General Certificate of Education
Advanced Subsidiary Examination
June 2014

Physics PHY3T/P14/TN

Unit 3 Investigative and Practical Skills in AS Physics

Investigative Skills Assignment (ISA) P

Teachers' Notes Confidential

The Exams Officer should make two copies of these Teachers' Notes; one copy for the Head of A-level Physics and one for the technician.
These copies can be released to the Head of A-level Physics and the technician at any point following publication but must be kept under secure conditions at all times.
Teachers can have sight of the Teachers' Notes but no further copies should be made.

All teacher-assessed marks to be submitted by 15 May.

AS Resistor Characteristics – ISA P

Centre Instructions for the investigation

In this ISA, candidates will be investigating the current – potential difference (pd) characteristics of resistors. Candidates will be required to vary the pd across a resistor and to measure the corresponding current. This will be repeated with a resistor of lower value and with a combination of both resistors.

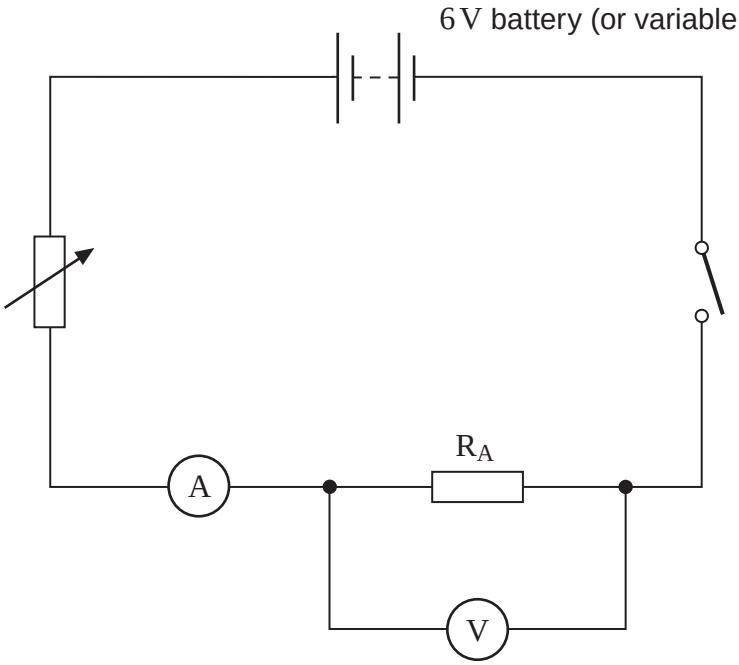
Apparatus
Centres should ensure that the apparatus provided can be used safely. In particular it might be necessary to remind candidates to avoid touching the resistors when they are hot. Each candidate will need:

(a) dc supply, minimum $6\,\text{V}$ (eg dc lab pack with variable pd $0–12\,\text{V}$, four $1.5\,\text{V}$ dry cells with the dry cell holder tapped so that candidates can access $1.5\,\text{V}$, $3.0\,\text{V}$, $4.5\,\text{V}$ easily).
(b) variable resistor to allow the pd across a resistor to be varied.
(c) resistor labelled R_A (eg $15\,\Omega\ 3\,\text{W}$). The resistance value written on the component should be covered over
(d) resistor labelled R_B having approximately 50–75% of resistance of R_A (eg $10\,\Omega\ 3\,\text{W}$). The resistance value written on component should be covered over.
(e) dc ammeter (eg $0–5\,\text{A}$ digital), reading to $0.01\,\text{A}$
(f) dc voltmeter (eg $0–10\,\text{V}$ digital), reading to $0.01\,\text{V}$
(g) connecting leads
(h) crocodile clips, or component clip holders for connection of resistors
(i) means of switching off the circuit (eg a switch or a means of disconnecting the circuit with which candidates are familiar).

Candidates will be required to set up the circuit on page 3. They should be able to adjust the supply to obtain a pd range from approximately $1\,\text{V}$ to $4\,\text{V}$ across resistor R_A and measure the corresponding current.

Supervisors will be required to check each candidate's circuit. Candidates will be awarded 1 mark for correctly setting up the circuit as given in the circuit diagram. If candidates fail to set up the circuit correctly, help can be given but the 1 mark available should not then be awarded.

It should be noted that there is no requirement to use the resistor values given in the examples above. Any values of R_A and corresponding value of R_B can be used, provided a range of different pd and current values can be achieved. The power ratings of the resistors and the voltmeter and ammeter specifications will need to be appropriate in terms of safety for the resistors used.



Information for centres

Candidates can be told approximately one week before undertaking Stage 1 of the ISA that they will be investigating the characteristics of a resistor. The ISA test will also include questions on resistivity and the variation of resistance of a wire with cross-sectional area.

Task Sheet

You are going to investigate how the current varies through two different resistors when the potential difference (pd) across them is changed

The resistors used in this experiment may become hot. Take care when changing the resistors.

- Set up the circuit as shown in **Figure 1** (overleaf), using the resistor labelled R_A. If a switch has not been provided you will be instructed as to a suitable alternative method to disconnect your circuit.
- **Before switching on you must ask your supervisor to check your circuit.**
- Switch on the circuit and adjust the variable resistor and/or dc supply to achieve a pd, V, of approximately $1\,V$ across the resistor. Record in a table the value of V and the corresponding value of current, I.
  (If your apparatus will not allow a pd of $1\,V$, use the lowest non-zero value you can achieve)
- Make adjustments to achieve a higher value of V and take the corresponding reading of I.
- Repeat this procedure to obtain a **range** of different readings for V and I, up to a maximum value for V of $4\,V$.
- Switch off the circuit, remove R_A and replace it with R_B.
- Repeat the whole procedure to obtain a range of readings of V and I for resistor R_B.
- Switch off the circuit, connect R_A and R_B in parallel and repeat the whole procedure to obtain a range of readings of V and I for resistor R_A and R_B in parallel.
- For R_A and R_B in parallel plot a graph of I on the vertical axis against V. Draw a straight line of best fit.
- **On the same axes as the previous graph** plot a graph of I against V for resistor R_A and also another graph of I against V for resistor R_B and draw straight lines of best fit.
- Record the precision of the ammeter and voltmeter used in this experiment.

Figure 1