Questions

Q1.

Complete the sentence by putting a cross (☒) in the box next to your answer.

An electric current is the rate of flow of

(1)

☒ **A** atoms

☒ **B** charge

☒ **C** voltage

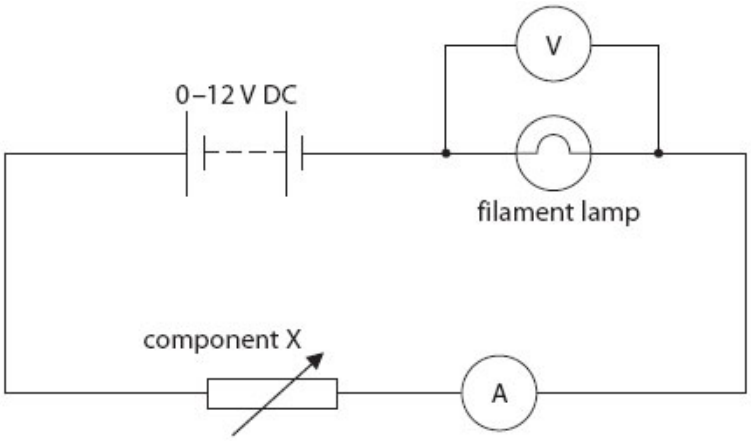
☒ **D** watts

Q2.

A student sets up an experiment to measure the potential difference (voltage) across a filament lamp.

She changes the current through the lamp.

The diagram shows the circuit she used.



(c) Calculate the resistance of the lamp when the current is 0.44 A and the potential difference is 10.0 V.

(2)

$$R = \frac{V}{I}$$

resistance = ...**Ω**

Q3.

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

Q4.

A battery sends a current through a metal wire.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Direct current is movement of charge

(1)

☒ **A** backwards and forwards

☒ **B** in many directions

☒ **C** in one direction

☒ **D** up and down

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The particles that flow in the metal wire are

(1)

- ☒ **A** atoms
- ☒ **B** electrons
- ☒ **C** protons
- ☒ **D** neutrons

Q5.

A battery sends a current through a metal wire.

The current in a wire is 3.7 A.

Calculate the charge that flows into the wire in 13 s.

(2)

charge = ...C

Q6.

A torch has a battery and a bulb.

The current in its circuit is 0.08 A.

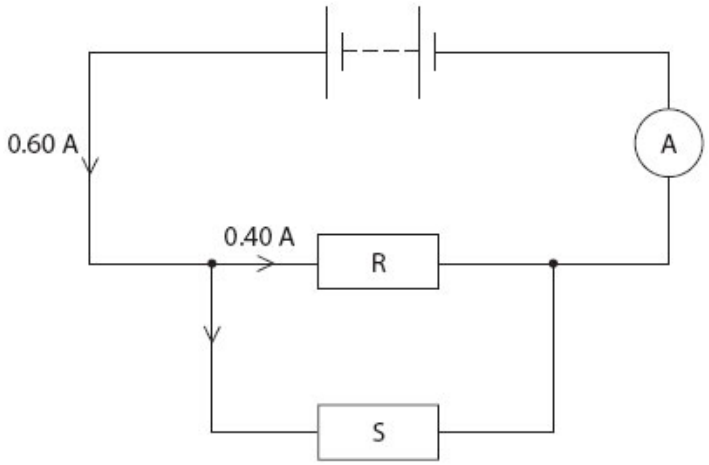
Calculate the amount of charge passing a point in this circuit in 2 minutes.

(3)

charge = ... coulombs

Q7.

The diagram shows an electric circuit with two resistors, R and S.



(i) R has a resistance of 11 ohms.

Calculate the potential difference across R.

(2)

potential difference = ...V

(ii) Use information from the diagram to calculate the current in S.

(1)

current = ...A

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

A student wants to measure the battery voltage with a voltmeter.

The voltmeter should be placed

(1)

☒ **A** in series with the battery

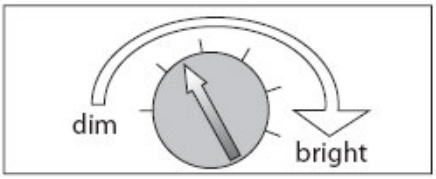
☒ **B** in parallel with the battery

☒ **C** in parallel with the ammeter

☒ **D** in series with either resistor R or S

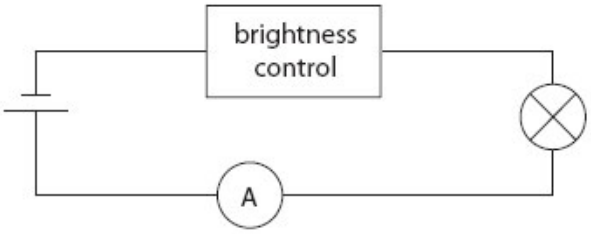
Q8.

An inventor is designing a battery-powered torch.
She wants the torch to have a brightness control.



brightness control

She builds this circuit to test the lamp in the torch.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the lamp.

(1)

(ii) $R = \frac{V}{I}$

She sets the control at the "bright" position.
The current is 0.26 A and the potential difference (voltage) across the lamp is 6.0 V.

Calculate the resistance of the lamp.

(2)

resistance of the lamp = ...Ω

Q9.

A wire in a circuit carries a current of 0.9 A.
Calculate the quantity of charge that flows through the wire in 50 s.

State the unit of charge with your answer.

Use the equation

charge = current × time

(3)

quantity of charge = ... unit .....

(Total for question = 3 marks)

Q10.

Figure 2 shows the junction of three wires, F, G and H, in a circuit.
The current in wire F is 6.0 A.
The current in wire G is 3.5 A.

Calculate the current in wire H.

(1)

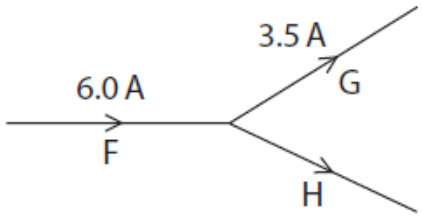


Figure 2

current in wire H = ... A

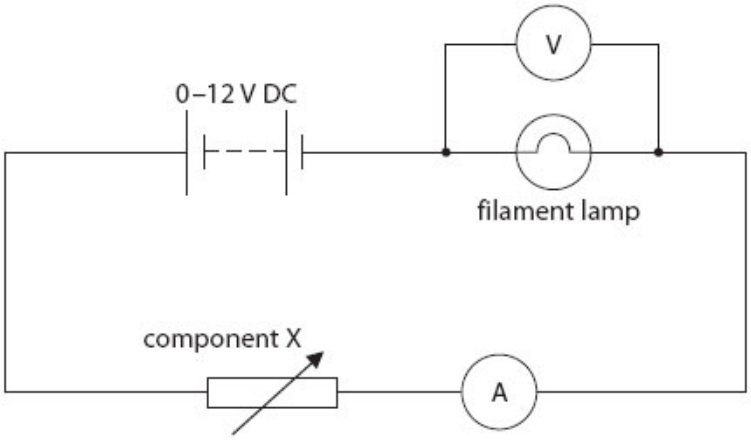
(Total for question = 1 mark)

Q11.

A student sets up an experiment to measure the potential difference (voltage) across a filament lamp.

She changes the current through the lamp.

The diagram shows the circuit she used.



Complete the sentence by putting a cross (☒) in the box next to your answer.

(i) The component X in the circuit diagram is a

(1)

☒ **A** diode

☒ **B** fixed resistor

☒ **C** thermistor

☒ **D** variable resistor

(ii) The meter that measures potential difference is

(1)

☒ **A** in parallel with the power supply

☒ **B** in parallel with the lamp

☒ **C** in series with the lamp

☒ **D** in series with the component X

(iii) Describe how the student should increase the current in the lamp.

(2)

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Q12.

A lamp is connected to a potential difference of 0.24 V.

The current in the lamp is 0.12 A.

(i) Calculate the power of the lamp.

Use the equation

$P = I \times V$

(2)

power of the lamp = ... W

(ii) The potential difference is changed to 0.30 V.

The current in the lamp is now 0.13 A.

The lamp is switched on for 35 s.

Calculate the energy that is transferred in this time.
Select an equation from the list of equations at the end of this paper.

(2)

energy transferred = ... J

(iii) The current in the lamp stays at 0.13 A.

Calculate the charge that flows through the lamp in 35 s.
Use the equation

$Q = I \times t$

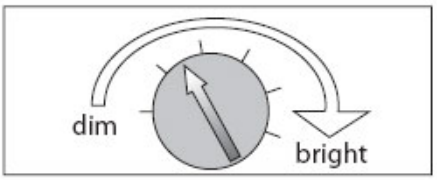
(2)

charge = ... C

(Total for question = 6 marks)

Q13.

An inventor is designing a battery-powered torch.
She wants the torch to have a brightness control.

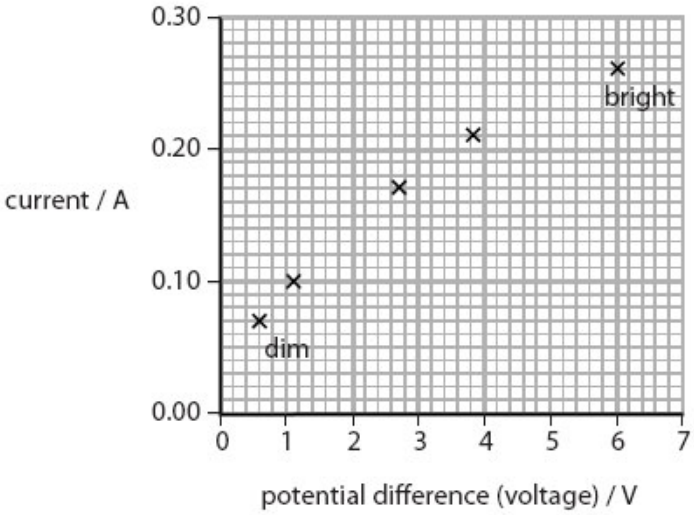


brightness control

The inventor takes readings of the potential difference (voltage) across the lamp and the current at different positions of the control from "dim" to "bright".

	dim →					bright
voltage / V	0.6	1.1	2.0	2.7	3.9	6.0
current / A	0.07	0.10	0.14	0.17	0.21	0.26

She plots a graph of the readings.



(i) Complete this graph by plotting the missing point and drawing the curve of best fit.

(2)

(ii) Describe what this graph shows about how the current changes as the voltage changes.

(2)

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(iii) The lamp gives no light when the brightness control is at its lowest setting.

Suggest why the torch would still need an on/off switch as well as the brightness control.

(2)

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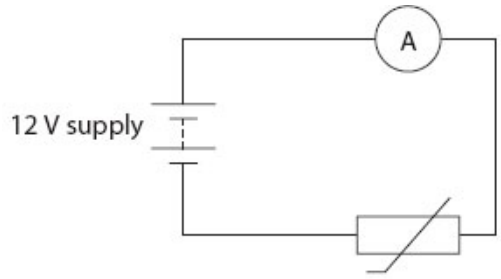
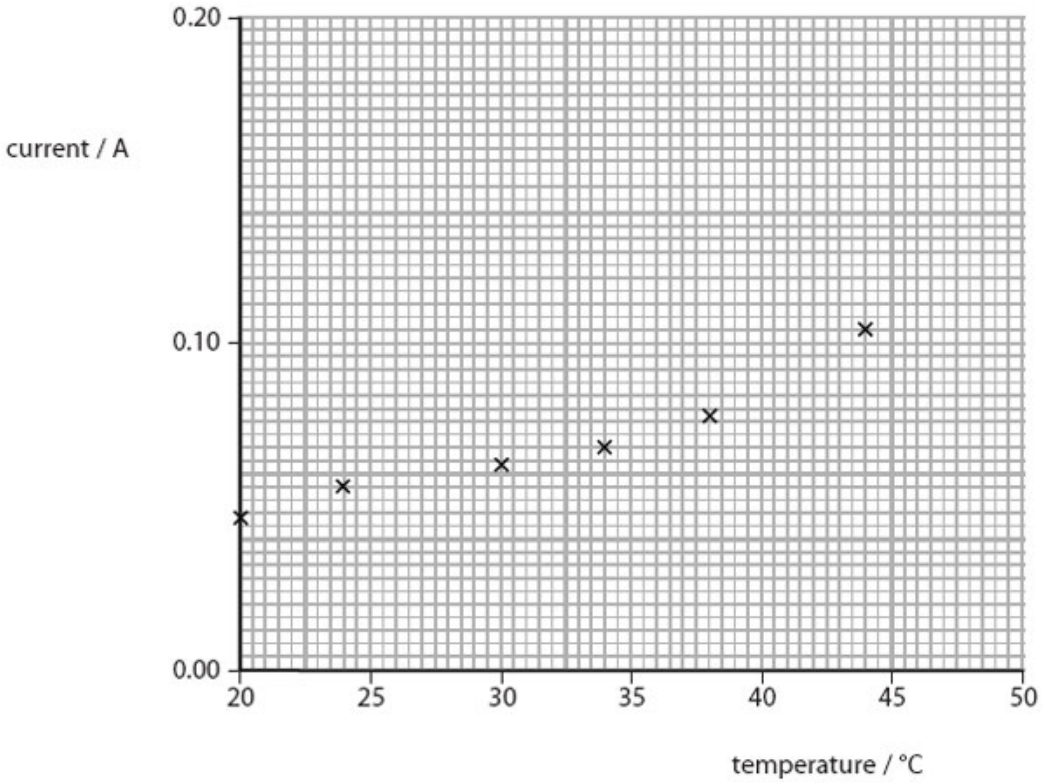
Q14.

A designer is going to use a thermistor in a temperature gauge. He connects the thermistor into this circuit.



He heats the thermistor and measures the current at different temperatures. Here are some of the results plotted on a graph.



At 47 °C the current was 0.138 A.

(i) Plot this value on the graph.

(1)

(ii) Draw the curve of best fit through the points.

(1)

(iii) The supply voltage is 12 V.
At 20 °C the current is 0.047 A.

Calculate the resistance of the thermistor at this temperature.

(3)

resistance = ...Ω

(iv) Use this graph of current against temperature to explain the relationship between resistance and temperature for this thermistor.

(2)

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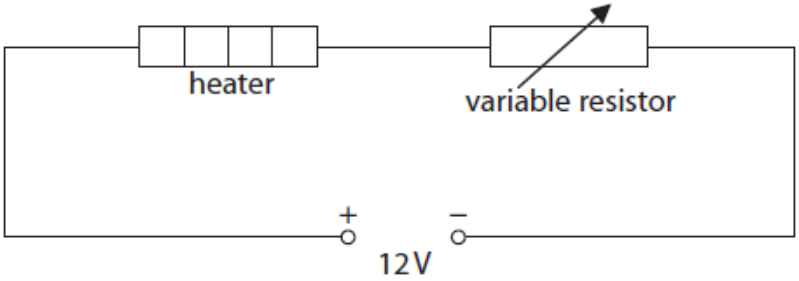
Q15.

A technician investigates the potential difference (voltage) across an electrical heater.

This circuit diagram shows the circuit the technician uses.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the heater.

(2)

(ii) The resistance of the heater is 15 Ω.

The current in the heater is 0.56 A.

Calculate the potential difference (voltage) across the heater.

(2)

potential difference = ... V

(iii) The technician changes the value of the variable resistor.

She measures the new voltage across the heater and the new current in it.

Here are her results:

voltage = 6.0 V current = 0.40 A.

Calculate the amount of electrical energy transferred in 30 s by the heater.

(2)

energy transferred = ... J

(iv) The total energy supplied by the battery in 30 s is 144 J.

Explain why your answer in (iii) is not the same as the total energy supplied by the battery.

(2)

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Q16.

A student uses an electric kettle.

It works from the 230 V mains supply.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

A potential difference of 1 volt is the same as

(1)

☒ **A** 1 joule per coulomb

☒ **B** 1 joule per ohm

☒ **C** 1 watt per ohm

☒ **D** 1 watt per coulomb

(b) The power of the kettle when it is heating water is 1.8 kW.
The mains voltage is 230 V.

(i) Calculate the current in the kettle.

(3)

current = ... A

(ii) The kettle is switched on for 2 minutes.

Calculate the total amount of energy transferred by the kettle in this time.

(2)

energy transferred = ... J

(iii) The heating element of the kettle contains a resistor made from a long length of wire.
Explain why an electric current in a resistor makes the resistor heat up.

(2)

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(Total for Question = 8 marks)

Q17.

A student is investigating a filament lamp.

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The current in the filament lamp is a flow of

(1)

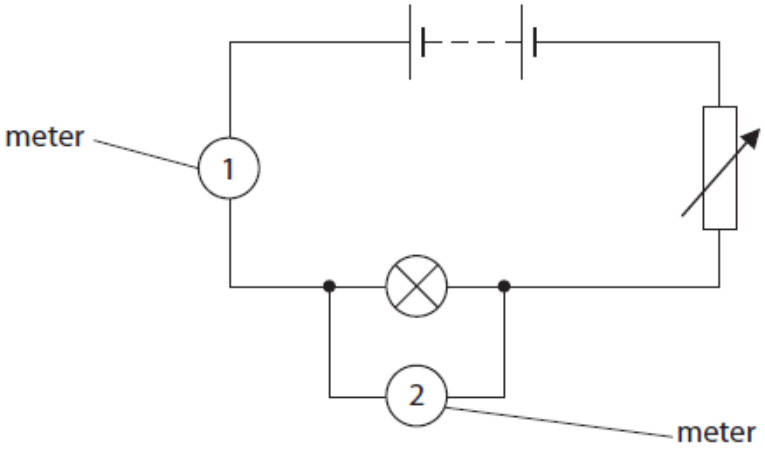
☒ **A** protons

☒ **B** neutrons

☒ **C** electrons

☒ **D** atoms

(ii) The student uses this circuit in his investigation.



State what is measured by the meters.

(2)

Meter 1 measures
.....

Meter 2 measures
.....

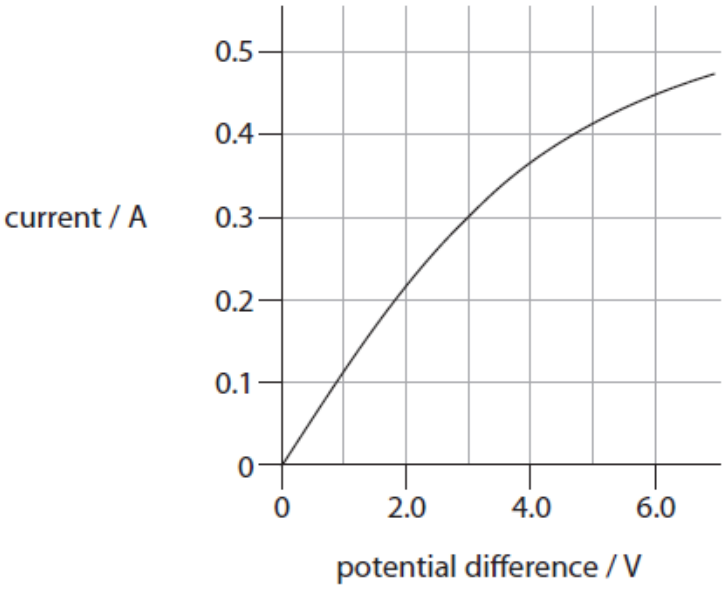
(b) The normal operating potential difference (voltage) and current of the filament lamp is 6 V, 0.4 A.

Calculate the energy supplied to the lamp under these conditions in 20 s.

(2)

energy = ... J

(c) The graph shows how current varies with potential difference (voltage) for another filament lamp.



Calculate the resistance of the lamp when the current in the lamp is 0.3 A.

resistance = potential difference ÷ current ($R = V / I$)

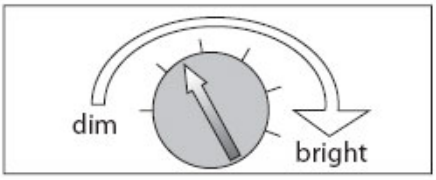
(3)

resistance = ... Ω

(Total for Question = 8 marks)

Q18.

An inventor is designing a battery-powered torch.
She wants the torch to have a brightness control.



brightness control

(a) Which of these could she use in this control?

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

(1)

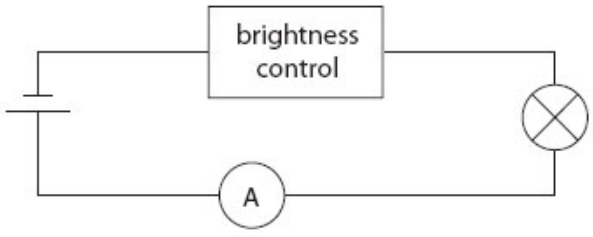
☒ **A** a diode

☒ **B** a light-dependent resistor

☒ **C** a thermistor

☒ **D** a variable resistor

(b) She builds this circuit to test the lamp in the torch.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the lamp.

(1)

(ii) $R = \frac{V}{I}$

She sets the control at the "bright" position.
The current is 0.26 A and the potential difference (voltage) across the lamp is 6.0 V.

Calculate the resistance of the lamp.

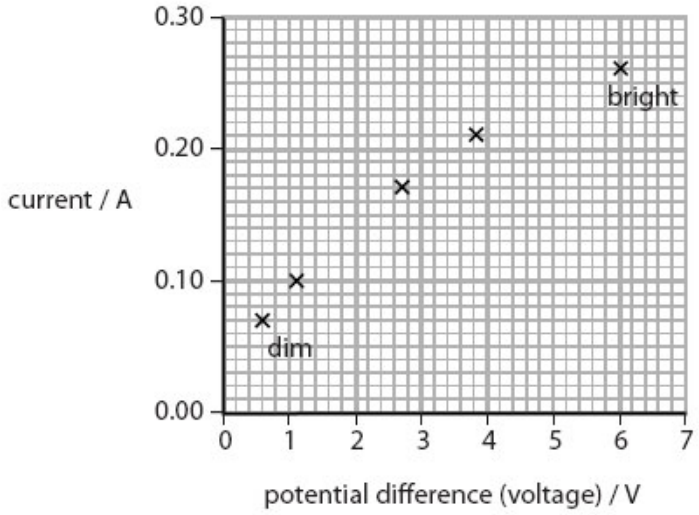
(2)

resistance of the lamp = ...Ω

(c) The inventor takes readings of the potential difference (voltage) across the lamp and the current at different positions of the control from "dim" to "bright".

	dim → bright					
voltage / V	0.6	1.1	2.0	2.7	3.9	6.0
current / A	0.07	0.10	0.14	0.17	0.21	0.26

She plots a graph of the readings.



(i) Complete this graph by plotting the missing point and drawing the curve of best fit.

(2)

(ii) Describe what this graph shows about how the current changes as the voltage changes.

(2)

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(iii) The lamp gives no light when the brightness control is at its lowest setting.

Suggest why the torch would still need an on/off switch as well as the brightness control.

(2)

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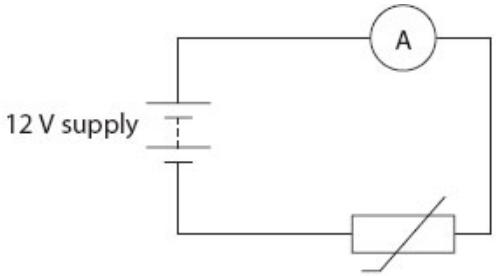
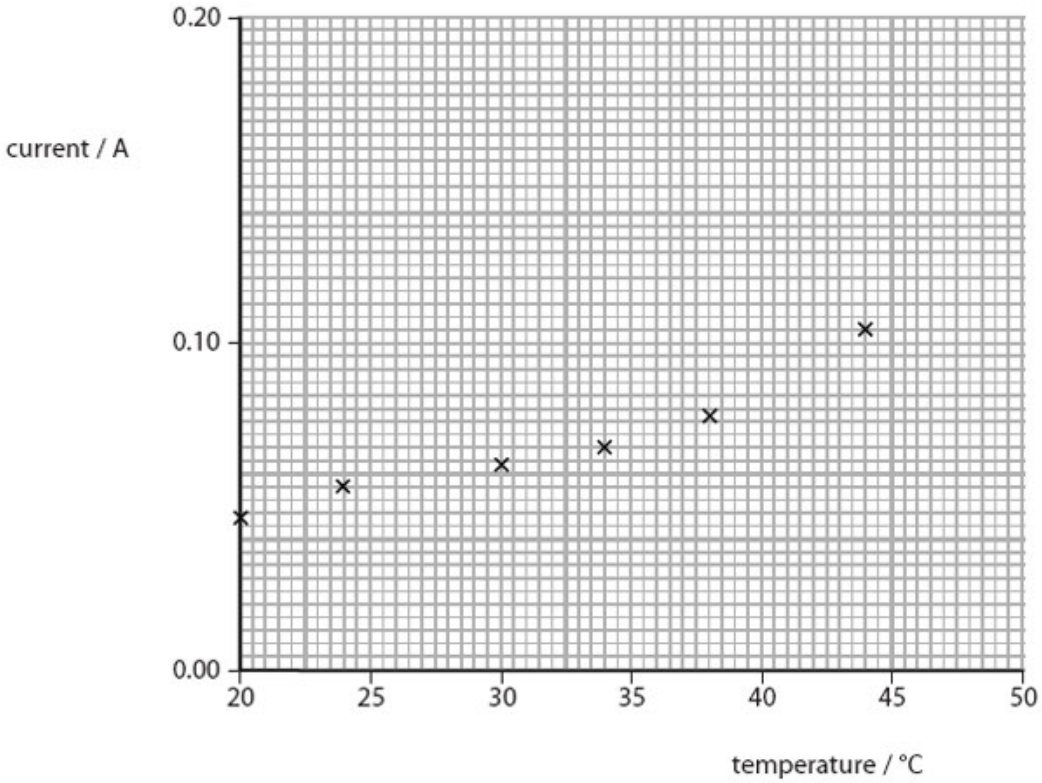
(Total for Question = 10 marks)

Q19.

(a) A designer is going to use a thermistor in a temperature gauge. He connects the thermistor into this circuit.



He heats the thermistor and measures the current at different temperatures. Here are some of the results plotted on a graph.



At 47 °C the current was 0.138 A.

(i) Plot this value on the graph.

(1)

(ii) Draw the curve of best fit through the points.

(1)

(iii) The supply voltage is 12 V.
At 20 °C the current is 0.047 A.

Calculate the resistance of the thermistor at this temperature.

(3)

resistance = ...Ω

(iv) Use this graph of current against temperature to explain the relationship between resistance and temperature for this thermistor.

(2)

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(b) (i) When there is an electric current in a resistor, the resistor gets hot.

Explain why the resistor gets hot.

(2)

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(ii) Suggest why the thermistor in a temperature gauge might indicate a temperature slightly higher than the actual temperature of its surroundings.

(1)

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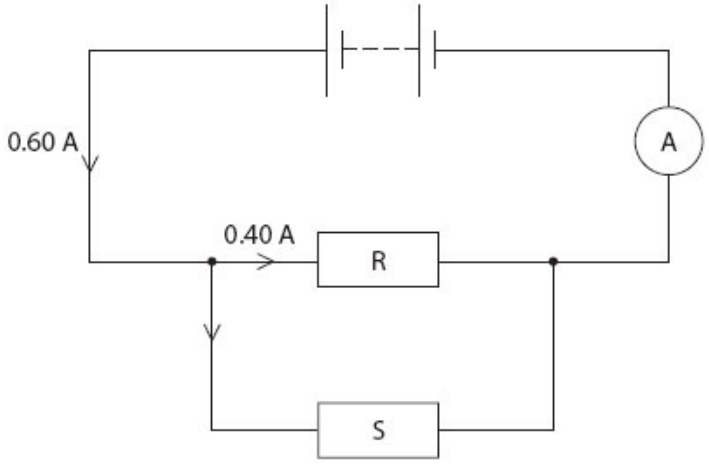
(Total for Question = 10 marks)

Q20.

(a) The diagram shows an electric circuit with two resistors, R and S.



(i) R has a resistance of 11 ohms.

Calculate the potential difference across R.

(2)

potential difference = ...V

(ii) Use information from the diagram to calculate the current in S.

(1)

current = ...A

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

A student wants to measure the battery voltage with a voltmeter.

The voltmeter should be placed

(1)

☒ **A** in series with the battery

☒ **B** in parallel with the battery

☒ **C** in parallel with the ammeter

☒ **D** in series with either resistor R or S

(b) Explain why the temperature of a resistor increases when a current passes through it.

(2)

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*(c) A resistor is a circuit component.

Two other circuit components are a light dependent resistor (LDR) and a thermistor.

Explain how LDRs and thermistors can be used to control the current in a circuit.

(6)

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(Total for Question is 12 marks)

Q21.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

An electric current is the rate of flow of

(1)

☒ **A** atoms

☒ **B** charge

☒ **C** voltage

☒ **D** watts

(b) An electric kettle is connected to a mains voltage of 230 V.
The current in the kettle is 12 A.

Calculate the power of the kettle.

(2)

power of the kettle = ...W

(c) A television has a power of 400 W.
The cost of 1 kW h of electrical energy is 15p.

Calculate the cost of using the television for 10 hours.

(3)

cost of using the television for 10 hours = ...p

*(d) Some students found this information about an energy saving lamp and a filament lamp that give out almost the same amount of light.

energy saving lamp

power = 15 W

cost = £1.50

lifetime = 10 000 hours

produces 20 J of light energy for each 100 J of electrical energy supplied

filament lamp

power = 60 W

cost = £0.30

lifetime = 1 000 hours

produces 5 J of light energy for each 100 J of electrical energy supplied

Describe the advantages and disadvantages of each type of lamp.

(6)

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(Total for Question = 12 marks)