	Statement	Guidance
11.1.U1	Qualitative data includes all non-numerical information obtained from observations not from measurement.	
11.1.U2	Quantitative data are obtained from measurements, and are always associated with random errors/uncertainties, determined by the apparatus, and by human limitations such as reaction times	The number of significant figures in a result is based on the figures given in the data. When adding or subtracting, the final answer should be given to the least number of decimal places. When multiplying or dividing the final answer is given to the least number of significant figure
11.1.U3	Propagation of random errors in data processing shows the impact of the uncertainties on the final result.	Record uncertainties in all measurements as a range (±) to an appropriate precision
11.1.U4	Experimental design and procedure usually lead to systematic errors in measurement, which cause a deviation in a particular direction	
11.1.U5	Repeat trials and measurements will reduce random errors but not systematic errors	
11.2.U6	Graphical techniques are an effective means of communicating the effect of an independent variable on a dependent variable, and can lead to determination of physical quantities.	Drawing graphs of experimental results including the correct choice of axes and scale. Interpretation of graphs in terms of the relationships of dependent and independent variable.
11.2.U7	Sketched graphs have labelled but unscaled axes, and are used to show qualitative trends, such as variables that are proportional or inversely proportional	Production and interpretation of best-fit lines or curves through data points, including an assessment of when it can and cannot be considered as a linear function
11.2.U8	Drawn graphs have labelled and scaled axes, and are used in quantitative measurements.	Calculation of quantities from graphs by measuring slope (gradient) and intercept, including appropriate units
11.3.U9	The degree of unsaturation or index of hydrogen deficiency (IHD) can be used to determine from a molecular formula the number of rings or multiple bonds in a molecule.	
11.3.U10	Mass spectrometry (MS), proton nuclear magnetic resonance spectroscopy (^{1}H NMR) and infrared spectroscopy (IR) are techniques that can be used to help identify compounds and to determine their structure	The electromagnetic spectrum (EMS) is given in the data booklet in section 3. The regions employed for each technique should be understood.. For ^{1}H NMR, only the ability to deduce the number of different hydrogen (proton) environments and the relative numbers of hydrogen atoms in each environment is required. Integration traces should be covered but splitting patterns are not required.
21.1.U11	Structural identification of compounds involves several different analytical techniques including IR, ^{1}H NMR and MS	
21.1.U12	In a high resolution ^{1}H NMR spectrum, single peaks present in low resolution can split into further clusters of peaks	Students should be able to interpret the following from $_1$H NMR spectra: number of peaks, area under each peak, chemical shift and splitting patterns. Treatment of spin-spin coupling constants will not be assessed but students should be familiar with singlets, doublets, triplets and quartets
21.1.U13	The structural technique of single crystal X-ray crystallography can be used to identify the bond lengths and bond angles of crystalline compounds	The precise details of single crystal X-ray crystallography need not be known in detail, but students should be aware of the existence of this structural technique in the wider context of structural identification of both inorganic and organic compounds