Appendix A – Significant Figures

Laboratory measurements must be recorded with the appropriate number of significant figures. The number of significant figures recorded includes the number of known digits plus one estimated digit. The last digit is the estimated digit and represents the degree of uncertainty. The precision of the measurement is determined by the ability to read the smallest gradation of the device used for measurement.

Table A.1 Rules and Examples for Significant Figures

Rule	Example	#Sig Figs
1. All non-zero digits are significant	77,806	5
2. If the number is less than one:		
a) The zero to the left of the decimal is not significant	0.5	1
b) All zeros between the decimal point and the first non-zero digit are not significant.	0.005	1
c) All zeros to the right of the first non-zero digits are significant	0.0050100	5
3. If the number is greater than one:		
a) and there is a decimal point, all zeros are significant	40,000	5
	450	3
	3,200	2
b) and there is no decimal point, the number of significant figures is ambiguous. (The way these examples are written the zeros in the ones and tens place are not significant. However, if they are measurements they could be significant and should be written with scientific notation.)	30,200	3
	3.020×10^4	4
4. Counted numbers and conversion factors have an infinite number of significant digits	1000 mL/L	∞

SCIENTIFIC NOTATION

Using scientific notation removes ambiguity when using significant figures. Numbers are presented as powers of ten. This means that we divide the number by as many factors of ten as possible and then rewrite the number usually with one non-zero digit before the decimal point.

For numbers larger than 10:

32,000, = 3.2 x 10 x 10 x 10 x 10 = 3.2 x 104 .= 3.2E4

30,200 = 3.02 x 10 x 10 x 10 x 10 = 3.02 x 104 = 3.02E4

For numbers less than one:

0.0051 = 5.1 x 10-1 x 10-1 x 10-1 = 5.1 x 10-3. = 5.1E-3

SIGNIFICANT FIGURES AND CALCULATIONS

Addition and Subtraction

In addition and subtraction the result must be reported with no more decimal places than the measurement with the fewest number of decimal places.

Example: Find the sum of the following:

63.1	one decimal place
24.256	three decimal places
+ 19.07	two decimal places
= 106.426	

Correct Answer: 106.4 (one decimal place)

Multiplication and Division

In multiplication and division the result should be reported with the same number of significant figures as the measurement with the fewest number of significant figures.

Example: Find the product of the following:

35.3 x 4.3123 = 152.2242
Three SF digit # multiplied by a five SF digit #

Correct Answer: 152 (three significant figures)

Logarithms

NOTE: In CHM 116 you will learn more about the significant figures for Logarithms.

The log of a number with n significant digits should have n decimal places. The number in front of the decimal place represents the order of magnitude and is not a significant digit.

Example: Find the log of the following:

Log (7.893 x 10-6) = -5.102757897 The log of a four-digit number

Correct Answer: -5.1028 four significant figures
(the negative 5 is the magnitude and is not part of the significant digits).