Analytical Instrumentation: Performance, Characteristics and Quality

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Analytical instruments continue to increase in sophistication, and as a consequence, the range of materials that can now be almost routinely analysed has increased accordingly. This volume forms part of the *Analytical Techniques in the Sciences* series of open learning texts, which aim to provide a broad coverage of many areas of science in which analytical techniques and methods are now increasingly applied. Volumes in this series therefore provide not only coverage of the actual techniques themselves, but also the scientific disciplines that have a requirement for such analytical methods. The central aim of this volume is to develop an understanding of the performance characteristics of analytical instruments. Many laboratory professionals would consider this to mean 'the bottom up approach'. How the instrument works, the underlying concepts, its limitations with regard to sensitivity and the quality of the data obtained. However, this text goes beyond the laboratory bench to consider the business performance characteristics, 'the top down approach', for example: is the instrument the most appropriate for the sample; will it provide data of the required quality; what level of uncertainty is acceptable; the cost effectiveness with respect to time and facilities, etc.

The first two chapters present fundamental topics such as analytical measurement, calibration, precision, repeatability and reproducibility, uncertainty, random errors, and error propagation. The third chapter provides a discussion of instrument performance characteristics, and covers topics such as responsivity, noise, offset and drift, linearity, selectivity and specificity, and quality. These three introductory chapters help to set the overall scene and lead nicely into the fourth chapter, which deals with quality systems in analytical measurements, discussing the need for quality systems, quality standards and accreditation, proficiency testing and certified reference materials, validated methods, and quality control of instrument performance.

The next eight chapters consider a variety of commonly utilised specific analytical techniques and instrumentation, namely UV–visible spectrophotometers, atomic spectroscopy, FT-IR spectrophotometers, GC, HPLC, CZE, and MS systems. Specific areas of discussion include wavelength scanning, spectral characteristics, photometric characteristics, radiation processes, interferograms, pumping systems, detectors, injection systems, and hybrid coupling systems. This leads into the final six chapters, which discuss some of the fundamental concepts underlying such instrumentation. Topics presented include signals, noise, drift and interference, convolution, monochromators, radiation sources and radiation detectors.

In summary, this volume is well written and illustrated with good clear diagrams. Formulae are explained and worked examples are given. Questions and responses are provided at the end of appropriate chapters, which enable self-assessment. Professionals and students alike using or interested in analytical instrumentation would find this text a very useful reference work and a valuable aid to independent study.

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