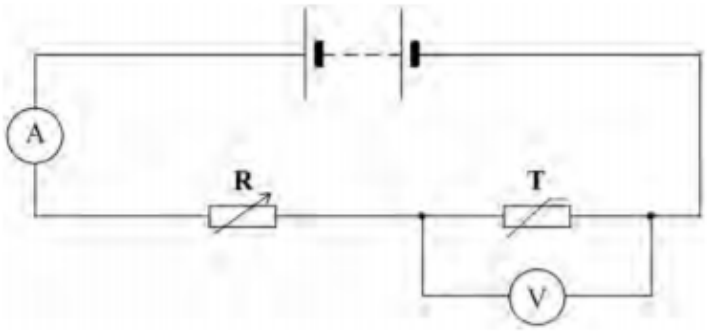
Electricity- Potential Dividers Past Paper Questions AQA Physics A Level

1.

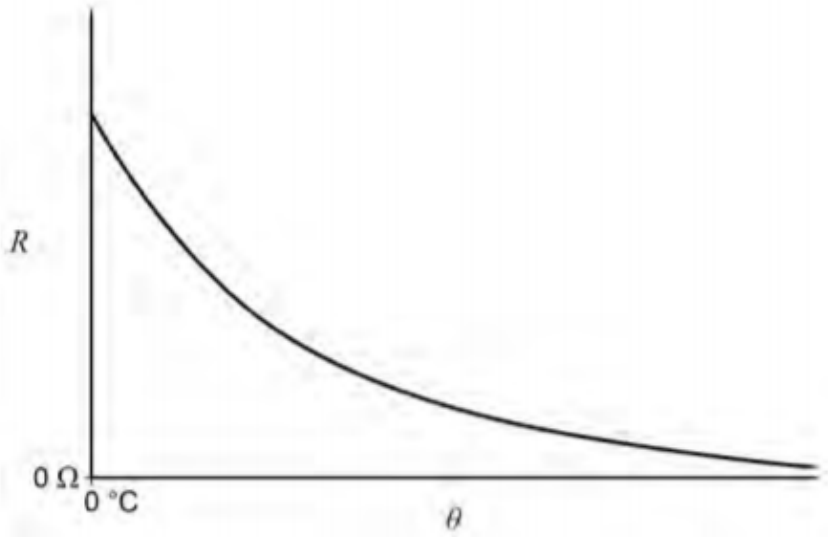
Figure 4 shows a circuit including a thermistor **T** in series with a variable resistor **R**. The battery has negligible internal resistance.

Figure 4



The resistance–temperature (R-θ) characteristic for **T** is shown in **Figure 5**.

Figure 5



. 1 The resistor and thermistor in **Figure 4** make up a potential divider.

Explain what is meant by a potential divider.

[1 mark]

. **2** State and explain what happens to the voltmeter reading when the resistance of **R** is increased while the temperature is kept constant.

[3 marks]

] . **3** State and explain what happens to the ammeter reading when the temperature of the thermistor increases.

[2 marks]

] . **4** The battery has an emf of 12.0 V. At a temperature of 0 °C the resistance of the thermistor is $2.5 \times 10^3\ \Omega$.

The voltmeter is replaced by an alarm that sounds when the voltage across it exceeds 3.0 V.

Calculate the resistance of R that would cause the alarm to sound when the temperature of the thermistor is lowered to 0 °C.

[2 marks]

resistance = _____ Ω

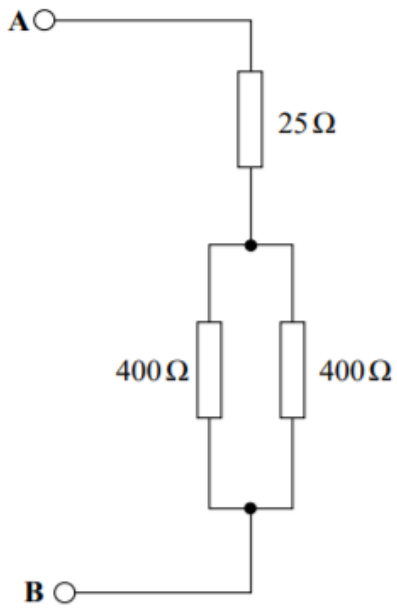
. 5 State **one** change that you would make to the circuit so that instead of the alarm coming on when the temperature falls, it comes on when the temperature rises above a certain value.

[1 mark]

2.

Figure 5 shows an arrangement of resistors.

Figure 5



(a) Calculate the total resistance between terminals **A** and **B**.

answer = ... Ω

(2 marks)

(b) A potential difference is applied between the two terminals, **A** and **B**, and the power dissipated in each of the 400 Ω resistors is 1.0 W.

(b) (i) Calculate the potential difference across the 400 Ω resistors.

answer = ... V

(b) (ii) Calculate the current through the 25 Ω resistor.

answer = ...A

(b) (iii) Calculate the potential difference applied to terminals **A** and **B**.

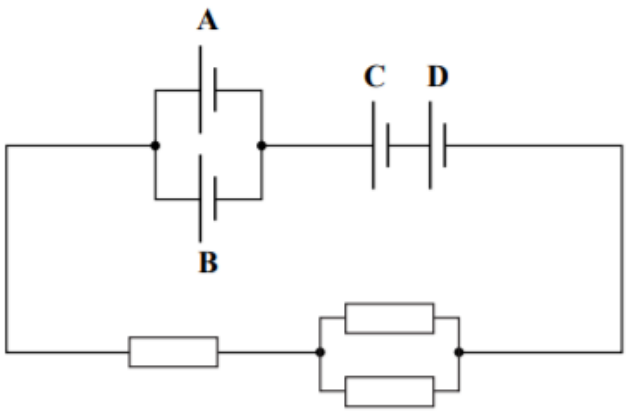
answer = ... V

(6 marks)

3.

The circuit in **Figure 2** contains four identical new cells, **A**, **B**, **C** and **D**, each of emf 1.5 V and negligible internal resistance.

Figure 2



(a) The resistance of each resistor is 4.0 Ω.

(a) (i) Calculate the total resistance of the circuit.

answer = ... Ω
(1 mark)

(a) (ii) Calculate the total emf of the combination of cells.

answer = ... V
(1 mark)

(a) (iii) Calculate the current passing through cell **A**.

answer = ... A

(2 marks)

(a) (iv) Calculate the charge passing through cell **A** in five minutes, stating an appropriate unit.

answer = ...

(2 marks)

(b) Each of the cells can provide the same amount of electrical energy before going flat. State and explain which two cells in this circuit you would expect to go flat first.

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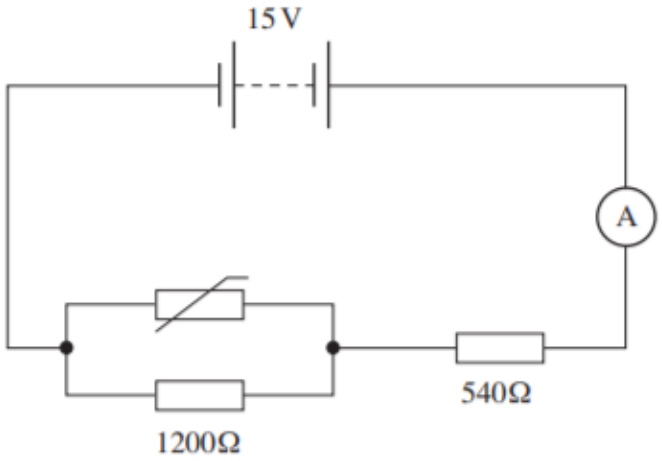
(3 marks)

4.

The circuit shown in **Figure 3** shows a thermistor connected in a circuit with two resistors, an ammeter and a battery of emf 15 V and negligible internal resistance.

Figure 3



(a) When the thermistor is at a certain temperature the current through the ammeter is 10.0 mA.

(a) (i) Calculate the pd across the 540 Ω resistor.

answer = ... V
(1 mark)

(a) (ii) Calculate the pd across the 1200 Ω resistor.

answer = ... V
(1 mark)

(a) (iii) Calculate the resistance of the parallel combination of the resistor and the thermistor.

answer = ... Ω

(2 marks)

(a) (iv) Calculate the resistance of the thermistor.

answer = ... Ω

(2 marks)

(b) The temperature of the thermistor is increased so that its resistance decreases.
State and explain what happens to the pd across the 1200 Ω resistor.

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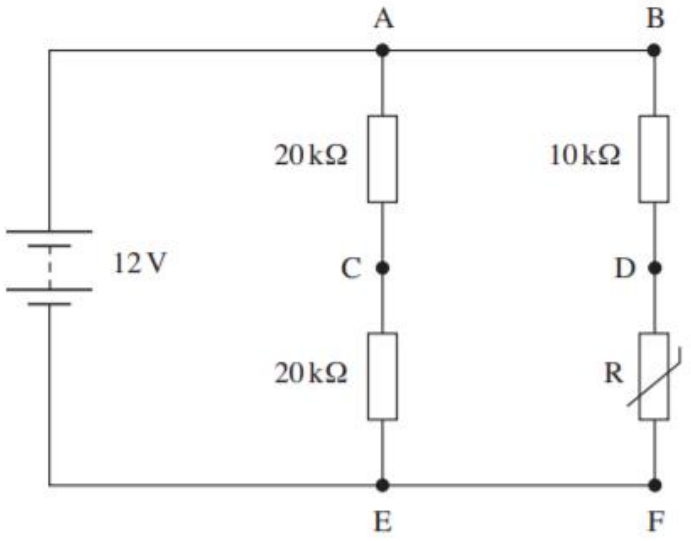
(3 marks)

5.

Figure 2 shows a 12 V battery of negligible internal resistance connected to a combination of three resistors and a thermistor.

Figure 2



(a) When the resistance of the thermistor is 5.0 kΩ

(a) (i) calculate the total resistance of the circuit,

total resistance = ... kΩ

(3 marks)

(a) (ii) calculate the current in the battery.

current = ... mA

(b) A high-resistance voltmeter is used to measure the potential difference (pd) between points A–C, D–F and C–D in turn.
Complete the following table indicating the reading of the voltmeter at each of the three positions.

voltmeter position	pd / V
A–C	
D–F	
C–D	

(3 marks)

(c) The thermistor is heated so that its resistance decreases. State and explain the effect this has on the voltmeter reading in the following positions.

(c) (i) A–C .....

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(2 marks)

(c) (ii) D–F .....

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(2 marks)