

LESSON 2

Properties of Mirrors and Lenses in Optical Instruments

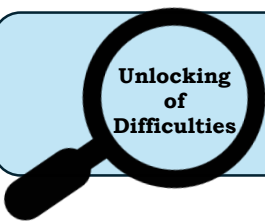
MELC: *Identify ways in which the properties of mirrors and lenses determine their use in optical instruments*

Objectives:

1. State the properties of mirrors and lenses
2. Compare reflection and refraction
3. Illustrate ways in which the properties of mirrors and lenses determine their use in optical instruments.



Let's Discover!



Mirrors and lenses are optical devices used to manipulate light and form images.

Have you ever heard of the term selfie? Are you someone who enjoys taking pictures of yourself, or perhaps someone who frequently checks the mirror to see how you appear? Have you ever been curious about how you can see and observe everything around you? Let's dive in and discover how the properties of mirrors and lenses contribute to their roles in different optical instruments.

The **human eye** is often considered an optical instrument because it enables us to see objects in our surroundings, working in a way like a camera. Both rely on light to capture images. Without light, neither the eye nor a camera can function effectively. For example, if you try to take a photo in a completely dark room without using a flash, the camera will not capture anything visible. Light plays a crucial role in our ability to see and in the functioning of optical devices. In this lesson, we will focus on two key aspects related to light: the properties of mirrors and lenses. But before diving deeper, let's first understand its properties.



Figure 1: Eye

Optical instruments, such as cameras, binoculars, and eyeglasses, are essential tools in our everyday lives. These instruments are all built around the basic properties of mirrors and lenses, which determine how they work and are used. In the Philippines, where outdoor activities, photography, and vision care are part of daily life, understanding the science behind these instruments can help students connect their knowledge to real-world experiences.



Figure 2: Optical Instruments



Figure 3: Mirror reflection

Mirrors and **lenses** both interact with light in unique ways. A mirror has a smooth, reflective surface that bounces light back, allowing us to see our reflections or images of other objects. Reflection occurs when light bounces back into the same medium after striking a surface. Images are created through reflection when light hits an object, bounces off, and is then received by your eyes, allowing you to perceive the object.

As shown in the figure on the right, the angle at which the light strikes a surface (angle of incidence) is equal to the angle at which it reflects back (angle of reflection), returning to the same medium. Since the law of reflection does not depend on the wavelength of light, mirrors are particularly useful in telescopes and other optical systems, making them advantageous for various applications.

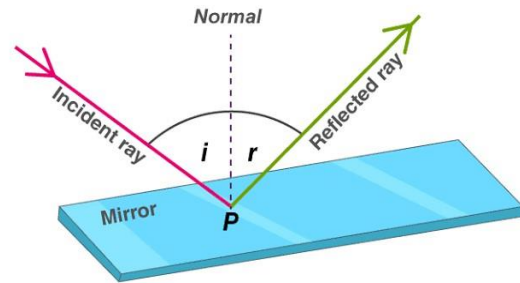


Figure 4: Law of reflection

Lenses, on the other hand, are transparent objects that bend or refract light as it passes through them.



Figure 5: Camera lens

Source: <https://images.app.goo.gl/akGet1ZJAhhTWaJd8>

This **refraction** changes the direction of light rays, which helps in focusing or spreading out the light, making objects appear closer or clearer. These properties of mirrors and lenses are key to how various optical instruments function.

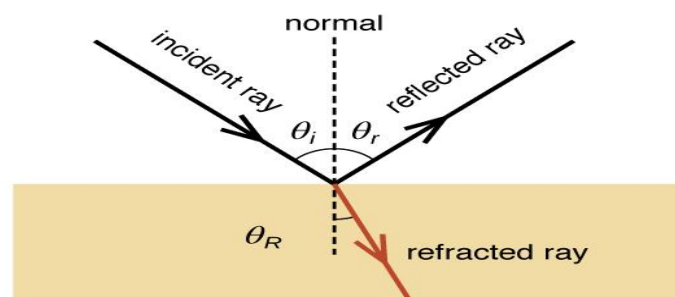


Figure 6: Refraction

Binoculars, which are popular in the Philippines for outdoor adventures like birdwatching in the forests of Palawan or whale watching in Bohol, also depend on a combination of mirrors and lenses. Inside the binoculars, lenses bend light to magnify distant objects, making them appear larger and closer. At the same time, mirrors inside the binoculars reflect the light path in such a way that the image remains upright and clear, even when viewed from far away. This combination of lenses and mirrors ensures that binoculars provide powerful magnification tool for viewing objects that are out of reach.

Light enters binoculars through the objective lens, where it is then reflected by the Porro prisms and directed to the eyepiece, creating a larger image that you can view. When the light rays pass through the objective lens, the curvature of the lens causes them to diverge and cross over each other. These

rays continue their path until they reach the eyepiece, where the shape of the eyepiece lens causes the rays to become parallel again, resulting in a clear and magnified image.

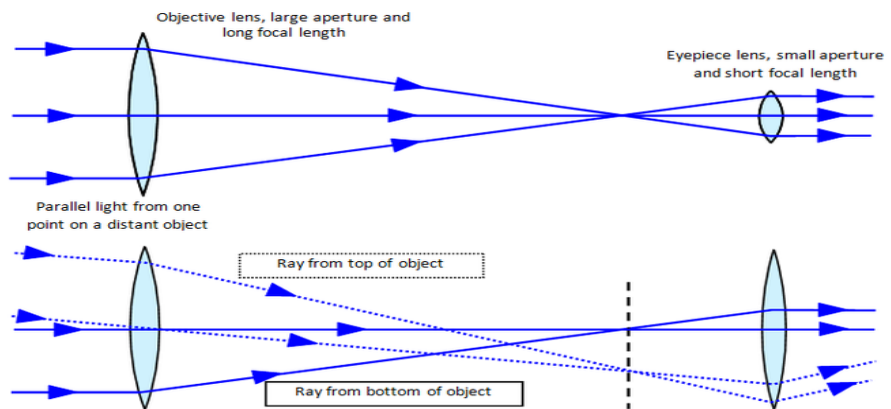


Figure 7: How binoculars Work?

In **cameras**, lenses are responsible for capturing clear images. Whether it's a smartphone camera used to snap a picture of a colorful festival in Cebu or a professional camera documenting a wedding in Manila, the lens is what focuses the light onto the camera's sensor. This focused light creates sharp, detailed images, allowing Filipinos to capture important moments in their lives. The ability of lenses to control light is why photographers can adjust the focus, zoom, and sharpness of their pictures. The size and shape of the lens determine how much light is captured, which is crucial in capturing high-quality images even in dim settings, such as during a sunset at the famous Mayon Volcano.

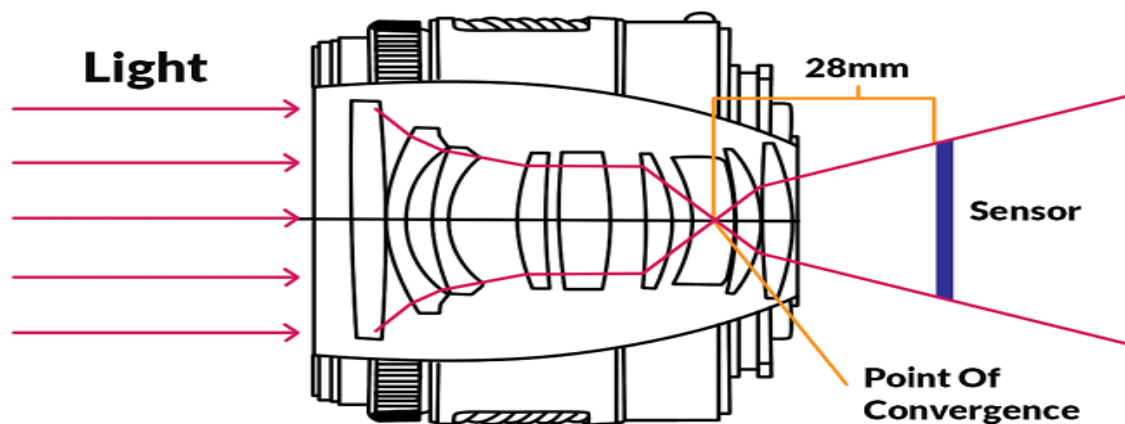


Figure 8: How does a camera work?

Eyeglasses, which many Filipinos wear to correct vision problems, are another everyday example of lenses at work. The lenses in eyeglasses are designed to adjust the focus of light entering the eyes, helping people with nearsightedness or farsightedness see more clearly. By changing the angle at which light enters the eye, these lenses compensate for the imperfections in a person's natural vision. Whether a student is reading a textbook, or a parent is driving through the streets of Quezon City, eyeglasses help ensure that they can see their surroundings clearly and safely.

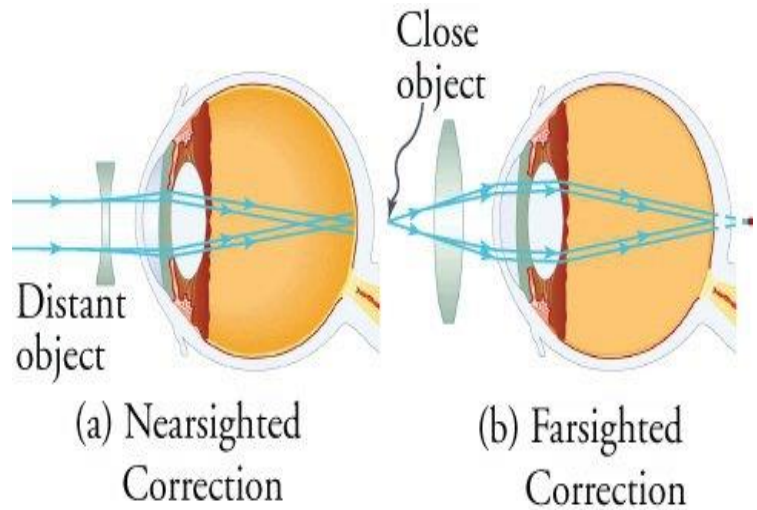
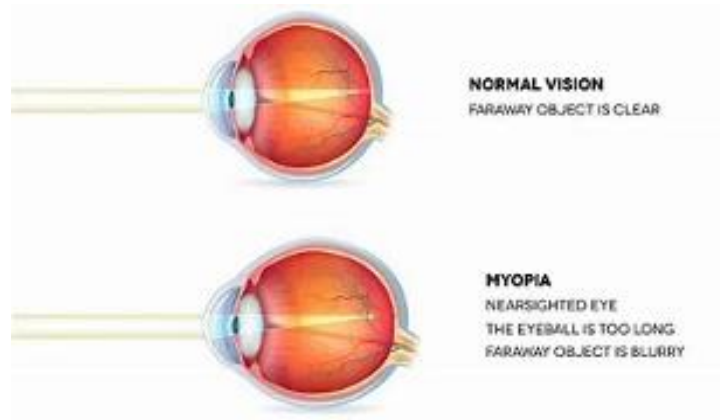


Figure 9: How do eyeglasses work?

Source: <https://lumenlearning>

Nearsightedness, also known as myopia, is a condition where the eyes can clearly see nearby objects but have difficulty focusing on distant objects. This occurs because the lens of the eye is either too strong or overly curved, causing light rays from distant objects to converge in front of the retina instead of directly on it. As a result, distant objects appear blurry. However, when viewing nearby objects, the light rays are naturally more divergent, allowing them to focus correctly on the retina, resulting in a clear image. To correct nearsightedness, a diverging (concave) lens is placed in front of the eye, reducing its power



and allowing light rays to focus properly on the retina.

Figure 10: Nearsighted eye

Source: <https://images.app.goo.gl/dadhLCKuSxB3qHAC8>

On the other hand, **farsightedness**, or hyperopia, is a condition where the eyes can clearly see distant objects but struggle with close-up vision. In this case, light rays from nearby objects do not converge sufficiently to focus on the retina, resulting in blurry vision for close objects. This can occur because the lens of the eye is too weak or because the eye is shorter than normal. With farsightedness, light rays from distant objects, which require less convergence, can still focus on the retina, allowing for clear distance vision.

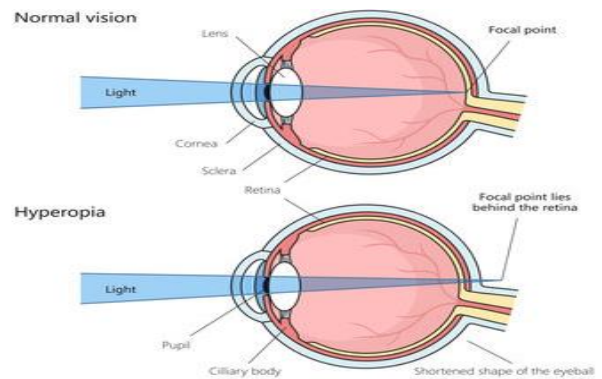


Figure 11: Farsighted sighted eye

Source: <https://stock.adobe.com/ph/search?k=hyperopia>

The use of **mirrors** and **lenses** extends beyond just these instruments. Optical technologies are also found in microscopes used in schools and hospitals, telescopes for stargazing, and even in the headlights of vehicles navigating the busy roads of Metro Manila. These applications highlight the importance of understanding how mirrors and lenses work, as these tools play a vital role in both personal life and professional settings in the Philippines.

By studying the properties of mirrors and lenses, students can appreciate the practical applications of these tools and recognize their importance in everyday activities. From capturing a memorable moment with a camera to exploring the natural beauty of the country with binoculars, these optical instruments enhance the way Filipinos experience the world. Understanding the science behind these instruments can help students see the connection between their classroom lessons and the technology they use daily.