Questions

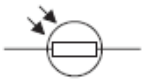
Q1.

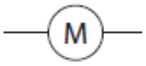
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Which of these symbols is used to represent a thermistor in an electrical circuit?

(1)

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(Total for question = 1 mark)

Q2.

A resistor is connected to a power supply.

The resistor becomes warm while there is a current in it.

Explain why the resistor becomes warm.

(2)

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(Total for question = 2 marks)

Q3.

Figure 16 shows a cardboard tube with a wire coming out from each end.

Figure 16

There are two 10 ohm resistors inside the cardboard tube.

A potential difference of 6.0 V is connected between P and Q.

There is a current of 1.2 A in the wires.

Deduce how the resistors have been arranged inside the cardboard tube.

(3)

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(Total for question = 3 marks)

Q4.

Figure 19 shows two electrical devices for heating water.

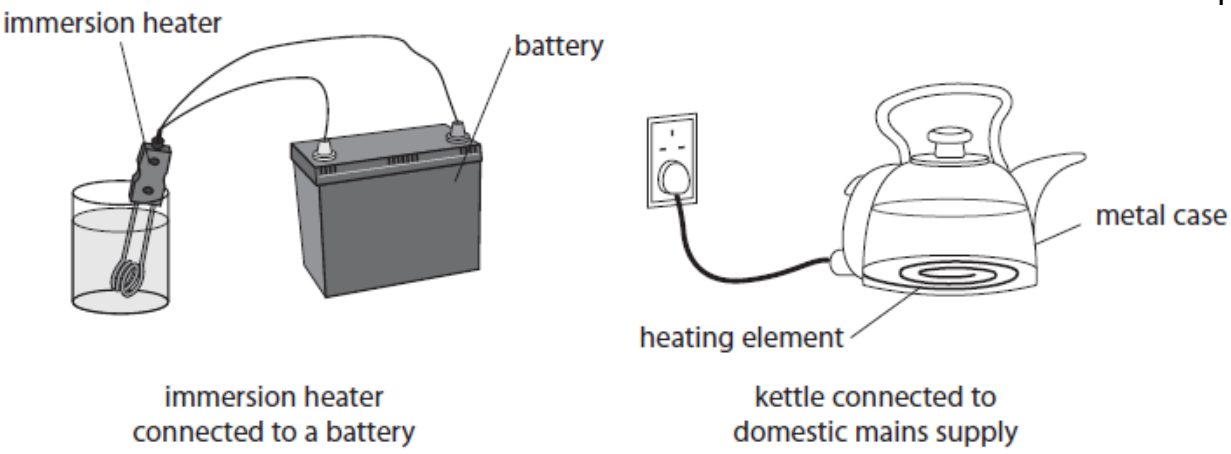

Figure 19

(i) The current in the element of the immersion heater is 14 A.

The power of the immersion heater is 130 W.

Calculate the resistance of the immersion heater.

Give your answer to two significant figures.

(3)

resistance of immersion heater = ... Ω

(ii) The current in the heating element of the kettle is 8.3 A.

State **two** differences between the movement of charge in the heating element of the kettle and the movement of charge in the immersion heater.

(2)

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(Total for question = 5 marks)

Q5.

Figure 18 shows identical filament lamps connected together to a 12 V power supply.

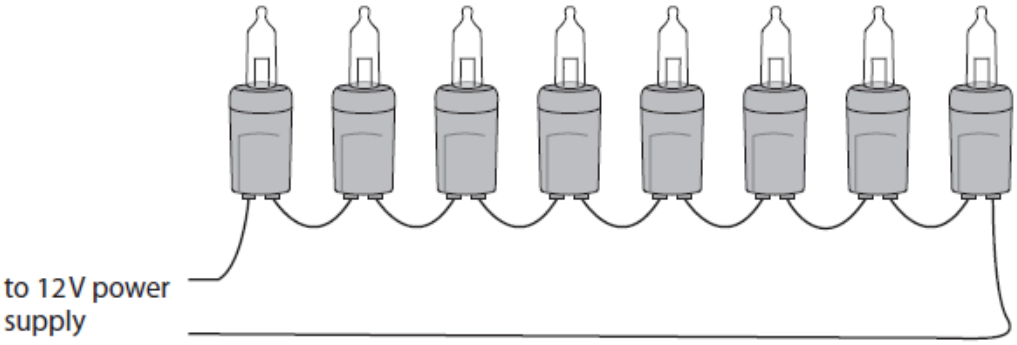

Figure 18

(i) Calculate the potential difference across each lamp.

(1)

potential difference = ... V

(ii) The power output of each lamp is 0.75 W

Calculate the resistance of each lamp.

(4)

resistance = ... Ω

(Total for question = 5 marks)

Q6.

* Explain, with the aid of a circuit diagram, the method a student could use to investigate how the resistance of a single lamp changes with the potential difference across the lamp.

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(Total for question = 6 marks)

Q7.

* Figure 20 shows the three-pin plug used to connect the kettle to the mains.

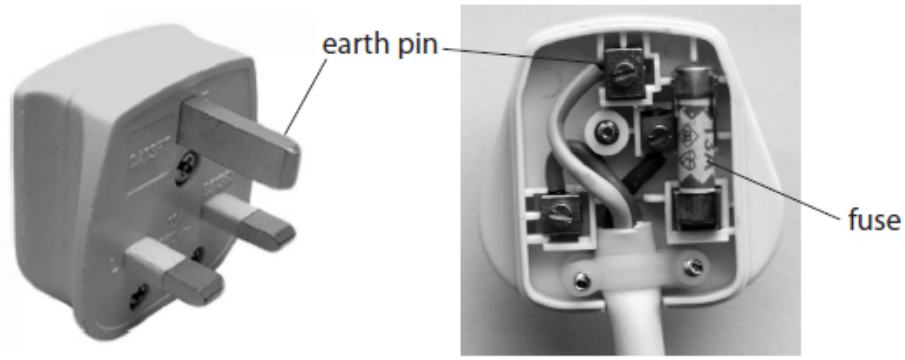

Figure 20

A fault occurs in the kettle causing the live wire to touch the metal case of the kettle.

Explain how the safety features of the plug operate when this fault occurs.

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(Total for question = 6 marks)

Q8.

A resistor is connected to a power supply.

The potential difference across the resistor is 6.0 V.

(i) Which of these corresponds to a potential difference of 6.0 V?

(1)

☒ **A** 6.0 joules per ohm

☒ **B** 6.0 amps per coulomb

☒ **C** 6.0 joules per coulomb

☒ **D** 6.0 amps per ohm

(ii) The resistor remains connected for a period of time.

The current in the resistor is 200 mA.

A total charge of 42 C flows through the resistor.

Calculate, in minutes, the time taken for this amount of charge to flow through the resistor.

(3)

time = ... minutes

(iii) Calculate the total energy transferred by the 6.0 V power supply when a charge of 42 C flows through the resistor.

(2)

energy = ... J

(Total for question = 6 marks)

Q9.

A man monitors how much money he spends on electricity.
He uses a device which calculates the cost of electrical energy used.
He connects his 2.9 kW electric kettle to the 230 V mains supply.

(i) Calculate the current in the kettle element.

(3)

current = ... A

(ii) The device shows that in one week the total cost of the electrical energy used by the kettle is 97 p.
1kW h of electrical energy costs 17 p.

Calculate the length of time for which the kettle has been switched on during the week.

(3)

time = ... hours

Q10.

A battery sends a current through a metal wire.

(a) (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

(b) The current in a wire is 3.7 A.

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

(2)

charge = ...C

(c) Plastic is an insulator.

A student rubs a piece of plastic with a cloth.

This gives the plastic a negative charge.

(i) Explain how the plastic is charged by the rubbing.

(2)

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(ii) The cloth is also charged when it rubs against the plastic.

Describe the charge on the cloth.

(2)

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(Total for Question is 8 marks)

Q11.

A student investigates how the current in a lamp changes with the potential difference across the lamp.

The student uses the results to calculate the resistance of the lamp.

The results are shown in the table in Figure 5.

potential difference in V	current in A	resistance in Ω
1.0	0.09	11
2.0	0.14	14
3.0	0.18	17
4.0	0.22	18
5.0	0.26	
6.0	0.30	20

(i) One value of resistance is missing from the table in Figure 5.

Calculate the value of resistance that is missing from the table.

(3)

missing resistance = ... Ω

(ii) The student writes this conclusion:

'The resistance of the lamp is directly proportional to the potential difference.'

Comment on the student's conclusion.

Use information from Figure 5 in your answer.

(3)

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(iii) The student used a power supply that had fixed output voltage settings.

Each of these outputs was a whole number of volts.

Describe how the student could add a component to the circuit that would provide a continuously variable voltage across the lamp.

(2)

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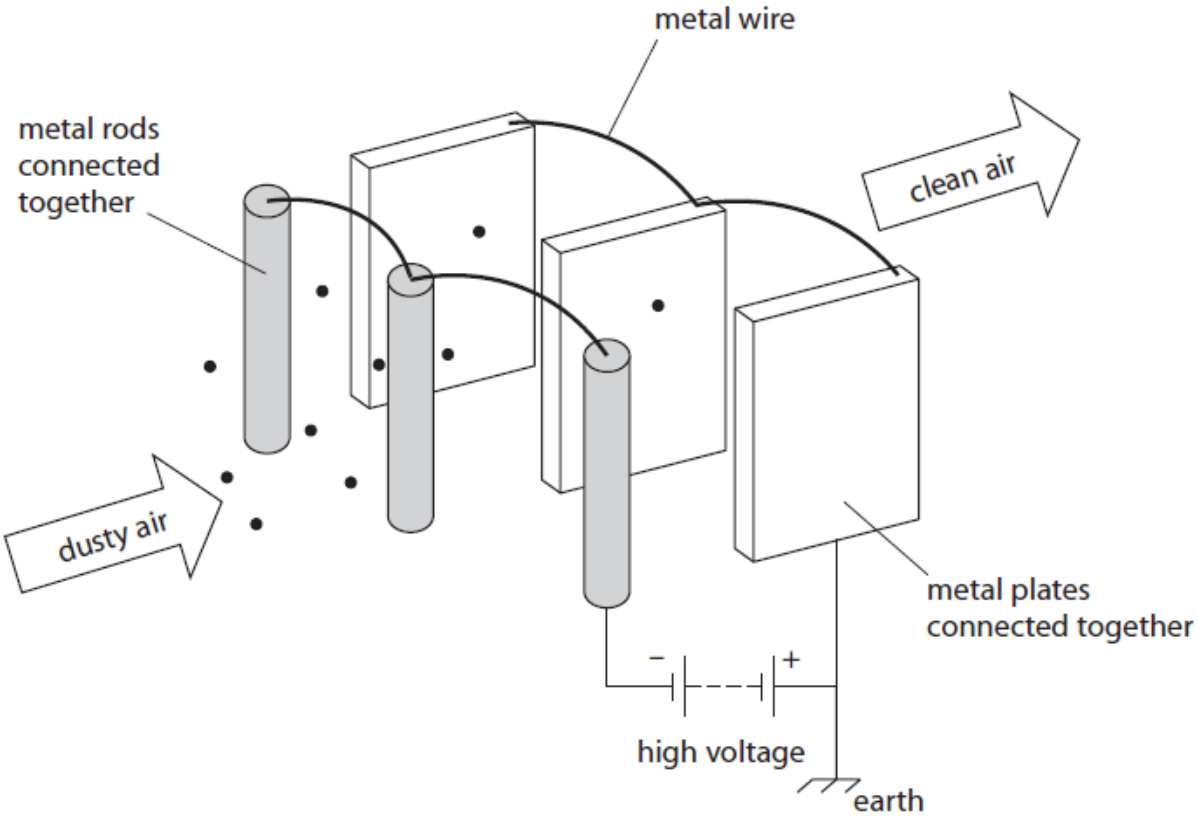
(Total for question = 8 marks)

Q12.

An electrostatic air filter is designed to remove dust particles from the air in a room.

A fan blows dusty air past several metal rods and metal plates.

There is a large potential difference (voltage) between the metal rods and the metal plates.



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

When dusty air goes past the metal rods, the dust particles become negatively charged.

This is because the dust particles

(1)

☒ **A** lose electrons

☒ **B** lose protons

☒ **C** gain electrons

☒ **D** gain protons

(b) When the dusty air flows past the metal plates, the dust particles settle on the metal plates.

Explain why the dust particles settle on the metal plates.

(2)

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(c) (i) State what happens to the charge on the dust particles when they settle on the metal plates.

(1)

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(ii) Explain why the charge does not build up on the metal plates.

(2)

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(d) There is a current of 1.2 mA in the circuit.

Calculate the charge transferred by this current in 40 s.

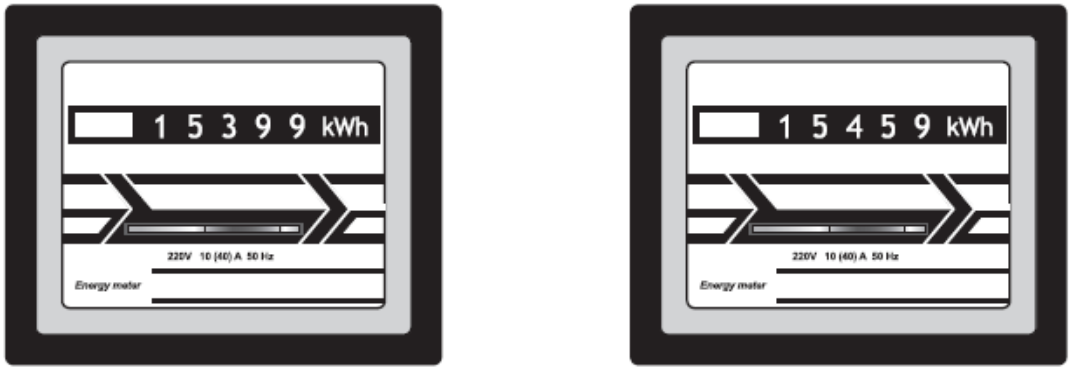
State the unit.

(3)

charge transferred = ... unit: .....

Q13.

(a) Electricity costs 20p for each kW h.
The pictures show a domestic electricity meter at two different times.



(i) Calculate the cost of the electricity used between the two readings.

(2)

cost =.....p

(ii) The time between these two readings is 15 hours.

Calculate the average power supplied.

(2)

average power =.....kW

(b) Explain why step-up transformers are used in the transmission of electricity in the National Grid.

(2)

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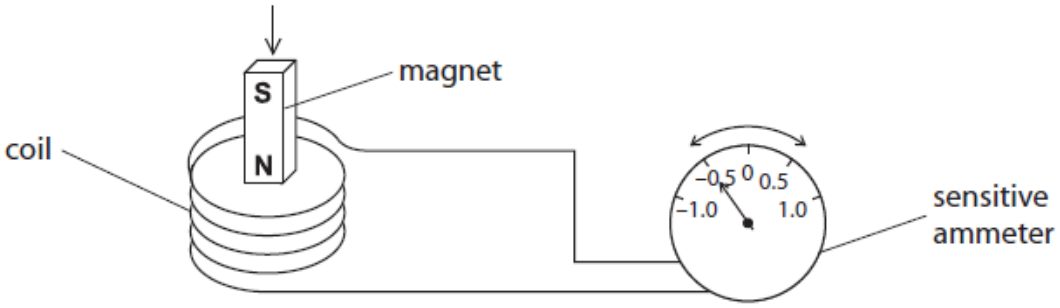
*(c) The diagram shows a magnet moving into a coil of wire.

The coil of wire is attached to a sensitive ammeter.



The moving magnet and the coil of wire are producing an electric current.

The size and direction of the current can be changed in a number of ways.

Describe changes that can be made to produce different currents and the effect of each change.

(6)

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(Total for Question = 12 marks)

Q14.

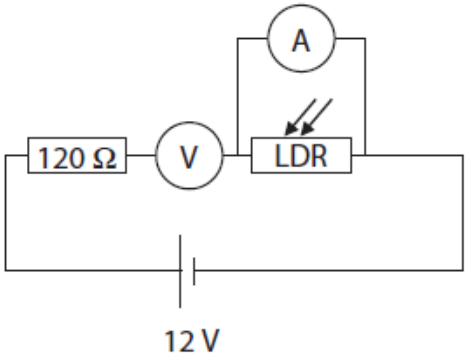
(a) A technician investigates a light-dependent resistor (LDR) connected in series with a 120 Ω resistor and a voltage source.

The technician measures the voltage across the LDR and also the current in the LDR.

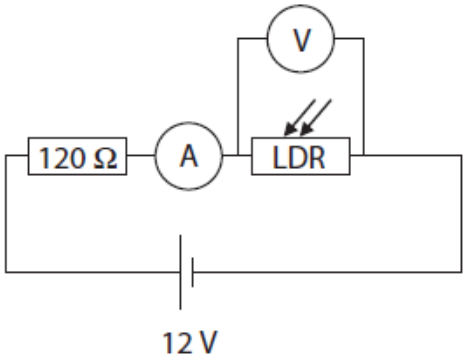
(i) Which **one** of these circuits should the technician use?

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

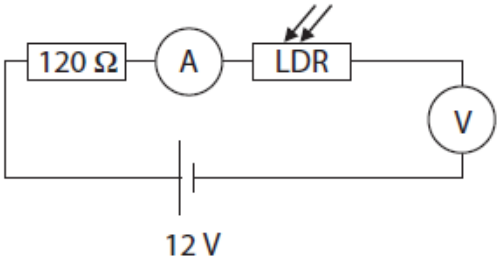
(1)



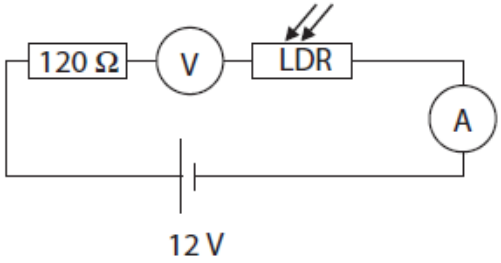
☐ **A**



☐ **B**



☐ **C**



☐ **D**

(ii) When the LDR is in bright sunlight, its resistance is 185 Ω.
The voltage across the LDR is then 7.2V.

Show that the current in the LDR is about 0.039 A.

(2)

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

The current in the 120 Ω resistor is

(1)

☒ **A** much more than the current in the LDR

☒ **B** much less than the current in the LDR

☒ **C** the same as the current in the LDR

☒ **D** the opposite of the current in the LDR

(iv) The technician repeats the readings with the LDR in different light conditions.

The table gives two of the readings.

light condition	current in LDR
bright sunlight	0.039 A
cloudy skies	0.028 A

Explain why the two current readings are different.

(2)

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*(b) The photograph shows a temporary traffic sign.

The traffic sign uses many small lights all powered by a rechargeable battery.
These lights need to be very bright during the day so that they can be seen clearly.
They do not need to be as bright at night.

Explain how using a light-dependent resistor can make the energy stored in the battery last longer.

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