

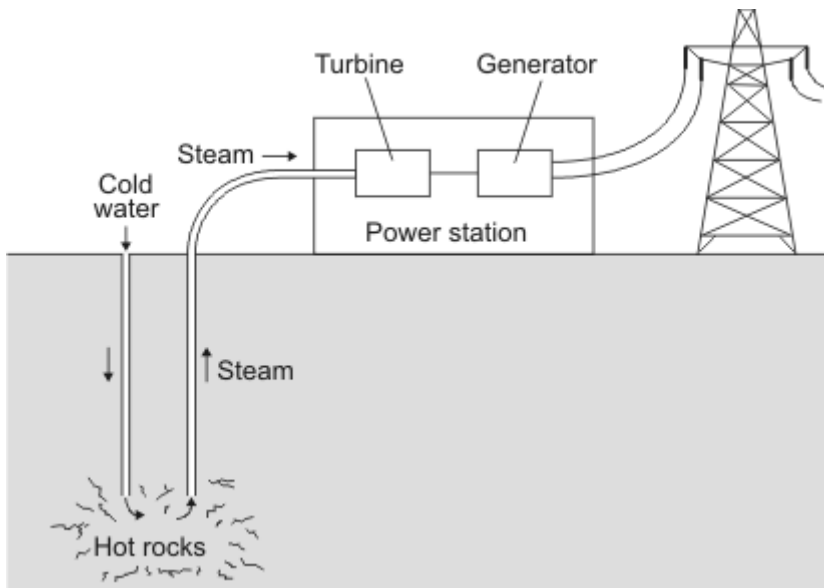
Methods we use to generate electricity

1. (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
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(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.

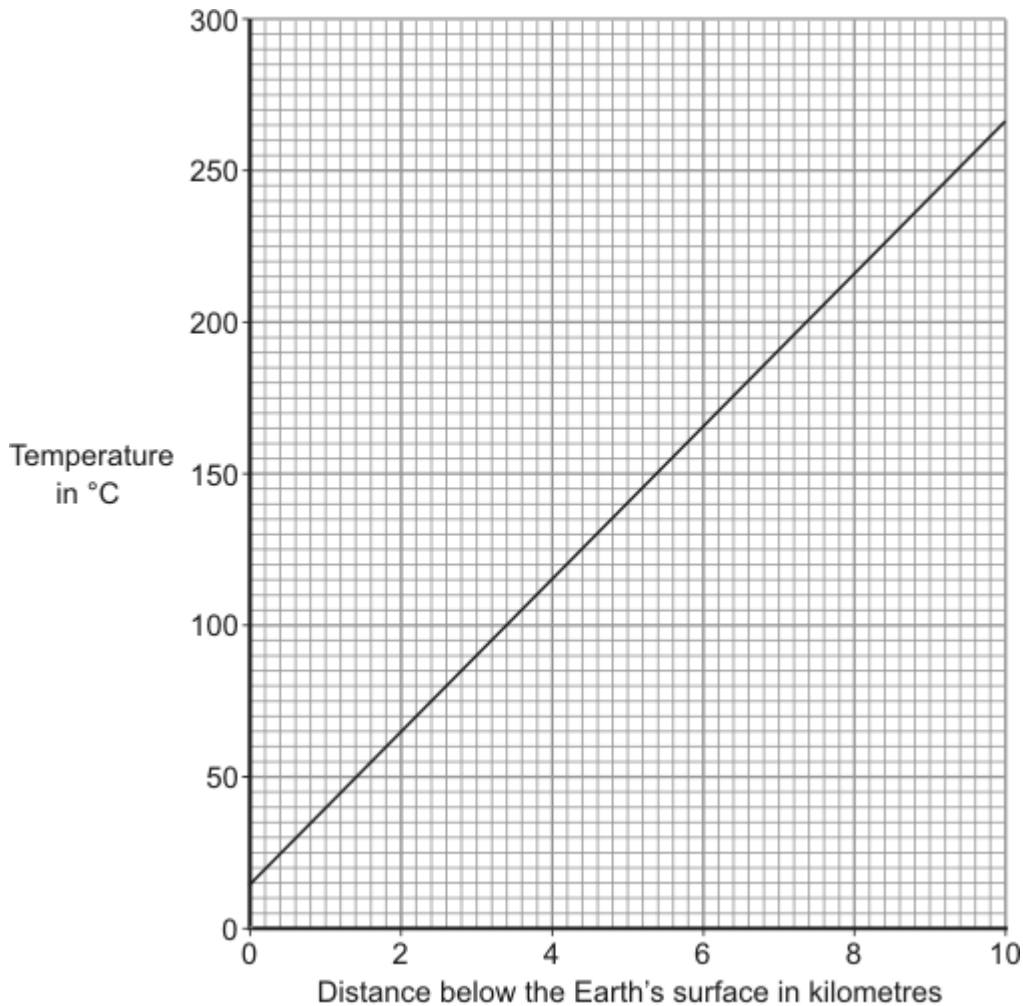


How is the way in which a geothermal power station generates electricity the same as the way in which a coal burning power station generates electricity?

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(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.

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Temperature = °C

(2)

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

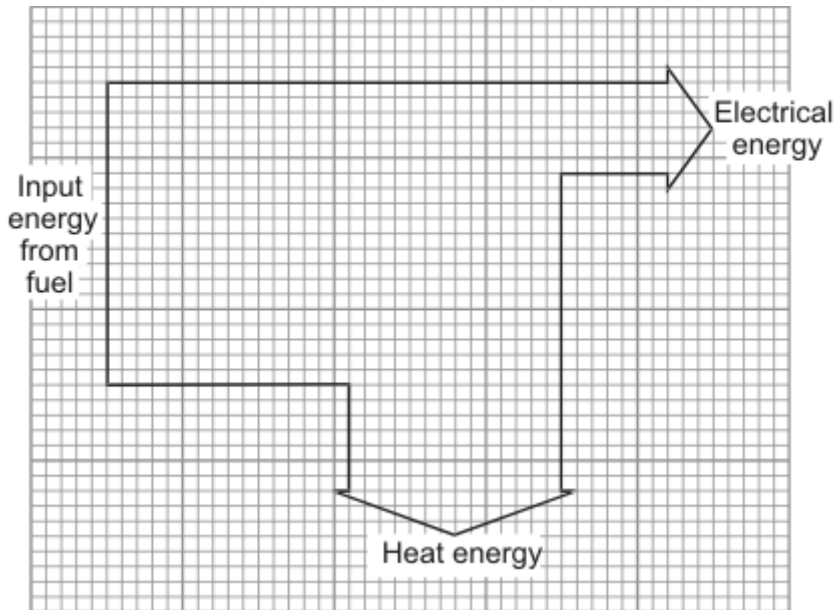
Give **one** reason that scientists might use to persuade a government to spend large amounts of money building geothermal power stations.

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(1)

(Total 6 marks)

2. (a) The diagram shows the energy transformations in a fuel burning power station.



(i) Name **one** fuel that is burned to provide the energy source for a power station.

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(1)

(ii) Use the diagram and the equation in the box to calculate the efficiency of the power station.

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

Show clearly how you work out your answer.

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Efficiency =

(2)

(iii) Name the process by which a nuclear fuel provides the energy needed to generate electricity in a nuclear power station.

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(1)

(b) 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*?

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(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.

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(2)

- (c) 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?

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(1)

- (ii) The information does not say how many children were studied. Why should this data have been included in the article?

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(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.

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(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.

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(1)
(Total 12 marks)

3. 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.

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(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.

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(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.

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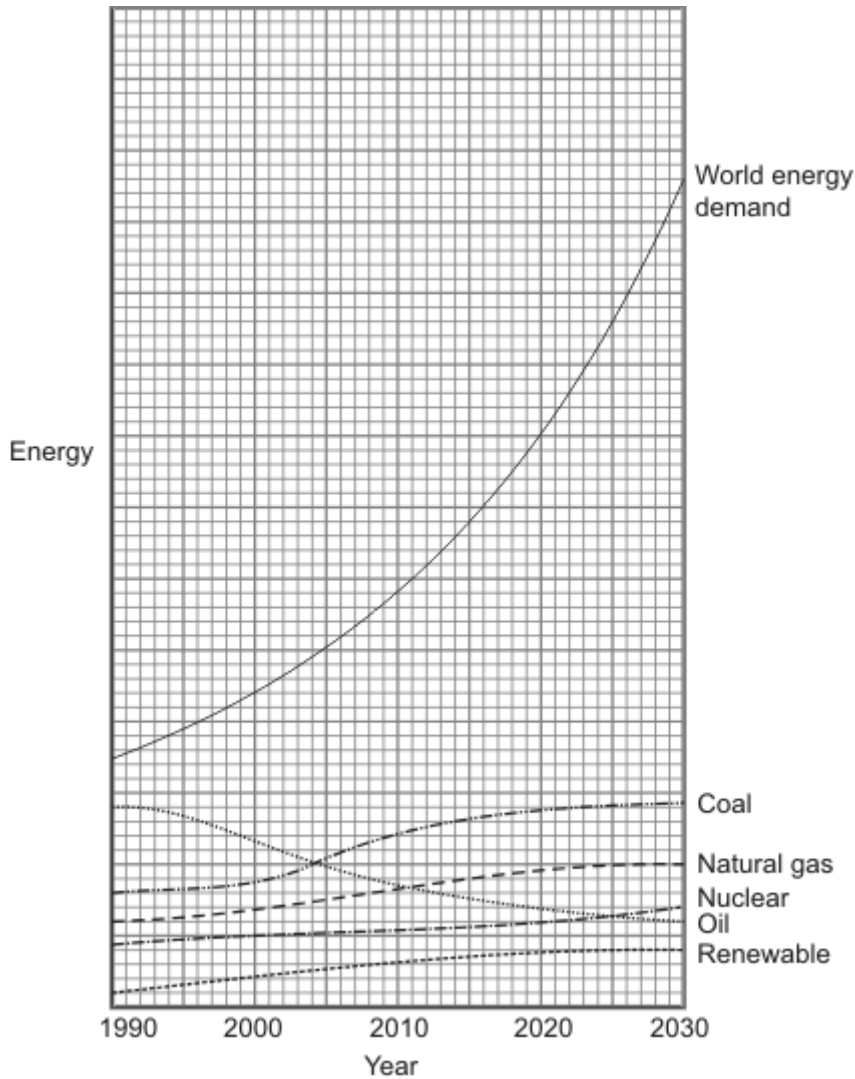
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(3)
(Total 7 marks)

4. The graph shows the expected change in the world demand for energy. It also shows how the supplies of various energy resources are expected to change.



(a) Use the graph to estimate when supplies from oil and coal are equal.
..... (1)

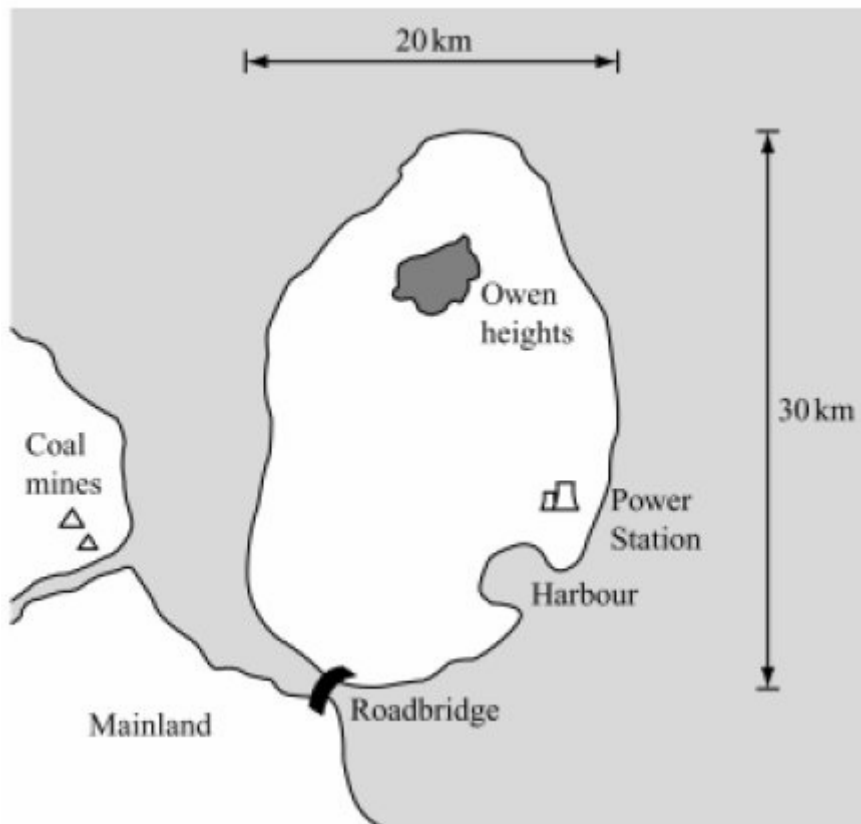
(b) Currently we rely on coal, oil and gas to supply most of our energy needs.
Use the graph to explain why we must develop alternative energy resources.
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..... (2)

(c) On average, the energy use of each family in the UK releases over 25 tonnes of carbon dioxide and 4 kilograms of sulfur dioxide into the air every year.
(i) State **one** environmental effect that is increased by releasing carbon dioxide into the air.
..... (1)

(ii) State a different environmental effect caused by the releasing of sulfur dioxide into the air.
..... (1)

(d) Nuclear power stations use the energy released by *nuclear fission* to generate electricity.
Explain what is meant by *nuclear fission*.
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..... (2)

- (e) A 200 MW coal burning power station provides all the electrical power for a small island. The coal is bought to the island from the mainland.



The islanders who want to replace the power station with wind turbines have been given the following information.

Maximum output from one turbine	800 kW
Maximum number of turbines on one square kilometre of land	6
Average yearly output as a percentage of the maximum	25%
Percentage of land suitable for a wind turbine	20%
Reduced carbon dioxide emissions per year (in tonnes)	200 000

- (i) Would you recommend that the islanders replace the coal power station with wind turbines? Explain the reasons for your recommendation. To gain full you must support your explanation with relevant calculations.

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(3)

- (ii) Some islanders want to find out if it would be possible to generate the electricity they need using solar energy. How could the islanders find the data needed to make an informed decision?

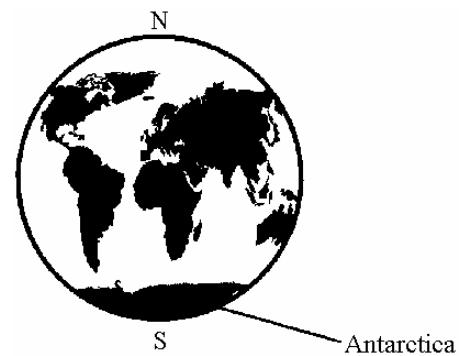
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(1)
 (Total 11 marks)

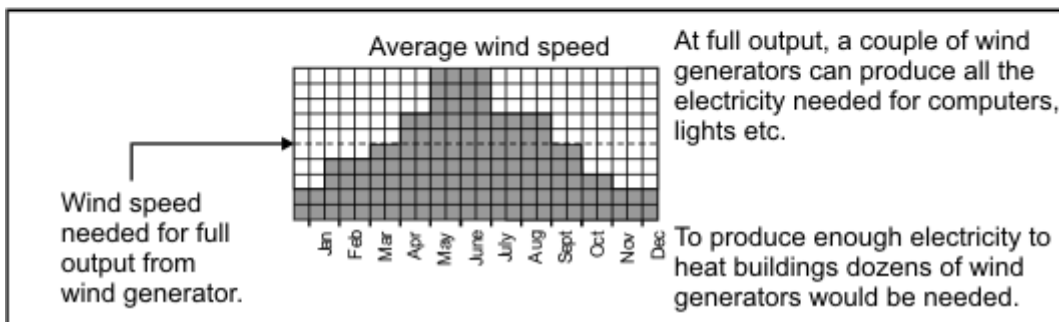
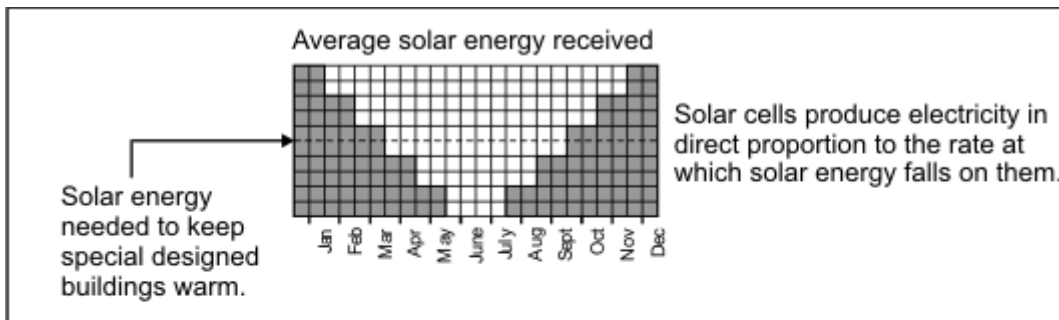
5. The following information is needed for the question below.

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.

- (a) Complete the table to explain **one** advantage and **one** disadvantage of using each energy source to meet the scientist's needs.

You should **not** refer to differences in cost.

Energy Source	Advantage	Disadvantage
Solar Energy		
Energy from Wind		
Natural Gas		
Diesel Oil		

(8)

- (b) Which **one** energy source would you choose to support most of the energy needed by the scientists?

Give the reason for your answer.

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(2)

(Total 10 marks)