

**McGraw-Hill Ryerson**

# **BC Science CONNECTIONS**



BC Science Connections 8

# UNIT 3

Energy can be transferred as both a particle and a wave

## TOPIC 3.3

**How does light behave  
when it encounters  
different materials and  
surfaces?**



## Topic 3.3: How does light behave when it encounters different materials and surfaces?

- Light can be reflected, absorbed, transmitted, or refracted.
- Light behaves in different ways when it encounters different materials.



Light from a lighthouse needs to be visible through dense fog.

## Concept 1: Light can be reflected, absorbed, transmitted, or refracted.

- Light can be:
  - Reflected
  - Absorbed
  - Transmitted
  - Refracted



Light is being reflected, refracted, absorbed, and transmitted in this photo of Elk Lakes Provincial Park.

## Reflection: Light Bounces Off

### Reflection:

- Process in which light “bounces off” a surface and changes direction
- Two types of reflection:
  - Reflection off an extremely smooth surface
  - Reflection off a rough surface



Figure 3.17: Emerald Lake in Yoho National Park has an extremely smooth surface in which an image is visible.

## Reflection Off an Extremely Smooth Surface

- **Examples:** mirrors, a very still body of water
  - When they reflect light, the pattern of reflected rays are similar to the pattern of the incoming rays
  - This similarity lets you see an image when the light reaches your eye (example: your “reflection” in a mirror)

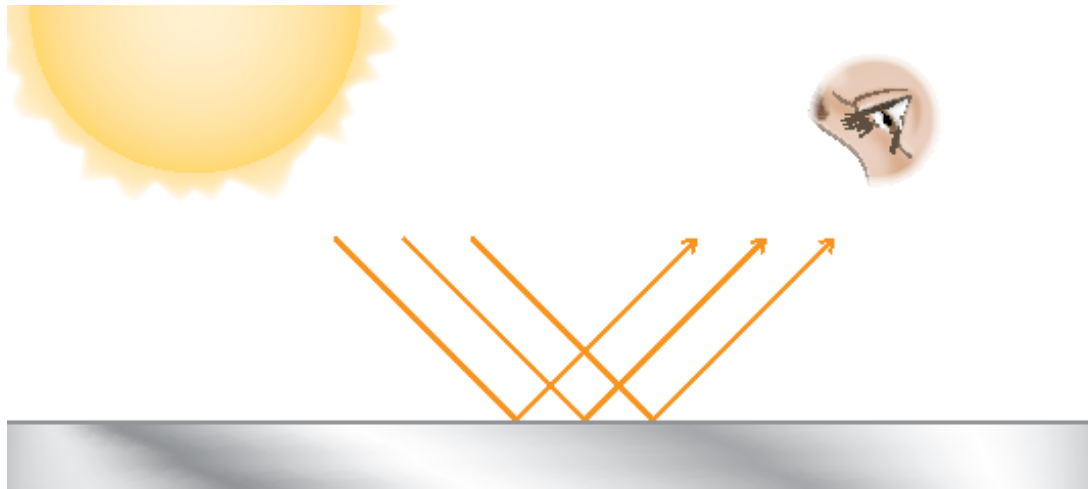


Figure 3.18: Lights rays reflecting off a smooth surface have a pattern similar to incoming rays.

## Reflection Off a Rough Surface

- **Example: Paper**
  - When reflected rays hit the rough surface of the paper, they scatter in different directions
  - Pattern of reflected rays is not similar to incoming rays, so no image appears
  - Some reflected rays reach your eyes, which make the paper visible

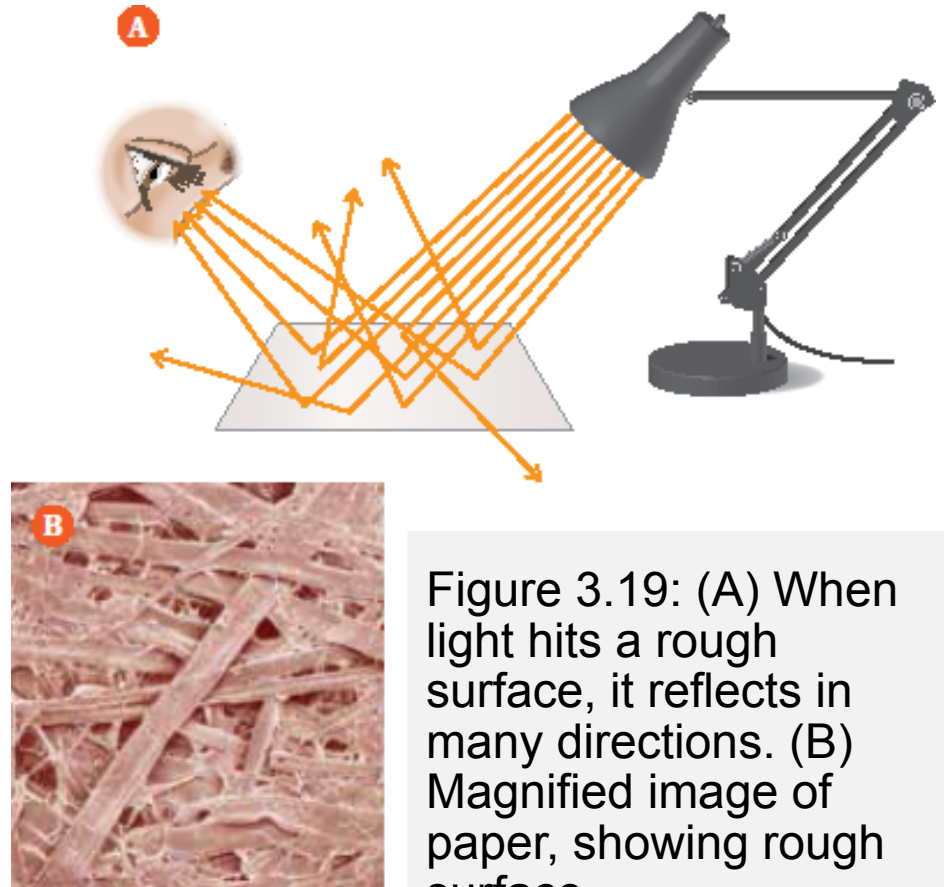


Figure 3.19: (A) When light hits a rough surface, it reflects in many directions. (B) Magnified image of paper, showing rough surface



## Absorption: Light Energy is Trapped

- **Absorption:** the process in which light energy is trapped in an object as heat
- **Example 1:** a printed black letter on a piece of paper
  - Reflection off a rough surface (paper) lets you see the paper
  - Printed letter is made up of black ink that absorbs the incoming light
  - No rays reflect off the letter, so it looks black



Figure 3.20A: Rays that hit the black letter are absorbed, so the letter looks black.



## Absorption: Light Energy is Trapped

- **Example 2:** a printed blue letter on a piece of paper
  - Reflection off a rough surface (paper) lets you see the paper
  - Printed letter absorbs all colours except blue
  - Blue wavelengths are reflected from the letter into your eyes, so it looks blue

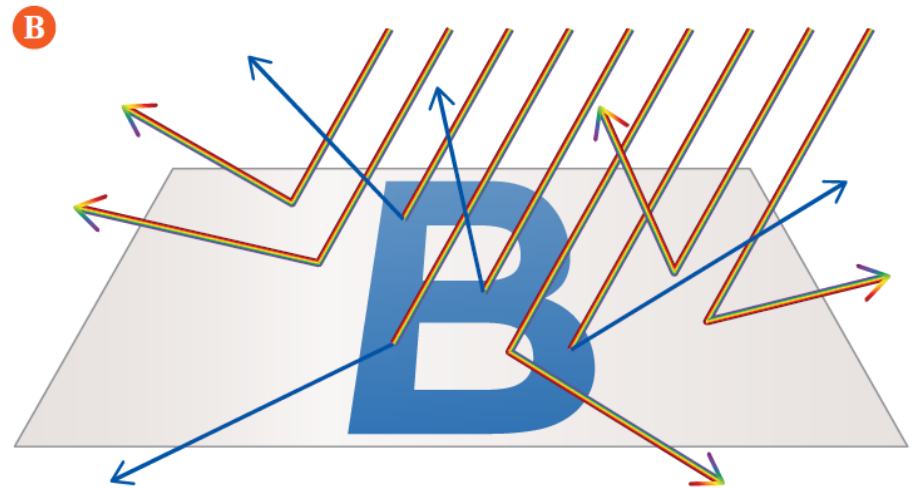


Figure 3.20B: The blue letter absorbs all wavelengths of light except blue. Only the blue light reaches your eye.

## Transmission: Light Passes Through

- **Transmission:** the process in which light passes through a medium and keeps travelling
  - When light passes through a material, that material is called a *medium*
  - Different materials transmit different amounts of light
  - Example: clear glass window transmits more light than a sheet of paper

## Refraction: The Path of Light Bends

- **Refraction:** the process in which light changes direction when it moves from one medium to another
- **Example:** Light bends as it moves from air to water



Figure 3.21: The beam of red light allows you to see the path of light bend as it enters and leaves the water.

## Discussion Questions

- Use a flowchart to describe what can happen to light when it strikes an object.
- The Moon is not a source of visible light. Why does it seem to glow brightly at night?



## Concept 2: Light behaves differently when it encounters transparent, translucent, or opaque materials.

- A material can be transparent, translucent, or opaque depending on:
  - How much light it lets pass through
  - How the light behaves
  - If you can see through it

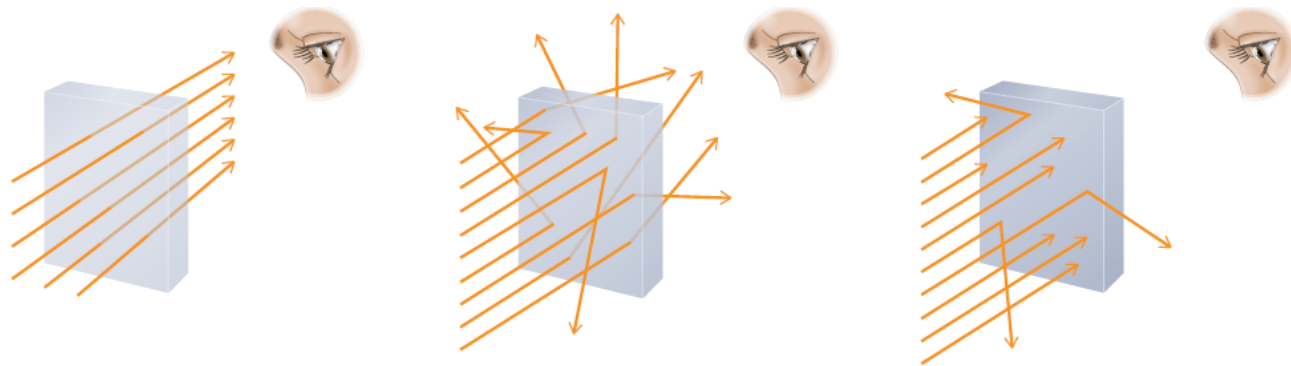
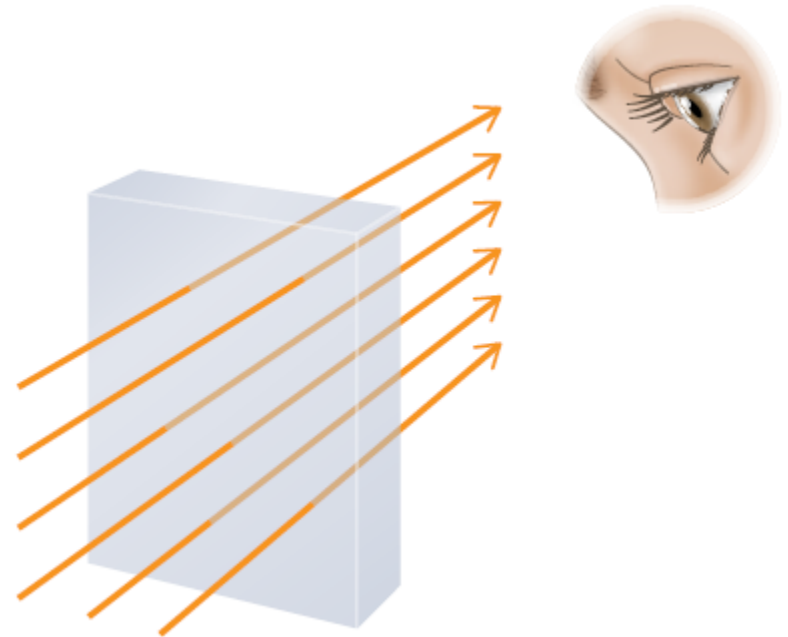


Figure 3.23: Light interacts with different materials in different ways.

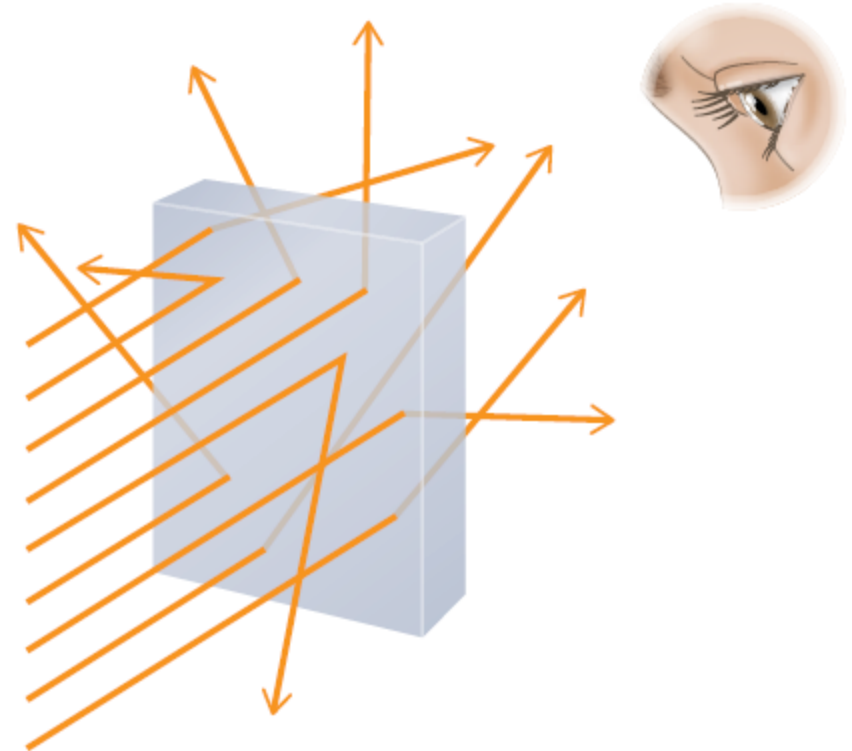
## Transparent Materials Transmit Light

- **Transparent materials:**
  - Transmit almost all light rays
  - Objects can be seen clearly through them
  - Examples: clear glass, plastic, water, air



## Translucent Materials Scatter Light

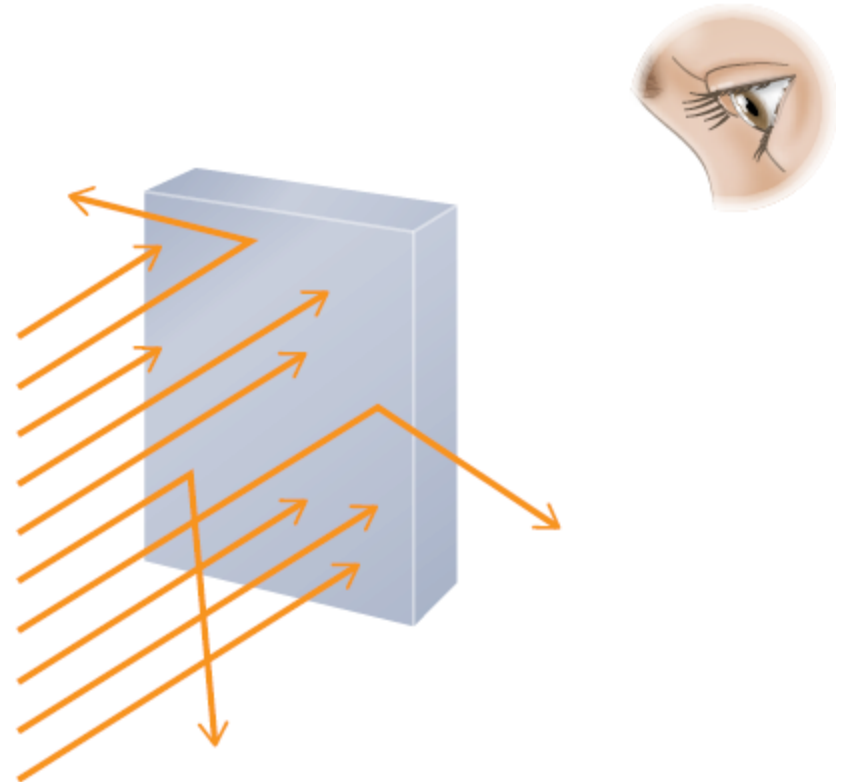
- **Translucent materials:**
  - Allow most light to pass through them
  - Light is scattered in many directions as it passes through
  - Objects seen through them are blurry
  - Examples: frosted plastic, waxed paper





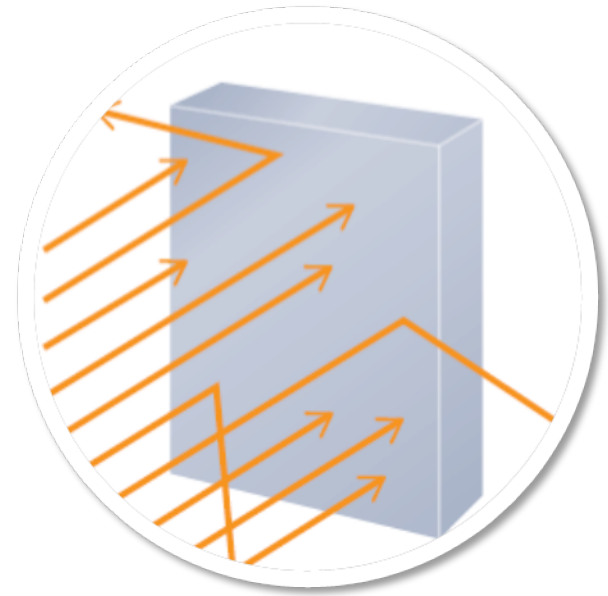
# Opaque Materials Reflect and Absorb Light

- **Opaque materials:**
  - Reflect and absorb light
  - Do not allow any light to pass through them
  - Objects cannot be seen through them
  - Examples: wood, metal, stone



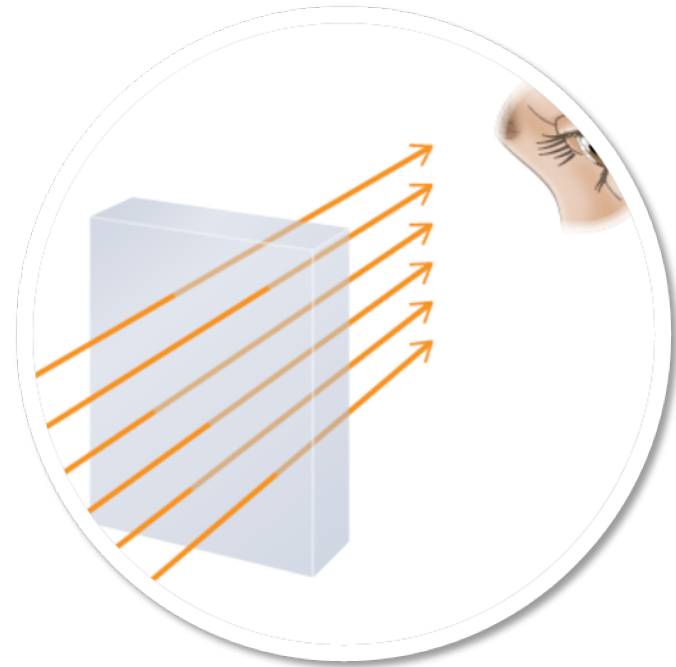
## Discussion Questions

- Choose a material from your daily life.
  - a) Is the material transparent, translucent, or opaque? How could you confirm your decisions?
  - b) Explain how the material's interaction with light is related to its function.



## Discussion Questions

- Some jellyfish are transparent. How might this affect their ability to survive?



## Summary: How does light behave when it encounters different materials and surfaces?

- Light can be reflected, absorbed, transmitted, or refracted.
- Light behaves different when it encounters transparent, translucent, or opaque materials.

