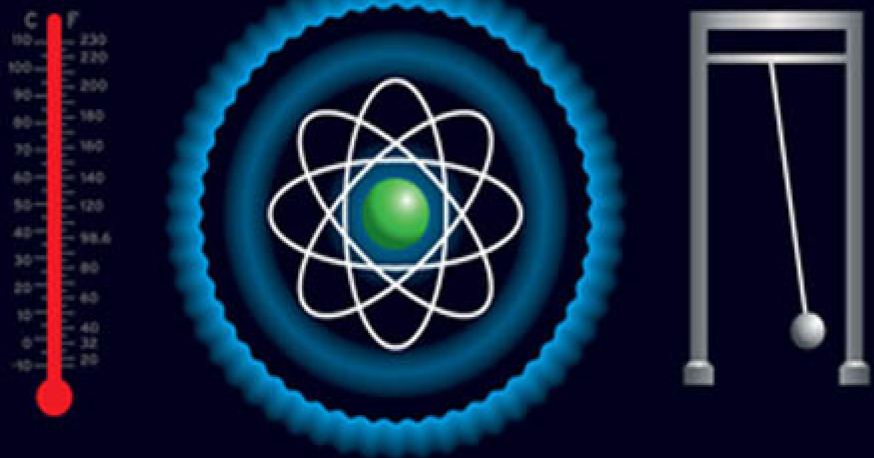
46 SCIENCE FAIR PROJECTS FOR THE EVIL GENIUS



TAB ELECTRONICS

- Each project contains a suggested entry category, a hypothesis, materials list, conclusion, and list of suggestions for going further

BOB BONNET AND DAN KEEN

46 Science Fair Projects for the Evil Genius

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46 Science Fair Projects for the Evil Genius

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DAN KEEN

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Bob Bonnet, who holds a master's degree in environmental education, has been teaching science for over 25 years. He was a state naturalist at Belleplain State Forest in New Jersey. Mr. Bonnet has organized and judged many science fairs at both the local and regional levels. He has served as the chairman of the science curriculum committee for the Dennis Township School system, and he is a Science Teaching Fellow at Rowan University in New Jersey.
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Together, Mr. Bonnet and Mr. Keen have had many articles and books published on a variety of science topics for international publishers, including McGraw-Hill.

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Contents

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Introduction

Welcome to the exciting exploration of the world around us. . . the world of science! Researching a project for entry into a science fair gives us a glimpse into the marvels of this world.

Participating in a science fair is not only enjoyable, but it also encourages logical thinking, involves doing interesting research, develops objective observations, and gives experience in problem solving.

Before you do any project, discuss it in detail with a parent or science instructor. Be sure they understand and are familiar with your project.

Science fair projects must follow a procedure called the scientific method. This procedure is also used by actual scientists. First, a problem or purpose is defined. A hypothesis or prediction of the outcome is then stated. Next, a procedure is developed for determining whether or not the hypothesis was correct. Do not think that your science project is a failure if the hypothesis is proven to be wrong. The idea of the science fair project is either to prove or disprove the hypothesis. Learning takes place even when the results are not what you expected. Thomas Edison tried over a thousand different materials before he found one that would work best in his light bulb. Edison said he failed his way to success!

Generally, school science fairs have 12 standard categories under which students can enter their projects: behavioral and social, biochemistry, botany, chemistry, Earth and space, engineering, environmental, physics, zoology, math and computers, microbiology, and medicine and health.

Some projects may involve more than one science discipline. A project that involves using different colors of light to grow plants could fall under the category of either botany or physics. This crossing over of sciences may allow you to choose between two categories in which to enter your project. It can give you an edge at winning a science fair by entering your project in a category where there are fewer competitors or avoiding a category where other entries are of particularly outstanding quality.

In this book, we present a wide variety of project ideas for all 12 science fair categories. Select a topic you find interesting, one you would like to research. This will make your science fair experience a very enjoyable one. Many projects in this book are merely "starters," which you can expand on and then create additional hypotheses for.

Know the rules of your school's science fair before you decide on a project topic. Projects must follow ethical rules. A project cannot be inhumane to animals. Never interfere with ecological systems. Use common sense.

Safety

When planning your science fair project, safety must be your first consideration. Even seemingly harmless objects can become a hazard under certain circumstances. Know what potential hazards you are faced with before you start a project. Take no unnecessary risks. Have an adult or a science instructor present during all phases of your project. Be prepared to handle a problem even though none is expected (for example, keep heat gloves or oven mitts handy when you work around a hot stove). Wear safety glasses when appropriate.

Be Especially Aware of These Hazards

- Sharp objects: Construction tools (hammer, saw, knife, scissors, drill). Be careful how you pick up sharp tools and glass objects, which can fragment and become sharp objects.
- Fire: Cooking fat can catch on fire; alcohol has a low flash point. To boil alcohol, use a "double boiler." First, bring a pot of water to a boil. Next, turn off the stove burner. And then, lower a test tube filled with alcohol into the water.
- Chemicals: Keep everything out of the reach of children that specifies "keep out of the reach of children" on the label (alcohol, iodine, and so forth). Know what materials you are working with that have extreme pH levels (acids, bases).
- Allergens: When growing mold in sealable plastic bags, keep the bags closed during and after the project. When the project is over, discard the plastic bags without ever opening them, so mold is contained and does not become airborne.
- Carcinogens, mutagens: Stand away from microwave ovens when in use.
- Water and electricity don't mix. Use caution whenever both water and electricity are present (as with a fish tank heater that must be plugged into a wall outlet). Use only UL-approved electrical devices.
- Heat: Use heat gloves or oven mitts when you deal with hot objects. When using a heat lamp, keep away from curtains and other flammable objects. Be aware that glass may be hot, but it might not give the appearance of being hot.
- Secure loose clothing, sleeves, and hair.
- Wash your hands. When you return home after touching surfaces at public places, be sure to wash your hands to avoid bringing bacteria into your home.
- Rivers, lakes, oceans: Do not work near or around large bodies of water without an adult present, even if you know how to swim.
- Nothing should be tested by tasting it.
- Be aware of others nearby. A chemical reaction, for example, could cause a glass container to shatter or a caustic material to be ejected from a container. Keep

others in the room at a safe distance or have them wear proper safety protection.

- Thermometers made of glass have the potential to break and cause glass to shatter.
- Be aware of gas products that may be created when certain chemicals react. Such projects must be carried out in a well-ventilated area.
- Never look directly at the Sun. Do not use direct sunlight as a source of light for microscopes.
- Loud sounds can be harmful to your hearing.

Being aware of these possible hazards and working with adult supervision should ensure a safe and enjoyable project experience.

What Makes a Good Science Fair Project?

A good science fair project is either something that is unique or it is something that is already common, but done uniquely. For example, many elementary students construct a small model of a volcano, and then use the reaction of vinegar and baking soda to make it "erupt." Such a project could have a unique "twist" to it by hypothesizing that some other substance or chemical reaction would effervesce and give a better eruption.

A good project is also one where the student has done a solid background study and fully understands the project. It's fine to have an adult or even a science professional assist a student in their project, but a judge will expect the student to understand the project and be able to articulate the work to the judges and others attending a science fair. A project will be judged on its completeness. Students should look at their projects as if they are the judges and check for any deficiencies. Presentation is important, but many science fairs weigh more heavily on the science aspect of projects.

Good luck with your project!

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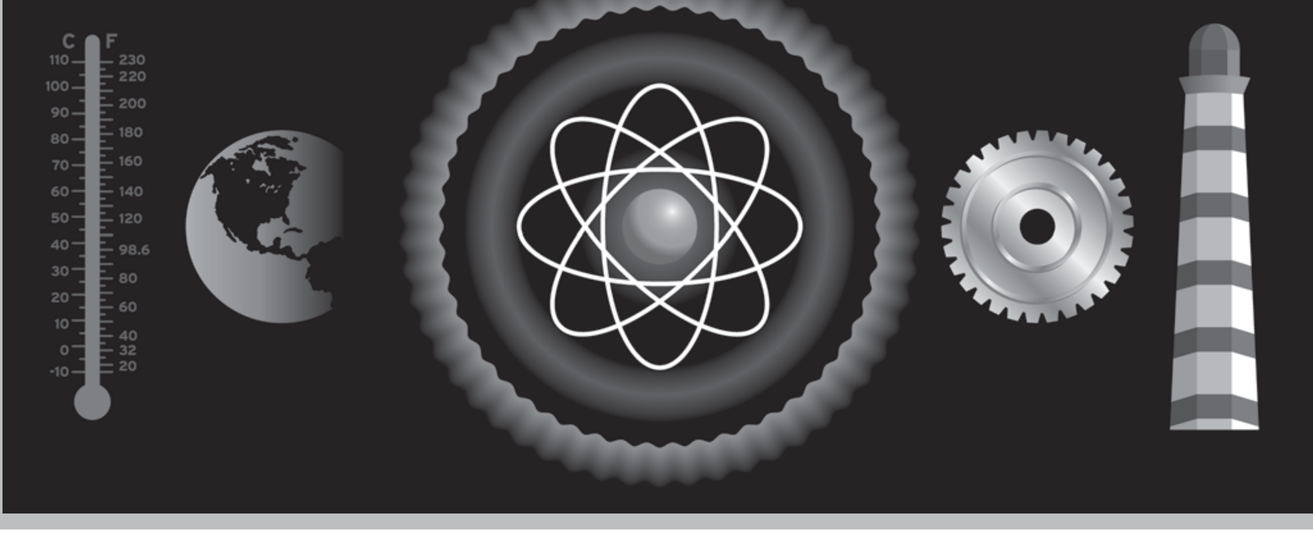


Project 1

Water, Water, Everywhere

The effect of fresh water and coastal salt water flooding on lawns

Suggested Entry Categories

- Biochemistry
- Botany
- Chemistry
- Earth Science
- Environmental Science

Overview

People often pay a high price to purchase land and build a house along the coast, or along a scenic river or stream. The view is always magnificent; the fresh air and walking along the shore are especially healthy. However, not only is the initial cost of real estate expensive, but so is property upkeep. For coastal homes, the salt air and strong winds act as sand blasters to pit the metal on door knobs, window casings, and house paint. Coastal storms are an ever-present threat, too. Another risk for home owners living along rivers or oceans is flooding.

Even a small flood can damage the beautiful and expensive lawns around a home.

Is more damage done to a lawn by fresh water river flooding or coastal salt water flooding?

Hypothesis

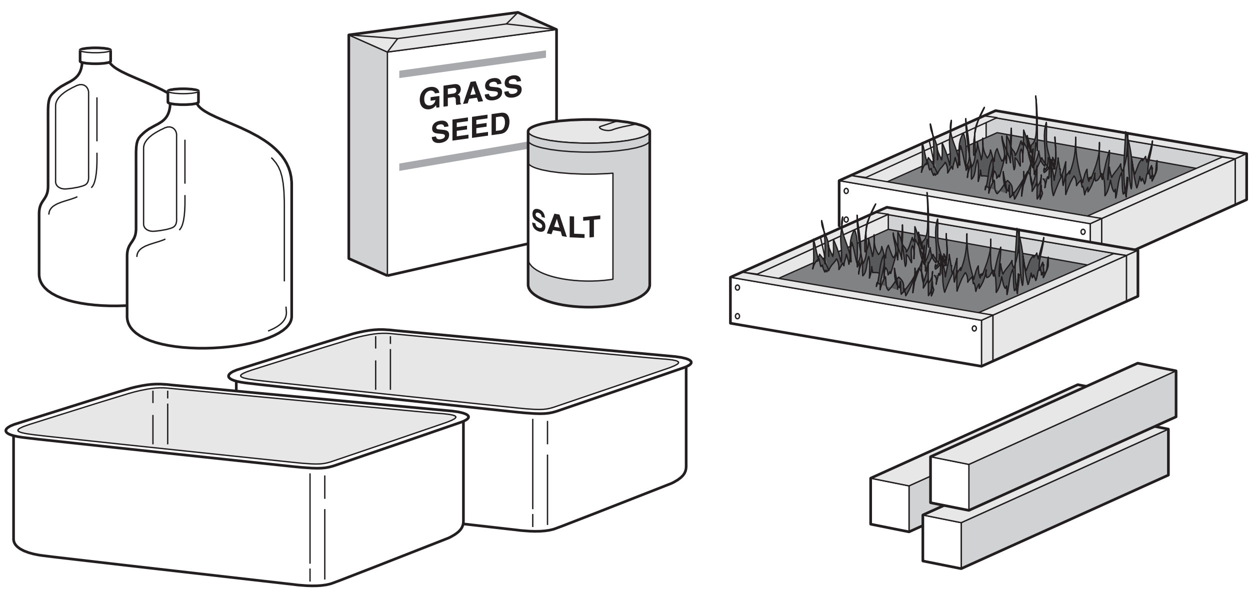
Hypothesize that more damage to lawns is caused by coastal salt water flooding than by the flooding of a fresh water stream or river.

Materials' List

- Two large dishpans
- Several pieces of 1×2 lumber
- Small nails
- Use of a hammer and hand saw
- Several feet of cheesecloth
- Instant synthetic sea salt mix (available inexpensively from school science supply catalogs)
- Water
- Grass seed
- Potting soil
- Staple gun
- Funnel
- Scissors
- Kitchen measuring cup
- Four empty plastic gallon milk or water jugs
- A warm, lighted area indoors, but not in direct sunlight
- Several weeks of time, because we are dealing with germination and growth

Procedure

Grass seed will germinate and grow in two wooden frames of potting soil. Both

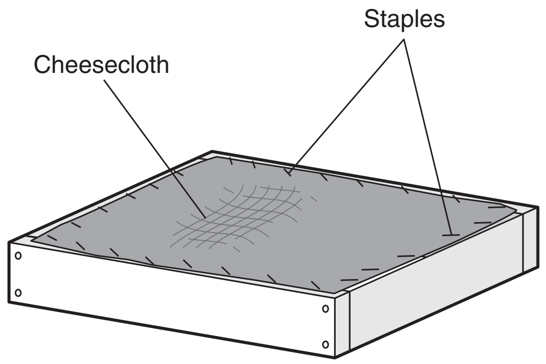


"miniature lawns" will be kept next to each other to maintain the same environment, each receiving an equal amount of light and being kept at the same temperature.

The variable in this project is the exposure of one lawn to severe salt water flooding, and the other to fresh water flooding.

Locate two large rectangular dishpans, used for washing dishes.

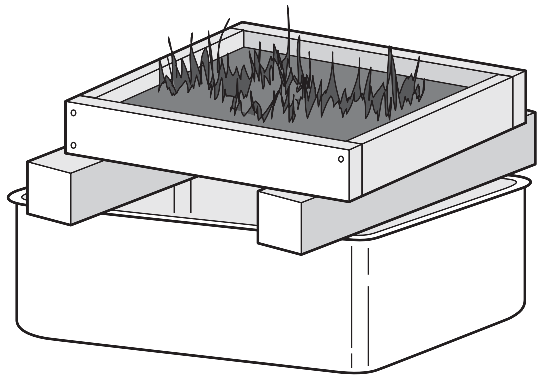
With several pieces of 1×2 wood and small nails (or screws), construct two rectangular frames that fit inside the dishpans. Cut a rectangular piece of cheesecloth to cover a frame. Staple the cheesecloth to the wooden frame, keeping it pulled tight. Repeat for the other frame. Now, turn the frames upside down and fill them with potting soil. The cheesecloth holds the potting soil in the frames, but it allows excess water to pass through.



Place the two dishpans in a warm, well-lit area, but not in direct sunlight. Across the top of each dishpan, lay two pieces of wood, and set a wooden frame over each one. The pieces of wood will support the frames over the dishpans. Pour some grass seed in a kitchen measuring cup, and then spread the seeds out on the soil of one of the frames.

Pour an equal amount of seed into the cup, and spread over the soil in the second frame. Lightly cover the seeds with soil and moisten the soil in the frames.

Make observations daily and keep the soil moist (but not soaked), watching for germination. Equal amounts of water should be given to each lawn frame. Allow the grass to grow until the blades are around one to two inches tall. When that happens, continue to the next step.



Fill four 1-gallon plastic milk or water jugs with tap water. To two of the jugs, add a synthetic sea salt mix, as per the instructions on the package. These mixes are available at science shops and through science catalogs from your school science teacher. They are inexpensive. The mix contains all the essential major and minor elements to create a solution that closely matches ocean water.

Remove the two wooden supports on one flat and lower it into the dishpan. Slowly, so you don't cause erosion of the soil, pour the two gallons of salt water solution into the dishpan. Leave the water in the pan for one hour, and then pour it off. You can save the solution by using a funnel and pouring it back into the bottles. Lift the frame out of the dishpan and place the wood supports back under it, so the soil can drain.

Similarly, lower the other lawn frame into its dishpan and flood it with two gallons of fresh water. Let it sit for one hour, and then pour off the water and place the supports back under the frame.

Allow the lawn frames to dry for two days. Make observations, looking for any changes in grass (color, turgor, and so forth) Record your observations. If no differences are observed, repeat the flooding procedure on the third day. Then, again allow to dry for three days. Continue to repeat the flooding and drying process until you see an observable difference.

Results

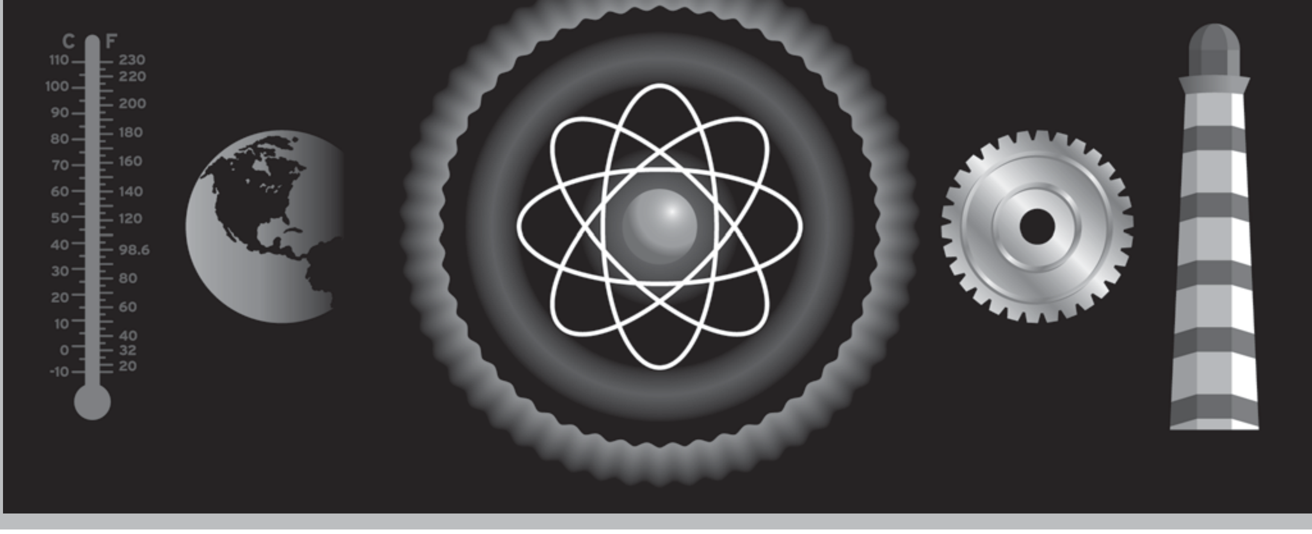
Write down the results of your experiment. Document all observations and data collected.

Conclusion

Come to a conclusion as to whether or not your hypothesis was correct.

Something More

1. If a lawn is killed by salt water flooding, can the home owner simply replant grass seed on the lawn once the flooding has passed, or is the soil made unfit for growing new plants? If the soil is unfit, how can it be cleared of salt and made ready to support life again? Should a home owner turn on his lawn sprinklers after a flood to dilute and wash the salts and other materials left by the sea water?
2. Is one type of seed more tolerant of salt water flooding? This would be important to know for landscapers and home owners in seashore communities.
3. Does pouring salt in the cracks in a sidewalk or driveway kill any grass or weeds that grow there? If so, this would be a safe way to kill unwanted weeds, because salt is not a hazard to people or pets.



Project 2

Who's Home?

Determining whether or not organisms other than birds live in birds' nests

Suggested Entry Categories

- Environmental Science
- Microbiology
- Zoology

Purpose or Problem

The purpose is to determine if a bird's nest is home to more organisms than just birds.

Overview

The Earth is teeming with life. Just think how many things are alive within 100 feet of where you are right now: worms in the ground, flowers, trees, grasses, an insect on a window screen, a microscopic mite on your pillow, mold on a piece of bread left uncovered in the kitchen, perhaps even a family member in the next room. You may hear the peaceful singing of a bird building a nest outside your window.

Birds lack the carpentry skills of humans, and they obviously don't have the use of arms or hands. Yet, they are quite capable of constructing nests that are structurally sufficient for the laying of eggs and raising their young.

Nature provides all the nest-building materials a bird needs: twigs, feathers, animal hair, straw, moss, leaves, pebbles, blades of grass, and even some items provided by humans—a piece of yarn, string, or paper.

Because nest building materials come from nature, and life is abundant all around us, do you think other things are living in birds' nests besides birds?

Hypothesis

Hypothesize that you can find other forms of life besides birds in a bird nest.

Materials' List

- Bird nest containing baby birds
- Desk lamp that uses a standard 60 to 75 watt incandescent bulb
- Large funnel
- Clear jar about the size of a drinking glass
- High-power hand lens (magnifying glass)
- Microscope
- Small plastic bag
- Ten petri dishes with agar

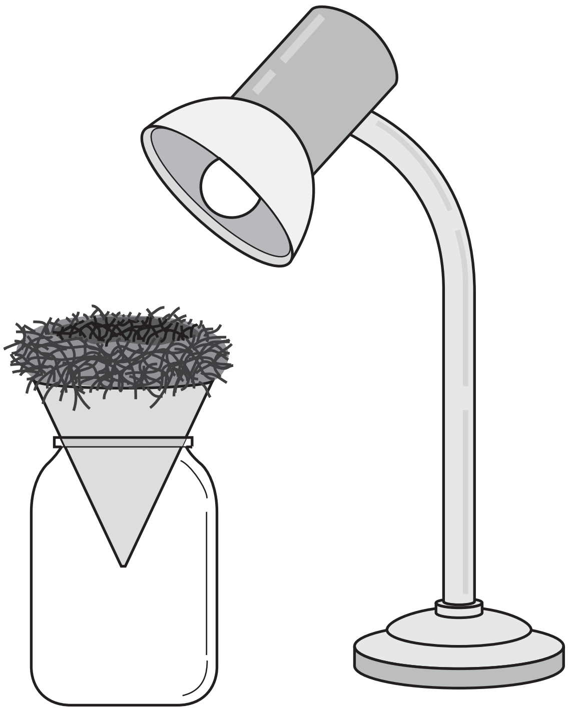
Procedure

Scout around the trees on your property or in your neighborhood and look for a bird's nest with baby birds inside. The nest must be within reach or able to be easily and safely retrieved (you don't want one that is 50 feet in a tree top).

Once you locate a suitable nest, watch it once or twice a day, waiting for the day when the last baby bird leaves the nest. Do not get too close or disturb the nest in any way.

As soon as possible after you see all the birds are gone and the nest is no longer used by the mother bird, carefully remove the nest and place it in a plastic bag.

Take the nest home (or to school), but do not take it inside your house, just in case it contains insects or microscopic life that would not be good to have inside your home. Set the nest on a picnic table, a portable card table, or on a workbench in a garage. To collect tiny insects that may be living in the nest, place a large-mouth funnel in a clear jar. Then, set the nest in the mouth of the funnel. Position a desk lamp over the top of the nest, but keep a space of several inches between the lamp's bulb and the nest to prevent the nest from getting hot. The incandescent bulb in the desk lamp should be about 60 or 75 watts. The heat from the bulb may drive any insects down into the glass, as they try to escape the heat. Leave the bulb on for one hour, and then carefully examine the glass for anything that has been collected. During the time the light is on, do not leave it unattended. Watch that the nest is not becoming too hot (to avoid a fire hazard and



harming anything that may be living in the nest). Use a high-power magnifying glass to examine any material that falls into the jar. Attempt to identify the organisms using field guides and other reference materials.

Next, check for the presence of smaller organisms in the nest. Do this by taking ten pieces from different locations on the nest and wiping them several times on agar in petri dishes. Cover the petri dishes and place them in a warm, dark location. After two weeks, examine each petri dish under a microscope. Never open any of the petri dishes once they have been closed. Eventually, when the project is over, dispose of the petri dishes, continuing to keep them sealed shut.

Results

Write down the results of your experiment. Document all observations and data collected.

Conclusion

Come to a conclusion as to whether or not your hypothesis was correct.

Something More

1. Can you locate other similar nests in your area that would indicate they were built by the same species of bird? The mother bird, the structure of the nest, and the size and designs on the egg shells will help you identify the species of bird using the nest. A good book on birds will be necessary to help you identify the species. Then, run the same tests as you did previously. Are the same organisms found in these nests?
2. What else did you find in the nest: leftover food, a piece of egg shell?
3. What is the composition of the nest? Can you identify other materials used making the nest?
4. How are nests adapted for rain? How are they adapted to ward off attacks from other animals?

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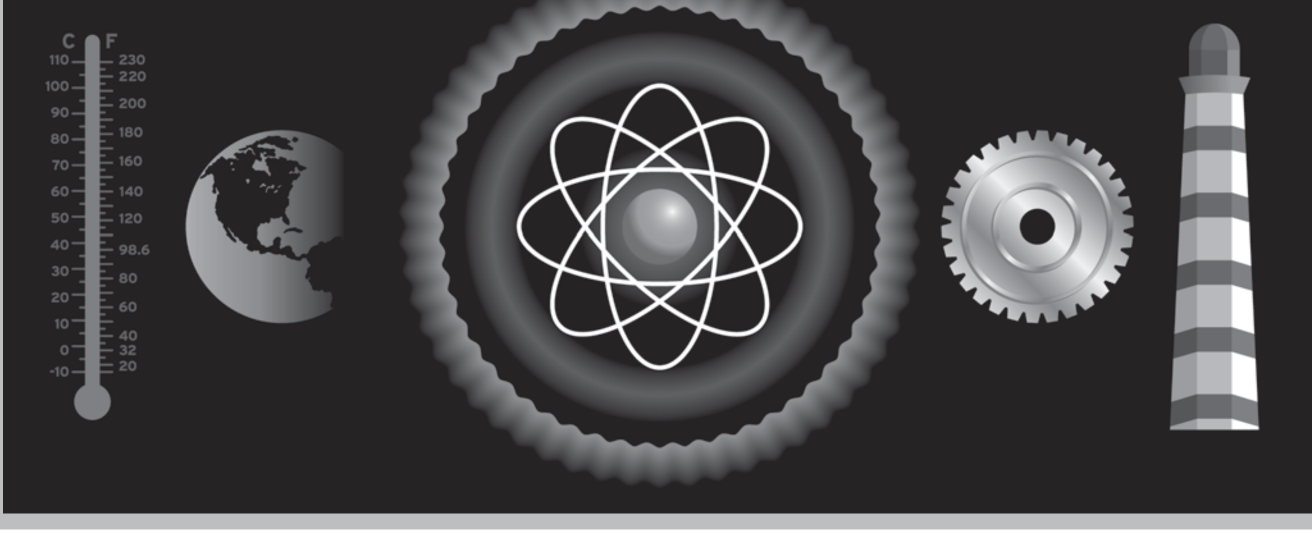

Project 3

Go with the Flow

Lighthouses are cylindrically shaped, so they can structurally withstand high-velocity winds

Suggested Entry Categories

- Earth Science
- Engineering
- Environmental Science
- Physics

Purpose or Problem

Lighthouses must be built along the coast and they must be tall, but that subjects these structures to fierce winds. Builders have learned to make the shape of lighthouses round, causing air to flow around them with less resistance, and allowing them to withstand strong winds.