

Physics > Big idea PSL: Sound, light and waves > Topic PSL1: Sound and light

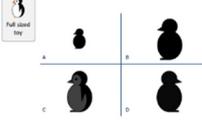
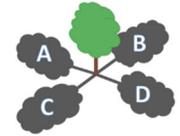
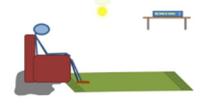
Progression toolkit: Light movement

Learning focus	Light travels in straight lines at very high speeds.				
As students' conceptual understanding progresses they can:					
Diagnostic questions	Identify the shadow made by an object. <div style="background-color: #4a4a8a; color: white; padding: 2px; width: 15px; margin: 5px auto;">P</div>	Describe how light travels in straight lines. <div style="background-color: #4a4a8a; color: white; padding: 2px; width: 15px; margin: 5px auto;">P</div>	Explain how shadows are formed.	Explain how light from a bulb illuminates a place.	Explain why light gets dimmer farther from a light source.
Response activities	A penguin's shadow	Spotting light <hr/> A tree's shadow	Making a shadow	Lighting a room	Night vision

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

<p>BEST STUDENT WORKSHEET</p> <p>A penguin's shadow</p> <p>Light from a small light source is shining on a screen. A toy penguin is put behind the screen and the shadow is cast.</p>  <p>What would you see on the screen?</p>  <p>Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/></p>	<p>BEST STUDENT WORKSHEET</p> <p>Spotting light</p> <p>Janis has set up an experiment. She uses a torch to find a bug in her garden.</p>  <p>Where is the light?</p> <p>Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/></p>	<p>BEST STUDENT WORKSHEET</p> <p>A tree's shadow</p> <p>Janis is sitting in the park. She is looking at the shadow of a tall tree.</p>  <p>Where will she see the shadow?</p>  <p>Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/></p>	<p>BEST STUDENT WORKSHEET</p> <p>Making a shadow</p> <p>Marta is thinking about how a shadow is made.</p>  <p>Which is the best description of how the shadow is made?</p> <p>Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/></p>	<p>BEST STUDENT WORKSHEET</p> <p>Lighting a room</p> <p>Kate has the light on in the classroom. Her desk is empty in the corner.</p>  <p>How does the bulb light the room?</p> <p>Which of these statements do you think are right?</p> <p>Put a tick (✓) in the box next to the best answer.</p> <table border="1"> <thead> <tr> <th>Place</th> <th>Light source is right</th> <th>Light source is left</th> <th>Light source is top</th> <th>Light source is bottom</th> </tr> </thead> <tbody> <tr> <td>A</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>B</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>C</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>D</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>	Place	Light source is right	Light source is left	Light source is top	Light source is bottom	A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Place	Light source is right	Light source is left	Light source is top	Light source is bottom																									
A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																									
B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																									
C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																									
D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																									
<p>Simple multiple choice</p>	<p>Simple multiple choice</p>	<p>Simple multiple choice</p>	<p>Simple multiple choice</p>	<p>Confidence grid</p>																									
<p>BEST STUDENT WORKSHEET</p> <p>Night vision 1</p> <p>On a dark night a car is driving away from you. You want to be able to see the car's headlights.</p>  <p>1. What do the lights get done as the car drives away?</p> <p>Put a tick (✓) in the box next to the best answer.</p> <p>A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/></p>	<p>BEST DEMONSTRATION NOTES</p> <p>Laser shadow</p> <p>This demonstration shows students how ordinary light is made up of many rays of light, each moving forwards in a straight line.</p> <p>Safety</p> <p>Lasers can damage eyesight. Students should not be asked the direction in which the laser is pointing. All shiny or reflective surfaces that the laser could be pointed at should be removed.</p> <p>There should be local rules in place for using lasers and these should be followed.</p> <p>If a student demonstrates safety water must be dispensed to illuminate the beams. They should stand pointing away from the laser source. This role is best carried out by an experienced adult (teacher or technician) rather than a student.</p> <p>Apparatus and materials</p> <ul style="list-style-type: none"> A laser pointer (or laser) Powerful torch Fine water spray Card cut cardboard penguin (or other object to form a shadow) with a stand or flipback Clamp and stand to hold the torch in place Screen  <p>Procedure</p> <ol style="list-style-type: none"> Show that light travels, and is present, between the source and the illuminated patch of light. Show the powerful torch across the room and illuminate the beam using a fine spray of water. This shows that there is light throughout the beam, and not just at the end and on the ground. Show that a beam of torch light can be thought of as being made of many rays of light. With the torch still on, show a laser pointer along the same beam and illuminate with a fine spray of water. The ray of light from the laser can be moved around inside the beam to show how the beam is made from many rays of light. A ray is in fact a very fine beam of light - they are the same thing. Show that the idea that light travels in a straight line, can explain the formation of a shadow. With the torch and a penguin cut out (or other object) project a shadow onto a screen. Turn the laser pointer inside the beam to demonstrate how each 'ray' of light inside the beam travels in a straight line to form the shadow. A fine spray of water can show this more clearly. 	<p>BEST STUDENT WORKSHEET</p> <p>Extra light shadow</p> <p>Light from a small light lamp is shining on a screen. A toy penguin makes a shadow on the screen.</p>  <p>What do you think you will see when the second bulb is turned on?</p> <p>Explain why you think you will see this?</p> <p>Now carry out the investigation.</p> <p>Observe: Describe what you see when both bulbs are turned on.</p> <p>Explain: Were your prediction and explanation correct? If not, can you explain what you observe?</p>	<p>BEST STUDENT WORKSHEET</p> <p>Daylight</p> <p>On a sunny day a cyclist is coming towards you. It is hard to see if her light is on or off.</p>  <p>Some students are discussing why it is hard to see if the bike light is on or off.</p> <p>Hannah: Light from the bike lamp needs to get through the light from the sun.</p> <p>Therese: Light from the sun is brighter than the light from the bike lamp.</p> <p>Kevin: The sun lights up all of the road so you can't see the light from the bike lamp. It's almost too bright.</p> <p>James: There is so much light from the sun that the light from the bike lamp is almost invisible.</p> <p>To answer:</p> <ol style="list-style-type: none"> What do you think is right about why it is hard to see if the light is on or off? Explain your answer. What mistakes do you think the other students made? What would you say to help them to understand? 																										
<p>Simple multiple choice</p>	<p>Clarifying - demonstration/modelling</p>	<p>Predict, explain, observe, explain</p>	<p>Talking heads</p>																										

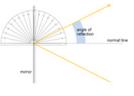
Progression toolkit: Light reflection

Learning focus	Light is reflected from all surfaces, and off a flat mirror it is reflected in a single direction.				
As students' conceptual understanding progresses they can:					
As students' conceptual understanding progresses they can:	Identify surfaces that reflect light. P	Predict the direction in which flat mirrors reflect light.	Draw a ray diagram to show how light reflects off a flat mirror.	Accurately measure angles of incidence and angles of reflection.	Explain how light reflects off rough surfaces.
Diagnostic questions	Reflecting light	Which way?	Angle of reflection	Measuring angles	Rough reflection
Response activities		Reflecting angles			Desert island rescue

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

<p>Reflecting light</p> <p>BEST STUDENT WORKSHEET</p> <p>Reflecting light</p> <p>Some objects are good at reflecting light.</p>  <p>Which of these objects can reflect light?</p> <p>A = a mirror B = a brick</p> <p>C = a shiny coin D = a sponge</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>	<p>Which way?</p> <p>BEST STUDENT WORKSHEET</p> <p>Which way?</p> <p>A ray of light reflects off a flat mirror.</p>  <p>Which picture shows how the ray of light reflects?</p> <p>A B</p> <p>C D</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>	<p>Angle of reflection</p> <p>BEST STUDENT WORKSHEET</p> <p>Angle of reflection</p> <p>A ray of light reflects off a flat mirror. It reflects in just one direction.</p>  <p>Which picture shows the angle of reflection?</p> <p>A B</p> <p>C D</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>	<p>Measuring angles</p> <p>BEST STUDENT WORKSHEET</p> <p>Measuring angles</p> <p>Getting a measurement right needs care. A protractor is used to measure an angle.</p>  <p>Who is measuring the angle correctly?</p> <p>Alice Beth</p> <p>Charlotte Daisy</p> <p>What would you say to the other students to help them?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>	<p>Rough reflection</p> <p>BEST STUDENT WORKSHEET</p> <p>Rough reflection</p> <p>Truck lights reflect brightly off a mirror.</p>  <p>What happens when a truck is above an other object?</p> <p>Which of these statements do you think is right?</p> <p>For each statement, tick (✓) or cross (✗) to show what you think.</p> <table border="1"> <thead> <tr> <th>Place</th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A Light reflects off the shiny coin</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B Light reflects off the coin like a mirror (all in one direction)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C Light reflects off the dull brick</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D The rough surface of the brick reflects light in all directions</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>	Place	I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A Light reflects off the shiny coin					B Light reflects off the coin like a mirror (all in one direction)					C Light reflects off the dull brick					D The rough surface of the brick reflects light in all directions				
Place	I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong																									
A Light reflects off the shiny coin																													
B Light reflects off the coin like a mirror (all in one direction)																													
C Light reflects off the dull brick																													
D The rough surface of the brick reflects light in all directions																													
<p>Simple multiple choice</p>	<p>Simple multiple choice</p>	<p>Simple multiple choice</p>	<p>Simple multiple choice</p>	<p>Confidence grid</p>																									
<p>Reflecting angles</p> <p>BEST STUDENT WORKSHEET</p> <p>Reflecting angles</p> <p>A protractor measures angles. It can be used to measure how light reflects off a mirror.</p>  <p>Apparatus and materials</p> <ul style="list-style-type: none"> mirror ray lamp cell for ray lamp cell pack rule sharp pencil protractor <p>Procedure</p> <ol style="list-style-type: none"> Put the back of the mirror on the mirror line. Put the cell into the ray lamp and turn it on. Aim the ray of light along the incident ray. Draw a small cross in the centre of the reflected ray. Take away the mirror. Use a ruler to join the cross to the mirror to show the reflected ray. Use the protractor to measure the angle of incidence and the angle of reflection. Repeat with different incident rays. <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>	<p>Desert island rescue</p> <p>BEST STUDENT WORKSHEET</p> <p>Desert island rescue</p> <p>Freya and her friends are stuck on a desert island. They want to be seen by a ship.</p>  <p>The friends are discussing what they should do to be seen.</p> <p>Freya: The flag can be seen because light reflects off it.</p> <p>George: The fire lanterns are seen in the day.</p> <p>Sarah: The mirror is shiny so it makes a very bright light that is easy to see by all ships.</p> <p>Hafsa: Ships can see the flag from all directions because the flag is made of rough material.</p> <p>To answer</p> <ol style="list-style-type: none"> Who do you think is right? <p>Explain your answer.</p> <ol style="list-style-type: none"> What mistakes do you think the other students made? <p>What would you say to them to help them to understand?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. The content has been developed for use in schools. It is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. © University of York Science Education Group. Best Evidence Science Teaching. 2018. All rights reserved.</small></p>																												
<p>Predict, explain, observe, explain</p>	<p>Talking heads</p>																												