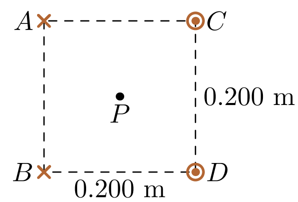
Recitation 8

Chapter 22

Problem 34. Two long, parallel conductors, separated by $r = 10.0$ cm, carry current in the same direction. The first wire carries current $I_1 = 5.00$ A, and the second carries $I_2 = 8.00$ A. (a) What is the magnitude of the magnetic field B_1 created by I_1 at the location of I_2? (b) What is the force per unit length exerted by I_1 on I_2? (c) What is the magnitude of the magnetic field B_2 created by I_2 at the location of I_1? (d) What is the force per unit length exerted by I_2 on I_1?

Problem 37. Four long, parallel conductors carry equal currents of $I = 5.00$ A. Figure P22.37 is an end view of the conductors. The current direction is into the page at points A and B and out of the page at points C and D. Calculate the magnitude and direction of the magnetic field at point P, located at the center of the square of edge length $a = 0.200$ m.



Problem 43. Niobium metal becomes superconducting when cooled below 9K. Its superconductivity is destroyed when the surface B field exceeds $B_{max} = 0.100$ T. Determine the maximum current in a $d = 2.00$ mm diameter niobium wire can carry and remain superconducting, in the absence of any external B field.

Problem 48. In Bohr's 1913 model of the hydrogen atom, the electron is in a circular orbit of radius $r = 5.29 \cdot 10^{-11}$ m, and its speed is $v = 2.19 \cdot 10^6$ m/s. (a) What is the magnitude of the magnetic moment μ due to the electron's motion? (b) If the electron moves in a horizontal circle, counterclockwise as seen from above, what is the direction of μ?

Problem 57. A positive charge $q = 3.20 \cdot 10^{-19}$ C moves with a velocity $\mathbf{v} = (2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} - \hat{\mathbf{k}})$ m/s through a region where both a uniform magnetic field and a uniform electric field exist. (a) Calculate the total force F on the moving charge (in unit-vector notation), taking $\mathbf{B} = (2\hat{\mathbf{i}} + 4\hat{\mathbf{j}} + \hat{\mathbf{k}})$ T and $\mathbf{E} = (4\hat{\mathbf{i}} - \hat{\mathbf{j}} - 2\hat{\mathbf{k}})$ V/m. (b) What angle θ does the force vector $\mathbf{F}$ make with $\hat{\mathbf{i}}$?

Problem 58. Protons having a kinetic energy of $K = 5.00$ MeV are moving in the $\hat{\mathbf{i}}$ direction and enter a magnetic field $B = 0.050\hat{\mathbf{k}}$ T directed out of the plane of the page and extending from $x = 0$ to $x = 1.00$ m as shown in Figure P22.58. (a) Calculate the y component of the protons' momentum as they leave the magnetic field. (b) Find the angle α between the initial velocity vector of the proton beam, and the velocity vector after the beam emerges from the field. Ignore relativistic effects and note that 1 eV $= 1.60 \cdot 10^{-19}$ J.