Data and Observations

Table 1. Measurements and Significant Digits			
Cube Data			
Mass (g)			
Dimensions (cm)	**Length**	**Width**	**Height**
Volume (mL)		**Initial**	**Final**
	Beaker		
	Graduated cylinder		
Sphere Data			
Mass (g)			
Dimensions (cm)	**Circumference**		
Volume (mL)		**Initial**	**Final**
	Beaker		
	Graduated cylinder		
Formulae for Calculating…			
Volume of a cube			
Circumference of a circle			
Diameter of a circle			
Volume of a sphere			

Analysis

Show your organized work on a separate piece of paper. Transfer your final answers to the blanks beside each question. Staple your work to your answer sheet before turning it in to your teacher.

Remember to follow the rules for reporting all data and calculated answers with the correct number of significant digits.

Table 2. Common Conversions		
Length	**Mass**	**Volume**
Standard		
1 in. = 2.54 cm	1 lb = 16 oz	1 gal. = 4 qts
1 ft = 12 in.		1 qt = 2 pints
1 mile = 5280 ft		1 pint = 2 cups
Standard to Metric		
1 mile = 1.61 km	1 lb = 454 g	1 L = 1.06 qts
1 m = 1.09 yds	1 kg = 2.21 lbs	1 tsp = 5 mL
Metric		
1 m = 100 cm	1 g = 1000 mg	1 cm^3 = 1 mL
1 m = 1000 mm	1 kg = 1000 g	1 L = 1000 mL
1 km = 1000 m		

1. For each of the measurements recorded in Table 1, indicate the number of significant digits in parentheses after the measurement. For example, 15.7 cm (3 sd).
2. Use dimensional analysis to convert the mass of the cube to:
   a. Milligrams (mg)

   b. Ounces (oz)

Analysis (continued)

3. Calculate the volume of the cube in cubic centimeters (cm^3).

4. Use dimensional analysis to convert the volume of the cube found in Question 3 from cubic centimeters (cm^3) to cubic meters (m^3).

5. Calculate the volume of the cube in mL as measured in the beaker. Convert the volume to cubic centimeters (cm^3) using $1\ cm^3 = 1$ mL.

6. Calculate the volume of the cube in mL as measured in the graduated cylinder. Convert the volume to cubic centimeters (cm^3) using $1\ cm^3 = 1$ mL.

Analysis (continued)

7. Using the density formula

$$D = \frac{\text{mass}}{\text{volume}}$$

calculate the density of the cube as determined by the following instruments:

a. Ruler

b. Beaker

c. Graduated cylinder

8. Use dimensional analysis to convert the three densities found in Question 7 into kg/m^3.

Analysis (continued)

9. Convert the mass of the sphere to the following units:
   a. Kilograms (kg)

   b. Pounds (lbs)

10. Using the measured circumference, calculate the diameter of the sphere in centimeters.

11. Calculate the radius of the sphere in centimeters.

Analysis (continued)

12. Calculate the volume of the sphere in cubic centimeters (cm^3) from its calculated radius.

13. Calculate the volume of the sphere in mL as measured in the beaker. Convert this volume to cubic centimeters (cm^3) using 1 cm^3 = 1 mL.

14. Calculate the volume of the sphere in mL as measured in the graduated cylinder. Convert this volume to cubic centimeters (cm^3) using 1 cm^3 = 1 mL.

Analysis (continued)

15. Using the density formula

$$D = \frac{\text{mass}}{\text{volume}}$$

calculate the density of the sphere as determined by the following instruments:

a. Tape measure

b. Beaker

c. Graduated cylinder

16. Use dimensional analysis to convert the three densities found in Question 15 into lbs/ft^3.

Conclusion Questions

1. Compare the densities of the cube when the volume is measured by the ruler, beaker, and graduated cylinder. Which of these instruments gave the most accurate density value? Use the concept of significant digits to explain your answer.

2. A student first measures the volume of the cube by water displacement using the graduated cylinder. Next, the student measures the mass of the cube before drying it. How will this error affect the calculated density of the cube? Your answer must be justified and should state clearly whether the calculated density will increase, decrease, or remain the same.

3. A student measures the circumference of a sphere at a point slightly above the middle of the sphere. How will this error affect the calculated density of the sphere? Your answer must be justified and should state clearly whether the calculated density will increase, decrease, or remain the same.