PHYS 1444 – Section 004
Lecture #14

Wednesday, Mar. 28 2007
Dr. Andrew Brandt

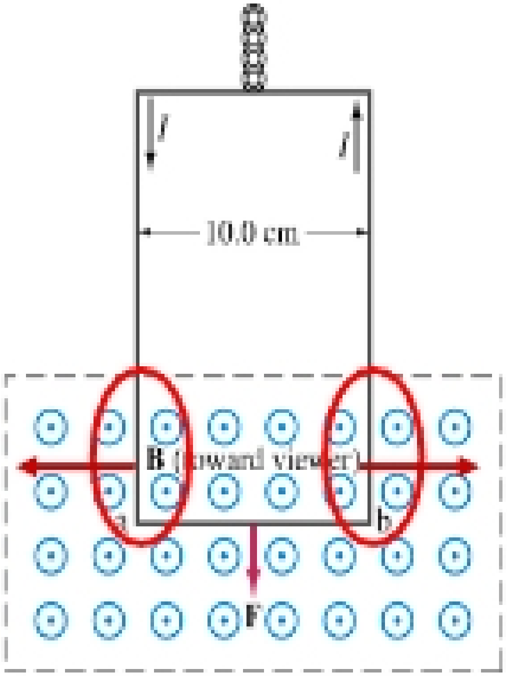
- Magnetic Forces
- Torque

HW6 due Fri 3/30 at 8 pm
Interim Grades posted

Magnetic Forces on Electric Current

- Direction of the force is always
  - perpendicular to the direction of the current and also
  - perpendicular to the direction of the magnetic field, **B**
- Experimentally the direction of the force is given by another right-hand rule ➔ When the fingers of the right-hand point to the direction of the current and the finger tips bent to the direction of magnetic field B, the direction of thumb points to the direction of the force
- I prefer the fingers along the B field, the thumb along the current (same as in the direction of B field around a wire) and palm for the force.

Example 27 – 1



Measuring a magnetic field. A rectangular loop of wire hangs vertically as shown in the figure. A magnetic field **B** is directed horizontally perpendicular to the wire, and points out of the page. The magnetic field **B** is very nearly uniform along the horizontal portion of wire **ab** (length l=10.0cm) which is near the center of a large magnet producing the field. The top portion of the wire loop is free of the field. The loop hangs from a balance which measures a downward force (in addition to the gravitational force) of $F=3.48\times10^{-2}N$ when the wire carries a current I=0.245A. What is the magnitude of the magnetic field B at the center of the magnet?

Magnetic force exerted on the wire due to the uniform field is $\vec{F} = I\vec{l} \times \vec{B}$

Since $\vec{B} \perp \vec{l}$ Magnitude of the force is $F = IlB$

Solving for B

$$B = \frac{F}{Il} = \frac{3.48 \times 10^{-2} N}{0.245A \times 0.10m} = 1.42T$$

What happened to the forces on the loop on the side?

The two forces cancel out since they are in opposite direction with the same magnitude.