

Magnetism

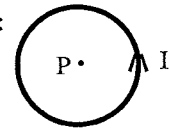
Direction of magnetic field produced by a current:

1. Find the direction of magnetic field at point P. a) next to a long straight current carrying wire: $\otimes I$

b) next to a long straight current carrying wire:

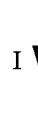
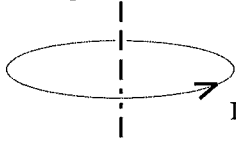


c) at the center of a circular current loop:



Draw magnetic field lines for the field produced by a current: (Not on the AP exam.)

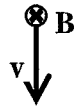
2. a) Draw magnetic field lines of a current loop, and b) draw magnetic field lines of a long straight current.



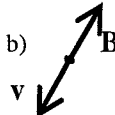
Magnetic force on a current or a moving charge:

3. Find the direction of the magnetic force on a positive charge for each diagram, where \mathbf{v} is the velocity of the charge and \mathbf{B} is the direction of the magnetic field.

a)

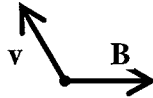


b)

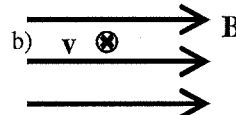


4. Find the direction of the magnetic force on a negative charge for each diagram, where \mathbf{v} is the velocity of the charge and \mathbf{B} is the direction of the magnetic field.

a)

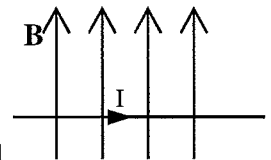


b)



5. a) What is the magnetic force per meter on a wire carrying a 3-A current when perpendicular to a 2-T magnetic field? b) What if the angle between the wire and field is 110° ?

6. Find the direction (draw an arrow to show direction) and magnitude of the magnetic force on a wire carrying 8 A. The wire is placed between the pole faces of a magnet. The diameter of the pole faces are 0.07 m. The magnetic field between the poles has a strength of 6 T. (Please refer to the figure to the right.)



7. Determine the magnitude and direction of the force on an electron traveling 2,000m/s vertically downward in a westward magnetic field of strength 6 T. Answer the direction in terms of north, south, east, west, up or down.

Charges doing circular motion in a uniform magnetic field:

8. A proton moves in a circular path perpendicular to a 1.2 T uniform magnetic field. The radius of its path is 2 cm. a) Calculate the speed of the proton. ($m_{\text{proton}} = 1.67 \times 10^{-27}$ kg) b) When looking downward, the path of the proton is clockwise. What is the direction of the magnetic field?

Applying both an electric field and a magnetic field to keep a charge moving straight undeflected:

9. A beam of β -ray (electrons) follows a eastward straight path through a region of uniform magnetic field and electric field. The northward magnetic field has a magnitude of 0.0002 T and the speed of the electrons is 200,000m/s.

a) What are the magnitude and the direction of the electric field?

The electric field is now removed, b) describe the path of the electrons in the uniform magnetic field, and c) determine the magnitude of the acceleration of the electrons. ($m_{\text{electron}} = 9.11 \times 10^{-31}$ kg)

Magnetic field produced by a long straight current:

10. a) What is the magnitude and direction of the magnetic field 0.2-m below a long straight horizontal wire carrying a 30 A westward current? b) What is the magnitude and direction of the magnetic field 0.1-m below the same wire?

Magnetic force between 2 currents:

11. a) What is the magnitude and direction of the force between two parallel wires (shown to the right) each 100 m long and 0.02 m apart, if one wire carries a 50 A current and the other a 30 A current in opposite direction?

b) What is the magnetic field halfway in between the two wires?

