# Assignment Summary

In this assignment, you will review some student lab results on electromagnets. You will analyze the data and graph the results. You will then present your results on the Student Worksheet found at the end of this document.

# Background Information

The strength of an electromagnet depends on several factors, including the number of coils wrapped around the core of the electromagnet and the voltage of the power source. The greater the number of coils, the stronger the electromagnet. And, the greater the voltage, the stronger the electromagnet.

Electromagnets Student Worksheet

# Scenario

A group of students has been testing electromagnets in the lab. They made an electromagnet by wrapping copper wire around a nail. For one set of tests, they wrapped the wire around the nail 25 times. For the second set of tests, they wrapped the wire around the nail 50 times. They also have 4 different batteries: 1.5 V, 3.0 V, 4.5 V, and 6.0 V. They use their electromagnets to see how many paper clips each can pick up.

# Data

For each electromagnet, two trials were conducted at each voltage. The data was recorded in the tables below.

**25-turn Electromagnet**

|  |  |  |  |
| --- | --- | --- | --- |
| **Battery Voltage** | **Number of Paper Clips Picked Up** | | **Average** |
| **First Try** | **Second Try** |
| 1.5 V | 5 | 7 | 6 |
| 3.0 V | 12 | 12 | 12 |
| 4.5 V | 14 | 17 | 15.5 |
| 6.0 V | 20 | 26 | 23 |

**50-turn Electromagnet**

|  |  |  |  |
| --- | --- | --- | --- |
| **Battery Voltage** | **Number of Paper Clips Picked Up** | | **Average** |
| **First Try** | **Second Try** |
| 1.5 V | 10 | 16 | 13 |
| 3.0 V | 28 | 24 | 26 |
| 4.5 V | 30 | 32 | 31 |
| 6.0 V | 44 | 50 | 47 |

# Graphing Data

Make a line graph of the data found above. On the same graph, show the average number of paper clips each electromagnet picked up for each voltage tested. Plot the voltage on the *x*-axis and the average number of paper clips picked up on the *y*-axis. Scale the *x*-axis in intervals of 1.5 volts and scale the *y*-axis in intervals of 5 paper clips.

## Questions

1. Look at the data table and graph for the 25-coil electromagnet. With the 1.5 V battery, the electromagnet picked up an average of 6 paper clips, and with the 6.0 V battery, it picked up an average of 23 paper clips.
   1. About how many times stronger than the 1.5 V battery is the 6.0 V battery?
   2. What is the approximate ratio of the number of paper clips picked up using the 6.0 V battery to the number picked up using the 1.5 V battery?
   3. Is this a direct relationship or an indirect relationship?
2. Look at the data table and graph for the 50-coil electromagnet. With the 1.5 V battery, the electromagnet picked up an average of 13 paper clips, while the 25-coil electromagnet picked up an average of 6 paper clips.
   1. What is the ratio of the number of turns of the 50-turn electromagnet to the number of turns of the 25-coil electromagnet?
   2. What is the approximate ratio of the number of paper clips picked up by the 50-coil electromagnet?
3. What does doubling the number of coils do to the strength of the electromagnet?
4. What does doubling the voltage do to the strength of the electromagnet?
5. Using the graph, predict how many paper clips a 7.5 V battery would pick up for both the 25-coil electromagnet and the 50-coil electromagnet.
6. Calculate the slope of the 25-coil line and the 50-coil line to determine the average number of paper clips that a 1 V battery would pick up.