

# CHM2260 Laboratory Handout

## Working with Significant Figures

During the course of this laboratory you will be performing a variety of calculations. When performing calculations, you will be required to report your answers to the proper number of significant digits. This handout describes the rules for working with significant digits.

### Determining the Number of Significant Digits in a Number

First, you must be able to recognize the number of significant digits in a number.

1. All nonzero integers are significant
2. Leading zeroes that precede all nonzero digits are not significant
3. Captive zeroes between nonzero digits are always significant
4. Trailing zeroes to the right of a nonzero number are significant if the number contains a decimal point
5. Exact numbers have an indefinite number of significant figures

Example	Number of Significant Digits
164.87	5
395	3
0.766	3
0.000033	2
2.028	4
5107	4
0.000304	3
14.30	4
0.0030	2

If you are unsure about the number of significant digits, try writing the number in scientific notation. Non-significant digits will disappear when the number is written in scientific notation.

$$14.30 = 1.430 \times 10^1$$

The zero is kept because it is a trailing zero

$$0.766 = 7.66 \times 10^{-1}$$

The zero disappears because it is leading zero and is not significant

## **Multiplication and Division with Significant Digits**

When carrying out a mathematic operation, the rules for multiplication and division are different from those for addition and subtraction.

When multiplying or dividing, the answer may not contain more significant digits than any of the numbers being multiplied or divided.

$$(5.77) / (1.9) = 3.0368421 = 3.0$$

$$(28.71)(0.0626)(128.54) / (5.0) = 46.203 = 46$$

Note that sine and cosine functions express a ratio and therefore follow the same rules as for multiplication and division; the number of significant digits in the input number determines the number of significant digits in the final answer regardless of the position of the decimal point.

$$\text{Sin } (45) = 0.71$$

$$\text{Sin } (45.0) = 0.707$$

$$\text{Sin } (45.00) = 0.7071$$

## **Rounding Off Final Answers**

Reducing the number of significant figures in a calculated number will likely involve rounding. To do this, locate the last significant digit that you are allowed to keep and look at the one digit immediately to its right

If this digit to be discarded is less than 5, leave the last digit kept unchanged.

If the digit to be discarded greater than 5, increase the last digit to be kept by 1

Therefore 1.33 rounds to 1.3 and 1.36 rounds to 1.4

If the digit removed is equal to five, the preceding number is increased by one if it is odd and remains unchanged if it is even

Therefore 17.75 rounds to 17.8 and 17.65 rounds to 17.6

## **Addition and Subtraction with Significant Digits**

The answer may not contain significant digits further to the right than those in any of the numbers being added or subtracted.

$$6.14 + 6.0375 = 6.1775 = 6.18$$

$$0.002631 - 0.0014278 = 0.0012032 = 0.001203$$

$$5200 + 63.40 = 5263.40 = 5260$$