



Fuel and Feathers

Grade: 2

Subject Areas:
Life Science, Physical Science, Art,

Skills: sorting, modeling, motor skills, observing

Duration: 1 hour

Connections:
Paleontology, geology, math, natural resources

Vocabulary

energy

electricity

fossil fuels

coal

oil

propane

diesel

pollution

Objective:

Students will be introduced to fossil fuels and their uses. They will make connections between oil spills and wildlife by investigating the affects oil has on feathers.

Materials

- pictures or specimens of fossils
- pictures of ancient coal swamps, oil rigs, etc.
- pictures of plants that produce oil like coconuts, safflower and corn
- cooking oil
- water (food coloring is optional)
- petri dishes
- measuring cups or beakers
- jars and screw cap lids
- eye droppers or plastic pipets
- paper towels for clean up
- book—there are several
- pictures of oil spills especially birds that are negatively affected by oil spills
- aluminum pie plates or other shallow dishes
- bird feathers (3-4 feathers per student)
- paper towels
- vegetable oil in sturdy spray bottles
- mild detergents
- science journals or paper
- newspaper to cover the tables (optional)
- rain coat (optional)

Standards

Strands: Excellence in Environmental Education Guidelines

Strand 1 —Questioning and Analysis Skills: A) Questioning: Learners are able to develop questions that help them learn about the environment and do simple investigations.

Strand 2.1 — The Earth as a Physical System: C) Energy: While they may have little understanding of formal concepts associated with energy, learners are familiar with some basic behavior of some different forms of energy.

Strand 2.4 — Environment and Society: A) Human/environment interactions: Learners understand that people depend on, change, and are affected by the environment.

California State Educational Standards:

Earth Science (ES) 3d: Students know that fossils provide evidence about the plants and animals that lived long ago and that scientists learn about the past history of Earth by studying fossils

ES 3e: Students know rock, water, plants, and soil provide many resources, including food, fuel, and building materials, that humans use.

Investigation and Experimentation (I and E) 4a: Students will make predictions based on observed patterns and not random guessing.

I and E 4f: Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.

Background

Finding Power

The universe is made of two things: matter and energy. Matter has form and takes up space. All matter, therefore, even particles smaller than an atom, have mass. **Energy** on the other hand, has no mass and takes up no space. It is the ability to do work. In the last century, humans have learned to harness energy through a variety of means to perform a host of activities well beyond what our ancestors may have believed possible.

In the old days, people used horses and other animals for transportation. Oxen would plow fields, kerosene would light their homes and fire would keep them warm. Today, people mostly depend on electricity, natural gas and gasoline for these things. Streets and buildings are lit by electric lights. Homes and offices run TV sets, computers, washing machines and refrigerators on electricity. **Electricity** is the flow of power in the form of electrons. Tractors, trucks and cars run on diesel or gasoline.

Energy comes in many forms: heat (thermal), light (radiant), motion, electrical, chemical, nuclear and gravitational. This lesson will focus mostly on fossil fuels which are a form of **chemical energy**. Most electricity comes from power plants that either use combustion of fuels or nuclear power.

80% of the energy that powers America comes from fossil fuels. Fossil fuels are a type of non-renewable energy source because they took millions of years to form and cannot be replaced. They include oil, coal and natural gas. The burning

of fossil fuels allowed the industrial revolution to take place. **Combustion** (burning things) releases water, carbon dioxide and other pollutants which are contributing to an increased warming of our planet.

Fossil fuels aren't really made from fossils, but are a result of millions of years of accumulated decomposition of ancient plant and animal remains. During the time of dinosaurs (Mesozoic Era) many places on Earth were covered by swamps. These swamps were eventually buried over millions of years. During this time, heat and pressure compressed the plant material into a type of sedimentary rock called **coal** or lignite. In the U.S., most coal is found in Montana, Wyoming and states in the northern Appalachian Mountains. Thus, these places were once covered by ancient swamps.

Oil formation goes back even further than the age of the dinosaurs. In the primitive ocean, tiny organisms similar to ones that live today, slowly died by natural processes over millions of years. These microscopic plants and animals (diatoms) settled on the ocean floor and were slowly buried by sand and silt. Again heat and pressure slowly transformed these ancient organisms into crude oil. Crude oil is a stinky liquid, yellowish to black in color, and is often found in reservoirs below the earth's surface. We refine it into petroleum. The word petroleum means "rock oil" or "oil from the earth".

Just as paper mills turn lumber into paper, refineries turn crude oil into petroleum and petroleum products. It takes billions of dollars to build and maintain an oil refinery. One gallon

of crude oil can make 19 gallons of gasoline, 10 gallons of diesel and other petroleum products like propane and rubber. **Propane** is a gas commonly used to heat buildings and cook food. Other things that come from petroleum are crayons, chewing gum, plastic, and DVDs.

Dangers of Oil

Oil is slippery and easy to spill. When oil is spilled, it often ends up in our waterways. Oil spills cause some of the most damaging pollution. **Pollution** is something that harms the environment. Oil is often drilled for offshore which creates risk of it spilling into the ocean. Oil rigs sit on tall, flat platforms in the ocean and send long pipes deep into the earth to drill for oil stored in reservoirs. On April 20, 2010, the largest oil spill in America occurred when an offshore oil rig exploded. Over 5 million barrels (258.2 million gallons) of oil were spilled into the gulf of Mexico harming fragile ecosystems like bayous, wetlands, and coastal waters. The effects of this massive oil spill still threatens many endangered animals including seabirds, sea turtles and whales. Other large oil spills have happened off the coasts of Brazil, Australia, Alaska and the Middle East.

Humboldt Bay, San Francisco Bay, and other areas in northern California, have had major oil spills too. In 1997, a fuel tank from a logging ship was punctured and over 5,000 gallons of diesel oil was dumped into Humboldt Bay. The fragile bay ecosystem was threatened including nearby wildlife refuges and oyster farms. Many animals living on the

bottom of the ocean like oysters filter water for food. These types of animals can't swim away from harm. When oil is present, they may absorb toxins or their gills can get clogged and they die.

Thousands of little oil spills go unnoticed every day. Sometimes when people change the motor oil in their cars they are careless and spill it. Motor oil can be recycled and should never be put down a drain. Other times, cars have minor oil leaks. Evidence of these leaks are often seen as rainbow-like stains visible in wet parking lots and on roads. In remote locations near the King Range National Conservation Area, diesel spills are relatively common. Here, **diesel**, a type of gas used to power generators, can leak into the environment. Like other oil compounds, diesel often finds its way into our local streams and rivers which pollutes the water, and can kill fish and other wildlife.

Most people know that oil and water don't mix. This can be a good thing and a bad thing for wildlife. Shorebirds are vulnerable to oils spills because they live along the coastline and spend a large portion of their lives fishing in the ocean. Feathers help protect birds. To insulate themselves, birds preen their feathers, lining them up to make an air tight seal. Using a special oil gland at the base of their tail, they coat their feathers with oil to make them water proof. Just a little bit of crude oil stuck to their feathers, however, causes some serious problems. Oily feathers make it impossible for birds to correctly preen, which breaks the air tight seal. Because this seal is vital, birds will try and clean their feathers anyway. While they do so, they ingest some of the oil which harms their internal organs. Oily feathers on a bird can cause a lot of stress too. Birds can become easy prey, get too cold, drown, or even starve. This can lead to big problems for birds, including our local populations.

Many shorebirds migrate through Humboldt County in the fall and winter. Many birds need to migrate in order to find enough food to eat for both themselves and their young. Humboldt Bay and surrounding estuaries are rich sources of food for these birds. In the cracks and crevices of mud and sand live tiny little animals. These are what most shorebirds eat. They migrate along the Pacific flyway which extends from San Francisco Bay to Alaska.

Convenient energy has become a necessity of life for people, but it comes with a cost. In the past oil and coal have been cheap to use and easy to burn. These cheap sources of energy pollute our water and air. They can cause toxic spills are damaging to human health and wildlife. Today, many people are protecting our environment by finding clean renewable energy alternatives to dirty fossil fuels

Activity 1: Oil and Water Don't Mix

Preparation

Prepare table tops by placing absorbable newspaper or butcher paper down on them to avoid an oily mess.

Procedure

1. Explain to the students that you are going to focus on types of energy that most of the world uses. To introduce non-renewable energy sources, read a book about fossil fuels. Gather the students around and have them listen and learn.

2. After reading the book, write “energy” on the board. Have the students read and say the word. Below this title, list different types of energy sources. Ask the students to help you. Point out that there are two main types of energy: non-renewable and renewable. The focus of this discussion will be on non-renewable forms.

3. Define the term non-renewable and pollution. Circle the non-renewable energy sources from the classroom generated list with the students help. Ask to see if they know what problems are associated with fossil fuels.

4. During the questioning period refer to what they learned in the book. Reinforce the idea that oil is a type of fossil fuel and fossil fuels cannot be replaced. Be sure to not misinform the students about the formation of oil and coal. Oil and coal are not your typical fossils. They are called fossil fuels because they take millions of years to form from once living organisms. This would be a good time to show the students some fossils or even pictures of the coal swamps dating back 300 millions years.

Materials

- pictures or specimens of fossils
- pictures of ancient coal swamps, oil rigs, etc.
- pictures of plants that produce oil like coconuts, safflower and corn
- cooking oil
- water (food coloring is optional)
- petri dishes
- measuring cups or beakers
- jars and screw cap lids
- eye droppers or plastic pipets
- paper towels for clean up
- book—there are several—you will have to pick

- *What do we use oil for?*
- *What are some different types of oil? What types of oil come from plants?*
- *Where does crude oil come from? How can we describe oil?*
- *Does oil and water mix?*
- *What happens if oil is spilled in water?*
- *What do we call stuff that harms our environment?*
- *Can oil cause pollution?*
- *Can you come up with an example of this?*
- *Why won't oil and water mix? (oil is less dense than oil. Oil is also non-polar but this is an advanced concept)*
- *Can you think of an oil that you use at home?*
- *How come we use oil for energy? (it burns easily and gets very hot)*
- *What can we use to clean up an oily mess?*
- *How can we get oil out of feathers?*

5. Next, explain that they are going to conduct an experiment using oil and water. The question is: Can I get oil and water to mix? Have the students work at group tables. Each table should have a large container of water, a small container of oil, eye droppers, plastic petri dishes, sealable jars and paper towels.

6. First have the students pour a small amount of water into one petri dish and a small amount of oil into the other petri dish. Have them touch both and describe what they observe. Next, have them place a few drops of oil on the water and see what happens (the oil should float on top). Then, have them place a few drops of water on the oil and observe what happens (the water should be repelled by the oil). In the jar, have them try and answer the question: Can I get oil and water to mix. In a jar, have them add 1 T of oil to 1/2 cup of water. Make sure the cap is screwed on tightly and then have them shake it several times. After shaking the jar have them count to see how long it takes for the oil and water to separate.

Activity 2: Oily Feathers

Preparation

Prepare student stations by laying out newspaper for them to work on. This activity may make an oily mess. Each station should have a pile of feathers, several pie pans full of water, and several paper towels. Some of the pie pans need to remain clean for rinsing purposes. Have the oil in small bottles standing by along with detergent.

Procedure

1. The purpose of this activity is to show how oil spills can harm birds. Begin the lesson by putting on a rain coat. The rain coat is an example of water proofing. Introduce students to the topic of birds and explain how feathers are a form of water proofing for birds. Next, explain that a lot of oil is drilled offshore. When oil is drilled offshore oil gets into the ocean which can be dangerous for wildlife like birds. Show them pictures of oil spills and the pollution it can cause. Show a few disturbing pictures of oiled birds and people cleaning them.
2. This activity is a student lead investigation. Science journals work well for recording observations. Tell the students that they are going to find out what oil does to feathers. Before they get a feather wet, have them take a dry feather and feel it on the back of their hand. Tell them to remember what a normal feather feels like. Next, have them place the feather in plain water. Pat the feather dry and then have them rub it on the back of their hand again. This is what a wet feather feels like.

Materials

- pictures of oil spills especially birds that are negatively affected by oil spills
- aluminum pie plates or other shallow dishes (for oil-water mix and plain water)
- bird feathers (3-4 feathers per student)
- paper towels
- vegetable oil
- mild detergents (Dawn detergent works the best)
- science journals or paper
- rain coat (optional)
- newspaper to cover the tables (optional)

Next, have them get the feather oily by adding a few drops of oil to it. Place the oiled feather in water and pat it dry again. Like before, have them drag it across the back of their hand and take note of any differences. They should make a comparison and record their observations in their journal or on a piece of paper.

3. Next, have them investigate whether they can remove oil from the feathers. To make an oil spill, place 2-3 T of cooking oil into in a pie pan full of water. This pan can be shared by a group of students. Have them dip a dry feather into the oil-water mixture. Next, have them clean the feather with detergent by working it into the feather with their hands. Have them rinse the feather in clean water periodically. They may have to rinse it several times. Once they have their feather as clean as they can get it, have them pat it dry. Again, they should feel it on the back of their hand and compare it with the original feather. They should record their observation.

4. After the investigation, gather the students together and have them share their observations. Remind them that many birds have been saved by people helping them just like they did today, except they use real birds and not just feathers. Cleaning birds is very stressful to them, but many have recovered from the work of volunteers. You may want to ask them how else oil can get into water. (homes, diesel spills, leaky cars, etc.) Next, discuss the problems of oil spills. Be sure to include the connection between oil spills on land, and how they enter the local rivers through storm drains or runoff. Inform them of the proper way to dispose of oil. Brainstorm together what solutions there are to oil spills.

Extensions

- Perform experiments around different forms of energy including sound and motion.
- Investigate the life of birds, including reproduction, stages of life, and the habitats in which they live.
- Look at assorted fossils. Have the students make up a story about a particular fossil.
- Take a field trip to Scotia Bluffs. This is a popular place to find local fossils.
- Make a classroom bulletin board about water pollution. It can include newspaper clippings, pictures and solutions.
- Match pictures of young animals to their adult parents.

References

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- Coal Basics, and Oil sections, http://www.eia.doe.gov/kids/energy.cfm?page=coal_home-basics, 2011
- Doyle, Jim Oil Spill Closes Humboldt Bay, Endangers Wildlife, http://articles.sfgate.com/1997-11-06/news/17762260_1_major-spill-humboldt-bay-spill-area/2, 1997
- Kure/Humboldt Bay Oil Spill report, http://www.humboldt.edu/mwcc/KureDARP_Final.pdf, July 2008
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- Oil Spill activity, <http://www.nwf.org/Global-Warming/School-Solutions/Eco-Schools,2011>
- Oil Spill Closes Humboldt Bay, Endangers Wildlife/Leak Biggest Ever For Area, <http://articles.sfgate.com/1997>
- Shankles, Kristina, Oil Pollution, http://www.eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Environmental_Education/ENV0206.html, 2011
- Water Planet, <http://www.wqsb.qc.ca/mydestiny/Lesson%20Plans/Lesson%20Plans%204/Unit%20-The%20Water%20Planet.pdf>

FOSS Connection

- Grades 1-2: Earth Science
Air and Weather
Grades 1-2: Physical Science
Solids and Liquids