PHYS 1444 – Section 02
Lecture #15

Tuesday Mar 29 2011

Dr. Andrew Brandt

Chapter 27

- Magnetic Force+Torque

HW7 Ch 27 is due Fri. April 1 @10pm

HW8 Ch 28 is due Th April 7 @ 10pm

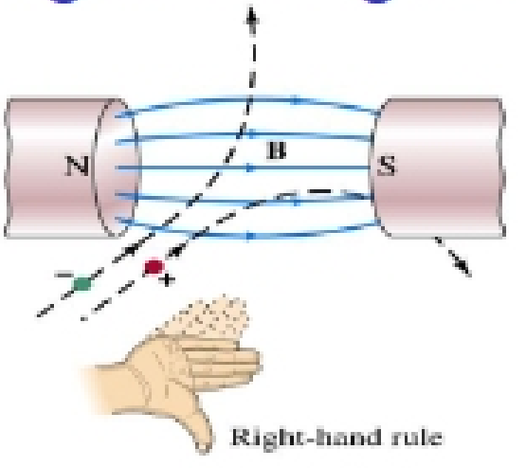
HW9 Ch 29 is due Tu April 12 @ 10 pm

Review April 12

Test 2 will be Thurs April 14 on Ch 26-29

Magnetic Forces on a Moving Charge

- This can be an alternative way of defining the magnetic field.
  - How?
  - The magnitude of the force on a particle with charge q moving with a velocity v
    - $F = qvB\sin\theta$
    - What is θ?
      - The angle between the magnetic field and the direction of particle's movement
    - When is the force maximum?
      - When the angle between the field and the velocity vector is perpendicular.
    - $F_{max} = qvB \rightarrow B = \frac{F_{max}}{qv}$
  - The direction of the force follows the right-hand-rule and is perpendicular to the direction of the magnetic field



Example 27 – 3

Magnetic force on a proton. A proton having a speed of 5×10^{6}m/s in a magnetic field feels a force of $F=8.0\times10^{-14}$N toward the west when it moves vertically upward. When moving horizontally in a northerly direction, it feels zero force. What is the magnitude and direction of the magnetic field in this region?

What is the charge of a proton? $q_p = +e = 1.6\times10^{-19}\,C$

What does the fact that the proton does not feel any force in a northerly direction tell you about the magnetic field?

The field is along the north-south direction. Why?

Because the particle does not feel any magnetic force when it is moving along the direction of the field.

Since the particle feels force toward the west, the field should be pointing to …. North

Using the formula for the magnitude of the field B, we obtain

$$B = \frac{F}{qv} = \frac{8.0\times10^{-14}\,N}{1.6\times10^{-19}\,C\cdot 5.0\times10^{6}\,m/s} = 0.10T$$

We can use a magnetic field to measure the momentum of a particle.