CHAPTER 1

Portable Electronics: The Periodic Table in the Palm of Your Hand

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REFLECT

What's in Your Cell Phone?

Watch the Chapter 1 opening video at www.acs.org/cic to get a glimpse of how chemistry plays a central role in controlling the properties of electronic devices.

a. List some desirable attributes of a cell phone, and some that you would like to see in the future.
b. Cite two elements that combine to form a substance important to your cell phone.
c. What is the expected lifespan of your cell phone?

COMPELLING QUESTIONS

In this chapter, you will explore the following questions:

- What are the different components in your portable electronic device made from?
- How does the periodic table of elements guide us in the design of your device?
- What are rocks, and how do we isolate and purify metals from these natural sources?
- How is ordinary sand converted into silicon—the fundamental component of processor chips?
- How is sand converted into glass, and how can its structure be modified for crack-resistant screens?
- What are the environmental implications of fabricating and recycling your portable electronic devices?

Introduction

Email, phone calls, texts, and social media. Our modern society demands constant contact during busy days filled with meetings, classes, travel, and social activities. The tablet or cell phone you hold in your hand is a combination of a variety of materials that have been carefully crafted to give you special capabilities you can't imagine living without.

In order to satisfy the ever-rigorous demands of today's consumer, the latest portable electronics must be lightweight, thin, durable, multifunctional, and easily synced with computers and next-generation wearable devices. Such complex designs are possible only by putting together the elements of the periodic table in many different ways to form materials with the above physical properties that we need or desire.

In this chapter, you will learn about the various components that make up your cell phone, tablet, or other portable electronic device. Perhaps most importantly, you will discover where these components came from and what happens to them after their lifetime is finished.

1.1 How Do Touchscreens Work?

It's wintertime and you need to respond to an urgent text on your smartphone. You touch the screen with a gloved finger and get no response. The hassle of removing your gloves and risking frostbite, just to operate your cell phone or tablet, is an all-too-common occurrence for those who live in cold climates. However, there are now a variety of commercially available gloves that use a special thread or have pads sewn into them, which allow users to seamlessly control their touchscreen devices. Most smartphones and tablets will also respond to a stylus. Nevertheless, this begs the question: Why are touchscreens so restrictive in responding to only a small number of stimuli?

Your Turn 1.1 Touchscreen Response

Taking care not to damage your screen, use a variety of materials to touch the screen of your portable electronic device. In addition to your finger, items that may be used include a paper clip, a plastic pen, a key, a battery, fabrics, pencil lead, a sponge (wet and dry), a pencil eraser, a coin, a glass marble, paper, cardboard, or any other items. Did any of these materials other than your finger cause a response?

As you saw in the previous activity, touchscreens respond only to objects that are electrically conductive. If you have experienced a shock by touching a metal object after sliding your feet across a carpet, you realize that the human body is a conductor of **electricity**. Some other examples of electrically conductive materials are metals such as copper, silver, and aluminum. On the other hand, materials such as concrete, wood, and most plastics do not allow electricity to flow and are referred to as electrically