

Today: Ch 21 & Ch 22 E&M Induction 1st ½

HW 16

Wednesday: Ch 22 E&M Induction 2nd ½

HW15 Redo; HW17

21.1 The Force on a Current in a Magnetic Field

- Force on Single Charged Particle:
- Force on a stream of charged particles with same speed:
- Application: Stereo speakers

21.2 Magnetic Fields Produced By Currents

21.2.1 A Long, Straight Wire

- Direction?
- Magnitude
-

Example 1: Bring back two parallel wires with opposite current of ~ 2 amps, wires about 1 m long and about 5 mm apart.

- A) What is the direction and what is the magnitude of the magnetic field due to the right hand wire (current going up) at the position of the left hand wire?
- B) What is the force (direction and magnitude) the right hand wire exerts on the left hand wire?

21.2.2 Loop of Wire

- Qualitatively

21.2.3 A Solenoid

- Qualitatively

Chapter 22 Electromagnetic Induction

22.1 Induced EMF and Induced Current

- Current Induction in the Swing
- Demo: Current swing – swing it up toward the magnet
- Demo: Electric Guitar String
 - Supply Current in presence of Field – Induce Motion
 - Supply Mechanical motion in presence of Field – Induce Current
- Induced EMF
 - Demo: LED & Battery vs. Generator
 - 1) Electric Field Driving Charge
 - 2) Magnetic Field Driving Charge

Demo: Repeat Generator & Diode

Example 2: Say I took my 0.01 m long wire swing, and put it in the presence of a uniform 3 Tesla magnetic field. With what speed would I have to move it to get up the 1.7 Volt *Emf* needed to light a diode?

- Motional Emf / Magnetic Drag Force.
- Demo: Drag force on copper fin through magnet

22.3 Magnetic Flux

- Flux:
 - Units:
- Conceptualizing flux.
 - Conceptualizing B Field Lines

HW 17

Ch 21

26. A 45-m length of wire is stretched horizontally between two vertical posts. The wire carries a current of 75 A and experiences a magnetic force of 0.15 N. Find the magnitude of the Earth's magnetic field at the location of the wire, assuming that the field makes an angle of 60.0° with respect to the wire.
46. A long, straight wire carries a current of 48 A. The magnetic field produced by this current at a certain point is $8.0 \times 10^{-5} \text{T}$. How far is the point from the wire?

Ch 22

4. In 1996, NASA performed an experiment called the Tethered Satellite experiment. In this experiment a 2.0×10^4 -m length of wire was let out by the space shuttle *Atlantis* to generate a motional emf. The shuttle had an orbital speed of $7.6 \times 10^3 \text{m/s}$, and the magnitude of the Earth's magnetic field at the location of the wire was $5.1 \times 10^{-5} \text{T}$. If the wire had moved perpendicular to the Earth's magnetic field, what would have been the motional emf generated between the ends of the wire?