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Grade 4

## **Cluster 2: Light**

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### **Overview**

In previous grades, students had an informal introduction to energy. In this cluster, students begin to examine in more depth one form of energy they encounter on a daily basis — light. In *Grade 4, Cluster 3: Sound*, students study another aspect of energy — sound. Whether these clusters are addressed separately or as part of a combined unit, the emphasis is on building an understanding of energy. Students become familiar with the properties of light by investigating and observing how light interacts with various objects in the environment. From these observations, students come to recognize that light travels in a straight line, knowledge which they will apply, along with their design-process skills, to the construction of simple optical devices.

**PRESCRIBED LEARNING OUTCOMES**

**SUGGESTIONS FOR INSTRUCTION**

*Students will...*

**4-2-01** Use appropriate vocabulary related to their investigations of light.  
 Include: energy, reflect, absorb, transmit, artificial, light beam, transparent, translucent, opaque, technological development, science, brightness.  
 GLO: A5, B1, C6, D4

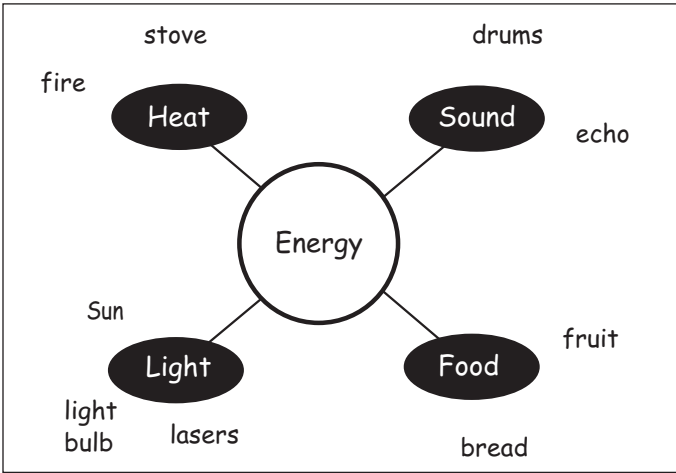
➤ Introduce, explain, use, and reinforce vocabulary throughout this cluster.

**4-2-02** Give examples of various forms of energy.  
 Include: light, heat, food, sound.  
 GLO: D4, E4

**4-2-03** Recognize that energy is an integral part of daily life.  
 GLO: B1, D4, E4

➤ **Forms of Energy**

Use a Thinking Map to assist recall and organization of prior knowledge and to develop shared knowledge about various forms of energy. (Note: Thinking Maps are discussed in *ELA, Strategies*, p. 49.) Example:



**4-0-4e.** Identify problems as they arise, and work with others to find solutions. GLO: C3, C7

**4-0-6d.** Sort and classify according to an established classification system. (Math PR-II.2.4) GLO: C2, C3

**4-0-7e.** Communicate results and conclusions in a variety of ways. *Examples: point-form lists, sentences, graphs, labelled diagrams, charts...* (ELA 2.3.5, 4.2.5; Math SP-III.1.4, SP-III.2.4; TFS 2.1.4) GLO: C6

➤ **Observing the Environment — Finding Energy**

Have students work in pairs to list examples of energy found in their school building and schoolyard. Students then work with another pair to sort and categorize the energy examples according to the form of energy. Students may put the same example into more than one category. Use a Sharing Circle to have each group share their chart. (Note: Sharing Circle is discussed in *ELA, Strategies*, p. 106.)

➤ **Light Energy**

Have students draw pictures in their science journals representing light as a form of energy.

## TEACHER NOTES

## SUGGESTIONS FOR ASSESSMENT

**Planning Note:** Outcomes 4-2-02 and 4-2-03 are similar to outcomes 4-3-02 and 4-3-03 in Cluster 3: Sound. If the class has already studied sound energy, a quick review of energy with a “light” focus would be sufficient.

**Energy** is a very important, yet challenging concept in science. It is recommended that students at this level talk about and use the term “energy” before they are able to define it. An appropriate working definition would be that energy makes things go, run, or happen. (See American Association for the Advancement of Science, *Benchmarks for Science Literacy*, p. 81.)

In later years, students will work towards the more formal definition of energy as the ability to do work. Energy can be identified through things such as movement, heat, electricity, magnetic attraction, gravity, sound, and light. Energy can also be stored and used at later times (potential energy).

**Science Journal Entry: Energy**

Student directions: In your science journal, draw four pictures to show a variety of forms of energy found in your home. Be sure to label your pictures with the form of energy and its location.

Look for

- four pictures drawn
- clearly labelled
- a variety of energy forms shown
- work neatly done

**PRESCRIBED LEARNING OUTCOMES**

**SUGGESTIONS FOR INSTRUCTION**

*Students will...*

**4-2-04** Demonstrate that white light can be separated into colours.  
GLO: C2, D4

**4-0-7a.** Draw a conclusion based on evidence gathered through research and observation. GLO: A1, A2, C2  
**4-0-7b.** Identify new questions that arise from what was learned. (ELA 3.3.4) GLO: A1, C2, C3

**4-2-05** Distinguish between objects that produce their own light and those that reflect light from another source.  
*Examples: the Sun emits its own light, the Moon reflects light from the Sun...*  
GLO: A1, A2, D4

**4-2-06** Identify a variety of natural and artificial light sources.  
*Examples: Sun, candle, light bulb, firefly, lightning, aurora borealis, lasers...*  
GLO: D4

**4-0-4g.** Communicate questions, ideas and intentions, and listen effectively to others during classroom-learning experiences. GLO: C6  
**4-0-6d.** Sort and classify according to an established classification system. (Math PR-II.2.4) GLO: C2, C3

➤ **Investigating Colours**

Have students hold a prism in sunlight to observe the colour of the rays that are separated onto a white paper background.

Ask the following questions:

- What do you see when the light passes through the prism?
- Are the colours all the same? What are the colours?
- Why does this happen?
- What does this tell you about white light?

➤ **Produce or Reflect?**

Have students work in small groups to sort a variety of pictures into two categories. Provide a word list and categories. (See *Success for All Learners*, 6.33-6.35.)

<u>Produce Own Light</u>	<u>Reflect Light from Other Sources</u>
fireflies	bicycle reflector
Sun	moonlight on water
stars	planets
light bulb	Moon

Have students share their categorizations.

➤ **Natural or Artificial?**

As a class, brainstorm and list a large number of sources of light. Have students work in small groups to categorize items as having natural or artificial light. Students may add other items as they work together. Have students share their work with classmates.

➤ **Carroll Diagram**

Have students revisit their lists from **Natural or Artificial?** and regroup these items according to the new variable of either producing or reflecting light.

	Natural	Artificial
produces light		
reflects light		

**TEACHER NOTES**

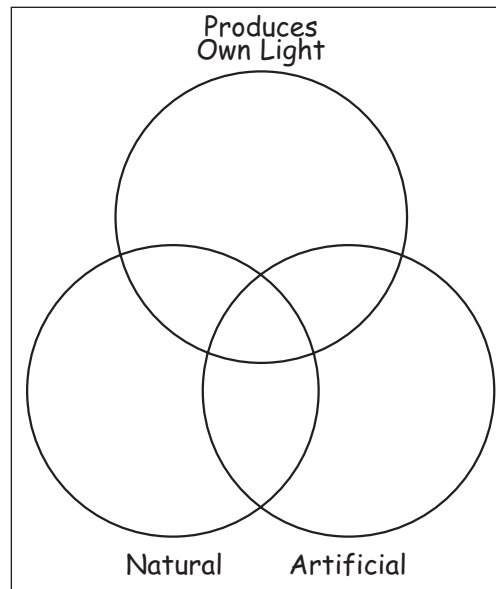
**Caution:** Ensure the students do not look directly at the Sun.

Visible white light is made up of the colours of the rainbow: red, orange, yellow, green, blue, indigo, and violet (Roy G. Biv). A prism (or even a glass of water) helps to separate out all the colours within white light.

**SUGGESTIONS FOR ASSESSMENT**

**Paper and Pencil Task: Light Sources**

1. Give four examples of objects that produce their own light.
2. Give four examples of objects that reflect light from other sources.
3. What is the difference between natural and artificial light?
4. Sort the following light sources using the Venn diagram.
  - fireflies
  - light bulb
  - candle
  - flashlight
  - Sun
  - Moon
  - stars
  - mirror
  - lightning



PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p><b>4-2-07</b> Observe and describe properties of light. Include: travels in a straight path, bends as it passes from one medium to another, can be reflected, can be different colours. GLO: C2, D4</p> <p><b>4-2-08</b> Explore to determine effects different materials and objects have on a light beam. <i>Examples: prisms and water bend light; some lenses intensify light, whereas others disperse light...</i> GLO: C2, D3, D4</p>
<p><b>4-0-1a.</b> Ask questions that lead to investigations of living things, objects, and events in the local environment. (ELA 1.2.4, 3.1.2) GLO: A1, C2, C5</p> <p><b>4-0-1b.</b> Make and justify predictions based on observed patterns, collected data, or data provided from other sources. <i>Examples: graph, chart...</i> (ELA 1.1.1, 1.2.1; Math PR-III.1.4) GLO: A1, C2</p> <p><b>4-0-4f.</b> Assume roles, and share responsibilities as group members. (ELA 5.2.2) GLO: C7</p> <p><b>4-0-4h.</b> Use tools and apparatus in a manner that ensures personal safety and the safety of others. GLO: C1</p> <p><b>4-0-5c.</b> Record observations in a variety of ways. <i>Examples: point-form notes, sentences, labelled diagrams, charts...</i> (ELA 2.1.1, 3.3.1, 4.1.1, 4.1.2; Math SP-1.2.4, SP-II.2.4) GLO: C2, C6</p> <p><b>4-0-7a.</b> Draw a conclusion based on evidence gathered through research and observation. GLO: A1, A2, C2</p> <p><b>4-0-8a.</b> Recognize that experimental results may vary slightly when carried out by different persons, or at different times or places; but that if the results of repeated experiments are very different, something must be wrong with the design of the experiment. GLO: A1, A2, C2</p> <p><b>4-0-9c.</b> Report and record what is observed, not what they think they ought to observe, nor what they believe the teacher expects. GLO: C5</p>

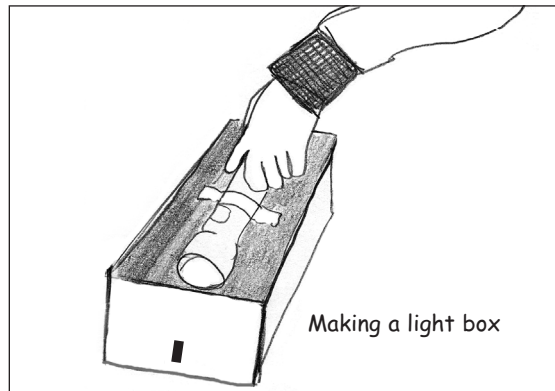
SUGGESTIONS FOR INSTRUCTION

➤ **Properties of Light**

Use a KWL strategy (Ogle, 1986) with the whole class to activate and share students’ prior knowledge about the properties of light (K), and to focus attention on what they will be learning about light. Have students delete misconceptions in the K column and add questions to the W column as the study ensues. Students also list facts in the L column. (See *ELA, Strategies*, p. 89.)

➤ **Constructing a Light Box**

Have students paint the interior of a shoebox black. Include the lid. Cut one vertical slit 2 cm long x 1 cm wide in one end. The slit should begin 2 cm from the bottom of the. With tape, affix a flashlight inside the box so that the beam will shine through the slit. (The flashlight may need to be mounted on a base.) The tape will prevent the flashlight from moving when the box is placed on an upright angle. The light box will be used in a number of investigations. Teachers may choose to have each student make a light box or have students work in small groups.



➤ **Investigation 1: Observing How Light Travels**

Provide students/small groups with two squares of heavy black cardboard and one square of white cardboard, each approximately 10 cm x 10 cm square. Each black card should have a hole punched in the centre. Have students use a knitting needle to align the three cards in an upright position with each other and with the light box. (Keep the cards within 45-50 cm of the light box.) The white card should be at the end of the row of cards in order to serve as a screen for the light beam. The cards should be centred so that the two holes on the black cards line up. Have students use plasticine or modelling clay to affix the cards in place to the ground, desk-top, or level surface.

(continued)

**TEACHER NOTES**

**SUGGESTIONS FOR ASSESSMENT**

Ensure students include what they recently learned about white light being made up of different colours.

How well the light box works is dependent on the quality of the flashlight and the distance over which the beam is expected to travel. Try to limit distances to 45-50 cm. Commercial light boxes are available and would be beneficial for teacher demonstrations.

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
<p><i>Students will...</i></p>	<p>Darken the room and have students turn on their light boxes and observe how light travels. (Students should see the light travel through the holes of the black cards, producing a circular beam of light on the white screen.) Note: The holes in the cards must be aligned in order for this to work.</p> <p>Have students predict what will happen to the light beam if they repeat the above investigation after having moved the second black card out of alignment. Have students then move the second black card a few centimetres to the right or left so the holes no longer match up. Have them shine their light boxes in the darkened room. (The circular beam of light will appear on the card that was moved, rather than on the white screen.) Ask the students the following questions:</p> <ul style="list-style-type: none"> <li>• Does a light ray bend?</li> <li>• How do you know?</li> </ul> <p><b>Extension — Teacher Demonstration</b></p> <p>Repeat the previous activities, using a stick of incense, directing the smoke onto the ray of light. This will give students an opportunity to see that the light beam travels in a straight line.</p> <div data-bbox="673 1066 1399 1360" data-label="Image"> <p>The diagram illustrates the experimental setup. On the right is a 'light box' containing a 'flashlight inside'. A 'beam of light' is shown as a line originating from the flashlight and passing through three 'black cards' that are held in place by 'plasticine'. The beam continues to a 'white card' on the left, where it forms a circular spot. Labels with leader lines identify each component: white card, beam of light, flashlight inside, plasticine, black cards, and light box.</p> </div> <p>➤ <b>Investigation 2: Observing Light Travelling through Water</b></p> <p>Have each student/small group place the light box on an elevated stand such as a stack or a box of books. The light box should be arranged so that it is pointing down on an angle, into a large, transparent container of water below, no more than 20-30 cm away. A small aquarium or clear, plastic tub are both suitable. Make the water murky by adding a few drops of milk or some milk powder. Darken the room and have students turn on their light boxes to observe what happens to the beam of light. (The beam will bend when it hits the water.) Ask students:</p> <ul style="list-style-type: none"> <li>• Where does the light beam hit the water? (Answers will vary. Beam may enter from the side or top of the container.)</li> <li>• What happens to the light beam when it hits the water? (It bends. The light does not travel in a straight line.)</li> </ul> <p style="text-align: right;">(continued)</p>



TEACHER NOTES

SUGGESTIONS FOR ASSESSMENT

**Observation Checklist: Light Investigations**

The student

- asks questions that lead to investigations of light
- makes predictions
- assumes roles and shares group responsibilities
- asks relevant questions
- shares ideas
- uses tools in a manner that ensures personal safety and the safety of others
- records observations in a variety of ways
- draws a conclusion based on evidence gathered through research and observation
- recognizes that experimental results vary slightly when experiments are carried out by different people

**PRESCRIBED LEARNING OUTCOMES**

*Students will...*

**SUGGESTIONS FOR INSTRUCTION**

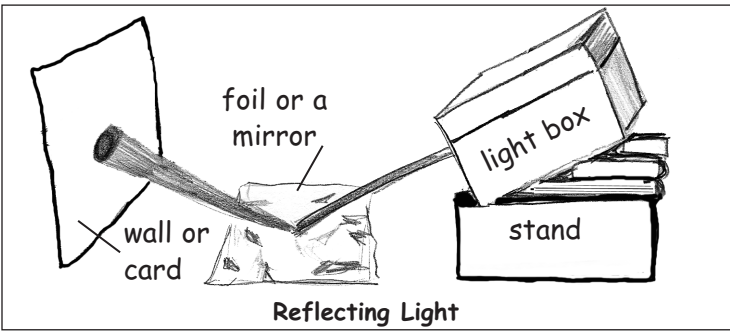
➤ **Investigation 3: Reflecting Light**

The purpose of this investigation is to observe how light is reflected. Have students elevate their light boxes on stands half a metre away from a light-coloured wall. Have the light boxes shine down, on an angle, onto the floor, where a mirror lies. Have students observe the size and brightness of the patch of reflected light on the wall that occurs as a result of light being shone down onto the reflective surface and bounced onto the wall. For the strongest reflection, boxes should be placed as close as possible to the mirror (10-15 cm) with the mirror placed close to the wall. (The smaller and brighter the patch, the more reflective the surface.) Have students try a variety of materials in place of the mirror, such as crumpled tin foil, flat tin foil, fabric, paper, etc.

Math extension: Have students undertake this activity with a variety of materials. Students should measure the diameter of the patch of light on the wall and describe the quality of the light.

Example:

<u>Materials</u>	<u>Diameter</u>	<u>Quality of Light</u>
mirror	7.5 cm	bright, shiny
crumpled foil	4.5 cm	less bright, spotty
flat foil	7 cm	bright, shiny
metal mesh fabric	3 cm	spotty, dull
paper	1 cm	faint light
black paper	0 cm	no reflection



TEACHER NOTES

SUGGESTIONS FOR ASSESSMENT

**Learning Log Entry: Light Beams**

Student directions: How do materials and objects affect light beams? Make reference to your investigations.

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Look for

- intensifies the beam
- bends the beam
- reflects light
- breaks it into different colours

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
<p><i>Students will...</i></p>	
<p><b>4-2-09</b> Recognize that most objects that produce light also give off heat, and identify objects that produce light but give off little or no heat. GLO: D4</p>	<p>➤ <b>Observing Objects in Our Environment</b></p> <p>With students, brainstorm to list objects in our environment that produce light. (Examples: glow-in-the-dark sticks, light bulbs, light sticks, clock radios, glow-in-the-dark stickers, microwaves, calculators, fireflies, etc.)</p> <p><b>Questions for Discussion</b></p> <ul style="list-style-type: none"> <li>• Do all lights give off heat?</li> <li>• Can light be produced without heat?</li> </ul>
<p><b>4-2-10</b> Classify materials as transparent, translucent, or opaque. GLO: D3, E1</p> <p><b>4-2-11</b> Evaluate the usefulness of a material for a particular task based on its ability to transmit, reflect, or absorb light.</p> <p><i>Examples: usefulness of coloured glass to preserve food and drink by protecting them from light...</i></p> <p>GLO: A5, B1, D3</p>	<p>➤ <b>Demonstration: Transparent, Opaque, and Translucent Materials</b></p> <p>Show students three different drinking glasses — clear, coloured, and styrofoam. Fill the glasses with the same coloured liquid. Ask the following questions:</p> <ul style="list-style-type: none"> <li>• What is in each glass?</li> <li>• How do you know?</li> <li>• Which one was easiest to tell? Why?</li> </ul> <p>➤ <b>Investigating Materials</b></p> <p>Have students work in small groups. Have students begin a class collection of different objects or illustrations of objects that are transparent, translucent, or opaque. Have students sort and classify the materials according to the amount of light that shines through. Discuss their classifications. If the terms “transparent,” “opaque,” and “translucent” don’t come up in the discussion, introduce them at this time. Ask students the following questions:</p>
<p><b>4-0-4e.</b> Identify problems as they arise, and work with others to find solutions. GLO: C3, C7</p> <p><b>4-0-4f.</b> Assume roles, and share responsibilities as group members. (ELA 5.2.2) GLO: C7</p> <p><b>4-0-4h.</b> Use tools and apparatus in a manner that ensures personal safety and the safety of others. GLO: C1</p>	<p>• When might you want to use materials that are transparent? Translucent? Opaque? (Some drinks are put in opaque bottles because they would spoil in the light; windows are transparent because we want light to come in and we want to see outside.)</p>

## TEACHER NOTES

## SUGGESTIONS FOR ASSESSMENT

**Transparent** - materials which allow light to pass through and allow objects on the other side to be seen clearly, e.g., clear glass.

**Translucent** - materials which allow some light to pass through, but objects behind them cannot be seen clearly, e.g., frosted glass, tissue paper.

**Opaque** - materials which do not allow light to pass through, e.g., wood, black paper.

**Interview: Transparent, Translucent, Opaque**

Before the interview gather the following objects: book, piece of frosted glass, aluminum foil, clear plastic bag, clear glass, wax paper, paper bag, and milk carton.

- Which of the objects in the collection are opaque? How do you know?
  - book
  - aluminum foil
  - paper bag
  - milk carton
  - mentions that no light passes through them
- Which of the objects are transparent? How do you know?
  - clear plastic bag
  - clear glass
- Which of the objects are translucent? How do you know?
  - frosted glass
  - wax paper
  - mentions that some light passes through but objects cannot be clearly seen
- Is it possible to change a transparent object into a translucent object? How?
  - painting or colouring it
  - any reasonable explanation

PRESCRIBED LEARNING OUTCOMES
<i>Students will...</i>
<p><b>4-2-12</b> Predict the location, shape, and size of a shadow based on the position of a light source relative to an object. GLO: C2, D4</p>
<p><b>4-0-3a.</b> Brainstorm, in small groups, one or more methods of finding the answer to a given question, and reach consensus on which method to implement. GLO: C2, C7</p> <p><b>4-0-3b.</b> Identify, in small groups, variables that have an impact on an investigation. GLO: A1, A2, C2, C7</p> <p><b>4-0-3c.</b> Create, in small groups, a plan to answer a given question. (ELA 3.1.4; Math SP-V.2.4) GLO: C2</p> <p><b>4-0-4a.</b> Carry out a plan, and describe the purpose of the steps followed. (Math SP-V.2.4) GLO: C2</p> <p><b>4-0-4f.</b> Assume roles, and share responsibilities as group members. (ELA 5.2.2) GLO: C7</p> <p><b>4-0-5b.</b> Estimate and measure mass/weight, length, volume, area, and temperature using standard units. (Math SS-IV.1.4, SS-I.1.4, SS-III.1.4, SS-II.1.4) GLO: C2, C3, C5</p> <p><b>4-0-6e.</b> Evaluate, with guidance, the methods used to answer a question or solve a problem. GLO: C2, C3</p> <p><b>4-0-7a.</b> Draw a conclusion based on evidence gathered through research and observation. GLO: A1, A2, C2</p>

SUGGESTIONS FOR INSTRUCTION

➤ **What Do I Know about Shadows?**

Activating Prior Knowledge: Have students complete a Knowledge Chart such as the following

**Shadows**

Know Now (Draw)	Know Now (List)
Want to know:	

(See the discussion of Prior Knowledge Strategies in *Success for All Learners*, 6.20-6.23.)

➤ **Puppet Shadows: Shadows Investigation**

In small groups, have students identify and carry out a plan to find out what impact the position of the flashlight (light source) has on the location, shape, and size of a shadow from a puppet. Ensure that the groups identify variables that may have an impact on their investigation.

Art Extension: Have students research shadow puppets from different cultures (e.g., Inuit, Chinese, Indonesian, etc.) using a variety of print and electronic resources.

➤ **Reflecting on Shadows**

Have students use their learning logs to summarize what they have found out about shadows. Example:

When the light source is moved closer to the object the shadow gets \_\_\_\_\_ and its shape looks \_\_\_\_\_.

When the light source is moved farther from the object the shadow gets \_\_\_\_\_ and its shape looks \_\_\_\_\_.

When the light source is moved to the left of the object the shadow moves \_\_\_\_\_ and its shape looks \_\_\_\_\_.

When the light source is moved to the right of the object the shadow moves \_\_\_\_\_ and its shape looks \_\_\_\_\_.

**TEACHER NOTES**

**SUGGESTIONS FOR ASSESSMENT**

Students were first introduced to shadows in Grade 1. They should know that shadows are caused by blocking light.

Have students use Blackline Master 2: Scientific Inquiry Recording Sheet: Grades 3 and 4.

**Group Assessment: Shadows Investigation**

Answer Yes or No:

During the Shadow Investigation my group

- brainstormed one or more ways to find the answer \_\_\_\_\_
- identified the variables that have an impact on the experiment \_\_\_\_\_
- created a plan \_\_\_\_\_
- identified problems and found a solution \_\_\_\_\_
- shared roles and responsibilities \_\_\_\_\_
- estimated and measured the length of the shadows \_\_\_\_\_
- recorded our results \_\_\_\_\_
- evaluated our experiment and our results \_\_\_\_\_
- arrived at a conclusion \_\_\_\_\_

Next time we will \_\_\_\_\_  
\_\_\_\_\_.

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
<p><i>Students will...</i></p>	
<p><b>4-2-13</b> Identify technological developments that extend our ability to see, and recognize their impact on science.</p> <p><i>Examples: the telescope allows astronomers to obtain new information...</i></p> <p>GLO: A5, B1</p>	<p>➤ <b>Centres: The Technology of Light</b></p> <p>Provide students with samples of technological devices and tools, a video about sight and technology, or pictures of objects that extend our ability to see. Examples: binoculars, telescope, optical microscope, eyeglasses, magnifying lens, periscope, telescope, camera, magnifying glass, bug’s eye, etc. After viewing these materials, have students select one object to record what it is used for and how it helps us to do something better or something we weren’t able to do before. Have students share their recordings from the centres. Ask students the following reflection questions to extend their learning:</p> <ul style="list-style-type: none"> <li>• How has the microscope helped scientists to fight disease?</li> <li>• How have binoculars extended our knowledge of animal species?</li> </ul>
<p><b>4-0-5c.</b> Record observations in a variety of ways. <i>Examples: point-form notes, sentences, labelled diagrams, charts...</i> (ELA 2.1.1, 3.3.1, 4.1.1, 4.1.2; Math SP-1.2.4, SP-II.2.4) GLO: C2, C6</p>	
<p><b>4-2-14</b> Use the design process to construct a device that transmits and reflects light.</p> <p><i>Examples: periscope, kaleidoscope...</i></p> <p>GLO: B1, C3</p>	<p>➤ <b>Design an Optical Device</b></p> <p>Provide students with a problem that emerges from the narrative literature read by the class. For example, a character in a fictional story may require a device that allows him or her to see around a corner or over a divider wall. Sample evaluation criteria may include the following:</p> <ul style="list-style-type: none"> <li>• is hand-held</li> <li>• uses readily available materials</li> <li>• is constructed during a given time period</li> <li>• allows the viewer to see what object the subject is holding when standing around the corner or on the other side of the wall</li> </ul>
<p><b>4-0-1c.</b> Identify practical problems to solve in the local environment. GLO: C3</p> <p><b>4-0-3d.</b> Brainstorm possible solutions to a practical problem, and identify and justify which solution to implement. (ELA 1.2.3) GLO: C3</p> <p><b>4-0-3e.</b> Create a written plan to solve a problem or meet a need. Include: identify steps to follow, prepare a labelled diagram. GLO: C3</p> <p><b>4-0-3f.</b> Develop criteria to evaluate an object, device, or system based on its function, aesthetics, and other considerations such as materials, and cost. GLO: C3</p> <p><b>4-0-4b.</b> Construct an object, device, or system to solve a problem or meet a need. GLO: C3</p> <p><b>4-0-4c.</b> Test an object, device, or system with respect to pre-determined criteria. GLO: C3, C5</p> <p><b>4-0-4d.</b> Identify and make improvements to an object, device, or system, and explain the rationale for the changes. GLO: C3</p> <p><b>4-0-5a.</b> Select and use tools to observe, measure, and construct. <i>Examples: tuning fork, prism, binoculars, measuring tape...</i> GLO: C2, C3, C5</p> <p><b>4-0-7c.</b> Identify new problems that arise. GLO: C3</p> <p><b>4-0-8c.</b> Recognize that designing a solution to a simple problem may have considerations, such as cost, materials, time, and space. GLO: B2, C3</p>	



## TEACHER NOTES

## SUGGESTIONS FOR ASSESSMENT

Appendix B: Selecting Science-Based Literature provides support to teachers for selecting fictional and non-fictional science literature.

Have students use Blackline Master 4: Design Process Recording Sheets: Grades 3 and 4.

**Design Process Checklist**

The student

- understands the problem
- brainstorms possible solutions
- creates a written plan
- develops criteria for success
- includes labelled diagram
- constructs a device that reflects or transmits light
- tests the device
- identifies and makes improvements
- identifies new problems that arise
- recognizes that designing a solution may involve cost and materials

PRESCRIBED LEARNING OUTCOMES	SUGGESTIONS FOR INSTRUCTION
<p><i>Students will...</i></p>	
<p><b>4-2-15</b> Describe practices that help ensure protection of eyes and sight. <i>Examples: direct mirrors away from the eyes when reflecting intense light sources...</i> GLO: B3, C1</p>	<p>➤ <b>Safety Posters</b> Have students conduct research into practices that protect the eyes and eyesight. Students will then design posters that illustrate how to protect eyes and eyesight. Remind students that posters generally consist of slogans and simple eye-catching illustrations. These posters could also be created at the start of the cluster so that they remind students of safe practices during their investigations.</p>
<p><b>4-0-2a.</b> Access information using a variety of sources. Examples: school libraries, videos, traditional knowledge, CD-ROMs, Internet... (ELA 3.2.2, 3.2.4, TFS 2.1.1) GLO: C6 <b>4-0-2b.</b> Review information to determine its usefulness to inquiry or research needs. (ELA 3.2.3, 3.3.3) GLO: C6, C8 <b>4-0-7e.</b> Communicate results and conclusions in a variety of ways. Examples: point-form lists, sentences, graphs, labelled diagrams, charts... (ELA 2.3.5, 4.2.5; Math SP-III.1.4, SP-III.2.4; TFS 2.1.4) GLO: C6</p>	
<p><b>4-2-16</b> Identify different uses of light at home, at school, and in the community, and explain how the brightness and colour of the light are appropriate for each use. <i>Examples: vivid neon lights for advertising, blue lights for snow removal vehicles...</i> GLO: B1, B3, C1</p>	<p>➤ <b>Red Means Stop!</b> Have students work in partners to identify examples of particular colours that are used to mean specific things (e.g., a stoplight and cars’ brake lights use a red light to mean “stop;” snow removal trucks have blue lights; police cars use flashing red lights).</p>
<p><b>4-0-4f.</b> Assume roles, and share responsibilities as group members. (ELA 5.2.2) GLO: C7 <b>4-0-4g.</b> Communicate questions, ideas and intentions, and listen effectively to others during classroom-learning experiences. GLO: C6</p>	

## TEACHER NOTES

## SUGGESTIONS FOR ASSESSMENT

A poster indicating the dangers of pen-light lasers should be developed. Serious harm can be done by shining these lasers into someone's eyes.

**Scoring Rubric: Safety Posters and Research**

Scale	Research	Poster
4	used at least three sources, findings are detailed and clear	neatly and carefully done, depicts eye protection practices in both pictures and words
3	used at least two sources, findings are detailed and clear	neatly and carefully done, depicts eye protection practices in both pictures and words
2	used at least two sources, findings are incomplete or unclear	depicts eye protection practices in both pictures and words
1	used at least one source, findings are incomplete or unclear	depicts eye protection practices in pictures only, carelessly done

**Paper and Pencil Task: Red Means Stop**

You are in charge of the lighting for your town. What colour and how bright should the lights be for the following objects?

1. street lights?
2. emergency vehicles?
3. snow plows?
4. the signs advertising the town stores?
5. the meeting room in the town hall?
6. classroom lights?

Explain your choices.

Look for

- appropriate colours
- appropriate degrees of brightness
- reasonable explanations

NOTES