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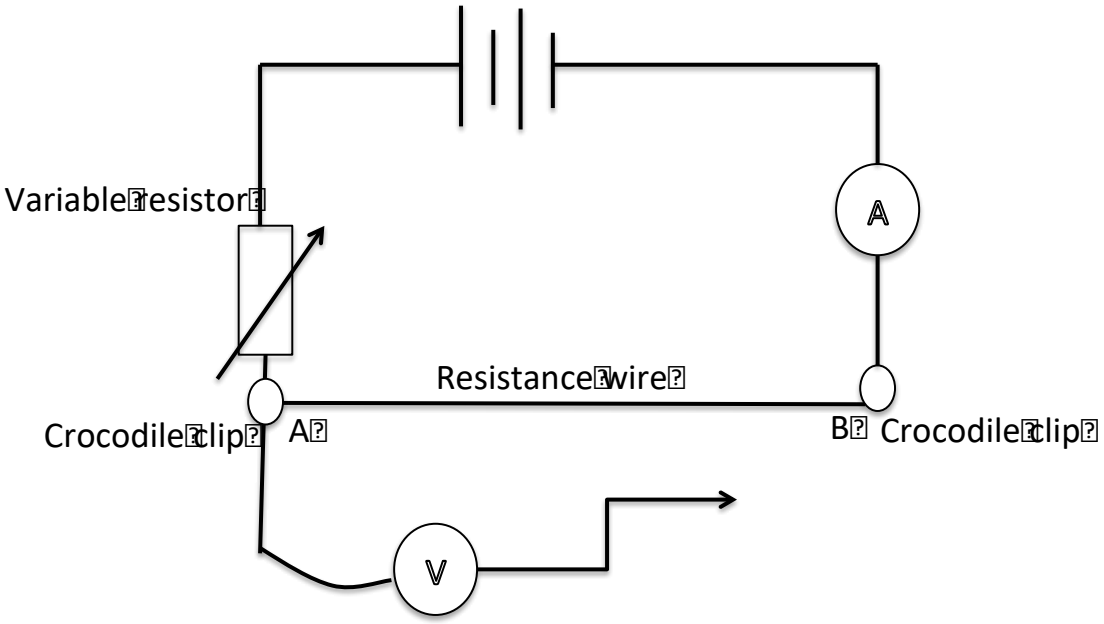
Suggested Answers to 2016 O level Science Physics 5076/5077/5078 Paper 5

In the 2016 GCE O Level Science (Physics) practical examination, students were asked to measure the resistance of a resistance wire (nichrome wire) using two different formulas.

$R_1 = \frac{V_L}{I_{Standard}}$ and $R_2 = \frac{gradient \times length\ (x)}{100 \times I_{Standard}}$

The length of the resistance wire was 90.5cm (0.905m) and students were asked to derive a $I_{standard}$ value between 0.12A and 0.20A on the ammeter. For a current within the 0.12A – 0.20A range, the student had to determine the V_L, the p.d. across the entire length of the wire, from the voltmeter.

Teacher's Comment: Since students were given two 1.5V batteries to be connected in series, the total p.d. must have been 3V. Thus the p.d. across points A and B in the diagram below must also be 3V. As such, if V_L = 3V and for a range of $I_{standard}$ values between 0.12A and 0.20A, students should get R_1 values **between 15Ω and 25Ω.**



Next, to determine R_2, students were asked to carry out the following:

i. Measure the length of the wire and record.
ii. Fix the ammeter from 0.12 to 0.20 A.
iii. Measure and record V_1 using the 50 cm ruler.
iv. Measure and record V_2, which is to pull the clip A to the right so that the wire sticks out of the circuit by 10 to 20 cm.
v. Find the average V.
vi. Repeat the experiment using lengths between 0 cm to 50 cm.
vii. Plot Average Voltage against Length and find the gradient of the graph.

Length x/cm	Voltage V_1/V	Voltage V_2/V	Average Voltage V_{ave}/V
10			

Teacher's Comment: Since R_1 must be equal to R_2, working backwards, the gradient of the straight line must be **3.31**, for a nichrome wire with resistivity 1.5×10^{-6}.

Question: A student wound up the nichrome wire around clip A to make it secure. How will this affect the reading of the resistance R_2?

Teacher's Comment: As the crocodile clip is a good electrical conductor, when the wire is coiled around the clip, the wire will be in contact with the conductor hence causing the current to flow through a greater length. Since $R = \frac{\rho l}{A}$, the resistance of the wire will increase therefore R_2 value will be greater.