Notes – Section 9.2

Example 1: U.S. Customary System (USCS)

a) The length of the Kentucky Derby horse race is 10 furlongs. How long is the race in miles?

$$10 \text{ furlongs}\left(\frac{\frac{1}{8}\text{ mile}}{1 \text{ furlong}}\right) = 1.25 \text{ miles}$$

b) How many inches are in 24 fathoms?

$$24 \text{ fathoms}\left(\frac{6 \text{ ft}}{1 \text{ fathom}}\right)\left(\frac{12 \text{ in}}{1 \text{ ft}}\right) = 1728 \text{ in}$$

c) The speed of a boat is 60 mi per hour. Find the speed in knots.

$$\left(\frac{60 \text{ mi}}{\text{hour}}\right)\left(\frac{5280 \text{ ft}}{1 \text{ mile}}\right)\left(\frac{1 \text{ naut mi}}{6076.1 \text{ ft}}\right) = 52.139 \frac{\text{Naut Mi}}{\text{hour}} = 52.139 \text{ Knots}$$

d) How many bushels of wheat can fit into a container that's 2 ft by 3 ft by 5 ft?

$$(2 \text{ ft})(3 \text{ ft})(5 \text{ ft})\left(\frac{12 \cdot 12 \cdot 12}{1728}\frac{\text{in}^3}{\text{ft}^3}\right)\left(\frac{\text{dry qt}}{67.2 \text{ in}^3}\right)\left(\frac{1 \text{ Peck}}{8 \text{ dry qt}}\right)\left(\frac{1 \text{ bushel}}{4 \text{ pecks}}\right)$$

$$= 34.1 \text{ bushels}$$

Example 2: Using Metric Prefixes

a. Convert 2759 centimeters to meters.

$$2759 \text{ cm}\left(\frac{10^{-2} \text{ m}}{1 \text{ cm}}\right) = 27.59 \text{ m}$$

b. Covert 200,000 micrograms to kilograms.

$$200{,}000 \text{ micrograms}\left(\frac{10^{-6} \text{ g}}{1 \text{ microgram}}\right)\left(\frac{1 \text{ kg}}{10^{3} \text{ g}}\right) = .0002 \text{ kg}$$

(.2 g)

c-f Fill in the blank with a number.

c) A liter is 10^6 L times as large as a microliter. (10^{-6} L)

$$\frac{\text{L}}{10^{-6}\text{L}} = \times \frac{10^{-6}\text{L}}{10^{-6}\text{L}}$$

d) A centimeter is 10 (10^{-2} m) times as large as a millimeter. (10^{-3} m)

e) A microsecond is 1000 (10^{-6} sec) times as large as a nanosecond. (10^{-9} sec)

f) A cubic meter is $(10)^3 = 1000$ (1 m) times as large as a cubic decimeter. ($\frac{1}{10}$ m, .01 m)

Example 3: Metric-USCS Conversions

a) Change 10 gallons to liters

$$10\,\text{gal}\left(\frac{1\,\text{L}}{0.2642\,\text{gal}}\right) = 37.85\,\text{L}$$

b) Change 14 meters to inches

$$14\,\text{m}\left(\frac{3.28\,\text{ft}}{1\,\text{m}}\right)\left(\frac{12\,\text{in}}{1\,\text{ft}}\right) = 551.04\,\text{in.}$$

c) Convert 55 miles per hour to kilometers per second.

$$\left(\frac{55\,\text{miles}}{\text{hour}}\right)\left(\frac{1.6093\,\text{km}}{1\,\text{mi}}\right)\left(\frac{1\,\text{hour}}{60\,\text{min}}\right)\left(\frac{1\,\text{min}}{60\,\text{sec}}\right) = .0246\,\text{km/sec}$$

d) How many square kilometers are in one square mile?

2.5898

$$1\,\text{mile}\cdot\text{mile}\left(\frac{1.6093\,\text{km}}{1\,\text{mile}}\right)\left(\frac{1.6093\,\text{km}}{1\,\text{mile}}\right) = 2.5900\,\text{km}^2$$

e) Convert 7 cubic meters to cubic inches.

426,867.84

$$7\,\text{m}\cdot\text{m}\cdot\text{m}\left(\frac{36\,\text{in}}{.9144\,\text{m}}\right)\left(\frac{36\,\text{in}}{.9144\,\text{m}}\right)\left(\frac{36\,\text{in}}{.9144\,\text{m}}\right) = 427,166\,\text{in}^3$$

f) A gas station in Canada sells gasoline for CAD 1.10 per liter. (CAD is an abbreviation for Canadian dollars.) What is the price in dollars per gallon? Use the currency exchange rate in Table 2.1.

$$\left(\frac{1.10\,\text{CAD}}{1\,\text{L}}\right)\left(\frac{\$1}{1.277\,\text{CAD}}\right)\left(\frac{3.785\,\text{L}}{1\,\text{gal}}\right) = 3.260 = \frac{\$3.26}{\text{gallon}}$$

g) Convert 50 pounds per cubic foot to grams per cubic inch.

$$\left(\frac{50\,\text{lb}}{\text{ft}\cdot\text{ft}\cdot\text{ft}}\right)\left(\frac{.4536\,\text{kg}}{1\,\text{lb}}\right)\left(\frac{1000\,\text{g}}{1\,\text{kg}}\right)\left(\frac{1\,\text{ft}}{12\,\text{in}}\right)\left(\frac{1\,\text{ft}}{12\,\text{in}}\right)\left(\frac{1\,\text{ft}}{12\,\text{in}}\right)$$

$$= 13.125\,\text{g/in}^3$$

Example 4: Temperature

a) Average human body temperature is 98.6°F. What is it in Celsius and Kelvin?

$\frac{98.6 - 32}{1.8} = 37\ C$ $\qquad 37 + 273.15 = 310.15\ K$

b) The temperature in Phoenix is 305° K. Convert this to Fahrenheit and to Celsius.

$305° K - 273.15 = 31.85\ C$

$F = 1.8(31.85) + 32$

$F = 89.33$