Chapter 1

About Science

THE MAIN IDEA

Science is the study of nature's rules

1.3 Technology Is Applied Science

Science is concerned with gathering knowledge about the natural world. When we apply this knowledge for practical purposes, we have what we call **technology**. From scientific discoveries, an engineer can design new technologies. New technologies, in turn, can be of assistance to scientists in conducting their research. The computer, for example, is technology scientists use on a daily basis. So, technology arises from science, but technology also supports science—the two are different from each other but very much related.

Technology is a double-edged sword that can be both helpful and harmful. We have the technology, for example, to extract fossil fuels from the ground and then to burn the fossil fuels for the production of energy. Energy production from fossil fuels has benefited our society in countless ways. On the flip side, the burning of fossil fuels endangers the environment. It is tempting to blame technology itself for problems such as pollution, resource depletion, and even overpopulation. These problems, however, are not the fault of technology any more than a shotgun wound is the fault of the shotgun. It is humans who use the technology, and humans who must decide how to use it responsibly.

Remarkably, we already possess the technology to solve many environmental problems. In this 21st century, we are seeing a switch from fossil fuels to more sustainable energy sources, such as photovoltaics, hydroelectric, wind, solar, thermal electric generation, and biomass conversion. Whereas the paper on which the hard copy of a book is printed came from trees, paper can also come from fast-growing weeds, and less of even these materials are needed with the rise of online learning. In some parts of the world, progress is being made to stem the rapid growth of our human population, which is an issue that aggravates almost every problem

FOR YOUR INFORMATION

Science is a way of knowing.
Technology is a way of doing.

faced by humans today. We live on a finite planet, and Earth's population carrying capacity is being acknowledged. The greatest obstacle to solving today's problems lies more with social inertia than with a lack of technology. Technology is our tool. What we do with this tool is up to us. The promise of technology is a cleaner and healthier world. Wise applications of technology can lead to a better world.

READING CHECK

What is the promise of technology?

Risk Assessment

The numerous benefits of technology are paired with risks. When the benefits of a technological innovation are seen to outweigh its risks, the technology is accepted and applied. X rays, for example, continue to be used for medical diagnosis despite their potential for causing cancer. But when risks are perceived to outweigh the benefits, the technology tends to be used very sparingly or not at all. Risk can vary for different groups. Aspirin is useful for adults, but for young children it can cause a potentially lethal condition known as Reye's syndrome. Dumping raw sewage into the local river may pose little risk for a town located upstream, but for towns downstream the untreated sewage is a health hazard. Similarly, storing radioactive wastes underground may pose little risk for us today, but for future generations the risks of such storage are greater if there is leakage into groundwater. Technologies involve different risks and benefits for different people, raising questions that are often hotly debated. Which medications should be sold over the counter to the general public, and how should they be labeled? Should food be irradiated in order to minimize food poisoning, which kills more than 3000 Americans each year? The risks to all members of society need to be considered when public policies are decided.

Some people seem to have difficulty accepting the impossibility of zero risk. You cannot go to the beach without risking skin cancer, no matter how much sunscreen you apply. You cannot avoid radioactivity, for it occurs naturally in the air we breathe and the foods we eat. Science, however, can help to determine relative risks. As the tools of science improve, the accuracy of risk assessment improves. Acceptance of risk, on the other hand, is a societal issue. Zero risk is not possible, and a society that accepts no risks receives no benefits.

FOR YOUR INFORMATION

Pharmaceuticals provide measurable benefits. A recently noted risk, however, is that many of these pharmaceuticals are now ending up in our drinking water, lakes, and streams. Although their concentrations are quite low, they are detectable, and these materials are being shown to have a measurable effect on species living in the water. Conclusion: old medicines should be thrown in the trash and never flushed down the drain. Better yet, bring your old prescription drugs to your local pharmacist who will have the means to dispose of these chemicals properly.

CONCEPT **CHECK**

Does technology come from science or does science come from technology?

CHECK YOUR ANSWER

Both! The practical application of knowledge gained through science is technology. In this sense, the science comes first. The tools of technology, however, can be used by scientists to further our understandings of nature. A case in point would be the telescope, which is a tool that permits us to learn about the stars. Science and technology are different, but they complement each other.