Chapter 29 – Problem Day

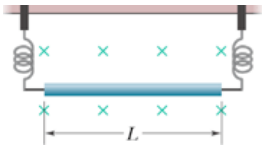
9. An electron has an initial velocity of $12\,\hat{j} + 15\,\hat{k}$ km/s and a constant acceleration of $(2 \times 10^{12})\hat{i}$ m/s² in a region with uniform electric and magnetic fields present. If $\vec{B} = 400\,\hat{i}$ μT, find the electric field $\vec{E}$.

18. An electron is accelerated from rest by a potential difference of 350 V. It then enters a uniform magnetic field of magnitude 200 mT with its velocity perpendicular to the field. Calculate (a) the speed of the electron and (b) the radius of its path in the magnetic field.

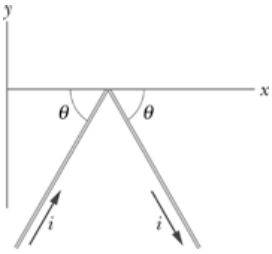
24. In the figure, a particle moves along a circle in a region of uniform magnetic field of magnitude $B = 4.00$ mT. The particle is either a proton or an electron (you must decide which). It experiences a magnetic force of magnitude 3.2×10^{-15} N. What are (a) the particle's speed, (b) the radius of the circle, and (c) the period of the motion?

26. A particle undergoes uniform circular motion of radius 26.1 μm in a magnetic field. The magnetic force on the particle has a magnitude of 1.6×10^{-17} N. What is the kinetic energy of the particle?

39. A 13.0 g wire of length $L = 62.0$ cm is suspended by a pair of flexible leads in a uniform magnetic field of magnitude 0.440 T. What are the (a) magnitude and (b) direction (left or right) of the current required to remove the tension in the supporting leads?

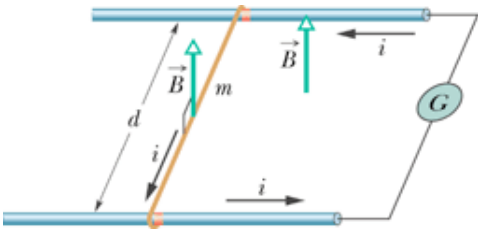


40. The bent wire shown in the figure lies in a uniform magnetic field. Each straight section is 2.0 m long and makes an angle of 60° with the x axis, and the wire carries a current of 2.0 A. What is the net magnetic force on the wire in unit-vector notation if the magnetic field is given by (a) $4\,\hat{k}$ T and (b) $4\,\hat{i}$ T?



41. A horizontal power line carries a current of 5000 A from south to north. Earth's magnetic field (60 μT) is directed toward the north and inclined downward at 70.0° to the horizontal. Find the (a) magnitude and (b) direction of the magnetic force on 100 m of the line due to Earth's field.

44. In the figure, a metal wire of mass $m = 24.1$ mg can slide with negligible friction on two horizontal parallel rails separated by distance $d = 2.56$ cm. The track lies in a vertical magnetic field of magnitude 56.3 mT. At time $t = 0$, device G is connected to the rails, producing a constant current $i = 9.13$ mA in the wire and rails (even as the wire moves). At $t = 61.1$ ms, what are the wire's (a) speed and (b) direction of motion (left or right)?



Chapter 29 – Problem Day Answers

9) $-11.4\,\hat{i} - 6\,\hat{j} + 4.8\,\hat{k}$ V/m

18a) 1.11×10^{7} m/s
18b) 3.16×10^{-4} m

24a) 4.99×10^{6} m/s
24b) 7.10 mm
24c) 8.93×10^{-9} s

26) 2.09×10^{-22} J

39a) 0.467 A
39b) left to right

40a) $-16\,\hat{j}$ N
40b) 0

41a) 28.2 N
41b) west

44a) 3.34 cm/s
44b) left