1(a). The demand for energy in the home keeps increasing.

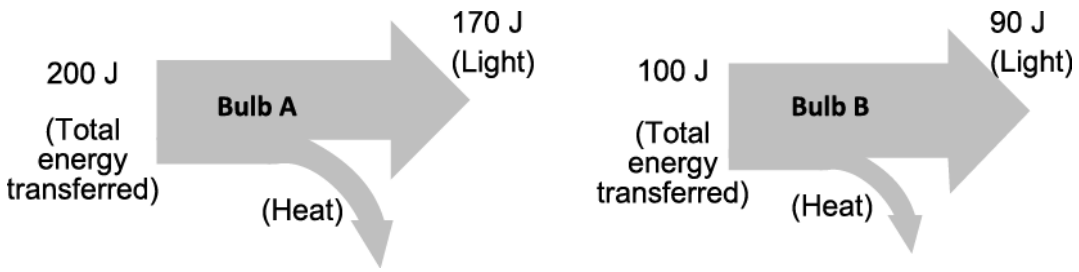
What does the **amount** of energy transferred electrically by an appliance depend upon?

Put ticks (✓) in the boxes next to the **two** correct answers.

its power rating	☐
the frequency of the mains supply	☐
how much it cost to buy	☐
the cost of one unit of electricity	☐
how long it is used for	☐

[2]

(b). Look at these Sankey diagrams for two different energy efficient bulbs.
(The diagrams are not drawn to scale.)



(i) Which **two** of the following conclusions can be made from these diagrams?

Put ticks (✓) in the boxes next to the **two** correct answers.

Bulb B produces 10 J by heating for every 100 J of energy transferred by the electric current. ☐

Bulb A is more efficient. ☐

Both bulbs transfer more energy by lighting than heating. ☐

The bulbs do not waste any energy. ☐

Bulb B will not last as long as bulb A. ☐

[2]

(ii) Calculate the efficiency of bulb A as a percentage.

_____ % **[3]**

2. In an experiment to look at work done, Molly uses different electric motors to lift a large mass to find out which motor is the most efficient. She measures the input electrical energy and the work done on the mass.

Look at the table of her results.

Electric motor	Input energy (J)	Output energy (J)
Q	800	760
R	2 000	1 920

Molly's statement is partly correct and partly wrong.

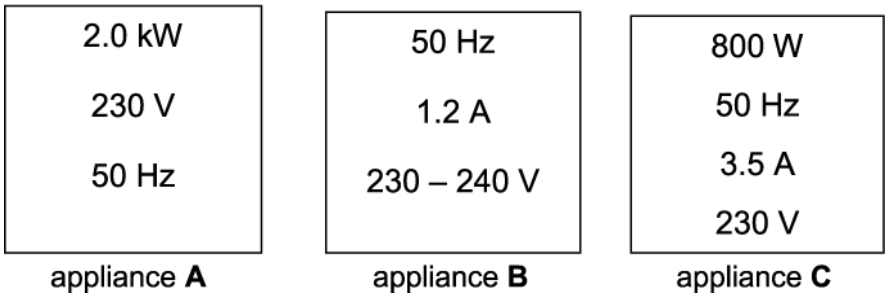
Use the data in the table above and calculations to explain why.

---

[2]

3(a). This question is about energy transfers in electrical appliances.

The plates on the back of three electrical appliances are shown below.



(i) Calculate the number of kWh of energy transferred by appliance **A** if it is on for 195 minutes. In your answer use the equation: energy transferred = power × time

_____ kWh **[3]**

(ii) Calculate which appliance (**A, B** or **C**) takes the biggest electric current from the mains power supply.

_____ **[4]**

(b). A householder heats water with an electric heater.
The water is then stored in a large storage tank until it is needed.
If the water is not used for some hours, it will cool down and the electric heater must be put on again.

Suggest and explain **one** way in which the householder can reduce the energy wasted in this way, and so save money on the electricity bills.

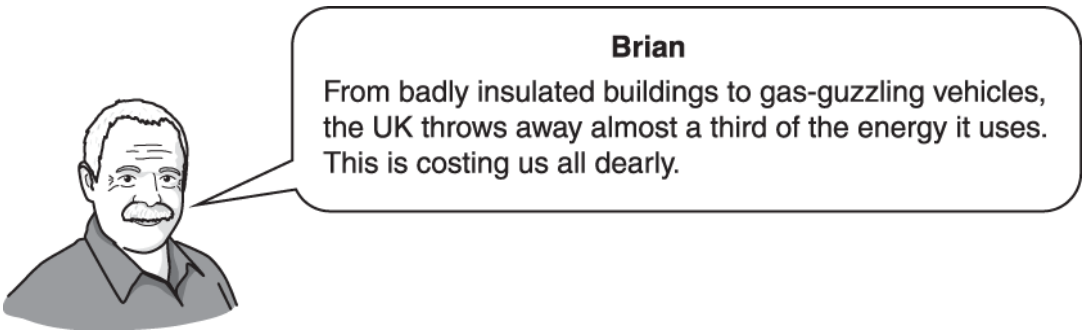
---

[2]

(c). The cost of electricity is 16p per kWh. Appliance C transfers 3.2 kWh when on for 4hrs. Calculate the cost in pounds.

£ _____ **[2]**

4. An environmental speaker made this statement.

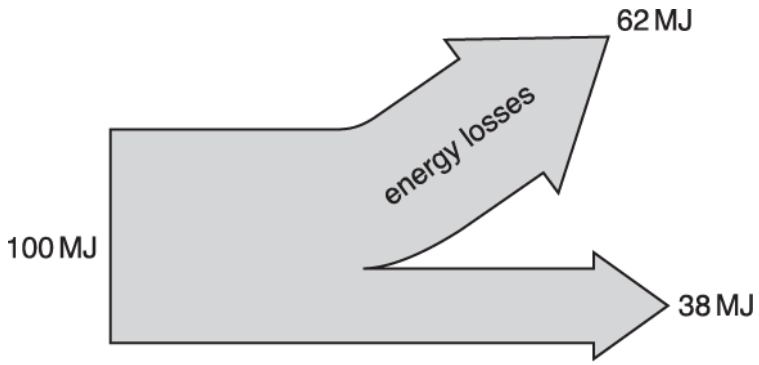


Explain the science that supports Brian's comments regarding energy waste and make suggestions to reduce these problems.

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

[6]

5. The Sankey diagram (energy flow diagram) shows the energy transferred by a power station from 100 MJ in the primary fuel.



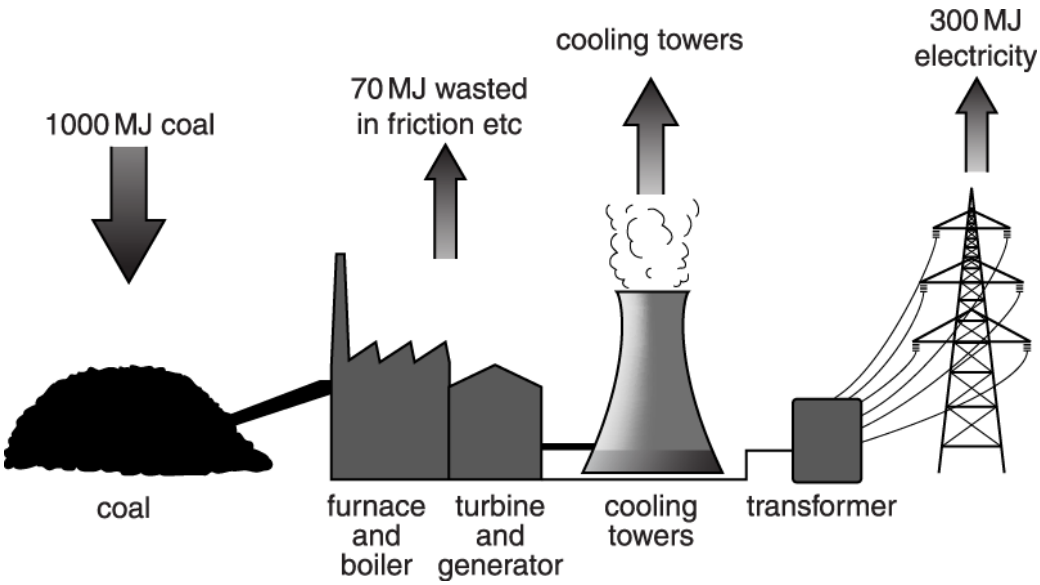
Which **one** of the following values is the efficiency of this power station?

Put a (ring) around the correct value.

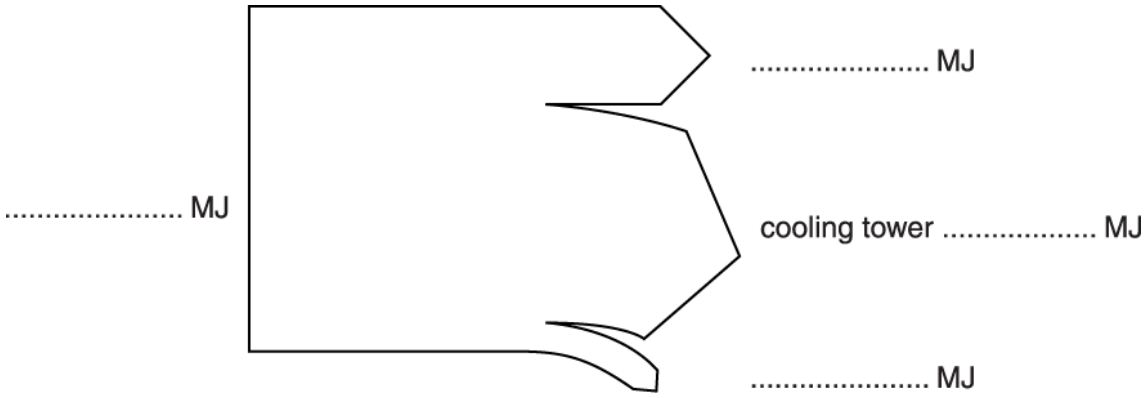
38% 62% 100%

[1]

6(a). The diagram shows the energy flow through a coal-burning power station each second.



Complete the Sankey diagram to show this energy flow.



[3]

(b). What is the efficiency of the coal-burning power station?

efficiency = _____ % **[1]**

7(a). Here are some data about kettles.

Kettle	Maximum volume in litres	Power rating in kilowatts
A	2	2.5
B	1	2
C	2	3
D	1.5	1.5

Use data from the table to suggest which kettle will boil 1 litre of water the fastest.

answer = _____ **[1]**

(b). How many seconds will it take kettle **B** to transfer 6 kilojoules of energy?

answer = _____ seconds **[1]**

(c). When kettle **C** is full, it takes about 0.1 hours to boil.

The cost of 1 kilowatt hour of electricity is 25p.

How much does it cost to boil the water?

cost = _____ p **[3]**

(d). The mains voltage is 230 V.

One of the kettles has a current of 6.5 A when it is heating water.

Which kettle is it?

Justify your answer.

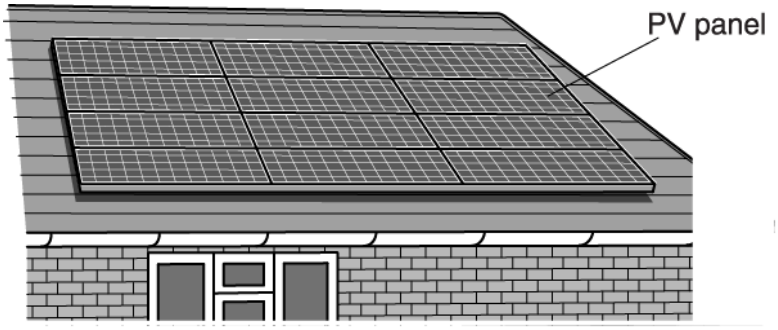
kettle _____

because _____

_____

_____ [2]

8. Many house-owners are putting sets of photovoltaic (PV) panels on their roofs to generate electricity during daylight. The panels work best if the roof used is facing south.



The data about the type of PV panel shown in the diagram are given in the table.

size of one panel (m × m)	1.5 × 0.8
average daily energy output of one panel (kWh)	0.6
cost per panel	£200

A family needs about 24 kWh of electricity per day, averaged out over the winter and the summer.

This family has decided to fit 12 panels on their roof to provide their energy needs throughout the year.

Discuss the advantages and disadvantages of fitting these panels to their roof.

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

[6]

9(a). An old fridge works for 24 hours a day, every day of the year.
The power used is 150 watts.

(i) Calculate the number of kilowatt hours of energy transferred in three months.
Assume that three months = 2000 hours.
Show your working.

number of kilowatt hours = _____ **[3]**

(ii) How much does it cost to run this fridge for three months?
1 kilowatt hour costs 15 p.

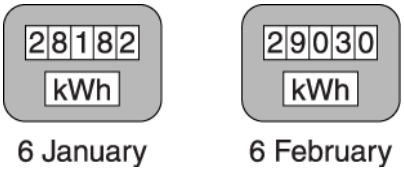
cost = £ _____ [1]

(b). A modern fridge rated A++ uses 20 watts.
This fridge will cost much less to use than the old one.
Suggest why.

---**[1]**

10(a) The Robinson family have an electricity meter.

. The diagram shows their meter on two different dates.



6 January 6 February

Use the meters to find the number of kilowatt hours of energy transferred between 6 January and 6 February. Show your working clearly.

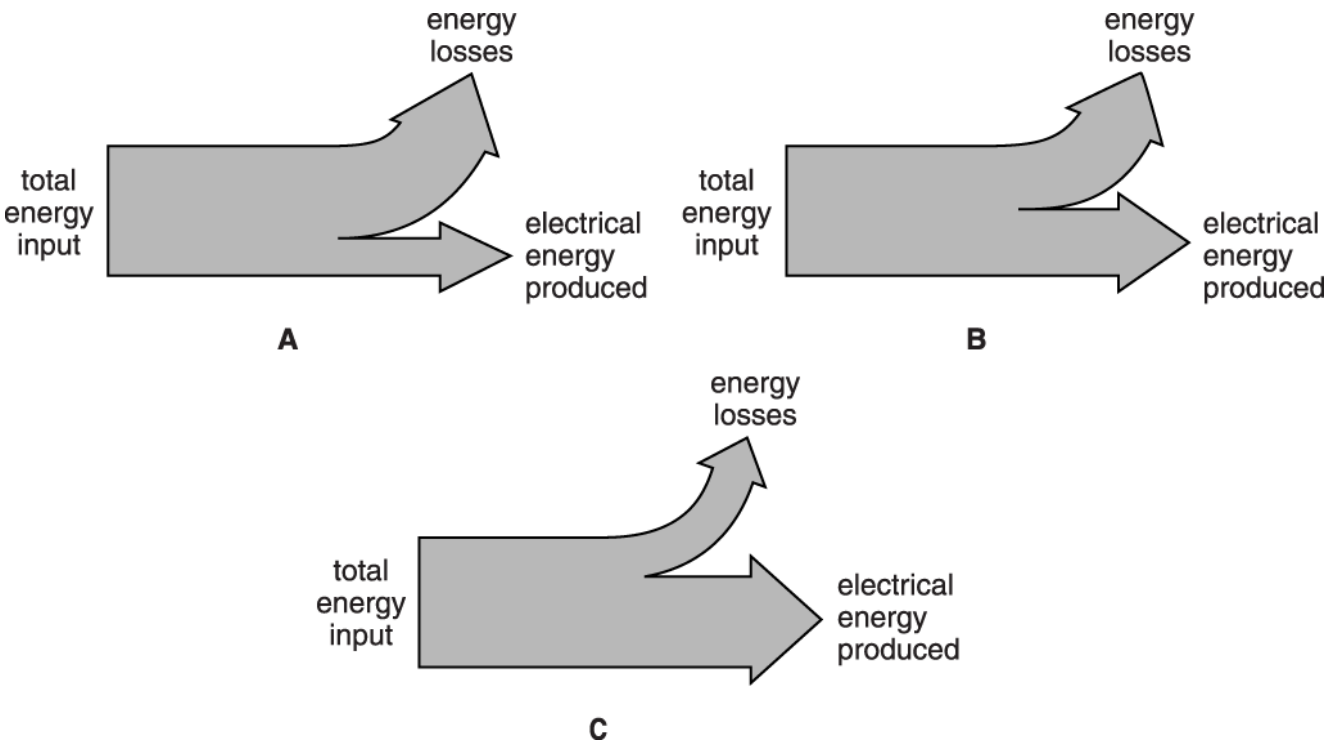
energy transferred = _____ kWh **[1]**

(b). Between 6 July and 6 August, the Robinson's electricity bill showed that they used much fewer kilowatt hours than in **(a)**.

Suggest and explain **one** reason for this.

---**[2]**

11. The Sankey diagrams below show the energy transfers in three different power stations.



Some of the statements below are true, and some are false.
Put a tick (✓) in the correct box after each statement.

	true	false
In each power station, total energy input = total energy output.	☐	☐
Modern power stations are more than 100% efficient.	☐	☐
Power station **A** is more efficient than power station **B**.	☐	☐
Power station **B** has an efficiency of about 50%.	☐	☐
Power station **C** is the most efficient of the three.	☐	☐

[3]

12. Margaret runs a small transport company.

She decides to review the possible fuel sources for her delivery trucks.

At present all her vehicles use petrol.

She finds the following table of information on the internet.

Fuel	Energy efficiency	CO_2 equivalent emission units	Cost of fuel per tonne
biogas	22%	20	similar for all three fuels
diesel	35%	750	
petrol	27%	740	

The data are given for equal masses of fuel.

She wants to take into account economic factors, sustainability and environmental impact.

Use the information in the table and your knowledge of energy sources to discuss the three fuel sources and make a recommendation about which one Margaret should use.

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

[6]

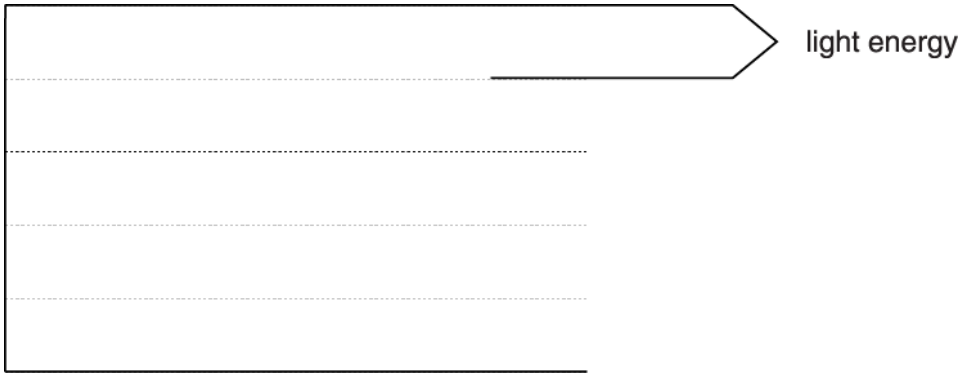
13(a) A TV set uses 500 J of electrical energy.

.

The TV produces 100 J of sound energy and 300 J of heat energy.

It also produces light energy.

(i) Complete and label the Sankey diagram to show the energy transfers in the TV set.



[4]

(ii) How much light energy is produced by the TV set?

light energy = _____ J **[1]**

(b). A new television is designed to be more efficient.

It uses 500 J of electrical energy to produce 120 J of light energy and 180 J of sound energy.

Calculate how efficient the new television is.

efficiency = _____ % **[3]**

14(a) Joe has been checking how much his electrical appliances are costing him to use.

.

He has kept a record of the power of each one and the time it is on for one day.

Finish Joe's table by calculating the energy for each appliance and then find the total amount of energy he used in a day. Joe has already completed the first row.

Appliance	Power (kW)	Time (hours)	Energy (kWh)
all the lighting	0.6	5	3
oven	2.2	2	
kettle	2.0	0.5	
TV	0.1	10	
		total	

[3]

(b). On another day, all of Joe's electrical appliances transferred a total of 6 kWh.

How much is the total cost if each unit (kWh) costs 15p?

Put a (ring) around the correct value.

6p 15p 21p 90p

[1]

(c). The power ratings of Joe's oven and kettle are much higher than power ratings for his lighting and TV.

What is the reason for this?

Put a tick (✓) in the box next to the correct reason.

The oven and kettle are connected to a higher voltage. ☐

The currents through the oven and kettle are greater. ☐

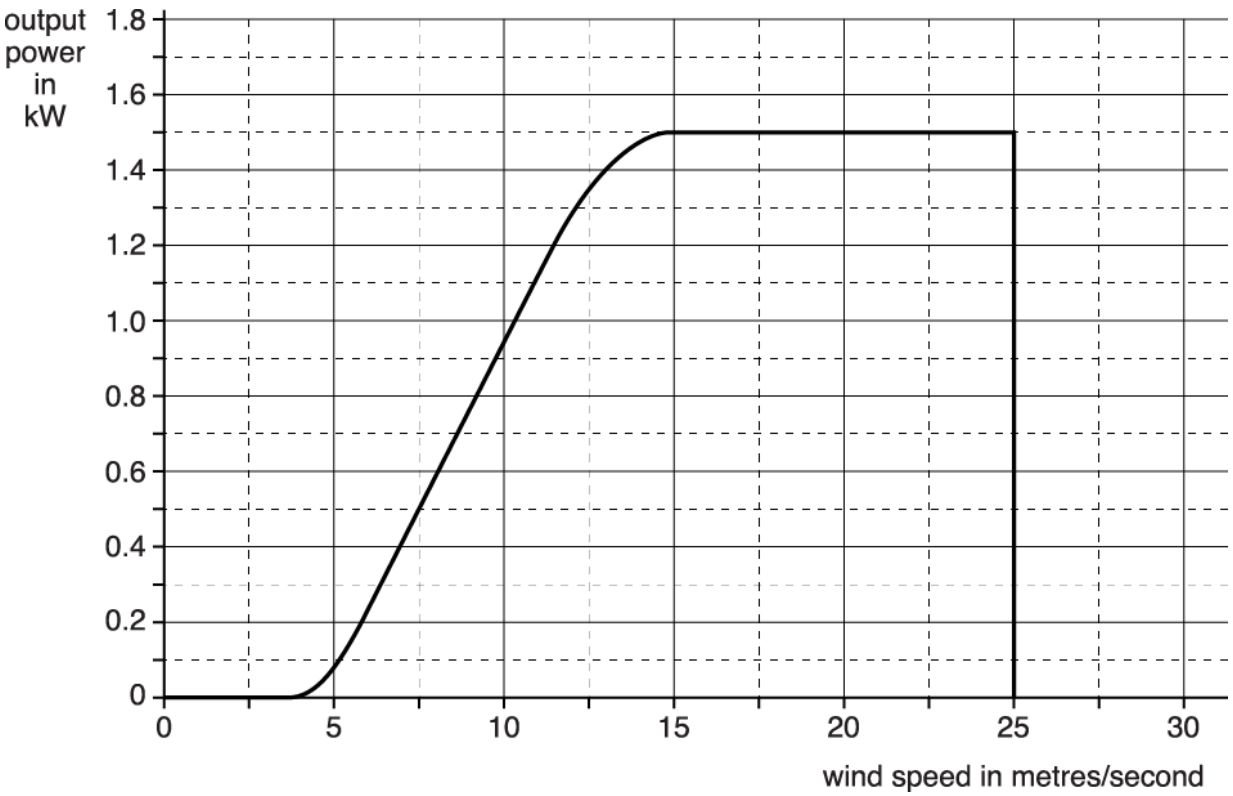
The oven and kettle are connected to the mains supply. ☐

The oven and kettle are more efficient. ☐

[1]

15. Wind turbines are used in wind farms in the UK to generate electricity.

The graph shows that a wind turbine does not give its maximum power all the time.



(i) What is the **maximum** power output from the wind turbine, measured in kW?

Put a (ring) around the correct value.

1.5 1.8 25 30 **[1]**

(ii) Use information from the graph to find the total electrical energy generated over a day (24h) when the wind speed was constant at 7.5 m/s.

Show your working, and give your answer in kWh.

electrical energy = _____ kWh **[2]**

16. A toothbrush uses a rechargeable battery.

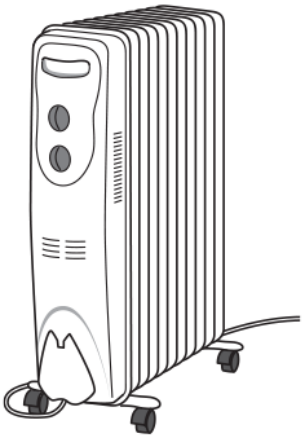
The energy that is stored in the battery comes from a power station.

State how the energy is transferred from the power station to the chemical store in the battery.

---

[1]

17. The diagram shows a common type of electric heater. It contains oil which is heated by an electrical element.



The table shows some information about the heater.

Electrical power	1500 W
230 V	Voltage rating
Specific heat capacity of oil	1600 J / kg °C
Mass of oil	4.5 kg

(i) 720 000 J is needed to heat the oil from 20C to 120C. Calculate the minimum time for the oil to reach a temperature of 120 °C, starting at 20 °C.

Minimum time = ... s **[3]**

(ii) In practice, it will take longer than this for the heater to reach 120 °C.

State the reason for this.

---

[1]

18. There is a film about an astronaut named Mark Watney. He is left alone on the planet Mars. He has to use science to stay alive until he can be rescued.

To be rescued, Watney needs to travel 3200 km across Mars to a rocket.

He drives there using a battery-powered vehicle. The battery is recharged using solar panels.

The Sankey diagram in **Fig. 5.1** shows the energy transferred in one hour by the solar panels.

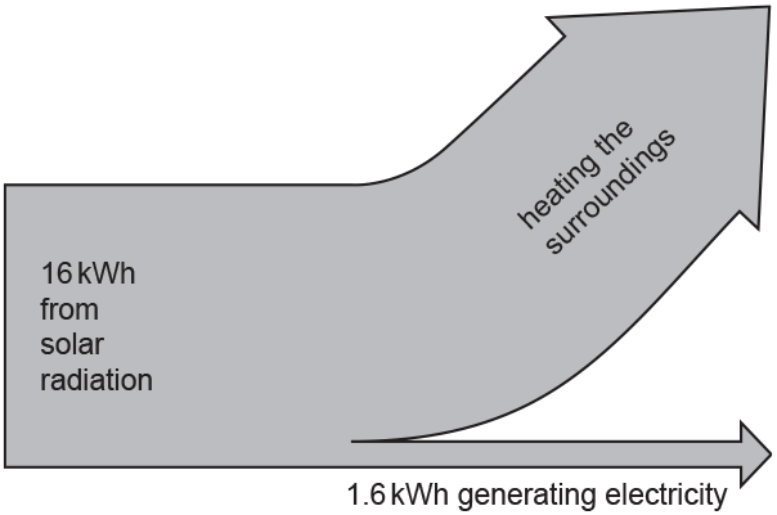


Fig. 5.1

(i) Calculate, as a percentage, the efficiency of the solar panels.

Use the equation: efficiency = (useful energy transferred ÷ total energy transferred) × 100

Efficiency = ---------- % **[3]**

(ii) The rechargeable battery stores 18 kWh of energy.

Use data from **Fig. 5.1** to show that the solar panels need more than 10 hours to recharge the battery.

[2]

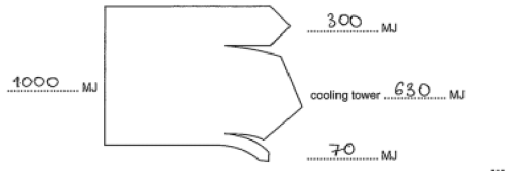
END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		Its power rating (1) How long it is used (1)	2	
	b	i	Bulb B produces 10 J by heating for every 100 J of energy transferred by the electric current (1) Both bulbs transfer more energy by lighting than heating (1)	2	
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE. If answer = 85(%) award 3 marks Recall: efficiency = useful energy transferred ÷ total energy transferred (1) 170 J / 200 J = 0.85 (1) = 85(%) (1)	3	correct substitution gains first 2 marks (if equation is missing)
			Total	7	
2			Q wastes 40 J and R wastes 80 J (1) Q is 95% efficient and R is 96% efficient (1)	2	**allow** R is 1% more efficient (1)
			Total	2	
3	a	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 6.5 (kWh) award 3 marks Convert 195 minutes in hours = 3.25 h (1) 2.0 (kW) × 3.25 (h) = 6.5 (kWh) (1)	3	correct substitution gains first 2 marks (if equation is missing)

Question			Answer/Indicative content	Marks	Guidance
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 8 – 9 (A) and therefore appliance A award 4 marks Recalls Power = Voltage × Current (1) Converts 2 kW to 2000 W (1) Rearranges to I = P/V = 2000 / 230 (1) Gets 8 – 9 A so appliance A has largest current (1)	4	correct substitution gains first 2 marks (if equation is missing) or applies $P = IV$ to appliance B (to find P) which is 276 – 288 W so 2 kW (appliance A) is greatest power and so greatest current
	b		Insulate the tank (1) So less heat is lost through conduction over time (1)	2	method stated explain why energy loss is less e.g. not heat water until needed
	c		FIRST CHECK ANSWER ON ANSWER LINE If answer = £0.51 award 2 marks 16p × 3.2 kWh = 51.2 p (1) 51.2 p ÷ 100 = (£)0.51 (1)	2	
			Total	11	

Question			Answer/Indicative content	Marks	Guidance
4			**(Level 3)** Addresses Brian's comments including at least two scientific points **AND** Makes at least two suggestions to reduce a problem. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Explains the science that supports one of Brian's comments **AND** suggests one way to reduce a problem. **OR** Several explanations of the science that supports Brian's comments, **OR** Suggests several ways to reduce problems. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Attempts to explain the science that supports one of Brian's comments **AND** suggests a simple way to reduce a problem, e.g. 'Don't waste so much energy', 'turn off lights' Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	[6]	**This question is targeted at grades up to E** **Indicative scientific points may include:** **Brian's comments** inefficient power stations • buildings/houses lose heat • so need to use energy to heat them more • vehicles burn petrol/diesel/fossil fuels • vehicle (engines) are inefficient • fossil fuels running out or not renewable • pollution, global warming, or other example. • There are other causes, suitable example (e.g. electrical appliances left on standby, inefficient lights) **Indicative ways to reduce a problem:** • Reduce the use of fossil fuels • use example alternative sources (e.g. nuclear power, solar) • make power stations more efficient/use waste heat from power stations • improving insulation (examples of which double glazing, draught proofing, cavity walls = three ways) • use electric vehicles or more efficient engines • use public transport, walk, cycle (= one way). • reduce other causes of energy waste e.g. energy efficient lights. • encourage fuel efficient technology (legislation, financial incentives) • encourage fuel efficient behaviour (use smart meters, increase price of fuel/electricity, offers on improvements) 'More efficient' (cars, power stations, etc.) suggests inefficiency and an improvement. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** **Examiner's Comments**

Question			Answer/Indicative content	Marks	Guidance
					We saw very encouraging responses that suggest many GCSE students understand the actions required to reduce global warming and improve the environment. Those candidates who addressed Brian's comments made some very good points A few candidates expanded on these with extra detail. There were some good answers that covered alternative transport and candidates could suggest many improvements. As well as those points specifically mentioned on the mark scheme, which were often seen, candidates suggested car sharing, hybrid cars, and driving more slowly. Some explained that a bus uses more fuel than one car and saves energy by replacing many cars. Similarly, with insulation, candidates explained how badly insulated buildings resulted in heat loss and suggested many ways of reducing the energy waste. Alternative sources of power were often suggested. Students lost marks most often by not covering both parts of the question. Some candidates did not focus on Brian's comments but talked instead about leaving lights on, and turning them off, or not wasting energy. They were given some credit for these answers.
			Total	6	
5			38%	1	Examiner's Comments The majority of candidates knew that the efficiency was 38%. Weaker candidates thought it was 62%.
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
6	a		cooling tower – 630 as second label down on right (1) **max** 2 marks (coal) 1000 (MJ) (electricity) 300 (MJ) (wasted in friction) 70 (MJ)  	3	3 correct = 2 marks 2 correct = 1 mark 0 or 1 correct = 0 marks
	b		30	1	no error carried forward do not accept 0.3
			Total	**4**	

Question			Answer/Indicative content	Marks	Guidance
7	a		C	1	Examiner's Comments This was a very poorly answered question.
	b		3	1	Examiner's Comments The most common answer was B, presumably because it was a 1 litre kettle.
	c		choosing 3(kW) as correct power 3 × 0.1 × 25 7.5p	1 1 1	3 must be in working not final answer 7.5p = 3 marks £0.075 scores 3 as long as they have included the £ any power of 10 error × 7.5 = 2 marks (eg 7500p, 0.75p, £75) Examiner's Comments Very few knew 3 seconds to be the correct answer.
	d		D 230 × 6.5 / 1495W / 1.495kW	1 1	 ORA 1500/6.5 =230.7V or 1500/230 = 6.5A Examiner's Comments Most candidates ignored the reference to kettle C in the stem of the question and those that did use this data often ignored the time used and had a power of ten error, so that it was quite common for a kettle of water to cost 75p or even £7.50 to boil.
			Total	7	

Question			Answer/Indicative content	Marks	Guidance
8			**(Level 3)** Uses a correct, relevant calculation(s) and discusses both advantages and disadvantages. Quality of written communication does not impede communication of the science at this level. (5–6 marks) **(Level 2)** May quote data without calculation. Attempts a balanced argument of advantages and disadvantages OR an unbalanced argument supported by calculation. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) **(Level 1)** Qualitative discussion of one side of the argument only. May not attempt a balanced argument. Quality of written communication impedes communication of the science at this level. (1–2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks) **Use the L1, L2, L3 annotations in Scoris; do not use ticks**	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** Ignore confusion between PV and solar heating panels. **Advantages** • no CO_2 / no pollution produced / won't harm environment / eco-friendly • renewable / will not run out • power cuts won't affect them • reduces the household bill • can get money for excess electricity produced in the summer • the electricity produced is free • would help towards a government target of renewable energy generation. **Disadvantages** • doesn't produce all of the electricity required / less electricity in winter when needed most • needs lots of panels / not enough panels for whole bill • initial cost / outlay of money / takes time to pay back • cloud cover will reduce output • won't work at night / no light at night • will have to have other source of energy / mains supply for the night • heavy / damaging on roof • ugly • maintenance needed. **Data calculations** • 40 panels required to provide all the electricity • 12 panels produce 12X0.6 = 7.2 kWh not 24kWh • total area of 12 panels is = 12 × 1.5 × 0.8 = 14.4 m2 • energy bill is reduced by a third • the cost of 12 panels is 12 × £200 = £2400. **Examiner's Comments** Almost all candidates attempted this six-

Question			Answer/Indicative content	Marks	Guidance
					mark extended writing question. It was pleasing to see that many candidates achieved level 3 by including a calculation in addition to addressing advantages and disadvantages. Most often this was the initial cost of the panels, but sometimes they calculated the electricity produced by 12 panels. It was also pleasing that most candidates achieved at least level 2 by identifying one or two straight-forward advantages or disadvantages. Often the advantages given were 'provides free electricity', 'renewable' or 'no pollution'. Common disadvantages given were 'initial expense', 'less electricity produced when low light level' or 'will not work at night'.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
9	a	i	150W is 0.15kW (1) 0.15 kW × 2000 hours OR 150 W × 2000 hours (1) = 300 (kWh) (1)	3	300 with a power of ten error e.g. '300,000' = 2 marks if 300 or 300 000 etc. is followed by more calculation to get a final incorrect answer, do not award the final mark (300 + further error scores 2 and 300 000 etc. + further error scores 1) **Examiner's Comments** Some candidates calculated the kWh used by a fridge. Many candidates calculated Wh.
		ii	cost = 300 × 15 = 4500 p = £45.00	1	ecf own kWh **accept** 4500p **Examiner's Comments** Some candidates scored the mark for correctly calculating the cost, or the cost of their answer to (i).
	b		Uses less power OR uses less energy (per unit time) OR 20W is smaller than 150W OR more efficient	1	**accept** other examples but must be comparative **ignore** 'before it was 150W now it's 20W' 'now it is only 20W' scores 1 **accept** it uses less watts **accept** uses less current / electricity **Examiner's Comments** Most candidates gave a comparative answer and explained that the old fridge used less power, or that 20W was less than 150W.
			Total	**5**	

Question			Answer/Indicative content	Marks	Guidance
10	a		(units used = 29030 ? 28182) = 848 (kWh) (1)	1	Examiner's Comments Many candidates successfully found the difference between the two readings. To get the mark here candidates need to understand that this is the same meter at 2 different times and a difference is needed, not a sum or a product.
	b		sensible reason (1) relevant explanation (1)	2	Examples: it was summer / warmer / more daylight so: Didn't need so much heating / lighting OR didn't watch so much TV = 2 marks OR reverse i.e. Didn't need…because it was summer… they were away (on holiday) OR didn't watch so much TV so they didn't use so much electricity = 2 marks OR reverse i.e. they didn't use… because they were away. they replaced light bulbs with more energy efficient bulbs which use less energy = 2 marks **ignore** 'which use less kWh' (in question) Examiner's Comments The large majority of candidates explained that summers were hotter and/or lighter and an associated behaviour that reduced electrical use.
			Total	3	

Question			Answer/Indicative content	Marks	Guidance
11			T, F, F, T, T	3	all 5 correct = (3) 4 correct = (2) 3 correct = (1) Examiner's Comments It was pleasing to see this question so well answered by the majority. Some candidates needed to understand that 'in each power station, total energy input = total energy output'.
			Total	3	

Question			Answer/Indicative content	Marks	Guidance
12			**Level 3 (5–6 marks)** Considers all three fuels using all data from table and other information. Considers all three key factors. Draws a clear conclusion based on and consistent with the data considered. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Considers all three fuels using some data from table. Considers two key factors. Draws a conclusion based on the data considered. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Considers two fuels using some data from table, considers one key factor. OR Considers one fuel and two factors. Draws a relevant conclusion which may not be based on the data. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** **key factor — sustainability** • biogas is renewable * • diesel and petrol are non-renewable. * **key factor — economics** • unit cost of fuel is the same for all • may be expensive to convert vehicles * • may be difficult to find supplies of biogas* • same amount of fuel diesel will go further • replacement costs to replace vehicles* • order of energy efficiency linked to amount used. **key factor — environmental impact** • order of CO_2 equivalent emissions • more CO_2 from diesel or / and petrol than biogas • CO_2 emissions contribute to global warming * • not clear what is meant by 'CO_2 equivalent emissions'. * These are examples of other information beyond that provided in the table. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.** Examiner's Comments This was a six-mark extended writing question. It was fairly well answered with the majority of candidates understanding the importance of low emission of carbon dioxide and high efficiency of diesel and petrol. Fewer candidates understood the term sustainability and many interpreted it to mean viable. Candidates have obviously had practice at interpreting data and

Question			Answer/Indicative content	Marks	Guidance
					scored well, mentioning all three fuels and two of the factors using the data provided.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
13	a	i	arrow with three heads (1) scale correct outputs 3units, 1 units (1) input (LHS) labelled 500J / electrical energy (1) outputs correctly labelled sound energy AND heat energy (1)	4	**allow** maximum of 2 marks if only two output arrows if scales are not correct then allow last mark if the sound arrow is smaller than heat arrow Examiner's Comments Many candidates did well on this question, most scoring the mark for having three output arrows. Many candidates correctly labelled heat and sound though not quite as many drew them to the correct scale. The least scored mark was the 500J input. There was some evidence that certain candidates had never met or used Sankey diagrams
		ii	100 (J)	1	can be labelled on diagram Examiner's Comments The majority of candidates correctly calculated the amount of light energy produced.
	b		(useful output) = 120J + 180J = 300J (efficiency = useful energy out / energy in =) 300J / 500J 60(%)	3	300 / 500 on its own worth 2 marks correct numerical answer gains full marks 0.6 gains 2 marks Examiner's Comments A considerable number of candidates understood that 300J of useful energy was used and many could then go on to calculate the correct efficiency although it was surprising how many candidates performed the calculation ‘upside down’ and came out with an answer greater than 100%.
			Total	**8**	

Question			Answer/Indicative content	Marks	Guidance
14	a		(3) 4.4 1 1 9.4 all correct = (2) two correct = (1) (1) ecf own entries above	3	Examiner's Comments Lots of correct answers. Those candidates who slipped up in calculating the energy often still scored for totalling the values correctly.
	b		90 p	1	Examiner's Comments Most candidates correctly chose 90p here.
	c		The currents through them… (2nd box)	1	Examiner's Comments?? This was quite varied with wrong answers spread among the possible options, but 'The oven and kettle are connected to a higher voltage' was the most common incorrect answer.
			Total	5	

Question			Answer/Indicative content	Marks	Guidance
15		i	1.5 (kW)	1	?Examiner's Comments?? Most candidates read the maximum power correctly, a few gave 1.8kW
		ii	 P = 0.5 (kW) E = 0.5 kW × 24 h = 12 (kWh)	2	A bald answer of 12 (2) if not (2) then **EITHER** 0.5 in working or answer (1) **OR** any number × 24 correctly evaluated and presented as the final answer (1) e.g. 7.5 × 24 = 180 ?Examiner's Comments?? Many candidates did not realise they needed to use the graph to find the power. They thought that 7.5 m/s must feature in the calculation. It was common to see 24 x 7.5 = 180.
			Total	**3**	
16			(transferred by) electric current / electrically / electrical working ✓	1 (AO 1.1)	**ALLOW** by a flow of electrons / current / electricity / **IGNORE** references to National Grid / wires /cables /transformers Examiner's Comments For this question many candidates referred to various stages of the power network, such as transformers and cables rather than simply stating that the energy was transferred by an electric current.
			Total	**1**	

Question			Answer/Indicative content	Marks	Guidance
17		i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 480 (s) award 3 marks recall **and** rearrange: time = energy / power ✓ substitution 720 000 / 1500 ✓ = 480 (s) ✓	3 (AO 1.2) (AO 2.1) (AO 2.1)	**ECF** (a) or energy = 700 000 (J) **ALLOW** for 2 marks '48' or '4800' as a transcription error. <u>Examiner's Comments</u> Candidates found this question difficult as it required use of the data given on the previous page. The question stem referred to the rise in temperature so many candidates divided the value calculated in the previous part by the temperature difference as they were unable to recall and rearrange the equation.
		ii	energy transferred to the metal radiator / in the wires ✓	1 (AO 1.1)	**ALLOW** 'energy is lost to the surroundings' **IGNORE** it heats up the room / ignore efficiency arguments **DO NOT ALLOW** 'loss' on its own <u>Examiner's Comments</u> This question was not well answered. Most candidates simply stated that the heater would not start at 20° C for instance or that the calculation was only approximate.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
18		i	FIRST CHECK THE ANSWER ON THE ANSWER LINE. If answer = 10 (%) award 3 marks = 1.6 (kWh) / 16 (kWh) **OR** 0.1 ✓ = 0.10 × 100 (%) ✓ = 10 (%) ✓	3 (AO 3.1b) (AO 1.2 ×2)	**ALLOW** 1 mark for 90% Examiner's Comments The majority of candidates scored full marks here. There was a small minority who worked out the percentage of wasted energy instead of useful energy.
		ii	18(kWh) ÷ 1.6(kWh) ✓ = 11.25 (hours) (which is more than 10 h) ✓	2 (AO 2.2) (AO 3.1a)	**ALLOW** 1.6 (kWh) × 10 (h) = 16 (kWh) Which is less than 18 (h) **AW** Examiner's Comments Many candidates chose a neat way to show this by calculating that in 10 hours 16kWh of energy would have been transferred, which was less than the 18 kWh required. Some went on to show that 11 hours was not enough. A few successfully calculated that 11.25 hours would be needed.
			Total	5	