**28.54.** In Fig. 28.51 the battery branch of the circuit is very far from the two horizontal segments containing two resistors. These horizontal segments are separated by 5.00 cm, and they are much longer than 5.00 cm. A proton (charge $+e$) is fired at 650 km/s from a point midway between the upper two horizontal segments of the circuit. The initial velocity of the proton is in the plane of the
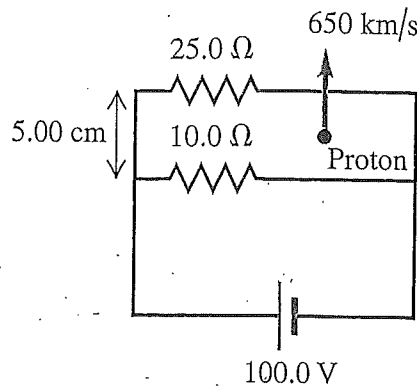
circuit and is directed toward the upper wire. Find the magnitude and direction of the initial magnetic force on the proton.

28.62. A pair of long, rigid metal rods, each of length L, lie parallel to each other on a perfectly smooth table. Their ends are connected by identical, very light conducting springs of force constant k (Fig. 28.55) and negligible unstretched length. If a current I runs through this circuit, the springs will stretch. At what separation will the rods remain at rest? Assume that k is large enough so that the separation of the rods will be much less than L.

Figure **28.55**
Problem 28.62.
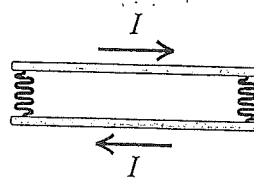
28.66. The wire semicircles shown in Fig. 28.58 have radii a and b. Calculate the net magnetic field (magnitude and direction) that the current in the wires produces at point P.

Figure **28.58**
Problem 28.66.