

**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?**



The image is a slide for a unit and topic. It features a background of a lighthouse on a rocky island with a blue sky and sea. The lighthouse is white with a red base and a red lantern room. The island is surrounded by water, and the sky is a mix of blue and purple. The text is arranged in a clear, hierarchical manner. The unit title 'UNIT 3' is in orange, and the topic title 'TOPIC 3.3' is in purple. The main question is in black. The circular inset image is on the right side of the slide.

**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.

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**TOPIC 3.3** How does light behave when it encounters different materials and surfaces?

**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.

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**TOPIC 3.3** How does light behave when it encounters different materials and surfaces?

## 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.

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## 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)



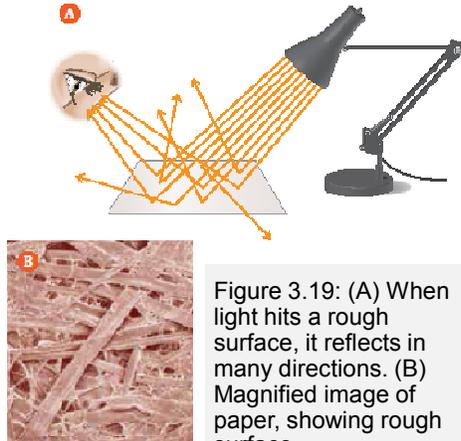
Figure 3.18: Light rays reflecting off a smooth surface have a pattern similar to incoming rays.

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## 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



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## 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.

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## 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

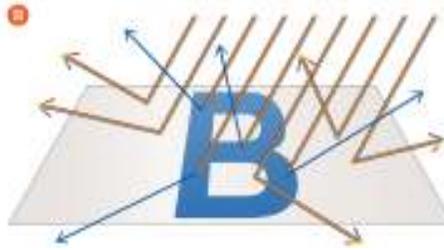


Figure 3.20B: The blue letter absorbs all wavelengths of light except blue. Only the blue light reaches your eye.

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## 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

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## 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.

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## 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?



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**TOPIC 3.3** How does light behave when it encounters different materials and surfaces?

**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



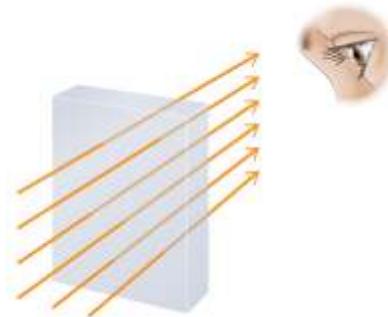
Figure 3.23: Light interacts with different materials in different ways.

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**TOPIC 3.3** How does light behave when it encounters different materials and surfaces?

**Transparent Materials Transmit Light**

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

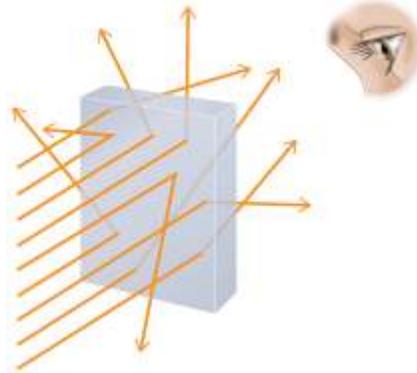


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### Translucent Materials Scatter Light

- **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

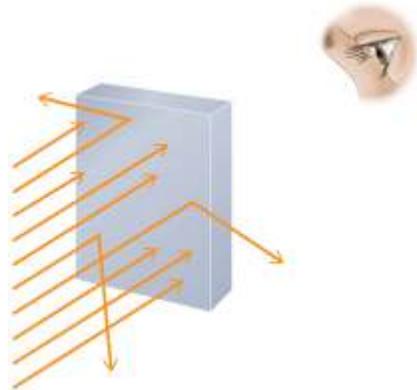


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### Opaque Materials Reflect and Absorb Light

- **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

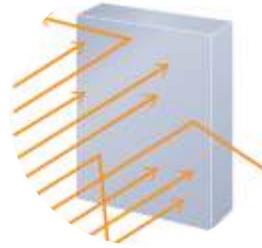


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**TOPIC 3.3** How does light behave when it encounters different materials and surfaces?

## 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.

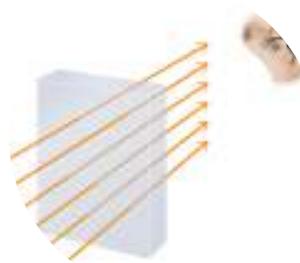


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## Discussion Questions

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



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**TOPIC 3.3** How does light behave when it encounters different materials and surfaces?**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.

