

## **A level Physics B**

**H557/03** Practical skills in physics

### **Question Set 11**

1

This question is about the electrical conductivity of a metal.

- (a)\* Describe a suitable experimental procedure which could be used to determine the electrical conductivity  $\sigma$  of the metal.

The following apparatus is available.

Length of metal wire  
Metre rule  
Micrometer screw gauge  
Ammeter  
High resistance voltmeter  
Battery  
Variable resistor  
Connecting wires and crocodile clips

You should include details of the measurements to be taken and how they are used to accurately determine the electrical conductivity  $\sigma$  of the metal. You should also consider the uncertainties present in the investigation.

[6]

- (b) (i) The conductivity  $\sigma$  of the metal wire in (a) at room temperature is  $2.1 \times 10^6 \Omega^{-1} \text{m}^{-1}$ . The cross-section area,  $A$ , of the wire is  $0.166 \text{mm}^2$ .

The potential difference across  $0.330 \text{m}$  of the wire is  $2.0 \text{V}$ .

Calculate the current  $I$  in the wire.

$I = \dots\dots\dots \text{A}$  [3]

- (ii) Use the relationship  $I = nAvq$  and the data below to estimate the mean drift velocity,  $v$ , of electrons in the wire.

number density of free electrons in the metal  $n \approx 10^{28} \text{m}^{-3}$   
charge on one electron  $q = 1.6 \times 10^{-19} \text{C}$

$v = \dots\dots\dots \text{ms}^{-1}$  [1]

- (iii) The temperature of the metal wire is now increased.

State and explain qualitatively the change, if any, to the mean drift velocity  $v$  of the electrons in the wire.

[3]

**Total Marks for Question Set 11: 13**

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