

Week 10

Prerequisite knowledge

Please revise the following sections from Giambattista Physics (5th ed.). New York: McGraw-Hill:

- Section 11.1 Waves and Energy Transport.
- Section 11.2 Transverse and Longitudinal Waves.
- Section 11.3 Speed of Transverse Waves on a String.
- Section 11.4 Periodic Waves.
- Section 11.5 Mathematical Description of a Wave.
- Section 11.6 Graphing Waves.

Detailed learning goals

By completing this topic, you should be able to:

- Explain the wave character of light
- Identify and explain the changes when light enters a medium - the index of refraction
- Explain the ray model of light including the ideas and assumptions we need to make to use it
- Explain reflection of light from polished and rough surfaces
- Explain with ray diagrams the formation of an image using spherical mirrors
- Determine the index of refraction, given the speed of light in a medium
- Calculate the distance to either the image or the object when viewed through a different material
- Explain the difference between converging lenses and diverging lenses
- Explain and demonstrate the rules for ray tracing for thin converging lenses.
- Demonstrate the formation of images using the technique of ray tracing
- Explain and demonstrate the rules for ray tracing for thin diverging lenses.
- Demonstrate the formation of images for thin diverging lenses using the technique of ray tracing.

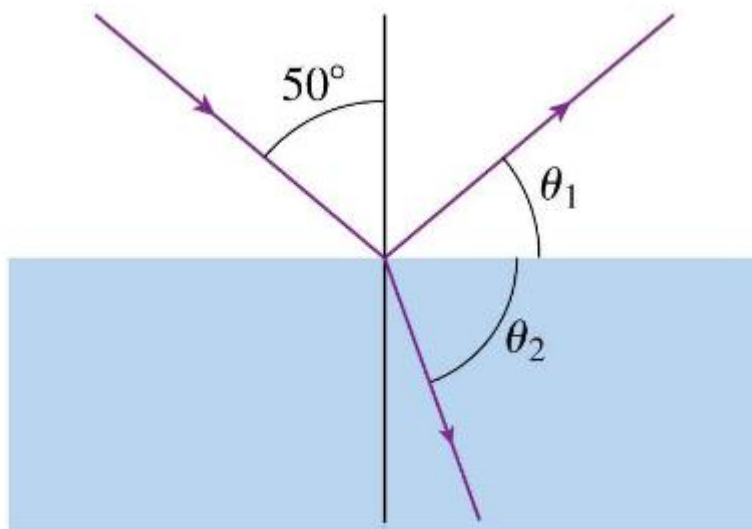
Prescribed readings for SLE123 content

Please read the following sections from Giambattista Physics (5th ed.). New York: McGraw-Hill:

- Section 22.3 The Electromagnetic Spectrum.
- Section 22.4 Speed of EM Waves in Vacuum and Matter.
- Section 23.1 Wavefronts, Rays, and Huygens's Principle.
- Section 23.2 The Reflection of Light.
- Section 23.3 The Refraction of Light: Snell's Law.
- Section 23.7 Plane Mirrors.
- Section 23.9 Thin Lenses.

SLE123 – Week 10 - Practice questions:

1. The frequency of a light wave in air is 4.6×10^{14} Hz. What is the wavelength of this wave after it enters a pool of water? ($n_{\text{water}} = 1.33$)
 - a. 300 nm
 - b. 490 nm
 - c. 650 nm
 - d. 870 nm
2. Looking at the image below, a beam of light in the air encounters a transparent block with index of refraction $n = 1.53$. Some of the light is reflected and some is refracted.



What is θ_2 ?

- a. 20°
 - b. 30°
 - c. 50°
 - d. 60°
3. A laser beam in air is incident on a liquid at an angle of 30° with respect to the normal. The liquid has an index of refraction of 1.4. What is the laser beam's angle in the liquid?

4. A diamond is underwater. A light ray enters one face of the diamond at an angle of 65° with respect to the normal. What is the angle at which the ray travels inside the diamond? ($n_{\text{water}} = 1.33$; $n_{\text{diamond}} = 2.42$)