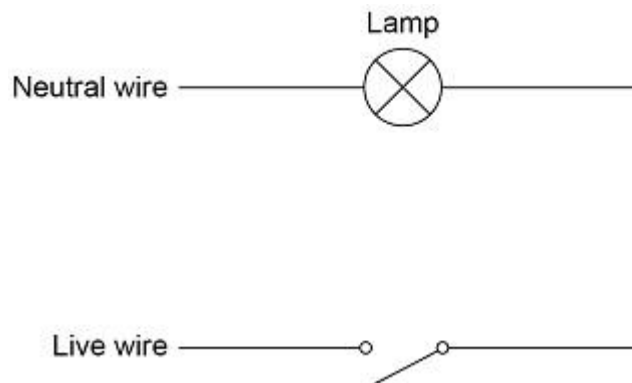


## P5 Electricity – In the home, task 1

### Foundation Questions

#### Q1.

The diagram shows part of a lighting circuit in a house.



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

Tick (✓) **one** box.

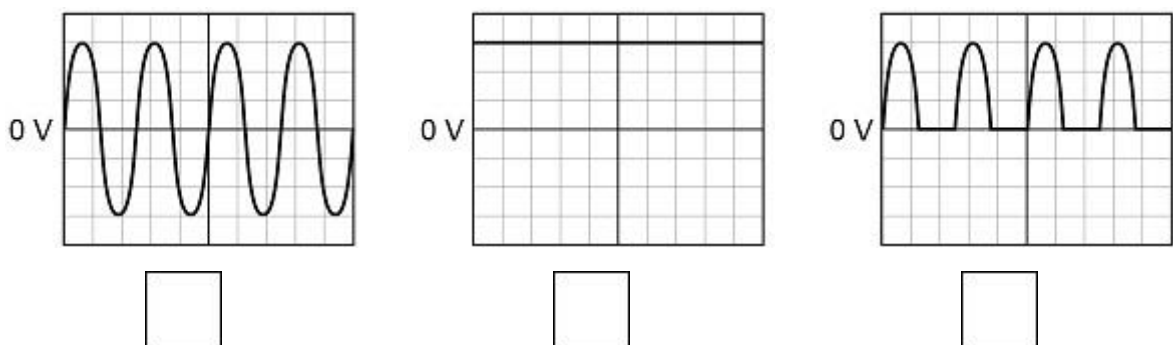
20 Hz     50 Hz     60 Hz     100 Hz

(1)

- (b) The mains electricity supply has an alternating potential difference.

Which diagram shows an alternating potential difference?

Tick (✓) **one** box.



(1)

- (c) The potential difference across the lamp is 230 V.

The current in the lamp is 0.020 A.

## P5 Electricity – In the home, task 1

Calculate the power output of the lamp.

Use the equation:

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

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$$\text{Power} = \text{_____} \text{ W}$$

(2)

- (d) The potential difference across the lamp is 230 V.

Calculate the energy transferred by the lamp when 180 C of charge flows through the lamp.

Use the equation:

$$\text{energy transferred} = \text{charge flow} \times \text{potential difference}$$

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$$\text{Energy transferred} = \text{_____} \text{ J}$$

(2)

- (e) An electrician needs to replace the light switch in the diagram above.

Describe the possible hazard and the risk to the electrician of changing the light switch.

Hazard

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Risk

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(2)

(Total 8 marks)

## P5 Electricity – In the home, task 1

### Q2.

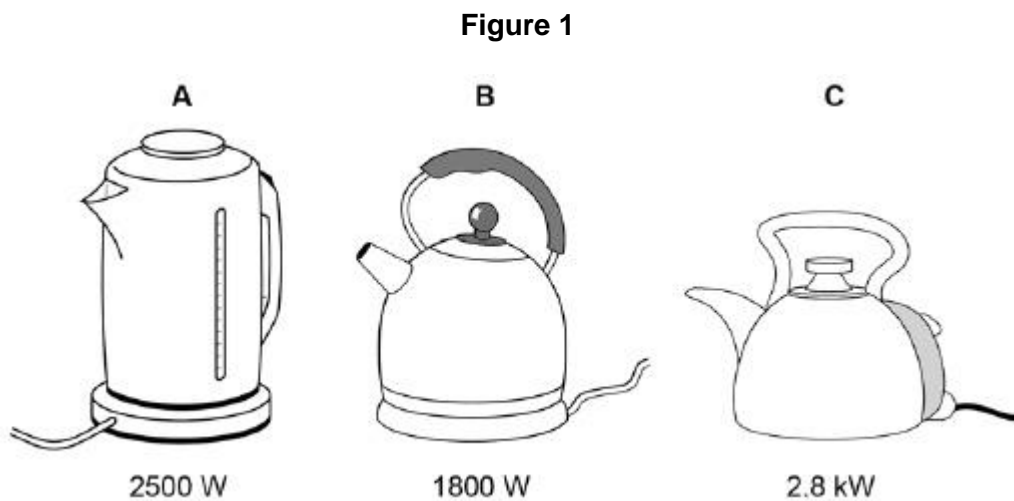
Most electric kettles use the ac mains electricity supply.

- (a) Complete the sentence.

The ac mains supply has a potential difference that continuously  
\_\_\_\_\_ polarity

(1)

Figure 1 gives the power output of three electric kettles.



A student investigated how the power output of a kettle affected the time taken to boil a fixed volume of water. The water in all three kettles had an initial temperature of 25 °C.

- (b) What type of variable was the time?

Tick **one** box.

Control

Dependent

Independent

(1)

- (c) Which kettle will boil the water in the shortest time?

Give a reason for your answer.

Kettle \_\_\_\_\_

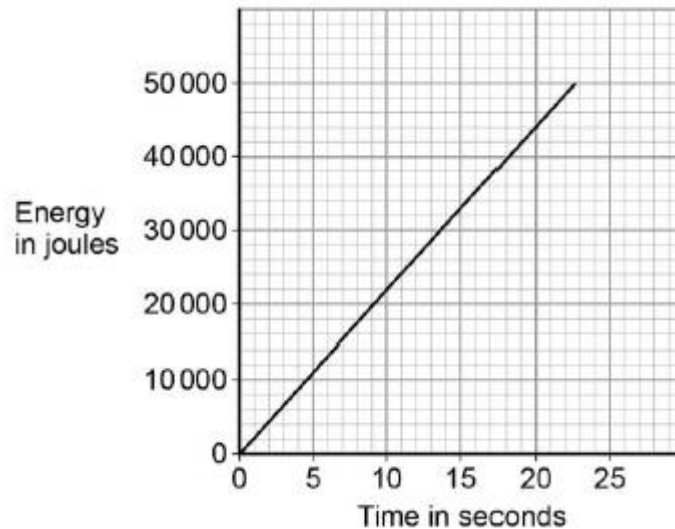
## P5 Electricity – In the home, task 1

Reason \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2)

- (d) **Figure 2** shows how the amount of energy transferred by a kettle varies with time.

**Figure 2**



The power output of the kettle is given by the gradient of the graph.

Calculate the power output of the kettle.

\_\_\_\_\_  
\_\_\_\_\_

Power output = \_\_\_\_\_ W

(2)

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

\_\_\_\_\_

(1)

- (f) Calculate the current through the kettle when 2400 coulombs of charge flows in 250 seconds.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Current = \_\_\_\_\_ A

(3)

## P5 Electricity – In the home, task 1

(Total 10 marks)

### Higher Questions

#### Q3.

The photograph below shows a coffee machine. The coffee machine uses an electric element to heat water.



- (a) The coffee machine has a metal case.

Why would it be dangerous for the live wire of the electric cable to touch the metal case?

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(1)

- (b) The power output of the coffee machine is 2.53 kW.

The mains potential difference is 230 V.

Calculate the current in the coffee machine.

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## P5 Electricity – In the home, task 1

Current = \_\_\_\_\_ A

(3)

- (c) The coffee machine heats water from 20 °C to 90 °C.

The power output of the coffee machine is 2.53 kW.

The specific heat capacity of water is 4200 J/kg °C.

Calculate the mass of water that the coffee machine can heat in 14 seconds.

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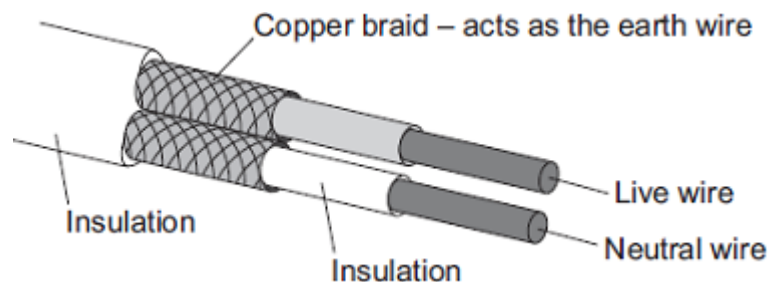
Mass = \_\_\_\_\_ kg

(5)

(Total 9 marks)

### Q4.

The diagram shows the structure of a cable. The cable is part of an undersoil heating circuit inside a large greenhouse.



- (a) The cable is connected to the mains electricity supply through a residual current circuit breaker. If the cable is accidentally cut the circuit breaker automatically switches the circuit off.

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

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(1)

- (ii) What happens, as the cable is cut, to cause the circuit breaker to switch the circuit off?

## P5 Electricity – In the home, task 1

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(2)

- (iii) A circuit can also be switched off by the action of a fuse.

Give **one** advantage of using a circuit breaker to switch off a circuit rather than a fuse.

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(1)

- (b) The 230 volt mains electricity supply causes a current of 11 amps to flow through the cable.

- (i) Calculate the amount of charge that flows through the cable when the cable is switched on for 2 hours and give the unit.

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Charge = \_\_\_\_\_

(3)

- (ii) Calculate the energy transferred from the cable to the soil in 2 hours.

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Energy transferred = \_\_\_\_\_ J

(2)

- (c) The heating circuit includes a thermistor. The thermistor is buried in the soil and acts as a thermostat to control the increase in the temperature of the soil. Describe how an **increase** in the temperature of the soil affects the thermistor.

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(2) (Total 11 marks)

## P5 Electricity – In the home, task 1

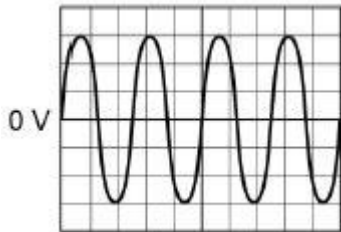
Mark schemes

### Q1.

(a) 50 Hz

1

(b)



1

(c)  $P = 0.020 \times 230$

1

$P = 4.6 \text{ (W)}$

1

(d)  $E = 180 \times 230$

1

$E = 41\,400 \text{ (J)}$

1

(e) Hazard:  
live wire  
**or**  
high potential difference

*ignore current in his body*

1

Risk:  
electric shock  
**or**  
electrocution

*allow (electrical) burn*

*allow death (by electric shock)*

*allow 1 mark for hazard and risk in incorrect order*

1

[8]

### Q2.

(a) changes

*allow reverses*

1



## P5 Electricity – In the home, task 1

(b) dependent 1

(c) kettle **C**  
or  
2.8 kW 1

highest power (output)  
*allow higher power (output)* 1

(d) values for gradient calculation shown on graph or on answer lines 1

power input = 2200 (W)  
*accept an answer that rounds to 2200 (W) for 2 marks* 1

(e) charge flow = current × time  
*allow  $Q = It$*  1

(f)  $2400 = I \times 250$  1

$$I = \frac{2400}{250}$$
 1

$I = 9.6$  (A)  
*an answer of 9.6 (A) scores 3 marks* 1

[10]

### Q3.

(a) risk of electric shock (if someone touched the case)  
*allow risk of electrocution (if someone touched the case)* 1

(b)  $2530 = I \times 230$   
*this mark may be awarded if  $P$  is incorrectly / not converted* 1

$$I = \frac{2530}{230}$$

*this mark may be awarded if  $P$  is incorrectly / not converted* 1

$I = 11$  (A)

## P5 Electricity – In the home, task 1

*this answer only*

*an answer of 0.011 (A) scores 2 marks*

1

*an answer of 11 (A) scores 3 marks*

(c)  $E = 2530 \times 14$

*this mark may be awarded if P is incorrectly / not converted*

1

$E = 35\,420 \text{ (J)}$

*this answer only*

1

$35\,420 = m \times 4200 \times 70$

*allow their calculated  $E = m \times 4200 \times 70$*

1

$$m = \frac{35\,420}{4200 \times 70}$$

*allow  $m = \frac{\text{their calculated } E}{4200 \times 70}$*

1

$m = 0.12 \text{ (kg)}$

*allow an answer that is consistent with their calculated value of E*

1

[9]

### Q4.

(a) (i) 50(Hz)

*ignore any unit given*

1

(ii) any **two** from:

- (some) current flows to Earth  
*accept ground for Earth*
- current flows through copper braid  
*accept current flows through the earth wire*  
*accept electricity for current in either the first or second marking point but not both*
- RCCB detects difference between current in live and neutral wire

2

(iii) can be reset

*accept does not need replacing*

## P5 Electricity – In the home, task 1

or

faster acting

*accept switches circuit off faster*

1

(b) (i) 79 200

*allow 1 mark for correct substitution, ie  $11 = \frac{Q}{2 \times 3600}$*

*an answer 22 gains 1 mark*

2

coulombs / C

*do not accept c*

1

(ii) 18 216 000

*accept for 2 marks 18 216 kJ or 18.216 MJ*

or

230 × their (b)(i) correctly calculated

*allow 1 mark for correct substitution, ie 230 × their (b)(i) or*

*allow 1 mark for power calculated as 2530(W)*

2

(c) increases temperature of thermistor

1

changes resistance (of thermistor)

*do not accept increases resistance (of thermistor)*

*an answer decreases resistance (of thermistor) gains 2 marks*

1

[11]