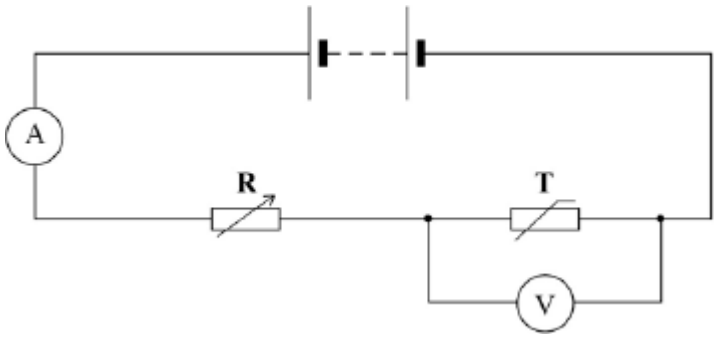
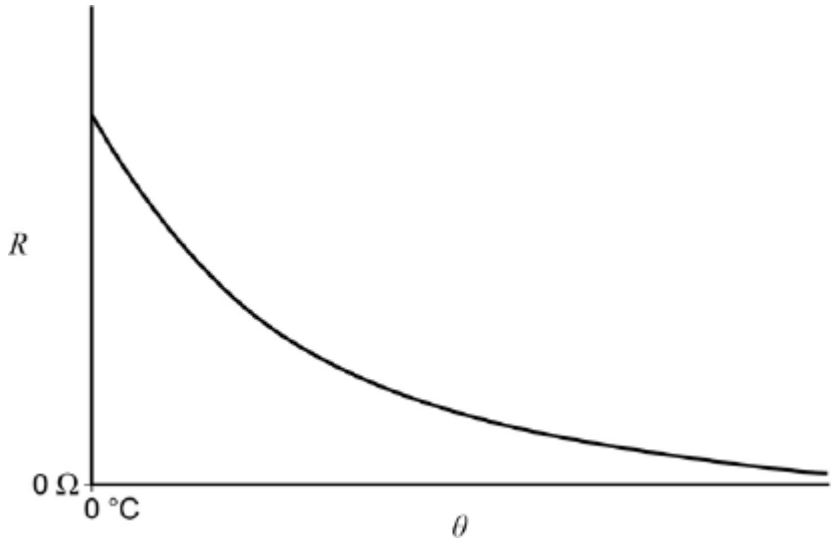
Q1.Figure 1 shows a circuit including a thermistor **T** in series with a variable resistor **R**. The battery has negligible internal resistance.

Figure 1



The resistance–temperature ($R-\theta$) characteristic for **T** is shown in **Figure 2**.

Figure 2



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

Explain what is meant by a potential divider.

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(1)

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

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(3)

(c) State and explain what happens to the ammeter reading when the temperature of the thermistor increases.

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(2)

(d) The battery has an emf of 12.0 V. At a temperature of 0 °C the resistance of the thermistor is 2.5 10^3 Ω.

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.

resistance = ... Ω

(2)

(e) 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.

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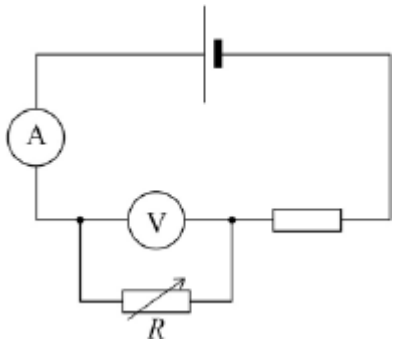
(1)
(Total 9 marks)

Q2. In the circuit shown in the diagram the cell has negligible internal resistance.

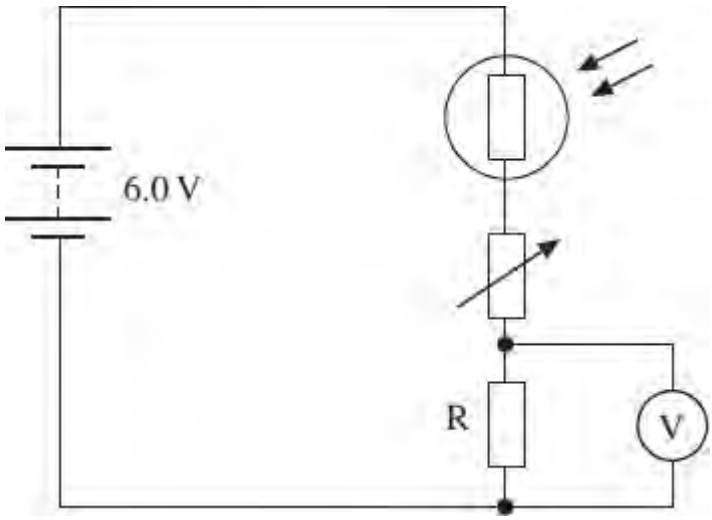


What happens to the reading of both meters when the resistance of R is decreased?

	Reading of ammeter	**Reading of voltmeter**	
A	increases	increases	⬭
B	increases	decreases	⬭
C	decreases	increases	⬭
D	unchanged	decreases	⬭

(Total 1 mark)

Q3. The circuit diagram below shows a 6.0 V battery of negligible internal resistance connected in series to a light dependent resistor (LDR), a variable resistor and a fixed resistor, R.



(a) For a particular light intensity the resistance of the LDR is 50 kΩ. The resistance of R is 5.0 kΩ and the variable resistor is set to a value of 35 kΩ.

(i) Calculate the current in the circuit.

current.....A

(2)

(ii) Calculate the reading on the voltmeter.

voltmeter reading V

(2)

(b) State and explain what happens to the reading on the voltmeter if the intensity of the light incident on the LDR increases.

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(2)

(c) For a certain application at a particular light intensity the pd across R needs to be

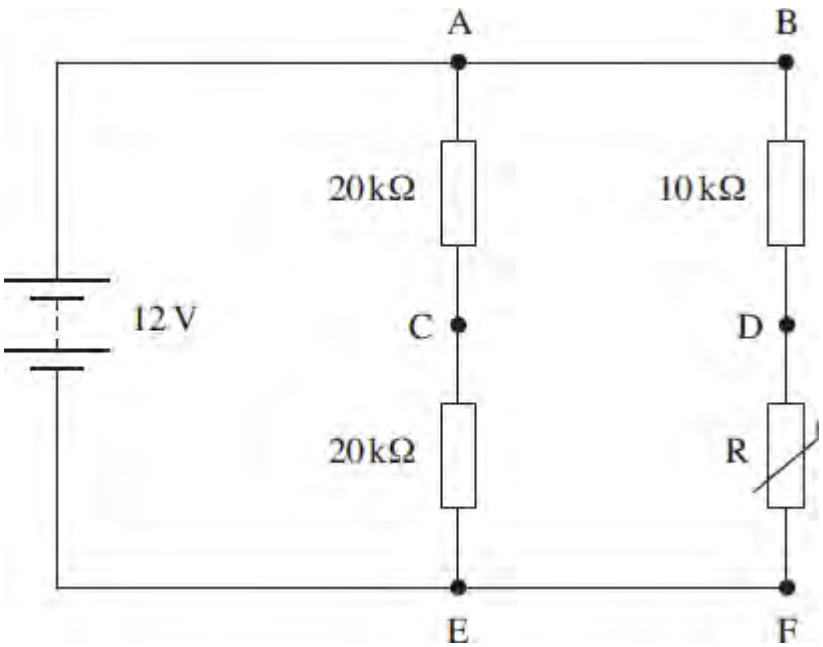
0.75 V. The resistance of the LDR at this intensity is 5.0 kΩ.

Calculate the required resistance of the variable resistor in this situation.

resistance ..... Ω

(3)
(Total 9 marks)

Q4. The circuit diagram below shows a 12 V battery of negligible internal resistance connected to a combination of three resistors and a thermistor.



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

(i) calculate the total resistance of the circuit,

total resistance = ... kΩ

(3)

(ii) calculate the current in the battery.

current = ... mA

(1)

(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)

(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.

(i) A–C.....

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(2)

(ii) D–F.....

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(2)

(Total 11 marks)

Q5.(a) Define the volt.

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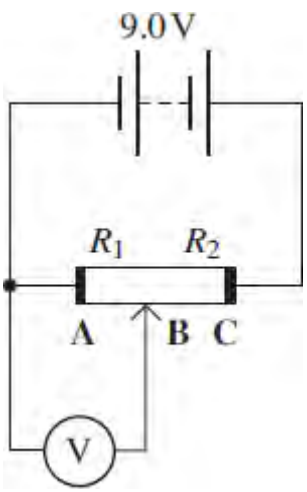
(1)

(b) To test the potential differences in a potential divider circuit, a student sets up the circuit of **Figure 1**. R_1 is the resistance of section **AB** and R_2 that of section **BC** of the potential divider. The battery has an emf of 9.0 V and negligible internal resistance

Figure 1



(i) Calculate the voltmeter reading when R_1 = 2.2 k and R_2 = 1.8 k. Assume that the voltmeter has infinite resistance.

voltmeter reading V

(2)

(ii) State the benefit of using a high value of resistance in potential divider circuits.

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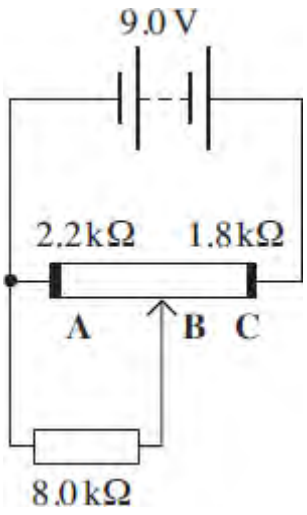
(1)

(iii) An 8.0 k resistor is connected in the circuit to replace the voltmeter in **Figure 1**.
This is shown in **Figure 2**.

Figure 2



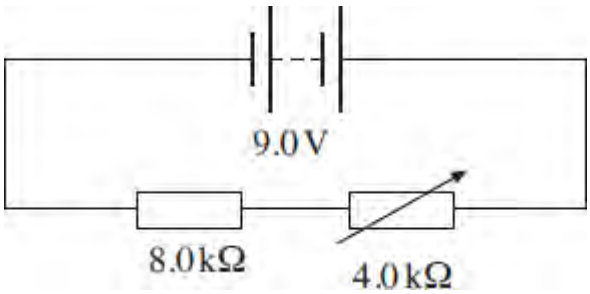
Calculate the potential difference across this resistor when the sliding contact **B** is in the position shown in **Figure 2**.

potential difference V

(3)

(iv) The 8.0 k resistor is now connected in a circuit with a 4.0 k variable resistor as shown in **Figure 3**.

Figure 3



Compare this arrangement for controlling the current in the 8.0 k resistor with the potential divider arrangement in **Figure 2**.

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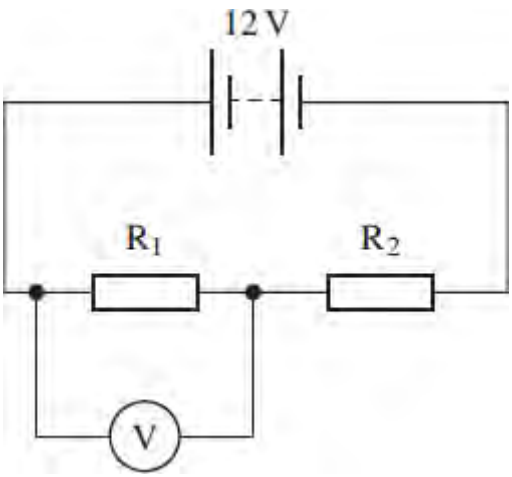
(2)
(Total 9 marks)

Q6. The figure below shows two resistors, R_1 and R_2, connected in series with a battery of emf 12 V and negligible internal resistance.



(a) The reading on the voltmeter is 8.0 V and the resistance of R_2 is 60 Ω.

(i) Calculate the current in the circuit.

answer = ... A

(2)

(ii) Calculate the resistance of R_1.

answer = ... Ω

(1)

(iii) Calculate the charge passing through the battery in 2.0 minutes. Give an appropriate unit for your answer.

answer = ... unit = ...

(2)

(b) In the circuit shown in the figure above R_2 is replaced with a thermistor. State and explain what will happen to the reading on the voltmeter as the temperature of the thermistor increases.

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(3)

(Total 8 marks)