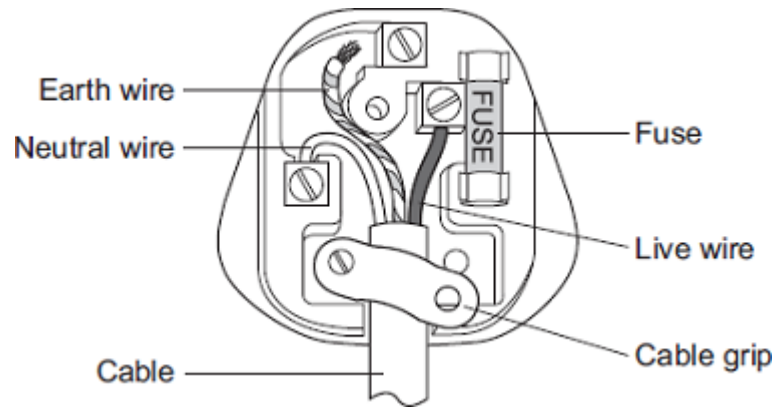


## P5 Electricity – In the home, task 2

### Foundation questions

#### Q1.

- (a) The diagram shows the inside of an incorrectly wired three-pin plug.



- (i) What **two** changes need to be made so that the plug is wired correctly?

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

(2)

- (ii) The fuse inside a plug is a safety device.

Explain what happens when too much current passes through a fuse.

\_\_\_\_\_

\_\_\_\_\_

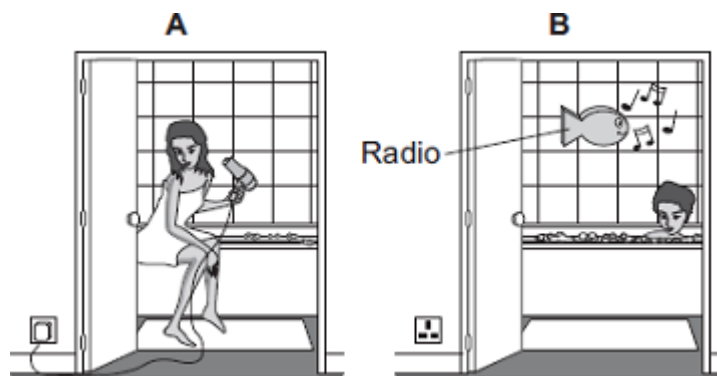
\_\_\_\_\_

\_\_\_\_\_

(2)

- (b) Each of these pictures shows an electrical appliance being used in a bathroom.

## P5 Electricity – In the home, task 2



Using the hairdryer in picture **A** is dangerous. However, it is safe to use the battery-operated radio in picture **B**.

Explain why.

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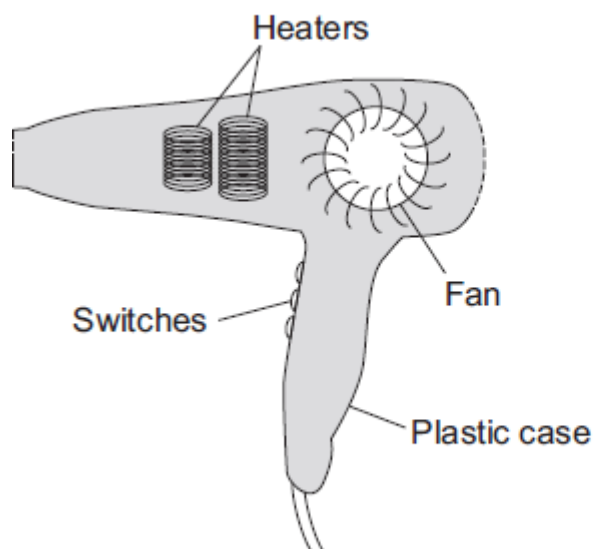
(2)

(Total 6 marks)

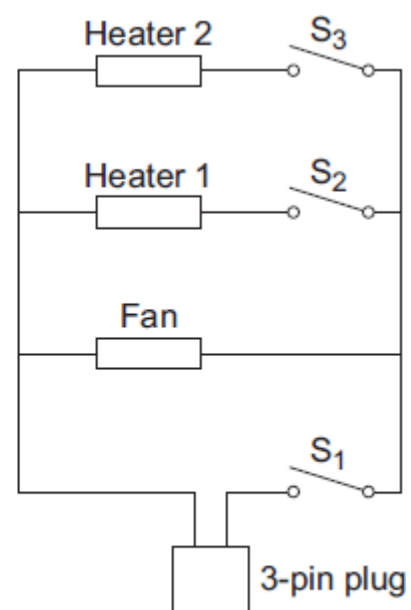
### Q2.

**Diagram 1** shows a hairdryer.

**Diagram 2** shows how the heaters and fan of the hairdryer are connected to a 3-pin plug. The hairdryer does not have an earth wire.



**Diagram 1**



**Diagram 2**

## P5 Electricity – In the home, task 2

(a) What colour is the insulation around the wire connected to the live pin inside the plug? .....(1)

(b) Why does the hairdryer **not** need an earth wire?

\_\_\_\_\_ [1]  
 \_\_\_\_\_

(c) All the switches are shown in the OFF position.

(i) Which switch or switches have to be ON to make:

(1) only the fan work; \_\_\_\_\_

(2) heater 2 work? \_\_\_\_\_

(2)

(ii) The heaters can only be switched on when the fan is also switched on.

Explain why.

\_\_\_\_\_  
 \_\_\_\_\_ [2]  
 \_\_\_\_\_

(d) The table shows the current drawn from the 230 volt mains electricity supply when different parts of the hairdryer are switched on.

	Current in amps
Fan only	1.0
Fan and heater 1	4.4
Fan and both heaters	6.5

Calculate the maximum power of the hairdryer.

Show clearly how you work out your answer and give the unit.

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

Maximum power = \_\_\_\_\_

(3)

(Total 9 marks)

## P5 Electricity – In the home, task 2

### Higher Questions

#### Q3.

- (a) A company is developing a system which can heat up and melt ice on roads in the winter. This system is called 'energy storage'.

During the summer, the black surface of the road will heat up in the sunshine.

This energy will be stored in a large amount of soil deep under the road surface. Pipes will run through the soil. In winter, cold water entering the pipes will be warmed and brought to the surface to melt ice.

The system could work well because the road surface is black.

Suggest why.

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(1)

- (b) (i) What is meant by specific latent heat of fusion?

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(2)

- (ii) Calculate the amount of energy required to melt 15 kg of ice at 0 °C.

Specific latent heat of fusion of ice =  $3.4 \times 10^5$  J/kg.

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

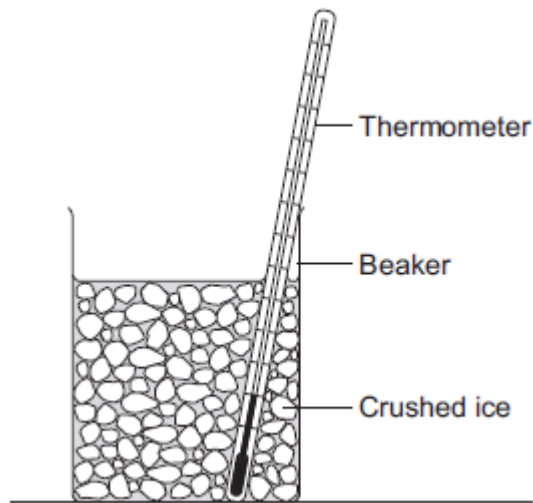
(2)

- (c) Another way to keep roads clear of ice is to spread salt on them. When salt is added to ice, the melting point of the ice changes.

A student investigated how the melting point of ice varies with the mass of salt added.

The figure below shows the equipment that she used.

## P5 Electricity – In the home, task 2



The student added salt to crushed ice and measured the temperature at which the ice melted.

- (i) State **one** variable that the student should have controlled.

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(1)

- (ii) During the investigation the student stirred the crushed ice.

Suggest **two** reasons why.

Tick (✓) **two** boxes.

	Tick (✓)
To raise the melting point of the ice	
To lower the melting point of the ice	
To distribute the salt throughout the ice	
To keep all the ice at the same temperature	
To reduce energy transfer from the surroundings to the ice	

(2)

- (iii) The table below shows the data that the student obtained.

<b>Mass of salt added in grams</b>	0	10	20
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## P5 Electricity – In the home, task 2

Melting point of ice in °C	0	-6	-16
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Describe the pattern shown in the table.

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(1)

- (d) Undersoil electrical heating systems are used in greenhouses. This system could also be used under a road.

A cable just below the ground carries an electric current. One greenhouse system has a power output of 0.50 kW.

Calculate the energy transferred in 2 minutes.

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

(3)

- (e) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

A local council wants to keep a particular section of a road clear of ice in the winter.

Describe the advantages and disadvantages of keeping the road clear of ice using:

- energy storage
- salt
- undersoil electrical heating.

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## P5 Electricity – In the home, task 2

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Extra space \_\_\_\_\_

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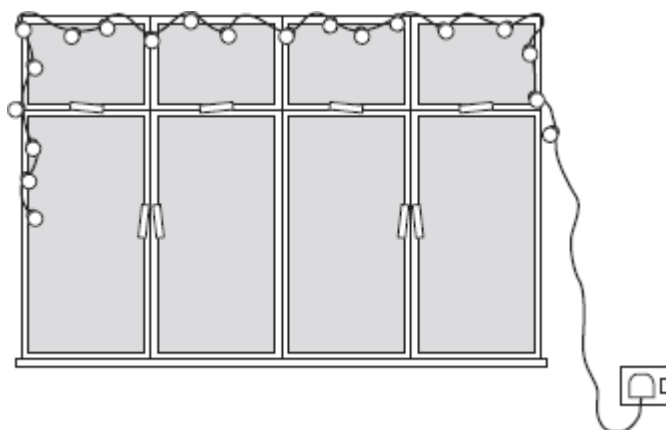
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(6)  
(Total 18 marks)

### Q4.

A set of lights consists of 20 lamps connected in series to the 230 V mains electricity supply.



- (a) When the lights are switched on and working correctly, the current through each lamp is 0.25 A.
- (i) What is the total current drawn from the mains supply?

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(1)

## P5 Electricity – In the home, task 2

- (ii) Calculate the charge passing through **one** of the lamps in 5 minutes.

Show clearly how you work out your answer and give the unit.

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Total charge = \_\_\_\_\_

(3)

- (b) One of the lamps in the set is a fuse lamp. This contains a filament which melts if a fault occurs. A short time after the lights are switched on, a fault causes the filament inside the fuse lamp to melt and all the lamps go out.

The householder cannot find another fuse lamp so connects a piece of aluminium foil across the contacts inside the fuse lamp holder.

When switched on, the nineteen remaining lamps work.

What the householder has done is dangerous.

Explain why.

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(2)

(Total 6 marks)



## P5 Electricity – In the home, task 2

### Mark schemes

#### Q1.

- (a) (i) connect the earth wire (to pin)  
*answers must be in terms of correcting the faults* 1
- screw cable grip (across cable)  
*accept tighten the cable grip* 1
- (ii) any **two** from:
- fuse gets (very) hot
  - fuse melts  
*accept blows for melts*  
*do **not** accept break / snap fuse / blow up*
  - circuit breaks / switches off  
*accept stops current flowing* 2
- (b) any **two** from:
- hairdryer is plugged into mains (electricity socket)  
*it refers to hairdryer*  
*hairdryer works from the mains*
  - or**  
hairdryer is using 230 V  
*accept 240 for 230*
  - water conducts electricity  
*do **not** accept water and electricity don't mix*
  - radio is low power / current / pd / voltage  
*accept radio not connected to the mains*  
*do **not** accept radio is waterproof*
  - (the current in / pd across) hairdryer more likely to give a (fatal) electric shock  
*accept the idea of electrocution if hairdryer is wet*  
*accept the idea of radio not causing electrocution if wet* 2

[6]

#### Q2.

- (a) brown

## P5 Electricity – In the home, task 2

- 1
- (b) outside / case is plastic / an insulator  
*accept is double insulated*  
*accept non-conductor for plastic*  
*do **not** accept it / hairdryer is plastic*
- 1
- (c) (i) (1) S<sub>1</sub>  
*and no other*
- 1
- (2) S<sub>1</sub> and S<sub>3</sub>  
*both required, either order*
- 1
- (ii) S<sub>1</sub> must be ON (for either heater to work)  
*do **not** accept reference to 'fan' switch*
- 1
- S<sub>1</sub> switches the fan on
- 1
- (d) 1495
- allow 1 mark for correct substitution*  
*ie, 6.5 × 230*
- 2
- watt(s) or W
- an answer of 1.495 kW gains 3 marks*  
*although the unit is an independent mark for full credit*  
*the unit and numerical value must be consistent*  
*accept joules per second or J/s*
- 1

[9]

### Q3.

- (a) (black) is a good absorber of (infrared) radiation
- 1
- (b) (i) amount of energy required to change (the state of a substance) from solid to liquid (with no change in temperature)  
*melt is insufficient*
- 1
- unit mass / 1kg
- 1
- (ii) 5.1 × 10<sup>6</sup> (J)  
*accept 5 × 10<sup>6</sup>*

## P5 Electricity – In the home, task 2

- allow 1 mark for correct substitution ie  $E = 15 \times 3.4 \times 10^5$*  2
- (c) (i) mass of ice  
*allow volume / weight / amount / quantity of ice* 1
- (ii) to distribute the salt throughout the ice 1  
to keep all the ice at the same temperature 1
- (iii) melting point decreases as the mass of salt is increased  
*allow concentration for mass*  
*accept negative correlation*  
*do **not** accept inversely proportional* 1
- (d) 60 000 (J)  
*accept 60 KJ*  
*allow 2 marks for correct substitution ie  $E = 500 \times 2.0 \times 60$*   
*allow 2 marks for an answer of 1000 **or** 60*  
*allow 1 mark for correct substitution ie*  
 *$E = 500 \times 2.0$  **or**  $0.50 \times 2.0 \times 60$*   
*allow 1 mark for an answer of 1* 3
- (e) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

### 0 marks

No relevant content

### Level 1 (1–2 marks)

There is *an attempt at a description of some advantages or disadvantages.*

### Level 2 (3–4 marks)

There is a *basic description of some advantages **and** / **or** disadvantages for some of the methods*

### Level 3 (5–6 marks)

There is a *clear description of the advantages and disadvantages of all the methods.*

### examples of the points made in the response

*extra information*

### energy storage

advantages:

## P5 Electricity – In the home, task 2

- no fuel costs
- no environmental effects

disadvantages:

- expensive to set up and maintain
- need to dig deep under road
- dependent on (summer) weather
- digging up earth and disrupting habitats

### salt spreading

advantages:

- easily available
- cheap

disadvantages:

- can damage trees / plants / drinking water / cars
- needs to be cleaned away

### undersoil heating

advantages:

- not dependent on weather
- can be switched on and off

disadvantages:

- costly
- bad for environment

6

[18]

### Q4.

(a) (i) 0.25 (A)

1

(ii) 75

*allow 1 mark for converting 5 minutes to 300 seconds*

*or allow 1 mark for correct substitution*

*ie  $0.25 \times 300$*

*allow 1 mark for an answer 1.25*

*allow 1 mark only for their (a)(i)  $\times 300$  correctly calculated*

2

coulombs or C

*do **not** accept c*

1

## P5 Electricity – In the home, task 2

(b) any **two** from:

- fault not repaired  
*accept if a fault was to occur*
- larger current will (still) flow
- aluminium foil will not melt (if a fault)  
*accept aluminium foil needs a higher current / charge to melt*
- wiring will overheat / (may) cause a fire  
*accept idea of fire hazard*  
*do **not** accept explode etc*

2

[6]