

MICROSCOPE Unit Overview

In this unit, students are introduced to the microscope. They take a closer look at familiar objects and see them in a way that they have probably never seen them before.

Microscopes demonstrate the interplay between science and engineering. Curiosity drove people to craft better lenses and invent microscopes; microscopes in turn led to scientific discoveries. Over time, engineers have designed better and better microscopes, allowing scientists to make more and more discoveries.

In this unit students are the scientists and engineers. They first explore with hand lenses, then design a magnification device using two or more lenses. Next they are given a modern microscope and invited to figure out its structures and functions.

Although learning to use a microscope is not explicitly included in the standards, it is an important skill that will allow students to make observations and see things for themselves, particularly when they study cells.

In the lessons that follow, students use the microscope to make discoveries, identify mystery substances, and look closely at different materials for clues about how they were made. They learn technique and precision, they learn to work carefully and observe closely, and they learn to gather and interpret evidence. The unit culminates with the Micrographia project; students follow in the footsteps of Robert Hooke, examining everyday objects of their choice under a microscope and keeping a detailed journal about what they see.

Students are assessed on their developing skill at using a microscope, as well as the care with which they make drawings and observations, particularly with the Micrographia project. There is no unit test.

Materials

- ★ Hand lenses (1 per student, plastic is fine; for Lessons 1-3 and)
- ★ Microscopes (ideally at least 1/pair of students, for Lessons 4-10)
- ★ Rulers, preferably metric
- ★ Something small to project for Lesson 1 Engage activity: feather, ant farm, etc.
- ★ pieces of paper with words printed on them for Lesson 1 (e.g. old worksheets or magazines; groups can cut up and share)
- ★ sheets with the letter e, one for each microscope (for Lesson 5; students can cut up and share)
- ★ Materials for building devices (gather these or similar items ahead of time; students can bring in additional materials with your permission)
 - cardboard
 - cardboard tubes

- plastic or paper cups
- construction paper
- other materials you may have on hand such as foil, egg cartons, plastic tubing, wooden dowels (optional)
- ★ tape
- ★ scissors

- ★ a word wall
- ★ a reading or video clip about the invention of the glass lens (optional, as an Extension)

Handouts:

- ★ Engineering Design Process handout for Lesson 2
- ★ Microscope Diagram handout for Lesson 4

Advance Preparation

Save up cardboard tubes and boxes, egg cartons, paper or plastic cups, etc. that students might use to build their devices, or look for these in the recycling bin

Arrange to use a set of microscopes for the duration of the unit: ideally a class set, otherwise one per pair of students.

Set up a word wall.

Hi Tech option

- ★ CAD or other design software for Lesson 2
- ★ device to take digital pictures of students' finished or unfinished devices before they disassemble them at the end of class for Lesson 3

Lessons

- Lesson 1: Lenses
- Lesson 2: Design a Device (Day 1)
- Lesson 3: Design a Device (Day 2)
- Lesson 4: Introducing the Microscope
- Lesson 5: Focusing the Microscope
- Lesson 6: How Was It Made?
- Lesson 7: Mystery Substances
- Lesson 8: Magnification Power
- Lesson 9: Micrographia Project (Day 1)

Lesson 10: Micrographia Project (Day 2/3)

Vocabulary

lens
magnify/magnification
microscope
structure
function
focus
parts of a microscope (see Microscope Diagram handout from Lesson 4)
procedure

MICROSCOPE Unit Next Generation Science Standards

Disciplinary Core Ideas

- ETS 1.B Developing possible solutions
- ETS 2.A: Interdependence of Science, Engineering, and Technology

Science and Engineering Practices

- Asking questions and defining problems
- Planning and carrying out investigations
- Constructing explanations and designing solutions
- Using mathematics and computational thinking
- Obtaining, evaluating, and communicating information

Cross Cutting Concepts

- Scale, proportion, and quantity
- Structure and function