Students analyze a diagram showing different types of light. (5 min)

Examining Light Waves
The diagram below shows two different types of light shining on the same material.

The type of light from Light Source 1 transmits through the material.

The type of light from Light Source 2 reflects off of the material.

Examine the diagram, then decide which light wave could be emitted from Light Source 2.
Which light wave could be emitted from Light Source 2?

A

B

C

Explain your answer.
Reviewing the Warm-Up:
The diagram shows two types of light doing different things, even though they are hitting the same material.

1. What makes types of light different?  
   Wavelength

2. Which wave—A, B, or C—has a different wavelength than the type of light emitted by Light Source 1?  
   Wave C

3. How is Wave A different from the type of light emitted by Light Source 1?  
   The amplitude (or height) of the wave is different, but it is still the same type of light since the wavelength is the same
Modeling Active Reading with an emphasis on summarizing main ideas. Students read and annotate the “What Eyes Can See” article. (25 min)

Chapter 3 Question:

Why does Australia get more ultraviolet light than other parts of the world?

You have conducted hands-on and Sim investigations to gather evidence about what can happen to light as it travels.

We will need to learn more about how light travels to understand why Australia gets more UV lights than other parts of the world.
READING: “What Eyes Can See.”

“What Eyes Can See” will provide you with more evidence about different types of light and help you to answer the Investigation Question.

Why does Australia get more ultraviolet light than other parts of the world?

You have learned that different things can happen to light as it travels.

Light can be...

How does this affect how we see the world around us?

Today, you will read an article about what happens to light as it travels, and how that determines what we see.
Read and annotate “What Eyes Can See”

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.

2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.

3. Examine all visual representations carefully. Consider how they go together with the text.

4. After you read, discuss what you have read with others to help you better understand the text.

What Eyes Can See

Look around. What do you see? Take a careful look at the objects closest to you. You might see a desk, your friend, maybe an apple. Are you really seeing those things? What you are actually seeing is light bouncing off the objects around you. The only thing that eyes can actually see is light.

Light carries energy. When light hits a material, three different things can happen. The material can absorb the energy (take it in), transmit the energy (let it pass through), or reflect the energy (cause it to bounce off). Depending on the material and the type of light hitting it, all three things can happen at once.

These three possibilities determine the way you see light moves from a light source to your eye in a straight line, passing through some materials.

The color of an object is determined by the way it absorbs, transmits, and reflects energy from light.
Students share and discuss their annotations and introduce a key concept. (15 min)

1. Look over your annotations on the “What Eyes Can See” article. Pick one or two of your annotations to share with your partner. Then, edit them and add #share.

2. Discuss the tagged annotations with your partner. After you have discussed the annotations with your partner, edit these annotations by changing the tag to #discussed.

3. Now, choose one of the questions or connections you already discussed, or a different question or connection that you still want to discuss with the class. Edit the annotation and add #present.

Discussing Annotations

#share
Carefully choose an interesting annotation (comment, question, connection, vocabulary word) you’d like to share with your partner and add #share to this annotation.

#discussed
Add #discussed to your annotation if you feel that you and your partner have resolved a question OR if your discussion gave you a deeper understanding about something in the article.

#present
Add #present to your annotation to mark any unresolved questions or ideas you would like to present to the class.
A material absorbs energy from some types of light and not others.

Different types of light have different wavelengths, so different things can happen as they travel. In Chapter 2, we focused on one thing that can happen to light as it travels: absorption. A material can absorb energy from some types of light and not others. Now we know that a material can also reflect or transmit some types of light and not others.
The new key concept helps answer our Investigation Question,

What can happen to light as it travels?

A material transmits or reflects some types of light and not others.
Students reread a passage to explain why visible light warms dark-colored objects but not light-colored or clear objects.

In our observations, we have seen that when energy is reflected or transmitted by a material, the energy travels with the light. If the energy is not absorbed, the material does not change.

**Guiding Question**

What happens to visible light as it hits black, white, and clear objects?

- When visible light shines on a black object, it gets warm because...
- When visible light shines on a white object or a clear object, there is no change because...

Discuss your ideas with your partner and then write your response below.
Guiding Question: What happens to visible light as it hits black, white, and clear objects?

For a black object to get warm, what has to happen? **Energy must be absorbed.**

What did the article say about black materials? **They absorb all types of visible light.**

If there is no change to a white object or clear object, what must be true? **No energy is absorbed.**

What did the article say about white materials? **They reflect all types of visible light.**

What did the article say about clear materials? **They transmit all types of visible light.**
Students predict the effect of visible light when it is reflected by aluminum foil. (5 min)

The image above shows light from a light bulb reflecting off aluminum foil. All of the light is being reflected. Do you think that the aluminum foil will get warm?

- Yes
- No

Explain your answer:
Students use the Sim to observe what happens when light is reflected off and transmitted through materials. (20 min)

**Energy in Reflection and Transmission**

**Sim Mission: Reflection and Transmission**

In this mission, you will find two materials that transmit green light and two materials that reflect green light. Then, you will observe what happens to energy when light is transmitted or reflected. Use your observations in this mission to help you answer the Investigation Question: What happens to energy when light is transmitted through or reflected off a material?

1. Open the *Light Waves Simulation*.
2. Set the light source to LASER, set the color to GREEN, and turn it ON.
3. Search for materials that transmit or reflect green light by dragging them to a platform in the testing area, one at a time.
4. When you find a material that either transmits or reflects light, do the following:
   - Turn Show Energy on to observe what happens to the energy in the light.
   - Press INSPECT to observe whether the material changes.
   - Record your observations in the data table below.
5. Repeat steps 3–4 until you have completed the data table with two materials that transmit green light and two materials that reflect green light.
### LW 3.3.2 SIM

**Use your observations from the Sim to answer the Investigation Question, What happens to energy when light is transmitted through or reflected off a material?**

<table>
<thead>
<tr>
<th>What happened to the green light?</th>
<th>Material tested</th>
<th>What happened to the energy in the light?</th>
<th>Did the material change?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No energy is absorbed, so the material does not change.
Guiding Question: What happens to visible light as it hits black, white, and clear objects?

Since light carries energy, when the light bounces off of a material or goes through a material all of the energy is carried with it, so the material does not change. We got evidence of this in the Sim; when we trace energy, we see that it is carried with the light when light is reflected or transmitted, and none of it is absorbed.
Students revisit responses to questions in the Anticipation Guide, then choose an animal and read about types of light that animal can see.

You will revisit 2 statements from the Anticipation Guide that you completed in the first lesson...

Revisiting the Anticipation Guide

Note: if you do not have access to Amplify Science at home, your teacher will provide you with an alternate way to complete this homework.

Review your original responses to these statements from the Anticipation Guide.

Press NEXT to complete the homework activity.

3. All light can be seen.

Do you agree or disagree with this statement now?

agree

disagree

not sure

Explain your thinking.

4. Light can travel through materials that you cannot see through, like wood or aluminum foil.

Do you agree or disagree with this statement now?

agree

disagree

not sure

Explain your thinking.
...and then read about differences between how humans and other animals see the world.

Read the introduction of the article and then choose the animal you are most interested in learning about.
Students revisit the Warm-Up to revise or add to their explanation.

Revisiting the Warm-Up

Light Reflection

The image above shows light from a light bulb reflecting off aluminum foil. All of the light is being reflected. Do you think that the aluminum foil will get warm?

Yes

No

Explain your answer:

Revisit your ideas from the Warm-Up. Revise or add to your explanation using what you learned in this lesson.