Matter, Minerals, and Rocks

Lesson 1

SPACESHIP EARTH

Buckminster Fuller, an amazing thinker, inventor, and scientist, introduced the expression *Spaceship Earth.* He wanted us to be aware that all humankind rides a globe through space, that Earth is home to all of us. The atmosphere, the land, the oceans, and all the living things on Earth are part of a single system—the Earth system.

Just as all humans depend on each other to make a living, every part of the Earth system depends on every other part. For example, Earth's atmosphere contains enough oxygen for you and me to breathe because plants produce it for us. Plants use sunlight and gases from the air to produce sugar they store in their fruits and flowers. That process is called *photosynthesis,* which means "putting together using light." The waste product of plant photosynthesis is oxygen, which we need to breathe. On the other hand, as we humans and other animals breathe, we exhale a waste product called *carbon dioxide,* which the plants need for photosynthesis. Plants take in carbon dioxide, use it, and give off oxygen. We take in oxygen, use it, and give off carbon dioxide. And so it goes.

The whole Earth system works like that. Dead animals—or their solid or liquid wastes—are food for bacteria. If bacteria didn't process these wastes, the soil would die and plants couldn't grow, because soil is fed by recycling plant and animal remains. Earth is like a huge recycling system. The air you just breathed may have been used a day or so ago by a farmer in China. Everything, everywhere, gets used and reused over and over and over again.

You may think that learning about the state or the town you live in is all you need to know about our Spaceship Earth. And it's fine to know those things, but it's both interesting and wise to learn how your town and your neighborhood fit into the Earth system. No part of Earth exists apart from all the other parts.

A LOOK AT LESSON 1

When builders begin the process of constructing a house, the first thing they do is establish a foundation. This process usually involves the pouring of cement to form a solid base on which to build the rest of the house.

This is what Chapter 1 does. It establishes a foundation for the rest of the chapters in Lesson 1, as well as for those in the remainder of the text. Your text begins building this foundation by introducing you to science in general and Earth science in particular.

Chapter 2 introduces you to some specific features of Earth. You'll learn about the shape and size of Earth, and you'll study such topics as gravity and the subdivisions of Earth. Chapter 3 presents a fascinating topic—maps. You'll learn the vocabulary of maps, and you'll study how scientists mark locations on a map. Finally, you'll read about an interesting characteristic of Earth—its magnetic field.

In Chapter 4, you'll learn about *atoms,* the smallest particles of matter, and their unique properties. You'll learn how atoms, through chemical reactions, form various chemical compounds. These compounds have definite compositions and specific properties due to their unique combinations of atoms. What you learn about chemical reactions and compounds will enable you to understand the nature of minerals—the basic materials that make up Earth's crust.

In Chapter 5, you'll study various characteristics of minerals—color, luster, crystal form, hardness, streak, cleavage, and specific gravity. Some minerals are easy to identify and are found in relative abundance in Earth's crust; others are rare, have unique qualities all their own, and possess high commercial value.

In Chapter 6, you'll apply your knowledge of minerals to the study of rocks. Understanding how rocks form and how the rock cycle produces many of Earth's features is fundamental to the study of Earth science.

ASSIGNMENT 1: THE SCIENCE OF PLANET EARTH

Read this introduction. Then study Chapter 1, pages 1–6, in your textbook *Earth Science: Reviewing the Essentials.*

The Nature of Science

Chapter 1 begins by defining *science* as "an organized approach to gathering, analyzing, verifying, and utilizing information about the world." Earth science is just one of many sciences, such as biology, astronomy, chemistry, physics, anatomy, and many others. Science is *dynamic,* which means it's always changing. Scientists are always studying new ideas and discovering new facts. These new discoveries then pave the way for further investigation and discoveries.

Scientists do their work in a very orderly fashion, called the *scientific method.* The scientific method is a process used by scientists to study the natural world. Your textbook defines the terms *hypothesis* and *theory,* which are two important components of this scientific method. Read this section carefully, as it's the basis for all scientific work.

What Is Earth Science?

Earth science is a discipline, or field of study, that uses information from many other disciplines. Earth scientists gather facts from geology, meteorology, oceanography, astronomy, ecology, and many other areas. These individual disciplines help to establish a past, present, and future picture of Earth and its many processes. That may be a surprise to you. You may have thought that Earth science was mostly about studying rocks and fossils. Although that's part of it, Earth science uses contributions from nearly all of the natural sciences. (A *natural science* deals with the physical world.)

Why Study Earth Science?

Earth science may be a required part of your program of study, and that certainly is a good reason for studying it. However, it can be much more than just a requirement. Your work with Earth science can be much more interesting and more enjoyable if you think about how it can benefit you.

First of all, you'll have a much more rounded education after you complete this course. Education without science—and particularly Earth science—is definitely lacking an important element.

Second, you live on Earth. It's your home. Therefore, studying it and the processes that are important to it will help you to take better care of your home. For example, recycling paper, plastic, and aluminum can help to protect the environment. Starting a compost heap, instead of throwing out garbage can help put important elements back into the soil.

Your textbook says, "In order to make intelligent decisions regarding the planet, . . . people need to understand Earth systems." You're just beginning to gain some of that understanding.

Scientific Observations

Observation is a very important part of any science. In fact, the scientific method begins with observation, and all modern science is based on observation. Scientists observe animals, weather, stars, water, and other factors that are part of Earth to learn about Earth processes. In this section of your textbook, you'll learn about two different kinds of observation: qualitative observation and quantitative observation.

Systems of Measurement

You're probably familiar with the English system of measurements, which uses units such as inches, feet, pounds, and miles. Most sciences today use the metric system. The main reason is because of its consistency. To work with the English system, you must learn many different multiples. For example, 12 inches = 1 foot, 36 inches = 1 yard, 16 ounces = 1 pound. In the metric system, however, all units are related to each other in terms of the number 10.

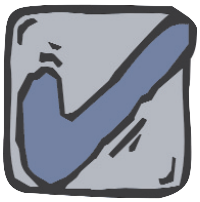
You may have learned the metric system in some previous study. If so, you should still take some time to quickly review Tables 1-1 and 1-2 on page 6 in the textbook. If you aren't familiar with this system, study the tables carefully until you understand the relationship between the prefixes used in the system.

For Fun and Profit

Here are some Web sites that you may enjoy studying. The material in these sites is related to the material you've just studied in Chapter 1.

http://teacher.nsrl.rochester.edu/phy_labs/AppendixE/AppendixE.html

http://physics.nist.gov/cuu/Units/



Self-Check 1

At the end of each assignment of *Earth Science*, you'll be asked to pause and check your understanding of what you've just read by completing a "Self-Check" exercise. Answering these questions will help you review what you've studied so far. Please complete *Self-Check 1* now.

When you've completed your study of Chapter 1, answer questions 1–25 on pages 7–9 in the textbook. Then check your answers with those given at the back of this study guide.

Remember: This self-check is for your benefit only. Do *not* submit your answers to the school for grading.

Check your answers with those on page 147.