PH202 Reading Guide

Chapter 18: Ray Optics

This chapter is about effects we see when light interacts with relatively large objects. Have you ever seen interference when the sun is shining into the window of your room? Do you see interference of the light from your ceiling lamp when you stand under it? Probably not. But we see a shadow, and many of us have used a mirror, a, lens, a telescope, a microscope or wears glasses or contact lenses. You might know that "light travels in a straight line," here we will learn what this actually means. And we will learn a representation to draw light as a straight line: a ray. You will see how drawing rays allows you to position the mirror in the correct position in your bathroom or bedroom for comfortable use. Learning how light rays pass through different media will allow you to construct images of lenses by using ray tracing. Ray tracing is so powerful that companies have made a living writing ray tracing programs for the computer to optimize lens combination for camera lenses and specialty optics, which we will cover in chapter 19.

Student Learning Objectives

In covering the material of this chapter, students will learn to

- Use the ray model of light—how light is emitted from objects, how we see objects, and how shadows are formed.
- Understand the law of reflection and image formation in plane mirrors.
- Understand and apply the law refraction.
- Understand total internal reflection and the concept of the critical angle.
- Understand image formation by lenses, and how to use graphical ray tracing.
- Understand image formation and ray tracing for spherical mirrors.
- Use the thin-lens equation to analyze image formation by lenses and mirrors.

When reading the text

- Answer all "Stop To Think" questions (the answers are in the back of the chapter)
- Understand all examples
- Answer the following questions to ensure you understood the text

Physics Tools

- Draw ray diagrams for reflection and refraction
- Explain formation of real and virtual images using ray diagrams
- Apply ray tracing to show optical processes including lenses and mirrors

Some questions that successful students can answer after reading the text:

Section 18.1 (page 566-569): The Ray Model of Light

What is a light ray?

What are sources of light rays?

How do we see and object?

What is scattering? Draw a picture that shows the difference between reflection, refraction and scattering

Section 18.2 (page 569-571): Reflection

What is the law of reflection?

Why is a virtual image called a "virtual" image?

Section 18.3 (page 571-576): Refraction

When light hits a transparent material how much of the light is transmitted, and how much is reflected?

What is the critical angle for glass?

What is a critical angle?

Section 18.4 (page 576-577): Image Formation by Refraction

Show why an object under water looks closer to the observer than it is (Fig. 18.24).

Section 18.5 (page 577-584): Thin Lenses: Ray Tracing

What is a converging lens?

What is a diverging lens?

What is the focal length of a converging lens?

What is the focal length of a diverging lens?

What are the three "special rays" in a ray diagram of a lense?

Section 18.6 (page 584-588): Image Formation with Spherical Mirrors

See that the image formation with spherical mirror is physically identical to lenses.

Section 18.7 (page 588-592): Image Formation with Spherical Mirrors

Understand and be able to reproduce Figure 18.46.

Suggested Workbook Problems (best is answering all workbook questions)

Chapter 18: 1-8, 9 (sorry, the solutionbook looks bad), 10-13, 16-20