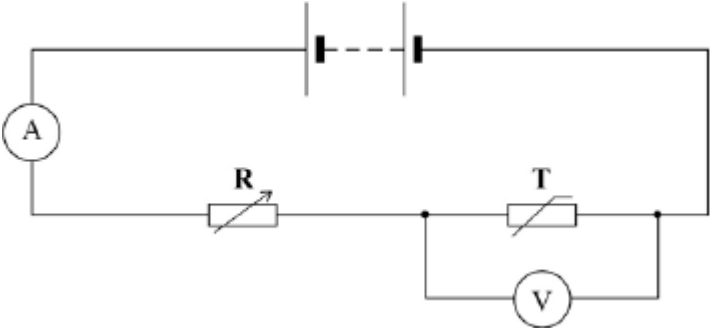


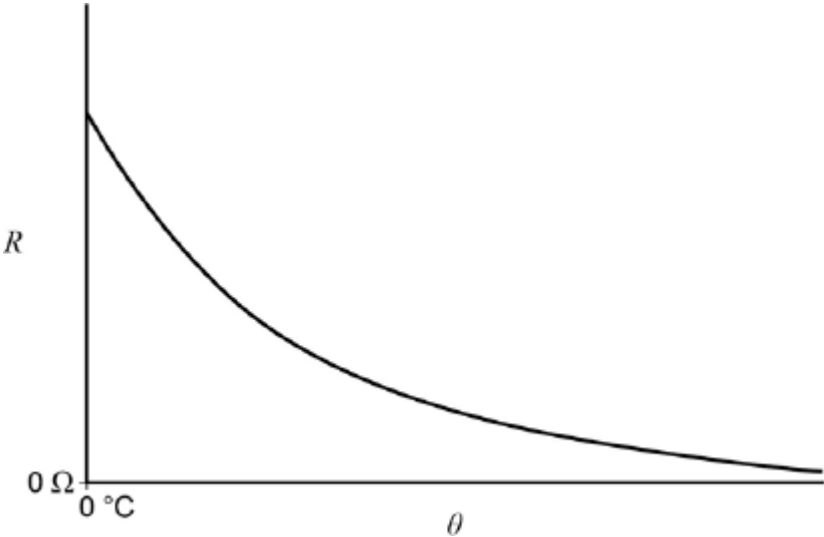
**Q1.**Figure 1 shows a circuit including a thermistor **T** in series with a variable resistor **R**. The battery has negligible internal resistance.

**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.

.....

.....

.....

(1)

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

.....  
.....  
.....  
.....  
.....  
.....

(3)

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

.....  
.....  
.....  
.....

(2)

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

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.

resistance = .....  $\Omega$

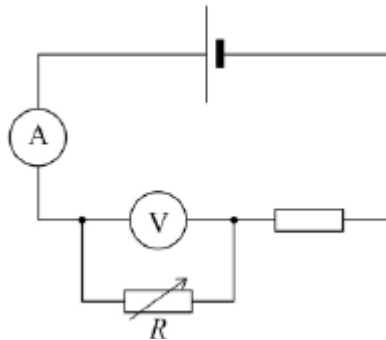
(2)

- (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.

.....

(1)  
(Total 9 marks)

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

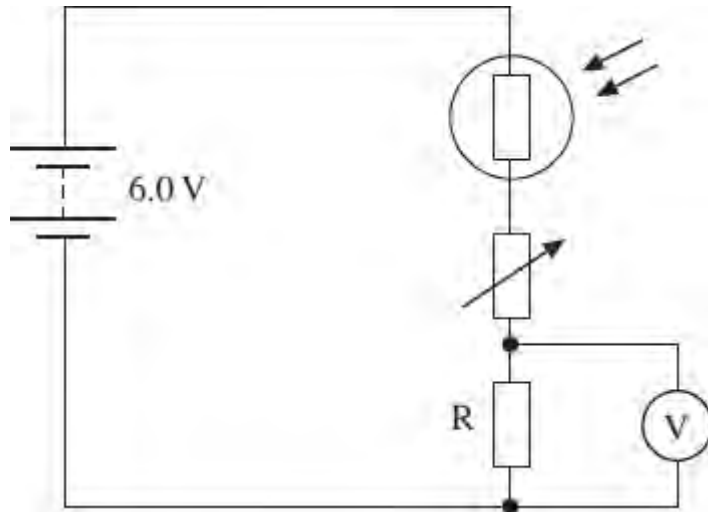


What happens to the reading of both meters when the resistance of  $R$  is decreased?

	Reading of ammeter	Reading of voltmeter	
A	increases	increases	<input type="checkbox"/>
B	increases	decreases	<input type="checkbox"/>
C	decreases	increases	<input type="checkbox"/>
D	unchanged	decreases	<input type="checkbox"/>

(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  $50\text{ k}\Omega$ . The resistance of R is  $5.0\text{ k}\Omega$  and the variable resistor is set to a value of  $35\text{ k}\Omega$ .

(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.

.....  
 .....  
 .....

(2)

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

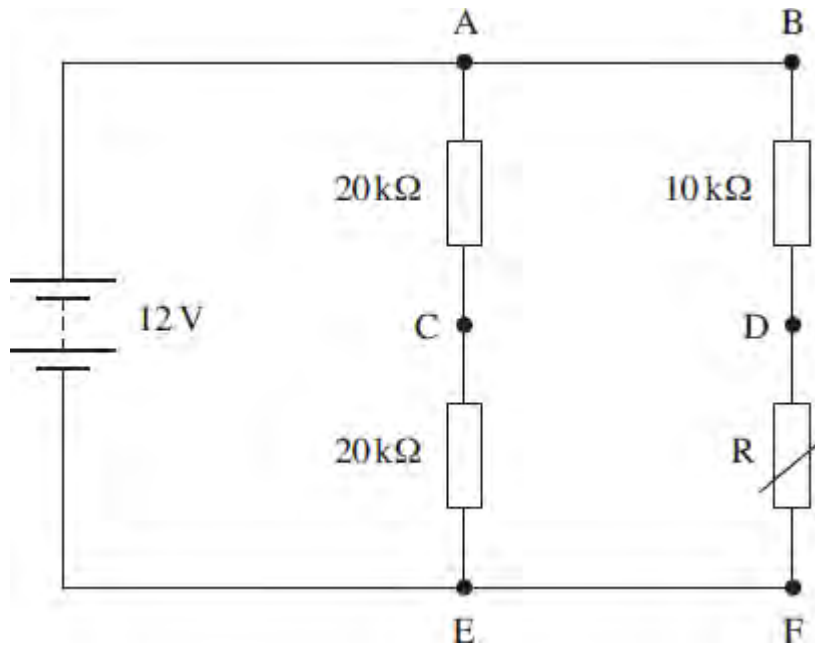
0.75 V. The resistance of the LDR at this intensity is 5.0 k $\Omega$ .

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

resistance .....  $\Omega$

(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 k $\Omega$

(i) calculate the total resistance of the circuit,

total resistance = ..... k $\Omega$

(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.....  
.....  
.....  
.....

(2)

(ii) D-F.....  
.....  
.....  
.....

(2)

(Total 11 marks)

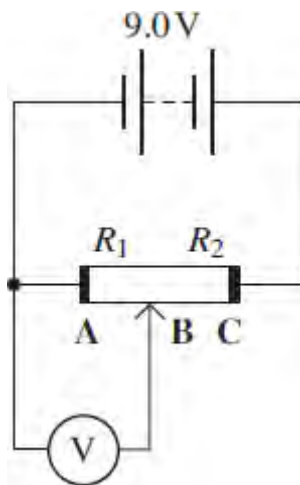
Q5.(a) Define the volt.

.....  
 .....

(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  $R_1 = 2.2 \text{ k}$  and  $R_2 = 1.8 \text{ k}$ . Assume that the voltmeter has infinite resistance.

voltmeter reading ..... V

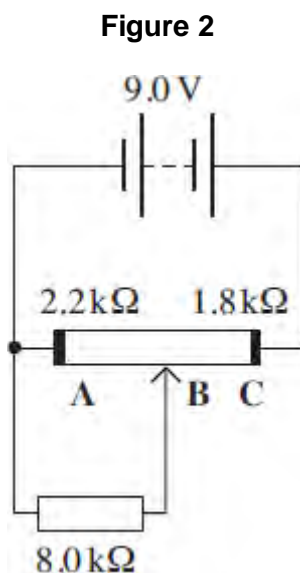
(2)

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

.....

(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**.



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

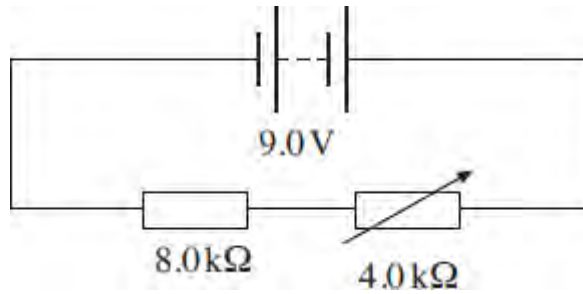
potential difference ..... V

(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  $8.0\text{ k}$  resistor with the potential divider arrangement in **Figure 2**.

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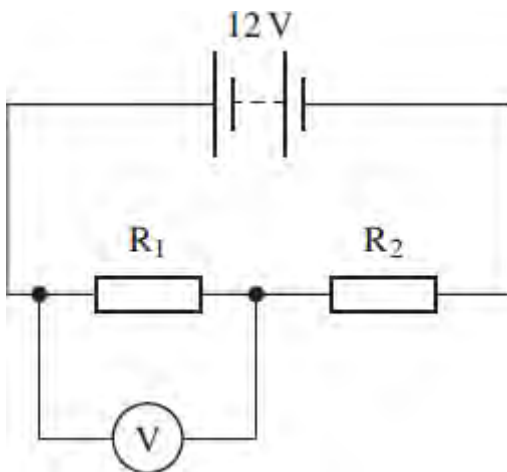
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(2)  
(Total 9 marks)

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



- (a) The reading on the voltmeter is  $8.0\text{ V}$  and the resistance of  $R_2$  is  $60\ \Omega$ .
- (i) Calculate the current in the circuit.

answer = ..... A (2)

(ii) Calculate the resistance of  $R_1$ .

answer = .....  $\Omega$  (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)

