Significant Digits

The examples below illustrate the proper use of significant digits for the Chemistry 30 Diploma Examination in a response.

Example 1

A 10.0 mL sample of an unknown weak monoprotic acid is titrated with a standardized 1.20 mol/L sodium hydroxide solution. The following data are recorded.

Trial	I	II	III
Final burette reading (mL)	10.10	19.22	28.33
Initial burette reading (mL)	1.00	10.10	19.22
Titrant added (mL)	**9.10***	9.12	9.11

2 decimal places (10.10–1.00) according to the addition/subtraction rules

The concentration of the weak monoprotic acid is _____.

Average volume of titrant added is 9.11 mL

Concentration of HA(aq) =

$$\frac{1.20 \text{ mol/L} \times 9.11 \text{ mL}}{10.00 \text{ mL}} \times \frac{1 \text{ mol HA(aq)}}{1 \text{ mol NaOH(aq)}}$$

[HA(aq)] = **1.09** mol/L

Exact number, therefore does **not** change the final number of significant digits

* Final answer has 3 significant digits (least number present according to the multiplication/division rule)

Example 2

The pH of a 0.100 mol/L solution of acetic acid is _____.

$K_a = \mathbf{1.8 \times 10^{-5}}$ is approximately $= \frac{x^2}{0.100 \text{ mol/L}}$

K_a value has 2 significant digits

$x = [H_3O^+(aq)] = \mathbf{0.001342}$

Additional digits carried through on an interim basis

pH = –log(0.001342 mol/L)

= **2.87** or 2.89 (depending on the number of extra digits carried)

Final answer has 2 significant digits

Example 3

A student conducts a calorimetry experiment to determine the energy transferred when solution A is mixed with Solution B. The data collected is shown below. Assume the specific heat capacity for each solution is the same as water.

Mass of Solution A	100.0 g
Mass of Solution B	100.0 g
Mass of final solution mixture	200.0 g
Initial temperature of solution A and B	20.0 °C
Final temperature of the solution mixture	23.0 °C

The original data is limited to 3 significant digits.

$\Delta H = mc\Delta t$

$\Delta H = (200.0\text{ g})\ (4.19\text{ J/g}\cdot\text{°C})\ (\mathbf{3.0}\text{ °C})$

The resulting temperature has 2 significant digits.

$\Delta H = \mathbf{2.51}\text{ kJ}$

The final answer should be rounded to the same number of significant digits contained in the original data with the fewest number of significant digits.

The final answer has 3 significant digits because the original data contained 3 significant digits.

Changes to the Chemistry Data Booklet

The most current version of the Chemistry 30 Data Booklet has a publication date of 2010, and a red cover. This version replaces previous versions, which have an earlier publication date and blue covers.

Rationale

- To address feedback received from the field regarding the Chemistry 30 Data Booklet, specifically regarding the solubility table
- To better align the Chemistry 30 Data Booklet with the *Chemistry 30 Program of Studies, 2007*
- To reflect current values