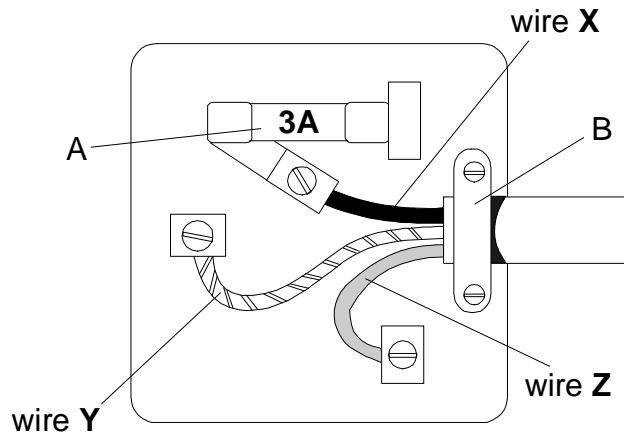


Using mains electricity safely and the power of electrical appliances

1. The diagram below shows an electric mains plug.



(a) Name the parts of the plug labelled **A** and **B**.

A

B

(2)

(b) Name the colour of each of the wires **X**, **Y** and **Z**.

X

Y

Z

(3)

(c) Name a suitable material for the case of the plug.

.....

(1)

(d) Electric fires have three wires connected in the plug. One is the live wire to feed electric current in, another is the neutral (return) wire.

(i) What is the third wire called?

.....

(1)

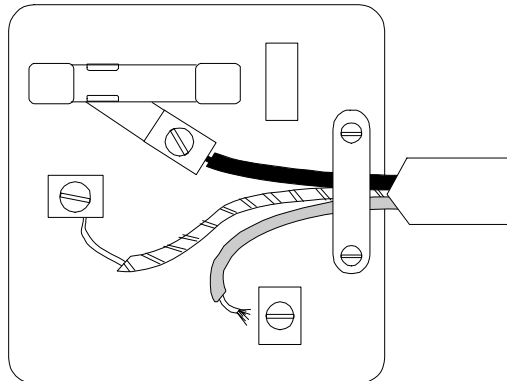
(ii) Why is it important that the third wire is also connected?

.....

.....

(1)

(e) The diagram below shows a badly wired mains plug.



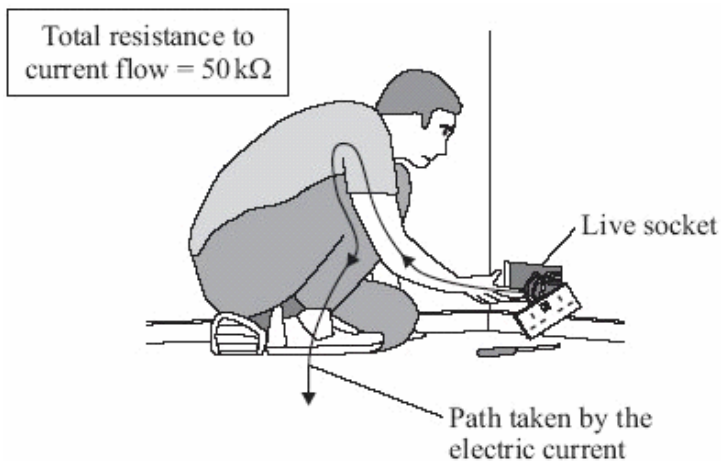
Look at the plug carefully. What **four** changes should be made to make the plug safe?

1.
.....
2.
.....
3.
.....
4.
.....

(4)
(Total 12 marks)

2. The diagram shows someone accidentally touching the live wire inside a dismantled 230 volt mains electricity socket.

A current flows through the person giving him an electric shock.



- (a) (i) Use the equation in the box to calculate the current that will flow through the person.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

Current = A

(2)

- (ii) Rubber is a good insulator.

Explain why it is a good idea for electricians to wear rubber soled boots when working.

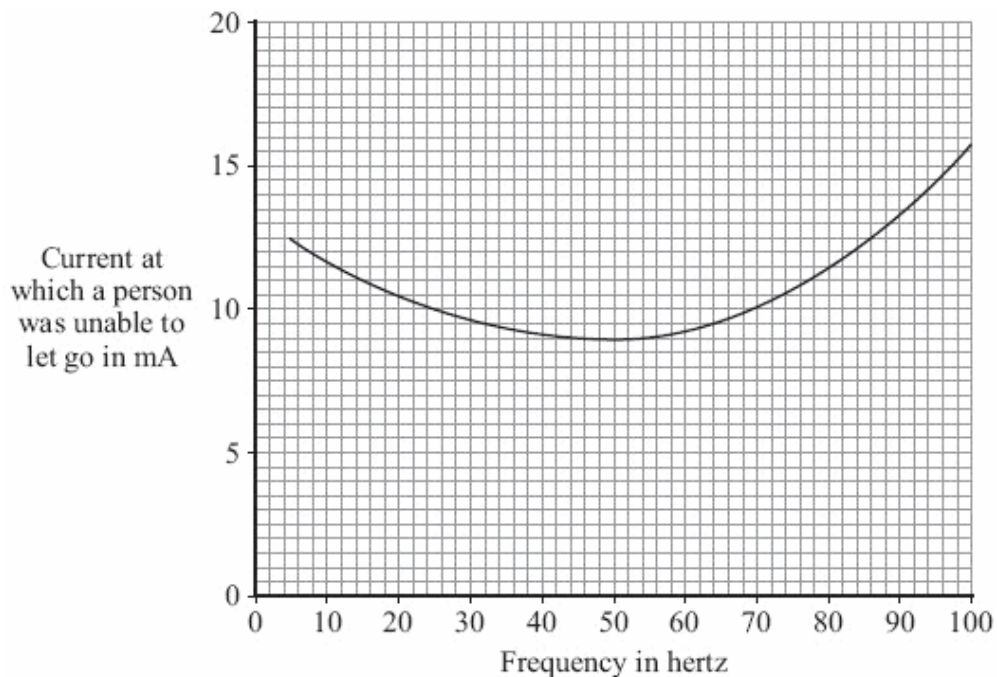
.....

(2)

- (b) If the current flowing through a person is too high, the person cannot let go of the electrical source.

Different people were tested to see whether the ability to let go of an electrical source depended on the frequency of the current.

The results of the test are shown in the graph.



- (i) What is the frequency of the mains electricity supply in the UK?

.....

(1)

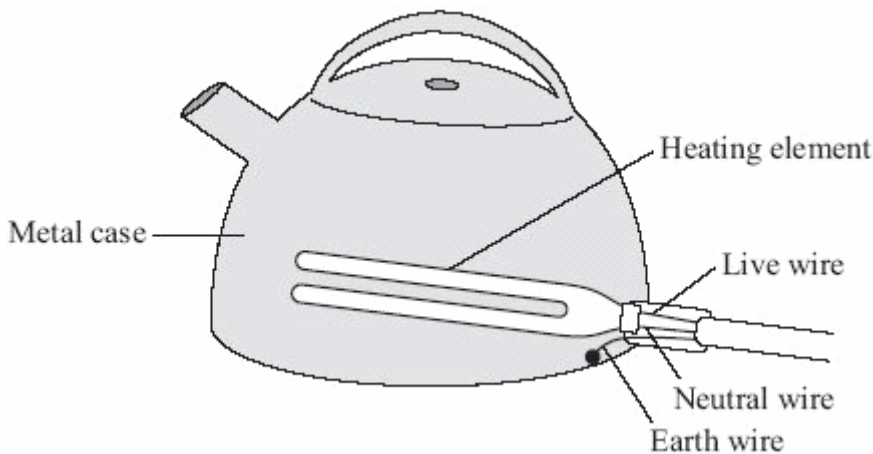
- (ii) From a safety point of view, is the frequency of the UK mains electricity supply suitable?

Give a reason for your answer.

.....

(1)

- (c) The diagram shows how the electric supply cable is connected to an electric kettle. The earth wire is connected to the metal case of the kettle.



If a fault makes the metal case live, the earth wire and the fuse inside the plug protect anyone using the kettle from an electric shock.

Explain how.

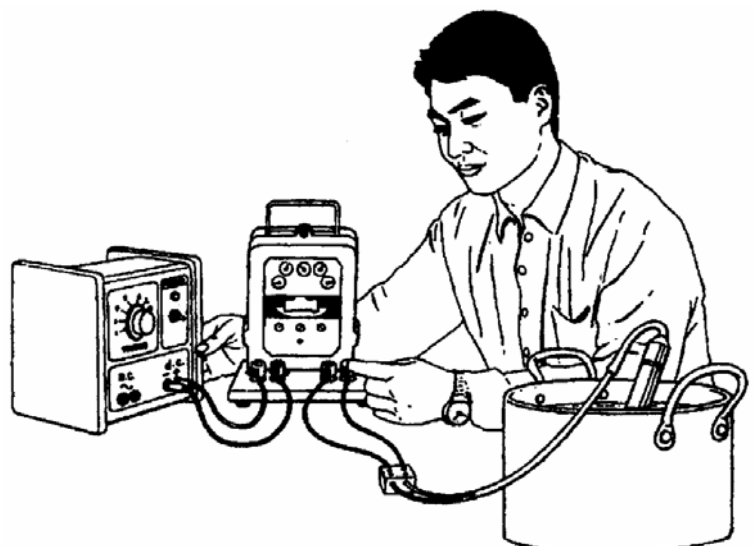
.....

(2)

(Total 8 marks)

3. The drawing shows an experiment using a low voltage supply, a joulemeter, a small immersion heater and a container filled with water.

The voltage was set at 6 V d.c. The reading on the joulemeter at the start of the experiment was 78 882 and 5 minutes later it was 80 142.



(i) Use the equation:

$$\text{voltage} = \frac{\text{energy}}{\text{charge}}$$

to work out the total charge which flowed through the immersion heater in five minutes. Clearly show how you get to your answer and give the unit.

.....

Charge = (3)

(ii) Calculate the current through the immersion heater during the 5 minutes. Write the equation you are going to use, show clearly how you get to your answer and give the unit.

.....

Current = (3)

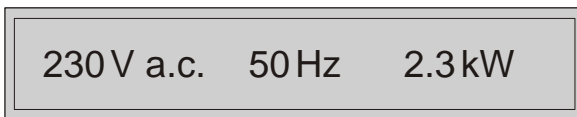
(Total 6 marks)

4. (a) Describe the difference between an alternating current (a.c.) and a direct current (d.c.).

.....

(2)

(b) The diagram shows the information plate on the bottom of an electric wallpaper steamer.



(i) Use the equation in the box to calculate the current used by the steamer.

$$\text{power} = \text{current} \times \text{potential difference}$$

Show clearly how you work out your answer.

.....

Current A (2)

- (ii) Which **one** of the following fuses should be used inside the plug of the steamer?
Draw a ring around your answer.

1 A 3 A 5 A 10 A 13 A

(1)
(Total 5 marks)

5. Carefully read the following extract from a safety leaflet. Then answer the questions.

An RCD adaptor is an automatic safety switch. It should be used when there is a particular risk of electric shock. For example, it is recommended that it is used with an electric lawnmower.

Inside one make of RCD is an electromagnet that holds the switch closed so that the RCD is switched on. An electronic circuit in the RCD monitors the difference between the current in the live wire and the current in the neutral wire.

If something goes wrong and this difference is greater than 30 milliamps then the RCD will trip (= switch off) within 40 milliseconds.

- (a) Suggest **two** reasons why there is a particular risk of an electric shock when using an electric lawnmower.

1.
.....
.....
2.
.....
.....

(2)

- (b) Why will there be a difference between the current in the live wire and the current in the neutral wire if something goes wrong?

.....
.....

(1)

- (c) (i) Use the words charge, current and time to write an equation which shows the relationship between them.

.....

(1)

- (ii) Calculate how much charge flows when a current of 30 milliamps passes for 40 milliseconds.

Clearly show how you get to your answer and give the unit.

.....
.....

Charge =

(3)
(Total 7 marks)