

Teaching ideas for Chapter 11, *Measurement and data processing*

Questions

A worksheet of questions is provided that deals with the Standard Level part of the syllabus.

There are also a large number of questions available in the Coursebook and on the accompanying CD-ROM.

Teaching ideas and practical activities

- Most of this topic can be taught through practical work applicable to the other parts of the course. For example, uncertainties on measurements can be introduced by carrying out a simple experiment such as determining the empirical formula of magnesium oxide (see **Chapter 1 – Practical 2, *Determination of the empirical formula of magnesium oxide***). If the experiment is done first with a very small piece of magnesium (the mass of which approaches the limit that the electronic balance can measure) then repeated with a much larger piece the results can be compared.
- The difference between random and systematic errors can be illustrated by, for instance, a thermochemistry experiment such as measuring the enthalpy change of solution. The existence of systematic errors can be compared by reference to the literature value of that quantity. The difficulty in identifying systematic errors when no literature value exists could be discussed.
- The importance of uncertainties could be discussed with reference to, for example, the Hubble Space Telescope or the International Space Station. When building components for these what sort of tolerance is acceptable? How does this compare to the acceptable tolerance when building a car or a house?

ICT

- Students can construct graphs using experimental data and a suitable software package such as Microsoft Excel.
- Significant figures quizzes:
<http://www.lon-capa.org/~mmp/applist/sigfig/sig.htm>
<http://science.widener.edu/svb/tutorial/sigfigures.html>
- Graph Lab:
<http://www.molsci.ucla.edu/pub/explorations.html#Crystalline%20Solids>

Theory of knowledge (TOK)

The idea that, due to uncertainties on all instruments used for measurement, an exact value for a quantity can never be obtained in science, could be discussed.