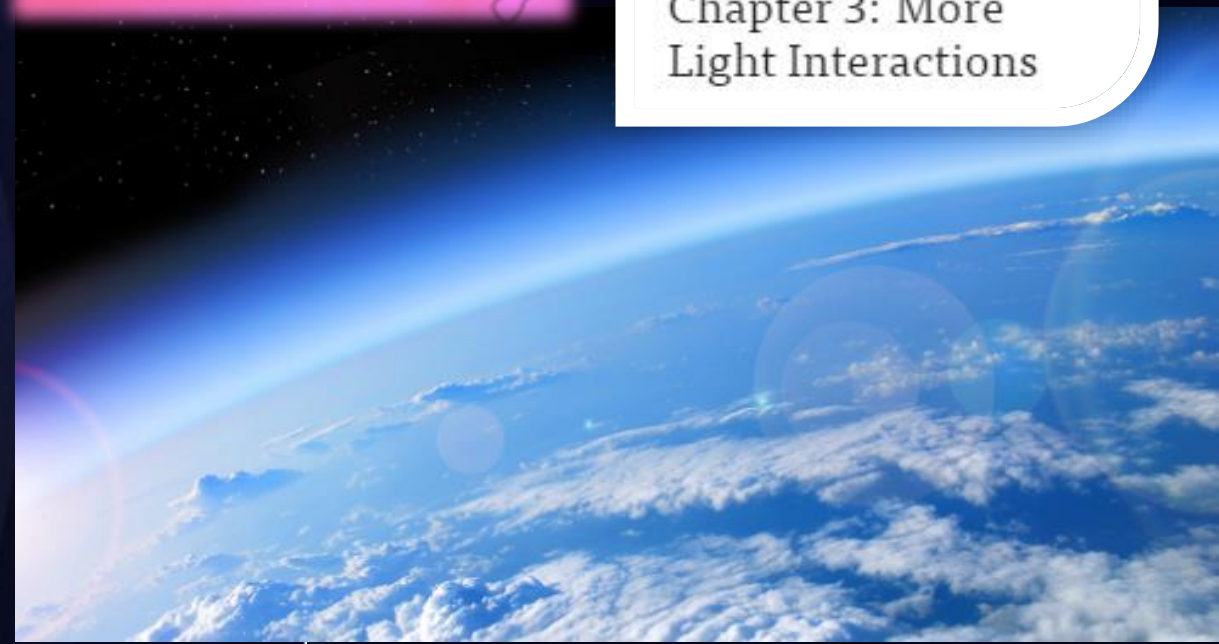
Chapter 3: More Light Interactions

3.1: Following the Path of Light



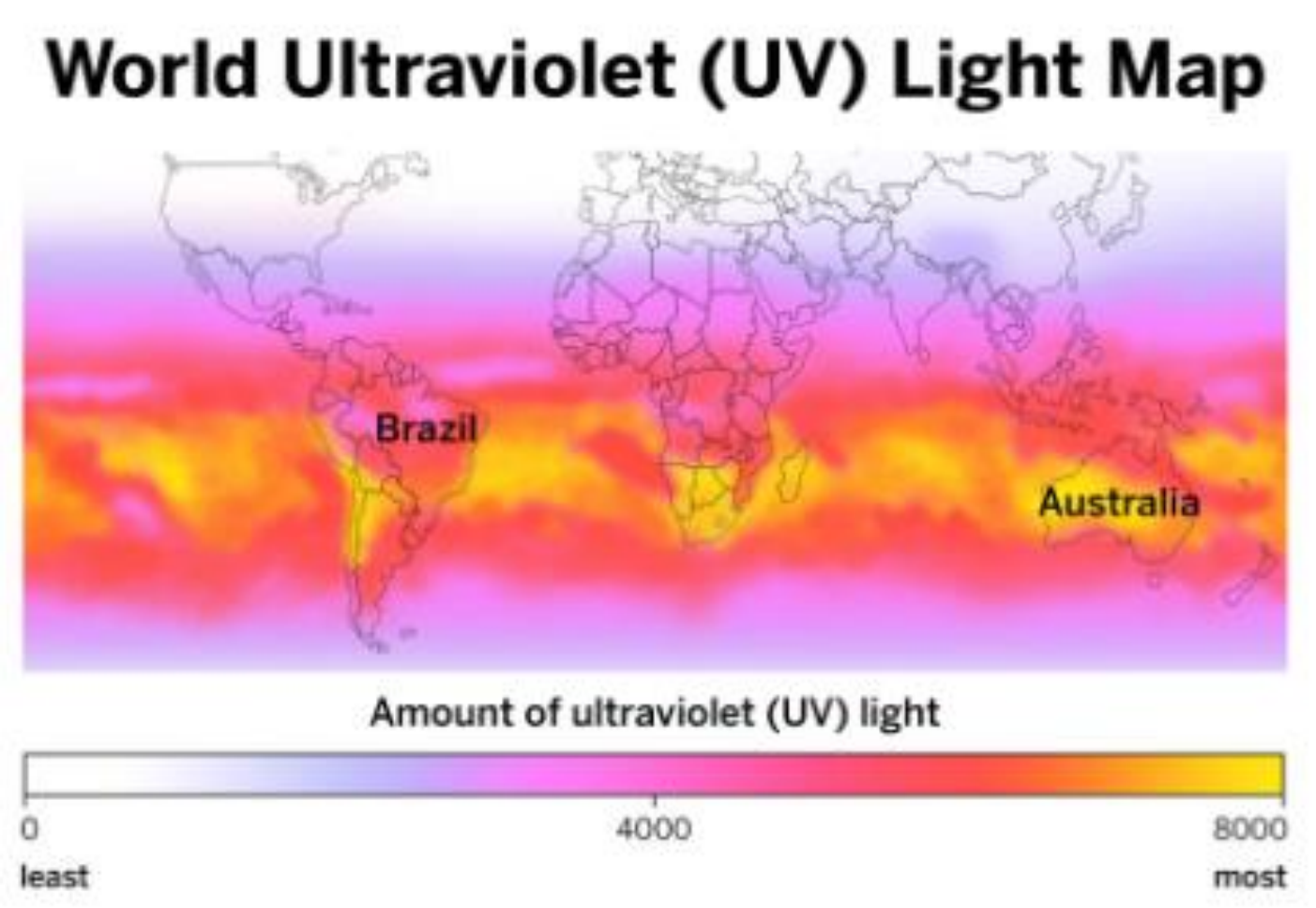
1 WARM UP
Warm-Up

LW: 3.1.1 WARM-UP

HAND IN

Ultraviolet Light

You've learned that light from the sun includes different types of light, including gamma rays, X-rays, ultraviolet (UV) light, infrared light, microwaves, radio waves, and visible light. You've also learned that Australia gets more UV light than other parts of the world.

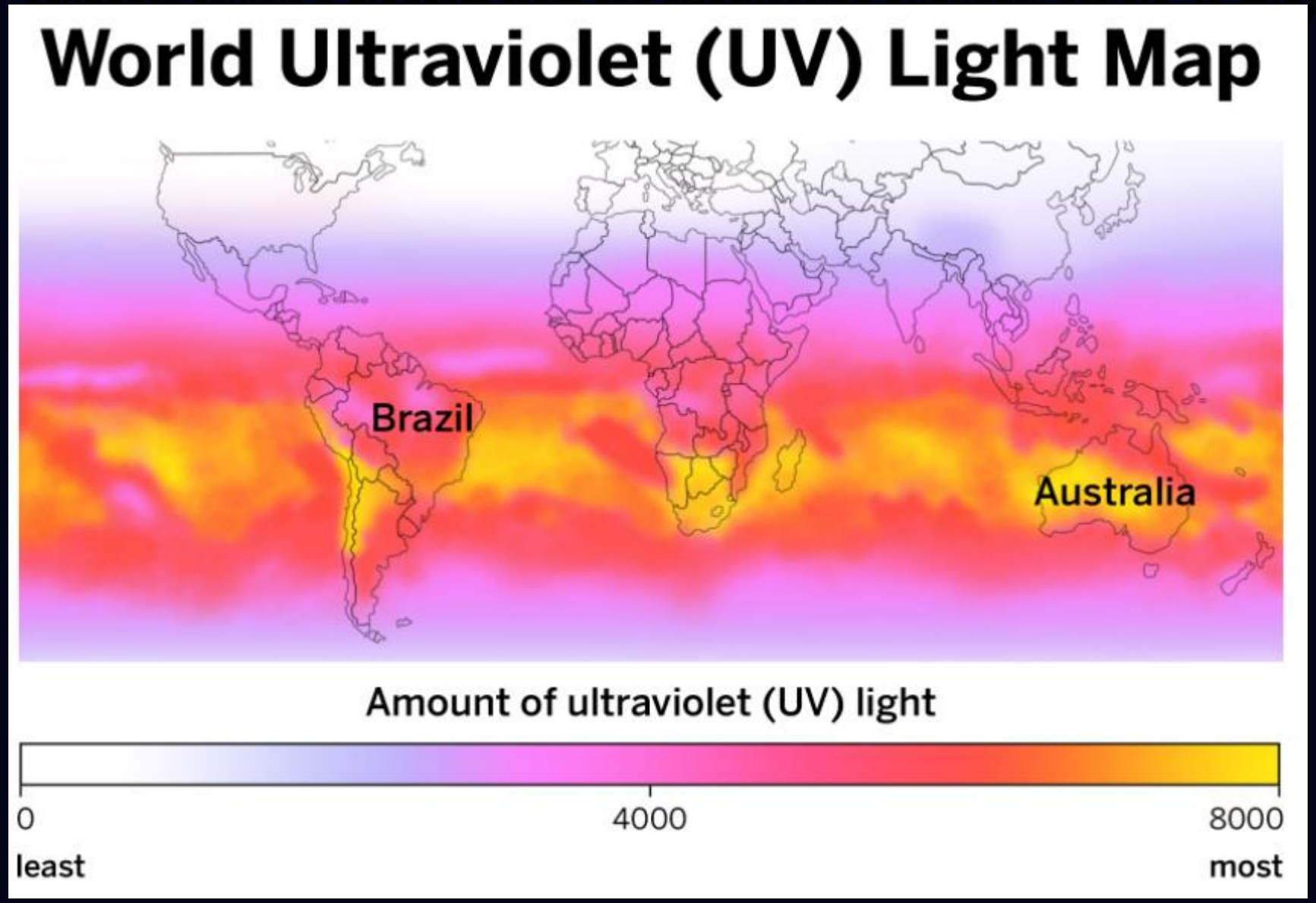


Why does Australia get more UV light than other parts of the world? Record your initial ideas.

Answer Here

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT



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

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Students revisit a diagram from the "Harvesting Sunlight" article. (5 min)

Earth's Atmosphere

We know that light from the sun has to travel through the atmosphere to reach Earth's surface. There must be something different happening to the UV light as it travels through the atmosphere over Australia before it reaches Earth's surface.

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Students revisit a diagram from the "Harvesting Sunlight" article. (5 min)

Earth's Atmosphere

The atmosphere is the envelope of air that surrounds Earth. Air is made of different gasses and also includes a small but important amount of liquid droplets. To understand why Australia is getting more UV light, we need to know more about what happens to UV light when it travels through these gasses and droplets.

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Students revisit a diagram from the "Harvesting Sunlight" article. (5 min)

Claims About How Light Travels

- Light can travel in a curved line.
- Light can go through materials.
- Light can bounce off materials.

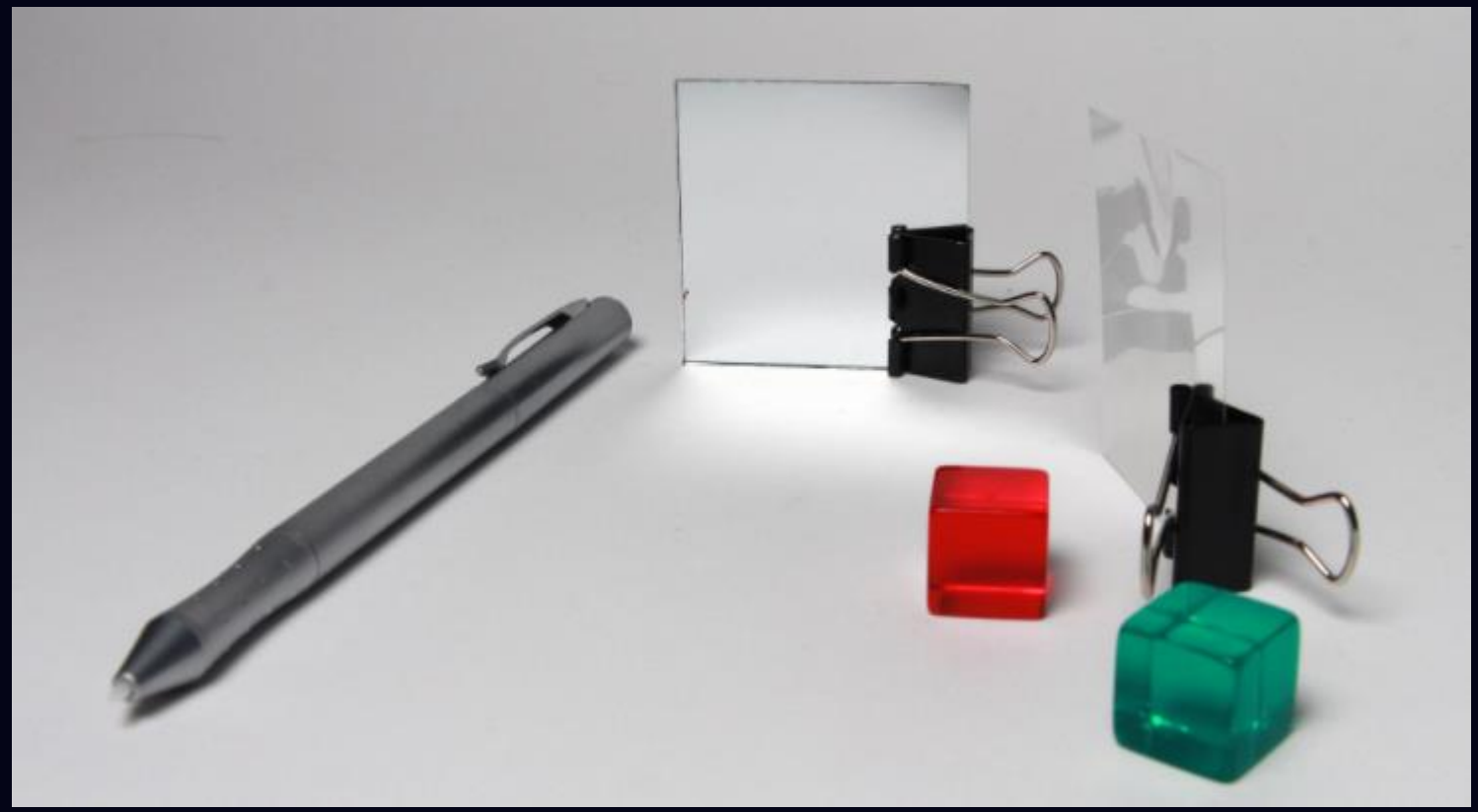
We will do a hands-on investigation to find evidence that supports or refutes these claims.

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Students revisit a diagram from the "Harvesting Sunlight" article. (5 min)

Each group of four will get a tray of investigation materials, including a laser pointer with a red light. Your mission is to set up the materials so that the light from the laser pointer touches every object in its path. This will help you learn more about how light travels.

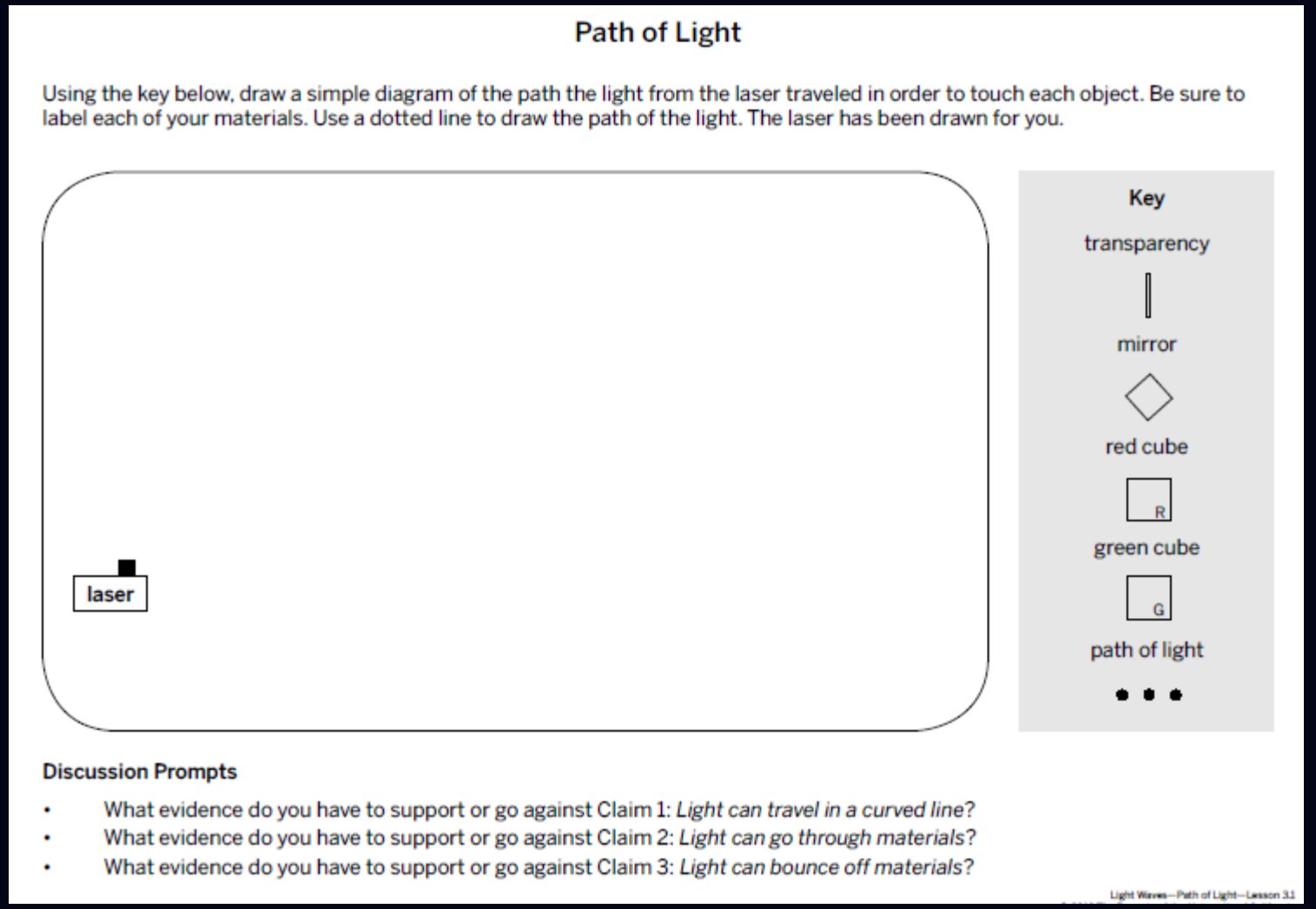


2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Students revisit a diagram from the "Harvesting Sunlight" article. (5 min)

After your group sets up the materials so that light touches every object in its path, each student will draw a diagram of their group's setup and then draw the path of light. You will use these drawings as evidence to support or refute claims about how light travels, so the drawings should be as complete and accurate as possible.



Path of Light

Using the key below, draw a simple diagram of the path the light from the laser traveled in order to touch each object. Be sure to label each of your materials. Use a dotted line to draw the path of the light. The laser has been drawn for you.

Discussion Prompts

- What evidence do you have to support or go against Claim 1: *Light can travel in a curved line*?
- What evidence do you have to support or go against Claim 2: *Light can go through materials*?
- What evidence do you have to support or go against Claim 3: *Light can bounce off materials*?

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Students revisit a diagram from the "Harvesting Sunlight" article. (5 min)

SAFETY NOTE

Safety Note: Laser Pointers

Although the laser pointers in the kit are fairly low energy, they should not be shined into eyes.

Lasers produce a very concentrated beam of light, and if that light is shined in someone's eye it can cause burns and damage. DO NOT DO IT!

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

It can be difficult to tell what light is doing as it travels, but spraying a mist of water on the beam will help them see how the light travels because the small droplets of water reflect some of the laser light.

- Clear the other objects from your table, so they don't get wet.
- Dim the lights.
- One student in each will press the button on the laser pointer while a second student sprays a fine mist in front of the laser. The remaining two students can view the laser beam by facing toward the laser pointer (without looking directly into the beam) and observing carefully at the instant that the water is sprayed. Crouching down so that their eye level is just above the beam may make it easiest to see the beam. Students should be able to see the beam as red light reflecting from the mist of water.
- Students should then switch roles, so all students get a chance to observe the beam.

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Path of Light Mission

Your mission is to set up the materials so that the red light from the laser touches every object in its path. During this mission, you will gather evidence to support or refute these claims about how light moves:

- **Claim 1:** Light can travel in a curved line.
- **Claim 2:** Light can go through a material.
- **Claim 3:** Light can bounce off a material.

When you have found a setup that works, draw a diagram of your setup on the Path of Light sheet. Use a dotted line to draw the path of light from the laser to each of the objects.

One student in each group press the button on the laser pointer while a second student sprays a fine mist in front of the laser. The remaining two students can view the laser beam by facing toward the laser pointer (without looking directly into the beam) and observing carefully at the instant that the water is sprayed. Crouching down so that their eye level is just above the beam may make it easiest to see the beam. Students should be able to see the beam as red light reflecting from the mist of water.

2 HANDS ON
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

NEXT >

Path of Light Mission

Your mission is to set up the materials so that the red light from the laser touches every object in its path. During this mission, you will gather evidence to support or refute these claims about how light moves:

- **Claim 1:** Light can travel in a curved line.
- **Claim 2:** Light can go through a material.
- **Claim 3:** Light can bounce off a material.

When you have found a setup that works, draw a diagram of your setup on the Path of Light sheet. Use a dotted line to draw the path of light from the laser to each of the objects.

What evidence have you found to support or refute Claim 1, *Light can travel in a curved line.*

Light travels in a straight line. This evidence refutes Claim 1.

2 HANDS ON
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

NEXT >

Path of Light Mission

Your mission is to set up the materials so that the red light from the laser touches every object in its path. During this mission, you will gather evidence to support or refute these claims about how light moves:

- **Claim 1:** Light can travel in a curved line.
- **Claim 2:** Light can go through a material.
- **Claim 3:** Light can bounce off a material.

When you have found a setup that works, draw a diagram of your setup on the Path of Light sheet. Use a dotted line to draw the path of light from the laser to each of the objects.

What evidence have you found that supports or refutes Claim 2:
Light can go through materials.

The light went through the red cube and the transparency. This evidence supports Claim 2.

You can use the word transmit to explain what you observed: The light was transmitted through the red cube and the transparency paper.

transmit: to pass through

(noun form: transmission)

2 **HANDS ON**
Investigating the Path of Light

LW: 3.1.2 INVESTIGATING THE PATH OF LIGHT

Path of Light Mission

Your mission is to set up the materials so that the red light from the laser touches every object in its path. During this mission, you will gather evidence to support or refute these claims about how light moves:

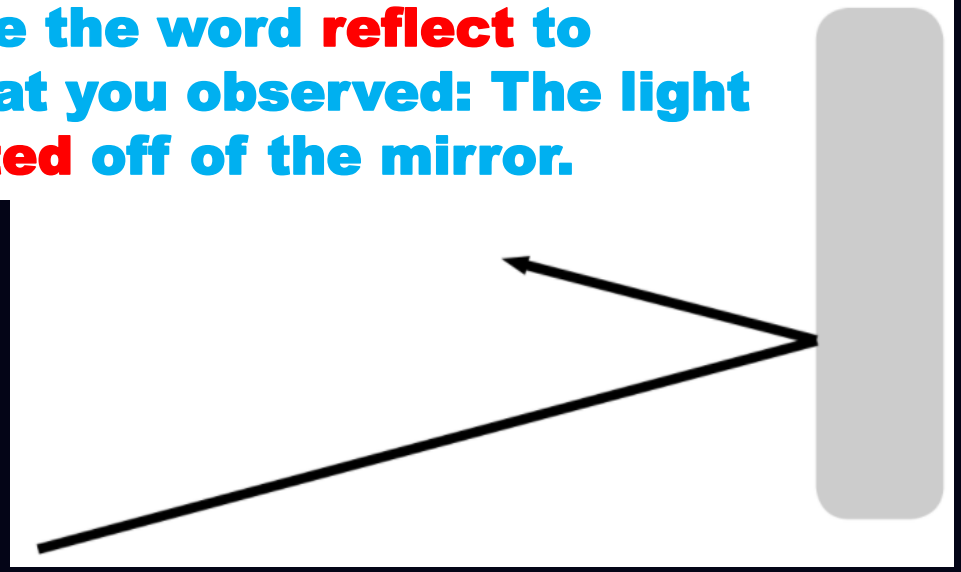
- **Claim 1:** Light can travel in a curved line.
- **Claim 2:** Light can go through a material.
- **Claim 3:** Light can bounce off a material.

When you have found a setup that works, draw a diagram of your setup on the Path of Light sheet. Use a dotted line to draw the path of light from the laser to each of the objects.

What evidence they found that supports or refutes Claim 3: Light can bounce off materials.

The light bounced off the mirror. This evidence supports Claim 3.

You can use the word reflect to explain what you observed: The light was reflected off of the mirror.



reflect: to bounce off without absorbing

(noun form: reflection)

3 **SIM**
Testing Glass and Aluminum Foil

LW: 3.1.3 TESTING GLASS AND ALUMINUM FOIL

You will use the Light Waves Simulation to continue your investigation of what can happen to light as it travels.

You used red light from a laser in the previous activity, which is a type of visible light. The Sim will allow students to investigate what can happen to other types of light as they travel.

3 SIM
Testing Glass and Aluminum Foil

LW: 3.1.3 TESTING GLASS AND ALUMINUM FOIL

NEXT >

Predictions About Glass and Aluminum

With a partner, discuss which types of light you think will pass through glass and which will pass through aluminum foil. Note your predictions below.

glass

aluminum foil

I predict that ▼ will pass through glass.

I predict that ▼ will pass through aluminum foil.

3 SIM
Testing Glass and Aluminum Foil

LW: 3.1.3 TESTING GLASS AND ALUMINUM FOIL

Investigating Glass and Aluminum

Investigate what happens when light hits glass and when light hits aluminum foil. Remember:

If the light is taken in by the material, it is absorbed.
If the light passes through the material, it is transmitted.
If the light bounces off the material, it is reflected.

1. Open the *Light Waves* Simulation
2. Choose LASER and turn the light source on.
3. Drag GLASS to a platform in the testing area.
4. Partner A: Move the slider to select different types of light and test how they interact with glass.
5. Partner B: Record the results below.
6. Switch roles and repeat steps 3 and 4 with ALUMINUM FOIL.
7. When you are done testing, discuss the results with your partner and answer the questions below.

3 SIM
Testing Glass and Aluminum Foil

LW: 3.1.3 TESTING GLASS AND ALUMINUM FOIL

HAND IN

What happened to each type of light when it hit glass?

Gamma ray: ▼

X-ray: ▼

Ultraviolet (UV): ▼

Visible (all colors): ▼

Infrared (IR): ▼

Microwave: ▼

Radio: ▼

What happened to each type of light when it hit aluminum foil?

Gamma ray: ▼

X-ray: ▼

Ultraviolet (UV): ▼

Visible (all colors): ▼

Infrared (IR): ▼

Microwave: ▼

Radio: ▼

Did the same thing happen to every type of light when it hit glass? Use evidence from the Sim to explain your answer.

Did the same thing happen to every type of light when it hit aluminum foil? Use evidence from the Sim to explain your answer.

4 HOMEWORK
Homework

LW: 3.1.4 HOMEWORK

HAND IN

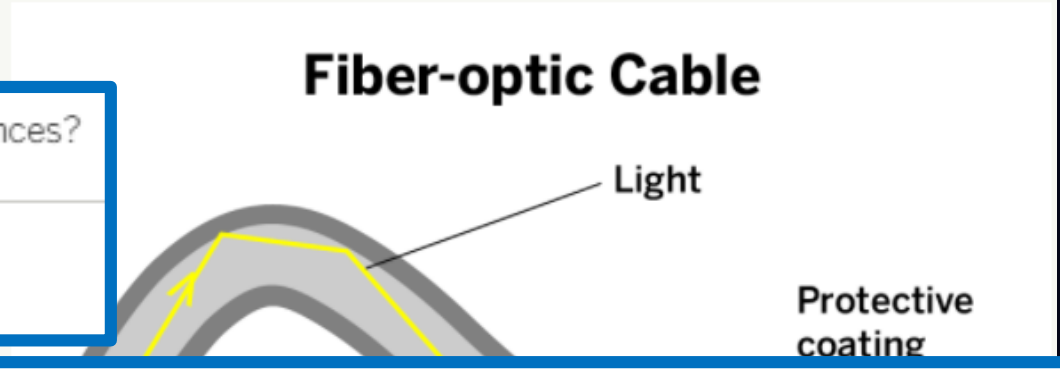
Reading "How Fiber-optic Communication Works"

Did you know that light can be used to send information? To find out how, **read and annotate** the article below using the Active Reading strategies that work best for you. Then, answer the questions below the article.

How Fiber-optic Communication Works

As far as we know, nothing moves faster than the speed of light. In a single second, light can travel all the way around Earth 7.5 times! Because of its incredible speed, light can be used to transport information in an instant. One way of using light to carry information is through fiber-optic cable.

Fiber-optic cable is made of long, thin strands of glass about the width of a human hair. These strands are made of very pure glass that reflects light well and are covered in a protective coating. Light bounces along inside the fiber-optic cable at the speed of light, making fiber-optic cable the fastest possible way to get information from place to place. One fiber-optic cable can transmit information about 100 kilometers (60 miles). After 100 km, there's a device that receives the signal traveling along the cable and re-transmits it along the next cable for another 100 km (60 mi).



1. How does a fiber-optic cable send information quickly over long distances?

Answer Here

2. Why are digital signals an accurate and reliable way to record and send information?

Answer Here