, you will investigate a few different units used to measure fuel efficiency and how to compare such units.

In the US, we define fuel efficiency as the number of miles a car can travel using one gallon of fuel. The unit of choice for this measurement is miles per gallon (mpg). This number is the rate of miles traveled per gallons used. European countries commonly define fuel efficiency as the amount of fuel a car requires to travel a fixed distance. The unit of choice for this measurement is liters per 100 kilometers $\left(\frac{\text{L}}{100 \text{ km}}\right)$. This number is the rate of liters of fuel used per 100 kilometers traveled. Notice that mpg is a rate of distance per volume of fuel while $\frac{\text{L}}{100 \text{ km}}$ is a rate of volume of fuel per distance.

The 2021 Honda Accord has a reported highway fuel efficiency of 38 mpg. Complete the following steps to find the Accord's equivalent highway fuel efficiency in the European standard of $\frac{\text{L}}{100 \text{ km}}$.

Recall that 1 US gallon is equal to 3.785 liters and that 1 mile is approximately equal to 1.61 kilometers.

- Determine how many 100 kilometers are in 38 miles. Round your answer to the nearest hundredth, if necessary. (**Hint:** Find the number of kilometers in 38 miles and divide your answer by 100.)
- Organize this information using the table below.

Distance	Miles	38
	100 Kilometers	
Fuel Volume	Gallons	1
	Liters	