18. If a solenoid were suspended by a string so that it could rotate freely, could it be used as a compass when it carried a direct current? Could it also be used if the current were alternating in direction?

MAGNETIC FORCE

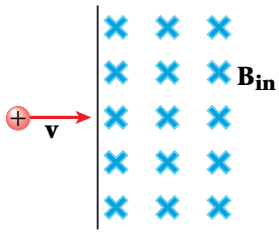
Review Questions

19. Two charged particles are projected into a region where there is a magnetic field perpendicular to their velocities. If the particles are deflected in opposite directions, what can you say about them?

20. Suppose an electron is chasing a proton up this page when suddenly a magnetic field pointing into the page is applied. What would happen to the particles?

21. Why does the picture on a television screen become distorted when a magnet is brought near the screen?

22. A proton moving horizontally enters a region where there is a uniform magnetic field perpendicular to the proton's velocity, as shown below. Describe the proton's subsequent motion. How would an electron behave under the same circumstances?

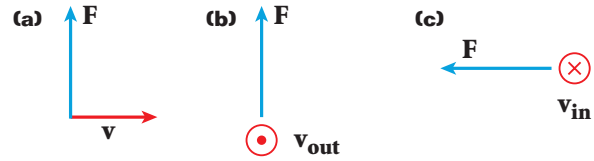


23. Explain why two parallel wires carrying currents in opposite directions repel each other.

24. Can a stationary magnetic field set a resting electron in motion? Explain.

25. At a given instant, a proton moves in the positive x direction in a region where there is a magnetic field in the negative z direction. What is the direction of the magnetic force? Does the proton continue to move along the x-axis? Explain.

26. For each situation below, use the movement of the positively charged particle and the direction of the magnetic force acting on it to find the direction of the magnetic field.



Conceptual Questions

27. A stream of electrons is projected horizontally to the right. A straight conductor carrying a current is supported parallel to and above the electron stream.

a. What is the effect on the electron stream if the current in the conductor is left to right?

b. What is the effect if the current is reversed?

28. If the conductor in item 27 is replaced by a magnet with a downward magnetic field, what is the effect on the electron stream?

29. Two wires carrying equal but opposite currents are twisted together in the construction of a circuit. Why does this technique reduce stray magnetic fields?

Practice Problems

For problems 30–31, see Sample Problem A.

30. A duck flying due east passes over Atlanta, where the magnetic field of Earth is 5.0×10^{-5} T directed north. The duck has a positive charge of 4.0×10^{-8} C. If the magnetic force acting on the duck is 3.0×10^{-11} N upward, what is the duck's velocity?

31. A proton moves eastward in the plane of Earth's magnetic equator, where Earth's magnetic field points north and has a magnitude of 5.0×10^{-5} T. What velocity must the proton have for the magnetic force to just cancel the gravitational force?

For problems 32–33, see Sample Problem B.

32. A wire carries a 10.0 A current at an angle 90.0° from the direction of a magnetic field. If the magnitude of the magnetic force on a 5.00 m length of the wire is 15.0 N, what is the strength of the magnetic field?