OUR MELTING OCEANS: SOLID AND LIQUID WATER

SECOND GRADE
SUSTAINABILITY THEMED UNIT PLAN

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SUSTAINABILITY FOR YOUNG LEARNERS
COURSES

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STANDARDS

MAIN STANDARDS

2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid.

K-2-ETS1-1: Engineering Design - Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

STANDARD CONNECTIONS

2-ESS2-1 Earth's Systems - Connections to the Nature of Science, Crosscutting Concepts: Science addresses questions about the natural and material world. Scientists study the natural and material world.

2-ESS2-1 Crosscutting Concepts - Connection to Engineering, Technology, and Application of Science: Developing and using technology has impacts on the natural world.

Colorado Academic Standards: Second Grade, Standard 1: Physical Science. Grade Level Expectations: Matter exists as different substances that have observable different properties.

DESIRED RESULTS

OBJECTIVE

Students will describe that there is both solid and liquid water in the ocean and that ocean ice is melting faster due to climate change. Students will identify and learn about different solutions to mitigate climate change.

ESSENTIAL QUESTIONS

1. Can water be found in both a solid and liquid form?
2. Why does water melt?
3. Why are the ice sheets melting?
4. Is climate change caused by human activities?
5. What are some ways that humans can reduce their impact on the environment?

FACTUAL KNOWLEDGE

Students will learn:

1. Water on Earth can be found in both a solid and liquid state.
2. A basic understanding of climate change for their grade level.

PROCEDURAL KNOWLEDGE

Students will be able to:

1. Conduct an experiment showing when the outside air temperature or water temperature increases, solid water will melt into liquid water.
2. Identify which items can be composted and which items cannot be composted.

CONCEPTUAL KNOWLEDGE

Students will understand:

1. That human activity is causing climate change, which has led to ice sheets melting at a faster pace.
2. Several different solutions to climate change that the students can implement into their own lives.

PERFORMANCE TASK

Students will create a poster, either individually or in small groups. The poster will show:

1. Students' understanding that water is found in a solid and liquid form in the ocean. Students will draw ocean ice in a liquid state, solid state, and a melting state.
2. Different solutions that the students have identified to reduce their carbon footprint.

MATERIALS NEEDED

Materials	Lesson and Activity
"Our Oceans are Melting" – Final Project Poster/Worksheet • Option #1: Print out a copy of the paper titled "Our Ocean Ice is Melting" • Option #2: Provide students with a large piece of poster paper. Project the printout and have students draw the layout themselves. This option would be useful if the final project is intended to be displayed within the classroom.	Lesson #1, Activity #2.3 Lesson #5, Activity #1-2
Ice cube experiment: 1. Ice cubes – 10 to 14 pieces 2. Cooler 3. Bowls – 8 4. 8 cups of hot water 5. Thermos – to hold hot water 6. 8 cups of cold water 7. Hot and cold labels - 4 of each	Lesson #2, Activity #1
"Ice Cube Experiment" – Student Worksheet • One paper per student	Lesson #2, Activity #1.3
Composting 101 (Optional if compost is available. Photos provided if compost if not available) 1. Compost with large pieces of food waste 2. Compost that is halfway through the process 3. Finished compost 4. Bowls or jars to hold the compost	Lesson #3, Activity #1
"What Causes Climate Change and How to Help" – Student Worksheet • One paper per student	Lesson #3, Activity 3.2
Composting Hands on Demo 1. Print out the photos in the attached document titled, "Objects to print out for the composting demo" 2. Bin titled compost 3. Bin titled trash 4. Bin titled recycling	Lesson #4, Activity #1
"What to Compost" – Student Worksheet • One paper per student	Lesson #4, Activity 2.2
PowerPoint – Fully created PowerPoint outlining all of the information within the lesson, including the vocabulary words, links to all videos, photos, and screenshots of the in-class worksheets.	Lesson #1-5

LESSON #1: SOLID AND LIQUID BODIES OF WATER

LESSON TIME: 45 MINUTES

ACTIVITY #1 (25 MINUTES): VOCABULARY WORDS

Students learn about the lesson's vocabulary words. The teacher teaches the vocabulary word, uses it in a sentence, and then asks a question about the word.

Vocabulary words:

1. **Solid**: Having a firm shape or form that can be measured in length, width, and height.
2. **Liquid**: A form of matter that flows easily and can take on the shape of any container it is poured into.
3. **Melt / Melting**: To change from a solid to a liquid state.
4. **Ice sheet**: A thick layer of ice covering a large area for a long time.
5. **Climate change**: A change in global and regional climate patterns from humans burning fossil fuels, such as electricity or natural gas.
6. **Emissions**: Particles that are released into the air by the burning of fossil fuels.
7. **Climate**: The usual weather conditions in a place, over the course of many years.
8. **Weather**: The conditions outside right now or next week.
9. **Compost**: A mixture of decaying leaves, vegetables, or manure that is used to improve garden soil.

ACTIVITY #2 (20 MINUTES): VIDEOS/DISCUSSION AND STARTING ON THE POSTER

Activity #2.1 – Photos of ocean water in a solid and liquid state (5 minutes)

The teacher shows students photos on the PowerPoint provided, which shows photos of the ocean in both a solid and liquid state. The teacher can ask the students the following discussion questions while the students look at the photos.

Potential Discussion Questions to ask students while looking at the photos:

1. What do you see in the photos?
2. What type of plants and animals live in the ocean?
3. It is cold in parts of the ocean where there is ice?
4. Have you ever been to the ocean?

Activity #2.2 – Glacier video and discussion (5 minutes)

Students watch the video "Ilulissat Glacier, June 2007 - June 2009" to show how an ice sheet moves and deposits glaciers into the ocean. The ice sheet shown in the video flows at 125 feet per day, which is double the pace that the same ice sheet was moving 10 years ago. This ice sheet is "Greenland's single largest contributor to global sea level rise" (NASA Global Climate Change). After the video, the teacher can ask students some discussion questions.

Potential Discussion Questions to ask students after viewing the video:

1. What did you see happening in the video?
2. Is the ice sheet big or small?
    a. How do you know?
3. Does anyone know why this ice sheet is moving?

Video: "Ilulissat Glacier, June 2007 - June 2009" (51 seconds)

- Click here to watch the video
- Link to the video: https://climate.nasa.gov/interactives/global-ice-viewer/#/2/22

Activity #2.3 – Individual work on "Our Oceans are Melting" poster (10 minutes)
Students will start working on the poster titled "Our Oceans are Melting". They will draw and/or write a few words describing: solid ocean water, melting ocean ice, and liquid ocean water. The teacher can walk around the classroom and assist students as needed.

LESSON #2: HOW GLOBAL WARMING IS HEATING UP OUR EARTH

LESSON TIME: 45 MINUTES

ACTIVITY #1 (35 MINUTES): ICE CUBE EXPERIMENT

Activity #1.1: Describing the experiment to the students (5 minutes)

The teacher will describe the experiment to the students. Here is a script that the teacher can use to describe the experiment:

- Yesterday we learned the words solid, liquid, and melting. Can anyone tell me what solid, liquid, and melting means? [students answer these questions].
- We are going to conduct an experiment today where we will see for ourselves how ice melts when placed in warm and cold water. We will see which ice cubes will melt the fastest, depending on the heat of the water.

Activity #1.2: Conducting the Experiment (20 minutes)

Students conduct an experiment where they take two ice cubes and watch how the ice cubes in a cold environment would melt much slower than an ice cube in a warm environment. This activity is to show students how increases to air or water temperature will make the ice sheet and ocean ice melt much faster.

Experiment description, depending on the outside weather:

- One ice cube is put in cold water and another ice cube is put in warm/hot water. Students see the effects that the ice cubes have on warming oceans, where the hot water represents warming oceans. Photos of this experiment are shown on the PowerPoint.

Activity 1.2A: Setting up the experiment (5 minutes)

1. First set up two bowls in four different parts of the room.
2. Pour cold water into one of the bowls. Replicate this process for all of the other three stations.
3. Then, pour hot water into one of the bowls. Replicate this process for all of the other three stations. Note, this water just needs to be warm and not boiling. Bring warm water in a thermos or get hot water from the classroom's sink.
4. Have students write "hot" and "cold" on a scrap piece of paper and put this next to the bowl.
5. Have students put one piece of ice into each of the bowls.

Activity 1.2B: During the experiment (15 minutes)

1. The teacher will be keeping time and checking on the ice cubes every minute.
2. Students can watch and take note on how fast the ice melts depending on the water temperature. The students can fill out the worksheet titled “Ice Cube Experiment” while watching the experiment.
3. The class will discuss what is happening to the ice cubes in their own groups.
4. The students can stick their hands in the hot and cold water, to understand why the ice cube would melt more in the hot water versus the cold water.
    a. Note: The hot water should not be boiling for safety purposes. The water temperature of a warm/hot shower will be sufficient.

Activity 1.3: Filling out the worksheet (15 minutes)

Students fill out the worksheet titled “Ice Cube Experiment” during and after the experiment. While the students are filling out the worksheet, the teacher can go around the room helping students. Students that finish the assignment quickly can help clean up the experiment.

ACTIVITY #2 (10 MINUTES): MELTING OCEAN ICE DISCUSSION AND VIDEO.

Activity 2.1: Melting Oceans Discussion (5 minutes)

The teacher starts the activity by posing some discussion questions to the students related to the activity.

Possible discussion questions:

- What did you see happen during the experiment?
- Why did the ice melt faster in the hot water than in the cold water?
- What happens to ocean ice in the summer?
- What happens to ocean ice in the winter?
- If ocean temperatures rise globally, what will happen to the ocean ice?

After the activity is completed, students learn that it is natural for some ocean ice to melt in the summer. However, with temperatures increasing throughout the world, students learn that ocean ice is melting at a faster pace and is not re-freezing in the winter.

Activity 2.2: Optional Activity (time permitting): "Sea Level Rise Video" (5 minutes)
Optional video: NASA's Earth Minute: Sea Level Rise (1 minute, 30 seconds)
The video explains why oceans are rising and the impact that this will have on our Earth. If there is not enough time to show the video, Lesson #3 will go further into this topic.

- Click here to watch the video "NASA's Earth Minute: Sea Level Rise"
- Link to the video: https://www.youtube.com/watch?v=msnOHuPep9I

Discussion questions after the video:

1. What did you learn from the video?
2. Why are sea levels rising?
3. What do you think will happen if sea levels rise?

LESSON #3: INTRODUCTION TO CLIMATE CHANGE

LESSON TIME: 45 MINUTES

ACTIVITY #1: REVIEW (5 MINUTES)

Students will review the activity that took place during lesson #2 via a group discussion.

The teacher can ask the following questions during this review:

- What is solid water?
- What is liquid water?
- What is melting water?
- What did we do yesterday during our melting ice experiment?
- What did we learn from the melting ice experiment?

ACTIVITY #2 : CLIMATE CHANGE - MELTING THE ICE SHEETS (10 MINUTES)

Activity #2.1: Watch both videos (5 minutes)

Students watch the video titled "Oceans of Climate Change," which explains that our oceans are absorbing 80-90% of the extra heat in our atmosphere that is there because of humans burning fossil fuels.

Students then watch the video titled "Arctic Sea Ice Each September from 1979-2018," which shows that the area of Arctic ice has been getting smaller and smaller over the last 50 years.

Click here to watch the video "Oceans of Climate Change" (3 minutes, 39 seconds)

- Link to video: https://climatekids.nasa.gov/ocean/

Click here to watch the video "Arctic Sea Ice Each September From 1979-2018" (54 seconds)

- Link to the video: https://climatekids.nasa.gov/climate-change-evidence/

Activity #2.2: Discussion on the videos (5 minutes)

After watching the two videos, the teacher has a short discussion with the class regarding global warming and our oceans heating up. The teacher can ask these following guiding questions:

• What did you learn from the video?
• What happens when our oceans heat up?
• Why is it bad for our oceans to heat up?

ACTIVITY #3: SOLUTIONS TO CLIMATE CHANGE (30 MINUTES)

Activity 3.1: Discussing what causes climate change (15 minutes)

Student learn about different causes of emissions that lead to our world heating up.

- People are emitting tons are carbon dioxide and greenhouse gases into the atmosphere. Emissions are released by:
  - Driving combustion engine cars (gas powered cars)
  - Using electricity (aside from electricity from renewable sources)
  - Turning on the lights
  - Growing food (fertilizers used, transportation, water run-off, etc.)
  - Cow, chicken, and dairy production
  - Running appliances
  - Throwing away food instead of composting
  - Factories that produce different goods (e.g.: clothing, toys, appliances, furniture, books, cars etc.)

After this, students brainstorm different ways to reduce their use of emissions to reduce their impact on the environment. The options that the students come up with can be written on the white board to aid with the next activity.

- Potential solutions to climate change that students can do:
  - Turning off the lights when you leave the room
  - Unplugging appliances when not in use
  - Turing off the TV
  - Not driving in a car
  - Walking, riding a bike, or taking the bus to school or errands to reduce emissions released from driving
  - Reducing paper usage and reusing the back sides of paper
  - Reusing other items
  - Bringing reusable bags to the store
  - Bringing lunch in reusable containers
  - Using a reusable water bottle instead of a single-use plastic water bottle
  - Composting
  - Recycling
  - Eating less meat and dairy products (eating beef is one of the biggest contributors to greenhouse gas emissions in the USA)

Activity 3.2: Student Worksheet – What Causes Climate Change and How to Help (15 minutes)

Students will be given 15 minutes to fill out the worksheet titled, *What Causes Climate Change and How to Help*.

- Note that this is a two-sided worksheet.

In the worksheet, students will be given four photos, which shows a problem affecting climate change. Students will use the word box titled "Problems Word Box" and match the four answers to the photos shown. Then, students will use the "Solutions Word Box" to find the solution that can help with that problem. Students will need to then draw a photo that shows the solution. An example is provided for the students within the document.

LESSON #4: COMPOSTING 101 – INFORMATION, ACTIVITY, AND WORKSHEET

LESSON TIME: 45 MINUTES

Information about composting: When food is thrown into the garbage, it releases methane, which is a harmful greenhouse gas that heats up the earth. Composting reduces the release of methane, saves room in the landfill, and gives back the food waste's nutrients to the soil to create a regenerative process.

How this relates to the unit: The methane released from food sent to the landfill is one contributor to why our earth is heating, and thus why our ocean ice is melting and sea levels are rising.

ACTIVITY #1 (25 MINUTES): COMPOSTING 101

Activity 1.1: "Composting for Kids" video (10 minutes)

Students will start by watching the video titled "Composting for kids." This video goes over why composting is important, shows what can be composted, and explains a school composting system.

After the students watch the video, the teacher will engage the students in a short discussion about composting and the benefits of composting.

Potential questions to ask, with answers:

- What is composting?
  - Answer: Turning food scraps, sticks, and leaves into soil that is rich in nutrients.
- Why is it important to compost?
  - Answers: Composting gives back nutrients to the soil.
  - Composting saves space in the landfill.
  - Composting does not harm our ground water.
  - Composting does not release toxic emissions, which leads to global warming and melting the ice sheets.
- Does anyone compost at home?
- Do we compost here at school?

Click here to watch the 'Composting for Kids" video (5 minutes, 56 seconds)

• Link to the video: https://www.youtube.com/watch?v=dRXNo7Ieky8

Activity 1.2: "How Compost is made Video" (10 minutes)
Students are shown the video "How Compost is Made," which goes over how food scraps turn into useful soil. This video goes into the compost bin and shows how different organisms breaks down the compost via an animated video. After the video, the teacher can ask the students what they learned from the video.

Click here to watch the "How Compost is Made" video (6 minutes, 30 seconds)

- Link to the video: https://www.recyclenow.com/recycle/recycle-school/composting/how-compost-made

Activity 1.3: Composting Stages - Showing students compost (5 minutes)
Students will be shown different stages of compost in order for the students to visually see and understand the decomposition process.

- If composting is available: Students will be shown different stages of composting within the classroom. Students will be shown compost that has not yet been broken down, compost that is in the process of being broken down, and compost that is ready to use.
- If compost is not available: Photos of different stages of compost are provided within the PowerPoint.

ACTIVITY #2 (20 MINUTES): COMPOSTING HANDS-ON DEMO AND WORKSHEET

Directions: The teacher will work with small groups of students and have them participate in a hands-on composting activity. The rest of the class will be working independently on the "What to Compost" worksheet. The teacher will pass out the worksheet to each student and explain the worksheet. Then, the teacher will work with small groups on the composting hands-on activity.

Activity #2.1: Composting hands-on activity
Students participate in a composting demo and activity, where they sort out what can and cannot be composted. For the items that cannot be composted, the students will put these items either in the trash or recycling bin. Photos for this activity can be found in the last section of this unit plan titled, "Objects to print out for the composting demo" along with an answer sheet. The activity will take roughly 4-5 minutes per group.

Activity #2.2: What to Compost Worksheet

While small groups of students are participating in the composting hands-on demo, the other students are working independently on the handout titled, "What to Compost." Students will need to draw different items that can be composted. On the worksheet, there are a few items, which gives students a general idea of what to draw. Student can draw any type of edible food, without the wrapper, along with natural items such as leaves and sticks.

- Please note that what can go in the compost bin at school, which is typically processed through a commercial compost system, is different than what can go into a backyard compost pile. Backyard compost piles should not have any meat, dairy, or bread products. This is because it attracts unwanted animals to the bin. Additionally, commercial composting facilitates get warm enough to break down these meat and dairy products much quicker and more efficiently than a backyard system.

LESSON #5: WRAP-UP AND PRESENTATION

LESSON TIME: 45 MINUTES

ACTIVITY #1 (15 MINUTES): POSTER COMPLETION

Students will be given time to complete the last two boxes on the "Our Oceans are Melting" poster. Here, the student will write the name of the solution to climate change/ocean ice melting and also draw a photo of their solution on the poster.

ACTIVITY #2 (25 MINUTES): STUDENT PRESENTATION TIME

Students present their poster to the class, particularly discussing how ocean ice melts and their solutions that they came up with. Each student should talk for 30 seconds to one minute. Students can speak from their desks depending on time and how many students are in the classroom.

Each student can discuss the following points and can use their posters as a guide:

- How ocean water can be found in both a solid and liquid form.
- When it is hot, ice melts from a solid to a liquid form.
- Human activities are leading to ice sheets melting.
- Discuss ways that they (the student) can reduce their impact on the environment.

ACTIVITY #3 (5 MINUTES): FINAL DISCUSSION.

Students have a final discussion about the things that they learned this week. The teacher can use the following questions to guide the discussion, which are the essential questions from this unit:

- Can water be found in both a solid and liquid form?
- Why does water melt?
- Why are the ice sheets melting?
- Is climate change caused by human activities?
- What are some ways that humans can reduce their impact on the environment?

TEACHER RESOURCES

This section contains resources for teachers to learn more about the environmental and sustainability topics presented within this unit plan. If you need more information regarding why climate change, sustainability, and environmental literacy should be taught within elementary schools, please email the content creator of this unit plan for more information.

INFORMATION ON COMPOSTING

Article: Why Should I Compost?

- A short article explaining why composting is important for saving resources, improving soil health, reducing impacts on the environment, and saving money.

Video: How Composting Helps to Save the Environment

- This 3-minute video goes over why composting is a helpful climate mitigation tool. More than 50% of the waste that we throw away can be composted. When food and yard scraps end up in the landfill, the food scraps naturally release liquids, which mixes with other harmful chemicals inside the landfill, which creates a liquid called leachate. This leachate is very harmful if exposed to groundwater, which could lead to water contamination.

INFORMATION ON ICE SHEETS MELTING

Article by National Snow and Ice Data Center: Quick Facts on Ice Sheets

- This short article covers what ice sheets are, how they form, and how climate change is already impacting the ice sheets.

INFORMATION ON GLOABL WARMING

Article by NASA: The Causes of Climate Change

- This article explains the root causes of climate change, explains the greenhouse effect, and discusses the various gasses which most contributes to climate change.
- “In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change, a group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded there's a more than 95 percent probability that human activities over the past 50 years have warmed our planet.”

Video and Article by The Royal Society: The Basis of Climate Change

- Article contains a one-minute video titled “Climate Change in 60 Seconds.” The article covers the scientific claims that the Earth has been heating at a much faster pace since the start of the Industrial Revolution, where humans began to utilize and burn fossil fuels.
- “Many other impacts associated with the warming trend have become evident in recent years. Arctic summer sea ice cover has shrunk dramatically. The heat content of the ocean has increased. Global average sea level has risen by approximately 20 cm (8 inches) since 1901, due both to the expansion of warmer ocean water and to the addition of melt waters from glaciers and ice sheets on land.”

OUR OCEAN ICE IS MELTING

Name: _____

Direction: In the boxes below, draw solid, melting, or liquid ocean water in each box.

Solid Ocean Water	Melting Ocean water	Liquid Ocean Water

Directions: Draw or write two solutions how we can help the ocean ice from melting.

Solution #1:	Solution #2:

ICE CUBE EXPERIMENT

Name: _____

Describe the experiment: _____

_____

_____

Direction: Draw photos of what you see during each part of the experiment.

Cold Water

Start of the experiment	Middle of the experiment	End of the Experiment

Warm Water

Start of the experiment	Middle of the experiment	End of the Experiment

Results – Describe what you learned: _____

_____

_____

_____

WHAT CAUSES CLIMATE CHANGE & HOW TO HELP

Name: _____

Directions: Using the Problems Word Box, match the problems in the word box to the problems shown in the photo. Then, using the Solutions Word Box find a solution to solve the problem and draw a picture of the solution.

Problems Word Box

Driving a car	Throwing away food in the trash can
Using electricity when you do not need it	Buying things you do not need
~~Leaving the water running while brushing your teeth~~	

Solutions Word Box

Buying only things that you need	Turning off the lights when you leave the room
Riding a bike or taking the bus	Composting food waste
~~Turing off the water when you brush your teeth~~	

Example:

Problem	Solution
	
Problem: Leave the water running while brushing your teeth	Solution: Turning off the water when you brush your teeth

Problem	Solution
	
Problem:	Solution:

WHAT CAUSES CLIMATE CHANGE & HOW TO HELP

Problem	Solution
 Problem:	Solution:
 Problem:	Solution:
 Problem:	Solution:

WHAT TO COMPOST

Name: _____

Directions: In the box below, draw different items that can be put into the compost bin.

School Compost Bin

OBJECTS TO PRINT

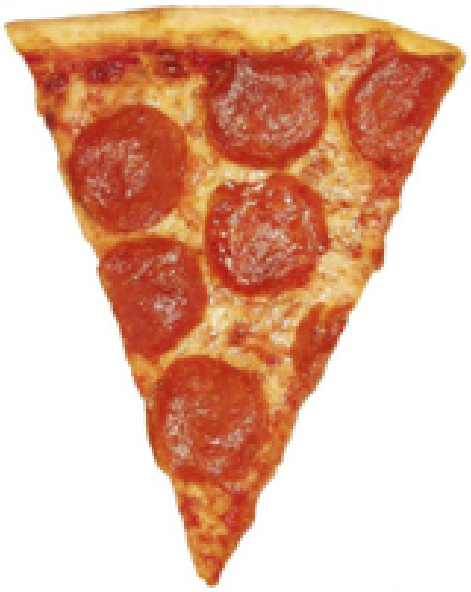
Objects to print for the composting activity.

Key for composting activity

Compost	**Recycling**
Blueberries	Plastic water bottles
Banana Peel	Plastic applesauce container
Applesauce	
Hamburger	
Chicken Tenders	**Trash**
Carrots	Fruit Rollup Package
Half eaten PB&J	Starburst package
Pizza	Plastic sandwich bags
Bread	Milk cartons
Orange peels	Spork
Apple juice	Fruit squeeze packs (packaging)
Apple core	Styrofoam tray
Salmon and Pasta	Plastic wrap
Cookies	
Pretzels	

OBJECTS TO PRINT

OBJECTS TO PRINT



OBJECTS TO PRINT

OBJECTS TO PRINT