

Charge, fields and sparks

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

The model answers use the sample table. Your own counts will vary with humidity, the cloth and how evenly you rub, but you should still see more bits lifted at first and then a levelling off.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE P2, HS-PS2-4

Question 1 Plot the graph

Plot (10, 2.3), (20, 5.0), (30, 8.3), (40, 11.0), (50, 12.3). The curve rises steeply at first and then flattens near **12 bits**.

Question 2 Describe the trend

The number of bits rises from 2.3 at 10 rubs to 12.3 at 50 rubs. It is roughly proportional at first, so **more rubbing gives more charge**, but it increases more slowly at the end.

Question 3 Why it levels off

As charge builds up it leaks into the air, and more charge on the strip repels further charge. Once the gain and the loss balance, rubbing no longer adds charge, so the strip reaches a **maximum**.

Question 4 Control variables

Same strip and cloth, same rubbing speed and pressure, same height of 2 cm and same time over the paper. **Changing any of these** would alter the charge or the force and spoil the comparison.

Question 5 Humidity

Damp air contains water that conducts, so charge leaks off the strip quickly. Fewer bits would be lifted; the result would be **lower** for every number of rubs.

Question 6 Reliability

The three repeats differ by at most 2 bits at any number of rubs, which is a spread of about 8-40 % at low counts. Averaging three trials gives a **fairly reliable** mean, but more repeats would help.

Question 7 Improvement

Use a gold-leaf electroscope or a charge sensor, or lift bits of foil of a known mass, so that the measure is **continuous instead of a count**.