PHYS 1444 – Section 003
Lecture #16

Thursday, Oct. 27, 2011

Dr. Jaehoon Yu

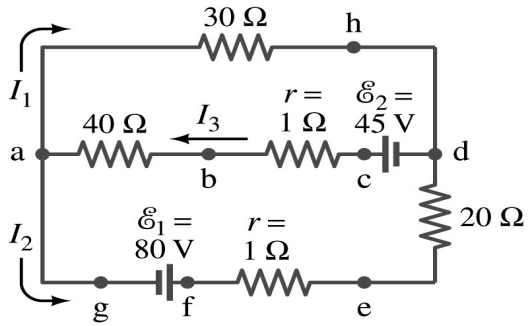
- Magnetism and Magnetic Field
- Electric Current and Magnetism
- Magnetic Forces on Electric Current
- About Magnetic Field
- Magnetic Forces on a Moving Charge
- Charged Particle Path in a Magnetic Field

Announcements

- Midterm exam results
  - Class average: 73/110
    - Equivalent to 66.4/100
    - How did you do last time?: 59.5/100
  - Top score: 99/110
- Mid-term grade discussion
  - Today in the bottom half of the class
  - Come to my office CPB342
  - Sequence of discussions
    - Those with time restrictions: 1 – 1:20pm
    - A – F: 1 – 2pm
    - F – O: 1:45 – 3pm
    - O – Z: 2:45 – 4pm

Special Project #5

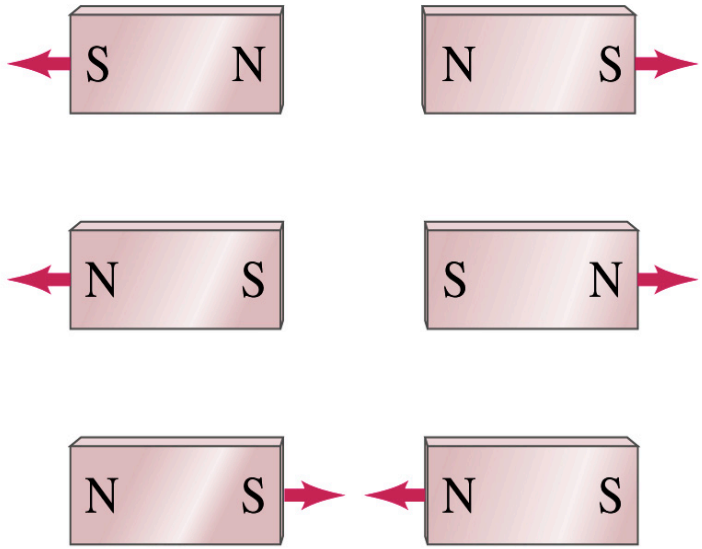
- In the circuit on the right, find out what the currents I_1, I_2 and I_3 are using Kirchhoff's rules in the following two cases:



  - All the directions of the current flows are as shown in the figure. (3points)
  - When the directions of the flow of the current I_1 and I_3 are opposite than what is drawn in the figure but the direction of I_2 is the same. (5 points)
  - When the directions of the flow of the current I_2 and I_3 are opposite than what is drawn in the figure but the direction of I_1 is the same. (5 points)
- Show the details of your OWN work to obtain credit.
- Due is at the beginning of the class Thursday, Nov. 3.

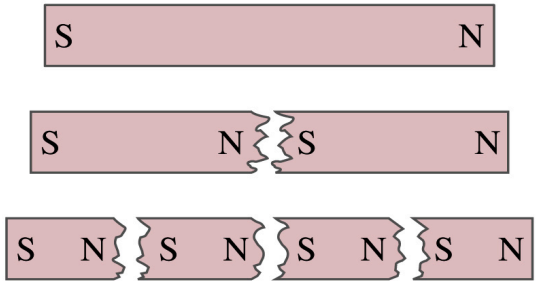
Magnetism

- What are magnets?
  - Objects with two poles, north and south poles
    - The pole that points to geographical north is the north pole and the other is the south pole
      - Principle of compass
  - These are called magnets due to the name of the region, Magnesia, where rocks that attract each other were found
- What happens when two magnets are brought to each other?
  - They exert force onto each other
  - What kind?
  - Both repulsive and attractive forces depending on the configurations
    - Like poles repel each other while the unlike poles attract



Magnetism

- So the magnet poles are the same as the electric charge?
  - No. Why not?
  - While the electric charges (positive and negative) can be isolated the magnet poles cannot be isolated.
  - So what happens when a magnet is cut?
    - If a magnet is cut, two magnets are made.
    - The more they get cut, the more magnets are made



  - Single pole magnets are called the monopole but it has not been seen yet
- Ferromagnetic materials: Materials that show strong magnetic effects
  - Iron, cobalt, nickel, gadolinium and certain alloys
- Other materials show very weak magnetic effects

Magnetic Field

- Just like the electric field that surrounds electric charge, a magnetic field surrounds a magnet
- What does this mean?
  - Magnetic force is also a field force
  - The force one magnet exerts onto another can be viewed as the interaction between the magnet and the magnetic field produced by the other magnet
  - What kind of quantity is the magnetic field? Vector or Scalar? **Vector**
- So one can draw magnetic field lines, too.
  - The direction of the magnetic field is tangential to a line at any point
  - The direction of the field is the direction the north pole of a compass would point to
  - The number of lines per unit area is proportional to the strength of the magnetic field
  - Magnetic field lines continue inside the magnet
  - Since magnets always have both the poles, magnetic field lines form closed loops unlike electric field lines