

Magnets, fields and electromagnets

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

Model answers use the sample table. Your own counts will differ a little, but you should still find that the number of clips rises steadily with the turns, giving a line close to a straight line through the origin.

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

Question 1 What changes and what stays

You change the **number of turns** and measure the **number of paper clips lifted**. Keep the same nail, the same cells and the same type of paper clip.

Question 2 Mean values

10: $(3 + 4 + 3) \div 3 = 3.3$; 20: $(6 + 7 + 7) \div 3 = 6.7$; 30: $(10 + 9 + 10) \div 3 = 9.7$; 40: $(13 + 13 + 14) \div 3 = 13.3$; 50: $(16 + 17 + 16) \div 3 = \mathbf{16.3 \text{ clips}}$.

Question 3 Graph

The points lie close to a **straight line through the origin**, so the clips are proportional to the turns. Gradient = $(16.3 - 3.3) \div (50 - 10) = 13 \div 40 = \mathbf{0.33 \text{ clips per turn}}$.

Question 4 Prediction

35 turns: $0.325 \times 35 = 11.4$, so about **11 clips**. 60 turns: $0.325 \times 60 = 19.5$, about **20 clips**. The 60-turn value is less reliable because it is outside the range tested.

Question 5 Explain the trend

Each turn of wire carries the same current and makes its own magnetic field. The fields of all the turns add together, so **the nail becomes a stronger magnet** and attracts more clips.

Question 6 Reliability

Repeating shows how much the results vary, and **a mean reduces the effect of random errors**. A reading far from the rest is an anomaly: check it, repeat it, and leave it out of the mean if it is clearly a mistake.

Question 7 Improvements

The cells run down as the current flows, so switch on briefly and check the voltage; also use

small steel washers or weigh the load lifted to get a finer measure than whole paper clips.

Any two sensible improvements.