Name: _____ Date: _____ Period: _____

Student Sheet #4: Three Ways to Generate Electricity

Part 1: Iron Filings Activity

Directions:

1. Place a piece of paper on top of firm plastic surface
2. Place bar magnet in the middle of the paper, underneath the plastic
3. Carefully shake iron filings on top of the paper while moving the container of iron back and forth attempting to evenly coat the paper.
4. Draw the shape of the iron filings on top of the paper

Part 2: Measuring Magnetic Force

Question: How does the distance of a magnet from a compass affect the angle of deflection?

Hypothesis:

Materials:
1 Compass
1 ruler/meterstick
1 weak magnet

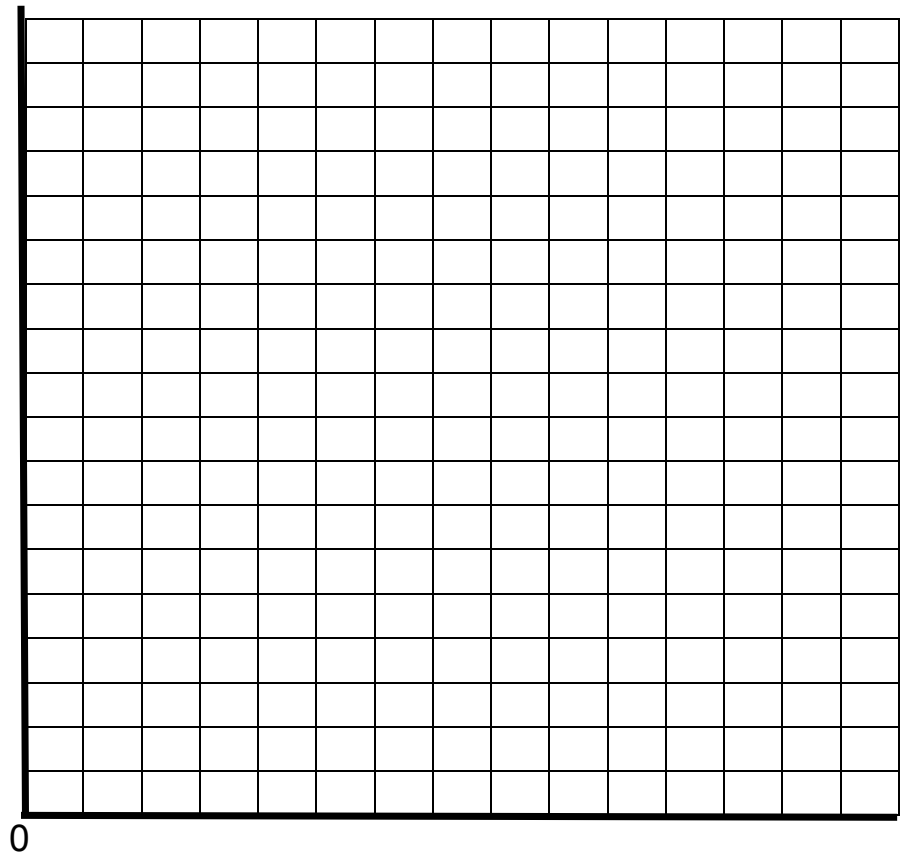
Procedure:

1. Place compass on a flat surface. Observe the needle pointing north.
2. Rotate the "face" of the compass until it is lined up with arrow pointing north. Tape your compass to the table (make sure you can still see the numbers☺)
3. Place a ruler next to the compass (on the right side if you are facing North) so that it extends out from the compass at 90 degrees. Tape the ruler down on the table as well.
4. Slowly move your magnet from the far end of the ruler towards the compass in increments of 2 cm each time (make sure you keep the orientation of the magnet the same the whole time). If the needle moves the opposite way, then change the orientation of the magnet. When you see the compass begin to move, note the distance on the ruler and move the magnet 2 cm farther away (to the previous location of the magnet). Record the distance in your data table and the angle of the compass (the angle should be zero for this point – this will be the distance for "zero" deflection in your table.)
5. Move the magnet 2 cm towards the compass. The needle should move this time. Record the distance and the angle of the compass.
6. Continue moving the magnet towards the compass by 2 cm each time. Record the distance and angle each time.
7. Stop moving the magnet when the needle no longer moves.

Data: Magnet Distance vs. Angle of Deflection

Distance between compass and magnet (cm)	Angle of Deflection (Degrees)

Graph: Title: Distance from Compass vs. Angle of Deflection



Conclusion:

- Answer the question
- Discuss your hypothesis
- Include data
- Explain how your data supports your hypothesis

Questions from the investigation:

1. As you moved the magnet closer to the compass, what happened to the angle of the compass?

2. What does this tell us about the strength of a magnetic field as you move closer to a magnet?

3. Look at your graph, what is the shape of the line? What does this tell us about the relationship between distance and magnetic field strength?

Part 3: Can you light a bulb with a motor?

Directions:

1. See if you can use the materials provided (electric motor, alligator clips, light bulb, and multimeter) to generate electricity to light up the bulb.
2. Whether or not you are able to light your bulb, use your multimeter to measure the amount of voltage being created.
3. Draw a labeled diagram of your successful apparatus in the box below:

What was the highest amount of voltage you were able to generate with your "motor"?

Part 4: Can you light a bulb with a photovoltaic cell?

Directions:

1. Use the same experimental setup from Part 3 except this time replace the motor/generator with the photovoltaic cell provided. Direct the clamp light so that the light from the bulb is shining directly on the photovoltaic cell (be careful not to place the light too close or it will melt the photovoltaic cell).
2. Whether or not you are able to light your bulb, use your multimeter to measure the amount of voltage being created.
3. Draw a labeled diagram of your successful apparatus in the box below:

What was the highest amount of voltage you were able to generate with your "Photovoltaic cell"?

Questions to Answer:

1. What happened when you spun the electric motor?

2. How did the amount of voltage change when you turned the axle on the motor at different speeds?

3. What happened when you placed the photovoltaic cell in direct light?

4. How did the angle of light affect the amount of voltage you generated from the PV cell?

5. What challenges did you face as you tried to get the light bulb to light up with the motor?

6. What challenges did you face as you tried to get the light bulb to light up with the photovoltaic cell?

7. What energy transformation(s) occurred when you lit the light bulb with the motor? With the photovoltaic cell?

8. Do you think the “motor” or the PV cell is more similar to how we generate electricity in hydroelectric, coal, and wind energy?