Numbers and Conversions

1. Discuss the relationship between significant digits and instrument precision and accuracy.

2. How many significant digits are in each number?

10.06　　0.00260　　001002　　100　　1.00×10^{-9}

3. Write each number in the previous problem so that exactly 3 significant digits are reported.

4. Kelvin is the SI unit for temperature; however, it is not commonly used except by scientists. The temperature in Kelvin can be determined by adding EXACTLY 273.15 to the temperature in °C.
    a. A thermometer reads 22.8°C. What is the temperature in Kelvin? Make sure to report this value with the correct significant digits.

    b. Liquid nitrogen has a temperature of 77 K. What is this temperature in °C? Again, report your answer with the correct number of significant digits.

5. 5.00 kilometers is a common distance for runners. What is this distance in miles? 1 mile = 1.609 km

6. Dr. Grossoehme is a pretty slow runner (it's true). The fastest time he has completed a 5 km race is 27 minutes and 48 seconds. In this problem, we are going to figure out how fast he is when the rate is expressed in SI units.
   a. What is the SI unit for speed? The process for this is similar to determine the SI units for volume (like we did in class); we need to know an equation for rate and determine the SI units for each variable in the equation.
      i. What an equation for rate (or speed)?
      ii. What is the SI unit for distance?
      iii. What is the SI unit for time?
      iv. Put it all together. What is the SI unit for rate?

   b. Ok, now we need to do a couple things: determine the distance run (5 km) in SI units and determine the time in SI units.
      i. Calculate the distance in SI units (do you remember your metric prefixes?)

      ii. Calculate the time in SI units.

      iii. Put it all together. How fast (or slow) is Dr. G in SI units?

      iv. How close is he to the speed of light? (the answer is very close!)

      v. What is this speed in miles per hour?

7. The volume of an Olympic swimming pool (even when it is green) is 6.6043×10^5 gallons. If the length of the pool is 50 m and the width is 25 m, how deep is an Olympic sized pool?
   a. What is the equation for the volume of a box?

   b. What SI unit does volume have?

   c. To figure out the depth, we need to convert gallons to the SI unit! This can be done using your metric prefixes and the two conversion factors listed below.

      1 mL = 1 cm^3 1 L = 0.264172 gallons

      What is the volume of an Olympic pool in SI units? How many sig figs should this number have?

   d. How deep is the pool? Report your answer in meters.

   e. How deep is the pool in inches? 1 inch = 2.54 cm

8. Dr. G's mother-in-law lives in Matthews, NC. She likes to use the excuse "gas is cheaper in South Carolina" as a reason to come visit us in Rock Hill. In this exercise, let's see if it is actually worth it for her to drive down here.

Here are the facts:

- Gas in Matthews is $1.98/gallon
- Gas in Rock Hill is $1.79/gallon
- Her vehicle has a 25 gallon tank.
- Her vehicle gets 24 miles per gallon.
- It is 32.1 miles from Matthews to Rock Hill
- She has 2 gallons of gas left in her tank.

Give it a shot. My recommendation is for you to break the problem into pieces as we did above. Perhaps the first section would be the cost of gas to fill up her car in Matthews and the second how much to fill up in Rock Hill. Make sure to account for the trip back to Matthews! We may use slightly different assumptions as we work this problem. Consequently, we'll have different answers – that's ok. The point is to do a complicated dimensional analysis problem.