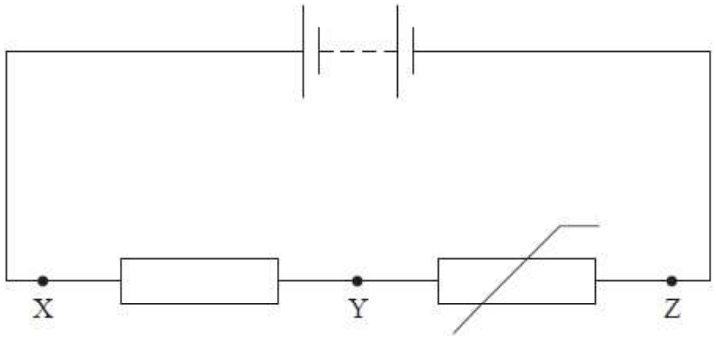
Resistance, Components and Resistivity - Questions by Topic

Q1.

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)

.....

.....

.....

.....

.....

.....

.....

.....

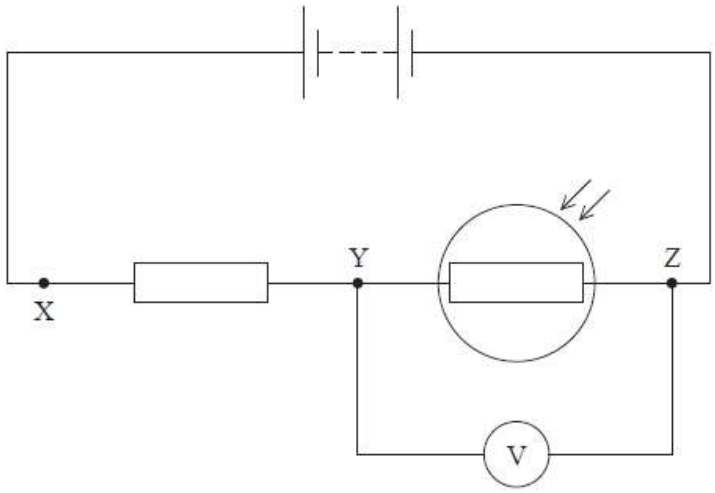
.....

.....

.....

.....

(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 kΩ. 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)

.....

.....

.....

.....

.....

.....

Change in resistance of the LDR = ...

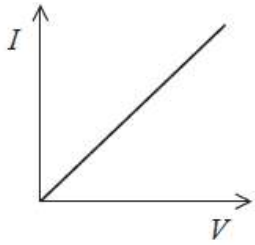
(Total for question = 9 marks)

Q2.

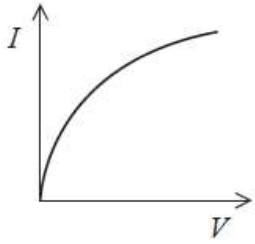
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of the following graphs shows how current *I* varies with potential difference *V* for a negative temperature coefficient thermistor?

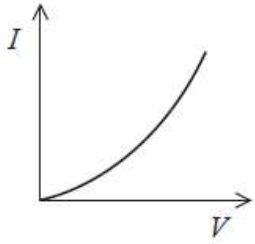
☐ **A**



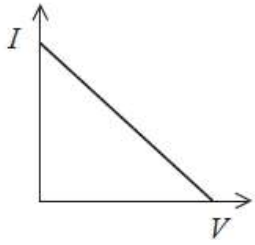
☐ **B**



☐ **C**



☐ **D**



(Total for question = 1 mark)

Q3.

A student carried out an experiment to determine the resistivity of a metal in the form of a wire. She made the following measurements:

length of wire = 0.20 m
resistance of wire = 50 mΩ
diameter of wire = 0.36 mm

Determine the metal of the wire using information from the table below.

Metal	Resistivity / Ω m
aluminium	2.7×10^{-8}
tungsten	5.6×10^{-8}
iron	1.0×10^{-7}

(3)

.....

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q4.

The equation $I = nqvA$ can be used to establish the drift velocity v of electrons in a copper wire.

(a) State what is meant by drift velocity.

(1)

.....

.....

(b) A copper wire has a cross-sectional area of $2.64 \times 10^{-7} m^2$ and carries a current of 1.31 A. Calculate the drift velocity of the electrons in this copper wire.

$n = 8.49 \times 10^{28} m^{-3}$

(2)

.....

.....

.....

.....

Drift velocity = ...

(Total for question = 3 marks)

Q5.

A student is planning an experiment to determine a value for the resistivity of a metal in the form of a wire, by a graphical method.

(a) State the physical quantities she should measure, suggesting a suitable measuring instrument for each quantity.

(3)

.....

.....

.....

.....

.....

.....

(b) Describe how she should use her measurements to determine an accurate value for the resistivity of the wire using a graphical method.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q6.

The resistance of some electrical components decreases as the applied potential difference increases.

Which row of the table contains two components that behave in this way?

☒ **A**	diode	ohmic conductor
☒ **B**	ohmic conductor	filament lamp
☒ **C**	negative temperature coefficient thermistor	diode
☒ **D**	negative temperature coefficient thermistor	filament lamp

(Total for question = 1 mark)

Q7.

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)

.....

.....

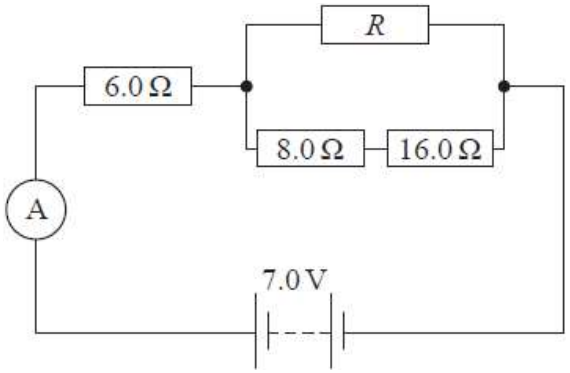
.....

.....

.....

.....

(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)

.....

.....

.....

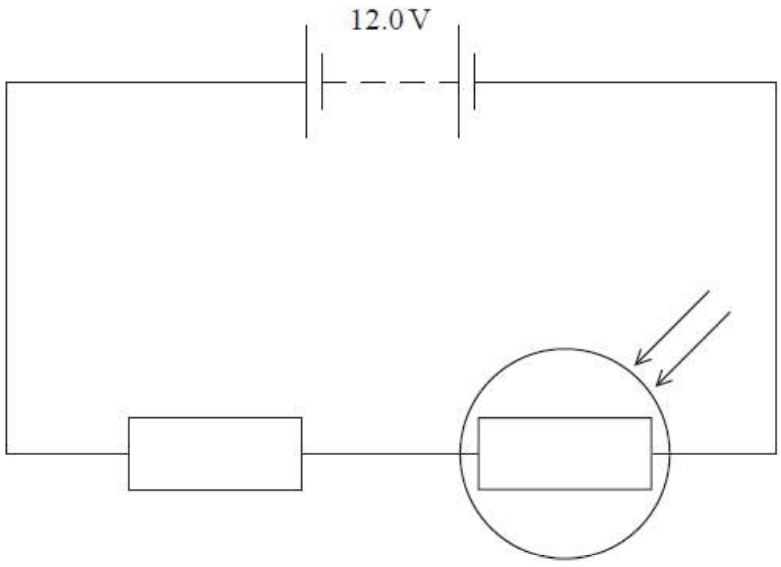
.....

.....

.....

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 Ω.

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

resistance of fixed resistor = 8.00 kΩ

(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)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 13 marks)

Q8.

A copper wire has a cross-sectional area of 5.0×10^{-7} m^2. There is a current in the wire of 0.93 A. Copper has 8.4×10^{28} conduction electrons per metre cubed.

Which of the following gives the magnitude of the drift velocity v in m s^{-1} for the conduction electrons in this wire?

☐ **A** $v = \dfrac{0.93}{(8.4 \times 10^{28})(5.0 \times 10^{-7})}$

☐ **B** $v = \dfrac{(8.4 \times 10^{28})(1.6 \times 10^{-19})(5.0 \times 10^{-7})}{0.93}$

☐ **C** $v = \dfrac{(8.4 \times 10^{28})(5.0 \times 10^{-7})}{0.93}$

☐ **D** $v = \dfrac{0.93}{(8.4 \times 10^{28})(1.6 \times 10^{-19})(5.0 \times 10^{-7})}$

(Total for question = 1 mark)