

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

Storyline introduction and overview:

Solar energy in the form of light is available to organisms on Earth in abundance. In this storyline, students explore cultural connections with the sun, learn about light and discover how light interacts with other materials through hands-on activities, literacy integration and engineering.

Renewable Energy: Solar NGSS Learning Progression: The 1st grade storyline is part of a larger learning progression that includes students mastering standards pre-K to 12th grade. Take a look at how the 1st grade performance expectations fit in a continuum of learning for your students.

<p>Placemaking:</p> <p>Gather students together and take them outside. Have students touch bare pavement that has been in the sun then have students touch pavement that has been shaded. Ask students to observe what they feel.*</p> <p>*This could also be done at a student’s home or other location.</p>	<p>Anchoring phenomena:</p> <p>Light is absorbed and reflected.</p> <p>“Don’t get burned!” activity</p>	<p>Drawdown:</p> <p>Insulation Solar Water Distributed Solar Panels</p>
<p>Indigenous and other relevant cultural connections:</p> <p>Since time immemorial Indigenous peoples used the Sun and materials in their environment to heat their homes, provide light, mark the passage of time and facilitate crop growth.</p>	<p>NGSS PEs (progress towards):</p> <p>1-PS4-3 Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.</p>	

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

Estimated time required to implement this storyline: 2 to 3 weeks

NGSS PEs:

1-PS4-3 Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.

Science & Engineering Practice (SEP)	Disciplinary Core Idea (DCI)	Cross Cutting Concept (CCC)
<p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</p> <ul style="list-style-type: none"> Plan and conduct investigations collaboratively to produce evidence to answer a question. 	<p>PS4.B: Electromagnetic Radiation Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)</p>	<p>Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.</p>

Materials:

Learning Session	Materials
1.	<ul style="list-style-type: none"> Video Native American Story- Grandmother Spider Steals the Sun Print Journal cover page
2.	<ul style="list-style-type: none"> Anchor chart - record observations Science Notebook pages for pre-assessment
3.	<ul style="list-style-type: none"> Science Notebook pages for pre-assessment Variety of materials Flashlight Assessment Rubric
4.	<ul style="list-style-type: none"> What is light video: Primary Science Lesson Idea: What is light? Sunny day Tape White and black construction paper Large outside area with hard surface (suggestions: table or sidewalk) Timer/Watch/Phone Science notebook
5.	<ul style="list-style-type: none"> Science Notebook

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

	<ul style="list-style-type: none"> ● Anchor text found in the learning session ● Stuffed bear ● Box ● Tape
6.	<ul style="list-style-type: none"> ● Transparent Objects, Opaque Objects and Translucent Objects ● Playing with Light and Shadows (PowerPoint book) ● Post it notes ● Anchor chart paper
7.	<ul style="list-style-type: none"> ● Anchor text in the session ● Science Notebook ● 6 different colored square pieces of card or paper. Black and white are essential, and any other 4 colors will do (the three primary colors red, blue and yellow, as well as green are good choices for the other cards). Make the squares about 7cm x 7cm (3 inches x 3 inches). ● 6 ice cubes of the same shape and size ● food dyes (optional)
8.	<ul style="list-style-type: none"> ● Science Notebook- post assessment pages ● Anchor Text ● Variety of materials ● Flashlight

Learning Sessions

1.	Grounding Native Ways of Knowing	Estimated time: 45 minutes
<p>To connect to native ways of knowing consider exploring the following ideas in connection with your local tribal nation:</p> <ul style="list-style-type: none"> ● Sun as part of life ● Sun in relation to dwelling design ● Sun as an indicator of time <p>In addition to stories of the past, research and connect with tribal nations close to your community and their actions to mitigate, adapt and find solutions to a changing climate. To access information on how to reach out and build relationships with local tribes, visit the OSPI Office of Native Education: Partnering with Tribes webpage or contact your district’s tribal liaison/Title VI coordinator.</p> <p>Some examples of regional tribal connections to this work are found below.</p> <p>Native American Story ~ Grandmother Spider Steals the Sun</p>		

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

	<p>Set up the students’ science notebook. Students can illustrate/sketch while listening to Grandmother Spider Steals the Sun.</p> <p>In addition to stories of the past, research and connect with tribal nations close to your community and their actions to mitigate and adapt to a changing climate. To access information on how to reach out and build relationships with local tribes, visit the OSPI Office of Native Education: Partnering with Tribes webpage.</p>
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2.	Examine phenomena: “Don’t get Burned” activity	Estimated time: 30 minutes
	<p>Create a t-chart; one side - describe how our heads felt inside; second side - describe how our heads felt outside.</p> <p>Before you go outside, have students feel their heads and record their responses on the t-chart. Take students for a walk outside to look and observe ourselves in relationship to the Sun. Feel their heads outside in the sun. Once you go inside, record students' thoughts about how their head felt outside.</p> <p>Introduce the question: What materials would we need to make a hat to keep our heads cool?</p> <p>Next, have students sketch a hat to protect the eagle’s head from the sun. If they can, label the materials they used for their hats. See the third page in the science notebook .</p> <p>Have students complete the pre-assessment page, “Don’t get Burned” in their science notebook.</p> <p>If students need more experiential phenomena activities, see the list below:</p> <ul style="list-style-type: none"> ● Dark clothes vs light clothes to discuss temperature different ● Opaque vs transparent to discuss temperature using a thermometer ● Shine light on different materials and make observations ● Discuss and show a video (not necessarily this one) about Vantablack: Vantablack- The Darkest Material on Earth ● Discuss and show one-way mirrors 	


3.	Pre-Assessment: Beam of Light	Estimated time: 30 minutes
	<p>Gather two different materials either provided to the students or in their home. Some materials that might be accessible include tin foil, saran wrap, wax paper, copy paper, construction paper, or t-shirt/fabric. Then shine a flashlight on the material and see what the light looks like on the material and behind the material. See example below.</p>	

“Solutions-Oriented Learning” Storyline


1-Renewable Energy: Solar





Square or piece of tin foil

Material (Cause)



Beam of Light (effect)



Transparent	Translucent	Opaque	Reflective
			
		XXXX	XXXX

I see the light reflected. I see no light behind the tin foil.

[Pre-Assessment Rubric](#)

Possible distance learning extensions: Include possible materials tray, share bag, scavenger hunt.

4.	Guiding question: What is light?	Estimated time: 30 minutes
<p>Discussion: Ask students-- <i>What is light?</i> Record in their thinking in journals, share out. (Science Notebook: Teachers add extra blank or lined paper as you need OR use an existing science notebook if your class already has one started.)</p> <p>Show video: What is Light video</p> <p>Students may notice:</p> <ul style="list-style-type: none"> ● That light travels in a path through a beam (<i>Grandmother’s Web</i>) ● Without light it’s dark ● Light is energy ● Light has a purpose, we need light to see, to make things visible ● Light provides heat <p>Activity: <u>How does it feel?</u></p>		

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

	<p>Materials</p> <ul style="list-style-type: none"> ○ Sunny day ○ Tape ○ White and black construction paper ○ Large outside area with hard surface (suggestions: table or sidewalk) ○ Timer/Watch/Phone ○ Science notebook <p>Student procedure</p> <ol style="list-style-type: none"> 1. Tape your white paper on the surface of your choice 2. Tape the black paper next to the white paper; make sure they do not touch. 3. Sit the papers in the sun for 10 minutes. 4. Touch your papers with the palm of your hand and record which one feels warmer on your data table. Write down any observations you have. 5. Let it sit in the sun for another 10 minutes. Record which one feels warmer under 20 minutes on the data table. Write down any observations you have. 6. Leave it for another 10 minutes. Record which one feels warmer under the 30 minutes on the data table. Write down any observations you have. 7. Complete the sentence frame, “The ____ paper feels warmer because _____.”
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5.	Guiding question: Why do we need light?	Estimated time: 45 minutes
	<p>Discussion: If you lived in a place with zero light, what would that be like?</p> <p>First have the students write in their journals with a prompt based off of <u>Grandmother Spider Steals the Sun</u>; “The World was a dark and very cold place... (draw picture, add story extensions to the prompt). This is a creative writing opportunity for students.</p> <p>After the students write their story, have them relisten to the story Grandmother Spider Steals the Sun while adding details to their journal cover illustration.</p> <p>Read the anchor text, How Does Light Interact with Materials? <u>*You could make this anchor text into a wall story or a big book.</u></p>	

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

<p>The three types of interactions introduced in this reading are transmission, reflection, and absorption.</p>	<p>Anchor Reading: How Does Light Interact with Materials? Define the key terms below in your notebook. Use the reading to find the meanings. Give one example for each term.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>light energy (n) transmission (n)/transmit (v) natural light (n) reflection (n)/reflect (v) artificial light (n) absorption (n)/absorb (v) material (n) transparent (adj)</p> </div> <p>When we see something, it is because light bounces off it and goes back to our eyes. Light energy is a form of energy that travels in waves. It is the only form of energy that we can see. Natural light is produced by the sun, other stars, and chemical reactions such as fires. Artificial light is produced by human technology. What happens to light when it hits something depends on the material - the type of matter - that it is made of. Clear or transparent materials transmit light, meaning that light goes through them. An example of something that transmits light is a window. Shiny and light-colored materials reflect light, meaning light hits them and bounces off the way a ball bounces off a floor. Two examples of things that reflect light are mirrors and light-colored clothes. Dark-colored materials absorb light. A black road absorbs light. After the light is absorbed, it is transformed into heat. Many materials do all three things - reflect some light, transmit some, and absorb some.</p> <p>by Appleseed Education</p>
<p>Next, have the students experience the Bear in a Box activity from ESD 105.</p>	

<p>6.</p>	<p>Guiding question: How does material affect the path of light?</p>	<p>Estimated time: 30 minutes</p>
<p>Show Video: Transparent Objects, Opaque Objects and Translucent Objects</p> <p>Read story Playing with Light and Shadows (PowerPoint book)</p> <p>Create an anchor chart with class definitions for transparent, opaque, reflective and translucent and examples of these materials.</p> <p>Class activity:</p>		

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

	<p>Give each student 4 post-it notes. The students write 1 characteristic on each post-it.</p> <p>Students use post-its to then label objects around the room. Teachers extend activities as needed (graphing etc.)</p> <p>Students list objects in their journal. Students justify the label with the sentence frame: “_____ is/ is not (opaque, reflective, translucent, transparent) _____.”</p>
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7.	Guiding question: What happens to light with different colors?		Estimated time: 45 minutes		
<p>Review/Revisit vocabulary and anchor chart</p> <p>Read the anchor text, How Does Light Interact with Materials? *You could make this anchor text into a wall story or a big book.</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 20%; vertical-align: top;"> <p>The three types of interactions introduced in this reading are transmission, reflection, and absorption.</p> </td> <td style="width: 80%;"> <p>Anchor Reading: How Does Light Interact with Materials? Define the key terms below in your notebook. Use the reading to find the meanings. Give one example for each term.</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>light energy (n) transmission (n)/transmit (v) natural light (n) reflection (n)/reflect (v) artificial light (n) absorption (n)/absorb (v) material (n) transparent (adj)</p> </div> <p>When we see something, it is because light bounces off it and goes back to our eyes. Light energy is a form of energy that travels in waves. It is the only form of energy that we can see. Natural light is produced by the sun, other stars, and chemical reactions such as fires. Artificial light is produced by human technology. What happens to light when it hits something depends on the material - the type of matter - that it is made of. Clear or transparent materials transmit light, meaning that light goes through them. An example of something that transmits light is a window. Shiny and light-colored materials reflect light, meaning light hits them and bounces off the way a ball bounces off a floor. Two examples of things that reflect light are mirrors and light-colored clothes. Dark-colored materials absorb light. A black road absorbs light. After the light is absorbed, it is transformed into heat. Many materials do all three things - reflect some light, transmit some, and absorb some.</p> <p>by Appleseed Education</p> </td> </tr> </table> <p>Eagle hat revision: Have students revise their eagle hat drawing from the pre-assessment.</p> <p>Activity: Solar Energy Experiment Notebook entry: Students predict which color will melt the ice cube the fastest.</p>				<p>The three types of interactions introduced in this reading are transmission, reflection, and absorption.</p>	<p>Anchor Reading: How Does Light Interact with Materials? Define the key terms below in your notebook. Use the reading to find the meanings. Give one example for each term.</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>light energy (n) transmission (n)/transmit (v) natural light (n) reflection (n)/reflect (v) artificial light (n) absorption (n)/absorb (v) material (n) transparent (adj)</p> </div> <p>When we see something, it is because light bounces off it and goes back to our eyes. Light energy is a form of energy that travels in waves. It is the only form of energy that we can see. Natural light is produced by the sun, other stars, and chemical reactions such as fires. Artificial light is produced by human technology. What happens to light when it hits something depends on the material - the type of matter - that it is made of. Clear or transparent materials transmit light, meaning that light goes through them. An example of something that transmits light is a window. Shiny and light-colored materials reflect light, meaning light hits them and bounces off the way a ball bounces off a floor. Two examples of things that reflect light are mirrors and light-colored clothes. Dark-colored materials absorb light. A black road absorbs light. After the light is absorbed, it is transformed into heat. Many materials do all three things - reflect some light, transmit some, and absorb some.</p> <p>by Appleseed Education</p>
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1-Renewable Energy: Solar

Complete activity after you give them an overview of the activity.



photo: Shelly Massey

3. Melting Rates

Different colors have different heat absorbing capacities. Black has the greatest heat absorbing capacity, which results in ice melting quicker than on white, which reflects the most light. Learn how to observe and report on which colors affect ice's melting rates [here](#), on Green Planet Solar Energy. Get more sidewalk science ideas [here](#).

Science Notebook entry: Record observations and results. Add new thinking after observations and how predictions compared to results.

Watch Video [Color and Heat](#) and discuss how this connects to the activity the students did with the color paper

8.	Post -Assessment: “Don’t get burned” and “Beam of Light”	Estimated time: 1 hour and 30 minutes
Read the anchor text, How Does Light Interact with Materials? *You could make this anchor text into a wall story or a big book.		

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

The three types of interactions introduced in this reading are transmission, reflection, and absorption.

Anchor Reading: How Does Light Interact with Materials?

Define the key terms below in your notebook. Use the reading to find the meanings. Give one example for each term.

light energy (n)
 transmission (n)/transmit (v)
 natural light (n)
 reflection (n)/reflect (v)
 artificial light (n)
 absorption (n)/absorb (v)
 material (n)
 transparent (adj)

When we see something, it is because light bounces off it and goes back to our eyes. Light energy is a form of energy that travels in waves. It is the only form of energy that we can see. Natural light is produced by the sun, other stars, and chemical reactions such as fires. Artificial light is produced by human technology. What happens to light when it hits something depends on the material - the type of matter - that it is made of. Clear or transparent materials transmit light, meaning that light goes through them. An example of something that transmits light is a window. Shiny and light-colored materials reflect light, meaning light hits them and bounces off the way a ball bounces off a floor. Two examples of things that reflect light are mirrors and light-colored clothes. Dark-colored materials absorb light. A black road absorbs light. After the light is absorbed, it is transformed into heat. Many materials do all three things - reflect some light, transmit some, and absorb some.

by [Appleseed Education](#)

Beam of light- Properties of different materials

Gather four different materials either provided to the students or in their home. Some materials that might be accessible include tin foil, saran wrap, wax paper, copy paper, construction paper, or t-shirt/fabric. Then shine a flashlight on the material and make an observation of what the light looks like on the material and behind the material. See example below.

“Don’t Get Burned”- Engineering a Hat

Have students review their first two eagle hat drawings. Then give students a variety of materials) different fabrics, paper, tin foil, saran wrap, wax paper, grass, leaves, etc.) to create a hat that would protect an eagle head. Students should be able to explain why they choose the materials that they did.

[Post-Assessment Rubric](#)

“Solutions-Oriented Learning” Storyline

1-Renewable Energy: Solar

9.	Possible next steps/off-ramps/actions:	
	<ul style="list-style-type: none"> ● Math Extension: Sun-based calendar work ● Create a sundial ● Building insulated “homes” for ice cubes, record temp and melting rates ● Add labels and vocabulary to journal illustration, (ex. Spiderweb = beam of light) ● Explore jobs in energy with the following resources: <ul style="list-style-type: none"> ○ PEI Career Card- Program Manager of Energy Efficiency ○ Map a Career in Clean Energy 	

[1-Renewable Energy: Solar OER Tracker](#)

Pacific Education Institute would like to acknowledge and thank the writing team for their work. The team included Paula Cox, Samantha Fulton, Crystal Fissler-Jones and Shelley Stromholt. In you have comments or questions please contact info@pacificeducationinstitute.org

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