Homework Problem Set 11 – Due THURSday, 12/8

Problem 1 - Hewitt 24.34, p. 467

Problem 2

How does a permanent dipole magnet attract pieces of unmagnetized iron? If the iron is attracted to the north pole of the dipole, will it be repelled by the south pole?

Problem 3

What is the net force on a magnetic dipole (e.g., a compass needle) in a (nearly) homogeneous magnetic field (e.g., Earth's magnetic field)? Is the needle in equilibrium? (What happens if it is NOT aligned with Earth's magnetic field?)

Problem 4

A wire carrying 5000 A of current is pulling with a net force of 50 N on a 1 m long nearby wire carrying a current of 50 A. What is the force of the second wire on the first one?

Problem 5

In a particle accelerator, you will find both strong electric fields (inside RF cavities) and strong magnetic fields (inside electromagnets). One of those is to accelerate the particles to higher kinetic energy, while the other is used to guide the particles on curved paths. Which field performs which function?

Problem 6

A van de Graaf particle accelerator produces a mixed beam of two different particle species. The beam is directed into a strong magnetic field perpendicular to the beam. We observe that some particles are bent towards the left of their original direction, and some are bent to the right. What can we say about what distinguishes the two particle species?

Problem 7 - XC

An old-fashioned incandescent light bulb is operated with the usual 110 V AC power from a standard electrical outlet. Once the light bulb is placed into a strong magnetic field (perpendicular to the filament), you observe that the filament inside light bulb is oscillating in position (moving back and forth). Can you think of a reason for that?