

Guidelines for Significant Digits, Manipulation of Data and Rounding for Science Diploma Examinations

Significant Digits (measured values)

- For all non-logarithmic values, regardless of decimal position, any of the digits 1 to 9 is a significant digit; 0 may be significant. For example:

123 0.123 0.00230 2.30×10^3 2.03
all have 3 significant digits

- Leading zeros are not significant. For example:

0.12 and 0.012 each have two significant digits

- The Learner Assessment Branch considers all trailing zeros to be significant. For example:

200 has three significant digits
0.123 00 and 20.000 each have five significant digits

- For logarithmic values such as pH, any digit to the left of the decimal is **not** significant. For example:

a pH of 1.23 has two significant digits
a pH of 7 has no significant digits

Manipulation of Data

- When adding or subtracting measured quantities, the calculated answer should be rounded to the same degree of precision as that of the least precise number used in the computation **if this is the only operation**. For example in the following addition:

$$\begin{array}{r} 12.3 \text{ (least precise)} \\ 0.12 \\ \hline 12.34 \\ 24.76 \end{array}$$

The answer should be rounded to 24.8.

- When multiplying or dividing measured quantities, the calculated answer should be rounded to the same number of significant digits as are contained in the quantity with the fewest number of significant digits **if this is the only operation**. For example:

$(1.23)(54.321) = 66.81483$

The answer should be rounded to 66.8.

- When a series of calculations is performed, each interim value should not be rounded before carrying out the next calculation. The final answer should then be rounded to the same number of significant digits as are contained in the quantity in the **original data** with the fewest number of significant digits. For example:

In determining the value of $(1.23)(4.321) / (3.45 - 3.21)$, three calculations are required:

- $3.45 - 3.21 = 0.24$
- $(1.23)(4.321) = 5.31483$
- $5.31483 / 0.24 = 22.145125$
[Not $5.31 / 0.24 = 22.125$]

The value should be rounded to 22.1.

Note: In the example given, steps *a* and *b* yield interim values. These values should not be used in determining the number of significant digits.

- When calculations involve exact numbers (counted and defined values) the calculated answer should be rounded based upon the precision of the measured value(s). For example:

12 eggs \times 52.3 g/egg = 627.6 g
or
5 mol \times 32.06 g/mol = 160.30 g
or
 $(1 \text{ mol})(-1095.8 \text{ kJ/mol}) + (2 \text{ mol})(40.8 \text{ kJ/mol}) = -1014.2 \text{ kJ}$

Rounding

- When the first digit to be dropped is less than or equal to 4, the last digit retained should not be changed. For example:

1.2345 rounded to three digits is 1.23

- When the first digit to be dropped is greater than or equal to 5, the last digit retained should be increased by one. For example:

12.25 rounded to three digits is 12.3