# 4. Electricity and magnetism

## 4.4 Electrical safety

## Paper 3 and 4

Question Paper

# Paper 3

**Questions are applicable for both core and extended candidates**

1 **(a)** Fig. 9.1 shows the power cable for connecting a desktop computer to the mains electricity circuit.

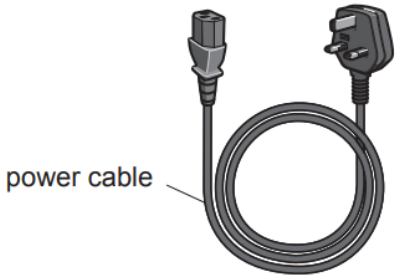


**Fig. 9.1**

**(i)** State the name of each of the **three** wires inside the power cable.

1 .....

2 .....

3 .....

[2]

**(ii)** The cable is designed for a maximum current of 13A.

Suggest **one** hazard due to a current of 30A in the cable.

..... [1]

2 **(a)** Fig. 9.1 shows an electricity cable that has a fault.

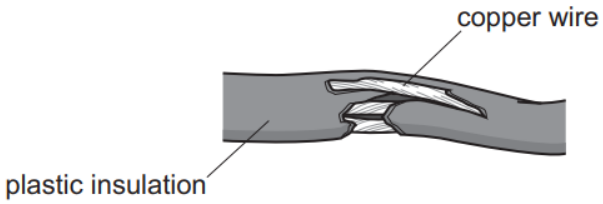


**Fig. 9.1**

The cable is used for supplying electricity at a high voltage.

State the fault and describe the hazard shown in Fig. 9.1.

fault .....

hazard .....

[2]

**(b)** Fig. 9.2 shows a piece of cable used in a mains circuit.

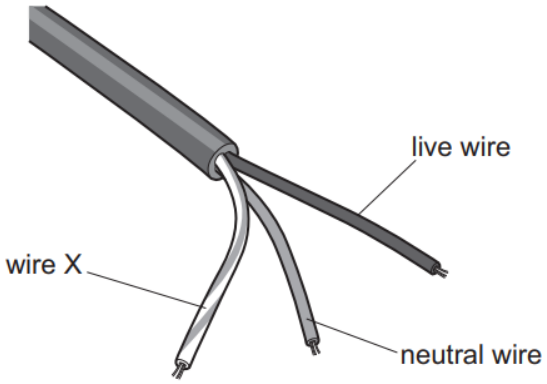


**Fig. 9.2**

**(i)** State the name of wire X in Fig. 9.2.

..... [1]

**(ii)** An electrical appliance is connected in the mains circuit. One of the wires in the cable is connected to the switch for the appliance.

State and explain which wire is connected to the switch.

.....

.....

..... [2]

[Total: 5]

3 Fig. 9.1 shows an electric water heater. The heater is connected to the mains electrical supply.

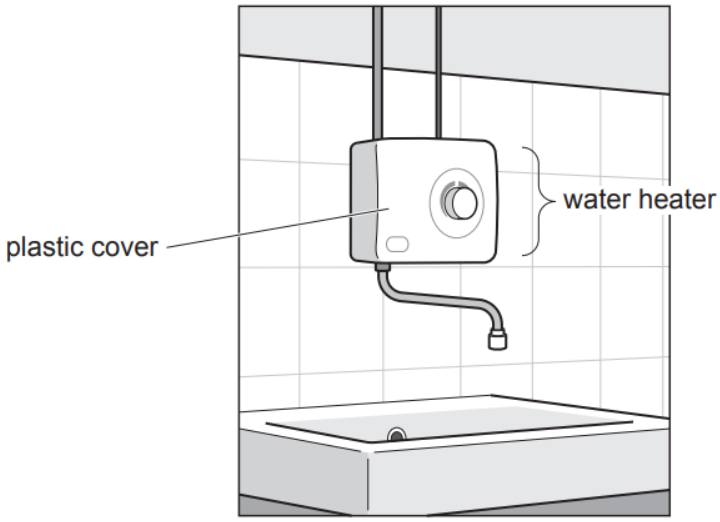


**Fig. 9.1**

Fig. 9.2 shows the electrical safety label for the heater.

| |
|---|
| Water Heater Model xxxxxx1 |
| 230 V (volts) |
| 720 W (watts) |
| Disconnect from the mains supply before removing the plastic cover. |

**Fig. 9.2**

**(a) (i)** Explain why the safety label states, 'Disconnect from the mains supply before removing the plastic cover.'

.....

..... [1]

**(ii)** The heater is switched on.

Calculate the current in the heater. Use the information in Fig. 9.2.

current = ..... A [3]

**(b)** Table 9.1 shows some electrical meter readings for the water heater.

**Table 9.1**

| date | meter reading/kWh |
|---|---|
| 1st October | 3771 |
| 31st October | 3797 |

Electrical energy costs 18 cents per kWh.

Calculate the cost of using the heater from 1st October until 31st October.

cost = ..... cents [3]

[Total: 7]

4 Fig. 9.1 shows a transformer used on a building site.

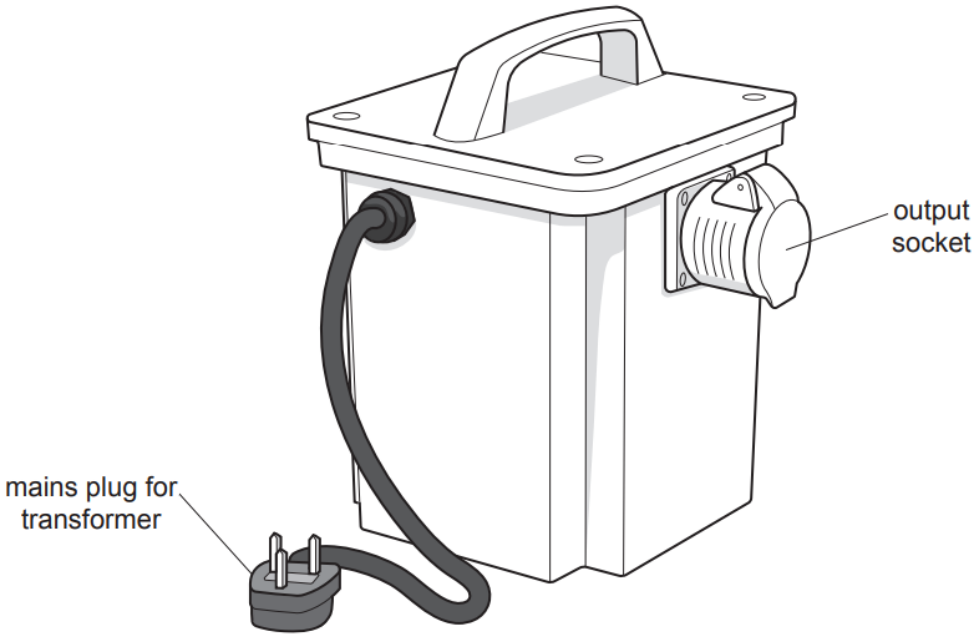


**Fig. 9.1**

**(a)** The mains plug for the transformer contains a fuse.

**(i)** Give a reason why the plug includes a fuse.

..... [1]

**(ii)** Explain how a fuse works.

.....

..... [2]

5 A microwave oven has a metal case and is connected to a 240 V electricity supply.

**(a)** The microwave oven is fitted with a 13A fuse and an earth wire is connected to the metal case of the microwave oven. A fault occurs and the live wire of the microwave oven touches the metal case.

Explain how the fuse and an earthed metal case protect the appliance and the user.

.....

.....

.....

.....

..... [4]

6 Fig. 10.1 shows a metal kettle used for heating water. The kettle is connected to the mains power supply. The metal case is connected to earth. A fault causes the live wire to come loose and touch the metal case, as shown.

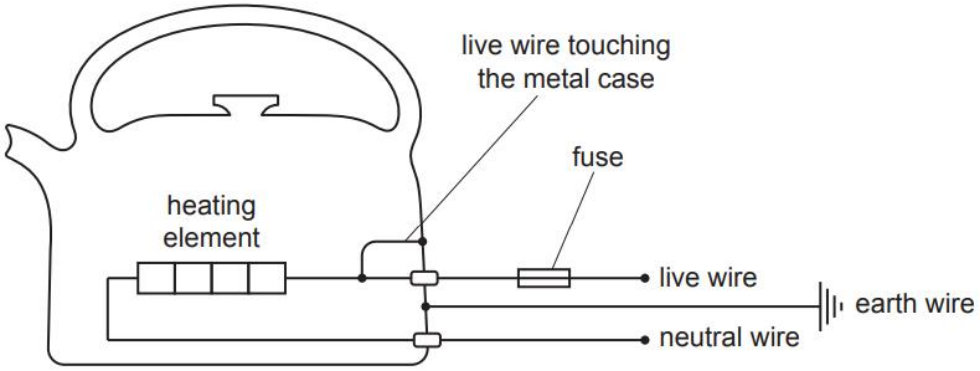


**Fig. 10.1**

**(a) (i)** The kettle is switched on. There is a very large electric current in the live wire.

Explain why this large electric current can be dangerous.

.....

..... [1]

**(ii)** Explain how a fuse helps to protect against the danger of a large electric current.

.....

.....

..... [2]

**(iii)** Explain why the kettle is **not** safe to use with the fuse connected into the neutral wire instead of the live wire.

.....

..... [1]

**(b)** The current in a device when operating normally is 3.1A.

State a suitable value for the fuse.

Choose **one** of these values: 3A, 5A, 10A and 13A.

..... [1]

**(c)** A small kettle has a potential difference (p.d.) of 12 V (d.c.) across its heating element. The current in the heating element is 2.5 A.

Calculate the resistance of the heating element.

resistance of the heating element = ..... Ω [3]

[Total: 8]

7 A teacher uses a power supply in a metal case. The circuit for the power supply includes a fuse.

**(a) (i)** Draw the electrical symbol for a fuse. [1]

**(ii)** The metal case of the power supply is earthed. A fault occurs and a live wire touches the metal case.

Explain how earthing the metal case protects the teacher.

.....

.....

.....

..... [3]

# Paper 4

**Questions are applicable for both core and extended candidates unless indicated in the question**

8 **(c)** The metal tap is earthed and there is a fuse in the cable that connects the heater to the mains.

1. Explain how the earth wire protects the user.

.....

.....

2. Explain how the fuse protects the circuit.

.....

.....

[3]

9 **(a)** State and explain why electrical sockets and plugs used outside in a garden need to be different from those that can be used safely in a room inside a house.

.....

.....

.....

..... [2]

**(b)** State and explain why fuses and circuit breakers are installed in electrical circuits connected to the mains supply.

.....

.....

.....

..... [2]

[Total: 4]