

Magnets, fields and electromagnets

Grade 8 science (Year 9 · Class 8) · Lab

Name: _____ Date: _____ Class: _____

How does the number of turns in a coil change the strength of an electromagnet? In this lab you wind coils with different numbers of turns on an iron nail, count how many paper clips each one lifts, and look for a pattern in your results.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS2-3, MS-PS2-5

Aim

To find how the number of turns in a coil changes the strength of an electromagnet, measured by the number of paper clips it lifts.

Equipment

- Iron nail, about 10 cm long
- Insulated copper wire, about 3 m
- 2 cells in a holder (3.0 V) and a switch
- Connecting leads
- 50 steel paper clips

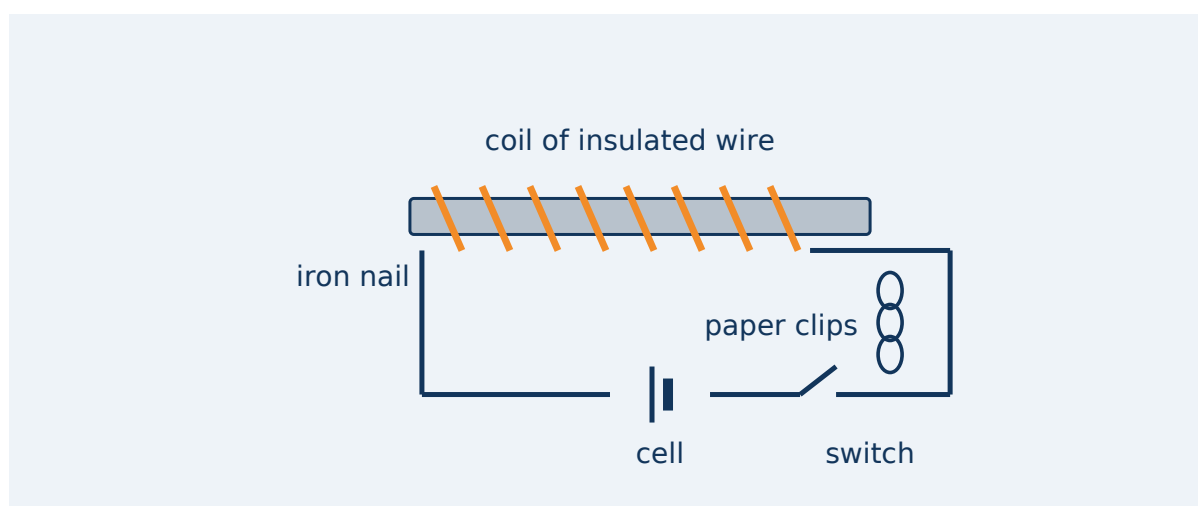
Safety

Safety

The coil and nail get warm. Keep the switch closed for only a few seconds at a time and never short-circuit the cells. Keep magnets away from phones and bank cards.

Method

1. Wind 10 turns of wire tightly round the nail and connect it to the cells and switch as shown.
2. Close the switch and touch the end of the nail to the pile of paper clips.
3. Lift the nail slowly and count the clips that hang from it, then open the switch.
4. Repeat the reading 3 times for the same coil.
5. Wind more turns (20, 30, 40, 50) in the same direction and repeat steps 2 to 4 each time.



Electromagnet set-up for counting the paper clips lifted.

Results

Sample results from one group:

Number of turns	Trial 1	Trial 2	Trial 3
10	3	4	3
20	6	7	7
30	10	9	10
40	13	13	14
50	16	17	16

Analysis questions

Question 1 What changes and what stays

Name what you change, what you measure and two things you keep the same.

Question 2 Mean values

Calculate the mean number of clips for each number of turns.

Question 3 Graph

Plot a graph of mean clips (y-axis) against turns (x-axis) and describe the line. Calculate the gradient.

Question 4 Prediction

Use the gradient to predict the clips lifted by 35 turns and by 60 turns. Say which prediction is less reliable.

Question 5 Explain the trend

Explain why more turns lift more clips.

Question 6 Reliability

Explain why the readings were repeated three times and what you would do about a reading far from the others.

Question 7 Improvements

Suggest two improvements to the method.