

Powered by the Sun



Unit 5
The Natural
World



Lesson Plan

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Smithsonian

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Answer Key: *Powered by the Sun*

page 10—Where Did You Learn It?

Sample responses are shown.

	What the Image Shows
Sunflowers	The solar panels are set in rows in the shape of a circle.
Electricity	Mirrors take in heat from the sun; power lines bring electricity to homes.
Solar Oven	A solar oven can be shaped like a large dish; a solar oven has many mirrors inside it.
Butterfly Wings	The wings of the butterfly have small patterns of holes; solar panels are also made with patterns of holes.

page 11—Favorite Innovation

Student responses should include a sun-inspired innovation and supporting reasons for why it is their favorite.

page 17—*Powered by the Sun* Quiz

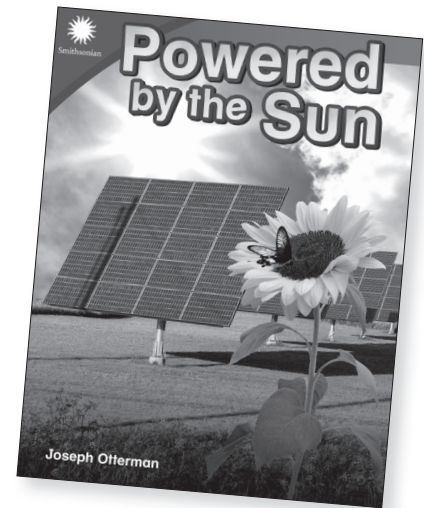
1. C
2. A
3. C
4. Student responses may include: solar bags, solar panels, and solar ovens.

Powered by the Sun

Materials

- ▶ *Powered by the Sun* books
- ▶ copies of student activity sheets (pages 9–19)
- ▶ **STEAM Challenge materials include but are not limited to the following:**
 - ✓ aluminum foil
 - ✓ cardboard boxes or pieces
 - ✓ crayons*
 - ✓ dowels or sticks
 - ✓ empty containers (plastic cups, butter tubs, etc.)
 - ✓ paper bowls
 - ✓ wax paper

**off-brand crayons may melt faster*



Learning Objective

- ▶ **Reading:** Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.
- ▶ **Writing:** Write opinion pieces in which they introduce the topic or name the book they are writing about, state an opinion, supply a reason for the opinion, and provide some sense of closure.
- ▶ **Speaking and Listening:** Participate in collaborative conversations with diverse partners about grade appropriate topics and texts with peers and adults in small and larger groups.
- ▶ **Engineering:** Define an engineering problem, design and evaluate solutions, and optimize a design based on test results.

Phenomena

The sun gives off heat; sunflowers follow the sun.

Lesson Timeline

Day 1	Day 2	Day 3	Day 4	Days 5–10
Introductory and Before Reading Activities (page 4)	During Reading Activities (page 5)		After Reading Activities (page 5)	STEAM Challenge and Assessments (pages 6–8)
Define the STEAM Challenge and preview the text and images in the book.	Research how the sun can be used to power inventions, identify information provided in the text and images, and brainstorm design solutions.		Write opinions about sun-powered innovations.	Design, build, test, improve, reflect on, and share solar devices. Complete the assessments.

Powered by the Sun (cont.)

STEAM Vocabulary

electricity
solar panel

lenses
turbines

Introductory Activity

Define the Problem

1. Generate student interest in the topic by telling a couple of jokes about the sun.
Q: Why did the sun go to school?
A: To get brighter!
Q: What does the sun drink out of?
A: Sunglasses!
 ▶ Discuss the play on words used in each joke.
2. Display the cover of *Powered by the Sun*. Have students share any background knowledge they have about the solar panels and sunflower shown in the photograph.
3. Distribute the *Powered by the Sun* books to students. Reveal the STEAM Challenge by reading aloud to students pages 20–21 of the book.
 ▶ Display the Interactiv-eBook for a more digitally enhanced introduction to the challenge.
4. Distribute *Make a Plan* (page 9) to students. Have them summarize the STEAM Challenge. Summaries should include all the goals of the challenge.
 ▶ **Support** students with the following sentence frame to help them summarize:
Create a device that will _____ using _____.

Before Reading

1. Write the vocabulary words on the board. Have students discuss what they think the words mean and where they may have heard them before.
 ▶ Explain the meaning of each word. Show students pictures related to the words. (Pictures from the glossary or main body of the book may be used in addition to pictures found online.)
2. Write the following related words on the board: *power, help, technology, and flow*.
 ▶ Ask students which words relate to each vocabulary word. Accept any grouping as long as students can provide a logical explanation.
3. Flip through the pages of *Powered by the Sun* as you display the book for students to see. Identify the main text and images on each page. Discuss with students how the photographs and illustrations are carefully chosen to directly support the text or give the reader additional information. Tell students that when reading, they can use both the text and the images to support their understanding of the topic.
 ▶ Point out the captions and explain how they support the images.

Powered by the Sun (cont.)

During Reading

Research and Brainstorm

1. Distribute the *Powered by the Sun* books to students. Read the text aloud as students follow along. Stop to discuss what information is learned in the text and what information can be learned from the images.
 - ▶ Display the Interactiv-eBook for a more digitally enhanced reading experience. You may wish to have students annotate the PDFs as you read.
 - ▶ Play the audio recording as students follow along to serve as a model of fluent reading. This may be done in small groups or at a listening station. The recording will help **English language learners** practice fluency and aid in comprehension.
2. Distribute *Where Did You Learn It?* (page 10) to students. Have students reread the books in small groups, taking turns reading pages. Have them complete their activity sheets, telling what they learn from the images.
3. Have students brainstorm and discuss the STEAM Challenge with some guiding thoughts or questions (e.g., *What do you need to make crayons melt? How can the sun help? What size, shape, or materials will work best?*). Record their ideas on a sheet of chart paper.

After Reading

1. Review the vocabulary words in the glossary on pages 22–23 of the book. Have students return to the main body of the text to review the context in which each vocabulary word is used.
 - ▶ electricity (page 12)
 - ▶ lenses (page 17)
 - ▶ solar panel (page 7)
 - ▶ turbines (page 12)
2. Tell students that even though the sun is 93 million miles away, people have figured out ways to use the sun to help us. Brainstorm a list of the innovations described in the book. Refer back to the book as needed to identify the innovations.
3. Distribute *Favorite Innovation* (page 11) to students. Have students name their favorite sun-inspired innovation to the group and explain why it is important.
 - ▶ Have students write individual pieces, or group students who identified the same innovation as their favorite to work together to write about it.
 - ▶ **Support** students as needed by creating and filling out a chart on chart paper as students suggest ideas. Students can use this chart to help fill out their own.



Powered by the Sun (cont.)

Prep

- ▶ Review all designs prior to building.
- ▶ Prepare all materials for the STEAM Challenge.
- ▶ If doing the STEAM Challenge with multiple groups at once, you may choose to invite volunteers to help monitor and facilitate group work.

STEAM Challenge

Design and Build

1. As a group, discuss the following questions to connect the reading to the STEAM Challenge:
 - ▶ *Why are the solar panels on pages 10–11 arranged in a circular pattern?* Review the photograph and reread the text. Guide students to recall that based on what had been learned from studying sunflowers, the solar panels were arranged in the same shape as the sunflowers.
 - ▶ *What shape is the solar oven shown on page 15?* Have students describe the shape of the solar oven. Point out how the circular, rounded shape helps reflect the sun's rays to the item that needs to be heated. Ask students to consider if and how that will influence the shape of their design.
2. Review the STEAM Challenge on pages 20–21 together. List materials on the board, and allow students to preview the materials they will have to work with.
 - ▶ Look at the weather forecast together, and decide on the best day and time for testing.
3. Ask students to independently sketch and label two designs on their *Make a Plan* activity sheets. Encourage them to label their designs with materials.
4. Organize students into teams. Distribute one copy of *Team Designs* (page 12) to each team. Ask teams to have members share their designs. Then, have each team choose, sketch, and label a team design.
 - ▶ Review team designs and offer guidance as needed.
 - ▶ **Challenge** students by adding goals (e.g., the crayons must melt within a time limit or the solar devices must use certain shapes).
5. Explain to students that they must follow their design plans when they build their models. Reassure them that they will have an opportunity to change and improve their designs after they present them. Review classroom expectations for working with materials. Then, give teams time to gather materials and build their solar devices.
 - ▶ Digitally record students' processes to share at a later date with students and parents.
6. Distribute *Think about It* (page 13) to each student. Explain that reflection is an important part of the engineering design process. Read aloud number 1 on the activity sheet and have students write their responses. Ask volunteers to share.

Powered by the Sun (cont.)

Prep

- ▶ Review all designs prior to building.
- ▶ Prepare all materials for the STEAM Challenge.

STEAM Challenge

Test and Improve

1. As a group, discuss the following questions to connect the reading to the STEAM Challenge:
 - ▶ *How do scientists know how to use the sun?* Reread page 6 and point out how scientists test its energy to learn about it. Tell students they will test their solar devices to learn about them and try to make them better.
 - ▶ *What are some different things scientists have done with solar panels?* Review how solar panels are put on many different items, such as homes, backpacks, boats, and cars. Students will act like scientists as they brainstorm new ideas while testing their solar devices.
 - ▶ *How many crayons will go in each solar device, and where will the devices be placed?*
 - ▶ *How long will the solar devices be outside? What time(s) will students check them?*
 - ▶ *What will be considered successful? Do the crayons have to melt completely or only a little?*
2. Gather teams for testing. Explain that teams will offer feedback after the test. Use *Friendly Feedback* (page 14) to review best practices for giving feedback.
3. Distribute *Sun-Powered Test Results* (page 15) to students, and ask them to record results for each team.
4. Explain to students how the challenge will work. Tell students that each team will place unwrapped crayons inside their solar devices and then place them in the sun. Determine and explain the following factors on your own or with student input:
 5. When testing is complete, allow each team to present their solar devices and share their results. Ask volunteers to give feedback.
 6. Provide time for teams to brainstorm ways to improve their designs based on test results and feedback. Refer students back to their *Team Designs* activity sheets. Ask them to sketch their improved designs and explain any changes.
 - ▶ Review improved designs and offer guidance as needed.
 - ▶ **Challenge** successful teams with additional goals for the second design (e.g., increase the number of crayons or try to melt something different).
 7. Have teams gather materials to improve their designs. Then, have them make their improvements and retest their solar devices.
 8. Have students complete numbers 2 and 3 on their *Think about It* activity sheets.

Powered by the Sun (cont.)

STEAM Challenge

Reflect and Share

1. Assign each team member a different number. Ask the 1s to form a group, the 2s to form a group, and so on. Each person in these new groups will share answers 1–3 from their *Think about It* activity sheets, giving students the opportunity to hear about the processes and discoveries made by other groups.
2. Ask groups to think about and discuss which materials or designs worked the best and why that might be.
3. Have students complete number 4 on their *Think about It* activity sheets.
4. Distribute *Engineering Design Process* (page 16) to students, and review how they used each step to complete the challenge. Annotate the infographic together with details specific to this challenge.
5. Read “Career Advice” on page 24 of the book. Ask students to brainstorm other tips for a career using the sun to power innovations.

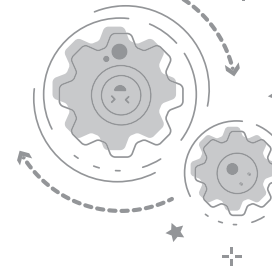
Assessment Activities

1. Have students complete a short posttest, *Powered by the Sun Quiz* (page 17), to assess this lesson’s reading objective.
 - Students may use the Interactiv-eBook activities in the Digital Resources for assessment purposes (optional).
2. Have students complete *Teamwork Rubric* (page 18) and *Engineering Design Process Checklist* (page 19) to reflect on and evaluate their work and collaboration skills.
3. Have students complete the Think and Do questions from the book.



Name: _____

Date: _____



Make a Plan

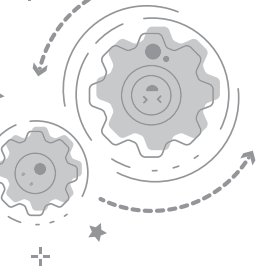
Directions: Write the challenge in your own words. Sketch two designs. Then, circle the one you like best.

Challenge: _____

Design 1

Design 2

Two large dashed rectangular boxes for sketching designs. A large diagonal watermark reading 'SAMPLE' is overlaid across the center of the page.



Name: _____

Date: _____

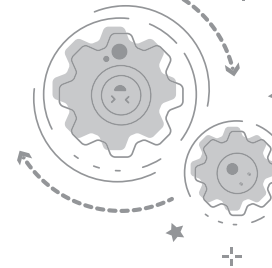
Where Did You Learn It?

Directions: Read one thing the text says in each section. Then, look at the images. Write or draw what you learn.

Section	What the Text Says	What the Image Shows
Sunflowers	They face the sun as they grow.	
Electricity	We can use energy from the sun to make steam.	
Solar Oven	People have learned to cook with the sun.	
Butterfly Wings	They grab energy from the sun.	

Name: _____

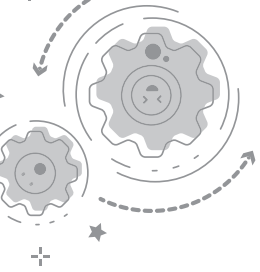
Date: _____



Favorite Innovation

Directions: Choose a new device or idea from the book. Draw it. Write about why it is your favorite.

Is AMP LE



Team Members: _____

Date: _____

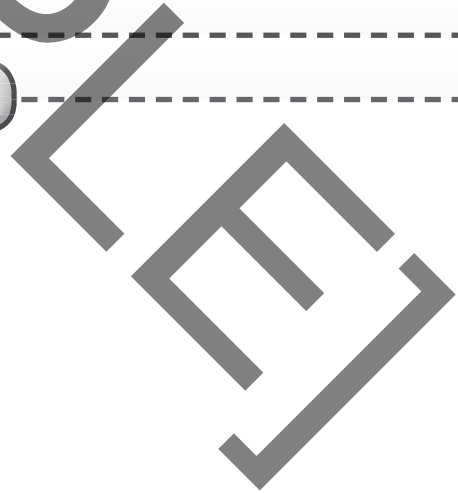
Team Designs

Directions: Sketch your team's design in the first box.
Sketch your team's new design in the second box.

Design 1

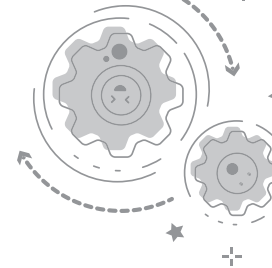
SAMPLE

Design 2



Name: _____

Date: _____



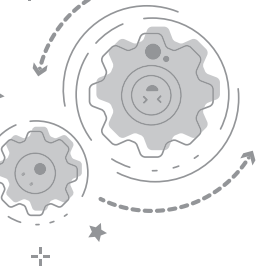
Think about It

1. I helped my team when _____

2. Our plan (worked/did not work) because _____

3. Our second plan was (better/worse) because _____

4. My favorite part was _____



Name: _____

Date: _____

Friendly Feedback

Directions: Feedback from others can help you. Use these sentence stems. Give feedback to your peers.

Clarify

Why did you _____ ?

How did you _____ ?

Warm Feedback

I like _____ because _____ .

_____ is a good idea because _____ .

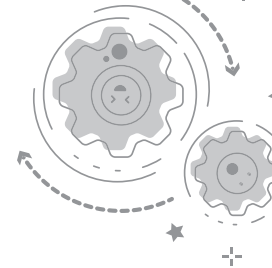
Cool Feedback

Have you thought about _____ ?

You might want to try _____ .

Name: _____

Date: _____

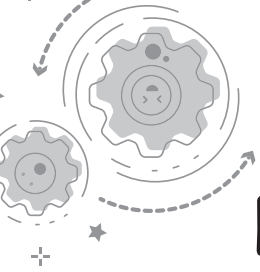


Sun-Powered Test Results

Directions: Record the results of each team's test. Look at the crayons. Write or draw what you notice. Then, answer the questions.

Team	Did the crayons melt?	What do you notice?
	yes no a little	
	yes no a little	
	yes no a little	
	yes no a little	
	yes no a little	

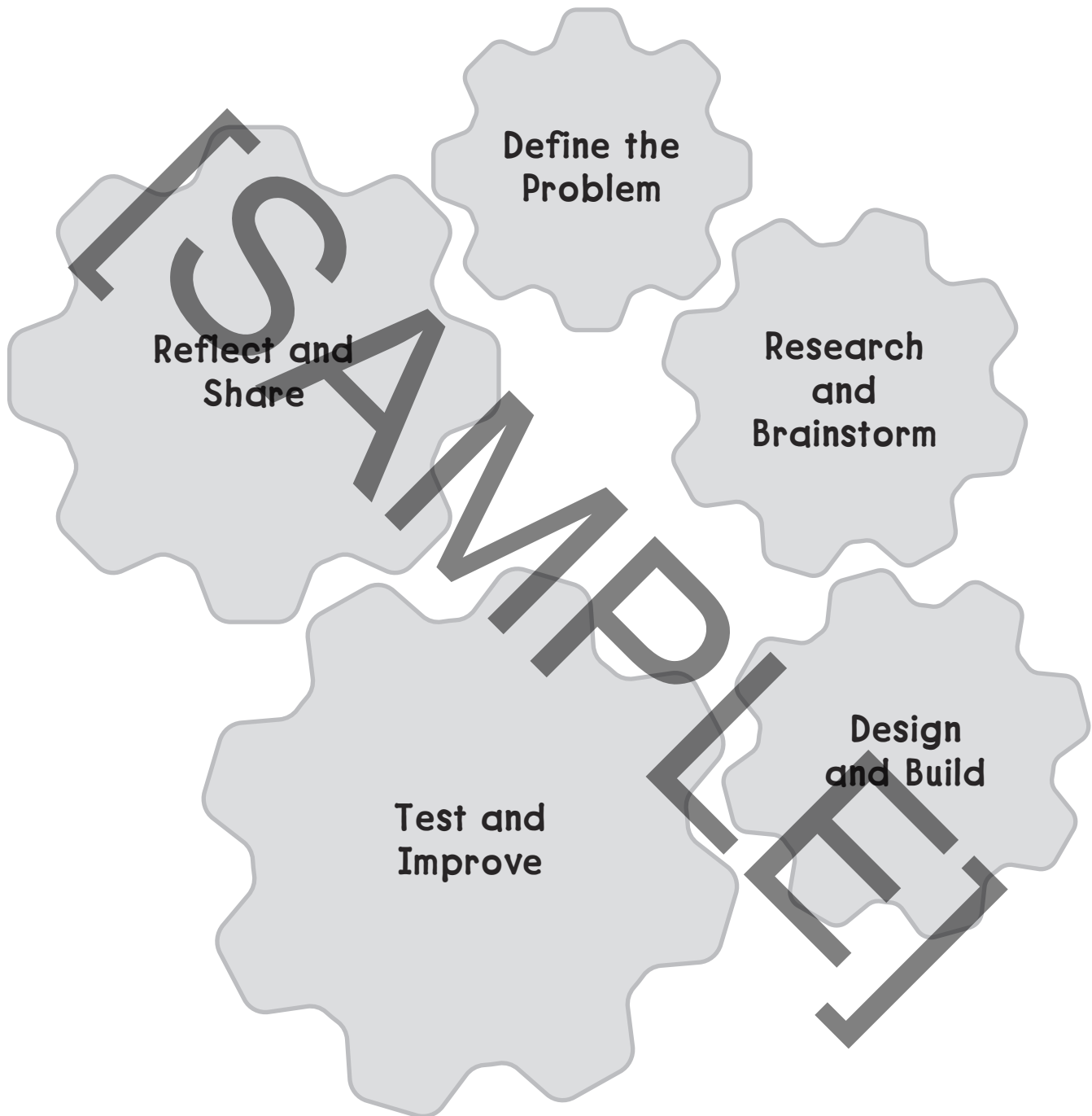
What material do you think was the most helpful?



Name: _____

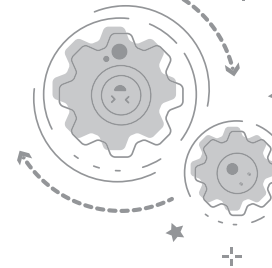
Date: _____

Engineering Design Process



Name: _____

Date: _____



Powered by the Sun Quiz

Directions: Read each question. Fill in the bubble for the best answer. Then, answer the last question.

1. What do we NOT get from the sun?

- ☐ (A) light
- ☐ (B) heat
- ☐ (C) ideas
- ☐ (D) energy

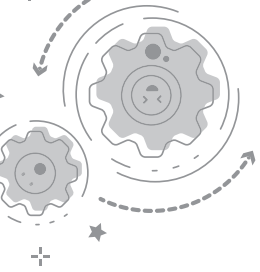
2. Why do sunflowers move in the day?

- ☐ (A) to follow the sun
- ☐ (B) to move turbines
- ☐ (C) to make electricity
- ☐ (D) to make iced tea

3. The sun gives off _____ that can be used to cook.

- ☐ (A) electricity
- ☐ (B) lenses
- ☐ (C) heat
- ☐ (D) mirrors

4. What has been made from studying the sun?







Name: _____

Date: _____

Teamwork Rubric

Directions: Think about how you worked in your team.
Score each item on a scale of 4 to 1.

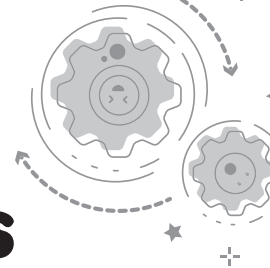
4 = Always 3 = Often 2 = Sometimes 1 = Never

 I listened to people on my team.	4	3	2	1
 I helped people on my team.	4	3	2	1
 I shared ideas with people on my team.	4	3	2	1
 We made choices as a team.	4	3	2	1
Total				

Teacher Notes: _____

Name: _____

Date: _____



Engineering Design Process Checklist

Directions: Read the list. Check the boxes to show what you did.

Define the Problem

- ☐ I wrote the problem in my own words.

Research and Brainstorm

- ☐ I read a book and thought of ideas.

Design and Build

- ☐ I planned and made a model.
- ☐ I thought about shape, size, and/or weight in my design.

Test and Improve

- ☐ I tested a design.
- ☐ I improved a design.
- ☐ I thought about shape, size, and/or weight in my design.

Reflect and Share

- ☐ I shared my results.



STEAM CHALLENGE



Research and Brainstorm

What is the best way to melt crayons in the sun? How long does it take for crayons to melt?



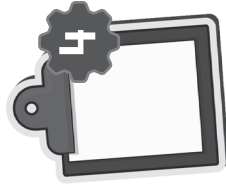
Design and Build

Draw your plan. How will it work? What materials will you use? Build your device. Be careful not to burn yourself!



Test and Improve

Remove the paper from the crayons. Place the crayons in your device. Place your device outside. Do the crayons melt and blend? Can you make it better? Try again.



Reflect and Share

How many pieces melted? Do some colors melt faster than other colors? Do the new crayon blends work well?

The Problem

Your art class is stuck with broken crayon pieces. Your job is to make new crayons by melting and mixing the old bits. You must use the sun to make it happen. What will you do?

The Goals

- Create a device that will use the sun to melt crayons together.
- Create an area in your device that can hold the crayons.
- Create your device with any supplies. A box, aluminum foil, and wax paper might be helpful.

