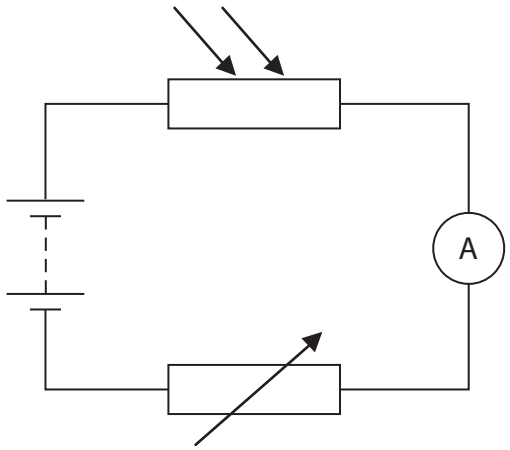
All questions are for both separate science and combined science students

1 The resistance of a Light Dependent Resistor (LDR) is affected by the amount of light that shines on it.

A student investigates this relationship using the circuit shown.



(a) (i) The student uses a voltmeter to measure the voltage across the LDR.

Add this voltmeter to the circuit diagram.

(2)

(ii) Explain how the student can work out the resistance of the LDR using this circuit.

(2)

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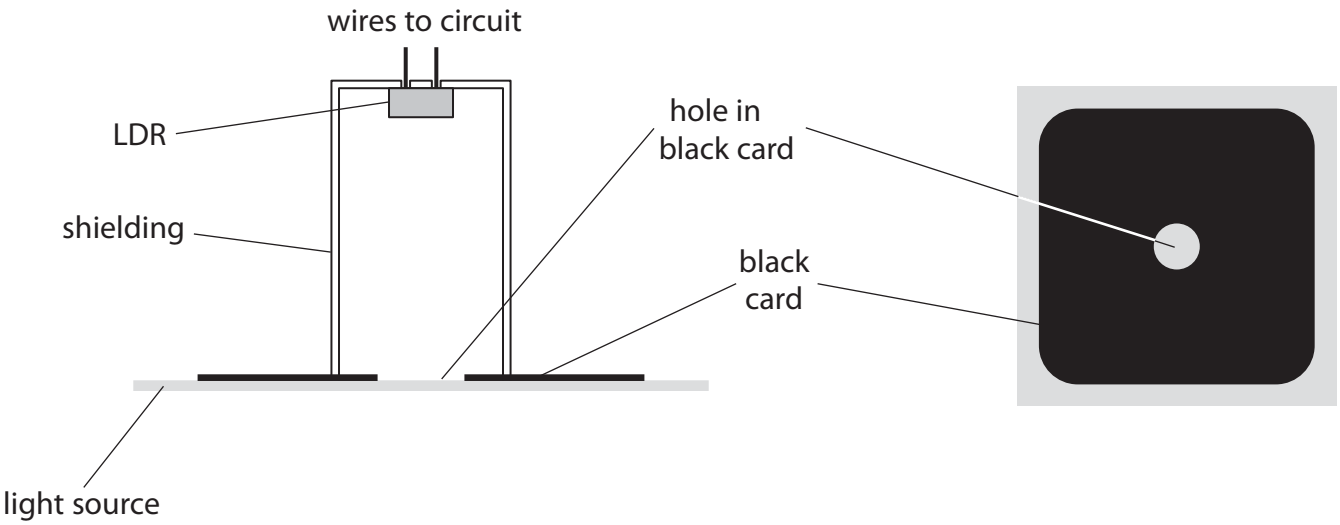
(b) The student shines light on the LDR through a circular hole in a piece of black card, as shown in the diagram.

The student repeats the experiment using cards with holes of different diameter.

The distance from the card to the LDR is always 5 cm.

The student varies the current in the circuit by adjusting the variable resistor.



(i) The independent variable in this experiment is

(1)

☒ **A** the brightness of the light source

☒ **B** the diameter of the hole

☒ **C** the distance from the card to the LDR

☒ **D** the resistance of the LDR

(ii) A controlled variable in this experiment is

(1)

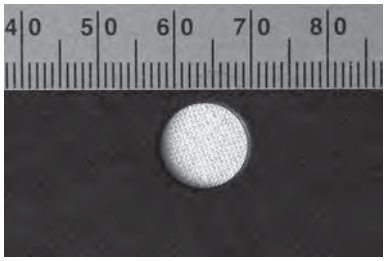
☒ **A** the current in the circuit

☒ **B** the diameter of the hole

☒ **C** the distance from the card to the LDR

☒ **D** the resistance of the LDR

(iii) The photograph shows how the student places a metal ruler to measure the diameter of one of the holes.



Suggest how the student can improve this technique while still using the same ruler.

(1)

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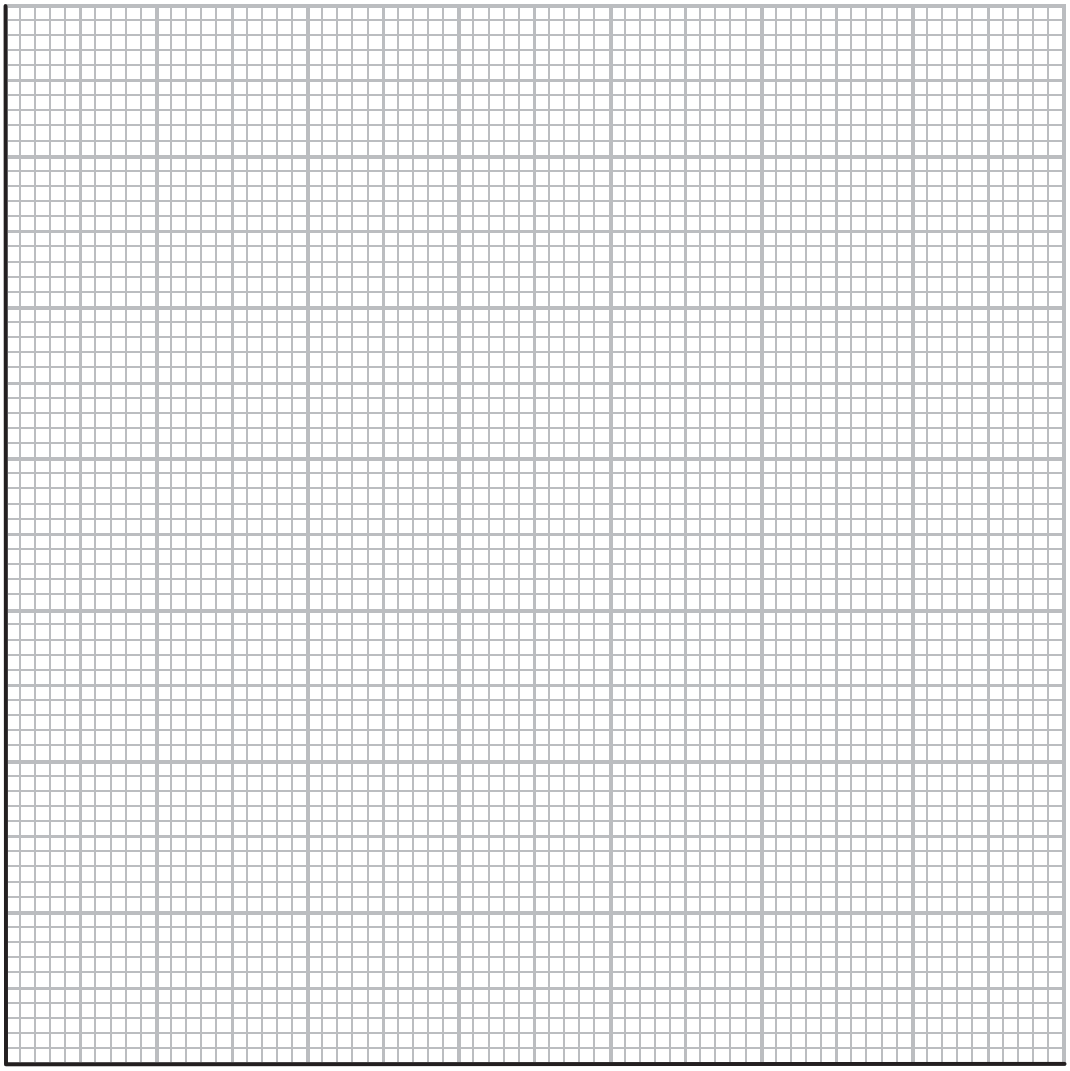
(c) The table shows the student's results.

Diameter of hole in mm	Resistance of LDR in Ω
8	1050
10	890
15	640
20	490
23	430
30	340

(i) Plot the student's results on the grid.

(4)



(ii) Draw a curve of best fit on the graph.

(1)

(iii) Describe the relationship between the resistance of the LDR and the diameter of the hole.

(2)

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(Total for Question 1 = 14 marks)

2 The table shows information about three electrical appliances.

Appliance	Power in W	Current in A
lamp	40	0.
clothes iron	2200	9.6
television	110	

(a) (i) State the relationship between power, current and voltage.

(1)

(ii) Calculate the current in the television.
[assume that the mains voltage is 230 V]

(2)

current = ... A

(b) The photographs show the different cables used for the clothes iron and the lamp.

clothes iron cable

lamp cable

(i) Suggest why the wires in the clothes iron cable are thicker than the wires in the lamp cable.

(1)

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(ii) The clothes iron cable has three wires, E, N and L.

Which of these wires is connected to the fuse?

(1)

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(iii) Suggest why the lamp is safe to use, even though its cable only has two wires.

(1)

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(c) The lamp is switched on for 55 minutes.

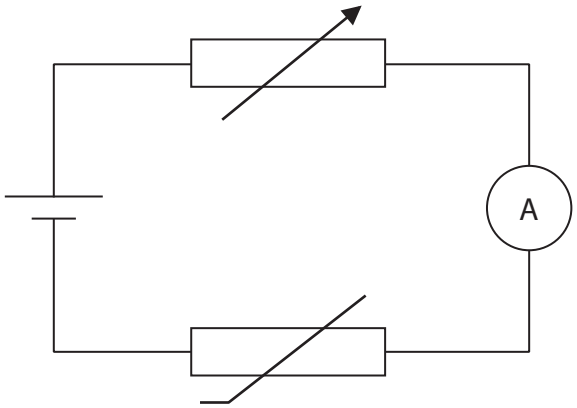
Calculate the energy transferred by the lamp in this time.

(3)

energy transferred = ... J

(Total for Question 2 = 9 marks)

3 A student investigates the current in a thermistor at different temperatures, using the circuit shown in the diagram.



(a) The student uses a voltmeter to check that the voltage across the thermistor stays constant throughout the investigation.

(i) Add this voltmeter to the circuit diagram.

(2)

(ii) Give a reason for keeping the voltage across the thermistor constant.

(1)

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(iii) Give a reason for including the variable resistor in the circuit.

(1)

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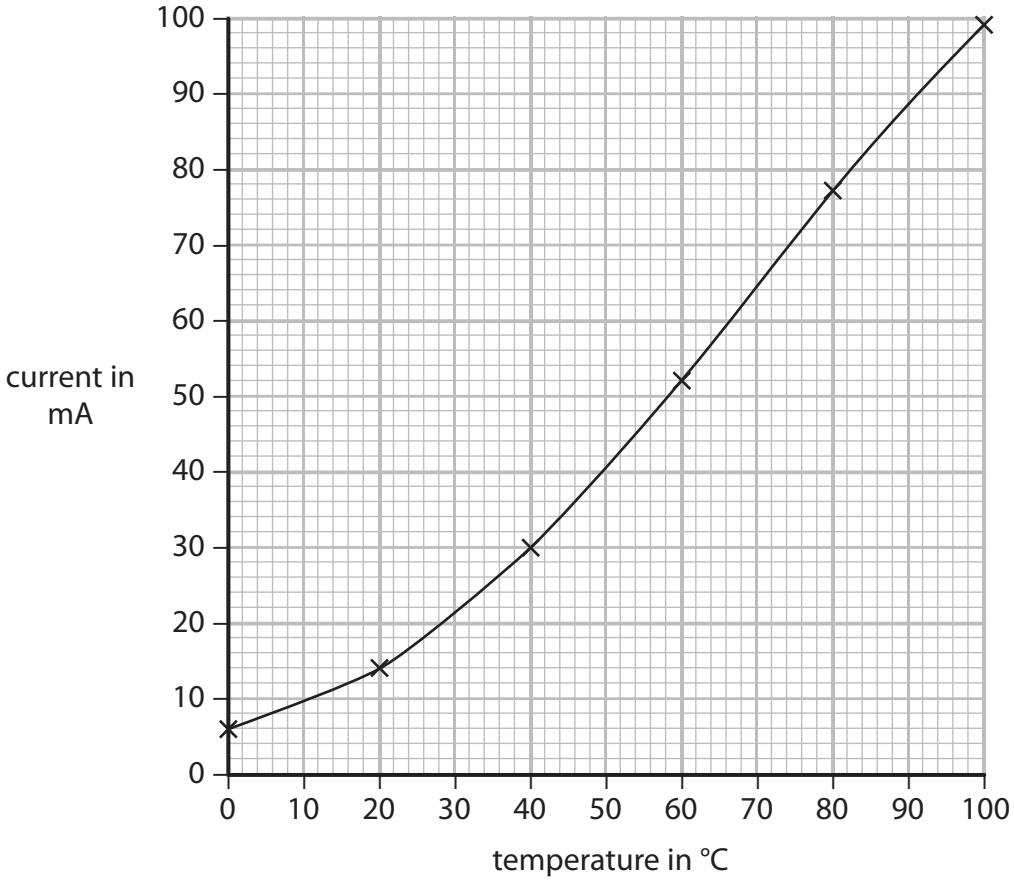
(b) The student increases the temperature of the thermistor and records the current and temperature readings.

The graph shows the student's results.



The student plans to use his circuit to make an electronic thermometer.

He notices that both the scales on the graph go up to 100.

He thinks that the current reading, measured in mA, gives a direct indication of the temperature measured in °C.

He labels the ammeter's scale 'temperature in °C'.

Give three reasons why the student's electronic thermometer is unlikely to show the correct temperature.

You may use information from the circuit and the graph to support your answer.

(3)

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2 .....

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3 .....

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(Total for Question 3 = 7 marks)

4 (a) The diagram shows part of an electric circuit.

Complete the circuit diagram by adding

- a resistor in series with the lamp and battery
- a second lamp in parallel with the first lamp
- a voltmeter that measures the voltage across the resistor
- an ammeter that measures the current in the resistor

(4)

(b) The current in a resistor is measured for different voltages.

The table shows the results.

Voltage in V	Current in A
1.0	0.10
2.5	0.25
3.0	0.30
4.5	0.40
5.0	0.50
6.0	0.60

(i) Plot a graph of this data on the grid.

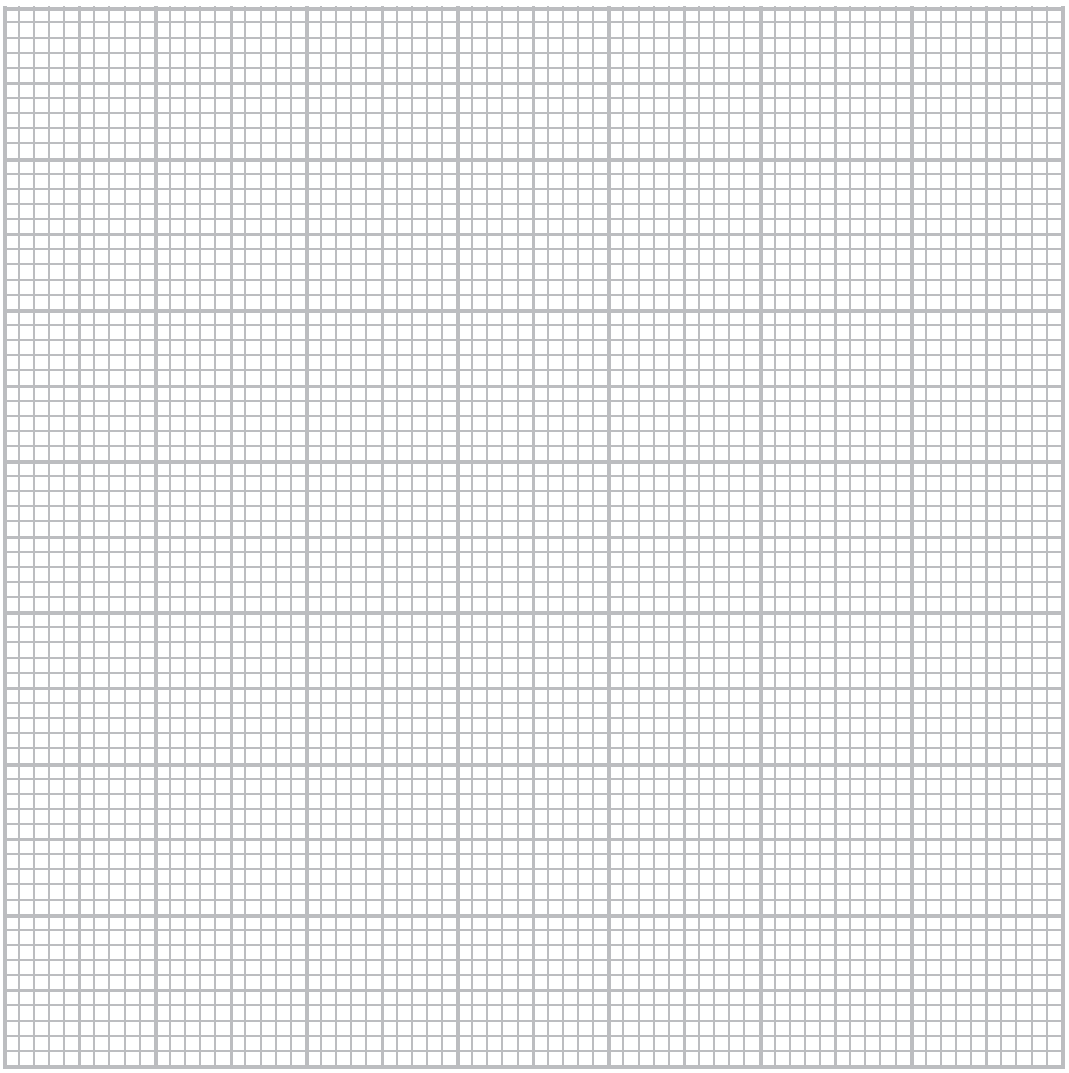
(4)

(ii) Circle the anomalous point on the graph.

(1)

(iii) Draw a line of best fit.

(1)



(iv) State the equation linking voltage, current and resistance.

(1)

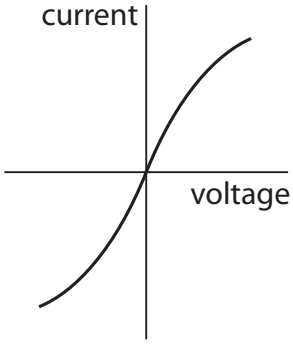
(v) Use your graph to find a value for the resistance of the resistor.

(2)

resistance ..... Ω

(Total for Question 4 = 13 marks)

5 The graph shows how current and voltage vary for a filament lamp.



(a) Draw a circuit diagram to show how you should connect the equipment needed to make the measurements needed to plot the graph.

(4)

(b) The resistance of the filament lamp changes as the voltage is increased.

(i) How can you tell this from the graph?

(1)

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(ii) Explain these changes in resistance.

(3)

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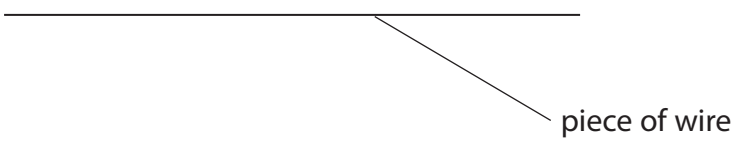
(Total for Question 5 = 8 marks)

6 A student investigates how the resistance of a piece of wire changes with voltage across the wire.

The student connects an ammeter, a voltmeter, a battery, a variable resistor and the wire in an electrical circuit.

(a) (i) Complete the diagram to show how the student should connect the circuit.

(3)



(ii) Describe what she should do to obtain a set of results for her investigation.

(3)

(b) The student keeps the temperature of the wire constant during the investigation.

(i) Suggest **why** she does this.

(1)

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(ii) Suggest **how** she does this.

(1)

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(c) When the student looks at her results, she notices that the voltage across the wire is directly proportional to the current in it.

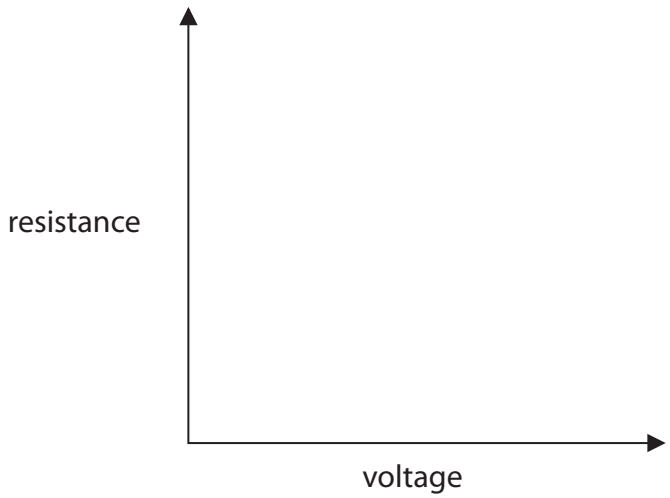
(i) State the relationship linking voltage, current and resistance.

(1)

(ii) The student calculates the resistance and then plots a graph of resistance against voltage.

On the axes, sketch the shape of her graph.

(1)



(Total for Question 6 = 10 marks)