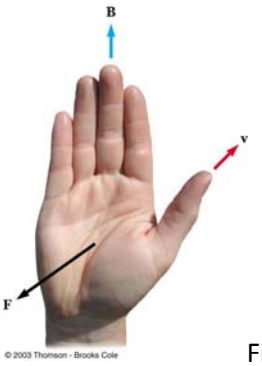
Chapter 19

Magnetism

- Magnets have poles; a north and south pole; opposite poles attract and like poles repel
- Magnetic field lines (B) travel from north to south; form closed loops with no beginning or end.
- The earth's magnetic north pole is not the exact same location as its geographic north pole. Geographic poles stay the same, the magnetic pole reverses throughout geologic time. The earth's magnetic north pole is actually a south pole now.
- Electric fields surround a stationary electric charge.
- Magnetic fields (and Electric fields) surround a moving charge.

$F=qvB\sin\Theta$ where F is magnetic Force in Newtons, q is charge in Coulombs, v is speed of m/s, and B is Magnetic Field in Tesla, Θ is angle between v and B

Right-hand rule #1 for a +q (for a –q, F in opposite direction by 180 degrees)



Fingers in direction of B, thumb in direction of v (or current I) and F comes out palm if a +q, or out top of hand if a –q.

Remember:

$F_{gravity}=m*g$

$F_{electric}=q*E$

$F_{magnetic}=qvB\sin\Theta$

$F=BIL\sin\Theta$

B in Tesla, I is current in Amps, L in length in meters, Θ is angle between B and I

Torque is $\mathbb{T}$

T caused by a magnetic field in a single loop

$\mathbb{T}=BIA\sin\Theta$ where B is in Tesla, I is in amps, A is area in m^2, and Θ is between I and B

if there is more than one loop, then $\mathbb{T}=NBIA\sin\Theta$

N=number of loops, n=N/l, which is #loops/unit length

if F=qvB then $F=qvb=mv^2/r$

so **r=mv/(qB)**

(use for the mass spectrometer problem); the radius of curvature of the path of a particle in a magnetic field)

Ampere's Law $B=\mu_o I/(2\pi r)$ $\mu_o=4\pi X10^{-7}$ Tm/A (permeability constant)

- Right-hand rule #2; Fingers-B curved around loop, and v or I is the thumb