Life Lab Science

Preview Sampler

LIFE LAB Science Program

Fifth Grade Edition

An Introduction
to the
Life Lab Science Curriculum

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First Edition 1994

12 11 10 9 8 7 6 5 4 3 2 1

Printed in the United States of America

ISBN 1-56307-243-2

Grade 5: Change Over Time

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Published by:
Videodiscovery, Inc.
1700 Westlake Ave. N., Suite 600
Seattle, WA 98109-3012

(206) 285-5400 / (800) 548-3472

Nature Rap

Written by Larry Graff

I'm the Nature Man, I teach whoever I see;
'Cuz I want you to love the Earth just like me.
We only got one so you got to care;
There's other critters here so we got to share.
Yeah there's only one Earth, you know what I mean;
I'm here to RAP, not to make a scene;
I'm the Nature Man and I got a plan;
I want you all to clap your hands.
I say we take all the people polluting our land;
Bring 'em here so they understand.
Take all the the people that believe in hate;
Teach 'em to laugh before it's too late.
We take all the people that are full of greed;
We teach 'em love, that's what we need.

I'm the Nature Man, I'm the D.J.
If you like my plan, just say YEAH! (Yeah!)
I'm the Nature Man, I'm rappin' for you
I rap for the plants and the animals too.
I'm the Nature Man, I really do care;
I'm rappin' for the Bees and the Grizzly Bear.
I'm the Nature Man, I hope you like my song;
If you do, just sing along...
Say Yeah! (Yeah!)
Say Love the Earth (Love the Earth)
Love the Earth (Love the Earth)
Love the Earth (Love the Earth)

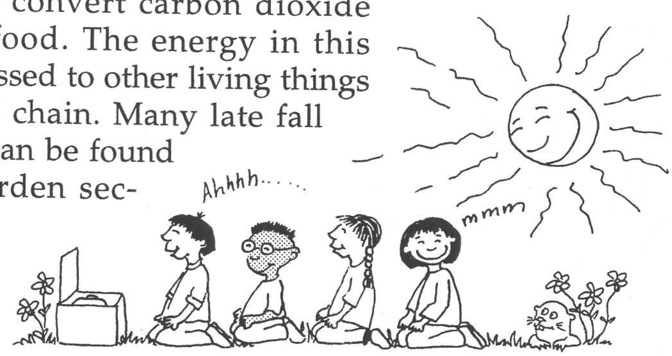
Energy and Change

Everything we do and everything that happens to us involves energy. Energy is what makes things work. You may depend on your battery-operated alarm clock to wake you up in the morning, or your breakfast cereal to power your body until lunch, and on the energy released by burning gasoline to get you to work via bus or car. Light, sound, heat, and electricity are all different forms of energy. All of these forms are similar in that one form can change into another. Most of what happens in the universe—from the growth and decay of living things to the workings of machines and computers to the collapsing and exploding of stars—involves one form of energy being transformed into another.

Wherever there is change, energy is involved. In looking at energy as a part of change, students build on the theme of Change Over Time. In this unit, students focus on heat energy and examine ways heat changes things. In the following units—particularly Seasons, and Weather and Climate—students will build on the foundation of energy as they explore how heat energy from sunlight affects the living and non living elements of our planet.

Energy is not something we can see, though all around us we see evidence that it exists. Through activities in this unit, students practice making inferences—giving explanations based on their observations. By examining data they collect about heat energy in experiments, and through reasoning, students begin to form an understanding of what energy is and how it works.

In the garden, students can explore the importance of energy to all living things. For example, green plants use energy from sunlight to convert carbon dioxide and water into food. The energy in this food is in turn passed to other living things through the food chain. Many late fall gardening ideas can be found in the In the Garden sections of this unit.



Student Goals

Theme: Students examine heat energy and consider how energy is involved in change.

Science Exploration: Students explore ways that heat energy changes things, focusing on sunlight as a source of heat.

Process Skills: Students practice inferring ideas from data they collect and from reasoning.

Science Concepts

Life Science: Green plants use energy from sunlight to produce food.

Earth Science: The sun emits sunlight, which is a source of energy.

Physical Science: Energy is involved when matter moves or changes. Heat is a form of energy. When sunlight is absorbed, it transforms to heat. When energy is transferred from one form to another, change occurs in matter.

Science, Technology, and Society: Alternative energy sources help conserve natural resources and protect the environment. Technologies are advancing to use energy more efficiently as our society learns to face a growing population and its impact on air, water, and land.

Activity Chart

Unit Activity	Description	Process Skills	Instructional Model			Science Concepts				Related Subjects
			Preassessment	Exploration & Challenge	Application & Reflection	Life	Earth	Physical	STS	
Energy Words	Students devise different ways to group energy-related words and share ideas about what energy is.	Comparing Communicating	✔			✔	✔	✔	✔	Language Arts
The Heat Is On	Students make bread dough or batter and observe the changes caused by heat energy.	Communicating Inferring		✔				✔	✔	Math Health
Heat on the Go	Students place warm stones in a container of ice water and describe what happens to the heat energy.	Inferring Synthesizing		✔				✔		Math
A Lot of Hot Air	Students experiment with covered and uncovered boxes to learn which gets hottest in sunlight.	Modeling Inferring		✔			✔	✔	✔	Math
Hot Colors	Using jars of water and powdered paints, students experiment to find out which colors absorb the most sunlight.	Inferring Synthesizing		✔		✔	✔	✔		Art Math
Keeping Things Warm	Students experiment with insulating materials to find out how they affect heat's movement.	Inferring Synthesizing		✔		✔		✔	✔	Math
Solar Box Challenge	Students use what they have learned in the unit to design solar boxes that get as hot as possible when placed in the sun for two hours.	Synthesizing Applying			✔	✔	✔	✔	✔	Math

Unit Planner

Unit Activity	Time	Special Arrangements	Literature Links
Energy Words	25 min.	• Send home Parent Letter.	Yanda, *Rads, Ergs, and Cheeseburgers* Challoner, *Eyewitness Science—Energy*
The Heat Is On	60–90 min.	• Set up hot plate, toaster oven, or electric skillet; arrange for help from parents or older students.	Halacy, *Cooking with the Sun*
Heat on the Go	30 min.	• Review thermometer use; introduce vocabulary to describe temperature; collect small stones.	Ardley, *The Science Book of Hot and Cold*
A Lot of Hot Air	20 min.: set-up 60 min.: wait 15 min.: record data	• Plan this activity for a sunny day; collect at least 3 identical boxes.	Challoner, *Eyewitness Science—Energy* Watts, *The Wind and the Sun*
Hot Colors	20 min.: set-up 5-10 min.: monitoring every hour 3-4 hrs.: duration	• Collect quart jars; activity is best on calm, sunny day; fill jars nearly full with water the night before.	Spence, *Solar Power* Shetterly, *Raven's Light*
Keeping Things Warm	Part 1: varied Part 2: varied	• Fill two jars with tap water the day before; do Part 1 at beginning of the day; ice cubes needed for Part 2.	Yanda, *Rads, Ergs, and Cheeseburgers* Charles, *Chancay and the Secret of Fire*
Solar Box Challenge	Part 1: 60 min Part 2: varied	• Collect a shoe box for each group. Collect newspaper to cover 2 tables; Part 2 to be conducted on a sunny day.	Halacy, *Cooking with the Sun* Hillerman, *Done in the Sun*

Unit Planner

Life Lab Center

Use the Life Lab Center to collect materials that students can explore on their own, as well as to store experiments that will be used throughout the unit (such as solar collector boxes). Consider some of the following ideas:

- Set up an Energy bulletin board as a place to display data from experiments. Students can refer to the bulletin board for experimental results.
- Use the bulletin board for students to post other materials about energy that they find, such as pictures of different forms of energy or information about energy resources and consumption.
- Display books and articles about solar energy or other related literature.

Garden Activities

- If the weather in your area continues to be mild and your class built a compost pile several weeks ago, you may want to turn the pile now to speed up its decomposition. Turning simply means mixing up the compost pile and getting more air into it. For small piles, this can be done quickly with spades and forks. Using a thermometer, measure the heat inside the compost pile before you turn it.
- If you live in an area with a wet winter, cover your piles with tarps or plastic sheets to keep them from being saturated by the rain or melting snow. Soggy piles are very slow to decompose.
- If weather is consistently dry, water cover crops as needed.
- Plant bulbs for an early spring bloom.

Recommended Literature

Story Books

Baylor, Byrd. *The Way to Start a Day*. New York: Charles Scribner's Sons, 1977. Text and illustrations describe how people all over the world celebrate the sunrise.

Bruchac, Joseph, and Michael Caduto. *Keepers of the Earth*. Golden, CO: Fulcrum, 1988. American Indian legends and environmental activities for children. Chapters 7 and 14 feature the sun.

Charles, Donald. *Chancay and the Secret of Fire*. New York: G.P. Putnam and Sons, 1992. In this retelling of a Peruvian folk tale, Chancay frees a beautiful fish he has caught. As a reward, his wish of finding a way to relieve his people from the cold and darkness by releasing the power of the sun is granted.

d'Aulaire, Ingri, and Edgar Parin. *d'Aulaire's Book of Greek Myths*. New York: Doubleday, 1962. This classic collection of Greek myths includes tales about Apollo, the sun god, and Phaeton, who attempted to drive the chariot of the sun across the heavens. Interesting illustrations.

Dixon, Ann. *How Raven Brought Light to the People*. New York: Macmillan, 1992. In this Tlingit Indian legend of southeast Alaska, Raven gives the sun, moon, and stars to the people of the world by tricking the great chief who is hoarding them in three boxes. Beautiful illustrations.

McDermott, Gerald. *Arrow to the Sun*. New York: Puffin Books, 1974. An adaptation of the Pueblo Indian myth that explains how the spirit of the Lord of the Sun was brought to the world. Caldecott award-winning illustrations.

Shetterly, Susan. *Raven's Light*. New York: Atheneum, 1991. Retelling of an American Indian myth from the Northwest Coast about how the sun came to illuminate the earth.

Watts, Bernadette. *The Wind and the Sun*. New York: North-South Books, 1992. A retelling of the classic Aesop fable in which the sun and the wind test their strength by seeing which of them can force a man to remove his cloak.

Reference Books

Alexander, Alison, and Susie Bower. *Power Magic*. New York: Simon and Schuster Books for Young Readers, 1991. Presents experiments for exploring ways of harnessing and using energy.

Ardley, Neil. *The Science Book of Hot and Cold*. San Diego and New York: Harcourt Brace Jovanovich, Gulliver Books, 1992. Explores and explains different properties of temperature through simple experiments. Focuses on heat energy.

Challoner, Jack. *Eyewitness Science—Energy*. New York: Dorling Kindersley, 1993. Surveys various sources of energy and the ways in which they have been harnessed. Interesting photographs.

Halacy, Beth, and Dan Halacy. *Cooking with the Sun*. Lafayette, CA: Morning Sun Press, 1992. Includes instructions for making solar powered oven, hot plate, and other cookers and describes how to use them. Also contains many recipes for everything from oven rice to applesauce cake.

Hillerman, Anne. *Done in the Sun*. Santa Fe: Sunstone Press, 1988. An introduction to the sun as a renewable energy source. Demonstrates through simple experiments and craft projects how the sun's light and heat can be used in our everyday lives. Very simple text, but projects and activities adaptable for older students.

Levenson, Elaine. *Teaching Children About Science.* New York: Prentice Hall, Inc., 1985. A guide book to science learning activities for parents and teachers to use with children.

Lowery, Lawrence F. *The Everyday Science Sourcebook.* Palo Alto, CA: Dale Seymour Publications, 1985. This book is a treasure trove of classroom demonstrations and experiments in all areas of science.

Math, Irwin. *Tomorrow's Technology.* New York: Charles Scribner's Sons, 1992. Describes the technology and energy sources of the future.

McVey, Vicki. *The Sierra Club Kid's Guide to Planet Care and Repair.* San Francisco: Sierra Club Books for Children, 1993. Explains how human activities are destroying the balance of nature and suggests ways to prevent further damage. Of special interest are chapters on energy, the atmosphere, the greenhouse effect, and smog.

Ross, Michael Elsohn. *What Makes Everything Go?* Yosemite National Park, CA: Yosemite Natural History Association, 1979. A light look at energy and how plants use sunlight to make food, and pass energy up the food chain.

Seymour, Simon. *The Sun.* New York: Mulberry Books, 1986. Describes the nature of the sun, its origins, source of energy, layers, atmosphere, sunspots and activity. Excellent photographs.

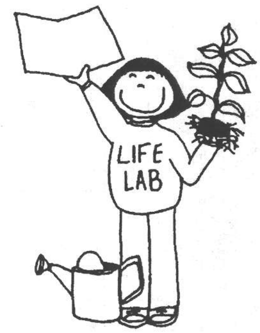
Spence, M. *Solar Power.* New York: Gloucester Press, 1993. Simple description of how the sun's energy can be harnessed and put to use.

Yanda, Bill. *Rads, Ergs, and Cheeseburgers.* Santa Fe: John Muir Publications, 1991. Ergon, a magical being, discusses the generation of various forms of energy, its transportation, uses in everyday life, conservation, and development of alternative sources.

Some of these books may be available in Spanish-language editions. Check with your local bookstore for Spanish titles currently in print and available by special order.

Date: ____________________

Dear Parent or Guardian:



Our Life Lab Science studies are turning now to the topic of energy. Students will be doing a variety of experiments to investigate energy, especially the form of energy called heat.

Energy can be thought of as the ability to change things or to cause motion. For example, electrical energy is used to cause a wide variety of changes, from drying clothes in electric dryers to lighting our homes in the evening. Solar energy can be used to heat air or water or to power electrical appliances. The energy stored in gasoline is used to move vehicles on our streets and highways. Heat is a form of energy that is used in our kitchens to change simple ingredients into family meals. Continuing the year's theme of Change Over Time, our class will focus on observing the changes that energy can cause in the world around us.

In several of the lessons, students will use sunlight to raise the temperature inside solar collectors that they build. We will need a variety of materials for these experiments, including shoe boxes; plastic wrap; large, glass jars (canning, spaghetti sauce, pickle, or mayonnaise jars); old sweaters or blankets; packing materials and scrap cardboard. If you have any of these items at home and are willing to donate them to the class, please send them to school with your child.

There are also a few ways to help your child's learning at home. You might read thermometers together, or list the different kinds of energy used in your household. You might also want to look for the changes that energy causes, such as the chilling of food in the refrigerator or the changing sounds coming from a radio or stereo. I would also suggest that you investigate together the costs and benefits of using an insulating jacket for your water heater. These items (costing only $10–$15) can save energy and money on your utility bill.

If you would like to work with our class during a Life Lab activity, please let me know on the form below. We would enjoy having you visit!

Sincerely,

Name ______________________________ **Phone** ____________________________

______**Yes. I would like to help with Life Lab activities. Please contact me.**

______**No. I cannot help in the classroom now, but please keep me informed.**

Keeping Things Warm

Students experiment with insulating materials to find out how they affect heat's movement.

Indoor

Time

Part 1: 10 minutes to set up at the beginning of the day and 10 minutes to wrap up at end of the day

Part 2: 20 minutes to set up, 5 minutes monitoring after 30 and 60 minutes, and 20–30 minutes to wrap up after several hours

Science Key

Life Science

Physical Science

Science, Technology, and Society

Related Subject

Math

Process Skills

Inferring

Synthesizing

Materials

For the Class:

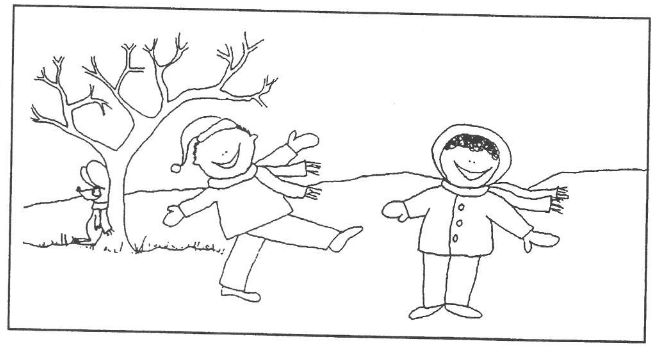
- 2 identical jars
- tap water
- old sweater or blanket
- 2 thermometers
- large pitchers for mixing ice water (enough to fill half the group's jars)
- 4 trays of ice cubes
- large pitchers of hot tap water (enough to fill half the group's jars)
- Energy chart from Energy Words lesson

For Each Group of 4:

- 2 identical jars
- old sweater or blanket
- thermometer
- Lab Sheets, pp. 52–53

Outcome

Students expand their understanding of heat energy by testing how insulation affects the temperature of water.



For the Teacher

On a cold winter night, wool sweaters keep us warm, and on a hot summer day, a foam cup keeps lemonade cold. Both the sweater and the cup are insulation. How can insulation keep one thing hot and another thing cold? It is easy to see the answer if you know that what insulation really does is prevent heat energy from moving.

Heat energy flows from hotter things to colder things. When insulation gets in the way, the process is slowed down. On cold winter nights, a sweater's insulation keeps us from losing heat to the chilly air. In the case of lemonade, insulation in the cup keeps heat from flowing out of the hot summer air into a cold drink. Wool and foam are good insulators because of the tiny pockets of still air they trap inside them. (Heat does not move well through air unless the air itself is moving.) Other good insulators include fiberglass, fur, feathers, and dry leaves.

Some fifth graders may have misconceptions about insulation. They may think that sweaters actually make things warmer, when what sweaters really do is keep us from losing the heat our bodies generate. In this activity, students have a chance to examine preconceived ideas they may have, and gain an understanding of what insulation does. Even after this experiment, some students may still ask, "But why does a sweater make you feel hotter?" Point out that when you feel comfortable, there is a balance between heat genereated by your body and heat lost to the air. Putting on a sweater can upset that balance by slowing down heat loss. Because your body continually generates heat, you feel warmer with a sweater. In this experiment, the jars of water are not continuously heated, so putting on a sweater does not make their temperature rise.

Part 1

Preparation

1. The day before you plan to do Part 1, fill two jars with tap water to allow them to come to room temperature.

2. Plan to begin Part 1 at the beginning of the day and to observe and discuss the results at the end of the same day.

Getting Started

Introduce the activity by asking students to think about whether people produce heat and how sweaters keep us warm.

Do people produce heat? How can you tell? (The temperature of our bodies is higher than the air temperature around us.) **If your body is warm but the outside air is cold, what will happen to the heat in your body? Where does the heat go? If you want to stay warm what can you do? How do sweaters and jackets keep us warm? Do you think a sweater or jacket could make a jar of water warmer?** Have student record their predictions and reasons under *Suspect* on the Lab Sheet.

Action

1. Place a thermometer in each of the jars and have students read the temperature of each. The temperatures should be the same. Record the temperatures on the chalkboard.

2. Ask a couple of student volunteers to wrap one jar in a sweater or blanket and leave the other jar unwrapped. Place the jars next to each other on a table or counter, making sure the jars will not get direct sunlight during the day.

3. Appoint students to record the temperatures of both jars several times during the day.

4. At the end of the school day, have students check the temperatures of each jar and record the temperatures one last time.

Assessment

Lead a discussion about how the sweater affected the jar of water.

Were the jars of water different temperatures at the end of the day? Did the sweater make the water warmer? How do you know?

Part 2

Preparation

1. Be sure to complete Part 1 before beginning Part 2.

2. Right before starting Part 2, fill some large pitchers with ice cubes and tap water to make ice water; fill others with hot tap water.

Getting Started

Have students predict whether a sweater would make hot water or ice water warmer.

Did the sweater make the room temperature water warmer? Do you think a sweater would make a jar of hot water warmer? Do you think a sweater would make a jar of ice water warmer?

Action

1. Divide the class into groups of four students. Assign one half of the groups to experiment with ice water and the other half to experiment with hot water.

2. Instruct each group to fill both of their jars with either ice water or hot water, depending on their assignment. Have them measure and record on their Lab Sheet the temperature of each jar. (The temperatures of the two jars for each group should be the same.)

3. Have groups wrap up one of their jars and leave the other unwrapped.

4. Give students time to complete the *Suspect* questions on their Lab Sheet.

5. Ask students to measure the temperatures of the jars again after 30 minutes, 60 minutes, and several hours.

6. Have students record their findings under *Evidence* on their Lab Sheet.

Assessment

Have groups graph their findings and add new ideas and questions to the Energy chart.

What differences did you observe between the jars with hot water and those with ice water? Do sweaters affect the movement of heat energy? If so, in what way? Insulation is a material used to keep heat from moving. A sweater is one example of insulation. What are some other examples of insulation in your life? (Examples include blankets, jackets, houses with insulation, thermoses, foam cups.) **How can a thermos be used to keep cold things cold *and* hot things hot? Can you think of examples of how animals use insulation?** (Animal fur provides insulation; other animals might bed down in a pile of leaves for insulation against cold.) **How does insulation affect the amount of energy we use?**

Digging Deeper

- Challenge each team to insulate an ice cube so that it stays as big as possible for one hour or one day. Have available materials to use for insulation, such as foam, puffed cereal or popped corn, and wadded-up newspapers.

- Read about energy conservation with your class and learn how insulation can save money and reduce pollution. For example, water-heater blankets cost only $10 or $15 dollars, and can save more than that in one year in reduced energy bills.

• Study ways that other animals use insulation to keep them warm. For example, marine mammals such as seals, dolphins, and whales depend on a fat layer to insulate themselves.

• Read and discuss the *Life Lab Beat* article "Hay Box Cookers," p. 64.

Teacher Reflections

• How well were students able to explain their findings?

• Did students seem to understand that insulation keeps heat energy from moving?

• Were students able to synthesize the data from their experiment into clear conclusions?

In the Garden

As colder weather approaches and the days grow shorter, it is hard to believe that it is already time to begin preparing for another growing season, but early winter is the ideal time to begin thinking about the seeds you will want for spring gardening. Most companies make their new catalogs available in December or January, and in many climates it's already time to start some vegetables indoors in February. Send for seed catalogs with your class before the winter vacation—make activities out of writing letters to seed companies and then deciding what seeds to order. Be sure to place seed orders several weeks before you need the seeds. There is a list of seed companies and their addresses in Gardening Know-How for the '90s, *p. 33.*

Assessment Checklist

Energy and Change

Use the following scale (or one of your own) in order to monitor your student's understanding and skill development as you teach this unit. Space is provided for you to record your own outcomes and/or anecdotal information.

1	2	3	4	5
Does not understand the concept or cannot use the skill.		Has partial understanding of the concept or partial ability to use the skill.		Has solid grasp of the concept or skill.

Expected Outcomes

A. Student can identify different sources and uses of energy in their own lives and discuss ways they can conserve energy. (content)
Energy Words, The Heat is On, Keeping Things Warm, Solar Box Challenge

B. Student is able to demonstrate and explain how heat is absorbed and transferred. (content)
The Heat is On, Heat on the Go, A Lot of Hot Air, Hot Colors, Keeping Things Warm, Solar Box Challenge

C. Student is able to use data and observations to infer how energy is being used or changed. (process skill)
All activities

D. Student is able to discuss ideas and listen to other group members as they synthesize data and develop an explanation. (cooperative learning)
Heat on the Go, A Lot of Hot Air, Hot Colors, Keeping Things Warm, Solar Box Challenge

Add other outcomes you would like to monitor throughout the unit:

E. ______________________________

Activities: ______________________________

____

F. ______________________________

Activities: ______________________________

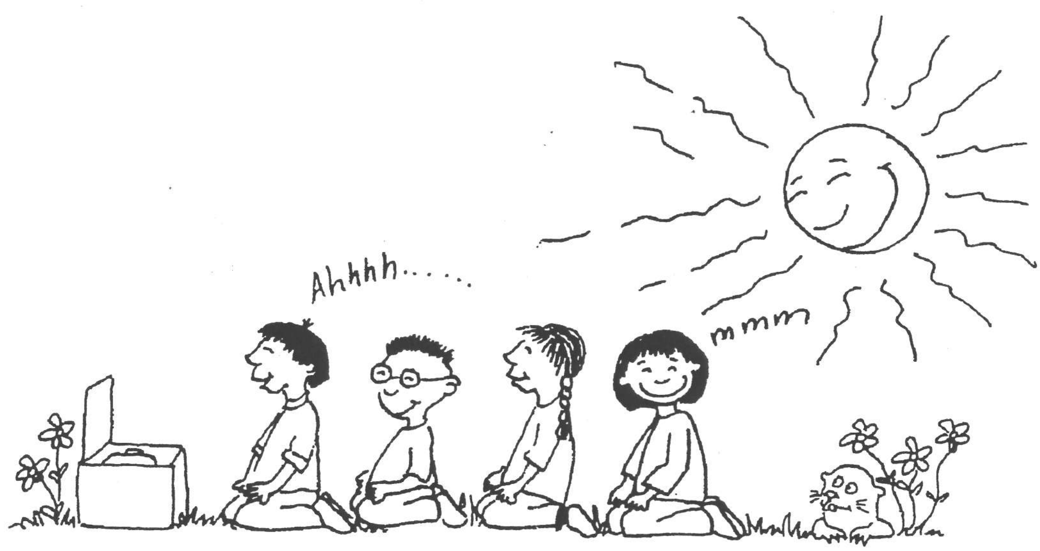
____

Energy and Change

Student Name	Outcomes						Notes
	A	B	C	D	E	F	

Student Lab Book Section

Student Lab Sheets
Field Log
Life Lab Beat



Month ______________________ Name ______________________

Monday	Tuesday	Wednesday	Thursday	Friday

Keeping Things Warm
Super Sleuth Report

Name(s) ______________________________ Date ____________

Will a sweater make a jar of water warmer?

Does a sweater help you stay warm even if the sweater does not feel warm to the touch? Think about this one. What does a sweater have in common with an ice chest?

Based on your experience with sweaters and ice chests, what do you suspect is the answer to the mystery? Why do you think so?

To test your suspicion, wrap a sweater around a jar of water and see whether the temperature of the water changes.

Which jar do you have? **Jar of Hot Water** **Jar of Ice Water**

Evidence

	Wrapped Jar	Unwrapped Jar
Initial Temperature		
Final Temperature		

Share your results with another group in your class so that you have evidence for hot water and cold water.

	Hot Wrapped	Hot Unwrapped	Cold Unwrapped	Cold Wrapped
Initial Temperature				
Final Temperature				

Solution

What happened to the temperature of the water in the two ice water jars?

____

____

What happened to the temperature of the water in the two hot water jars?

____

In which jars did the temperature change faster?

____

How is a sweater like an ice chest? ______________________________

____

Based on what you have observed, do you think a sweater makes a jar of water warmer?

____

Life Lab Beat

FOCUS ON ENERGY

NEWSFLASH!

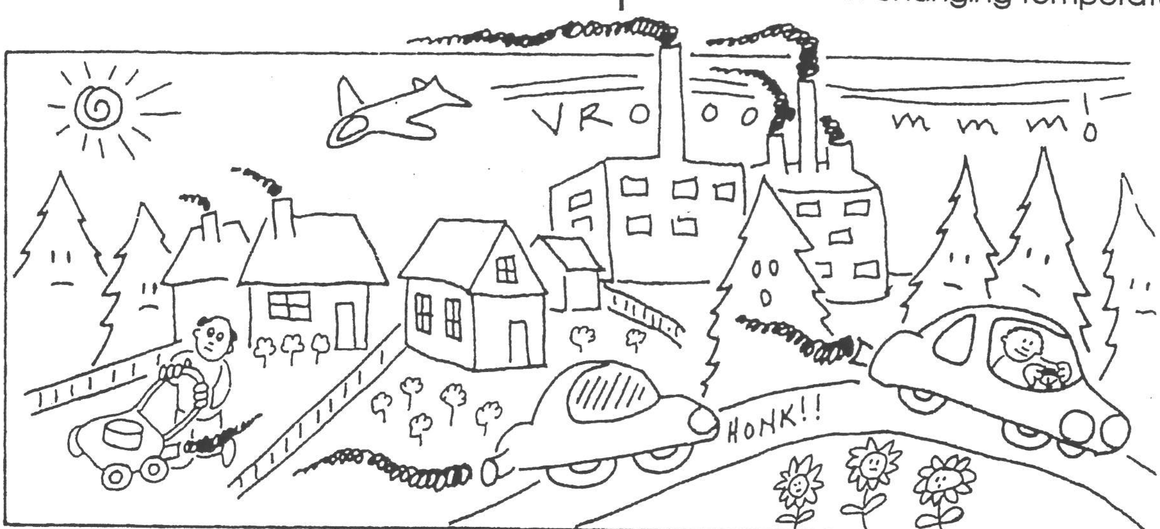
Debate Over Global Warming Heats Up

Will the world be a warmer place in the 21st century? Will the warmer temperatures melt the polar ice caps and cause sea levels to rise? Can we do anything to prevent global warming? These are some of the questions being discussed by scientists who study the *greenhouse effect*.

In 1896, a Swedish chemist came up with the term *greenhouse effect* to describe how the atmosphere affects the earth's temperature. He explained that the atmosphere, a thin blanket of gases that cover the earth, acts like the glass of a greenhouse. Sunlight is let in, but heat energy is kept from escaping. Think of how hot a car can get when it's parked in the sun. (Ouch! Watch out for those hot car seats!) The air inside the car gets hotter because the glass windows let the sunlight in but don't allow heat to escape.

The greenhouse effect is what makes our earth livable. Without it, earth would be too cold for most life. The icy-cold planet of Mars has no water and therefore no clouds of water vapor to blanket the planet. Without water vapor, Mars doesn't have much of a greenhouse effect to keep the planet warm. Water vapor is an important greenhouse gas.

On earth, the changing levels of other greenhouse gases like carbon dioxide could result in changing temperatures. For



When sunlight hits the earth's surface, the light energy changes to heat energy. The earth's soil, plants, and water absorb some of this heat energy. Much of it is reflected back toward space and absorbed by water vapor and other gases in the atmosphere. Carbon dioxide is one of the gases that absorbs heat in the atmosphere.

many years, scientists have been carefully monitoring the earth's level of carbon dioxide. A certain amount of carbon dioxide is normally present in the air around us. But since the last century, carbon dioxide levels have been rising. Today's levels are twenty-five percent higher than they were in 1860, when records were first kept.

The main reason for the rise in carbon dioxide has been the burning of fossil fuels like oil, coal, and gas. Fossil fuels come from ancient organisms, mainly plants. When fossil fuels are burned for energy, carbon dioxide is formed. Factories, power plants, and cars use fossil fuels for energy. Cutting and burning forests also releases huge amounts of carbon dioxide into the atmosphere.

Many scientists warn that the carbon dioxide we add to the atmosphere will make the planet heat up. Some point to the fact that the 1980s was the warmest decade on record. Others say that this hot spell was just part of a natural temperature cycle over time. But most scientists predict that by the year 2050, the planet will be a warmer place. Sound nice and cozy? Wait until you hear what else scientists predict.

Some scientists predict that an average world temperature increase of even 2°C (3.6°F) would cause many climate changes. For example, global warming could affect which lands have a suitable climate for farming, and melting polar ice caps could make sea levels rise by a foot causing flooding and covering shorelines.

Scientists don't all agree about the changes global warming will bring. But they do agree that something must be done to reduce the levels of carbon dioxide in the atmosphere. One way to reduce carbon dioxide levels is to switch to cleaner fuels. Coal-powered electric plants in the United States produce 7.5 percent of all carbon dioxide going into the earth's atmosphere. Burning natural gas, a cleaner fuel, produces half as much carbon dioxide as coal. Many countries are starting to use more natural gas and less coal in their power plants.

Another way to reduce carbon dioxide levels is by not using so much fuel. In one year, a gas-guzzling car can produce thousands of pounds of carbon (much of it as carbon dioxide)! Replacing gas-guzzlers with cars that get double the gas mileage would cut carbon dioxide levels by twelve percent in the United States. Fuel used for heating could also be conserved by insulating buildings and replacing windows that lose heat.

Governments around the world have agreed that carbon dioxide levels must be reduced. Some have already made some of the changes mentioned above. But others are still debating over the best and cheapest way to reduce carbon dioxide levels.

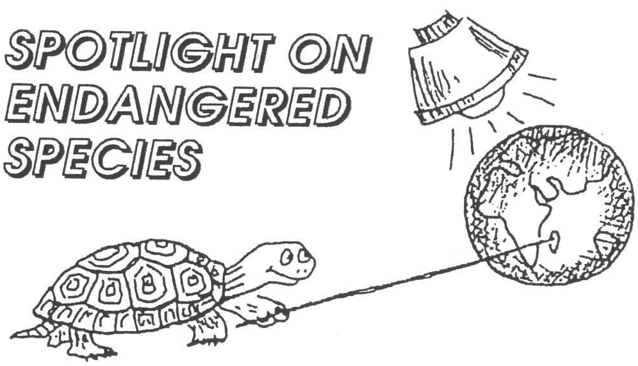
Meanwhile, there is a small bit of good news. In the early 1990s, carbon dioxide levels were not any greater than those in the late 1980s. This is good news because carbon dioxide levels have been rising steadily over the last 100 years. Scientists think that the efforts by some countries to reduce carbon dioxide levels have helped. Some hope that this news will assure other countries that cutting carbon dioxide levels may not be so difficult and costly after all.

5LLB-E-#2 missing

AMAZING ADAPTATIONS
Plants with Heaters

High in mountains still covered with snow, the Alpine Snowbell is one of the first wild flowers to bloom in the spring. How does it do it? The young shoot of the plant actually produces enough heat to melt a hole in the snow. This adaptation allows the plant to survive in a habitat where snow covers the ground much of the year.

SPOTLIGHT ON ENDANGERED SPECIES



Lizard Beats the Heat

Many things about this endangered lizard are a little odd—from the tip of its fringed toes to the tip-top of its third eye. Its third eye? Its fringed toes? What is this strange creature? It's the Coachella Valley fringe-toed lizard, which lives in southeastern California. This lizard has some great adaptations for life in the desert sand dunes of the Coachella Valley.

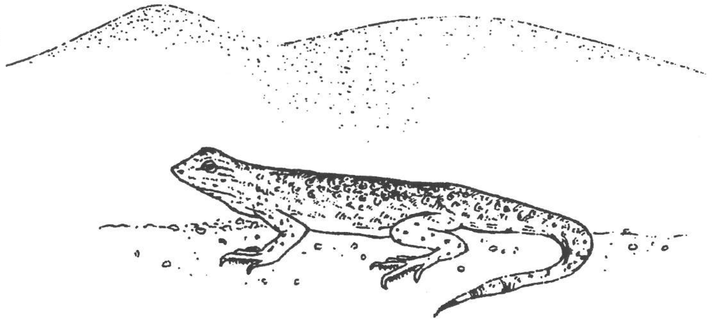
Temperatures in the summer can heat the surface of the sand dunes to 160°F. Like other cold-blooded reptiles, the fringe-toed lizard can't make its own internal heat. This means that the lizard is very affected by the temperature around it. Fringe-toed lizards are only active when the air temperatures is between 22°C and 39°C (72°F to 102°F). But they are very good at getting themselves into warm places or out of places that are too hot.

Many lizards have what is called a *parietal eye* that sits on top of their head. This tiny eye doesn't see images. Instead, it senses heat, like a thermostat. When the lizard gets the signal that it's too hot, it can flee to the shade on its fringe-toed feet (it has extra-long scales on its toes that make a wide "fringe"). These fancy feet allow it to run rapidly over the uneven, shifting sand dunes.

The fringe-toed lizard is also famous for its ability to dive into the sand to escape the heat or a predator. As it dives, it wiggles its head from side to side and pushes with its hind feet. By burying itself in the sand, the lizard can bring its temperature down.

Once fringe-toed lizards scurried all over the Coachella Valley. But when a canal brought water to the valley, people soon followed. Cities and towns in the Coachella Valley have been some of the fastest growing in California. Farms, towns, golf courses, and other development have changed much of the sand dune habitat where the fringe-toed lizard lives. After the lizard was listed as an endangered species in California, plans were made for a special sand dune habitat preserve.

When the planned preserve was fought by developers, the environmentalists and the developers had to compromise. A Coachella Valley Preserve was finally created, but it was smaller than the environmentalists had originally wanted. In return, the developers agreed to pay a "lizard tax," to support the preserve for each acre that is developed.



TIME MACHINE

Hay Box Cookers: Early Energy Savers

The hay box cooker is a nifty way to save energy while cooking. Once used in many European countries, this simple device is something you could make yourself. To find out more about hay box cookers, let's zip back to the year 1918 in England, when World War I was going on. Our time machine journalist, Ms. Q, has set up an interview with Mrs. Mabel Wedmore, who lives outside of London.

Ms. Q: Tell us, Mrs. Wedmore, how does your hay box cooker work?

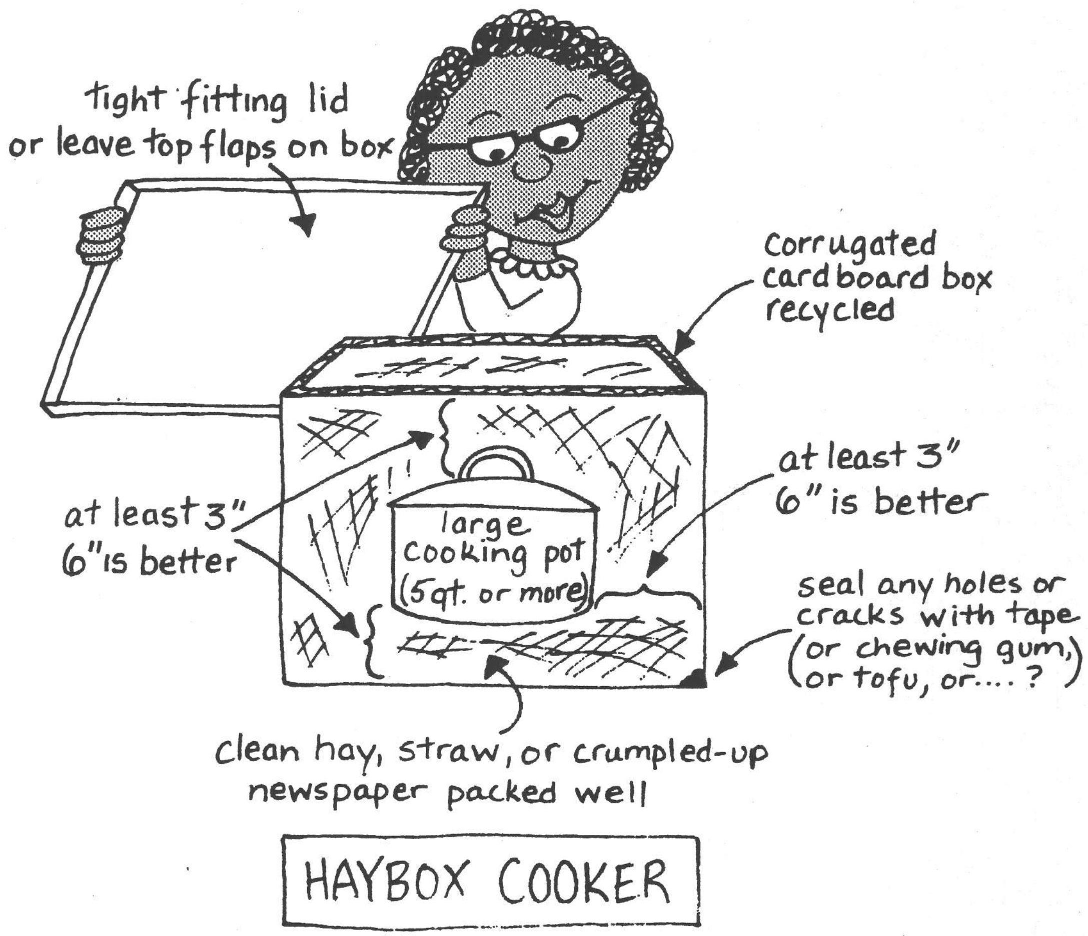
Mrs. Wedmore: Oh, it's really quite simple! First, I make the cooker by filling a box with hay, straw, or newspaper. Today I'm making soup in it. I brought the soup to a boil on the stove and covered the pot with a lid. Then I set the covered pot inside the hay box cooker and shut the box lid. It's been sitting in there for several hours, and it should be done now. The box is so nice and insulated, you see, that the soup stays hot and continues to cook.

Ms. Q: Why did you start using a hay box cooker?

Mrs. Wedmore: Well, because of the war, my dear! Fuel is so scarce now, with the war on. Every bit must be saved for the war effort. These little boxes are great energy savers.

Ms. Q: Well, thank you for your time. I can't wait to go back home now and try my own hay box cooking.

Mrs. Wedmore: Why don't you stay for some hot soup? It's fresh out of the hay box cooker!



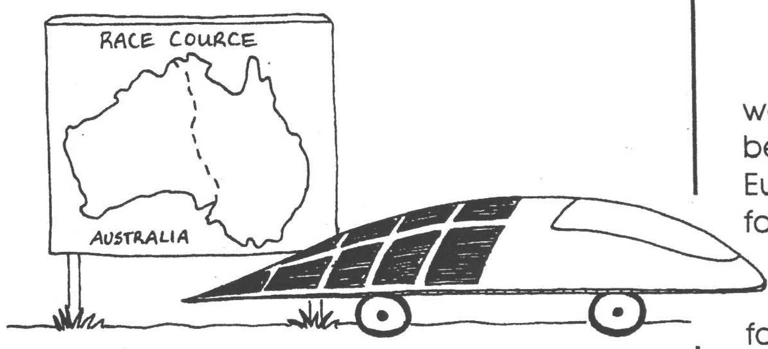
FUTURE FADS

Solar Car Races

What better place for a solar car race than the sun-baked Australian desert? Solar cars, topped with aerodynamic solar panels, use no other energy source than the sun. They can maintain speeds over 80 kilometers per hour (50 mph). Using solar powered batteries, they can surge up to 128 kilometers per hour (80 mph).

There have been many solar car races in the last ten years. But the 1987 race across Australia still stands out. In this race, solar cars sped from one side of Australia to the other (that's like driving from the southern tip of Texas to the border of U.S. and Canada.) The winner was a car called Sunraycer, designed by General Motors. Sunraycer crossed the finish line two-and-a-half days ahead of the second-place finisher.

Why don't we all have solar cars? Right now, they're very expensive to build. General Motors spent over 8 million dollars to build their one race car, the Sunraycer.

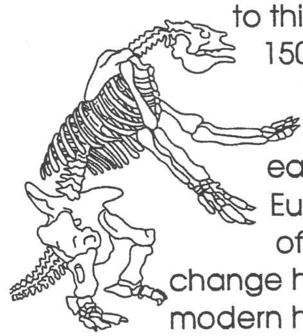


VOYAGE OF HMS BEAGLE

Geography Riddle #3

On September 7, 1832, HMS *Beagle* reached a small town near the southern end of a large continent. On the desert-like plains outside the town, Darwin discovered the fossil bones of a giant ground sloth. This sloth had been bigger than an elephant. It had huge claws that Darwin thought it had used to pull leaves from trees. He realized this extinct sloth looked much like the smaller sloths living today. Darwin wondered why the giant sloth had become extinct while its smaller relative had evolved to be able to survive in its environment.

Darwin also found a fossil tooth from an early type of horse that was now extinct. The European horse had not been brought to this continent until the 1500s. Darwin guessed that the now extinct horse was a very early ancestor of the European horse. Years of evolutionary change had created the modern horse. Darwin wondered why the early horse had become extinct, and its relative, the European horse, had evolved. Surely these fossils were evidence of evolution, Darwin thought. But he still couldn't explain how species evolve. The sloth and the horse fossils were two more pieces for the evolution puzzle that Darwin would later put together.



Find where Darwin discovered these fossils by looking for 39°S and 62°W. Trace the *Beagle's* path from the last point given in Geography Riddle #3 in *Life Lab Beat: Focus on Adaptations.* How did Darwin think the extinct giant sloth and the present-day sloth were related?

The Life Lab Scope and Sequence- A Full Program of Life, Earth, and Physical Sciences

The Life Lab Science Scope and Sequence demonstrates that Life, Earth, and Physical science concepts are integrated in a systems approach to science. As the garden grows and changes throughout the seasons, it provides a natural laboratory for studying how the science disciplines are interrelated. You will also discover numerous opportunities for integrating science with math, language arts, and social studies.

Life Lab Science	Grade 5		Change Over Time	Scope and Sequence	
	Theme/ Change Over Time	**Life Science**	**Earth Science**	**Physical Science**	**Process Skills**
Overview	The earth has changed continuously since its earliest beginnings. In any species there is variation in characteristics. The changing environment determines which variations have the most survival value. Variations that aid in a species' survival and reproduction are most likely to be passed on to the next generation. This process is called adaptation. The gradual change over time of a species is called evolution.	Ecosystems change through time. Species adapt to these changes through natural selection. If a species does not adapt to an ecosystem change, it can become extinct.	The earth's water bodies, atmosphere, and soil have observable characteristics. These characteristics change over days, seasons, and geologic epochs. The changes set the stage for the evolution of life.	Matter has observable properties. Energy is utilized when matter moves or changes. The amount of available heat and light energy from the sun changes throughout the year at a given location on the earth. The transfer of energy causes changes in matter.	Modeling. Synthesizing. Inferring. Communicating.
Changes	All things—living and non living—change over time. The garden is a living laboratory for observing different ways things change and for considering the causes of change.	Living things change over time. In the garden there are daily and seasonal changes.	Changes in the observable characteristics of the physical environment can be measured.	We use our senses to identify properties. Changes can be measured. Patterns of change can be identified.	Observe. Collect data. Review the scientific method. Practice cooperative listening skills.

Life Lab Science	Grade 5		Change Over Time		Scope and Sequence
	Theme/ Change Over Time	Life Science	Earth Science	Physical Science	Process Skills
Adaptations	Plants and animals are adapted to survive in their particular habitats. These adaptations have developed over many generations.	An adaptation is a trait that enables a living thing to survive. All living things have a variety of adaptations that increase their survival chances in specific environments.	Soil type and climate are two key components of the environment to which a plant or animal is adapted.	Motion is affected by weight, buoyancy, and shape.	Observe. Collect data. Organize data. Communicate observations.
Energy and Change	Any change in living or non living matter involves a change in energy. The sun is the earth's major source of heat and light energy.	Living things require energy to grow and change.	The sun emits sunlight, which is a major source of heat and light energy. This energy drives many earth processes.	Energy is utilized when matter moves or changes. Heat is a form of energy. When sunlight is absorbed it is transformed into heat. When energy is transformed from one form to another, change occurs in matter.	Infer ideas from data. Create a model from learned concepts. Communicate ideas to group members.
Seasonal Change	Seasonal changes are the result of the earth's orbit around the sun and the tilt of its axis. Animals and plants have evolved in response to seasonal changes.	Living things must have their survival needs met in their environment. Living things are adapted to seasonal variations in the environment.	Seasons result from the earth's orbit around the sun and the tilt of the earth's axis. The lower the angle of the sun, the less solar energy received per unit of time and area on the earth's surface. The characteristics of seasons vary with latitude.	The sun is a source of energy. This energy is strongest when the angle of sunlight falling on the receiver is most direct. From one season to the next, the amount of available energy from the sun changes at a given location on the earth.	Set up and monitor experiments. Create models to infer information. Synthesize data and propose solutions. Work as a team to present experimental results and conclusions.
Weather and Climate Changes	Weather in an area changes, typically in a yearly pattern called climate. Climates have changed over long periods of time. Different plants and animals are adapted to different climates.	All organisms are influenced by environmental factors and conditions, and each organism also impacts its environment to some extent. Climate is an important environmental factor, affecting the survival of plants and animals.	Major climatic differences are due to the orientation of the earth to the sun, which causes the regions of the earth to be heated differently. In addition, complex interactions between earth's air, water, and land masses affect the climates of different regions.	Gas molecules push against the things they touch. This is called air pressure. Air flows from areas of higher pressure to areas of lower pressure. Wind results from differences in air pressure and from the rotation of the earth.	Create and use tools for measurement. Use maps as models to infer information. Synthesize and analyze data. Work as a team to synthesize results.

Life Lab Science	Grade 5		Change Over Time	Scope and Sequence	
	Theme/ Change Over Time	**Life Science**	**Earth Science**	**Physical Science**	**Process Skills**
Soil Changes	Soil types have evolved over tens of thousands of years, through a variety of biological, geological, and chemical processes.	Living things in soil have characteristics that enable them to survive in that environment. These characteristics are examples of adaptations evolved over time. Living things interact with the soil environment over time and can change it.	Soil has evolved as a result of many physical and chemical forces, including weathering of rocks, erosion, and decomposition of organic material.	Physical processes such as freezing and thawing, heating and cooling, and the action of running water, ice, and wind contribute to soil formation and erosion.	Develop models for experiments. Synthesize data. Propose solutions based on data. Work as a team to present results.
Growing Together	Plants and animals pass traits from generation to generation. Certain individual organisms have traits that make them more likely to survive and reproduce. Over time, species adapt to other species that they interact with. This is called co-evolution. Plants and animals evolve together in a habitat.	Species that share a habitat co-evolve with each other, forming various interdependencies. They interact in many ways; these interactions include symbiosis, predator-prey interactions, and competition.	Organisms that have co-evolved may help each other survive in a broader range of environments than either species could survive in separately. Change in environmental factors is an important pressure on plants and animals and their survival.	Adaptations, such as the size, shape, weight, and characteristic movements of an organism, are functions of physical constraints and forces.	Apply concepts to observations in nature. Infer change over time from observations.
Change Over Time	The earth has changed continuously since its earliest beginnings. These changes set the stage for the evolution of life.	Living things change over time. Different kinds of changes occur over different scales of time. For example, it may take millions of years for a new species to evolve, but a few seconds for a single plant to be devoured by a deer.	The earth changes over time. Climates change, land masses move, and mountains rise. The geologic time scale is used to place geologic events in a time sequence.	Changes can be categorized by their characteristics. Different tools are used to measure changes over different lengths of time.	Create timelines to measure different lengths of time. Synthesize data onto timelines. Infer patterns of change over time. Communicate concepts learned throughout the year.

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