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Chapter Preview Questions

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   b. The building blocks the sun's light.

   c. The building's windows capture the light.

   d. The building gives off rays of darkness.

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b. blue.

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Chapter Preview Questions

4. Why can't you see a friend who hides behind a tree?

a. The tree reflects your friend's light back.

b. The tree's leaves cast a shadow on your friend.

c. The tree absorbs all the light that hits it.

d. The tree blocks the light from your friend from reaching your eyes.

Chapter Preview Questions

4. Why can't you see a friend who hides behind a tree?

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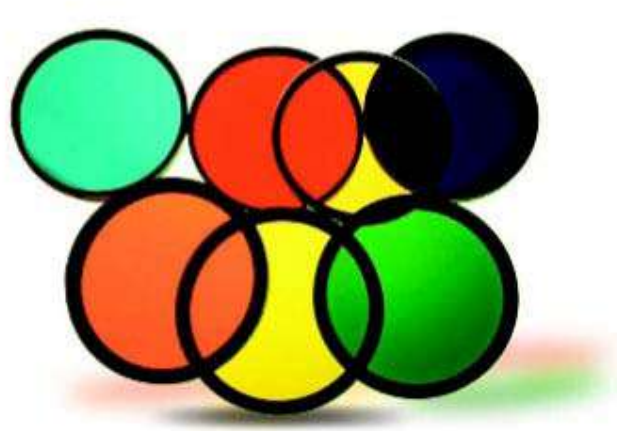
End of Chapter Preview

Focus on the BIG Idea

How does light allow you to see?

Suppose you aim a flashlight at a pair of colored light filters. The first filter is blue and the second one is red. When the light passes through the blue filter, it will emerge blue. But what happens when the blue light passes through the red filter?



Build Science Vocabulary

Latin Word Origins

Latin Word	Meaning of Latin World	Key Term
flectere	to bend	**reflection** The bouncing back of something, such as light or sound, when it hits a surface

Build Science Vocabulary

Latin Word Origins

Latin Word	Meaning of Latin World	Key Term
lux, lucere	to light	**translucent** Scattering light; allowing some, but not all, light to pass through

Build Science Vocabulary

Latin Word Origins

Latin Word	Meaning of Latin World	Key Term
re-	back; again	**reflection** The bouncing back of something, such as light or sound, when it hits a surface

Build Science Vocabulary

Latin Word Origins

Latin Word	Meaning of Latin World	Key Term
trans-	through; across	**transparent** Allowing light to pass through

Build Science Vocabulary

Apply It!

1. Which key term in the chart comes from the two Latin words *flect* and *re*? How does the meaning of this key term involve both those Latin words?

reflection; it is the bending back of light so it returns or comes back

2. What part of the word *translucent* lets you know that the word's meaning has something to do with light?

lucent; from the Latin *Lucere*, meaning to light

Section 1: Waves and the Electromagnetic Spectrum

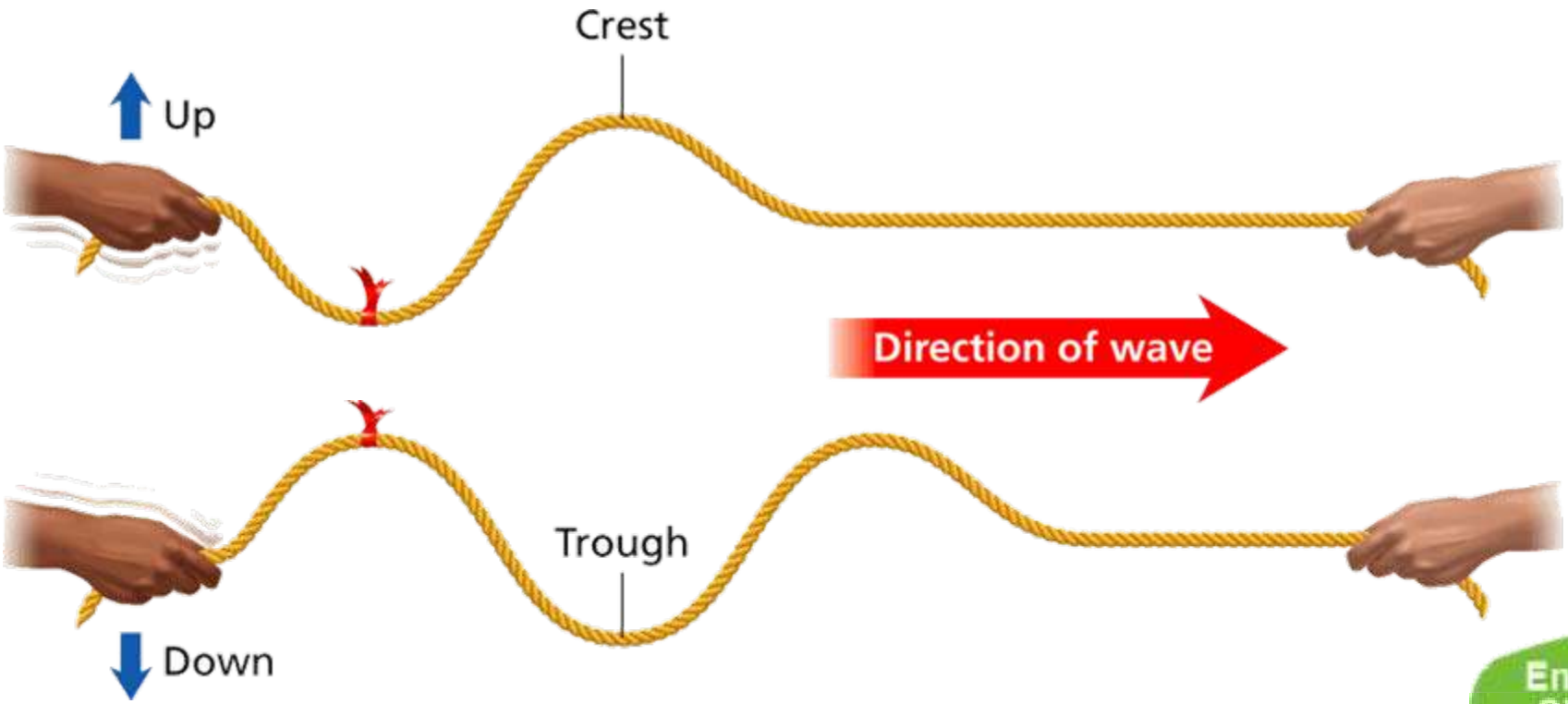
- What causes waves?
- What are the basic properties of waves?
- What does an electromagnetic wave consist of?
- What are the waves of the electromagnetic spectrum?

Electromagnetic Waves

Believe it or not, you are being “showered” all the time, not by rain but by waves.

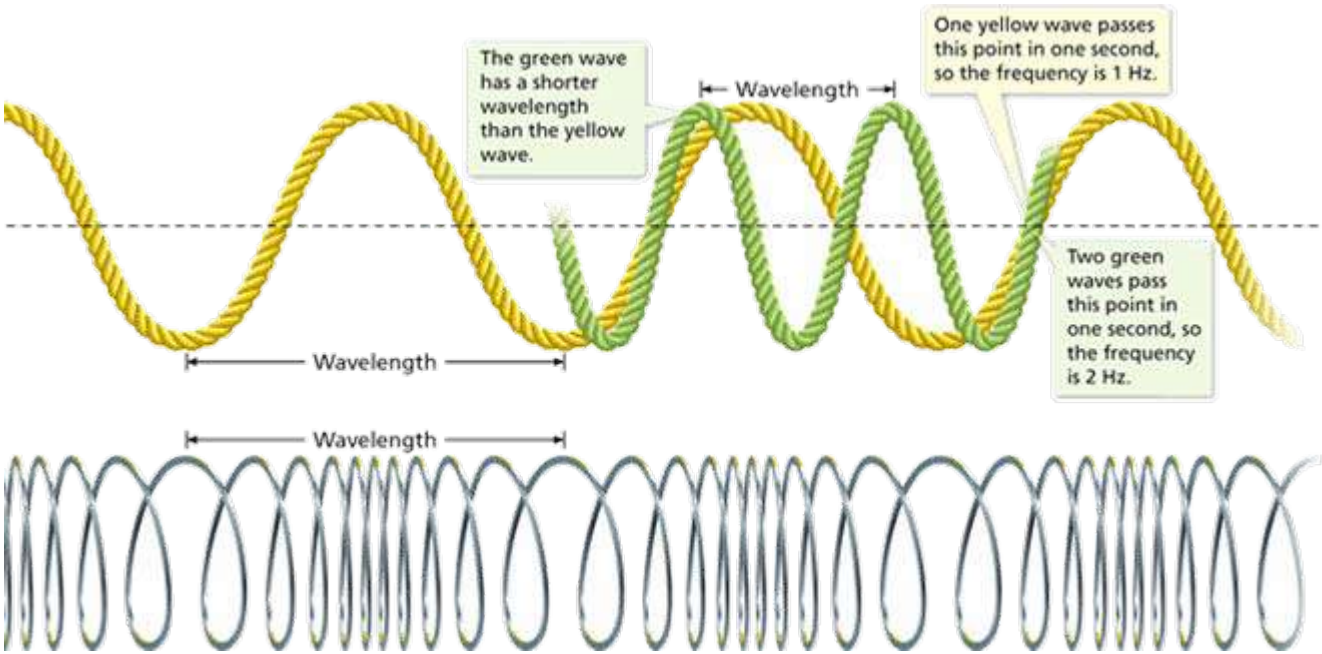
Transverse Waves

Waves that move the medium perpendicular to the direction in which the waves travel are called *transverse waves*.



Amplitude, Wavelength, and Frequency

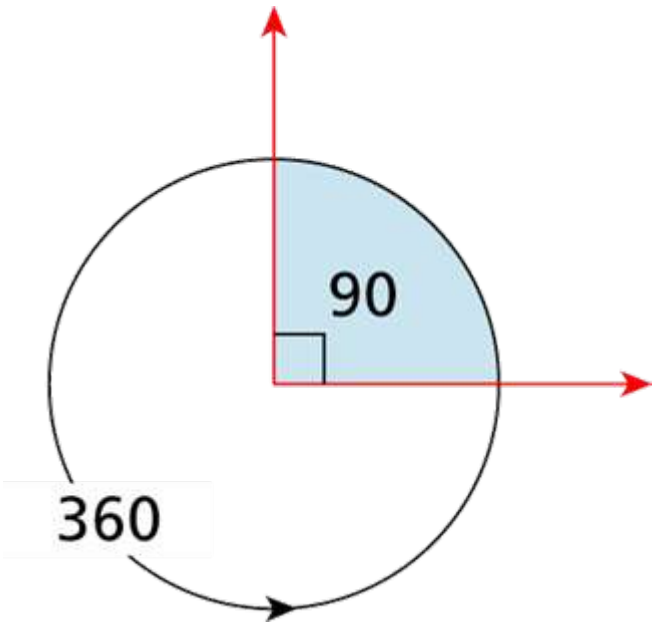
The basic properties of all waves are amplitude, wavelength, and frequency.



Math Skills

Angles

An angle is formed when two lines meet at a point. Angles are measured in degrees, indicated by the symbol º. A circle has 360 degrees. A right angle is an angle that contains 90 degrees. Two lines that meet at a point to form a 90º angle are said to be *perpendicular* to each other.



Math Skills

Angles

Practice Problem

Q. Draw a circle on a piece of paper. How many right angles can you fit in the circle?

A. Four right angles can fit in a circle.

Math Skills

Angles

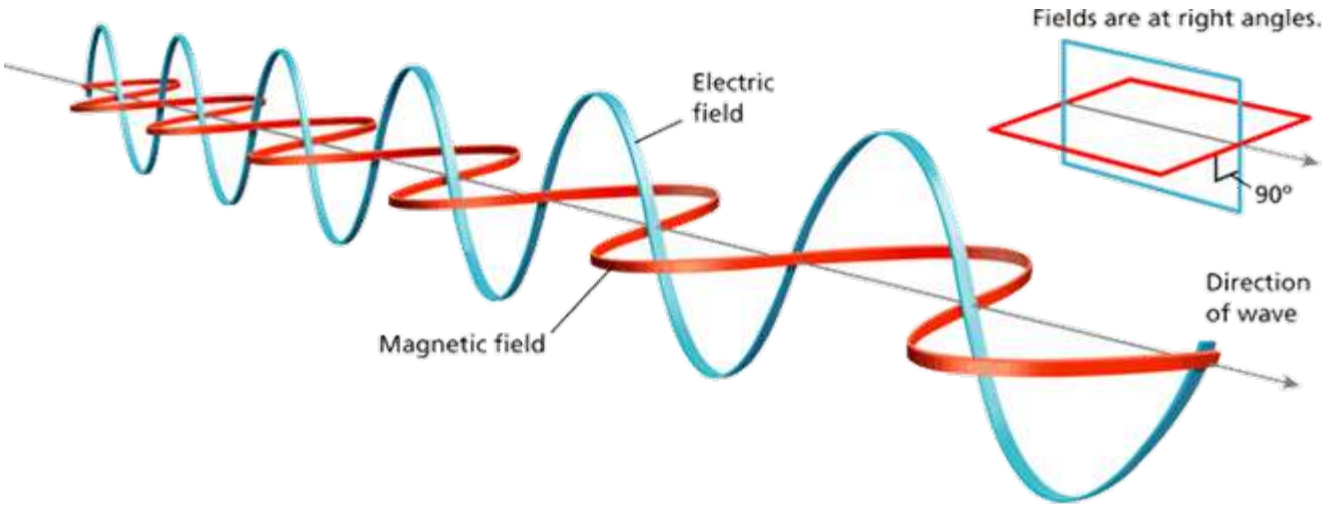
Practice Problem

Q. How many degrees do two right angles contain?

A. Two right angles contain 180 degrees.

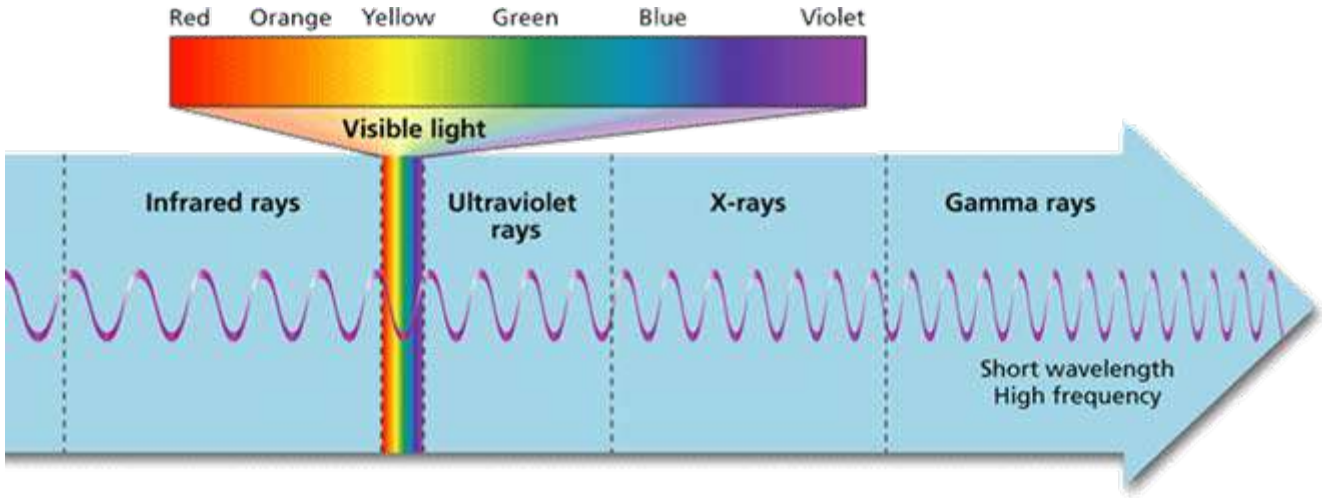
What Is an Electromagnetic Wave?

An electromagnetic wave consists of vibrating electric and magnetic fields that move through space at the speed of light.



What Is the Electromagnetic Spectrum?

The electromagnetic spectrum is the complete range of electromagnetic waves placed in order of increasing frequency.



Electromagnetic Waves Activity

Click the Active Art button to open a browser window and access Active Art about electromagnetic waves.

Links on the Nature of Waves

Click the SciLinks button for links on the nature of waves.

Electromagnetic Waves

Click the Video button to watch a movie about electromagnetic waves.

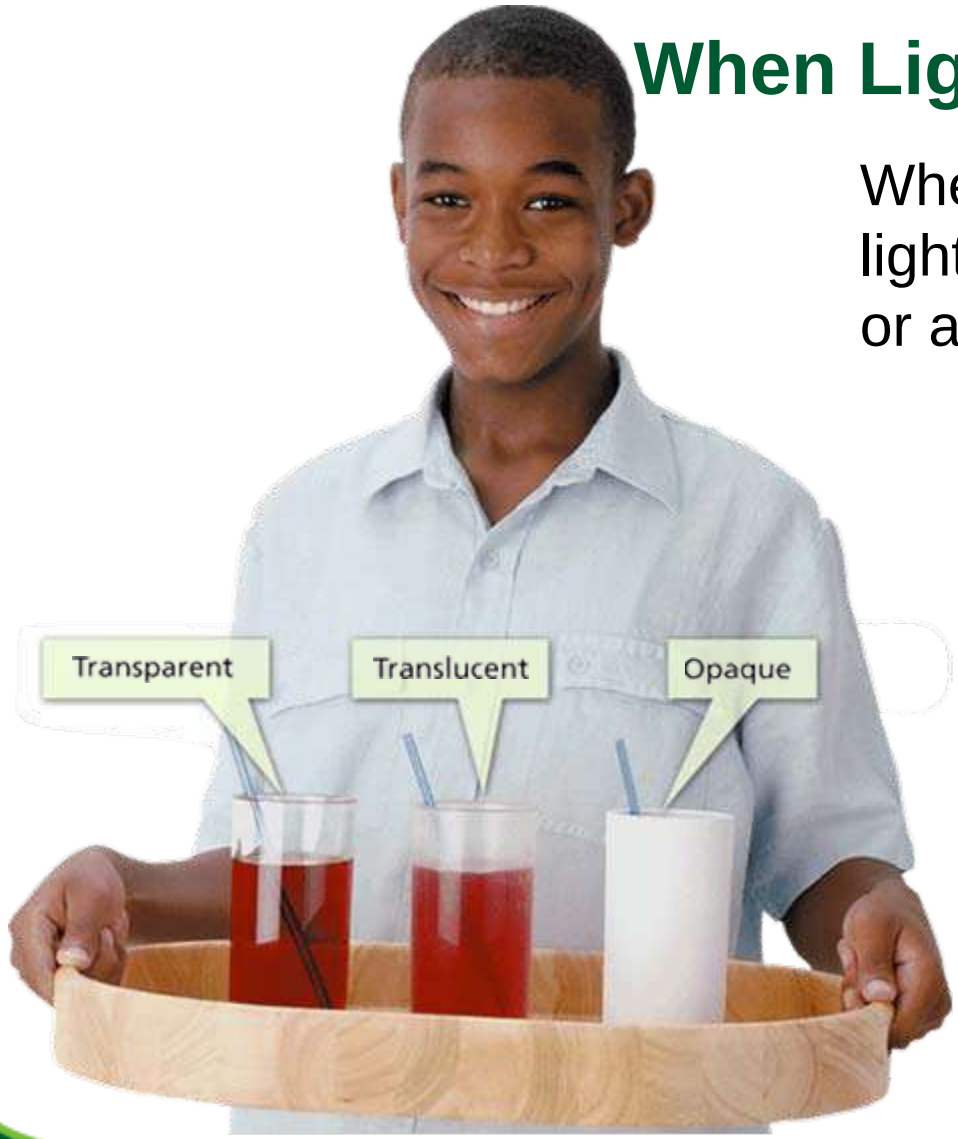
End of Section: Waves and the Electromagnetic Spectrum

Section 2: Visible Light and Color

- How does visible light interact with an object?
- What determines the color of an opaque object?
- How is mixing pigments different from mixing colors of light?

When Light Strikes an Object

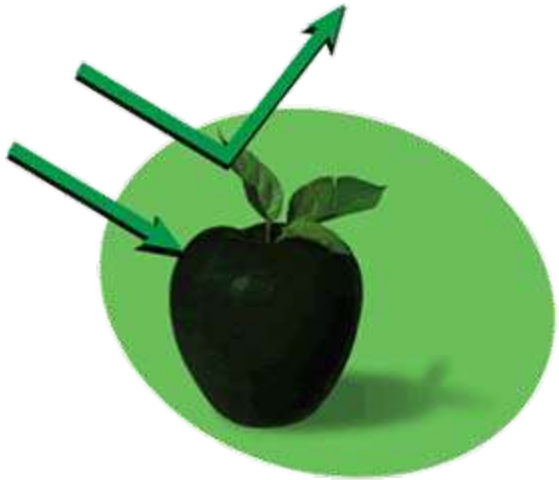
When light strikes an object, the light can be reflected, transmitted, or absorbed.



The Color of Objects

The color of an opaque object is the color of the light it reflects.

In red light, the apple appears red because it reflects the red light. But the leaves look black.

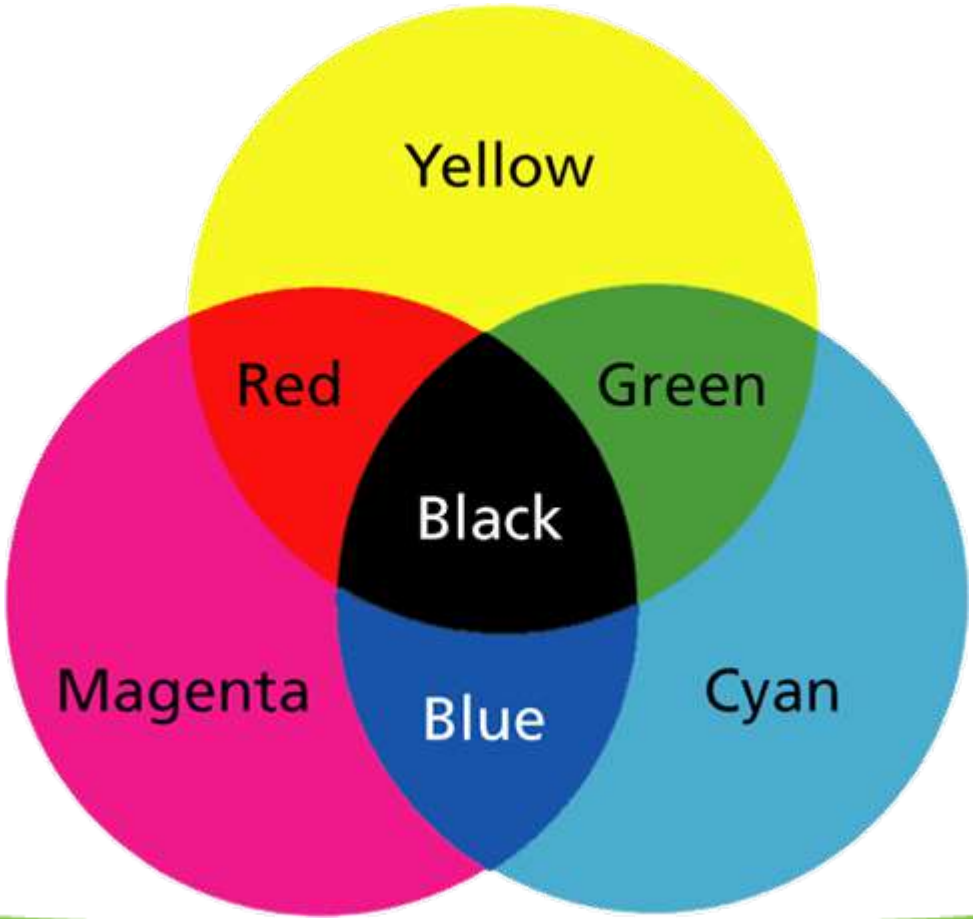


In green light, the apple appears black because no red light strikes it. But the leaves look green.

In blue light, both the apple and the leaves appear black.

Combining Colors

The primary colors of pigments combine in equal amounts to form black.



Links on Colors

Click the SciLinks button for links on colors.

Color

Click the Video button to watch a movie about color.

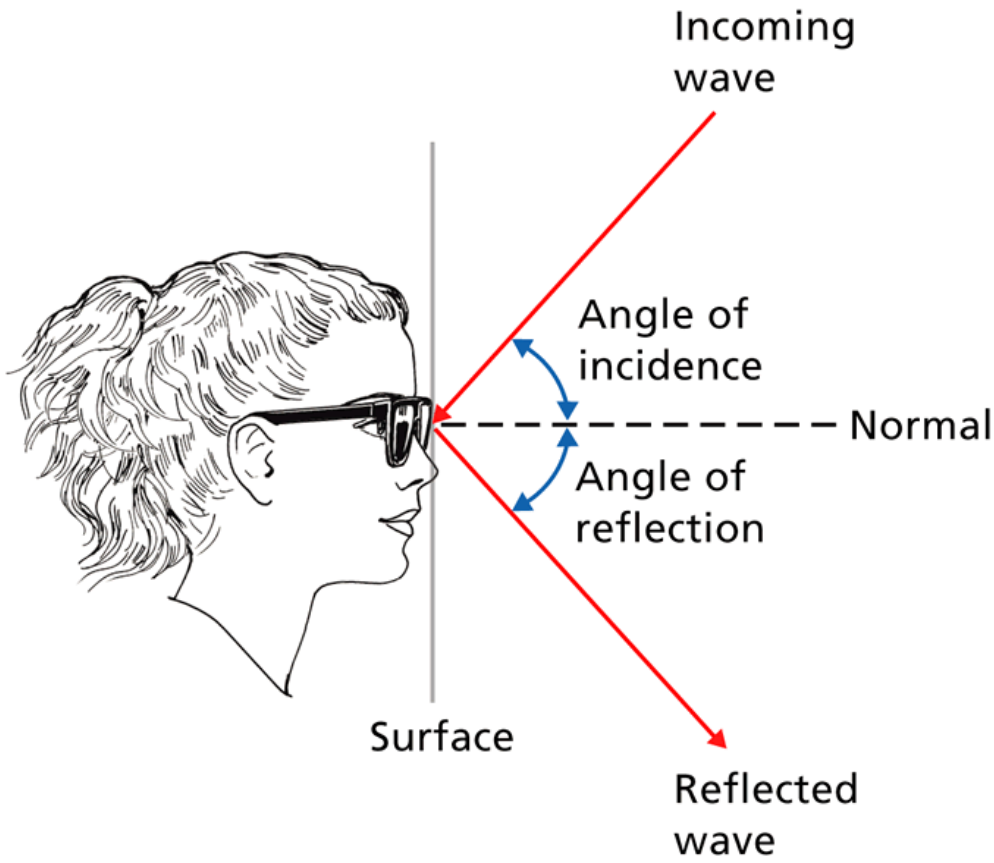
End of Section: Visible Light and Color

Section 3: Reflection and Refraction

- What does the law of reflection state?
- Why do light rays bend when they enter a new medium at an angle?
- What determines the types of images formed by convex and concave lenses?

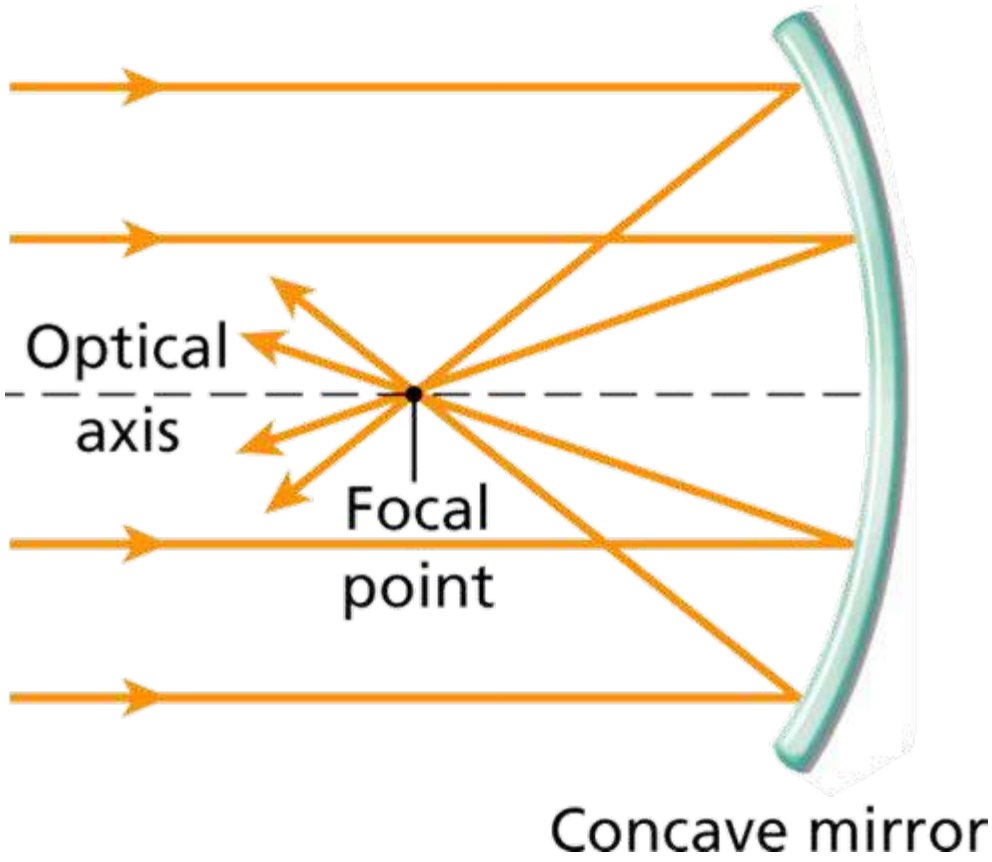
Reflection

When an object or wave hits a surface through which it cannot pass, it bounces back.



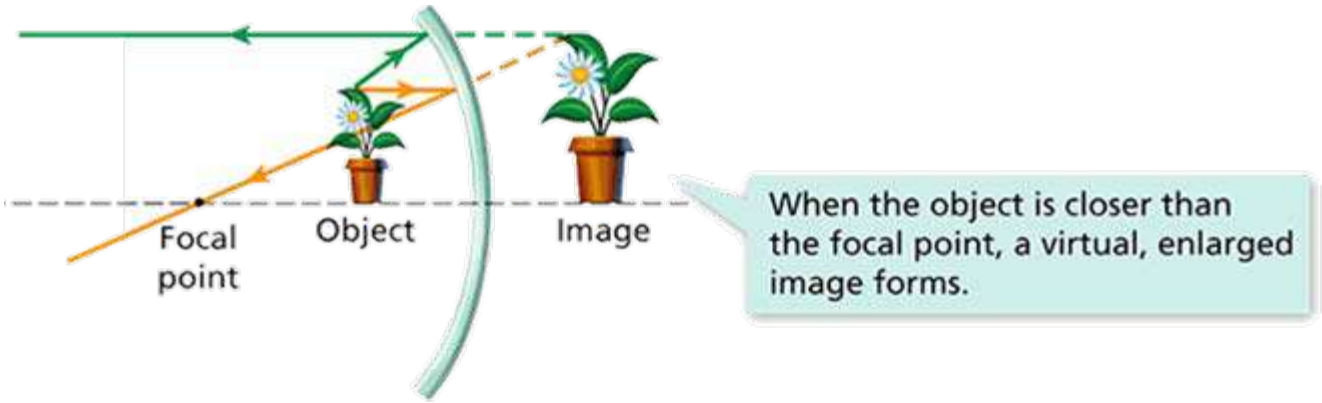
Concave Mirrors

A mirror with a surface that curves inward like the inside of a bowl is a *concave mirror*.



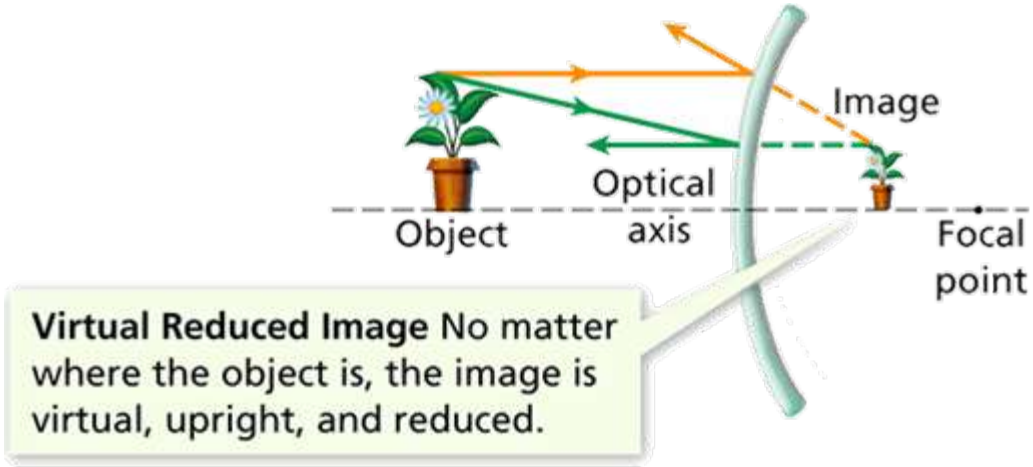
Concave Mirrors

Concave mirrors can form either virtual images or real images.



Convex Mirrors

A mirror with a surface that curves outward is called a *convex mirror*.

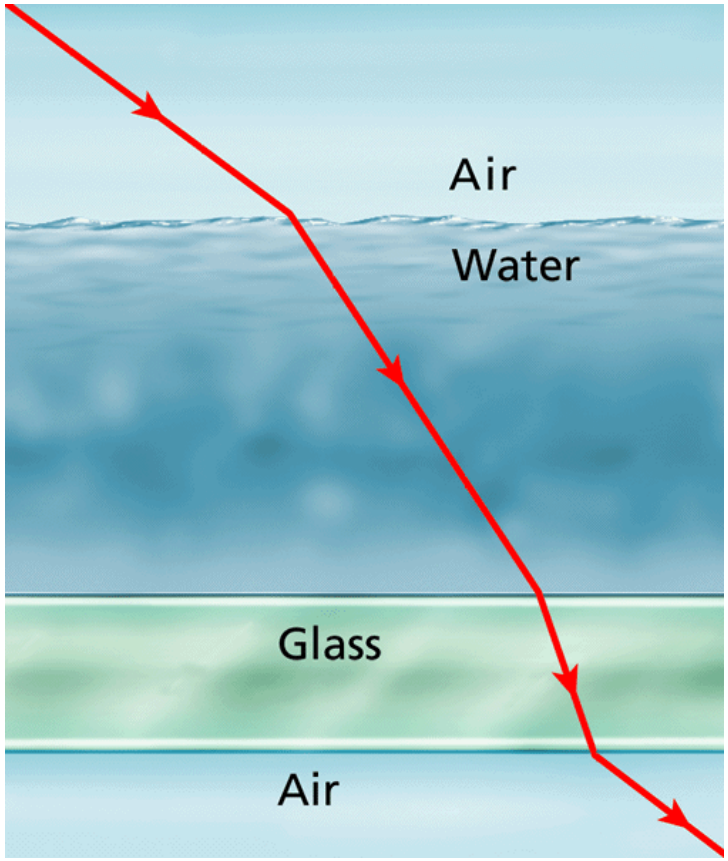


Mirrors Activity

Click the Active Art button to open a browser window and access Active Art about mirrors.

Refraction of Light

When light rays enter a medium at an angle, the change in speed causes the rays to bend, or change direction.



Math Analyzing Data

Bending Light

Index of Refraction	
Medium	**Index of Refraction**
Air (gas)	1.00
Water (liquid)	1.33
Ethyl alcohol (liquid)	1.36
Quartz (solid)	1.46
Corn oil (liquid)	1.47
Glycerol (liquid)	1.47
Glass, crown (solid)	1.52
Sodium chloride (solid)	1.54
Zircon (solid)	1.92
Diamond (solid)	2.42

The index of refraction of a medium is a measure of how much light bends as it travels from air into the medium. The table shows the index of refraction of some common mediums.

Math Analyzing Data

Bending Light

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Medium	**Index of Refraction**
Air (gas)	1.00
Water (liquid)	1.33
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Sodium chloride (solid)	1.54
Zircon (solid)	1.92
Diamond (solid)	2.42

Interpreting Data:

Q. Which medium causes the greatest change in the direction of a light ray?

A. Diamond causes the greatest change in the direction of a light ray traveling from air.

Math Analyzing Data

Bending Light

Index of Refraction	
Medium	**Index of Refraction**
Air (gas)	1.00
Water (liquid)	1.33
Ethyl alcohol (liquid)	1.36
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Sodium chloride (solid)	1.54
Zircon (solid)	1.92
Diamond (solid)	2.42

Interpreting Data:

Q. According to the table, which tends to bend light more: solids or liquids?

A. According to the graph, most solids bend light more than liquids do (quartz is an exception).

Math Analyzing Data

Bending Light

Index of Refraction	
Medium	**Index of Refraction**
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Diamond (solid)	2.42

Predicting:

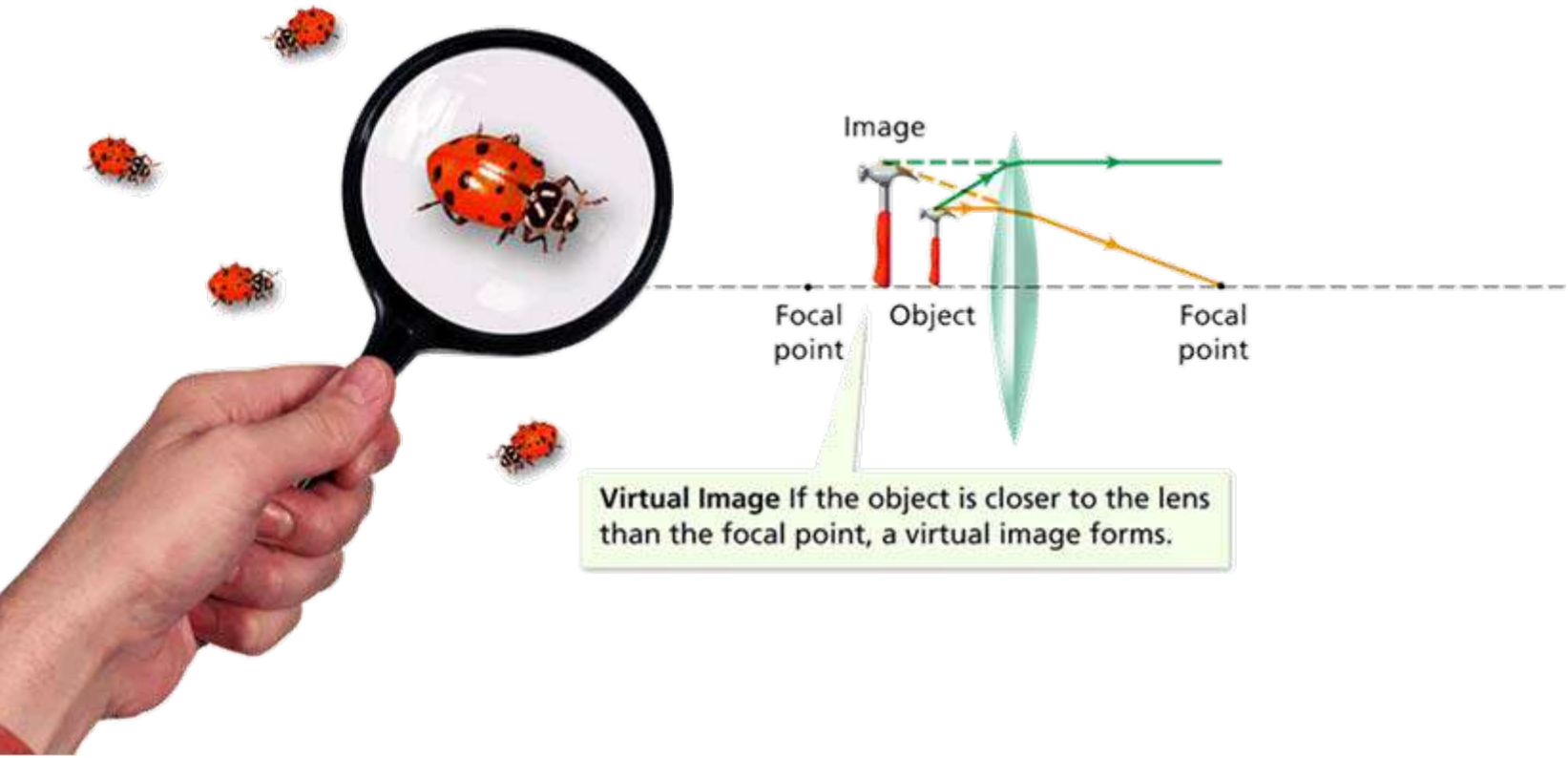
Q. Would you expect light to bend if it entered corn oil at an angle after traveling through glycerol? Explain.

A. You would not expect light to bend if it entered corn oil at an angle after traveling through glycerol, because corn oil and glycerol have the same value for the index of refraction.

End of Slide

Lenses

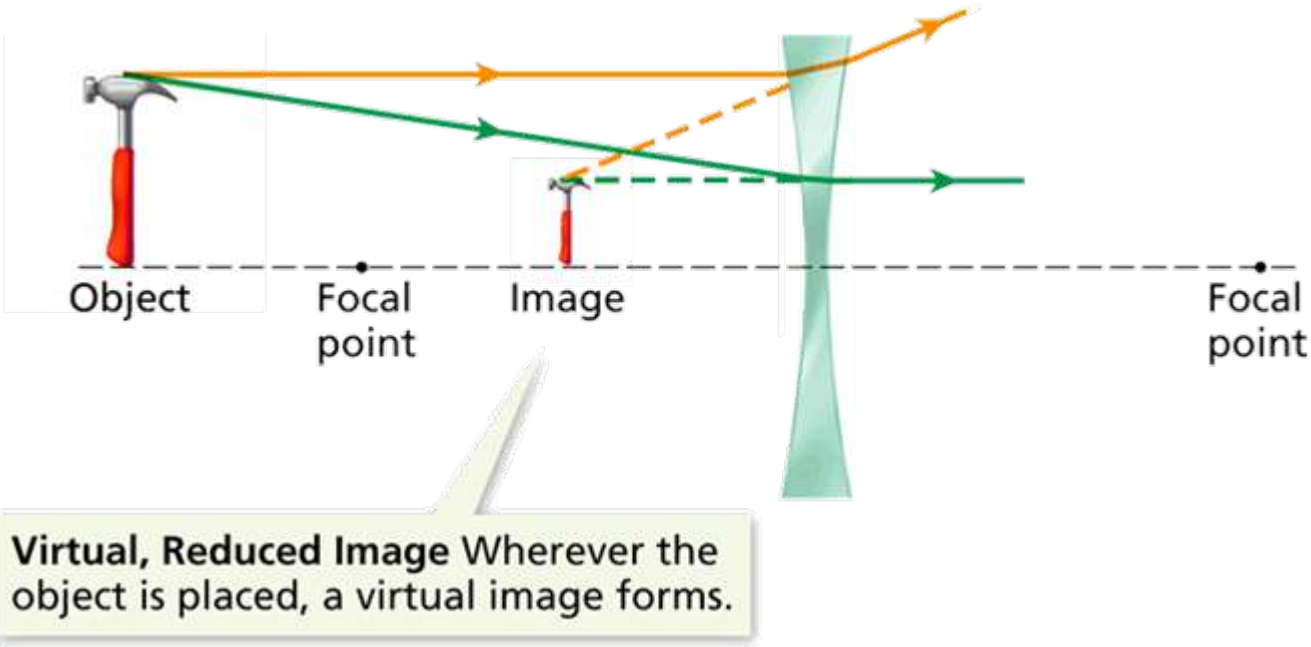
An object's position relative to the focal point determines whether a convex lens forms a real image or a virtual image.



Virtual Image If the object is closer to the lens than the focal point, a virtual image forms.

Lenses

A concave lens can produce only virtual images because parallel light rays passing through the lens never meet.



Lenses Activity

Click the Active Art button to open a browser window and access Active Art about lenses.

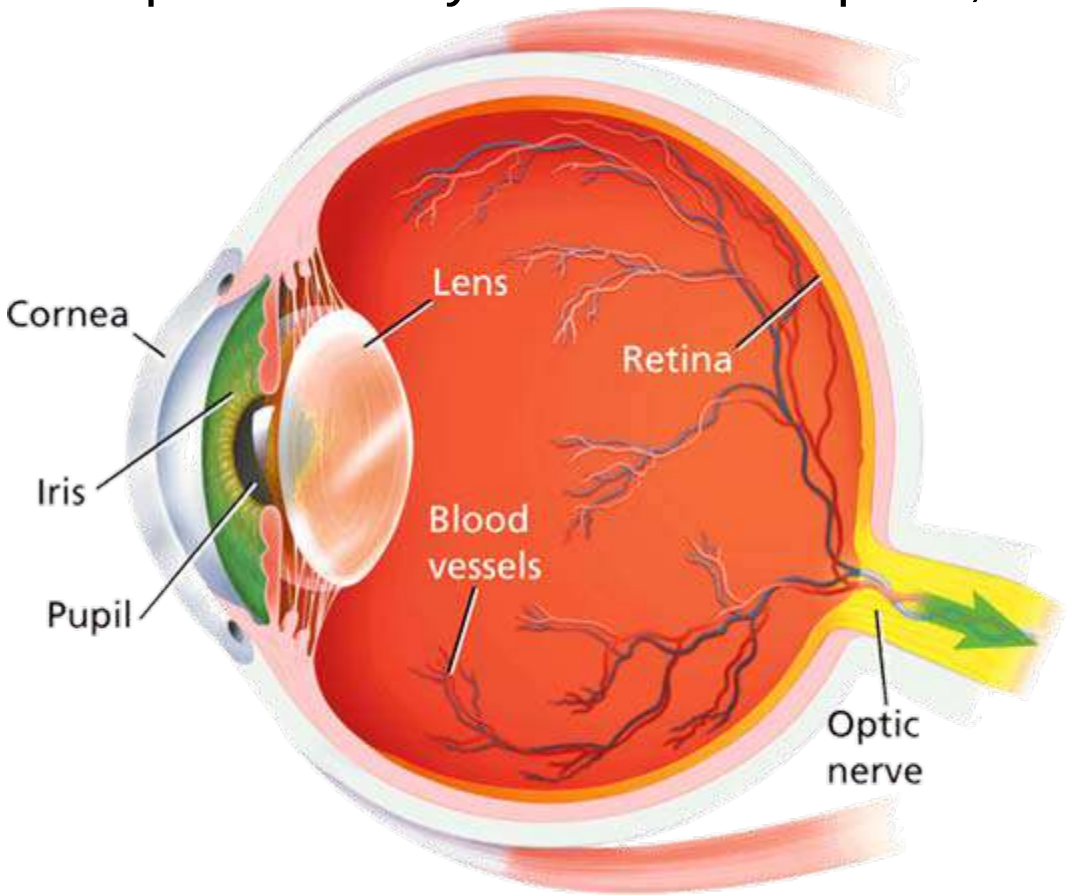
End of Section: Reflection and Refraction

Section 4: Seeing Light

- How do you see objects?
- What types of lenses are used to correct vision problems?

Vision

You eyes respond to the stimulus of light. They convert that stimulus into impulses that your brain interprets, enabling you to see.



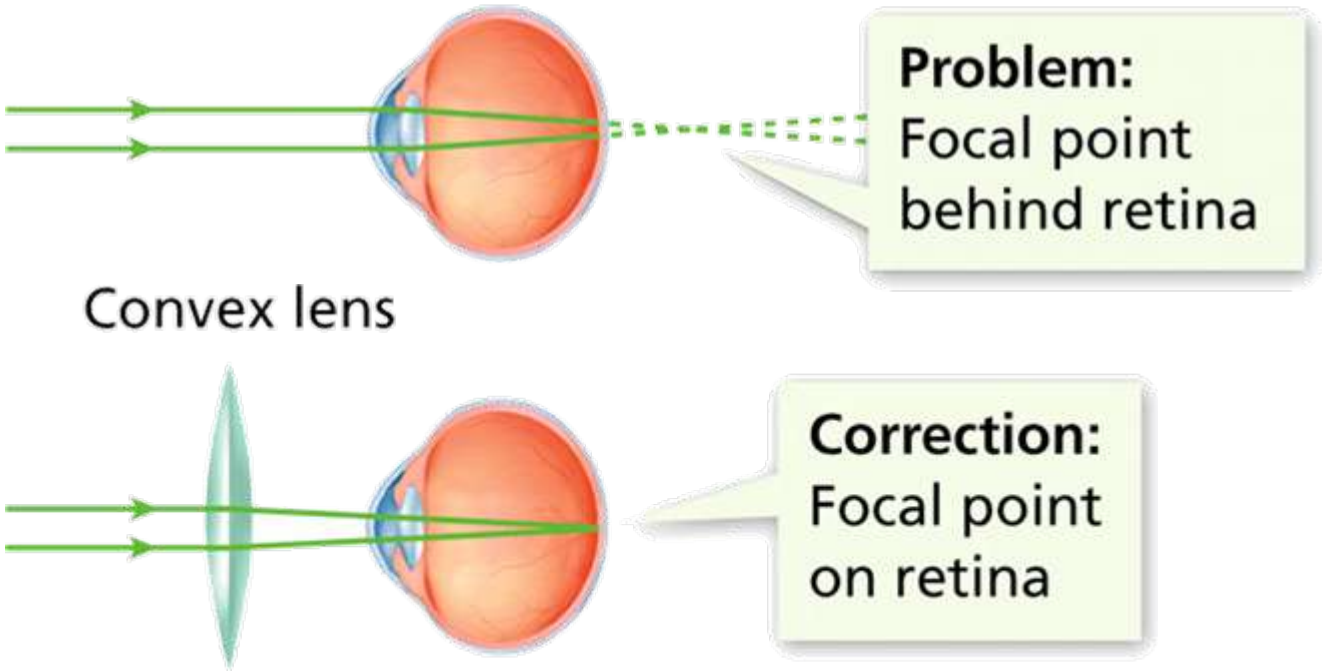
Virtual Dissection of the Eye Activity

Click the Active Art button to open a browser window and access Active Art about dissecting an eye.

Correcting Vision

Concave lenses are used to correct nearsightedness.
Convex lenses are used to correct farsightedness.

Farsightedness (eyeball too short)



More on Eyesight

Click the PHSchool.com button for an activity about eyesight.

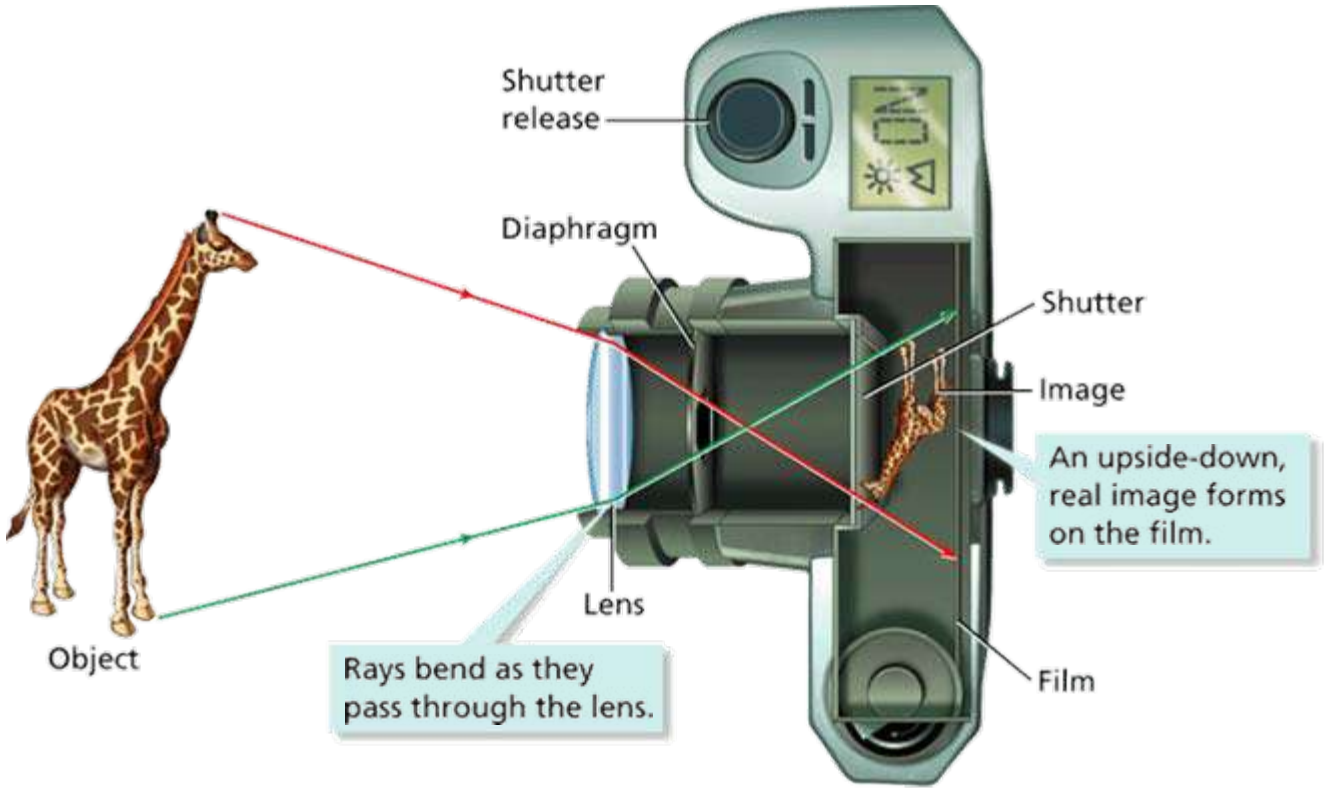
End of Section: Seeing Light

Section 5: Optical Tools

- How are lenses used in cameras, telescopes, and microscopes?

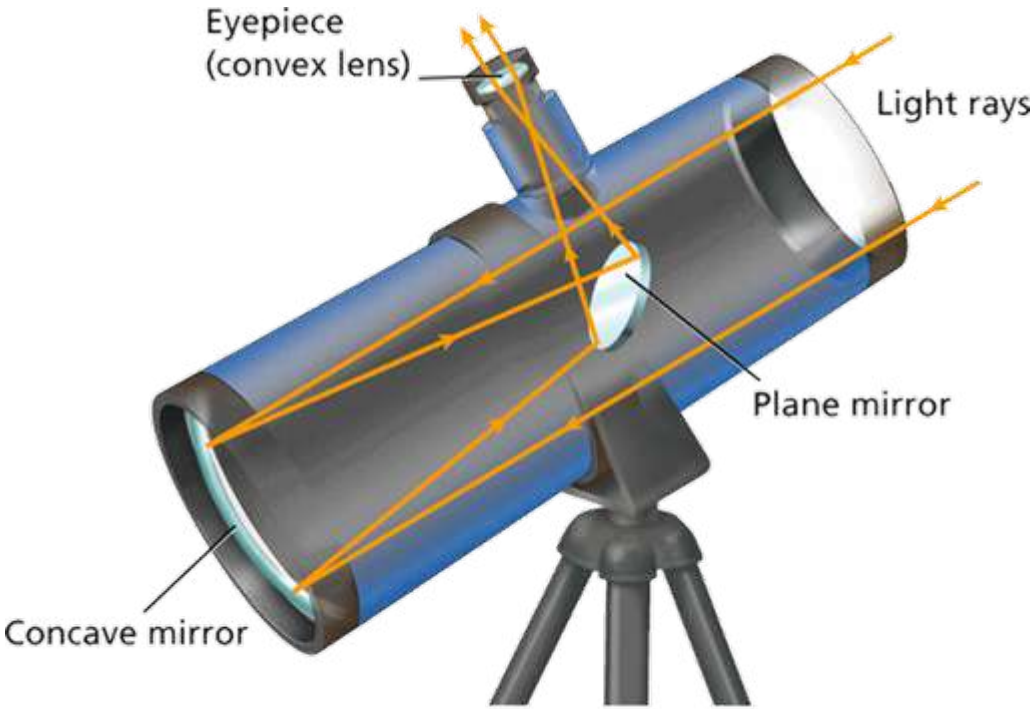
Optical Instruments

The lens of the camera focuses light to form a real, upside-down image on film in the back of the camera.



Optical Instruments

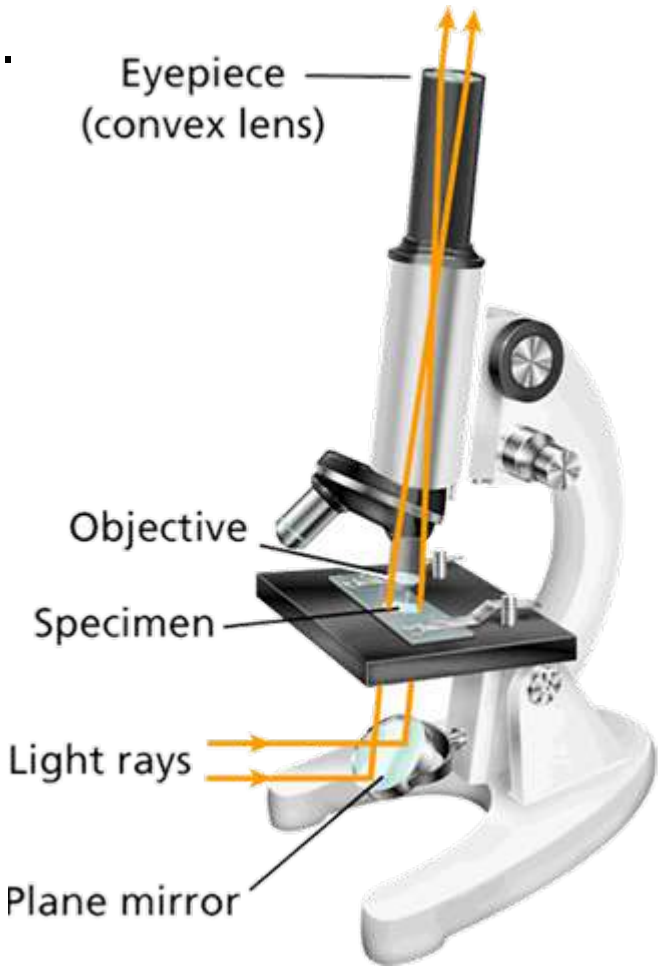
A telescope forms enlarged images of distant objects. Telescopes use lenses or mirrors to collect and focus light from distant obiects.



Reflecting Telescope

Optical Instruments

A microscope uses a combination of lenses to produce and magnify an image.



End of Section: Optical Tools

QuickTake Quiz

Click to start quiz.