



Who Uses a Microscope?

Boys and Girls Club After School Science
NSF Center for Chemical Innovation
Chemistry at the Space Time Limit (CaSTL)
<https://www.castl.uci.edu/>

Standard(s) Addressed:

Children will use inference skills to discuss the various careers that utilize microscopes.

Lesson Objective:

Children will learn about some of the many career professionals who use microscopes. They will then focus in on CaSTL scientists and the microscopes that they use. They will use a website application to practice using a virtual electron microscope to see objects magnified greatly.

Materials Used:

- Copies of data sheets and pictures: for each career that uses a microscope (see below)
- Internet connection, access to the website:
<http://school.discoveryeducation.com/lessonplans/interact/vemwindow.html>
- Poster of words/pictures helping students understand the vocabulary used in the website game (see below)
- Question page (for jigsaw, see below)

Classroom Management:

Setting up: Test technology (website and internet connection).

During Explore: Help groups in reading and comprehension when learning about their career professional using the microscope.

Signal: Stand silently in front of the room, raising hand in the air to get the children's attention.

Funding and Credits:

This project was funded by the National Science Foundation Centers for Chemical Innovation award #1414466 and #0802913 to V. Ara Apkarian, Ph.D. at the University of California, Irvine, Department of Chemistry. This lesson was written by Therese B. Shanahan, Ed.D., University of California, Irvine, School of Education and Cal Teach.

ENGAGE: *Connect to Prior Knowledge and Experience, Create Emotionally Safe Learning Environment, Preview New Vocabulary* **Estimated time: 5 minutes**

Description of Engage: Students will connect to prior knowledge by discussing their understanding about microscopes. They will then think about and report out who they think might use a microscope in their careers.

Teacher's Role	Teacher Questions	Children's Role
<p>Teacher reviews what the students have learned in the last lessons about microscopes.</p> <p>She asks students what are some careers that they think use microscopes. Teacher scribes students' responses.</p> <p>Teacher tells students that today they will learn about some careers that use microscopes. Then, teacher tells students that they will go online to "play" with a virtual high powered (electron) microscope like one of the professionals uses.</p>	<p>Turn to a partner: What can you tell me about microscopes? What are some parts of a microscope? What does a microscope do? What can you look at under a microscope?</p> <p>What do you think are some careers where the person uses a microscope?</p>	<p>Students first tell their partners about microscopes, then report back to the class.</p> <p><i>"A microscope helps you look at things more closely."</i></p> <p><i>"It magnifies things with 2 lenses."</i></p> <p><i>"I can look at my hair under a microscope."</i></p> <p><i>"A scientist."</i></p>

EXPLORE: *Hands-On Learning, Contextualize Language, Use of Scaffolding (Graphic Organizers, Thinking Maps, Cooperative Learning), Use of Multiple Intelligences, Check for Understanding* **Estimated time: 10-15 minutes**

Description of Explore: In small groups, students will become "experts" and learn about 1 professional who uses microscopes as part of his/her career. They will read a brief explanation of the career, to later share with other groups.

Teacher's Role	Teacher Questions	Children's Role
Teacher will organize students into small groups (ideally 3-4 students). Students will become experts on a particular		

<p>profession by reading (with staff support) a page on the career person and how he/she uses a microscope. At the end of this explore, each student in the group should be able to answer the following questions:</p> <ul style="list-style-type: none"> -What is the name of your professional? -What does he/she do? -How does he/she use a microscope? <p>Teacher models how to practice the answer to these questions.</p>	<p>Teacher supports group by helping read and asking:</p> <ul style="list-style-type: none"> -What is the name of your professional? -What does he/she do? -How does he/she use a microscope? 	<p>Students read and discuss their professional with their groups. They answer questions together. Each student should practice his/her response.</p> <p><i>"This is a chemist. She studies atoms and how they act. She uses a microscope because atoms are too small to see with your eye alone."</i></p>
<p>EXPLAIN: <i>Listening, Speaking, Reading, and Writing to Communicate Conceptual Understanding</i></p> <p style="text-align: right;">Estimated time: 10-15 minutes</p> <p>Description of Explain: Students take their learning and "expertise" to other groups. They "jigsaw"-- in that one student from each group goes to a new group to share the learning with peers who did not learn about the same professional. There, they each share the answers to the questions.</p>		
Teacher's Role	Teacher Questions	Children's Role
Teacher tells students how the jigsaw activity will work. She directs students to new groups where they will report their expertise to other students.	<p>Now you will share what you learned about your professional with other students.</p> <p>You will need to be a good listener because I am going to ask you about what you heard from another student. So be prepared.</p>	Students share their learnings with peers and listen to the other careers.
<p>EVALUATE: <i>Thinking Maps, Summarize Lesson and Review Vocabulary, Variety of Assessment Tools, Games to Show Understanding</i></p> <p style="text-align: right;">Estimated time: 5 minutes</p> <p>Description of Evaluate: Evaluation will occur throughout the lesson and particularly during the jigsaw activity. Teacher should listen carefully to the conversations and presentations during the jigsaw. Students will report back to the class about a career that they heard that was different from the one they read.</p>		
Teacher's Role	Teacher Questions	Children's Role
Teacher directs students to come back to the class and		Students report to the class

report to the whole group about something they learned from a peer. For example, if a student studied a chemist, he/she should report on a geologist.	What professional did your peers tell you about? What does he/she do? How does he/she use a microscope?	about a different career. They share what the career is, what the person does, and how she/he uses a microscope.
EXTEND/ELABORATE: <i>Group Projects, Plays, Murals, Songs, Connections to Real World, Connections to Other Curricular Areas</i> Estimated time: 5 – 10 minutes Description of Extend/Elaborate: Students will connect their learning to how CaSTL scientists/chemists use microscopes. They will practice using a virtual electron microscope to examine objects as a CaSTL chemist would.		
Teacher's Role	Teacher Questions	Children's Role
<p>Teachers explain that the chemists at UCI, in the CaSTL center use high-powered electron microscopes to look at very small things. Now, students will have an opportunity to “play” with a high-powered electron microscope virtually.</p> <p>First, teacher reviews the vocabulary that will be used on the site (use poster of pictures- below). Teacher shows pictures of mold, red blood cells, etc. at their normal size.</p>	<p>What do you notice? How does that look? How would you ever know that that is really a [spider's eye]?</p>	<p>Students use the website to place each specimen under the virtual electron microscope and investigate how it looks when magnified so greatly. The website requires students to guess what the specimen might be and gives clues throughout the game. Students should read the clues together to make their predictions.</p> <p>Students discuss what they notice and how they guessed if the specimen was correct.</p>

Data Sheet: Crime Scene Investigator

Crime scene investigators are also known as *forensic science technicians* because they use scientific methods to analyze physical evidence. They work out of laboratories, but must often travel to crime scenes at different locations. Crime scene investigators determine the *who, what, how and where* of a crime by collecting and examining physical evidence such as fingerprints and bodily fluids.

They first walk through the scene to determine what evidence is available and how to collect it. They may then take photographs, draw sketches or write notes about their observations. They use tools such as tweezers, black lights and kits as part of their methods.

Once in the lab, they look at their collections under a microscope, run tests on their collections and explore relationships between the results, suspects, and crime. Crime scene investigators sometimes make dry mount slides of hair like you did! They often work with police officers.



Data Sheet: Hospital Lab Technician

Hospital lab technicians work with doctors, lab managers or medical technologists. They perform laboratory tests on different objects or specimens. They often use microscopes to run tests to help doctors in figuring out the causes of an illness, making medical decisions and determining how to treat a sickness. Hospital lab technicians might look at samples of blood, skin, tissue, or urine. They check to see if there are any bacteria, or harmful objects inside these samples.



Data Sheet: Geologist

Geologists investigate many things about the earth. They collect and study samples that come from the earth. Some things that they find are too small to look at, so they use special, high-powered microscopes to look at them more carefully. Some geologists use microscopes to study tiny samples of mud, rocks, and fossils to learn about what happened to the Earth long ago. Geologists make dry mount slides just like you did! When geologists use microscopes to look at the objects from the Earth, they can tell how old the object is, where it might be from, and how it was made.



Data Sheet: Entomologist

An entomologist studies insects. Entomologists have discovered more than 800,000 types of insects. When entomologists want to learn more about an insect, they might use a microscope. They will first view the insect in its entirety- meaning all put together. They will make a tiny slide and place the small insect on it. After that, they might look at specific parts of the insect, such as its eyes or legs. Looking at the small parts of the insect under the microscope helps the entomologist know more about how they use their parts. When looking really closely at the insect, they also can learn how the insect is the same or different from other insects.



Data Sheet: Chemist

Everything in our world is made up of chemicals. Yes, even people! A chemist studies chemicals, matter and its properties, and atoms. Atoms are the smallest particles of an element that still have the properties of that element. For instance, you can take a piece of aluminum and cut it into pieces, and it still is a shiny, lightweight metal.

Chemists study atoms and how they join together. Atoms are too small to see with the naked-eye, so chemists use microscopes to look at atoms and what they do. Chemists have many different kinds of microscopes, but most are very high-powered in order to see the tiny atoms that exist in our world.



Data Sheet: Veterinarian

A veterinarian is a doctor for animals. Sometimes animals get sick and a veterinarian must help figure out why the animal isn't feeling well. The veterinarian will sometimes take samples of the animal's blood, urine, skin, or feces. He or she might not be able to tell by using his/her naked-eye if everything is okay. So, the veterinarian will look at the sample under a microscope. The veterinarian will look for anything in the sample that might be making the animal sick. Then, they can decide on the right medicine or surgery for the animal.



Question Page for Career Group

Each person in your group should **know**:

- What is the name of your professional?
- What does he/she do?
- How does he/she use a microscope?

Question Page for Mixed/Jigsaw Group

Each person in your group should **share**:

- What is the name of your own professional?
- What does he/she do?
- How does he/she use a microscope?