

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.1.3 NATIONAL AND GLOBAL ENERGY RESOURCES (PACK 2)

SCORE

/223

PERCENTAGE

%

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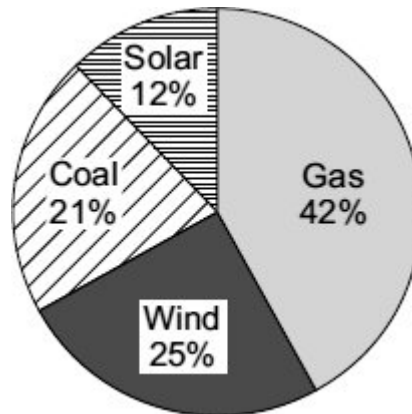
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Q1.

- (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)

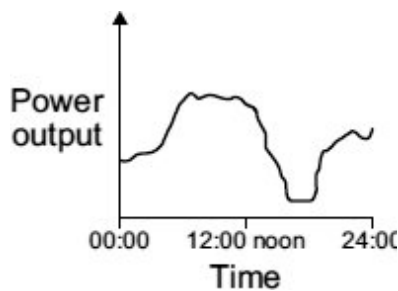
- (ii) Calculate the percentage (%) of electricity that is generated using energy sources that do **not** produce any polluting gases.

Percentage = _____

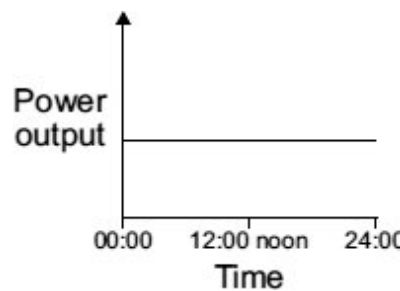
(1)

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

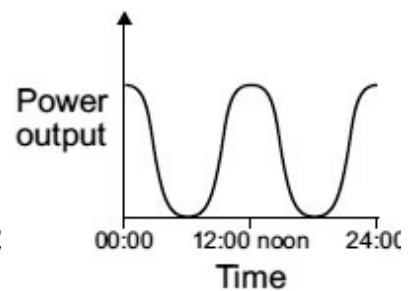
Write your answer, **A**, **B** or **C**, in the box.



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:

More wind farms, solar generators
and gas burning power stations
need to be built

Why is the statement in the newspaper incorrect?

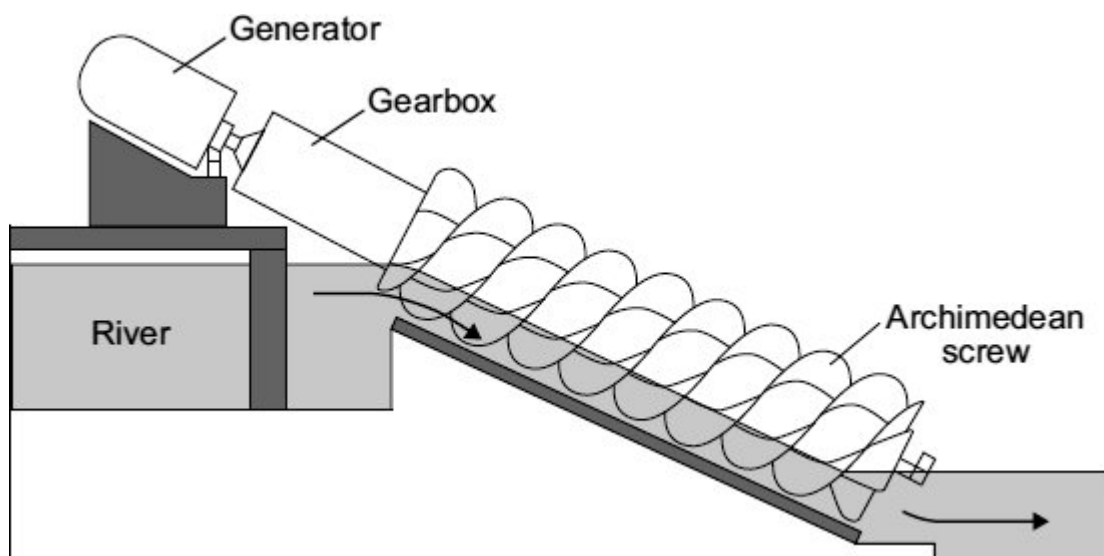
(1)

(Total 4 marks)

Q2.

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)

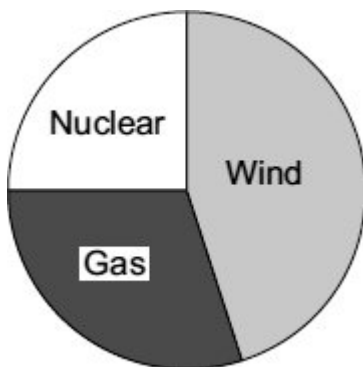
- (d) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

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

Q3.

- (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

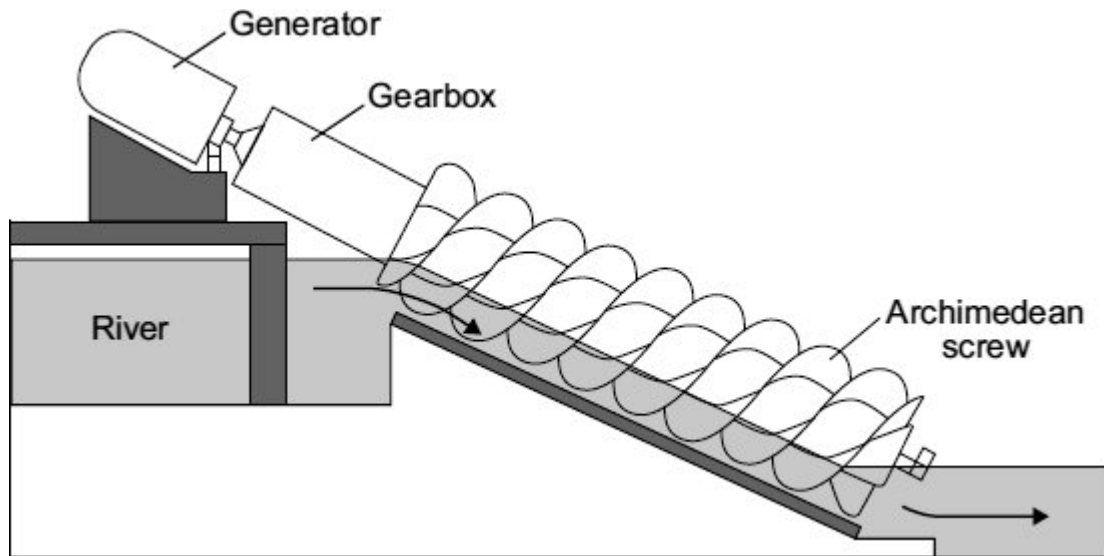
Why is the statement made in the newspaper incorrect?

(1)
(Total 3 marks)

Q4.

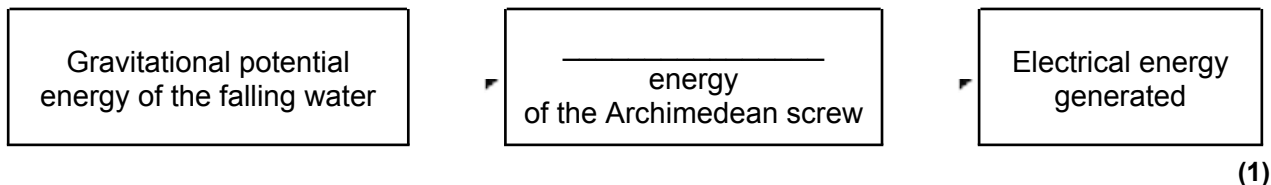
The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedeian screw, to rotate.

The Archimedeian 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.



(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)

Q5.

- (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

☐

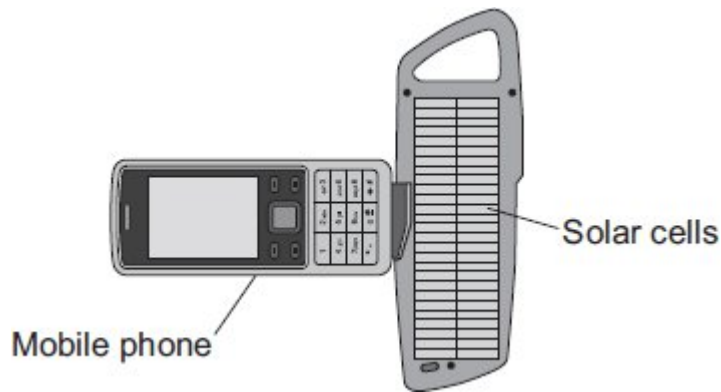
social issues

☐

(1)
(Total 7 marks)

Q6.

- (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.

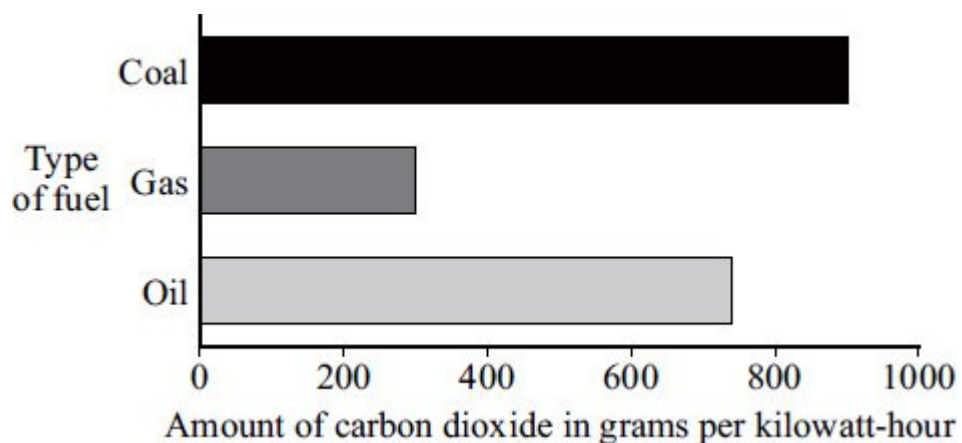
(2)

(Total 6 marks)

Q7.

- (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 kilowatt-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 categorical.

☐

Both variables are continuous.

☐

One variable is categorical, the other is continuous.

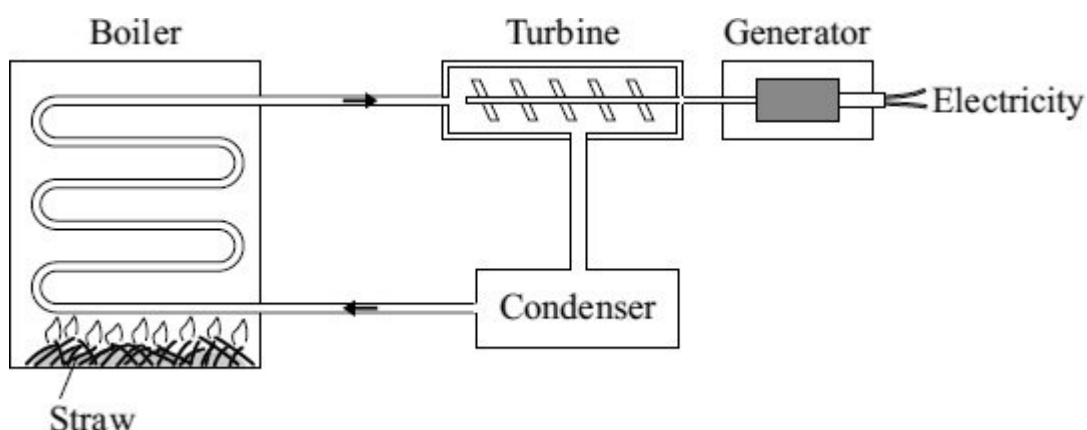
☐

(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)

Q8.

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?

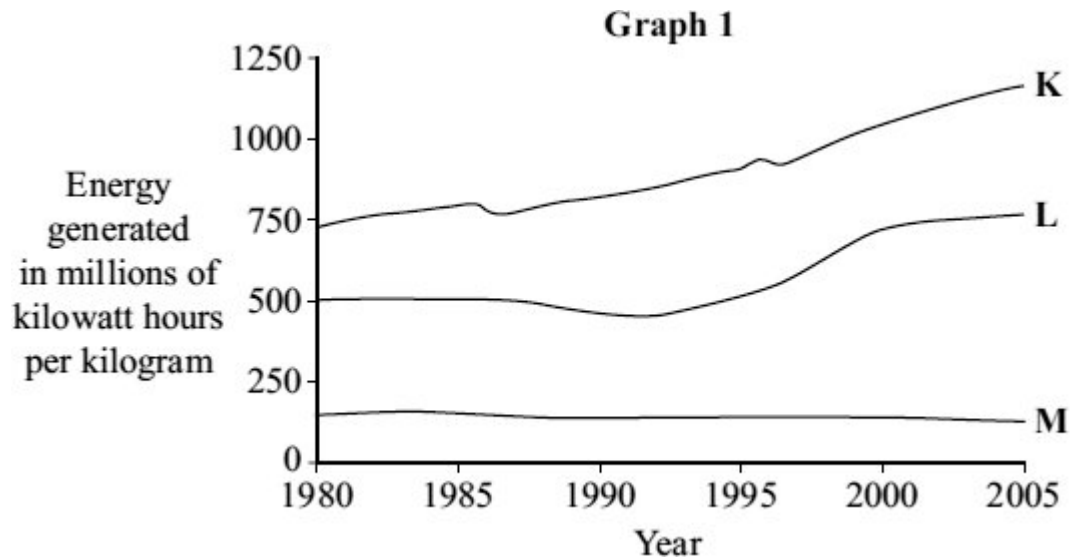
(1)

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

(1)

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

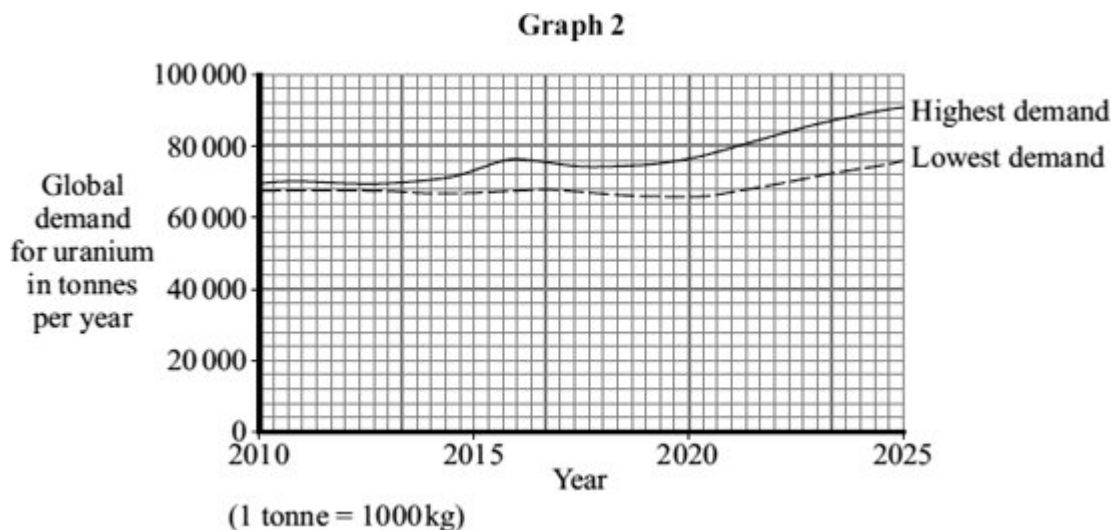
Graph 1 compares how the electricity generated from one kilogram of nuclear fuel changed between 1980 and 2005 in three different types of nuclear power station.



- (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.

Q9.

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

Where I live is the sunniest part of the country.

Where I live, the land is very flat and it always seems to be windy.

Where I live, it is not safe to swim. The sea is always too rough.

Where I live, you can see steam coming out of the ground.

List B
Energy source

Wind

Waves

Solar

Tides

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

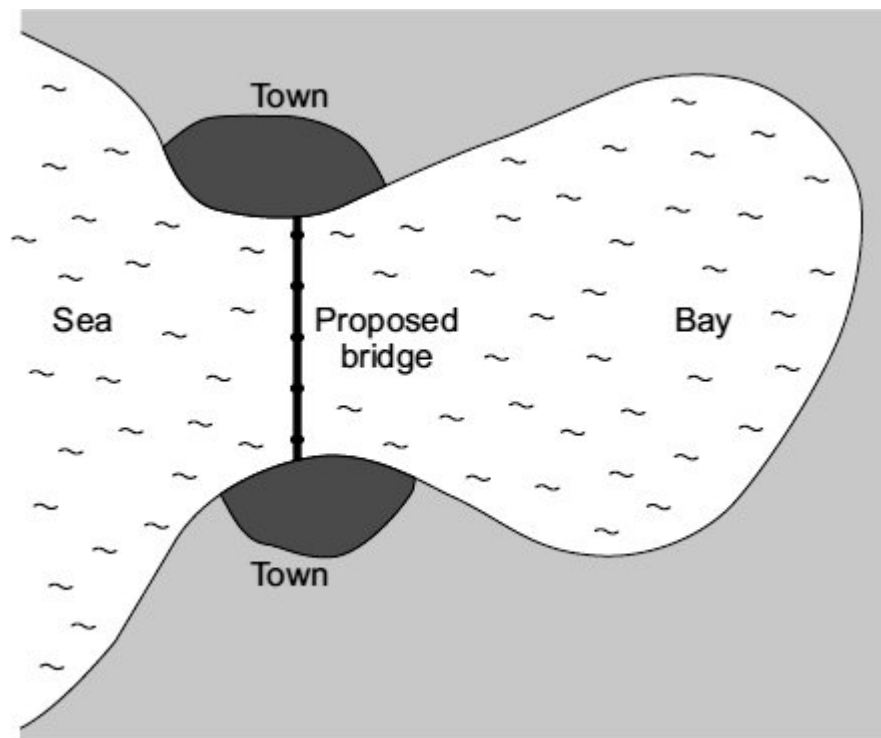
☐

(1)

(Total 6 marks)

Q10.

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 _____

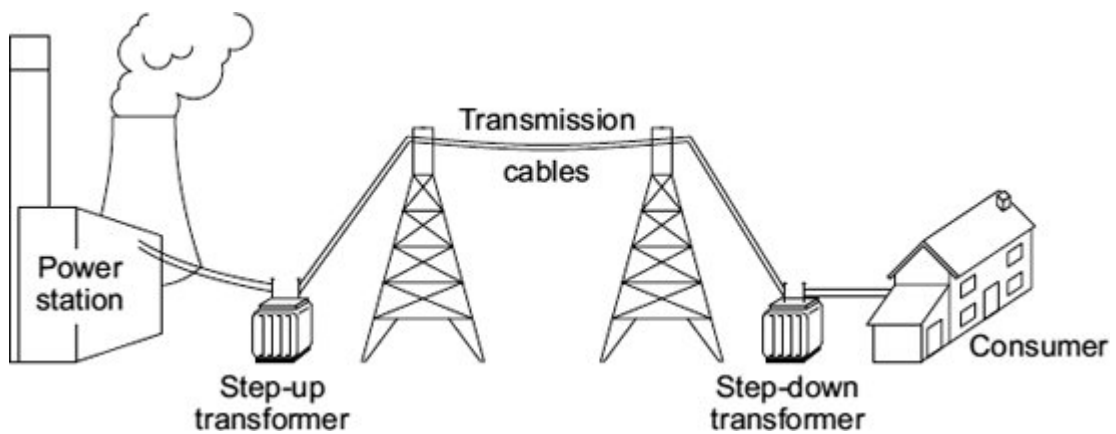
Reason 2 _____

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)

Q11.

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.

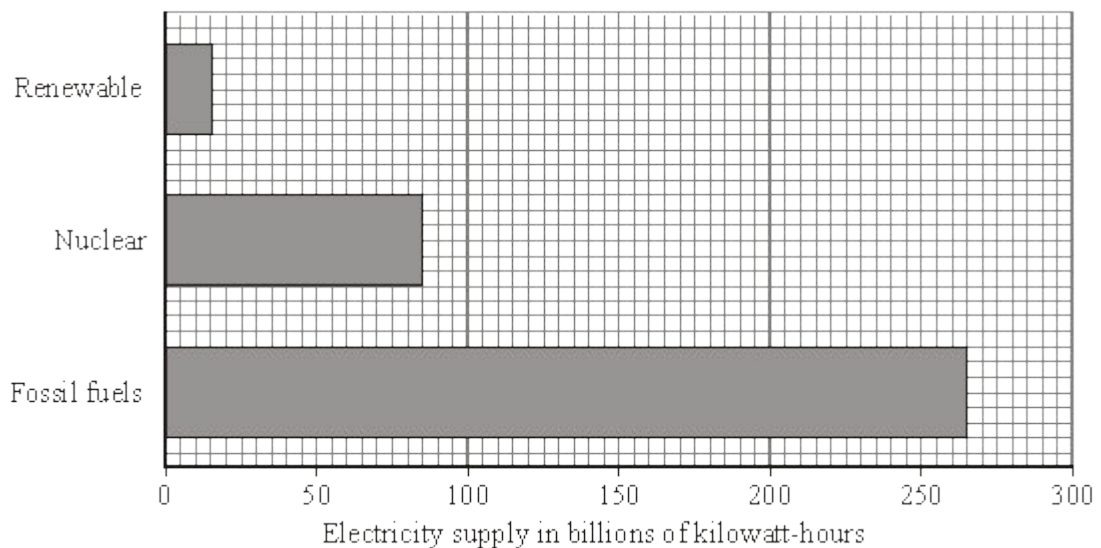
Suggest **one** possible use for an aircraft such as this.

(1)

(Total 6 marks)

Q12.

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

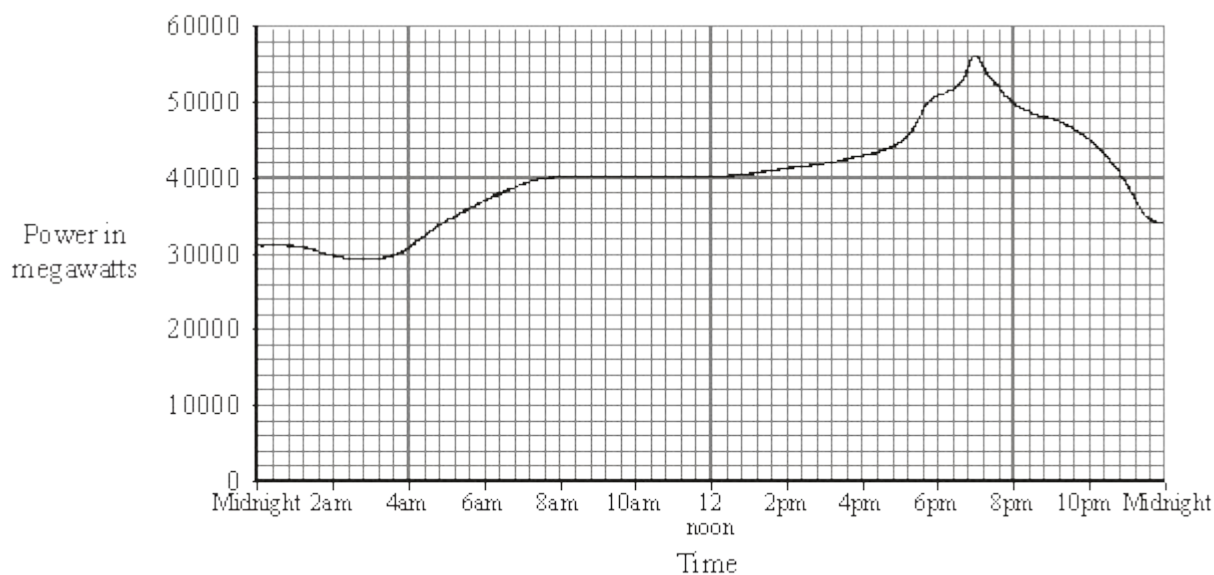
increase

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.

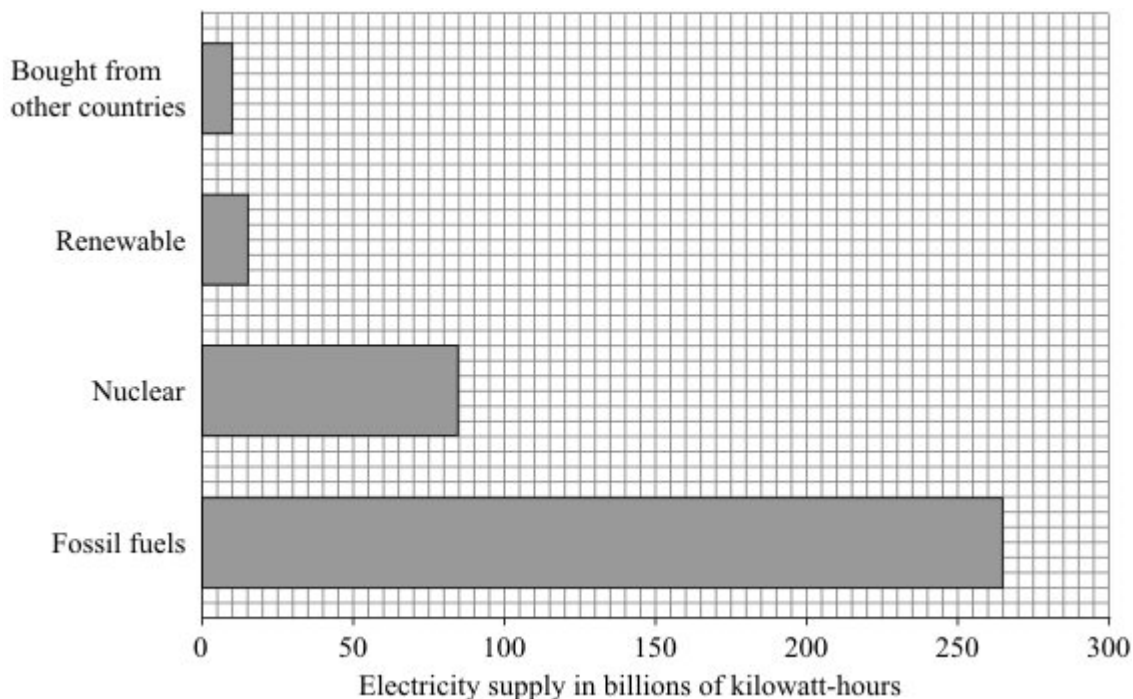
coal **natural gas** **nuclear** **oil**

(1)

(Total 5 marks)

Q13.

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.

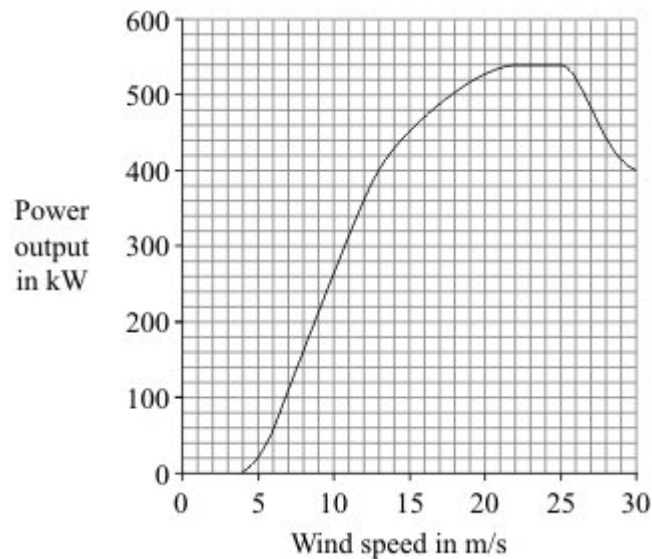
(2)

- (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)

Q14.

Electricity is generated in power stations. It is then sent to all parts of the country through a network of cables.

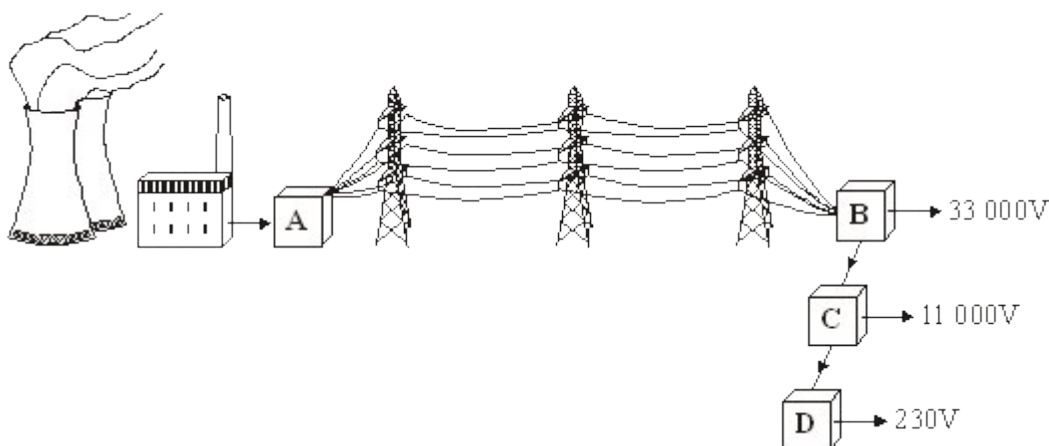
- (a) Complete the following sentence by using **one** of the words in the box.

Grid	Power	Supply
-------------	--------------	---------------

The network is called the National _____.

(1)

- (b) In the diagram, **A**, **B**, **C** and **D** are transformers.



- (i) Which transformer, **A**, **B**, **C** or **D**, is a step-up transformer?

Transformer _____

(1)

- (ii) Which transformer, **A**, **B**, **C** or **D**, will supply homes, offices and shops?

Transformer _____

(1)

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

In a step-down transformer, the potential difference (p.d.) across the

primary coil is

less than
the same as
more than

the p.d. across the secondary coil.

Q15.

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. ☐

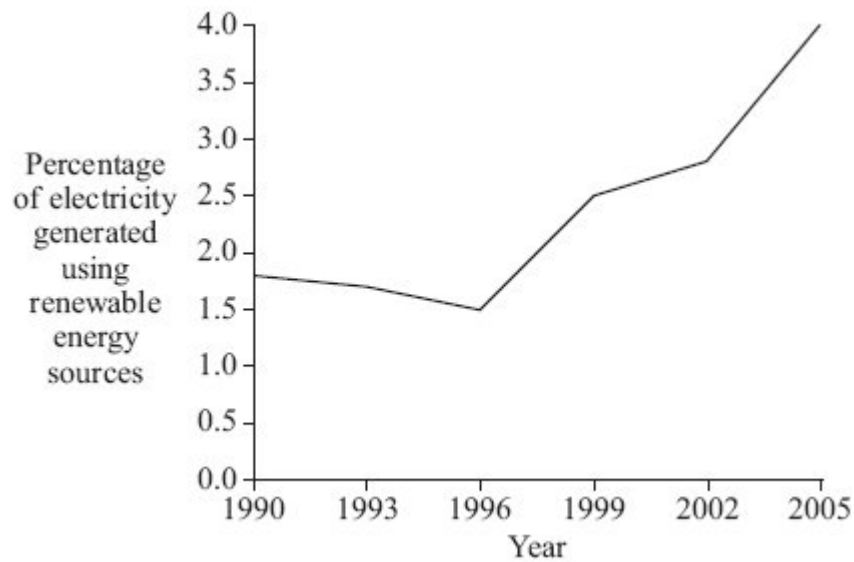
(1)

(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%

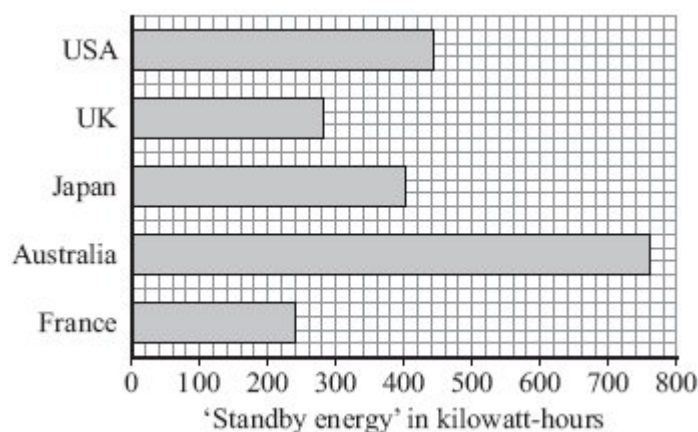
(1)

(Total 4 marks)

Q16.

Electrical appliances that are left on standby still use energy.

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



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

Draw a ring around your answer.

Australia

France

Japan

UK

USA

(1)

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

(1)

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

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

(1)

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

Wasting less electricity would be good for the Australian environment.

Explain why.

(2)

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

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

Draw a ring around your answer.

hertz

joule

watt

(1)

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

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

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

Show clearly how you work out your answer.

Give your answer in pence.

Cost = _____ pence

(3)

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

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

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

A nuclear power station is very expensive to build.

☐

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

☐

It is easy to store nuclear waste safely.

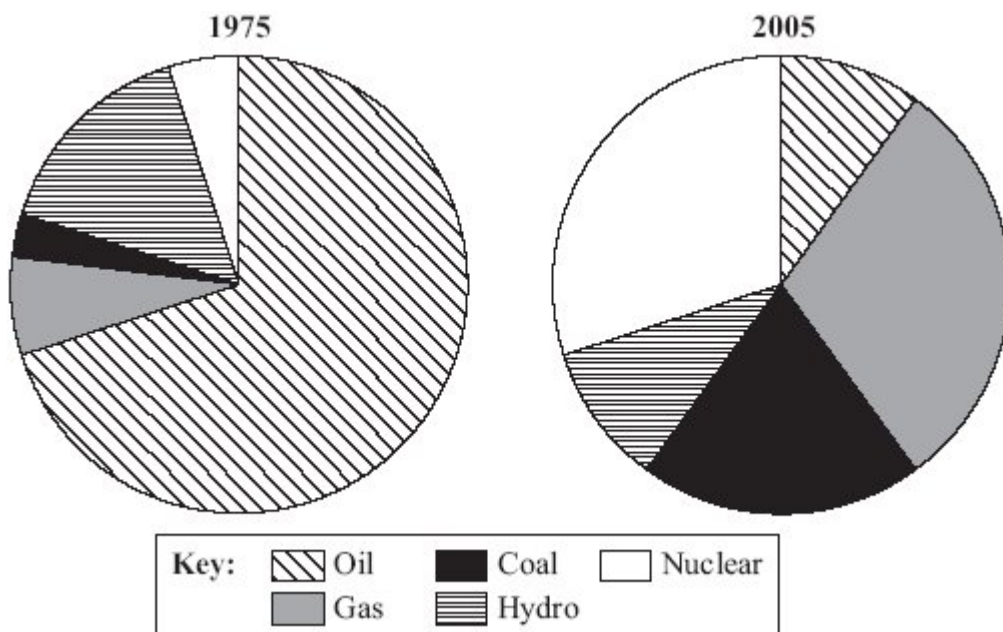
☐

(1)

(Total 10 marks)

Q17.

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.

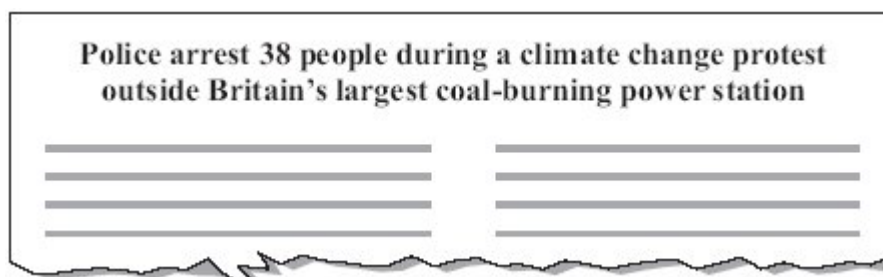
(2)

(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)

Q18.

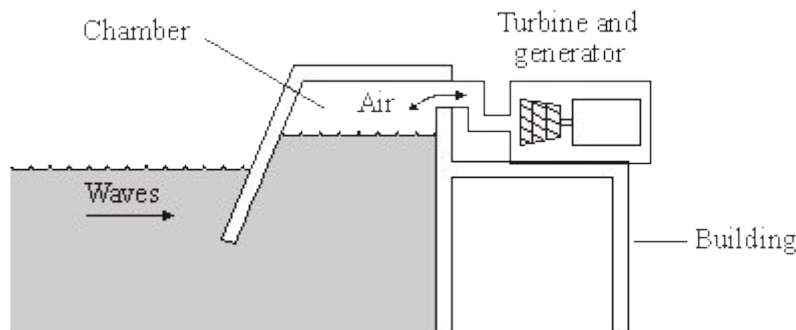
- (a) Water waves are a renewable energy source.

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.

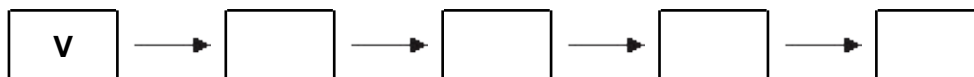


AQA GCSE SCIENCE CORE FOUNDATION STUDENT'S BOOK by Graham Hill, Nigel Heslop, Christine Woodward, Steve Witney and Toby Houghton. Published by Hodder and Stoughton 2006 © Reproduced by permission of John Murray (Publishers) Ltd

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**.



(3)

(Total 5 marks)

Q19.

(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)

Q20.

- (a) Different energy sources are used to generate electricity.

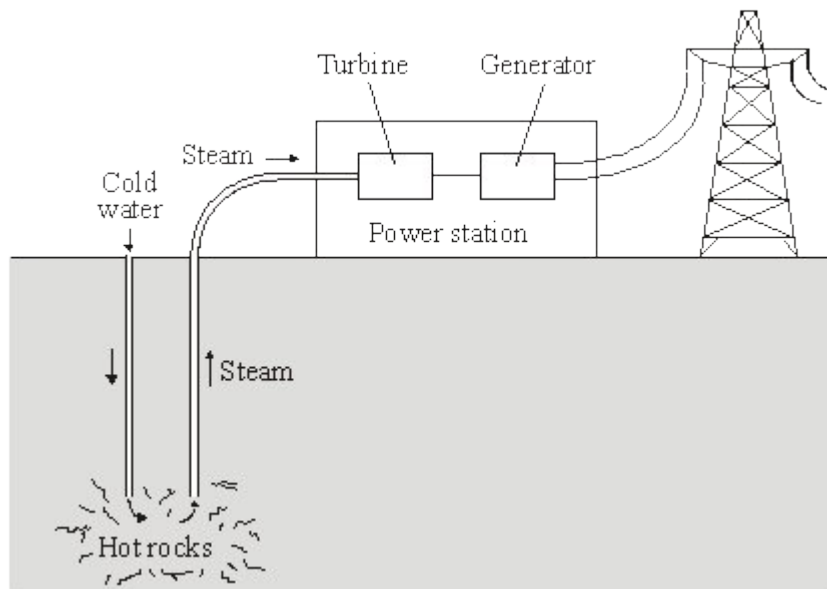
Which **two** of the energy sources in the box are likely to be used up first?

Draw a ring around each of your answers.

gas	oil	Sun	tides	waves	wind
-----	-----	-----	-------	-------	------

(2)

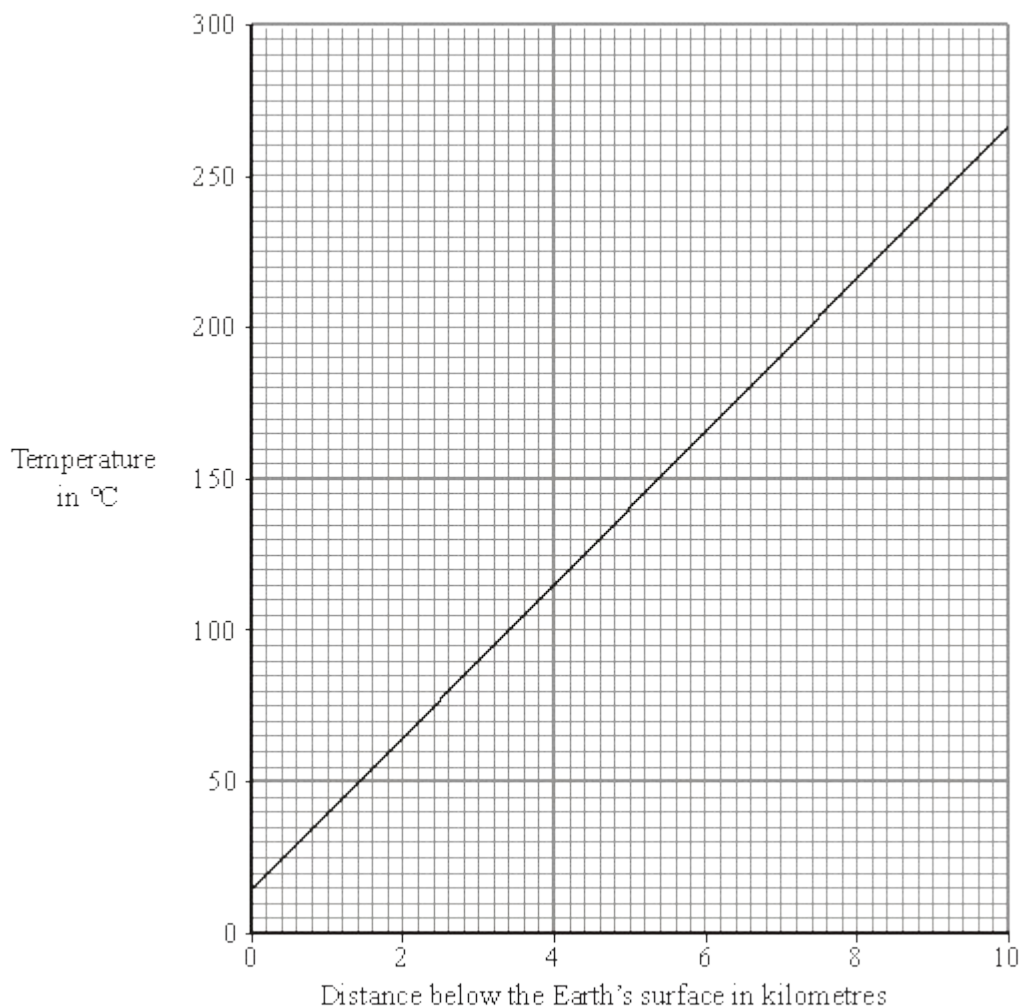
- (b) The diagram shows a geothermal power station. Hot rocks in the Earth's crust heat water to produce steam. The steam is used to drive turbines that turn electrical generators.



How is the way in which a geothermal power station generates electricity the same as the way in which a coal burning power station generates electricity?

(1)

- (c) The graph shows how the temperature of the rocks in the Earth's crust depends on how far the rocks are below the Earth's surface.



Estimate the temperature of the rocks 5 kilometres below the Earth's surface.

Show clearly how you have used the graph to get your answer.

Temperature = _____ °C

(2)

- (d) Scientists have estimated that one quarter of the world's electricity could be generated using geothermal energy.

Give **one** reason that scientists might use to persuade a government to spend large amounts of money building geothermal power stations.

(1)

(Total 6 marks)

Q21.

- (a) Solar energy is a *renewable* energy source that can be used to generate electricity.

- (i) What is meant by an energy source being *renewable*?

(1)

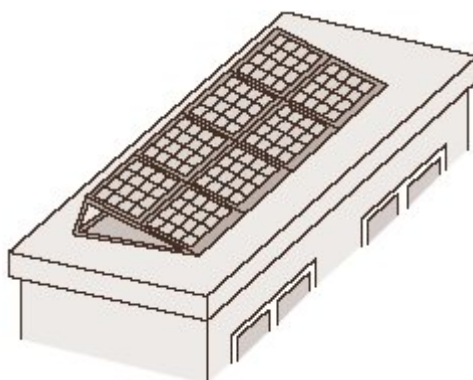
- (ii) Name **two** further renewable energy sources used to generate electricity.

1. _____

2. _____

(1)

- (b) A householder uses a bank of solar cells to generate electricity for his home. The solar cells are tilted to receive the maximum energy input from the Sun.



The data in the table gives the average energy input each second (in J/s), to a 1 m² area of solar cells for different angles of tilt and different months of the year.

Month	Angle of tilt			
	20°	30°	40°	50°
February	460	500	480	440
April	600	620	610	600
June	710	720	680	640
August	640	660	640	580
October	480	520	500	460
December	400	440	420	410

- (i) Use the data in the table to describe how the average energy input to the solar cells depends on the angle of tilt.

(2)

(ii) The bank of solar cells used by the householder has an area of 8 m².

The efficiency of the solar cells is 0.15

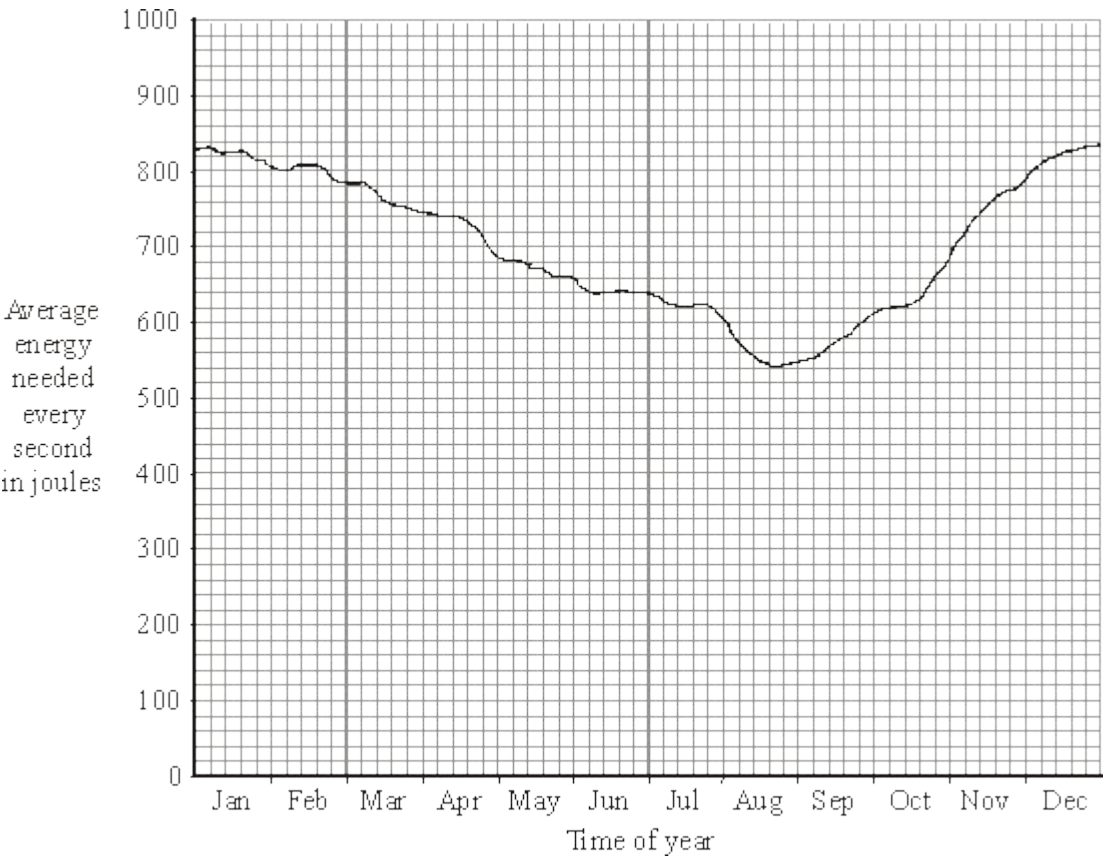
Calculate the average **maximum** electrical energy available from the bank of solar cells each second in June.

Show clearly how you work out your answer.

Maximum energy = _____ joules/second

(3)

(c) The graph shows how the householder’s electrical energy needs change over one year.



Why would it be advisable for the householder to remain connected to the National Grid?

(1)

(Total 8 marks)

Q22.

There is an increasing demand for electricity and the reserve of fossil fuels is decreasing. A way to meet increasing demand for electricity is to build new nuclear power stations. Some people feel that no new nuclear power stations should be built because of the risks associated with nuclear fuels.

- (a) Outline the arguments that a scientist working in the nuclear power industry could use to justify the building of more nuclear power stations in the future.

(3)

- (b) Nuclear waste is a problem that must be dealt with. One possible solution would be to bury the waste deep underground.

Suggest **one** reason why some people are against burying nuclear waste.

(1)

- (c) Electricity can also be generated using renewable energy sources.

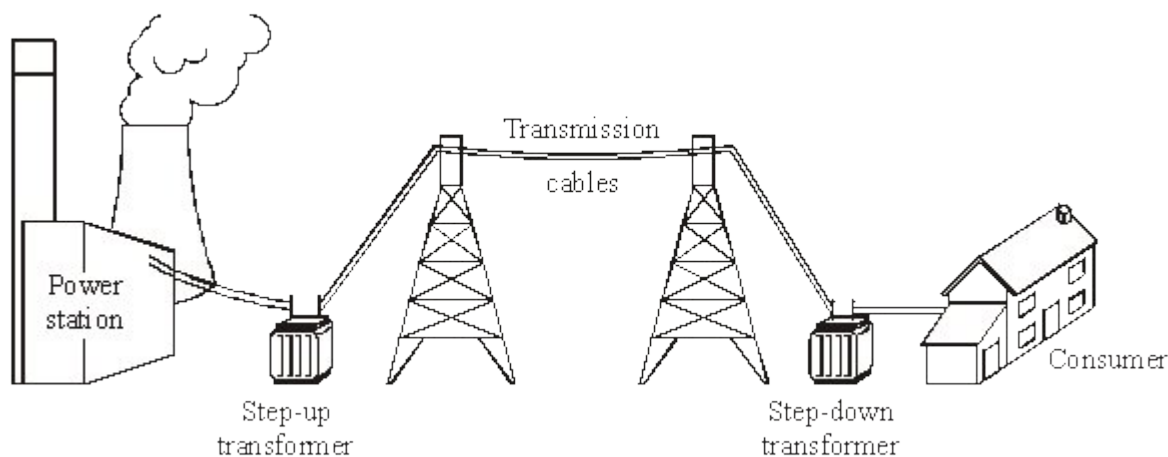
Look at this information from a newspaper report.

- The energy from burning bio-fuels, such as woodchip and straw, can be used to generate electricity.
- Plants for bio-fuels use up carbon dioxide as they grow.
- Farmers get grants to grow plants for bio-fuels.
- Electricity generated from bio-fuels can be sold at a higher price than electricity generated from burning fossil fuels.
- Growing plants for bio-fuels offers new opportunities for rural communities.

Suggest why, apart from the declining reserves of fossil fuels, power companies should use more bio-fuels and less fossil fuels to generate electricity.

Q23.

The diagram shows how electricity gets from power stations to consumers.



- (a) Complete the following sentences by drawing a ring around the correct line in each box.

- (i) The network of cables and transformers linking power stations to consumers

is called the national

grid
line
network

(1)

- (ii)

A step-up transformer

decreases voltage
increases current
increases voltage

(1)

- (iii)

Electricity is supplied to consumers' homes at

230 V
25 000 V
400 000 V

(1)

- (iv)

Making the current in the cables smaller will

increase

make no difference to
reduce

the energy lost in the cables.

(1)

(b) Transformers always waste some energy.

(i) What effect does the waste energy from a transformer have on the air around the transformer?

(1)

(ii) Which **one** of the following describes the efficiency of a transformer?

Draw a ring around your answer.

always 100 % less than 100 % more than 100%

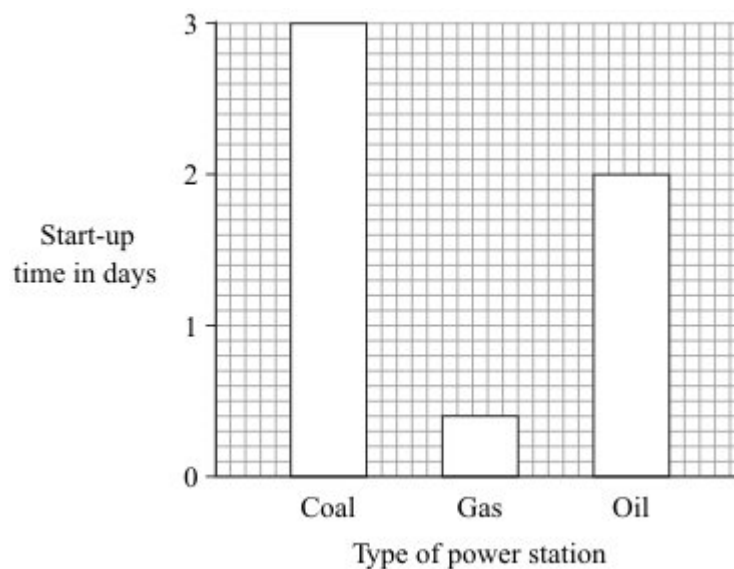
(1)

(Total 6 marks)

Q24.

Much of the world's electricity is generated in power stations that burn fossil fuels.

(a) The bar chart shows the start-up times for the three types of fossil fuel power station.



Which of these power stations would take the longest to start generating electricity?

(1)

(b) Which **two** of the following statements are good reasons for using fossil fuels to generate electricity?

Put a tick (✓) in the box next to each of your choices.

Supplies of fossil fuels are limited.

☐

Fossil fuels can be used to generate electricity at any time.

☐

Fossil fuels are non-renewable.

☐

A few large power stations can generate the electricity for a million homes.

☐

Burning fossil fuels produces carbon dioxide.

☐

(2)

(c) Electricity can be generated using energy from the wind.

(i) Why does a wind-powered generator **not** produce carbon dioxide?

(1)

(ii) Which form of energy is transferred from the wind to generate electricity?

Draw a ring around your answer.

heat kinetic light sound

(1)

(iii) Many people say that wind-powered generators are a good idea because:

“when the wind blows they generate electricity”

“they produce no pollution”

“they generate electricity cheaply”

But not everyone wants more wind-powered generators to be built.



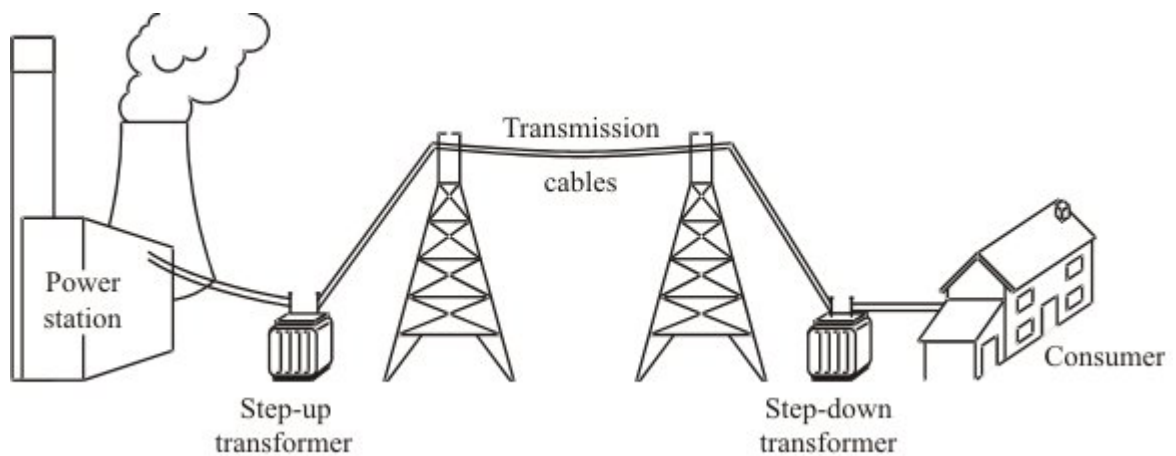
What reasons may be given by the people who think that wind-powered generators are **not** a good idea?

(2)

(Total 7 marks)

Q25.

The diagram shows how electricity is distributed from power stations to consumers.



- (a) (i) What name is given to the network of cables and transformers that links power stations to consumers?

(1)

- (ii) What does a step-up transformer do?

(1)

- (iii) Explain why step-up transformers are used in the electricity distribution system.

(2)

- (b) Most of the world's electricity is generated in power stations that burn fossil fuels.

State **one** environmental problem that burning fossil fuels produces.

(1)

- (c) Electricity can be generated using energy from the wind. A company wants to build a new wind farm. Not everyone thinks that this is a good idea.



- (i) What arguments could the company give to persuade people that a wind farm is a good idea?

(2)

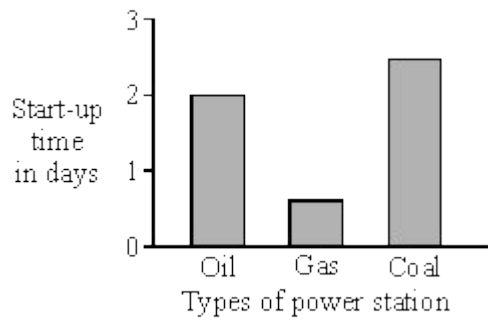
- (ii) What reasons may be given by the people who think that wind farms are **not** a good idea?

(2)

(Total 9 marks)

Q26.

- (a) The bar chart shows the start-up time for different types of fuel-burning power stations.



Which type of power station would be the quickest to start producing electricity?

_____ (1)

- (b) A fuel-burning power station is more reliable than a wind generator at producing electricity. Explain why.

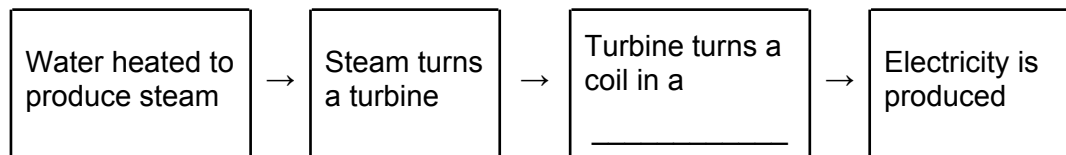
 _____ (2)

- (c) Fuel-burning power stations may produce air pollution. Why does a wind generator not produce any air pollution?

 _____ (1)
 (Total 4 marks)

Q27.

- (a) In Britain most power stations burn fuel to produce heat. The diagram shows the stages by which the heat is transferred into electrical energy. Complete the diagram by filling in the missing word.



(1)

- (b) A fuel burning power station uses 2000 joules of fuel energy to generate 600 joules of electrical energy. The rest of the fuel energy is wasted as heat.

- (i) For every 600 joules of electrical energy generated, how much fuel energy is wasted as heat?

(1)

- (ii) Calculate the efficiency of the power station.
Show clearly how you work out your answer.

efficiency = _____

(2)

- (c) List **A** gives three energy resources used to generate electricity. List **B** gives environmental problems that may be caused by using different energy resources. Draw a straight line from each energy resource in List **A** to the environmental problem it may cause in List **B**. Draw **three** lines only.

List A
Energy resource

Wind

Tides

Falling water
(hydroelectricity)

List B
Environmental problem that may be caused

Destroys the habitat of wading birds in river estuaries

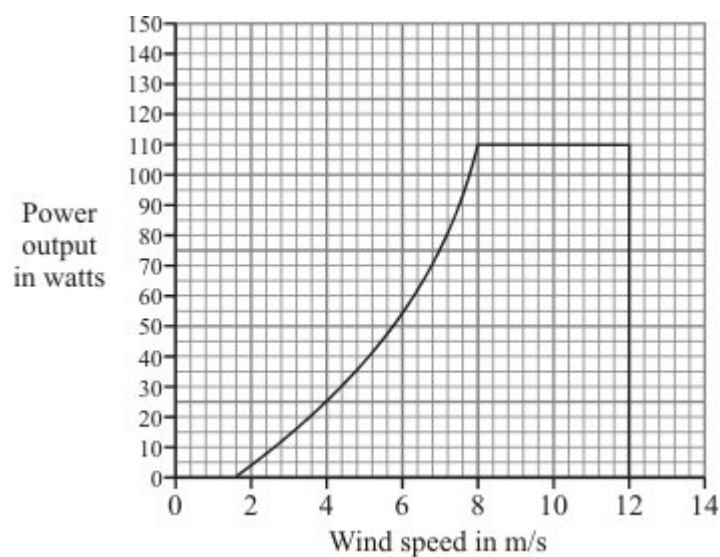
Produces a lot of noise

Produces the gas sulphur dioxide

Floods land used for farming or forestry

(3)

- (d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



- (i) What is the maximum power produced by the generator?

_____ watts
(1)

- (ii) The generator is designed to stop if the wind speed is too high.

At what wind speed does the generator stop working?

_____ m/s
(1)

- (iii) Give **one** disadvantage of using a wind generator to charge a battery.

(1)

(Total 10 marks)

Q28.

- (a) Explain how energy is produced in the Sun.

(3)

- (b) Read the following article that appeared in a magazine.

“Conservation of energy is important in today’s society. Energy sources, such as oil and coal, which have been used for the development of an industrial society, cannot be relied upon as heavily in the future. Renewable energy sources cannot provide such large quantities of energy for society without causing problems.”

- (i) Give **two** reasons why oil should not be relied on as a major source of energy for the future.

1. _____

2. _____

(2)

- (ii) Energy from the wind is a renewable energy resource. State **three** problems which may arise if the wind were to be used to meet the energy requirements of a large industrial city in Britain.

1. _____

2.

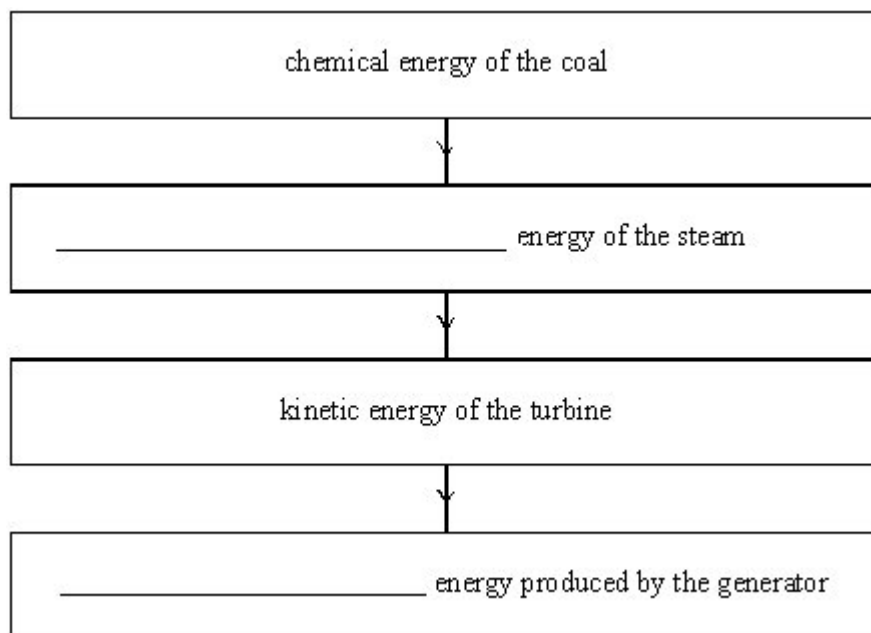
3.

(3)
(Total 8 marks)

Q29.

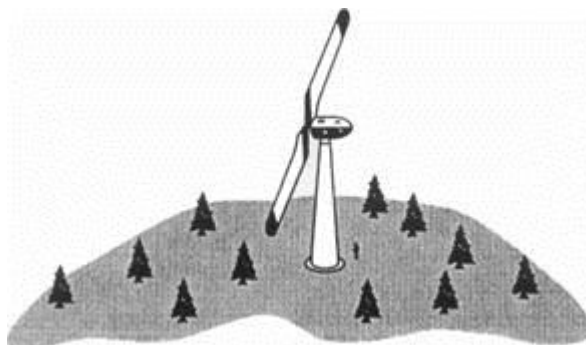
- (a) Most electricity in Britain is generated by coal fired power stations.

Complete the sequence of useful energy transfers which take place in the power station.



(1)

- (b) The diagram shows a wind turbine which is used to produce electricity using energy from the wind.



- (i) What is the source of energy which creates winds?

(1)

- (ii) Explain the advantage of using a wind turbine to produce electricity.

(2)

(Total 4 marks)

Q30.

- (a) A swimming pool has a wave making machine. The diagram shows the water wave pattern for 3 seconds.



- (i) How many water waves are shown in the diagram?

(1)

- (ii) What is the frequency of the water waves?

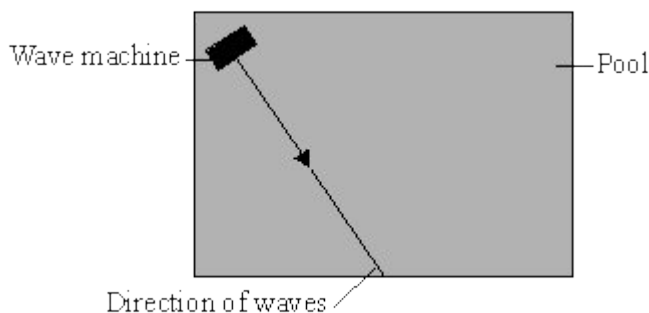
(1)

- (iii) Which **one** of the units below is used to measure frequency? Underline your answer.

hertz joule watt

(1)

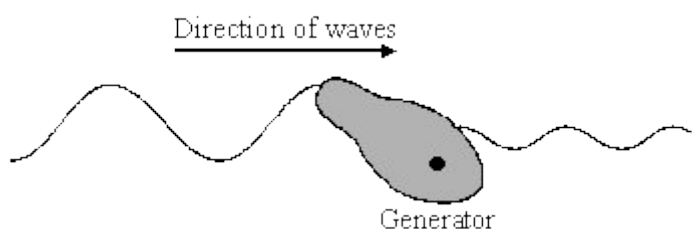
- (b) The diagram shows the direction of the waves across the pool. The waves reflect off the side of the pool.



Draw a line on the diagram to show the direction of the waves after they hit the side of the pool.

(1)

- (c) The swimming pool is used to test a model of an electricity generator. The waves make the floating generator move up and down. This energy is transferred to electricity.



- (i) In the following sentence, cross out the **two** lines that are wrong in the box.

The diagram shows that the amplitude of the waves

gets larger
stays the same
gets smaller

 as the waves pass the generator.

(1)

- (ii) What type of energy does the generator transfer to electricity?

(1)

- (iii) Energy from ocean waves could be used to generate electricity. Would this be a renewable or non-renewable energy resource?

(1)

(Total 7 marks)

Q31.

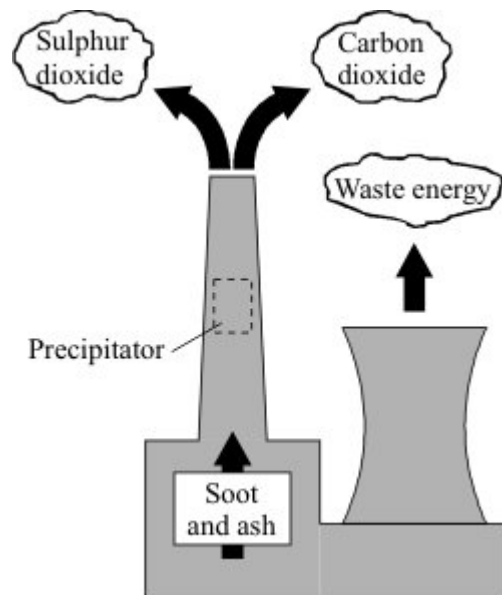
- (a) (i) A student wrote "Coal traps energy from the Sun". Explain what the student means.

(2)

- (ii) How is energy released from coal?

(1)

- (b) The diagram shows the waste products from a coal-fired power station.



- (i) In what form does the power station waste energy?

(1)

- (ii) Carbon dioxide released into the atmosphere will lead to a rise in the Earth's temperature. Why?

(1)

(Total 5 marks)

Q32.

- (a) Electricity can be generated using different energy resources.

- (i) Draw lines to link each way of producing electricity to a statement about an energy resource.

Method of producing electricity	Energy resource statements
Tidal barrage	Produces only a small amount of electricity
Solar panel	Is built across a river estuary
Wind turbine	Produces a lot of unwanted noise
Nuclear power station	Rough seas are needed
Wave machine	The waste is very dangerous

(4)

- (ii) Which **one** of these methods of producing electricity uses a non-renewable energy resource?

(1)

- (b) The wind is a renewable energy resource.

- (i) **One** of the following statements describes the source of energy that creates a wind. Tick the box next to the correct statement.

The Earth turning on its axis. ☐

The gravity pull of the Moon. ☐

Heat from the Sun. ☐

(1)

- (ii) Complete the sentence by choosing the correct word from the box.

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

A wind turbine transfers _____ energy to electrical energy.

(1)

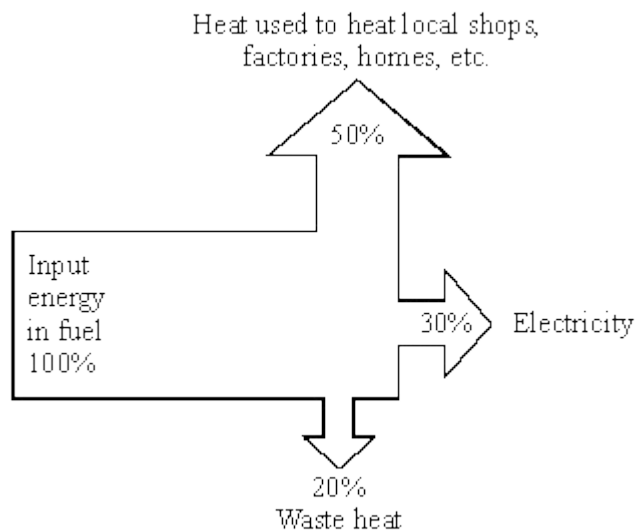
- (iii) A wind turbine does not produce electricity all of the time. Why not?

(1)

(Total 8 marks)

Q33.

In a traditional power station 30% of the energy input is usefully transferred to electricity, the rest is wasted as heat. The diagram shows the energy transfers in a combined heat and power (CHP) station.



Explain why replacing traditional power stations by CHP stations may be beneficial to the environment.

(Total 2 marks)

Q34.

(a) Coal, gas, oil and wood are all examples of fuels.

(i) What are fuels?

(1)

(ii) Write the names of these fuels in the table below to show which are renewable and which are non-renewable.

RENEWABLE FUELS	NON-RENEWABLE FUELS

(2)

- (b) The list below shows energy resources which are not fuels.

geothermal nuclear solar tides wind

Write the names of the energy resources in the table below to show which are renewable and which are non-renewable.

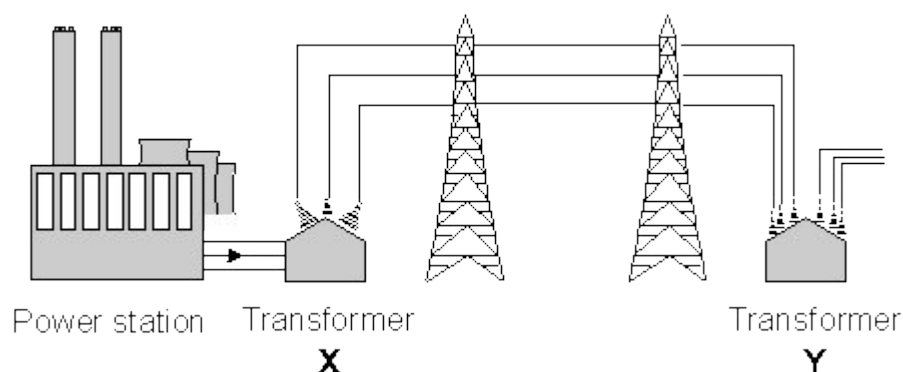
RENEWABLE FUELS	NON-RENEWABLE FUELS

(2)

- (c) Why is it better to use more renewable energy resources rather than non-renewable resources?

Q35.

The outline diagram below shows part of the National Grid. At **X** the transformer increases the voltage to a very high value. At **Y** the voltage is reduced to 240 V for use by consumers.



- (i) At **X** a transformer increases the voltage. What happens to the current as the voltage is increased?

_____ (1)

- (ii) Why is electrical energy transmitted at very high voltages?

_____ (1)

- (iii) The transformer at **Y** reduces the voltage before it is supplied to houses. Why is this done?

_____ (1)

(Total 3 marks)

Mark schemes

Q1.

- (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]

Q2.

- (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]

Q3.

- (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 CO₂ / SO₂ / oxides of nitrogen / greenhouse gas for pollutant gases
- nuclear produces no pollutant gases
 accept nuclear burns no fuel
- (burning) gas does not produce SO₂
 accept gas does not cause acid rain
 do **not** accept they don't / none produce pollutant gases

NO answers may include:

- nuclear produces radioactive waste
- (burning) gas produces CO₂ / 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]

Q4.

- (a) (i) kinetic
 accept KE
 do **not** accept movement

1

- (ii) 0.75

$\frac{60\,000}{80\,000}$

allow **1** mark for correct substitution ie

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 and 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]

Q5.

(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 nuclear power stations

*ignore references to efficiency / job creation / local economy
/ selling electricity*

1

(c) economic issues

1

[7]

Q6.

(a) (i) 4

allow 1 mark for correct transformation and substitution

$$\frac{0.6}{0.15}$$

ie

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]

Q7.

(a) (i) gas

1

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

1

- (iii) fuel is **not** 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 $36\,000\,000 \div 2\,000$
*an answer of 0.018 gains **1** mark*

2

[10]

Q8.

- (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:

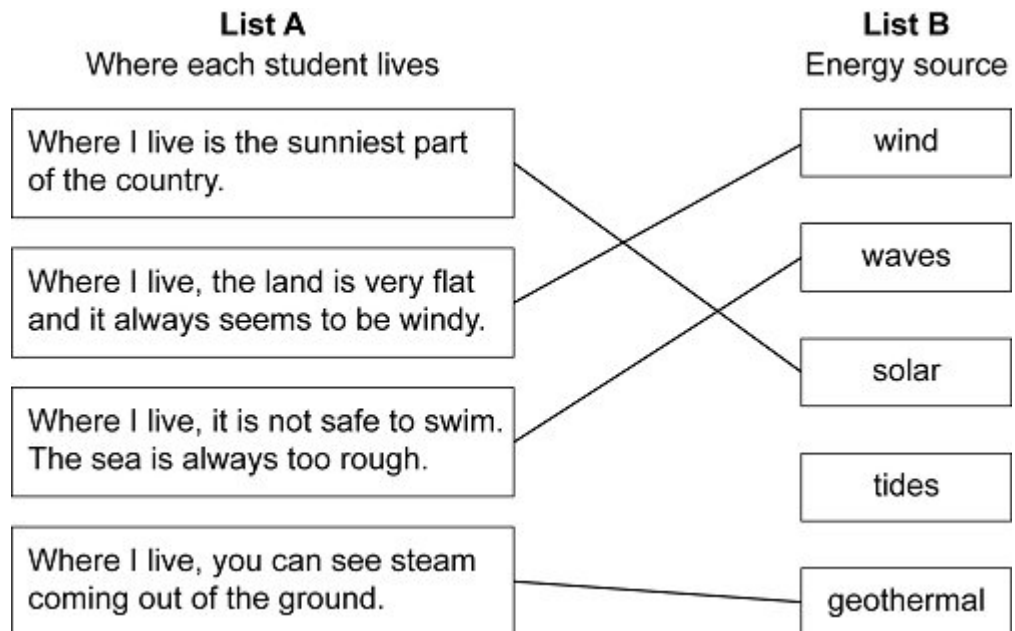
- do not know how many (nuclear) power stations there will be
- power stations may continue to increase in efficiency
- do not know what type of power station new ones will be
*accept new methods may be found to generate electricity /
energy*
accept other ways of generating energy may be expanded
- do not know future energy / electricity demands
accept we may become more energy efficient
- may be new uses for uranium

2

[6]

Q9.

- (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]

Q10.

(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 CO₂ / carbon emissions reduced

- energy source is free
- energy source / tides are predictable
- produces less / no pollutant gases (than fuel burning power stations)
accept no CO₂ / 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]

Q11.

- (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
- (ii) wasted
accept transformed to heat / other forms
accept transferred to the air / surroundings sound = neutral
- (b) (i) any **one** from:

2

1

- 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]

Q12.

(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]

Q13.

(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]

Q14.

(a) grid

accept any unambiguous indication

1

(b) (i) A (only)

1

(ii) D (only)

1

(c) more than

accept any unambiguous indication

1

[4]

Q15.

- (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]**Q16.**

- (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 gases 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 £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]

Q17.

(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 and 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) water heated to produce (high pressure) steam

1

steam turns turbine which drives generator

1

(iii) any **two** from:

- produces no pollutant gases
 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 CO₂

1

(increased) CO₂ increases / contributes to / causes global warming / greenhouse effect

mention of ozone layer negates this mark

do **not** accept CO₂ warms atmosphere

1

[9]

Q18.

(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]

Q19.

- (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 judge 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]

Q20.

- (a) gas 1
- oil 1
- (b) (both) use steam to drive a turbine
- accept (both) use turbines to drive generators*
- do **not** accept both have a turbine /generator / use steam*
- must describe a step in the process*
- accept heat / thermal energy transformed to kinetic / electrical energy* 1
- (c) 140 (°C)
- correct answer only*
- allow **1** mark for method clearly shown on graph*
- accept a cross or other indication at correct position on the line*
- accept correct description*
- accept even if numerical answer is incorrect* 2
- (d) any **one** from:
- do **not** accept answers purely in terms of disadvantages of other methods except for fossil fuels are running out*
- very large energy source / reserves
 - no polluting / harmful gases produced
- accept named gas CO₂ SO₂ NO_x*
- accept reduces harmful carbon emissions*

- reduces carbon emissions
accept does not contribute to global warming
- no fuel needed
- energy is free
- can generate energy for a long time
accept energy available for a long time
- renewable (energy source)
- fossil fuels are running out
accept it saves fossil fuels / non-renewable
accept reduces the amount of fossil fuels being burnt
accept a named fossil fuel
Better for the environment / environmentally friendly
insufficient
it is cheaper is insufficient

1

[6]

Q21.

- (a) (i) replaced faster than it is used
accept replaced as quick as it is used
accept will never run out
*do **not** accept can be used again*
- (ii) any **two** from:
***two** sources required for the mark*
- wind
 - waves(*)
 - tides(*)
()do **not** accept water / oceans*
accept OTEC
 - fall of water
accept hydroelectric
 - biomass
 - geothermal
accept a named biomass / biofuel eg wood
- (b) (i) any **two** from:
- increases from 20° to 30°
 - reaches maximum value at 30°

1

1

- then decreases from 30°
- same pattern for each month
*accept peaks at 30° for **both** marks*
*accept goes up then down for **1** mark*
ignore it's always the lowest at 50°

2

(ii) 864

*an answer of 108 gains **2** marks*
*allow **1** mark for using 720 value only from table*
*allow **2** marks for answers 852, 816, 768, 825*
*allow **1** mark for answers 106.5, 102, 96, 103 (.125)*

3

- (c) the solar cells will not meet demand at all times of the year / day
accept to maintain a constant supply of electricity / energy

or to make up the shortfall in energy required at certain times of the year

or to be able to sell surplus electricity (to the National Grid)

accept to provide energy at night
*do **not** accept because it's cloudy on it's own*

1

[8]

Q22.

- (a) only accept answers in terms of the argument of the nuclear power scientist any **three** from:

- produces a lot of energy for a small mass of fuel **or** is a concentrated energy source
accept amount for mass
- it is reliable **or** it can generate all of the time
- produces no pollutant gases
*accept named gas or greenhouse gases do **not** accept no pollution*
- produces only a small volume of (solid) waste
accept amount for volume
- advances in technology will make fuel reserves last much longer
accept an argument in terms of supply and demand

3

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

- may leak into the ground / environment
- geological changes
accept earthquakes etc

- may get into the food chain
*do **not** accept answers in terms of property prices or 'damages the environment'*
- over time if location not correctly recorded it may be excavated

1

(c) any **three** from:

- overall add no carbon dioxide to the environment
*accept do not add to global warming
accept they are carbon neutral*
- power companies can sell electricity at a higher price
accept power companies make more profit
- opportunity to grow new type crop
*accept specific examples e.g. growing plants in swamps
accept extends the life of fossil fuel reserve*
- more jobs
- more land cultivated **or** different types of land utilised

3

[7]

Q23.

(a) (i) grid

accept any way of indicating correct answer

1

(ii) increases voltage

accept any way of indicating correct answer

1

(iii) 230 V

accept any way of indicating correct answer

1

(iv) reduce

accept any way of indicating correct answer

1

(b) (i) increases the temperature

accept make it hotter / heat goes into the air

accept convection currents

accept sensible comment eg sound energy / it buzzes

ignore pollutes the air

1

(ii) less than 100%

1

[6]

Q24.

- (a) coal 1
- (b) fossil fuels can be used to generate electricity at any time
if more than 2 boxes ticked, mark incorrect boxes first 1
- a few large power stations can generate the electricity for a million homes 1
- (c) (i) no fuel is burnt
accept a named fuel
accept nothing is burnt
accept does not use (fossil) fuel 1
- (ii) kinetic 1
- (iii) any **two** from:
- ♦ cause noise pollution
 - ♦ cause visual pollution
- } *accept causes pollution for 1 mark*
- need concrete for bases
 - new roads / infrastructure needed
 - may interfere with TV / radio / mobile
phone signals
 - dangerous to birds
 - do not generate all of the time
accept generates only when the wind blows
*do **not** accept 'generate when the wind blows'*
 - need a lot of generators
*do **not** accept 'take up a lot of space / land'*
 - high initial / capital costs
 - reduces house prices
- 2

[7]

Q25.

- (a) (i) national grid 1
- (ii) increases voltage / potential difference

accept decrease current
accept step-up / boosts the voltage
*do **not** accept increases energy / power / current*
ignore reference to voltage going through

1

(iii) any **two** from:

- reduce current
ignore increased voltage / pd
- reduces energy loss / power loss (from cables)
accept reduces heat loss
*do **not** accept stops energy loss*
- increases efficiency (of distribution)

2

(b) any **one** from:

- produces pollutant gases
accept produces carbon dioxide / sulfur dioxide / nitrogen oxides
accept global warming / greenhouse effect / carbon emissions / air pollution / acid rain
ignore ozone layer
*do **not** accept carbon monoxide*
- produces solid waste / ash / smoke
accept global dimming
ignore produces pollution

1

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

any two valid points gains the marks

- using renewable energy
accept don't use up non-renewable / fossil fuels
accept named fuels
- non-renewable fuels can be used for other processes
- no pollutant gases produced
accept the opposite of (b)
ignore no pollution
- land can still be used for farming
ignore economic issues

2

(ii) any **two** from:

- cause noise pollution

- cause visual pollution
accept spoils the landscape
accept sunlight flicker
- may interfere with TV / radio / mobile phone signals
- need to put in new infrastructure
accept new roads needed
- not reliable owtte
- dangerous to birds
- lots of concrete needed for the bases
or
producing cement is environmentally damaging
accept reduces house prices
ignore any references to cost / jobs / number required
ignore takes up a lot of land
accept reference to obstruction of shipping etc. if clear
reference tooftshore wind farm

2

[9]

Q26.

(a) gas

1

(b) fuel burning stations produce electricity at any time / all the time
accept fuel available all the time

1

wind generator can only produce when the wind is strong enough
accept it's not always windy

1

(c) no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or**
does not emit harmful gases / soot / smoke
*do **not** accept wind is natural / environmentally friendly /*
renewable
*answer must be in terms of wind, **not** negative of fuel*
burning
specific examples of gases CO₂, SO₂,
acid rain and greenhouse gases can be accepted
ozone negates credit

1

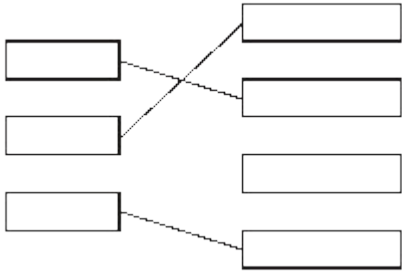
[4]

Q27.

(a) generator

accept dynamo
accept alternator

1

- (b) (i) 1400
ignore units 1
- (ii) 0.3 or 30%
any incorrect unit penalise 1 mark
allow 1 mark for the correct use of 600
or 0.3% or 30 2
- (c) 1 mark for each correct link
- 
- if more than 3 lines are drawn, mark only*
3 lines starting with those that are incorrect 3
- (d) (i) 110
no tolerance 1
- (ii) 12
no tolerance 1
- (iii) wind speed may be too low to operate the generator
accept wind may not always blow
accept power depends on wind speed
accept does not generate if wind speed is too high
accept does not generate if wind speed is above 12 (m/s)
accept does not generate if wind speed is below 1.6 (m/s)
accept it is unreliable
*do **not** accept answers referring to cost only* 1

[10]

Q28.

- (a) hydrogen converted to helium 1
- (nuclear) fusion 1
- ((small) loss in mass) which is converted to large amount of energy 1
- (b) (i) any **two** from

it is running out/ takes millions of years/finite

not non renewable

*allow acid rain **do not** allow waste*

pollution **or** problem with CO₂ production

allow a specific example

more responsible to use fossil fuels for
(important) chemical functions

2

(ii) any **three** from

need lots of land for generators **or** many generators needed

generators may not be conveniently located

uncertainty of supply

accept the wind may not always blow

social resistance **or** visual pollution

noise pollution

high initial costs

(possible) interference with (local) radio and TV signals

3

[8]

Q29.

(a) internal **or** thermal **or** heat **or** kinetic **or** movement

electrical

*both answers required for **one** mark*

1

(b) (i) Sun **or** solar

*do **not** accept sunshine*

1

(ii) any **one** of the follow:

- wind turbines produce no (gaseous) pollutants
 - wind turbines use renewable energy
 - wind turbines produce no (solid) waste
 - reduced running costs
- do **not** allow safety*

1

a supporting statement **or** comparison **or** explanation

1

[4]

Q30.

- (a) (i) 3 1
- (ii) 1
accept a definition of frequency ignore units 1
- (iii) hertz 1
- (b) straight line in correct direction
judge by eye (from 'a' of waves to 's' of across) ignore arrow
accept equal angles shown on waves 1
- (c) (i) gets smaller 1
- (ii) kinetic
accept movement 1
- (iii) renewable 1

[7]

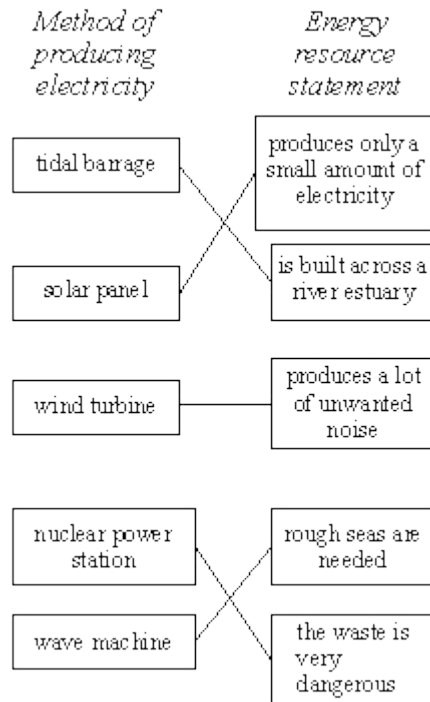
Q31.

- (a) (i) photosynthesis for growth
accept plants require sunlight for growth 1
- plants change into coal
any mention of animals negates second mark 1
- (ii) burning
*do **not** accept heating*
accept combustion 1
- (b) (i) heat 1
- (ii) less heat radiated into space
accept increased insulation round earth
accept reflects heat back to earth
accept greenhouse effect
*accept traps heat **or** energy* 1

[5]

Q32.

- (a) (i) correct links shown



4

1 link for 1 mark
 2 links for 2 marks
 3 links for 3 marks
 4 links for 3 marks
 5 links for 4 marks
 do **not** credit if more than one link goes to **or** from any box

- (ii) nuclear (power station)
 do **not** accept power station

1

- (b) (i) heat from the Sun

1

- (ii) kinetic

1

- (iii) insufficient wind (to turn turbine)
 accept wind does not always blow
 do **not** allow it does not always work or it is switched off
 do **not** accept wind in wrong direction

1

[8]

Q33.

any **one** from:

basic idea of reduced use of fuels to heat homes **or** offices
or shops for 1st mark

less (heat) energy wasted (to the environment)

reduced demand for fuels to heat homes etc

simply re-quoting figures gets no credit

1

any **one** from:

idea of less pollution for the 2nd mark

reduced (air) pollution

*do **not** accept no pollution*

fewer power stations required **or** less electricity needs to be produced

less (fossil) fuels being burnt (in power stations)

reduced greenhouse effect

reduced global warming

1

[2]

Q34.

- (a) (i) sources of energy
for 1 mark

- (ii) wood coal
oil
gas

all correct gains 2 marks

3 correct gains 1 mark

3

- (b) geothermal nuclear
tides
wind
solar

all correct gains 2 marks

4 correct gains 1 mark

2

- (c) non-renewable fuels cause pollution (or reverse)
conserve/limit use of coal/gas/oil;
so supplies last longer/renewable sources can be replaced
any 2 from 4 for 1 mark each

2

[7]

Q35.

- (i) reduces
for 1 mark

1

- (ii) less heat/energy/power wasted (in power lines)

for 1 mark

1

(iii) for safety

for 1 mark

1

[3]