



### Activity 15.2: How Do Magnetic Domains Store Information?

- a) Hang a paper clip from a permanent bar magnet. Touch another paper clip to the end of the first clip. Now touch a third clip to the end of the second clip. How long a chain of paper clips can you make? \_\_\_\_\_ Explain what holds the clips together.
  
- b) Your instructor will demonstrate a magnet placed against a cassette tape. Describe what happens. Why does the magnet affect the tape?

### Activity 15.3: Magnetic Forces and Magnetic Fields

#### a) Magnetic Forces

- 1) Place two square magnets on a wooden dowel so that one magnet "floats" above the other. What force(s) act on the floating magnet?
  
- 2) What happens if you press the floating magnet down? Does the strength of the magnetic force change as you move the magnets closer together?
  
- 3) How does the magnetic force depend on the distance between the magnets?
  
- 4) If the floating magnetic has a mass of 5.0 grams, how large is the magnetic force that holds it up?

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#### b) Magnetic Fields

- 1) Move a magnet on the 2-dimensional square filled with liquid and iron filings. Place a cylindrical magnet inside the 3-dimensional shape with iron filings. Why do the filings clump in certain places?
  
- 2) Draw a diagram of a magnet and its field.

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- 3) Place the small compass magnaprobe on the model of the Earth. If like magnetic poles repel and unlike poles attract, why does the north end of the magnaprobe point toward the geographic North Pole of the globe?

### **Activity 15.4: How Are Magnetic Forces Related to Moving Charges?**

#### **a) Magnetic Force on a Current**

- 1) Place a wire between the ends of a large C shaped magnet. Briefly touch the ends of the wire to both terminals of a 3 battery tray. What happens to the wire?
- 2) Change the direction of the current flowing through the wire by switching the leads to the battery. Describe what happens.
- 3) Your instructor will demonstrate a metal swing placed near a large magnet. What happens when the swing is connected to a current source?

#### **b) Magnetic Force on a Moving Charge**

Cathode ray tubes (CRTs), used in computer screens and television tubes, shoot a beam of electrons from the back of the tube to the screen. A dot of light appears where the moving beam of electrons hits the screen. Locate the green dot on the screen of the cathode ray tube. (You may need to remove any magnets near the tube and adjust the two knobs on the side of the tube.) Now move a strong magnet near the screen. Explain what happens.

Your instructor will demonstrate a large magnet placed near a TV screen. **Caution: Do not try this at home!** A strong magnet will permanently damage a TV or computer screen.

#### **c) A Current-Carrying Wire Induces a Magnetic Field**

- 1) Press the black button on the board with a small compass connected to a battery. Make sure that the board is level and no large magnets are close to it. Describe what happens.

- 2) Your instructor will demonstrate a flicker light. What causes the light to flicker?
  
- 3) Your instructor will demonstrate the force between two parallel current-carrying wires.
  - a) Do the currents in the wires flow so that the wires attract or repel? \_\_\_\_\_
  - b) If the direction of the currents in both wires were reversed, would the wires attract or repel? \_\_\_\_\_
  - c) If the direction of current in one wire was reversed, but the current in the other wire was kept the same, would the wires attract or repel? \_\_\_\_\_
  
- 4) In each of these examples, what is the source of the magnetic force? Explain why the objects moved.

**d) Solenoids**

- 1) Place an iron rod partially inside the coil of a solenoid. Connect the solenoid to a 3-battery tray. Describe what happens.
  
  - 2) Repeat the activity using rods made of aluminum, brass, and steel. Which rod produces the strongest magnetic field? \_\_\_\_\_
  
  - 3) Does a coil of wire or a single straight wire have a stronger magnetic field? \_\_\_\_\_
  
  - 4) Your instructor will demonstrate a large electromagnet capable of lifting several hundred pounds. How can a battery make a magnet?
- e) Group Discussion Question: Some circuit breakers use a solenoid to open and close the circuit. How could a solenoid act like a switch to open and close a circuit?