

# Solution 5.4

## Answer 1

Year 11

(19 marks)

Several students were carrying out an investigation to determine the resistance of an unknown device. They set up a suitable circuit and measured the current while changing the potential difference. The table below shows their results.

Potential Difference (V)	Current (A)	Calculated resistance ( $\Omega$ ) to three significant figures
1.00	0.0740	13.5
1.50	0.0940	16.0
2.00	0.136	14.7
2.50	0.165	15.2
3.00	0.198	15.2
3.50	0.230	15.2
Average resistance		15.0

- (a) Complete the table above, calculating each resistance value and the average resistance, to **three** significant figures. (3 marks)

Description	Marks
Calculated values correct	1
Average is 15.0	1
Three significant figures shown on all values	1
<b>Total</b>	<b>3</b>

- (b) Any investigation has a number of variables that can affect the results. For this investigation, name the independent and dependent variables. (2 marks)

Description	Marks
Independent variable – potential difference	1
Dependent variable - current	1
<b>Total</b>	<b>2</b>

- (c) The accuracy of any measurement is affected by the precision of the instrument used. With the ammeter, the students were able to read the current accurately to three decimal places. Complete the reading below to include the absolute error of this reading. (1 mark)

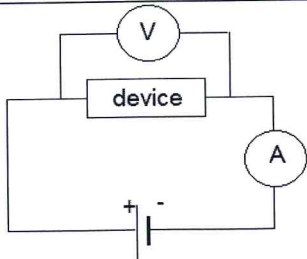
Description	Marks
$0.250 \pm 0.0005$ A	1
<b>Total</b>	<b>1</b>

# Solution 5.4

## Answer 1 continued

Year 11

- (d) Draw a simple circuit that includes the device, power pack, an ammeter and a voltmeter that could be used to conduct this investigation. Label the ammeter 'A' and the voltmeter 'V'. (3 marks)

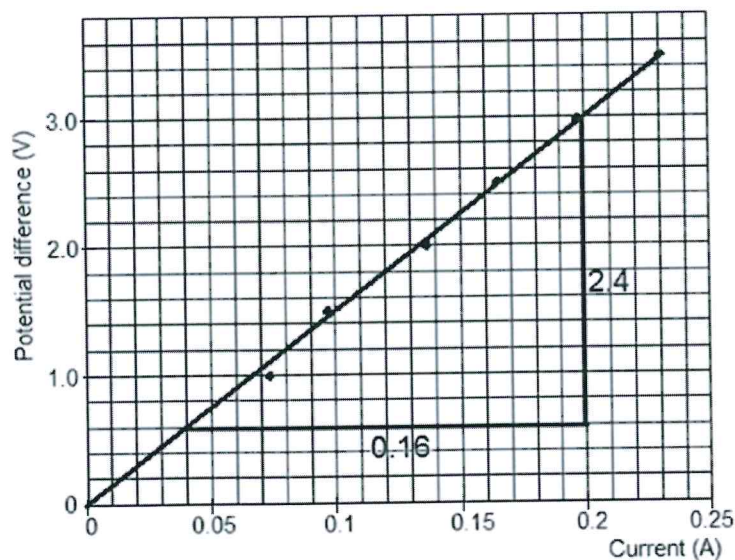
Description	Marks
	1-2
Labels for voltmeter and ammeter	1
<b>Total</b>	<b>3</b>

- (e) Use the grid below to graph the potential difference against the current.

Plot the potential difference on the Y-axis and the current on the X-axis. Rule in a line of best fit. (3 marks)

Description	Marks
Axis have correct labels	1
Points clearly shown and correctly plotted	1
Accurate ruled line of best fit	1
<b>Total</b>	<b>3</b>

Potential difference vs current for an unknown device



- (f) Determine the gradient of the line of best fit and include the correct units in your answer. (3 marks)

Description	Marks
Gradient = rise/run = $2.4 / 0.16 = 15 \Omega$ (range between 14 and 16 $\Omega$ )	1
Values are not data points in the table	1
Units = $\Omega$ or $V A^{-1}$	1
<b>Total</b>	<b>3</b>

# Solution 5.4

## Answer 1 continued

Year 11

(g) Resistors can be ohmic or non-ohmic.

(i) Is the unknown device ohmic or non-ohmic? Circle the correct answer. (1 mark)

Description	Marks
Ohmic	1
Total	1

(ii) Justify your choice by explaining the difference between an ohmic and a non-ohmic resistor. (3 marks)

Description	Marks
Ohmic resistors obey Ohm's Law, $V = IR$	1
current is proportional to the potential difference producing a straight line graph	1
Non-ohmic resistors do not obey Ohm's Law. Current is not proportional to potential difference	1
Total	3