33.7 The Magnetic Force on a Moving Charge

27. For each of the following, draw the magnetic force vector on the charge or, if appropriate, write "\( \vec{F} \) into page," "\( \vec{F} \) out of page," or "\( \vec{F} = 0 \)."

![Diagram](image)

28. For each of the following, determine the sign of the charge (\(+\) or \(-\)).

![Diagram](image)

29. The magnetic field is constant magnitude inside the dashed lines and zero outside. Sketch and label the trajectory of the charge for

a. A weak field.

b. A strong field.

![Diagram](image)

30. A positive ion, initially traveling into the page, is shot through the gap in a horseshoe magnet. Is the ion deflected up, down, left, or right? Explain.

![Diagram](image)
31. A positive ion is shot between the plates of a parallel-plate capacitor.
   a. In what direction is the electric force on the ion?

   b. Could a magnetic field exert a magnetic force on the ion that is opposite in direction to the electric force? If so, show the magnetic field on the figure.

32. In a high-energy physics experiment, a neutral particle enters a bubble chamber in which a magnetic field points into the page. The neutral particle undergoes a collision inside the bubble chamber, creating two charged particles. The subsequent trajectories of the charged particles are shown.

   a. What is the sign (+ or −) of particle 1?

   What is the sign (+ or −) of particle 2?

   b. Which charged particle leaves the collision with a larger momentum? Explain. (Assume that \( |q| = e \) for both particles.)

33. A solenoid is wound as shown and attached to a battery. Two electrons are fired into the solenoid, one from the end and one through a very small hole in the side.

   a. In what direction does the magnetic field inside the solenoid point? Show it on the figure.

   b. Is electron 1 deflected as it moves through the solenoid? If so, in which direction? If not, why not?

   c. Is electron 2 deflected as it moves through the solenoid? If so, in which direction? If not, why not?

34. Two protons are traveling in the directions shown.

   a. Draw and label the electric force on each proton due to the other proton.

   b. Draw and label the magnetic force on each proton due to the other proton. Explain how you determined the directions.