“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.

<table>
<thead>
<tr>
<th>Placemaking:</th>
<th>Anchoring phenomena:</th>
<th>Drawdown:</th>
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</table>
| 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.* | Light is absorbed and reflected. | Insulation
Solar Water
Distributed Solar Panels |
*This could also be done at a student’s home or other location. |

<table>
<thead>
<tr>
<th>Indigenous and other relevant cultural connections:</th>
<th>NGSS PEs (progress towards):</th>
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</thead>
<tbody>
<tr>
<td>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.</td>
<td><strong>1-PS4-3</strong> Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.</td>
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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.

<table>
<thead>
<tr>
<th>Science &amp; Engineering Practice (SEP)</th>
<th>Disciplinary Core Idea (DCI)</th>
<th>Cross Cutting Concept (CCC)</th>
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<tbody>
<tr>
<td>Planning and Carrying Out Investigations</td>
<td>PS4.B: Electromagnetic Radiation</td>
<td>Cause and Effect</td>
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<tr>
<td>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.</td>
<td>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.</td>
<td>Simple tests can be designed to gather evidence to support or refute student ideas about causes.</td>
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<tr>
<td>● Plan and conduct investigations collaboratively to produce evidence to answer a question.</td>
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Materials:

<table>
<thead>
<tr>
<th>Learning Session</th>
<th>Materials</th>
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</table>
| 1.               | ● Video [Native American Story- Grandmother Spider Steals the Sun](#)  
                   ● Print Journal cover page |
| 2.               | ● Anchor chart - record observations  
                   ● [Science Notebook](#) pages for pre-assessment |
| 3.               | ● Science Notebook pages for pre-assessment  
                   ● Variety of materials  
                   ● Flashlight  
                   ● [Assessment Rubric](#) |
| 4.               | ● 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.               | ● Science Notebook |

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Learning Sessions

1. **Grounding Native Ways of Knowing**

   Estimated time: 45 minutes

   To connect to native ways of knowing consider exploring the following ideas in connection with your local tribal nation:
   - Sun as part of life
   - Sun in relation to dwelling design
   - Sun as an indicator of time

   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](https://www.ospi.k12.wa.us/Programs/OSPI/Office_of_Native_Education/Partnering_with_Tribes) webpage or contact your district’s tribal liaison/Title VI coordinator.

   Some examples of regional tribal connections to this work are found below.

   Native American Story ~ [Grandmother Spider Steals the Sun](https://www.ospi.k12.wa.us/Programs/OSPI/Office_of_Native_Education/Partnering_with_Tribes)
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<tr>
<th><strong>Set up the students’ science notebook. Students can Illustrate/sketch while listening to Grandmother Spider Steals the Sun.</strong></th>
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<th><strong>2. Examine phenomena: “Don’t get Burned” activity</strong></th>
<th><strong>Estimated time:</strong> 30 minutes</th>
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<tr>
<td>Create a t-chart; one side - describe how our heads felt inside; second side - describe how our heads felt outside.</td>
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<tr>
<td>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.</td>
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<tr>
<td>Introduce the question: What materials would we need to make a hat to keep our heads cool?</td>
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<tr>
<td>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.</td>
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<tr>
<td>Have students complete the pre-assessment page, “Don’t get Burned” in their science notebook.</td>
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<tr>
<td>If students need more experiential phenomena activities, see the list below:</td>
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<tr>
<td>● Dark clothes vs light clothes to discuss temperature different</td>
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<td>● Opaque vs transparent to discuss temperature using a thermometer</td>
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<tr>
<td>● Shine light on different materials and make observations</td>
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<tr>
<td>● Discuss and show a video (not necessarily this one) about Vantablack: Vantablack- The Darkest Material on Earth</td>
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<td>● Discuss and show one-way mirrors</td>
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<th><strong>3. Pre-Assessment: Beam of Light</strong></th>
<th><strong>Estimated time:</strong> 30 minutes</th>
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<tr>
<td>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.</td>
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Pre-Assessment Rubric

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

4. Guiding question: What is light?

Discussion: Ask students-- What is light? 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.)

Show video: What is Light video

Students may notice:
- That light travels in a path through a beam (Grandmother’s Web)
- Without light it’s dark
- Light is energy
- Light has a purpose, we need light to see, to make things visible
- Light provides heat

Activity: How does it feel?
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Materials
- Sunny day
- Tape
- White and black construction paper
- Large outside area with hard surface (suggestions: table or sidewalk)
- Timer/Watch/Phone
- Science notebook

Student procedure
1. Tape your white paper on the surface of your choice
2. Taper 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 ________.”

5. Guiding question: Why do we need light?

Discussion: If you lived in a place with zero light, what would that be like?

First have the students write in their journals with a prompt based off of Grandmother Spider Steals the Sun: “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.

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.

Read the anchor text, How Does Light Interact with Materials?
*You could make this anchor text into a wall story or a big book.
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.

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Next, have the students experience the Bear in a Box activity from ESD 105.

6. Guiding question: How does material affect the path of light? Estimated time: 30 minutes

- Show Video: Transparent Objects, Opaque Objects and Translucent Objects
- Read story Playing with Light and Shadows (PowerPoint book)

Create an anchor chart with class definitions for transparent, opaque, reflective and translucent and examples of these materials.

Class activity:
Give each student 4 post-it notes. The students write 1 characteristic on each post-it.

Students use post-its to then label objects around the room. Teachers extend activities as needed (graphing etc.)

Students list objects in their journal. Students justify the label with the sentence frame: “_______ is/ is not (opaque, reflective, translucent, transparent) ______.”

Guiding question: What happens to light with different colors?

Estimated time: 45 minutes

Review/Revisit vocabulary and anchor chart

Read the anchor text, How Does Light Interact with Materials? *You could make this anchor text into a wall story or a big book.

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Eagle hat revision: Have students revise their eagle hat drawing from the pre-assessment.

Activity: Solar Energy Experiment

Notebook entry: Students predict which color will melt the ice cube the fastest.
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<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
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<td>Complete activity after you give them an overview of the activity.</td>
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**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.*
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.

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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
1-Renewable Energy: Solar

9. Possible next steps/off-ramps/actions:
   - 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:
     - 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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