Dara

8th Grade Science

Week 1	Lessons 2.4 to 2.5
Week 2	Lessons 3.1, 3.2, 3.3
Week 3	Lesson 3.6 and End of Unit Assessment

Name: ______________________________ Date: ________________

Lesson 2.4: Effects of Different Types of Light

We know that types of light are different because they have different wavelengths, and that these different types of light can change materials in different ways. The sun emits all types of light, but which types can cause skin cancer? Today, you will use the *Light Waves* Simulation to investigate this question. Determining which types of light can cause skin cancer will bring you one step closer to figuring out why the rate of skin cancer in Australia is so high.

Unit Question

- How does light interact with materials?

Chapter 2 Question

- How can the same amount of sunlight cause different rates of skin cancer?

Key Concepts

- There are different types of light that can change a material in different ways.
- A light source can emit more than one type of light.
- Different types of light have different wavelengths.

Vocabulary

- absorb
- emit
- energy
- light
- light source
- wave
- wavelength

~~Digital Tools~~

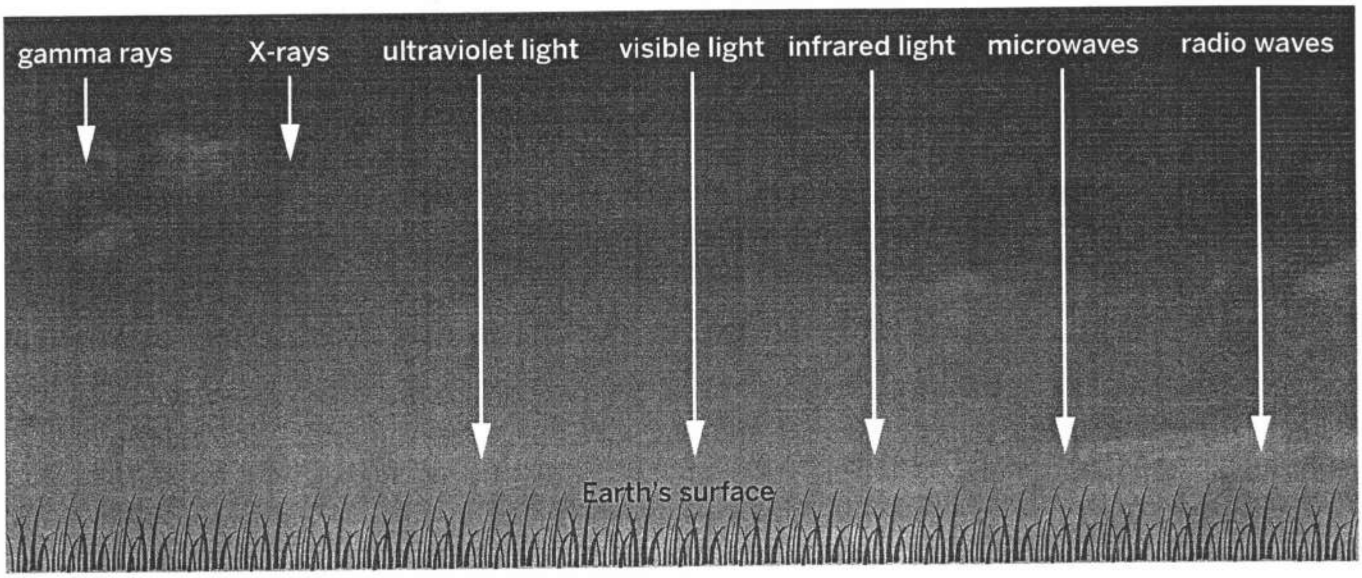
- ~~*Light Waves* Simulation~~

Name: ______________________ Date: ______________

Warm-Up

Light that Reaches Earth's Surface

Earth's atmosphere can absorb some wavelengths of light emitted from the sun. The diagram below shows which types of light are absorbed in the atmosphere, and which types of light travel through the atmosphere and reach Earth's surface. Use this diagram to help you think about which types of light could be causing the damage that can lead to skin cancer.



Which types of light reach Earth's surface? (check all that apply)

- ☐ gamma rays
- ☐ X-rays
- ☐ ultraviolet light
- ☐ visible light
- ☐ infrared light
- ☐ microwave
- ☐ radio waves

From the types of light that reach Earth's surface, which do you think could be causing skin cancer? Explain your reasoning.

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Name: ______________________ Date: ______________

Homework: Reading "What Is Melanin?"

Learning more about melanin, which is found in skin cells, might help you solve the mystery of Australia's high skin cancer rate. Read and annotate the article using the Active Reading strategies that work best for you. Then, answer the questions below.

1. What did you find interesting in the article?

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2. What questions do you have about melanin?

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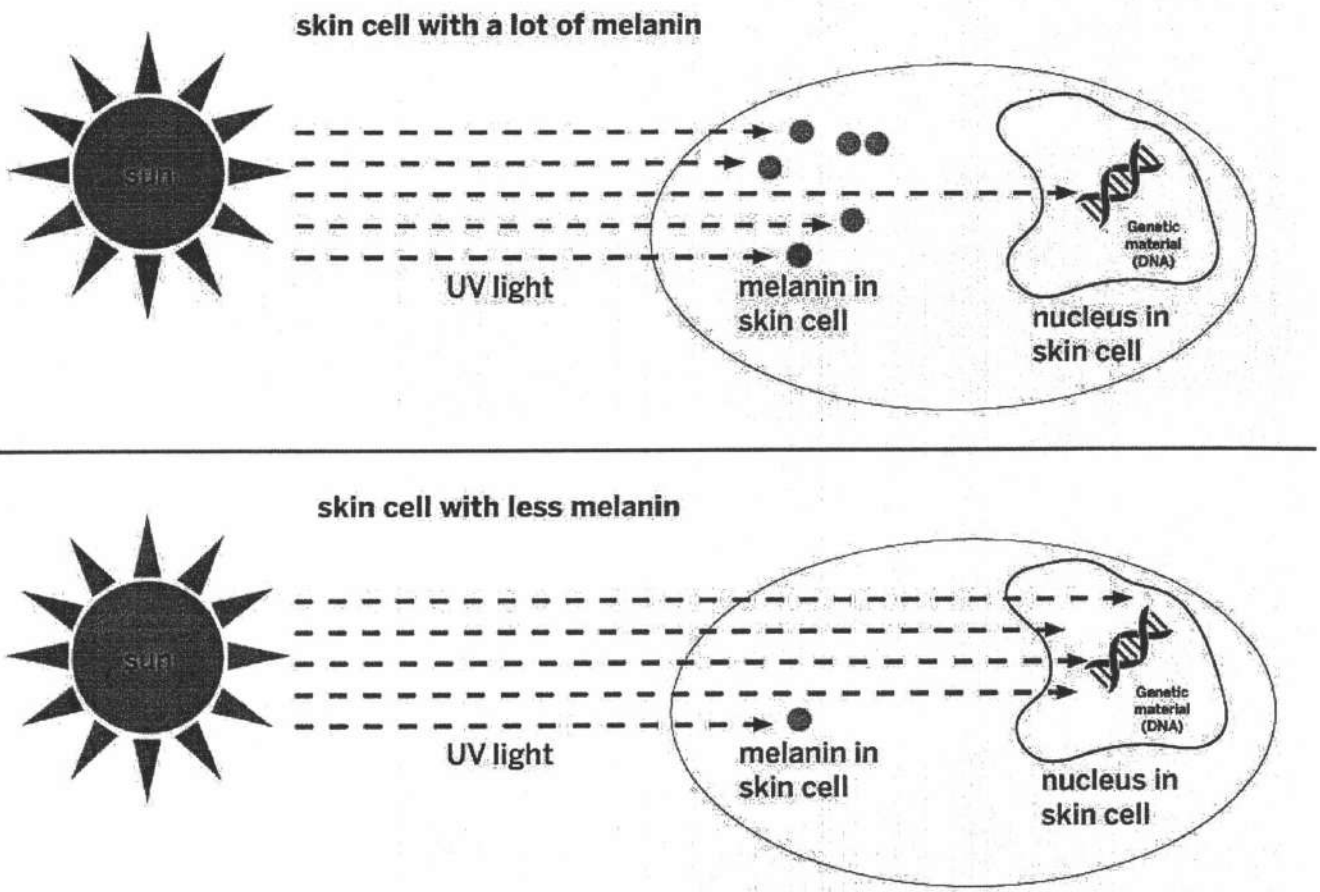
Active Reading Guidelines

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.

Name: ______________________ Date: ______________

Evidence Source: Diagram from the "What Is Melanin?" article.



Prompt: How does melanin provide protection against skin cancer?

Examine and annotate the diagram from the "What Is Melanin?" article, then write an explanation of how this evidence helps answer the question. Use the following words in your explanation: *absorb, energy, light.*

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Name: ______________________________ Date: ______________

Prompt: How does melanin provide protection against skin cancer?

Read and annotate the second paragraph of the "What Is Melanin?" article, then write an explanation of how this evidence helps answer the question. Use the following words in your explanation: *absorb, energy, light.*

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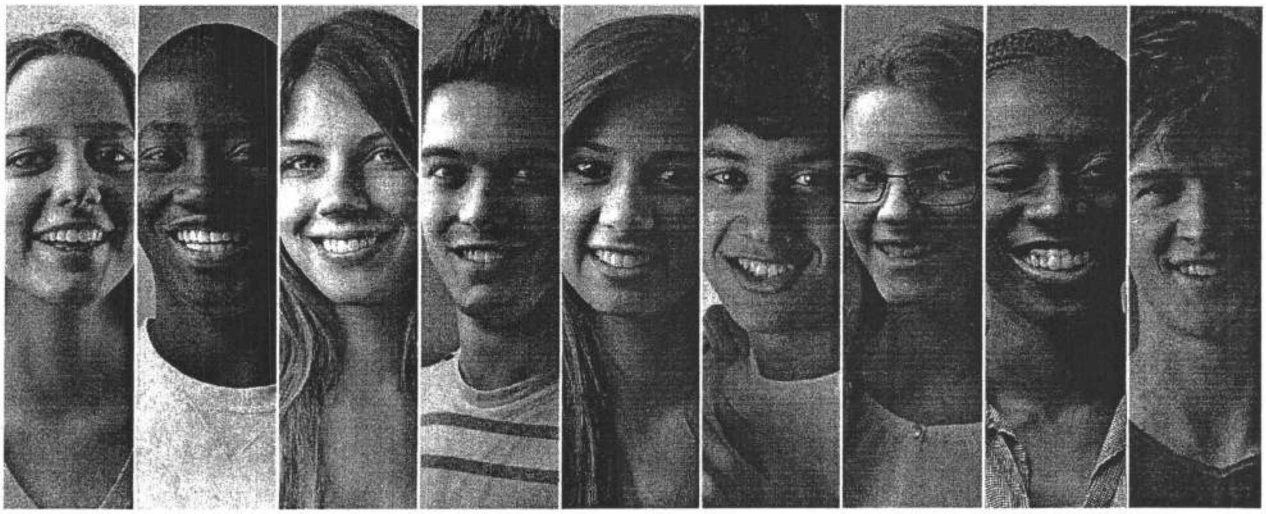

Melanin inside our cells determines our hair, skin, and eye colors. For example, people with blond hair and pale skin tones don't have very much melanin in their hair and skin. People with dark hair and pale skin tones have a lot of melanin in their hair, but not very much melanin in their skin. People with dark hair and dark skin tones have a lot of melanin in both their hair and their skin.

What Is Melanin?

Nearly everyone on Earth has cells that make a substance called melanin. Melanin can be found in our hair, skin, eyes, and many other organs, including the kidneys, spleen, liver, lungs, and heart. Skin tone, like hair and eye color, is determined by the amount of melanin produced in our cells. People with darker skin tones have more melanin in their skin cells than people with paler skin tones.

Melanin doesn't just help determine our appearance—it also protects our skin against damage from the sun. Scientists are researching the important role melanin plays in keeping us healthy. The sun emits ultraviolet (UV) light that can damage our skin, leading to sunburns and even skin cancer. Skin cancer is a disease caused by damage to the DNA inside our skin cells. DNA is the genetic material found inside the nuclei of our cells. DNA can be damaged when it absorbs energy from UV light. Skin cancer does not happen every time the DNA in our skin is damaged, but the more it is damaged the more likely it is that cancer can develop. The melanin in skin cells can absorb UV light as the light enters the cells, before it gets to the nucleus where it can damage the DNA. (See the diagram on the next page.) The more melanin there is inside a cell, the more energy is absorbed before UV light can reach the nucleus and cause damage. This means that people with a lot of melanin in their skin have more protection against skin damage from UV light. More melanin gives people more protection against skin damage, but it doesn't give them complete protection. Anyone can get skin cancer, whatever the level of melanin in their skin.

People can actually make more melanin in response to being exposed to UV light. This is what we call a suntan. The skin gets darker because the body starts producing more melanin to protect its DNA. However, a suntan only provides some protection against UV light. UV light can still get through and lead to DNA damage.

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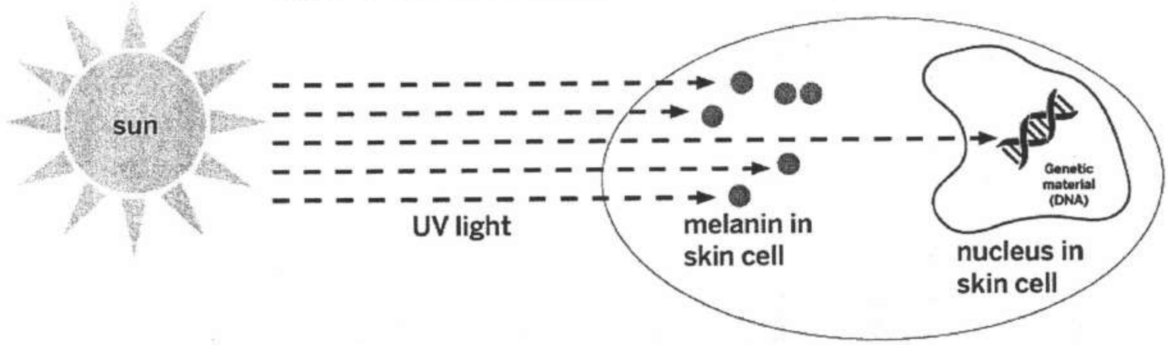
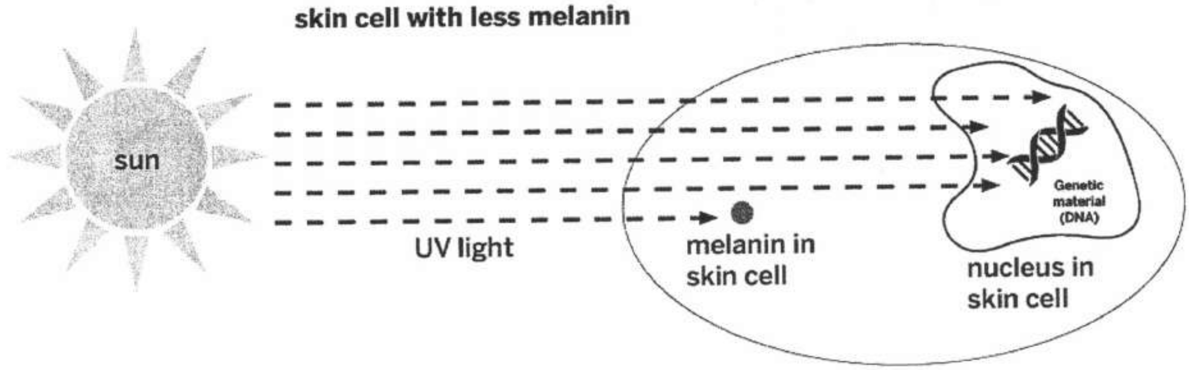
skin cell with a lot of melanin



skin cell with less melanin



This diagram shows how melanin inside the skin cell can protect against damage from UV light.

Name: ______________________________ Date: ______________________

Lesson 2.5: Analyzing Evidence About Melanin and UV Light

We now know that when ultraviolet (UV) light travels through the atmosphere and reaches someone's skin, it can be absorbed by the genetic material in skin cells and cause damage that can lead to skin cancer. Luckily we have something in our skin called melanin, which provides some protection against UV light. In this lesson, you will investigate how melanin protects skin and examine evidence about melanin levels and UV light in Australia. This will allow you to make a clearer explanation of why the skin cancer rate in Australia is so high.

Unit Question

- How does light interact with materials?

Chapter 2 Question

- How can the same amount of sunlight cause different rates of skin cancer?

Key Concepts

- There are different types of light that can affect a material in different ways.
- A light source can emit more than one type of light.
- Different types of light have different wavelengths.
- A material absorbs energy from some types of light and not others.

Vocabulary

- absorb
- claim
- emit
- energy
- evidence
- light

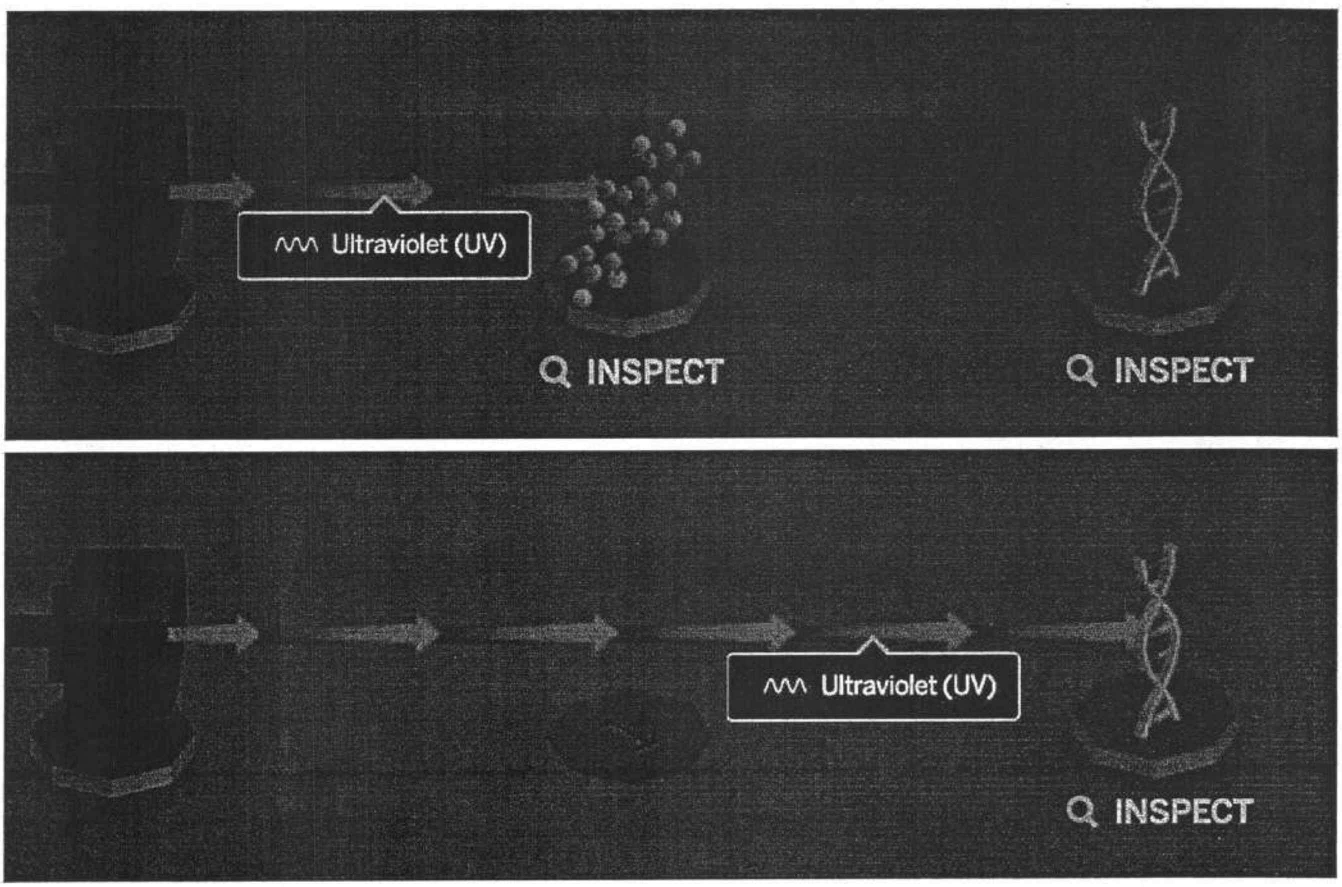
~~Digital Tools~~

- ~~*Light Waves* Simulation~~

Name: ______________________ Date: ______________

Write and Share: Student 1

Evidence Source: Screenshot from the *Light Waves* Simulation.



Prompt: How does melanin provide protection against skin cancer?

Examine and annotate this screenshot from the Sim, then write an explanation of how this evidence helps answer the question. Use the following words in your explanation: *absorb, energy, light.*

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Name: ______________________ Date: ______________

Discussing Skin Cancer Factors

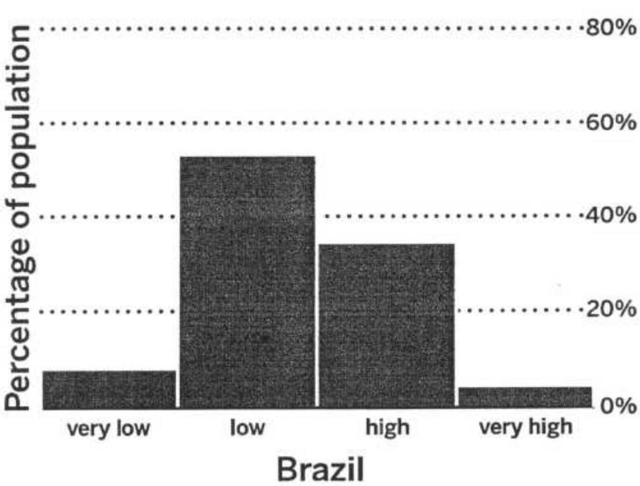
Part 1: Discussing Melanin Levels Bar Graphs

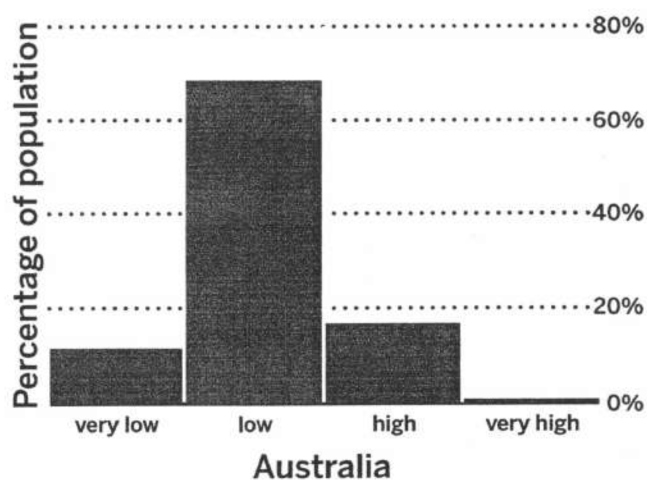
When studying the connection between melanin levels and skin cancer risk, scientists group people by how much melanin they have in their skin cells. Below are two bar graphs, one for Australia and one for Brazil. Each bar graph shows the estimated percentage of the population with different levels of melanin. Examine and annotate this evidence, using the questions below to guide you.

1) Compare the graphs. What does the evidence show?

2) How does this evidence help explain why the skin cancer rate is higher in Australia than in Brazil, even though the two countries get the same amount of sunlight?

Estimated Percentage of Populations with Each Melanin Level





Name: ______________________ Date: ______________

Discussing Skin Cancer Factors (continued)

Part 2: Discussing World Ultraviolet (UV) Light Evidence

The World Ultraviolet (UV) Light Map below shows the amount of UV light reaching the surface. Examine and annotate the map, using the questions below to guide you.

1) What does the evidence show?

2) How does this evidence help explain why the skin cancer rate is higher in Australia than in Brazil, even though the two countries get the same amount of sunlight?

Note: Your teacher will project a color version of this image.

World Ultraviolet (UV) Light Map

Amount of ultraviolet (UV) light (joules per square meter)

0 least — 4000 — 8000 most

Source: NASA Earth Observatory

Name: ____________________ Date: ____________

Homework: Supporting a Claim

You have been investigating why Australia's skin cancer rate is so high. The Australian Health Alliance has asked you to write a short argument that explains this to the Australian public. Remember to explain how your evidence supports your claim to make your argument as complete and convincing as possible. You can agree with one or both of the claims.

Question: Why is Australia's skin cancer rate so high?

Australia has a higher skin cancer rate because . . .

Claim 2: There is something different about the sunlight in Australia.

Claim 3: More people in Australia have skin that is easily damaged by sunlight.

Name: ______________________________ Date: ____________________

Homework: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond to the questions below.

Scientists investigate in order to figure things out. You have been investigating why Australia's skin cancer rate is so high. Are you getting closer to understanding the cause of Australia's high skin cancer rate?

1. I understand how light from the sun can cause skin cancer. (check one)
   - ☐ yes
   - ☐ not yet

Explain your answer choice.

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2. I understand why different types of light can change materials in different ways. (check one)
   - ☐ yes
   - ☐ not yet

Explain your answer choice.

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3. I understand the different things that can happen when a light wave hits a material. (check one)
   - ☐ yes
   - ☐ not yet

Explain your answer choice.

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Name: ______________________ Date: ______________

Homework: Check Your Understanding (continued)

4. I understand why light sometimes changes a material and sometimes doesn't. (check one)

☐ yes

☐ not yet

Explain your answer choice.

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5. What do you still wonder about how light can interact with materials?

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Name: ____________________ Date: ____________

Lesson 3.1: Following the Path of Light

Australian citizens are still waiting to understand why the skin cancer rate in their country is so high. You now know that skin cancer rates are affected by differences in the amount of melanin in skin cells and by differences in the amount of ultraviolet (UV) light that skin cells absorb. Why does Australia receive more UV light than Brazil, even though the two countries receive the same amount of sunlight? To answer this question, you will need to know more about what happens to light as it travels.

Unit Question

- How does light interact with materials?

Chapter 3 Question

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

Vocabulary

- absorb
- energy
- light
- light source
- reflect
- transmit
- visualize
- wave

[redacted]

- [redacted]

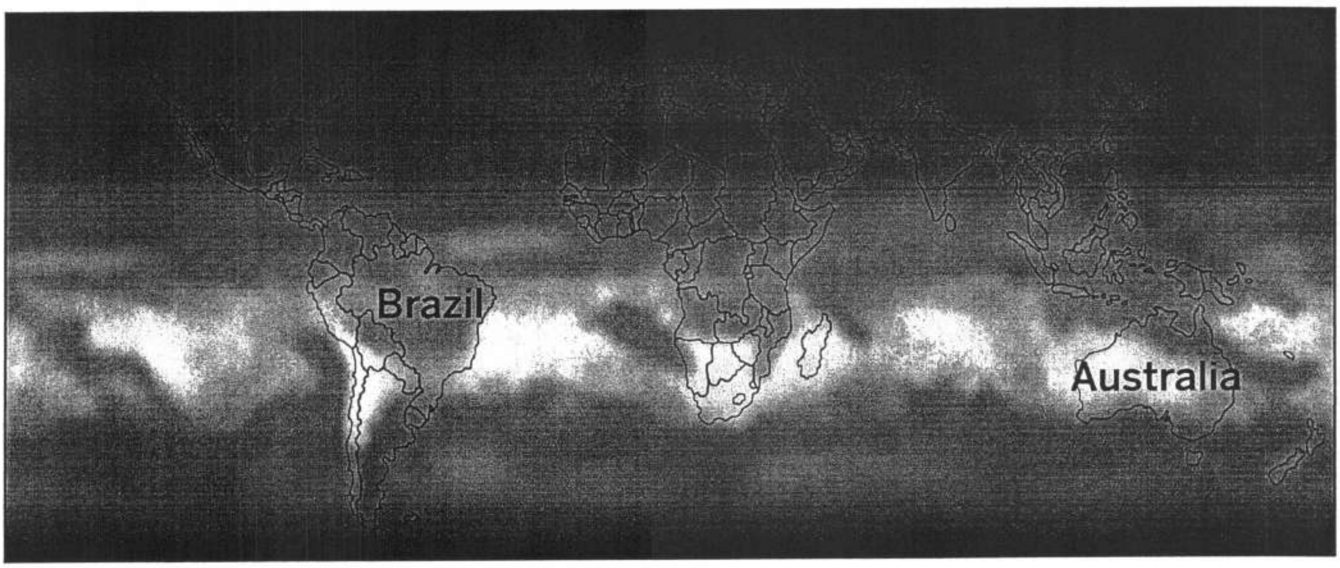
Name: ______________________________ Date: ____________________

Warm-Up

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. [redacted] or [redacted]

World Ultraviolet (UV) Light Map (joules per square meter)



Amount of ultraviolet (UV) light

Source: NASA Earth Observatory

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

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Name: ______________________ Date: ______________

Homework: 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 using the Active Reading strategies that work best for you. Then, answer the questions below.

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

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

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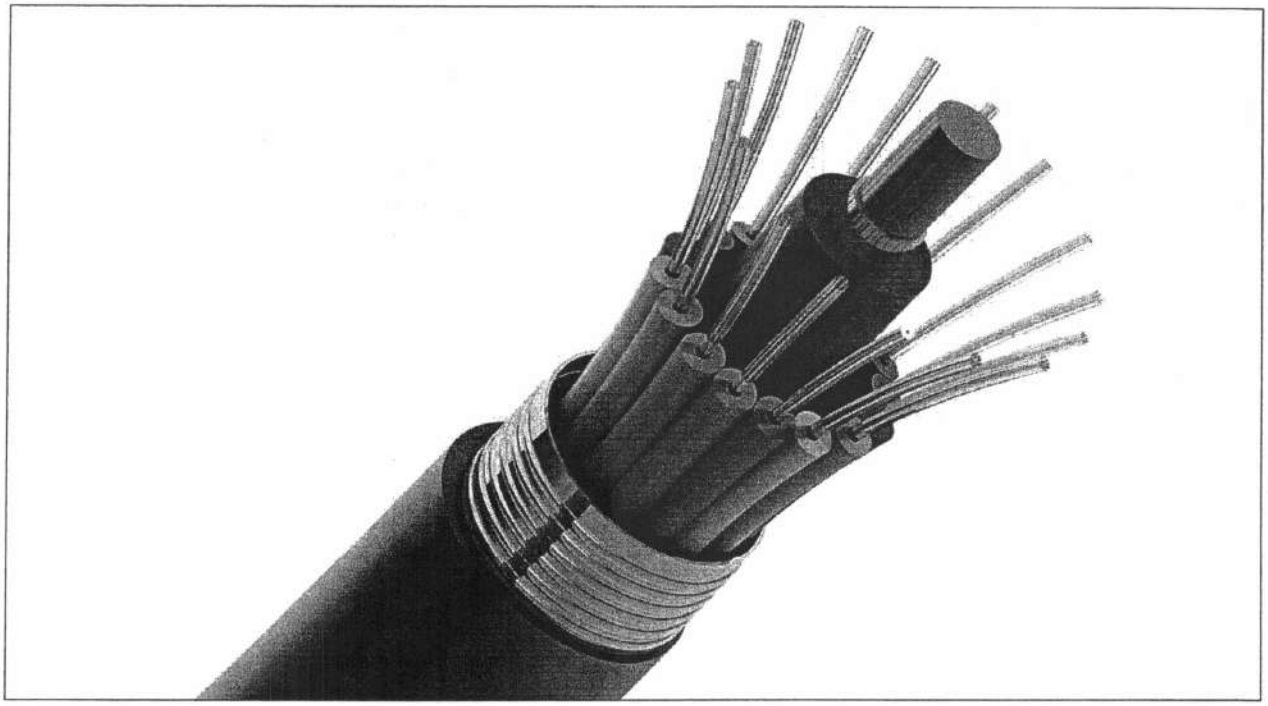
Active Reading Guidelines

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.



Fiber-optic cable can be used to send information very quickly over long distances.

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.

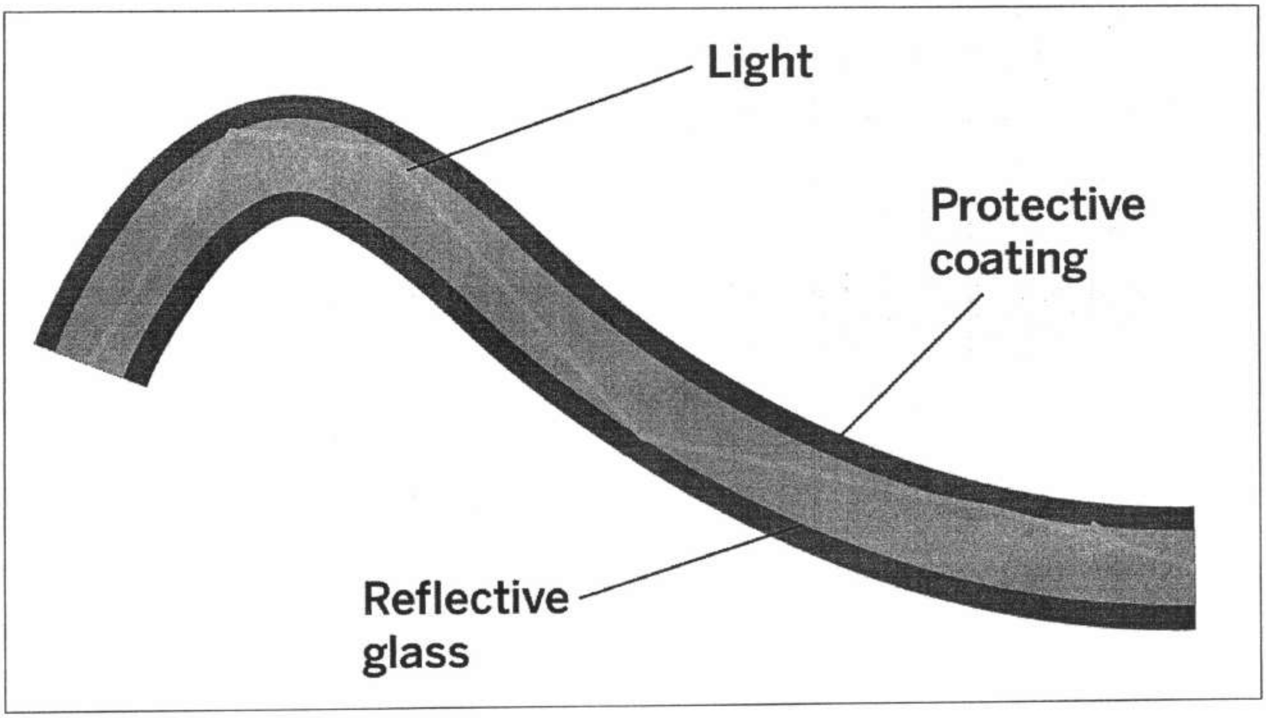
Fiber-optic cable is made of long, thin strands of glass about the width of a human hair. These strands are made of very pure glass that reflects light well and are covered in a protective coating. Light bounces along inside the fiber-optic cable at the speed of light, making fiber-optic cable the fastest 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).

How can light transport information? First let's look at different ways a specific kind of information—your voice—can be transported. When you are talking to your friend and she is standing right next to you, your vocal cords create a sound wave that travels through the air into your friend's ear. But what if your friend is far away? Before cell phones and fiber-optic cables, the only option was to talk to your friend on telephones connected by metal wires (what we now call landlines). If you talk on a landline phone, the phone changes the sound wave of your voice into an electrical signal that carries the information from the sound wave. As the electrical signal travels along the wire, it loses power and picks up "noise." "Noise" is when a wave gets changed little by little as it travels. When the electrical signal reaches your friend's telephone, it gets changed back into a sound wave, but the noise is now part of the sound wave. This isn't a problem for short distances, but over very long distances, the noise can sound like static in your friend's ear!

A better way to transport information over long distances is by sending light through fiber-optic cables. The information carried by the light takes the form of a digital signal. Sound waves and other kinds of waves are not digital, but they can be converted to digital form. To convert the sound wave created by your vocal cords to digital form, a device measures the height of the wave a certain number of times per second. It records the height of the wave at each moment as a number. When it's time to recreate the wave, those numbers can be used in the right order to produce a wave with exactly the same heights at exactly the same places in the wave—that is, it will be nearly exactly the same wave that was recorded. A wave that has been digitized can be played back as a wave over and over, and it will be the same every time. For that reason, digital signals are a very reliable way to record information—as long as the numbers in the digital signal don't change, the information can be reproduced exactly over and over again.

To make a digitized signal into something that can be transmitted by light, all those numbers are converted again into a pattern of light flashes (wave pulses). Each pattern of flashes represents one number in the signal. The pattern of light flashes is sent along the fiber-optic cable by a laser that can flash very quickly—hundreds of times per second. When the flashes of light are received on the other end of the fiber-optic cable, they are converted back into numbers and then back into sound waves we can hear with our ears. This means your friend won't hear any static, even if she's halfway around the world when you talk to her!

Fiber-optic Cable



Fiber-optic cables are made of strands of reflective glass coated with a protective substance. The light bounces along inside the strands of glass.

Name: ________________________________ Date: ________________

Lesson 3.2: "What Eyes Can See"

To learn more about what is happening to ultraviolet light as it reaches Australia, you are investigating what can happen to light as it travels. Humans have amazing light-detection tools that can help investigate this: our eyes! Today, you'll read an article about vision that will help you learn more about transmission, reflection, and absorption.

Unit Question

- How does light interact with materials?

Chapter 3 Question

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

Key Concepts

- Light travels in a straight line.
- When a light wave hits a material, the light can be absorbed by the material, transmitted through the material, or reflected off the material.

Vocabulary

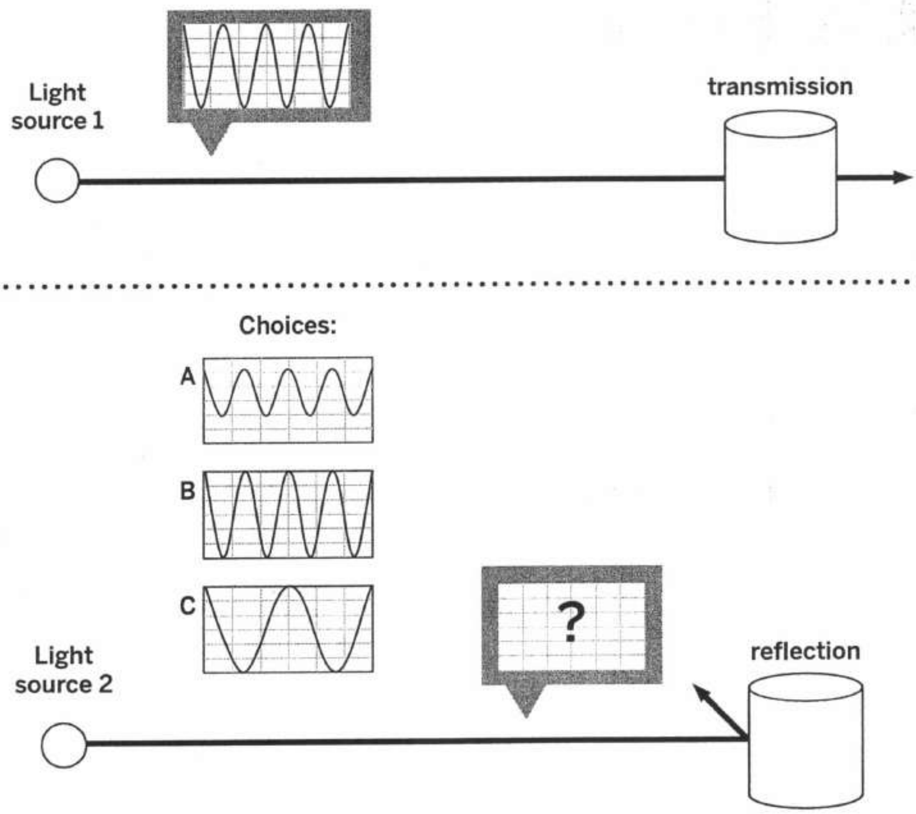
- absorb
- emit
- energy
- light
- light source
- reflect
- transmit
- wave
- wavelength

Name: ______________________________ Date: ______________

Warm-Up

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? (check one)

☐ A ☐ B ☐ C

Explain your answer.

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Name: ______________________________ Date: ____________________

Reading "What Eyes Can See"

1. Read and annotate the article "What Eyes Can See."
2. [redacted] these [redacted].
3. Now, choose and mark a question or connection, [redacted]t [redacted]s.
4. Answer the reflection question below.

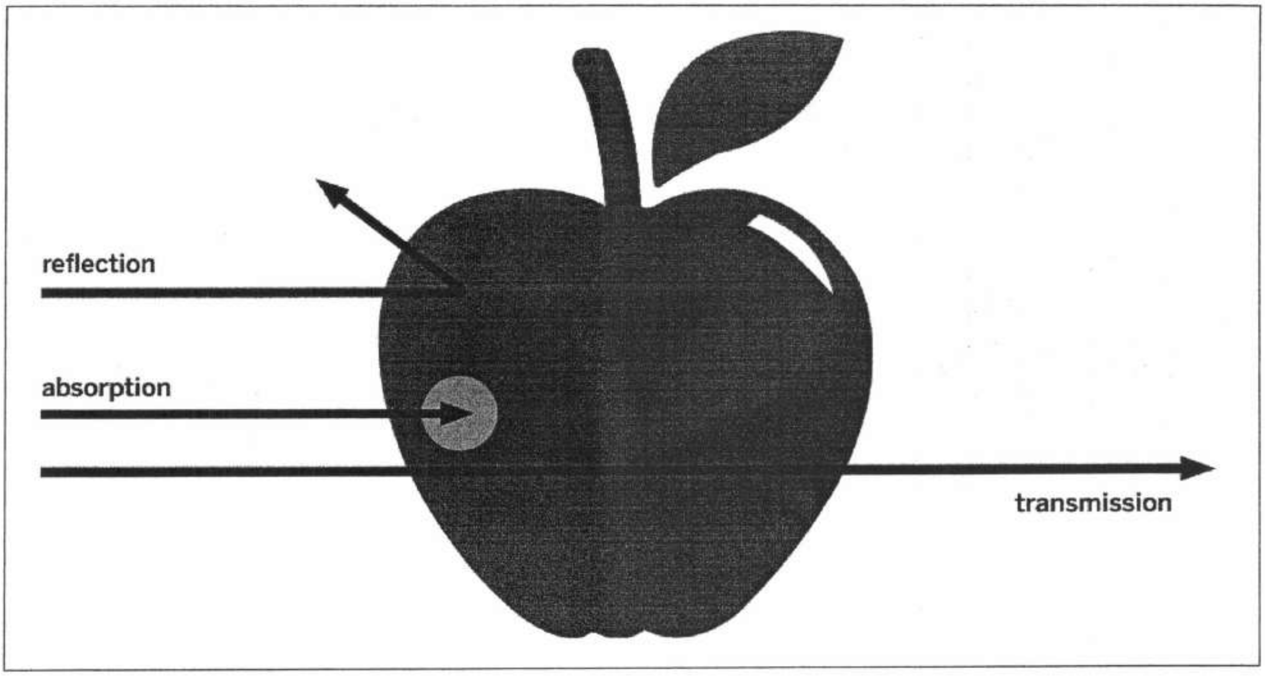
Rate how successful you were at using Active Reading skills by responding to the following statement:

As I read, I paid attention to my own understanding and recorded my thoughts and questions.

- ☐ Never
- ☐ Almost never
- ☐ Sometimes
- ☐ Frequently/often
- ☐ All the time

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.



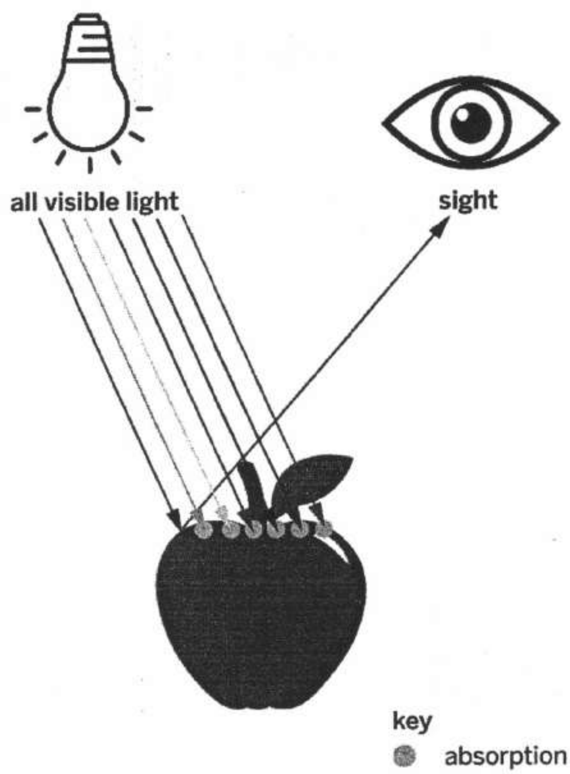
This diagram shows the three things that can happen when light interacts with a material: energy can be absorbed (taken in), transmitted (allowed to pass through), or reflected (caused to bounce off).

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 types 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



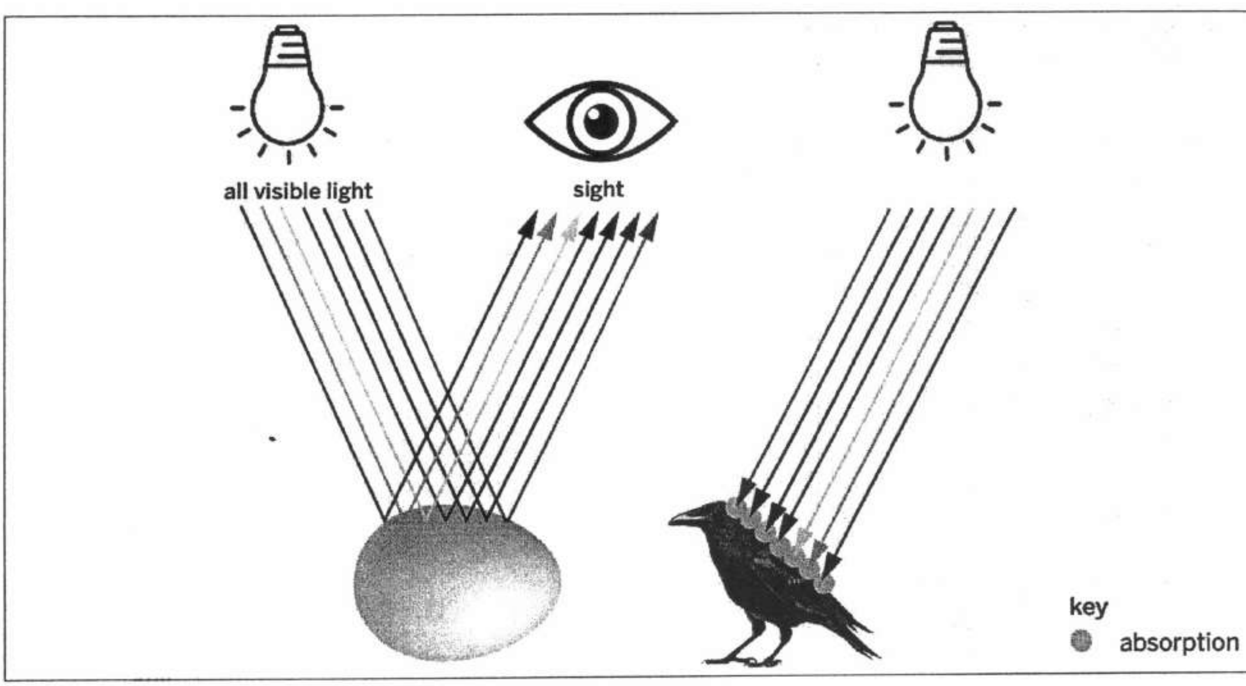
The color of an object is determined by the way it absorbs, transmits, and reflects energy from light.

and bouncing off others, before the light is finally absorbed by the back of your eyeball. There, tiny organs called rods and cones absorb energy from the light. This energy triggers a chemical signal with information about the color and brightness of the light. Depending on the wavelength of the light, different signals are sent to the brain. We perceive different signals as different colors.

So your eyes are actually seeing light. Still, this does not explain why you see certain objects as certain colors. For instance, why are some apples green and other apples red? Red apples look red because they reflect red light. The energy from red light is not absorbed by the apple; it bounces off instead. When you look at the apple, reflected red light waves hit your eye and are absorbed. The energy you take in from these light waves sends a signal to your brain, which causes you to see the color red when you look at the apple. The process is the same for green apples, except green apples reflect green light instead of red light.

What about when you look at something black, like a crow, or something white, like an egg? People usually think of black and white as colors, just like red. To your eyes, however, black and white are different from the colors of the rainbow. Black is what we see when no visible light is reflected off an object. Black objects don't reflect any visible light because they absorb all types of visible light. Taking in energy from so many different types of light can make black clothes feel hot and uncomfortable on sunny days. White, on the other hand, is what we see when all colors of visible light reflect off an object. White objects reflect all types of visible light. White clothes are great for staying cool on a sunny day because they don't absorb any energy from visible light.

If black is the absence of color, what about things that appear to have no color, like a clear piece of glass? Clear glass seems to have no color of its own, but it isn't black, either. When you look through a piece of clear glass, you see



White objects, like this egg, reflect all types of visible light. Black objects, like this crow, do not reflect any types of light. To your eyes, white is the combination of all colors, and black is the absence of color.

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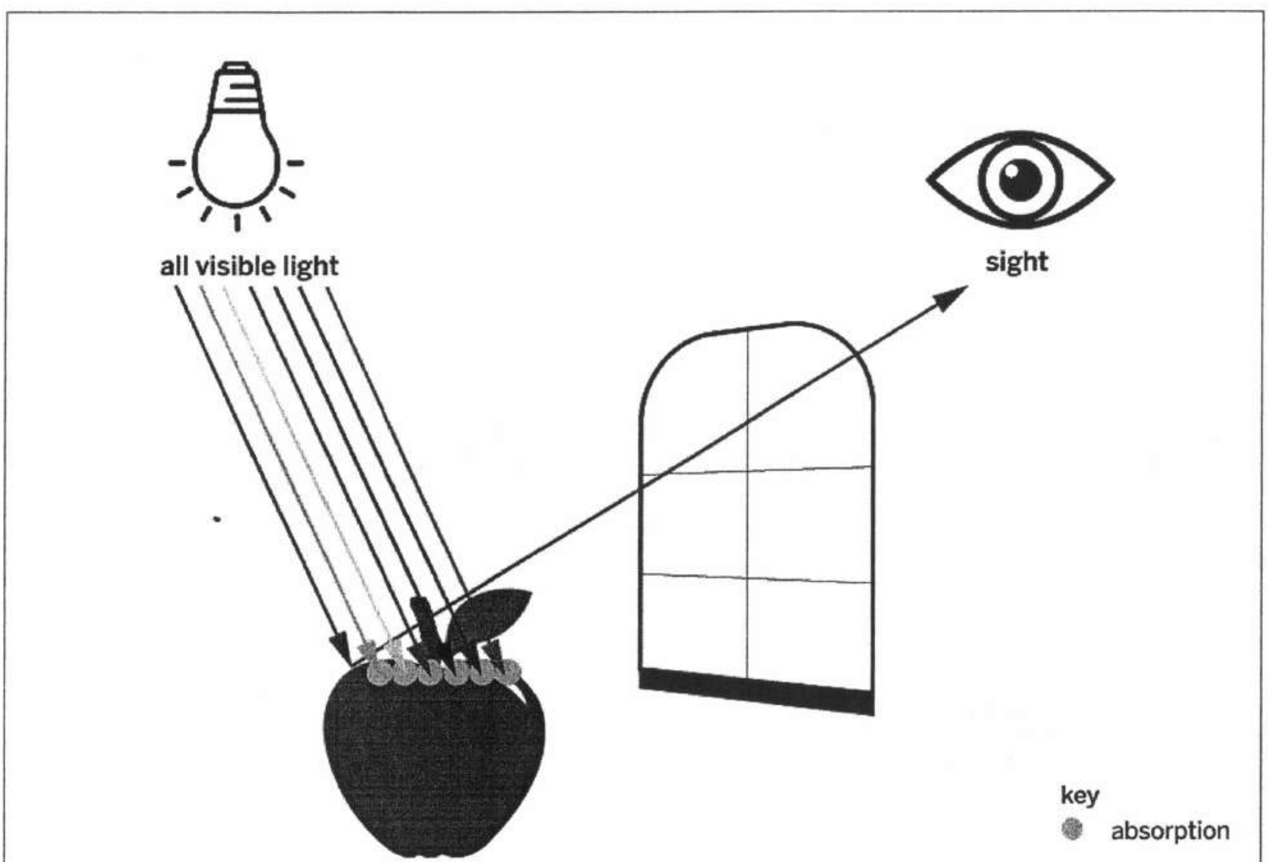
the colors of objects on the other side. This is because clear glass transmits all types of visible light. When these light waves hit a pane of glass, they pass right through, carrying their energy across to the other side. Through a clear glass window, you see a world full of colorful objects, each of which is reflecting certain wavelengths of light through the glass to your eye.

As you look around, what you see isn't really what you see. Everything you can see is just light reflecting off things. The colors of objects are determined by the colors of light they reflect. If apples didn't reflect visible light, they would look black to us—and if our eyes responded to a different type of light with a different range of wavelengths, everything in our world would look very different!



Clear glass transmits all types of visible light, so your eyes see the colors of the objects behind the glass instead of the glass itself.

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Name: ______________________ Date: ______________

Homework: Revisiting the Anticipation Guide

Review your original responses to these statements from the Anticipation Guide

1. All light can be seen.

   Do you agree or disagree with this statement now? (check one)

   ☐ agree

   ☐ disagree

   ☐ not sure

Explain your thinking.

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

   Do you agree or disagree with this statement now? (check one)

   ☐ agree

   ☐ disagree

   ☐ not sure

Explain your thinking.

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Making Waves at Swim Practice

1. Read and annotate each paragraph

Par 1

Par 2

Par 3

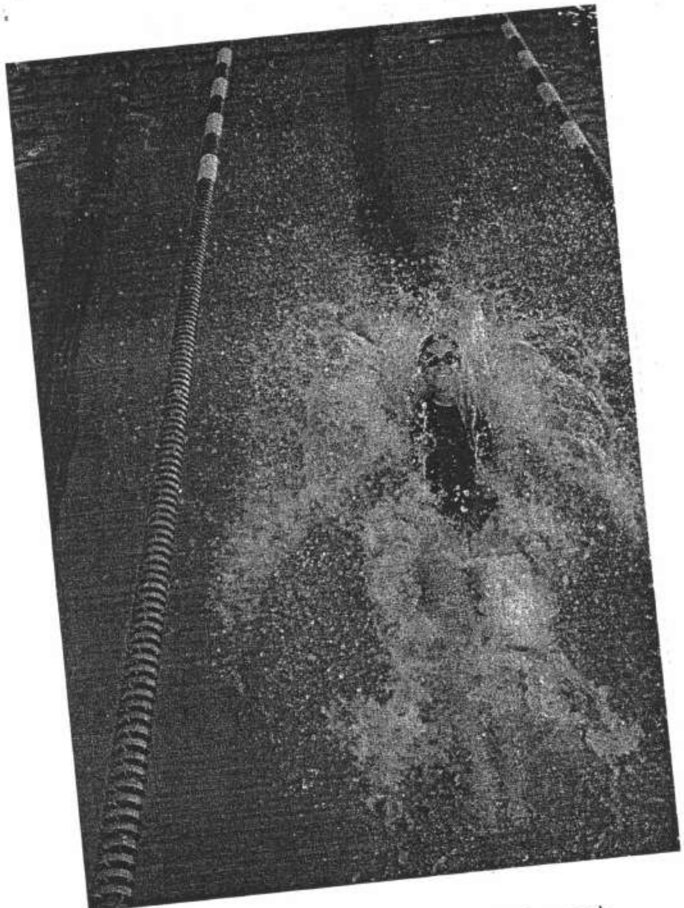
Par 4

Par 5

2. Write a summary, at least five sentences

3. Question: You read that light waves travel through air and water at different speeds. What is one way this can affect what you see around you?

Making Waves at Swim Practice



1 You're sitting with the rest of the swim team, waiting for practice to start. Everybody's on a long metal bench next to the pool. Suddenly, you hear banging over and over, and it's really annoying. You look around, and realize a teammate at the other end of the bench is kicking the bench—that's what's making the noise. You get up to go ask them to stop, but as soon as you get off the bench you can barely hear the sound of the kicking anymore. You try sitting back down, and it's just as loud as before. Is your teammate playing a trick on you? Why can you hear the sound when you sit on the bench, but not when you're standing up? It's not a trick—when you're sitting on the bench, that banging sound is actually traveling to you through the metal of the bench. You probably know sound waves can travel through the air, but they can also travel through solid materials like metal. That's because metal and air are both made of matter.

2 Sound waves can travel through any kind of matter, including water and other liquids. After practice starts and you jump into the pool, you can hear splashing sounds underwater. Sometimes, during free swim time, you and your friends sing and shout words to each other underwater for fun. People sound different underwater than they do in the air, so it's not always easy to understand what a person is saying underwater. That's because sound waves travel a little bit differently in water than they do in the air. Sound waves travel at different speeds in different materials. When sound waves are moving through water, they travel faster than they do through air. Surprisingly, sound waves travel fastest when they are moving through solid materials like the metal of the bench.

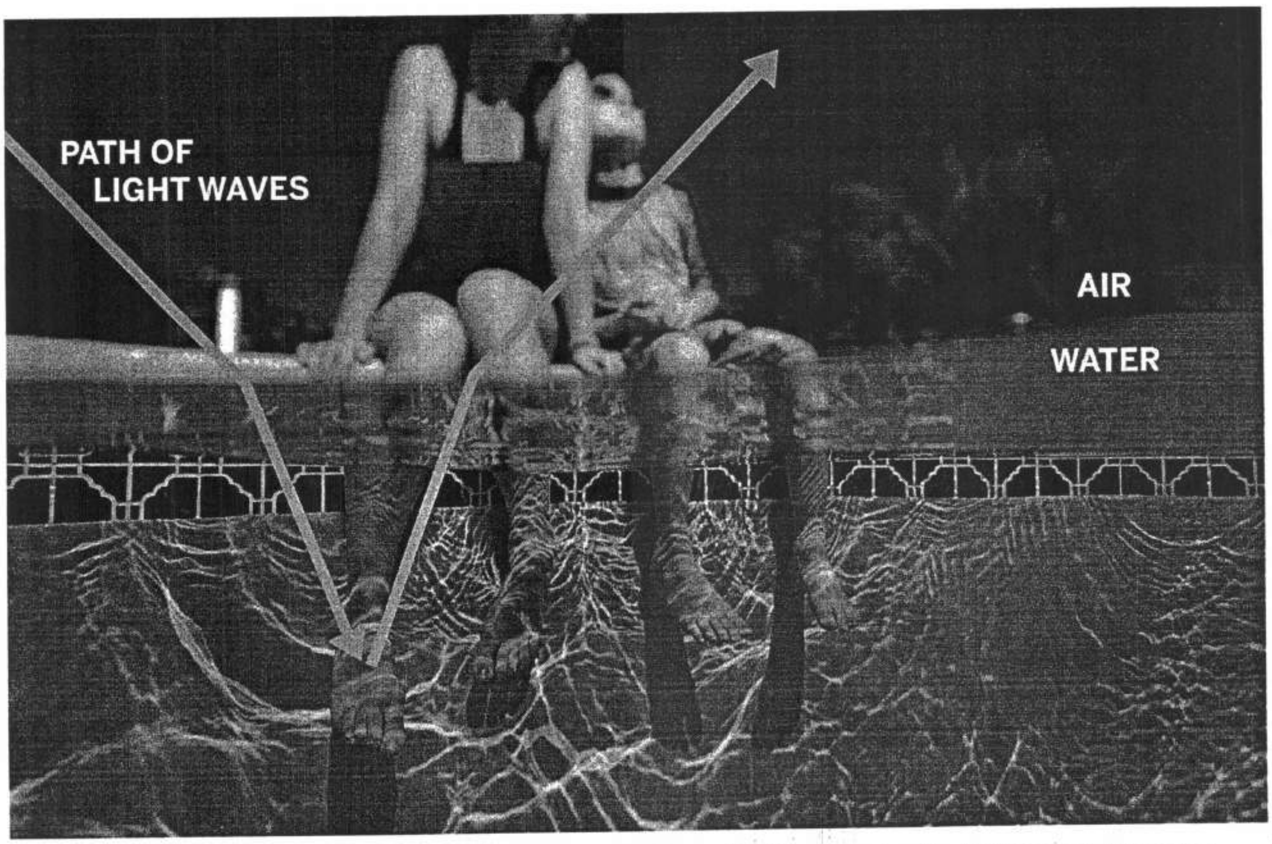
3 Now practice is over, and you and the rest of the team are resting on the edge of the pool, dangling your feet in the water. You notice how weird everybody's feet and legs look through the water. When they're in the water, your legs look ripply and even seem to bend in odd directions, but if you pull them out, they look straight again. It's not your legs that are bending in the water, it's light! Both water and air transmit light, meaning light can pass through them. Light reflects off your legs, traveling through the water and then passing into the air. The light bends as it passes from the water to the air, and the bending light makes your legs look bent. This bending of light is called refraction: light refracts when it passes from one material (such as water, air, glass, or plastic) into another.

Why does light refract? Just like sound waves, light waves travel at different speeds depending

4 on what they are traveling through. Light always travels fast, but light waves move fastest when they are traveling through empty space. (Unlike sound waves, light waves can move through empty space—they don't need matter to travel through.) Light waves move a little bit more slowly when they travel through matter, such as the gases that make up air. When traveling through water, light waves move more slowly than they do when they move through air. As the light waves pass from one material to another, they speed up or slow down, and this change in speed makes the light bend.

When light bends, interesting things happen. Have you ever noticed a rainbow in the spray of water droplets from a hose? Rainbows also happen because of refraction. White light (such as sunlight) is actually made up of many different colors of light, and each color has a different wavelength. For example, blue light has a shorter wavelength than red light. The wavelength of a light wave affects the angle at which it bends when it passes from one material to another. (That's called the angle of refraction.) When sunlight passes from the air into droplets of water, all the different colors in the light refract differently—some bend farther than others because they have different wavelengths. Refraction separates the white light into bands of different colors, and we see a rainbow.

5 All waves—light waves, sound waves, and every other kind of wave—travel at different speeds in different materials. That affects the way you see and hear everything around you, from an annoying noise to the sparkle of sunshine on the water.



Light waves refract (bend) as they pass from the air to the water. Then they reflect off the leg. The light waves refract again as they pass from the water to the air.

Name: ______________________________ Date: ____________________

Lesson 3.3: Reflection, Transmission, and Energy

You know that a material changes when it absorbs energy from light. What about when a material reflects or transmits light? Today, you will return to the article "What Eyes Can See" and use the *Light Waves* Simulation to investigate what happens to energy from light when light is reflected off or transmitted through a material. Understanding all the ways light can travel will help you explain why Australia gets more UV light than other parts of the world.

Unit Question

- How does light interact with materials?

Chapter 3 Question

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

Key Concepts

- Light travels in a straight line.
- When a light wave hits a material, the light can be absorbed by the material, transmitted through the material, or reflected off the material.
- A material transmits or reflects some types of light and not others.

Vocabulary

- absorb
- emit
- energy
- light
- light source
- reflect
- transmit
- wavelength
- visualize

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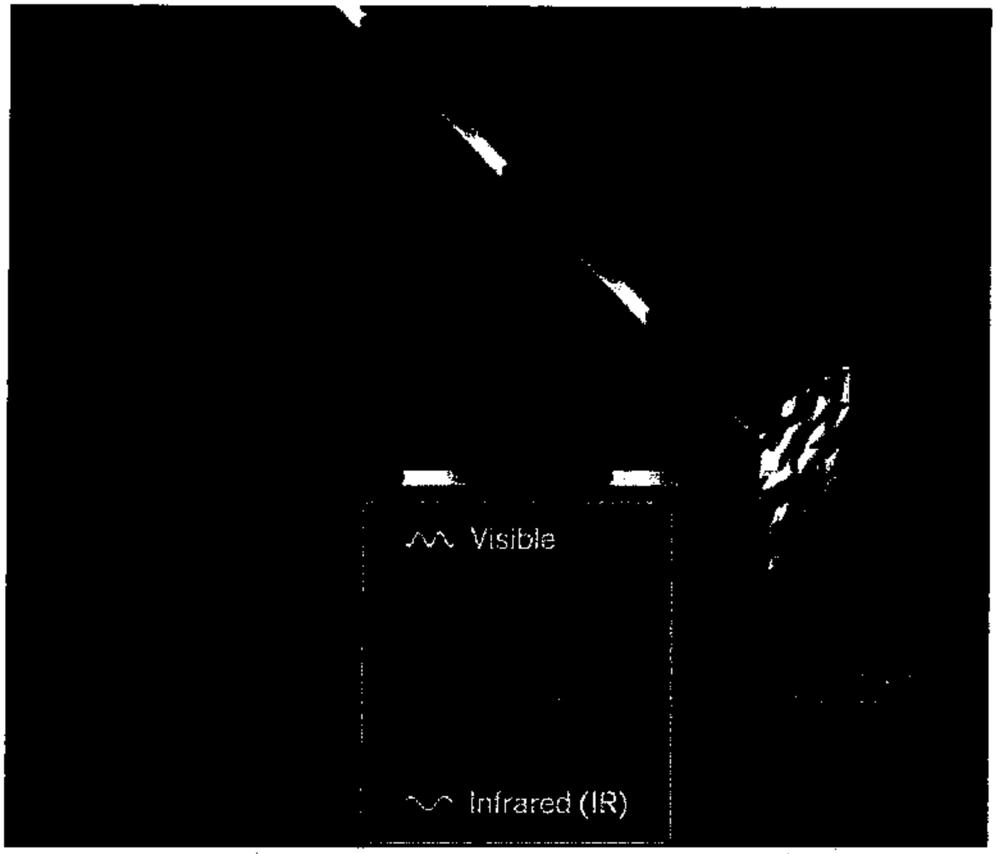
Name: ______________________________ Date: ________________

Warm-Up



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? (check one)

☐ yes

☐ no

Explain your answer.

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Name: ______________________ Date: ______________

Rereading "What Eyes Can See" From Lesson 3.1

How Visible Light Affects Temperature

When visible light shines on black objects, the objects get warm, but when the same light shines on white or clear objects, there is no change. How can this be true? Preview the question below, then reread the fifth and sixth paragraphs in the "What Eyes Can See" article to answer the question. As you read, you may want to highlight or annotate parts of the text that will help you to answer the question.

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

Discuss your ideas with your partner and then write your response below.

1. When visible light shines on a black object, it gets warm because . . .

____

____

____

2. When visible light shines on a white object or a clear object, there is no change because . . .

____

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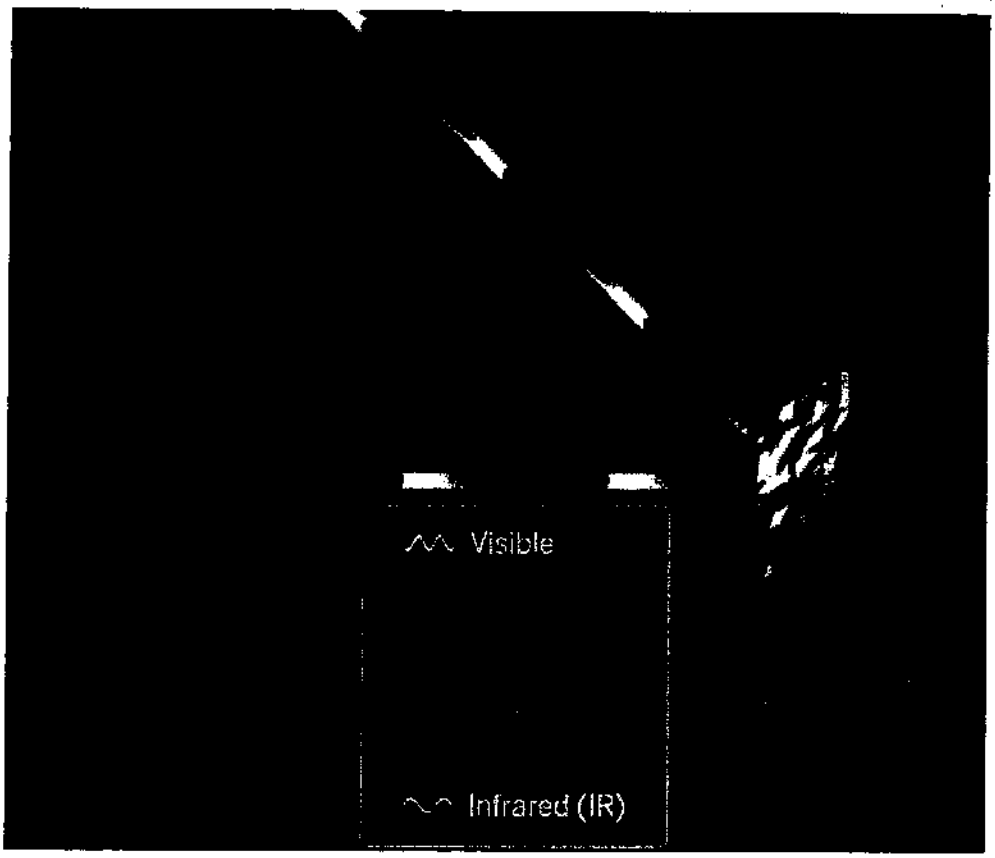
Name: ______________________ Date: ______________

Homework: Revisiting the Warm-Up

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



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? (circle one)

yes **no**

Explain your answer.

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Name: ______________________ Date: ______________

Lesson 3.6: Explaining Australia's Skin Cancer Rate

You've learned a lot about what can happen to light as it travels! Today, you will use what you have learned to show why Australia gets more UV light than other parts of the world. Using the Modeling Tool, you'll compare what happens to UV light as it travels through the atmosphere above Australia and the atmosphere above Brazil. The Reasoning Tool (on page 108) will help you organize your evidence before you revise your argument about why the skin cancer rate in Australia is so high. Finally, you'll be ready to help the people of Australia!

Unit Question

- How does light interact with materials?

Chapter 3 Question

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

Key Concepts

- Light travels in a straight line.
- When a light wave hits a material, the light can be absorbed by the material, transmitted through the material, or reflected off the material.
- A material transmits or reflects some types of light and not others.
- When light is transmitted through or reflected off a material, the energy is not absorbed, so the material does not change.

Vocabulary

- absorb
- energy
- light
- reflect
- transmit
- visualize

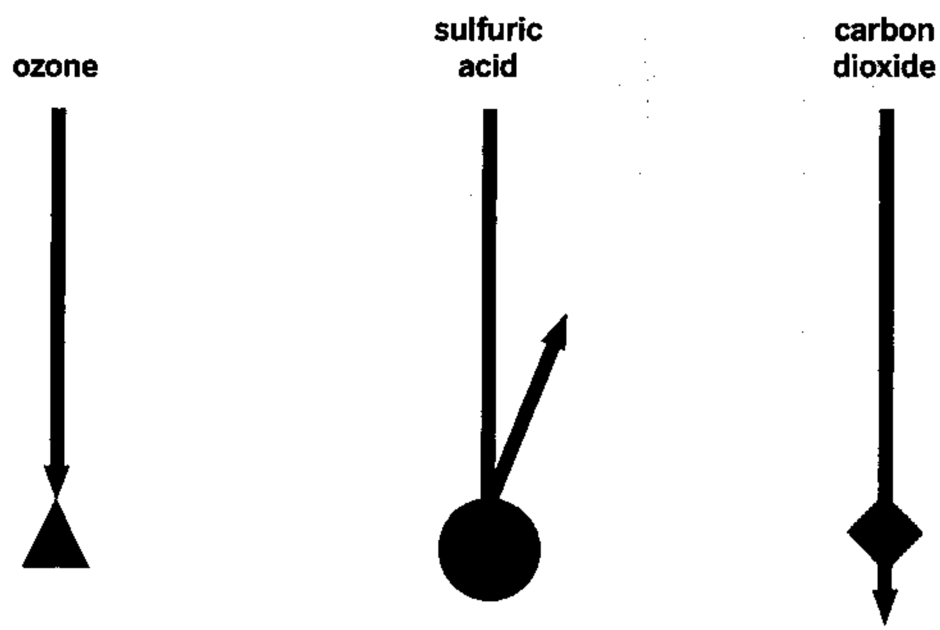
Name: ______________________ Date: ______________

Warm-Up

Ultraviolet Light in the Atmosphere

Review what you learned in the last lesson about how ultraviolet (UV) light interacts with ozone, sulfuric acid, and carbon dioxide. Write the correct label under each interaction to show what happens when UV light hits each material.

Results of Interactions with UV Light



reflects	**transmits**	**absorbs**

Name: ______________________________ Date: ______________

Preparing to Write

Reasoning About the Evidence

You have been investigating why the cancer rate in Australia is so high. Use the Reasoning Tool below to connect each piece of evidence to the claim you think is accurate. Explain why each piece of evidence matters, then note the claim you think the evidence supports.

Question: Why is the skin cancer rate in Australia so high?

Claim 2: There is something different about the sunlight in Australia.

Claim 3: More people in Australia have skin that is easily damaged by light from the sun.

Evidence	This matters because . . . (How does the evidence support the claim?)	Therefore, . . . (claim)
The atmosphere above Australia has less ozone than the atmosphere above other parts of the world. Ozone in the atmosphere absorbs UV light before it reaches Earth.		
A lot of Australians have low levels of melanin in their skin cells. Melanin in skin cells absorbs UV light before it reaches the genetic material inside the cell		

Name: ____________________ Date: ____________

Homework: Writing an Argument About Australia's Skin Cancer Rate

You now have enough evidence to explain why Australia's skin cancer rate is so high. Review your argument from Chapter 2 and think about how you will convince the AHA that both Claim 2 and Claim 3 are accurate. You will use your completed Reasoning Tool from Activity 3 to revise and add to your argument.

Question: Why is the skin cancer rate in Australia so high?

4

Name: ____________________ Date: ____________

Homework: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond to the questions below.

Scientists investigate in order to figure things out. You have been investigating why Australia's skin cancer rate is so high. Are you getting closer to understanding the cause of Australia's high skin cancer rate?

1. I understand how light from the sun can cause skin cancer. (check one)

   - ☐ yes
   - ☐ not yet

Explain your answer choice.

____

____

____

2. I understand why different types of light can change materials in different ways. (check one)

   - ☐ yes
   - ☐ not yet

Explain your answer choice.

____

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3. I understand the different things that can happen when a light wave hits a material. (check one)

   - ☐ yes
   - ☐ not yet

Explain your answer choice.

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5

Name: ______________________ Date: ______________

Homework: Check Your Understanding (continued)

4. I understand why light sometimes changes a material and sometimes doesn't. (check one)

   ☐ yes
   ☐ not yet

Explain your answer choice.

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5. What do you still wonder about how light can interact with materials?

____

____

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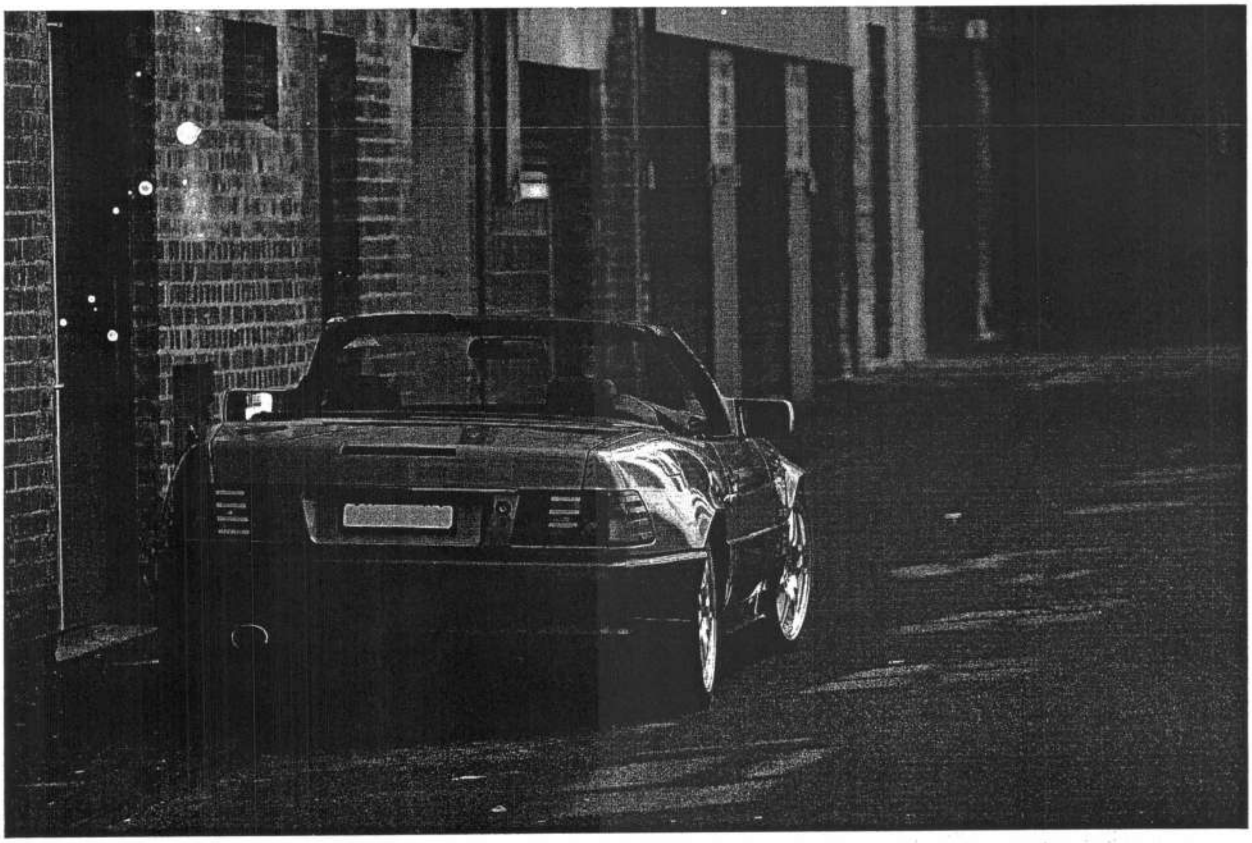
6

Multiple-Choice Questions

Assessment



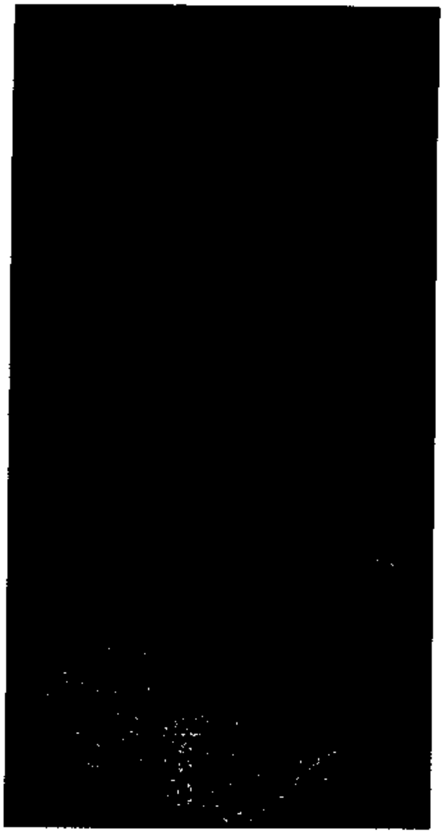
1. If a car sits out in the sun every day for a long time, can light from the sun damage the car's paint?

ⓐ Yes. The paint can take in energy from the light, causing it to be damaged.

ⓑ No. Light can only change things by warming them up, so it cannot damage the car's paint.

ⓒ No. Light is not a physical thing, so it cannot change physical things like paint.

ⓓ Yes. Light from the sun can pull energy out of the paint, causing it to be damaged.



2. **Alex has a type of rock called calcite, which sometimes glows. He puts the calcite under a desk lamp but the calcite does not glow. Then he puts it under an ultraviolet lamp and the calcite glows. Why does ultraviolet light make the calcite glow when light from the desk lamp does not?**

   ⓐ Because ultraviolet light carries energy, and light from the desk lamp does not.

   ⓑ Because ultraviolet light pulls energy out of the calcite, and light from the desk lamp does not.

   ⓒ Because calcite can take in energy from ultraviolet light but not from the light from the desk lamp.

   ⓓ Because ultraviolet light carries glowing molecules, and light from the desk lamp does not.

3. Shonda is learning about a new kind of material that might be used to make new satellites, and she wonders if light can damage the material. The table below shows what happens when different types of light hit the material.

X-ray light	Reflected off the material
Gamma ray light	Transmitted through the material

Based on this information, which type of light is more likely to damage the material?

ⓐ The gamma ray light is more likely to damage the material because the gamma ray light can pull energy out of the material when it passes through the material.

ⓑ The X-ray light is more likely to damage the material because the X-ray light bounces off of the material, which means that it has more energy.

ⓒ There is no way to know because they are two different types of light, and different types of light can change a material in different ways.

ⓓ Neither type of light is likely to damage the material because the material does not take in energy from either the X-ray light or the gamma ray light.

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4. Your friend says that she heard about a special type of ink that is only visible when it is out in the sun. Can light from the sun cause this ink to become visible?

ⓐ No. Light can only change things by warming them up, so it cannot make the ink become visible.

ⓑ No. Light is not a physical thing, so it cannot change physical things like ink.

ⓒ Yes. The ink can take in energy from the light, causing it to become visible.

ⓓ Yes. Light from the sun can pull energy out of the ink, causing it to become visible.

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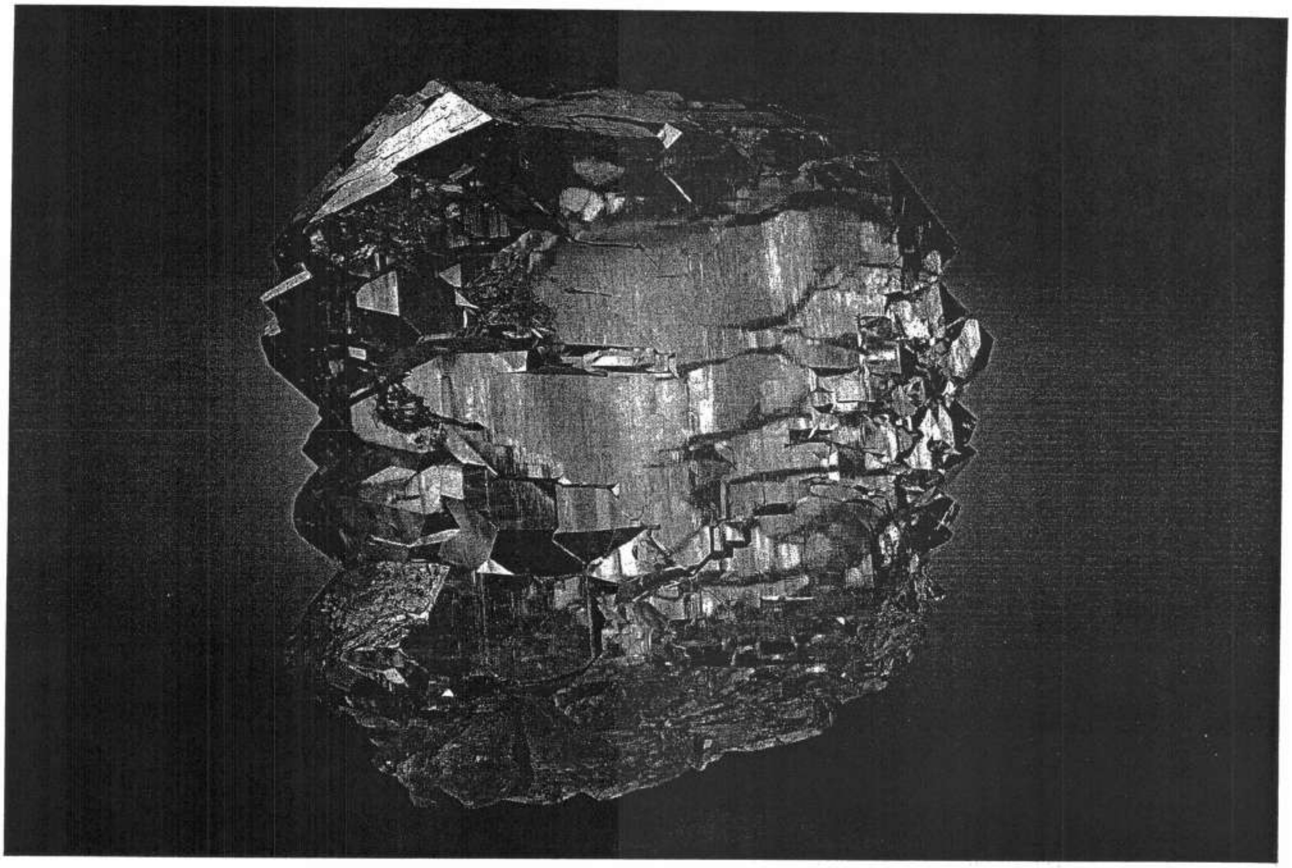
5. Alina notices that when she shines a desk lamp on a mirror, nothing happens. When she shines an infrared lamp on the mirror, the mirror starts to get warmer. Why does light from the infrared lamp warm the mirror when light from the desk lamp does not?

ⓐ Because the mirror can take in energy from infrared light but not from the light from the desk lamp.

ⓑ Because infrared light carries energy, and light from the desk lamp does not.

ⓒ Because infrared light carries heat molecules, and light from the desk lamp does not.

ⓓ Because infrared light pulls energy out of the mirror, and light from the desk lamp does not.



6. Omar has a piece of rock called quartz. He wonders whether light can cause the quartz to become warm. The table below shows what happens when different types of light hit the quartz.

Infrared light	Reflected off the quartz
Visible light	Transmitted through the quartz

Based on this information, which type of light is more likely to cause the quartz to become warm?

ⓐ The visible light can cause the quartz to become warm because the visible light can pull energy out of the quartz when it passes through the quartz.

ⓑ The infrared light can cause the quartz to become warm because the infrared light bounces off the quartz, which means that it has more energy.

ⓒ There is no way to know because they are two different types of light, and different types of light can change a material in different ways.

ⓓ Neither type of light can cause the quartz to become warm because the quartz does not take in energy from either the infrared light or the visible light.

7. Your friend shows you a special kind of paper that can change color. He says that it will change color if it is out in the sun. Can light from the sun cause the paper to change color?

ⓐ Yes. Light from the sun can pull energy out of the paper, causing it to change color.

ⓑ Yes. The paper can take in energy from the light, causing it to change color.

ⓒ No. Light is not a physical thing, so it cannot change physical things like paper.

ⓓ No. Light can only change things by warming them up, so it cannot cause the paper to change color.

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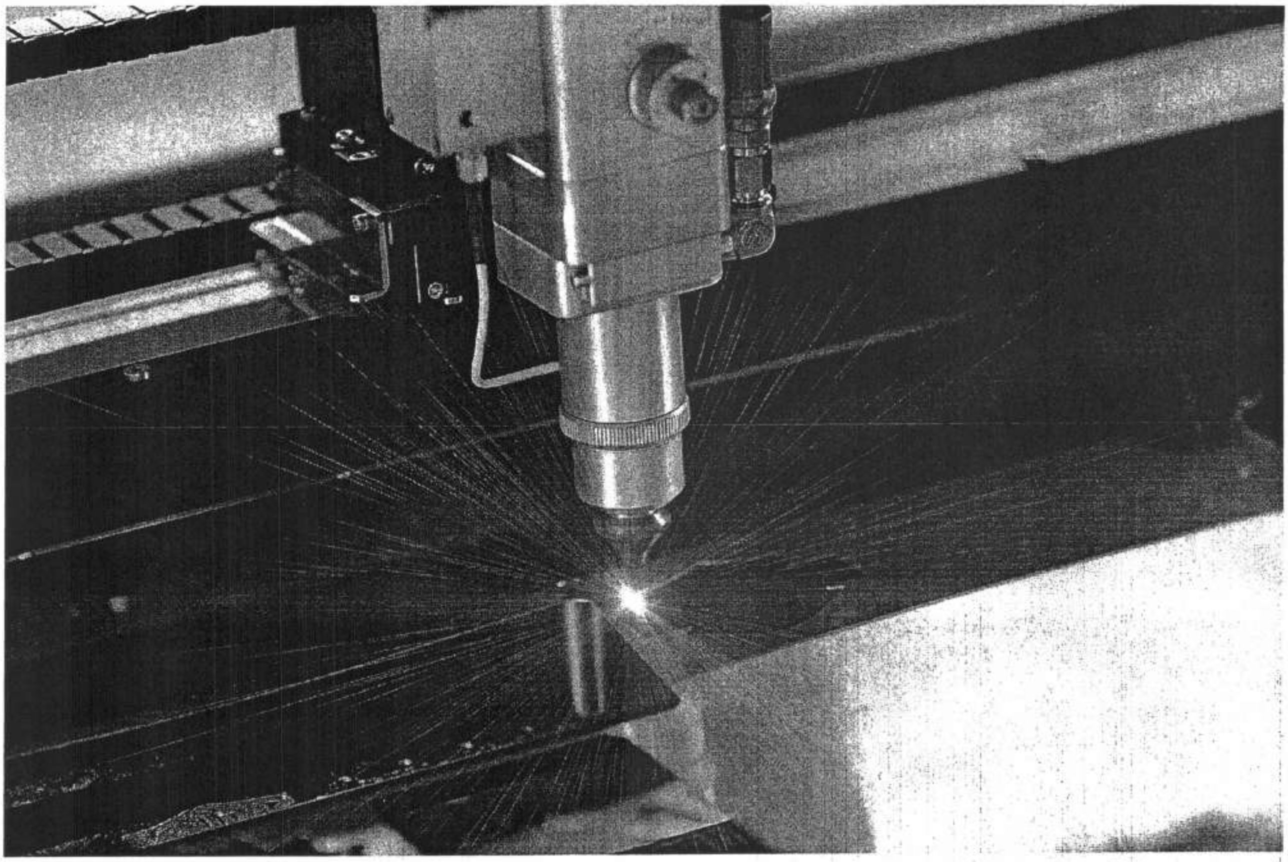
8. Khaled has a red toy that is painted with a special kind of paint. When he puts the toy under a desk lamp, it stays red. When he puts the under an infrared lamp, it turns blue. Why does the infrared light cause the toy to turn blue when the light from the desk lamp does not?

ⓐ Because infrared light pulls energy out of the paint, and light from the desk lamp does not.

ⓑ Because infrared light carries colored molecules, and light from the desk lamp does not.

ⓒ Because the paint can take in energy from infrared light but not from the light from the desk lamp.

ⓓ Because infrared light carries energy, and light from the desk lamp does not.



9. **Kayla wonders if lasers will be able to cut a hole in a piece of silicone, which is a change that requires energy. The table below shows what happens when different types light from lasers hit the silicone.**

Helium-neon laser light	Reflected off the silicone
Carbon dioxide laser light	Absorbed by the silicone
Diode laser light	Transmitted through the silicone

Based on this information, which type of laser light can cut a hole in the silicone?

ⓐ The helium-neon laser can cut a hole in the silicone.

ⓑ The carbon dioxide laser can cut a hole in the silicone.

ⓒ The diode laser can cut a hole in the silicone.

ⓓ Any of these types of light can cut a hole in the silicone, because all light carries energy that can cause materials to change.

10. Your friend says that there is a kind of glue that only dries when it is exposed to a special type of light. Can light cause glue to dry?

ⓐ No. Light can only change things by warming them up, so it cannot cause glue to dry.

ⓑ Yes. The glue can take in energy from the light, causing it to dry.

ⓒ Yes. Light can pull energy out of the glue, causing it to dry.

ⓓ No. Light is not a physical thing, so it cannot change physical things like glue.

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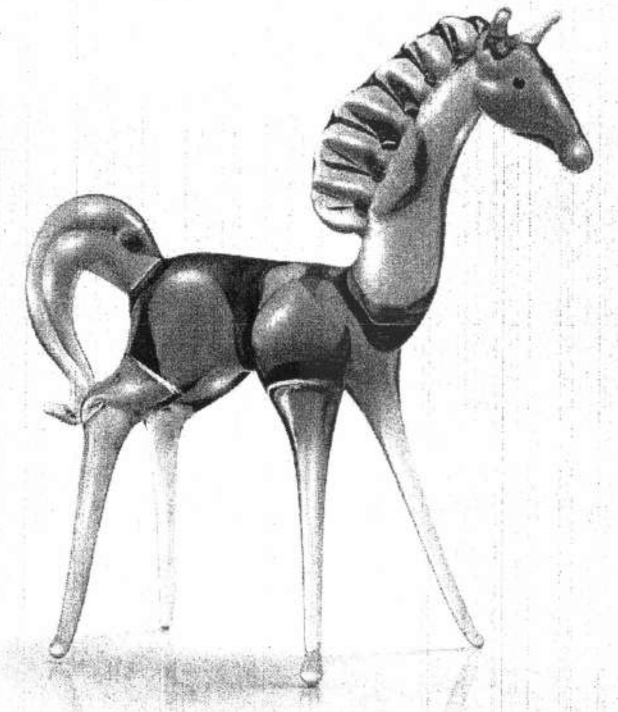
11. Santiago's teacher showed him a kind of cloth that changes color if it is placed out in the sun, but does not change color if it is placed under a desk lamp. Why will light from the sun change the color of the cloth when the light from the desk lamp does not?

ⓐ Because light from the sun carries colored molecules, and light from the desk lamp does not.

ⓑ Because light from the sun pulls energy out of the cloth, and light from the desk lamp does not.

ⓒ Because the sun gives off a type of light that carries energy, and light from the desk lamp does not.

ⓓ Because the cloth can take in energy from the light from the sun but not from the light from the desk lamp.



12. Pedro has a special type of glass that he wants to melt down to make some models. He wonders if light can cause the glass to melt. The table below shows what happens when different types of light hit the glass.

Infrared light	Absorbed by the glass
Yellow light	Reflected off the glass
X-ray light	Transmitted through the glass

Based on this information, which type of light might cause the glass to melt?

ⓐ The infrared light can cause the glass to melt.

ⓑ The yellow light can cause the glass to melt.

ⓒ The X-ray light can cause the glass to melt.

ⓓ Any of these types of light can cause the glass to melt, because all light carries energy that can cause materials to change.

Written-Response Question #1

Sierra has a special kind of liquid rubber. She knows that ultraviolet light is absorbed by the rubber, X-ray light is transmitted through the rubber, and blue light is reflected off the rubber. Sierra wonders if the liquid rubber will become solid if she shines the lights on it.

Can light cause the rubber to become solid? Why or why not? Does it matter what type of light she shines on the rubber?

Written-Response Question #2

Will is learning about a new kind of plastic used to make models. He learns that infrared light is absorbed by the plastic, X-ray light is transmitted through the plastic, and visible light is reflected off the plastic. Will wonders if the plastic will melt if he shines the lights on it.

Can light cause the plastic to melt? Why or why not? Does it matter what type of light he shines on the plastic?