Many problems in analytical chemistry begin with the need to identify what is present in a sample. This is the scope of a *qualitative analysis*, examples of which include identifying the products of a chemical reaction, screening an athlete’s urine for the presence of a performance-enhancing drug, or determining the spatial distribution of Pb on the surface of an airborne particulate. Much of the early work in analytical chemistry involved the development of simple chemical tests to identify inorganic ions and organic functional groups. The classical laboratory courses in inorganic and organic qualitative analysis, still taught at some schools, are based on this work. Currently, most qualitative analyses use methods such as infrared (IR) spectroscopy and nuclear magnetic resonance (NMR) spectroscopy. These qualitative applications are covered adequately elsewhere in the undergraduate curriculum and, so, will receive no further consideration in this text.

Perhaps the most common analytical problem is a *quantitative analysis*. Examples of typical quantitative analyses include the elemental analysis of a newly synthesized compound, measuring the concentration of glucose in blood, or determining the difference between the bulk and surface concentrations of Cr in steel. Much of the analytical work in clinical, pharmaceutical, environmental, and industrial labs involves developing new quantitative methods for trace amounts of chemical species in complex samples. Most of the examples in this text are quantitative analyses.

At the beginning of each year, the ACS journal *Analytical Chemistry* publishes a review issue. This volume contains articles reviewing recent developments, both fundamental and applied in analytical science. Each article is written by a team of researchers who are known leaders in their respective sub-disciplines.

Another important area of analytical chemistry, which receives some attention in this text, is the development of new methods for characterizing physical and chemical properties. Determinations of chemical structure, equilibrium constants, particle size, and surface structure are examples of a *characterization analysis*.

The purpose of a qualitative, quantitative, or characterization analysis is to solve a problem associated with a particular sample. The purpose of a *fundamental analysis*, on the other hand, is to improve our understanding of the theory behind an analytical method. Extending and improving the theory on which an analytical method is based, studying an analytical method’s limitations, and designing and modifying existing analytical method are examples of fundamental studies in analytical chemistry.

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