

## Introduction to Scientific Measurement

### Significant digits in measurements - "Significant means measured"

Significant digits are used to avoid saying too much or too little about a measurement. When you make a measurement, significance digits are all the digits that are known "**certain digits**" (can be read directly from the measuring instrument) and ONE **uncertain** or **estimated digit**. You must "guess" this digit because this scale is not calibrated (marked off) on the measuring instrument. It would be the next finest scale to be marked off if you were going to make a more precise measuring instrument. All the measurements you make must have one estimated digit (0 thru 9)

### The following are a set of rules for determining the number of significant digits:

1. Digits 1 - 9 are always significant in a measurement!
2. Zero's may or may not be significant (\*this does not compromise place value)
  - A. Zero(s) BETWEEN other significant digits ARE significant.
    - a. End zero(s) to the **right** of decimal point **AND** a digit 1-9 ARE significant.

**Mathematical Operations with Significant Digits:** If you perform mathematical operations with significant digits, there are some other rules you must consider for determining the correct number of significant digits in the answer.

- In **multiplication or division**, the answer should contain no more significant digits than are contained in the measurement with the least number of significant digits.
- Look at your measurements in the problem and determine the number of significant digits in each. Numbers such as the value of pi and other defined values are not considered as measurements.

Retain in your answer only as many significant digits as you have in the measurement having the least number of significant digits.

Work the problem.
- Carry out the multiplication/division problems so that you have one (1) more digit than your answer needs.

Then round off to the correct number of significant digits. If the extra digit is a 5 the following rounding rule should be used: round to get an even final digit. Example: 4565 g --> 4560 g and 9875 m --> 9880 m

### How many significant digits are in each of the following:

- |                  |                          |
|------------------|--------------------------|
| 1) 124 m         | 6) 20000 pm              |
| 2) 56.20 km      | 7) 60 dm                 |
| 3) 203 cm        | 8) 890.00 mm             |
| 4) 10230 mm      | 9) $3.00 \times 10^8$ km |
| 5) .0034 $\mu$ m | 10) 10203040 nm          |

### Scientific Notation

The form in which exponential quantities are most often expressed in science is known as scientific notation. A number written in scientific notation is in the form  $a \times 10^b$ . Where **a** is equal to or greater than 1 and less than 10 and **b** is either a positive or negative integer.

### Write the following measurements in scientific notation:

- |            |                |                |
|------------|----------------|----------------|
| 11) 100 cm | 13) 3,700 m    | 17.) 0.0403 km |
| 12) 12 km  | 14) 450,100 mm | 18.) 0.556 hm  |