Some of these are from Tillery's textbook.

Exercise 1 Suppose you weigh 150 pounds. What would your weight be in kilograms?

One kilogram weighs 2.2 pounds, so your mass is

$$m = (150 \text{ lb}) \left(\frac{1 \text{ kg}}{2.2 \text{ lb}} \right) = \boxed{68 \text{ kg}}$$

Exercise 2 What is the mass density of iron if 5.0 cm^3 has a mass of 39.5 g?

Density is mass/volume, so

$$\rho = \frac{m}{V} = \frac{39.5 \text{ g}}{\boxed{5.0 \text{ cm}^3}} \quad (1)$$

$$= 7.9 \text{ g/cm}^3 \quad (2)$$

Exercise 3 What is the mass (in grams) of a 10 cm^3 cube of copper?

We need the density, so we look it up in Table 1.4: 8.96 g/cm^3. The volume is 10 cm^3, and if each cm^3 has a mass of 8.96 g, then the total mass is 10 times that, or **89.6 g**. Formally,

$$m = \rho V = (8.96 \text{ g/cm}^3)(10 \text{ cm}^3) = \boxed{89.6 \text{ g}}$$

Exercise 4 If ice has a mass density of 0.92 g/cm^3, what is the volume of 5,000 g of ice? Give the answer in liters.

By definition, $\rho = m/V$ so $V = m/\rho$:

$$V = \frac{5{,}000 \text{ g}}{0.92 \text{ g/cm}^3} = 5400 \text{ cm}^3$$

We need to convert to liters, so we write:

$$V = (5400 \text{ cm}^3) \left(\frac{\text{L}}{1000 \text{ cm}^3} \right) = \boxed{5.4 \text{ L}}$$

Note: more significant digits than 2 are not justified.

Exercise 5 What is the mass of gasoline ($\rho = 0.680$ g/cm^3) in a 94.6 L gasoline tank?

To keep the units straight, we need to either convert L to cm^3 or g/cm^3 to g/L. It does not really matter which we do. Lets convert L to cm^3. There are 1000 cm^3 in a liter, so the volume of the gas tank is (94.6 L)(1000 cm^3/L) = 94,600 cm^3. Now, $m = \rho V$ so

$$m = (0.680 \text{ g/cm}^3)(94{,}600 \text{ cm}^3) = \boxed{64{,}300 \text{ g or } 64.3 \text{ kg}}$$

Exercise 6 Convert 20.0 furlongs to its equivalent length in meters. *Show clearly how you are using conversion factors, as we demonstrated in class.*

A furlong is 1/8 of a mile, which you may find from a variety of sources. Therefore, so convert we write:

$$(20.0 \text{ furlongs}) \left(\frac{0.125 \text{ mile}}{\text{furlong}}\right) \left(\frac{1609 \text{ m}}{\text{mile}}\right) = \boxed{4020 \text{ m}}$$

Since we were given only 3 significant digits in the original number, we keep only 3 significant digits in the answer.

Exercise 7 What is the volume of a 2.00 kg pile of iron cans that are melted, then cooled into a solid cube? Give the answer in cubic centimeters.

We know the mass, so to find the volume we must have the density. From Table 1.4, the density of iron is $\rho = 7.87$ g/cm^3. Since by definition $\rho = m/V$, $V = m/\rho$.

$$V = \frac{2.00 \text{ kg}}{7.87 \text{ g/cm}^3} = \cdots$$

Whoa! This does not quite work, because g divided into kg does not "cancel" or give us 1. We have to convert kg to g: 2.00 kg is 2000 g. Now try it:

$$V = \frac{2000 \text{ g}}{7.87 \text{ g/cm}^3} = \boxed{254 \text{ cm}^3}$$

Exercise 8 A cubic tank holds 1,000.0 kg of water. What are the dimensions of the tank in meters? Explain your reasoning.

The volume of the tank is length × width × height. In this case, all those dimensions are the same: call the length L. Then $V = L^3$. Taking the cube root of both sides gives us $L = \sqrt[3]{V}$. However, we still need to know the volume! We get that from density: water has a density of 1.00 g/cm^3. We have 1,000,000 g, since each kg is 1000 g. Therefore the volume is 1,000,000 cm^3.

$$L = \sqrt[3]{1{,}000{,}000 \text{ cm}^3} = \boxed{100 \text{ cm or } \mathbf{1.00 \text{ m}} \text{ on a side}}$$

Exercise 9 A hot dog bun (volume 240 cm^3) with a density of 0.15 g/cm^3 is crushed in a picnic cooler to a volume of 195 cm^3. What is the new density of the bun?

The mass of the bun is found from

$$m = \rho V = \ 0.15 \text{ g/cm}^3)(240 \text{ cm}^3) = 36 \text{ g}$$

The new density is then

$$\rho = \frac{m}{V} = \frac{36 \text{ g}}{195 \text{ cm}^3} = \boxed{0.18 \text{ g/cm}^3}$$

Exercise 10 The age of the sun is thought to be about 4.5 billion years. Convert this to seconds, keeping only one significant figure. (A number with two significant figures might be expressed as "2.7×10^6 miles", whereas with one significant figure it would be "3×10^6 miles.")

The format would be

$$\begin{aligned} & (4.5\times10^9 \text{ y}) \left(\frac{365 \text{ d}}{\text{y}}\right) \left(\frac{24 \text{ h}}{\text{d}}\right) \left(\frac{3600 \text{ s}}{\text{h}}\right) \\ = \ & 1.4\times10^{17} \text{ s} \\ \approx \ & \boxed{10^{17} \text{ s}} \end{aligned}$$