

Since about the 1990s, “green” has come into widespread use as a term to describe practices and disciplines that deal with sustainability and the maintenance of environmental quality. One area that has been particularly active is in chemistry with green chemistry the subject of large numbers of symposia, international meetings, books, and journal papers. In addition, green chemistry institutes and academic programs have been established in various countries.

Green Chemistry and the Ten Commandments of Sustainability, Third Edition, is a basic book on green chemistry and environmental sustainability designed for readers who have a need to learn about these topics at a fundamental level. Most works on green chemistry have concentrated on aspects of chemical synthesis, especially organic chemical synthesis. *Green Chemistry and the Ten Commandments of Sustainability*, discusses chemistry as a whole particularly as it relates to the environment and sustainability. In addition to covering green chemistry, the book deals with sustainable science and technology in general. In so doing, it views Earth and its environment as consisting of five highly interactive spheres: (1) The hydrosphere, (2) the atmosphere, (3) the geosphere, (4) the biosphere, (5) and the anthrosphere. It is particularly important to consider the anthrosphere, that part of Earth’s environment made and operated by humans, because of its overwhelming importance in determining Earth’s environment.

Chapter 1, “Sustainability and the Environment,” consists of an introduction to environmental science and the concept of sustainability. It introduces and defines the five environmental spheres. Green science and green technology are introduced and explained. In recognition of the overwhelming importance of energy in sustainability, this chapter includes a section entitled “Sustainable Energy: Away from the Sun and Back Again” that explains how humankind relied on solar energy, such as photosynthetically produced food and wood, for most of its time on Earth, then entered an approximately two-century era in which fossil fuels became dominant energy sources, but now must return to the sun directly and indirectly for basic energy supply.

Chapter 3, “The Key Role of Chemistry and Making Chemistry Green” outlines the importance and role of chemistry in sustainability. Environmental chemistry is introduced as a key discipline in sustainability. Green chemistry is defined and the twelve principles of green chemistry are listed and explained. The chapter provides a brief introduction to the most basic aspects of chemistry to aid in understanding chemical concepts in later chapters. Chapters 3 through 7 cover the fundamentals of chemistry from a green chemistry perspective. Chapter 6 is a basic coverage of organic chemistry and Chapter 7 deals with biochemistry as it relates to green chemistry.

Chapters 8 through 13 are organized according to the five spheres of the environment. Chapter 8, “The Five Environmental Spheres and Biogeochemical Cycles,” defines and explains each of these spheres and how they relate and interact through biogeochemical cycles of matter. Chapter 9, “Water, the Ultimate Green Substance,” covers the hydrosphere. It also emphasizes the unique properties of water as related to the structure of the water molecule and explains the important role of water in green technology. Chapter 10, “The Atmosphere: Blue Skies for a Green Environment,” deals with air and the atmosphere, the natural capital provided by the atmosphere, the protective role of the atmosphere, and threats to the atmosphere and climate from activities in the anthrosphere, including the combustion of carbonaceous fuels. Chapter 11, “The Geosphere and a Green Earth,” covers a number of topics related to the geosphere including aspects of geology, natural hazards of the geosphere (volcanoes, earthquakes), natural capital of the geosphere (minerals), and the geosphere as a repository of wastes. Important sections of this chapter discuss soil, how its productive capacity may be lost through erosion and desertification, and how green technology may prevent these harmful effects. Chapter 12, “The Biosphere and the Role of Green Chemistry in Feeding a Hungry World,” begins with a basic coverage of biology as it relates to sustainability and among other topics discusses the production of food and fiber by the biosphere (agriculture). It also contains a discussion of agricultural applications of genetically modified organisms as well as a section on how the anthrosphere may be operated in a way that supports and benefits the biosphere. Chapter 13, “The Anthrosphere, Industrial Ecology, and Green Chemistry,” begins with a discussion of the emerging area of industrial ecology, which treats industrial systems in a manner analogous to natural ecosystems including industrial metabolism through which materials are processed to produce manufactured products. Life cycles of materials are discussed with respect to sustainability. The role of green chemistry in sustainable manufacturing is explained in this chapter.

As the title implies, Chapter 14, “Feeding the Anthrosphere: Utilizing Renewable and Biological Materials,” discusses how feedstocks for manufacturing may be produced sustainably. Emphasis is placed upon biological sources of feedstocks produced through photosynthesis. Biorefineries and their role in biomass utilization are explained.

Chapter 15, “Sustainable Energy: The Essential Basis of Green Systems,” explains the key importance of sustainable energy in sustainability and how most environmental and sustainability problems can be solved if abundant sources of energy are available and if they can be used without doing unacceptable harm to the environment. Part of the chapter pertains to green technology for efficient energy conversion and utilization. Renewable sources of energy including solar electric, wind, moving water, and biomass are discussed in this chapter.

Chapter 16, "Terrorism, Toxicity, and Vulnerability: Green Chemistry and Technology in Defense of Human Welfare," discusses the role of green chemistry, science, and technology in dealing with terrorist threats. A major part of the chapter deals with toxic substances and toxicology as they relate to terrorist threats. The chapter also covers potential biohazards in terrorism and protecting water, food, and air.

Chapter 17, "The Ten Commandments of Sustainability and Sensible Measures," presents ten important rules for the achievement of sustainability upon which part of the book title is based. It concludes with a section on "sensible measures" that might be taken to enhance sustainability. Designed to provoke thought, these suggestions range from small measures to grandiose schemes. The author welcomes input from readers and may be contacted at the following e-mail address: manahans@missouri.edu