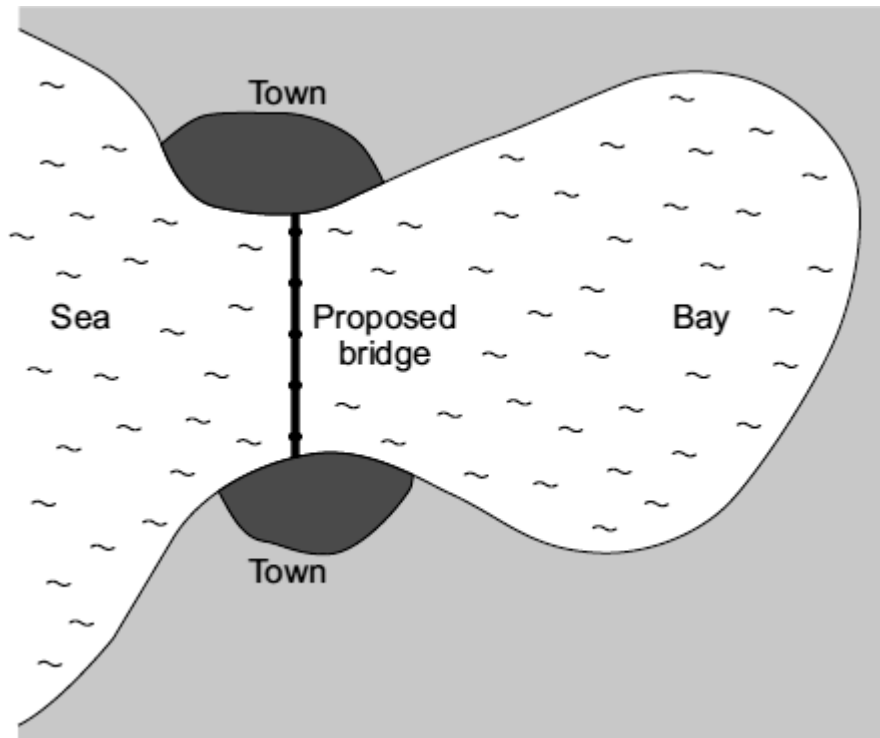


NATIONAL AND GLOBAL ENERGY RESOURCES PART II

Q1.

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.

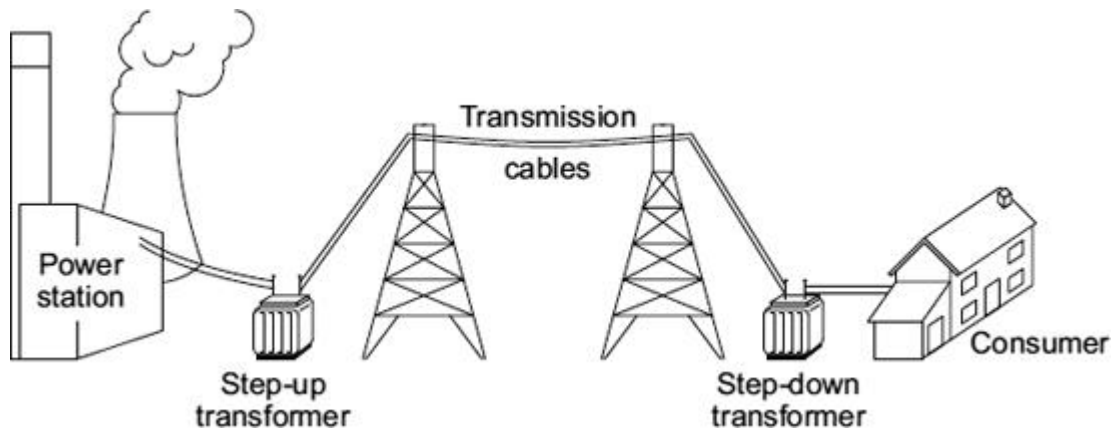
Reason 1 _____

Reason 2 _____

Reason 3 _____

- (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)

Q2.

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.

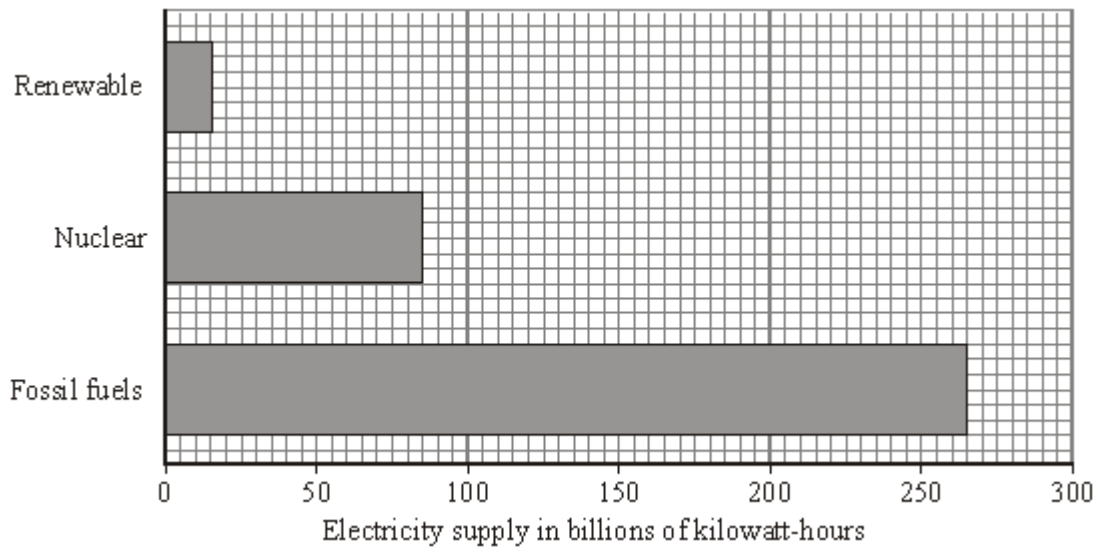
Suggest **one** possible use for an aircraft such as this.

(1)

(Total 6 marks)

Q3.

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

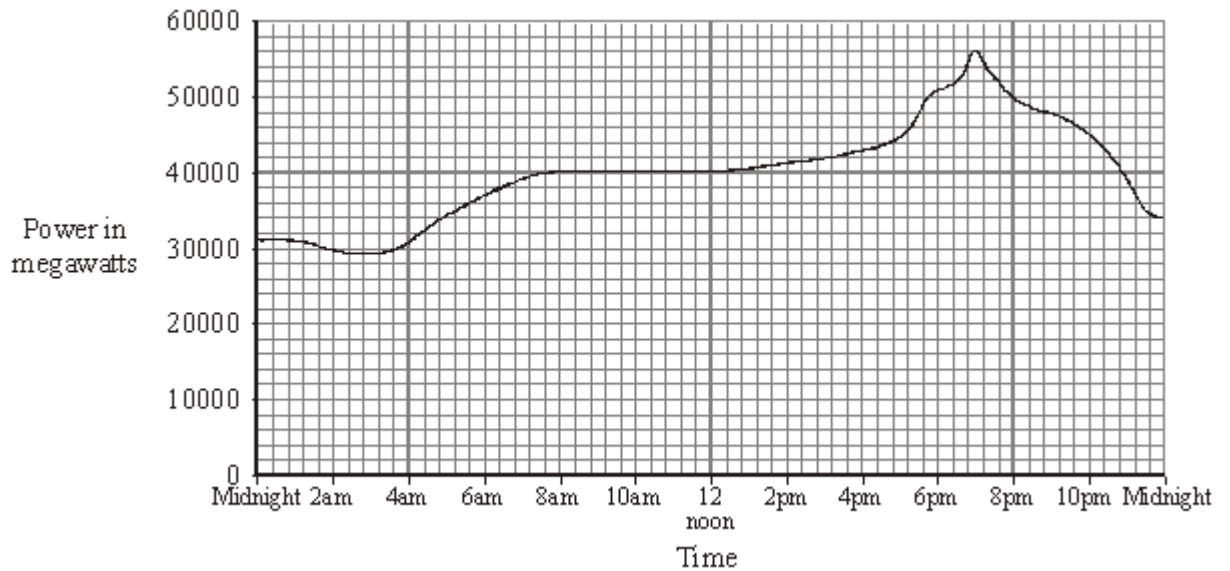
decrease
not change
increase

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.

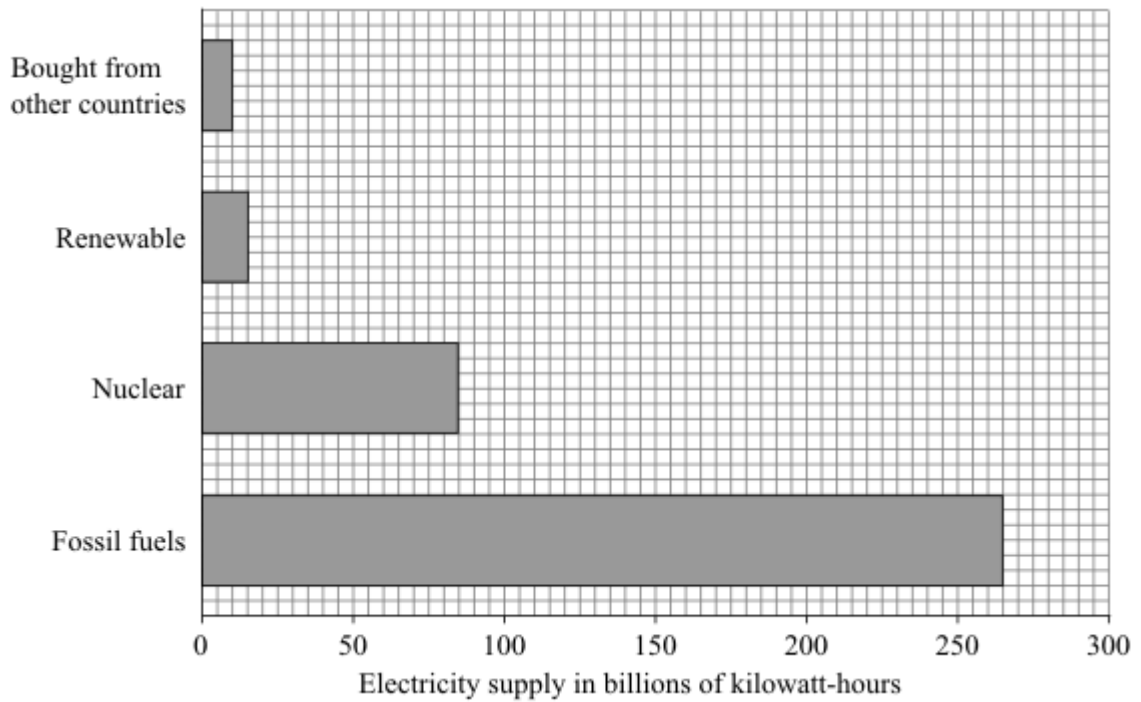
coal natural gas nuclear oil

(1)

(Total 5 marks)

Q4.

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.

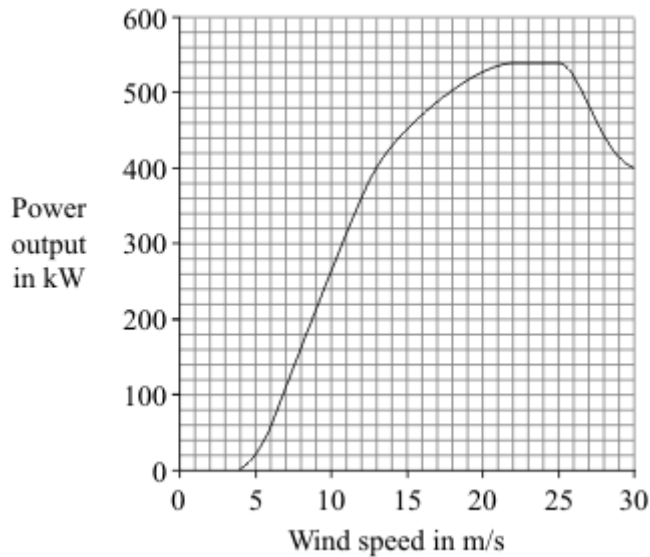
(2)

- (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.

Q5.

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

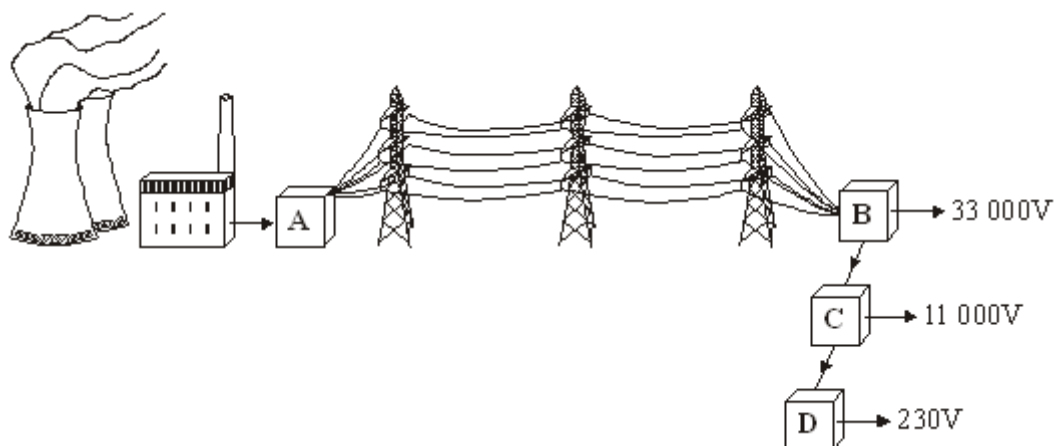
- (a) Complete the following sentence by using **one** of the words in the box.

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.

(1)

(Total 4 marks)

Q6.

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.

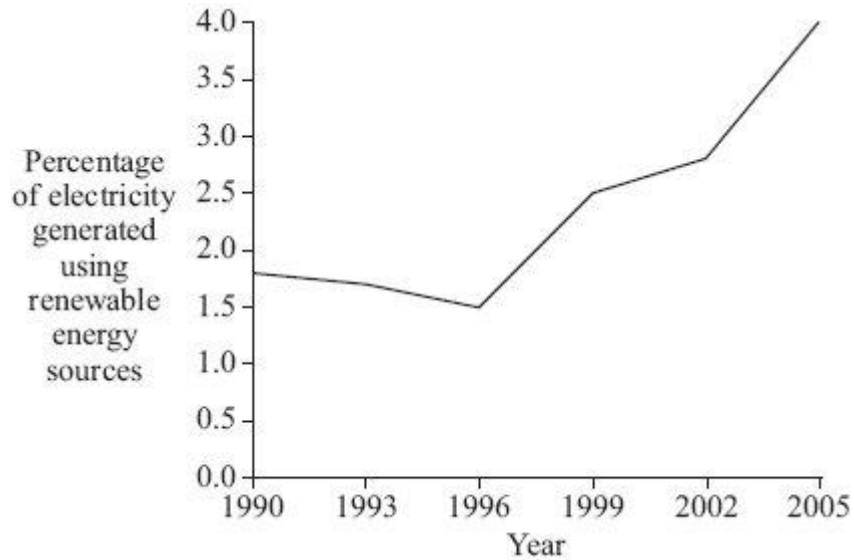
(1)

(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% |

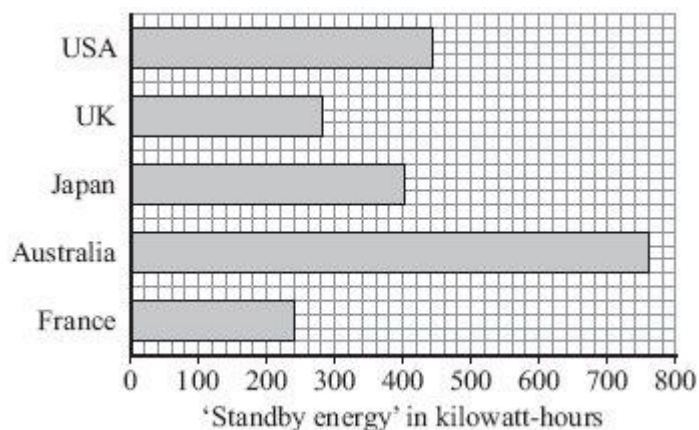
(1)

(Total 4 marks)

Q7.

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.

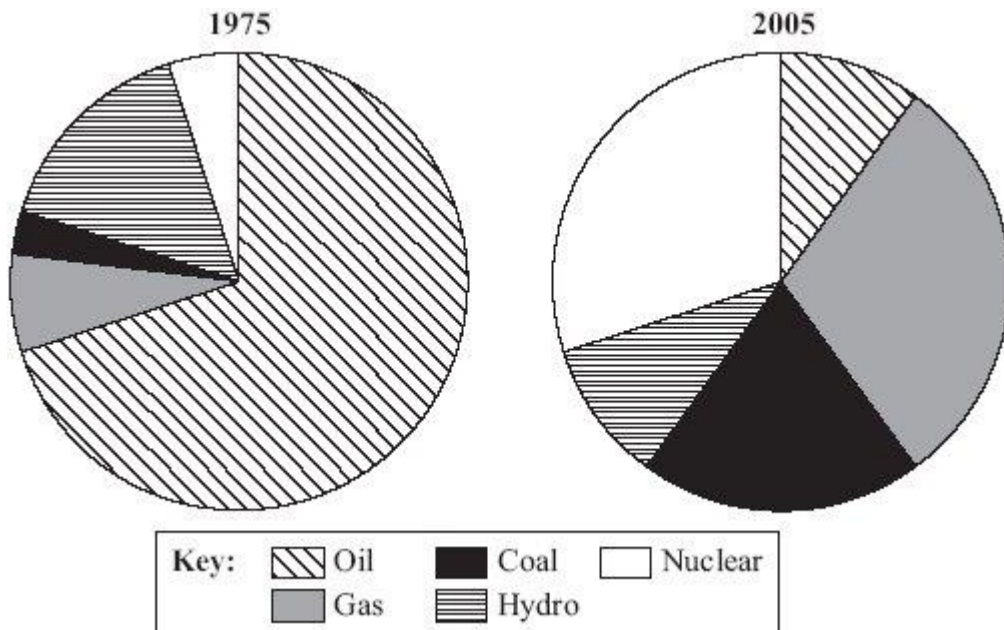
It is easy to store nuclear waste safely.

(1)

(Total 10 marks)

Q8.

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. _____

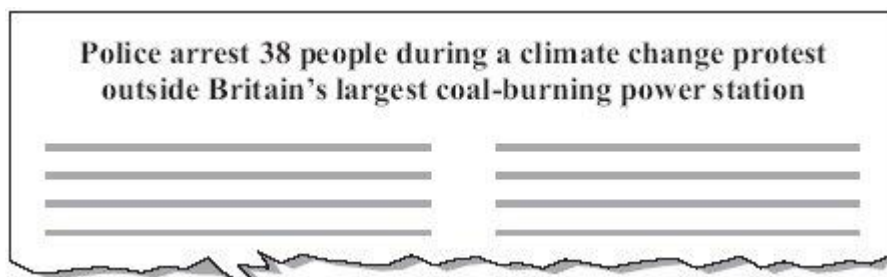
(2)

(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*.

Q9.

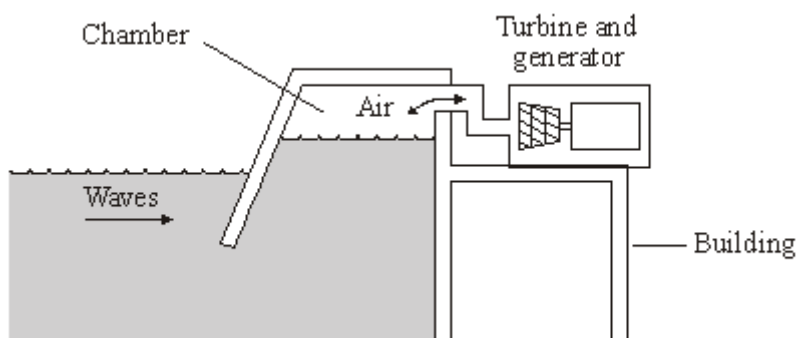
- (a) Water waves are a renewable energy source.

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.

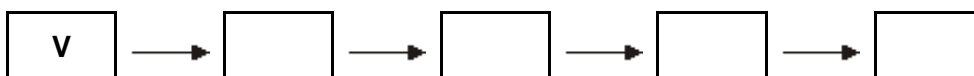


AQA GCSE SCIENCE CORE FOUNDATION STUDENT'S BOOK by Graham Hill, Nigel Heslop, Christine Woodward, Steve Witney and Toby Houghton. Published by Hodder and Stoughton 2006 © Reproduced by permission of John Murray (Publishers) Ltd

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)

Q10.

(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)

Q11.

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

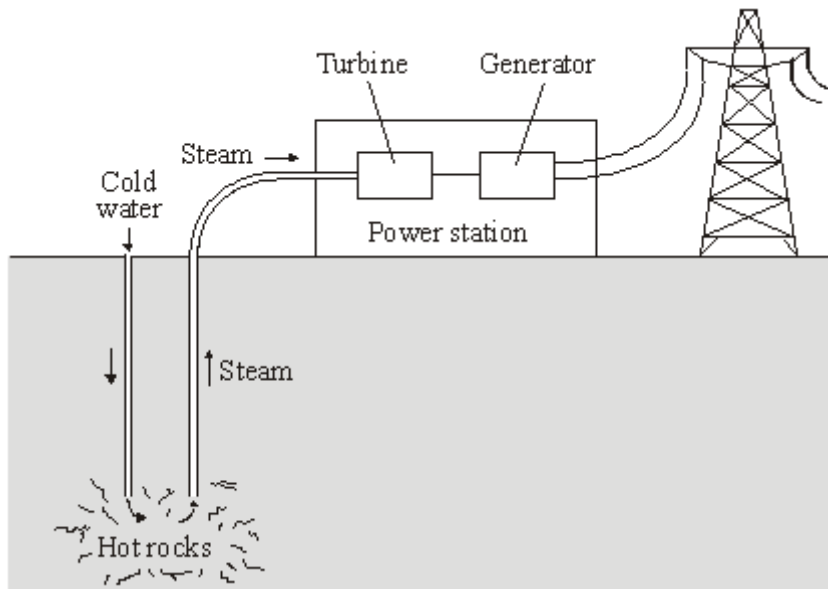
Which **two** of the energy sources in the box are likely to be used up first?

Draw a ring around each of your answers.

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

(2)

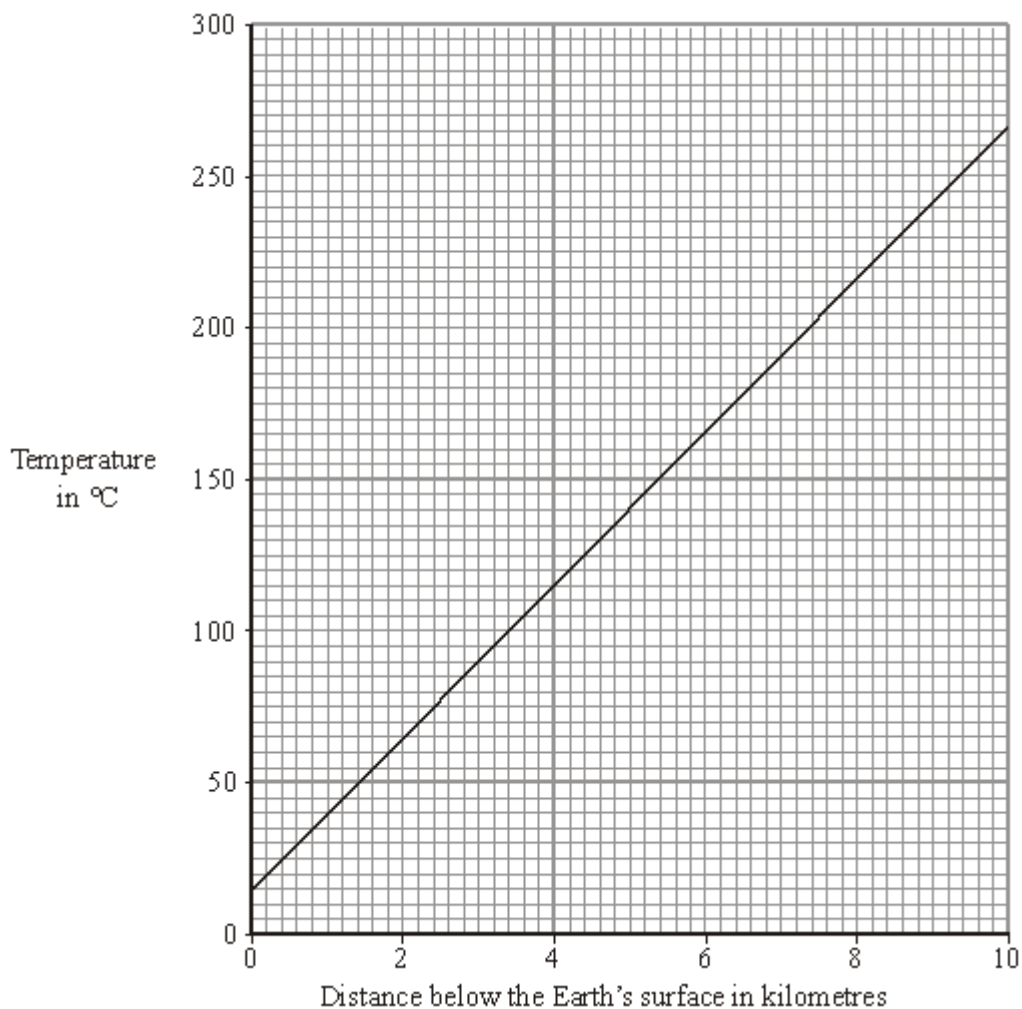
(b) The diagram shows a geothermal power station. Hot rocks in the Earth's crust heat water to produce steam. The steam is used to drive turbines that turn electrical generators.



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)

Q12.

- (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)

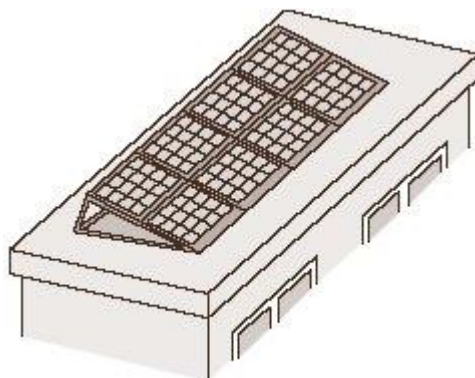
- (ii) Name **two** further renewable energy sources used to generate electricity.

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

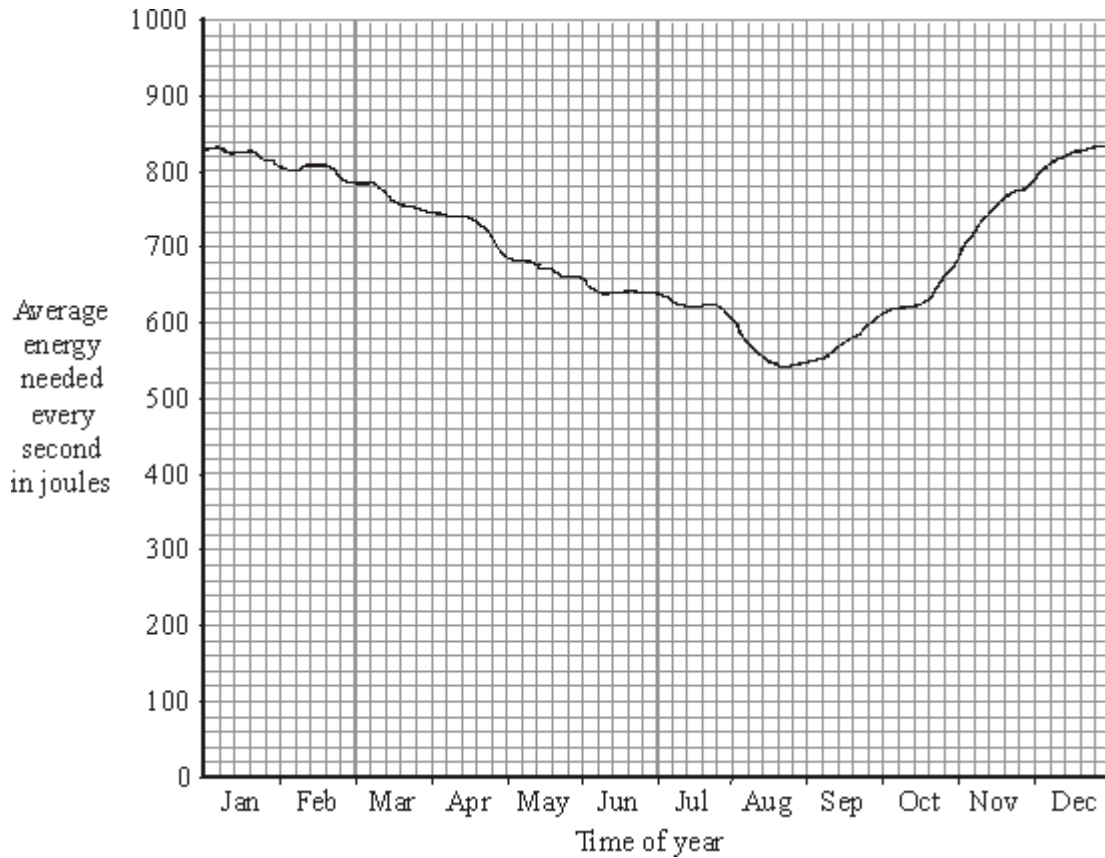
Calculate the average **maximum** electrical energy available from the bank of solar cells each second in June.

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)

Q13.

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.

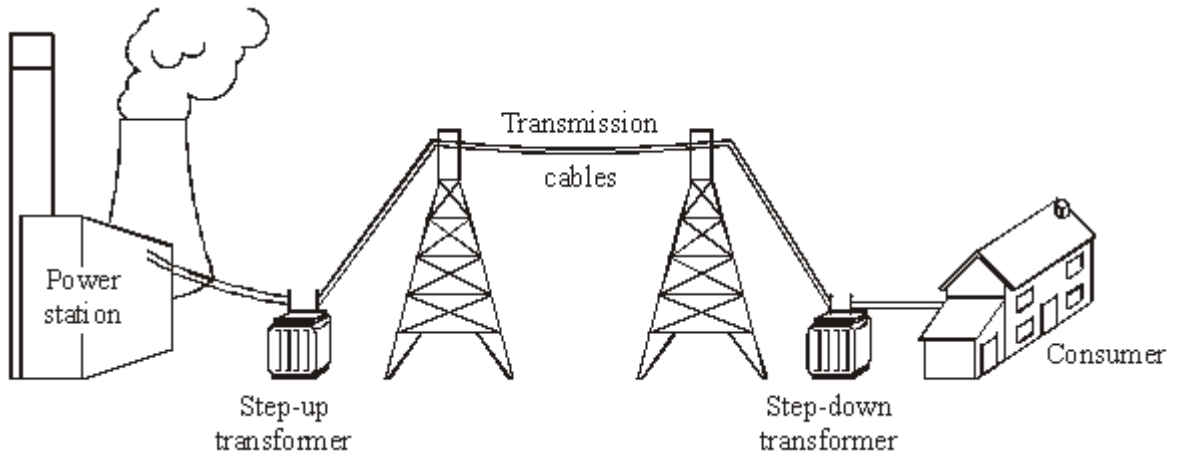
Suggest why, apart from the declining reserves of fossil fuels, power companies should use more bio-fuels and less fossil fuels to generate electricity.

(3)

(Total 7 marks)

Q14.

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%

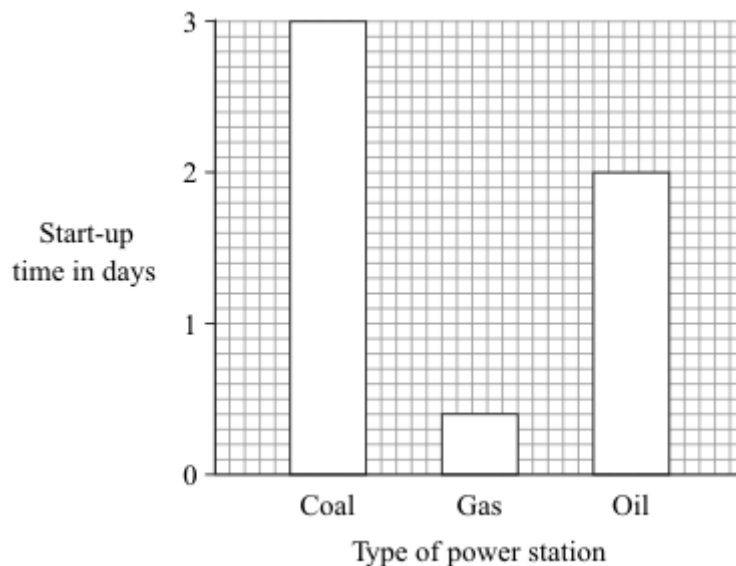
(1)

(Total 6 marks)

Q15.

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”

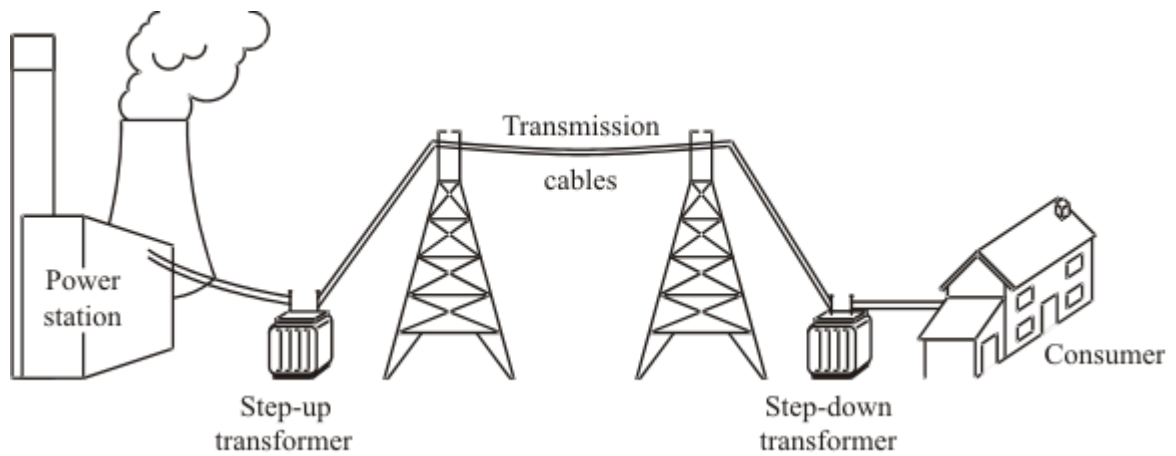
But not everyone wants more wind-powered generators to be built.



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

Q16.

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)

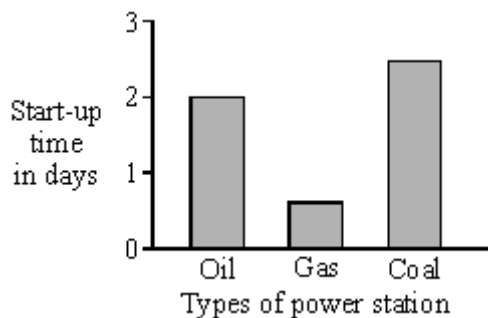
- (ii) What reasons may be given by the people who think that wind farms are **not** a good idea?

(2)

(Total 9 marks)

Q17.

- (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)

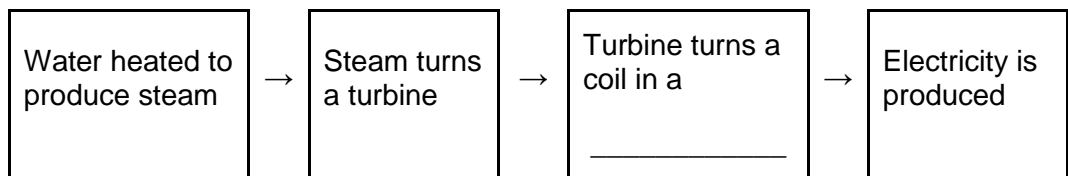
- (c) Fuel-burning power stations may produce air pollution. Why does a wind generator not produce any air pollution?

(1)

(Total 4 marks)

Q18.

- (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)

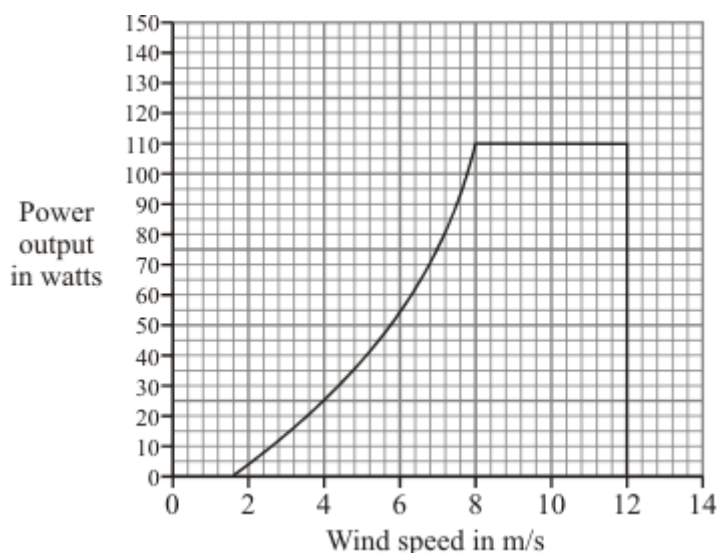
- (c) List **A** gives three energy resources used to generate electricity. List **B** gives

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	List B Environmental problem that may be caused
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	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)

Q19.

- (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. _____

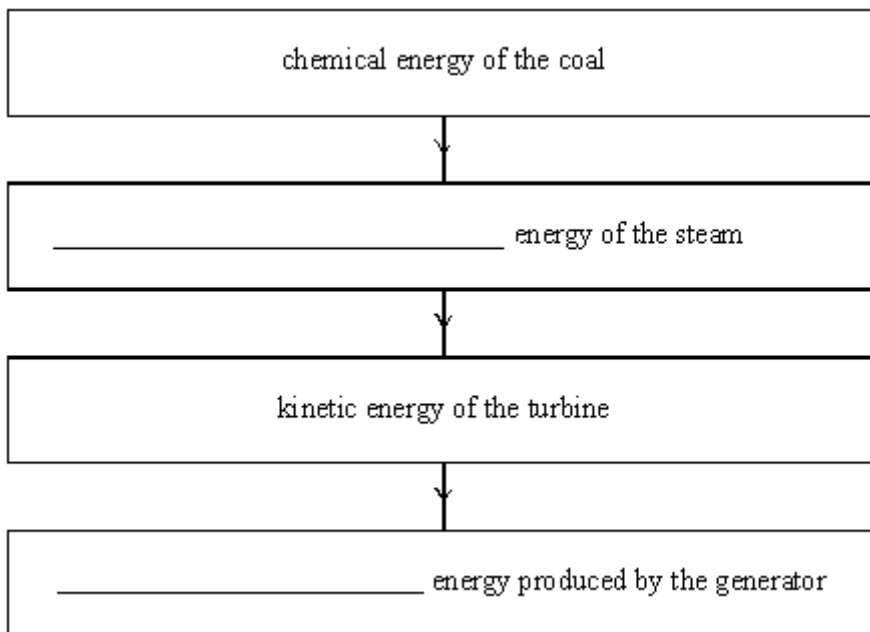
(3)

(Total 8 marks)

Q20.

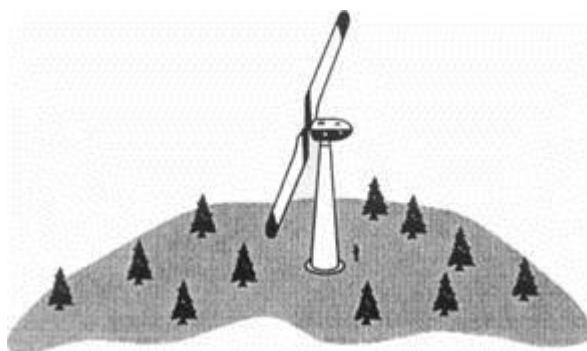
- (a) Most electricity in Britain is generated by coal fired power stations.

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)

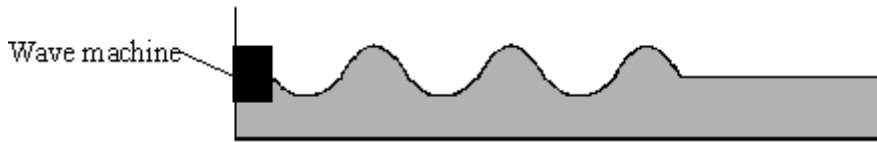
- (ii) Explain the advantage of using a wind turbine to produce electricity.

(2)

(Total 4 marks)

Q21.

- (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?

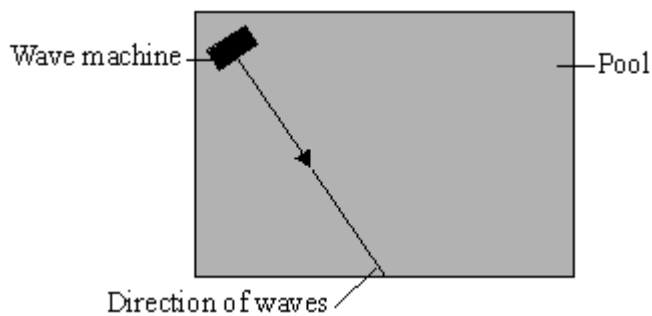
(1)

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

hertz joule watt

(1)

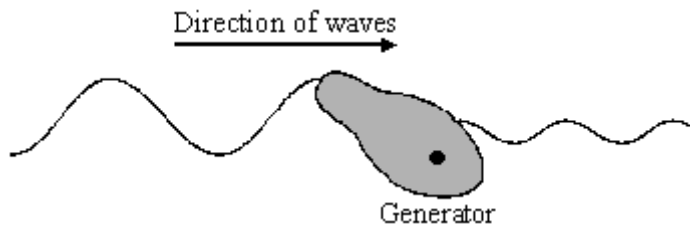
(b) The diagram shows the direction of the waves across the pool. The waves reflect off the side of the pool.



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.

gets larger
stays the same
gets smaller

The diagram shows that the amplitude of the waves _____ 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)

Q22.

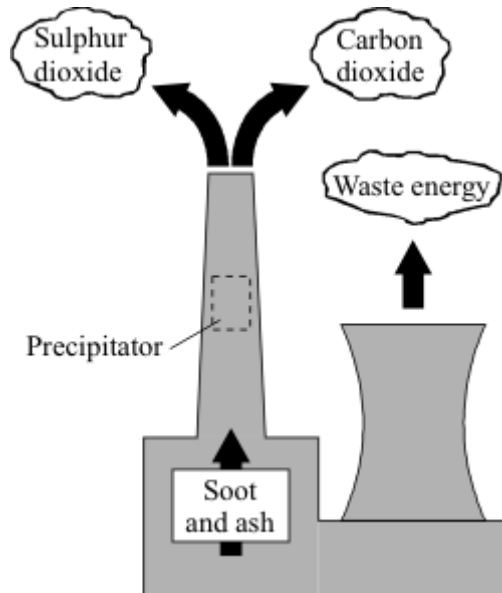
- (a) (i) A student wrote "Coal traps energy from the Sun". Explain what the student means.

(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?

Q23.

(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)

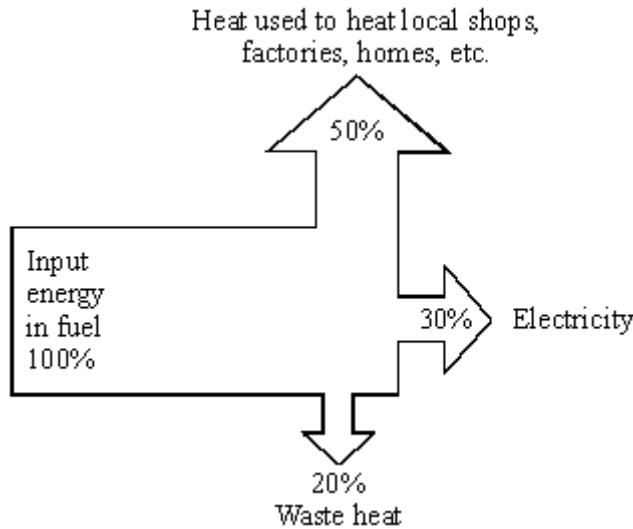
(iii) A wind turbine does not produce electricity all of the time. Why not?

(1)

(Total 8 marks)

Q24.

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)

Q25.

(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

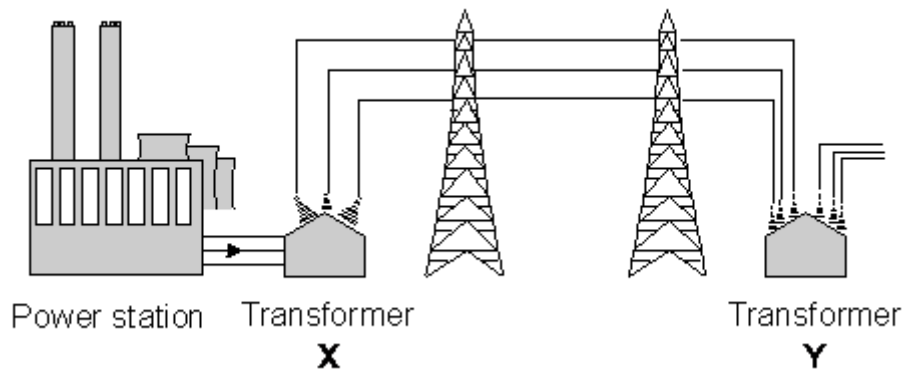
(2)

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

(2)

Q26.

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)

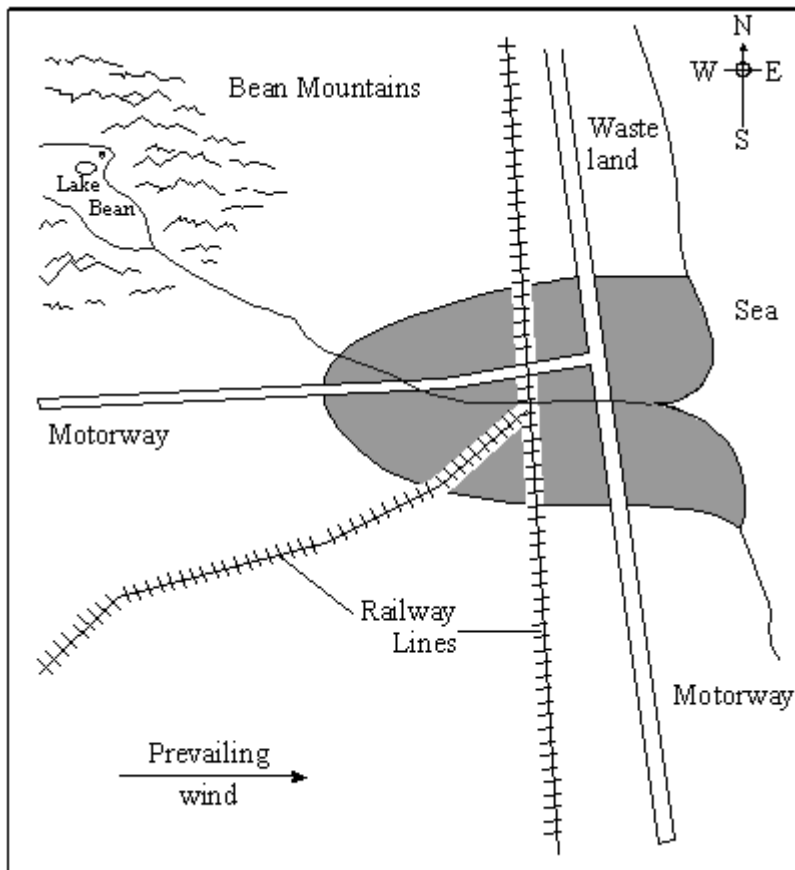
- (iii) The transformer at **Y** reduces the voltage before it is supplied to houses. Why is this done?

_____ (1)

(Total 3 marks)

Q27.

The map below shows an industrial region (shaded).



The prevailing wind is from the west. There is a nearby mountainous area, from which a river flows through the region. The major road and rail links are shown.

A power station is to be built to supply electrical energy to the region. The energy will be for a range of domestic and industrial uses.

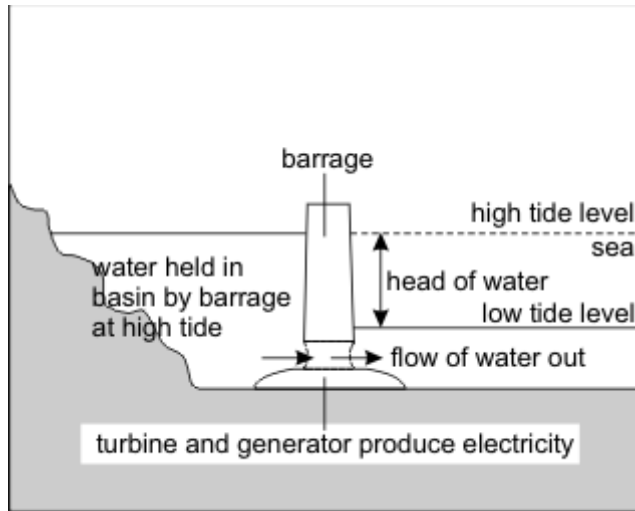
The choice is between a coal fired power station, wind turbines and a hydroelectric scheme.

Three local groups each support a different option. Choose which option you would support and justify your choice by making reference to the financial, social and environmental implications of your choice compared with those of the alternative systems.

(Total 8 marks)

Q28.

The outline diagram below shows a tidal power generating system.



Gates in the barrage are open when the tide is coming in and the basin is filling to the high tide level. The gates are then closed as the tide begins to fall.

Once the tide outside the barrage has dropped the water can flow through large turbines in the barrage which drive generators to produce electrical energy.

In one second 1.2×10^9 kg of water flows through the turbines at a speed of 20 m/s.

- (a) When used with a water speed of 20 m/s the system has an efficiency of 90% in converting the kinetic energy of the water into electrical energy. Calculate the power output of the generators.

(2)

- (b) The power output of a coal fired power station is 1000 MW (1×10^9 W).

- (i) Suggest **two** advantages of coal fired power stations over tidal power generating systems.

1. _____

2. _____

- (ii) Suggest **two** advantages of tidal power generating systems over coal fired power stations.

1. _____

2. _____

- (iii) Suggest and explain **one** disadvantage of a tidal power generating system.

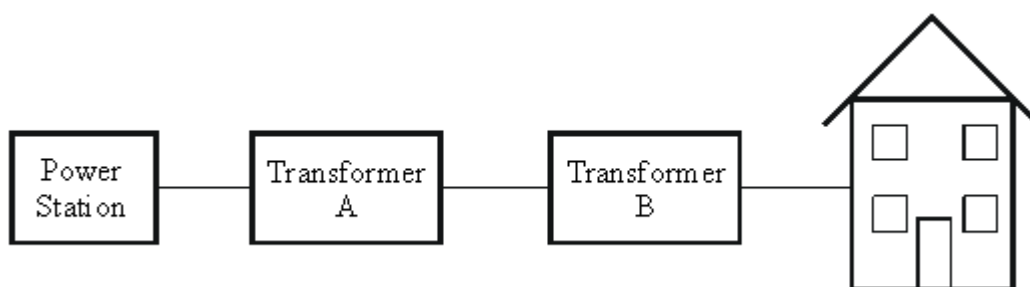
(6)
(Total 8 marks)

Q29.

Describe, in as much detail as you can, how the energy stored in coal is transferred into electrical energy in a power station.

(Total 5 marks)

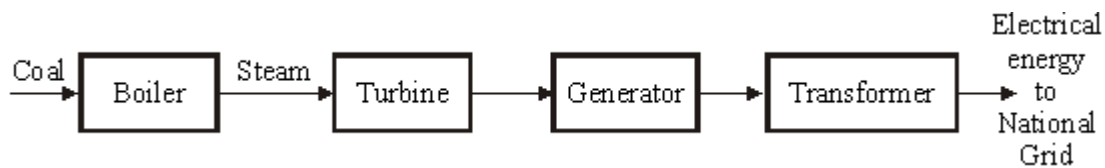
Q30.



Transformer A produces a very high voltage to transmit the electrical energy through the National Grid.
Explain why electrical energy is transmitted at a very high voltage.

Q31.

The diagram below shows four stages in the production of electricity by a coal-fired power station.



(a) (i) Write down **two** environmental problems which are caused by burning coal to generate electricity.

1. _____

2. _____

(ii) How may these environmental problems be reduced?

1. _____

2. _____

(4)

(b) Some data for Didcot coal-fired power station is given below.

Number of generators	4
Maximum continuous power rating of a generator	500 MW at 23 500 V
Energy content of coal used	2.66×10^{10} J per tonne
Total quantity of coal used each day	18 289 tonnes

Use the given data to calculate:

(i) the total electrical energy output each day.

Answer _____ J/day

(ii) the total input of coal energy each day.

Answer _____ J/day

(iii) the efficiency of the power station.

Answer _____ %

(8)

(c) Energy is conserved.

(i) Choose **one** of the stages in the diagram at the start of the question. State what happens to the wasted energy during this stage.

(ii) Explain what happens to all wasted energy during energy transfers.

(3)

(Total 15 marks)

Q32.

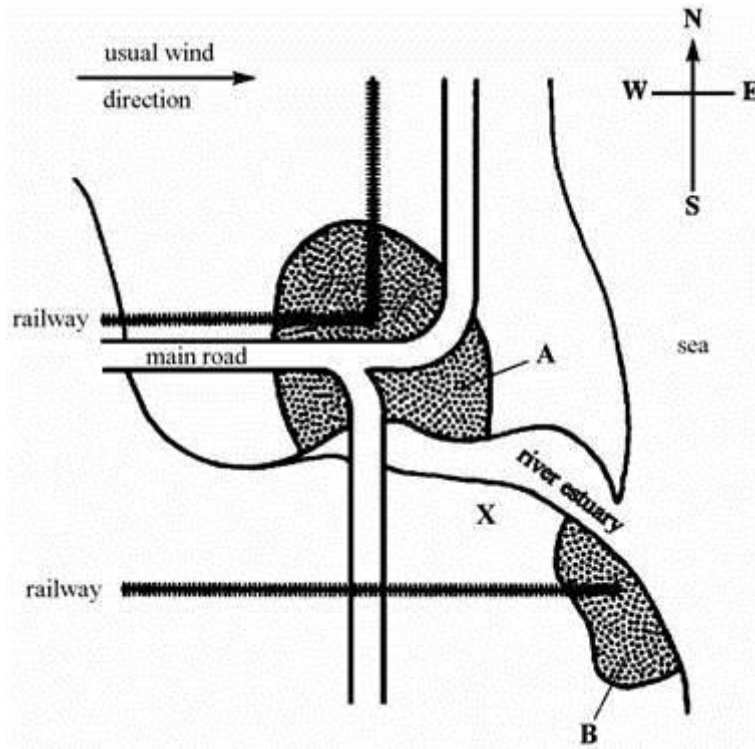
The map below shows the position of two towns, **A** and **B**, on the banks of a large river estuary.

A is an important fishing and ferry port.

The wind usually blows from the west. The major roads and railways are shown.

A power station is to be built in area X to generate electricity for the region.

The choice is between a nuclear power station and a coal fired power station.



(a) State the advantages and disadvantages of the two methods of generating electrical energy.

(6)

(b) Which method would you choose for this site?

Explain the reason for your choice.

(3)
(Total 9 marks)

Q33.

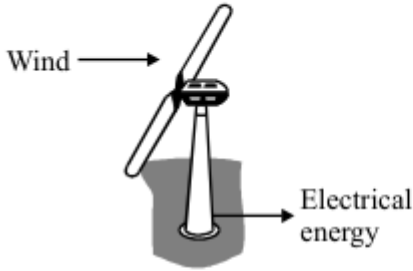
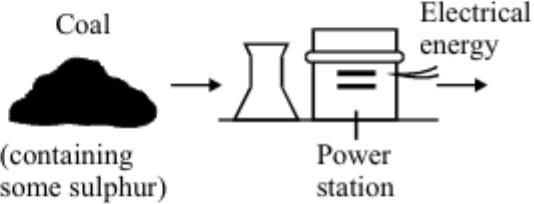
State and explain the advantages and disadvantages of using nuclear power stations to produce electricity.

(Total 4 marks)

Q34.

Electricity is a useful form of energy.

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

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

Give **one** advantage and **one** disadvantage (other than cost) of using each energy

source to generate electricity in the UK.

Advantage	Disadvantage
Using wind <hr/> <hr/> <hr/>	Using wind <hr/> <hr/> <hr/>
Using coal <hr/> <hr/> <hr/>	Using coal <hr/> <hr/> <hr/>

(4)

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

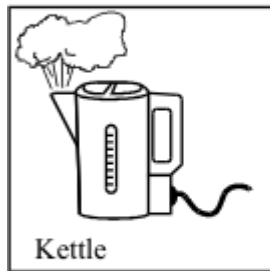
Draw a straight line from each electrical device in List **A** to the useful energy it transfers in List **B**.

List A

List B

Electrical device

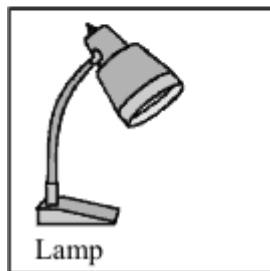
Useful energy transferred



heat



light



sound

(2)

(Total 6 marks)

Q35.

Use of renewable sources of energy is expected to increase. The table shows the comparative costs of producing 1 kWh of electricity from different energy sources.

Types of energy sources used in the UK	Cost of producing 1 kWh of electrical energy	
Fossil fuels(non-renewable)	Coal	1.0 p
	Gas	1.4 p
	Oil	1.5 p
Nuclearfuels (non-renewable)	Nuclear	0.9 p
Renewable	Hydroelectric	0.2 p
	Wind	0.9 p

Installation and decommissioning costs are not included

At present about 2% of electricity generated in the UK uses renewable energy sources. Consider the three types of energy sources in the table and give **one** advantage and **one** disadvantage for each (other than installation and decommissioning costs).

Advantage	Disadvantage
Using fossil fuels _____ _____ _____	Using fossil fuels _____ _____ _____
Using nuclear fuels _____ _____ _____	Using nuclear fuels _____ _____ _____
Using renewable sources _____ _____ _____	Using renewable sources _____ _____ _____

(Total 6 marks)

Q36.

Different energy sources are shown in the box.



An 'Eco-home' is one which is friendly to the environment.

Imagine you are designing an 'Eco-home' which can use any of the energy sources above to generate electricity

- (a) Choose **one** non-renewable energy source from the box above that could provide the electricity supply to your 'Eco-home', but which would be **unsuitable**.

Write the energy source in the table and explain, as fully as you can, why it is

unsuitable for an 'Eco-home'.

Non-renewable energy source	Unsuitable for an 'Eco-home' because
<hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

(2)

- (b) Choose **two** suitable renewable energy sources from the box opposite that could provide an electricity supply to your 'Eco-home'.

Write the two energy sources in the table and describe, in as much detail as you can, the undesirable environmental effects of using these.

Renewable energy source	Undesirable environmental effects
<p>1</p> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>2</p> <hr/> <hr/>	<hr/> <hr/>

(4)
(Total 6 marks)

Q37.

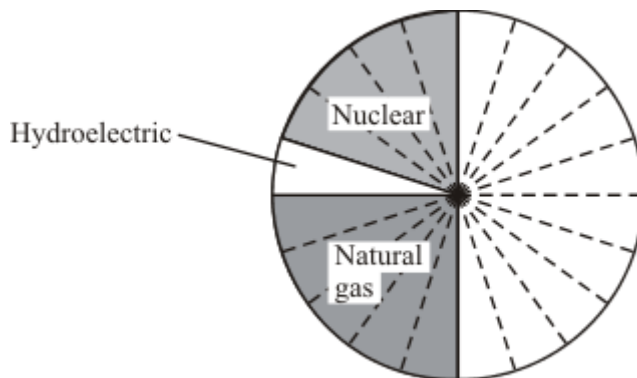
The table shows the main sources of energy used to generate electricity.

Energy source	Percentage (%)
coal	35
hydroelectric	5
natural gas	25
nuclear	
oil	15

(a) Complete the table by writing in the percentage for nuclear power.

(1)

(b) Use the information from the table to complete and label the pie chart below.



(2)

(c) Why can hydroelectric generators be used to meet sudden increases in the demand for electricity?

(1)

(d) Gases are released when fossil fuels burn.

(i) Which **one** of these gases increases the greenhouse effect?

(1)

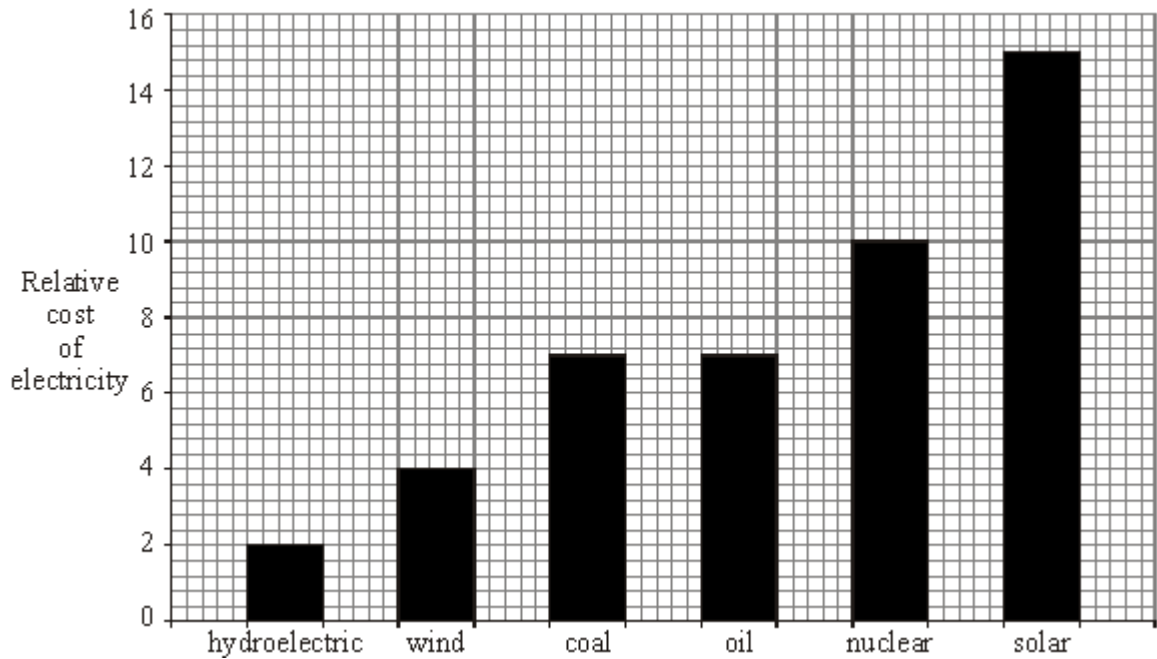
(ii) Which **one** of these gases produces acid rain?

(1)

(Total 6 marks)

Q38.

The bar chart shows the relative costs of some different energy sources that are used to generate electricity.



(a) Apart from cost, give **two** advantages that a hydroelectric power station has compared with a wind farm.

1. _____

2. _____

(2)

(b) Apart from cost, give **one** advantage and **one** disadvantage that a nuclear power station has compared with a coal-fired power station.

Advantage _____

Disadvantage _____

(2)

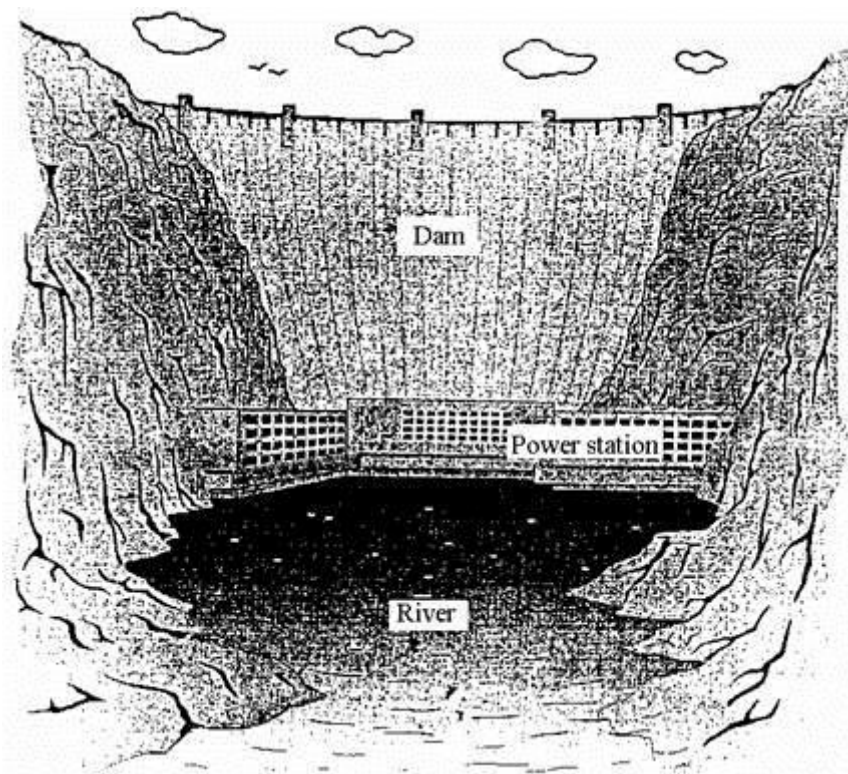
(c) State and explain **one** situation where it is better to use solar energy, rather than

any of the other energy sources, to generate electricity.

(2)
(Total 6 marks)

Q39.

The drawing shows a hydro-electric dam. Water from the top of the dam flows through pipes to the power station at the bottom of the dam.



- (a) Complete the following boxes to show the **useful** energy transfer which occurs as the water flows through the pipes **to** the power station.



(2)

- (b) The electricity generated by the power station is transmitted over long distances. Before this happens its voltage is increased by using a step-up transformer.

State and explain **one** advantage and **one** disadvantage of transmitting electricity at high voltage.

Advantage _____

(2)

Disadvantage _____

(2)

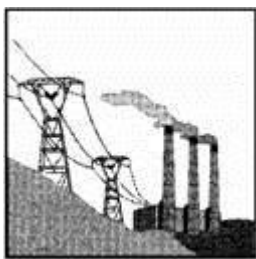


(Total 6 marks)

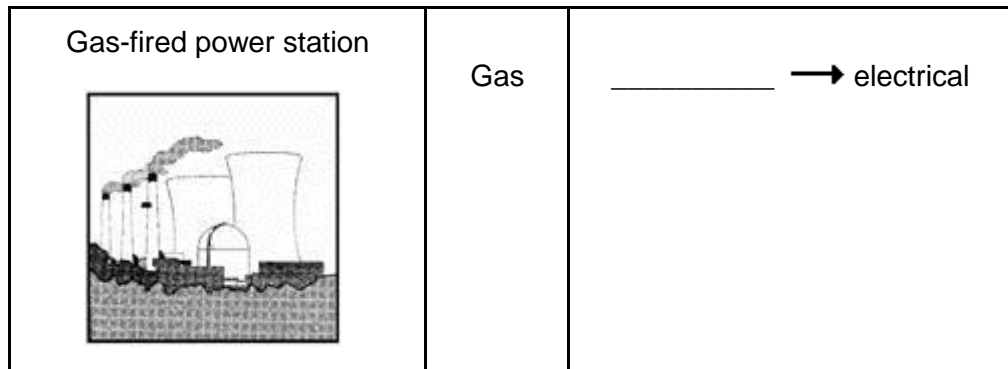
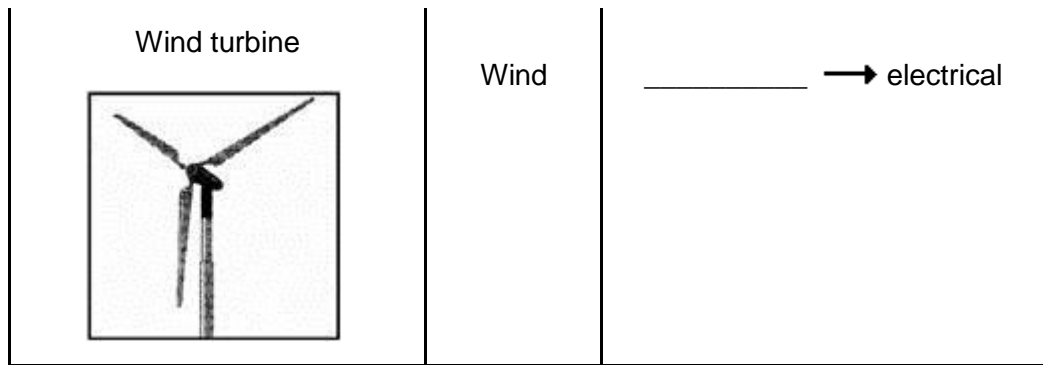
Q40.

Electricity may be produced from a number of different energy resources.

(i) Complete the table below.

The first one has been done for you.

Device	Energy resource	Useful energy transfer from resource
Coal-fired power station 	Coal	Chemical → electrical
Hydroelectric power station 	Stored water	_____ → electrical
Solar cell in calculator 	Sun	_____ → electrical



(4)

- (ii) Give **one** of the five energy resources opposite, which is **not** classified as renewable.

(1)

- (iii) State another non-renewable energy resource.

(1)

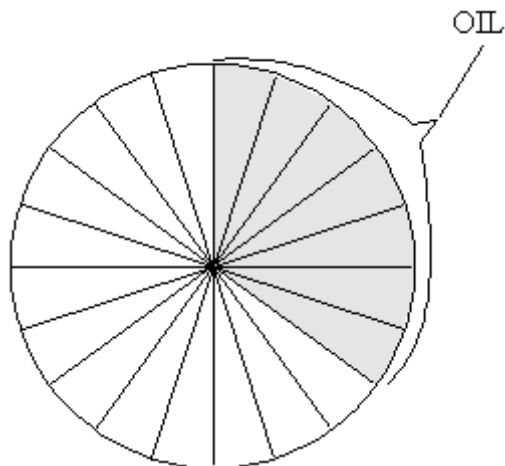
(Total 6 marks)

Q41.

The table shows the main sources of energy used in Britain in 1990.

coal	35%
oil	35%
gas	24%
nuclear	5%
moving water (hydro)	1%

- (a) Finish the pie-chart, using the figures in the table.



(4)

(b) Complete the following sentences.

To release energy from coal, gas and oil they must be burned.

Coal, gas and oil are all _____

(1)

(c) Which **one** of the energy sources in the table is renewable? _____

Write down the name of **one** other renewable energy source. _____

(2)

(d) How does the amount of energy obtained from nuclear sources in 1990 compare with the amount obtained from moving water?

(2)

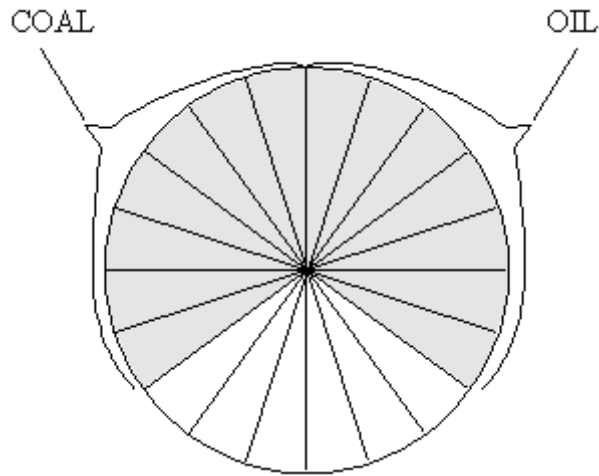
(Total 9 marks)

Q42.

The table shows the main sources of the energy used in Britain in 1990.

coal	35%
oil	35%
gas	24%
nuclear	5%
moving water (hydro)	1%

(a) Finish the pie-chart, using the figures in the table.



(3)

- (b) How does the amount of energy obtained from nuclear sources in 1990 compare with the amount obtained from moving water?

(1)

- (c) Moving water (hydro) is a renewable energy source.

Write down the name of **one** other renewable energy source.

(1)

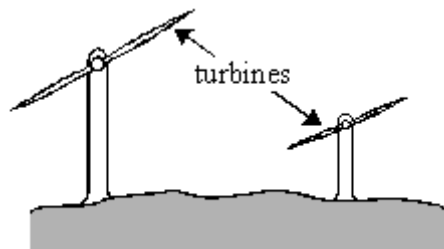
- (d) Explain why electricity is **not** included in the table of energy sources.

(1)

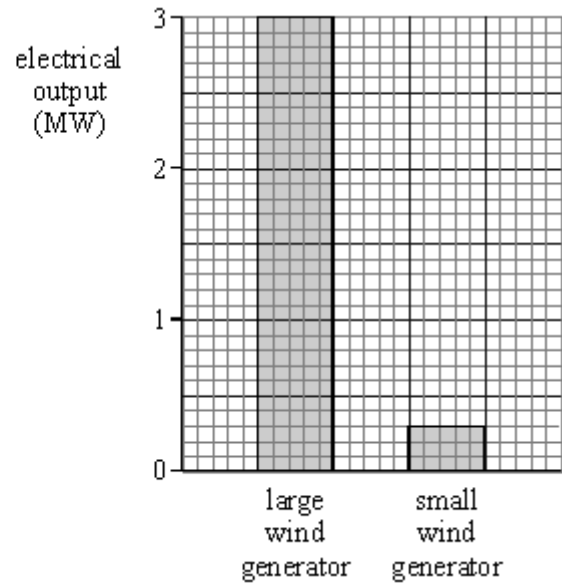
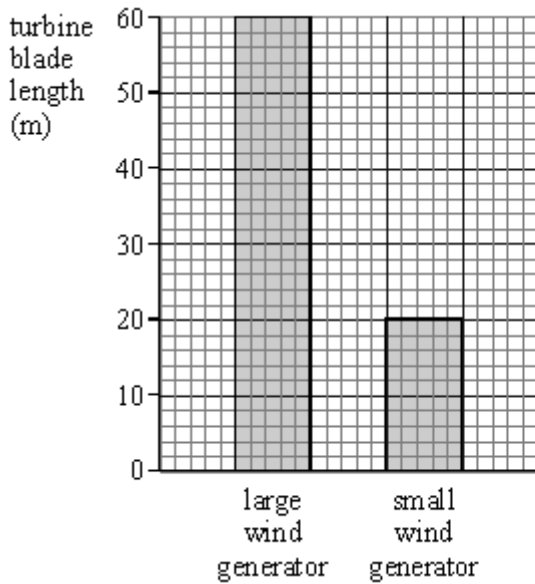
(Total 6 marks)

Q43.

On a very windy hilltop there are two wind generators side by side.



The bar charts show the lengths of the turbine blades and the electrical outputs of the two wind generators.



Complete the following table.

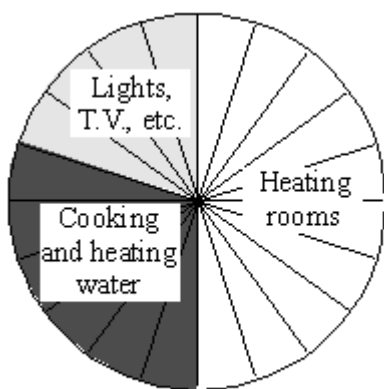
	LENGTH OF TURBINE BLADE (m)	ELECTRICAL OUTPUT (MW)
Large wind generator	60	
Small wind generator		

(Total 3 marks)

Q44.

- (a) The pie-chart shows how energy is used in a home.

Complete the table using the information on the pie-chart.

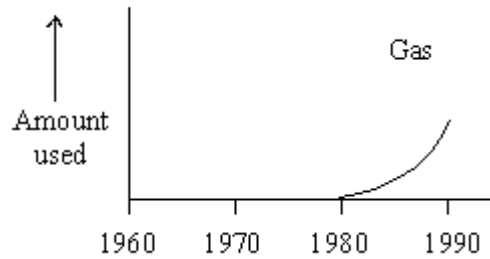
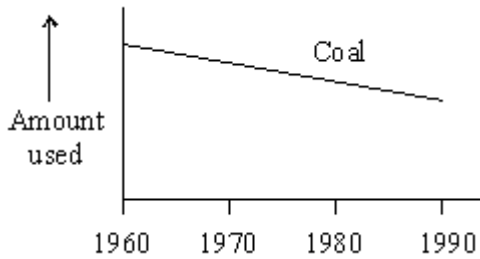


USE OF ENERGY	%
lights, T.V., etc.	20
cooking and heating water	
heating rooms	

(2)

- (b) We get some of the energy we need in our homes from electricity.

The graphs show how the amounts of coal and gas used to generate electricity changed between 1960 and 1990.



Describe these changes.

Coal _____

Gas _____

(4)

(c) Read the information below.

- More carbon dioxide in the air may change the weather. Farmers may then not be able to produce the food we need.
- Burning coal produces sulphur dioxide. Burning gas does not do this.
- It is cheaper to generate electricity from gas than from coal.
- Sulphur dioxide causes acid rain which can kill fish and damage buildings.
- Two power stations generate the same amount of electricity. The one which burns gas produces less carbon dioxide than the other which burns coal.

Many people say that the change from coal to gas is better for the environment.

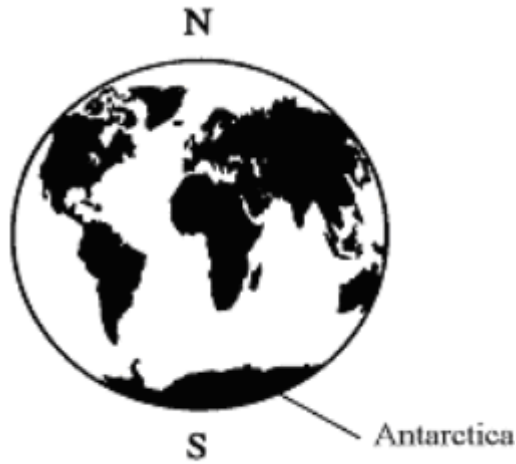
Why do you think they say this?

(3)

(Total 9 marks)

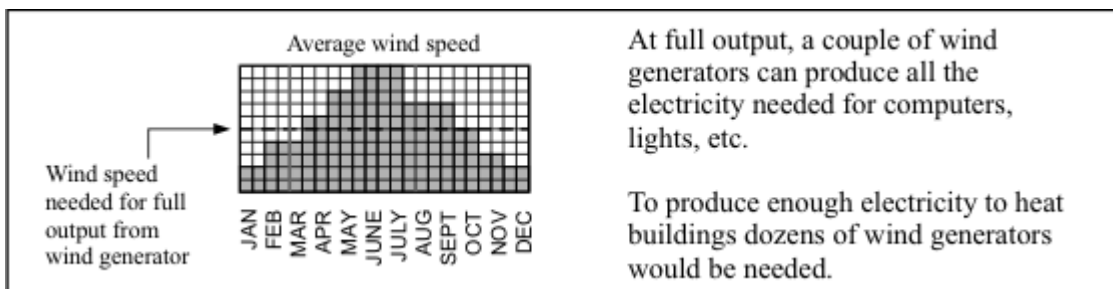
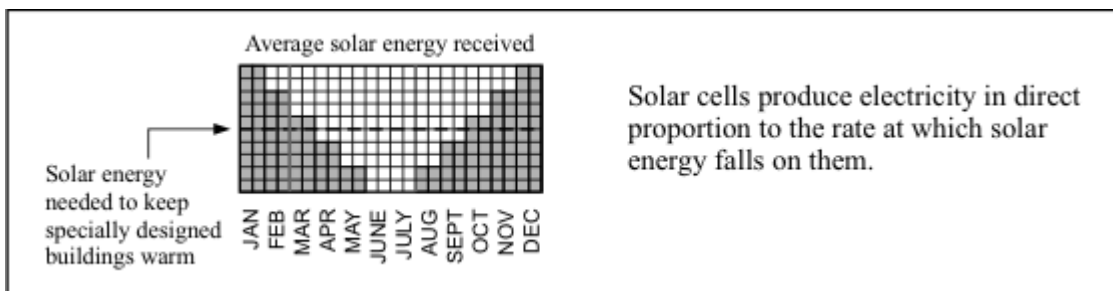
Q45.

Antarctica is a huge land mass surrounding the Earth's south pole. It is covered in a very thick layer of ice and is the only remaining large area of the Earth's surface that has not been affected very much by humans.



There are, however, teams of scientists from various countries studying Antarctica. These scientists need electricity for lighting, for their computers and other scientific instruments and to communicate, via satellite, with the rest of the world. The temperature in Antarctica is always sub-zero, so the scientists need some way of keeping their buildings warm. They also need fuel to be able to get around on their snowmobiles.

Scientists cannot avoid affecting the environment. However, they want to affect it as little as possible.



Atmospheric pollution produced in one country eventually affects the whole of the Earth's atmosphere. The hole that appears each year in the ozone layer above Antarctica, for example, is mainly caused by pollutants such as CFCs from countries in the northern half of the Earth.

Discuss the advantages and disadvantages of using the following energy sources to meet the scientists' needs:

- solar energy
- energy from the wind
- natural gas (present in large quantities deep down in the Antarctic land mass)
- diesel oil (which would have to be imported)

