Measurement Review

Making Measurements

1. Describe the difference between the accuracy and precision of a measurement.

   Accuracy = Correct; Precision = Consistent (explain more fully, this is the general idea!)

2. Describe the difference between qualitative and quantitative measurements.

   Qualitative = describes the qualities (i.e. color, physical changes, chemical changes, general observations)

   Quantitative = a number and a unit (describes in more detail)

3. Your lab partner completes their portion of an experiment with the following data. Describe the accuracy and precision of their data if the accepted value for the reaction time is 14.0 s.

Trial	Rxn Time
1	11.6 s
2	12.0 s
3	11.1 s
4	11.8 s

   The data is precise because each trial is within the range of 1 s.

   The data is inaccurate because no trials gave results near the 14.0 s accepted value.

4. Calculate the percent error an experimentally determined measurement.

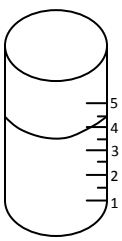
   Example: The mass of an object known to be 1.25 g was experimentally measured as 1.20 g. Compute the percent error.

   4% (this is the correct number of sig figs)

5. Explain the differences in accuracy between different types of laboratory glassware.

   Glassware is more accurate with more graduations ("tick marks"). Beakers and flasks are good for approximations but not for accurate measurement. Graduated cylinders, pipettes, burets, etc. are much more accurate.

6. Record the volume of the following graduated cylinder to the correct number of significant figures.



   3.5 mL (can't really measure with any additional precision)

Scientific Notation

7. Write the following numbers in scientific notation:
   a. 5,672,000,050 — **5.67200005×10^{9}**
   b. 34,100 — **3.41×10^{4}**
   c. 0.002102 — **2.102×10^{-3}**
   d. 0.0000000000001244 — **1.244×10^{-13}**

8. Write the following numbers in standard notation:
   a. 3.420×10^{3} — **3420**
   b. 7.9403×10^{12} — **7,940,300,000,000**
   c. 4.220×10^{-15} — **0.000000000000004220**
   d. 3.00×10^{-4} — **0.000300**

Significant Figures

Complete the problems below and the following problems from your textbook: **Practice Problems 33-38, pp. 41-42.**

9. Rewrite measurements in scientific notation.
   a. 0.000758 g — **7.58×10^{-4}**
   a. 4,573,217 cm — **4.573217×10^{6}**
   b. 0.03438 ml — **3.438×10^{-2}**

10. Identify the number of significant figures in a measurement.
   b. 0.42 L — **2**
   c. 78.00 m — **4**
   d. 320 g — **2**
   e. 6.270×10^{3} cm — **4**

11. Apply the rules for significant figures in calculations to round off numbers correctly.
   f. Round of 8670 km to **two** significant figures. — **8700 km**
   g. Round off 0.01025 m to **three** significant figures. — **0.0103 m OR 0.0102 m**
   h. Round off 7.013 g to **three** significant figures. — **7.01 g**

12. Perform the following operations and give the answers with the correct number of significant figures.

i.	37.2 mL + 18.0 mL + 380 mL =	**435 mL OR 440 mL**
j.	(0.57 cm)(0.86 cm)(17.1 cm) =	**8.4 cm^3**
k.	$(8.13 \times 10^4) / (3.8 \times 10^2)$ =	**210 OR 2.1 x 10^2**
l.	$(1.04 \times 10^{-5})(4.33 \times 10^{-3})$ =	**4.5 x 10^8**
m.	7.31 kg + 0.08 kg =	**7.39 kg**

Problem Solving and Dimensional Analysis

11. What conversion factor would you use to convert the following:

a.	meters to kilometers	**1000 m = 1 kg (or equivalent)**
b.	liters to cubic decimeters	**1 L = 1 dm^3 (or equivalent)**
c.	milligrams to grams	**1000 mg = 1 g (or equivalent)**
d.	milliliters to cubic centimeters	**1 mL = 1 cm^3 (or equivalent)**

12. Make the following conversions.

    a. 384 mg to grams

    0.384 g

    b. 125 g to kilograms

    0.125 kg

13. If a car goes 30.0 miles per gallon of gasoline, how many kilometers could it travel on 1 liter of gasoline? (1.61 km = 1 mile; 1 gal = 4 qt; and 1.06 qt = 1.0 L)

    12.8 km/L

14. A golf ball weighs four ounces. How many golf balls would there be in a 2.5 ton sample of golf balls, assuming that every golf ball had the same weight and that the golf balls contributed all the weight of the sample? (1 ton = 2,000 lbs; and 1 lb = 16 oz)

20,000 golf balls

15. What is the mass of 24.0 cm^3 of mercury? The density of mercury is 13.5 g/cm^3.

324 g

16. The density of dry air is 1.12 x 10-3 g/cm^3. What volume of air, in cm^3, has a mass of 15.5g?

1.38×10^4 cm^3

17. A new U.S. penny has a mass of 2.49 x 10^3 mg. Express this mass in kilograms.

2.49×10^{-3} kg

18. THOUGHT QUESTION: What mass of lead (density 11.4 g/cm^3) would have an identical volume to 15.0 g of mercury (density 13.6 g/cm^3).

12.8 g Pb