

Introduction

My hopes in researching and compiling this curriculum are threefold. Firstly, I attempted to find or create some lessons which would encourage busy teachers to add some hands-on science to their days. Secondly, I sought to design lessons so that children going from kindergarten to fifth grade in a school in which this curriculum was taught would develop over the years a somewhat well-rounded sense of our environmental impact and responsibilities. Finally, I am also hopeful that if teachers in a school work together to implement this curriculum it might increase instructional cohesion. I am motivated by a deep belief in the importance of teaching science; a fear of what will happen to our democracy and our world if people who deny science continue to gain power; and a commitment to ensure that students who have been underrepresented in science and engineering fields--women and people of color--are exposed early on to the excitement and empowerment that science learning provides.

In order to put together the lessons in this offering, I did a lot of research on line. Most of the lessons are taken or adapted from other sources. I am not a great scientist myself (which is one reason I so fervently hope that we can improve our science teaching--so that kids like me can get a better grounding in science) so I relied on the work of others. It goes without saying that these lessons will benefit from much tweaking; as I worked to write out my ideas I was encouraged by the colleagues I envisioned trying out the ideas here, and improving them. That is, I very much hope that some of you will accept this offering, try out these lessons, and tell me in detail what you, as accomplished and resourceful teachers, think would enhance them. Because I know that you are all experienced, I did not spend time adding details about management of time or materials; I know that you are all more than capable of doing this part yourselves.

I know that we are all pressed for time, and that many of us are already incorporating science into our instruction in various ways. My hope is that we can work as a school to try out these lessons, that you will give me feedback on what worked and what might work better, and that we can become the sort of school which lives up to our environmentalist namesake, John Muir.

In brief:

- 3 to 5 lessons per grade
- literature tie-ins
- hands-on activities
- environmental service project
- writing connection

Note: this is a google doc and the links are embedded; to use them you'll need to access this online, with this link:
<https://docs.google.com/document/d/1xaELJX9yn80XuRcrgNIzQOVusicNwlwcdvGcBKEfMCo/edit?usp=sharing>

Kindergarten

COMPOST

Seasons, Apples, and Compost

<https://betterlesson.com/lesson/628569/the-ever-changing-seasons>

Lesson	Time	Scientific/ Engineering Practice	Cross-cutting Concept	Disciplinary Core Idea	Materials	Arts Integration
1.Seasons	45 min	Obtaining, evaluating, and communicating information	Patterns	Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. ESS2.D	Book A Tree For All Seasons, nature or science journals, pencils	Movement Studies: rainstorm, change in the weather, moving various weather words to deepen and check for understanding
2.Apples and Seeds	45 min	Analyzing and interpreting data	Patterns	Plants and animals grow and change and have predictable characteristics at different stages of development. (LS1.B)	A variety of different kinds of apples, several intact and enough cut in half so that each student can observe, sketch, and record her own; nature or science journals; chart paper for class record	Movement study: seed root stem leaf flower fruit. Music: Justin Roberts, "Apple Tree"

3.Apple Oxidation	45 min	Planning and carrying out investigations	Cause and effect/Structure and Change	Substances react chemically in different ways. (PS1.B)	Apples Water; milk; vinegar; lemon juice	
4.Compost!		Asking questions and defining problems	Cause and effect/Structure and Change	Substances react chemically in different ways. (PS1.B)	Nature journals; chart paper; 2 or 3 gallon zip lock bags; a bit of leaves and grass and compost; scraps from universal breakfast; assorted bits of plastic/nonorganic rubbish; books From Garbage to Compost/Compost Stew	And that old favorite song to celebrate compost-- Dirt Made My Lunch!

Essential Questions: What are seasons? What happens to organic matter over time? Why should we compost?

Lesson 1:

Anticipatory set

TPS what kids know about the seasons. What are the seasons? What happens in different seasons? Etc

Teaching

Interactive read aloud *A Tree for All Seasons* --stop to discuss and emphasize certain parts

Guided practice/Hands-on Exploration

Take the children outside for a look at the different trees on the JM Campus. Tell them that they are going to use their skills as scientists to OBSERVE and describe what they see. Which of these are deciduous? Which might not be? Ask the children to explain their thinking. Then, choose one tree to sketch. Spend some time modeling what you do when you sketch a tree--you look at it, then at your paper, drawing what you see, not your idea of a tree.

Movement Study: form the shape of the different trees with your body.

Share

Back in the classroom, do a gallery walk or just hold up the students' work

Debrief

What did you learn about seasons today? What skills did you use?

Lesson 2:

Anticipatory set

Show the video "I Love Apples" <http://ccssk.watchknowlearn.org/Video.aspx?VideoID=23975&CategoryID=8709> and discuss--what do all apples have? What do they know about apples? Where do apples come from?

Teaching

There are many different kinds of apples, but all apples have some of the same parts. Teach the children about the skin, stem, flesh, core, and seeds. Connect with garden learning about the function of a fruit and the function of seeds. So, what is the same about apples?

Guided practice/Hands-on Exploration

Scientists make observations, as we did when we looked at our trees outside, and they collect and analyze data. Today you are going to be apple scientists. At your desks you are going to find out all that you can about apples. Look at your half of an apple. Copy the name of it into your notebook. Touch it. Sketch and label your sketch. Then, count the number of seeds in your apple half and write it next to your apple sketch.

Share

Have students bring their science journals to the front and ask them to tell you what they found out. Then, work together to create a chart telling how many seeds are in each different kind of apple.

Writing/Reading/Debrief

What are some of the things we learned about apples today? What did you learn when you counted the seeds in your apples?

Lesson 3:

Anticipatory set

Say "ew" and pick up a partly-eaten, browning apple from your desk. Ask children if they've ever had an apple go brown. Why did that happen? See what they think/know. Tell them it's because of a process called "oxidation". Today you will be exploring ways to slow or stop the oxidation process.

Teaching

Depending on whether or not you've designed any experiments with your class before, this will take more or less guidance. Help the students to think about how they could experiment to find out which liquids slow or prevent the browning of an apple. Keep in mind the need to have a control and to make the test fair (i.e. all conditions same except for the liquid). With student input, place one section of apple in four different containers, and if kids don't tell you to label the containers, help them to figure out that you should. Then, pour a small amount of each of the liquids on the different apples. Again with student input create a large chart on which you will ultimately record the results.

Guided practice/Hands-on Exploration

Give each student a section of apple to observe and sketch in his nature journal. If you are ambitious, also have the kids draw the experiment itself. After fifteen minutes, come back to the front to observe the apples in the different liquids. (If there's not much to note at this time, then wait till a later point in the day.)

Share

What happened? Show the students the different samples and elicit their observations of what happened when the apple slices were put in different apples.

Writing

In their nature journals, students record the results. You could give them a frame to help them focus on the cause and effect of the experiment: "The milk caused the apple to _____."

Lesson 4:

Anticipatory set Watch this video for an overview of composting: <https://www.youtube.com/watch?v=dRXNo7Ieky8>

Talk to the kids. What do they know about compost? What did they learn from the video?

Teaching

Review with the kids how to construct a good experiment. Ask them how you could do an experiment to see the best way of composting leftovers from universal breakfast. Guide them to come up with the idea of having one (or more) containers with a variety of rubbish (i.e. plastics, bags, etc) and one with only organic materials. Create a chart to record the progress and write the experimental question, something like--How can we help food break down into soil?

Have the children write about the experiment in their science/nature journals, then

Guided practice/Hands-on Exploration

Follow these steps to make a small compost bag in your room:

1. Put one generous handful of each of leaves & grass or other green material into the bag.
2. Add one handful of finished compost or soil.
3. Add enough water to make it damp, it shouldn't need to be watered often. It should be wet like a damp sponge not soggy and sopping.
4. Add a few scraps from the universal breakfast leftovers.
5. LOVE YOUR COMPOST BAG!!! Open it up every other day or so to give it air.
6. LOVE IT EVEN MORE!!! Hug your compost bag to help break up the stuff and mix it around. (This could be a rotating chore.)
7. Do NOT place live worms in the baggie.. they will suffocate.
8. Watch it change to wonderful compost!

Share

Check in on the compost every few days, and discuss observations/record if possible.

Writing/Reading/Debrief

Read aloud From Garbage to Compost or Compost Stew. Hold a science talk and discuss with kids what causes the organic material to become soil.

When the compost bag has composted, discuss and write about the results.

Writing and Service Project:

Following these lessons, you could do a few different writing activities:

- “How To” prevent an apple from going brown
- “How To” compost an apple
- Persuasive writing about why it's important to compost
- Posters to put around school, esp in cafeteria, urging others to compost their food waste

Of course, there are tons more lessons you could do on this. You could follow up the tree observation at several times of year, comparing it through the season. You could do a taste test of different apples. You could do a compare/contrast of different apples or different fruits. You could graph kids' favorite kinds of apples. You could make apple juice or apple sauce. You could read books about apples; paint apples; do apple prints....go to town with apples!

1st Grade

SOLAR ENERGY

unit on sun/moon/stars and solar energy:

<https://betterlesson.com/lesson/636908/where-am-i>

http://static.lawrencehallofscience.org/diy_sun_science/downloads/diy_ss_cook_solar_oven.pdf

http://www.lawrencehallofscience.org/do_science_now/science_apps_and_activities/diy_sun_science

Lesson	Time	Scientific/ Engineering Practice	Cross-cutting Concept	Disciplinary Core Idea	Materials	Arts Integration
1.The Sun's Energy (maybe in two parts)	15 minutes set up take readings throughout day 20 min write about info at end of day	Asking questions; Planning and carrying out investigations Analyzing and interpreting data	Patterns	Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (ESS1.A)	*thermometers *book Sun *student notebooks * graph paper for charting info *bowls containing ice water; hot oatmeal; room temp water	
2.Exploring the Sun's Energy	20 min discuss and read aloud days' worth of data 20 min debrief and write	Asking questions; Planning and carrying out investigations Engaging in argument from evidence/ Constructing explanations	Patterns Energy and Matter	All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (ESS3.A)	*thermometers *book Sun *student notebooks *chart paper *six cups--three for sun, three for shade-- *materials: soil, water *solar power books	Movement Study: Use their descriptive words to make sequential phrases: wilt, unfurl, etc.
3.Solar Oven			Energy and Matter	All materials, energy, and fuels	• one large pizza box • glue •	Sing: Good Day Sunshine! You

				that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (ESS3.A)	aluminum foil • one sheet of black construction paper • clear plastic wrap • tape • scissors • ruler • marker • chocolate • marshmallows • graham crackers • plate • thermometer (optional)	Are My Sunshine Big Beautiful Planet
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Note: This set of lessons is part of a longer unit on the Sun, Moon, and Stars; it should also be taught in the context of a year-long recording of the temperature and weather during calendar routine every day

Essential Questions: How does the temperature change over the course of a day? What causes that change? Can we use solar power?

Lesson 1: Over the course of one or two days; collect data one day, discuss/analyze that day or the next

Anticipatory set

TPS What a thermometer is. Have you used one of these? Where have you seen it? What kind of tool is it?

Teaching

Scientists make observations, and they use tools to help them do this. Scientists also record their observations and look for patterns. We've been recording the temperature every day. Who can tell us what happens when it's warmer outside? How does the thermometer show us the temperature?

Does anyone remember/notice any patterns in the temperatures we've recorded this year so far?

(Optional, depending on kids' understanding of the way thermometers work:

We're going to use thermometers to measure three different items. I want you to predict what will happen when I put the thermometer in each of these bowls. Go through and discuss as you highlight for the kids what happens to the mercury on the thermometer in hot, warm, and cold temperatures.)

Guided practice/Hands-on Exploration

In addition to making observations, scientists conduct investigations. Today (or could be tomorrow) we are going to investigate how the temperature changes throughout the day. We'll look at our thermometer every hour and record the temperature on our own [graphs](#), then discuss our findings.

Share (possibly the next day)

We pull out our graphs and have a whole group discussion about our findings. ***Today you used a graph to record the temperature. This is called data. Each time you colored in your graph you recorded new data. When you look at this data do you notice anything interesting? I want you to look at your data and when you notice something, please give me a thumbs up. What part of the day is the warmest? Please turn and share your data with your partner.***

Writing/Reading/Debrief

Students write in their science notebooks to answer the question: What part of the day is the warmest? What makes that part of the day warm? How do you know?

Lesson 2:

Anticipatory set Review the data and the students' conclusions about what makes the temperature change throughout the day. In the context of the unit on the sun, several of them should have come up with the idea that the sun is responsible for the temperature change. Review what was the warmest part of the day.

Teaching

Read Aloud The Sun

Discuss. What makes the temperature change?

Today we're going to extend our learning and investigate what happens to our natural resources--soil, water, and air--when they are in the sun.

Guided practice/Hands-on Exploration

Ask the kids what they know about designing an experiment. How can we make sure our experiment is fair? Review or teach how to set up an experiment and a control. Share the materials--cups, soil, water, thermometers. Challenge students to come up with an idea of how to explore what happens to these resources in the sun. Give them time to think, then write their ideas for how to explore in their science notebooks. Next, have students share their plans with their science partner, and amend them after discussion. Finally, bring the group together to come up with an experiment. Guide them to plan to put three cups, one each of water, soil, and air, in the sun and three cups which are the same in the shade. Put the materials in their respective areas, making sure that the cups in the sun stay in the sun and the cups in the shade stay in the shade. Have students write in their science notebooks what they hypothesize will happen to the cups in the sun. Why do they think this?

Share

Three or four hours of sun/shade later, bring the class back together. Use thermometers to take readings, and record these in front of the class. Discuss the results.

Writing/Reading/Debrief

Students record in their science notebooks what happened to natural resources in the sun. Why?

Lesson 3: Read the [directions for creating the solar oven](#) and prepare the parts ahead of time.

Anticipatory set

Review results of experiment with sun and shade. Do you think this information could be useful in any way?

Teaching

Read aloud book about solar power. Discuss some of the ways people use solar power. Today we are going to use solar power to heat some food!

Guided practice/Hands-on Exploration

With the kids' help, construct the solar oven and put the s'more ingredients in. Leave in the sun to bake.

Share

After hours, check on the solar cooking. What has happened? How did this happen? What energy did we use to cook our food? Eat!

Writing/Reading/Debrief

Write in science journals. How did the energy of the sun help us today? What other things could the sun help us do?

Service Project: Write to Donald Evans and Tim White persuading them to use solar panels on BUSD buildings.
Zero waste classroom?

2nd Grade

RENEWABLE ENERGY

<http://www.alliantenergykids.com/FunandGames/CoolProjects/index.htm>

http://www.alliantenergykids.com/wcm/groups/wcm_internet/@int/@aekids/documents/document/mdaw/mdi5/~edisp/029639.pdf

https://www.teachengineering.org/lessons/view/cub_energy2_lesson01

Note: the actual science of energy is not something easily accessible to second graders, so this set of lessons does not aspire to teach those concepts. Rather, the objective is that children will come away with an understanding of the benefits of conserving energy; the advantages of renewable vs non-renewable sources; and some hands-on experience of solar and wind energy.

Lesson	Time	Scientific/ Engineering Practice	Cross-cutting Concept	Disciplinary Core Idea	Materials	Arts Integration
1. Energy: What is Energy? Renewable vs. Nonrenewable (2 part lesson)	50 minutes	Asking questions and defining problems; Obtaining, evaluating, and communicating information	Energy and Matter	All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time; others are not. (ESS3.A)	Book--Wind, Rain, Hydro and Renewable Energy; All About Energy Materials for activity--	Movement Idea: kinetic energy and generating power: machines. How do we renew the energy in our bodies?
2. Energy Use in Our Classroom	30 minutes to start	Plan and carry out investigations	Energy and Matter	All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable	Sheet for recording info *****	

				over time; others are not. (ESS3.A)		
3.How Can We Reduce Our Energy Use at School and At Home? Why should we? (2 part lesson)	30 minutes plus homework	Engaging in argument	Energy and Matter	Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (ESS3.C)	chrome-extension://bpmcpldpdmajfigpchkicefoigmkfalcv/iews/app.html Worksheet 1 Worksheet 2 glue sticks, scissors Book Go Easy on Energy Chart paper for scribing ideas HW sheet	
4.Renewable Energy Fun!	50 minutes	Planning and carrying out investigations	Energy and Matter	Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (ESS3.C)	http://goseek.weebly.com/elementary-school.html Stations making windmills ; pinwheels ; windsocks ; and solar-powered toys (available in Room 7, along with books for the lessons)	
5.Persuasive Letters to Newspapers/Politicians/School Board Urging Adoption of		Engaging in argument from evidence				Bonus: Sing a song !

Renewable Energy Sources						
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Essential Questions: What is the difference between renewable and non-renewable energy? Why might it be good to use energy from renewable sources?

Lesson 1, part 1:

Anticipatory set

Facilitate a TPS with the students. What do they know about energy? What are some things that they do that require energy? What do they use for energy? What about other kinds of energy? Do they see evidence of energy use in the classroom? List a few things. Teaching

Read aloud What is Energy?

Have children work in groups to come up with three things they learned from the book, and share as a class.

Lesson 1, part 2:

(Depending how much time has elapsed since part 1): Rvw what they know about energy. Then, have a TPS about renewable vs nonrenewable sources of energy, and read aloud Wind, Rain, and Hydro; discuss.

Writing/Reading/Debrief

Students write a sentence comparing renewable vs nonrenewable energy, or draw pictures of some sources of renewable energy.

Share:

Have a science talk. Why is renewable energy a good idea? Can you think of any reasons why it might not make sense in some areas?

HW: Challenge students to talk to their families about what they've learned about energy, and to think about what items in their homes use energy.

Lesson 2:

Anticipatory set

What did students find out when they looked around at home and thought about energy use? What are some things that use energy every day?

Guided practice/Hands-on Exploration

Have the students go around the classroom in pairs and locate items which use energy. They should record *** at least five items and be prepared to share with their classmates.

Share

As a class, chart the ways that the classroom uses energy every day.

Writing/Reading/Debrief

Students reflect and write about one thing the class could do to reduce energy use.

Lesson 3, part 1:

Anticipatory set

Review what we learned about different sources of energy. Why would it be a good idea to conserve energy? Invite a few children to share their ideas, possibly for inclusion in a class opinion piece.

Teaching

Today we'll be exploring two different ways to think about reducing our energy consumption. The first is to think about designing more efficient buildings. We'll watch a slide show and then design our own zero energy classroom. Show [slide show](#)--

Guided practice/Hands-on Exploration

In groups, pairs, or individually, challenge the class to use the information gathered in the slide show plus the worksheets to create a Net Zero Energy Classroom

Share

Gallery Walk of designs

Lesson 3, part 2:

If our buildings are not so energy efficient as we'd like (*The classroom light fixtures were changed out to newer high efficiency T8 bulb fixtures which use approximately 35% less energy than the older T12 bulbs. Occupancy sensors were installed which help control the lights and keep them off when not needed.*

The exterior light fixtures were changed out to LED type which are approximately 70% more efficient than the old fixtures.)

what are some things we can do to conserve energy? Read aloud Go Easy on Energy.

As a class, brainstorm a few things you all could do to conserve energy [at school](#) and [at home](#); chart

Writing/Reading/Debrief

Have each student write one goal for how s/he'll help conserve energy at school. For homework, kids could talk to their families and come up with one goal for saving energy at home.

Lesson 4: *It would be good to have several adults present to help with kids in small groups

Anticipatory set

Review previous lessons; gather goals kids came up with for energy conservation at home; touch base on how the class is doing on classroom energy goals (you could of course appoint energy monitors or set more specific goals related to turning lights off/putting computer monitors to sleep etc).

Teaching

Today we're going to have the chance to explore two of the forms of renewable energy which we discussed in an earlier lesson. Read the info on [solar energy](#) and [wind energy](#) and then explain the different stations they can take part in.

Guided practice/Hands-on Exploration

It would be great if you had volunteers to help with this menu of activities:

[Windssocks](#)

[Plastic Bottle Windmill](#) (tricky) or [Paper Pinwheel](#) (consider reusing paper and sticks for this)

Experiment with solar toys (put them in the sun and take them out to see solar power at work)

Share

Celebrate what they've created and learned!

Writing/Reading/Debrief

What have we learned about renewable power sources?

Lesson 5:

Service Project: Persuasive letters to school board or other politicians urging use of renewable energy sources. Review the lessons learned about renewable vs non-renewable energy. Work to create a graphic organizer for a paragraph urging someone (a school board member, the mayor?) to install energy efficient and/or solar or wind powered appliances.

3rd Grade

HABITATS/ECOSYSTEMS

--terraria? <https://climatekids.nasa.gov/mini-garden/>

<https://betterlesson.com/lesson/632382/biomes>

<https://www.coastal.ca.gov/publiced/poster/poster.html>

Lesson	Time	Scientific/ Engineering Practice	Cross-cutting Concept	Disciplinary Core Idea	Materials	Arts Integration
1.What is a habitat/bioeme?	30 minutes	Ask questions	Stability and change	Plants and animals depend on their surroundings to get what they need. (LS2.A)	Chart paper Books about habitats Science notebooks	
2.Studying a habitat at John Muir	30 minutes	Obtaining, evaluating, and communicating information	Systems and system models	Plants and animals depend on their surroundings to get what they need. (LS2.A)	Science notebooks Movement study: dancing in the different habitats. How does the environment shape the way you move in it?	
3.Habitat stations	60 minutes?	Obtaining, evaluating, and communicating information		Plants and animals depend on their surroundings to get what they need. (LS2.A)	Books, chromebooks	
4.How do human activities affect habitats?	30 minutes	Asking questions and defining problems		Human activities...have had major effects on the land....but individuals and communities are	Elmo set to show images and watch video about pollution and other human impacts on environment	

				doing things to help protect Earth's resources and environments. (ESS3.C)		
5.Design a habitat Bug hotel Terrarium	45 minutes	Developing and using models	Systems and system models	Designs can be conveyed through sketches, drawings, or physical models (ETS1.B)	Glass containers charcoal dirt pebbles plants (Pre-cut) plastic bottles Sticks Info about greenhouse effect	
6.Science talk and Habitat paragraph--what can we do to lessen our impact? Plan for litter clean ups, and write info paragraph on habitats and/or opinion piece about why we should be thoughtful about the ways we live on the earth	45 minutes	Asking questions and defining problems				

Essential Question: How do people affect habitats?

Lesson 1:

Anticipatory set

What is a habitat? TPS and discuss what makes a habitat. If you're a skilled KWL facilitator, go for it. I've not had much success with KWLs myself but some version of this might work well over the course of the next few lessons.

Teaching

Read aloud Habitats of The World and have a discussion to share new knowledge. Guide children to come up with some examples of habitats (chart as they share) as well as four things which animals need to find in their habitats in order to survive (food, water, shelter, oxygen) (chart these as well).

Writing/Reading/Debrief

In their science notebooks, have children record the information learned today--summarize habitat info.

Lesson 2:

Decide ahead of time if you want to explore the creek, the garden, or another area of campus. A creek key is available from Ms. J. or Mr. John; if you plan to use the garden, of course find out first if a garden class will be meeting there. You may want to coordinate with the garden teacher about this lesson as well. It would be great if you'd already done a lesson or two on making observations and sketching so that the children will be more successful in their efforts outside.

Anticipatory set

Rvw what we know about habitats in a brief class discussion.

Teaching

Today we're going to explore one of the habitats at our school. Your job will be to be scientists who observe and record what they find. At the end of this fifteen minutes you'll be sharing your work with other scientists. Explore one area of this habitat. Locate and record with drawings and labels any animals you see as well as the sources of shelter, water, food, and oxygen in the space. You may not know for sure what these are, but as a scientist you are not only making observations but also constructing explanations.

Guided practice/Hands-on Exploration

Send children off with their notebooks and pencils to sketch and write for ten or fifteen minutes.

Share

Back together--in the classroom if you prefer--have the students share with a partner what they observed and what elements of a habitat they found. Did they see any creatures in their habitat?

Writing/Reading/Debrief

Whole group discussion. What other creatures might like to live in the garden/creek? Why do you think that?

Lesson 3: (depending how long you want each group to spend in its station, this lesson might be broken up into two sessions)

Anticipatory set

Who can tell us one thing we know about habitats? Today we're going to see if we can learn more about specific habitats in the world.

Guided practice/Hands-on Exploration

Divide the children into four groups: One group is working on chromebooks and exploring habitat learning [online](#); another is writing four things they know about what an animal needs in its habitat; a third is drawing a habitat of their choice; the fourth is with you, reading the book Habitat ABCs.

Share/Debrief

After several rotations, bring the class back together. Pick sticks to invite students to add knowledge to what the community already knew about habitats.

Lesson 4

Anticipatory set Project an image of a habitat which has been altered by humans. (Try one from this [site](#) or from [here](#), or find your own.) Conduct a mini-VTS session on it (see this [link](#) to observe VTS in action), or touch base with Ms. J., or just base your discussion off of these questions:

What's going on in this picture? What do you see that makes you say that? What more can we find?

Teaching

Watch this [video](#) (you need to register to watch it all) or maybe this [one](#) from about habitat destruction.

Guided practice/Hands-on Exploration

In small groups, students discuss these questions:

What is habitat destruction? How do humans cause it? What are some reasons it might be hard to stop?

Share

Whole group share out.

Writing/Reading/Debrief

If you were in charge, what would you do to stop or slow habitat destruction? Have children write their ideas in their science notebooks.

Lesson 5 There are two possible craft activities. If you have extra help, you could try to give kids the chance to do both; or you could do them on separate occasions; or you could only offer one of the two.

Anticipatory Set

If you were going to create a habitat, what would you need to provide? Discuss--

Guided Practice

Create your own habitat(s)! Follow the steps provided in the links:

[Terrarium](#)

[Bug House](#)

Share/Debrief

Read the [information](#) on the greenhouse effect and discuss.

Service Project: Cleaning up around the school; raising money to give NWF

Field Trip: <http://juniorcenter.org/wp-content/uploads/2016/03/2016-17OutreachBrochure.pdf>

Of course there is so much more you can do. Focus on a landscape artist; do a research project on a particular habitat; study the creek; tie in with John Muir or another environmentalist who was concerned about natural habitats. The terraria could become items for sale at the Art Auction possibly?

4th Grade

FOSSIL FUELS

https://www.growingyourfuture.com/civi/sites/default/files/fossil_fuels.pdf

<http://www.calacademy.org/educators/lesson-plans/fossil-fuels-chocolate-chip-mining>

<https://kidsagainstclimatechange.com/start-learning/#what-kids>

Lesson	Time	Scientific/ Engineering Practice	Cross-cutting Concept	Disciplinary Core Idea	Materials
1.Natural Resources	30 min	Asking Questions	Energy and Matter	All materials, energy, and fuels that humans use are derived from natural sources (ESS3.A)	Book Fossil Fuels; Video overview
2.Chocolate Chip Cookie Mining	40 min	Develop and use models Plan and carry out investigations	Cause and Effect	Human activities....have had major effects on the land (ESS3C)	Chocolate chip cookies Toothpicks Plates Worksheet
3. Renewable vs Nonrenewable Resources/ Resources are Finite	50 min	Develop and use models Plan and carry out investigations	Cause and Effect	Human activities....have had major effects on the land (ESS3C)	https://www.growingyourfuture.com/civi/sites/default/files/fossil_fuels.pdf 200 pennies • piece of coal • toy pinwheel • data sheet • 4 plastic cups per pair of students (reuse them each year or recycle) • permanent markers • overhead projector • chart paper
4.What should we do? (maybe split into two	90 min	Ask questions and define problems; engage in argument		The sustainability of human societies and the biodiversity that	Elmo prepared to project images; chromebooks for

lessons)		from evidence		supports them requires responsible management of natural resources. (ESS3C)	research Paper for writing
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Essential Question: How Does Fossil Fuel Mining Affect the Earth and Its Inhabitants?

Lesson 1:

Anticipatory set

What are natural resources? What are some things we use which come from the earth? What *isn't* provided by the earth? TPS to find out what students know/think about natural resources.

Teaching

Read aloud book Fossil Fuels; return to topic and add to knowledge, and have kids take notes in science notebooks

Guided practice/Hands-on Exploration

Watch [fossil fuels video](#) and take notes, focusing on the question of what might be a problem with fossil fuels?

Share

Share what learned today. What is a problem with fossil fuels? (Sort of guide to main ideas--fossil fuels are nonrenewable and they contribute to damaging emissions.)

Writing/Reading/Debrief

Write as a class or individually one learning and one question following today's lesson.

Movement Study: Watch the Flocabulary video <https://www.flocabulary.com/unit/natural-resources/> ;create tableaux for sections of the song, string together into a dance phrase.

Lesson 2:

Anticipatory set

Discuss where we get the majority of the energy that we use.

- What is a fossil fuel?
- What does it mean to be renewable? Are fossil fuels renewable?

Teaching

Review information from previous lesson's book and video; tell the students that today we'll be investigating what happens to the earth when it is mined for fossil fuels

Guided practice/Hands-on Exploration

Teacher tip: Start this activity by making sure students have washed their hands. They will have the option to eat their cookies later.

1. Pass out the cookies, plates, and one [Cooking Mining Worksheet](#) for each student.
2. Students will sketch their cookie in two ways and answer the questions on the “Before Mining” side of their worksheet:
 1. In the box on the left, students will make a sketch of their cookie.
 2. In the box on the right, student will draw what fictional habitat is above ground on their cookie. Tell students to imagine that the cookie is actually the bedrock and dirt below ground – the second box is a bird’s eye view of that habitat on top. They should think of this as a fairly large area – the size of a city or national park. It can be a forest, desert, mountain, or any other ecosystem they like.
3. Pass out the toothpicks and explain that the students are actually coal miners. The chocolate chips in their cookies are the coal deposits underground, and they need to use their tools (toothpicks) to remove as much of that coal as possible. Give them about 5 minutes to “mine” for chocolate chips.
4. After mining, students will sketch their cookie in two ways and answer the questions again, this time on the “After Mining” section of their worksheet:
 1. In the box on the left, they will make a sketch of their cookie.
 2. In the box on the right, they will compare the damage to the cookie and the “before” image of the habitat to predict what their imaginary habitat looks like now. Encourage them to be specific when drawing and writing about what damage occurred.

Share

In partners or table groups, students share their drawings and conclusions about the impact of mining on the environment.

Writing/Reading/Debrief

Have a discussion about the activity. Are the chocolate chips a renewable resource? Why not? What about coal? What is the problem with this? In their science notebooks, students write about the effects of mining on a habitat.

Lesson 3:

Prior to the lesson, hide 200 pennies around the room, some in pretty obscure places.

Anticipatory set Conduct a review of the activity with the chocolate chip coal. Ask students to remind you of what two main types of energy are (Renewable and Nonrenewable). Write these on a T-chart.

Teaching

Show the students a piece of coal. What is it? What is it used for? Lead them to classify it as a source of energy and to state that it must be burned in order to create energy. Next, blow on a pinwheel. What powers this? (Not only you, of course, but wind.) Ask the students which of the energy sources might be more likely to run out, and therefore where each energy source should go on the cart (coal to non, wind to renewable energy).

Guided practice/Hands-on Exploration

In partners, students will have several opportunities to go around the room finding pennies--which today represent coal. Give each partnership a plastic cup (please keep this to reuse next year!) and 30 seconds to go around the room to “mine” for them. In their science notebooks, students

should record how many pennies they found after the first round. Then, allow them two or three more rounds with the same instructions, making sure to record after each mining experience.

After the rounds of penny mining, you might want to ask the students to make a graph of the results.

Share

Bring the class together. What did they discover as they attempted to find pennies/coal in the later rounds? Did it get harder or easier to find the resource? Now that they've "mined" all the pennies, will more pennies generate?

Writing/Reading/Debrief

Students should write in their science notebook about the results of this investigation.

Lesson 4: A VTS-propelled science talk and writing

Engage

Project an image of [fracking](#) or [hydraulic gold mining](#) and conduct a little VTS discussion (for more on VTS, please speak to Ms. J.--I love it!--or go to the VTS [website](#)). Here's a brief outline of what to do:

Say, "let's take a quiet moment to look at this image" as you project the image.

Invite students to put their thumb up in front of their hearts when they have something to say.

Ask, "What's going on this image?"

As the student makes observations, "paraphrase" what s/he notices by pointing out what s/he's saying. When the student has finished, restate the observations. If there is something that you can productively question, ask "What do you see that makes you say that....(this is from the past/this has to do with mining/etc)?"

Then move on to another student, asking "What more can we find?" and follow the same steps of paraphrasing and probing. This could go on for up to fifteen or twenty minutes. You may of course use both images. The point is NOT to identify exactly what the images are, but to use observation and careful thinking to provide evidence for assertions about what's going on in the images.

Explain

After the discussion, give the students time to reflect (if they haven't already in the talk) about the connection with the work you've been doing for the past few lessons. Then, tell them what the image(s) is/are and briefly make parallels with coal mining

Explore

Having made the connection, guide the children to have a science talk about the problems associated with mining for nonrenewable natural resources. Use these [talk moves](#) to guide the talk (read more about science talks [here](#)). As the discussion unfolds, guide the students to think about what we might do with the knowledge of what occurs as a result of using these resources. Ideally students will be thinking of what they can do to consume fewer resources.

Extend

Challenge students to do some research on their chromebooks into how to consume less energy. They might want to look into other sources of energy or they might focus on what they and people they know can do personally.

Writing/Reading/Debrief

Following all this teaching and discussion, prompt students to write about what they've learned. They might wish to write an informational essay about the impact of nonrenewable resources, or they might want to write persuasive letters to people encouraging them to consume less.

Service Project: Letter to someone urging use of Renewable Energy; campaign at school and home to use less energy

Fun (?) Facts about Saving Energy

- A heavy coat of dust on a light bulb can block up to half of the light.
- Across America, home refrigerators use the electricity of 25 large power plants every year.
- A hot water faucet that leaks one drop per second can add up to 165 gallons a month. That's more than one person uses in two weeks. (Teacher can hold up a gallon jug to show how big it is.)
- An energy-smart clothes washer can save more water in one year than one person drinks in an entire lifetime!
- When you turn on an incandescent light bulb, only 10 percent of the electricity used is turned into light. The other 90 percent is wasted as heat. A compact fluorescent light bulb uses 75 percent less energy than a regular bulb – and it can last up to four years. (Teacher can show examples of both.)
- A crack as small as 1/16th of an inch around a window frame can let in as much cold air as leaving the window open three inches!
- Some new refrigerators are so energy-smart they use less electricity than a light bulb!
- An automatic dishwasher uses less hot water than doing dishes by hand - an average of six gallons less, or more than 2,000 gallons per year.
- Every time you open the refrigerator door, up to 30 percent of the cold air can escape.
- Every year, more than \$13 billion worth of energy leaks from houses through small holes and cracks. That's more than \$150 per family! Adapted from Alliant Energy/Powerhouse Kids; www.powerhousekids.com

5th Grade**CLIMATE CHANGE**

<https://betterlesson.com/lesson/633533/environmental-issues-global-warming>

<http://sciencing.com/simple-models-global-warming-science-projects-20316.html>

Lesson	Time	Scientific/ Engineering Practice	Cross-cutting Concept	Disciplinary Core Idea	Materials
1.What is global warming?	40 min	Asking questions; Obtaining, evaluating, and communicating information	Stability and change; Cause and effect; Systems and system models	If earth's global mean temperature continues to rise, the lives of humans and other organisms will be affected in many ways. (ESS3.D)	Book, website , video
2.Greenhouse effect demonstration and learning about impacts of greenhouse effect/global warming	50 min	Asking questions; Obtaining, evaluating, and communicating information; Developing and using models	Stability and change; Cause and effect; Systems and system models	If earth's global mean temperature continues to rise, the lives of humans and other organisms will be affected in many ways. (ESS3.D)	Two glasses Ice cubes Plastic bag
3.What can we do about it?	45 min	Defining problems	Stability and change; Cause and effect; Systems and system models	Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in global warming. (ESS3.D)	Ideas for what to do about it A Kid's Guide to Global Warming

Essential Question: What is global warming? What causes it? What can we do to stop it?

Lesson 1:

Anticipatory set

What do you know about Global Warming? TPS/KWL if you like--this will help guide research in the next step; or some kind of concept chart with which you and the kids have had experience might be a good way to document learning as well.

Guided practice/Hands-on Exploration

Students use chromebooks to explore [website](#) about global warming and take notes in science notebooks. They should be prepared to share three things they learned while looking at the website.

Share

In small groups, students share what they learned; then in a whole class discussion. Use these [talk moves](#) to guide the discussion. After that, watch the [video](#) about climate change.

Writing/Reading/Debrief

In their science notebooks, students write down three key new ideas from the day's lesson.

Lesson 2:

Engage What did we learn about global warming yesterday? TPS, discuss.

Explore

Talk to the students about making a model. A model is a way of simulating or showing a natural process. Today you will create a model of how a greenhouse works. Explain the following procedure to them as you prepare the materials, and have them write down the materials and steps in their science notebooks. Don't tell them what will happen--ask them to include in their notebooks their prediction as to what will happen to the two glasses and why.

MAKE A GREENHOUSE

The best way to understand how [a greenhouse works](#) is to make a small and simple one. Fill two glasses of equal size each with 2 cups of cold water. Put five ice cubes in each glass, then wrap one in a plastic bag and seal it tightly. Place both glasses in the sun for one hour, then measure the water temperature in each glass using a household thermometer. (The glass covered in plastic should be warmer because the bag will have trapped heat in the glass, in the same way that greenhouse gases trap heat in the atmosphere.)

Explain

Following the experiment, have the students record the different temperatures in their science notebooks and discuss why the glass covered in plastic was warmer. Help the students make the connection between the way the plastic trapped the heat in the glass and the way greenhouse gases (such as carbon dioxide and methane) trap heat in the atmosphere.

Extend

Give the students time to explore more about global warming and greenhouse emissions on line. Here are a couple of websites they might look into (though of course there are many more):

<https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

<https://climate.nasa.gov/causes/>

Share

Add to the KWL or concept chart you're keeping with a science talk about the day's model and what you found out on line.

Writing/Reading/Debrief

In their science notebooks, invite the students to write down what they think could be done to decrease the amount of emissions and thus the rate of climate change.

Lesson 3:

Anticipatory set

Have the kids read the newsela* [article on the Paris Climate Accord](#) on their chromebooks. TPS what are some things people are doing to try to slow global warming?

Teaching

Read aloud A Kid's Guide to Global Warming (????) and challenge the class to come up with some ways they could shrink their own carbon footprint or that of the school/their family.

Guided practice/Hands-on Exploration

Students return to their chromebooks and look into these websites:

<http://www.amnh.org/ology/features/askascientist/question05.php>

<http://www.amnh.org/explore/ology/climate-change/what-s-the-big-idea-about-climate-change2>

In small groups, they should come up with three or four things your class could do to make a difference at John Muir School/at home.

Share

Come together to chart your ideas (I think starting a Green Team at school to help raise awareness of need to sort waste would be a great, practical, satisfying thing to do, but I'm sure you and they will come up with other ideas).

Writing/Reading/Debrief

Students should spend some time writing in their science notebooks about one or two commitments they will make to reduce the emissions they are responsible for!

*I think you all have newsela accounts?

Additional resources/ideas for extension:

<https://scied.ucar.edu/activity/very-very-simple-climate-model-activity>

<https://sites.google.com/site/sed695b4/projects/longitudinal-research/cellular-respiration-anna-tavitian>

You could have your students write informational or persuasive pieces related to this topic.

Movement Study: watch the KQED piece on KT Nelson's *Dead Reckoning*. <https://www.youtube.com/watch?v=1N41d7BjShY&t=19s>

Create a short dance on one aspect of climate change (this could be a brainstorm/draft/share)

Service Project: Green Team/Cafeteria Helpers with 4th grade
Field Trip: Chabot Space and Science Center

Science and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

SEVEN CROSSCUTTING CONCEPTS OF THE FRAMEWORK

The committee identified seven crosscutting scientific and engineering concepts:

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
2. *Cause and effect: Mechanism and explanation.* Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, proportion, and quantity.* In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models.* Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. *Energy and matter: Flows, cycles, and conservation.* Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
7. *Stability and change.* For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.