SCS 139 Applied Physic II — Semester 2/2011

Practice Questions for "Magnetic Forces and Fields (II)"

1. [HRW, 9E, P29.1] A surveyor is using a magnetic compass 6.1 m below a power line in which there is a steady current of 100 A. (a) What is the magnetic field at the site of the compass due to the power line? (b) Will this field interfere seriously with the compass reading? The horizontal component of Earth's magnetic field at the site is 20 ~~m~~μT.
   Ans: (a) 3.3 μT (b) yes
2. [YFF, 2011, E28.3] A long, straight conductor carries a 1.0 A current. At what distance from the axis of the conductor does the resulting magnetic field have magnitude $B = 0.5\times10^{-4}$ T (about that of the earth's magnetic field in Pittsburgh)?
   Ans: 4 mm
3. [HRW, 9E, P29.9] Two long straight wires are parallel and 8.0 cm apart. They are to carry equal currents such that the magnetic field at a point halfway between them has magnitude 300 ~~m~~μT. (a) Should the currents be in the same or opposite directions? (b) How much current is needed?
   Ans: (a) opposite (antiparallel) (b) 30 A
4. [HRW, 9E, P29.7] In Figure 1, two circular arcs have radii a = 13.5 cm and b = 10.7 cm, subtend angle $\theta = 74.0°$, carry current i = 0.411 A, and share the same center of curvature P. What are the (a) magnitude and (b) direction (into or out of the page) of the net magnetic field at P?

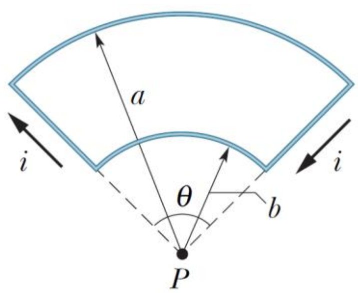

Figure 1: [HRW, 9E, Fig. 29-38]

   Ans: (a) 1.03×10^{-7} T (b) out of the page
5. [HRW, 9E, P29.8] In Figure 2, two semicircular arcs have radii R_2 = 7.80 cm and R_1 = 3.15 cm, carry current i = 0.281 A, and share the same center of curvature C. What are the (a) magnitude and (b) direction (into or out of the page) of the net magnetic field at C?

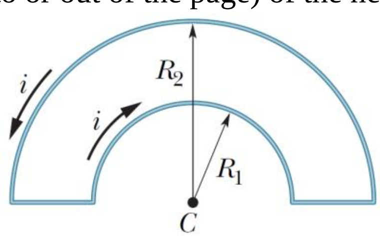

Figure 2: [HRW, 9E, Fig. 29-39]

Ans: (a) 1.67 μT (b) into the page

6. [HRW, 9E, P29.10] In Figure 3, a wire forms a semicircle of radius R = 9.26 cm and two (radial) straight segments each of length L = 13.1 cm. The wire carries current i = 34.8 mA. What are the (a) magnitude and (b) direction (into or out of the page) of the net magnetic field at the semicircle's center of curvature C?

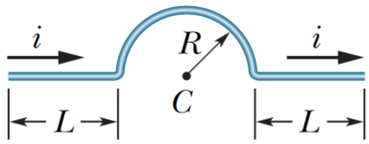

Figure 3: [HRW, 9E, Fig. 29-40]

Ans: (a) 1.18×10^{-7} T (b) into the page

7. [HRW, 9E, P29.11] In Figure 4, 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?

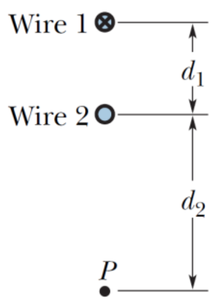

Figure 4: [HRW, 9E, Fig. 29-41]

Ans: (a) 4.3 A (b) out

Additional Questions for "Magnetic Forces and Fields (II)"

1. [HRW, 9E, Q29.1] **Error! Reference source not found.** shows three circuits, each consisting of two radial lengths and two concentric circular arcs, one of radius *r* and the other of radius *R* > *r*. The circuits have the same current through them and the same angle between the two radial lengths. Rank the circuits according to the magnitude of the net magnetic field at the center, greatest first.

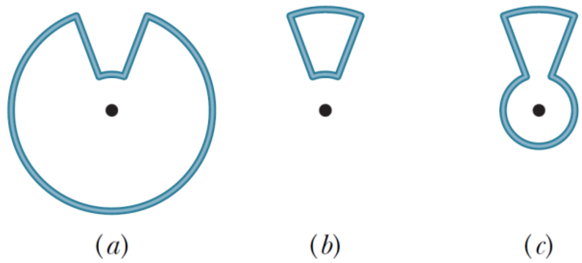

Figure 5: [HRW, 9E, Fig. 29-23]

Ans: c > a > b

2. [HRW, 9E, P29.21] Figure 6 shows two very long straight wires (in cross section) that each carry a current of 4.00 A directly out of the page. Distance d_1= 6.00 m and distance d_2 = 4.00 m. What is the magnitude of the net magnetic field at point *P*, which lies on a perpendicular bisector to the wires?

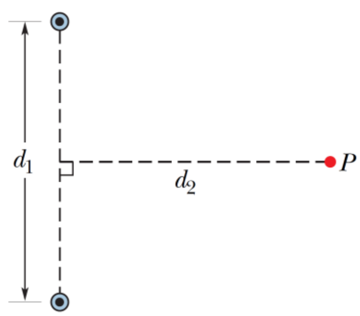

Figure 6: [HRW, 9E, Fig. 29-48]

Ans: 2.56×10^{-7} T

3. [HRW, 9E, P29.44] Figure 7 shows two closed paths wrapped around two conducting loops carrying currents i_1 = 5.0 A and i_2 = 3.0 A. What is the value of the integral for (a) path 1 and (b) path 2?

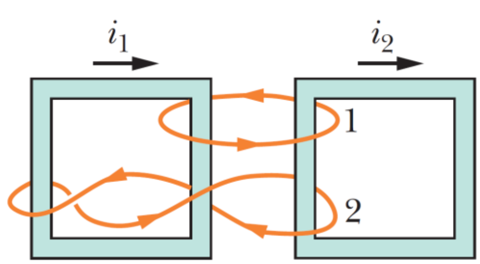

Figure 7: [HRW, 9E, Fig. 29-67]

Ans: (a) -2.5×10^{-6} T·m (b) -1.6×10^{-5} T·m