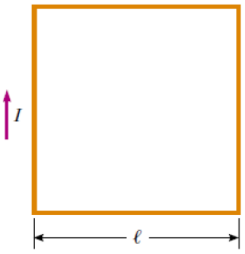
106 PHYS – Homework 1

Chapter 1 Sources of the Magnetic Field

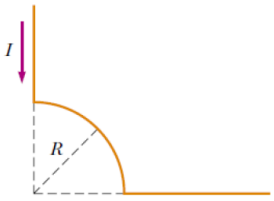
Chapter 30 in the text book

1. Calculate the magnitude of the magnetic field at a point 100 cm from a long, thin conductor carrying a current of 1.00 A.

2. A conductor in the shape of a square loop of edge length l = 0.40 m carries a current I = 10.0 A as shown in figure.
(a) Calculate the magnitude and direction of the magnetic field at the center of the square. (b) If this conductor is formed into a single circular turn and carries the same current, what is the value of the magnetic field at the center?



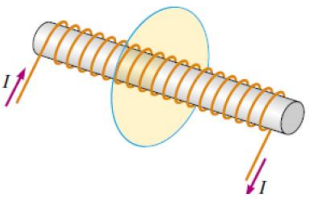
3. The segment of wire in the opposite figure carries a current of I = 5.0 A, where the radius of the circular arc is R = 3.0 cm. Determine the magnitude and direction of the magnetic field at the origin.



4. Two long, parallel conductors, separated by 10.0 cm, carry currents 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 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?

5. What current is required in the windings of a long solenoid that has 1000 turns uniformly distributed over a length of 0.40 m, to produce at the center of the solenoid a magnetic field of magnitude 1.0×10^{-4} T?

6. A solenoid 2.5 cm in diameter and 3.0 cm long has 300 turns and carries 12.0 A current. Calculate the flux through the surface of a disk of radius 5.0 cm that is positioned perpendicular to and centered on the axis of the solenoid as shown in the figure.



7. A 0.10 A current is charging a capacitor that has square plates 5.0 cm on each side. The plate separation is 4.0 mm. Find (a) the time rate of change of electric flux between the plates and (b) the displacement current between

8. A cube of edge length l = 2.50 cm is positioned as shown in the following figure. A uniform magnetic field given by B = (5i + 4j + 3k) T exists throughout the region. (a) Calculate the flux through the shaded face. (b) What is the total flux through the six faces?