

PH202 Reading Guide

Chapter 19: Optical Instruments

This chapter we will cover optical instruments that are often used, including our eye. Many optical instruments make use of various lenses, so this chapter heavily uses what we learned in chapter 18 and builds on what we learned there. We will see how a camera works, how our eyes create an image, and we will study a magnifying glass, a microscope and a telescope. Have you ever paid a few hundred \$ for a new lens for your camera. It is interesting to characterize and learn about the development of optical instrumentation during the past 20 years. Cameras have changed from large glass lenses and films to very small lenses and CCD chips with millions of pixels. You will learn about the tools to characterize differences of the various technologies.

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 image formation by a pinhole camera.
- Understand how a camera works by focusing a real image on a detector.
- Understand the eye, focusing and accommodation, and the use of lenses in correcting near- and farsightedness.
- Understand apparent size and how a magnifier works.
- Understand color and dispersion.
- Understand microscopes and telescopes.
- Recognize that diffraction limits the resolution of optical systems.

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 the human eye, a magnifying glass, a telescope and a microscope.

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

Section 19.1 (page 601-602): The Camera

Does the image in a pinhole camera stand heads up or upside down?

What is a CCD camera? What does CCD stand for?

Section 19.2 (page 603-606): The Human Eye

Draw human eye as a physicist would draw it (Figure 19.5)

What is accommodation?

How is farsightedness called?

How is nearsightedness called?

For farsightedness is the retina too close or too far away from the lens?

Section 19.3 (page 606-608): The Magnifier

Draw a ray diagram for a magnifier

Section 19.4 (page 608-610): The Microscope

Draw a ray diagram for a microscope

Section 19.5 (page 610-611): The Telescope

Draw a ray diagram for a telescope

Suggested Workbook Problems (best is answering all workbook questions)

Chapter 19: 1, 2, 3, 4, 8, 9