1 A student investigates how the resistance of a thermistor varies with temperature.

(a) The student sets up the circuit shown in Figure 5 to measure current and voltage.

He finds that it does not work.

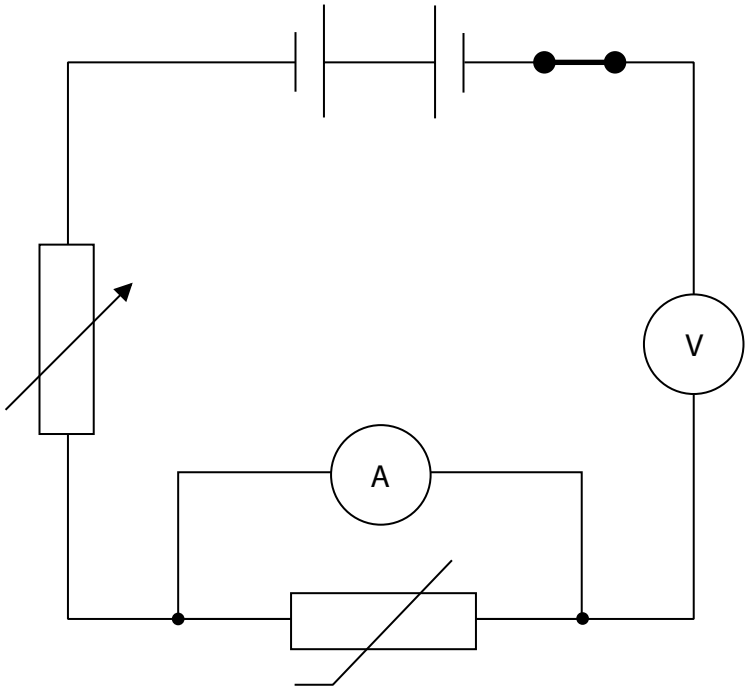


Figure 5

Give **three** modifications the student should make to the circuit so that the circuit works correctly.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(b) The student uses the equipment shown in Figure 6 to measure the temperature of the thermistor.

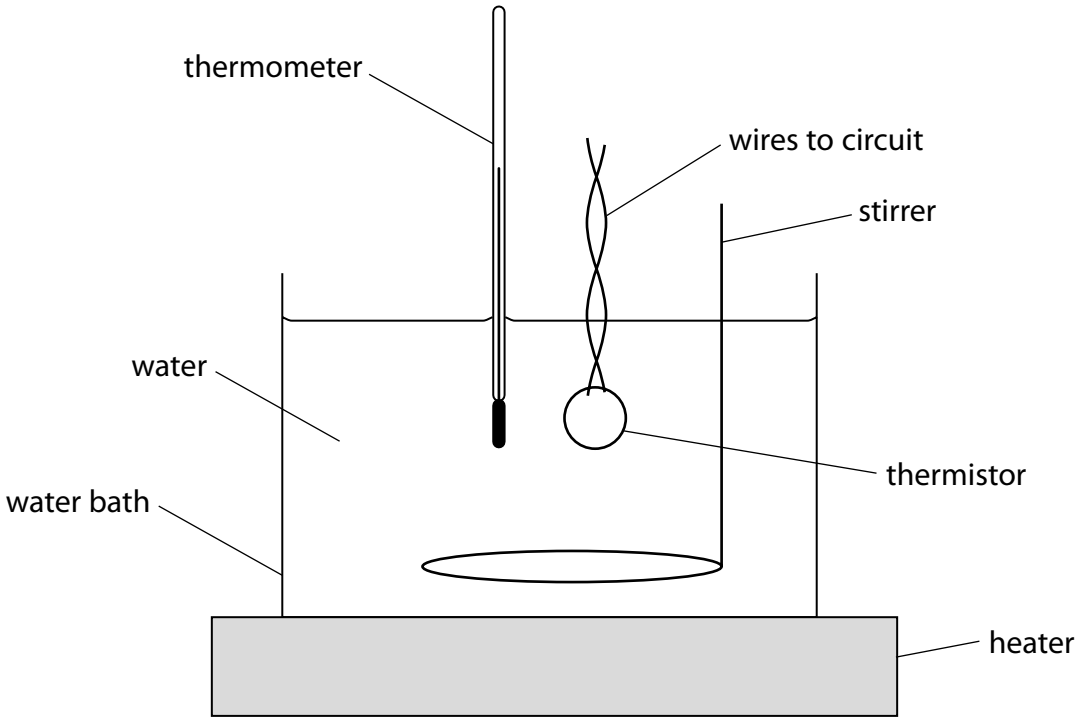


Figure 6

(i) Give **one** reason for using the water bath.

(1)

.....

.....

(ii) The equipment shown in Figure 6 is for investigations in the temperature range from 20 °C to 100 °C.

State **one** way the student could develop this experimental procedure to investigate temperatures outside this range.

(1)

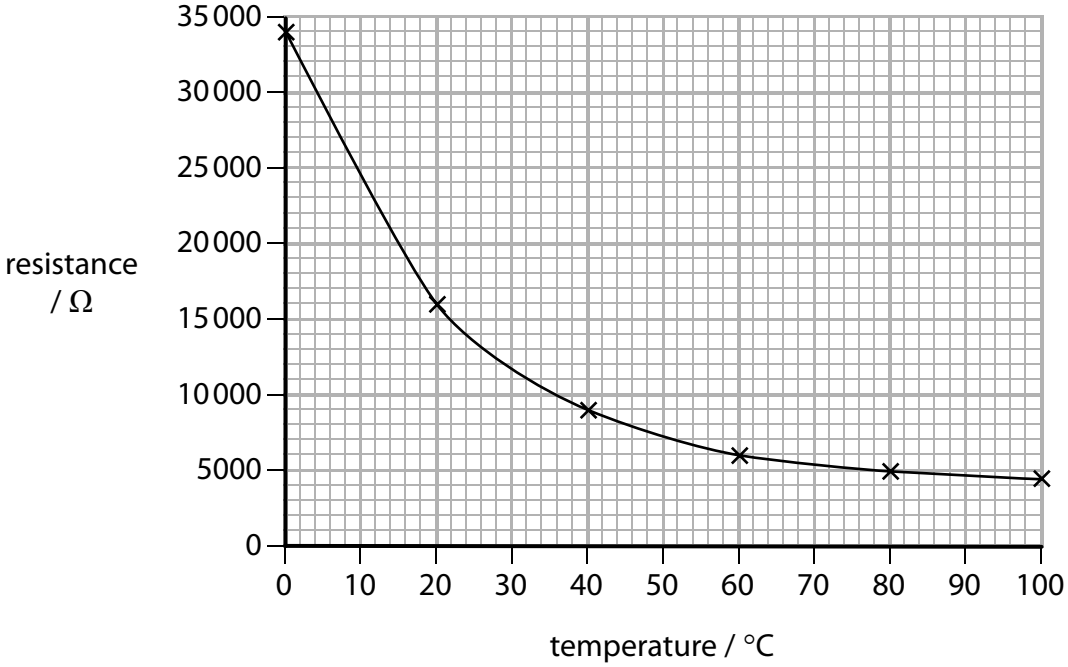
.....

.....

(c) The student takes measurements for two other components, **A** and **B**.

The results for both these components are shown in Figure 7.

Component A



Component B

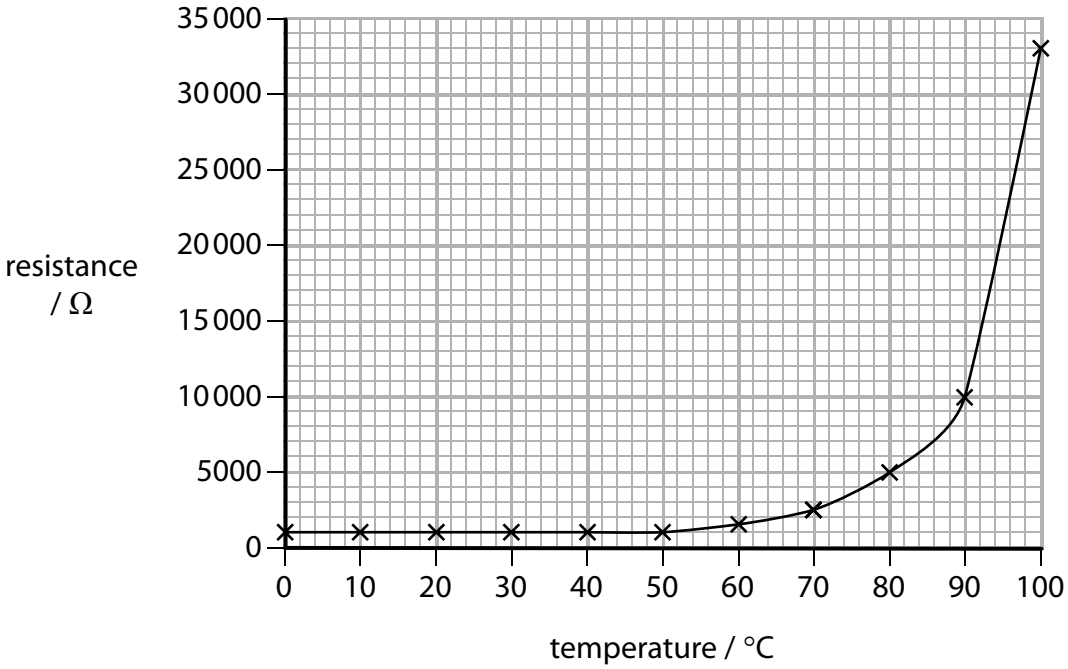


Figure 7

(i) Compare and contrast how the resistances of component **A** and component **B** vary with temperature.

(3)

(ii) Component **A** is connected to a 12 V supply.

Which of these is the current in component **A** when the temperature is 80 °C?

(1)

☒ **A** $I = 12 \times 5000$

☒ **B** $I = \frac{12}{5000}$

☒ **C** $I = \frac{12^2}{5000}$

☒ **D** $I = \sqrt{\left(\frac{12}{5000}\right)}$

(Total for Question 3 = 9 marks)

2 Figure 23 shows an electric car connected to a battery charger.

(Source: © Danil Roudenko/123RF)

Figure 23

The car has a rechargeable battery to drive its motor.

The rechargeable battery provides a potential difference of 330 V and can store up to 64 MJ.

It takes 8 hours for the battery to receive a full charge.

Assume that the charging process is 100% efficient.

(a) Calculate the total charge that flows while the battery is being charged.

(3)

total charge = ... C

(b) Calculate the average charging current.

(3)

current = ... A

*(c) The battery charger shown in Figure 23 is connected to the 230 V a.c. domestic mains supply.

The output voltage of the charger is 335 V and it provides a d.c. charging current. Charging stops if the charging current exceeds 15 A.

Explain how electrical components in the charger can be connected together to give this type of output.

(6)

(Total for Question 8 = 12 marks)

Electric charge

3 (a) A plastic rod and a piece of cloth are both uncharged.

A student rubs the plastic rod with the cloth.

The plastic rod becomes negatively charged.

(i) Compared with the plastic rod, which row of the table is correct for the charge on the cloth?

Put a cross (☒) in the box next to your answer.

(1)

	sign of charge	size of charge
☒ **A**	positive	equal
☒ **B**	negative	equal
☒ **C**	positive	bigger
☒ **D**	negative	bigger

(ii) Explain how the plastic rod becomes negatively charged.

(2)

.....

.....

.....

.....

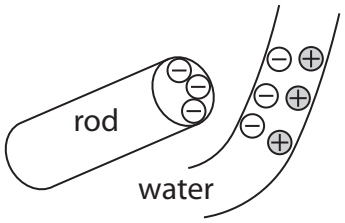
(iii) The student then holds the plastic rod near to a stream of water coming from a tap.

The stream of water bends towards the plastic rod.

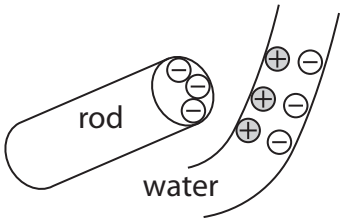
Which picture shows the correct arrangement of charges in the stream of water?

Put a cross (☒) in the box next to your answer.

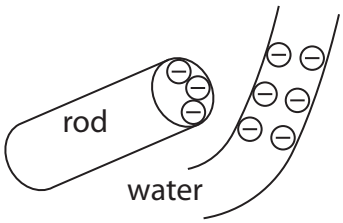
(1)



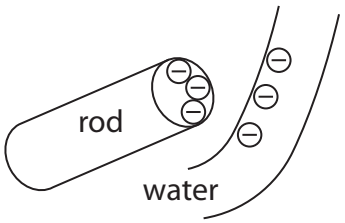
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(iv) The student puts the plastic rod into the stream of water and pulls it out.

Now, when he holds the plastic rod near the stream of water, the stream of water does not bend.

Suggest why the stream of water does not bend.

(1)

.....

.....

(b) A torch has a battery and a bulb.

The current in its circuit is 0.08 A.

Calculate the amount of charge passing a point in this circuit in 2 minutes.

(3)

charge = ... coulombs

(Total for Question 2 = 8 marks)