CHEM 1004  
Homework #3  
(Modified Due Date)  
Spring 2011  
Buckley  

This homework is due on Wednesday, January 26, at class time. The assignment will be accepted up until the start of class on Thursday, January 27, with a 20% penalty. Assignments turned in after class that day will receive no credit, though I will look through them if you want me to.

1. (5 points) Circle the larger of the two measurements below.
   a. 34.5 m or 1.23 km  (\(\approx 123 \text{ m}\))
   b. 100 Mg or \(1.00 \times 10^{10} \text{ mg} \rightarrow 10 \text{ Mg}\)
   c. 8.45 mL or \(8.45 \times 10^{-4} \text{ L} \rightarrow 8.45 \text{ mL}\)
   d. 3.45 miles or 2.5 km  (\(1.6 \text{ km} = 1 \text{ mile}\))
   e. 5 L or 5 gallons

2. (5 points) Make the following conversions.
   a. \(3.75 \text{ cm} = \frac{3.75}{0.0375} \text{ m} \quad 2 \text{ places left}\)
   b. \(6.54 \text{ GHz} = \frac{6.54 \times 10^9}{6.54 \times 10^9} \text{ MHz} \quad 3 \text{ places right}\)
   c. \(5.32 \times 10^{21} \text{ mm} = \frac{5.32 \times 10^{15}}{5.32 \times 10^{15}} \text{ km} \quad 6 \text{ places left} \quad \text{(just subtract 6 from exponent)}\)
   d. \(73400 \text{ ms} = \frac{73400}{73400} \text{ s} \quad 3 \text{ places left}\)
   e. \(0.00000654 \text{ g} = \frac{0.00000654}{0.00000654} \text{ mg} \quad 3 \text{ places right}\)

3. (5 points) A rectangle has dimensions 0.300 m \(\times\) 0.500 m. Show your work.
   a. What is the area of the rectangle in m\(^2\)?
      \[0.300 \text{ m} \times 0.500 \text{ m} = \boxed{0.15 \text{ m}^2}\]
   b. What is the area of the rectangle in mm\(^2\)?
      \[500 \text{ mm} \times 300 \text{ mm} = 1.5 \times 10^5 \text{ mm}^2 \quad \text{or} \quad 150000 \text{ mm}^2\]
   c. How many mm\(^2\) are in 1 m\(^2\)? Describe your reasoning.
      Look at the ratio from a and b:
      \[\frac{150000 \text{ mm}^2}{0.15 \text{ m}^2} = 1000000 \frac{\text{mm}^2}{\text{m}^2}\]
      \[\text{or} \quad 1 \times 10^6 \frac{\text{mm}^2}{\text{m}^2}\]
4. (5 points) The mass of a particular sample is 52.35 g and its volume is 7.28 cm$^3$. Show your work.

a. What is its density in g/cm$^3$?

\[
\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{52.35 \text{ g}}{7.28 \text{ cm}^3} = 7.19 \frac{\text{g}}{\text{cm}^3}
\]

b. What is its density in kg/m$^3$?

\[
\text{Convert g to kg:} \quad 7.19 \text{ g} \rightarrow 0.00719 \text{ kg}
\]
\[
\text{Convert cm}^3 \text{ to m}^3: \quad 7.28 \text{ cm}^3 \approx 7.28 \times 10^{-6} \text{ m}^3
\]
\[
\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{7.19 \text{ kg}}{7.28 \times 10^{-6} \text{ m}^3} = 980 \frac{\text{kg}}{\text{m}^3}
\]

c. What volume of this material would be required to have a mass of 475 g?

\[
\text{Density} = \frac{\text{Mass}}{\text{Volume}} \Rightarrow \text{Volume} = \frac{\text{Mass}}{\text{Density}} = \frac{475 \text{ g}}{7.19 \frac{\text{g}}{\text{cm}^3}} = 66.1 \text{ cm}^3
\]

5. (3 points) Estimate the temperatures indicated below. Report your answers in the Fahrenheit, Celsius, and Kelvin scales. Show your work.

a. Human body temperature

\[
\begin{align*}
\text{C} &= \frac{5}{9} (100 - 32) = 37.8^\circ\text{C} \Rightarrow K = 310.9 \text{ K}
\end{align*}
\]

b. Room temperature

\[
\begin{align*}
\text{C} &= \frac{5}{9} (70 - 32) = 21.1^\circ\text{C} \Rightarrow K = 294.3 \text{ K}
\end{align*}
\]

c. The temperature of liquid nitrogen (you may have to look a little for this one – it is basically the boiling point of nitrogen)

\[
6.8 \quad 77 \text{K} = -196.15^\circ\text{C} = -321^\circ\text{F}
\]

6. (3 points) Several pieces of a metal, totaling 32.5 cm$^3$, are placed on a piece of paper and the mass is found to be 64.3 g. If the paper has a mass of 1.45 g, what is the density of the metal?

\[
\text{Mass of metal} = 64.3 \text{ g} - 1.45 \text{ g} = 62.85 \text{ g metal}
\]
\[
\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{62.85 \text{ g}}{32.5 \text{ cm}^3} = 1.93 \frac{\text{g}}{\text{cm}^3}
\]