

Scientific Inquiry Project Ideas

Earth and Space Science

Anybody Thirsty?

Middle school students compare bottled, filtered, and tap water by testing the water's chlorine, lead, pH, hardness, and nitrates. They use their data to draw conclusions about the health and cost benefits of using each type of water. For an extension of the experiment, some students investigate the environmental impact of bottled water.

Don't Trash the Earth

Due to the increasing garbage people produce, the local community landfill is running out of space. Students are presented with a scenario in which they are hired to evaluate their school and community recycling and waste management practices. After researching and analyzing past and current methods, teams develop a new recycling plan, complete with cost analysis and supporting data. Teams propose recommendations to a committee, supported by brochures that inform and persuade the public to take action.

<http://educate.intel.com/en/ProjectDesign/UnitPlanIndex/DontTrashEarth>

Cleaning Up

Students learn about ecosystems and the interdependence of organisms in an ecosystem. They try to understand how oil spills affect the environment, identify different methods for cleaning up oil spills, and determine the best method.

El Niño

After hearing about El Niño in the news, middle school students collect online data on rainfall in a selected geographic location for a decade between 1950 and the present. They use online resources to figure the Northern Oscillation Index (NOI) during that time period to learn whether El Niño was present. After investigating ocean temperatures to determine the effect of El Niño on sea surface temperatures, the students create an animation to show the relationships among barometric pressure, NOI, rainfall, and ocean surface temperatures.

The Global Sun Temperature Project

Schools from around the world determine how their geographic location affects their average daily temperatures and hours of sunlight. Specifically, students measure the

temperature and record the number of minutes of sunlight per day over a common week. They submit their data on the project Web site, and compare and contrast the results with classes from around the world. Then, students analyze data to determine how proximity to the equator affects average daily temperatures and hours of sunlight. www.ciese.org/curriculum/tempproj*

The Global Water Sampling Project

Students from around the globe collaborate to test fresh water. Students submit their data online and compare the water quality of their local river, stream, lake, or pond with other fresh water sources around the world. The focus of the project is to assess the quality of water based on physical characteristics and chemical substances, and look for relationships and trends among the data collected by all project participants. www.k12science.org/curriculum/waterproj*

Plants and Pollution

High school students investigate the effects of air pollutants on plant growth. Using videoconferencing, they interview a university professor, and collect preliminary test data and expert subject matter knowledge before beginning their own investigations.

Tracking Pollution: A Hazardous Whodunit

Residents of the fictional town of Riverville complain about the taste of their drinking water that they all get from private wells. The mayor hires an environmental consultant to test water from several wells, and the expert concludes that the water is being contaminated with some kind of fuel. Several local companies are targeted as possible sources of the pollution. In small groups, students use given data to estimate ground water flow by creating a topographic map. With this information, they determine the source of the pollution and ask more questions about the future impact of the contamination. They also conduct research to suggest strategies for addressing the problem and preventing its reoccurrence.

http://water.epa.gov/learn/kids/drinkingwater/upload/2005_03_10_kids_activity_grades_9-12_trackingpollution.pdf*

What's the Weather?

Junior meteorologists learn about fronts, pressures, and weather patterns. In small groups, they propose questions related to weather in their area. One group asks, *How cold will this winter be?* Another group wants to know, *How does living near the ocean affect our weather?* Once questions are approved, students explore their questions by learning to read weather maps, analyze trends, and make predictions. They share their predictions with the class.

Life Science

Achoo!

Flu season has arrived, and in this science class, students are learning about bacteria and viruses. The teacher asks students what they already know and what questions they have. Once a long list of student-generated questions is produced, the class discusses the questions and narrows the list to the testable questions that can be investigated through experiments or observations.

Biodynamic Farming

Students in high school study and work with appropriate and organic technologies that support the sustainable food resources necessary to combat current global food shortages. Students research biodynamic farming systems, conduct investigations, and engage in a series of design challenges. Ultimately, students around the world collaborate to design an aquaponics system that sustains plant and animal life.

Classify Animals

Fifth-grade students devise their own animal classification system to prompt them to think about which characteristics are essential, leading to discussion of the unit question, *How can we classify animals for study?* Working in pairs, students use the *Visual Ranking Tool* to put a list of animals in order, ranking them on their human-like qualities and justifying their thinking using the comment feature. This critical thinking process helps students discover what they already know, and need to know, about scientific classification systems. After learning about the classification system developed by Linnaeus, students revisit the Visual Ranking Tool to assess how well they have grasped the concept of scientific classification. They apply this understanding to further inquiry studies based on the unit question, *How are animals like us?*

http://educate.intel.com/en/ThinkingTools/VisualRanking/ProjectExamples/ProjectIdeas/VR_ProjectIdeas4.htm

Ecology Explorers

In this unit, students study problems that arise as wildlife and human habitats increasingly overlap in our shrinking world. Taking the role of wildlife conservationists, students become experts on an endangered animal or plant that is at risk in their region. They study the organism's needs and understand interdependencies in the ecosystem in which it lives. Using the *Seeing Reason Tool*, students model their developing understanding of the intricacies of a balanced ecosystem, and then map the human factors that influence that balance. They apply

this understanding to further inquiry studies based on the unit question, *What influences the biological success of a species?*

<http://educate.intel.com/en/ThinkingTools/SeeingReason/ProjectExamples/UnitPlans/EcologyExplorers>

Invasion of the Lionfish

News reports of the growing population of the invasive lionfish have raised numerous concerns in a town on the north Atlantic coast. After conducting research on invasive species in general, students investigate the history of the lionfish, how it was introduced into their area, and what the impact has been on the area. They use available data to predict future consequences, and identify other possible dangerous invasive plants and animals. They combine what they learned into a presentation that tells the story of the town's interaction with the lionfish from ecological, economic, and public health perspectives.

Leftovers

Primary students wonder what would happen to their lunch if they did not eat it for a while. In groups, they set up experiments to see what happens to the different parts of their lunches—sandwich, chips, cookies, apple, and milk—if they are left uneaten in different environments, such as near the heater, in the refrigerator, in the dark or light, and so on. They conduct guided research to determine the reasons for the changes in appearance, smell, touch, and so forth.

Something Fishy

Middle school students determine the type of fish that should be used to stock a pond on school property. They investigate the pond by collecting data, taking samples, and researching the types of fish that are native to ponds in their area. Small groups decide on a fish and persuade the principal to stock the pond with their selected fish.

Where Are the Elk in Yellowstone?

Students investigate the phenomenon that elk seem to live much longer in certain areas of Yellowstone National Park than in other areas. They conduct research on elk habitats, predators, and prey in different sections of the park, as well as weather and geological features, including geothermal activity, to determine the reasons for the difference in life span. Students synthesize their findings and conclusions in a narrative account of an elk herd's life in the park (Graves, 2009).

Physical Science

Float That Boat

Students investigate density, displacement, and buoyancy to create a boat that is structurally sound and fun. They create a prototype, conduct trials, and make revisions. They also collect data on what features potential users would like to see in the boats and try to incorporate those features in their design. To conclude the project, students create a presentation directed at a toy company that shows why the boat will be durable and popular based on their data.

<http://educate.intel.com/en/ProjectDesign/UnitPlanIndex/FloatThatBoat>

Go-Go Gadget

Students study the concepts of force, motion, and work as they analyze simple machines. They learn about the simple machines in complex machines, and track the transfer of force from input (effort) to output (work). Students collect, organize, represent, and analyze data from a human automation investigation using spreadsheet software. In a design challenge, students become inventors and identify work they want to perform. Then, they invent labor-saving machines to do the jobs.

<http://educate.intel.com/en/ProjectDesign/UnitPlanIndex/InventAMachine>

In the Wind

A public utility installs a wind turbine near a middle school and provides ongoing data on a range of factors, including wind speed and direction, energy produced, temperature, and so forth. Students analyze the data, communicate their findings, and use what they are learning to address energy consumption in the community.

The International Boiling Point Project

The International Boiling Point Project has people all over the world boiling water, from climbers on Mount Everest to school children in La Paz, Bolivia. The purpose of the project is to discover which factor in the experiment (room temperature, elevation, volume of water, or heating device) has the greatest influence on boiling point. Participants boil water, record data, and submit the results on the Web site to be included in the collaborative database. Students can analyze the data to reach an answer to the question, *What causes a pot of water to boil?*

www.ciese.org/curriculum/boilproj*

Keeping Warm

Young children often have the misconception that heat is a property of certain objects, such as sweaters and blankets. To address this misconception, students are asked to design an experiment to identify the heat in different objects. They place a collection of items, such as mittens, scarves, metal items, and books, in a corner of the classroom and measure their temperatures over different time periods. This data introduces an inquiry project on heat transfer.

On the Move

Students design an experiment to measure the speed of an object in motion over different surfaces. They look for patterns in the data they have collected, and draw conclusions about friction and motion. They use the results to create an animated simulation that demonstrates the effect of friction on motion.

Sound Off

High school students investigate the properties of sound in a popular song. They use an online virtual laboratory to turn their computer monitor into an oscilloscope, manipulating the appearance of the graphed sound waves. They collect data on how the manipulations change the quality of the sound.

Pendulums

Students in a third grade classroom investigate the mechanics of pendulums with a range of questions related to mass and weight. They use an Internet simulation to test the behavior of their pendulum on the moon and other planets. They compare their results with data collected in the classroom to determine the effect of gravitational force on a pendulum's swing.

Web Sites with Inquiry Project Ideas

Doing Science: The Process of Scientific Inquiry

<http://science.education.nih.gov/supplements/nih6/inquiry/default.htm>*

Information about inquiry with ideas for classroom inquiry projects.

The Inquiry Project

<http://inquiryproject.terc.edu>*

A set of activities designed to develop inquiry skills in students in grades 3– 5.

pHet Simulations

<http://phet.colorado.edu/en/for-teachers/browse-activities>*

Interactive simulations of physical phenomena with inquiry-based activities.

Whelmers

<http://mcirel.org/whelmers>*

Standards-based inquiry science projects adaptable for different grade levels.