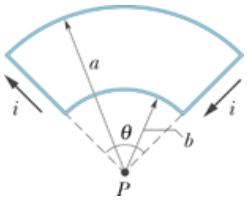
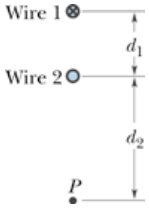
Chapter 30 – Problem Day

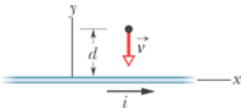
5. In the figure, two circular arcs have radii a = 13.5 cm and b = 10.7 cm, subtend angle θ = 74°, carry current i = 0.411 A, and share the same center of curvature P. What are the (a) magnitude and (b) direction of the magnetic field at P?



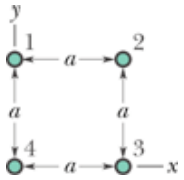


9. In the figure, two long straight wires are perpendicular to the page and separated by distance d_1 = 0.75 cm. Wire 1 carries 6.5 A into the page. What are the (a) magnitude and (b) direction (into or out of the page) of the current in wire 2 if the net magnetic field due to the two currents is zero at point P located at distance d_2 = 1.50 cm from wire 2?

13. A proton moves at $v = -200\,\hat{j}$ m/s toward a long wire with i = 350 mA. At the instant shown, the proton distance is d = 2.89 cm from the wire. In unit-vector notation, what is the magnetic force on the proton due to the current?

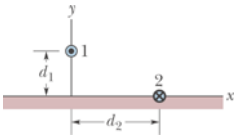


19. In the figure, four long straight wires are perpendicular to the page, and their cross sections form a square of edge length a = 20 cm. The currents are out of the page in wires 1 and 4 and into the page in wires 2 and 3, and each wire carries 20 A. In unit-vector notation, what is the net magnetic field at the square's center?



27. One long wire lies along an x-axis and carries a current of 30 A in the positive x direction. A second long wire is perpendicular to the xy plane, passes through the point (0, 4 m, 0), and carries a current of 40 A in the $+z$ direction. What is the magnitude of the magnetic field at the point (0, 2 m, 0)?

35. The figure shows wire 1 in cross section; the wire is long and straight, carries a current of 4.00 mA out of the page, and is at distance d_1 = 2.4 cm from a surface. Wire 2, which is parallel to wire 1 and also long, is at horizontal distance d_2 = 5.0 cm from wire 1 and carries a current of 6.80 mA into the page. What is the x component of the magnetic force *per unit length* on wire 2 due to wire 1?



49. A 200-turn solenoid having a length of 25 cm and a diameter of 10 cm carries a current of 0.29 A. Calculate the magnitude of the magnetic field inside the solenoid.

55. A long solenoid has 100 turns/cm and carries current i. An electron moves within the solenoid in a circle of radius 2.30 cm perpendicular to the solenoid axis. The speed of the electron is 0.046c ($c = 3\times10^8$ m/s). Find the current i in the solenoid.

Chapter 30 – Problem Day Answers

5a) 1.02×10^{-7} T
5b) out of the page

9a) 4.3 A
9b) out of the page

13) $-7.75 \times 10^{-23} \hat{i}$ N

19) $8.0 \times 10^{-5} \hat{j}$ T

27) 5 μT

35) 8.84×10^{-11} N/m

49) 2.9×10^{-4} T

55) 0.272 A