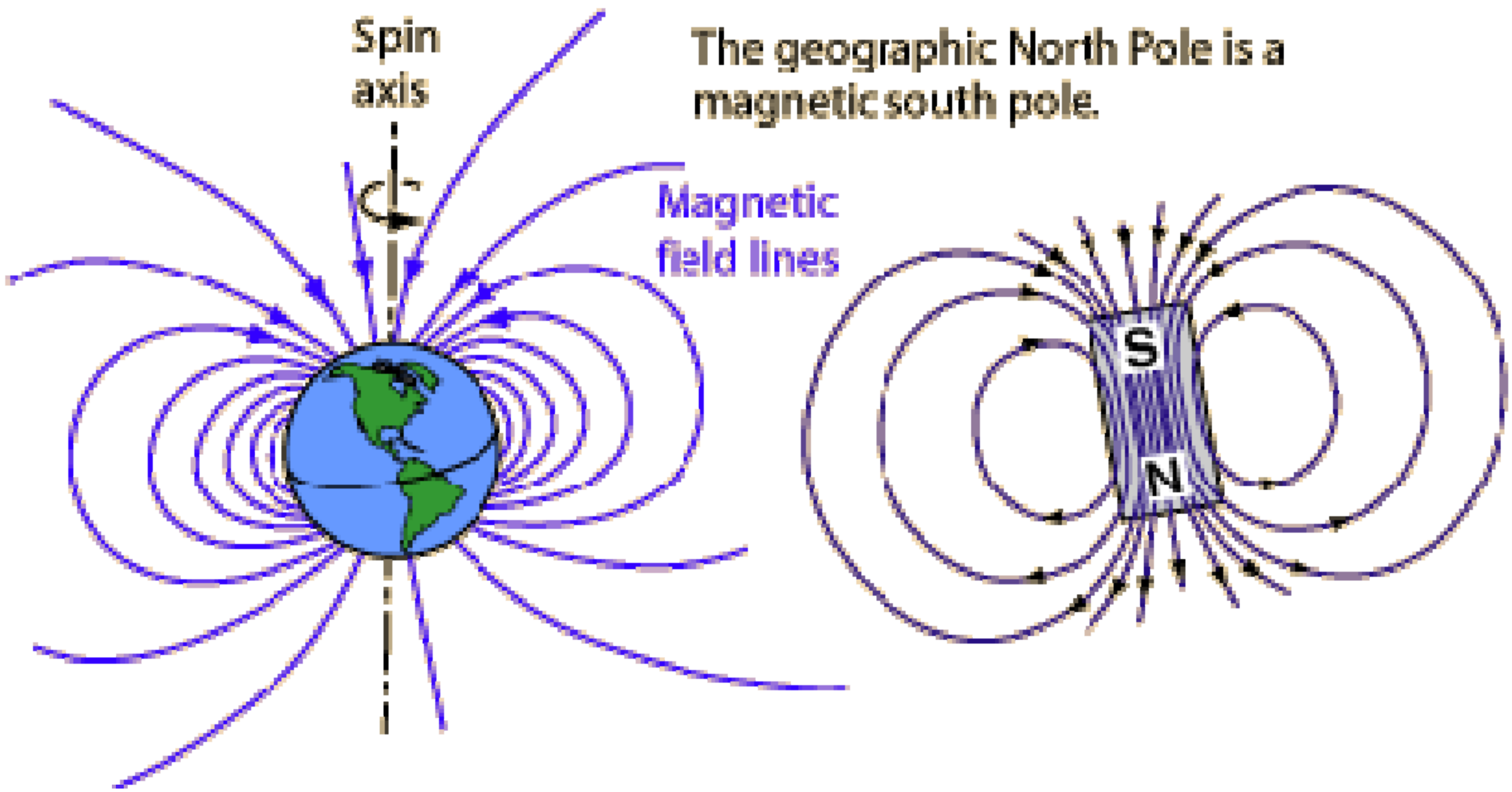
Test 3 Next Wednesday (Nov 1)

1. Chapters 9, 10 and possibly 11.
2. 45 minutes sharp.
3. 4 multiple choices and 2 long problems.
4. Formula sheet provided.
5. Contact me before next Monday for prearrangement if you need special accommodation.

Magnetic force acting on a moving point charge

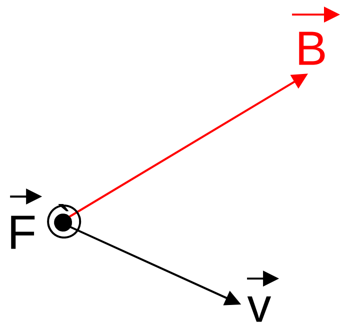
Magnetic Field



1. All single magnets have two poles, N and S.
2. Externally, magnetic field lines come out from the N pole and getting into the S pole.
3. Between two magnets, like poles repel and unlike poles attract.
4. The geographical north pole of earth is actually the S pole of a bar magnet.
5. We will explain why there is magnetic field later.

Magnetic Force Acting on a Moving Charge

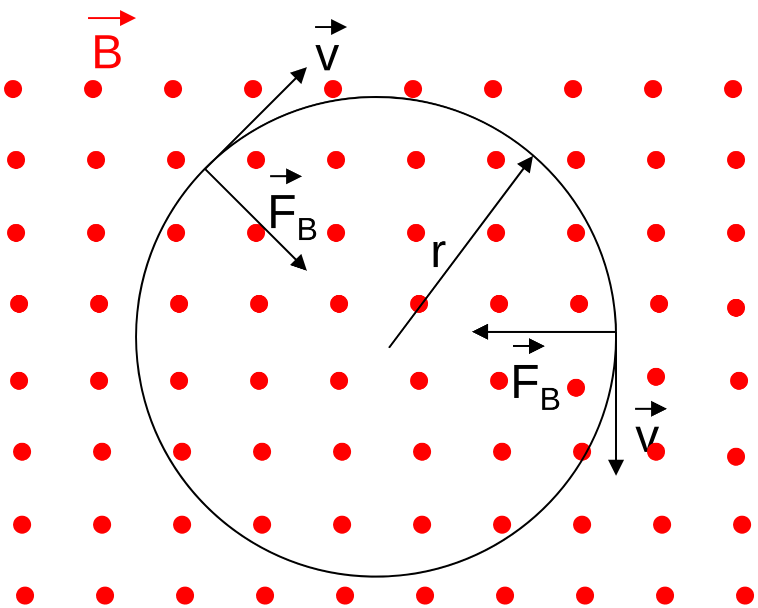
When a charge particle moves in a magnetic field B, there will be magnetic force acting on the particle:



$$\vec{F}_B = q\,\vec{v} \times \vec{B}$$

1. Unit of magnetic field is Tesla (T).
2. If there is magnetic field, only under two conditions the magnetic force on the charge particle will be zero: (i) the particle is not moving (v=0), or (ii) it is moving in parallel or antiparallel to the magnetic field ($\sin\theta=0$).
3. The magnetic force is always perpendicular to the magnetic field and the velocity.
4. The magnetic force does no work because $\vec{F}_B \cdot \vec{v} = 0$.
5. If you want to determine the direction acting on a negative charge particle, treat it like a positive charge first, then reverse the force direction at the end.

Motion of Charge Particle in a Uniform B field
$\Rightarrow$ Circular Motion of Constant Speed



1. $\vec{F}_B$ always perpendicular to $\vec{v} \Rightarrow$ Centripetal force
2. Magnetic force does no work $\Rightarrow$ Constant speed

Equation of motion:

$$q\,|v \times B| = m\frac{v^2}{r} \Rightarrow \boxed{qvB = m\frac{v^2}{r}} \Rightarrow \frac{v}{r} = \frac{q}{m}B$$

$$\Rightarrow \omega = \frac{q}{m}B \qquad \leftarrow \text{Cyclotgron frequency}$$