



# Light

Light and Color  
Reflection and Mirrors  
Refraction and Lenses  
Seeing Light  
Using Light



# Light and Color

- What happens to the light that strikes an object?
  - When light strikes an object, the light can be reflected, transmitted, or absorbed.
    - Transparent material: a material that transmits light without scattering
    - Translucent material: a material that scatters light as it passes through
    - Opaque material: a material that reflects or absorbs all of the light that strikes it



# Light and Color

- What determines the color of an Opaque, transparent, or translucent object?
  - An opaque object is the color of the light it reflects.
  - A transparent or translucent object is the color of the light it transmits.



# Light and Color

- How is mixing pigments different from mixing colors of light?
  - When combined in equal amounts, the three primary colors of light produce white light.
  - As pigments are added together, fewer colors of light are reflected and more are absorbed.
    - Primary colors: three colors that can be used to make any other color
    - Secondary color: any color produced by combining equal amounts of any two primary colors
    - Complementary colors: any two colors that combine to form white light or black pigment
    - Pigment: a colored substance used to color other materials



# Reflection and Mirrors

- What are the kinds of reflection?
  - There are two types of reflection--regular reflection and diffuse reflection.
    - Ray: a straight line used to represent a light wave
    - Regular reflection: reflection that occurs when parallel rays of light hit a smooth surface and all reflect at the same angle
    - Diffuse reflection: reflection that occurs when parallel rays of light hit a rough surface and all reflect at different angles



# Reflection and Mirrors

- What types of images are produced by plane mirrors?
  - A plane mirror produces a virtual image that is upright and the same size as the object.
    - Plane mirror: a flat mirror that produces an upright, virtual image the same size as the object
    - Image: a copy of an object formed by reflected or refracted rays of light
    - Virtual image: an upright image formed where rays of light appear to meet or come from



# Reflection and Mirrors

- What types of images are produced by concave mirrors?
  - Concave mirrors form virtual or real images.
    - Concave mirror: a mirror with a surface that curves inward
    - Optical axis: an imaginary line that divides a mirror in half
    - Focal point: the point at which light rays parallel to the optical axis meet, or appear to meet, after being reflected by a mirror
    - Real image: an upside-down image formed where rays of light meet



# Reflection and Mirrors

- What types of images are produced by convex mirrors?
  - Convex mirrors form only virtual images.
    - Convex mirror: a mirror with a surface that curves outward





# Refraction and Lenses

- Why do light rays bend when they enter a medium at an angle?
  - When light rays enter a medium at an angle, the change in speed causes the rays to bend, or change direction.
    - Index of refraction: a measure of the amount a ray of light bends when it passes from one medium to another
    - Mirage: an image of a distant object caused by refraction of light as it travels through air of varying temperature



# Refraction and Lenses

- What determines the types of images formed by convex lenses?
  - An object's position relative to the focal point determines whether a convex lens forms a real image or a virtual image.
    - Lens: a curved piece of glass or other transparent material that is used to refract light
    - Convex lens: a lens that is thicker in the center than at the edges



# Refraction and Lenses

- What determines the types of images formed by concave lenses?
  - A concave lens can only produce only virtual images because parallel light rays passing through the lens never meet.
    - Concave lens: a lens that is thinner in the center than at the edges



# Seeing Light

- How do you see objects?
  - You see objects when a process occurs that involves both your eyes and your brain.
    - Cornea: the transparent front surface of the eye
    - Pupil: the opening in the center of the iris through which light enters the inside of the eye
    - Iris: the ring of muscle that controls the size of the pupil and gives the eye its color
    - Retina: the layer of cells that lines the inside of the eyeball
    - Rods: cells in the retina that detect dim light
    - Cones: cells in the retina that respond to and detect color
    - Optic nerve: short, thick nerve that carries signals from the eye to the brain



# Seeing Light

- What types of lenses are used to correct nearsightedness?
  - Convex lenses are used to correct nearsightedness.
    - Nearsighted: a condition that causes a person to see distant objects as blurry



# Seeing Light

- What types of lenses are used to correct farsightedness?
  - Concave lenses are used to correct farsightedness.
    - Farsighted: a condition that causes a person to see nearby objects as blurry



# Using Light

- How are lenses used in telescopes?
  - Telescopes use lenses or mirrors to collect and focus light from distant objects.
    - Telescope: an optical instrument that forms enlarged images of distant objects
    - Refracting telescope: a telescope that uses two convex lenses to form images
    - Objective: a lens that gathers light from an object and forms a real image
    - Eyepiece: a lens that magnifies the image formed by the objective
    - Reflecting telescope: a telescope that uses a concave mirror to gather light from distant objects



# Using Light

- How are lenses used in microscopes?
  - A microscope uses a combination of lenses to produce and magnify an image.
    - Microscope: an optical instrument that forms enlarged images of tiny objects





# Using Light

- How are lenses used in cameras?
  - The lens of a camera focuses light to form a real, upside-down image on film in the back of the camera.
    - Camera: an optical instrument that uses lenses to focus light and film to record an image of an object



# Using Light

- What makes up laser light?
  - Laser light consists of light waves that all have the same wavelength, or color. The waves are coherent, or in step.
    - Laser: a device that produces a narrow beam of coherent light



# Using Light

- How are lasers used safely?
  - In addition to their use by stores, industry, and engineers, lasers are used to read information on compact discs, create holograms, and perform surgery.



# Using Light

- Why can optical fibers carry laser beams a long distance?
  - Optical fibers can carry a laser beam for long distances because the beam stays totally inside the fiber as it travels.
    - Hologram: a three-dimensional photograph created by using lasers
    - Optical fiber: a long, thin strand of glass or plastic that can carry light for long distances without allowing the light to escape
    - Total internal reflection: the complete reflection of light by the inside surface of a medium