Energy Questions Part 2

35 Questions

Name: _____

Class: _____

Date: _____

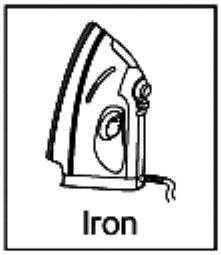
Time:

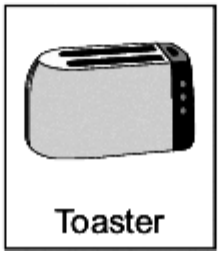
Marks:

Comments:

Q1.

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.

3

(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)

Q2.

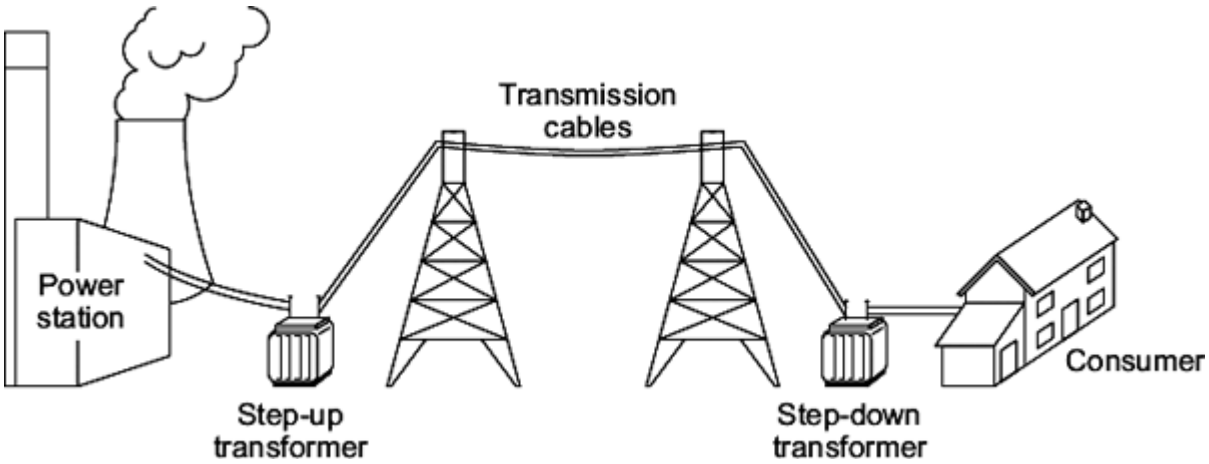
In the UK, most electricity is generated in power stations that burn fossil fuels.

(a) Which type of fossil fuel power station has the shortest start-up time?

_____

(1)

(b) The diagram shows how electricity is distributed around the UK.



(i) Which of the parts labelled in the diagram form the National Grid?

_____

(1)

(ii) A step-up transformer is used near the power station.

Draw a ring around the correct answer in each box to complete each sentence.

A step-up transformer increases the

- current.
- power.
- voltage.

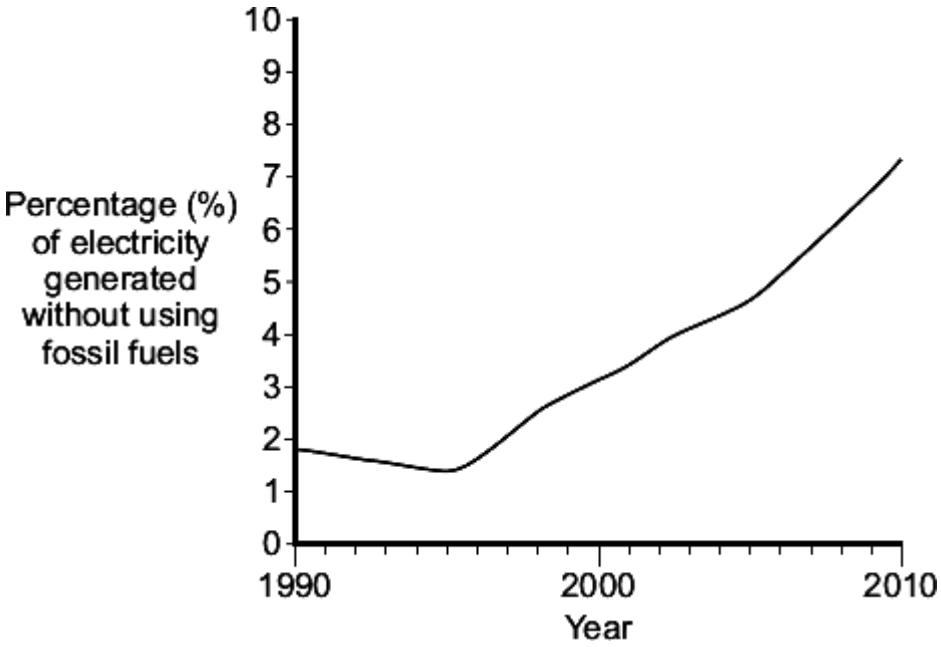
Using a step-up transformer makes the distribution of electricity

- less dangerous.
- more efficient.
- work faster.

(2)

(c) Electricity in the UK is also generated without using fossil fuels.

The graph shows how the percentage of electricity generated in the UK without using fossil fuels changed between 1990 and 2010.



What does the data in the graph suggest will probably happen to the percentage of electricity generated in the UK without using fossil fuels over the next 10 years?

_____

_____

(1)

(Total 5 marks)

Q3.

(a) Geothermal energy and the energy of falling water are two resources used to generate electricity.

(i) What is geothermal energy?

_____

_____

(1)

(ii) Hydroelectric systems generate electricity using the energy of falling water.

A pumped storage hydroelectric system can also be used as a way of storing energy for future use.

Explain how.

_____

_____

_____

_____

_____

(2)

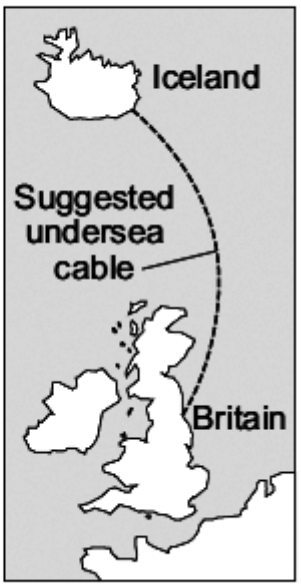
(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Read the following extract from a newspaper.

Britain may be switched on by Iceland

Iceland is the only country in the world generating all of its electricity from a combination of geothermal and hydroelectric power stations. However, Iceland is using only a small fraction of its energy resources. It is estimated that using only these resources, the amount of electricity generated could be increased by up to four times.

To help supply the future demand for electricity in Britain, there are plans to build thousands of new offshore wind turbines. It has also been suggested that the National Grid in Britain could be linked to the electricity generating systems in Iceland. This would involve laying a 700 mile undersea electricity cable between Iceland and Britain.



Discuss the advantages and disadvantages of the plan to build thousands of offshore wind turbines around Britain **and** the suggested electricity power link between Britain and Iceland.

_____

_____

_____

_____

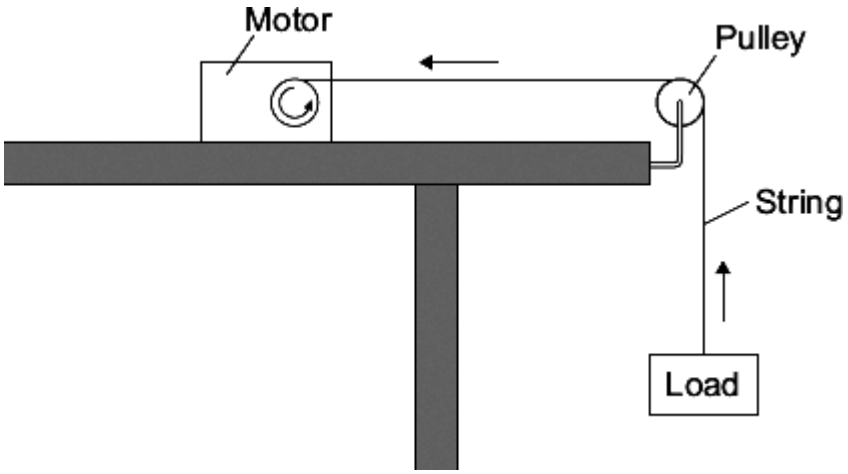
_____

(6)

(Total 9 marks)

Q4.

A student uses an electric motor to lift a load.



In the motor, the electrical energy is transferred into other types of energy. Some of this energy is useful and the rest of the energy is wasted.

(a) (i) Name the useful energy output from the electric motor.

_____

(1)

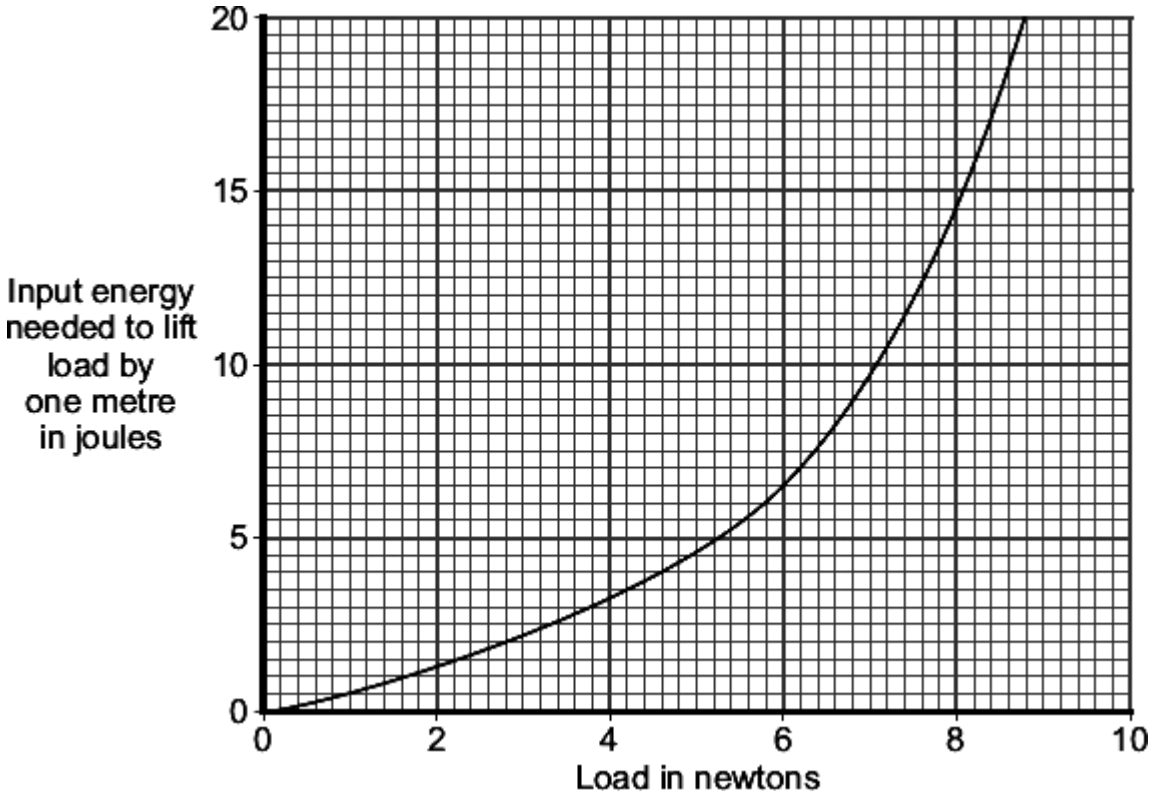
(ii) What eventually happens to the wasted energy?

_____

_____

(1)

(b) The graph shows the input energy the motor needs to lift different loads by one metre.



What can you conclude from the graph about the relationship between the load lifted and the input energy needed?

_____

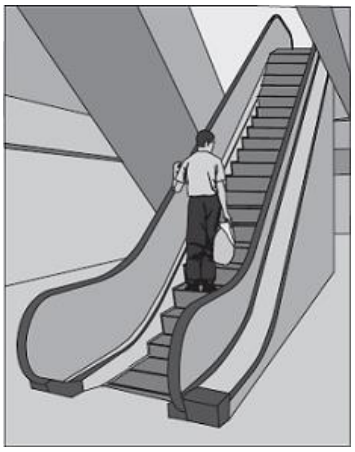
_____

_____

_____

(2)

(c) A shop uses escalators to lift customers to different floor levels. The escalators use electric motors. When the shop is not busy some escalators are turned off. A sign tells the customers that the escalators are turned off to save energy.



(i) Each escalator has one motor with an average power of 4000 W. The motor is turned on for an average of 8 hours each day, 6 days each week. Electricity costs 15 pence per kilowatt-hour.

Calculate the cost of the electricity used in an average week to run **one** escalator.

Show clearly how you work out your answer.

_____

_____

_____

_____

Cost = _____ pence

(3)

(ii) Give **one** environmental advantage to turning off electrical appliances when they are not being used.

_____

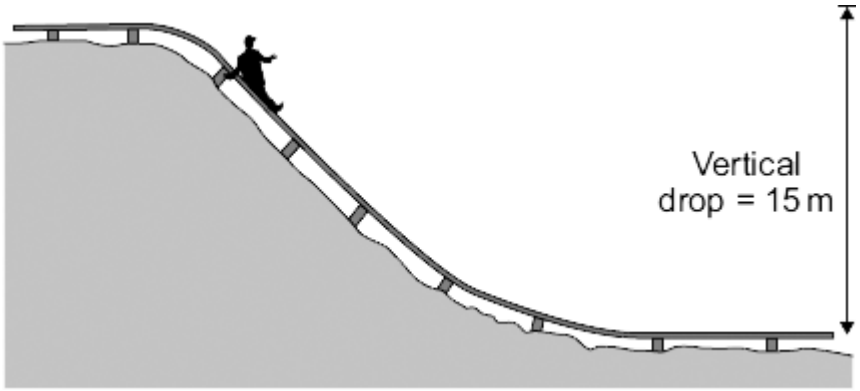
_____

(1)

(Total 8 marks)

Q5.

The miners working in a salt mine use smooth wooden slides to move quickly from one level to another.



(a) A miner of mass 90 kg travels down the slide.

Calculate the change in gravitational potential energy of the miner when he moves 15 m vertically downwards.

gravitational field strength = 10 N/kg

Show clearly how you work out your answer.

_____

_____

Change in gravitational potential energy = _____ J

(2)

(b) Calculate the **maximum** possible speed that the miner could reach at the bottom of the slide.

Show clearly how you work out your answer.

Give your answer to an appropriate number of significant figures.

_____

_____

_____

_____

Maximum possible speed = _____ m/s

(3)

(c) The speed of the miner at the bottom of the slide is much less than the calculated maximum possible speed.

Explain why.

_____

_____

_____

_____

_____

_____

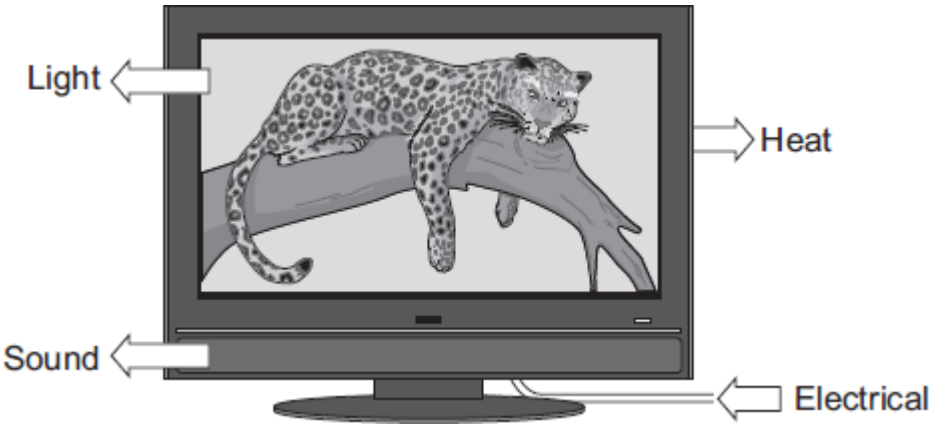
_____

(3)

(Total 8 marks)

Q6.

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



When the television is working, 1200 joules of energy are supplied to the television every second. The useful energy transferred by the television is 720 joules every second.

(i) Use the equation in the box to calculate the efficiency of the television.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

_____

_____

Efficiency = _____

(2)

(ii) Use **one** word from the diagram to complete the following sentence.

The electrical energy that is **not** usefully transformed by the television is

wasted as _____ .

(1)

(b) A homeowner is sent an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 800 kilowatt-hours.
Electrical energy costs 15p per kilowatt-hour.

Use the equation in the box to calculate the cost of the energy transferred from the mains electricity supply.

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

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

_____

_____

Cost = _____

(2)

(Total 5 marks)

Q7.

A farmer has installed a biogas electricity generator on his farm. This device generates electricity by burning the methane gas produced from rotting animal waste. Methane is a greenhouse gas. When methane burns, carbon dioxide and water are produced.

The animal waste rots in an anaerobic digester. The digester and the generator are kept inside a farm building and cannot be seen from the outside.

(a) The animal waste used in the anaerobic digester is a *renewable* energy source.

What is meant by an energy source being *renewable*?

_____

_____

(1)

(b) Suggest **one** reason why farmers have been encouraged to install their own biogas

generators.

_____

_____

(1)

(c) The farmer's monthly electricity bill using the mains electricity supply was £300. The biogas generator cost the farmer £18 000 to buy and install.

Assuming the biogas generator provides all of the farmer's electricity, what is the pay-back time for the generator?

_____

Pay-back time = _____

(1)

(d) It would have been cheaper for the farmer to have bought and installed a small wind turbine.

Give **two** advantages of using the biogas generator rather than a wind turbine, to generate the electricity used on the farm.

1. _____

_____

2. _____

_____

(2)

(Total 5 marks)

Q8.

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.

_____

_____

_____

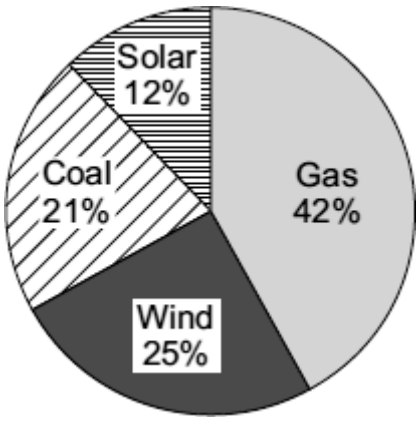
_____

(2)

(Total 6 marks)

Q9.

(a) The pie chart shows the energy sources used by one company to generate electricity.



(i) Which two energy sources used by the company do **not** produce any polluting gases?

_____ and _____

(1)

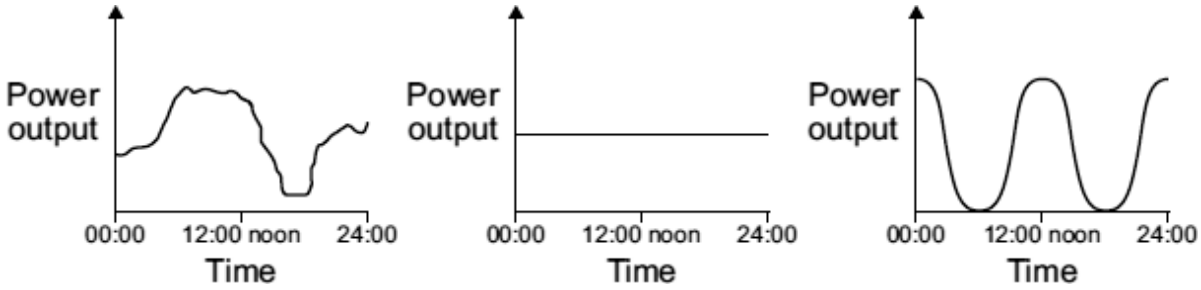
(ii) Calculate the percentage (%) of electricity that is generated using energy sources that do **not** produce any polluting gases.

Percentage = _____

(1)

(b) Which graph, **A**, **B** or **C**, is most likely to show the electrical power output from a wind turbine over one day?

Write your answer, **A**, **B** or **C**, in the box.

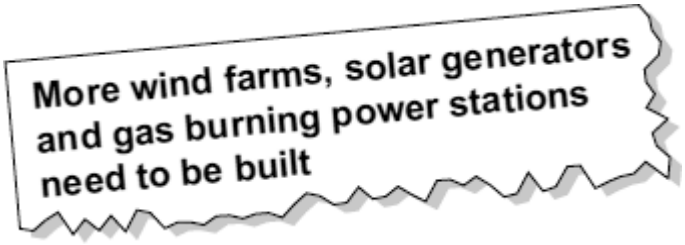


Graph **A** Graph **B** Graph **C**

Graph ☐

(1)

(c) The government has said that more electricity must be generated from renewable energy sources. A newspaper reported that:



Why is the statement in the newspaper incorrect?

_____

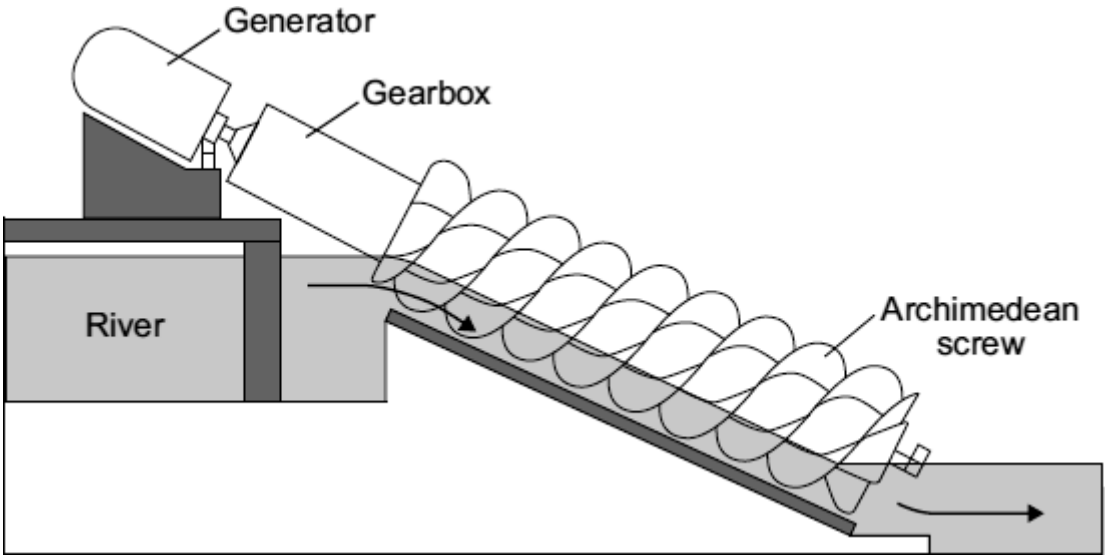
_____

(1)

(Total 4 marks)

Q10.

The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.
The Archimedean screw is linked to the generator by a gearbox.



(a) Complete the following sentence by drawing a ring around the correct word in the box.

The gravitational potential energy of the falling water is transformed

into the

chemical
electrical
kinetic

energy of the Archimedean screw.

(1)

(b) A micro-hydroelectric system generates about 60 kW of electricity, enough for 50 homes. A conventional large-scale hydroelectric power station may generate more than 5 000 000 kW of electricity.

(i) Give **one** advantage of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system.

_____

_____

(1)

(ii) Which **one** of the following statements gives a **disadvantage** of a conventional large-scale hydroelectric power station compared to a micro–hydroelectric system?

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

Energy is wasted as heat and sound. ☐

Large areas of land are flooded. ☐

A constant flow of water is needed. ☐

(1)

(c) The electricity generated by the micro-hydroelectric system is transferred directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to homes anywhere in the country through a system of cables and transformers.

(i) What name is given to the system of cables and transformers used to transfer electricity to homes anywhere in the country?

_____

(1)

(ii) Using short cables to transfer electricity to local homes is much more efficient than using very long cables to transfer electricity to homes anywhere in the country.

Why?

_____

_____

(1)

(d) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

Suggest **one** reason why in the UK much less electricity is generated using micro-hydroelectric generators, than in Nepal.

_____

_____

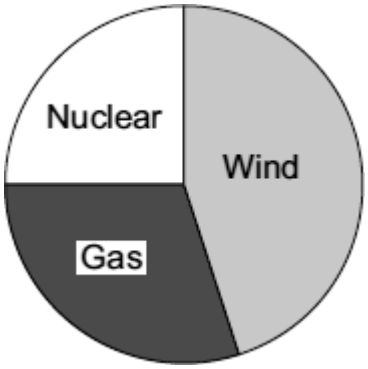
(1)

(Total 6 marks)

Q11.

(a) An electricity company claims to generate all of its electricity from environmentally friendly energy sources.

The energy sources used by the company are shown in the pie chart.



Do you think that the claim made by the company is correct?

Draw a ring around your answer.

Yes **No** **Maybe**

Explain the reasons for your answer.

_____

_____

_____

_____

(2)

(b) The government is committed to increasing the amount of electricity generated from renewable sources. A newspaper reported that:

> **More wind farms, wave powered generators, solar generators and nuclear power stations would need to be built**

Why is the statement made in the newspaper incorrect?

_____

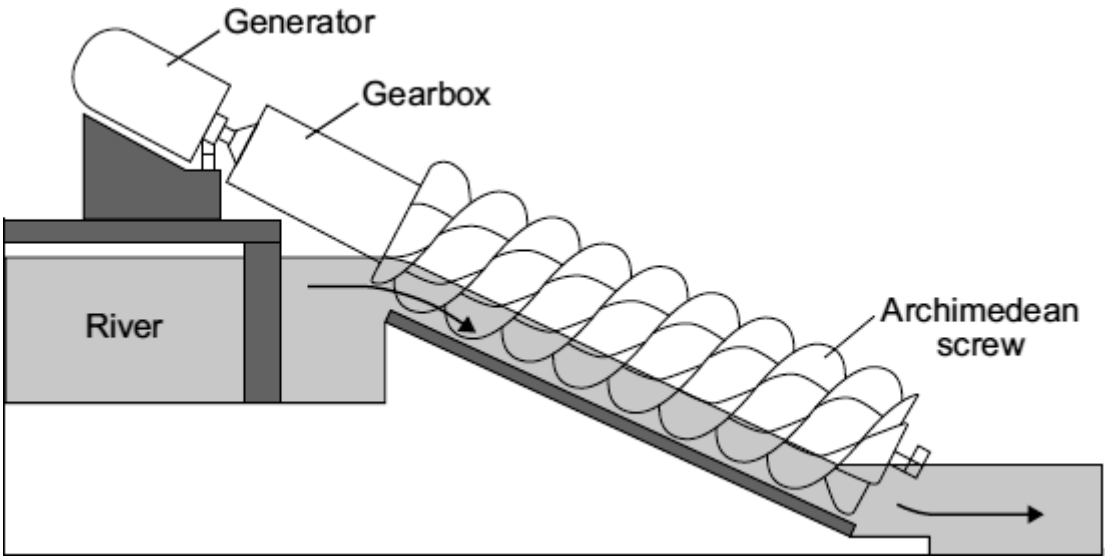
_____

(1)

(Total 3 marks)

Q12.

The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.
The Archimedean screw is linked to the generator by a gearbox.



(a) Each second, the *micro-hydroelectricity* generator transforms 80 000 joules of gravitational potential energy into 60 000 joules of electrical energy.

(i) Fill in the missing word to complete the energy transformation diagram.

Gravitational potential energy of the falling water	→	_____ energy of the Archimedean screw	→	Electrical energy generated

(1)

(ii) Use the equation in the box to calculate the efficiency of the *micro-hydroelectricity* generator.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

_____

_____

Efficiency = _____

(2)

(b) The power output from a conventional large-scale hydroelectric power station is 100 000 times more than the power output from a micro-hydroelectric system.

Give **one** disadvantage of a conventional large-scale hydroelectric power station compared to the micro-hydroelectric system.

_____

_____

(1)

(c) The electricity generated by a micro-hydroelectric system is transferred via a transformer directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to the National Grid, which distributes the electricity to homes anywhere in the country.

(i) What is the National Grid?

_____

_____

(1)

(ii) Explain why transferring the electricity directly to local homes is more efficient than using the National Grid to distribute the electricity.

_____

_____

_____

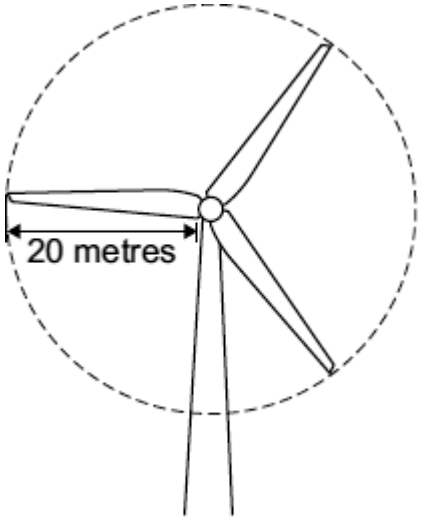
_____

(2)

(Total 7 marks)

Q13.

The diagram shows a wind turbine.



(a) The blades of the turbine are 20 metres long. On average, 15 000 kg of air, moving at a speed of 12 m/s, hit the blades every second.

Calculate the kinetic energy of the air hitting the blades every second.

Show clearly how you work out your answer.

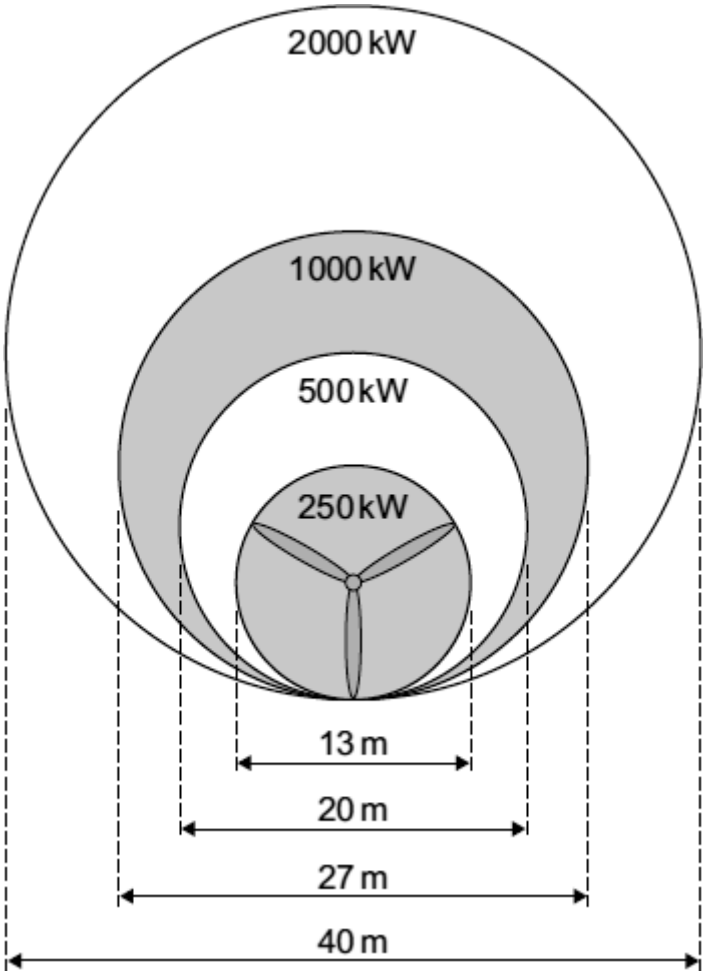
_____

_____

Kinetic energy = _____ J

(2)

(b) Part of the kinetic energy of the wind is transformed into electrical energy.
The diagram shows that, for the same wind speed, the power output of a turbine, in kilowatts, depends on the length of the turbine blades.



Give a reason why doubling the diameter of the blades more than doubles the power output of a turbine.

_____

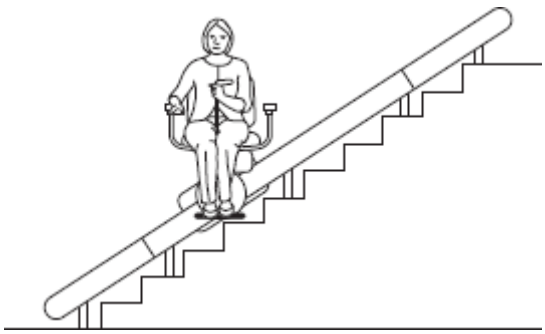
_____

(1)

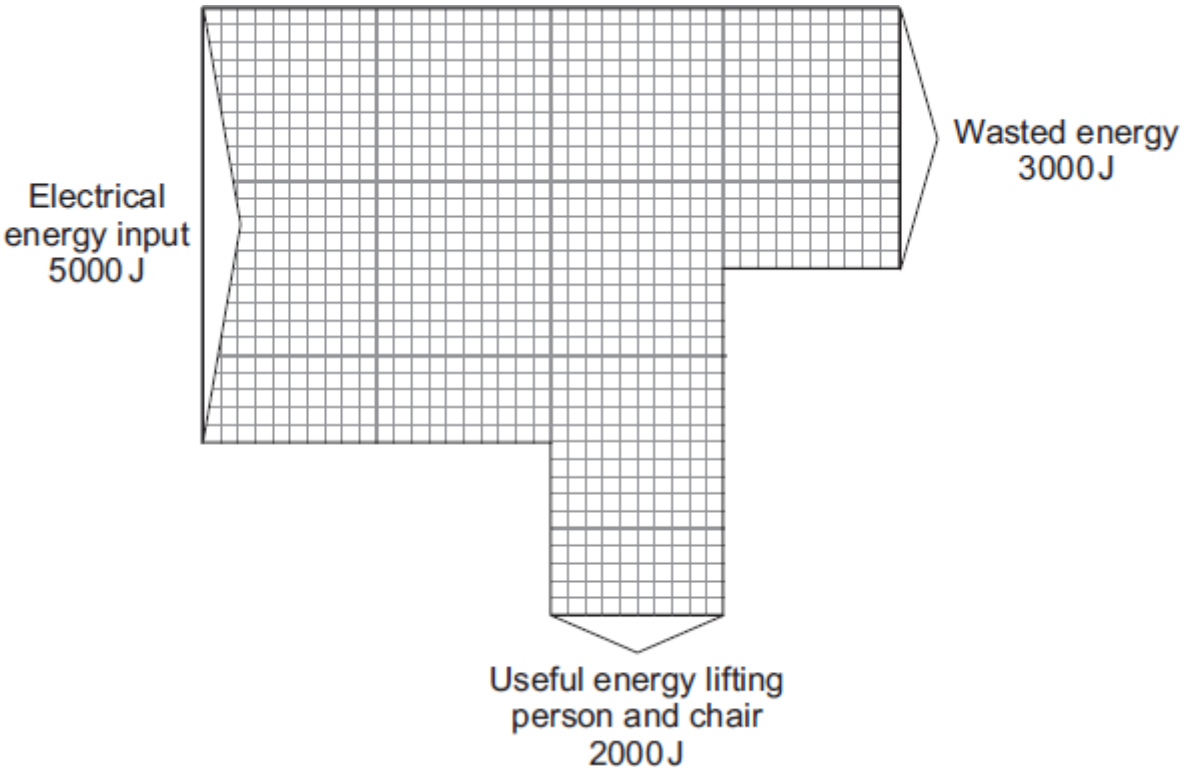
(Total 3 marks)

Q14.

A person uses a stairlift to go upstairs. The stairlift is powered by an electric motor.



The Sankey diagram shows the energy transfers for the electric motor.



(a) Complete the following sentence.

The electric motor wastes energy as _____ energy.

(1)

(b) Use the equation in the box to calculate the efficiency of the electric motor.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

_____

_____

Efficiency = _____

(2)

(Total 3 marks)

Q15.

(a) By 2023, nearly all of the existing nuclear power stations in the UK will be closed down.

(i) Before a nuclear power station can be demolished, the remaining nuclear fuel, radioactive waste materials and reactor must be carefully removed.

What is this process called?

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

decommissioning ☐

decontaminating ☐

dismantling ☐

(1)

(ii) The workers are exposed to radiation as they remove the reactor. One of the biggest risks is from the isotope cobalt-60, which has a half-life of 5.3 years.

Explain the advantage of waiting 11 years after a nuclear power station has closed down before starting to remove the reactor.

_____

_____

_____

_____

(2)

(b) It is almost certain that new nuclear power stations will be built in the UK.

The table shows the results of surveys asking people in the UK whether they were in favour of, or against, the building of new nuclear power stations.

	2001	**2005**	**2007**
Percentage (%) in favour	20	41	65
Percentage (%) against	60	28	20
Percentage (%) not sure	20	31	15

(i) From these surveys, how did public opinion on the building of new nuclear power stations change between 2001 and 2007?

_____

_____

(1)

(ii) Suggest a reason why some people may think that the results from these surveys are unreliable.

_____

_____

(1)

(iii) Give **one** reason in favour of building new nuclear power stations.

_____

_____

(1)

(c) The government of one Middle Eastern country has decided to build its first nuclear power station. The oil that would have been used to generate electricity can then be sold to other countries.

On what is this decision based?

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

economic issues ☐

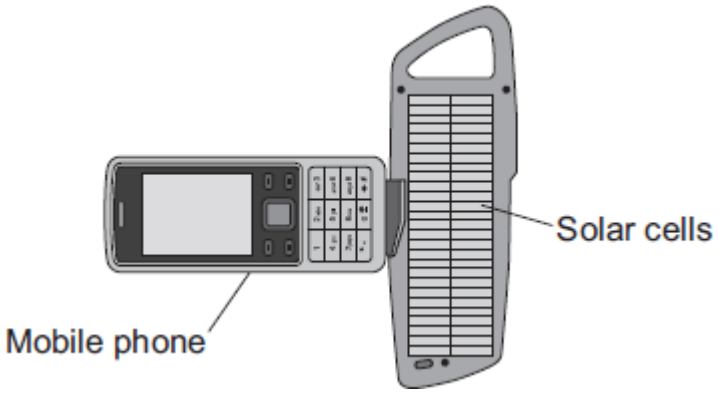
ethical issues ☐

social issues ☐

(1)
(Total 7 marks)

Q16.

(a) The diagram shows a solar powered device being used to recharge a mobile phone.



On average, the solar cells produce 0.6 joules of electrical energy each second.
The solar cells have an efficiency of 0.15.

(i) Calculate the average energy input each second to the device.

Show clearly how you work out your answer.

_____

_____

Average energy input each second = _____ J/s

(2)

(ii) Draw a labelled Sankey diagram for the solar cells.
The diagram does **not** need to be drawn to scale.

(1)

(b) Scientists have developed a new type of solar cell with an efficiency of over 40 %.
The efficiency of the solar cell was confirmed independently by other scientists.

Suggest why it was important to confirm the efficiency independently.

_____

_____

(1)

(c) The electricity used in homes in the UK is normally generated in a fossil fuel power station.

Outline some of the advantages of using solar cells to generate this electricity.

_____

_____

_____

_____

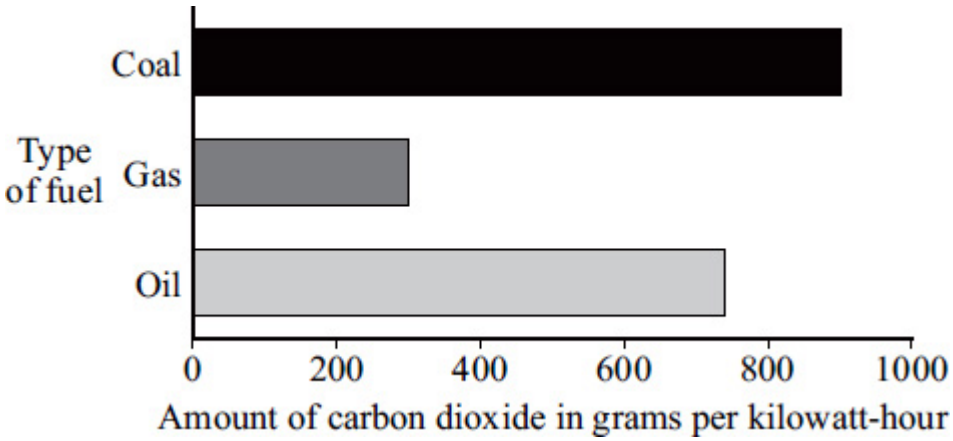
(2)

(Total 6 marks)

Q17.

(a) Most electricity in the UK is generated in power stations that burn fossil fuels.

The bar chart shows how much carbon dioxide is produced for each kilowatt-hour of electricity generated using a fossil fuel.



(i) Which fossil fuel produces the smallest amount of carbon dioxide for each kilowat-hour of electricity generated?

_____

(1)

(ii) Which **one** of the following statements gives the reason why the data has been shown as a bar chart and not as a line graph?

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

Both variables are categoric. ☐

Both variables are continuous. ☐

One variable is categoric, the other is continuous. ☐

(1)

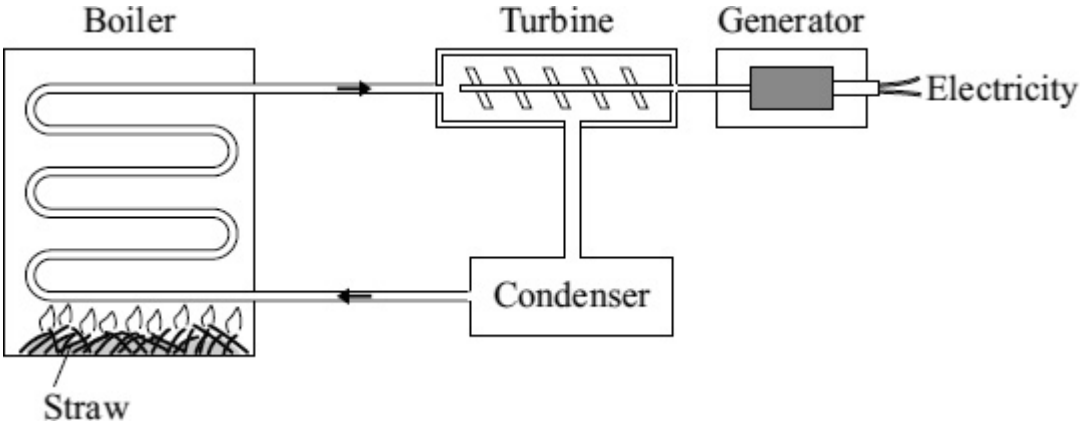
(iii) Why does a nuclear power station **not** produce any carbon dioxide?

_____

_____

(1)

(b) Some types of power station generate electricity by burning straw.



(i) Use words from the box to complete the following sentences.

boiler	**gas**	**generator**	**steam**	**turbine**	**water**

Straw is burned in a _____ Water is heated to make

_____ which is used to drive a _____

This turns a _____ to produce electricity.

(4)

(ii) Straw is a type of renewable energy source known as a biofuel.

Name **one** other type of renewable energy source used to produce electricity.

_____

(1)

(iii) A power station generates 36 000 000 watts (36 MW) of electrical power by burning straw. The average power used in each home in the UK over one year is 2000 watts.

Calculate the number of homes that the power station could supply electricity to.

Show clearly how you work out your answer.

_____

_____

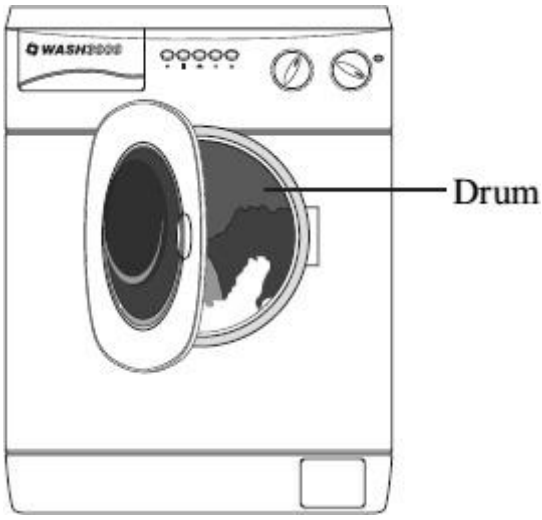
Number of homes = _____

(2)

(Total 10 marks)

Q18.

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 A B C D E Less efficient	A
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.

_____

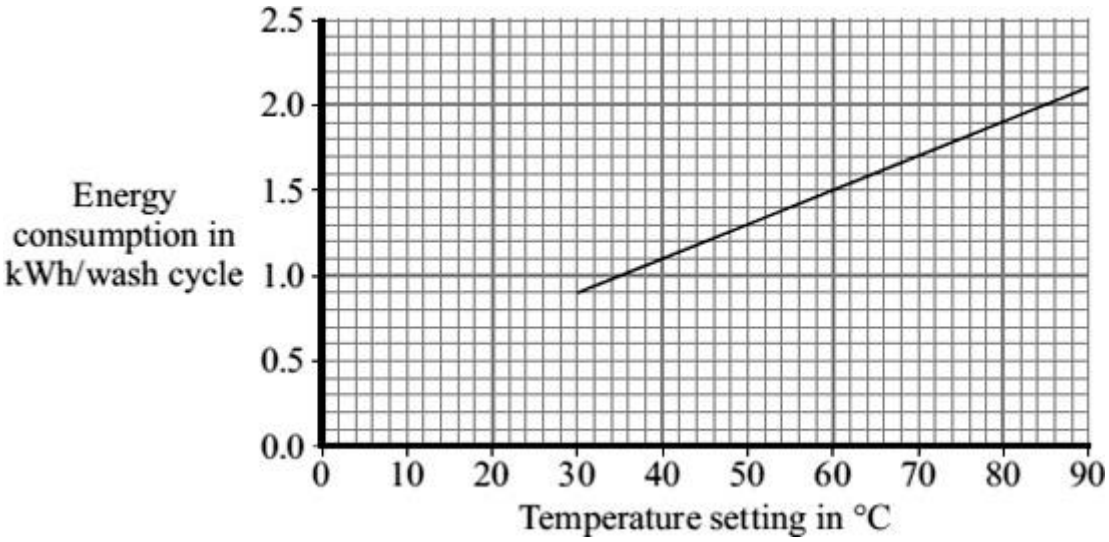
_____

_____

_____

(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.

total cost = number of kilowatt-hours × 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)

Q19.

Over the next 15 years, some of the older nuclear power stations will be closed down, and the process of *decommissioning* will start. In the same period, several countries plan to build a number of new nuclear power stations.

(a) (i) What does it mean to *decommission* a nuclear power station?

_____

_____

(1)

(ii) How does *decommission*ing affect the overall cost of electricity generated using nuclear fuels?

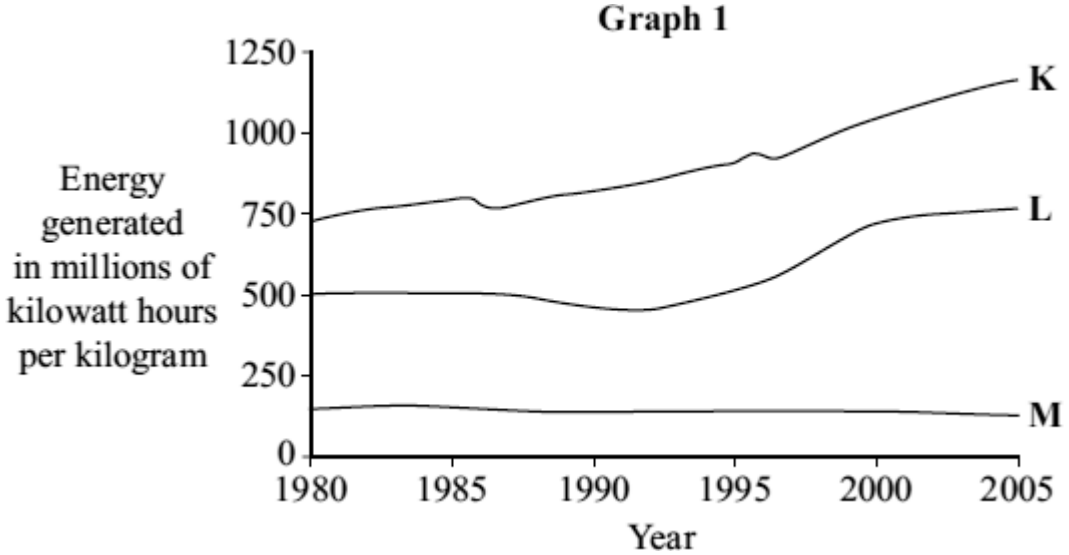
_____

_____

(1)

(b) Uranium is a fuel used in nuclear power stations to generate electricity.

Graph 1 compares how the electricity generated from one kilogram of nuclear fuel changed between 1980 and 2005 in three different types of nuclear power station.



(i) Compare the efficiency of the three types of power station, **K**, **L** and **M**, between 1980 and 2005.

_____

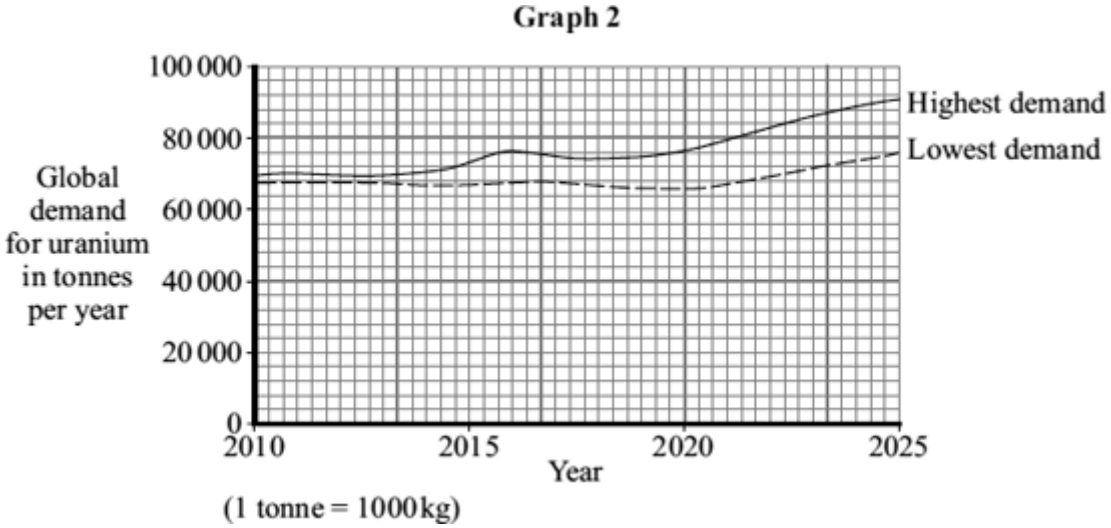
_____

_____

_____

(2)

Graph 2 shows two different predictions for the global growth in uranium demand over the next few years.



(ii) Suggest reasons why it is **not** possible to predict accurately how much

uranium will be needed in 2025.

_____

_____

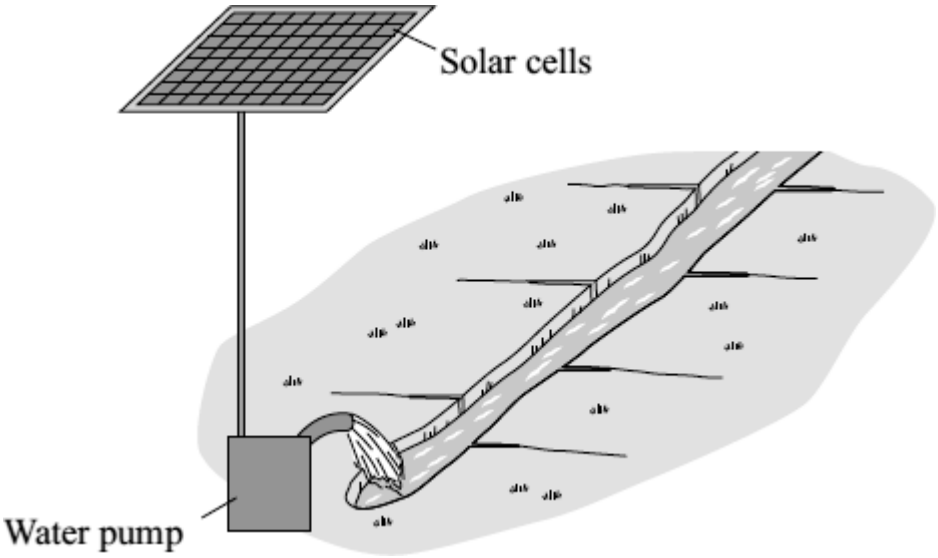
_____

_____

(2)
(Total 6 marks)

Q20.

The farmers in a village in India use solar powered water pumps to irrigate the fields.



On average, a one square metre panel of solar cells receives 5 kWh of energy from the Sun each day.
The solar cells have an efficiency of 0.15

(a) (i) Calculate the electrical energy available from a one square metre panel of solar cells.

Show clearly how you work out your answer.

_____

_____

Electrical energy = _____ kWh

(2)

(ii) On average, each solar water pump uses 1.5 kWh of energy each day.

Calculate the area of solar cells required by one solar water pump.

Area = _____ square metres

(1)

(b) Give **one** reason why the area of solar cells needed will probably be greater than the answer to part (a)(ii).

_____

_____

(1)

(Total 4 marks)

Q21.

Four students are talking about the different energy sources used to generate electricity in the areas where they live.

(a) Draw **one** line from where each student lives (**List A**) to the energy source in their area (**List B**).

Draw only **four** lines.

List A Where each student lives	**List B** Energy source
	Wind
Where I live is the sunniest part of the country.	
	Waves
Where I live, the land is very flat and it always seems to be windy.	
	Solar
Where I live, it is not safe to swim. The sea is always too rough.	
	Tides
Where I live, you can see steam coming out of the ground.	
	Geothermal

(4)

(b) All of the energy sources given in part **(a)** can be used to generate electricity.

What else do all these energy sources have in common?

_____

_____

(1)

(c) In a hydroelectric power station, the energy from falling water is used to generate electricity.

Which **one** of the following gives a **disadvantage** of a hydroelectric power station?

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

has a fast start-up time ☐

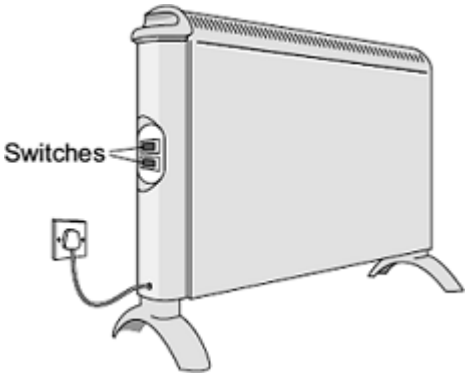
large areas of land are flooded ☐

polluting gases are produced ☐

(1)
(Total 6 marks)

Q22.

(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, in kilowatts, when it is switched to the **high** power setting?

_____

Power = _____ kilowatts

(1)

(ii) The heater is used on the **high** power setting. It is switched on for 1½ hours.

Calculate the energy transferred from the mains to the heater in 1½ hours.

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

_____

_____

_____

Energy transferred = _____

(3)

(iii) This type of heater is a very efficient device.

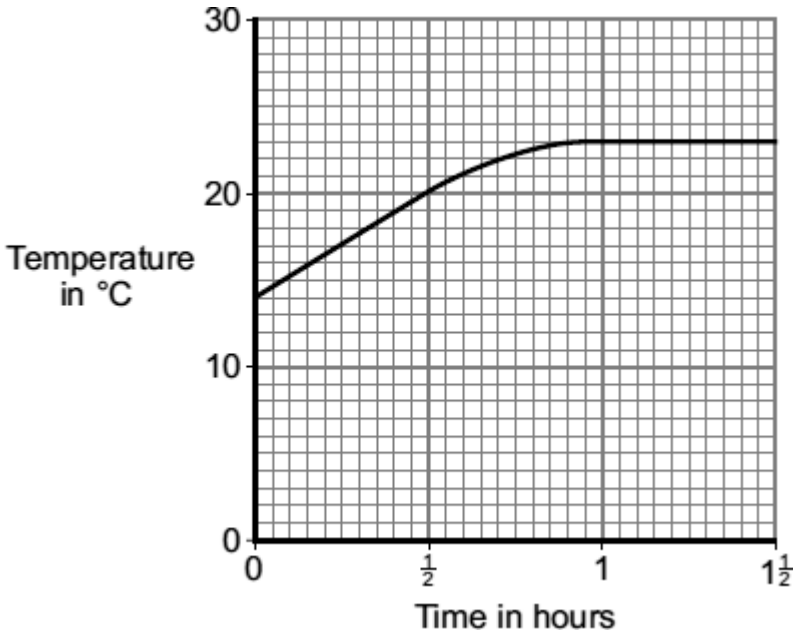
What is meant by a device being very efficient?

_____

_____

(1)

(b) The graph shows how the temperature of a room changes during the 1½ hours that the heater is used.



After 1 hour, the temperature of the room has become constant, even though the heater is still switched on.

Explain why.

_____

_____

_____

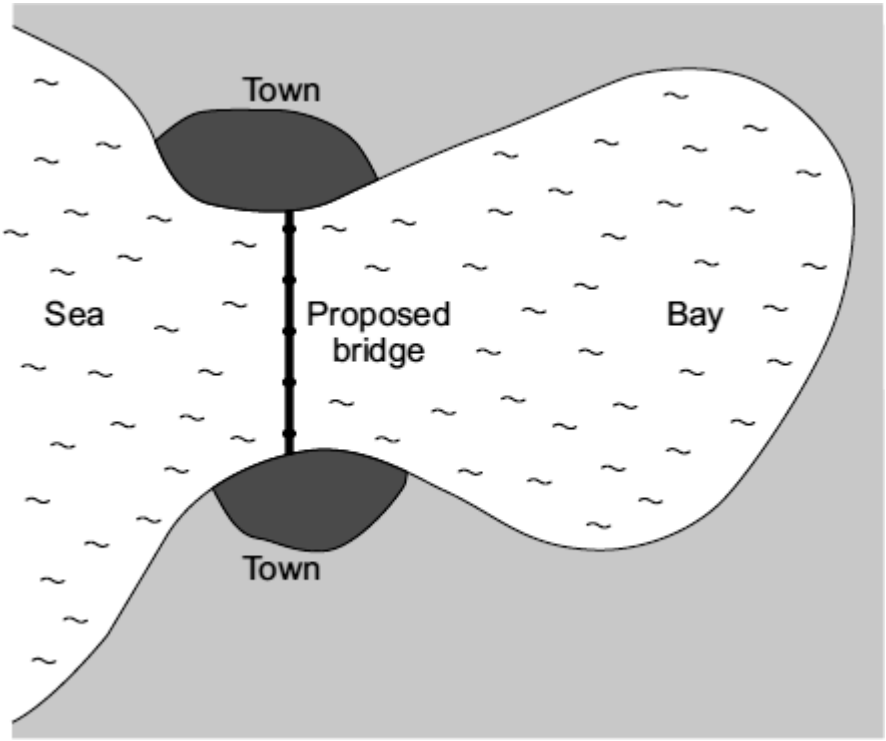
_____

(2)

(Total 7 marks)

Q23.

The map shows the positions of two towns on either side of a very large coastal bay in England. The map also shows where a bridge may be built to link the towns. The road journey from one town to the other is about 60 kilometres at present.



(a) It is estimated that building turbines and generators inside the legs of the bridge would produce enough electricity for both towns. In addition, enough electricity would be generated to run electric buses over the bridge between the two towns.

(i) If the bridge is built, what form of renewable energy will be used to generate the electricity?

_____

(1)

(ii) Most people living in the area are in favour of the proposed bridge.

Suggest **three** reasons why people would be in favour of building the bridge and the associated electricity generating scheme.

Reason 1 _____

_____

Reason 2 _____

_____

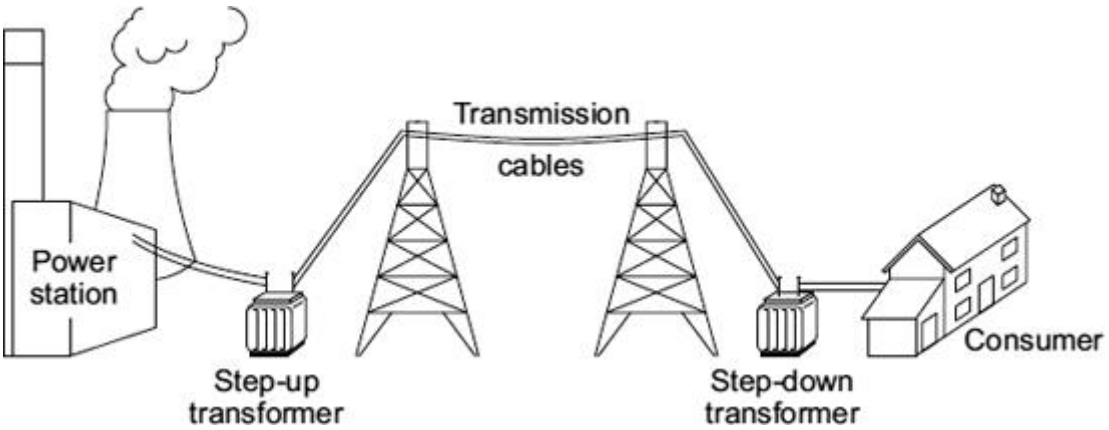
Reason 3 _____

_____

(3)

(b) Even with the proposed bridge, the two towns will need to stay connected to the National Grid.

The diagram shows part of the National Grid.



(i) Give **one** reason why the towns need to stay connected to the National Grid.

_____

_____

(1)

(ii) Explain how the step-up transformer increases the efficiency of the National Grid.

_____

_____

_____

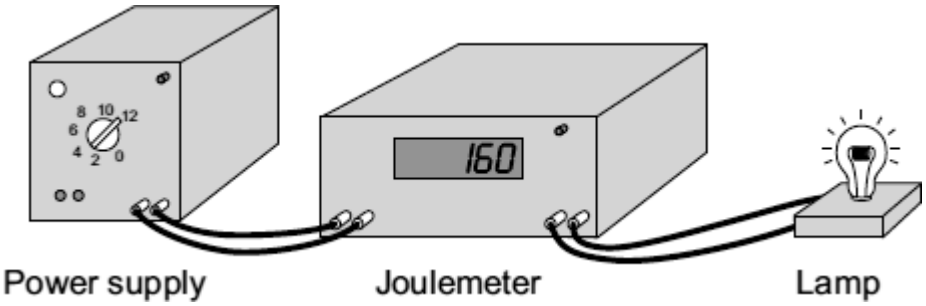
_____

(2)

(Total 7 marks)

Q24.

A student used a joulemeter to measure the energy transformed by a lamp.



The student set the joulemeter to zero, and then switched on the power supply.

After 120 seconds (2 minutes), the reading on the joulemeter had increased to 2880.

(a) In the space below, draw the circuit symbol used to represent a lamp.

(1)

(b) (i) Use the equation in the box to calculate the power of the lamp.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer.

_____

_____

Power = _____

(2)

(ii) Which **one** of the following is the unit of power?

Draw a ring around your answer.

joule **newton** **watt**

(1)

(c) Complete the following sentence using one of the phrases from the box.

larger than	the same as	smaller than

If the lamp was left switched on for 10 minutes, the amount of energy transformed would be _____ the amount of energy transformed in 2 minutes.

(1)

(Total 5 marks)

Q25.

The picture shows a solar-powered aircraft. The aircraft has no pilot.

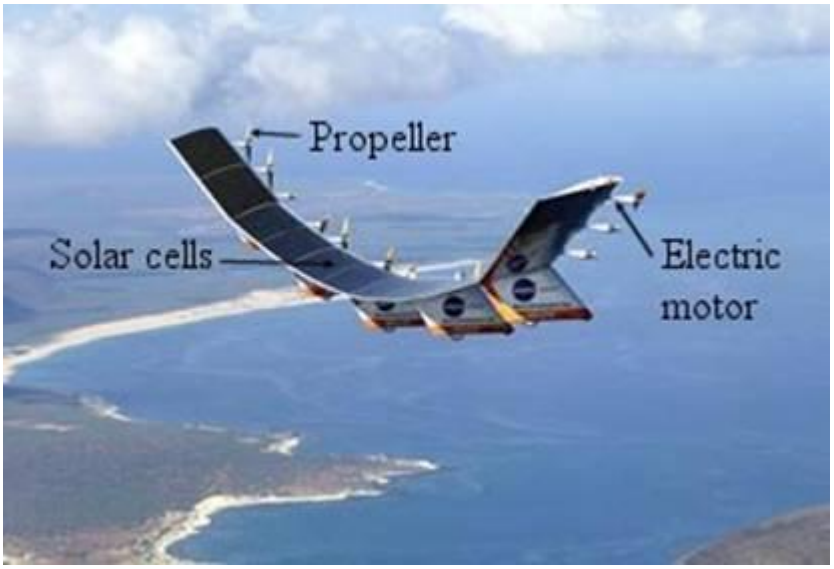


Photo by NASA.

(a) On a summer day, 175 000 joules of energy are supplied to the aircraft's solar cells every second. The useful energy transferred by the solar cells is 35 000 joules every second.

(i) Use the equation in the box to calculate the efficiency of the solar cells.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

_____

_____

Efficiency = _____

(2)

(ii) What happens to the energy that is **not** usefully transferred by the solar cells?

_____

(1)

(b) The aircraft propellers are driven by electric motors. As well as the solar cells, there are fuel cells that provide additional power to the electric motors.

(i) Suggest **one** advantage of the aircraft having fuel cells as well as the solar cells.

_____

(1)

(ii) Give **one** environmental advantage of using electric motors to drive the aircraft propellers rather than motors that burn a fuel.

_____

_____

(1)

(iii) Eventually, the designers want to produce an unmanned aircraft that can fly at twice the height of a passenger jet for up to six months.

Suggest **one** possible use for an aircraft such as this.

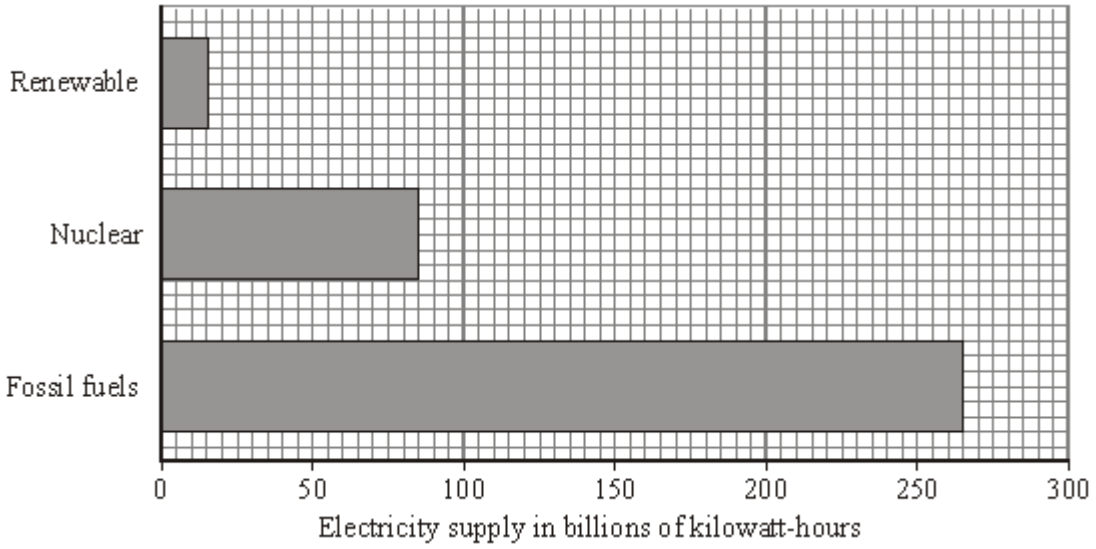
_____

_____

(1)
(Total 6 marks)

Q26.

The bar chart shows the different energy sources used to generate the UK's electricity in 2007.



(a) (i) The wind is a renewable energy source.

Name **one** more renewable energy source used to generate electricity.

_____

(1)

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

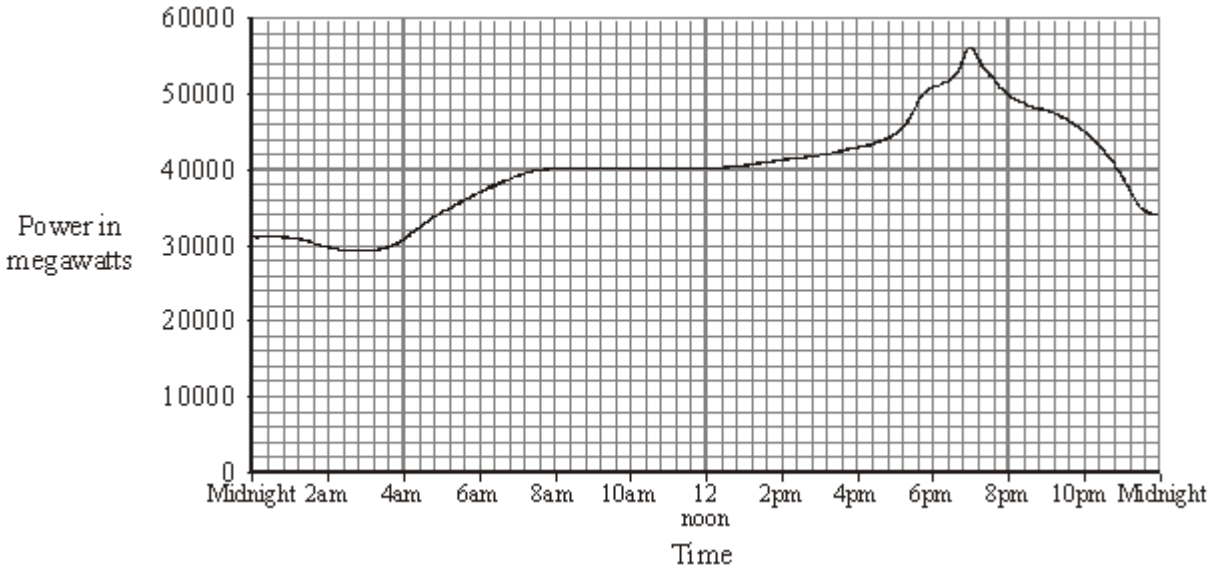
Using less fossil fuels to generate electricity will

decrease
not change
increase

the amount of carbon dioxide emitted into the atmosphere.

(1)

(b) The graph shows how the demand for electricity in the UK varied over one day in the winter.



(i) Describe how the demand for electricity varied between 4.00 am and 10.00 am.

_____

_____

_____

_____

(2)

(ii) Which type of power station has the fastest start-up time?

Draw a ring around your answer.

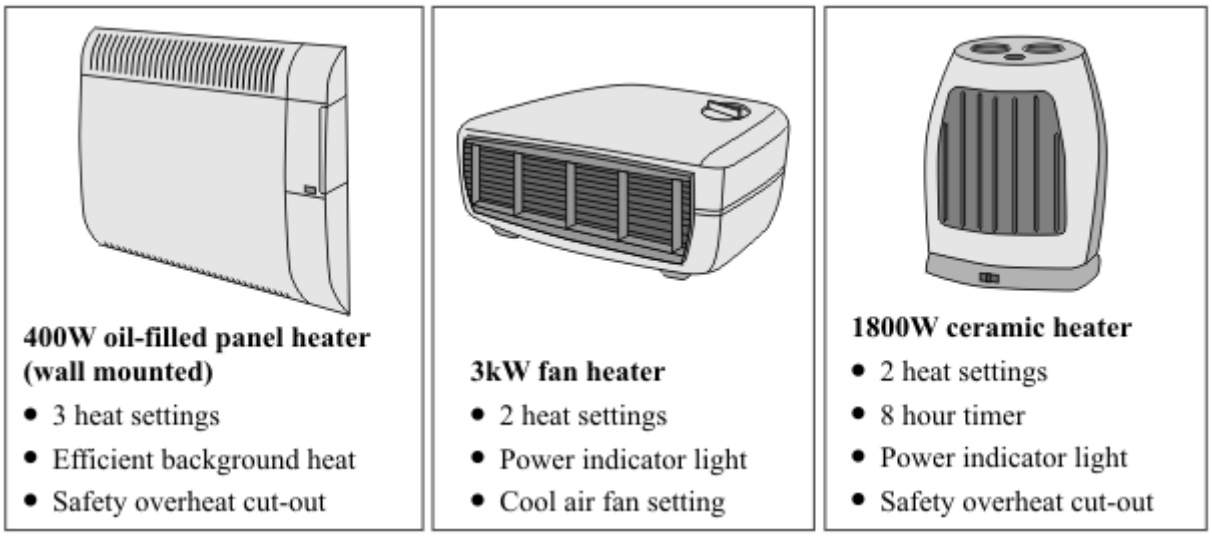
coal **natural gas** **nuclear** **oil**

(1)

(Total 5 marks)

Q27.

The pictures show three different types of electric heater.



(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 _____

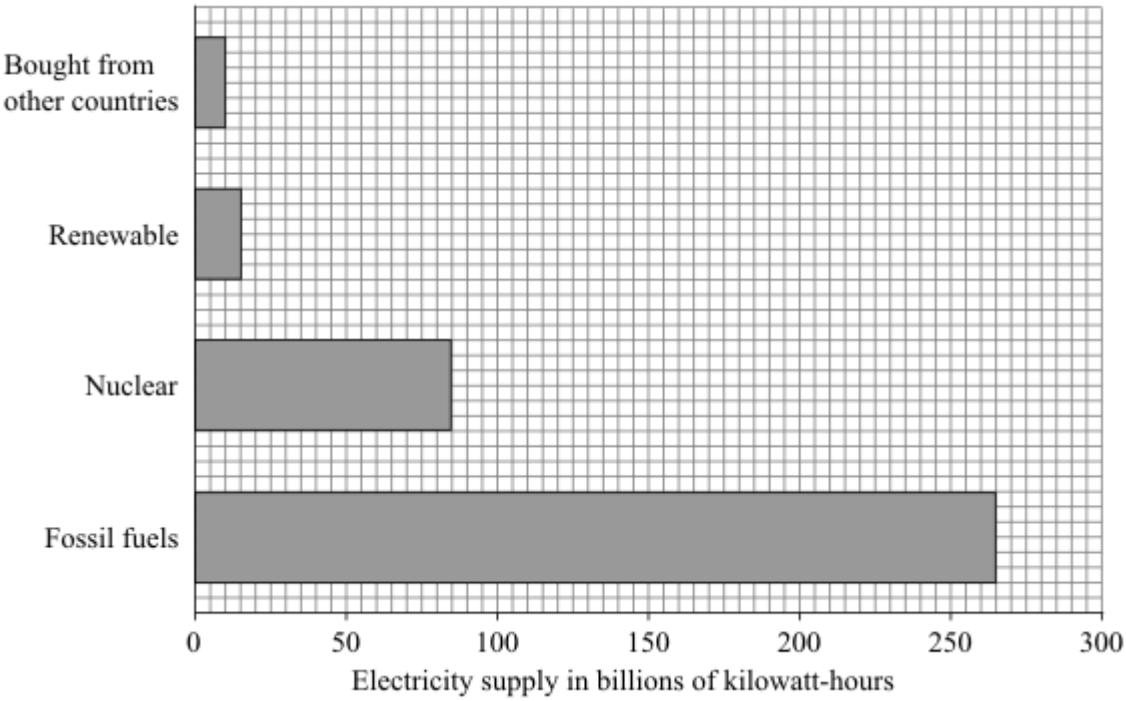
_____

(3)

(Total 6 marks)

Q28.

The bar chart shows how the UK's electricity demands in 2007 were met.



(a) What proportion of electricity was generated using renewable energy sources?

Show clearly how you work out your answer.

_____

_____

_____

_____

(2)

(b) By 2020, most of the UK's nuclear reactors and one-third of coal-fired power stations are due to close, yet the demand for electricity is expected to increase.

Four students, **A**, **B**, **C** and **D**, were asked how a demand of 380 billion kilowatt-hours could be met. They made the suggestions given in the table.

Student	Fossil fuels	Nuclear	Renewable	Bought from other countries
A	200	100	40	40
B	80	240	40	20
C	160	80	100	40
D	280	0	100	0

(i) Which student has made the suggestion most likely to result in the lowest carbon dioxide emissions?

_____

Give a reason for your answer.

_____

_____

(2)

(ii) Suggest **one** realistic way in which a householder could help to reduce the annual electricity demand.

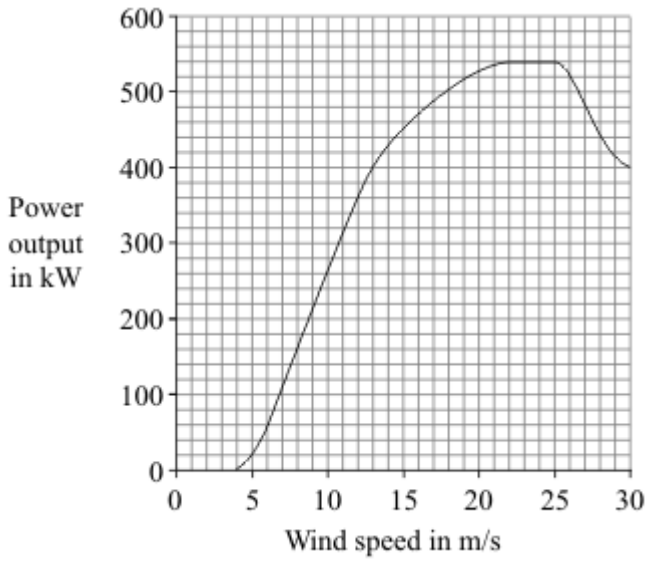
_____

_____

(1)

(c) To increase the amount of electricity generated using renewable energy resources would probably involve erecting many new wind turbines.

The graph shows the power curve of a wind turbine.



(i) Describe, in detail, how the power output of the turbine varies with the wind speed.

_____

_____

_____

_____

_____

_____

(3)

(ii) Give **one** disadvantage of using wind turbines to generate a high proportion of the electricity required in the UK.

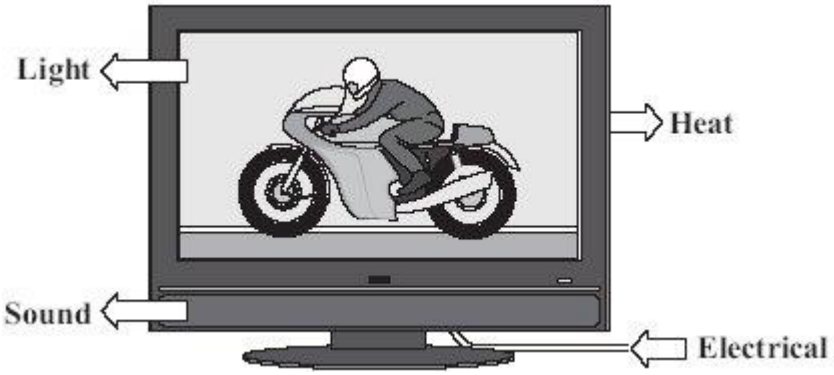
_____

_____

(1)
(Total 9 marks)

Q29.

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)

Q30.

Wind and tides are renewable energy sources that are used to generate electricity.

(a) Complete each sentence by putting a tick (✓) in the box next to the correct answer.

(i) The wind is:

a predictable energy source. ☐

a constant energy source. ☐

an unreliable energy source. ☐

(1)

(ii) The tides are:

a predictable energy source. ☐

a constant energy source. ☐

an unreliable energy source. ☐

(1)

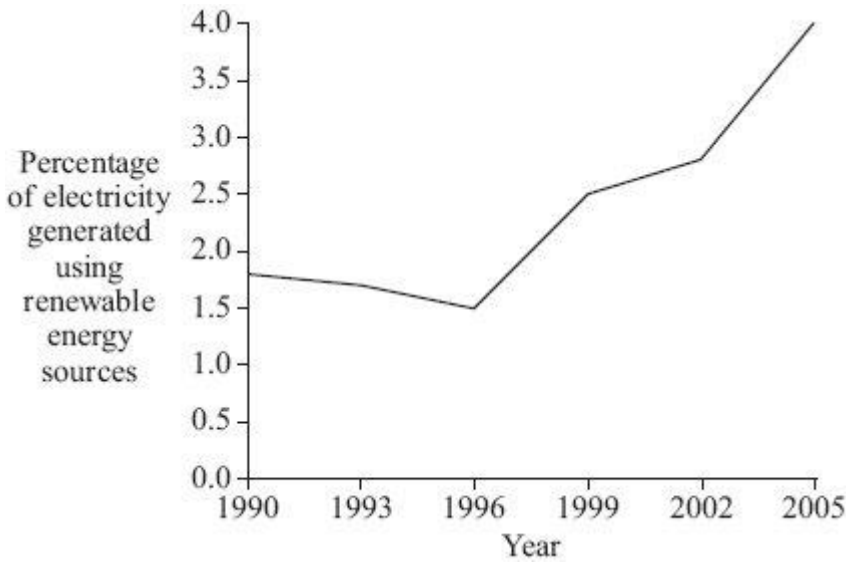
(b) If wood is to be used as a renewable energy source, what must be done each time a tree is chopped down?

_____

_____

(1)

(c) In the UK, electricity is generated using renewable and non-renewable energy sources.
The graph shows the percentage of electricity generated using renewable energy sources between 1990 and 2005.



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

In 2015, the percentage of electricity generated using renewable energy sources is

most likely to be

greater than 4%
equal to 4%
less than 4%

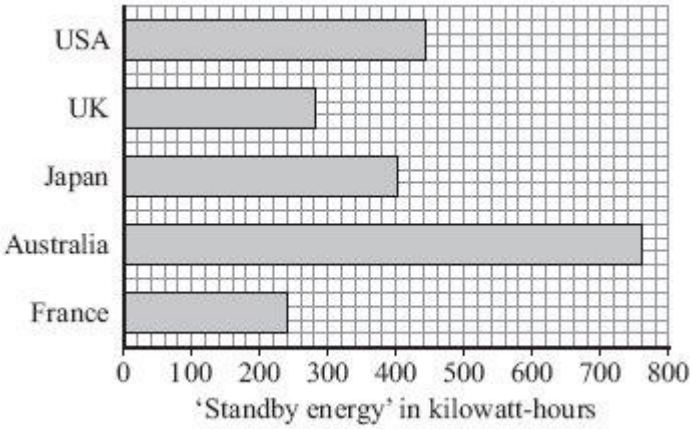
.

(1)
(Total 4 marks)

Q31.

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.

total cost = number of kilowatt-hours × 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. ☐

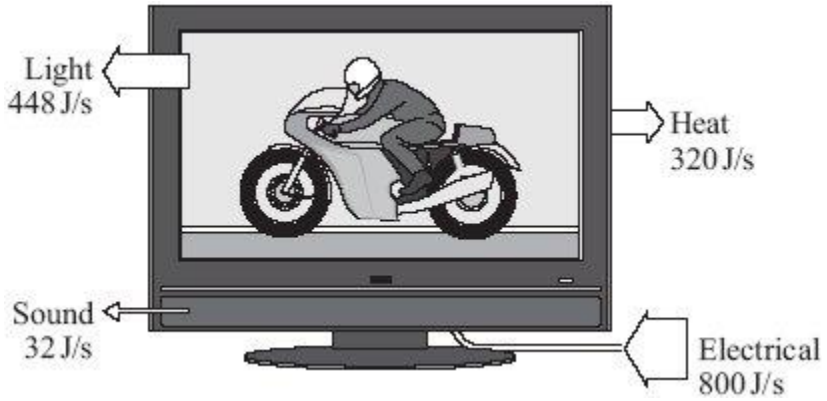
A small amount of nuclear fuel generates a large amount of electricity. ☐

It is easy to store nuclear waste safely. ☐

(1)
(Total 10 marks)

Q32.

(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?

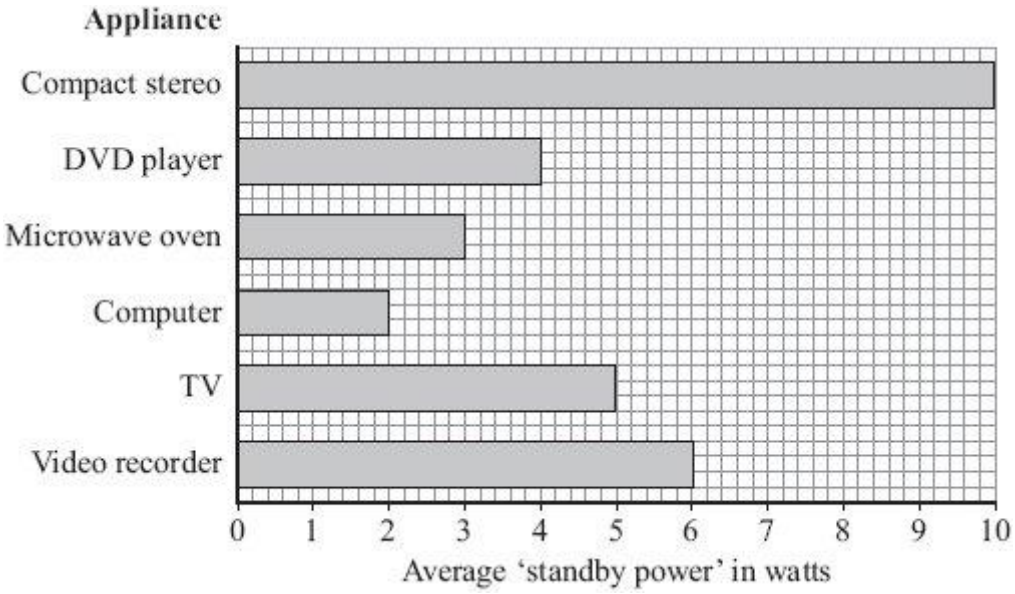
_____

_____

(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.

total cost = number of kilowatt-hours × cost per kilowatt-hour

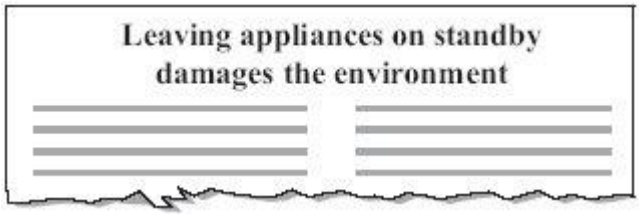
Show clearly how you work out your answer.

_____

Cost = _____ p

(1)

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



Explain why leaving appliances on standby damages the environment.

_____

_____

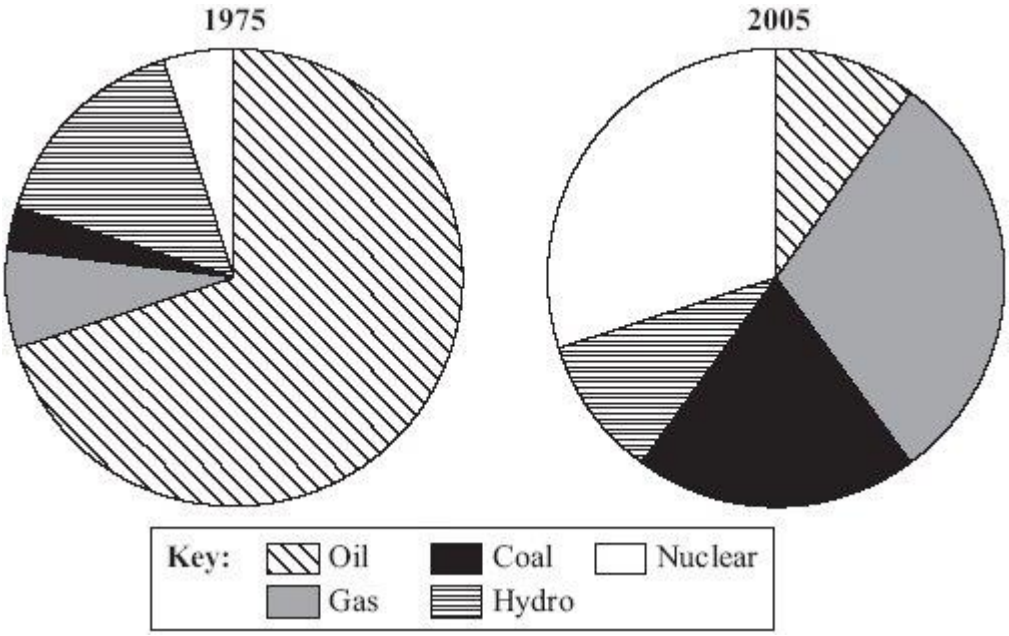
_____

_____

(2)
(Total 8 marks)

Q33.

The pie charts show the relative proportions of electricity generated in Japan from different energy sources in 1975 and 2005.



(a) Describe the main differences in the energy sources used in 2005 compared with 1975.

_____

_____

(1)

(b) In the UK, nuclear fuels are used to generate about 21% of the total electricity supply.

(i) What is the name of the process by which a nuclear fuel produces heat?

_____

(1)

(ii) Explain how the heat released from a nuclear fuel is used to generate electricity in power stations.

_____

_____

_____

_____

(2)

(iii) Some people have suggested that more nuclear power stations should be built in the UK.

Give **two** reasons to support this suggestion.

1. _____

_____

2. _____

_____

(2)

(iv) Nuclear power stations create dangerous waste.

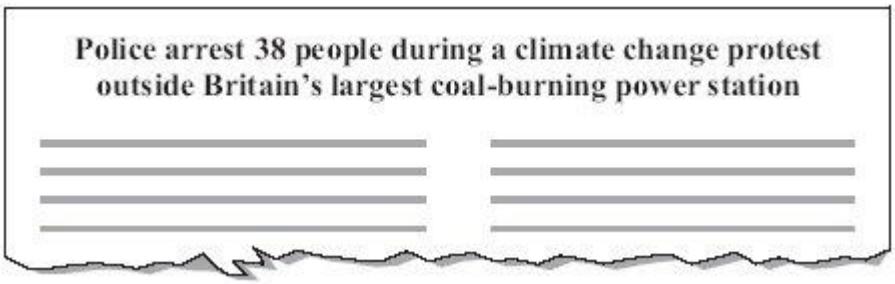
Why is the waste from a nuclear power station dangerous?

_____

_____

(1)

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



Explain the possible link between *climate change* and *coal-burning power stations*.

_____

_____

_____

_____

(2)

(Total 9 marks)

Q34.

(a) Water waves are a renewable energy source.

The government wants more electricity to be generated from renewable energy sources. Some people do not think this is a good idea.

What reasons could a government scientist give to show people that using more renewable energy sources is a good idea?

_____

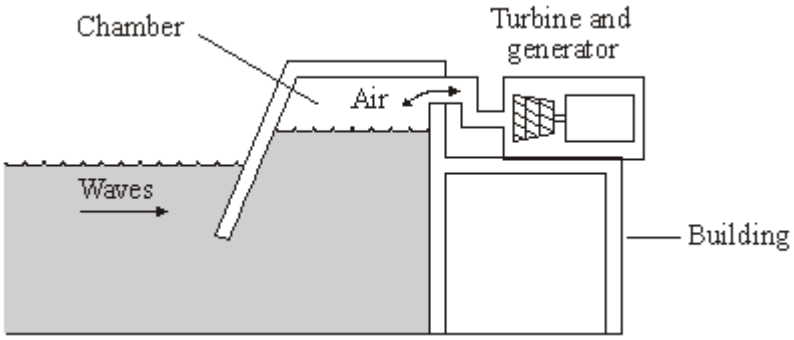
_____

_____

_____

(2)

(b) The diagram shows a wave-powered generator. The generator transforms kinetic energy from the waves to electrical energy.



AQA GCSE SCIENCE CORE FOUNDATION STUDENT'S BOOK by Graham Hill, Nigel Heslop, Christine Woodward,Steve Witney and Toby Houghton. Published by Hodder and Stoughton 2006 © Reproduced by permission of John Murray (Publishers) Ltd

The following sentences describe how the wave generator works. The sentences are in the wrong order.

R Waves push air up and down a chamber inside the building.
S The turbine turns the generator.
T The generator transforms kinetic energy to electrical energy.
U The air rushes through a turbine making it spin.
V Strong waves move towards the wave-powered generator.

Arrange these sentences in the correct order. Start with letter **V**.

V → [ ] → [ ] → [ ] → [ ] → [ ]

(3)

(Total 5 marks)

Q35.

(a) Electricity is distributed from power stations to consumers along the National Grid.

(i) Transformers are part of the National Grid. Transformers are *efficient* devices. What is meant by a device being *efficient*?

_____

_____

(1)

(ii) When electricity flows through a cable, some energy is transformed into heat.

Explain how the National Grid system reduces the amount of energy lost as heat.

_____

_____

_____

_____

(2)

(b) Read this information taken from a recent newspaper article.

- Researchers have found that children living close to overhead power cables are more likely to develop leukaemia.
- The researchers studied two groups of children. One group had developed leukaemia, the other group was healthy.
- Although the researchers found a link, they are unable to explain why it happened. They say that the results may have happened by chance.
- Other factors that have not been investigated, such as the environment, the geographical area or the children's genes, could be important.
- A cancer research charity said that childhood leukaemia was most likely to be caused by factors that parents were unable to control.

(i) Why did the researchers study a group of healthy children?

_____

_____

(1)

(ii) The information does not say how many children were studied.

Why should this data have been included in the article?

_____

_____

(1)

(iii) The researchers could not be certain that the overhead power cables were responsible for the increased chance of children developing leukaemia.

Explain why.

_____

_____

_____

_____

(2)

(iv) The results of the research carried out by scientists may worry some people.

What do you think scientists should do?

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

Scientists should publish their research findings straight away.	☐
Scientists should not publish their research findings until they have found out as many facts as possible.	☐

Give a reason for your choice.

_____

_____

(1)

(Total 8 marks)

Mark schemes

Q1.

(a) fan

1

drill

1

washing machine

*four circled including correct three scores **1** mark*

five circled scores zero

1

(b) Appliances only transfer part of the energy usefully

1

The energy transferred by appliances makes the surroundings warmer

1

[5]

Q2.

(a) gas (burning)

1

(b) (i) (transmission) cables and (step-up and step-down) transformers

if transformers are named ie step-up transformer then both step-up and step-down must be given

mention of power station or consumer negates mark

1

(ii) voltage

1

more efficient

1

(c) increase

1

[5]

Q3.

(a) (i) energy from hot rocks in the Earth

accept heat that occurs naturally in the Earth

accept steam / hot water rising to the Earth's surface

accept an answer in terms of the energy released by radioactive decay in the Earth

heat energy is insufficient

1

(ii) water is pumped / moved

1

up (to a higher reservoir)

this mark point only scores if first mark point is awarded

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks
No relevant content

Level 1 (1-2 marks)
There is a brief description of at least one advantage or disadvantage for either the planned wind turbines or the suggested electricity power link.

Level 2 (3-4 marks)
There is a description of advantages and disadvantages for either the planned wind turbines or the suggested electricity power link.
or
A description of the advantages or disadvantages for both the planned wind turbines and the suggested electricity power link.

Level 3 (5-6 marks)
There is a clear and detailed description of at least one advantage and one disadvantage for both the planned wind turbines and suggested electricity power link.

examples of the points made in the response

Offshore wind turbines

advantages

- renewable (energy resource)
- low running costs
- energy is free
- no gas emissions (when in use)
  accept a named gas eg CO_2
  accept no fuel is burned
  accept less dependent on fossil fuels
- land is not used (up)

disadvantages

- unreliable – accept wind does not always blow
  ignore references to destroying or harming habitats
- hazard to birds / bats
- visual pollution – do not accept noise pollution
  *do **not** allow if clearly referring to onshore wind turbines*
  *do **not** accept spoils landscape*
- difficulty of linking turbines to the National Grid

- large initial cost
- difficult to erect / maintain
  accept a lot of maintenance needed
- CO_2 emissions in manufacture (of large number of turbines)

Suggested Link

advantages

- income for Iceland
- using Iceland's (available) energy (resources)
  accept using (Iceland's) renewable energy (resources)
  *do **not** accept reduce the amount of Iceland's wasted energy*
- provide electricity when wind does not blow / reliable
- provide electricity at times of peak demand
- even out fluctuations in supply
- excess electricity from Britain (windy days) to Iceland and used to pump water up to store energy
- Britain less dependent on fossil fuels
  accept Britain needs fewer (new) power stations
  accept conserves fossil fuels

disadvantages

- large initial cost
  accept expensive (to lay cables)
- power loss along a long cable
- (engineering) difficulties in laying / maintaining the cable
  accept difficult to repair (if damaged)

6

[10]

Q4.

(a) (i) kinetic (energy)
allow <u>gravitational</u> potential (energy) / gpe
movement is insufficient

1

(ii) dissipates into the surroundings
allow warms up the surroundings / air / motor
accept lost to the surroundings
accept lost as heat
ignore reference to sound
it is lost is insufficient

1

(b) energy (required) increases with load

accept positive correlation

*do **not** accept (directly) proportional*

1

further amplification eg increases slowly at first (or up to 4 / 5 N), then increases rapidly

simply quoting figures is insufficient

an answer that only describes the shape of the line gains no marks

1

(c) (i) $E = P \times t$

2880

*accept £28.80 for all **3** marks*

*an answer £2880 gains **2** marks*

*allow **1** mark for obtaining 48 h **or** converting to kW*

*allow **2** marks for correct substitution*

ie 4 × 48 × 15

note: this substitution may be shown as two steps

*an answer 2 880 000 gains **2** marks*

*an answer £4.80 / 480 gains **2** marks*

*an answer of 192 (ie calculation of energy without subsequent calculation of cost) gains **1** mark)*

3

(ii) any sensible suggestion eg

conserves fossil fuels

less (fossil) fuels burned

less pollutant gas (produced)

accept a named pollutant gas

less greenhouse gas (produced)

saves energy is insufficient

1

[8]

Q5.

(a) 13 500 (J)

*allow **1** mark for correct substitution, ie 90 x 10 x 15 provided no subsequent step shown*

2

(b) 17

or

$\sqrt{\frac{\text{their (a)}}{45}}$

correctly calculated and answer given to 2 or 3 significant figures

accept 17.3

*allow **2** marks for an answer with 4 or more significant figures, ie 17.32*

or

*allow **2** marks for correct substitution, ie 13 500/ their (a) = ½ x 90 x v^2*

or

*allow **1** mark for a statement or figures showing KE = GPE*

3

(c) work is done

1

(against) friction (between the miner and slide)

*accept 'air resistance' **or** 'drag' for friction*

1

(due to the) slide not (being perfectly) smooth

accept miners clothing is rough

or

causing (kinetic) energy to be transferred as heat/internal energy of surroundings

accept lost/transformed for transferred

accept air for internal energy of surroundings

1

[8]

Q6.

(a) (i) 0.6
or
60%

*allow **1** mark for correct substitution ie* $\frac{720}{1200}$ *provided no subsequent step shown*

*an answer of 0.6 / 60 with a unit gains **1** mark only*

*an answer of 60 gains **1** mark only*

2

(ii) heat

allow thermal

1

(b) 12 000 p
or
£120

to score both marks the unit must be consistent with the numerical answer

*answers 12 000 and 120 gain **1** mark only*

*allow **1** mark for correct substitution ie 800 × 15 **or** 800 × 0.15*

provided no subsequent step shown

2

[5]

Q7.

(a) can be replaced as fast / faster than it is used

accept will not run out

can be used again negates this mark

1

(b) any **one** from:

- reduce demand on power stations / National Grid (system)
- to <u>increase</u> the amount of electricity generated (from renewable energy)
- to conserve fossil fuels

  accept use less fossil fuels
- plenty of animal waste / fuel (available)

  accept so animal waste can be used usefully
  accept to save money / sell the electricity
  produces less harmful gases / SO_2 is insufficient
  better for environment is insufficient

1

(c) 60 (months) / 5 (years)

ignore any unit given

1

(d) *answers must be in terms of the biogas generator*

any **two** from:

- reliable energy source
  or
  does not depend on the weather

  accept works all of the time
- uses up waste products

  accept animal waste readily available
- not visually polluting
- concentrated energy source
- quieter

  ignore it is renewable

  *do **not** accept generates more electricity (than wind turbine)*

2

[5]

Q8.

(a) (i) 7.6

*allow **1** mark for correct substitution and / or transformation*

ie $0.95 = \frac{x}{8}$

95 × 8.0

2

(ii) 25 (hours)

*allow **1** mark for obtaining number of kWh = 200*

an answer of 26(.3) gains both marks

2

(b) any **two** from

- transferred to the surroundings / air / atmosphere
- becomes spread out
- shared between (many) molecules
- (wasted as) heat / sound

2

[6]

Q9.

(a) (i) solar and wind

both required for mark either order

1

(ii) 37(%)

*accept their **two** sources in a(i)*

correctly added as an error carried forward (ecf)

1

(b) **A**

1

(c) gas is non-renewable

*do **not** accept they are not all renewable*

statements such as gas produces CO_2 is neutral

1

[4]

Q10.

(a) kinetic

1

(b) (i) generates a lot more energy / electricity / power

need fewer conventional large-scale hydroelectric power stations is neutral

or

can supply (energy / electricity / power) to more homes

1

(ii) Large areas of land are flooded.

1

(c) (i) National Grid

this answer only

1

(ii) less energy / heat loss (from the cables)

accept wasted for loss

accept answers in terms of fewer transformers needed

*do **not** accept less electricity lost / wasted*

*do **not** accept no energy lost*

1

(d) any **one** from:

- fewer rivers (suitable for generators)
- less mountainous (so rivers fall smaller distances)

  accept answers in terms of difficulty linking villages and towns to grid (in Nepal)

  accept answers in terms of more isolated communities

  accept answers in terms of UK having more resources for large-scale power stations

1

[6]

Q11.

(a) *marks are awarded only for the reason but must match the ringed answer*

*for both marks a **MAYBE** answer should include a **YES** and **NO** response answers in terms of the sources being renewable or*
non-renewable are insufficient

any **two** from:

YES answers may include:

- wind produces no pollutant gases

  accept wind burns no fuel

  accept CO_2 / SO_2 / oxides of nitrogen / greenhouse gas for pollutant gases

- nuclear produces no pollutant gases

  accept nuclear burns no fuel

- (burning) gas does not produce SO_2

  accept gas does not cause acid rain

  *do **not** accept they don't / none produce pollutant gases*

NO answers may include:

- nuclear produces <u>radioactive</u> waste
- (burning) gas produces CO_2 / pollutant gases / air pollution

  accept contributes to global warming / greenhouse effect

2

(b) nuclear power stations use a non-renewable fuel

accept uranium / plutonium is non-renewable

*do **not** accept some are unrenewable*

1

[3]

Q12.

(a) (i) kinetic

accept KE

*do **not** accept movement*

1

(ii) 0.75

*allow **1** mark for correct substitution ie* $\frac{60\,000}{80\,000}$

or

75 %

*an answer 0.75 % **or** 0.75 with a unit gains **1** mark only*

*an answer 75 with or without a unit gains **1** mark only*

2

(b) any **one** from:

- large areas of land are flooded

  uses large areas of land / takes up large areas of land is insufficient

- people's homes may be destroyed

- habitat (of animals and plants) lost / damaged

  construct is neutral

  very noisy is neutral

1

(c) (i) system of cables <u>and</u> transformers

both required for the mark

accept power lines / wires for cables

ignore reference to pylons

inclusions of power stations / consumers negates answer

1

(ii) less energy loss / wasted (in the cables)

accept heat for energy

*do **not** accept no energy loss*

*do **not** accept electricity for energy*

1

as the cables are shorter

1

[7]

Q13.

(a) 1 080 000

*allow **1** mark for correct substitution*

ie ½ × 15 000 × 12 × 12

2

(b) any **one** from:

- KE (of wind) <u>more than</u> doubles

- mass of air (hitting blades) more than doubles
- area swept out by blades more than doubles

  *do **not** accept blades are larger / have a bigger area*
- area swept out by blades increases × 4

1

[3]

Q14.

(a) heat / thermal
or / and
sound

*do **not** accept noise*
other forms of energy eg light negates answer

1

(b) 0.4
or
40 %

*allow **1** mark for* $\frac{2000}{5000}$
or
equivalent fraction
*an answer 0.4 % gains **1** mark*
*answers 0.4 or 40 given with any unit gains **1** mark*
*40 without % gains **1** mark*

2

[3]

Q15.

(a) (i) decommissioning

1

(ii) level of radiation **or** radiation dose (to workers) decreased

accept the isotope / cobalt(-60) has decayed (a lot)
accept the isotope / cobalt(-60) has decayed in 2 half lives
accept exposed to less radiation
*do **not** accept no radiation left*

1

less hazardous / dangerous (to workers' health)

accept safer
*do **not** accept there is no hazard*
accept allows reactor to cool (down)
*an answer of radiation levels decrease by 75 % or drops to 25 % gains **2** marks*

1

(b) (i) more in favour
or
fewer against

quoting figures alone is insufficient

*do **not** accept it increases*
ignore any reasons given

1

(ii) any **one** from:

- sample too small
- do not know how many (people) were asked
- different people asked (in different years)
- sample not representative (of population)
- people did not understand the questions
- do not know who carried out the surveys
  *do **not** accept they are biased unless acceptable reason for bias given*
- do not know if surveys asked same questions

1

(iii) any **one** from:

- no / less pollutant gases produced
  accept a named gas
  accept does not contribute to global warming
- reliable source (of energy / electricity)
- running out of fossil fuels
  accept a named fossil fuel
- conserve fossil fuels
  accept fossil fuels won't have to be used
- meet increasing demand
- less reliance on imported fossil fuels / electricity
  accept named fossil fuel
- concentrated energy source(s)
- lower transportation costs for fuel
- to replace old <u>nuclear</u> power stations
  ignore references to efficiency / job creation / local economy / selling electricity

1

(c) economic issues

1

[7]

Q16.

(a) (i) 4

*allow **1** mark for correct transformation and substitution*

ie $\frac{0.6}{0.15}$

substitution only scores if no subsequent steps are shown

2

(ii) diagram showing two output arrows with one arrow wider than the other with the narrower arrow labelled electrical / electricity / useful

1

(b) any **one** from:

- to check reliability / validity / accuracy
- to avoid bias

1

(c) any **two** from:

- produce no / less (air) pollution
  accept named pollutant
  accept produces no waste (gases)
- energy is free
  accept it is a free resource
  *do **not** accept it is free*
- (energy) is renewable
- conserves fossil fuel stocks
- can be used in remote areas
- do not need to connect to the National Grid

2

[6]

Q17.

(a) (i) gas

1

(ii) one variable is categoric, the other is continuous

1

(iii) fuel is **<u>not</u>** burned
accept nothing is burned
*do **not** accept they don't use fossil fuels*

1

(b) (i) boiler

1

steam

1

turbine

1

generator

1

(ii) any **one** from:

- wind
  accept wind turbines
- waves
- tidal
  accept tide
- geothermal
- solar
  accept the Sun / sunlight
  accept solar panels / cells
  *do **not** accept light*
- falling water
  accept hydroelectric
  *do **not** accept water*
  *do **not** accept any named biofuel*

1

(iii) 18 000
*allow **1** mark for showing a correct method*
ie 36 000 000 ÷ 2 000
*an answer of 0.018 gains **1** mark*

2

[10]

Q18.

(a) transferred to surroundings / surrounding molecules / atmosphere
'it escapes' is insufficient

or

becomes dissipated / spread out
accept warms the surroundings
accept degraded / diluted
accept a correct description for surroundings eg to the washing machine
*do **not** accept transformed into heat on its own*

1

(b) a smaller proportion / percentage of the energy supplied is wasted
owtte
*accept a statement such as 'less energy is wasted' for **1** mark*
*do **not** accept costs less to run*
ignore references to uses less energy

2

(c) (i) 2.4 (p)
accept 2 p if it is clear from the working out this is rounded

from 2.4 p

*allow **1** mark for correct substitution of correct values*

ie 0.2 × 12

*allow **1** mark for calculating cost at 40 °C (13.2 p)*

or

cost at 30 °C (10.8 p)

2

(ii) any **one** from:

- less electricity needed

  ignore answers in terms of the washing machine releasing less energy

  an answer in terms of the washing machine releasing CO_2 negates the mark

  *do **not** accept less energy is produced*

- fewer power stations needed

- less fuel is burned

  accept a correctly named fuel

  *do **not** accept less fuel is needed*

1

[6]

Q19.

(a) (i) (dismantle and) remove radioactive waste / materials / fuels

accept nuclear for radioactive

*do **not** accept knock down / shut down*

1

(ii) increases it

*do **not** accept it has a negative effect*

1

(b) (i) *if efficiency is not mentioned it must be implied*

answers in terms of energy

generated only gains no credit

K most efficient
or
M least efficient

*accept **K** and / or **L** are more efficient than **M***

1

(efficiency) of **K** and **L** increases, (efficiency) of **M** (almost) constant / slightly reduced

all 3 power stations must be mentioned to get this mark

1

(ii) any **two** from:

- do not know how many (nuclear) power stations there will be

- power stations may continue to increase in efficiency

- do not know what type of power station new ones will be
  accept new methods may be found to generate electricity / energy
  accept other ways of generating energy may be expanded

- do not know future energy / electricity demands
  accept we may become more energy efficient

- may be new uses for uranium

2

[6]

Q20.

(a) (i) 0.75

*allow **1** mark for correct transformation and substitution*
ie 0.15 = 5

2

(ii) 2

accept 1.5 ÷ their (a)(i) correctly calculated

1

(b) any **one** from:

- seasonal <u>changes</u>
  accept specific <u>changes</u> in conditions
  eg shorter hours of daylight in winter

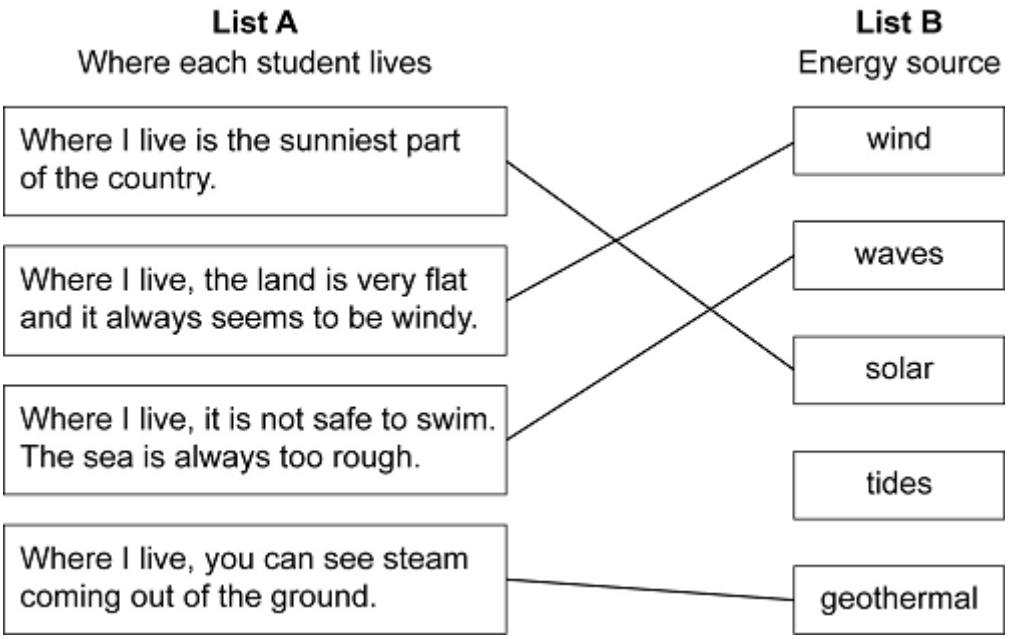
- cloud cover
  accept idea of <u>change</u>
  must be stated or unambiguously implied
  eg demand for water will not (always) match supply of solar energy
  *do **not** accept figures are average on its own*
  *do **not** accept solar panels are in the shade*

1

[4]

Q21.

(a) all 4 lines correct



*allow **1** mark for each correct line*
*if more than 1 line goes from a box in **List A** then all those lines are incorrect*

4

(b) all renewable

accept a correct description of renewable
*eg replaced faster than used **or** never run out*
*do **not** accept can be used again*
accept any other common feature
eg do not produce pollution /
polluting (gases)
no fuel is burnt
(energy input) is free
eco-friendly / environmentally friendly / natural resources / sustainable sources are insufficient

1

(c) large areas of land are flooded

1

[6]

Q22.

(a) (i) 2.1

correct answer only

1

(ii) 3.15
or
their (a)(i) × 1.5 correctly calculated

*allow **1** mark for correct substitution*
ie 2.1 × 1.5
or
their (a)(i) × 1.5

2

kilowatt-hour

accept kWh

or

*a substitution 2100 × 5400 scores **1** mark*

*2100 × 5400 incorrectly calculated with answer in joules scores **2** marks*

*an answer of 11 340 000 scores **2** marks*

*an answer of 11 340 000 J scores **3** marks*

1

(iii) most (input) energy is usefully transformed

accept does not waste a lot of energy

accept most of the output / energy is useful

*do **not** accept it does not waste energy*

1

(b) the room is losing energy / heat

1

at the same rate as the heater supplies it

this mark only scores if the first is scored

*do **not** accept heater reaches same temperature as room / surroundings*

rate of heat gain = rate of heat loss scores both marks

1

[7]

Q23.

(a) (i) tidal / tides

*do **not** accept water / waves*

1

(ii) any **three** from:

- shorter journey time

  accept easier to go from town to town
  accept less petrol / fuel used

- less pollution from traffic

  accept CO_2 / carbon emissions reduced

- energy source is free

- energy source / tides are predictable

- produces less / no pollutant gases (than fuel burning power stations)

  accept no CO_2 / greenhouse gases produced
  accept air pollution for pollutant gases

- conserves supplies of fossil fuels

- uses renewable energy (to generate electricity)

- provides employment

- no visual / noise pollution

less harm to the environment is insufficient

the electricity is cheaper is insufficient

*do **not** accept produces no radioactive waste*

the pollution mark scores twice only if it is clear one reference is to traffic and the other is to electricity generation

3

(b) (i) (sometimes) electricity demand may be greater than supply (of electricity from the system)

accept in case turbines / generators fail

or

can sell (excess) electricity (to the National Grid)

1

(ii) decreases the current

accept increases the voltage

1

reducing energy loss (along cables)

accept less heat / thermal energy lost / produced

1

[7]

Q24.

(a)

accept 'the humpback bridge' symbol

accept circle with cross but no lines

if more than one symbol drawn, no mark unless lamp is labelled

1

(b) (i) 24

*allow **1** mark for correct substitution ie* $\frac{2800}{120}$

*allow **1** mark for an answer 1440*

ignore any unit

2

(ii) watt

1

(c) larger than

accept correct indication inside the box

accept an answer meaning larger than ie greater than

1

[5]

Q25.

(a) (i) 0.2 **or** 1/5

accept 20% for both marks

*allow **1** mark for correct substitution answer of 0.2% **or** 20 gains **1** mark*

ignore units

2

(ii) wasted

accept transformed to heat / other forms
accept transferred to the air / surroundings sound = neutral

1

(b) (i) any **one** from:

- can fly at night
  accept can fly when it is cloudy
  accept as a back-up
- can stay in the air for longer
- can fly in the winter
- can fly faster
  increases power is neutral

1

(ii) any **one** from:

- produces no (pollutant) gases

or no greenhouse gases

accept named gas
accept no air pollution
*do **not** accept no pollution*
accept less global warming
accept harmful for pollutant
accept produces no carbon
*do **not** accept environmentally friendly*

- produces no / less noise
- less demand for fuels
  accept any other sensible environmental advantage

1

(iii) accept any sensible suggestion eg, map the Earth's surface / weather forecasting / spying / monitoring changes to the Earth's atmosphere, etc

*do **not** accept ideas in terms of transporting*
accept use as a satellite

1

[6]

Q26.

(a) (i) any **one** from:

- waves
  *do **not** accept water*
- tides

- falling water
  accept hydroelectric

- biofuel / biomass

- solar
  accept sun / sunlight
  *do **not** accept light*
  accept solar cells / panels

- geothermal
  *do **not** accept heat*

1

(ii) decrease

1

(b) (i) increases from 4am (to 8am) remains constant from 8am (to 10am)
accept increases from 30 000
accept stays constant from 40 000
*allow **1** mark for goes up then stays the same*
for full credit must be some indication of time or power

2

(ii) natural gas

1

[5]

Q27.

(a) 32,400,00 J
*allow **1** mark for correct substitution*
3.24×10^{7} J

2

(b) (3kW) fan heater
accept 3kW
accept the middle one

1

(c)
features common to more than one heater, treat as neutral

<u>oil-filled</u>

low level heat

cannot be knocked over / space saving / no trailing wires
*do **not** accept just wall-mounted*

or more control over heat output
*do **not** accept just 3 heat settings*

1

<u>fan</u>

warms (office) rapidly **or** can be used to cool air (in summer)
accept can be used as a fan

accept cool air fan (setting)
accept 'it has a cool air setting in case it gets too hot'
*do **not** accept a specific reference to cooling the heater*

1

<u>ceramic</u>

can be switched on for set periods of time
*do **not** accept just has a timer*

or can be switched on before office is used / switched off automatically at night

1

[6]

Q28.

(a) 1/25 **or** 1:25 **or** 0.04

accept 4 % or $\frac{15}{375}$ *or* $\frac{3}{75}$ *or 1 in 25 for both marks*

*allow **1** mark for total of 375*
*allow **1** mark for a clearly correct method using a clearly incorrect total*
*do **not** accept 1:26*

2

(b) (i) **B**

*do **not** credit reason if **B** is not chosen*

1

(only) burning fossil fuels produces carbon dioxide / carbon (emissions)
or nuclear fuels don't produce carbon dioxide
insufficient – smallest amount of fossil fuels
accept less carbon dioxide

1

(ii) accept anything reasonable eg

increased level of insulation

use energy efficient light bulbs

do not leave appliances on standby

switch thermostats down (1°C)

generate own electricity

install solar panels
accept insulate
accept specific examples eg loft

1

(c) (i) any **three** from:

- no power output until wind speed exceeds 4m/s

- output rises rapidly after 4m/s
- output begins to level out / rises less rapidly at / after 13m/s
- output peaks at 21 / 22m/s
- output constant between 21 / 22 and 25 / 26 m/s
- output falls (rapidly) after 25 / 26m/s

  *accept for **1** mark goes up then comes down*

3

(ii) any **one** from:

- unreliable energy source
- dilute energy source
- take up too much land

  accept wind does not always blow
  accept need thousands / lots of turbines
  ignore reference to visual / noise pollution
  ignore reference to kill birds

1

[9]

Q29.

(a) electrical

1

sound

correct order only

1

(b) the energy transformed by the TV will be destroyed

1

(c) a higher efficiency than

1

[4]

Q30.

(a) (i) an unreliable energy source

1

(ii) a predictable energy source

1

(b) plant / grow (at least) one new tree

1

(c) greater than 4 %

1

[4]

Q31.

(a) (i) France

1

(ii) any **one** from:

- different homes have different appliances(*)
- different homes have different numbers of appliances(*)
  (*) accept all homes are different
- standby power not the same for all appliances
- some people will switch appliances off
  accept named appliances
  accept people waste different amounts of energy
- homes have different numbers of residents
- can't measure every (individual) home
  accept any sensible suggestions
  *do **not** accept answers in terms of accurate / precise etc*

1

(b) (i) increases amount of energy wasted
accept (encourages) people to leave appliances on (standby)
accept increases it

1

(ii) any **two** from:

- less electricity needed / generated
- fewer power stations needed
- less coal is burned
  *do **not** accept coal is non-renewable / running out*
  answers in terms of fuel stocks neutral
- less pollutant <u>gases</u> produced
  accept named gases
  accept harmful for pollutant
  accept greenhouse gases
  accept reduce / slow / stop global warming
  accept reduces acid rain

2

(c) joule

1

(d) (i) 6800
*accept <u>£</u>68 for **3** marks an answer of 68 gains **2** marks*
*allow **2** marks for correct substitution ie 400 × 17*
*allow **1** mark for obtaining 400*
*answers of 7480, 4760, 12920, 4080 gain **2** marks*

3

(ii) a small . . . . . electricity

1

[10]

Q32.

(a) (i) 0.6

accept 60 %
*allow **1** mark for useful energy = 480*
*answer 0.6 with any unit or 60 gains **1** mark only*

2

(ii) transferred to surroundings

accept goes into the air
accept heats the surroundings up
accept gets spread out
accept transferred into heat (only)

*do **not** accept wasted / lost unless qualified*
destroyed negates mark
transferred into light / sound negates mark

1

(b) (i) 1.75

*allow **1** mark for converting to kW*

*answers of 0.7, 0.525, 0.35, 0.875, 1.05, 5.25 gains **1** mark*
*answers of 1750 or 17.5 gains **1** mark*

2

(ii) 21p or £0.21 or their (b)(i) × 12

1

(c) any **two** from:

- (more) electricity needs to be generated
  (more) electricity is being used
- (more) power stations needed
- (more) fossil fuels burnt
  accept named fossil fuel
- (more) pollutant gases emitted
  accept named gas
  accept harmful for pollutant
  accept greenhouse gases
  accept atmospheric pollution

  accept answer in terms of any form of electricity generation and an associated environmental problem

2

[8]

Q33.

(a) decrease in oil

PLUS

any **one** from:

- increase in (proportion of) coal

- increase in (proportion of) nuclear

- increase in (proportion of) gas

  must have decrease in (proportion of) oil <u>and</u> increase in (proportion of) coal / nuclear / gas

1

(b) (i) (nuclear) fission

accept fision

*do **not** accept any answer that looks like fusion*

1

(ii) <u>water</u> heated to produce (high pressure) steam

1

<u>steam</u> turns turbine which drives generator

1

(iii) any **two** from:

- produces no pollutant <u>gases</u>

  accept named gas or greenhouse gases
  accept no atmospheric pollution
  accept harmful for pollutant
  accept does not contribute to global warming

  *do **not** accept no pollution on its own*
  *do **not** accept better for the environment unless qualified*

- it is reliable **or** can generate all of the time

- concentrated energy source **or** produces a lot of energy from a small mass

- produces only small volume of (solid) waste

- fossil fuels will last longer

  accept a named fossil fuel
  accept fossil fuels are running out

  *do **not** accept fossil fuels are non-renewable unless qualified*

- will need to buy less fuel from other countries

  accept no new fossil fuel power stations needed

  *do **not** accept it is cheap*
  *do **not** accept import less electricity*

2

(iv) it is / can be radioactive

*do **not** accept answers in terms of kills cells / cancer*

or emits radiation (from the nuclei)

accept emits gamma (rays)

1

(c) coal (burning) power stations / burning coal produces carbon dioxide

they refers to coal-burning power stations

accept sulfur dioxide / nitrogen oxides for CO_2

1

(increased) CO_2 increases / contributes to / causes global warming / greenhouse effect

mention of ozone layer negates this mark

*do **not** accept CO_2 warms atmosphere*

1

[9]

Q34.

(a) any **two** from:

- (burning) fossil fuels produces greenhouse gases / pollutant gases / acid rain / leads to global warming

  accept a named fossil fuel

  accept a named pollutant gas

- nuclear fuels produce dangerous waste

  accept radioactive for dangerous

  accept reference to dangers of nuclear fuels

- fossil fuels are non-renewable

  accept running out of fuels

- renewable energy resources produce no pollutant gases

- large amounts of energy are available

  accept renewable won't run out

- running costs are low

  accept any reasonable benefit of renewables

  accept any reasonable drawback of non-renewables

  *do **not** accept better for the environment on its own*

2

(b) **R U S T**

all in correct order

*allow **2** marks for 2 correct*

*allow **1** mark for one correct*

3

[5]

Q35.

(a) (i) small proportion of energy / power is wasted

accept little / less energy / power / heat is wasted

*do **not** accept it wastes no energy / power*

or transfers most / more / a lot of energy power usefully

1

(ii) it decreases the current / uses low current

or *it* increases the voltage / potential difference

accept pd for potential difference

1

or uses high voltage / potential difference

smaller the current the smaller the energy loss
accept power / heat for energy

1

(b) (i) as a control
accept to make a comparison
*do **not** accept fair test on its own*

1

(ii) so people know how much data the link was based on
accept idea that larger numbers are better

or

people can <u>judge</u> the significance / reliability of the link
*do **not** accept significance / reliability on its own*
ignore reference to accuracy

1

(iii) other possible factors may be responsible

1

or have not been investigated

named factor eg environment / genetic

1

(iv) first box ticked plus reason
acceptable reason such as so people know there may be a risk as soon as possible / so that other scientists can use findings

or second box plus reason
acceptable reason such as no point to worry / confuse / panic people (until the research has been confirmed)
accept idea that it may lead to wrong advice
*do **not** accept in case they are wrong*

1

[8]