Massachusetts Institute of Technology - Physics Department

Physics - 8.02 **Assignment #6** March 22, 2002.

We strongly recommend that you read about a topic before it is covered in lectures.

Lecture Date	Topics Covered	Reading from Giancoli
#20 Mon 4/1	Inductance - RL Circuits Magnetic Field Energy	Chapter 30 through Sect. 30-4
Tue 4/2	**Due Date Electric Motor!** **Testing 1-5 PM, 26-110**	
#21 Wed 4/3	Magnetic Materials Dia-, Para-, and Ferromagnetism **Prize Ceremony Motor Contest**	*Lecture Supplement* Sect. 28-8, 28-9, 28-10
#22 Fri 4/5	Hysteresis - Electromagnets - Bohr Magneton ***Maxwell's Equations***	Sect. 28-8 & 28-9 Sect. 32-3 & 40-7

Due before 4 PM, Friday, April 5 in 4–339B.

Problem 6.1
Flip Coil.
Giancoli 29-62.

Problem 6.2
Displacement Current.
Giancoli 32-4.

Problem 6.3
Self-inductance of a toroid.
Giancoli 30-48.

Problem 6.4
Magnetic Field Energy and Self-Inductance.
A long straight solid cylindrical conducting wire with radius R carries a steady uniform current I.

(a) Calculate the magnetic field energy *inside* a length ℓ of the wire.

(b) What is the contribution of the interior portion of the conductor to the total self-inductance?

Problem 6.5
RL Circuit.
A coil with resistance $0.05\,\Omega$ and self-inductance $0.09\,\mathrm{H}$ is connected across a 12-volt car battery of negligible internal resistance.

(a) How long after the switch is closed will the current reach 95 percent of its final value?

(b) At that time how much energy (in Joules) is stored in the magnetic field?

(c) How much energy has been delivered by the battery up to that time?

Problem 6.6
RL Circuit.
Giancoli 30-30.

Problem 6.7
Integrating circuit.
Giancoli 30-57.
In spite of what Giancoli's thinks and writes, **Kirchhoff's loop rule does not hold** for the closed loop LRV_{in}. Kirchhoff's loop rule does hold for the closed loop containing the resistor, R, and V_{out}. In short: **Faraday's law always holds, and Kirchhoff's loop rule is only a special case of Faraday's law. See the Lecture Supplements of March 15 and April 1.**

Recitations.

There are 28 recitation sections (see the 8.02 Website). If for any reason you want to change, please see Maria Springer in 4-352.