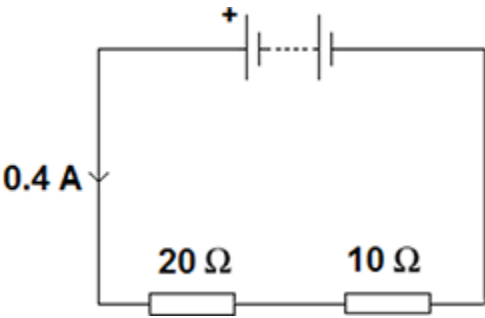


1

An electrical circuit is shown in the figure below.



(a) The current in the circuit is direct current.

What is meant by direct current?

Tick **one** box.

Current that continuously changes direction.

Current that travels directly to the component.

Current that is always in the same direction.

(1)

(b) The equation which links current, potential difference and resistance is:

potential difference = current x resistance

Calculate the potential difference across the battery in the circuit in the figure above.

.....
.....

Potential difference = V

(3)

(c) The equation which links current, potential difference and power is:

power = current x potential difference

Calculate the power output of the battery in the figure above.

Give your answer to one significant figure.

.....
Power = W

(2)

(Total 6 marks)

2

An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in the figure below.



© Michael Priest

- (a) The electrician should **not** change the shower unless he switches off the mains electricity supply.

Explain why.

.....

.....

.....

.....

(2)

- (b) The new shower has a power output of 10 690 W when it is connected to the 230 V mains electricity supply.

The equation which links current, potential difference and power is:

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

Calculate the current passing through the new shower.

Give your answer to two significant figures.

.....
.....
.....

Current = A

(4)

- (c) The new shower has a higher power rating than the old shower.

How does the power of the new shower affect the cost of using the shower?

Give a reason for your answer.

.....
.....
.....
.....

(2)
(Total 8 marks)

3

An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in **Figure 1**.

Figure 1



© Michael Priest

(a) If the electrician touches the live wire he will receive an electric shock.

Explain why.

.....

.....

.....

.....

.....

.....

.....

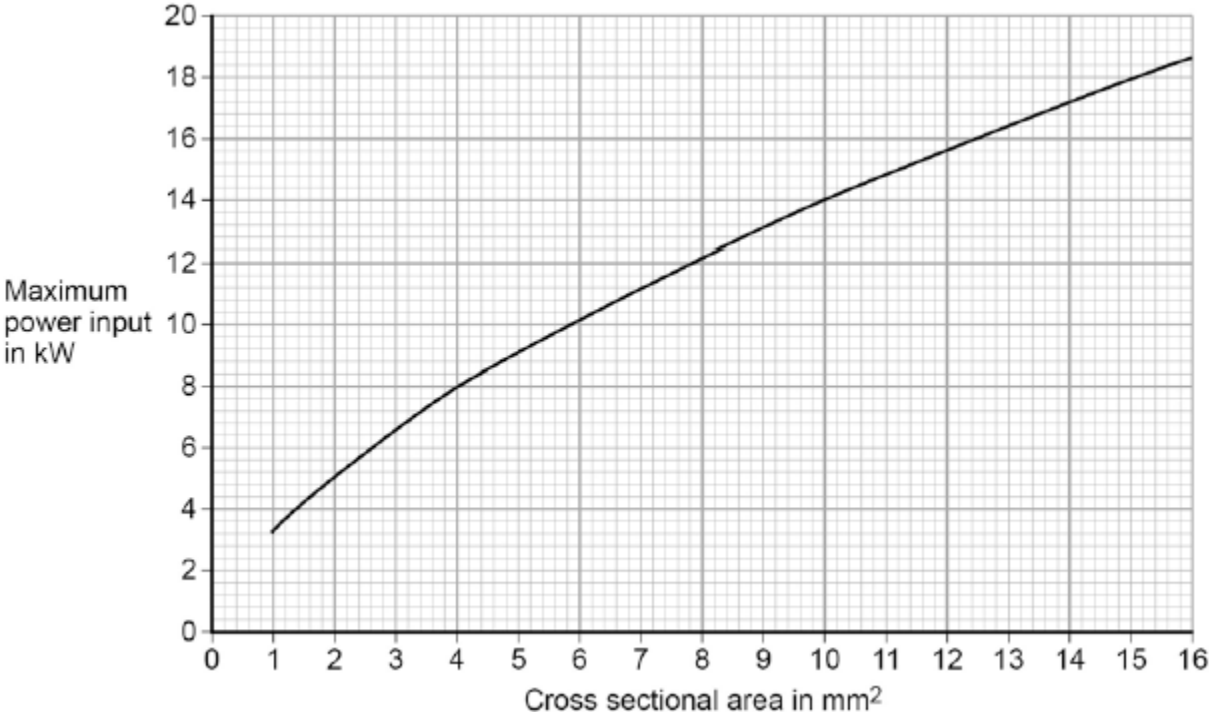
.....

(4)

- (b) Different electrical wires need to have a cross-sectional area that is suitable for the power output.

Figure 2 shows the recommended maximum power input to wires of different cross-sectional areas.

Figure 2



The new electric shower has a power input of 13.8 kW.

Determine the minimum **diameter** of wire that should be used for the new shower.

The diameter, *d*, can be calculated using the equation:

$$d = \sqrt{\frac{4A}{\pi}}$$

A is the cross-sectional area of the wire.

.....

.....

Minimum diameter = mm

(2)

- (c) The charge that flows through the new shower in 300 seconds is 18 000 C.
The new electric shower has a power of 13.8 kW.

Calculate the resistance of the heating element in the new shower.

Write down any equations you use.

.....

.....

.....

.....

.....

.....

.....

Resistance = Ω

(5)
(Total 11 marks)

4

A small community of people live in an area in the mountains.
The houses are not connected to the National Grid.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

Figure 1 shows where these people live.

Figure 1



© Brian Lawrence/Getty Images

- (a) It would not be economical to connect the houses to the National Grid.
Give **one** reason why.

.....

(1)

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

Information about the two electricity generation systems is given in **Figure 2**.

Figure 2

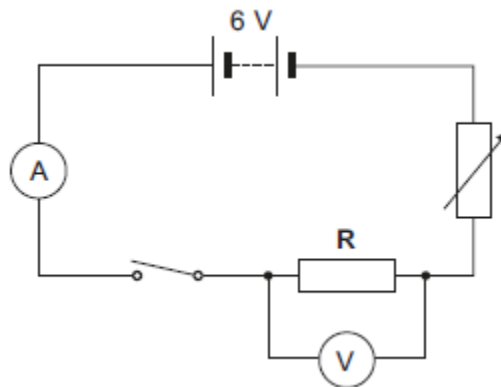
The wind turbine costs £50 000 to buy and install.
 The hydroelectric generator costs £20 000 to buy and install.
 The average power output from the wind turbine is 10 kW.
 The hydroelectric generator will produce a constant power output of 8 kW.

Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy sources as well as information from **Figure 2**.

(6)
 (Total 7 marks)

- 5** The diagram shows an electrical circuit.



- (a) The 6 V battery shown in the diagram is made up of a number of identical 1.5 V cells.
 Calculate the minimum number of cells needed to make the battery.

.....
 Number of cells =

(1)

- (b) The switch in the diagram is shown in the open position. Closing the switch completes the circuit.

Charge flows through the completed circuit and a reading is shown on both the ammeter and the voltmeter.

- (i) In 10 seconds, 20 coulombs of charge flows through the circuit.

Calculate the current reading shown on the ammeter.

.....

Current = A

(2)

- (ii) For 20 coulombs of charge to flow through the resistor R, 100 joules of work must be done.

Calculate the potential difference reading given by the voltmeter.

.....

Potential difference = V

(2)

(Total 5 marks)

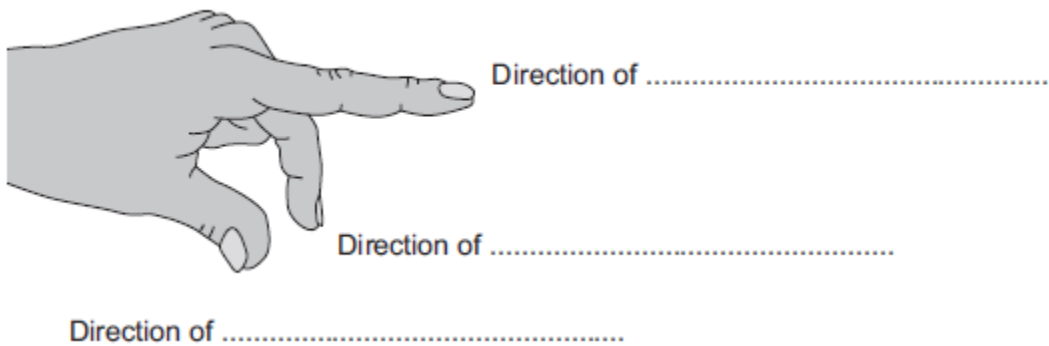
6

The left-hand rule can be used to identify the direction of the force acting on a current-carrying conductor in a magnetic field.

- (a) Use words from the box to label **Figure 1**.

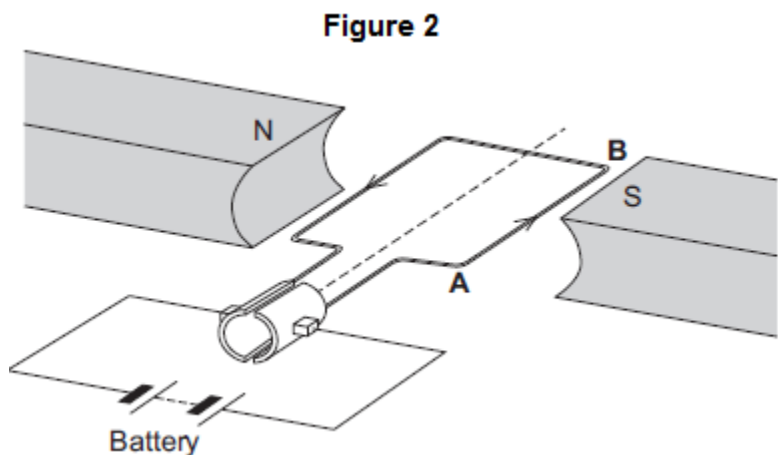
current	field	force	potential difference
---------	-------	-------	----------------------

Figure 1



(3)

(b) **Figure 2** shows an electric motor.

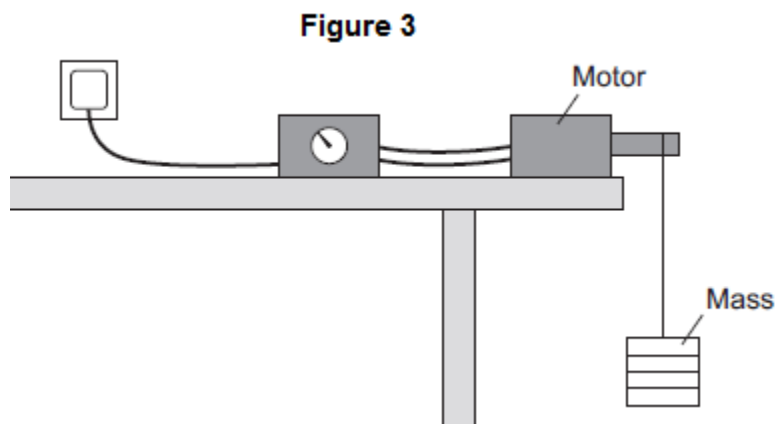


(i) Draw an arrow on **Figure 2** to show the direction of the force acting on the wire **AB**. (1)

(ii) Suggest **two** changes that would increase the force acting on the wire **AB**.
1.....
2..... (2)

(iii) Suggest **two** changes that would reverse the direction of the force acting on the wire **AB**.
1.....
2..... (2)

(c) A student used an electric motor to lift a mass. This is shown in **Figure 3**.



The student varied the electrical input power to the motor. For each different electrical input power, he recorded the time taken to lift the mass and calculated the output power of the motor.

The results are shown in the table.

Test	Electrical input power in watts	Work done lifting the mass in joules	Time taken to lift the mass in seconds	Output power in watts
A	20	24	2.4	10
B	40	24	1.2	20
C	60	24	0.8	30
D	80	24	0.2	120

The result for **Test D** is anomalous.

(i) Calculate the efficiency of the motor in **Test D**.

.....

 Efficiency =

(2)

(ii) Comment on your answer to part (c)(i).

.....

(1)

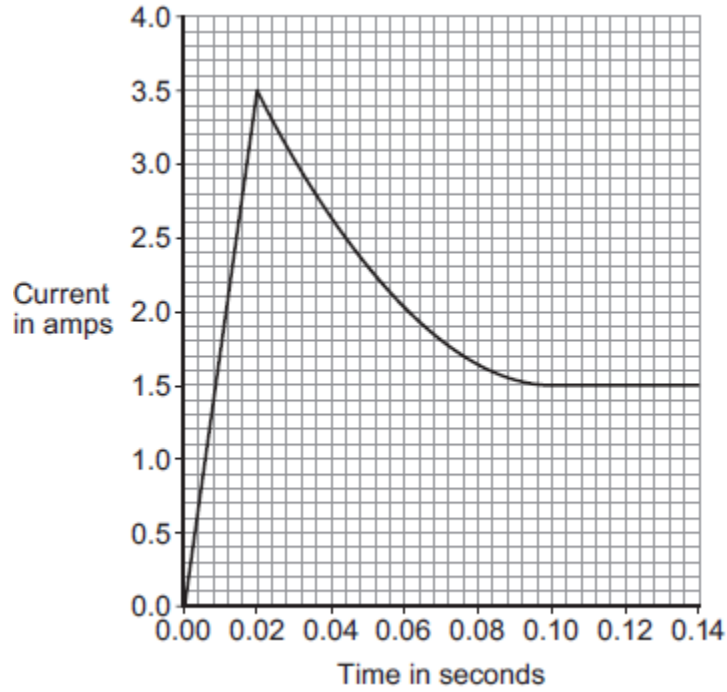
(iii) Suggest a reason for this anomalous result.

.....
.....

(1)
(Total 12 marks)

7

The graph shows how the current through a filament bulb changes after the bulb is switched on.



(a) What happens to the current through the bulb in the first 0.02 seconds after the bulb is switched on?

.....

(1)

(b) Between 0.02 seconds and 0.08 seconds the current through the bulb decreases.

(i) What, if anything, happens to the **resistance** of the bulb between 0.02 seconds and 0.08 seconds?

Draw a ring around the correct answer.

decreases

does not change

increases

(1)

(ii) What, if anything, happens to the **temperature** of the bulb between 0.02 seconds and 0.08 seconds?

Draw a ring around the correct answer.

decreases

does not change

increases

(1)

(c) The bulb is connected to a 12 V power supply.

Calculate the power of the bulb when the current through the bulb is 1.5 A.

Choose the unit from the list below.

coulomb

joule

watt

.....

.....

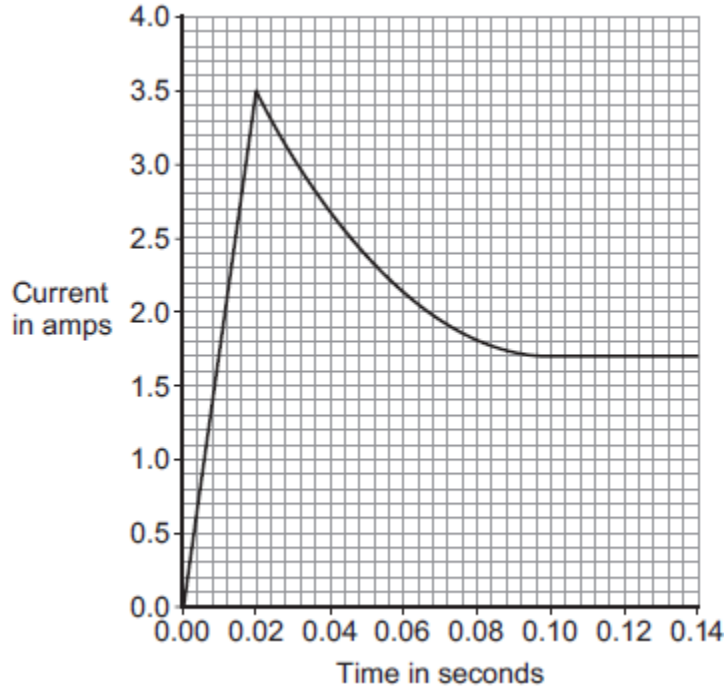
Power = unit

(3)

(Total 6 marks)

8

A 12 V filament bulb is connected to a 12 V power supply.
The graph shows how the current changes after the bulb is switched on.



(a) (i) After 0.10 seconds, the bulb works at its normal brightness.

What is the current through the bulb when it is working at normal brightness?

Current = A

(1)

(ii) The bulb works at normal brightness for 30 seconds before it is switched off.

Calculate the charge that flows through the bulb in the 30 seconds before it is switched off. Give the unit.

.....
.....
.....

Charge = unit

(3)

(iii) Calculate the energy transferred by the 12 V bulb when it is working at normal brightness for 30 seconds.

.....
.....

Energy transferred = J

(2)

- (b) Between 0.02 seconds and 0.08 seconds, there is an increase in both the resistance and the temperature of the metal filament inside the bulb.

Explain, in terms of the electrons and ions inside the filament, why both the temperature and the resistance increase.

.....

.....

.....

.....

.....

.....

(2)
(Total 8 marks)

9

Energy can be transferred through some materials by convection.

- (a) Use the correct answer from the box to complete the sentence.

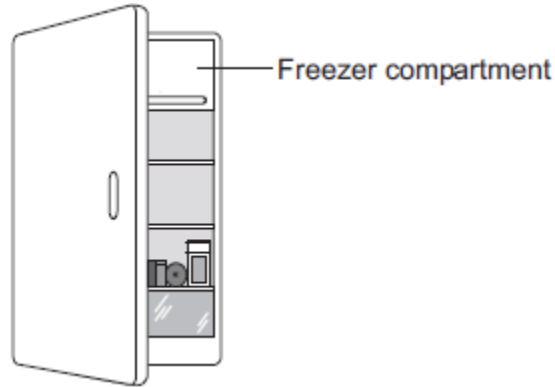
gas	liquid	solid
-----	--------	-------

Energy **cannot** be transferred by convection through a

(1)

(b) The figure below shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is $-5\text{ }^{\circ}\text{C}$.



Use the correct answer from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

decreased	unchanged	increased
------------------	------------------	------------------

When the air near the freezer compartment is cooled, the energy of the air particles is

The spaces between the air particles are

The density of the air is

(3)

(c) The table below shows some information about three fridges, **A**, **B** and **C**.

The efficiency of each fridge is the same.

Fridge	Volume in litres	Energy used in one year in kWh
A	232	292
B	382	409
C	622	524

(i) Which fridge, **A**, **B** or **C**, would cost the least to use for 1 year?

Give **one** reason for your answer.

.....
.....

(2)

(ii) A householder looks at the data in the table above.

What should she conclude about the pattern linking the volume of the fridge and the energy it uses in one year?

.....
.....

(1)

(iii) The householder could not be certain that her conclusion is correct for all fridges.

Suggest **one** reason why not.

.....
.....

(1)

(Total 8 marks)

10

Electricity can be generated using various energy sources.

(a) Give **one** advantage and **one** disadvantage of using nuclear power stations rather than gas-fired power stations to generate electricity.

Advantage

.....

Disadvantage

.....

(2)

(b) (i) A single wind turbine has a maximum power output of 2 000 000 W.

The wind turbine operated continuously at maximum power for 6 hours.

Calculate the energy output in kilowatt-hours of the wind turbine.

.....
.....
.....

Energy output = kWh

(2)

(ii) Why, on average, do wind turbines operate at maximum power output for only 30% of the time?

.....
.....

(1)

(b) The UK produces most of its electricity from fossil fuels.

Many people in the UK leave their televisions in 'stand by' mode when not in use, instead of switching them off.

It is better for the environment if people switch off their televisions, instead of leaving them in 'stand by' mode.

Explain why.

.....
.....
.....
.....
.....
.....

(3)

(c) A scientist wrote in a newspaper:

'Appliances that do not automatically switch off when they are not being used should be banned.'

Suggest why scientists alone cannot make the decision to ban these appliances.

.....
.....

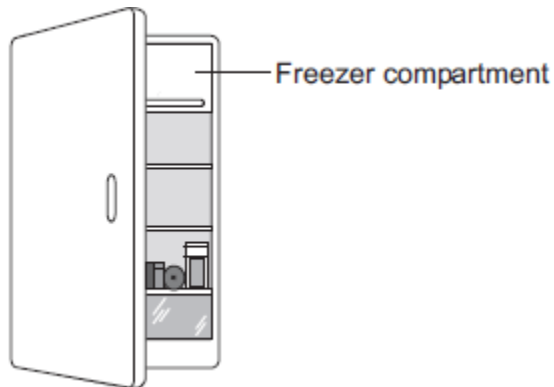
(1)

(Total 8 marks)

12

(a) The figure below shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is $-5\text{ }^{\circ}\text{C}$.



The air inside the fridge forms a convection current when the fridge door is closed.

Explain why.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(b) The table below shows information about four fridges.

Fridge	Volume in litres	Energy used in one year in kWh
A	250	300
B	375	480
C	500	630
D	750	750

A householder concludes that the energy used in one year is directly proportional to the volume of the fridge.

Explain why her conclusion is **not** correct.

Use data from the table in your answer.

.....
.....
.....
.....

(2)

(c) New fridges are more efficient than fridges made twenty years ago.

Give **one** advantage and **one** disadvantage of replacing an old fridge with a new fridge.

Ignore the cost of buying a new fridge.

Advantage

.....

Disadvantage

.....

(2)
(Total 8 marks)

13

Table 1 shows information about different light bulbs.

The bulbs all have the same brightness.

Table 1

Type of bulb	Input power in watts	Efficiency
Halogen	40	0.15
Compact fluorescent (CFL)	14	0.42
LED	7	0.85

(a) (i) Calculate the useful power output of the CFL bulb.

.....
.....
.....

Useful power output = watts

(2)

(ii) Use your answer to part (i) to calculate the waste energy produced each second by a CFL bulb.

.....

Waste energy per second = joules

(1)

- (b) (i) A growth cabinet is used to investigate the effect of light on the rate of growth of plants.

The figure below shows a growth cabinet.



In the cabinet the factors that affect growth can be controlled.

A cooler unit is used to keep the temperature in the cabinet constant. The cooler unit is programmed to operate when the temperature rises above 20 °C.

The growth cabinet is lit using 50 halogen bulbs.

Changing from using halogen bulbs to LED bulbs would reduce the cost of running the growth cabinet.

Explain why.

.....

.....

.....

.....

.....

.....

(4)

- (ii) A scientist measured the rate of growth of plants for different intensities of light.

What type of graph should be drawn to present the results?

.....

Give a reason for your answer.

.....

.....

(1)

(c) **Table 2** gives further information about both a halogen bulb and a LED bulb.

Table 2

Type of bulb	Cost to buy	Lifetime in hours	Operating cost over the lifetime of one bulb
Halogen	£1.50	2 000	£16.00
LED	£30.00	48 000	£67.20

A householder needs to replace a broken halogen light bulb.

Compare the cost efficiency of buying and using halogen bulbs rather than a LED bulb over a time span of 48 000 hours of use.

Your comparison must include calculations.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 12 marks)

14

Solar panels are often seen on the roofs of houses.

(a) Describe the action and purpose of a solar panel.

.....

.....

.....

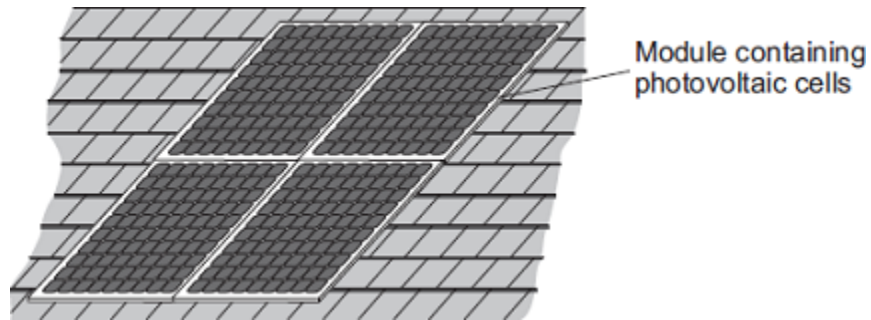
.....

(2)

(b) Photovoltaic cells transfer light energy to electrical energy.

In the UK, some householders have fitted modules containing photovoltaic cells on the roofs of their houses.

Four modules are shown in the diagram.



The electricity company pays the householder for the energy transferred.

The maximum power available from the photovoltaic cells shown in the diagram is $1.4 \times 10^3 \text{ W}$.

How long, in minutes, does it take to transfer 168 kJ of energy?

.....
.....
.....
.....
.....
.....
..... Time = minutes

(3)

- (c) When the modules are fitted on a roof, the householder gets an extra electricity meter to measure the amount of energy transferred by the photovoltaic cells.
- (i) The diagram shows two readings of this electricity meter taken three months apart. The readings are in kilowatt-hours (kWh).

21 November	0	0	0	4	4
21 February	0	0	1	9	4

Calculate the energy transferred by the photovoltaic cells during this time period.

.....

Energy transferred = kWh

(1)

- (ii) The electricity company pays 40p for each kWh of energy transferred. Calculate the money the electricity company would pay the householder.

.....

.....

Money paid =

(2)

- (iii) The cost of the four modules is £6000.

Calculate the payback time in years for the modules.

.....

.....

Payback time = years

(3)

- (iv) State an assumption you have made in your calculation in part (iii).

.....

.....

(1)

- (d) In the northern hemisphere, the modules should always face south for the maximum transfer of energy.

State **one** other factor that would affect the amount of energy transferred during daylight hours.

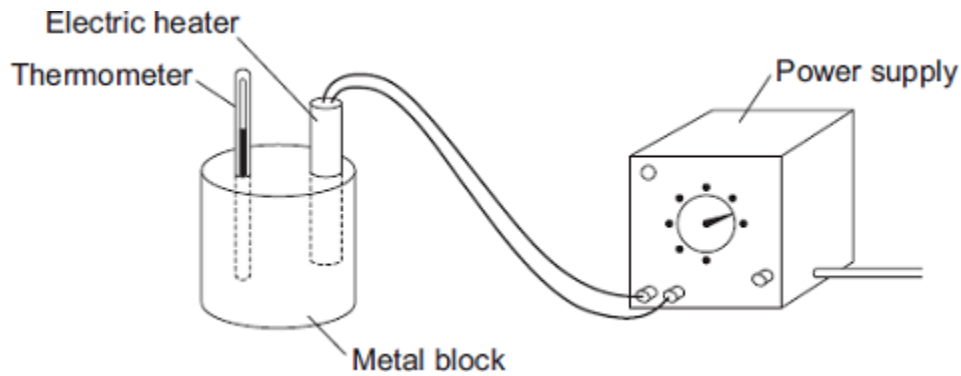
.....

.....

(1)
(Total 13 marks)

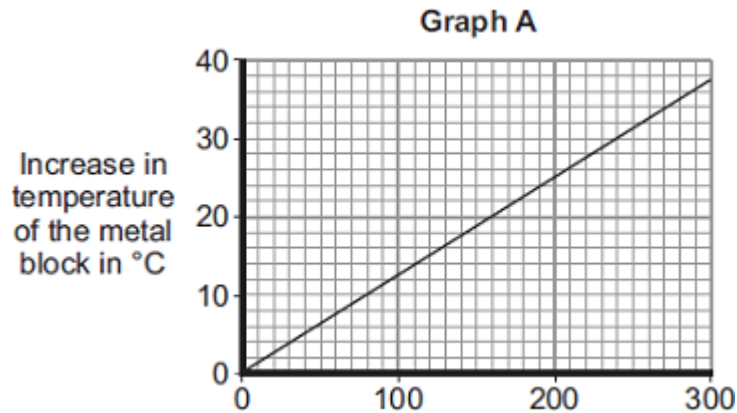
15

- (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



- (i) Before starting the experiment, the student drew **Graph A**.

Graph A shows how the student expected the temperature of the metal block to change after the heater was switched on.



Describe the pattern shown in **Graph A**.

.....

.....

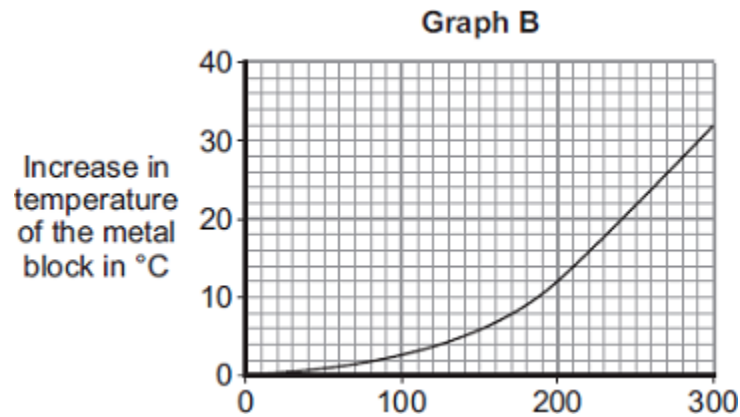
.....

.....

(2)

- (ii) The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted **Graph B**.



After 300 seconds, **Graph B** shows the increase in temperature of the metal block is lower than the increase in temperature expected from **Graph A**.

Suggest **one** reason why.

.....
.....

(1)

- (iii) The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

.....
.....
.....

Energy transferred = J

(2)

- (b) The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

Metal	Specific heat capacity in J/kg°C
Aluminium	900
Iron	450
Lead	130

Which **one** of the metals will heat up the most?

Draw a ring around the correct answer.

aluminium

iron

lead

Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

.....

.....

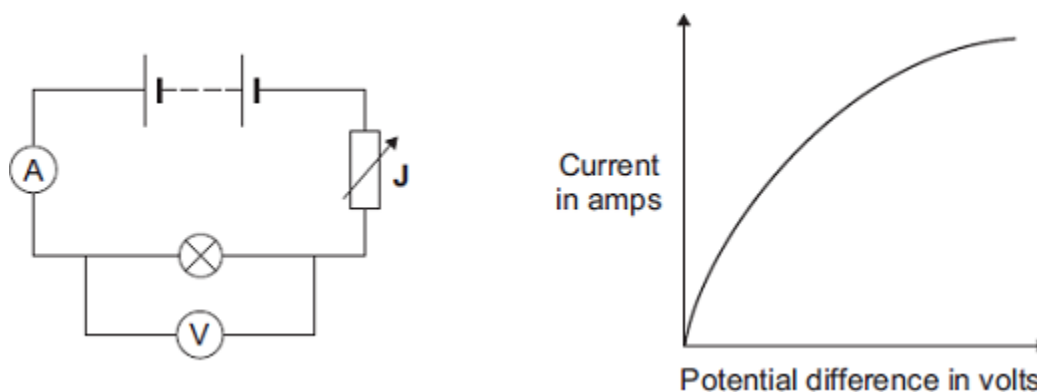
.....

.....

(2)
(Total 7 marks)

16

- (a) The diagram shows the circuit used to obtain the data needed to plot the current–potential difference graph for a filament bulb.



- (i) Why is the component labelled 'J' included in the circuit?

.....

.....

(1)

- (ii) The resistance of the bulb increases as the potential difference across the bulb increases. Why?

.....
.....

(1)

- (iii) The bulb is at full brightness when the potential difference across the bulb is 12 V. The current through the bulb is then 3 A.

Calculate the power of the bulb when it is at full brightness and give the unit.

.....
.....
.....

Power =

(3)

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

The table gives data about two types of light bulb people may use in their homes.

Type of light bulb	Energy efficiency	Cost of one light bulb	Average lifetime in hours
Halogen	10%	£1.95	2 000
Light Emitting Diode (LED)	32%	£11.70	36 000

Both types of light bulb produce the same amount of light.

Evaluate, in terms of cost and energy efficiency, the use of the two types of light bulb.

To gain full marks you must compare both types of light bulb and conclude which light bulb would be the best to use.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)
(Total 11 marks)

17

The pictures show six different household appliances.

Fan heater

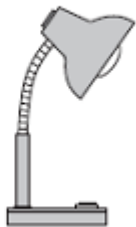
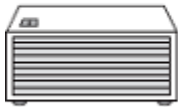
Iron

Hairdryer

Vacuum cleaner

Table lamp

Kettle



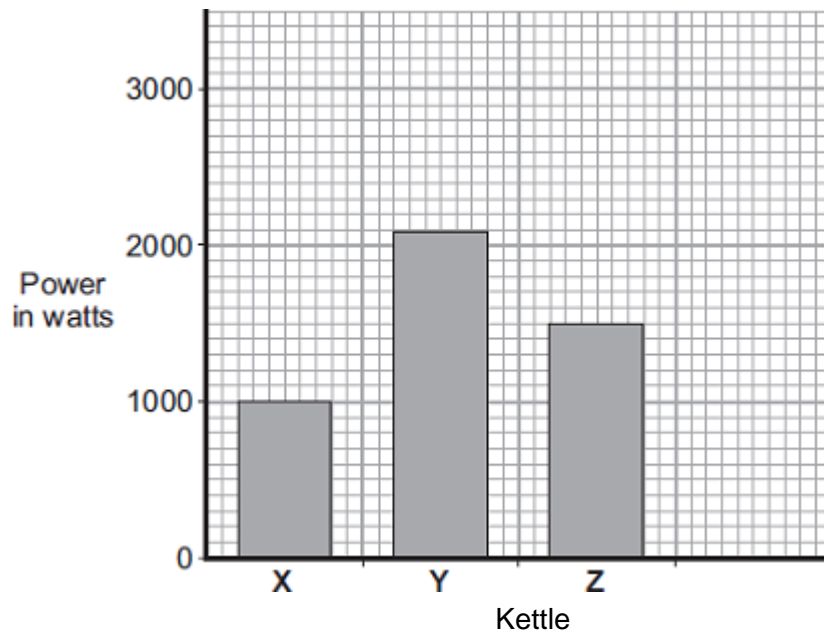
- (a) Four of the appliances, including the fan heater, are designed to transform electrical energy into heat.

Name the other **three** appliances designed to transform electrical energy into heat.

- 1
- 2
- 3

(3)

(b) The bar chart shows the power of three electric kettles, X, Y and Z.



(i) In one week, each kettle is used for a total of 30 minutes.

Which kettle costs the most to use?

Put a tick (✓) next to your answer.

X

Y

Y

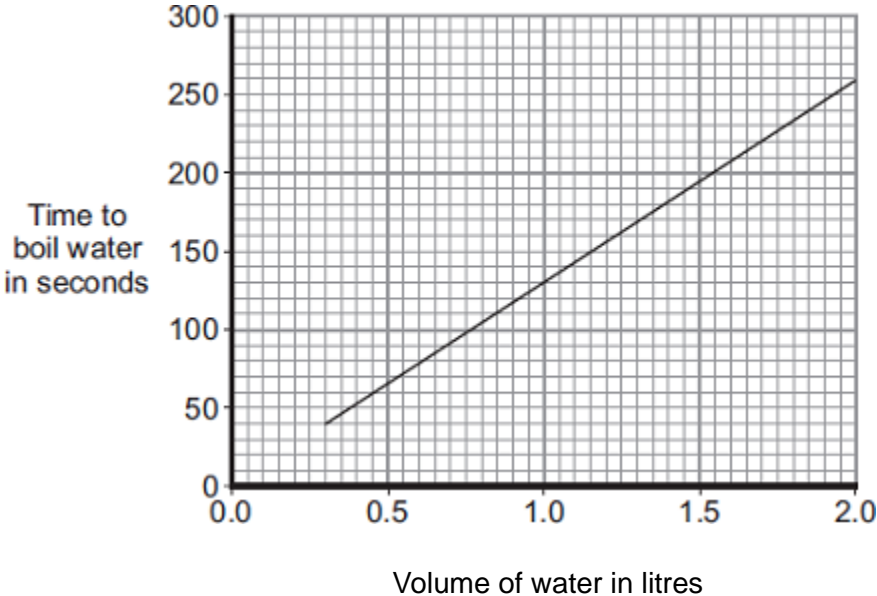
(1)

(ii) A new 'express boil' kettle boils water faster than any other kettle.

Draw a fourth bar on the chart to show the possible power of an 'express boil' kettle.

(1)

(c) The graph shows how the time to boil water in an electric kettle depends on the volume of water in the kettle.



A householder always fills the electric kettle to the top, even when only enough boiling water for one small cup of coffee is wanted.

Explain how the householder is wasting money.

.....

.....

.....

.....

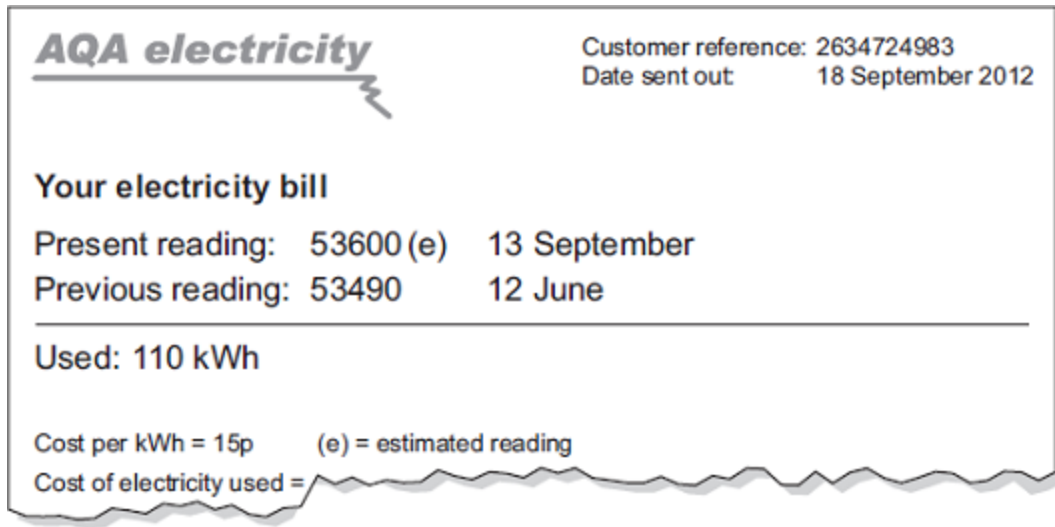
.....

.....

(3)
(Total 8 marks)

18

A householder was out shopping when her electricity meter reading should have been taken. The electricity company estimated the reading and sent the following bill. Unfortunately, the bill was damaged in the post.



- (a) Use the equation in the box to calculate the cost of the electricity used between 12 June and 13 September.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer.

.....

Total cost =

(2)

- (b) The estimated reading shown on the bill was not very accurate. The correct reading was 53782.

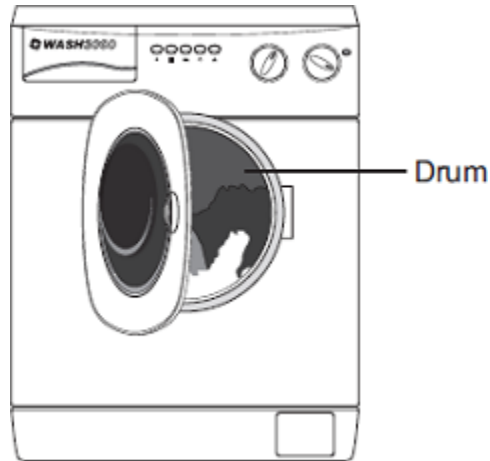
How many kilowatt-hours of electricity had the householder actually used between 12 June and 13 September?

.....

(2)
(Total 4 marks)

19

The picture shows a washing machine. When the door is closed and the machine switched on, an electric motor rotates the drum and washing.



(a) Complete the following sentences.

(i) An electric motor is designed to transform electrical energy into
..... energy.

(1)

(ii) Some of the electrical energy supplied to the motor is wasted as
..... energy and energy.

(1)

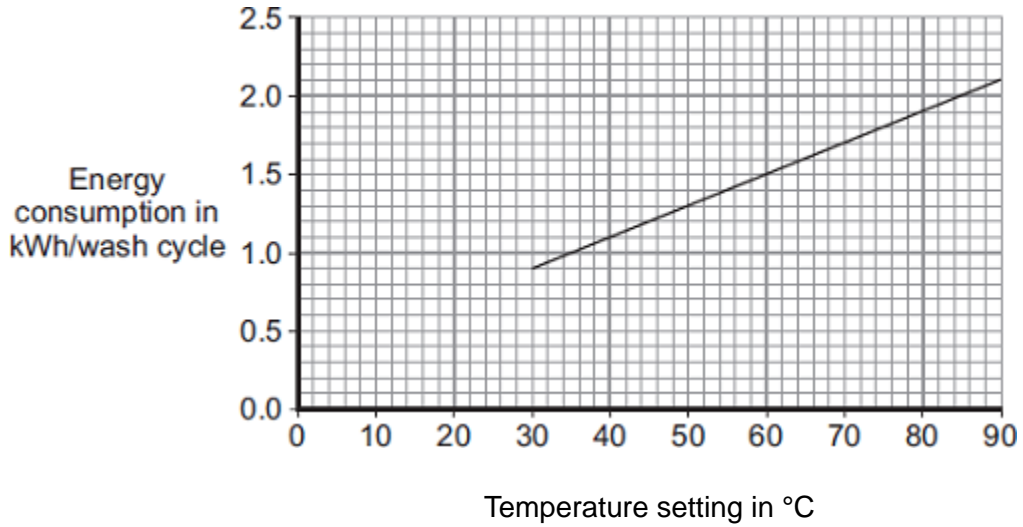
(b) What happens to the energy wasted by the electric motor?

.....

.....

(1)

- (c) The graph shows that washing clothes at a lower temperature uses less energy than washing them at a higher temperature. Using less energy will save money.



- (i) Electricity costs 15p per kilowatt-hour (kWh).

The temperature setting is turned down from 40 °C to 30 °C.

Use the graph and equation in the box to calculate the money saved each wash cycle.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer.

.....

Money saved =

(2)

- (ii) Reducing the amount of energy used by washing machines could reduce the amount of carbon dioxide emitted into the atmosphere.

Explain why.

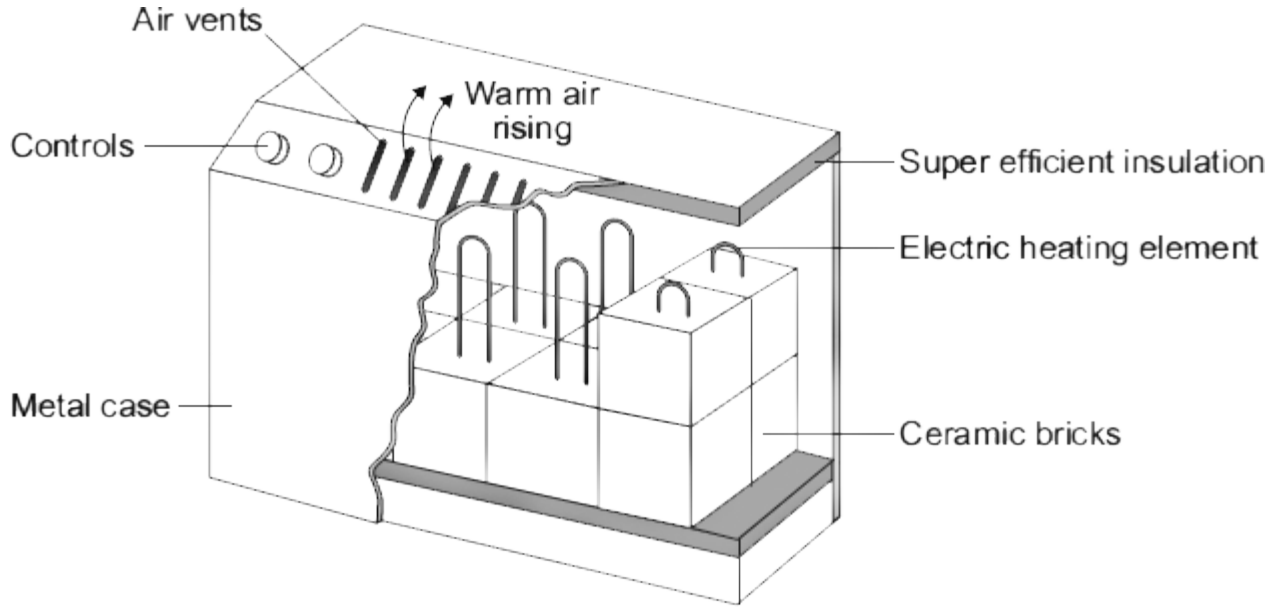
.....

(2)

(Total 7 marks)

20

The diagram shows how one type of electric storage heater is constructed. The heater has ceramic bricks inside. The electric elements heat the ceramic bricks during the night. Later, during the daytime, the ceramic bricks transfer the stored energy to the room.



(a) (i) Complete the following sentences using words from the box.

conduction	convection	evaporation
-------------------	-------------------	--------------------

Energy is transferred through the metal casing by

The warm air rising from the heater transfers energy to the room by

(2)

(ii) The inside of the metal case is insulated.

Which **one** of the following gives the reason why?

Tick (✓) **one** box.

- To transfer energy from the ceramic bricks to the room faster
- To stop energy from the room transferring into the heater
- To keep the ceramic bricks hot for a longer time

(1)

(b) In winter, the electricity supply to a 2.6 kW storage heater is switched on for seven hours each day.

(i) Calculate the energy transferred, in kilowatt-hours, from the electricity supply to the heater in seven hours.

Show clearly how you work out your answer.

.....
.....

Energy transferred = kWh

(2)

(ii) The electricity supply to the heater is always switched on between midnight and 7 am. Between these hours, electricity costs 5 p per kilowatt-hour.

Calculate how much it costs to have the heater switched on between midnight and 7 am.

.....
.....

Cost = p

(1)

(c) Between 7 am and 8 am, after the electricity supply is switched off, the temperature of the ceramic bricks falls by 25 °C.

Calculate the energy transferred from the ceramic bricks between 7 am and 8 am.

Total mass of ceramic bricks = 120 kg.

Specific heat capacity of the ceramic bricks = 750 J/kg °C.

Show clearly how you work out your answer.

.....
.....
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.....

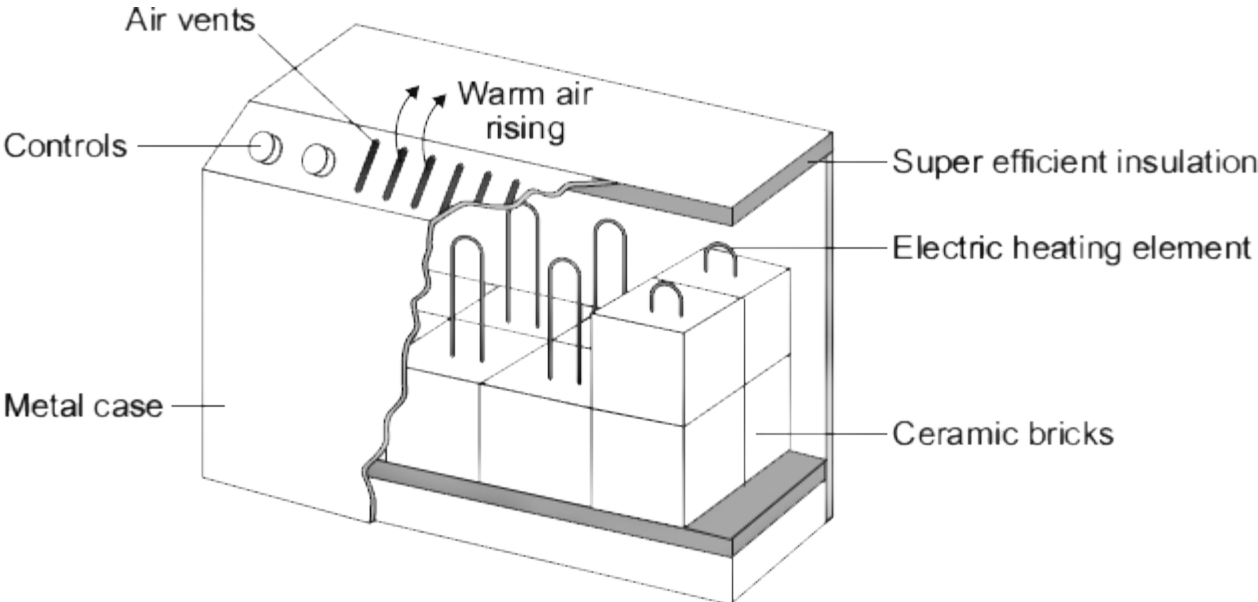
Energy transferred = J

(2)

(Total 8 marks)

21

The diagram shows how one type of electric storage heater is constructed. The heater has ceramic bricks inside. The electric elements heat the ceramic bricks during the night. Later, during the daytime, the ceramic bricks transfer the stored energy to the room.



- (a) In winter, the electricity supply to a 2.6 kW storage heater is switched on each day between midnight and 7 am. Between these hours, electricity costs 5 p per kilowatt-hour.

Calculate the daily cost of using the storage heater.

Show clearly how you work out your answer.

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.....

.....

Cost = p

(3)

- (b) Homes with electric storage heaters have a separate meter to measure the electricity supplied between midnight and 7 am. Another meter measures the electricity supplied at other times. This electricity supplied at other times costs 15 p per kilowatt-hour.

Electricity companies encourage people to use electricity between midnight and 7 am by selling the electricity at a lower cost.

Suggest why.

.....
.....

(1)

- (c) By 7 am, the temperature at the centre of the ceramic bricks is about 800 °C. The temperature of the outside metal casing is about 80 °C.

The ceramic bricks are surrounded by 'super-efficient' insulation.

Explain why.

.....
.....
.....
.....

(2)

- (d) At 7 am, the electricity supply switches off and the temperature of the ceramic bricks starts to fall. The temperature of the bricks falls by 100 °C over the next four hours. During this time, 9 000 000 J of energy are transferred from the bricks.

Calculate the total mass of ceramic bricks inside the heater.

Specific heat capacity of the ceramic bricks = 750 J/kg °C.

Show clearly how you work out your answer.

.....
.....
.....
.....

Mass = kg

(2)
(Total 8 marks)

22

The table gives data about two types of low energy bulb.

Type of bulb	Power input in watts	Efficiency	Lifetime in hours	Cost of one bulb
Compact Fluorescent Lamp (CFL)	8	20%	10 000	£3.10
Light Emitting Diode (LED)	5		50 000	£29.85

(a) Both types of bulb produce the same useful power output.

(i) Calculate the useful power output of the CFL.

Show clearly how you work out your answer.

.....

.....

.....

Useful power output = W

(2)

(ii) Calculate the efficiency of the LED bulb.

Show clearly how you work out your answer.

.....

.....

.....

Efficiency =

(1)

(b) LED bulbs are expensive. This is because of the large number of individual electronic LED chips needed to produce sufficient light from each bulb.

(i) Use the data in the table to evaluate the cost-effectiveness of an LED bulb compared to a CFL.

.....

.....

.....

.....

(2)

- (ii) Scientists are developing brighter and more efficient LED chips than those currently used in LED bulbs.

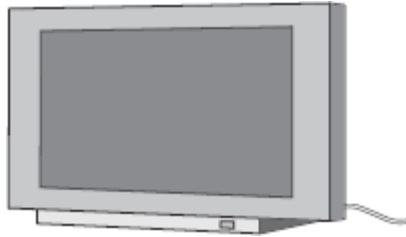
Suggest **one** benefit of developing brighter and more efficient LED chips.

.....

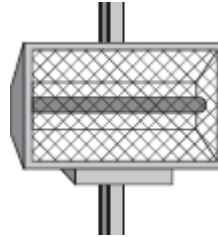
(1)
 (Total 6 marks)

23

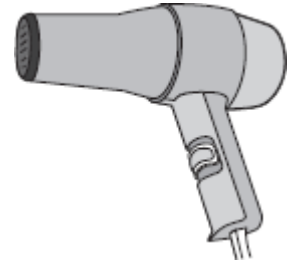
The data included in the diagrams gives the power of the electrical appliances.



TV
 160 W



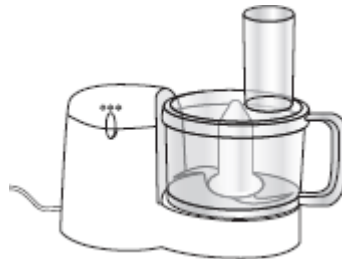
Radiant heater
 1.0 kW



Hairdryer
 1100 W



Sandwich toaster
 1.1 kW



Food processor
 0.4 kW



Table lamp
 40 W

- (a) (i) Which appliance is designed to transform electrical energy to light and sound?

.....

(1)

- (ii) Which **two** appliances transform energy at the same rate?

..... and

(1)

(b) During one week, the food processor is used for a total of 3 hours.

(i) Use the equation in the box to calculate the energy transferred, in kilowatt-hours, by the food processor in 3 hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)
--	---	-------------------------	---	-------------------

Show clearly how you work out your answer.

.....

.....

.....

.....

Energy transferred = kWh

(2)

(ii) Electricity costs 15 pence per kilowatt-hour.

Use the equation in the box to calculate the cost of using the food processor for 3 hours.

total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour
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Show clearly how you work out your answer.

.....

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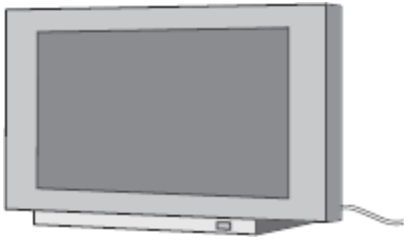
Cost = pence

(2)

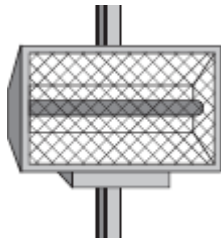
(Total 6 marks)

24

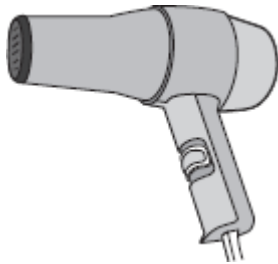
The data included in the diagrams gives the power of the electrical appliances.



TV
160 W



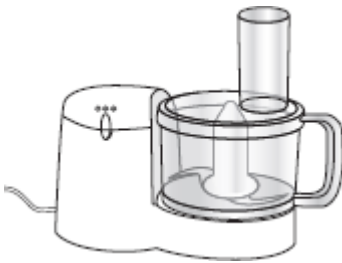
Radiant heater
1.0 kW



Hairdryer
1100 W



Sandwich toaster
1.1 kW



Food processor
0.4 kW



Table lamp
40 W

(a) (i) Which of the appliances are designed to transform electrical energy to kinetic energy?

.....
.....

(1)

(ii) Which of the appliances waste energy as heat?

.....
.....

(1)

(b) Leaving the radiant heater switched on is likely to lead to more carbon dioxide being emitted into the atmosphere than leaving the table lamp on for the same length of time.

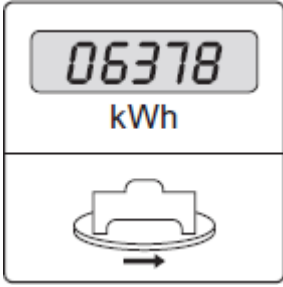
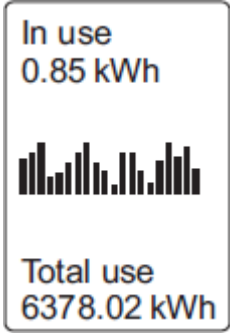
Explain why.

.....
.....
.....
.....

(2)

- (c) A homeowner decides to monitor the amount of electrical energy used in his home. He can do this by using the home's electricity meter or by using a separate electronic device.

The table gives some information about each method.

Electricity meter	Electronic device
Records to the nearest kilowatt-hour	Records to the nearest 1/100th kilowatt-hour
Homeowner takes readings at regular intervals	Energy use recorded continuously and stored for one year
	Displays a graph showing energy use over a period of time
	

- (i) Complete the following sentence.

The reading given by the electronic device is more
 than the reading given by the electricity meter.

(1)

- (ii) Suggest how data collected and displayed by the electronic device could be useful to the homeowner.

.....

.....

.....

.....

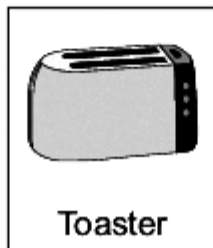
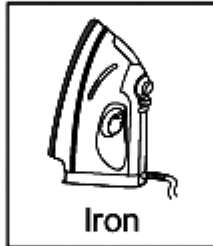
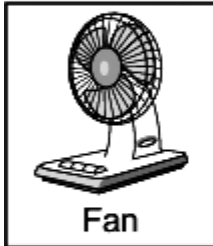
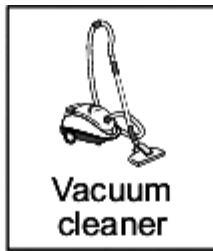
.....

.....

(3)
(Total 8 marks)

25

The appliances shown below transfer electrical energy to other types of energy.



(a) The vacuum cleaner is designed to transfer electrical energy to kinetic energy.

Three more of the appliances are also designed to transfer electrical energy to kinetic energy. Which **three**?

Draw a ring around each correct appliance.

(b) Which **two** of the following statements are true?

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully.

The energy transferred by appliances will be destroyed.

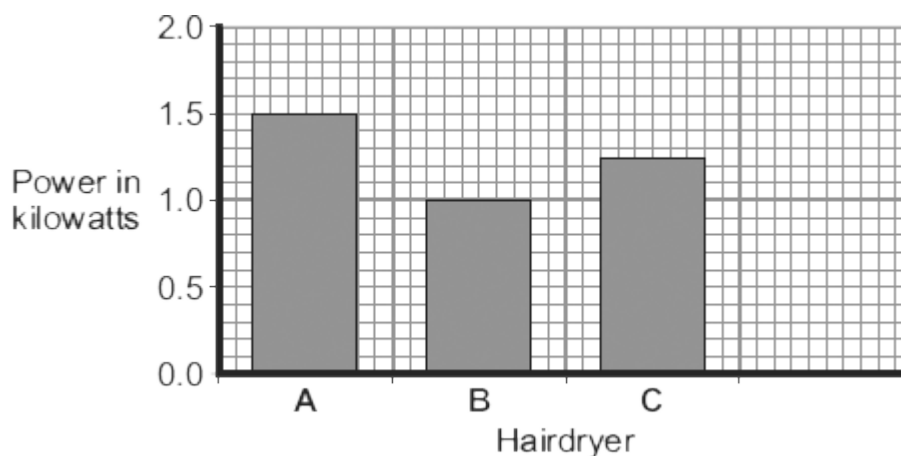
The energy transferred by appliances makes the surroundings warmer.

The energy output from an appliance is bigger than the energy input.

(2)
(Total 5 marks)

26

(a) The bar chart shows the power of three different electric hairdryers.



(i) Which **one** of the hairdryers, **A**, **B** or **C**, would transfer the most energy in 5 minutes?

Write the correct answer in the box.

(1)

(ii) A small 'travel' hairdryer has a power of 500 watts.

Draw a fourth bar on the bar chart to show the power of the 'travel' hairdryer.

(1)

(b) A family shares the same hairdryer.
The hairdryer has a power of 1.2 kW. The hairdryer is used for a total of 2 hours each week.

(i) Calculate how many kilowatt-hours (kWh) of energy the hairdryer transfers in 2 hours.

Show clearly how you work out your answer.

.....
.....

Energy transferred = kWh

(2)

(ii) Electricity costs 15 pence per kWh.

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

.....
.....

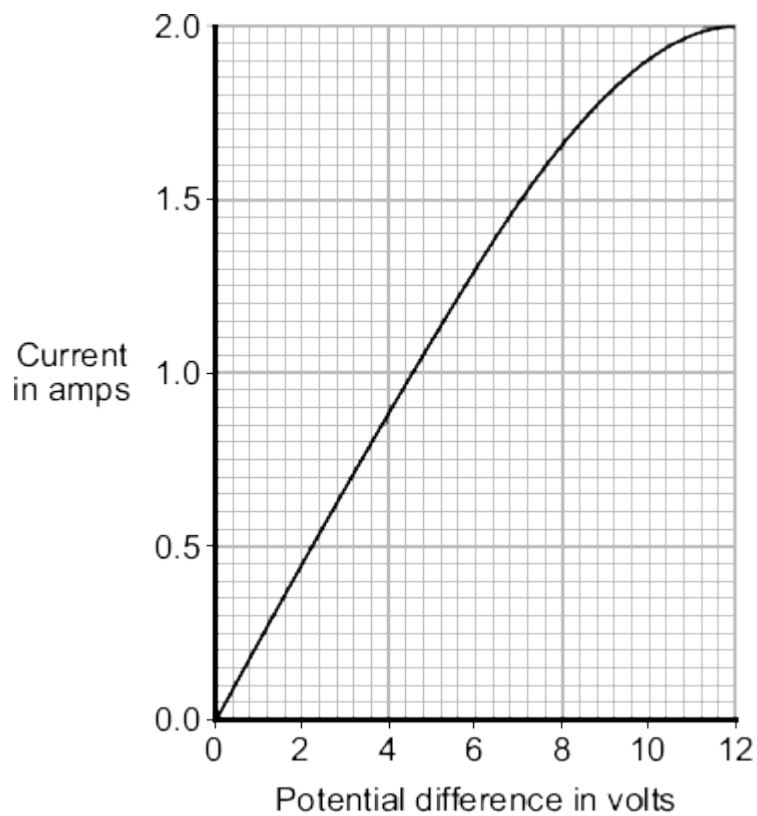
Cost = pence

(2)

(Total 6 marks)

27

The graph shows how the electric current through a 12 V filament bulb varies with the potential difference across the bulb.



(a) What is the meaning of the following terms?

electric current

.....
.....

potential difference

.....
.....

(2)

- (b) The resistance of the metal filament inside the bulb increases as the potential difference across the bulb increases.

Explain why.

.....

.....

.....

.....

.....

.....

.....

.....

(3)

- (c) Use data from the graph to calculate the rate at which the filament bulb transfers energy, when the potential difference across the bulb is 6 V.

Show clearly how you work out your answer.

.....

.....

Rate of energy transfer = W

(2)
(Total 7 marks)

28

Each letter, **A**, **B**, **C**, **D** and **E**, represents an energy transformation.

- A** electrical to chemical
- B** electrical to heat
- C** electrical to kinetic
- D** electrical to light
- E** electrical to sound

Match each of the following devices to the useful energy transformation that the device is designed to make.

Write the correct letter, **A**, **B**, **C**, **D** or **E**, in the box below each device.

Use each letter no more than once.

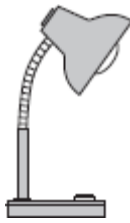
Fan



Kettle



Lamp



Radio



(Total 4 marks)

29

A homeowner had a new gas boiler installed.

(a) The following information is an extract from the information booklet supplied with the boiler.

Fuel	Natural Gas
Water temperature	60 °C
Energy supplied to gas boiler	8.0 kJ/s (8.0 kW)
Efficiency	0.95

(i) Calculate the energy transferred each second by the gas boiler to the water inside the boiler.

Show clearly how you work out your answer.

.....
.....

Energy transferred by the gas boiler each second = kJ

(2)

(ii) The energy value of the gas used in a home is measured in kilowatt-hours (kWh).

The homeowner has a pre-payment meter and pays £30 into his account. With a pre-payment meter, gas costs 15p per kilowatt-hour.

Calculate the total number of hours that the gas boiler would operate for £30.

Show clearly how you work out your answer.

.....
.....
.....
.....

Number of hours =

(2)

(b) Although the gas boiler is very efficient, some energy is wasted.

Explain what happens to the waste energy.

.....
.....
.....
.....

(2)
(Total 6 marks)

30

The diagram shows four electrical appliances. Each appliance is designed to transform electrical energy into one form of output energy.



Kettle



Toaster



Radio



Hair straighteners

(a) Which **one** of the appliances is designed to give a different form of output energy from the other three appliances?

.....

Give a reason for your answer.

.....
.....

(2)

(b) The power of each appliance is given in the table.

Appliance	Power
Kettle	2.5 kW
Toaster	920 W
Radio	15 W
Hair straighteners	75 W

Each appliance is switched on for 5 minutes.

Which appliance transforms the most energy?

.....

(1)

(c) The 75 watt hair straighteners are switched on for a few minutes each day. In one year, the amount of energy transferred from the mains electricity supply to the hair straighteners is 4 kilowatt-hours.

Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the yearly cost of using the hair straighteners.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

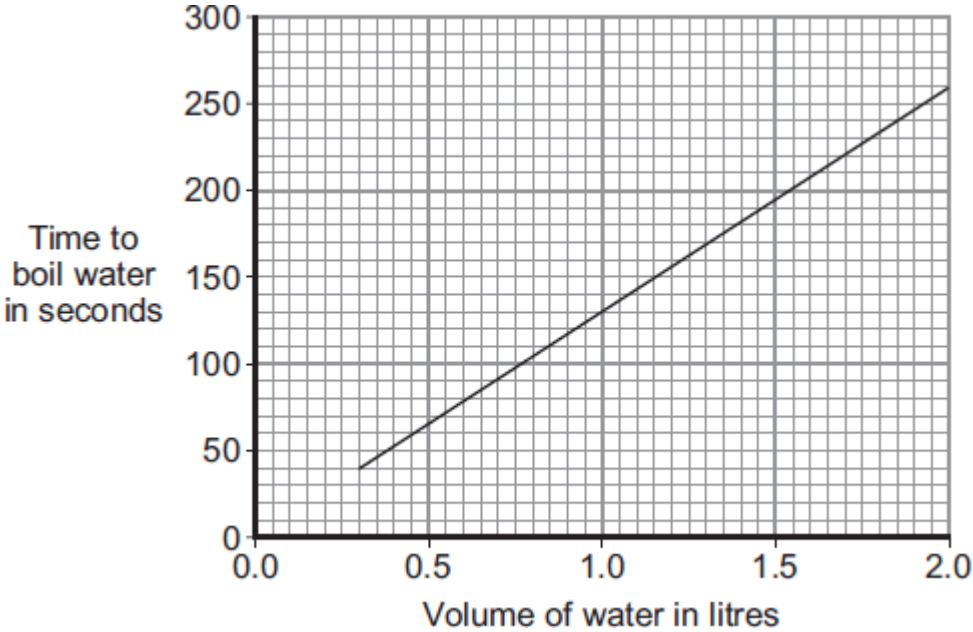
Show clearly how you work out your answer.

.....
.....

Total cost = pence

(2)

(d) The graph shows how the time to boil water in an electric kettle depends on the volume of water in the kettle.



A householder always fills the electric kettle to the top, even when only enough boiling water for one small cup of coffee is required.

Explain how the householder is wasting money.

.....

.....

.....

.....

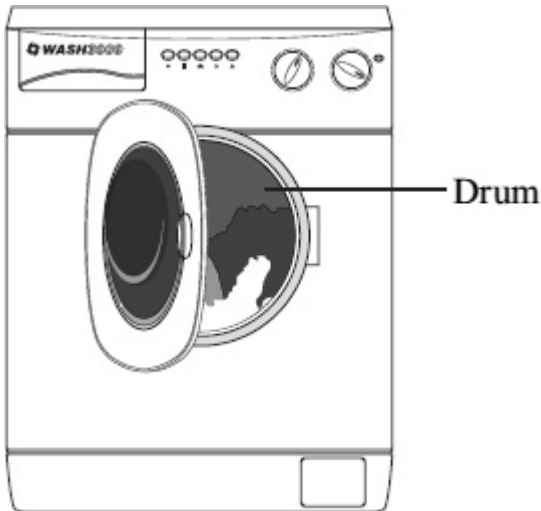
.....

.....

(3)
(Total 8 marks)

31

The picture shows a new washing machine. When the door is closed and the machine switched on, an electric motor rotates the drum and washing.

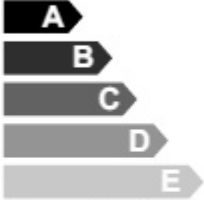



(a) What happens to the energy wasted by the electric motor?

.....
.....

(1)

(b) The diagram shows the label from the new washing machine.

Model – Wash 3000 Energy A	
More efficient  Less efficient	
Energy consumption kWh/wash cycle (based on 40 °C wash)	1.1

An 'A' rated washing machine is *more energy efficient* than a 'C' rated washing machine.

Explain what being *more energy efficient* means.

.....

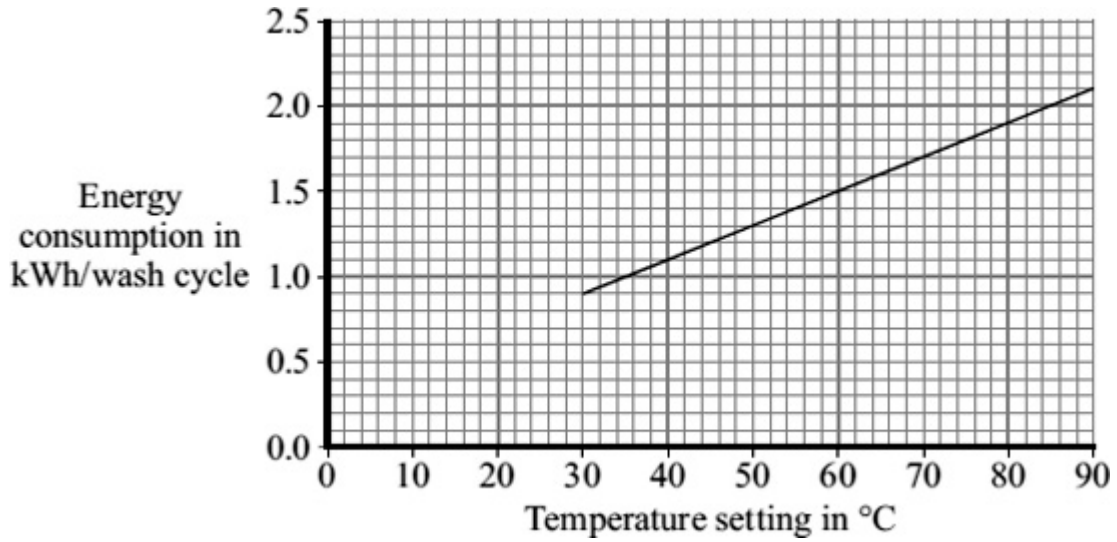
.....

.....

.....

(2)

- (c) The graph shows that washing clothes at a lower temperature uses less energy than washing them at a higher temperature. Using less energy will save money.



- (i) Electricity costs 12 p per kilowatt-hour (kWh).
The temperature setting is turned down from 40 °C to 30 °C.

Use the graph and equation in the box to calculate the money saved each wash cycle.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

Show clearly how you work out your answer.

.....

Money saved = p

(2)

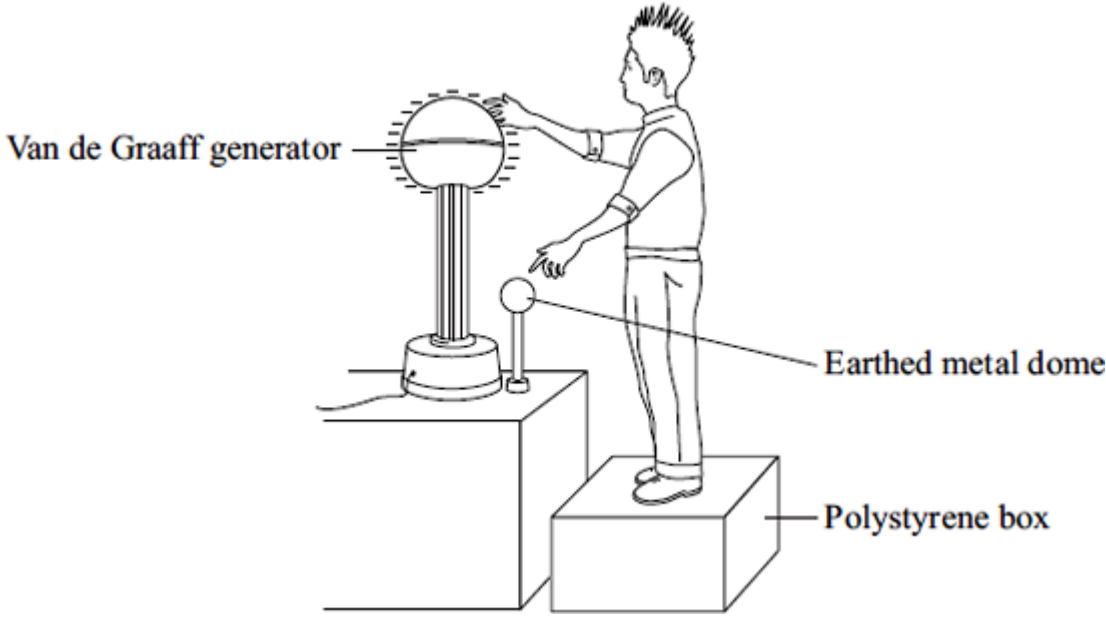
- (ii) Suggest why reducing the amount of energy used by washing machines could reduce the amount of carbon dioxide emitted into the atmosphere.

.....

(1)

(Total 6 marks)

- (a) The diagram shows a student touching the metal dome of a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain why the student's hair stands on end when the generator is switched on.

.....
.....
.....

(2)

- (b) When the potential difference between the student and a nearby earthed metal dome reached 15 kV, a spark jumped between the student and the earthed dome. The spark transformed 30 mJ of energy into heat, light and sound. (1 mJ = 0.001 J)

Calculate the charge carried by the spark.

.....
.....

Charge transferred = coulombs

(2)

- (c) What name is given to the rate of flow of charge?

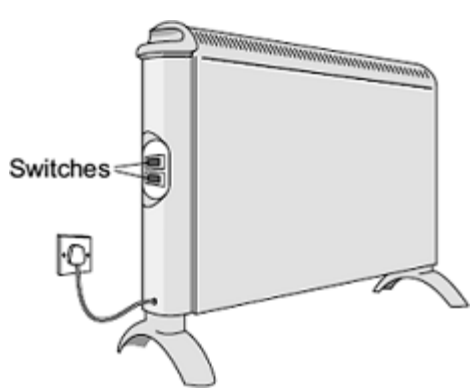
.....

(1)

(Total 5 marks)

33

(a) The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.



Setting	Power in kW
Low	0.5
Medium	1.5
High	

(i) When both switches are on, the heater works at the high power setting.

What is the power of the heater when it is switched to the **high** power setting?

.....

Power = kW

(1)

(ii) The heater is used on the **medium** power setting. It is switched on for three hours.

Use the equation in the box to work out the energy transferred from the mains to the heater in three hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)
--	---	-------------------------	---	-------------------

Show clearly how you work out your answer.

.....

.....

Energy transferred = kWh

(2)

(iii) Electricity costs 12 pence per kilowatt-hour.

Use the equation in the box to calculate how much the heater costs to use on **medium** power for three hours.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

Show clearly how you work out your answer.

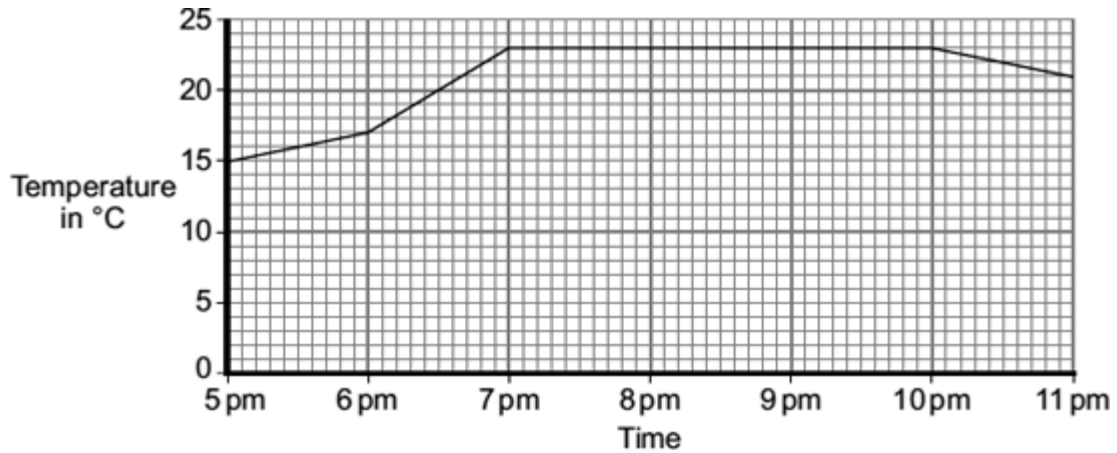
.....
.....

Total cost = pence

(2)

(b) The heater is used to warm a room.

The graph shows how the temperature of the room changes from the moment the heater is switched on.



The heater was first used on the medium setting.

(i) At what time was the heater setting changed to the **high** setting?

.....

Give a reason for your answer.

.....
.....
.....

(2)

(ii) From 7 pm until 10 pm, the temperature of the room is **not** changing.

Which **one** of the following statements gives the reason why the temperature of the room is **not** changing?

Put a tick (✓) in the box next to your answer.

The room is losing energy slower than the heater supplies energy.

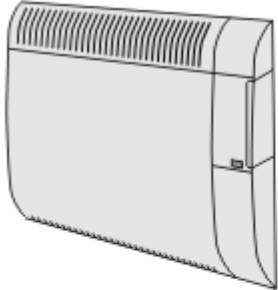
The room is losing energy as fast as the heater supplies energy.

The room is losing energy faster than the heater supplies energy.

(1)
(Total 8 marks)

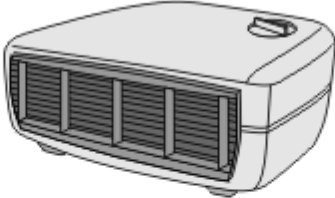
34

The pictures show three different types of electric heater.



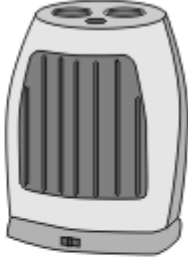
**400W oil-filled panel heater
(wall mounted)**

- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3kW fan heater

- 2 heat settings
- Power indicator light
- Cool air fan setting



1800W ceramic heater

- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out

- (a) The ceramic heater is run on full power for 5 hours.

Use the following equation to calculate, in joules, the amount of energy transferred from the mains to the heater.

energy transferred = power × time

Show clearly how you work out your answer.

.....
.....

Energy transferred = joules

(2)

- (b) Which heater will be the most expensive to run on its highest heat setting?

.....

(1)

- (c) A heater is needed for a small office.

Comparing each type of heater with the other two, give **one** advantage of using each type of heater in the office.

oil-filled panel heater

.....

fan heater

.....

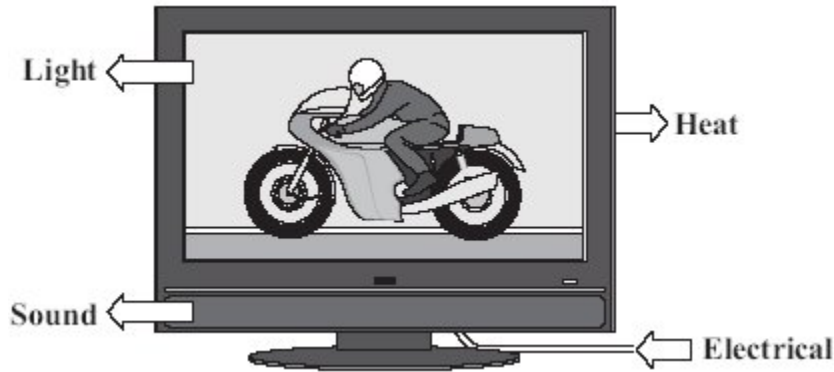
ceramic heater

.....

(3)
(Total 6 marks)

35

The diagram shows the energy transformations produced by a TV.



(a) Use words from the diagram to complete the following sentence.

The TV is designed to transform energy into light and energy.

(2)

(b) Which **one** of the following statements is **false**?

Put a tick (✓) in the box next to the **false** statement.

The energy transformed by the TV makes the surroundings warmer.

The energy transformed by the TV becomes spread out.

The energy transformed by the TV will be destroyed.

(1)

(c) Two different makes of television, **A** and **B**, transform energy at the same rate. Television **A** wastes less energy than television **B**.

Complete the following sentence by drawing a ring around the correct line in the box.

Television **A** has

a higher efficiency than
the same efficiency as
a lower efficiency than

television **B**.

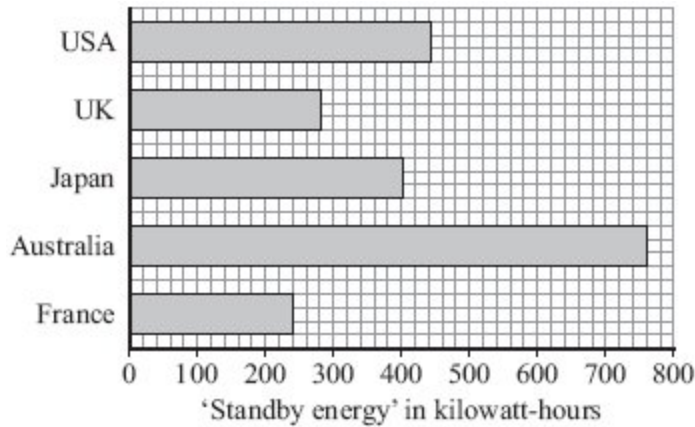
(1)

(Total 4 marks)

36

Electrical appliances that are left on standby still use energy.

The bar chart compares the *average* amount of 'standby energy' wasted each year in every home in five countries.



- (i) In which country are the homes that waste, on average, the smallest amount of 'standby energy'?

Draw a ring around your answer.

Australia France Japan UK USA

(1)

- (ii) Suggest a reason why an *average* value is used for the 'standby energy' wasted in the homes.

.....

(1)

- (b) (i) Australia has one of the lowest electricity prices in the world.

How does this low price seem to affect the amount of 'standby energy' wasted?

.....

(1)

- (ii) In Australia, most electricity is generated in coal-burning power stations. The Australian government wants less electricity to be wasted.

Wasting less electricity would be good for the Australian environment.

Explain why.

.....

.....

.....

.....

(2)

- (c) Energy is not usually measured in kilowatt-hours.

Which **one** of the following units is usually used to measure energy?

Draw a ring around your answer.

hertz

joule

watt

(1)

- (d) (i) Electricity in Japan costs the equivalent of 17 pence per kilowatt-hour.

Use the information in the bar chart and the equation in the box to calculate how much the 'standby energy' used in an average Japanese home costs each year.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

Show clearly how you work out your answer.

Give your answer in pence.

.....

.....

Cost = pence

(3)

(ii) In Japan, the largest proportion of electricity is generated using nuclear fuels.

Which **one** of the following statements gives a good reason for using nuclear fuels to generate electricity?

Put a tick (✓) in the box next to your answer.

A nuclear power station is very expensive to build.

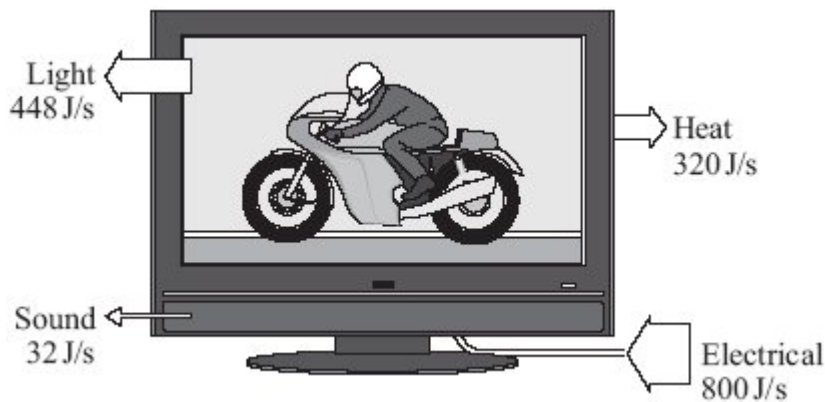
A small amount of nuclear fuel generates a large amount of electricity.

It is easy to store nuclear waste safely.

(1)
(Total 10 marks)

37

(a) The diagram shows the energy transformations produced by a TV.



(i) Calculate the efficiency of the TV, using the information in the diagram..

Show clearly how you work out your answer.

.....
.....

Efficiency =

(2)

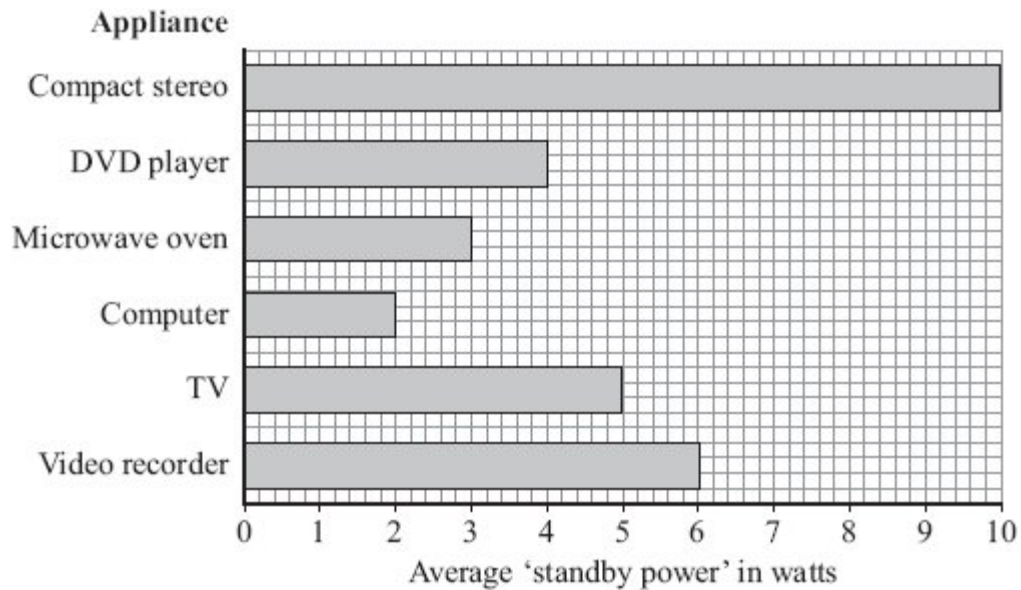
(ii) What eventually happens to the useful energy transferred by the TV?

.....
.....

(1)

(b) Electrical appliances left on standby use energy.

The bar chart shows the power for the appliances that one family leaves on standby when they go on holiday.



The family is on holiday for a total of 175 hours.

(i) Use the information in the bar chart and the equation in the box to calculate the energy wasted by leaving the compact stereo on standby while the family is on holiday.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)
--	---	-------------------------	---	-------------------

Show clearly how you work out your answer.

.....

.....

Energy wasted = kilowatt-hours

(2)

(ii) Electricity costs 12 p per kilowatt-hour.

Use the equation in the box to calculate the cost of leaving the compact stereo on standby while the family is on holiday.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

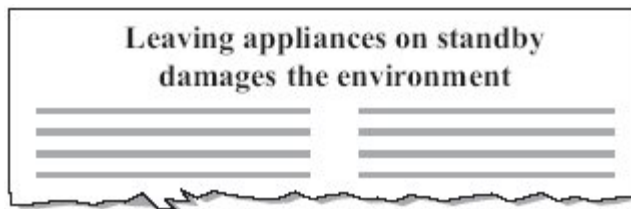
Show clearly how you work out your answer.

.....

Cost = p

(1)

(c) A headline from a recent newspaper article is shown below.



Explain why leaving appliances on standby damages the environment.

.....
.....
.....
.....

(2)
(Total 8 marks)

38

(a) Each letter **A, B, C, D** and **E** represents an energy transformation.

A electrical to gravitational potential

B electrical to heat



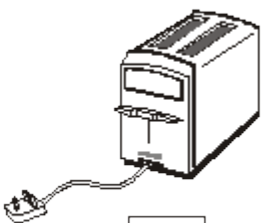
C electrical to kinetic

D electrical to light

E electrical to sound

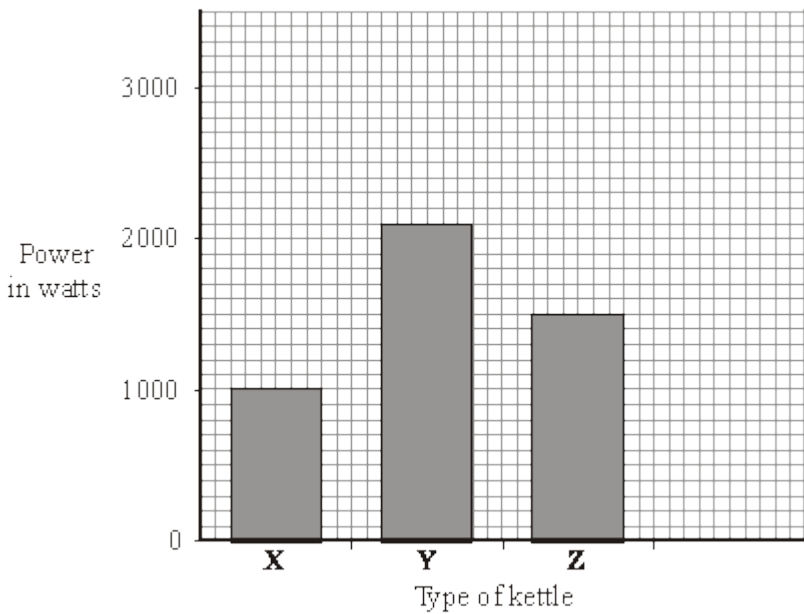
Match each of the following devices to the useful energy transformation that it is designed to make.

Write the correct letter, **A, B, C, D** or **E**, in the box below the device. Use each letter once or not at all.

Drill	MP3 player	Toaster
		
<input type="text"/>	<input type="text"/>	<input type="text"/>

(3)

(b) The bar chart shows the power of three electric kettles.



(i) What is the power of kettle Y?

.....

(1)

(ii) In one week each kettle is used for a total of 30 minutes.

Which kettle costs the most to use?

.....

(1)

(iii) A new 'express boil' kettle boils water faster than any other kettle.

Draw a fourth bar on the chart to show the possible power of an 'express boil' kettle.

(1)

(c) Some friends are going on holiday. They want to be able to boil water to make their own hot drinks. They cannot decide which to take, a travel kettle or a small portable immersion heater that can be placed in a mug.



Travel Kettle
<ul style="list-style-type: none">• 1 k W element• Holds 1 litre• Works on 110V or 230V• Washable water filter

Immersion heater
<ul style="list-style-type: none">• 0.4 k W element• Heates up to 0.5 litres of water• Works on 230 V only• Small compact size

(i) Give **one** advantage of taking the travel kettle.

.....

.....

(1)

(ii) Give **one** advantage of taking the immersion heater.

.....
.....

(1)
(Total 8 marks)

39

The diagram shows the label from a new freezer.

Model Energy A	SALE See inside for details
More efficient A B C D E Less efficient	A
Energy consumption per year	225 kWh

(a) An old freezer has an energy consumption per year of 350 kWh.

Use the equation in the box to calculate the extra cost of using the old freezer for one year compared with using a new 'A' rated freezer.

$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$
--

Assume 1 kilowatt-hour (kWh) of energy costs 12 p.

Show clearly how you work out your answer.

.....
.....

Extra cost per year = £

(2)

(b) The price of the new freezer was reduced in a sale.

Reducing the price reduces the payback time for replacing the old freezer from 12 years to 9 years.

Calculate, in pounds, how much the new freezer was reduced in the sale.

Show clearly how you work out your answer.

.....
.....

Price reduced by = £

(2)

(c) An advertisement in a shop claims that:

‘Replacing an old freezer with a new ‘A’ rated freezer will benefit the environment.’

Do you agree that replacing the freezer will benefit the environment?

Answer yes or no.

Explain the reasons for your answer.

.....
.....
.....
.....

(2)
(Total 6 marks)

40

The pictures show six different household appliances.

Fan heater

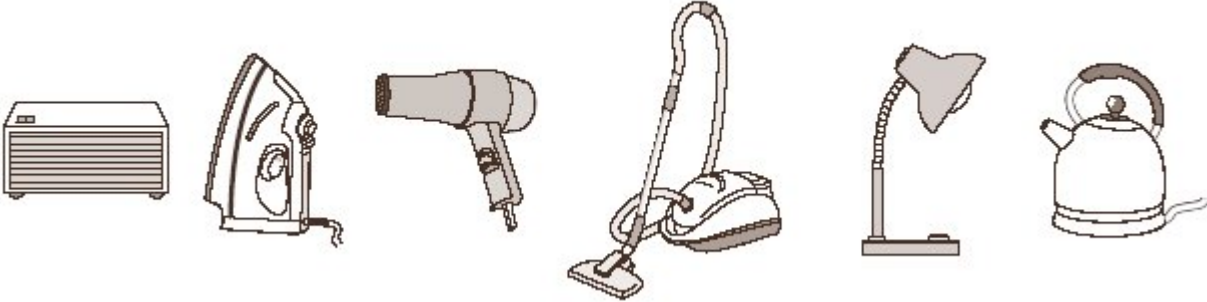
Iron

Hairdryer

Vacuum cleaner

Table lamp

Kettle



- (a) Four of the appliances, including the fan heater, are designed to transform electrical energy into heat.

Name the other **three** appliances designed to transform electrical energy into heat.

1

2

3

(3)

- (b) Complete the following sentence using **one** of the words from the box.

chemical	heat	kinetic	sound
-----------------	-------------	----------------	--------------

Energy that is not usefully transformed by the fan heater is wasted as

..... energy.

(1)

(c) The table gives information about two different fan heaters.

	Useful energy transferred each second in joules	Wasted energy transferred each second in joules
Fan heater L	1200	10
Fan heater M	1200	20

Complete the following sentence by drawing a ring around the line in the box that is correct.

Fan heater **L**

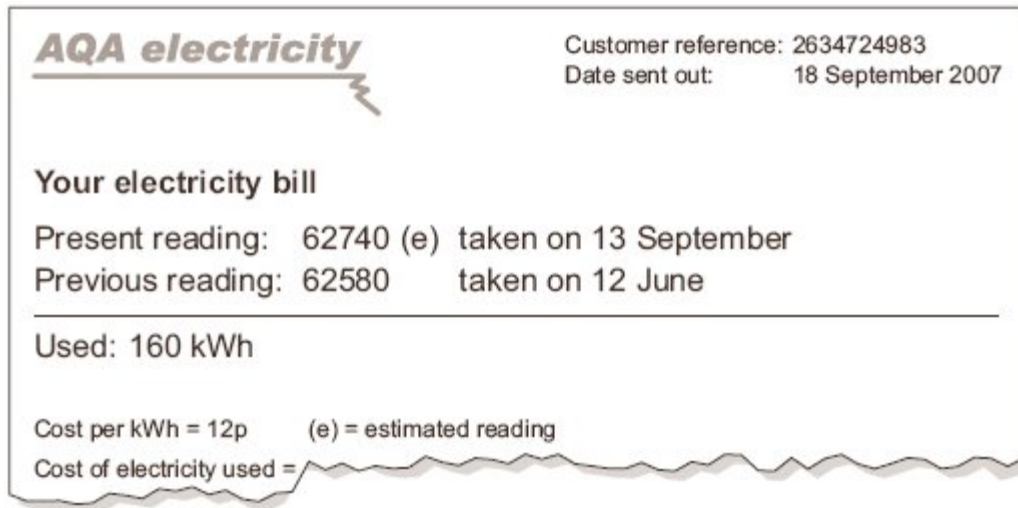
is more efficient than
has the same efficiency as
is less efficient than

 fan heater **M**.

(1)
(Total 5 marks)

41

A householder was out shopping when her electricity meter reading should have been taken. The electricity company estimated the reading and sent the following bill. Unfortunately, the bill was damaged in the post.



- (a) Use the equation in the box to calculate the cost of the electricity used between 12 June and 13 September.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer.

.....

.....

Total cost =

(2)

- (b) The estimated reading shown on the bill was not very accurate. The correct reading was 62920.

How many kilowatt-hours of electricity had the householder actually used between 12 June and 13 September?

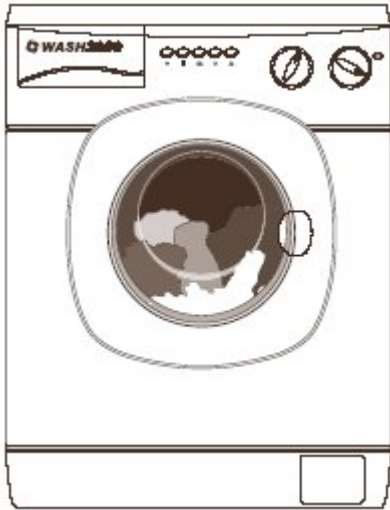
.....

.....

(2)
(Total 4 marks)

42

(a) The picture shows a new washing machine.



Complete the following sentence using **one** of the words in the box.

kinetic	light	sound
----------------	--------------	--------------

A washing machine is designed to transform electrical energy into heat and energy

(1)

(b) The instruction booklet for the washing machine contains the following information.

Wash cycle	Average power during cycle	Time taken to run cycle
HOT	1.5 kW	2 hours
COOL	1.1 kW	1½ hours
FAST	1.0 kW	¾ hour

(i) Use the following equation to calculate the energy transferred, in kilowatt-hours, to the washing machine during the HOT wash cycle. Show how you work out your answer.

energy transferred = power × time

.....
.....

Energy transferred = kWh

(2)

- (ii) Why does it cost more to use the washing machine on the HOT cycle than on the COOL or FAST cycle?

.....
.....

(1)

- (iii) Before buying a washing machine, a householder researched several makes to find out which washing machine was the most energy efficient.

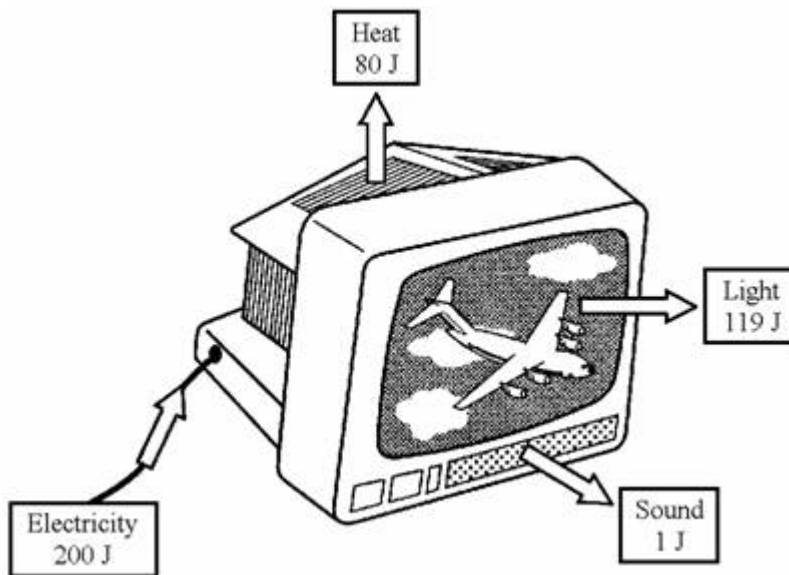
Write down **one** way that he could have done this research.

.....
.....

(1)
(Total 5 marks)

43

- (a) The drawing shows the energy transferred each second by a television set.



- (i) What form of energy is transferred as waste energy by the television set?

.....

(1)

- (ii) What effect will the waste energy have on the air around the television set?

.....

(1)

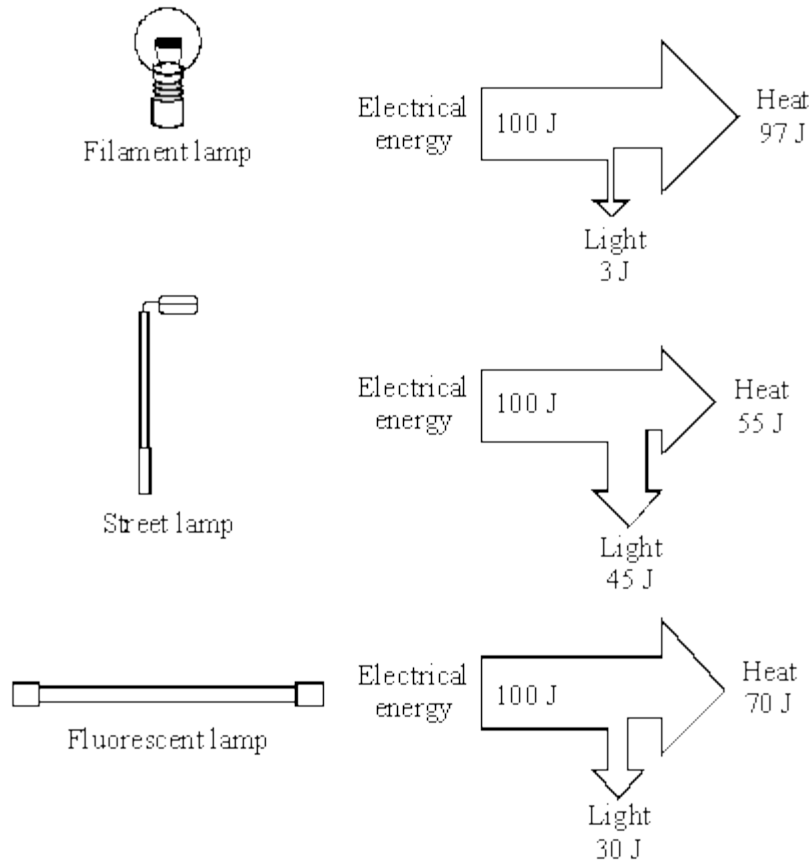
(iii) Calculate the efficiency of the television set.

.....
.....

Efficiency =

(2)

(b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.



Which type of lamp is the most efficient?

.....




Give a reason for your choice.

.....
.....

(2)
(Total 6 marks)

44

(a) List **A** shows three electrical devices. List **B** gives different forms of useful energy. Draw a straight line from each of the devices in List **A** to the useful energy form it produces in List **B**. Draw only **three** lines.

List A Device	List B Useful energy
<div style="border: 1px solid black; padding: 5px; display: inline-block;">Toaster </div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">Light</div>
<div style="border: 1px solid black; padding: 5px; display: inline-block;">Fan </div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">Kinetic</div>
<div style="border: 1px solid black; padding: 5px; display: inline-block;">Personal stereo </div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">Sound</div>
	<div style="border: 1px solid black; padding: 5px; display: inline-block;">Heat</div>

(3)

(b) The power of each device is given in the table.

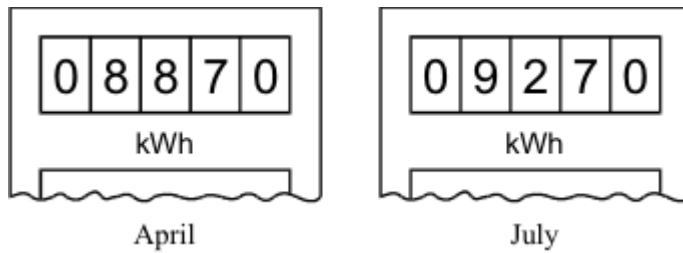
Device	Power
Toaster	1.2 kW
Fan	30 W
Personal Stereo	10 W

Which **one** of the devices will transfer the most energy in 10 minutes?

.....

(1)

(c) The diagrams show the readings on a domestic electricity meter in April and July.



(i) How many Units (kWh) of electricity were used between the two meter readings?

.....

Number of Units =

(1)

(ii) One Unit costs 6p.

Use the following equation to calculate the cost of the electrical energy used between the two meter readings. Show clearly how you work out your answer.

$$\text{total cost} = \text{number of Units} \times \text{cost per Unit}$$

.....

Cost =

(2)

(d) A 3000 watt electric cooker is switched on for 2 hours.

Use the following equation to calculate the number of Units of energy transferred by the cooker. Show clearly how you work out your answer.

$$\begin{array}{ccccc} \text{energy transferred} & = & \text{power} & \times & \text{time} \\ \text{(kilowatt-hour, kWh)} & & \text{(kilowatt, kW)} & & \text{(hour, h)} \end{array}$$

.....

Energy transferred =kWh

(2)

(Total 9 marks)

45

(a) (i) Complete the sentence by choosing the correct word from the box.

electrons	neutrons	protons
-----------	----------	---------

An electric current is a flow of

(1)

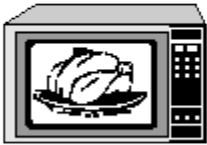
(ii) What is the name and circuit symbol for the instrument used to measure electric current?

Name:

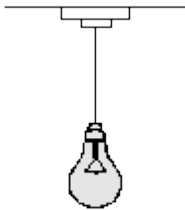
Symbol:

(2)

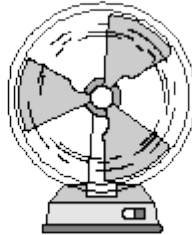
(b) When an electric current flows through a wire, the wire will get hot. **Two** of the following make use of this heating effect. Which **two**?



Microwave oven



Light bulb



Fan



Hairdryer

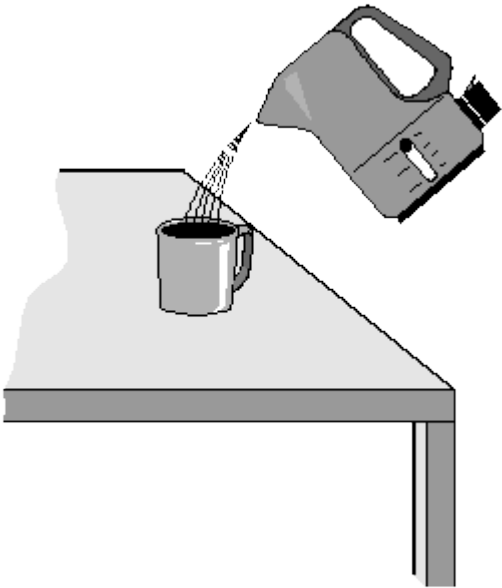
1.

2.

(2)
(Total 5 marks)

46

(a) The diagram shows hot water being poured into a mug.



(i) Complete the sentence by choosing the correct words from the box. Each word may be used once or not at all.

air	mug	table	water
-----	-----	-------	-------

Heat energy is being transferred from the to
the

(1)

(ii) When will this transfer of heat energy stop?

.....
.....

(1)

(b) In the box are the names of four types of fuel used to heat homes.

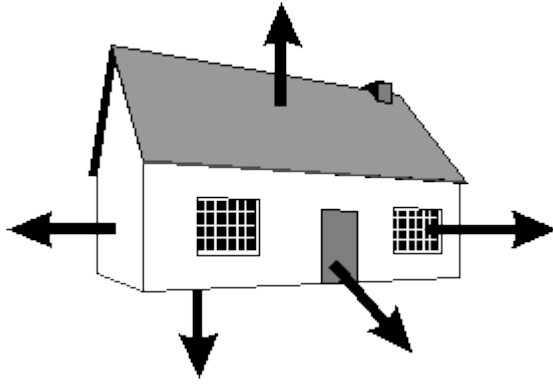
coal	gas	oil	wood
------	-----	-----	------

Which **one** of these types of fuel is renewable?

.....

(1)

(c) The diagram shows where heat energy is lost from a house.



(i) Complete the sentences by choosing the correct words from the box. Each word may be used once or not at all.

conduction conductor convection electric evaporation insulator
--

The amount of heat energy lost through the windows by
..... can be reduced by using thick
curtains. The curtains trap a layer of air and air is a good
..... . The curtains will also stop
..... currents pulling cold air
into the room through small gaps in the window.

(3)

(ii) Write down **one** other way of reducing heat loss from a house.

.....
.....

(1)

(Total 7 marks)

47

There are many forms of energy. Some of these forms of energy can be “stored” ready to be used when the energy is needed. The chemical energy in fuels is one example of stored energy.

(a) Complete the following sentences by adding the missing words.

The chemical energy in fuels such as coal came originally from the

Energy from fuels can be used to

(2)

- (b) An electric milk float has its batteries charged up overnight. Early in the morning the milkman sets off on his round. Describe the energy transfers which take place in the milk float as the milkman does his rounds.

.....

.....

.....

.....

.....

.....

(4)

- (c) Give another example of energy other than fuels which can be classed as “stored” energy. Give a use of the “stored” energy.

Type of “stored” energy

Use

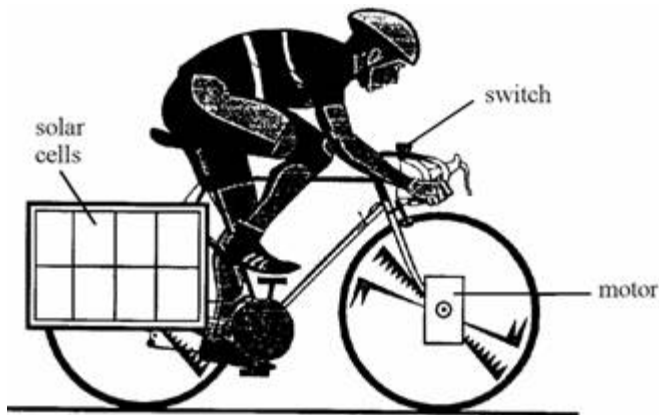
.....

(2)

(Total 8 marks)

48

The diagram shows an experimental solar-powered bike.



A battery is connected to the solar cells.
The solar cells charge up the battery.
There is a switch on the handlebars.
When the switch is closed, the battery drives a motor attached to the front wheel.

(a) Use words from the list to complete the following sentences. Words may be used once, more than once, or not at all.

- chemical** **electrical** **heat (thermal)** **kinetic**
- light** **potential** **sound**

(i) The solar cells transfer energy to energy.

(ii) When the battery is being charged up, energy is transferred to energy.

(iii) The motor is designed to transfer energy to energy.

(6)

(b) (i) The cyclist stops pedalling for 10 seconds. During this time the motor transfers 1500 joules of energy. Calculate the power of the motor.

.....
.....

Power W

(2)

(ii) Name **one** form of wasted energy which is produced when the motor is running.

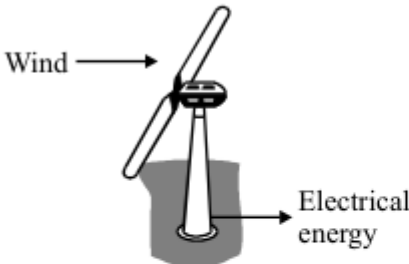
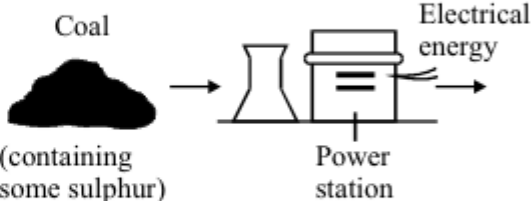
.....

(1)

(Total 9 marks)

49 Electricity is a useful form of energy.

(a) Different energy sources can be used to generate electricity.

Wind is an energy source	Coal, a fossil fuel, is an energy source
	
<p>This wind turbine generates 1 MW. (1 MW = 1000 kW)</p>	<p>This coal-fired power station generates 1000 MW.</p>
<p>Electricity demand in the UK can be 48 000 MW.</p>	




Give **one** advantage and **one** disadvantage (other than cost) of using each energy source to generate electricity in the UK.

Advantage	Disadvantage
<p>Using wind</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>Using wind</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>Using coal</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>Using coal</p> <p>.....</p> <p>.....</p> <p>.....</p>

(4)

- (b) List **A** shows three electrical devices.
List **B** gives the type of useful energy transferred.

Draw a straight line from each electrical device in List **A** to the useful energy it transfers in List **B**.

List A	List B
Electrical device	Useful energy transferred
 <p>Kettle</p>	<input type="text" value="heat"/>
 <p>Radio</p>	<input type="text" value="light"/>
 <p>Lamp</p>	<input type="text" value="sound"/>

(2)
(Total 6 marks)

50

(a) The student is using a microphone connected to a cathode ray oscilloscope (CRO).



The CRO displays the sound waves as waves on its screen. What does the microphone do?

.....
.....
.....

(2)

(b) The amplitude, the frequency and the wavelength of a sound wave can each be either increased or decreased.

(i) What change, or changes, would make the sound quieter?

.....

(1)

(ii) What change, or changes, would make the sound higher in pitch?

.....

(1)

(Total 4 marks)