## Chapter 1

- The diameter of metal wire is often referred to by its American wire gauge number. A 16gauge wire has the diameter of 0.05082 in. What length of wire, in meters, is there in a 1.00 lb spool of 16 gauge copper wire? The density of copper is 8.92g/mL.
- 2 A copper penny has a mass of 3.015 g and contains 95.0% Cu. What is the mass of the copper present in one penny? If Cu costs 80¢ per pound, what is the value of the Cu in 100 pennies (\$1.00)? How many pennies contain one dollars worth of Cu?
- 3 The unit the furlong is used in horse racing. The units chain and link, are used in surveying. There are 8 furlongs in one mile, 10 chains in 1 furlong, and 100 links in a chain. To three significant figures, what is the length of 1 link in inches?

## Answers

1 Type of problem: density problem.

Information you will need for this problem:

- $\bullet \quad \text{Conversion of } \mathsf{lb} \to \mathsf{g}$
- Density of wire
- Conversion of in  $\rightarrow$  cm  $\rightarrow$  m
- Conversion of mL  $\rightarrow$  cm<sup>3</sup>
- $V = r^2 h r = d/2$

$$1.00 \text{ lb} \times \frac{453.592 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ mL}}{8.92 \text{ g}} \times \frac{\text{cm}^3}{1 \text{ mL}} = 50.85 \text{ cm}^3$$

$$50.85 \text{ cm}^3 = (0.02541 \text{ in})^2 \times (\frac{2.54 \text{ cm}}{1 \text{ in}})^2 \times \text{h}$$

$$h = 3885.66 \text{ cm} \times \frac{1 \text{ m}}{100 \text{ cm}} = 38.9 \text{ m}$$

2 Type of problem: Mass percentage problem

Information you will need for this problem:

- Mass of 1 penny
- Number of pennies in 1 dollar
- Conversion of grams of copper in 1 penny
- $\bullet \quad \text{conversion of } g \to \mathsf{lb}$

$$\frac{3.015 \text{ g}}{1 \text{ penny}} \times \frac{95.0 \text{ g Cu}}{100 \text{ g penny}} = \frac{2.86 \text{ g Cu}}{1 \text{ penny}}$$

 $100 \text{ penny} \times \frac{2.86 \text{ g Cu}}{1 \text{ penny}} \times \frac{1 \text{ 1b}}{453.592 \text{ g}} \times \frac{80 \text{¢}}{1 \text{ lb Cu}} = 50.4 \text{ ¢ worth of Cu}$ 

\$1.00 worth of copper  $\times \frac{100 \text{ penny}}{50.4^{\circ} \text{ worth } Cu}$  = 198 penny

3 Type of problem: Unit conversion/dimensional analysis

Information you will need for this problem:

 $\begin{array}{l} \bullet \quad \mbox{Conversion of in} \rightarrow \mbox{mi} \\ 1 \mbox{link} \times \frac{1 \mbox{chain}}{100 \mbox{ link}} \times \frac{1 \mbox{furlong}}{10 \mbox{ chains}} \times \frac{1 \mbox{mile}}{8 \mbox{ furlongs}} \times \frac{5280 \mbox{ ft}}{1 \mbox{mi}} \times \frac{12 \mbox{ in}}{1 \mbox{ ft}} = 7.92 \mbox{ in} \end{array}$