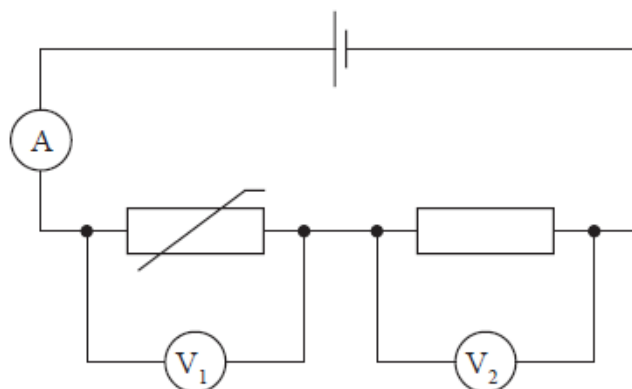


Questions

Q1.

A negative temperature coefficient thermistor is connected in a circuit as shown.



The temperature of the thermistor is increased.

Which row of the table shows how the readings on meters V_1 and V_2 and A change?

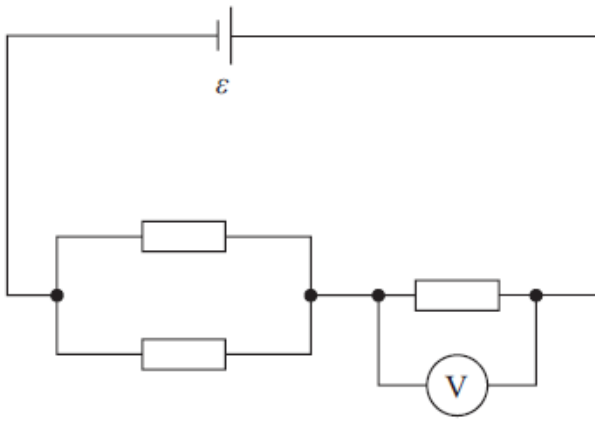
	Reading on V_1	Reading on V_2	Reading on A
☐ A	decreases	increases	increases
☐ B	decreases	stays the same	increases
☐ C	increases	decreases	decreases
☐ D	increases	stays the same	decreases

(Total for question = 1 mark)

Q2.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

A student connects three identical resistors in the circuit shown.



The cell has e.m.f. ε and negligible internal resistance.

Which of the following is equal to the reading on the voltmeter?

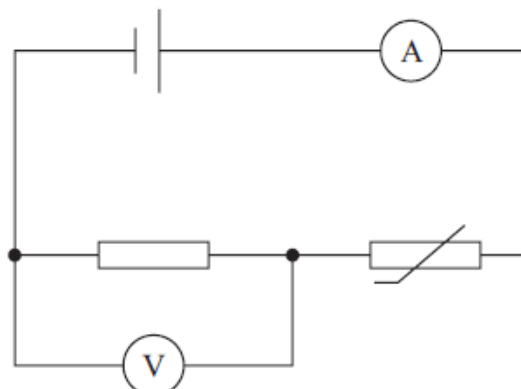
- ☐ A $\frac{\varepsilon}{2}$
- ☐ B $\frac{\varepsilon}{3}$
- ☐ C $\frac{2\varepsilon}{3}$
- ☐ D $\frac{3\varepsilon}{2}$

(Total for question = 1 mark)

Q3.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

The circuit shown includes a thermistor.



The temperature of the thermistor increases.

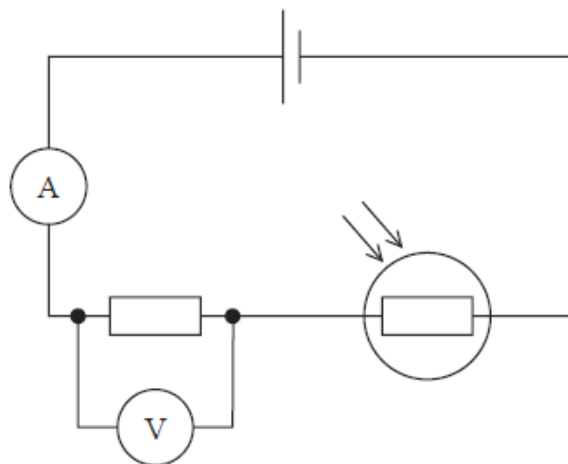
Which row of the table shows how the readings on the ammeter and voltmeter change?

	Ammeter reading	Voltmeter reading
☐ A	decreases	decreases
☐ B	decreases	increases
☐ C	increases	decreases
☐ D	increases	increases

(Total for question = 1 mark)

Q4.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☐ and then mark your new answer with a cross ☐.



The intensity of light incident on the light dependent resistor decreases.

Which row of the table is correct?

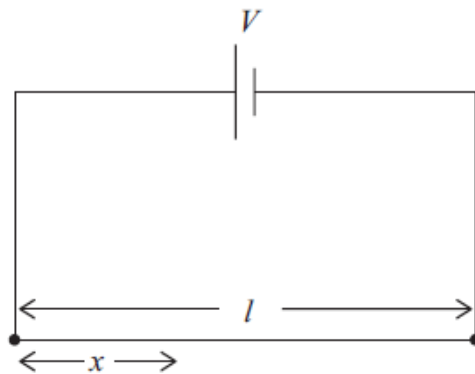
	Ammeter reading	Voltmeter reading
☐ A	decreases	decreases
☐ B	increases	increases
☐ C	decreases	increases
☐ D	increases	decreases

(Total for question = 1 mark)

Q5.

Answer the question with a cross in the box you think is correct (☐). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☐).

The circuit diagram shows a potential difference V applied across the ends of a uniform wire of length l .



Which of the following gives the potential difference across length x of the wire?

- ☐ A $V \times \frac{l}{x}$
- ☐ B $V \times \frac{x}{l}$
- ☐ C $\frac{V}{x \times l}$
- ☐ D $V \times x \times l$

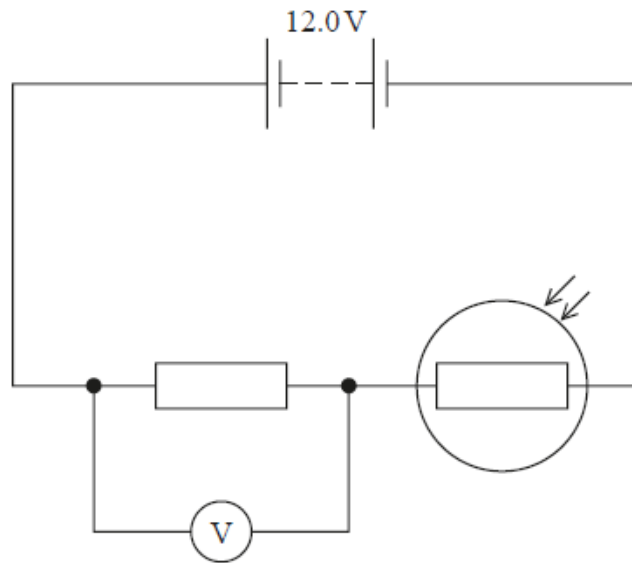
(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct (☐). If you change your mind about an answer, put a line through the box (☒) and then mark your new

answer with a cross ☒ .

The circuit shows a potential divider, including a battery of negligible internal resistance and a light dependent resistor (LDR). The potential difference (p.d.) across the fixed resistor is measured using a voltmeter.



Which of the following statements about this circuit is correct?

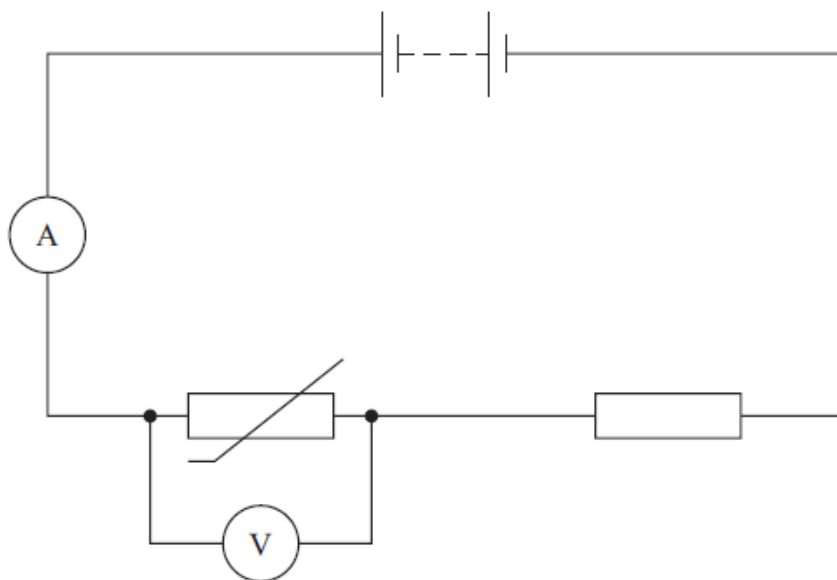
- ☐ **A** If the resistance of the LDR halves, the voltmeter reading halves.
- ☐ **B** Increasing the light intensity would decrease the voltmeter reading.
- ☐ **C** Increasing the light intensity would have no effect on the voltmeter reading.
- ☐ **D** The voltmeter reading added to the p.d. across the LDR will always be 12.0 V.

(Total for question = 1 mark)

Q7.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

A negative temperature coefficient thermistor is connected in a circuit, as shown.



The temperature of the thermistor is increased.

Which row of the table gives the changes to the readings on the ammeter and the voltmeter?

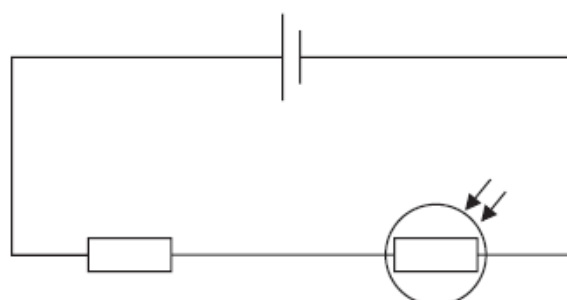
	Ammeter	Voltmeter
☐ A	decreases	increases
☐ B	decreases	decreases
☐ C	increases	increases
☐ D	increases	decreases

(Total for question = 1 mark)

Q8.

Select one answer from A to D and put a cross in the box ☐. If you change your mind about an answer, put a line through the box ☐ and then mark your new answer with a cross ☐.

A light dependent resistor (LDR) and a fixed resistor are connected in a circuit, as shown.



The intensity of the light incident on the LDR is increased.

Which of the following does **not** take place as the light intensity is increased?

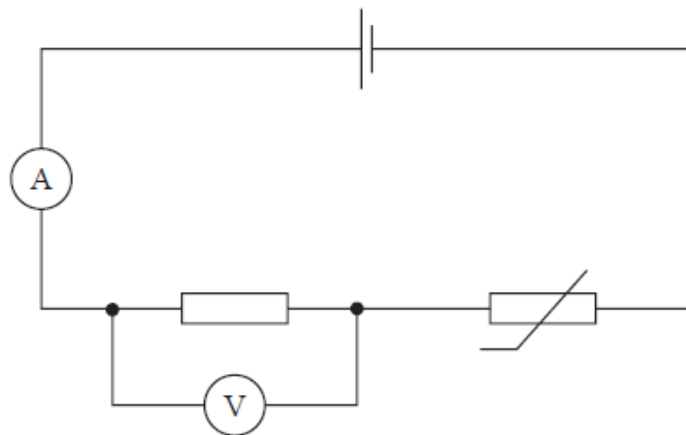
- ☐ **A** The current in the circuit increases.
- ☐ **B** The potential difference across the fixed resistor increases.
- ☐ **C** The total power dissipated in the circuit decreases.
- ☐ **D** The resistance of the LDR decreases.

(Total for question = 1 mark)

Q9.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

A negative temperature coefficient thermistor and a fixed resistor are connected in a circuit, as shown.



The temperature of the thermistor increases.

Which row of the table shows the changes to the ammeter and voltmeter readings as the temperature increases?

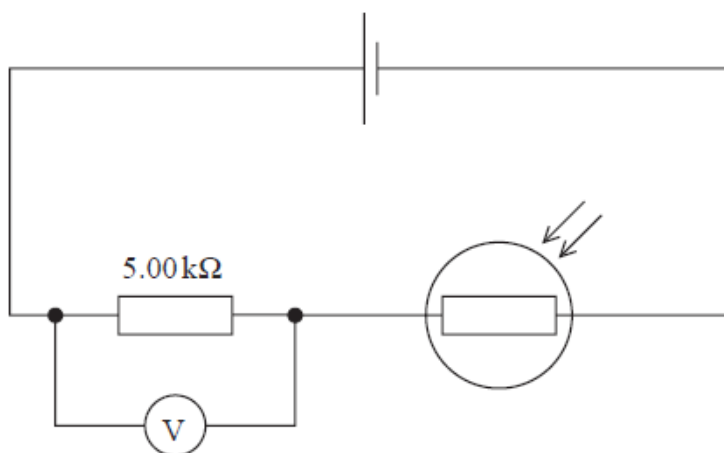
	Ammeter reading	Voltmeter reading
☐ A	decreases	decreases
☐ B	decreases	increases
☐ C	increases	decreases
☐ D	increases	increases

(Total for question = 1 mark)

Q10.

A student investigated how light intensity affects the resistance of a light dependent resistor (LDR).

She set up a circuit using a cell with negligible internal resistance, as shown.



The e.m.f. of the cell was 1.50 V. When the lights in the laboratory were switched off, the voltmeter reading was 1.19 V.

(a) Calculate the resistance of the LDR when the lights were off.

(2)

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Resistance of LDR = ...

(b) When the lights were switched back on, the student discovered that it was impossible to calculate the resistance of the LDR using this circuit. The teacher said that with the lights on, the resistance of the LDR was about $9\ \Omega$.

Explain why the student was unable to use the circuit to determine the resistance of the LDR with the lights on. The resolution of the voltmeter was $0.01\ \text{V}$.

(2)

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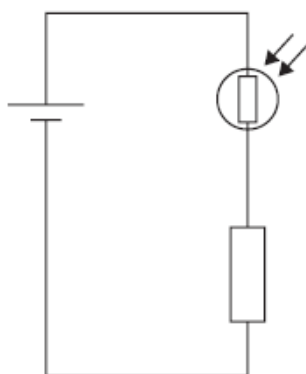
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(Total for question = 4 marks)

Q11.

A security lamp automatically switches on when the intensity of light incident on an LDR decreases.

Part of the electrical circuit in the security lamp is shown. The cell has negligible internal resistance.



(a) The light intensity incident on the LDR decreases.

Explain what happens to the potential difference across the fixed resistor.

(2)

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(b) The security lamp switches on when the potential difference across the fixed resistor is 0.62 V.

When the lamp switches on, the ratio of the resistance of the LDR to the resistance of the fixed resistor is 3 : 2

The current in the circuit is 28 mA.

Calculate the resistance of the LDR when the security lamp switches on.

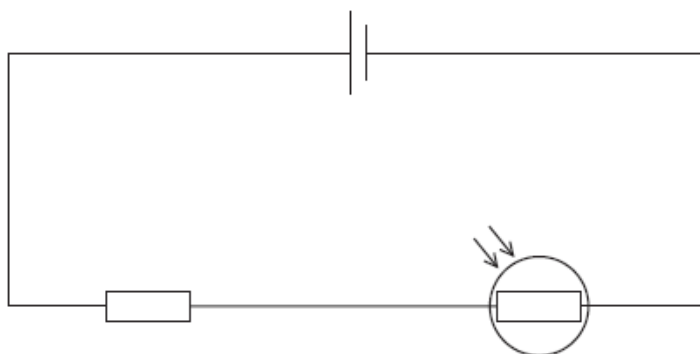
(3)

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Resistance = ...

(Total for question = 5 marks)

Q12.

* The circuit shown contains a fixed resistor and a light dependent resistor (LDR).



Explain why the power dissipated by the whole circuit changes as the intensity of the light incident on the LDR increases.

You should refer to why the resistance of an LDR changes as light intensity increases.

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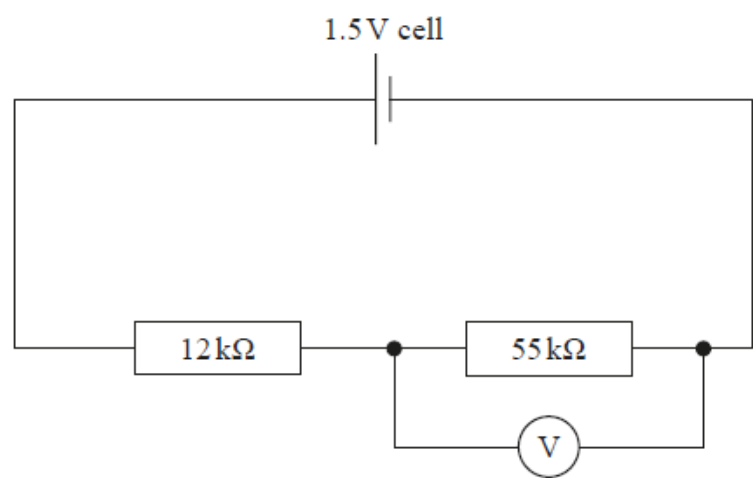
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(Total for question = 6 marks)

Q13.

A student is given the circuit diagram shown.



(a) Calculate a value for the voltmeter reading.

(2)

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Voltmeter reading = ...

(b) The student sets up the circuit and observes that the reading on the voltmeter is lower than the value calculated in (a).

Explain two reasons for the lower voltmeter reading.

(4)

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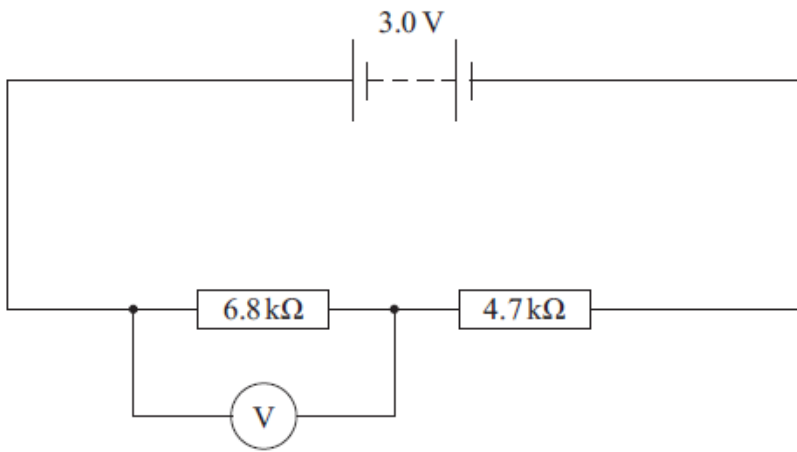
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(Total for question = 6 marks)

Q14.

A student connects the circuit shown in the diagram.



(a) Determine the reading on the voltmeter.

(3)

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Voltmeter reading = ...

(b) Determine the power dissipated by the circuit.

(2)

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Power dissipated = ...

(c) The student connects the battery to an ammeter and a motor.

There is a current of 2.5 A in the motor.

Calculate the energy transferred to the motor in 1.5 minutes.

(2)

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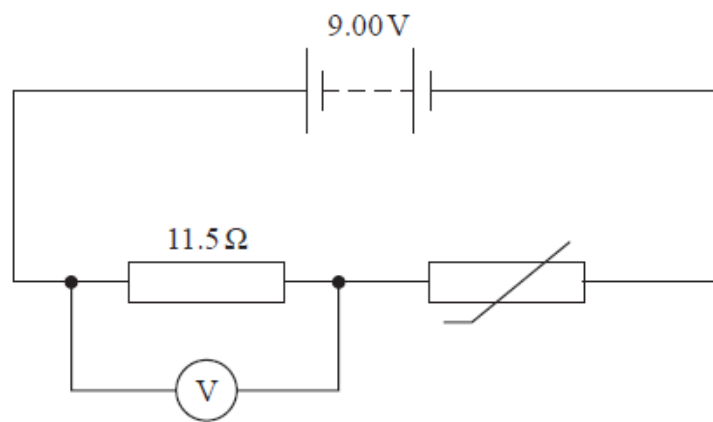
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Energy transferred = ...

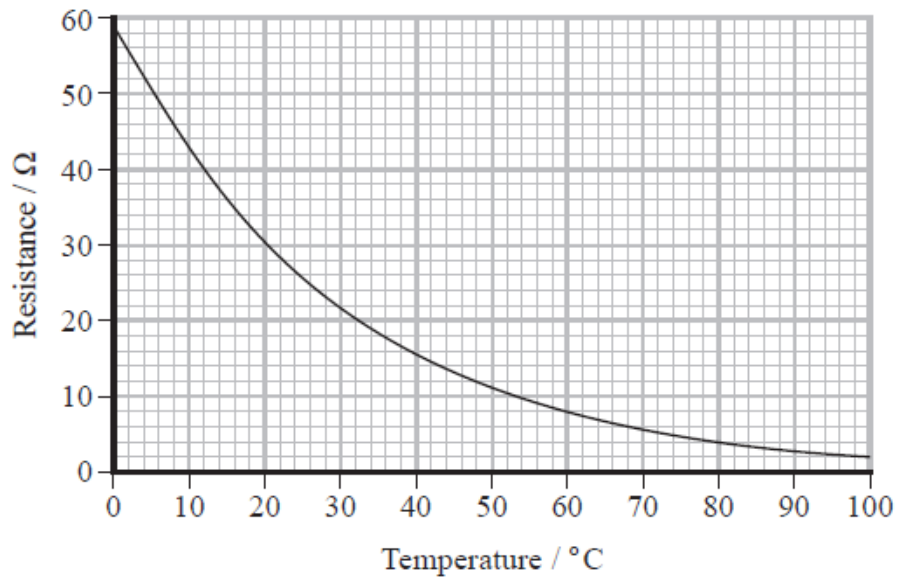
(Total for question = 7 marks)

Q15.

A student connected the circuit shown. The battery has negligible internal resistance.



The graph shows how the resistance of the thermistor varies with temperature.



(a) The reading on the voltmeter is 3.42 V.

Determine the temperature of the thermistor.

(4)

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Temperature = ...

(b) The student suggests that if the e.m.f. of the battery is doubled, the reading on the voltmeter will double.

Assess whether the student's suggestion is correct.

(4)

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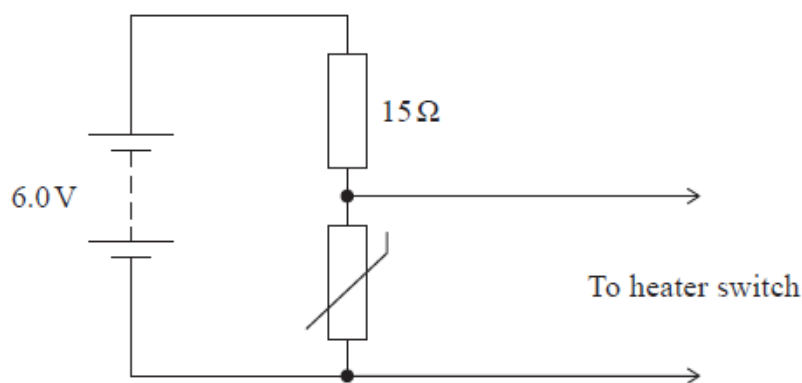
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(Total for question = 8 marks)

Q16.

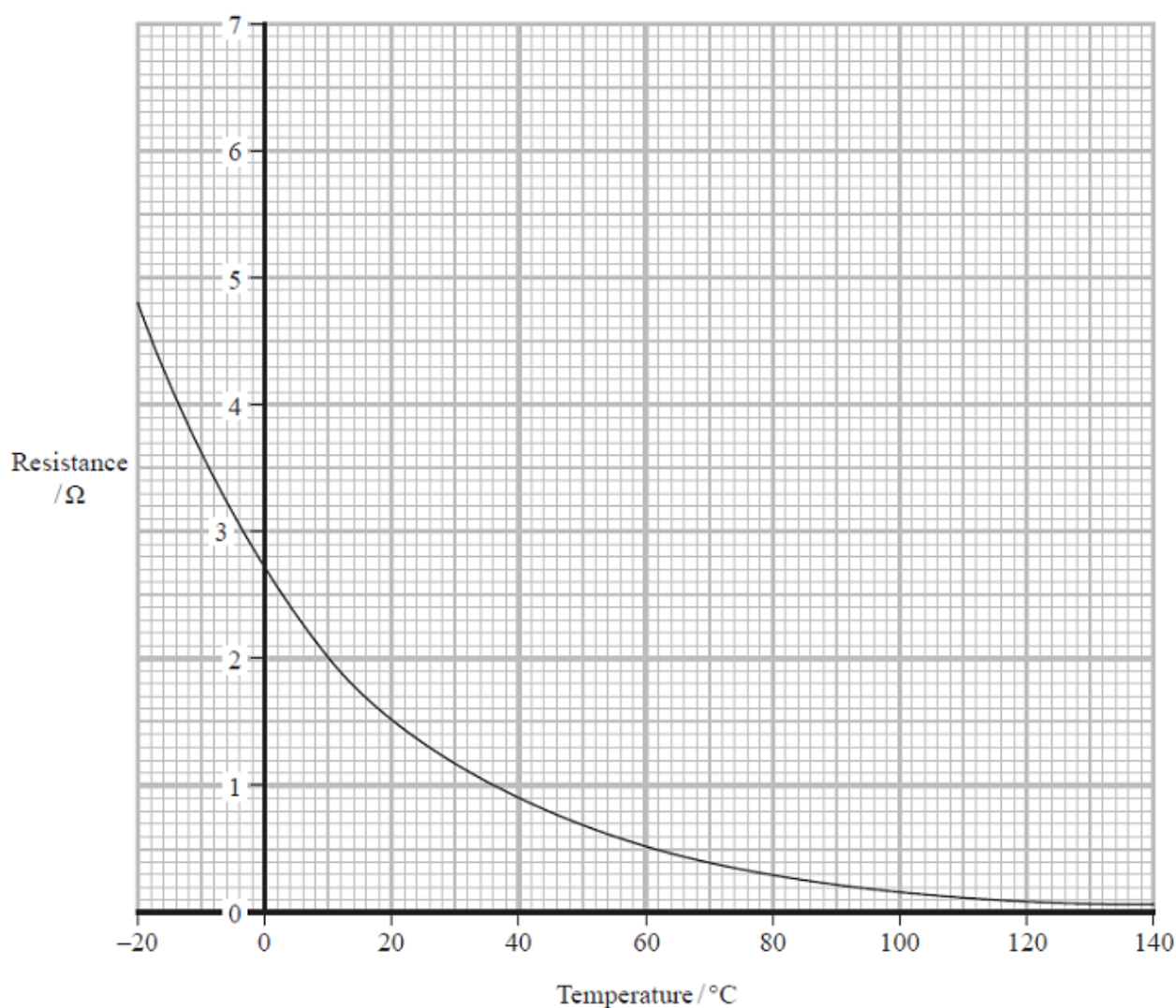
A temperature-sensing circuit consists of a fixed resistor and a thermistor, as shown.



The circuit supplies a potential difference (p.d.) to operate the heater switch.

The heater switches on when the p.d. across the thermistor is greater than 0.7 V.

The resistance of the thermistor varies with temperature as shown on the graph.



(a) Deduce whether this circuit would switch on the heater when the temperature falls below 10 °C.

You should include a calculation of the p.d. across the thermistor when the temperature is 10 °C.

(6)

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(b) Explain why the resistance of the thermistor changes with temperature.

(2)

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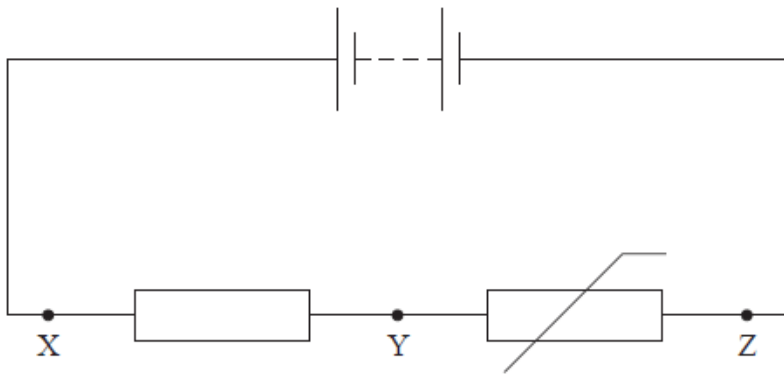
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(Total for question = 8 marks)

Q17.

The circuit shown includes a fixed resistor and a negative temperature coefficient thermistor.



A potential divider circuit can be created by making connections to a secondary circuit across the resistor (XY) or across the thermistor (YZ). As the temperature changes, the potential differences (p.d.) across XY and YZ both change.

Such a circuit can be used to operate an air conditioning unit in a hot classroom in order to keep the classroom cool. The air conditioning unit starts operating when the p.d. in the secondary circuit exceeds a certain value.

* (a) Explain how the circuit should be set up to keep the classroom cool. Your answer should include details of how a negative temperature coefficient thermistor works, in terms of particles.

(6)

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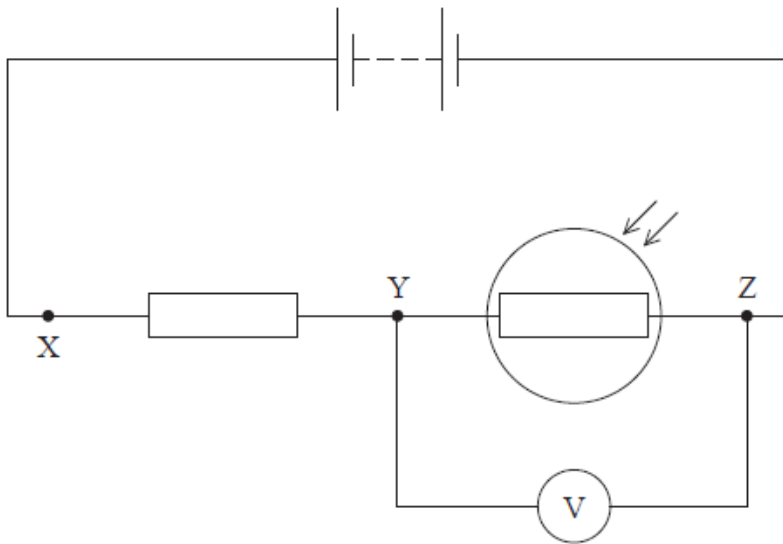
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(b) The thermistor in the circuit is replaced with a light dependent resistor (LDR) and a voltmeter placed across YZ as shown.



The fixed resistor has a resistance of $1.20 \text{ k}\Omega$. The battery has an e.m.f. of 12.0 V and negligible internal resistance. Initially the circuit is set up in a darkened room, and the voltmeter displays a reading of 4.71 V . When a light is shone directly onto the LDR, the voltmeter reads 2.16 V . Calculate the change in resistance of the LDR when the light is shone onto it.

(3)

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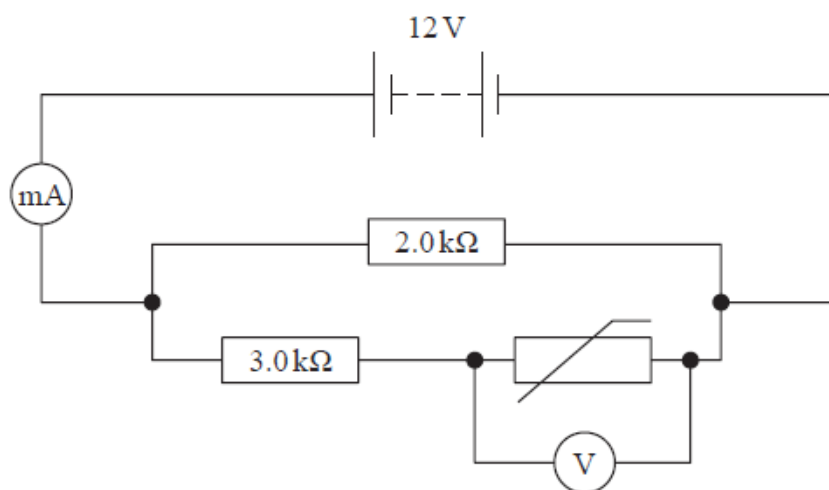
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Change in resistance of the LDR = ...

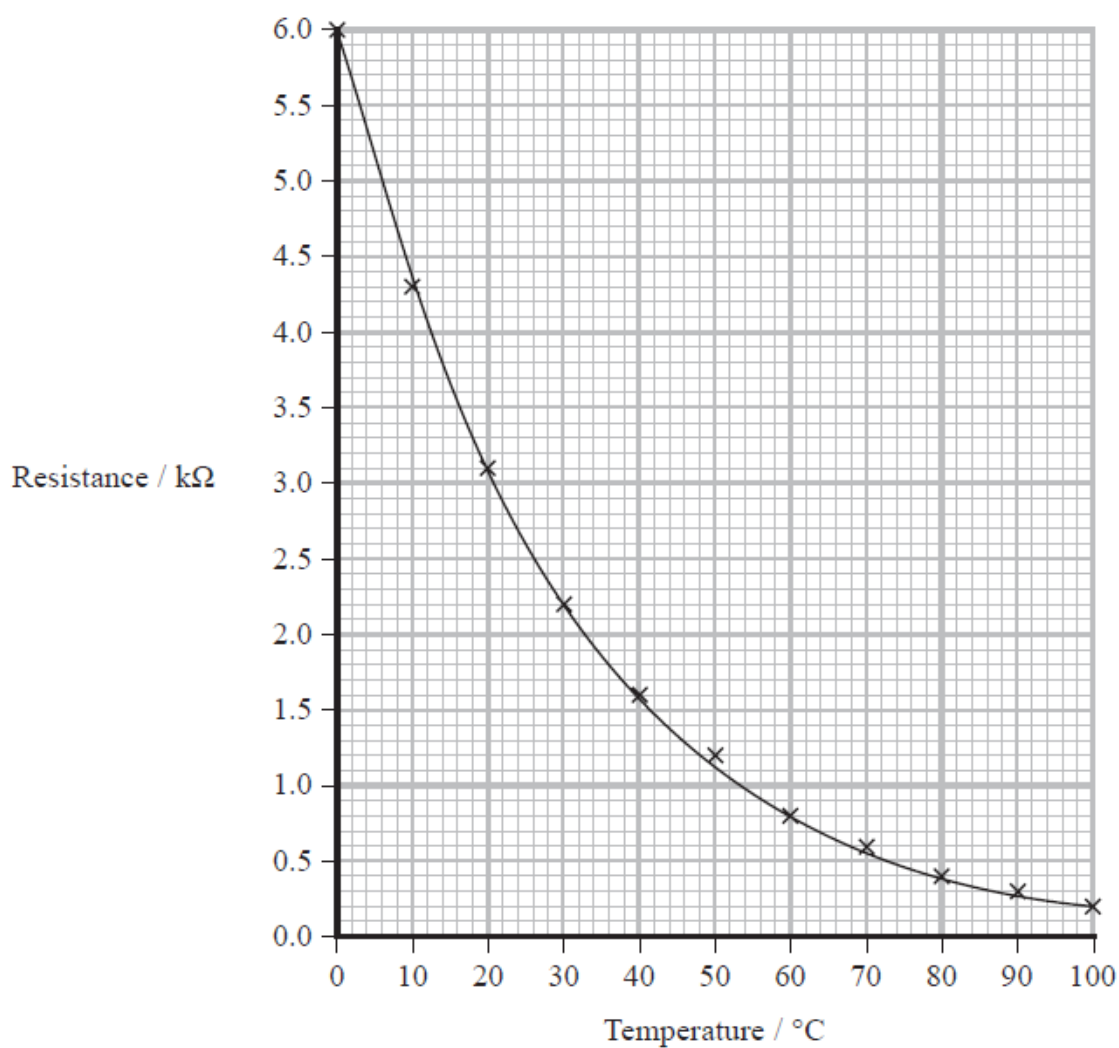
(Total for question = 9 marks)

Q18.

A student set up the circuit shown. The battery had a negligible internal resistance.



The resistance of the thermistor varies with temperature, as shown by the graph.



(a) Determine the milliammeter reading when the temperature of the thermistor is 54°C .

(4)

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Milliammeter reading = ...mA

(b) (i) Explain how decreasing the temperature of the thermistor affects the voltmeter reading. Do not include calculations in your answer.

(2)

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(ii) Explain how decreasing the temperature of the thermistor affects the power dissipated by the 2.0 kΩ resistor. Do not include calculations in your answer.

(2)

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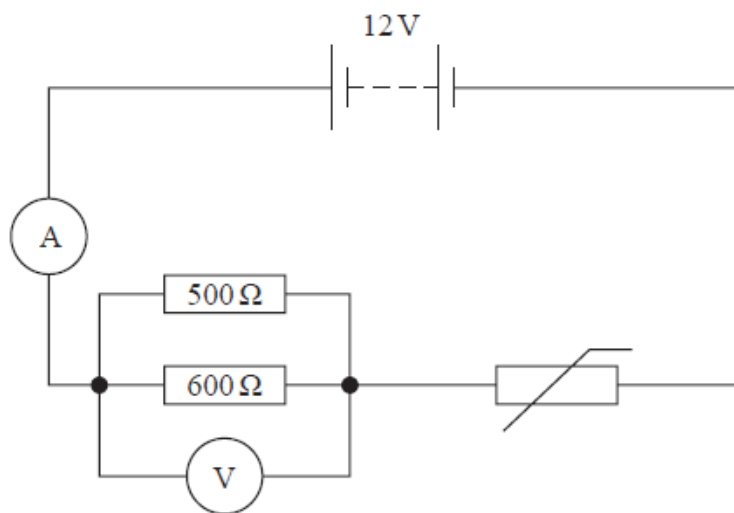
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(Total for question = 8 marks)

Q19.

A student set up the circuit shown to investigate the properties of a negative temperature coefficient thermistor.



The power supply has negligible internal resistance.

(a) (i) Show that the voltmeter reading was about 6 V.

ammeter reading = 23 mA

(3)

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(ii) Calculate the power dissipated by the thermistor.

(3)

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Power = ...

(b) The student decreases the temperature of the thermistor.

Explain the effect of decreasing the temperature of the thermistor on the ammeter and voltmeter readings.

(4)

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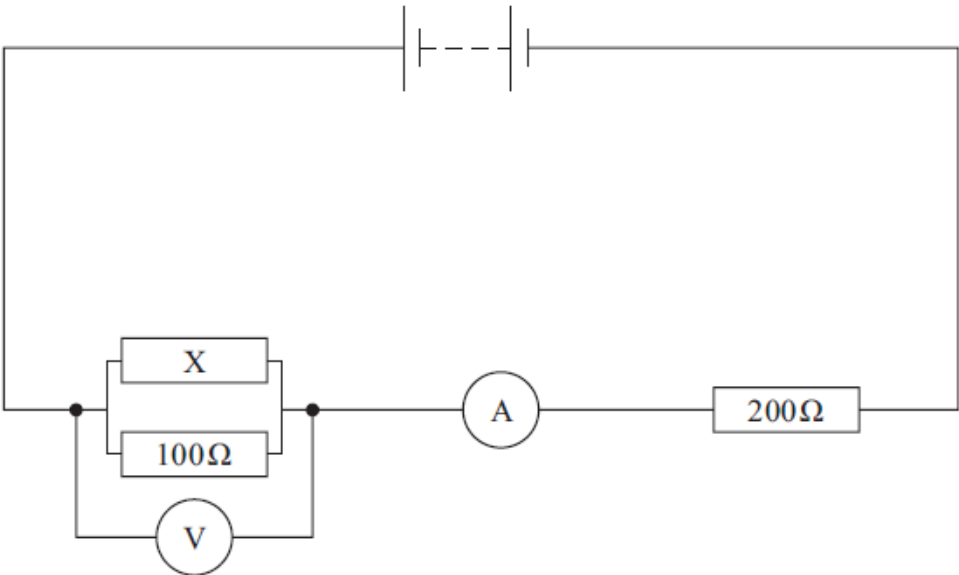
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(Total for question = 10 marks)

Q20.

A student connected the circuit shown.



The battery has an e.m.f. of 6.00 V and negligible internal resistance.

(a) State what is meant by an e.m.f. of 6.00 V.

(1)

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(b) The reading on the voltmeter is 1.64 V.

(i) Show that the reading on the ammeter is about 20 mA.

(3)

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(ii) Determine the resistance of resistor X.

(3)

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Resistance of resistor X = ...

(iii) Determine the power dissipated in the 100 Ω resistor.

(2)

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Power = ...

(c) The student makes the following prediction.

If I switch the positions of the 100 Ω resistor and the 200 Ω resistor, then the reading on the voltmeter will increase.

Discuss the student's prediction.

You do not need to include calculations in your answer.

(2)

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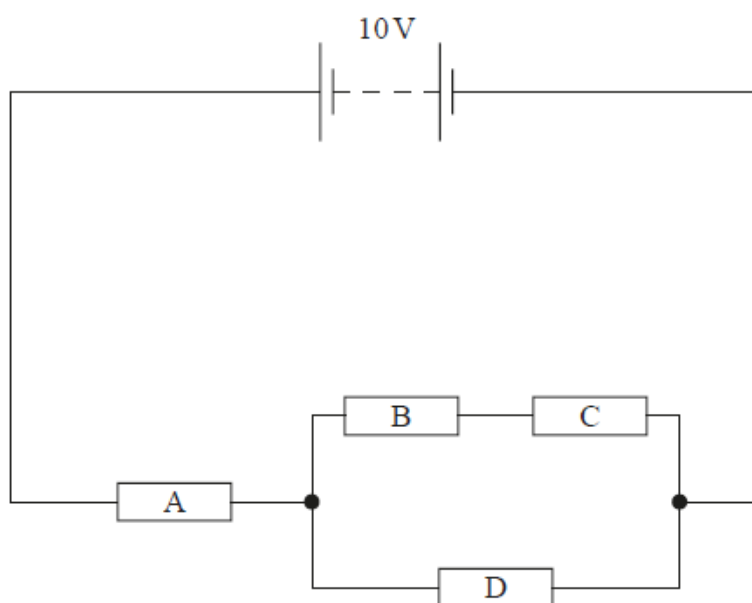
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(Total for question = 11 marks)

Q21.

Four identical resistors, A, B, C and D, are placed in a circuit as shown.



(a) Determine the power dissipated in each of the resistors.

resistance of each resistor = $2.0\ \Omega$

(6)

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(b) Explain, without further calculation, what would happen to the power dissipated by resistor A if resistor D were disconnected from the circuit.

(2)

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(c) If the resistors in the circuit used in (a) were replaced with filament lamps, the resistance of each lamp would be different depending on the potential difference across it.

Explain, in terms of particles, why the resistance of a filament lamp increases as the potential difference across the filament increases.

(4)

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Q22.

Resistors are included in circuits that are used as potential dividers.

(a) Derive an equation for the combined resistance R_T for two resistors, R_1 and R_2 , in series.

(3)

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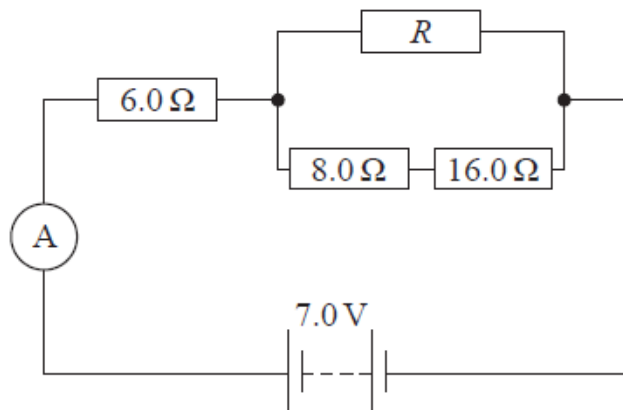
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(b) The diagram shows a circuit that includes a resistor combination. The battery has negligible internal resistance.



The ammeter displays a current of 0.50 A.

Calculate the resistance R.

(3)

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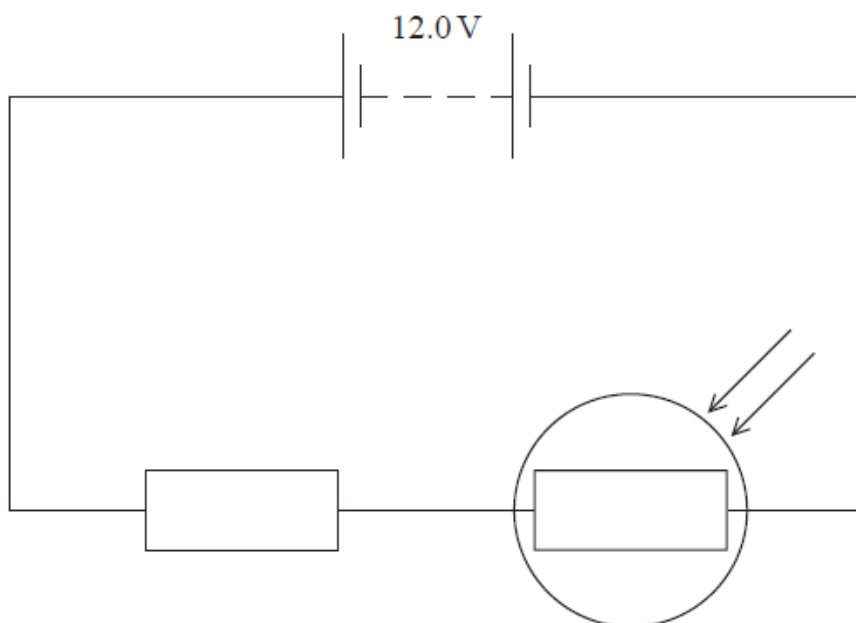
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Resistance R

(c) The circuit shown below includes a light dependent resistor (LDR). The battery has no internal resistance.



(i) In normal daylight, this particular type of LDR has a resistance of $670\ \Omega$.

Calculate the power dissipated in the fixed resistor in normal daylight.

resistance of fixed resistor = $8.00\ \text{k}\Omega$

(3)

Power = ...

(ii) As the light intensity incident upon the LDR decreases, the power dissipated in the fixed resistor decreases.

Explain why the power in the fixed resistor decreases. Your answer should include reference to the electrons in the LDR.

(4)

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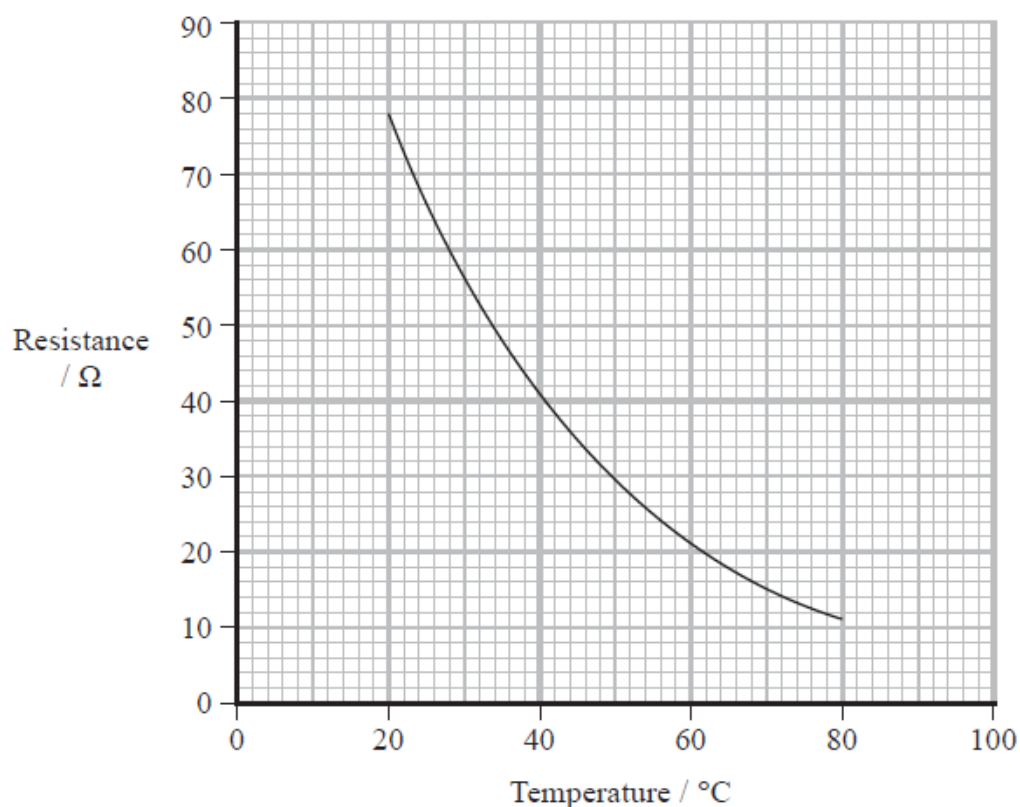
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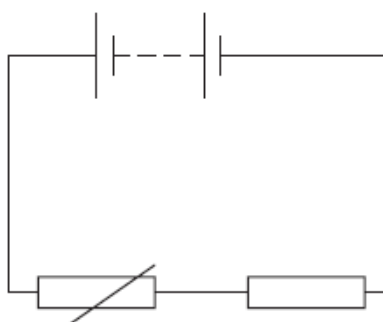
(Total for question = 13 marks)

Q23.

The resistance of a particular thermistor varies with temperature, as shown.



(a) A student connected the thermistor in series with a battery and a resistor, as shown. The resistor was made from a long length of wire.



At a temperature of 45 °C, the resistance of the thermistor was four times the resistance of the resistor. The power P dissipated in the resistor was 0.38 W.

(i) Derive the equation $P = \frac{V^2}{R}$

(2)

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(ii) Determine the potential difference across the battery.

(4)

[illegible]

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(ii) The student increased the temperature of both the wire resistor and the thermistor from 80 °C to 90 °C.

This image shows a full page of white paper with ten evenly spaced horizontal dashed lines, typical of primary school handwriting practice paper. The lines extend across the entire width of the page.

(5)

(Total for question = 13 marks)