

## Photo Description



This image shows a modern glass building with many rectangular windows arranged in a grid pattern. The glass surface reflects another building, creating a mirror-like effect where you can see the reflected building's windows and structure overlapping with the actual building's windows.

## Scientific Phenomena

The anchoring phenomenon here is reflection of light. When light rays hit the smooth glass surface of the building, they bounce back at the same angle they arrived, following the law of reflection. This creates a mirror image of the surrounding buildings on the glass surface. The glass acts like a giant flat mirror because its surface is very smooth and shiny, allowing light to reflect in an organized way rather than scattering in all directions.

## Core Science Concepts

1. Law of Reflection: Light bounces off surfaces at the same angle it hits them, which is why we can see clear reflections in smooth surfaces like glass and mirrors.
2. Properties of Materials: Glass has specific properties (smooth, transparent, and reflective) that allow it to both let light through and reflect light back, depending on lighting conditions.
3. Light Behavior: Light travels in straight lines and can be reflected, absorbed, or transmitted through different materials depending on their surface properties.
4. Engineering Design: Architects and engineers must consider how light interacts with building materials when designing structures, both for energy efficiency and visual effects.

### Pedagogical Tip:

Use a flashlight and various materials (mirror, rough paper, smooth metal) to demonstrate how surface texture affects reflection quality. This hands-on approach helps students connect the abstract concept to observable phenomena.

### UDL Suggestions:

Provide multiple ways to explore reflection: kinesthetic learners can use mirrors and flashlights, visual learners can observe reflection patterns, and auditory learners can describe what they observe to partners. Include reflection journals for students to draw and write their observations.

## Zoom In / Zoom Out

**Zoom In:** At the molecular level, glass has a very organized, smooth structure that allows light waves to bounce off in predictable patterns. The photons (particles of light) interact with the electrons in the glass molecules, causing them to bounce back rather than being absorbed.

**Zoom Out:** This building reflection phenomenon is part of larger urban heat island effects and energy considerations. Reflective buildings can redirect sunlight and heat to other areas, affecting local temperature patterns and energy use in cities.

### Discussion Questions

1. "What would happen to the reflection if the glass surface was rough instead of smooth?" (Bloom's: Analyze | DOK: 2)
2. "How might architects use reflective building materials to solve problems in hot climates?" (Bloom's: Apply | DOK: 3)
3. "Why can you see reflections better in this building's windows during the day than at night?" (Bloom's: Evaluate | DOK: 2)
4. "What patterns do you notice in how the reflected building appears compared to the real building?" (Bloom's: Analyze | DOK: 2)

### Potential Student Misconceptions

1. Misconception: "The reflection is actually inside the glass."

Clarification: The reflection appears to be behind the glass, but it's actually light bouncing off the front surface back to our eyes.

2. Misconception: "Only mirrors can create reflections."

Clarification: Any smooth, shiny surface can create reflections, including water, polished metal, and glass.

3. Misconception: "The reflected image is exactly the same size as the real object."

Clarification: The apparent size of reflections can change based on distance and viewing angle.

### Cross-Curricular Ideas

1. Math - Geometry and Patterns: Have students measure and calculate the grid patterns in the building's windows. They can count rows and columns, calculate the total number of windows, and explore symmetry in the reflected image versus the actual building. This connects to understanding 2D shapes and spatial reasoning.

2. ELA - Descriptive Writing: Ask students to write detailed descriptions of what they see in the reflection compared to the real building. They can use sensory language and comparison words (like, similar, different) to explain the mirror effect. This strengthens descriptive vocabulary and observation skills.

3. Social Studies - Urban Planning: Discuss how architects and city planners choose materials for buildings in different climates and environments. Students can research why some cities use reflective glass buildings and explore how these choices affect neighborhoods, energy costs, and quality of life for people living nearby.

4. Art - Perspective and Composition: Students can create drawings or paintings showing how reflections change perspective and composition. They can experiment with sketching reflected images and understanding how mirrors and reflective surfaces create visual interest in art and design.

## STEM Career Connection

1. Architect: Architects design buildings and decide what materials to use, including what type of glass and how windows should be arranged. They think about how light will interact with their building design and how it will look from different angles. They need to understand how reflections and light work to create beautiful and functional spaces. Average Annual Salary: \$80,000-\$95,000 USD
2. Materials Scientist: These scientists study the properties of different materials like glass, metal, and plastic to understand how they interact with light and other forces. They figure out how to make new materials that are stronger, lighter, or more reflective for use in buildings and other products. Average Annual Salary: \$65,000-\$85,000 USD
3. Optical Engineer: Optical engineers design systems that control light, such as windows, lenses, and reflective surfaces. They use their knowledge of how light behaves to solve problems, like making buildings more energy-efficient by controlling how light and heat enter through windows. Average Annual Salary: \$75,000-\$95,000 USD

## NGSS Connections

- Performance Expectation: 5-PS1-3 - Make observations and measurements to identify materials based on their properties
- Disciplinary Core Ideas: 5-PS1.A - Structure and Properties of Matter
- Disciplinary Core Ideas: 1-PS4.B - Electromagnetic Radiation
- Crosscutting Concepts: Patterns - Observable patterns in nature guide organization and classification
- Crosscutting Concepts: Cause and Effect - Cause and effect relationships are routinely identified and used to explain change

## Science Vocabulary

- \* Reflection: When light bounces off a surface and travels back toward where it came from.
- \* Transparent: A material that allows light to pass through it so you can see through it clearly.
- \* Surface: The outside or top layer of something.
- \* Angle: The space between two lines that meet at a point.
- \* Properties: Special characteristics or features that describe how a material looks or behaves.
- \* Photon: A tiny particle of light energy.

## External Resources

### Children's Books:

- "Light: Shadows, Mirrors, and Rainbows" by Natalie M. Rosinsky
- "Mirrors and Reflections" by David Dreier
- "Bouncing and Bending Light" by Barbara Alpert