Introduction
INTRODUCTION

• Unit title: Exploring Light Energy
• Grade level: 5th grade
• Target Group: Mainstream science class with integrated ELL students.
• Source for both written reading material and lessons:
  ENERGY EXPLORATIONS. AIMS Education Foundation, P.O. Box 8120, Fresno, CA 93747 www.aimsedu.org • permissions@aimsedu.org • 1.888.733.2467
• The learning goals I want my students to know are:
  ✓ Light reacts differently to objects that are opaque, transparent, and translucent.
  ✓ Light reflects off objects and colors in different ways.
  ✓ Refractions or bending of light happens when light travels through different transparent materials.
Lesson 1
Krista Morgan-FLA 518

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### Objectives for Lesson 1

<table>
<thead>
<tr>
<th>Content Objectives</th>
<th>Language Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determine how light reacts on paper.</td>
<td>1. and 2.</td>
</tr>
<tr>
<td>2. Compare how light reacts on paper with a drop of cooking oil.</td>
<td>a. Students will work in small groups to discuss their observations about light reacting to various types of paper with and without oil.</td>
</tr>
<tr>
<td>3. Understand content vocabulary: <em>transparent</em>, <em>translucent</em>, and <em>opaque</em>.</td>
<td>b. Students will work independently to write responses to questions that connect to learning.</td>
</tr>
<tr>
<td></td>
<td>c. As a whole group, students will orally share their findings.</td>
</tr>
<tr>
<td></td>
<td>3. Students will accurately use content vocabulary during small group discussion, independent written responses, and whole group oral sharing.</td>
</tr>
</tbody>
</table>

### PERFORMANCE INDICATORS

<table>
<thead>
<tr>
<th>Domain Topic</th>
<th>Level 5</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speaking:</strong> Observations about light reacting to paper with and without oil</td>
<td>Participate in a discussion that compares and explains how light reacts on various types of paper with and without a drop of oil on it using the vocabulary transparent, translucent, and opaque to describe their observations.</td>
<td>Participate in a discussion that compares how light reacts on various types of paper with and without a drop of oil on it using a word wall or word bank with key vocabulary (transparent, translucent, and opaque) to help describe their observations.</td>
<td>Participate in a discussion about the various types of paper, how they relate to light with and without oil on them using language prompts, phrases/simple sentences, and key vocabulary with visual examples to help describe their observations.</td>
<td>Participate in a discussion using simple and familiar phrases/sentences and key vocabulary with visual examples.</td>
<td>Participate in a discussion using labeled models to match paper by pointing to them.</td>
</tr>
<tr>
<td><strong>Writing:</strong> Responses to questions connecting to learning</td>
<td>Respond to 7 “Connecting to Learning” questions using complete sentences with accurate capitalization and punctuation.</td>
<td>Respond to 7 “Connecting to Learning” questions using shorter sentences and/or phrases.</td>
<td>Respond to 7 “Connecting to Learning” questions by filling in the blanks using an answer bank.</td>
<td>Respond to 7 “Connecting to Learning” questions by drawing, labeling, and matching.</td>
<td></td>
</tr>
</tbody>
</table>
### FUNCTIONAL LANGUAGE CHART: Lesson 1

<table>
<thead>
<tr>
<th>Function</th>
<th>Situation</th>
<th>Expression</th>
<th>Vocabulary</th>
<th>Grammar</th>
</tr>
</thead>
<tbody>
<tr>
<td>compare and contrast describe</td>
<td>Experimenting with how light reacts to various types of paper with and without oil</td>
<td>Light can <em><strong>1</strong></em> through objects</td>
<td>1. absorb \nsend \nscatter \nemit \nrefract \nreflect \npass through</td>
<td>verbs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light was <em><strong>2</strong></em>. So the material is <em><strong>3</strong></em>.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. absorbed \ntransmitted \nscattered \nemitted \nrefract \nreflected \npassed through</td>
<td>verb “to be” \npast participle.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. opaque \ctransparent \ctranslucent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Reflection

This science lesson is for a 5th grade mainstream classroom with integrated ELLs. I got the lesson from AIMS Education Foundation because I really like the way their lessons incorporate hands on tasks that use the scientific method approach and higher order thinking. The original lesson was modified / adjusted to incorporate various levels of ELLs.

One of the first modifications I made was to build background and review this subject by creating a visual chart and use realia, real objects, to model vocabulary. I also did this to connect this lesson to a previous lesson about opaque, translucent, and transparent. Another modification I made was to create differentiated worksheets for all students at various levels to follow during the hands on experiment. These were not part of the original lesson, but I thought students would stay on task better if they had something to follow and work off of. I also gave suggestions for higher order thinking questions and unknown questions that the teacher can use during the lesson for students working in small groups or during whole group discussion as a way to negotiate meaning of the concepts and vocabulary. Additionally, the original lesson gave questions that could be used to connect the learning. I took these questions and modified them into three different worksheets for the different levels of ELLs and mainstream students. Throughout the differentiated worksheets I used pictures, visual letters, data tables, word banks, bold faced and underlined key vocabulary, diagrams/models, and fill-in the blanks as strategies to help students at various levels.
Krista Morgan

LESSON 1: LIGHT ENERGY

Words in regular font are taken from the original lesson titled “Foiled by Oil” from the book ENERGY EXPLORATIONS; pages 125-129 published by AIMS: Education Foundation, Fresno, CA. 93747
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• Words in italics are modifications and adjustment made to the original lesson.
• Poster 1 and worksheets 1, 2, 3, 4, 5, and 6 are teacher made modifications for this lesson.

Grade Level: 5

NRC Standards:
• Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, and absorbed by the object.
• Light interacts with matter by transmission, absorption, or scattering. To see an object, light from that object—emitted by or scattered from it—must enter the eye.

CCSS:
• RI 5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
• W.5.2D Use precise language and domain-specific vocabulary to inform about or explain the topic.
• SL.5.1 Engage effectively in a range of collaborative discussions with diverse partners on grade 5 topics and texts, building on others’ ideas and expressing their own clearly.

Vocabulary: opaque (does not let light pass through, light is reflected and absorbed), transparent (can be seen through, capable of transmitting light), and translucent (transmits some light) should be reinforced throughout this experience.

Students will observe light being reflected from a piece of paper. The fibers of the paper (its “hairy” nature) cause the light to be scattered in various directions. When a spot of oil is placed on the paper, the oil fills in the unevenness of the fibers and allows light to be transmitted through the paper instead of being scattered and absorbed by the fibers. Students will notice that the oil will smooth out the hairiness of the paper towel. When the paper with the oil spot is on the desk, the spot looks dark; however, when the paper is held up to the light or placed over a piece of printed material, the spot seems translucent.
LESSON 1: LIGHT ENERGY

I. Background Information for teacher to reinforce:
   - Light travels in a straight line until it strikes an object.
   - Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.
   - Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).
   - To see an object, light from that object—emitted by or scattered from it—must enter the eye.

II. Materials for teacher:
   - Waxed paper
   - Clear wrap (i.e. Saran Wrap)
   - Construction paper or thick card stock
   - Chart paper

III. Materials for each group (3 to 4 students):
   - 3” x 5” piece of paper towel (preferably the brown type found in schools), white copy paper, construction paper any color, and card stock any color.
   - Small plastic bags to put paper samples in.
   - 1 cm depth of cooking oil in the plastic cup.
   - Flashlight (optional)

IV. Procedure: (students will be working in small groups of 3-4)

Part 1: Determine how light reacts to paper

1. Build Background and Review: Previous to this, a lesson on the concept of opaque, transparent, and translucent would have been taught. To begin this lesson, review these vocabulary terms using visuals of waxed paper (translucent), clear wrap (transparent), and construction paper (opaque). Additionally create a poster (see Poster 1) to display so students can reference words during lesson. Teacher will also make a copy of Poster 1 for students to use in their groups as well as distribute a smaller sample of waxed paper, clear wrap, and construction paper for the students to use as hands on examples. While the teacher holds up each example and the students place each sample next to the correct vocabulary word on Poster 1.

2. Next, pass out plastic bag with different types of paper in it and worksheet 1, 2, or 3
   - Worksheet 1 – Level 1 (page 9)
   - Worksheet 2 – Levels 2 and 3 (page 10)
   - Worksheet 3 – Levels 4 & 5 as well as Mainstream Students (page 11)

3. Hold up each paper and name them. Students will follow either worksheet 1, 2, or 3 in order to identify the different kinds of paper.
Krista Morgan

LESSON 1: LIGHT ENERGY

4. The teacher will model the first paper example for the class by holding up the paper towel to light source (window or flashlight). Ask students which term best describes it and why they determined that. [Possible response: Opaque. If we held a flashlight in front of the paper towel, the paper towel would cast a dark shadow because it blocked or absorbed the light.] Instruct students to fill out the appropriate section on their worksheet.

5. Then have students work in their groups and continue to follow the worksheet to determine how light interacts with the rest of the paper samples.

6. The teacher will walk around the room to:
   - Assess and monitor
   - Encourage the use of content vocabulary like: transmitted, absorbed, and scattered, opaque, transparent, and translucent
   - Ask higher order questions and/or unknown questions (i.e. Why do you think this. . .? How do you know that. . .? What would happen if. . .? How does this compare to. . .?)

7. The teacher will wrap up Part I of this lesson by bringing the whole group together for a group share of their findings through a whole class discussion.

Part 2: Compare how light reacts on paper with a drop of cooking oil on it.

1. Explain that the next step is to find out how light reacts to paper with a drop of cooking oil on it. Then distribute the cups of cooking oil to each group.

2. Tell students to dip the tip of a finger into the oil and place a spot of oil on the construction paper. Teacher models this process. Discuss their observations. [Possible response: The oil spot is darker than the rest of the paper.]

3. Invite them to hold the paper up to the light and observe. [Possible response: The oil spot is lighter, the rest of the paper is darker. The oil spot lets some light pass through. It is translucent.]

4. Direct them to hold the oil spot over some printed material and relate their observations. [Possible response: The print can be read through the oil spot.] Encourage students to use the vocabulary of opaque and translucent.

5. In conclusion, discuss their finding with their small group and whole group. Teacher will ask various levels of questions to wrap up the lesson.
   - Level 1: Point or hold up something transparent, translucent, opaque.
   - Level 2: Name something that was transparent, translucent, and opaque.
   - Level 3: Do you think the paper towel absorbs light or scatters light? Why? Do you think it is opaque or translucent?
   - Level 4 & 5 and Mainstream: What have you noticed about today’s lesson? What have you learned from it? How can this be useful in our everyday lives? What are you still wondering?

V. Connecting Learning / Assessment: See Worksheets 4, 5, 6 for differentiated levels of assessments.
Krista Morgan

LESSON 1: LIGHT ENERGY

Worksheet 4 is the assessment for Intermediate (4) / Advanced (5) / Mainstream (page 12)
Worksheet 5 is the assessment for Early Production(2) and Speech Emergent(3) (page 13 & 14)
Worksheet 6 is the assessment for Pre-Production (1) and Early Production (2) (page 15 and 16)
*Up to the teacher’s discretion whether to give worksheet 5 or 6 to Early Production (level 2) students.

The worksheets are modified from the original questions listed below.

Original Lesson Questions AND Answers:
1. What do we mean when we say light is transmitted? [It means that light passes through a material.]
2. What are some materials that light can pass through? [Any material that is transparent or translucent, such as clear glass, transparency film, plastic water bottles, acrylic light covers]
3. Was light transmitted through our paper samples? Explain how you know.
4. Describe the surfaces of the paper. [They are fuzzy because of the paper fibers sticking up. Copy paper is smoother than the construction paper and the paper towels.]
5. What effects did the oil have on the paper? [It smoothed the surface of the paper. Some of the paper that was opaque to begin with became translucent with the oil.]
6. Do you think color had anything to do with whether a paper became translucent or not? Explain.
7. In the colonial days, instead of using expensive and fragile glass, people would smear oil on papers and place them in window frames. How does what you learned in this activity apply to this practice? [The oiled paper would somewhat protect the inhabitants, but would allow light to pass through into the home.]
8. What are you wondering now?

Extension To make stained glass-looking pictures, have students use crayons to color a design on white paper and then use a paper towel dipped in cooking oil to coat the paper.
transparent: light passes through easily—light is transmitted.

translucent: some light passes through—light is scattered.

opaque: no light passes through—light is absorbed.
**PART 1:** Determine how light reacts to each type of paper then circle transmitted, absorbed, and/or scattered. Then circle each type of paper as transparent, translucent, or opaque?

<table>
<thead>
<tr>
<th>Types of Paper</th>
<th>How light reacts to paper?</th>
<th>transparent</th>
<th>translucent</th>
<th>opaque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>transmitted / scattered / absorbed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper towel</td>
<td></td>
<td>transparent</td>
<td>translucent</td>
<td>opaque</td>
</tr>
<tr>
<td></td>
<td>transmitted / scattered / absorbed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy paper</td>
<td></td>
<td>transparent</td>
<td>translucent</td>
<td>opaque</td>
</tr>
<tr>
<td></td>
<td>transmitted / scattered / absorbed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction paper</td>
<td></td>
<td>transparent</td>
<td>translucent</td>
<td>opaque</td>
</tr>
<tr>
<td></td>
<td>transmitted / scattered / absorbed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Card stock</td>
<td></td>
<td>transparent</td>
<td>translucent</td>
<td>opaque</td>
</tr>
<tr>
<td></td>
<td>transmitted / scattered / absorbed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PART 2:**

<table>
<thead>
<tr>
<th>Draw construction paper without oil.</th>
<th>Draw construction paper with oil.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**PART 1:** Determine how light reacts with each type of paper. Complete the sentence using the words transmitted, absorbed, and/or scattered. Then fill in the blank to describe each type of paper as transparent, translucent, or opaque.

<table>
<thead>
<tr>
<th>Types of Paper</th>
<th>How light reacts to paper?</th>
<th>transparent</th>
<th>translucent</th>
<th>opaque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper towel</td>
<td>Light is __________________</td>
<td>So the paper towel is __________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy paper</td>
<td>Light is __________________</td>
<td>So the copy paper is __________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction paper</td>
<td>Light is __________________</td>
<td>So the construction paper is __________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Card stock</td>
<td>Light is __________________</td>
<td>So the card stock is __________________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PART 2:** Dip finger into oil and place spot on construction paper. Discuss your observations. Fill in blanks using word bank.

<table>
<thead>
<tr>
<th>WORD BANK:</th>
<th>opaque</th>
<th>darker</th>
<th>lighter</th>
<th>translucent</th>
</tr>
</thead>
<tbody>
<tr>
<td>When the paper is on the table the oil spot looks __________________ than the rest of the paper.</td>
<td>When you hold the paper up to the light the oil spot looks __________________ than the rest of the paper.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The oil spot lets some light pass through so the __________________ paper becomes __________________.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART 1: Determine how light interacts with each type of paper. Write a sentence using the words transmitted, absorbed, and/or scattered to explain how light reacts to each type of paper. Then write a complete sentence to describe each type of paper as transparent, translucent, or opaque.

<table>
<thead>
<tr>
<th>Types of Paper</th>
<th>How light reacts to paper?</th>
<th>transparent</th>
<th>translucent</th>
<th>opaque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper towel</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy paper</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Card stock</td>
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</tr>
</tbody>
</table>

PART 2: Dip finger into oil and place spot on construction paper. Discuss your observations. Write about your observations when the paper with the spot of oil is on the table and when the paper with the spot of oil is held up to the light. Use the words in the word bank to help you.

<table>
<thead>
<tr>
<th>WORD BANK:</th>
<th>darker</th>
<th>lighter</th>
<th>opaque</th>
<th>translucent</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEFORE HOLDING IT UP TO LIGHT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFTER HOLDING IT UP TO LIGHT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Why do you think light is transmitted?

2. What are some materials that light can pass through? Tell whether they are translucent or transparent.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Translucent or Transparent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Was light transmitted, absorbed, or scattered in the different types of paper samples? Explain how you know. Write a complete sentence using the vocabulary words: opaque, transparent, and/or translucent.

   - Paper towel:
   - Copy paper:
   - Construction paper:
   - Card stock:

4. Describe the surfaces of each type of paper.

   - Paper towel
   - Copy paper
   - Construction paper
   - Card stock

5. What effects did the oil have on the construction paper?

6. Do you think color had anything to do with whether a paper became translucent or not? Explain.

7. In the colonial days, instead of using expensive and fragile glass, people would smear oil on papers and place them in window frames. How does what you learned in this activity apply to this practice?

8. On the back side of this paper, write what are you wondering now?
1. Do you think a plastic water bottle transmits light or scatters light? Why do you think this? Is it because it is opaque or transparent?

2. Fill in the blank with the word translucent or transparent to describe these objects.

   Eyeglasses are ____________ because light is transmitted.

   Wax paper is ____________ because light is scattered.

   Clear glass window is ____________ because light is transmitted.

   Sheer curtains are ____________ because light is scattered.

4. Fill in the blanks using word bank 1 for the first blank and word bank 2 for the second blank. Not all words are used and some are used more than once.

   **WORD BANK 1**
   transmitted  absorbed  scattered

   **WORD BANK 2**
   opaque  transparent  translucent

   The paper towel (1)__________ light so it is (2)__________.

   The copy paper (1)__________ light so it is (2)__________.

   The construction paper (1)__________ light so it is (2)__________.

   The card stock (1)__________ light so it is (2)__________.

5. Describe the surfaces of each type of paper use the words smooth or fuzzy.

   Paper towel
   Copy paper
   Construction paper
   Card stock
6. Circle the best answer from each of the three choices.

   The oil made the paper (smooth, fuzzy, flat). So the paper started out (translucent, transparent, opaque) but became (translucent, transparent, opaque) with the oil.

7. Use the words in the WORD BANK to fill in the blanks.

   opaque    oil    translucent    paper    light

   In the colonial days, instead of using expensive and fragile glass, people would smear ____________ on ______________ and place it in a window frame. The oiled paper would protect the people living in the houses while allowing ______________ to pass through into the home. The ______________ paper would turn _____________________.

8. Draw or write what you are wondering now.
1. Circle the objects that transmit light.
2. Point to the objects that are transparent translucent.
3. Write the letter for each. ______ ______ ______ ______
4. Put a check √ in the column next to each type of paper before spot of oil.

<table>
<thead>
<tr>
<th>Types of Paper</th>
<th>Transmits light - passes through</th>
<th>Does Not Transmit Light - does not pass through</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper towel</td>
<td>[ ] Transmit</td>
<td>[ ] absorb</td>
</tr>
<tr>
<td>Copy paper</td>
<td>[ ]</td>
<td>[ ] scatter</td>
</tr>
<tr>
<td>Construction paper</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Card stock</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

5. Circle the description for each type of paper.

<table>
<thead>
<tr>
<th></th>
<th>smooth</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper towel</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>Copy paper</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>Construction paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Card stock</td>
<td></td>
<td>[ ]</td>
</tr>
</tbody>
</table>

pg 15
Name: ________________________________

6. 

light absorbed

without oil opaque paper

light transmitted and scattered

with oil translucent paper

Use model to draw and label diagram.

7. Draw something you are wondering.
Lesson 2
Objectives for Lesson 2

<table>
<thead>
<tr>
<th>Content Objectives</th>
<th>Language Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explore light reflection.</td>
<td>1a. Students will work in small groups to discuss and record their observations about materials that reflect light.</td>
</tr>
<tr>
<td>2. Observe which colors reflect more light.</td>
<td>1b. Students will work independently to write responses to question that connect to learning about light reflection.</td>
</tr>
<tr>
<td>3. Understand content vocabulary:</td>
<td>1c. As a whole group, students will orally share their findings.</td>
</tr>
<tr>
<td><em>transmit = refraction</em></td>
<td>2a. Students will work in small groups to discuss and record their observations about which colors reflect more light.</td>
</tr>
<tr>
<td><em>absorption</em></td>
<td>2b. Students will work independently to write responses to questions that connect to learning about how different colors reflect light.</td>
</tr>
<tr>
<td><em>scatter = reflection = diffused</em></td>
<td>2c. As a whole group, students will orally share their findings.</td>
</tr>
</tbody>
</table>

PERFORMANCE INDICATORS

<table>
<thead>
<tr>
<th>Domain Topic</th>
<th>Level 5</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking: Observations about the kinds of objects, matters, and/or colors that reflect light</td>
<td>Participate in a discussion that compares the amount of light reflected off of shiny and non-shiny objects as well as different color paper using the vocabulary word <em>reflection</em> and connecting it to <em>scattered</em>, a word used in lesson 1, to describe their observations.</td>
<td>Participate in a discussion that compares the amount of light reflected off of shiny and non-shiny objects as well as different color paper using a word wall or word bank with key vocabulary from both lesson 1 and 2 (<em>reflection, scattered, transmit, refraction, absorption</em>) to help describe their observations.</td>
<td>Participate in discussion about the amount of light reflected off of shiny and non-shiny objects as well as different color paper using language prompts, phrases/simple sentences, and key vocabulary with visual examples to help describe their observations.</td>
<td>Participate in discussion about light reflection using simple and familiar phrases/sentences and key vocabulary with visual examples to help describe their observations.</td>
<td>Participate in a discussion about light reflection using labeled models to match paper by pointing to them.</td>
</tr>
<tr>
<td>Writing: Responses to questions connecting to learning</td>
<td>Respond to questions using complete sentences with accurate capitalization and punctuation.</td>
<td>Respond to questions using shorter sentences and/or phrases.</td>
<td>Respond to questions using sentence starters.</td>
<td>Respond to questions by filling in the blanks using an answer bank.</td>
<td>Respond to questions by drawing, labeling, and matching.</td>
</tr>
</tbody>
</table>
**Lesson 2**

**Reflection:**

This science lesson is for a 5th grade mainstream classroom with integrated ELLs. I got the lesson from AIMS Education Foundation because I really like the way their lessons incorporate hands on tasks that use the scientific method approach and higher order thinking. Before doing this lesson, students would have already learned about how the eye works with light to see things.

The original lesson was modified/adjusted to incorporate various levels of ELLs. The key vocabulary term I want students to understand is “reflection”. So one of the first modifications I made was to build background and vocabulary into this lesson. I did this by adding leading questions; a visual demonstration using a flashlight and mirror to physically show light reflection; and a “4-corner” vocabulary poster that shows a picture, sentence, definition, and vocabulary word.

I modified the original hands on task that allowed students to find their own objects to giving each group the same set of objects along with leveled worksheets they will use during the experiment. The level 1 worksheet shows larger pictures of the objects. The students at this level will check, draw, or circle answers. Level 2 and 3 students will work from the same worksheet because there still are picture supports for level 2 but this handout requires more written responses either a word, fill-in blanks, and word banks. The level 4 worksheet has smaller pictures, more words, and sentence starters to help answer questions. Level 5 and mainstream students will use the original worksheets provided by AIMS Foundation from the book “Energy Exploration” pages 134-135.

I also added a “Stop & Think” section to the worksheets so students can make predictions. Finally, the closing activity, “Value Line”, was incorporated into the lesson to encourage relevant discourse among students and so they can apply their knowledge from the experiment by ordering the colored paper from brightest to dimmest reflection and defend their position through small group and whole dialogue.
Words in regular font are taken from the original lesson titled “Light Reflection” from the book ENERGY EXPLORATIONS; pages 131-137 published by AIMS: Education Foundation, Fresno, CA. 93747

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• Words in italics are modifications and adjustments made to the original lesson.
• Worksheet pages 6-11 and 14 are teacher created. Pages 12 & 13 come from the original lesson.

NRC Standards:
• Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.
• Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object—emitted by or scattered from it—must enter the eye.

CCSS:
• RI 5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
• W.5.2D Use precise language and domain-specific vocabulary to inform about or explain the topic.
• SL.5.1 Engage effectively in a range of collaborative discussions with diverse partners on grade 5 topics and texts, building on others’ ideas and expressing their own clearly.

Vocabulary:
transmit = refraction
absorption
scatter = reflection = diffused
shiny
non-shiny

Key Questions:
• What kinds of objects reflect light?
• What effect does the color of a reflecting surface have on the light reflected?

Background Information for teacher to reinforce:
Part One:
It is common misconception that only mirrors or similar shiny objects reflect light. In fact, almost all things reflect light. (It is quite difficult to find something that will reflect no light.) The amount of light reflected by objects varies greatly and depends on such things as an object’s material, color, and texture.

Our eyes are able to see objects around us because light rays from the sun or other sources reflect off these objects and enter our eyes. If it were not for this reflected light, we could not see the objects.

In this activity, students will use objects with flat surfaces to reflect light from the sun onto a white paper screen. Although this activity uses objects with flat surfaces because they make it easier to reflect light onto the screen, it is important to note that objects without flat surfaces also reflect light. (Energy Explorations, page 131-132: AIMS FOUNDATION)

Part Two:
Sunlight is made up of all the colors of the spectrum. Things that reflect all the colors of the spectrum appear to be white in sunlight. (It is important to note that white objects only appear white when viewed in full-spectrum light. When viewed under different light, the white object takes on the color of the available light—the red light of a photographic darkroom for example.) Things that absorb all the colors of the spectrum appear black. Things that appear to be a
certain color absorb certain parts of the spectrum and reflect other parts. This can be fairly straightforward, or rather complex. For example, a red rose appears red because it reflects red light while absorbing the other colors of the spectrum, but a yellow daffodil reflects red, yellow, and green light (which combine to produce the yellow we see) while absorbing the other colors. The light reflected from a colored (non-white or non-black) object is not full-spectrum light.

In the activity, white construction paper reflects all colors of the visible spectrum and thus should produce the brightest reflection. Black paper will absorb all colors of the spectrum and therefore should produce the dimmest reflection. The other colors will reflect various amounts of light between these two extremes. The colored papers will also produce a tint on the white screen. Students will see a red tint when using the red paper and a green tint when using the green, for example. (Energy Explorations, page 131-132: AIMS FOUNDATION)

**Materials:** (some adjustments made from original lesson)

**Part One:** (For each group)
- worksheets and pencils
- white paper, 12" x 18" (for screen)
- tape
- mirror

**Part Two:** (For each group)
- worksheets and pencils
- white paper, 12" x 18" (for screen)
- tape
- 4 x 6 colored construction paper (black, white, red, green, yellow, blue)

**WARNING:** Caution students never to look directly at the sun or its reflection in a mirror (or similar shiny object) since this may result in permanent damage to their eyes.

For the greatest effect, this activity needs to be done on a sunny day when there are distinct shadows. However, it can be done in the classroom.

**Procedure:**

**Part One-Key Question:** “What kinds of objects reflect light?”

**Build Background and vocabulary:**

1. Show a mirror.
2. Ask, “Why do we use mirrors?”; “What do we call the image of ourselves in the mirror?”; “Where else can we see reflections?”; “What do you think will happen if I use a flashlight and pretend it is the sun and shine the light in the mirror?” (the light reflection will show up on the ceiling or wall). So what can we say about things that are reflected? (possible responses: they bounce back at us.)
3. Show “4-Corners Vocabulary” poster 1 (page 14) for the word “reflection”. This can also be given to students as a hand out.

**Hands-On Task**
4. Explain to the students that they will be doing an activity to help them determine what kinds of objects reflect light. (Key question)
5. Hand out objects and worksheet (pages 6-13).
   WORKSHEET 1 = pages 6-7 --use for level 1
   WORKSHEET 2 = pages 8-9 --use for level 2 and 3
   WORKSHEET 3 = pages 10-11 --use for level 4
   WORKSHEET 4 = pages 12-13 -- ORIGINALS from “Energy Exploration” pages 134-135 (AIMS) use for level 5 and mainstream
Krista Morgan

LESSON 2 Topic: Light Energy/Reflection: Grade 5

6. Hold up each object, identify it, and describe it as shiny or non-shiny.
7. Have students follow the directions on the student page.
8. The teacher will walk around the room to:
   - Assess and monitor
   - Encourage the small group discussion and use of content vocabulary like: reflection, scatter, bounce off, dim, bright, non-shiny, shiny, etc.
   - Ask higher order questions and/or unknown questions (i.e. Why do you think this...? How do you know that...? What would happen if...? How does this compare to...?)
9. The teacher will wrap up Part I of this lesson by bringing the whole group together for a group share of their findings through a whole class discussion.

Part Two

1. Direct students to “PART 2” of the worksheet and pass out colored construction paper.
2. Ask, “What do you notice about the paper you are receiving?” Ask the second Key Question: “What effect does the color of a surface have on the light reflection?”
3. Students will “Stop and Think” about this question and make a prediction on their worksheet in the space provided.
4. Students will then use the same process from Part One to reflect light off of the colored construction paper and record their results on the leveled worksheet.
5. The teacher will walk around the room to:
   - Assess and monitor
   - Encourage the small group discussion and use of content vocabulary like: reflection, scatter, bounce off, dim, bright, non-shiny, shiny, etc.
   - Ask higher order questions and/or unknown questions (i.e. Why do you think this...? How do you know that...? What would happen if...? How does this compare to...?)
6. The students will wrap up Part 2 of this lesson by using a “Value Line” to apply their knowledge. Small groups of students will discuss and organize the six pieces of colored paper from brightest to dimmest reflection. Once they have agreed, each group stands from brightest to dimmest holding up their colored paper sample. Then they state and support their positions.

Oral framework:
   - Stating position statement: I am standing here on the value line because ____________________.
   - Convincing others statement: I think you should move over here because ____________________.
7. After they do this discuss what students have learned about reflected light from doing this activity.

Possible Reflection Question to Ask at the Close of the Lesson: (From original lesson “Connecting Learning”)

Part One
1. What kinds of objects reflect light? [While light is reflected better by shiny objects, non-shiny objects also reflect light.]
2. What happened when you used the shiny objects to reflect light onto the screen? [These objects reflect a bright patch of light onto the screen.]
3. What did you notice when you used the non-shiny objects to reflect light onto the screen? [These objects reflect a noticeable amount of light, but this light is more diffused than the light reflected by the shiny objects.]
4. What does this tell you about the reflection of light? [All the objects used, not just the shiny ones, reflect light.]

Part Two
1. What effect does the color of a reflecting surface have on the light reflected? [The lighter colors reflect more light than the darker colors.]
2. What happened when you used the white paper to reflect light? [The white paper reflects the most light.]
3. What happened when you used the black paper to reflect light? [The black paper also reflects light, but not as much as the other colors.]
4. What did you notice when you used the red (or another color) paper to reflect light onto the screen? [The red paper reflects red light which gives the white screen a reddish tint.]
5. What did you learn about the reflection of light from this part of the activity? [All colors reflect some light, but the lighter ones reflect more than the darker ones. The color reflected corresponds to the color of the reflecting surface. The white paper seems to reflect the most light.]
6. What are you wondering now?
**PART 1 Directions:**

1. Put a check ✔ in the column that describes the object, shiny or non-shiny.
2. Make a prediction about what kinds of objects reflect light. Put a check ✔ in the "Before Task" column if you think it will reflect light.
3. Take large white construction paper outside and hang it up. This will be your screen.
4. Hold object so that the sunlight hits it and reflects light onto the screen.
5. After each object is tested, think about how well it reflected light and discuss it with your group.
6. Then put a check ✔ in the "After Task" column if the object reflected light.

<table>
<thead>
<tr>
<th>Object</th>
<th>Shiny</th>
<th>Non-Shiny</th>
<th>Reflects Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>mirror</td>
<td></td>
<td></td>
<td>Before Task</td>
</tr>
<tr>
<td>CD</td>
<td></td>
<td></td>
<td>After Task</td>
</tr>
<tr>
<td>overhead transparency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>folder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wood block</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Circle all the objects that reflected light the **brightest**. Then point to the pictures during group and class discussion.

**PART 2**
What do you think will happen when you use colored paper to reflect light?

Draw a picture of your prediction:

Repeat the process for reflecting light off objects from PART 1 using the different colored paper. Circle how each paper reflected light.

<table>
<thead>
<tr>
<th>CONSTRUCTION PAPER</th>
<th>Bright</th>
<th>Dim</th>
</tr>
</thead>
<tbody>
<tr>
<td>black</td>
<td>⭐⭐⭐⭐⭐</td>
<td>⭐ ⭐</td>
</tr>
<tr>
<td>white</td>
<td>⭐⭐⭐⭐⭐</td>
<td>⭐ ⭐</td>
</tr>
<tr>
<td>red</td>
<td>⭐⭐⭐⭐⭐</td>
<td>⭐ ⭐</td>
</tr>
<tr>
<td>green</td>
<td>⭐⭐⭐⭐⭐</td>
<td>⭐ ⭐</td>
</tr>
<tr>
<td>yellow</td>
<td>⭐⭐⭐⭐⭐</td>
<td>⭐ ⭐</td>
</tr>
<tr>
<td>blue</td>
<td>⭐⭐⭐⭐⭐</td>
<td>⭐ ⭐</td>
</tr>
</tbody>
</table>
### PART 1 Directions:

1. Describe each object as either **shiny** or **non-shiny**. Write the word in the box next to the object.
2. Make a prediction about what kinds of objects reflect light. Put a check ✅ in the “Before Task” column if you think it will reflect light.
3. Take large white construction paper outside and hang it up. This will be your screen.
4. Hold object so that the sunlight hits it and reflects light onto the screen.
5. After each object is tested, think about how well it reflected light and discuss it with your group.
6. Then put a check ✅ in the “After Task” column if the object reflected light.

<table>
<thead>
<tr>
<th>Object</th>
<th>Shiny</th>
<th>Non-Shiny</th>
<th>Reflects Light</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before Task</td>
</tr>
<tr>
<td>mirror</td>
<td></td>
<td></td>
<td>After Task</td>
</tr>
<tr>
<td>CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>overhead transparency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>folder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wood block</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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*Note: The table is to be filled in based on the instructions provided.*
Krista Morgan Lesson 2: Light Reflections

Worksheet 2—levels 2/3 (back)

Name: __________________________ Date: __________________________

WORD BANK

1. mirror
   CD
   overhead transparency

   book
   folder
   wood block

2. non-shiny
   shiny

3. dimly
   brightly

1. The (1.) __________________ is (2.) __________________ so it reflected light
   (3.) __________________ .

2. The (1.) __________________ is (2.) __________________ so it reflected light
   (3.) __________________ .

3. The (1.) __________________ is (2.) __________________ so it reflected light
   (3.) __________________ .

4. The (1.) __________________ is (2.) __________________ so it reflected light
   (3.) __________________ .

5. The (1.) __________________ is (2.) __________________ so it reflected light
   (3.) __________________ .

6. The (1.) __________________ is (2.) __________________ so it reflected light
   (3.) __________________ .

PART 2

What effect does the color of a surface have on light reflection?

Make a prediction by drawing a picture and filling in the blank.

I predict the effect of the colored paper will have on light reflection is __________________

______________________________

______________________________

______________________________

GENERALIZATION

Repeat the process for reflecting light off objects from PART 1 using the different colored paper. Write the word “bright” or “dim” to describe how paper reflected light.

<table>
<thead>
<tr>
<th>CONSTRUCTION PAPER</th>
<th>Bright</th>
<th>Dim</th>
</tr>
</thead>
<tbody>
<tr>
<td>black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>white</td>
<td></td>
<td></td>
</tr>
<tr>
<td>red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**PART 1 Directions:**
1. Write a description of each object using the words shiny or non-shiny.
2. Make a prediction about what kinds of objects reflect light. Put a check ✓ in the “Before Task” column if you think it will reflect light.
3. Take large white construction paper outside and hang it up. This will be your screen.
4. Hold object so that the sunlight hits it and reflects light onto the screen.
5. After each object is tested, think about how well it reflected light and discuss it with your group.
6. Then put a check ✓ in the “After Task” column if the object reflected light.

<table>
<thead>
<tr>
<th>Object</th>
<th>Shiny</th>
<th>Non-Shiny</th>
<th>Reflects Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mirror</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead transparency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood block</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What happens when you hold the shiny objects toward the light?
   When I do this with the shiny objects, _____________________________.

2. What happens when you hold the non-shiny objects toward the light?
   When I do this with the non-shiny objects, _____________________________.

3. What does this tell you about the reflection of light?
   This tells me that _____________________________.

---

**Krista Morgan Lesson 2: Light Reflections**

**Worksheet 3—levels 4 (front)**

Name: ______________________________ Date: ________________________

---

**Page 10**
PART 2

What effect does the color of a surface have on light reflection?

I predict the effect of the colored paper will have on light reflection is ____________________________

__________________________________________

Repeat the process for reflecting light off objects from PART 1 using the different colored paper. Write a sentence describing how the paper reflected the light using the words “bright” or “dim”

<table>
<thead>
<tr>
<th>CONSTRUCTION PAPER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>black</td>
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<tr>
<td>red</td>
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</tr>
<tr>
<td>green</td>
<td></td>
</tr>
<tr>
<td>yellow</td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td></td>
</tr>
</tbody>
</table>
LIGHT
REFLECTIONS
PART ONE

What kinds of objects reflect light?
Think about this question before doing the activity. List your thoughts about this below.

Collect a number of shiny and non-shiny objects that have at least one flat surface—the more objects you can find, the better. These can be things like a mirror, a piece of aluminum foil, a piece of paper, and a book.

Take a sheet of white paper outside and place it on a vertical flat surface. This paper will be your projection screen.

One at a time, hold your objects in such a way that they reflect light onto the screen.

What happens when you do this with the shiny objects?

What happens with the non-shiny objects?

What does this tell you about the reflection of light?
LIGHT REFLECTIONS

PART TWO

What effect does the color of a reflecting surface have on the light reflected? Think about this question before doing the activity. List your thoughts below.

Collect several different colors of construction paper (be sure to include white and black) and use them to repeat the process you used in Part One.

What happens when you use the white paper to reflect light onto the screen?

What happens when you use the black paper?

What happens when you use the other colors of paper to reflect light onto the screen?

What does this part of the activity tell you about the reflection of light?
<table>
<thead>
<tr>
<th>1. Picture</th>
<th>3. Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/150" alt="Image of a puddle with a reflection" /></td>
<td>I looked into the puddle of water and saw my <strong>reflection</strong>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Definition</th>
<th>4. Vocabulary Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>The return of light waves from a surface.</td>
<td><strong>reflection</strong></td>
</tr>
</tbody>
</table>

**Synonyms for reflecting:** bouncing, scattering, diffusing
## Objectives for Lesson 3

<table>
<thead>
<tr>
<th>Content Objectives</th>
<th>Language Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Observe properties of light as it travels through different transparent materials.</td>
<td>1. and 2. a. Students will work in small groups to discuss and record their observations about the properties of light as it travels through transparent materials and infer why and how light travels through transparent materials.</td>
</tr>
<tr>
<td>2. Infer why/how light travels through transparent materials.</td>
<td>b. Students will orally share their findings through whole group discussion.</td>
</tr>
<tr>
<td>3. Understand content vocabulary:</td>
<td>3. Students will accurately use content vocabulary during small group discussion, independent written responses, and whole group oral sharing.</td>
</tr>
<tr>
<td>transmit/ transmitting</td>
<td></td>
</tr>
<tr>
<td>refract/ refracting/ refraction</td>
<td></td>
</tr>
<tr>
<td>bend/ bending</td>
<td></td>
</tr>
<tr>
<td>transparent</td>
<td></td>
</tr>
</tbody>
</table>

## PERFORMANCE INDICATORS

<table>
<thead>
<tr>
<th>Domain Topic</th>
<th>Level 5</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking: Observations about the properties of light as it travels through transparent materials</td>
<td>Participate in a discussion questions that require high order thinking skills (ie. “why” questions) and responses in complete sentences.</td>
<td>Participate in a discussion using questions that generate one word or short phrase responses.</td>
<td>Participate in a discussion using visuals and yes or no questions.</td>
<td>Participate in a discussion using visuals, gestures, and pointing.</td>
<td></td>
</tr>
<tr>
<td>Writing: Apply understanding of key vocabulary through a contextualizing activity</td>
<td>Respond using complete sentences with accurate capitalization and punctuation.</td>
<td>Respond using shorter sentences and/or phrases.</td>
<td>Respond using fill in the blanks and visuals prompts.</td>
<td>Respond using fill in the blanks and visual prompts</td>
<td>Respond to drawing pictures</td>
</tr>
</tbody>
</table>
Krista Morgan  

**LESSON 3 Topic: Light Rays Slow Down-Refraction-- Grade 5**

<table>
<thead>
<tr>
<th>Function</th>
<th>Situation</th>
<th>Expression</th>
<th>Vocabulary</th>
<th>Grammar</th>
</tr>
</thead>
<tbody>
<tr>
<td>describe analyze infer</td>
<td>Experimenting with what happens when light travels from one transparent material to another.</td>
<td>Light can easily <strong><strong>1</strong></strong> through transparent materials. Light waves that <strong><strong>1</strong></strong> through transparent materials <strong><strong>2</strong></strong>. Light waves <strong><strong>2</strong></strong> because they are <strong><strong>3</strong></strong> slower through the transparent material than through air.</td>
<td>1. travel transmit pass</td>
<td>verbs and verbs adding -ing</td>
</tr>
</tbody>
</table>

**Reflection:**

This science lesson is for a 5th grade mainstream classroom with integrated ELLs. The original lesson is titled “Light Rays Slow Down” and comes from the book *Energy Exploration* published by AIMS Education Foundation.

One of the first adjustments I made to this lesson is to add a building background and vocabulary section. I incorporated realia (visuals) and a chart to show different transparent materials. In order to contextualize the two key vocabulary words (transparent and refraction) in this lesson, I created leveled “4-Corner” Vocabulary worksheets. The 4-corner vocabulary consists of four boxes. The first box is an illustration of the vocabulary word. The second box gives a sentence using the word. The third box is the definition and the fourth box has the actual word along with synonyms.

For level 1 the students draw the meaning of the word. Since at the beginning of the lesson I used various transparent realia, students can draw one of these examples. The sentence and definition are provided along with visual clues and underlined key words to help them understand what it says.

Levels 2 and 3 students draw the meaning of the word. The sentence is a fill-in the blank using a word bank. In the definition box there is still a visual but students now have to use underlined key words to fill-in the blanks. The synonyms are left blank and can be filled in using the chart created when discussing the properties of the transparent realia at the very beginning of the lesson.

Levels 4, 5 and mainstream students draw the meaning of the word. Create their own sentence and definition, as well as, fill in the synonyms for the word. I left the visual in the definition box just because it was a new word that I want students to get a firm grasp of.

This lesson has two mini hands on task so I created questioning prompts for different levels of language acquisition for both experiments. The level 1 student questions involve both teacher and students pointing, gesturing, and using the supplies from the experiment. The level 2 questions are designed to illicit simple responses like “yes” and “no”. The level 3 questions are “what” questions that give one word or short phrase responses. Levels 4 and 5 questions are higher order thinking questions using “why” and “how”. Response need applied knowledge and complete sentences.

pg. 2
LESSON 3 Topic: Light Rays Slow Down—Refraction—Grade 5

Words in regular font are taken from the original lesson titled “Light Reflection” from the book ENERGY EXPLORATIONS; pages 153-158 published by AIMS: Education Foundation, Fresno, CA. 93747

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- Words in italics are modifications and adjustments made to the original lesson.
- Worksheet pages are teacher created. Pages come from the original lesson.

NRC Standards:
- Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.
- Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from the object—emitted by or scattered from it—must enter the eye.

CCSS:
- RI 5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- W.5.2D Use precise language and domain-specific vocabulary to inform about or explain the topic.
- SL.5.1 Engage effectively in a range of collaborative discussions with diverse partners on grade 5 topics and texts, building on others’ ideas and expressing their own clearly.

Vocabulary:
- transmit/transmission
- refraction
- transparent
- bending

Key Questions:
- What happens when light travels from one transparent material to another?

Background Information for teacher to reinforce:
When light passes through some materials such as glass or water, it looks bent. This “bending” of light as it passes from air through water is called refraction. Light travels slower through glass and water than it does through air. To bend, light must strike a surface at an angle. It does not bend if it goes straight in.

Materials: clear plastic cups, pencils, water, yellow crayons, 4-Corner Vocab. worksheet and original worksheet

Procedure:

Building Background and vocabulary:

1. Hold up a clear plastic glass. Ask, “Is this transparent?” Hold up a clear overhead transparency. Ask, “Is this transparent?” Hold up a piece of plastic wrap. Ask, “Is this transparent?” How do we know that these things are transparent? Make a class chart listing of all the characteristics students come up with for the word transparent (possible responses: clear, see through, light can pass through it easily, transmits light, visible). Students will complete the top half of the “4 Corner” vocabulary card and may use the chart to help them fill it in especially levels 2, 3, 4 and 5.

Level 1 worksheet—page 7 Levels 2 and 3 worksheet—page 8 Levels 4, 5, and mainstream—page 9
Krista Morgan

LESSON 3 Topic: Light Rays Slow Down—Refraction—Grade 5

Explain to students that the bottom of the card has the word “refraction.” Write the word and definition for refraction on the board. Tell students that they will be filing out the bottom half of the “4 Corner” vocabulary card for the word “refraction” at the end of the lesson after they have done some experiments about light bending or refraction.

Hands-On Task

2. Set the purpose for the experiment by stating the key question “What happens when light travels from one transparent material to another?”

3. Hand out the original worksheet page titled “Light Rays Slow Down” page 6 (from Energy Exploration p.156 from AIMS Foundation) and supplies to be used during this experiment (so no pencils yet). Since there are two mini experiments, it might be a good idea for students to fold the paper in half so only one experiment is showing at a time. Ask students to name all the transparent materials that will be used in this experiment. (i.e. cup, water, air)

4. Students should work in pairs. One student will color in the “Happy Face” while the other fills one cup with water (about two-thirds full). When finished coloring, place an empty cup on the happy face.

5. Demonstrate for the students how to view the cup. It needs to be done at a 45 degree angle. A good way to do this is to tell students to rest their chin on the desk while their partner pours the water into the cup. Have one student pour water into the cup while the second student observes what happens to the happy face.

6. Direct them to slowly pour water into the cup until it is two-thirds full and observe the yellow happy face. (It will look as if it is rising to the top of the cup.)

7. Have them look straight into the cup from above; the yellow happy face is visible, but from the side—it disappears! The reflected light from the yellow happy face is bent (refracted) and we no longer see it. (You may want to place a small piece of tag board on top of the cup so that the yellow happy face is invisible from all angles.)

8. At the end of this experiment, have students stop, think, and discuss before moving on to the second experiment. Use leveled questioning prompts to encourage student participation during this whole class discussion.

Questioning Prompts for Different Levels of Language Acquisition: (experiment 1)

- **Level 1:** (Point to the happy face) Is the happy face on the bottom of the cup? (point to the bottom as you say it) Can you see it before pouring water in the cup? (hold up empty cup) After pouring the water, does it stay on the bottom? Have students gesture what happens to the happy face—they should move their hand from the bottom and go up.) When you look at the empty cup from the side, can you see the happy face? (gesture and model look from the side of the cup) After pouring the water in the cup, can you see the happy face from the side of the cup? (use gesture of pouring water).

- **Level 2:** What were the transparent materials used in this experiment? Where is the happy face on the top or bottom of the cup before pouring the water in? What happens to the happy face when you put water in the glass? Can you see the happy face when you look through the side of the empty cup? What happens when you look through the side of the cup filled with water?

- **Level 3:** What happens to the happy face when you put water in the glass? What happens to the happy face when you look through the side of the empty cup? What happens to the happy face when you look through the side of the cup filled with water?

- **Level 4 and 5:** What happens to the happy face when you put water in the glass? Why can’t you see the happy face on the bottom when you look at it from the side of the glass filled with water? Why do you think this is happening?
Krista Morgan

LESSON 3 Topic: Light Rays Slow Down-Refraction--Grade 5

9. Next, pass out a pencil to each group. Then ask the students to put a pencil inside the cup full of water. Direct them to let the pencil rest against the lip of the cup. Have them observe the pencil from above, below, and beside the cup.

10. Have the students draw what they observe.

11. At the end of this experiment, have students stop, think, and discuss. Use leveled questioning prompts to encourage student participation during this whole class discussion.

**Questioning Prompts for Different Levels of Language Acquisition: (experiment 2)**

- **Level 1:** Who can show me with their hands or body what the pencil in water looks like?
- **Level 2:** Does the pencil in the water look straight? Does the pencil look broken? Where? (show me)
- **Level 3:** What does the pencil in water look like? Where does the pencil appear to be broken? What happens when light travels from one transparent material to another? Besides water, what other things do you think might refract (bend) light?
- **Level 4 and 5:** What does the pencil in water look like? Why do you think it looks this way? What happens when light travels from one transparent material to another? From what you learned in this activity, why do you think it is so difficult to catch a fish in an aquarium?

12. In closing, students will then work independently to complete the second half of the “4 Corner” vocabulary worksheet for the word refraction.

For fun, let them place their thumb into the water and near the side of the cup. It will look enlarged and distorted. This is because the convex shape of the cup refracts the light and results in the magnification of the thumb.

**ORIGINAL “Connecting Learning” questions from** (Energy Explorations, pages 157-158; AIMS Foundation)

1. What happens to the happy face when you put water in the glass? [It looks like it is rising to the top of the cup.]

2. Why can’t you see the happy face on the bottom when you look at it from the side of the glass filled with water? [Light normally travels in straight lines and the reflected light from the happy face is bent (refracted) and we can no longer see it.]

3. What does a pencil look like in the cup of water? Why? [It looks broken or bent because light slows down when it travels through the glass and water, thus distorting the image.]

4. Where does the pencil appear to be broken? [at the surface of the water]

5. Why do you think it happens there? [The light’s speed changes as it goes from air to water. This causes the light rays to bend (refract).]

6. Have you ever tried to catch a fish in an aquarium and found it difficult? From what you learned in this activity, why do you think it was so difficult?

7. The bending of light rays is called refraction. Besides water, what other things do you think might refract (bend) the light rays?

8. What are you wondering now?
**Light Rays Slow Down**

1. Place a pencil into a cup of water.
2. Move it around. What happens?
3. Lean the pencil against the side and draw what you see.

1. Color the happy face. Place the empty cup on top of the face.
2. Slowly pour water into the cup. What happens?
3. Fill the cup two-thirds full. Look through the side of the cup. What happens?
<table>
<thead>
<tr>
<th>1. Picture (Draw a picture of something transparent)</th>
<th>3. Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Picture" /></td>
<td>I used a transparent diving mask, to help me see clearly underwater.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Definition</th>
<th>4. Vocabulary Word</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Something that light can easily pass through or transmit.</strong></td>
<td><strong>transparent</strong></td>
</tr>
<tr>
<td><img src="image2.png" alt="Diagram" /></td>
<td>Synonyms for transparent: clear, see through, visible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. Picture (Draw a picture of something refraction)</th>
<th>3. Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Picture" /></td>
<td>It is hard to grab a swimming fish because light refracts in water.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Definition</th>
<th>4. Vocabulary Word</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A light waves that bend when passing through transparent materials.</strong></td>
<td><strong>refraction</strong></td>
</tr>
<tr>
<td><img src="image4.png" alt="Diagram" /></td>
<td>Synonyms for refracting: bending</td>
</tr>
</tbody>
</table>
1. Picture (Draw a picture of something transparent)

2. Definition

Something that light can **easily** pass through or transmit.

3. Use word bank to finish the sentence.

   I used a _________ diving mask
to help me see _______ underwater.

   clearly transparent

4. Vocabulary Word

   transparent

   Synonyms for transparent:

   ___________  ___________

1. Picture (Draw a picture of something refraction)

2. Definition (use the words **bend** and **transparent**)

A light waves that _____________ when they pass through ______________ materials.

3. Write a sentence to describe the picture. Use any form of the word **refract**.

4. Vocabulary Word

   refracting

   Synonyms for refracting: ___________
1. Picture (Draw a picture of something transparent)

2. Definition

3. Write a sentence using the word transparent.

4. Vocabulary Word

transparent

Synonyms for transparent:

1. Picture (Draw a picture of something refraction)

2. Definition

3. Write a sentence to describe the picture. Use any form of the word refract.

4. Vocabulary Word

refraction

Synonyms for refracting:
Original Lessons
APPENDIX: ORIGINAL MATERIAL

Krista Morgan-FLA 518

INTRODUCTION

• **Unit title:** Exploring Light Energy
• **Grade level:** 5th grade
• **Target Group:** Mainstream science class with integrated ELL students.
• **Source for both written reading material and lessons:** ENERGY EXPLORATIONS. AIMS Education Foundation, Fresno, CA.
  Written reading material comes from pages 93-94.
• **The learning goals I want my students to know are:**
  ✓ Light reacts differently to objects that are opaque, transparent, and translucent.
  ✓ Light reflects off objects and colors in different ways.
  ✓ Refractions or bending of light happens when light travels through different transparent materials.
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LESSON 1

Topic: Light Energy

Key Question: Would you describe a paper towel as transparent, translucent, or opaque?

Learning Goals:  • determine how light reacts on paper,  • compare how light reacts on paper with a drop of cooking oil on it, and  • use the vocabulary of transparent, translucent, and opaque to describe their observations.

Objectives: Students will observe light being reflected from a piece of paper. The fibers of the paper (its “hairy” nature) cause the light to be scattered in various directions. When a spot of oil is placed on the paper, the oil fills in the unevenness of the fibers and allows light to be transmitted through the paper instead of being scattered by the fibers. Students will notice that the oil will smooth out the hairiness of the paper towel. When the paper with the oil spot is on the desk, the spot looks dark; however, when the paper is held up to the light or placed over a piece of printed material, the spot seems translucent.

Vocabulary: opaque (does not let light pass through, light is reflected and absorbed), transparent (can be seen through, capable of transmitting light), and translucent (transmits some light) should be reinforced throughout this experience.

Background Information:
  • Light travels in a straight line until it strikes an object.
  • Light can be reflected by a mirror, refracted by a lens, or absorbed by the object. Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).
  • To see an object, light from that object—emitted by or scattered from it—must enter the eye.

Materials For each group: paper towel (brown type found in schools), a variety of paper variety besides the paper towels. Suggestions are: white copy paper, various colors of construction paper, and card stock. Cut paper into 3" x 5" pieces. Scraps of paper will also work. Putting the paper samples into small plastic bags will allow for easy distribution. Each group needs a small bit of cooking oil in the plastic cup. A one-centimeter depth is sufficient.

1. Each group of three or four students needs a Procedure 1.
2. Tell students that they are going to review the terms transparent, translucent, and opaque. 2.
3. Hold up the paper towel. Ask students which term best describes it and why they determined that. [Opaque. If we held a flashlight in front of the paper towel, the paper towel would cast a dark shadow because it blocked the light.]
4. Invite a student from each group to get a paper towel.
5. Display the Key Question and Learning Goals page.
6. Discuss the first Learning Goal in relation to the paper towel. [Light did not pass through it. Light was absorbed and scattered.] Tell students that you have a variety of papers, and they are going to determine how light interacts with each one—is it transmitted, absorbed, or scattered?
7. Distribute the paper samples and let students discuss how light interacts with them.
8. Have students focus on the second Learning Goal. Ask them what material they need to accomplish this goal. [cooking oil] Distribute the cups of cooking oil.
9. Tell students to dip the tip of a finger into the oil and place a spot of oil on the paper towel. Discuss their observations. [The oil spot is darker than the rest of the paper.] Invite them to hold the paper up to the light and observe. [The oil spot is light, the rest of the paper is darker. The oil spot lets some light pass through. It is translucent.]
10. Direct them to hold the oil spot over some printed material and relate their observations. [The print can be read through the oil spot.] (Encourage students to use the vocabulary of opaque and translucent.)
11. Invite students to investigate different types and colors of paper, perhaps beginning with the white copy paper sample.

**Connecting Learning:**
1. What do we mean when we say light is transmitted? [It means that light passes through a material.]
2. What are some materials that light can pass through? [Any material that is transparent or translucent, such as clear glass, transparency film, plastic water bottles, acrylic light covers, etc.]
3. Was light transmitted through our paper samples? Explain how you know.
4. Describe the surfaces of the paper. [They are fuzzy because of the paper fibers sticking up. Copy paper is smoother than the construction paper and the paper towels.]
5. What effects did the oil have on the paper? [It smoothed the surface of the paper. Some of the paper that was opaque to begin with became translucent with the oil.]
6. Do you think color had anything to do with whether a paper became translucent or not? Explain.
7. In the colonial days, instead of using expensive and fragile glass, people would smear oil on paper and place them in window frames. How does what you learned in this activity apply to this practice? [The oiled paper would somewhat protect the inhabitants, but would allow light to pass through into the home.]
8. What are you wondering now?

**Extension** To make stained glass-looking pictures, have students use crayons to color a design on white paper and then use a paper towel dipped in cooking oil to coat the paper.
LESSON 2 Original

LIGHT REFLECTIONS

Topic
Light reflection

Key Questions
1. What kinds of objects reflect light?
2. What effect does the color of a reflecting surface have on the light reflected?

Learning Goals
Students will:
• explore the phenomenon of light reflection, and
• observe which colors reflect more light.

Guiding Document
NRC Standards
• Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.
• Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object—emitted by or scattered from it—must enter the eye.

Science
Physical science
light energy
reflection

Integrated Processes
Observing
Comparing and contrasting
Generalizing

Materials
Student pages
White paper, 12" x 18", for screen, one per group
Tape

Part One
For each group:
collection of shiny objects with at least one flat surface (e.g., mirrors, CDs, pieces of aluminum foil, overhead transparencies, pieces of plastic, etc.)
collection of non-shiny objects with at least one flat surface (e.g., books, binders, wood blocks, cardboard, paper, etc.)

Part Two
For each group:
sheets of various colors of construction paper, including white and black

Background Information
Part One
It is a common misconception that only mirrors or similar shiny objects reflect light. In fact, almost all things reflect light. (It is quite difficult to find something that will reflect no light.) The amount of light reflected by objects varies greatly and depends on such things as an object's material, color, and texture. Our eyes are able to see objects around us because light rays from the sun or other sources reflect off these objects and enter our eyes. If it were not for this reflected light, we could not see the objects.

In this activity, students will use objects with flat surfaces to reflect light from the sun onto a white paper screen. Although this activity uses objects with flat surfaces because they make it easier to reflect light onto the screen, it is important to note that objects without flat surfaces also reflect light.

Part Two
Sunlight is made up of all the colors of the spectrum. Things that reflect all the colors of the spectrum appear to be white in sunlight. (It is important to note that white objects only appear white when viewed in full-spectrum light. When viewed under different light, the white object takes on the color of the available light—the red light of a photographic darkroom for example.) Things that absorb all the colors of the spectrum appear black. Things that appear to be a certain color absorb certain parts of the spectrum and reflect other parts. This can be fairly straightforward, or rather complex. For example, a red rose appears red because it reflects red light while absorbing the other colors of the spectrum, but a yellow daffodil reflects red, yellow, and green light (which combine to produce the yellow we see) while absorbing the other colors. The light reflected from a colored (non-white or non-black) object is not full-spectrum light.

In the activity, white construction paper reflects all colors of the visible spectrum and thus should produce the brightest reflection. Black paper will absorb all colors of the spectrum and therefore should produce the dimmest reflection. The other colors will reflect
Lesson 2 Original

various amounts of light between these two extremes. The colored papers will also produce a tint on the white screen. Students will see a red tint when using the red paper and a green tint when using the green, for example.

Management
1. Caution students never to look directly at the sun or its reflection in a mirror (or similar shiny object) since this may result in permanent damage to their eyes.
2. For the greatest effect, this activity needs to be done on a sunny day when there are distinct shadows. However, it can be done in the classroom.
3. You will need to think of what flat objects you can find in the classroom to use in Part One. If you want each group to use the same sets of objects, you will need to collect enough of each item ahead of time. For example, each group could use a CD, an overhead transparency, and a mirror for its shiny objects and a dictionary, a blue folder, and a block of wood borrowed from the kindergarten classroom for their non-shiny objects.
4. Scout out a suitable site for the activity beforehand. This site should be a place where distinct shadows and sunlit areas intersect on a smooth, flat surface.
5. If it is windy, you will need to find a way to attach the large, white-paper screen to the flat surface.

Procedure
Part One
1. Discuss the first Key Question: “What kinds of objects reflect light?” Use student answers to determine what students currently understand about light reflection.
2. Tell students they will be doing an activity to help them answer this question. Hand out the student page and divide the class into small groups.
3. Have students collect a variety of classroom objects (having at least one flat surface), making sure to include both shiny and non-shiny things.
4. Have students follow the directions on the student page. After they do each part, lead them in a discussion and have them record their answers.

Part Two
1. Hand out the second student page and colored construction paper.
2. Ask the second Key Question: “What effect does the color of a reflecting surface have on the light reflected?”
3. Have students follow the directions on the second student page. After they do each part, lead them in a discussion and have them record their answers.
4. Return to the classroom and discuss what students have learned about reflected light from doing this activity.

Connecting Learning
Part One
1. What kinds of objects reflect light? [While light is reflected better by shiny objects, non-shiny objects also reflect light.]
2. What happened when you used the shiny objects to reflect light onto the screen? [These objects reflect a bright patch of light onto the screen.]
3. What did you notice when you used the non-shiny objects to reflect light onto the screen? [These objects reflect a noticeable amount of light, but this light is more diffused than the light reflected by the shiny objects.]
4. What does this tell you about the reflection of light? [All the objects used, not just the shiny ones, reflect light.]

Part Two
1. What effect does the color of a reflecting surface have on the light reflected? [The lighter colors reflect more light than the darker colors.]
2. What happened when you used the white paper to reflect light? [The white paper reflects the most light.]
3. What happened when you used the black paper to reflect light? [The black paper also reflects light, but not as much as the other colors.]
4. What did you notice when you used the red (or another color) paper to reflect light onto the screen? [The red paper reflects red light which gives the white screen a reddish tint.]
5. What did you learn about the refraction of light from this part of the activity? [All colors reflect some light, but the lighter ones reflect more than the darker ones. The color reflected corresponds to the color of the reflecting surface. The white paper seems to reflect the most light. Etc.]
6. What are you wondering now?

Extensions
1. Have students experiment with the variable of texture on the amount of light reflected.
2. Have students see what happens to the amount of light reflected when a shiny material like aluminum foil is crinkled.
3. Have students use a photographic light meter to quantify the amount of light reflected by various objects, colors, or materials.
LIGHT REFLECTIONS

PART ONE

What kinds of objects reflect light?
Think about this question before doing the activity. List your thoughts about this below.

Collect a number of shiny and non-shiny objects that have at least one flat surface—the more objects you can find, the better. These can be things like a mirror, a piece of aluminum foil, a piece of paper, and a book.

Take a sheet of white paper outside and place it on a vertical flat surface. This paper will be your projection screen.

One at a time, hold your objects in such a way that they reflect light onto the screen.

What happens when you do this with the shiny objects?

What happens with the non-shiny objects?

What does this tell you about the reflection of light?
LIGHT
REFLECTIONS
PART TWO

What effect does the color of a reflecting surface have on the light reflected?
Think about this question before doing the activity. List your thoughts below.

Collect several different colors of construction paper (be sure to include white and black) and use them to repeat the process you used in Part One.

What happens when you use the white paper to reflect light onto the screen?

What happens when you use the black paper?

What happens when you use the other colors of paper to reflect light onto the screen?

What does this part of the activity tell you about the reflection of light?
LIGHT REFLECTIONS

Connecting Learning

Part One
1. What kinds of objects reflect light?

2. What happened when you used the shiny objects to reflect light onto the screen?

3. What did you notice when you used the non-shiny objects to reflect light onto the screen?

4. What does this tell you about the reflection of light?
LIGHT REFLECTIONS

Connecting Learning

Part Two

1. What effect does the color of a reflecting surface have on the light reflected?

2. What happened when you used the white paper to reflect light?

3. What happened when you used the black paper to reflect light?

4. What did you notice when you used the red paper to reflect light onto the screen?

5. What did you learn about the reflection of light from this part of the activity?

6. What are you wondering now?
Light Rays SLOW DOWN

Topic
Refraction

Key Question
What happens when light travels from one transparent material to another?

Learning Goals
Students will:
• observe properties of light as it travels through different transparent materials, and
• make inferences as to why it reacts the way it does.

Guiding Document
NRC Standards
• Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.
• Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from the object—emitted by or scattered from it—must enter the eye.

Science
Physical science
light energy
refraction

Integrated Processes
Observing
Comparing and contrasting
Inferring
Collecting and recording data
Drawing conclusions

Materials
Clear plastic cups
Pencils
Water
Yellow crayons or sticky dots (see Management 2)
Student page

Background Information
When light passes through some materials such as glass or water, it looks bent. This “bending” of light as it passes from air through water is called refraction. Light travels slower through glass and water than it does through air. To bend, light must strike a surface at an angle. It does not bend if it goes straight in.

Management
1. Students should work in pairs. Have one student pour water into the cup while the second student observes what happens to the happy face.
2. Students may use a bright sticky dot to cover the happy face on the activity sheet or they may color it yellow.
3. Students must view the cups at about a 45° angle.

Procedure
1. Give each student or group of students a plastic cup and the student page. Tell them to color the happy face yellow or give them a bright sticky dot.
2. Demonstrate for the students how they need to view the cup at a 45° angle.
3. Direct them to slowly pour water into the cup until it is two-thirds full and observe the sticky dot. (It will look as if it is rising to the top of the cup.)
4. Have them look straight into the cup from above; the sticker is visible, but from the side—it disappears! The reflected light from the sticker is bent (refracted) and we no longer see the sticker. (You may want to place a small piece of tagboard on top of the cup so that the sticker is invisible from all angles.)
5. Next, ask the students to put a pencil inside the cup full of water. Direct them to let the pencil rest against the lip of the cup. Have them observe the pencil from above, below, and beside the cup.
6. Have the students draw what they observe.
7. For fun, let them place their thumb into the water and near the side of the cup. It will look enlarged and distorted. This is because the convex shape of the cup refracts the light and results in the magnification of the thumb.

**Connecting Learning**

1. What happens to the happy face when you put water in the glass? [It looks like it is rising to the top of the cup.]
2. Why can’t you see the happy face on the bottom when you look at it from the side of the glass filled with water? [Light normally travels in straight lines and the reflected light from the happy face is bent (refracted) and we can no longer see it.]
3. What does a pencil look like in the cup of water? Why? [It looks broken or bent because light slows down when it travels through the glass and water, thus distorting the image.]
4. Where does the pencil appear to be broken? [at the surface of the water]
5. Why do you think it happens there? [The light’s speed changes as it goes from air to water. This causes the light rays to bend (refract).]
6. Have you ever tried to catch a fish in an aquarium and found it difficult? From what you learned in this activity, why do you think it was so difficult?
7. The bending of light rays is called refraction. Besides water, what other things do you think might refract (bend) the light rays?
8. What are you wondering now?
Light Rays SLOW DOWN

Key Question
What happens when light travels from one transparent material to another?

Learning Goals

Students will:

• observe properties of light as it travels through different transparent materials, and

• make inferences as to why it reacts the way it does.
Light Rays SLOW DOWN

1. Place a pencil into a cup of water.
2. Move it around. What happens?
3. Lean the pencil against the side and draw what you see.

1. Color the happy face. Place the empty cup on top of the face.
2. Slowly pour water into the cup. What happens?
3. Fill the cup two-thirds full. Look through the side of the cup. What happens?
Connecting Learning

1. What happens to the happy face when you put water in the glass?

2. Why can’t you see the happy face on the bottom when you look at it from the side of the glass filled with water?

3. What does a pencil look like in the cup of water? Why?

4. Where does the pencil appear to be broken?

5. Why do you think it happens there?
Connecting Learning

6. Have you ever tried to catch a fish in an aquarium and found it difficult? From what you learned in this activity, why do you think it was so difficult?

7. The bending of light rays is called refraction. Besides water, what other things do you think might refract (bend) the light rays?

8. What are you wondering now?
Checklists
# TSL 518: Sheltered ELL Strategies Checklist

**Unit: Light Energy**

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