# Floating Paperclip Lab

## Standards Addressed:

GLE 0607.Inq.1 Design and conduct open- ended scientific investigations.
GLE 0807.Inq.2 Use appropriate tools and techniques to gather, organize, analyze, and interpret data.
SPI 0807.12.3 Distinguish among the Earth's magnetic field, a magnet, and the fields that surround a magnet and an electromagnet.

Please not that this lab includes three different versions of the same activity. One is a cookbook lab, one is guided inquiry, and one is a full inquiry lab. The teacher and fellow should choose the level of inquiry most appropriate to their classes.

This lab also calls for ring stands that are not provided. It is possible to substitute a stack of textbooks for the same purpose. The string can be on a diagonal rather than straight up and down. In order for the lab to be successful, the paper clip needs to be floating pulled toward a higher mounted magnet. There needs to be space between the magnet and the anchored paperclip that is pulled toward it.

**Caution:** Magnets are strong. They can usually be pulled apart by sliding rather than pulling straight. Please use caution as they can badly pinch skin and fingers coming together.

Supplies:

- Notebook with lesson summery and printable lessons
- 12 Neodymium magnets (smaller than a dime)
- 6 Bags each with:
    - Ceramic tile
    - Cardboard tile
    - Steel tile
    - Wooden stick
    - Metal Washer
    - Felt Square
    - Aluminum Foil
    - Foam Square
- 2 Pairs of Scissors
- 3 rolls of scotch Tape
- Bag with at least 4 Thread spools & at least 50 paperclips

# Floating Paperclip Cookbook Lab

**PURPOSE:**
The purpose of this lab is to determine what types of objects would attract a magnet and break a magnetic field between a magnet and suspended paperclip. We will use this to analyze what it means for an object to be magnetic or have magnetic properties.

**BACKGROUND:**
Magnetism is a natural force that acts between certain objects called magnets. The earth itself acts as if its center contains a large magnet. Surrounding the earth is a magnetic field where magnetism can be found. Magnetic fields lie around every magnet. Magnets and magnetism are used every day and in many ways. Magnets in telephones, television sets and radios help change electrical impulses into sounds. Compasses made with magnets help navigators guide ships safely. Without magnetism, we could not produce large amounts of electricity. The areas where magnetism is the strongest are called the poles of a magnet. Every magnet has two poles, a north and south pole. If a bar magnet is broken in the middle, new poles will appear at the broken ends. The poles are named by the direction to which they point. The north and south poles of a magnet point as they do because the earth's magnetic poles attract them. The magnetic poles of the earth are near the North and South geographic poles. In the above experiment, the paper clip floats in mid-air because the force of magnetism travels through the air between the paper clip and the magnet.

**MATERIALS:**
- Strong magnet
- Wood block
- Metal washer
- Aluminum foil
- Steel
- Cardboard square
- Felt square
- Foam square
- Piece of string or thread
- Paperclip
- Ring stand
- Ceramic tile

**PROCEDURES:**

1. Construct the floating paperclip apparatus:
    a. Clamp a strong magnet to the pole of a ring stand.
    b. Make sure the magnets do NOT come in contact with any computers!
    c. Attach a large metal paperclip to the thread or string.
    d. Tape the string to the base of the ring stand or the table at a point where the paperclip is attracted to, but not touching, the magnet.
    e. There should be a space approximately ½ inch wide between the paperclip and magnet.
    f. After assembling the apparatus, do not touch the apparatus.
2. The materials manager in the group will come to the supply table, gather all materials, and take the materials back to the group.
3. As a group, predict what you think will happen if you stick each of the materials into the space between the magnet and the paperclip.
4. Write your predictions in the table on the next page (PREDICTIONS section).
5. After you write down your predictions, you will test each material to see if it breaks the magnetic field.
6. Slowly insert each of the materials into the space between the magnet and the paperclip ONE AT A TIME.
7. Write your results in the RESULTS table on page 3.

**PREDICTIONS:**

| **Material** | **Will the material break the magnetic field? (YES or NO)** |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**RESULTS:**

| **Material** | **Did the material break the magnetic field? (YES or NO)** |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**DISCUSSION:**

1. Why did the different materials NOT break the magnetic field? It helps to write about one material at a time.

2. Why did the other materials break the magnetic field?

3. Can you think of an example of this lab in your everyday life?

# Floating Paperclip Guided Inquiry Lab

**TESTABLE QUESTION:**
What is the purpose of this lab, and what do you want to know?
In small groups, read the background section and write questions down on the post-it notes that you want answered.
Place the post-it-notes on the white board in the front of the room.
We will work as a group to identify which questions are testable, and those we cannot answer in class.
We will come up with one question for the entire class to answer.

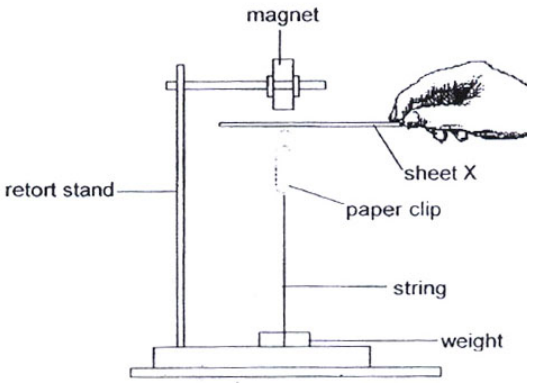
**BACKGROUND:**
Magnetism is a natural force that acts between certain objects called magnets. The earth itself acts as if its center contains a large magnet. Surrounding the earth is a magnetic field where magnetism can be found. Magnetic fields lie around every magnet. Magnets and magnetism are used every day and in many ways. Magnets in telephones, television sets and radios help change electrical impulses into sounds. Compasses made with magnets help navigators guide ships safely. Without magnetism, we could not produce large amounts of electricity. The areas where magnetism is the strongest are called the poles of a magnet. Every magnet has two poles, a north and south pole. If a bar magnet is broken in the middle, new poles will appear at the broken ends. The poles are named by the direction to which they point. The north and south poles of a magnet point as they do because the earth's magnetic poles attract them. The magnetic poles of the earth are near the North and South geographic poles. In the above experiment, the paper clip floats in mid-air because the force of magnetism travels through the air between the paper clip and the magnet.

**MATERIALS:**
- Strong magnet
- Wood block
- Metal washer
- Aluminum foil
- Steel
- Cardboard square
- Felt square

- Foam square
- Piece of string or thread
- Paperclip
- Ring stand

**PROCEDURES:**

8. Construct the floating paperclip apparatus:
    a. Clamp a strong magnet to the pole of a ring stand.
    b. Make sure the magnets do NOT come in contact with any computers!
    c. Attach a large metal paperclip to the thread or string.
    d. Tape the string to the base of the ring stand or the table at a point where the paperclip is attracted to, but not touching, the magnet.
    e. There should be a space approximately ½ inch wide between the paperclip and magnet.
    f. After assembling the apparatus, do not touch the apparatus.




9.

10.

11.

12.

13.

**HYPOTHESIS:**

Write a statement that will tell us what you think will happen based on the procedures the class designed.
Follow: If _____, then _____ will happen.
In other words, "If I do <u>this</u> (procedure), then <u>this</u> (result) will happen."

**RESULTS:**
We will design a data table that we can use as a class to communicate our findings.

**DISCUSSION:**
As a class, we will work in groups to discuss our results. We will then share the results as a class, and come up with explanations that help us to determine WHY the experiment worked the way it did.
Record here what the class determined for the explanation of the scientific phenomenon.

# Floating Paperclip Full Inquiry

We are studying magnetism today. We will be designing an apparatus that will tell us if something is magnetic or has magnetic properties. Your job is to take the materials provided and design a way to test if something is magnetic.

**Your rules are:**

- You are NOT allowed to touch the material to the magnet directly.
- You must create a magnetic field that can/cannot be broken by the material.
- You must define a testable question (able to answer in one class period).
- You must provide a hypothesis, and a list of materials and procedures to the teacher for approval BEFORE starting your experiments.
- Every member of the team MUST have a role in the design and experimentation process. Record each team member's name and role.
- You must record your results as you collect the data.
- You will conduct research about magnetism after you collect your data to determine WHY you got the results that you did.
- You will communicate your findings as one of the following:
    - Poster
    - Comic book
    - Painting or other artistic work approved by your teacher
    - Written report
    - Presentation