



STEM LESSONS



<https://www.cdc.gov/museum/education/lessons>

The CDC Museum Public Health Academy STEM Lessons aim to educate students about public health issues through the integration of science, technology, engineering, and mathematics (STEM). STEM Lessons offer inquiry-based, hands-on activities that allow students to work independently or in teams. Each lesson's activities use one of three lesson models:

- **Engineering Design Process**
Students will solve a public health problem by designing and building a solution.
- **Scientific Method**
Students will conduct an experiment to evaluate a health-related hypothesis.
- **Public Health Approach**
Students will use epidemiologic principles to investigate and address health issues.

All three lesson types make use of the eight essential science and engineering practices described by the *Next Generation Science Standards (NGSS)*:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

To provide for flexible learning experiences, each lesson contains four different downloadable documents:

- **STEM Lesson:** Contains the full lesson, including background information, activity instructions, and space for recording data and question responses; ideal for students working independently or for teachers planning to lead a lesson
- **Instruction Sheet:** Only contains the activity instructions and is ideal for students working individually or in small groups in a classroom environment
- **Data Collection Sheet:** Provides a place to record data and answers; designed to give students a place to record data and answers and submit them to an instructor
- **Presentation Slides:** Lesson overview containing bullet points and images; built for instructors to use while introducing the topic and guiding students through activities

Engineering Design Process



▪ **Cleaning the Air**

Analyze the factors that lead to air pollution. Conduct indoor and outdoor particle pollution sampling. Design, build, and test an air filter to measure its capacity to clean indoor air and improve air quality. Share prototype and experimental results on social media.



▪ **Contact Tracing**

Learn how contact tracing is used during disease outbreaks to stop the spread of infectious diseases. Conduct a contact tracing experiment using household chemicals. Plan and conduct a contact tracing interview based on background information provided.



▪ **COVID-19 Vaccination**

Learn important facts about mRNA vaccines and how they can stop the spread of COVID-19. Build a model that demonstrates how viral spread occurs in populations with different percentages of vaccination coverage. Publish a story about how COVID-19 and vaccines have impacted them.



▪ **Exploring Polio**

Learn about the cause, symptoms, and treatments for polio. Build a model of the lungs and then design and perform a demonstration of how phrenic nerve paralysis due to polio causes breathing problems. Communicate findings with others to spread awareness about the history and impacts of polio.



▪ **Hand Hygiene**

Learn how proper hand sanitation can reduce illness and deaths worldwide. Learn when and how to sanitize hands by performing a handwashing experiment. Explore the art exhibit, *Watching Hands: Artists Respond to Keeping Well*, and create a piece of handwashing-inspired art to share.



▪ **Making Water Safe**

Learn the importance of clean water in infectious disease prevention. Research the elements of an effective infographic and create an infographic about safe water. Brainstorm designs, build a prototype, and test the effectiveness of a water filter.



▪ **Masks Against COVID-19**

Learn about the SARS-CoV-2 virus and how it spreads primarily through respiratory droplets. Test different mask materials and then design and build an effective yet comfortable mask to protect against COVID-19. Share mask designs with others.



▪ **Polio Eradication**

Learn about how different types of vaccinations are being used to globally eradicate polio and the challenges involved. Design a vaccine carrier that can keep vaccines cool for use in remote areas and test its effectiveness. Communicate the test results to others.



▪ **Preparing for Disasters**

Learn how public health workers help communities prepare for, respond to, and recover from different types of emergencies and disasters. Develop a household emergency plan and assemble the necessary supplies to build a household emergency kit. Share preparations with others.



▪ **Protecting Our Lungs**

Investigate the dangers of e-aerosols, the aerosols associated with e-cigarette smoking. Create a lung model, test the effect of inhalants using the lung model, and plan a health demonstration to educate others about the effects of e-cigarette aerosols.



▪ **Trapping Mosquitoes**

Learn the life cycle of mosquitoes and their role in spreading malaria. Collect mosquito eggs to determine the mosquito population in your area. Implement a mosquito reduction strategy and determine its effects on the mosquito population. Contribute work to the greater scientific community.

Scientific Method



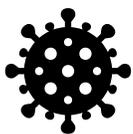
▪ **Climate Change & Health**

Learn about some of the health effects of climate change. Conduct an experiment to measure the effects of carbon dioxide concentrations on atmospheric temperature. Create and present a scientific research poster. Make an infographic about one of the health effects of climate change and share with others.



▪ **Focusing on Health Equity**

Examine the concepts of health equity and learn how social determinants of health can lead to unequal health outcomes for different groups of people. Use CDC's Environmental Justice Dashboard to compare environmental exposures, community characteristics, and health burdens of two different communities, then design a built environment evaluation checklist.



▪ **Investigating Influenza**

Learn about the structure and characteristics of the influenza virus. Design a scientific experiment to investigate a common myth about the flu. Analyze influenza surveillance data to look for patterns, identify vulnerable groups, and compare it to data from other diseases. Share findings with others.



▪ **Keeping Food Healthy**

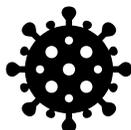
Learn the importance of keeping food safe from microorganisms such as *Salmonella* and *E. coli*. Design and conduct an experiment to determine the growth of microorganisms on produce and develop a communication strategy for spreading awareness on the importance of keeping food healthy.

Public Health Approach



▪ **Get the Lead Out**

Learn about the symptoms and sources of lead poisoning. Analyze graphs of historical blood lead levels and examine how public health interventions have affected lead exposure in different populations. Design an intervention to help those affected by lead exposure and communicate results.



▪ **Learning from Pandemic Flu**

Continue where *Investigating Influenza* left off and explore pandemic influenzas. Learn about pandemic preparedness measures and take on the role of a public health official to design effective interventions that will stop or prevent outbreaks. Share interventions with the public.



▪ **Mapping Public Health**

Learn how public health officials use different types of maps to visualize data. Create an area map of lung cancer to identify areas where interventions are necessary. Use different types of data visualizations to explore trends in flu, heart disease, and strokes and then design an intervention to help affected populations. Communicate results with others to show how information from maps improves public health.



▪ **Smallpox Eradication**

Learn about the cause and symptoms of smallpox. Explore the successes and challenges behind the global eradication of smallpox. Play a game to solve outbreaks using the public health approach to epidemic investigation and write a case report or field epidemiology handbook.



▪ **Uncovering the Opioid Epidemic**

Learn about different types of opioids and how each contributed to rising overdose deaths. Learn about interventions that have been effective in treating opioid use disorders and explore stories from people affected by it. Design and share an intervention to reduce opioid misuse and overdoses.

All STEM Lessons are available on the CDC Museum website:

<https://www.cdc.gov/museum/education/lessons>

Contact us with any questions, comments, or concerns: cpcm_phacademy@cdc.gov

IN ASSOCIATION WITH THE SMITHSONIAN INSTITUTION

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