Worksheet: Problem Solving by Dimensional Analysis (Due Th 9/8) – 8 points
(On all problems, show the set-up in dimensional analysis format with completely labeled factors and round answers to the proper number of significant figures. Use only conversion factors you are supposed to memorize or which will be provided for you - see Need to Know for Exam 1 list.)

1. How many significant figures are there in the following measurements?
   a. 20. m   b. 20.0 m   c. 0.002 m   d. 200 km   e. 2.0 x 10^2 km   f. 0.030 g

2. a. A student determines the mass of an object using a digital balance that shows two decimal places. The reading was 0.10 g. In his lab report, the student records the mass as 0.1g. Why is this wrong?
   b. A student reports the volume of an object as 9.10 mL. What possible range of values does the reported volume imply?

3. Perform the following calculations, and express answers to the correct number of sig. figs.
   a. 12.4 x 7.943 + 0.0064   b. (246.83 / 26.3) -1.349   c. 0.1273 - 0.000008

4. What is the mass in g of a piece of gold having a volume of 2.7 x 10^-4 cm^3? (What information do you need besides unit conversions? Find it in a table in your book.)

5. A swimming pool has a volume of 15000 gallons. How many hours will it take to fill the empty pool if water is added at a rate of 5.0 gal/min?

6. The required dosage for a certain medication is 4.5 mg per kg of body mass.
   a. What mass of medication is necessary for a female weighing 124 pounds?
   b. If the medication is available in capsules which contain 50 mg of medication, how many capsules are required for the correct dosage?

7. You are trying to watch the amount of fat in your diet so you are checking food labels for fat content.
   On a package of turkey sausage was the following information: package weight 16 oz (1 lb), serving size = 2.5 oz (75g), per serving the total fat = 5 g, sodium = 490 mg, carbohydrates = 2g, protein = 11g. There were 5 sausages approximately equal in size in the package.
   a. Is one sausage the serving size as specified by the package?
   b. How many grams of fat are there in 1 sausage?

8. In infants, dietary deprivation of vitamin B<sub>6</sub> may result in convulsions or abdominal distress. A brand of ready to feed infant formula contains 1.3 micrograms of vitamin B<sub>12</sub> and 420 micrograms of vitamin B<sub>6</sub> per liter. How many fluid ounces of formula would an infant have to drink to obtain a recommended daily amount of 0.30 milligrams of vitamin B<sub>6</sub>?

9. 0.58 square feet = _______ square cm.

10. a. How many gallons of oil is 5.00 x 10<sup>2</sup> cubic meters of oil?
    b. Suppose that 5.00 x 10<sup>2</sup> cubic meters of oil spilled on a lake and spread into a layer averaging 0.3 cm thick. How many square meters of lake would be covered?

11. The volume of a bacterial cell is 2.25 x 10^-9 m<sup>3</sup>.
    a. What is the volume of a bacterial cell in cubic millimeters? (mm<sup>3</sup>)
    b. How many bacterial cells would fit in a volume of 1.0 mL?

12. The average density of the earth is 5.52 g/cm<sup>3</sup>. What is that density in kg/m<sup>3</sup>?

Answers: 1a) 2, b) 3, c)1, d)1, 2, or 3. Many scientists would find this ambiguous and would not know how many sig. figs. it is unless they knew the measuring tool used. To clearly indicate the number of sig. figs. to anyone, it would be best to write the number in scientific notation., e) 2, f) 2; 2b) 9.09 to 9.11 mL; 3a) 98.5, b) 8.04, c) 0.1273; 4) 0.0052 g (or 5.2 x 10^-3 g; 5) 50. h, 6a) 2.5 x 10^2 mg, b) 5.0 capsules; 7a) no; b) 6 g (1 sig. fig. because 5 g is one sig. fig.); 8 24 fl. oz.; 9 5.4 x 10<sup>3</sup> cm<sup>2</sup>; 10a) 1.32 x 10<sup>4</sup> gal b) 2 x 10<sup>6</sup> m<sup>2</sup> (1 sig. fig. because 0.3 is one sig. fig.); 11a) 2.25 x 10<sup>-9</sup> mm<sup>3</sup>, b) 4.4 x 10<sup>11</sup> bacterial cells

Borowski, Spring 2000, additions and modifications by Long, Fall 2000, 2005