Moving Charges in a Magnetic Field

Charged Particles moving in a magnetic field experience a Force determined by...

$$F = qvB \sin \theta$$

1. What is the magnitude of the force exerted on an alpha particle (q = +2e) moving at 5.0 x 10^6 m/s at an angle of 25° to a magnetic field of strength 0.17 T?

The direction of the force can be determined using LHR #3 (see p.640)

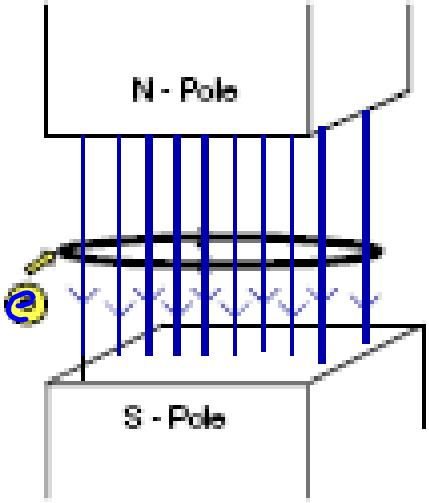
2. Calculate the magnitude and direction of the force acting on each of the particles below.

a) an electron moving at 6.0×10^6 m/s [right] in a magnetic field of 0.15 T [out of the page]

b) an electron moving at 2.8×10^6 m/s [down] in a magnetic field of 0.35 T [right]

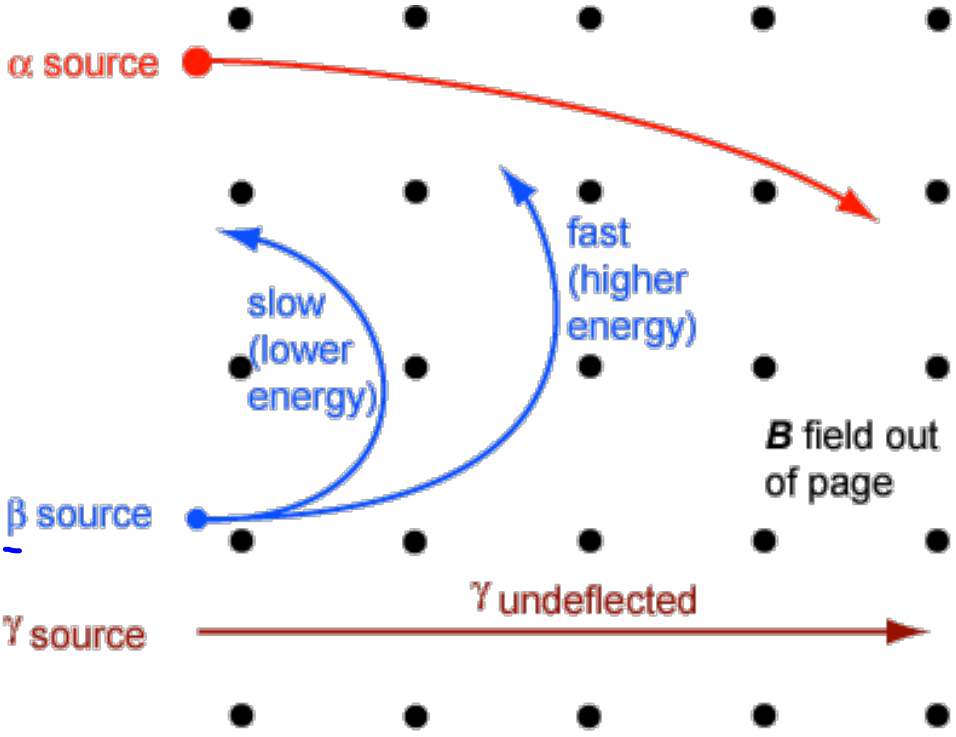
c) an electron moving at 5.5×10^6 m/s [out of the page] in a magnetic field of 0.50 T [down]

2. What is the magnitude of the force exerted on a proton (q = +e) moving at 3.0 x 10^6 m/s at an angle of 50° to a magnetic field of strength 0.0135 T?


N - Pole
S - Pole

Auroras are caused by high energy particles that are trapped in the Earth's magnetic field. The primary source of these charged particles is the stream of particles emanating from the Sun that we call the solar wind. As these particles spiral back and forth along the magnetic field lines, they come down into the atmosphere near the north and south magnetic poles where the magnetic field lines disappear into the body of the Earth.

The delicate colors are caused by energetic electrons colliding with oxygen and nitrogen molecules in the atmosphere. This excites the molecules, and when they decay from the excited states they emit the light that we see in the aurora.



Effect of a magnetic field on alpha, beta and gamma radiation

Physics 3204 August 2009
Value 3%

52.(f) An electron is projected perpendicularly into a 3.00×10^2 T magnetic field and travels in a circle with radius 7.5×10^3 m. Calculate the minimum velocity required to maintain the circular path.

A negatively charged particle with unknown mass enter the bending region of a mass spectrometer where the magnetic field is 0.6600 T. with a speed of 7.00 10^5 m/s. What is the mass of the particle if the radius of its circular path is 0.08m and the charge on the particle is 2.2 x 10^{-19}C?