

## Homework 7

Due October 23, 2009

272:

1.- Textbook Chapter 25 problem 34

2.- Textbook Chapter 25 problem 74

272H (the previous two and the following two):

3.- A hydrogen atom consists of a proton and an electron which may (for some purposes) be thought of as describing a circular orbit about the proton with the so-called Bohr radius  $a_0 = \hbar^2 / (4\pi^2 m e^2) = 0.53 \times 10^{-10}$  meters, with speed  $v = e^2 / (\hbar / 2\pi) = 2.19 \times 10^6$  meters/sec, with the electron charge  $e = 1.6 \times 10^{-19}$  C, electron mass  $m = 9.11 \times 10^{-31}$  kg, and Planck's constant  $h = 6.6 \times 10^{-34}$  Joule sec. What current is this circulating charge equivalent to? What is the magnetic dipole moment associated with the electron current?

4.- An ocean current flows at a speed of 2 knots (about 1 meter per second) in a region where the vertical component of the earth's magnetic field is 0.35 Gauss. The conductivity of sea water in that region is  $0.04 \text{ (Ohm cm)}^{-1}$ . Assuming that there is no other horizontal component of  $\mathbf{E}$ . Find the density of horizontal electric current in amperes per square meter generated by the magnetic field.

