**Magnetism Problems**

Current through a Wire: F = ILB

* B = magnetic field (T)
* I = current (A)
* L = length of wire (m)
* F = force (N)

Moving Charge: F = qvB

* B = magnetic field (T)
* q = charge (C)
* v = speed (m/s)
* F = force (N)

1. A proton (q = 1.6\*10-19 C) speeding through a synchrotron at 3.0\*107m/s experiences a magnetic field of 4.0 T that is produced by the steering magnets inside the synchrotron. What is the magnetic force pulling on the proton?
2. A 10.0-m long high-tension power line carries a current of 20.0 A perpendicular to Earth’s magnetic field of 5.5\*10-5 T. What is the magnetic force experienced by the power line?
3. Dean is hunting in the Northwest Territories at a location where Earth’s magnetic field is 7.0\*10-5 T. He shoots by mistake at a duck decoy, and the rubber bullet he is using acquires a charge of 2.0\*10-12 C as it leaves his gun at 300 m/s, perpendicular to Earth’s magnetic field. What is the magnitude of the magnetic force acting on the bullet?
4. A wasp accumulates 1.0\*10-12 C of charge while flying perpendicular to Earth’s magnetic field of 5.0\*10-5 T. How fast is the wasp flying if the magnetic force acting on it is 6.0\*10-16 N?
5. Kron, the alien freedom fighter from the planet Krimbar, shoots his gun that fires protons at a speed of 3.0\*106 m/s.
   1. What is Krimbar’s magnetic field if it creates a force of 2.88\*10-15 N on the protons?
   2. How does this compare to Earth’s magnetic field?
6. The magnetic field in Boston, Massachusetts has a horizontal component to the north of 0.18\*10-4 T and a vertical component of 0.52\*10-4 T straight downward.
   1. What is the magnitude and direction of Earth’s magnetic field in Boston?
   2. If a 2.0-m-long household wire is carrying a current of 15 A in a direction perpendicular to the field, what is the magnitude of the magnetic force experienced by the wire?

Ans: 1. 1.9 x 10-11 N 2. 0.011 N 3. 4.2 x 10-14 N 4. 12 m/s 5. 6.0 x 10-3 T, larger 6. 0.55 x 10-4 T, 710, 1.7 x 10-13 N