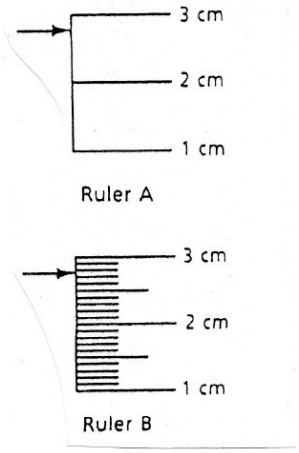
CHEMISTRY Name: _____

Chapter 1 & 2 Worksheet: Precision, Accuracy, & Significant Figures

Accuracy indicates how close a measurement is to the true or accepted value.

Precision refers to the reproducibility of a measurement.

No measurement of a physical quantity is absolutely certain. In other words, all measurements include a degree of *uncertainty*. The two main causes of uncertainty are: (1) the skill and care of the person making the measurement and (2) the limitations of the measuring instrument.



The two values in the illustration give measurements with different degrees of uncertainty. For both rulers, the measurement indicated by the arrow is clearly between 2 cm and 3 cm. But ruler B gives the additional information that the length is between 2.7 cm and 2.8 cm. Most persons who use ruler A would probably estimate a reading of 2.7 cm to 2.9 cm. Those who use ruler B would probably estimate a reading of 2.75 cm to 2.78 cm. The measurements made with Rulers A and B include one estimated, or uncertain figure. Measurements that include one uncertain figure in addition to those known with certainty are made up of *significant figures*. Thus, a reading of ruler A at 2.8 cm consists of two significant figures and the reading of ruler B at 2.76 cm has three significant figures.

To determine the number of sig figs in a measured number:

1. Non zero numbers count as significant. For example: 1234 + 4 sig figs and 3.17 = 3 sig figs

2. For zeros you must determine whether the 0 is a place holder or measured.
   a. Leading zeros: Zeros that precede non zero digits no not count. Ex. 0.00047 = 2 sig figs

   b. Captive zeros: Zeros in between non-zero digits count as significant. Ex. 20076 = 5 sig figs

   c. Trailing zeros: Zeros to the right of the number are significant only if the number contains a decimal point.
   Ex. 100 = 1 100. = 3 32.00 = 4

   d. Scientific Notation & Sig Figs: Ex. 1.20×10^4 = 3 sig figs 3.050×10^2 = 4 sig figs

3. Some numbers are not measured, they are EXACT. These have unlimited sig figs. Ex. 12 inches = 1 foot
   100 cm = 1 m 2.2 lbs = 1 kg

Measurements are often used to calculate other quantities. For example, the length and width of a surface might be used to find its area (A = length x width). It is necessary to be able to estimate the uncertainty in a calculated result. Suppose all measurements are given in significant figures. Then the number of significant figures in a result calculated from those measurements can be found by using the following simple rules.

MULTIPLICATION and DIVISION: The number of significant figures in a product or quotient obtained from measured quantities is the same as the number of significant figures in the quantity having the smaller number of significant figures.

ADDITION and SUBTRACTION: Round the sum or difference so that it has the same number of decimal places as the quantity having the least number of decimal places.

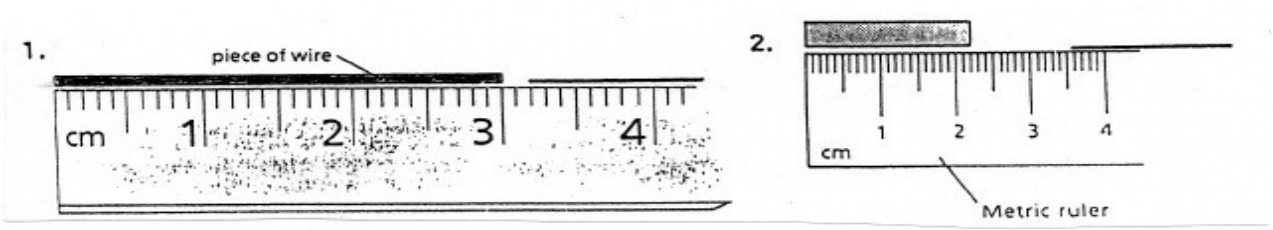
PROBLEMS

A. Tell how many significant figures are in the following measurements:

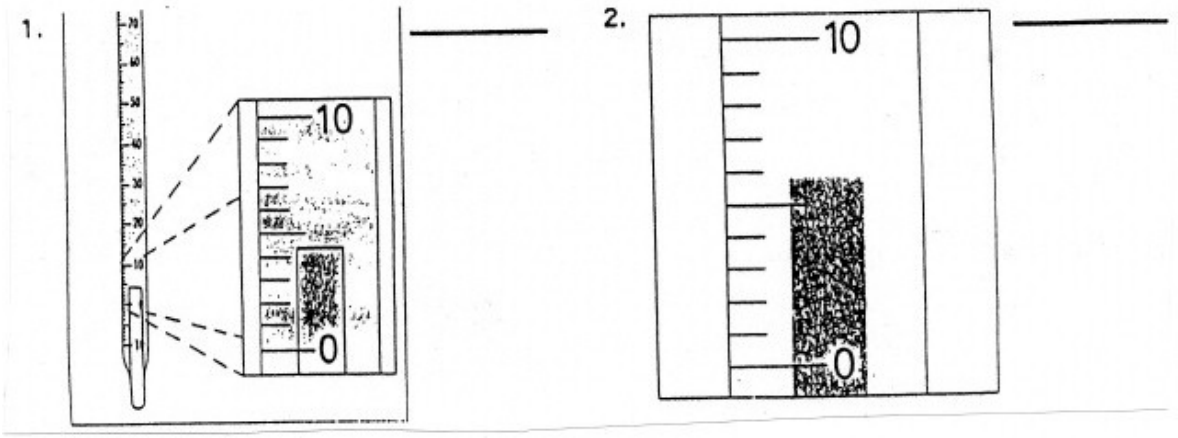
1. 40.04 cm^2 _____
2. 400.00 cm _____

3. 3.15 cm _____
4. 38.6 °C _____
5. 1.0 cm _____
6. 2.50 g _____
7. 3.05 cm _____
8. 4.050 g _____
9. 0.505 cm _____
10. 0.0602 g _____
11. 18.0 cm _____
12. 200. Kg _____
13. 0.128 L _____
14. 25.0 mL _____
15. 37.89 mm _____
16. 0.00007 g _____

B. Look at the following figures. Determine the number of cm for each object using the proper number of sig figs.



C. What would you say is the temperature being registered by each thermometer in °C?



D. For each of the following problems, give the answer in the proper number of sig figs.

1. 5.22 m x 82.7 m = 431.694 m^2 _____
2. 0.0322 cm x 6.5 cm = 0.2093 cm^2 _____
3. 4.08 g ÷ 0.061 g = 66.885 _____
4. 9.475 g ÷ 12.05 cm^3 = 0.7863 g/cm^3 _____
5. 9.6781 g ÷ 10.0 cm^3 = 0.96781g/cm^3 _____
6. 4.375 g + 14.62 g + 327.9 g = 346.895 g _____
7. 2.5725 m + 14.55 m + 0.035 m + 4.88 m = 22.0375 m _____
8. 16.748 s – 1.512s = 15.236 s _____
9. 6.0098 cm – 2.51 cm = 3.4998 cm _____

E. Perform the following calculations and round each answer to the correct number of sig figs.

1. 6.4 cm x 2.1 cm _____
2. 21.33 m x 5.15 m = _____
3. 62 g ÷ 1.62 cm = _____
4. 162.1 g + 38.73 g + 1.554 g = _____
5. 21.9 m + 6.34 m + 157 m = _____
6. 44.7 kg – 2.7 kg = _____
7. 9.88 s – 7.2 s = _____
8. 12000 ml x 4.5 = _____