

Answer the following on a separate sheet of paper, using complete sentences where appropriate.

SECTION 3.1 MEASUREMENTS AND THEIR UNCERTAINTY

- Why are numbers used in chemistry often expressed in scientific notation?
- What is 503,000,000 written correctly in scientific notation.
- Is the following sentence true or false? To decide whether a measurement has good precision or poor precision, the measurement must be made more than once. _____. Explain
- Decide whether each of the three following sentences that describes accuracy or precision.
 - Four of five repetitions of a measurement were numerically identical, and the fifth varied from the others in value by less than 1%.
 - Eight measurements were spread over a wide range.
 - A single measurement is within 1% of the correct value.
- Complete the following sentence. For an experimental measurement, the experimental value minus the accepted value is called the _____.
- Relative error is also called _____.
- The accepted value of a length measurement is 200 cm, and the experimental value is 198 cm. What is the percent error of this measurement?
- If a thermometer is calibrated to the nearest degree, to what part of a degree can you estimate the temperature it measures? _____
- Select the letter of the correct digit. In the measurement 43.52 cm, which digit is the most uncertain?
 - 4
 - 3
 - 5
 - 2
- Select the letter of the correct number of significant figures in the measurement 6.80 m.
 - 2
 - 3
 - 4
 - 5
- List two situations in which measurements have an unlimited number of significant figures.
- Which sentence(s) are true about significant figures.
 - Every nonzero digit in a reported measurement is assumed to be significant.
 - Zeros appearing between nonzero digits are never significant.
 - Leftmost zeros acting as placeholders in front of nonzero digits in numbers less than one are not significant.
 - All rightmost zeros to the right of the decimal point are always significant.
 - Zeros to the left of the decimal point that act as placeholders for the first nonzero digit to the left of the decimal point are not significant.
- Is the following sentence true or false? An answer is as precise as the most precise measurement from which it was calculated. _____

SECTION 3.2 THE INTERNATIONAL SYSTEM OF UNITS

- Copy and complete the table showing selected SI base units of measurement.

Units of Measurement		
Quantity	SI base unit	Symbol
Length		
Mass		
Temperature		
Time		

- All metric units of length are based on multiples of _____.
- Explain what is meant by a "derived unit."
- Give at least one example of a derived unit.

Match each metric unit with the best estimate of its length or distance.

5. Height of a stove top above the floor a. 1 km
6. Thickness of about 10 sheets of paper b. 1 m
7. Distance along a road spanning about 10 telephone poles c. 1 cm
8. Width of a key on a computer keyboard d. 1 mm
9. Which sentences are true about units of volume.
a. The SI unit for volume is derived from the meter, the SI unit for length.
b. The liter (L) is a unit of volume.
c. The liter is an SI unit.
d. There are 1000 cm^3 in 1 L, and there are also 1000 mL in 1 L, so 1 cm^3 is equal to 1 mL.
10. The volume of any solid, liquid, or gas will change with _____ .
11. A kilogram was originally defined as the mass of _____ .
12. Which of the unit of mass commonly used in chemistry that equals 1/1000 kilogram.
a. gram b. milligram c. milliliter d. Megagram

Match each of the three descriptions of a volume to the appropriate metric unit of volume.

Example	Unit of Volume
_____ 13. Interior of an oven	a. 1 L
_____ 14. A box of cookies	b. 1 m^3
_____ 15. One-quarter teaspoon	c. 1 mL

Match each unit of mass with the object whose mass would be closest to that unit.

Mass	Unit of Mass
_____ 16. A few grains of sand	a. 1 kg
_____ 17. A liter bottle of soda	b. 1 g
_____ 18. Five aspirin tablets	c. 1 mg

23. Which of the following instruments is used to measure mass.

- a. scale b. balance beam c. platform balance d. analytical balance

24. Is the following sentence true or false? The mass of an object changes with location. _____
Explain.

25. When brought to the surface of the moon, will a mass have more or less weight than it did on the surface of Earth, or will it be the same weight? Explain.

29. What is the zero point, 0 K, on the Kelvin scale called? _____

30. A change of temperature equal to one Kelvin is equal to a change of temperature of how many degrees Celsius? _____

32. One calorie is the quantity of heat that raises the temperature of _____ of pure water by _____ .

Answer the following on a separate sheet of paper, using complete sentences where appropriate.

SECTION 3.3 CONVERSION PROBLEMS

- How are the two parts of a conversion factor related?
- Look at Figure 3.11. In a conversion factor, the smaller number is part of the quantity that has the _____ unit. The larger number is part of the quantity that has the _____ unit.
- Is the following sentence true or false? The actual size of a measurement multiplied by a conversion factor remains the same, because the measurement being converted is multiplied by unity. Explain.
- Write two conversion factors based on the relationship between hours and minutes.
- The average lead for a mechanical pencil is 6.0 cm long when it is new. Which of the following conversion factors you would use to find its length in inches.

a. $\frac{2.54 \text{ cm}}{1 \text{ in}}$

b. $\frac{1 \text{ in}}{2.54 \text{ cm}}$

c. $\frac{6.0 \text{ cm}}{1 \text{ in}}$

d. $\frac{1 \text{ in}}{6.0 \text{ cm}}$

- A student is asked to calculate the volume, in milliliters, of 2 cups of oil. There are 225 mL per cup. The student calculates the volume as follows:

$$\text{Volume} = 2 \text{ cups} \times \frac{1 \text{ cup}}{25 \text{ mL}} = 0.08 \text{ mL}$$

List three errors the student made.

- What is dimensional analysis?
- Reread Sample Problem 3.5. The correct conversion factor has the _____ unit in the denominator and the _____ unit in the numerator.
- A container can hold 65 g of water. Circle the conversion factor needed to find the mass of water that 5 identical containers can hold.

a. $\frac{5 \text{ containers}}{65 \text{ g}}$

b. $\frac{1 \text{ container}}{65 \text{ g}}$

c. $\frac{65 \text{ g}}{1 \text{ container}}$

d. $\frac{65 \text{ g}}{5 \text{ containers}}$

- Show the calculation you would use to convert the following:

a. 0.25 m to centimeters

b. 9.8 g to kilograms

c. 35 ms to seconds

d. 4.2 dL to liters

- Complex conversions between units may require using _____ conversion factor.
- Name three common measurements that are expressed as a ratio of two units.
- What technique can be used to convert complex units?

SECTION 3.4 DENSITY

- Is the mass of one pound of lead greater than, less than, or equal to the mass of one pound of feathers?

- Which material has a greater density, lead or feathers? _____
- How is density defined?
- The mass of a sample is measured in grams, and its volume is measured in cubic centimeters. In what units would its density be reported?
- Look at Table 3.6 on page 90. Circle the letter of the material that will sink in liquid water at 4°C.
 - aluminum
 - corn oil
 - ice
 - gasoline
- The density of a substance generally decreases as its temperature increases. Are there any exceptions to this statement? Explain.

Vocabulary Review

Match the correct vocabulary term to each numbered statement. Write the letter of the correct term on your paper

Column A

1. the ratio of the mass of an object to its volume
2. closeness of a measurement to the true value
3. the mass of 1 L of water at 4°C
4. difference between the experimental value and the accepted value
5. the degree of hotness or coldness of an object
6. the SI base unit of length
7. a ratio of equivalent measurements
8. a quantity that has both a number and a unit
9. temperature scale on which water freezes at 0° and boils at 100°C
10. a way to analyze and solve problems, using the units of the measurements
11. a method of expressing numbers as a product of a coefficient and a power of 10
12. the SI unit of energy
13. the capacity to do work or to produce heat

Column B

- A. Celsius scale
- B. measurement
- C. scientific notation
- D. joule
- E. energy
- F. error
- G. density
- H. kilogram
- I. accuracy
- J. meter
- K. temperature
- L. conversion factor
- M. dimensional analysis

Multiplying and dividing with significant figures:

The Rule is simple: When multiplying and dividing, the answer must be rounded to the least number of significant figures.

Review Page 71 and Look at the practice problems in Sample Problem 3.3

Here is the process.

$$area = 4.83m \times 6.978m$$

First do the multiplication
on your calculator

$$area = 33.70374m^2$$

Count sig figs in each number

4.83 m has 3 significant figures

6.978 m has 4 significant figures

Round to the smallest number of
significant figures
(3 in this case)

$$area = 33.7m^2$$

Now complete the following problems. Write the answers on your own paper

14. $8.4 \text{ m} \times 3.33 \text{ m} =$

15. $4.823 \text{ g} \div 1.52 =$

16. $23.5 \text{ seconds} \times \left(\frac{1 \text{ minute}}{60 \text{ seconds}} \right) =$

17. Calculate the volume of a box with the following dimensions; 13.1 cm by 2.5 cm by 44.2 cm.