



HASPI Medical Earth Science Core Labs Summary

As funding is available, many of the supplies needed to implement the following labs will be available for purchase through HASPI. Visit www.HASPI.org for updates, additional resources, and purchasing information.

Lab 01 (MS-ESS1-1, MS-ESS1-2, MS-ESS1-3) – The Solar System

a. Earth's Seasons

The four seasons are caused by the Earth's changing relationship to the sun. As the Earth orbits the sun, it also rotates on its axis at a 23.5 degree angle. In this activity students will model how the tilt in the Earth's axis affects the amount of sunlight received by different regions of the planet, causing the seasons.

b. Mass vs. Weight

In this activity students will differentiate between mass and weight. They will be given the forces of gravity for several different objects in the solar system to calculate what their own mass and weight would be on each object, using the equation $W=mg$.

c. Weightlessness

In this activity students will learn why astronauts in space experience the feeling of weightlessness when they are in orbit around the Earth and conduct a demonstration to recreate the feeling of weightlessness. Students will also read the National Space Biomedical Research Institute's article *The Body in Space* to learn about the effects of a microgravity environment on the human body. Students will use information in the articles to create visual posters that can be shared with the class.

The lab introduction will discuss how big the universe is and how it was created came about through the Big Bang theory. It will explain how galaxies are collections of billions of stars and how gravity created all the objects in our solar system, including the sun, planets, moons, asteroids and comets. The lab introduction will also touch on the importance of space exploration and how studying the universe leads to a greater understanding of our world and everything in it.

Lab 02 (MS-ESS1-4, MS-ESS2-2) – Geological Time, the Fossil Record, & Health

a. Stratigraphic Layers & the Fossil Record

In certain areas, such as canyons, it is easy to see how rock has been layered over time. It is normally assumed that the bottom layers of rock are the oldest, and the uppermost layers are the youngest, and therefore fossils found in each layer are the same age as the layer they are found within. How can we identify rock layers and fossils in areas without visible layers?

Archeologists can use a machine to drill into the earth, similar to those that drill for oil, and pull out samples called drill cores from miles below the surface. To get a good idea of the fossils and rock strata in an area it is often necessary to pull out multiple drill cores and compare. In this activity students will compare two drill cores from an area to determine what organisms were fossilized in each rock strata layer.

b. Modeling the Geological Time Scale

The geological time scale marks major events that have happened throughout the history of the Earth. The Earth has changed significantly throughout time and it is estimated that 99.9% of all organisms that have one time lived on Earth are now extinct. By examining the fossil record scientists can develop a range of time when a species, or group of species, lived and became extinct. In this activity students will create a model of the geological time scale to get a better idea of when major events have occurred during Earth's history.

c. Human Health in the Fossil Record

The fossil record and geological time scale can provide us with important information about our current Earth. One area of information that is emerging is the trend to learn more about the history of diseases through the fossil record. Diseases such as cancer and even the status of the oral bacteria found in Neanderthals can provide insight into our current knowledge of human health. In this activity students will research and read about some recent archeological finds related to human health.

Lab 03 (MS-ESS2-1, MS-ESS2-2, MS-ESS2-3) – Plate Tectonics & Earthquake Safety

a. Tectonic Plate Movement

The upper mantle and crust is made up of the lithosphere, which is a series of plates separated by boundaries. These boundaries can be moving towards, away, or sideways against one another propelled by the liquid molten rock beneath them. The movement of tectonic plates can impact the Earth's surface above them by creating mountains, trenches, or rifts. Their movement can also cause events such as volcanoes and earthquakes. In this activity, you will learn more about tectonic plates and how their movement impacts the surface of the Earth.

b. Earthquake Safe Homes

Most earthquake-related injuries and deaths are associated with building collapse or falling objects. As a result, it is important to consider a building's ability to withstand an earthquake when designing and engineering structures in areas where earthquakes occur. In this activity, students will design, build, and test a 3-story building to withstand the rolling movement of a simulated earthquake.

c. Earthquake Safety

Being prepared in case of an earthquake or other disaster is the best defense. Individuals who experience an earthquake are at risk of injury related to falling debris, building collapse, fires, gas inhalation, suffocation, electrocution, dehydration, and death. Preparedness, awareness, and elimination of hazards can reduce the health risks associated with earthquakes and other disasters. Students complete the "*Earthquake Safety Checklist*" with a parent or guardian. Once the checklist has been completed and graded, students can store the checklist in a safe place to refer to in case of an earthquake emergency.

Lab 04 (MS-ESS2-1, MS-ESS2-2, MS-ESS2-4) – The Water Cycle

a. Modeling the Water Cycle

Do you realize that without the water cycle our health would suffer...in fact, forget about our health! Life could survive on planet Earth without the water cycle. The recycling of water on the Earth allows for its continual use. The water that you drink, swim in, and observe today is the same exact water that the dinosaurs used millions of years ago. It may sound funny, but the water cycle could not occur without heat, primarily from sunlight. In this activity, students will have the opportunity to model and observe the driving force behind the water cycle – heat from the sun. They will also have the opportunity to learn about acid rain and how it can impact human health.

b. Water Quality & Human Health

Water quality is a serious issue worldwide. Nearly 1 billion people in the world do not have access to safe drinking water, and poor water quality accounts for more than 2 million deaths worldwide, most of which are children under the age of five. In this activity, students will have the opportunity to test the quality of water from a fresh water source of your choice. Following the water quality test, students will have the opportunity to research and investigate the impact of water quality on our health.

Lab 05 (MS-ESS2-5) – Weather & Human Health

a. Monitoring the Weather

The study of weather and changes that occur in the atmosphere is called meteorology. Meteorologists are able to predict daily, and even weekly, weather conditions based on their long term observations of weather and climate. By predicting weather conditions, meteorologists are able to predict possible weather-related health hazards that may exist. This allows individuals who are at risk to prepare and prevent health issues that could arise as a result of weather. In this activity, students will build equipment to measure and monitor the weather in your area. Students will also have the opportunity to determine whether there are any health risks associated with weather conditions.

b. Weather & Human Health

Monitoring weather is important to our society in many ways, one of which is to predict and prevent health hazards. Minor weather-related conditions can lead to serious health problems if they are not treated or corrected. For example, short-term cold exposure is not harmful, but long-term exposure could lead to hyperthermia, frostbite, and even death. In this activity, students will have the opportunity to research and put together an informational brochure or newsletter to let others know about a specific weather-related health risk.

Lab 06 (MS-ESS2-6) – Climate & Health

a. Unequal Heating & Regional Climates

Unequal heating of substances and the rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. In this activity, students will have the opportunity to develop an experiment to test unequal heating of different natural substances that occurs due to different heat source angles or distances. The experiment models how the angles and distances of sunlight reaching the Earth can result in unequal heating of the substances sunlight contacts.

b. Climate & Health

Regional climates and climate change can have a profound impact on human health. You may have heard before that arthritis is worsened by cold weather, and that is why so many retired people move to regions with warmer climates such as Arizona or Florida. In this Internet activity students will have the opportunity to learn about diseases and disorders that are influenced by climate, and the influence of climate change on these conditions.

c. The 11th Hour

Man-made changes in our environment can have adverse impacts not only on our health, but the health of all living things on Earth. The 11th Hour is a documentary about issues such as habitat destruction, deforestation, and climate change can have on our health and our very future. The documentary also provides possible solutions. Students will watch the documentary and answer the following questions.

Lab 07 (MS-ESS3-2) – Natural Disasters

a. Hurricane Katrina Timeline

In this activity students will receive a copy of a National Geographic News article that outlines some of the major events of Hurricane Katrina as it navigated through the Gulf Coast. The copy of the article the students will receive will be re-organized into strips of single events and mixed up. Students will be tasked with cutting out each event into strips and arranging them back into the correct chronological order. Information provided for each event listed in the article includes, among other things, wind speed and location of Hurricane Katrina's progression, damage caused, and human actions in response to the storm. Students will also be asked to graph the wind speeds of Hurricane Katrina over its 11 day lifespan.

b. Emergency Preparedness Plan

In this activity students will complete an Emergency Preparedness Plan with their families. They will designate a time to identify possible disaster threats in the area they live, discuss experiences with previous emergency situations, create an emergency contact list, formulate a home evacuation plan, and assemble an emergency supply kit.

Lab 08 (MS-ESS3-1, MS-ESS3-3) – The Human Impact of Plastic

a. Website Review

Students will be asked to access a few different websites that highlight both positive and negative aspects of plastic production. Students will fill out a graphic organizer to summarize the main claims as they read through each website. They will also be given the opportunity to reflect on these points of view and share their own personal thoughts about plastics.

b. Addicted to Plastic

Students will watch a video titled "Addicted to Plastic". This documentary produced in 2008 focuses on the worldwide production and environmental effects of plastic. The host takes a 2-year trip around the world to portray the life cycle of plastic. Different research labs, manufacturing and recycling facilities, as well as the North Pacific Central Gyre, also known as the Eastern Garbage Patch, are among the places highlighted in the documentary. While watching the video students will answer related questions and, once again, be given the opportunity to reflect on the overall message of the video and share their own personal thoughts.

c. Plastic Discussion

Students will conduct a 30-45 minute student led discussion about plastics to gain a deeper understanding about its effects on everyday life. The focus of this conversation will be on the following questions: 1) Is plastic more harmful than beneficial? 2) Would the world be a better place without plastic? 3) What should be done about the problems that stem from plastic production? Students will use evidence from the websites they read and video they watched in Parts I & II to support the claims they share during the discussion.

d. Plastic Recycling Project

Students are asked to collect old plastic products (plastic bags, water/soft drink bottles, plastic utensils, old CDs, etc.) that would normally be thrown away or placed in the recycling bin and create something new that could be used for any given everyday activity. Students will be graded by the functionality of the product produced, aesthetics, reproducibility, use of recycled items, and creativity.

Lab 09 (MS-ESS3-4) – Natural Resources

a. Distribution of Natural Resources

Materials important to modern technological societies are not uniformly distributed across the planet. Historically, humans have populated regions that are climatically, hydrologically, and geologically advantageous for resource availability. In this activity students will access and analyze data from a set of interactive world maps online. Students will use the data to find correlations, if any between the distribution and use of various natural resources and the distribution and overall wellbeing of the human population. All charts and maps on the website students will use are based on data published in The World Factbook, which is a reference resource produced and updated by the US Central Intelligence Agency (CIA).

b. Hydropower

In this activity students will explore one of the world's main renewable energy sources, hydropower. Students will construct a basic water wheel to model how the kinetic energy of moving water can be harnessed and transformed into other forms of energy, in this case, mechanical energy. Students will run tests to see how the amount of water and how far the water drops affects the work output of the water wheel. Before the lab, students will read about how the principles of the water wheel led to the development of hydroelectric power plants.

Lab 10 (MS-ESS3-5) – Resource Availability

a. Greenhouse Gases

In this activity students will learn about the five main greenhouse gases and how the greenhouse effect naturally warms the Earth's atmosphere. They will create a model of the greenhouse effect and compare the thermal properties of air and a chlorofluorocarbon gas alternative. Chlorofluorocarbons (CFCs) are one of the main greenhouse gases. Students will use a CFC alternative called difluoroethane, which is commonly used in compressed air canisters. The difluoroethane will behave similarly to CFCs in this activity, but is considered much safer for the environment because it has lower global warming potential and breaks down much quicker in the atmosphere.

b. Ocean Acidification

In this activity students will examine how increasing amount of carbon dioxide (CO₂) affects ocean water quality. In Part I of this activity, students will model what happens to the pH of ocean water as CO₂ is absorbed from the air. In Part II of this activity, students will examine what happens to shelled organisms when they are exposed to more acidic environments.