1 Wendy's mobile phone charger contains a transformer.

Look at the information about the transformer.

Input voltage	230 V AC
Input current	50 mA
Output voltage	5 V

Describe, in detail, the construction of the transformer and explain how applying a 230 V input produces a 5 V output.

Include a diagram and a calculation in your answer.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

2 Car tyres grip the road when braking.

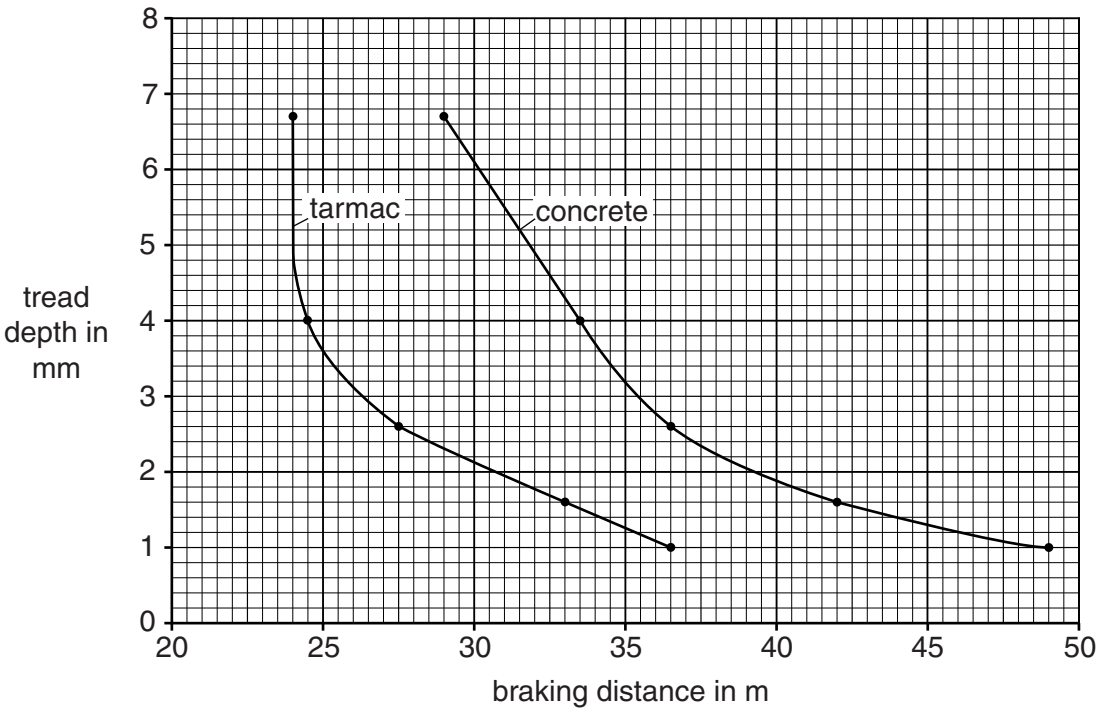
Tyres have a tread that wears away slowly with use.

New tyres have a tread that is 9 mm deep. The tread helps to move water away from the tyre when the road is wet.

This increases friction forces and improves braking.

(a) Look at the graph. It shows braking distances for tyres of different tread depths.

The data is for two different road surfaces on a wet day.



(i) Road safety experts recommend changing tyres when the tread depth reduces to 3 mm.

Why is this more important for concrete surfaces rather than for tarmac surfaces?

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..... **[1]**

(ii) The data in the graph was collected using sets of tyres with different tread depths.

The driver fits each set of tyres to the same car.

Suggest other things the driver needs to do to ensure the results can be compared in a fair way.

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..... **[2]**

(iii) The braking distance increases as the tread depth decreases.

Manjit calculates the percentage increase in braking distance for the tarmac.

She finds that reducing the tread depth from 6.7 mm to 1.6 mm changes the braking distance from 24 m to 33 m.

This is a 38% increase in braking distance.

Steve thinks that on concrete, for the same reduction in tread depth, the percentage increase in braking distance will double.

Is Steve correct? .....

Use a calculation to explain your answer.

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..... **[3]**

(b) The minimum legal tread depth is 1.6 mm in the UK.

Manjit has some tyres that have a tread depth of 6.7 mm.

The garage tells her that, for normal driving, the tread should wear by 0.17 mm per 1000 km.

(i) Calculate how many kilometres she can expect to travel before the tyres are illegal.

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answer ..... km **[3]**

(ii) It is unwise for Manjit to use the tyres for the distance calculated before replacing them.

Use the graph to explain why.

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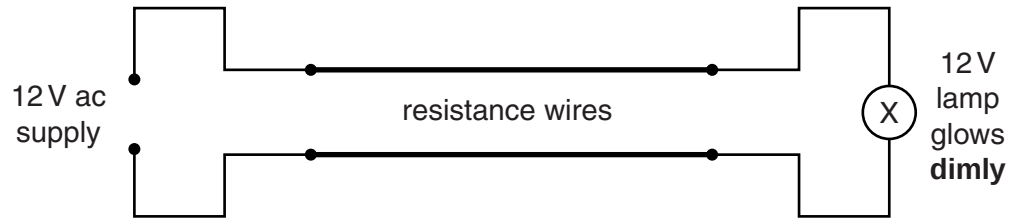
..... **[1]**

[Total: 10]

3 Ian is learning about power transmission and the National Grid.

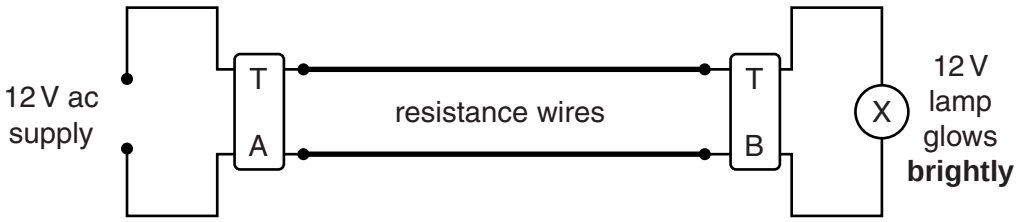
His teacher demonstrates how power loss can be reduced in a model transmission line.

She first sets up a system like this and the light glows dimly.



She adds two transformers (TA and TB) before and after the resistance wires.

The lamp now glows brightly.



Explain these observations, and how this type of arrangement is used to reduce energy losses in the National Grid.

The quality of written communication will be assessed in your answer to this question.

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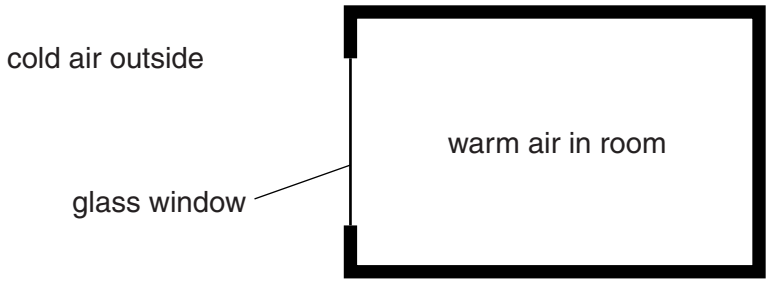
[Total: 6]

4 Bilhar has high fuel bills. His house has poor insulation.

(a) Look at the diagram of a window in his house.



A lot of energy is lost through the window.

Explain, in terms of particles, how the energy is transferred from the warm air inside the house to the cold air outside the house.

The quality of written communication will be assessed in your answer to this question.

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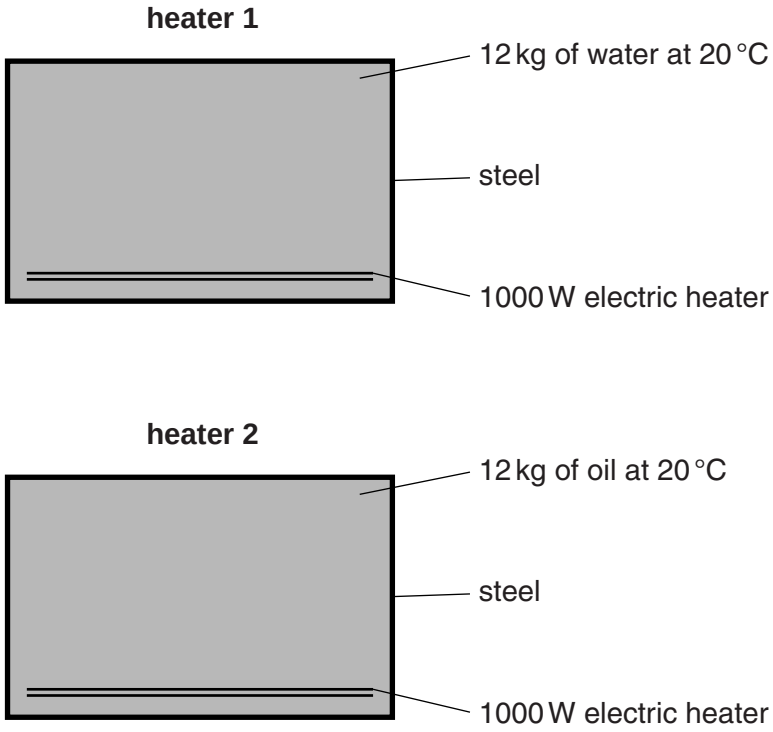
(b) Bilhar has two types of heater. They are filled with different liquids.

Look at the diagrams of Bilhar's heaters.



Heater **1** is filled with water. Heater **2** is filled with oil.

(i) The water in heater **1** is at 20 °C.

Bilhar switches on heater **1**. The electric heater heats the water.

The heater supplies 2 100 000 J of energy to the 12 kg of water.

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

Calculate the maximum **temperature** of the water.

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answer ..... °C **[3]**

(ii) It is unlikely the water will get to this temperature. Suggest why.

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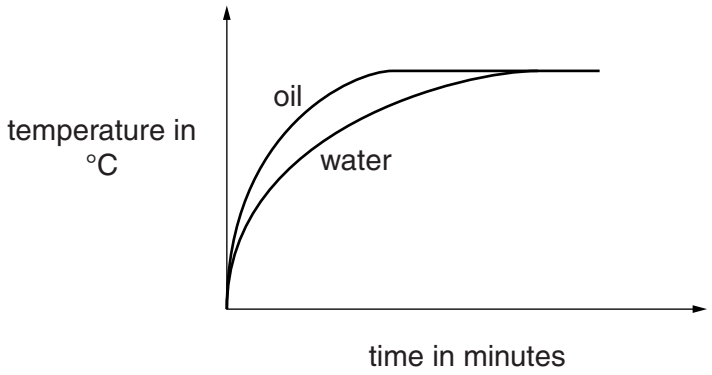
..... **[1]**

(c) Bilhar switches on heater **2**.

The specific heat capacity of oil is 1670 J/kg °C.

The liquids in the two heaters are heated to a temperature of 50 °C.

Look at the graph of the temperatures of the liquids in the heaters.



Water filled heaters are more useful for heating Bilhar's house.

Use the graph to help you explain why.

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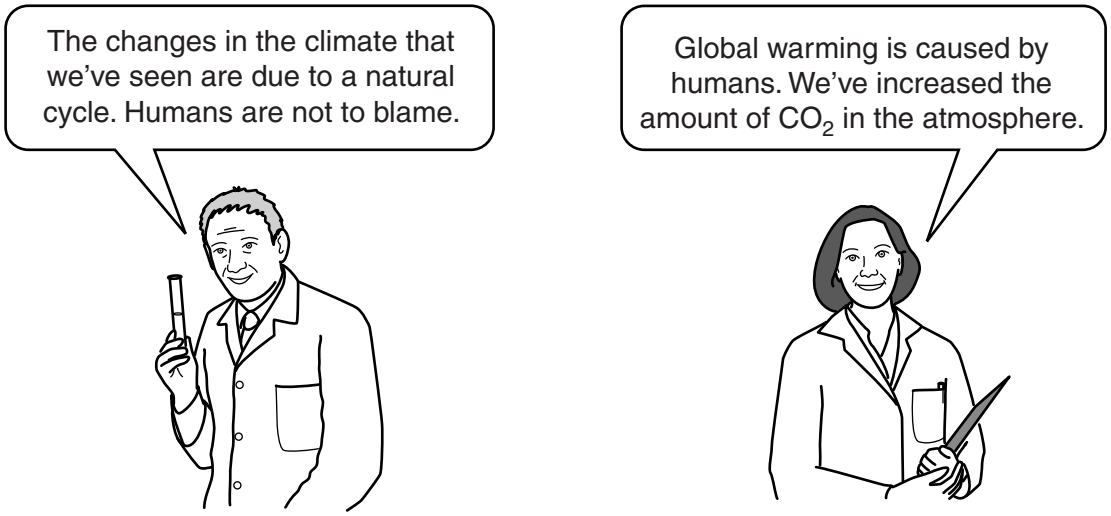
[Total: 13]

5 Most scientists agree that the greenhouse effect causes global warming.

However, other scientists disagree about the causes of global warming.



(a) Suggest reasons why scientists may **disagree** on the **causes** of global warming.

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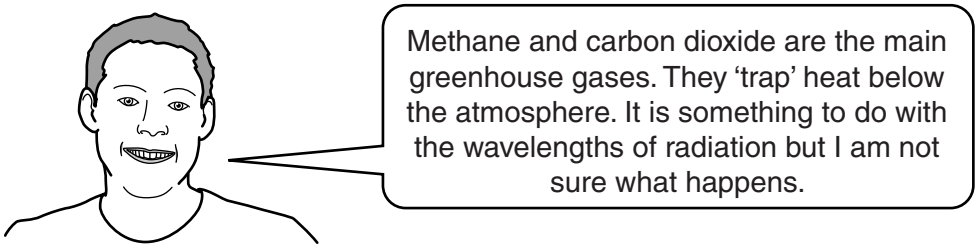
..... **[2]**

(b) Josh tries to explain what the greenhouse effect is.



Explain in more detail the role of radiation in the greenhouse effect**.**

The quality of written communication will be assessed in your answer to this question.

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[Total: 8]

6 Amy wants to reduce the cost of using electricity in her flat.

She is thinking of changing electricity supplier to a cheaper one.

Distas Electricity Company	**Skinner Electricity Company**
Cost per unit = 16 p	**Cost per unit = 14 p**

(a) Her main use for electricity is her central heating.

The average power of her central heating is 6500 W.

It is on for 4 hours each day.

She changes her supply from Distas to Skinner Electricity Company.

The cost per unit is the cost for one kilowatt hour of energy.

How much money will she save each day on her central heating costs?

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..... **[3]**

(b) Amy has a TV. It has a label on it, but it does not tell her about the power in kW.

Look at the label.

current = 3 A
voltage = 230 V

Calculate the power of the TV in kW.

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answer ..... kW **[2]**

(c) Amy reads about using **off-peak electricity** in her home. This will be cheaper.

Give one disadvantage to Amy of changing to off-peak electricity.

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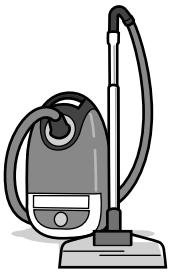
..... **[1]**

[Total: 6]

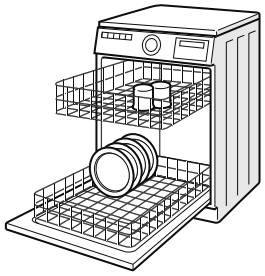
7 Zack uses many appliances in his home.

Look at the information about the appliances he uses the **most**.

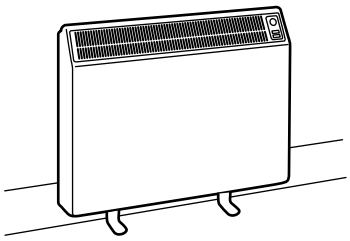
kettle used for 0.5 hours
during the day
current of 9 amps



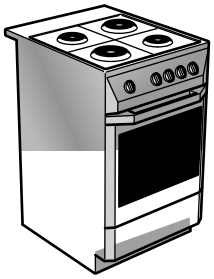
vacuum cleaner used for
0.25 hours during the day
current of 6 amps



dishwasher used for 1.5 hours
during the day
current of 9 amps



heater used for 12 hours
at night
current of 9 amps



cooker used for 1 hour
during the day
current of 14 amps

fridge-freezer on for 12 hours during
the day and 12 hours at night
current of 1.8 amps

All the appliances use the 230 V mains voltage. The currents shown are average values.

(a) The heater is only used at night.

(i) Calculate the power rating for the heater in **kilowatts**.

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power rating ..... kilowatts **[2]**

(ii) Calculate the total energy supplied to the heater in one night in **kilowatt hours**.

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total energy supplied ..... kilowatt hours **[2]**

(b) Zack pays **12p** per kilowatt hour for electricity he uses during the **day**.

He pays **6p** per kilowatt hour for electricity he uses during the **night**.

He is considering switching to the same cost for **day and night** of **10p**.

This would not save him money.

Suggest reasons why.

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..... **[2]**

[Total: 6]

Amrit spends a lot of money on her electricity bills. One of her appliances is an iron.

8 **(a)** Amrit uses the iron for 0.5 hours. Its power is 1500 W. Electricity costs 18 pence per unit.

Calculate the number of kilowatt hours used by the iron and how much this will cost.

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number of kWh = ...

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cost of using the iron = ... pence **[3]**

(b) Amrit has a fan heater. It has a power rating of 1955 W and a voltage of 230 V.

The fuse in the plug states a 'maximum current of 13 A'.

Amrit wants to find out whether the fuse is suitable.

Calculate the current in the fan heater.

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answer ..... A **[2]**

(c) Amrit decides to change to **off-peak** electricity.

Off-peak electricity has advantages for producers and consumers.

(i) Write down one advantage and one disadvantage of off-peak electricity **for Amrit**.

advantage.....

disadvantage ..... **[2]**

(ii) Power stations produce electricity 24 hours a day.

Producers sell off-peak electricity. This increases their profit.

Explain how using more off-peak electricity can benefit **energy supply**.

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..... **[1]**

[Total: 8]