

Tools and Measurement

Key Concept Scientists select and use tools and technology to perform tests and collect data.

What You Will Learn

- Scientists use technology, such as computers and microscopes, to perform tests and collect information.
- The International System of Units enables scientists to compare information and to convert between units.
- Measurements such as length, area, volume, temperature, and mass can be obtained with the right tools.

Why It Matters

Selecting and using the right tools and technology will help you conduct your own scientific investigations.

Vocabulary

- technology
- compound light microscope
- electron microscope
- area
- volume
- mass
- weight
- temperature

READING STRATEGY

Clarifying Concepts Take turns reading this section out loud with a partner. Stop to discuss ideas that seem confusing.

technology (tek NAHL uh jee) the application of science for practical purposes; the use of tools, machines, materials, and processes to meet human needs

Figure 1 Binoculars help scientists make observations when they cannot get close to their subject.

▶ Would you use a knife to mix cake batter? You probably would not. To be successful in many tasks, you need the correct tools.

Life scientists use various tools to make observations and to collect, store, and analyze information. Selecting and using tools properly are important parts of scientific work.

Technology in Science

The application of science for practical purposes is called **technology**. By using technology, life scientists are able to find information and solve problems in new ways. New technology allows scientists to get information that was not available previously.

Calculators and Computers

Calculators and computers are two types of technology that are frequently used in science. Scientists frequently collect large amounts of data. Calculators and computers can be used to quickly and accurately make calculations of data. Some calculators and computers can be programmed to create graphs and to solve complex equations. Computers also help scientists share data and ideas with each other and publish reports about their research.

Binoculars

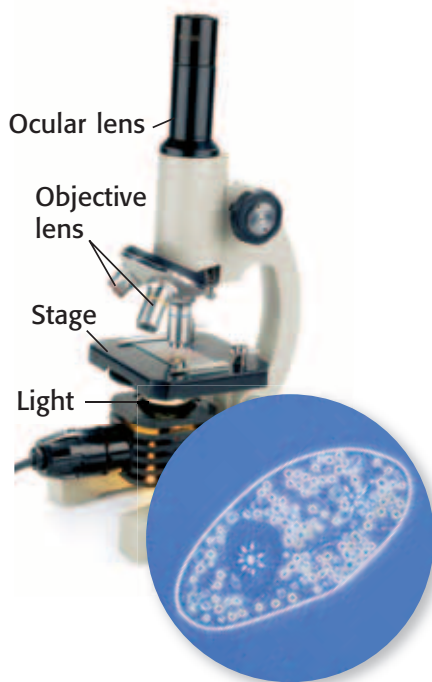
Imagine that you are studying eagles that nest in tall trees. You need to make observations. But it is not always easy or safe to get close to what you are studying. Binoculars can help you make observations from a distance. **Figure 1** shows a scientist using binoculars to make observations.



Figure 2 Types of Microscopes

Compound Light Microscope

Light passes through the specimen and produces a flat image.

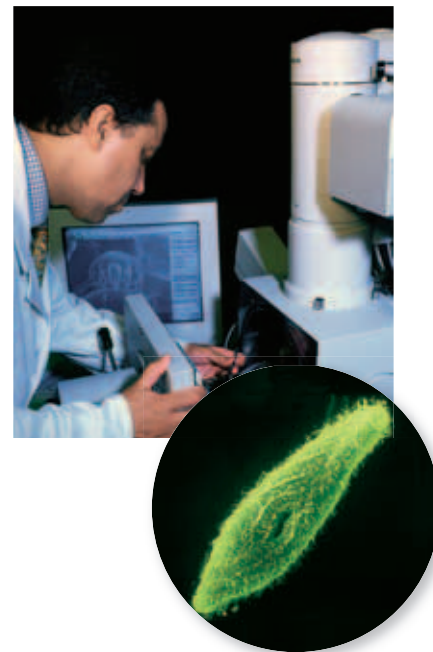


Transmission Electron Microscope Electrons pass through the specimen and produce a flat image.



Scanning Electron Microscope

Electrons bounce off the surface of the specimen and produce a three-dimensional (3-D) image.




Compound Light Microscope

The compound light microscope is a common tool in a life science laboratory. A **compound light microscope** is an instrument that magnifies small objects so that they can be seen easily. It has three main parts—a tube with two or more lenses, a stage, and a light. Items may be colored with special dyes to make them more visible. Items are placed on the stage so that the light passes through them. The lenses at each end of the tube magnify the image.

Electron Microscopes

Not all microscopes use light. In **electron microscopes**, tiny particles called *electrons* are used to produce magnified images. The images produced are clearer and more detailed than those made by light microscopes. However, living things cannot be viewed with electron microscopes because the preparation process kills them. The two kinds of electron microscopes used in life science are the transmission electron microscope (TEM) and the scanning electron microscope (SEM). **Figure 2** shows three kinds of microscopes and an example of the images that each kind can produce.

Standards Check Which type of technology would you use to observe the movement of a small living thing?  7.7.a

compound light microscope

(kahm POWND LIET MIE kruh SKOHP) an instrument that magnifies small objects so that they can be seen easily by using two or more lenses

Wordwise The root *micro-* means “small.” The root *-scope* means “an instrument for seeing or observing.”

electron microscope

(ee LEK trahn MIE kruh SKOHP) a microscope that focuses a beam of electrons to magnify objects



Investigation and Experimentation

7.7.a Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.