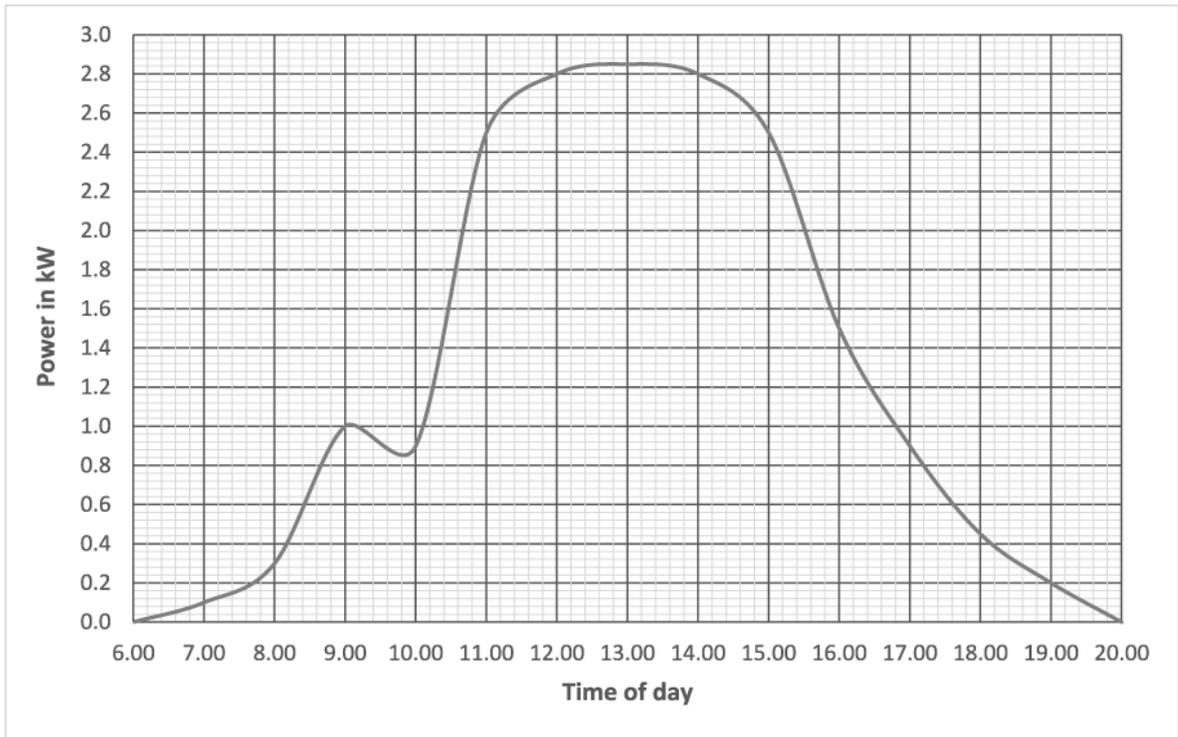


1(a). Write down the difference between a renewable and a non-renewable energy resource.

-----  
----- [1]

(b). More and more homes are having solar panels fitted to reduce household electricity bills.

The graph shows how the power output from a solar panel varies during a typical summer day.



With the help of the graph, estimate the mean power output **between 11:00 and 15:00 hours**.

----- kW [1]

(c). The output from the solar panel is d.c. This needs converting to the correct a.c. voltage for the household.

(i) What is the correct voltage and frequency of the UK mains supply?

Put a **ring** around the **two** correct values

Voltage			Frequency		
110 V	230 V	360 V	30 Hz	40 Hz	50 Hz

[2]

(ii) In the National Grid, what is the name of the device used to change the supply voltage before and after transmission?

----- [1]

(d). A new power station is being built in your town.

The table gives some information about three different types of power station.

Type of power station	Efficiency (%)	Cost per kWh in pence	Environmental factors
Wind	34	4 to 5.5	May damage local wildlife,  e.g. birds
Nuclear	35	2 to 2.5	Produces radioactive  waste
Gas	38	2 to 3	Produces carbon dioxide

Which type of power station would you recommend building?

Use information from the table to decide.

Explain your choice.

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[3]

(e). Some power stations include boilers where the steam is used to turn a turbine.

Name an energy resource for a power station that **does not** have a boiler.

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[1]



3. This question is about electric lamps.

The table gives information about different types of lamps.

The information is stated on the lamp and refers to its normal operating conditions.

Type of lamp	Information
fluorescent	230V, 8W
spiral	110V, 11W
filament	3V, 2W
LED	1.5V, 1W

(i) Which lamp uses most electrical energy every second when operating normally?

Put a **ring** around the correct answer.

fluorescent      spiral      filament      LED

[1]

(ii) Which lamp is designed to be connected to the mains supply in a house in the UK?

Put a **ring** around the correct answer.

fluorescent      spiral      filament      LED

[1]

(iii) The filament lamp can be powered by cells.

How many 1.5 V cells need to be connected in series so the lamp lights normally?

Put a **ring** around the correct answer.

one      two      three      four

[1]

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.*

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**[6]**

5. A family's electricity bill for March was more than their bill for June.

Which of the following statements could explain this?

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

The weather was colder in March.

The cost of 1 kWh was less in March.

The family used electric lights more in March.

The family used the tumble drier for clothes less in March.

The family used their washing machine more in June.

[2]

6. Complete the following sentences about generating electricity.

In many power stations, a fossil fuel is burnt to boil \_\_\_\_\_ into steam.

The steam rotates a turbine, and the turbine then turns a \_\_\_\_\_ which produces electricity.

The electricity is produced when a coil of wire has a \_\_\_\_\_ spinning near it.

[3]

7. Complete the following sentences about different types of energy sources which are used to produce electricity.

gas

hydroelectric

nuclear

oil

wave

Use words from the list.

Fossil fuel power stations use \_\_\_\_\_ and \_\_\_\_\_ as energy sources.

Power stations that do **not** use a boiler use \_\_\_\_\_ and \_\_\_\_\_ energy sources.

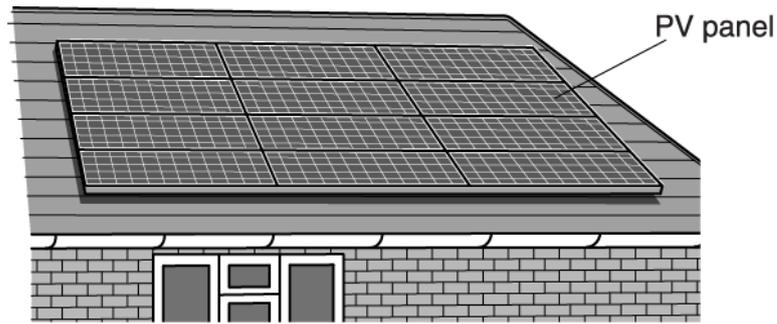
Two renewable energy sources are \_\_\_\_\_ and \_\_\_\_\_ .

The government makes regulations to control the risks of radioactive waste from \_\_\_\_\_ power stations.

[4]



9. 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.*

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10. Which one of these power stations produces greenhouse gases when it is working?

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

- |                             |                          |
|-----------------------------|--------------------------|
| coal burning power station  | <input type="checkbox"/> |
| hydroelectric power station | <input type="checkbox"/> |
| nuclear power station       | <input type="checkbox"/> |
| wind farm                   | <input type="checkbox"/> |

[1]



12(a) In the UK, the weather is usually windier in the winter than in the summer.

Explain why this is an advantage for a wind farm in the UK.

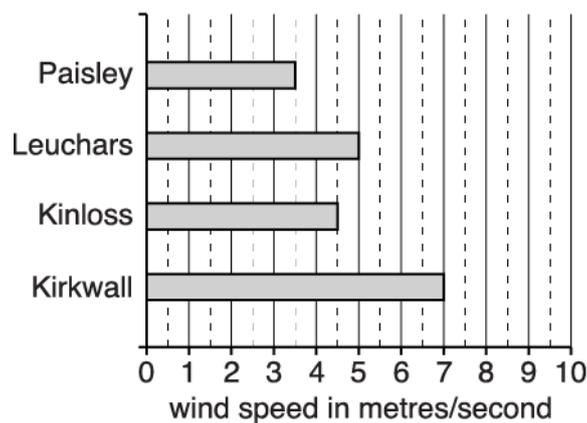
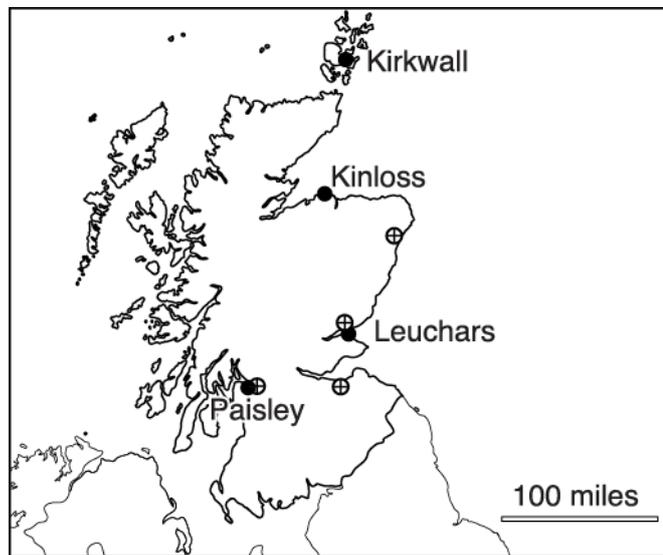
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[2]

(b). In Scotland, part of the UK, some places have stronger winds than others. Four places, Paisley, Leuchars, Kinloss and Kirkwall, have stronger winds. These have been marked (•) on the map of Scotland.

The wind speed for these four places is shown in the bar chart.

Half of all people in Scotland live in the four largest Scottish cities (marked ⊕).



There is a plan to build wind farms to supply electricity for Scotland's major cities.

An ideal location would be one where:

- the wind speed is at least 5 metres / second
- the electricity does not have to be distributed for more than a 100 miles.

Using the information in the bar chart and the map, write 'Yes' or 'No' in each box in the table below.

Place	Suitable for wind speed?	Suitable for distribution?
Paisley		
Leuchars		
Kinloss		
Kirkwall		

[4]

13. New providers of electricity are attempting to gain customers who are concerned about the environment.

Here is the advertisement for one provider:

**OCR Green Energy – the way forward**

Change to our company, and we can guarantee that all your electricity will come from renewable sources – wind, solar, water and biofuel.

Do your bit to combat global warming!

And that's not all – we're cheaper than the big energy suppliers, too!

For more information, see our website  
[www.OCRGreen.com](http://www.OCRGreen.com)



A householder is thinking about changing to this energy provider.

Discuss the advantages and disadvantages, for the householder and for the country as a whole, of making this change.



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

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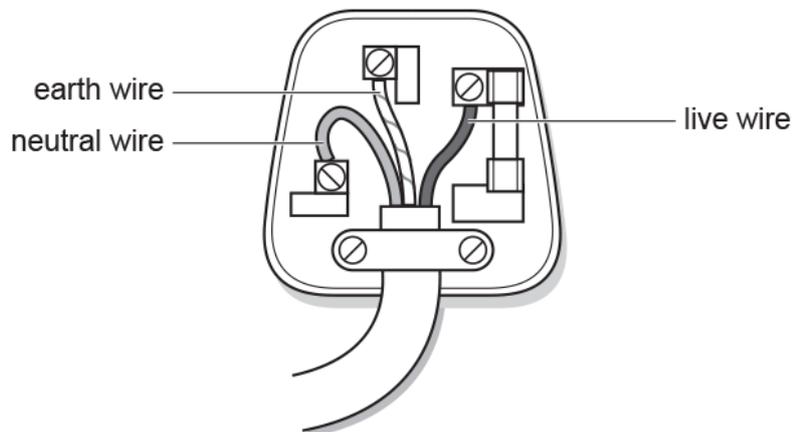
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[6]

[Total: 6]

14(a) The diagram shows the inside of a three-pin plug.



(i) Put a tick (✓) in the correct box in each row to show the correct descriptions of the live, neutral and earth wires.

Wire	Connected to the National Grid	Connected to the National Grid
Live		
Neutral		
Earth		

[2]

(ii) Put a ring around the voltage between the live and neutral wires.

0 V      12 V      230 V      25 000 V

[1]

(b). Batteries supply direct current (d.c).

Another type of current is alternating current (a.c).

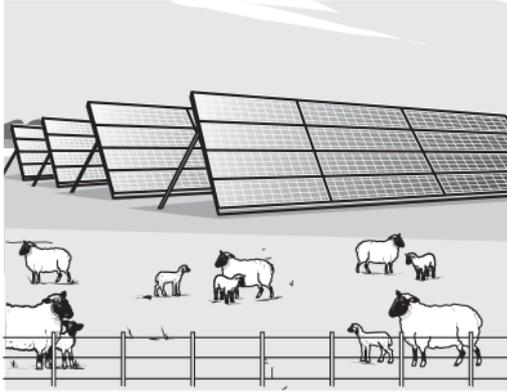
Each statement in the table below may be **true** about d.c, or **true** about a.c, or **true** for both d.c and a.c.

Put a **tick (✓)** in the correct box in each row.

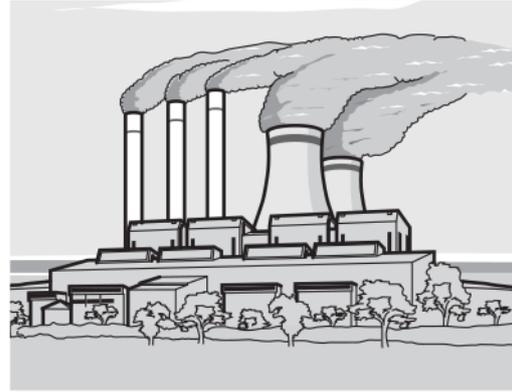
	True only for d.c	True only for a.c	True for both
The current always flows in the same direction.			
The domestic supply in the UK uses this.			

[2]

15(a) Solar farms are large power stations made up from many photovoltaic (PV) panels. Even though they are now very common, most of Britain's electricity is generated by burning gas.



A solar farm



A gas-burning power station

Here are some data about these two types of power station.

Type of power station	Solar farm	Gas-burning
Power output (MW)	35	1400

(i) Calculate the number of solar farms that would be needed to give the output power of this gas-burning power station.

Number of solar farms = ----- [2]

(ii) In the table, the 35 MW power of the solar farm is the **maximum** power it can produce.

Give **two** reasons why the output power is often less than 35 MW.

1 -----  
-----

2 -----  
-----

[2]

(b). \* Jane and Ben have different views about these power stations.



**Jane**

Solar farms look ugly and take up a lot of space. Their output power is really small. A gas-burning power station provides much more power. Making the PV panels is very polluting, so it's not as green as people say.

**Ben**  
Gas is not renewable. It produces carbon dioxide when burnt which is damaging for the environment.



Describe the **advantages** and **disadvantages** of both power stations using Jane and Ben's views.

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### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		A renewable energy resource will not run out / is not finite	1	<b>ora</b> <b>do not allow</b> 'can be used again'
	b		2.7 (kW)	1	<b>allow</b> answers between 2.6 and 2.8
	c	i	230 v (1)  50 Hz (1)	2	mark voltage and frequency responses independently
		ii	Transformer	1	<b>ignore</b> references to step up / down
	d		(Choice clearly stated)  Comparative comments made regarding:  Efficiency (1) Cost (1) Environmental (1)  Consistent with the choice made	3	answers must only be based on the information in the table  answers where no clear choice is made but the candidate has made a valid comparative comment can score a maximum of 1 mark  the environmental mark can be awarded if the candidate has either acknowledged concerns regarding the environmental problem or suggested a means for mitigating the environmental problem e.g. careful management of nuclear waste etc.  <b>allow</b> gas has 38% efficiency to imply most efficient <b>allow</b> nuclear costs 2 to 2.5 p per kWh to imply cheapest
	e		Wind / water / wave / hydroelectric / tidal / solar / geothermal	1	<b>do not allow</b> nuclear or biomass. <b>allow</b> gas turbine
			<b>Total</b>	<b>9</b>	

## Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
2	<p><i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p><b>(Level 3)</b></p> <p>Balanced explanation of both points of view linked to the risks / benefits.  <b>AND</b>            Judgement made as to the better argument.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p style="text-align: right;">(5–6 marks)</p> <p><b>(Level 2)</b></p> <p>Explains at least one point in favour of nuclear power and one against.  <b>AND</b>            Makes a reasoned choice of Pam or Suraiya as being right.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p style="text-align: right;">(3–4 marks)</p> <p><b>(Level 1)</b></p> <p>States differences between renewable and non-renewable energy sources.  <b>AND</b>            Considers only one side of the argument.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p>	6	<p><b>AO1.1 Renewable vs. Non-renewable energy resources</b>  <b>For example:</b></p> <ul style="list-style-type: none"> <li>• coal and oil are non – renewable so will run out</li> <li>• nuclear is also non renewable</li> <li>• a renewable energy resource will not run out e.g. wind, wave, solar etc.</li> </ul> <p><b>AO1.1 Nuclear energy hazards</b>  <b>For example:</b></p> <ul style="list-style-type: none"> <li>• ionising radiation can have hazardous effects, notably on human body tissue.</li> </ul> <p><b>AO2.2 Compare the ways in which the main energy resources are used to generate electricity</b></p> <p><b>AO 3.1b Risk / benefit</b></p> <ul style="list-style-type: none"> <li>• CO<sub>2</sub> contributes to global warming</li> <li>• nuclear waste could leak / enter the biosphere</li> <li>• risk small, but consequence serious</li> <li>• possibility of employment in new power station</li> <li>• which may bring money into the area</li> <li>• nuclear power stations don't produce CO<sub>2</sub> (once built)</li> <li>• coal / gas produce CO<sub>2</sub></li> <li>• solar / wind / hydroelectric / tidal don't produce CO<sub>2</sub></li> <li>• radioactive waste produced in nuclear power stations.</li> </ul> <p><b>AO3.2b</b>  <b>Judgement made as to the better argument</b></p>

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			(1–2 marks)		
			No response or no response worthy of credit.		
			(0 marks)		
			<b>Total</b>	<b>6</b>	
3		i	spiral (2 <sup>nd</sup> answer)	1	<p><b>Examiner's Comments</b></p> <p>Many candidates found this difficult and could not use the power given in the table to work out that the spiral bulb used the most energy each second.</p>
		ii	fluorescent (1 <sup>st</sup> answer)	1	<p><b>Examiner's Comments</b></p> <p>More candidates recognised that 230V was the mains supply in the UK and therefore the fluorescent bulb was the correct answer.</p>
		iii	two (2 <sup>nd</sup> answer)	1	<p><b>Examiner's Comments</b></p> <p>The majority of candidates worked out that two cells would power the filament lamp in this case.</p>
			<b>Total</b>	<b>3</b>	

### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
4	<p><b>(Level 3)</b> Addresses Brian's comments including at least two scientific points <b>AND</b> Makes at least two suggestions to reduce a problem. Quality of written communication does not impede communication of the science at this level.</p> <p style="text-align: right;">(5 – 6 marks)</p> <p><b>(Level 2)</b> Explains the science that supports one of Brian's comments <b>AND</b> suggests one way to reduce a problem. <b>OR</b> Several explanations of the science that supports Brian's comments, <b>OR</b> Suggests several ways to reduce problems. Quality of written communication partly impedes communication of the science at this level.</p> <p style="text-align: right;">(3 – 4 marks)</p> <p><b>(Level 1)</b> Attempts to explain the science that supports one of Brian's comments <b>AND</b> 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.</p> <p style="text-align: right;">(1 – 2 marks)</p> <p><b>(Level 0)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p> <p style="text-align: right;">(0 marks)</p>	[6]	<p>This question is targeted at grades up to E Indicative scientific points may include: <b>Brian's comments</b> inefficient power stations</p> <ul style="list-style-type: none"> <li>• buildings/houses lose heat</li> <li>• so need to use energy to heat them more</li> <li>• vehicles burn petrol/diesel/fossil fuels</li> <li>• vehicle (engines) are inefficient</li> <li>• fossil fuels running out or not renewable</li> <li>• pollution, global warming, or other example.</li> <li>• There are other causes, suitable example (e.g. electrical appliances left on standby, inefficient lights)</li> </ul> <p><b>Indicative ways to reduce a problem:</b></p> <ul style="list-style-type: none"> <li>• Reduce the use of fossil fuels</li> <li>• use example alternative sources (e.g. nuclear power, solar)</li> <li>• make power stations more efficient/use waste heat from power stations</li> <li>• improving insulation (examples of which double glazing, draught proofing, cavity walls = three ways)</li> <li>• use electric vehicles or more efficient engines</li> <li>• use public transport, walk, cycle (= one way).</li> <li>• reduce other causes of energy waste e.g. energy efficient lights.</li> <li>• encourage fuel efficient technology (legislation, financial incentives)</li> <li>• encourage fuel efficient behaviour (use smart meters, increase price of fuel/electricity, offers on improvements)</li> </ul> <p>'More efficient' (cars, power stations, etc.) suggests inefficiency and an improvement.</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> <p><b>Examiner's Comments</b></p>

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					<p>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.</p>
			<b>Total</b>	<b>6</b>	
5			1 <sup>st</sup> & 3 <sup>rd</sup> boxes (colder in March, used electric lights more)	2	<p>one mark each</p> <p><b>Examiner's Comments</b></p> <p>This question was done well, with the majority scoring at least one mark and many scoring two marks. A common error was to choose that the cost of a kWh was less in March.</p>
			<b>Total</b>	<b>2</b>	

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
6		water/ H <sub>2</sub> O (1); generator/ dynamo/ alternator (1); magnet/ electromagnet (1)	3	<p><b>Examiner's Comments</b></p> <p>Most candidates knew that water turns into steam, but turbines and generators were confused, and other suggestions such as fans, motors and 'wind' were suggested, for 'generator' and for 'magnet.' Reading the question more carefully might have helped students who suggested 'coal' or 'heat' instead of water.</p>
		<b>Total</b>	<b>3</b>	
7		oil and gas (1) hydroelectric and wave (1) hydroelectric and wave (1) nuclear (1)	4	<p>both needed either order</p> <p>both needed either order</p> <p>both needed either order</p>
		<b>Total</b>	<b>4</b>	

## Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
8	<p><b>[Level 3]</b> Gives two examples from two contexts of domestic, workplace or national or one example from all three contexts. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Quality of written communication does not impede communication of the science at this level. <span style="float: right;">(5–6 marks)</span></p> <p><b>[Level 2]</b> Concentrates on one context but gives several examples or gives examples from two of domestic, workplace and national contexts. For the most part the information is relevant and presented in a structured and coherent format. Quality of written communication partly impedes communication of the science at this level. <span style="float: right;">(3–4 marks)</span></p> <p><b>[Level 1]</b> Gives two examples in a domestic, workplace or national context. Answer may be simplistic. There may be limited use of specialist terms. Quality of written communication impedes communication of the science at this level. <span style="float: right;">(1–2 marks)</span></p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. <span style="float: right;">(0 marks)</span></p>	6	<p>This question is targeted at grades up to E</p> <p><b>Relevant points include:</b></p> <p><b>Domestic, eg:</b></p> <ul style="list-style-type: none"> <li>• better home insulation</li> <li>• double glazing</li> <li>• energy saving light bulbs</li> <li>• use public transport instead of cars.</li> </ul> <p><b>Work place, eg:</b></p> <ul style="list-style-type: none"> <li>• better insulation of offices</li> <li>• combined heat and power projects</li> <li>• factories use waste energy for heating.</li> </ul> <p><b>National, eg:</b></p> <ul style="list-style-type: none"> <li>• producing regulations to make buildings more energy efficient.</li> <li>• public awareness campaign</li> <li>• renewable example(s) reduce demand on power stations.</li> <li>• build more efficient power stations</li> <li>• recycling.</li> </ul> <p><b>Ignore other references to solar panels / wind turbines / renewable energy sources / environmentally friendly</b></p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> <p><b><u>Examiner's Comments</u></b></p> <p>The best responses were ones which were context led and well structured, clearly identifying 'home, workplace and nationally'. Unfortunately, the majority of responses were ones that did not refer to a specific context but concentrated on domestic examples and the weaker candidates simply referred to several examples of turning things off. The question was about reducing energy demand, so the many answers discussing renewable sources without realising this will not reduce demand gained no marks.</p>

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					Turning things off and using energy saving bulbs were common whilst better home insulation etc got mentioned far less.
			<b>Total</b>	<b>6</b>	

### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
9	<p><b>(Level 3)</b> Uses a correct, relevant calculation(s) and discusses both advantages and disadvantages.</p> <p>Quality of written communication does not impede communication of the science at this level.</p> <p style="text-align: right;">(5–6 marks)</p> <p><b>(Level 2)</b> May quote data without calculation. Attempts a balanced argument of advantages and disadvantages OR an unbalanced argument supported by calculation.</p> <p>Quality of written communication partly impedes communication of the science at this level.</p> <p style="text-align: right;">(3–4 marks)</p> <p><b>(Level 1)</b> Qualitative discussion of one side of the argument only. May not attempt a balanced argument.</p> <p>Quality of written communication impedes communication of the science at this level.</p> <p style="text-align: right;">(1–2 marks)</p> <p><b>(Level 0)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p> <p style="text-align: right;">(0 marks)</p> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks</b></p>	6	<p><b>This question is targeted at grades up to C</b> <b>Indicative scientific points may include:</b> Ignore confusion between PV and solar heating panels.</p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• no CO<sub>2</sub> / no pollution produced / won't harm environment / eco-friendly</li> <li>• renewable / will not run out</li> <li>• power cuts won't affect them</li> <li>• reduces the household bill</li> <li>• can get money for excess electricity produced in the summer</li> <li>• the electricity produced is free</li> <li>• would help towards a government target of renewable energy generation.</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• doesn't produce all of the electricity required / less electricity in winter when needed most</li> <li>• needs lots of panels / not enough panels for whole bill</li> <li>• initial cost / outlay of money / takes time to pay back</li> <li>• cloud cover will reduce output</li> <li>• won't work at night / no light at night</li> <li>• will have to have other source of energy / mains supply for the night</li> <li>• heavy / damaging on roof</li> <li>• ugly</li> <li>• maintenance needed.</li> </ul> <p><b>Data calculations</b></p> <ul style="list-style-type: none"> <li>• 40 panels required to provide all the electricity</li> <li>• 12 panels produce <math>12 \times 0.6 = 7.2</math> kWh not 24kWh</li> <li>• total area of 12 panels is <math>= 12 \times 1.5 \times 0.8 = 14.4</math> m<sup>2</sup></li> <li>• energy bill is reduced by a third</li> <li>• the cost of 12 panels is <math>12 \times \text{£}200 = \text{£}2400</math>.</li> </ul> <p><b>Examiner's Comments</b></p> <p>Almost all candidates attempted this six-</p>

### Mark Scheme

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'.
			<b>Total</b>	<b>6</b>	
10			coal burning power station	1	<p><b>Examiner's Comments</b></p> <p>It was pleasing to see that most candidates knew that coal burning power stations produce greenhouse gases.</p>
			<b>Total</b>	<b>1</b>	

### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
11	<p><b>(Level 3)</b> An advantage and a disadvantage for each identified power station. Quality of written communication does not impede communication of the science at this level.</p> <p style="text-align: right;">(5–6 marks)</p> <p><b>(Level 2)</b> <b>EITHER</b> One advantage <b>and</b> disadvantage for one identified power station <b>OR</b> One advantage or one disadvantage for nuclear <b>and</b> one advantage or one disadvantage for gas. Quality of written communication partly impedes communication of the science at this level.</p> <p style="text-align: right;">(3–4 marks)</p> <p><b>(Level 1)</b> An advantage or disadvantage for an identified power station. Quality of written communication impedes communication of the science at this level.</p> <p style="text-align: right;">(1–2 marks)</p> <p><b>(Level 0)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p> <p style="text-align: right;">(0 marks)</p>	6	<p>This question is targeted at grades up to E Indicative scientific points about gas may include:</p> <p><b>advantages</b></p> <ul style="list-style-type: none"> <li>• build power stations quickly / cheaply</li> <li>• can respond quickly to changes in demand</li> <li>• gas supply in the UK</li> <li>• doesn't depend on weather / season</li> <li>• can be built anywhere.</li> </ul> <p><b>disadvantages</b></p> <ul style="list-style-type: none"> <li>• produces carbon dioxide</li> <li>• (which is) a cause of global warming.</li> <li>• it is not renewable / sustainable</li> <li>• contributes to acid rain.</li> </ul> <p>Indicative scientific points about nuclear may include:</p> <p><b>advantages</b></p> <ul style="list-style-type: none"> <li>• no carbon dioxide produced (in use)</li> <li>• can provide lots of energy</li> <li>• doesn't depend on weather / season</li> <li>• not in short supply or more sustainable (ignore 'it is renewable').</li> </ul> <p><b>disadvantages</b></p> <ul style="list-style-type: none"> <li>• produces nuclear waste</li> <li>• which remains radioactive for a very long time</li> <li>• and can cause cancer</li> <li>• more expensive / slow to build and / or decommission</li> <li>• needs to be near water</li> <li>• will run out eventually.</li> </ul> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> <p><u>Examiner's Comments</u></p>

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				<p>?</p> <p>Candidates often gave the advantage of gas to be that the power stations produce a lot of energy, but this is not generally true when compared with nuclear power stations. Some candidates grouped both stations together to give the advantages and disadvantages of both (presumably when compared to renewable options). Better responses mentioned carbon dioxide and/or global warming. 'Air pollution' was a weaker answer often seen, and some other weak answers simply cited 'pollution'. A lot of candidates thought that nuclear was a renewable option, that nuclear power stations are cheap to build but expensive to run, and gas power stations are safer.</p>																				
		<b>Total</b>	<b>6</b>																					
12	a	dark / cold in the winter (1) need (more) energy / electricity / power for heat / light (in the wintertime in the UK) (1) in the wintertime turbines in action more (often) (1) more power / energy / electricity output (when windier) (1)	2	any two points <b>allow</b> light / hot in summer (1) <b>ignore</b> wind farms need wind  <u><b>Examiner's Comments??</b></u>  Many candidates said something about generating more power, or about needing more power for heating. There were a number who seemed not to understand the term wind farm. They thought that wind farms grew crops, or that the farmer could use the electricity to keep the animals warm. Some candidates thought that the electricity made in the winter could be stored to use in the summer.																				
	b	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Place</th> <th style="text-align: left;">wind?</th> <th style="text-align: left;">distribution?</th> <th></th> </tr> </thead> <tbody> <tr> <td>Paisley</td> <td>no</td> <td>yes</td> <td>(1)</td> </tr> <tr> <td>Leuchars</td> <td>yes</td> <td>yes</td> <td>(1)</td> </tr> <tr> <td>Kinloss</td> <td>no</td> <td>yes</td> <td>(1)</td> </tr> <tr> <td>Kirkwall</td> <td>yes</td> <td>no</td> <td>(1)</td> </tr> </tbody> </table>	Place	wind?	distribution?		Paisley	no	yes	(1)	Leuchars	yes	yes	(1)	Kinloss	no	yes	(1)	Kirkwall	yes	no	(1)	4	1 mark for each correct row <b>accept</b> only yes / Y and no / N responses  <u><b>Examiner's Comments??</b></u>  This was answered well. Candidates must take care to follow instructions; as all the boxes needed completing.
Place	wind?	distribution?																						
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		<b>Total</b>	<b>6</b>																					

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Question	Answer/Indicative content	Marks	Guidance
13	<p><b>(Level 3)</b> Discusses advantages and disadvantages to householders and to the country as a whole, using examples from all three areas. Quality of written communication does not impede communication of the science at this level.  (5–6 marks)</p> <p><b>(Level 2)</b> Discusses advantages and disadvantages, using examples from more than one area. May restrict answer to householders or to the country as a whole but not consider both. Quality of written communication partly impedes communication of the science at this level.  (3–4 marks)</p> <p><b>(Level 1)</b> Discusses advantages or disadvantages using examples from one area <b>OR</b> gives an advantage <b>and</b> disadvantage, using examples from one area. May restrict answer to householders or to the country as a whole but not consider both. Quality of written communication impedes communication of the science at this level.  (1–2 marks)</p> <p><b>(Level 0)</b> Insufficient or irrelevant science. Answer not worthy of credit.  (0 marks)</p>	[6]	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include: <b>Supply issues</b></p> <ul style="list-style-type: none"> <li>• reliability</li> <li>• capacity</li> <li>• locating sufficient sites for installation</li> <li>• displaced land use</li> <li>• reduces the need to import energy from other countries</li> </ul> <p><b>Environmental impact</b></p> <ul style="list-style-type: none"> <li>• reduces use of fossil fuels</li> <li>• less CO<sub>2</sub></li> <li>• reduces global warming</li> <li>• habitat loss</li> <li>• identified pollution, e.g. health issues related to air quality, ugly solar farms, noisy wind farms</li> <li>• no radioactive waste produced</li> </ul> <p><b>Economic impact</b></p> <ul style="list-style-type: none"> <li>• cheaper</li> <li>• installation costs</li> <li>• job loss / creation</li> <li>• payback time</li> <li>• need to be aware of lobbying by e.g. local groups, big oil companies</li> <li>• renewables won't run out / sustainable</li> </ul> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	<b>Total</b>	<b>6</b>	

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Question			Answer/Indicative content			Marks	Guidance
14	a	i	Wire	Connected to National Grid	Is at the same voltage as the ground	2 (AO 1.1 ×2)	all 3 correct gets 2 marks. 2 correct gets 1 mark. No marks if only one correct.  <u>Examiner's Comments</u>  Candidates were credited one mark out of the two available if they put 2 ticks in the correct columns. Whilst most candidates recalled that the Live wire is connected to the National Grid, there was some confusion about the Neutral and Earth wires.
			Live	✓			
			Neutral	✓			
			Earth		✓		
		ii	230 V ✓			1 (AO 1.1)	0 V   12 V <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">230 V</span> 25000 V  <u>Examiner's Comments</u>  Although many candidates correctly chose 230V, a common error was to choose 12V.
	b			True only for d.c	True only for a.c	2 (AO 1.1 ×2)	<u>Examiner's Comments</u>  Many candidates were able to recall that the current flows only in one direction for d.c. circuits, but fewer recalled that the UK domestic supply uses a.c. Several thought that both a.c and d.c were used.
		Current always flows in the same direction.	✓				
		The domestic supply in the UK uses this.		✓			
<b>Total</b>						<b>5</b>	

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Question			Answer/Indicative content	Marks	Guidance
15	a	i	<p><b>FIRST CHECK THE ANSWER ON THE ANSWER LINE.</b>  <b>If answer = 40 award 2 marks</b></p> <p>Number = <math>1400 \text{ (MW)} / 35 \text{ (MW)}</math> ✓            = 40 ✓</p>	<p>2            (AO 2.2            ×2)</p>	<p><b><u>Examiner's Comments</u></b></p> <p>This question was notable for being straightforward for all but the lowest ability candidates.</p>
		ii	<p><b>Any two from:</b></p> <p>Does not work at night ✓</p> <p>Days are shorter in winter ✓</p> <p>Less power generated in cloud/rain ✓</p> <p>Early morning/late evening the Sun is very low ✓</p> <p>Panels get dirty / rays blocked by objects (e.g. trees) ✓</p>	<p>2            (AO 2.1            ×2)</p>	<p><b>ALLOW</b> 1 max for idea that there is not always enough sunlight</p> <p><b>ALLOW</b> Sunlight not always directly on them</p> <p><b><u>Examiner's Comments</u></b></p> <p>Candidates' answers to this question were very good and showed a well-founded understanding of solar panels and how they should be sited for best effect. A minority of candidates overthought the question, missed the obvious answers, and struggled to find more technical reasons.</p>

### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
b	<p><i>Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.</i></p> <p><b>Level 3 (5–6 marks)</b> Describes some advantages and disadvantages of <b>BOTH</b> solar farms and gas-burning power stations, showing an understanding of non-renewable and renewable energy resources.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> Describes some <u>advantages</u> of <b>BOTH</b> solar farms and gas-burning power stations, showing an understanding of non-renewable and renewable energy resources. <b>OR</b> Describes some <u>disadvantages</u> of <b>BOTH</b> solar farms and gas-burning power stations, showing an understanding of non-renewable and renewable energy resources. <b>OR</b> Describes some advantages and disadvantages of <b>BOTH</b> solar farms and gas-burning power stations.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> Describes some advantages and disadvantages of gas-burning power stations <u>ONLY</u>. <b>OR</b> Describes some advantages and disadvantages of solar farms <u>ONLY</u>. <b>OR</b> Describes some advantages or disadvantages of <b>BOTH</b> solar farms and gas-burning power stations.</p>	<p style="text-align: center;">6 (AO 1.1 ×2) (AO 3.2b ×4)</p>	<p><b>AO1.1 Demonstrates knowledge and understanding of renewable vs. non-renewable energy resources</b> For example:</p> <ul style="list-style-type: none"> <li>• Gas is non – renewable so will run out</li> <li>• Solar is renewable</li> <li>• A renewable energy resource will not run out</li> </ul> <p><b>AO3.2b Draws a conclusion describing advantages and disadvantages</b> For example: Advantages – solar farm</p> <ul style="list-style-type: none"> <li>• A solar farm can be used for grazing animals</li> <li>• Less pollution produced when generating electricity</li> <li>• solar power stations don't produce CO<sub>2</sub> (once built)</li> </ul> <p>Advantages – gas-burning power station</p> <ul style="list-style-type: none"> <li>• More power produced than solar farms</li> <li>• Gas is not reliant on weather conditions/light levels</li> </ul> <p>Disadvantage – solar farm</p> <ul style="list-style-type: none"> <li>• maximum solar output is 40 × smaller than gas [ECF part (a)]</li> <li>• Reliant on the weather conditions</li> <li>• Solar panel production is polluting</li> <li>• Looks ugly</li> <li>• Solar farms take up space</li> </ul>

## Mark Scheme

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	<p>OR</p> <p>Shows an understanding of non-renewable and renewable energy resources.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b></p> <p><i>No response or no response worthy of credit.</i></p>		<p>Disadvantage – gas-burning power station</p> <ul style="list-style-type: none"> <li>• CO<sub>2</sub> contributes to global warming</li> <li>• Gas produces CO<sub>2</sub></li> <li>• which damages the environment</li> </ul> <p><b>Examiner's Comments</b></p> <p>Candidates were well prepared for this type of Level of Response (LoR) question. They had clearly spent time learning how to answer them and these efforts paid off. Many candidates wrote excellent well-balanced responses considering advantages and disadvantages of gas-fired power stations and solar farms. Lower ability candidates generally considered several of the factors in their answers. Most candidates made good use of the information they were given.</p> <p><b>Exemplar 3</b></p> <p><b>13</b> Describe the advantages and disadvantages of both power stations using Jane and Ben's views.</p> <p><i>Solar farms have a small output power which can be hard for people to sustain, whereas gas-burning power stations provide a lot of power for people to use. But gas is not renewable and can pollute the environment with CO<sub>2</sub> unlike solar farms. If looking into future, solar would be better on the environment would not be damaged in any way and the energy source would not run out.</i> [6]</p> <p>Exemplar 3 is a Level 3 response covering advantages and disadvantages, including the fact that gas is not renewable.</p>

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			<p><b>Exemplar 4</b></p> <p>Describe the advantages and disadvantages of both power stations using Jane and Ben's views.</p> <p>Using gas burning power stations it produces carbon dioxide which causes the green house effect which then leads to an increase in global warming, however they do produce more energy quicker. solar panels are good because it <del>does</del> does not cause harm to the environment, but they do take up a lot of space unless they are put on the roof of houses, however they do not provide as much energy as gas burning stations and there isn't always sunlight to provide us that energy.</p> <p>Exemplar 4 is a Level 2 response which gives a well-reasoned balance of advantages and disadvantages. However exemplar 4 does not mention the central issue that gas is non-renewable, or that solar panels use a renewable energy resource. This important factor was included in Ben's comment and at Level 3 candidates were expected to show an understanding of non-renewable and renewable energy resources</p> <p><b>Exemplar 5</b></p> <p>Describe the advantages and disadvantages of both power stations using Jane and Ben's views.</p> <p>A gas burning power station provides more power. It makes PV panels very polluted. However, it is not renewable and it produces carbon dioxide when burnt. Although it takes up a lot of space, it is providing 1400MW of power.</p> <p>Exemplar 5 is a Level 1 answer. The candidate considers only gas burning power stations. They clearly did not understand Jane's comment about making photovoltaic panels.</p>
	<b>Total</b>	<b>10</b>	