The last edition of McQuarrie and Rock came out in 1991. Over the years it has been gratifying to be told by so many people how much they regretted not seeing a fourth edition. It is with great pleasure to be able to have the opportunity to present this new edition, especially with the new perspective of having been away from it for almost twenty years.

Unlike many subsequent textbook editions, we have made a number of significant changes. Perhaps the most significant of these is that we are using the atoms first approach, which has made such inroads into the general chemistry curriculum since the third edition. After an introductory chapter on Chemistry and the Scientific Method, we then go on to discuss elements, compounds, and chemical nomenclature along with a brief introduction to atoms, molecules and the nuclear model of the atom. In Chapter 3 we emphasize the periodic properties of the elements by way of a few selected chemical reactions of the various groups of elements. Having introduced the periodic table, probably the most important topic in general chemistry, we then have six chapters where we use the quantum theory to present the underlying explanation of the periodic properties of the elements. The first of these six chapters discusses atomic spectra and the concept of the quantization of energy levels. Then in Chapter 5 we discuss multielectron atoms and show the connection between the electron configurations of multielectron atoms and chemical periodicity. Chapter 6 discusses ionic bonds, the simplest type of bonding. After a rather thorough discussion of Lewis formulas in Chapter 7, we then go on to use Lewis formulas to predict molecular geometries using VSEPR theory in Chapter 8. This introduces the students to a great variety of molecules and compounds and gives more practice writing Lewis formulas. In Chapter 9, the last of the six consecutive chapters on quantum theory and atomic and molecular structure, we present a fairly detailed introduction to covalent bonding, using simple molecular orbital theory for diatomic molecules and hybrid orbitals to describe the bonding in polyatomic molecules.

Finally in Chapter 10, we embark on a fairly conventional sequence of chapters on chemical reactivity, chemical calculations, the properties of gases, thermochemistry chemical kinetics, chemical equilibria, acids and bases, thermodynamics, oxidation-reduction reactions, electrochemistry and coordination chemistry.

We have noticed that many general chemistry texts do not make a clear distinction between a chemical reaction, which is an actual physical process that takes place in the laboratory, and the chemical equation that we use to express this reaction. How we choose to write a chemical equation to describe a chemical reaction is somewhat arbitrary in the sense that the balancing (stoichiometric) coefficients are arbitrary. We can write an equation with one set of balancing coefficients or any multiple of them. Thus we can express the reaction of hydrogen and oxygen as

$$2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(l)$$

or as

$$H_2(g) + \tfrac{1}{2}\ O_2(g) \rightarrow H_2O(l)$$

if we want to emphasize the combustion of one mole of hydrogen. Thus, for example, the value of the enthalpy of combustion of the reaction is – 237.1 kilojoules per mole in the first case and –118.5 kilojoules per mole in the second case, where mole refers to a mole of the reaction as described by the equation as written. This also strongly points out that the balancing coefficients are *relative* quantities and consequently are *unitless*. Both of these statements are in accord with just about every physical chemistry book and should be adhered to.

Another important feature, one that we used in previous editions but was not always appreciated, is that equilibrium constants as we define them in the introductory chapters on equilibria have units. There is no way to get around this. They are looking right at you when you define an equilibrium constant in terms of concentrations, K_c, or pressures, K_p. You can appeal to some sort of standard state of unit concentration or unit pressure to make the units mysteriously disappear, but certainly such an arbitrary convention is not justified at thus point. Furthermore, when doing equilibrium calculations, the resulting equilibrium concentrations should come out in terms of concentration or pressure, which they don't if K_c or K_p are taken to be unitless. The reason for suppressing the units in equilibrium constants is the anticipation of taking the logarithm of K_c or K_p. As a matter of fact, there is *no* equation that involves the logarithm of K_c or K_p. The equation involving the logarithm of an equilibrium constant is the thermodynamic equation

$$\Delta G^\circ = -RT\ln K$$

where K is the *thermodynamic equilibrium constant*, which is defined by

$$K = K_c / Q_c^\circ \qquad \text{or} \qquad K = K_p / Q_p^\circ$$

where Q_c° is the standard reaction quotient, which has a numerical value of unity with units of molarity and Q_p° is the similar quantity for pressure. Now, and only now, is K unitless. Clearly K can not have units in order to take its logarithm. It is important to realize in this case that K is *not* the same as K_c or K_p. It is the *thermodynamic equilibrium constant*. A formal introduction of the concept of the thermodynamic equilibrium constant is not just another way of saying the same thing as in the earlier chapters, but is an entirely new equilibrium constant. All this is in accord with the 1982 recommendation of the International Union of Pure and Applied Chemistry (IUPAC).

We have usually adhered to the IUPAC recommendations, but could not bring ourselves to do it in the case of pressure units. IUPAC recommends the use of the SI units of bars and Pascals, but atmospheres are so ingrained in the chemistry curriculum that it is difficult to not use them. Consequently we use both bars and atmospheres throughout the text and require the students to be bilingual in this regard. Along the same lines, we have eschewed the use of the term STP, which is woefully ambiguous. The IUPAC definition of STP designates the conditions one bar and 0 ºC, whereas the older, fully ingrained definition still permeating chemistry texts designates the conditions at one atmosphere and 0ºC. An informal survey of many high school chemistry teachers shows that the venerable fact that one mole of an ideal gas occupies 22.414 liters at one atmosphere and 0ºC is still in great use, whereas under the IUPAC recommendations one mole of an ideal gas occupies 22.711 liters at one bar and 0ºC.

One final innovation is the use of what we call Interchapters for the introduction of descriptive chemistry. As every general chemistry author knows all too well, how to present descriptive chemistry is a nagging problem, as numerous articles over the years in the Journal of Chemical Education attest to. In the third edition, for example, we included two full chapters on The Chemistry of the Main Group Elements. Unfortunately, many instructors simply do not have the time, and perhaps even the inclination, to cover these chapters because these chapters typically come toward the end of the text. We have elected to present descriptive chemistry in a number of short segments spread throughout the book that can be covered readily or assigned as reading. For example, some of the interchapters are called Hydrogen and Oxygen, The Alkali Metals, Nitrogen, Saturated Hydrocarbons, Unsaturated Hydrocarbons, Aromatic Hydrocarbons, The Main Group Elements and so on. It seems particularly worthwhile that the students be introduced to an *elementary* discussion of organic chemistry at an early stage so that organic molecules can be used throughout as examples. Although we have avoided references to the plethora of websites out there because of their volatility, we do recommend strongly the Journal of Chemical Education website called Periodic Table Live, http://www.chemeddl.org/collections/ptl/index.html. When you click on an element in the periodic table in this website, you get a list of its chemical and physical properties and even photos and videos of a number of its reactions. Students should be encouraged to refer to this website frequently.