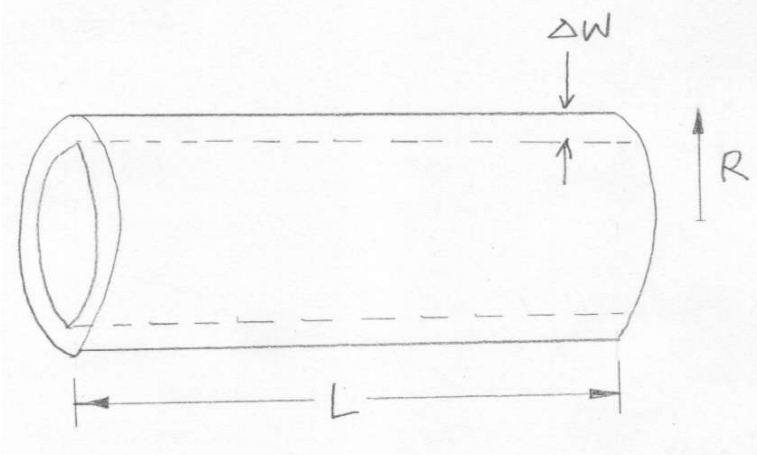
Physics 322, Winter Quarter 2016
Electrodynamics: Homework Assignment 8
(a) Turn in all problems and clearly note all constants and assumptions you use.
(1-point penalty each otherwise)
(b) Use 8½ x 11 paper & staple
(1-point penalty each otherwise)
(c) Due March 3 either 9:00 am in class or 8:45 am in the instructor's mailbox;
late homework gets 0.



1. Consider the hollow magnetized cylinder shown. The wall thickness Δw of the shell is small and the magnetization **M** of material comprising the shell is constant and directed axially.
a. Suppose you write $\nabla \bullet H = \rho_m$, where ρ_m is a "bound magnetic charge". Find the "bound magnetic surface charge" σ for this system. Hint: there are places where $\sigma \neq 0$.
b. What is $\nabla \times$ **H** everywhere?
c. From parts a and b, and reasoning from the equations of electrostatics, and the result of Griffiths problem 2.5, find the **B** field everywhere on the axis.

2. Radiation pressure. Suppose you're designing a spaceship powered by solar radiation pressure.
a. With the spaceship a distance *r* from the Sun, find the gravity force on the spaceship of mass M.
b. What's the intensity of the sunlight at the spacecraft a distance r from the Sun. Assume the light power emitted by the Sun is *P*.
c. Your spaceship has a reflecting sail of area *A*. You orient the sail so it reflects light directly back towards the Sun. Find the resulting radiation force on your spaceship at distance *r*.
d. Find the minimum area *A* assuming the spaceship mass *M* is 1000kg. You'll need to look up data on the Sun.

3. Lasers can have very large powers. (You might ponder the power that NIF at Lawrence Livermore Lab can achieve.) Industrial lasers can easily deliver a pulsed spot beam with intensity 10^{24} W/m^2. Find the RMS **E** and **B** field is such a beam.

4. Consider an electromagnetic wave travelling in free space with electric and magnetic fields **E** and **B**.
a. What's the value of E/H where E and H are magnitudes?
b. What's the ratio of the electric and magnetic energy densities?
c. Find the time-average Poynting vector.

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