For all problems, please show the dimensional analysis setup and give the answer to the correct number of significant figures.

1. Write 2 conversion factors for each of the following pairs of units:

   a) milligrams and grams $\frac{1000\ mg}{1\ g}$ **or** $\frac{1\ g}{1000\ mg}$

   b) microliters and liters $\frac{10^6\ \mu L}{1\ L}$ **or** $\frac{1\ L}{10^6\ \mu L}$

   c) centimeters and kilometers $\frac{10^5\ cm}{1\ km}$ **or** $\frac{1\ km}{10^5\ cm}$

   d) hours and seconds $\frac{3600\ s}{1\ hr}$ **or** $\frac{1\ hr}{3600\ s}$

2. Use dimensional analysis to solve each of the following problems:

   a) A cooler has a capacity of 5500 mL. What is this capacity in liters?

   $$5500\ \cancel{mL} \times \frac{1\ L}{1000\ \cancel{mL}} = 5.5\ L$$

   b) A hummingbird has a mass of 0.0055 kg. What is this mass in grams?

   $$0.0055\ \cancel{kg} \times \frac{1000\ g}{1\ \cancel{kg}} = 5.5\ g$$

   c) The thickness of a sheet of aluminum foil is 2.5 μm. What is this thickness in cm?

   $$2.5\ \cancel{\mu m} \times \frac{1\ \cancel{m}}{10^6\ \cancel{\mu m}} \times \frac{10^2\ cm}{1\ \cancel{m}} = 2.5 \times 10^{-4}\ cm$$

   d) The height of a student is 5'6". What is this height in meters? (1 in = 2.54 cm)

   Total height in inches = 66 in

   $$66\ \cancel{in} \times \frac{2.54\ \cancel{cm}}{1\ \cancel{in}} \times \frac{1\ m}{100\ \cancel{cm}} = 1.7\ m$$

3. Solve each of the following problems to the correct number of significant figures:

   a) The density of a liquid is 11.3 g/mL. How many grams does 32.0 mL of this liquid weigh?

$$32.0 \text{ mL} \times \frac{11.3 \text{ g}}{1 \text{ mL}} = 362 \text{ g}$$

   b) Ethyl alcohol has a density of 0.79 g/mL. What is the volume in mL of 1.5 kg of alcohol?

$$1.5 \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mL}}{0.79 \text{ g}} = 1900 \text{ mL}$$

   c) Potatoes cost $1.75/lb. If all the potatoes sold at a store cost $1420, how many kg of potatoes did the shoppers buy? (1 lb = 454 g)

$$1420 \cancel{\$} \times \frac{1 \text{ lb}}{1.75 \cancel{\$}} \times \frac{454 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 368 \text{ kg}$$

   d) How many mL of olive oil (d = 0.92 g/mL) weigh the same as 1.2 L of gasoline (d = 0.66 g/mL).

$$1.2 \text{ L gasoline} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{0.66 \text{ g}}{1 \text{ mL}} = 7\underline{9}2 \text{ g gasoline}$$

$$\text{mass of olive oil} = \text{mass of gasoline} = 7\underline{9}2 \text{ g}$$

$$7\underline{9}2 \text{ g oil} \times \frac{1 \text{ mL}}{0.92 \text{ g}} = 860 \text{ mL}$$

   e) What is the speed of an automobile that is traveling at 55 mi/h in m/s? (1 km = 0.62 mi)

$$\frac{55 \text{ mi}}{1 \text{ hr}} \times \frac{1 \text{ km}}{0.62 \text{ mi}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{3600 \text{ s}} = 25 \text{ m/s}$$