1993 PHYSICS B E & M



3. A particle of mass m and charge q is accelerated from rest in the plane of the page through a potential difference V between two parallel plates as shown above. The particle is injected through a hole in the right-hand plate into a region of space containing a uniform magnetic field of magnitude B oriented perpendicular to the plane of the page. The particle curves in a semicircular path and strikes a detector. Neglect relativistic effects throughout this problem.

(a) i. State whether the sign of the charge on the particle is positive or negative.

- ii. State whether the direction of the magnetic field is into the page or out of the page.
- (b) Determine each of the following in terms of *m*, *q*, *V*, and *B*.
 - i. The speed of the charged particle as it enters the region of the magnetic field B

ii. The force exerted on the charged particle by the magnetic field B

iii. The distance from the point of injection to the detector

iv. The work done by the magnetic field on the charged particle during the semicircular trip

Copyright © 1976 to 1998 by Educational Testing Service, Princeton, NJ 08541. All rights reserved. For face-to-face teaching purposes. Classroom teachers are permitted to reproduce the questions. Made available for convenience, accessibility and adaptation purposes by Ron Esman, Abilene High School, 2800 N. 6th Street, Abilene, Texas 79603