

Reading Guide

for the Electricity and Magnetism unit

This is an awful lot of stuff, so of course I'll just point out the high parts as we rush by. Hang on!

Physics Chapter 12: Charge

The important stuff in this chapter is how electric charge affects the force between objects.

pp. 105–110. This section is an introduction to the concept of electric **charge**. Notice that it does not actually tell you what charge is. This is no mistake: we do not really know! All we know is what it does.

pp 111–112. The biggest thing here is the equation of force for electric charges. From the formula alone, you should be able to figure out:

- How is the electric force between charged objects affected if they move farther apart?
- How is the electric force between charged objects affected if the charges become larger?

You should also be able to answer:

- What is the unit of electric charge?
- How is the electric force similar to gravity?
- How is the electric force different from gravity?

pp. 113–116. Skip.

Physics Chapter 13: Electric Fields

pp. 117–120. Skip. This discusses electric fields and potential energy in electric fields. It's beyond what we'll cover in any depth, I'm afraid.

p. 121. This introduces the important electrical unit, the **volt**. Do you understand what the unit means? Does it make sense to you?

p. 122. Read this if you want to. It points out (some of) the philosophical shortcomings of classical electrodynamics. It's basically a teaser to get you to hang on until chapter 24. We will not get that far in that class, but you are certainly encouraged to read it on your own.

Physics Chapter 15: Electric Currents

pp. 128–129. This introduces the **voltaic cell**, a principal means of generating electric current. We won't worry about it; the important concepts follow on...

p. 130. Electric **current** is the flow of electric charges through a conductor.

p. 131. Two things on this page:

1. An analogy likening electric current through a circuit to water flowing through pipes.
2. Ohm's Law, the relationship between electric current, electric potential (voltage), and electrical **resistance**. Here, current is the response (effect) to the applied voltage and the resistance of the circuit (causes).

- How does current change if resistance increases?

- How does current change if voltage increases?

p. 132. A little more explanation of electrical resistance.

pp. 133–139. Skip.

p. 140–141. **Power** in electrical circuits.

- How do you find the power (watts) in a circuit if you know the current (amps) and potential (volts)?

Physics Chapter 17: Magnetic Fields

pp. 149–150. A little background on magnets. You may already know how magnets interact with each other.

p. 151. Discusses **magnetic field** and magnetic **field lines**. Not a big deal for you to understand them; they're just a convenient way to describe the interactions between magnets and other things.

pp. 152–155. Read this, but only skim it. It explains how electric charges interact with magnetic fields. It is complicated and fairly hard to understand. The important thing is that electric charges and magnetic fields interact.

pp. 156–159. Skim these pages as well. It presents the converse of the previous pages. Here we see that electric current creates a magnetic field. So electricity and magnetism are inseparably entwined! That fact is the basis of many useful effects, such as electric motors and computer disks.

Physics Chapter 18: Permanent Magnets

This chapter is short and straightforward. Read the whole thing, though there is no need to study it carefully.

One correction I would like to make to the book is to the bottom illustration on page 162. In a magnetized permanent magnet, the individual domains are not all aligned together, but there is instead a slight bias in one direction. That is enough to make a magnetic field that acts beyond the magnet itself.

Wrap-Up

Electric motors, computer disks, and credit card stripes all exploit the connection between motion, magnetism, and electricity. Can you suggest what is happening when each one operates?