

## Significant Figures

**Significant Figures:** the number of digits in a number that are known with absolute certainty

All digits written down are significant except two types:

1. Zeros that come before the first nonzero digit are not significant.
2. Zeros that come after the last nonzero digit if there is no decimal in the number. We cannot tell without knowing something about the number.

The best way to represent numbers is to write them in scientific notation:

$$123 = 1.23 \times 10^2$$

$$0.00123 = 1.23 \times 10^{-3}$$

$$1.23 = 1.23 \times 10^0 \text{ (not commonly used, but the correct scientific notation)}$$

$$123000 = 1.23 \times 10^5$$

$$12300. = 1.2300 \times 10^4$$

How many significant figures are in the following numbers and what is the correct scientific notation?

- |              |       |       |
|--------------|-------|-------|
| a. 23.742    | _____ | _____ |
| b. 330       | _____ | _____ |
| c. 0.023     | _____ | _____ |
| d. 0.230     | _____ | _____ |
| e. 0.0000233 | _____ | _____ |
| f. 3.004     | _____ | _____ |
| g. 0.050008  | _____ | _____ |
| h. 32.0400   | _____ | _____ |
| i. 0.0002300 | _____ | _____ |
| j. 1.02000   | _____ | _____ |

## Multiplying and Dividing

The rule in multiplication and division is that the final answer should have the same number of significant figures as there are in the number with the fewest significant figures.

## Adding and Subtracting

In addition and subtraction, the rule is completely different. The number of significant figures in each number doesn't matter. The answer is given to the same number of decimal places as the term with the fewest decimal places.

## Rounding Off

When we have too many significant figures in our answer, it is necessary to round off. If the first digit dropped is a 5, 6, 7, 8, or 9, we raise the last digit kept to the next higher number, otherwise we do not.

Complete the following problems:

1.  $3.6 \times 4.27$

5.  $320.084 + 80.47 + 200.23 + 20.0$

2.  $0.004 \times 217.38$

6.  $61.4532 + 13.7 + 22$

3.  $42.1 / 3.695$

7.  $14.26 - 1.05041$

4.  $0.30652 \times \frac{138}{2.1}$

8.  $52.65 + 102 \left( \frac{1.56}{2.98} \right)$

## Counted or Defined Numbers

All the preceding rules apply to measured numbers and not to any numbers that are counted or defined. Counted and defined numbers are known exactly. For example, a triangle has 3 sides, not 3.1 or 2.9. Here, we treat the number 3 as if it has an infinite number of zeros following the decimal point.