

Problem-Solving Strategy 27.1 Magnetic Forces

IDENTIFY *the relevant concepts:* The equation $\mathbf{F} = q\vec{v} \times \vec{B}$ allows you to determine the magnetic force on a moving charged particle.

SET UP *the problem* using the following steps:

1. Draw the velocity \vec{v} and magnetic \vec{B} field with their tails together so that you can visualize the plane that contains them.
2. Determine the angle ϕ between \vec{v} and \vec{B} .
3. Identify the target variables.

EXECUTE *the solution* as follows:

1. Express the magnetic force using Eq. (27.2), $\mathbf{F} = q\vec{v} \times \vec{B}$. Equation (27.1) gives the magnitude of the force, $F = qvB \sin \phi$.
2. Remember that \vec{F} is perpendicular to the plane containing \vec{v} and \vec{B} . The right-hand rule (see Fig. 27.7) gives the direction of $\vec{v} \times \vec{B}$. If q is negative, \vec{F} is *opposite* to $\vec{v} \times \vec{B}$.

EVALUATE *your answer:* Whenever possible, solve the problem in two ways to confirm that the results agree. Do it directly from the geometric definition of the vector product. Then find the components of the vectors in some convenient coordinate system and calculate the vector product from the components. Verify that the results agree.