Lesson 10: Sundial Design
The View from Earth
5th Grade Earth/Space Science/ELD

How can we engineer a solution for a specific client?

Overview	**Total Time: 80 min**

Over 2 class periods, students learn about how a sundial works in a short video, select a client to design, build, and test a sundial to meet the needs of a client using various prototyping materials. Students share their designs with another group and discuss their successes and challenges with engineering a sundial

Language focus is on explaining and communicating experiences from the design process.

Unit essential question: *How do we know the Earth is moving?*
Lesson guiding question: *How can we engineer a solution for a specific client?*

Learning Targets	**Formative Assessment**
• I can design and test solutions to a problem in order to come up with a final product. • I can communicate about my experiences during the design process.	•

Materials

Teachers:	**Students:**
• Client Challenge Cards	For the class: • Cardstock • Hot glue guns • Hot glue sticks • Duct tape • Recyclable materials • Felt or fabric pieces • Velcro • Masking tape For each PAIR of students: • Scissors • Client Challenge Cards

Lesson Preparation

Begin to collect recyclable material from students at least 3 days before the lesson to have enough materials. Recyclable materials that are good for this project are: Plastic boxes, thin

cardboard boxes, yogurt containers, and egg cartons.

Print the Client Challenge Cards for student groups to decide on which client they would like to design and build for.

Science Vocabulary	Cross-Disciplinary Vocabulary
• Sundial • Engineer	• Build • Design

Standards Addressed	
NGSS	**ELP**
3-5.ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. Constructing explanations and designing solutions Influence of science, engineering, and technology on society and the natural world **3-5.ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. Planning and Carrying Out Investigations	1 - Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing 2 - Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions 3 - Speak and write about grade-appropriate complex literary and informational texts and topics 4 - Construct grade-appropriate oral and written claims and support them with reasoning and evidence 5 - Conduct research and evaluate and communicate findings to answer questions or solve problems 6 - Analyze and critique the arguments of others orally and in writing 7 - Adapt language choices to purpose, task, and audience when speaking and writing The last three ELP standards should be addressed throughout instruction: 8 - Determine the meaning of words and phrases in oral presentations and literary and informational text 9 - Create clear and coherent grade-appropriate speech and text 10 - Make accurate use of standard English to communicate in grade-appropriate speech and writing

Connection/Opening	**Time: 10 min**
1. Introduce the problem (5 min): Ask Students: For our engineering task, we need to design a sundial. First, we need to know, what is a sundial? Students Think-Pair-Share about what a sundial is or does. Display the definition of a sundial and show pictures of sundial examples. Show the video on how a sundial works. In pairs, students choose which Client Challenge Cards they would like to design a sundial for. • Client 1: Needs a sundial that is wearable. • Client 2: Would like a sundial for their garden. • Client 3: A teacher would like a sundial that can be used in science class and easily packed up. • Client 4: The school would like a sundial so kids can tell time when there is not any power.	
Activity	**Time: 60 min**
2. Sketch design ideas (20 min): **Teacher talk:** *Quickly sketch two of your own ideas on how to solve the client's problem.* Students then pair-share their best idea with their partner and create a collaborative sketch that incorporates ideas of each partner. Students are able to get materials after sharing their sketch with the teacher. **Ask students:** *How did you include each other's ideas in your sketch? Which materials will you start with first?* **3. Build and test (40 min):** Setup an area in the room for students to test their sundial designs with a lamp to be the sun in a place in the room. Encourage students to test often and return to redesign. Circulate among the groups to ensure students are both building and testing. **Ask students:** *"What has worked for you so far?" "What is a challenge you have had to figure out? How did you solve the problem?" "What is your plan to test to see if your design is working?" "What did you find out when you tested it out?"*	
Closing	**Time: 15 min**
4. Student presentations (15 min): **Teacher Talk:** Pair student groups up with another group. Each group presents their client problem, their current design, problems they had with the design and how they solved it, and what they would do next if there was more time.	

Possible Stems:
Our client wants a sundial that...
Our current design is...
One problem we had is...
We fixed the problem by...
If we had more time, we would...

Supplementary Materials

More sundial information for students or teachers:
SciShow Kids Make Your Own Sundial

Challenge Card #1	Challenge Card #2
Client Name: Raoul Needs: • Works outside • Wants something to tell time that doesn't need a battery or power • Wants something to wear • Will be used every day Design Challenge: Design and build a wearable sundial.	Client Name: Christine Needs: • Works outside • Wants something that adds beauty to her garden • Can be no larger than 1 foot by 2 feet • Will be used every day Design Challenge: Design and build a sundial for their garden.
Challenge Card #3	Challenge Card #4
Client Name: Shawntae Needs: • Works outside • Will last with many students using it • Can be easily moved for science experiments • Can be packed away when it is not in use Design Challenge: Design and build a sundial for a science teacher.	Client Name: Louis Needs: • Works outside • Will last with many students using it • Represent the school (colors, mascot, slogan, etc) • Will be in front of the school Design Challenge: Design and build a sundial for the school.