



Ch. 22 – The Nature of Light



Section 3
Interactions of Light Waves

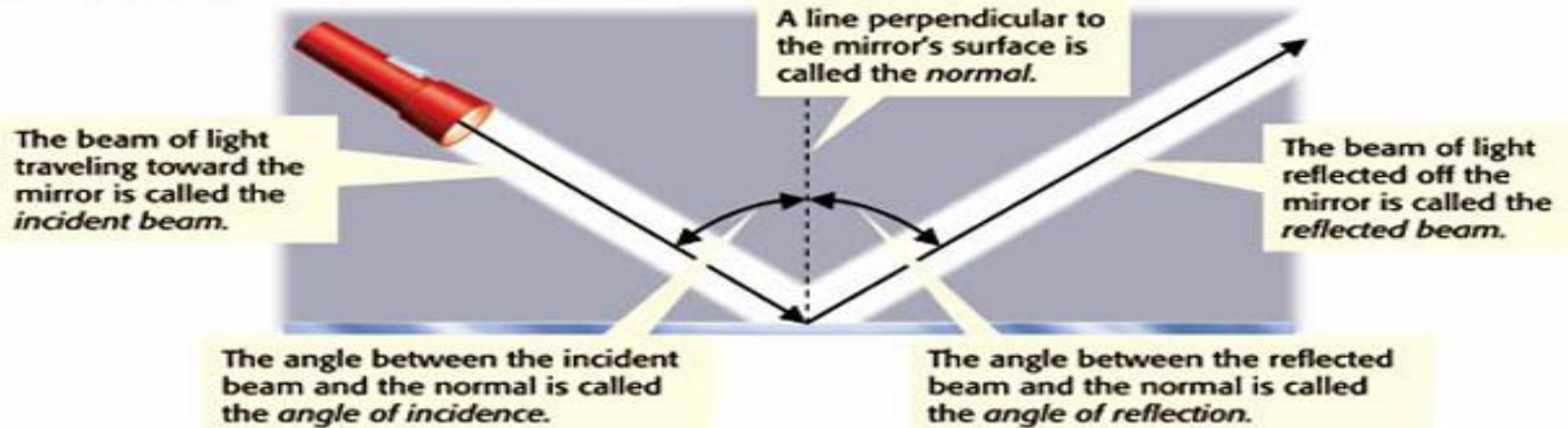
Essential Questions

- How does reflection allow you to see things?
- Compare and contrast absorption and scattering.
- How can refraction create optical illusions and separate white light into colors?
- What is the relationship between diffraction and wavelength?
- Compare and contrast constructive and destructive interference of light.

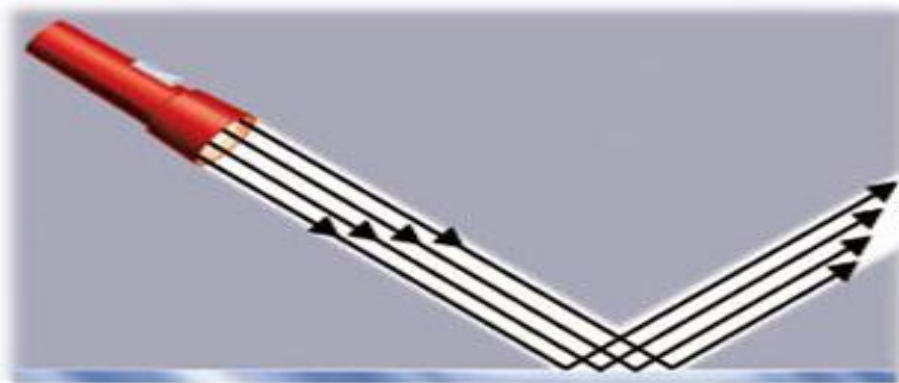
Reflection

- **Reflection** happens when light waves bounce off an object. Light reflects off objects all around you.
- **The Law of Reflection** states that the angle of incidence is equal to the angle of reflection.

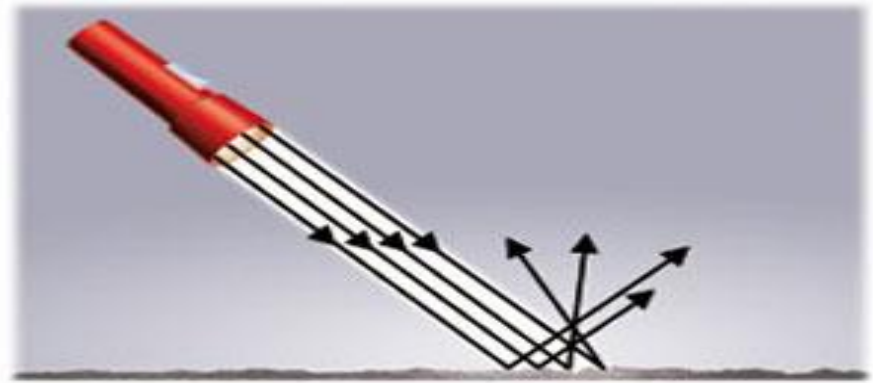
The Law of Reflection



Regular Reflection Versus Diffuse Reflection



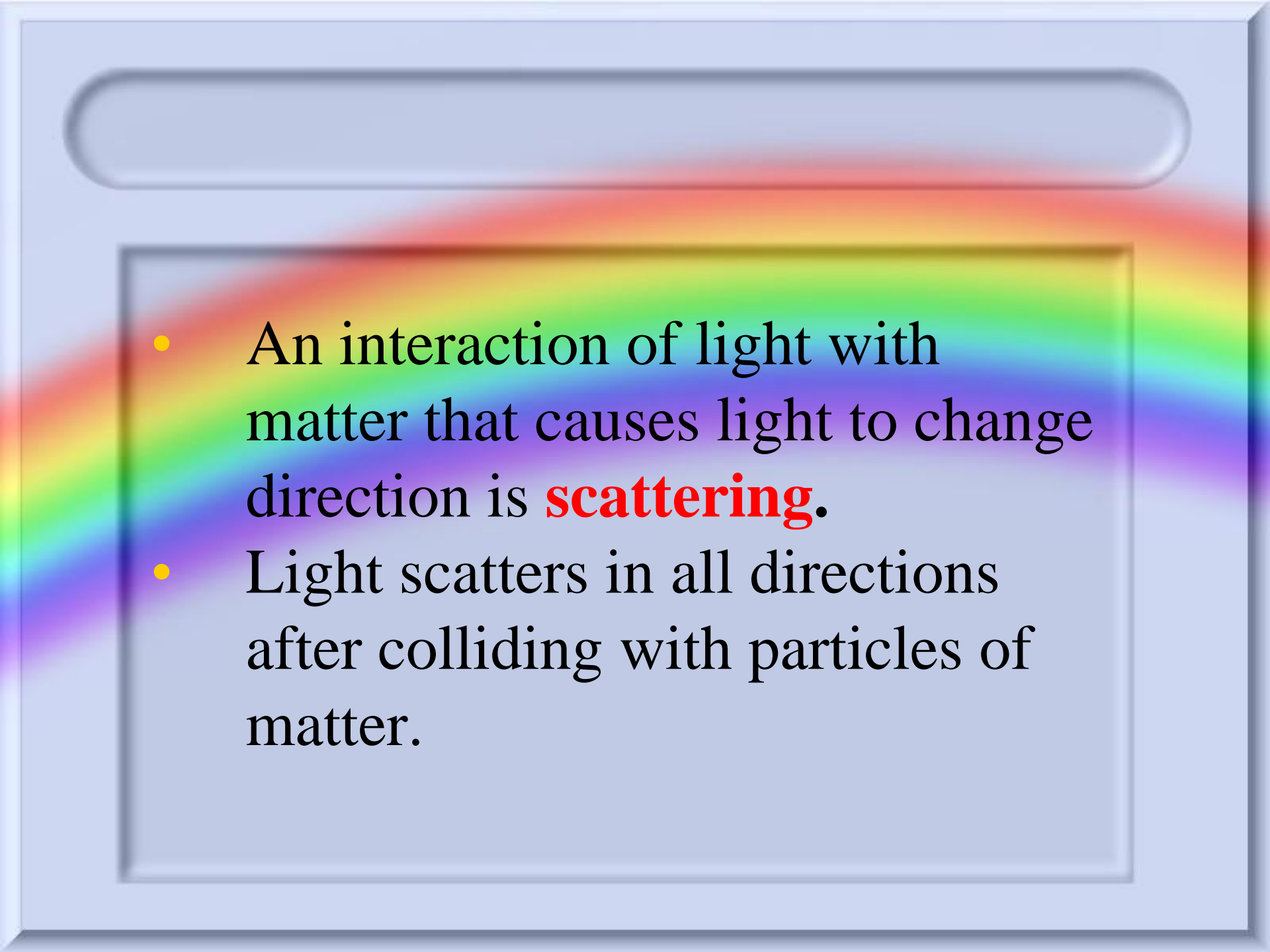
Regular reflection occurs when light beams are reflected at the same angle. When your eye detects the reflected beams, you can see a reflection on the surface.



Diffuse reflection occurs when light beams reflect at many different angles. You can't see a reflection because not all of the reflected light is directed toward your eyes.

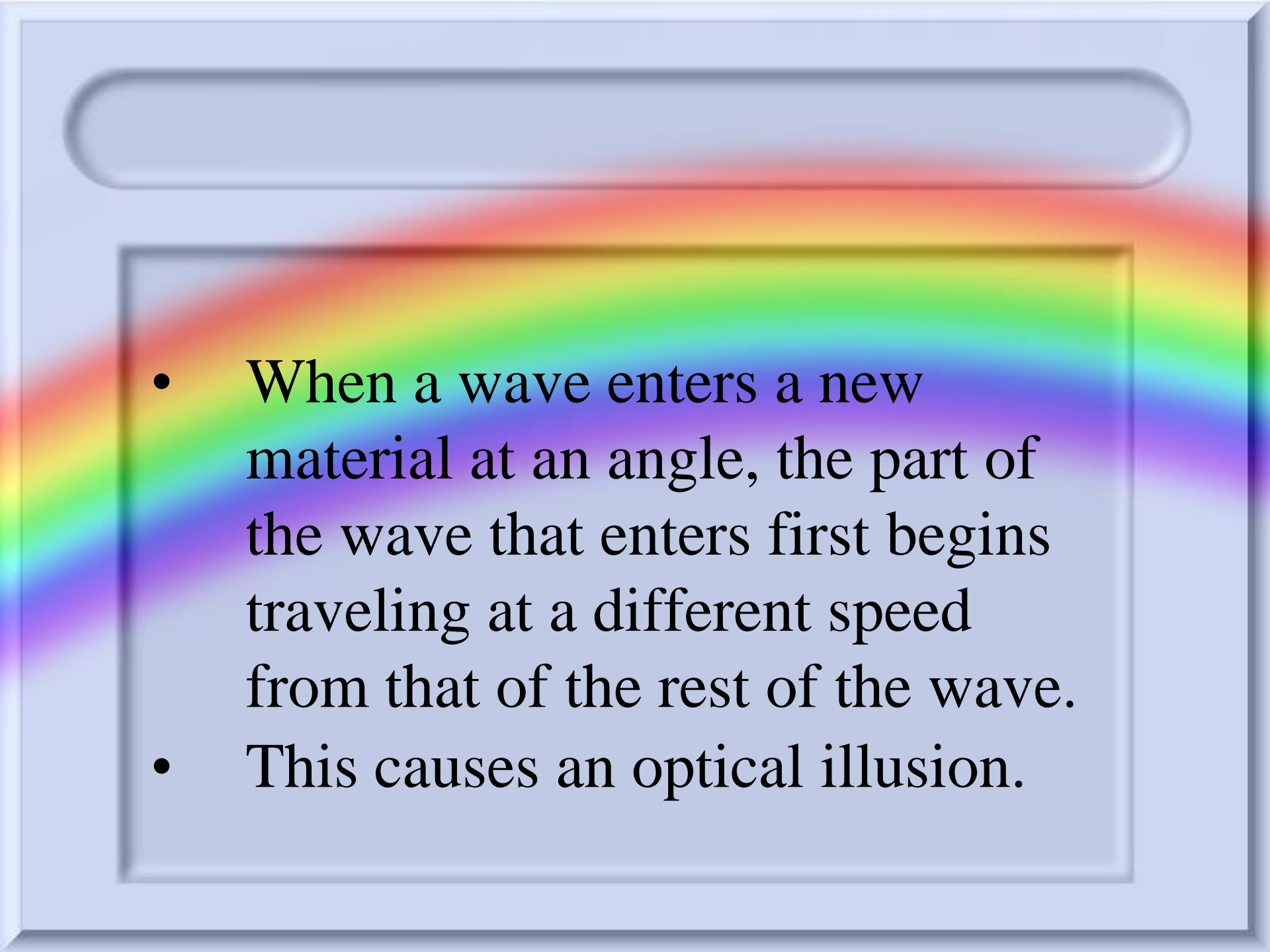
Absorption and Scattering

- The transfer of energy carried by light waves is called **absorption**.
- When a beam of light shines through the air, particles in the air absorb some of the light's energy. Therefore, the beam of light becomes dim.

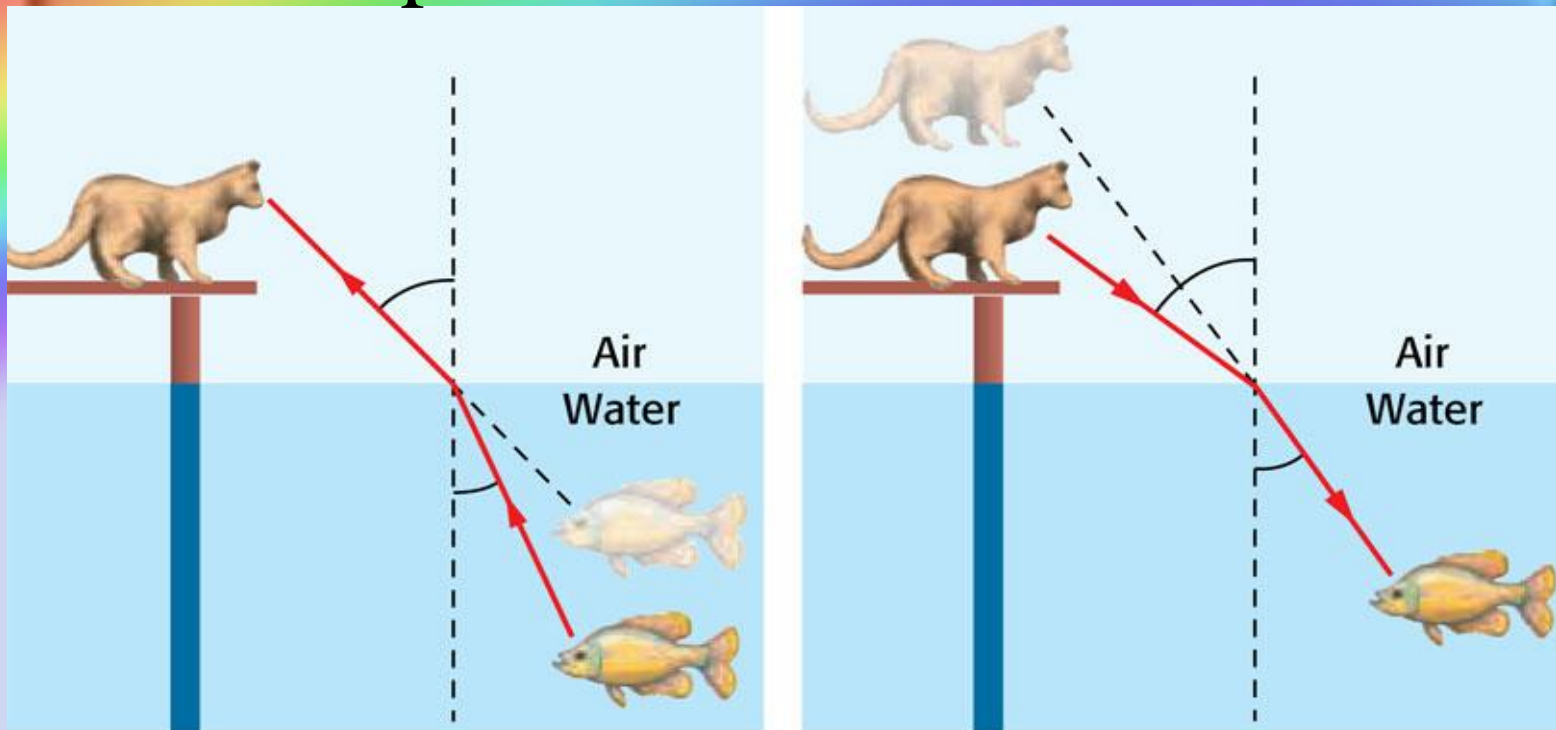
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- An interaction of light with matter that causes light to change direction is **scattering**.
 - Light scatters in all directions after colliding with particles of matter.

Refraction

- **Refraction** is the bending of a wave as it passes at an angle from one material to another.
- Refraction of light waves occurs because the speed of light varies depending on the medium through which the waves are traveling.

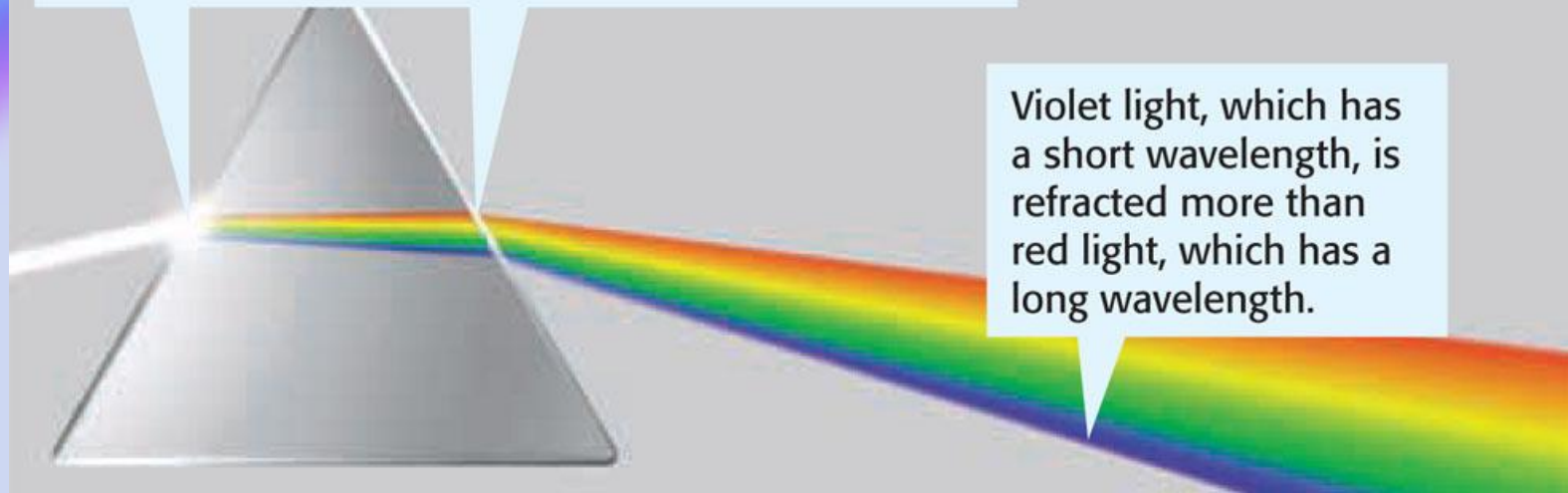
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- When a wave enters a new material at an angle, the part of the wave that enters first begins traveling at a different speed from that of the rest of the wave.
 - This causes an optical illusion.

Because of refraction, the cat and the fish see optical illusions.



- Waves with short wavelengths bend more than waves with long wavelengths.
- White light can be separated into different colors during refraction, as shown below.

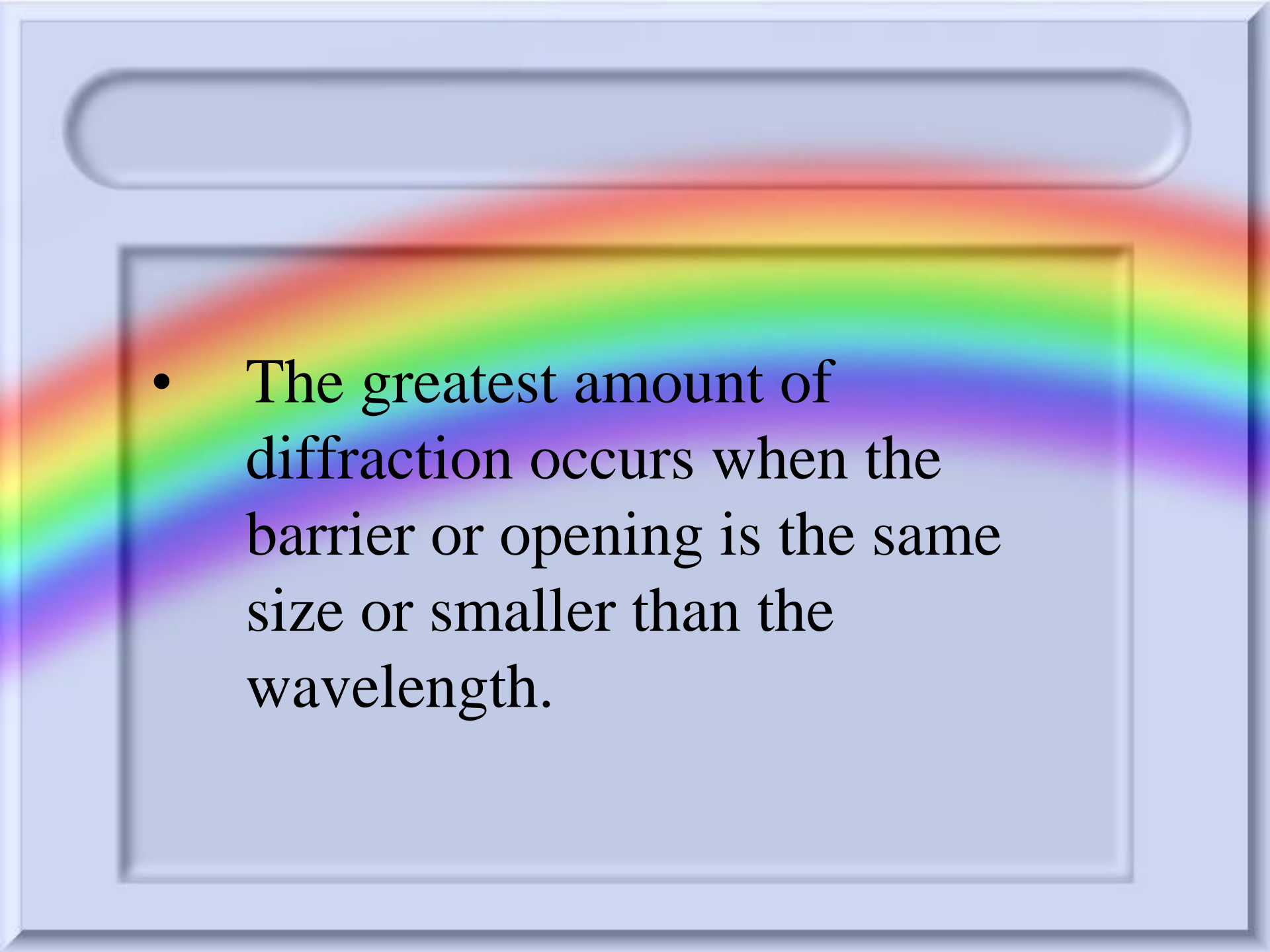
Light passing through a prism is refracted twice—once when it enters and once when it exits.



Violet light, which has a short wavelength, is refracted more than red light, which has a long wavelength.

Diffraction

- **Diffraction** is the bending of waves around barriers or through openings.
- The amount a wave diffracts depends on its wavelength and the size of the barrier or opening.

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- The greatest amount of diffraction occurs when the barrier or opening is the same size or smaller than the wavelength.

Interference

- Interference is what happens when two or more waves overlap: can be constructive or destructive (See Fig. 9 pg. 650)
- Constructive Interference – amplitude, or height, increases (you see the light bands)
- Destructive Interference – amplitude decreases (you see dark bands)

Lenses

- A *lens* is a transparent object that refracts light to form an image.
- *Convex lenses* are thicker in the middle than at the edges. When light passes through a convex lens, the beams are refracted toward each other.

- *Concave lenses* are thinner in the middle than at the edges. When light beams pass through a concave lens, the beams are refracted away from each other.