Name:

Date:

P2 - Test 3
ELECTRICITY
Beginner

GCSE

PHYSICS

AQA - Triple Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

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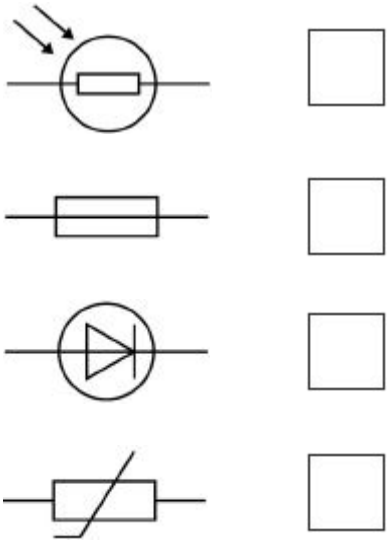
1. The plug of an electrical appliance contains a fuse.

(a) What is the correct circuit symbol for a fuse?

Tick **one** box.



(1)

(b) The appliance is connected to the mains electrical supply. The mains potential difference is 230 V.

Calculate the energy transferred when 13 C of charge flows through the appliance.

Use the equation:

energy transferred = charge flow × potential difference

_____

_____

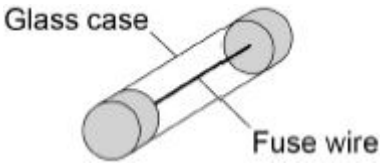
_____

_____

Energy transferred = _____ J

(2)

The diagram below shows the structure of a fuse.



(c) Write down the equation that links charge flow, current and time.

_____

(1)

(d) The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

_____

_____

_____

_____

Current = _____ A

(3)

(e) The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

_____

_____

_____

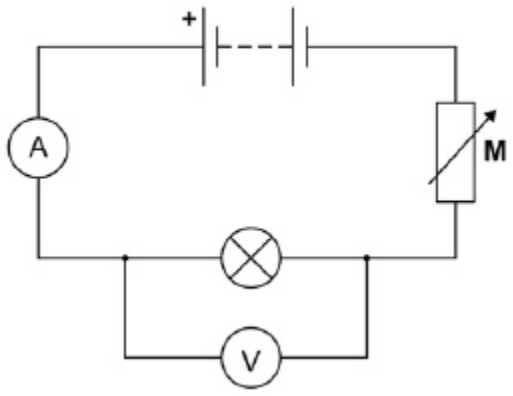
_____

Energy = _____ J

(2)

(Total 9 marks)

2. The diagram shows the circuit used to obtain the data needed to plot the current-potential difference graph for a filament lamp.



(a) Why is component **M** included in the circuit?

Tick **one** box.

To keep the current constant. ☐

To keep the potential difference constant. ☐

To vary the current. ☐

(1)

(b) Why does the resistance of the lamp increase as the potential difference across the lamp increases?

_____

_____

_____

(1)

(c) The potential difference across the lamp is 12.0 V

Calculate the energy transferred by the lamp when 8.5 C of charge flows through the lamp.

Use the equation:

energy transferred = charge flow × potential difference

_____

_____

_____

Energy transferred = _____ J

(2)

(d) The table gives data about two types of lamp that householders may use in their homes.

Type of lamp	Energy efficiency	Mean lifetime in hours
Halogen	10%	2000
LED	90%	36000

Both types of lamp produce the same amount of light.

Describe the environmental advantages of using the LED lamp compared with the halogen lamp.

_____

_____

_____

_____

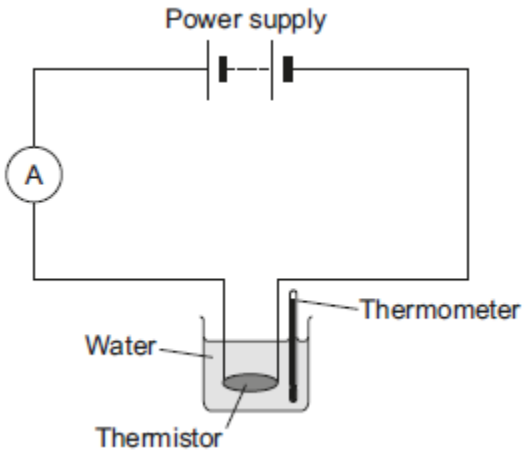
_____

(2)

(Total 6 marks)

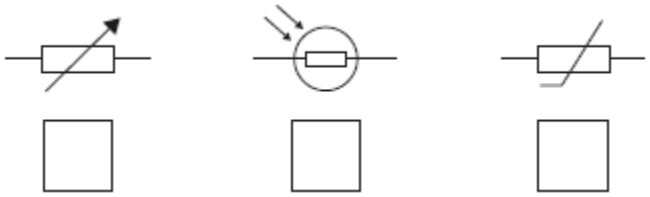
3. **Figure 1** shows the apparatus used to investigate how the current through a thermistor depends on the temperature of the thermistor.

Figure 1



(a) Which **one** of the following is the correct circuit symbol for a thermistor?

Tick (✓) **one** box.

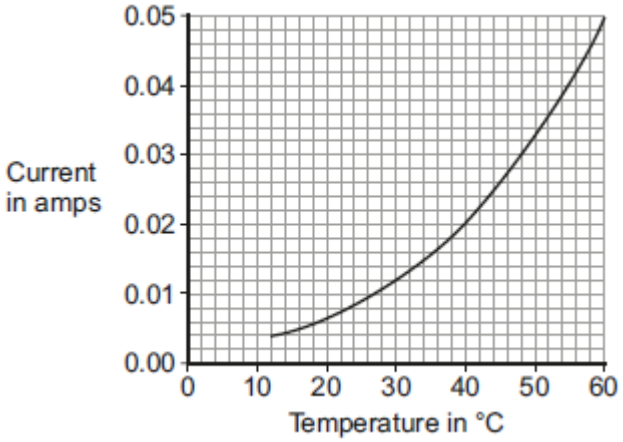


(1)

(b) To get a range of results, hot water at 60 °C was poured into the beaker.
The temperature of the water and current through the thermistor were then recorded as the water cooled.

The results of the investigation are shown in **Figure 2**.

Figure 2



(i) Suggest **one** way the investigation could have been changed to give a wider range of temperatures.

_____

_____

(1)

(ii) Describe how the current through the thermistor depends on the temperature of the thermistor.

_____

_____

(1)

(iii) Use **Figure 2** to determine the current through the thermistor at 40 °C.

Current at 40 °C = _____ A

(1)

(iv) At 40 °C the thermistor has a resistance of 250 Ω.

Use your answer to part **(iii)** and the resistance of the thermistor to calculate the potential difference across the thermistor.

_____

_____

_____

_____

Potential difference = _____ V

(2)

(v) The potential difference across the thermistor stays the same all through the investigation.

What conclusion can be made from the results in **Figure 2** about the resistance of the thermistor as the temperature of the thermistor **decreases?**

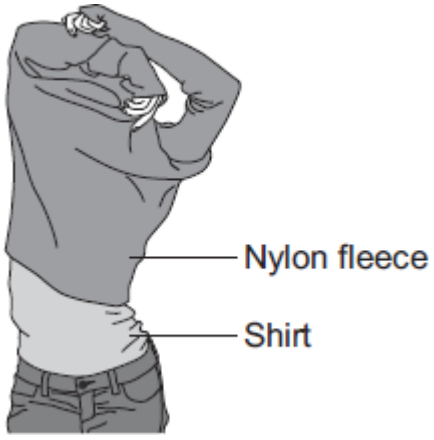
Tick (✓) **one** box.

the resistance increases	☐
the resistance does not change	☐
the resistance decreases	☐

(1)

(Total 7 marks)

4. (a) A student takes off his nylon fleece and feels a small electric shock.
He realises that this happens because his fleece becomes charged.



Explain why the fleece becomes charged.

_____

_____

_____

_____

_____

(2)

(b) Only **two** of the following statements are correct.

Put a tick (✓) in the boxes next to the **two** correct statements.

Positively charged objects repel negatively charged objects. ☐

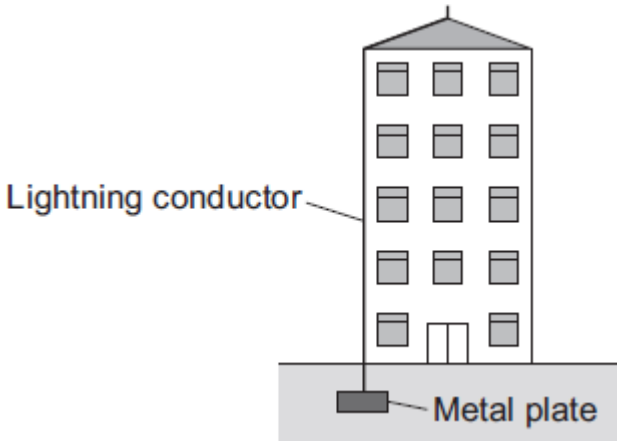
Electrical charges move easily through metals. ☐

Static electricity is safe; it never causes any danger. ☐

An electric current is a flow of electrical charge. ☐

(2)

(c) The diagram shows a lightning conductor attached to the side of a tall building.



If the building is struck by lightning, charge flows to earth through the lightning conductor.

(i) Which of the materials in the list is used to make the lightning conductor?

Draw a ring around your answer.

copper **glass** **plastic**

Give a reason for your answer.

_____

_____

_____

(2)

(ii) Complete the sentence by drawing a ring around the correct line in the box.

The resistance of the lightning conductor is

higher than
the same as
lower than

the resistance of the building.

(1)

(iii) It is almost impossible to test different designs of lightning conductor in controlled experiments during a lightning storm.

Suggest a reason why.

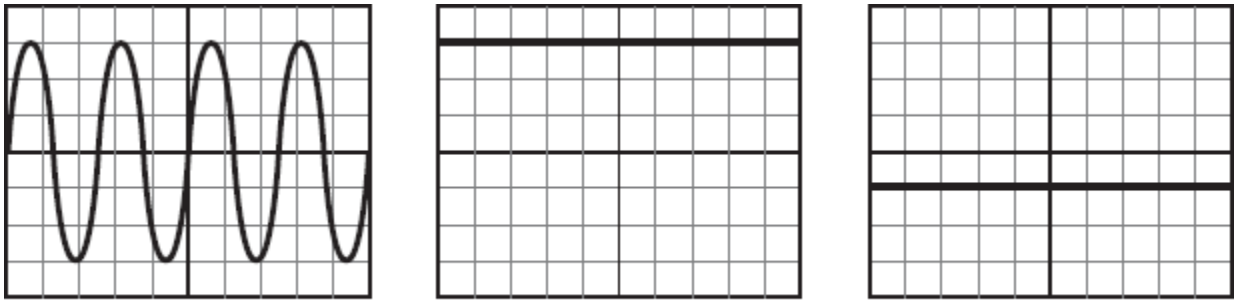
_____

_____

(1)

(Total 8 marks)

5. (a) The diagram shows the traces produced on an oscilloscope when it is connected across different electricity supplies.



A B C

Which of the traces could have been produced by the mains electricity supply?

_____

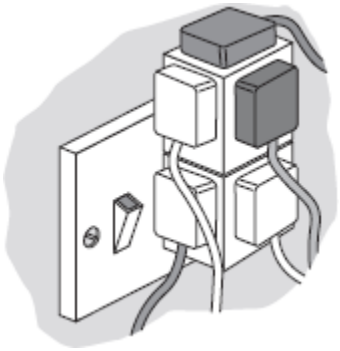
Give a reason for your answer.

_____

_____

(2)

(b) The picture shows two adaptors being used to plug five electrical appliances into the same socket.



Explain why it is dangerous to have all five appliances switched on and working at the same time.

_____

_____

_____

_____

(2)

(Total 4 marks)

6. (a) The diagram shows the information plate on an electric kettle. The kettle is plugged into the a.c. mains electricity supply.

230 V	**2760 W**
50 Hz	

Use the information from the plate to answer the following questions.

(i) What is the frequency of the a.c. mains electricity supply?

_____

(1)

(ii) What is the power of the electric kettle?

_____

(1)

(b) To boil the water in the kettle, 2400 coulombs of charge pass through the heating element in 200 seconds.

Calculate the current flowing through the heating element and give the unit.

Choose the unit from the list below.

amps **volts** **watts**

_____

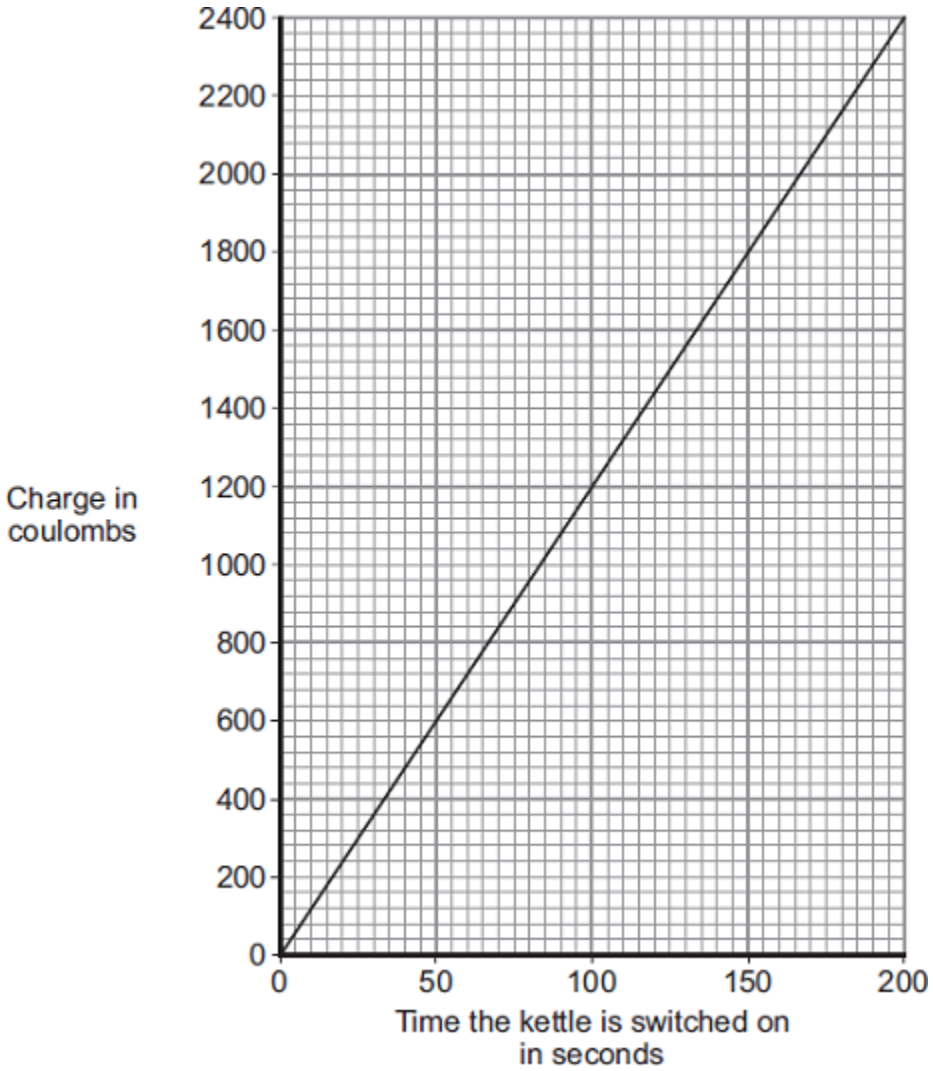
_____

_____

Current = _____

(3)

(c) The amount of charge passing through the heating element of an electric kettle depends on the time the kettle is switched on.



What pattern links the amount of charge passing through the heating element and the time the kettle is switched on?

_____

_____

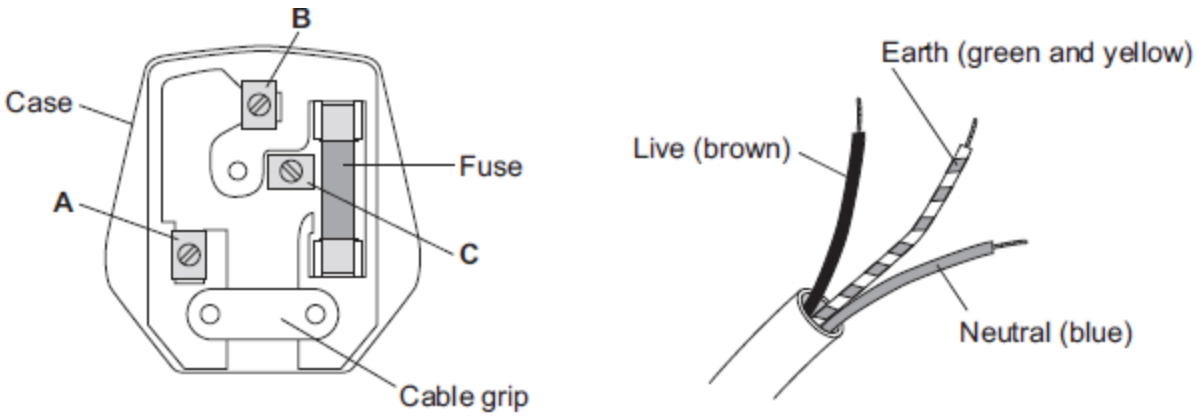
(2)

(Total 7 marks)

7. (a) **Figure 1** shows the inside of a three-pin plug and a length of three-core cable.

The cable is to be connected to the plug.

Figure 1



(i) Complete **Table 1** to show which plug terminal, **A**, **B** or **C**, connects to each of the wires inside the cable.

Table 1

Wire	Plug terminal
Live	
Neutral	
Earth	

(2)

(ii) Name a material that could be used to make the case of the plug.

_____

(1)

(b) **Figure 2** shows an electric drill and an extension lead. The drill is used with the extension lead.

Figure 2

Electric drill Extension lead

(i) The drill is used for 50 seconds.

In this time, 30 000 joules of energy are transferred from the mains electricity supply to the drill.

Calculate the power of the drill.

_____

_____

_____

Power = _____ W

(2)

(ii) A second drill is used with the extension lead. The power of this drill is 1200 W.

The instructions for using the extension lead include the following information.

When in use the lead may get hot:

DO NOT go over the maximum power

- lead wound inside the case: 820 watts
- lead fully unwound outside the case: 3100 watts

It would **not** be safe to use this drill with the extension lead if the lead was left wound inside the plastic case.

Explain why.

_____

_____

_____

_____

_____

_____

(3)

(c) **Table 2** gives information about three different electric drills.

Table 2

Drill	Power input in watts	Power output in watts
X	640	500
Y	710	500
Z	800	500

A person is going to buy **one** of the drills, **X**, **Y** or **Z**. The drills cost the same to buy.

Use only the information in the table to decide which **one** of the drills, **X**, **Y** or **Z**, the person should buy.

Write your answer in the box. ☐

Give a reason for your answer.

_____

_____

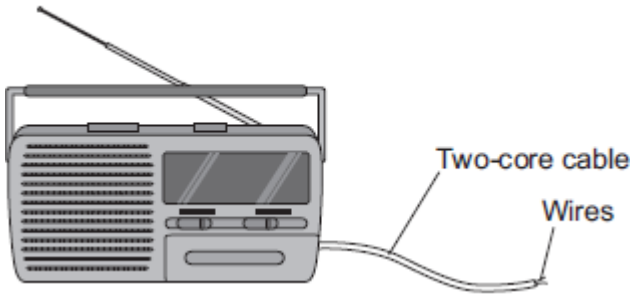
_____

(1)

(Total 9 marks)

8. **Figure 1** shows a radio. The radio can be powered by connecting the two-core cable to the mains electricity supply.

Figure 1



(a) (i) What must be fitted to the cable before it can be connected to the mains electricity supply?

_____

(1)

(ii) There are only two wires inside the cable.
What are the names of the two wires inside the cable?

Tick (✓) **one** box.

Earth and live ☐

Earth and neutral ☐

Live and neutral ☐

(1)

(iii) Use the correct answer from the box to complete the sentence.

double	**extra**	**fully**

It is safe to connect the radio to the mains electricity supply using a two-core cable because the radio is _____ insulated.

(1)

(b) The radio can also be powered by a battery.

What type of current does a battery supply?

Tick (✓) **one** box.

Alternating current (a.c.) only ☐

Direct current (d.c.) only ☐

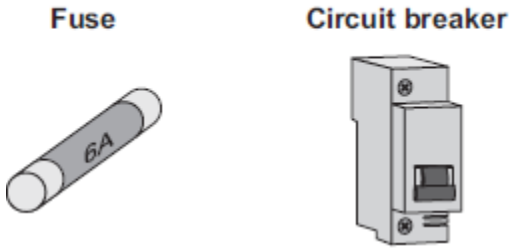
Both a.c. and d.c. ☐

(1)

(c) **Figure 2** shows a fuse and a circuit breaker.

Fuses and circuit breakers are able to disconnect and switch off circuits.

Figure 2



(i) Use the correct answer from the box to complete the sentence.

earth	**live**	**neutral**

A fuse or a circuit breaker is connected to the _____ wire in a circuit.

(1)

(ii) What happens to cause a fuse or circuit breaker to disconnect a circuit?

_____

_____

(1)

(iii) Suggest **two** advantages of using a circuit breaker to disconnect a circuit compared with using a fuse.

1. _____

_____

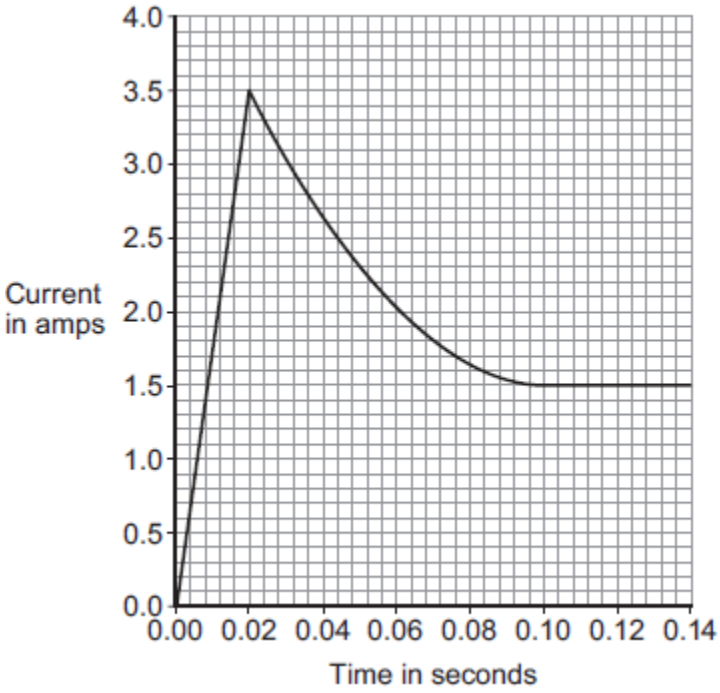
2. _____

_____

(2)

(Total 8 marks)

9. The graph shows how the current through a filament bulb changes after the bulb is switched on.



(a) What happens to the current through the bulb in the first 0.02 seconds after the bulb is switched on?

_____

(1)

(b) Between 0.02 seconds and 0.08 seconds the current through the bulb decreases.

(i) What, if anything, happens to the **resistance** of the bulb between 0.02 seconds and 0.08 seconds?

Draw a ring around the correct answer.

decreases **does not change** **increases**

(1)

(ii) What, if anything, happens to the **temperature** of the bulb between 0.02 seconds and 0.08 seconds?

Draw a ring around the correct answer.

decreases **does not change** **increases**

(1)

(c) The bulb is connected to a 12 V power supply.

Calculate the power of the bulb when the current through the bulb is 1.5 A.

Choose the unit from the list below.

coulomb **joule** **watt**

_____

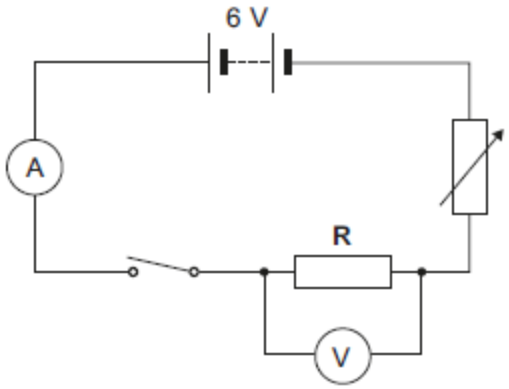
_____

Power = _____ unit _____

(3)

(Total 6 marks)

10. The diagram shows an electrical circuit.



(a) The 6 V battery shown in the diagram is made up of a number of identical 1.5 V cells.

Calculate the minimum number of cells needed to make the battery.

_____

Number of cells =_____

(1)

(b) The switch in the diagram is shown in the open position. Closing the switch completes the circuit.

Charge flows through the completed circuit and a reading is shown on both the ammeter and the voltmeter.

(i) In 10 seconds, 20 coulombs of charge flows through the circuit.

Calculate the current reading shown on the ammeter.

_____

_____

Current = _____ A

(2)

(ii) For 20 coulombs of charge to flow through the resistor R, 100 joules of work must be done.

Calculate the potential difference reading given by the voltmeter.

_____

_____

Potential difference = _____ V

(2)

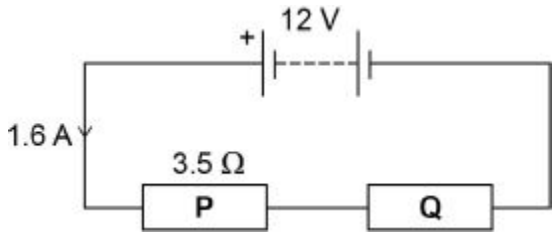
(Total 5 marks)

11. (a) Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

Use the correct circuit symbol for a cell.

(2)

A student built the circuit shown in the diagram below.



(b) Calculate the total resistance of the circuit in the diagram above.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

Total resistance = _____ Ω

(2)

(c) The resistance of **P** is 3.5 Ω.

Calculate the resistance of **Q**.

_____

_____

_____

_____

Resistance of **Q** = _____ Ω

(1)

(d) The student connects the two resistors in the diagram above in parallel.

What happens to the total resistance of the circuit?

Tick **one** box.

It decreases ☐

It increases ☐

It does not change ☐

(1)

Give a reason for your answer.

_____

_____

_____

_____

(1)

(Total 7 marks)