Significant Figures

The concept of significant figures (sf) may be used to indicate the degree of accuracy or precision in a measurement. The following rules apply in this book.

1. All non-zero digits are significant (22.4 has 3 sf)

2. All zeros between two non-zero digits are significant (1007 has 4 sf)

3. For numbers less than one, zeros directly after the decimal point are no significant (0.00024 has 2 sf)

4. A zero to the right of a decimal point and following a non-zero digit is significant (0.003400 has 4 sf)

5. All other zeros are not significant (600 has 1 sf)

Scientific notation allows you to give a zero significance. For example, 100 has 1 sf but 1.00×10^2 has 3 sf.

Rules for using significant figures in calculations.

Adding and Subtracting: When adding or subtracting a series of measurements, the final answer can only contain the same number of decimal places as the number with the fewest number of decimal places.

eg. If you add 24.2 g + 0.51 g + 7.134 g your answer is 31.844 g. Since the number with the fewest number of decimal places is 24.2 (it has one decimal point) therefore the answer can only have one decimal point i.e. 31.8 g.

Multiplying and Dividing: When multiplying or dividing a series of measurements, the number of significant figures in your answer should be equal to the least number of significant figures in any of the data of the series.

eg. If you multiply 3.22 cm by 123.4 cm by 1.8 cm to find the volume of a piece of wood your initial answer is 715.2264 cm^3. However, the least significant measurement is 1.8 with 2 sf. Therefore, the correct answer is 720 cm^3 or 7.2×10^2 cm^3.

Practise:

1. How many significant figures are indicated by each of the following?

a) 1247 b) 1000 c) 0.034 d) 1201.07 e) 62.0 f) 0.0025

g) 0.00250 h) $\sin 43.2^{0}$ i) 3.2×10^{-4} j) $\tan^{-1} 0.24$ k) 6.02×10^{23} l) 1.042

2. Determine the following to the correct number of significant figures

a) $(3.74 - 1.3) \times 2.12 \times 17.65$ b) $(2.9 + 3.2 + 7.1) \div 0.134$

3. Calculate the area of a square with a side of 3.2 m. (A = lw)

4. Add the following lengths of 2.35 cm and 14.2 cm and 7.620 cm.

5. Calculate the volume of a rectangular block 1.52 cm by 24.6 cm by 8.3 cm. (V = lwh)

6. A metal ingot has a mass of 2.0 g and a volume of 0.04 cm^3. Calculate the density of the metal ingot. (D = m/v)

7. Round off the following numbers to three significant figures:

a) 7.1249 b) 2561 c) 2001 d) 21256 e) 6.5647 f) 0.0034679