Prediction and planning

Business

The aim of this investigation is to find out if the length of a wire affects the amount of electrical resistance. Looking at the problem, I think that the longer the wire the more resistance there will be.

I think that the factors that affect the experiment are the Material the wire is made from, the Temperature of the wire, the Wire Width, and finally the Wire Length. The variable I will be changing is the wire length. I predict that as the wire length increases, the amount of resistance will increase in proportion to the length. I predict this because the longer the wire, the more atoms there are so the free electrons are more likely to collide with other atomsI will carry out my experiment by setting out the apparatus as it shows below. I will note down in a table the voltage and the current (amps) every 10cm (10, 20, 30, 40, 50, 60, 70, 80, 90, 100cm) along the wire so I will achieve 10 results per experiment.

Then I will repeat the experiment so I end up with three sets of results. To make sure the experiment is fair I will keep the same wire for each part of the experiment so the wire material and width are the same, and I will do the experiment in the same room at the same time to make sure the temperature is constant. I am going to record the current for all of the readings as you will get more accurate results, e. g. if the temperature changes the results won’t be affected too badlyEquipment1 m nickel chrome wire, 2 D size batteries, 1 circuit board, 1 metre ruler, safety glasses, 5 plastic coated wires with crocodile clips, 1 voltmeter and 1 ammeter.

Method1. Set up the apparatus as shown in the diagram2. Use the metre ruler to mark out every 10 cm along the wire3. Place the free wire from the

voltmeter on every mark and note down the voltage and current from each mark4. Record the voltage and current down in a table and use Ohm’s law (V= I*R) to work out the amount of resistanceFor safety reasons I made sure I had a pair of safety glasses on at all times and I used Cello tape to attach the wire to my desk.

Here is the table showing my resultsLength (cm)VoltageAmpsResistance (?)100. 150. 360. 41200. 310.

350. 89300. 470. 341. 38400. 630.

341. 85500. 790. 342. 32600. 930.

342. 74701. 080. 343. 18801.

340. 343. 65901. 220. 274. 521000.

960. 214. 57100. 160. 320.

48200. 30. 320. 94300. 450.

321. 41400. 60. 321. 88500.

760. 322. 38600. 880. 322.

75701. 040. 323. 25801. 20. 323.

75901. 320. 314. 261001. 520.

334. 61100. 140. 320. 44200.

290. 310. 94300. 450. 321. 40400.

660. 361. 83500. 810. 352.

31601. 020. 362. 8701. 180.

373. 2801. l220. 333. 69901. 320.

324. 161001. 620. 354. 62This table shows the average resistances of the previous table. With this I can draw an accurate graph.

Length (cm)Resistance (?)100. 44200. 92301. 39401. 85502. 34602.

76703. 21803. 70904. 311004. 6See line graphAnalysis and ConclusionFrom the graph I have drawn you can see that my prediction was correct – that the amount of resistance would increase as the length increased.

As the line of best fit I have drawn is straight, I know that the amount of resistance increases in proportion to the wire length. The reason resistance occurs is that the atoms of all conductors have free electrons in their outer shell. This means that the other electrons can move freely even in a solid substance. When there is a potential difference across a conductive metal all of the free electrons arrange themselves into lines moving in the same direction. This forms electrical current.

When the free electrons in the wire collide with the atoms of the wire, resistance occurs. Resistance turns electrical energy into heat energy, so the more resistance there is the more energy is lost. That means that the collisions slow down the flow of electrons and takes away some of their charged energy. Therefore, if the length of a wire is increased then the amount of resistance will also increase because the electrons will have to

travel further, so they will have more collisions. The resistance increases in proportion to the length as the amount of atoms in wire also increases in proportion to its length.

This means that if the length of wire was doubled, the amount of atoms would double and therefore the amount of collisions and resistance would also double. EvaluationI think that my experiment worked well and produced reliable results. I think this because the results I have achieved coincide with the scientific research I have carried out. There were no absolute anomalous results, but my results were not all perfect. I think that the problems with my experiment were that the electrical current going through the wire caused it to heat up which meant there was an increase in resistance and that because the wire was coiled, it was very difficult to straighten and to get accurate measurements.

Therefore if I were to repeat the experiment I would let the wire cool down more often than in the last experiment, carry out the experiment in a temperature controlled area and carefully lay out the wire so that it is completely straight. I would also change the circuit to the circuit below so the voltmeter is only reading the voltage in the wire, not the whole circuit. Another way to improve the accuracy of my results would be to change the crocodile clip ends of the wires from the voltmeter to be slimmer and more accurate. To expand the experiment you see how the different widths and materials of wire affect the resistance in relation to its length.