AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.1.3 NATIONAL AND GLOBAL ENERGY RESOURCES (PACK 3)

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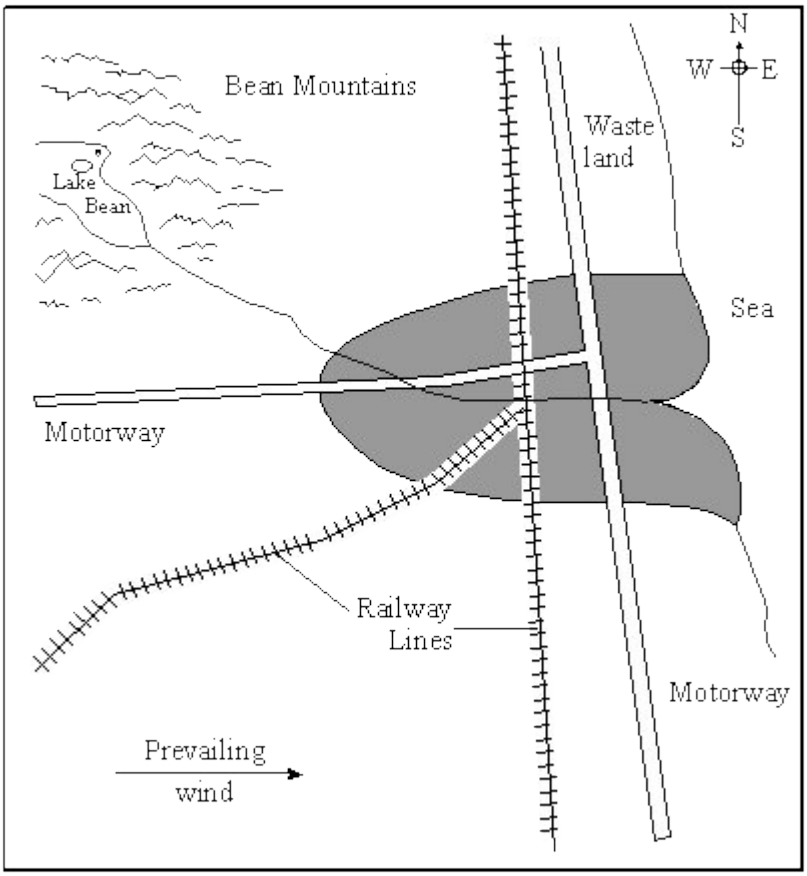
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Q1.

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.

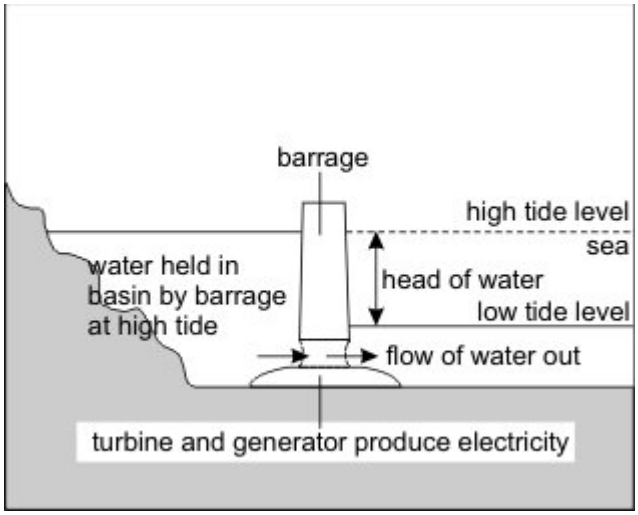
Three local groups each support a different option. Choose which option you would support and justify your choice by making reference to the financial, social and environmental implications of your choice compared with those of the alternative systems.

(Total 8 marks)

Q2.

The outline diagram below shows a tidal power generating system.

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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. _____

_____

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

_____

_____

_____

_____

(6)

(Total 8 marks)

Q3.

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

_____

_____

_____

_____

_____

_____

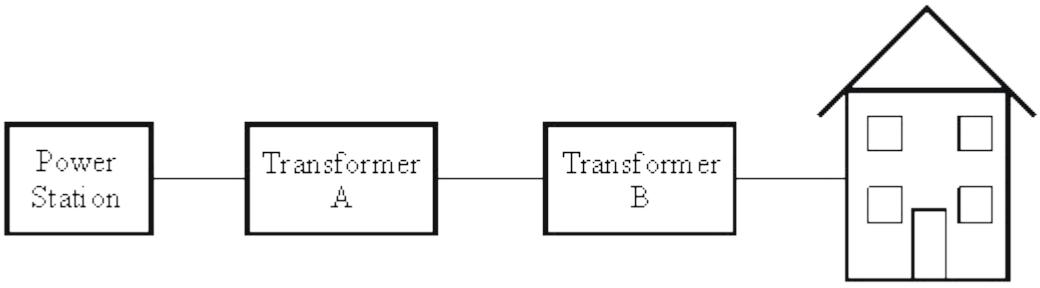
_____

_____

_____

(Total 5 marks)

Q4.



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.

_____

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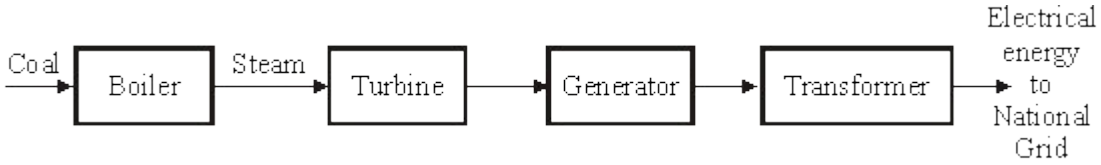
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_____

(Total 3 marks)

Q5.

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.

_____

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_____

_____

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)

Q6.

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

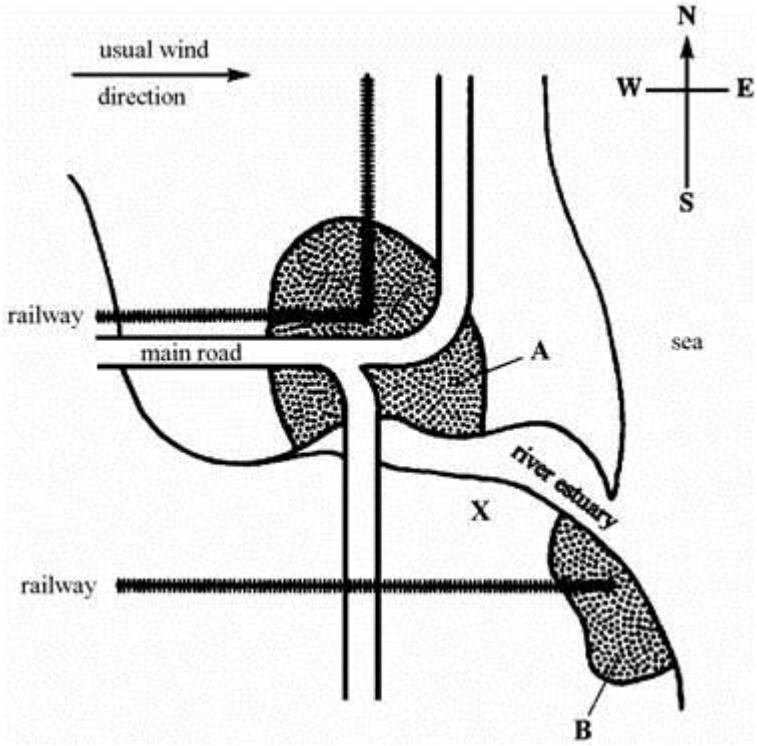
A is an important fishing and ferry port.

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.

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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.

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_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q7.

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

_____

_____

_____

_____

_____

_____

_____

_____

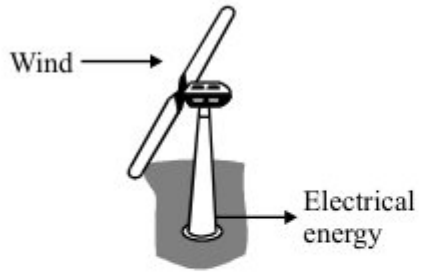
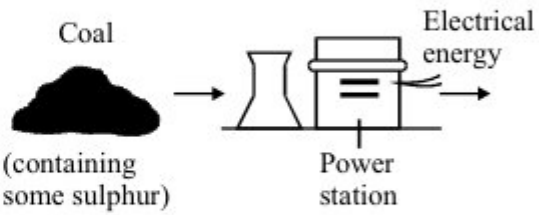
(Total 4 marks)

Q8.

Electricity is a useful form of energy.

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

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

Give **one** advantage and **one** disadvantage (other than cost) of using each energy source to generate electricity in the UK.

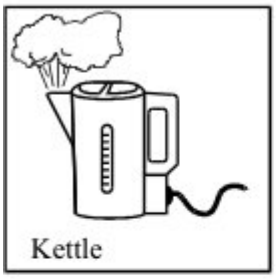
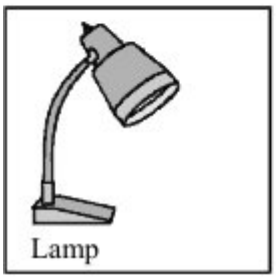
Advantage	Disadvantage
Using wind _____ _____ _____	Using wind _____ _____ _____
Using coal _____ _____ _____	Using coal _____ _____ _____

(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.**

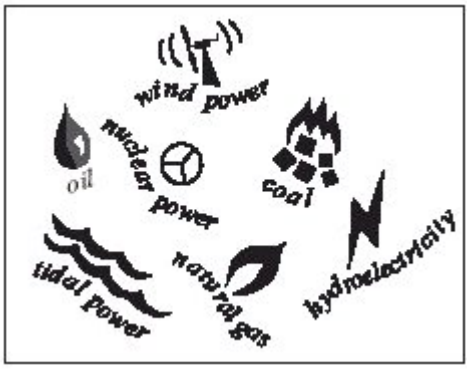
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List A Electrical device	List B Useful energy transferred
 Kettle	heat
 Radio	light
 Lamp	sound

(2)
(Total 6 marks)

Q9.

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

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(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
_____ _____	_____ _____ _____ _____ _____ _____ _____ _____

(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
1 _____ _____	_____ _____ _____ _____ _____ _____ _____
2 _____ _____	_____ _____ _____

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	_____ _____ _____ _____

(4)

(Total 6 marks)

Q10.

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 notincluded		

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 _____ _____

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_____	_____

(Total 6 marks)

Q11.

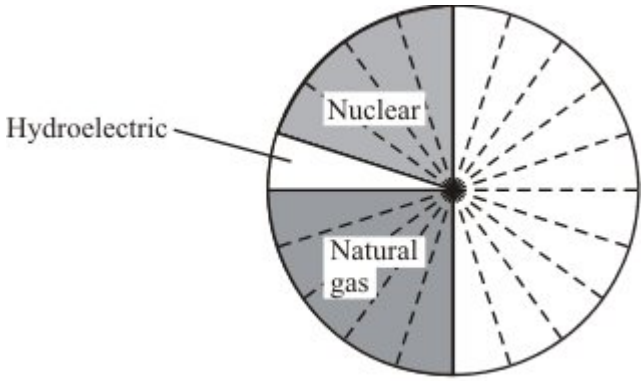
The table shows the main sources of energy used to generate electricity.

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?

_____

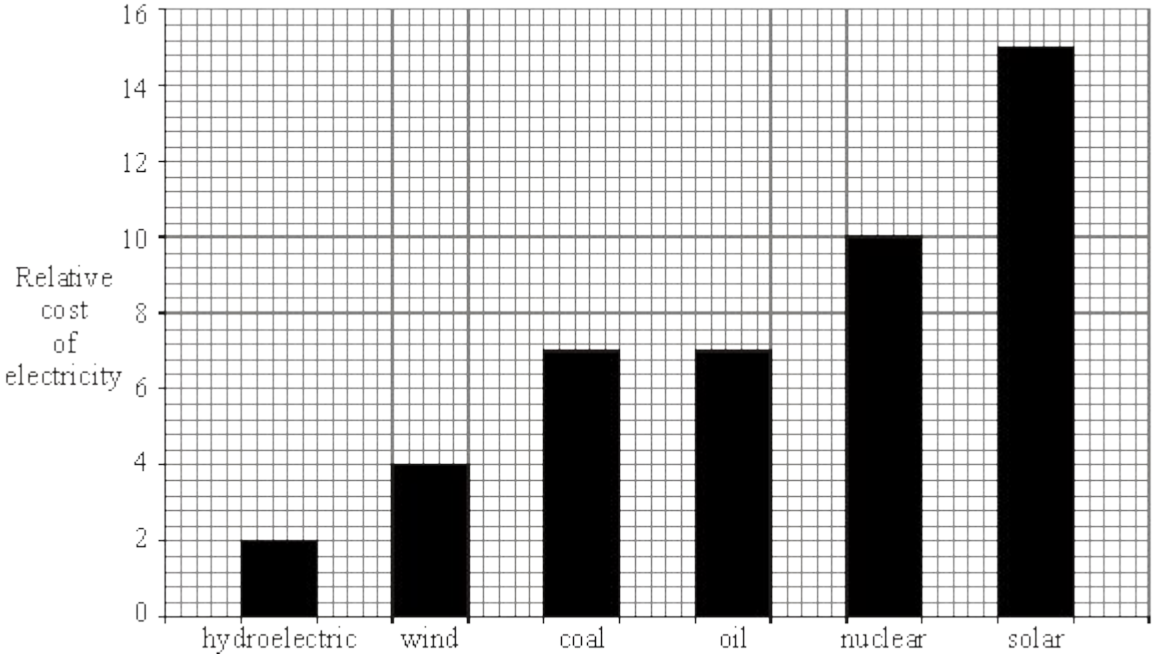
(1)

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(Total 6 marks)

Q12.

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.

_____

_____

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_____

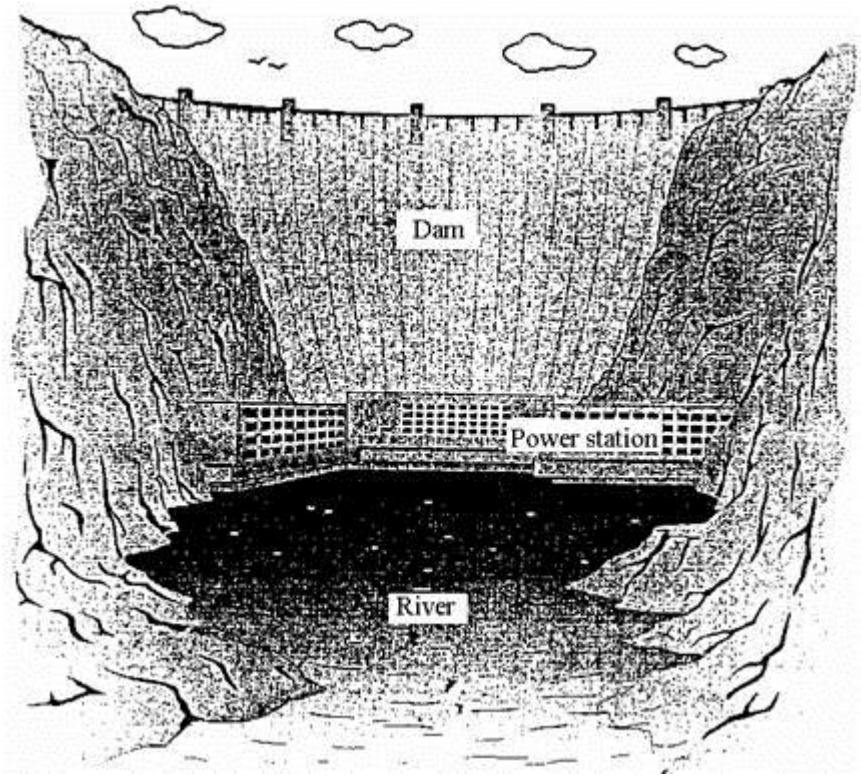
_____

(2)

(Total 6 marks)

Q13.

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 _____

_____

_____

_____

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Disadvantage _____

_____

_____

_____

(4)

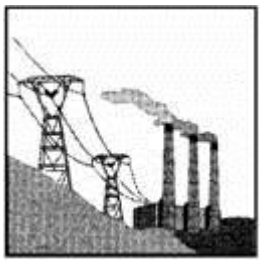
(Total 6 marks)

Q14.

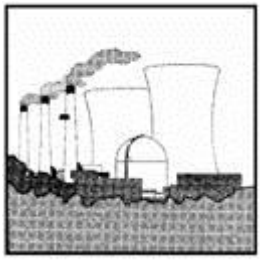
Electricity may be produced from a number of different energy resources.

(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
Wind turbine	Wind	_____ ⟶ electrical

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Gas-fired power station 	Gas	_____ → 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)

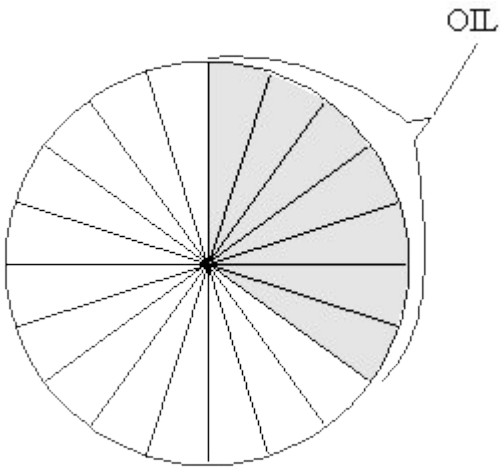
Q15.

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.

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(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)

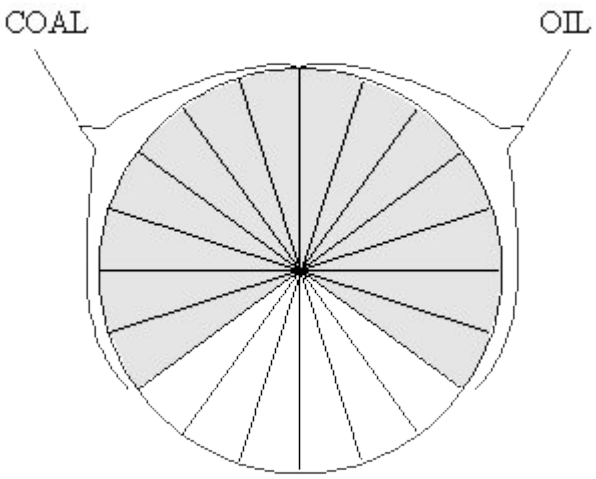
Q16.

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.

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(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.

_____

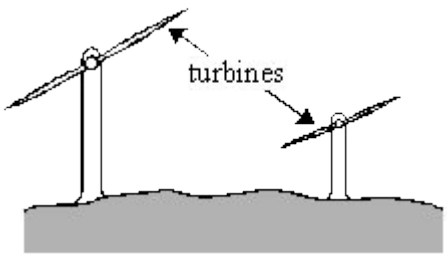
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(1)

(Total 6 marks)

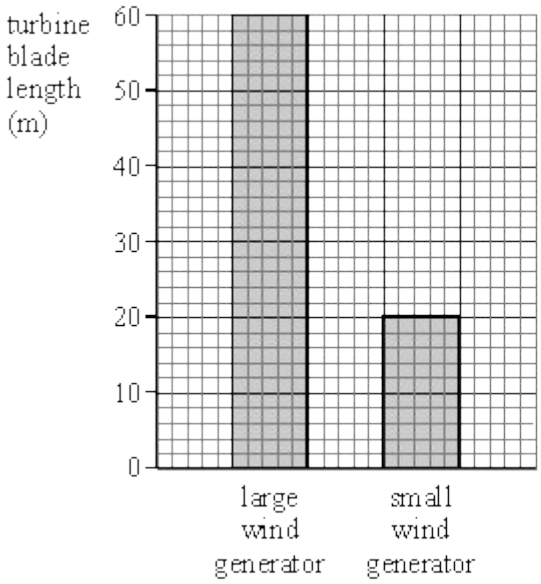
Q17.

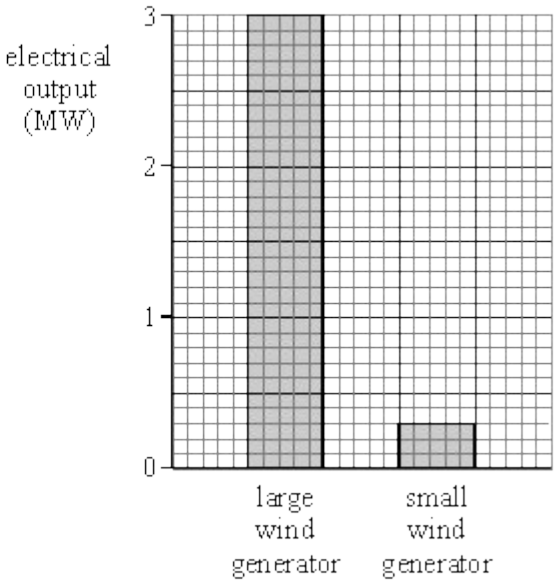
On a very windy hilltop there are two wind generators side by side.



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

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Complete the following table.

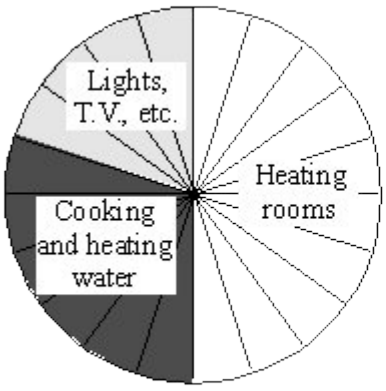
	LENGTH OF TURBINE BLADE (m)	ELECTRICAL OUTPUT (MW)
Large wind generator	60	
Small wind generator		

(Total 3 marks)

Q18.

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

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



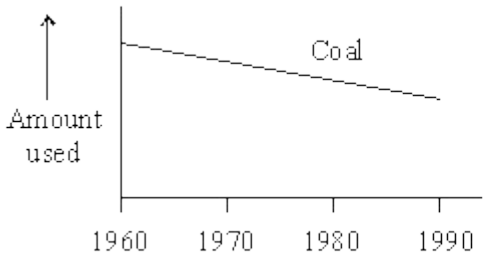
USE OF ENERGY	%
lights, T.V., etc.	20
cooking and heating water	
heating rooms	

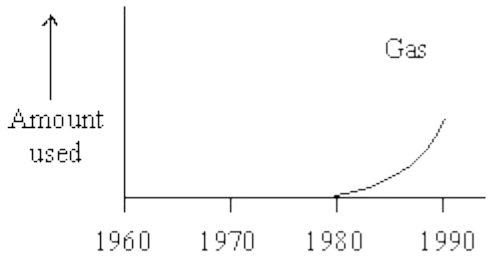
(2)

(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.

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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?

_____

_____

_____

_____

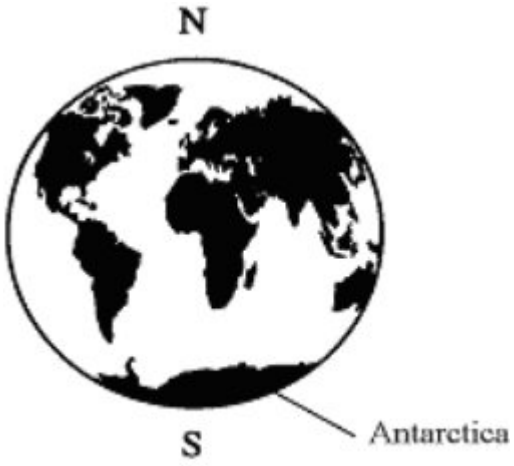
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Q19.

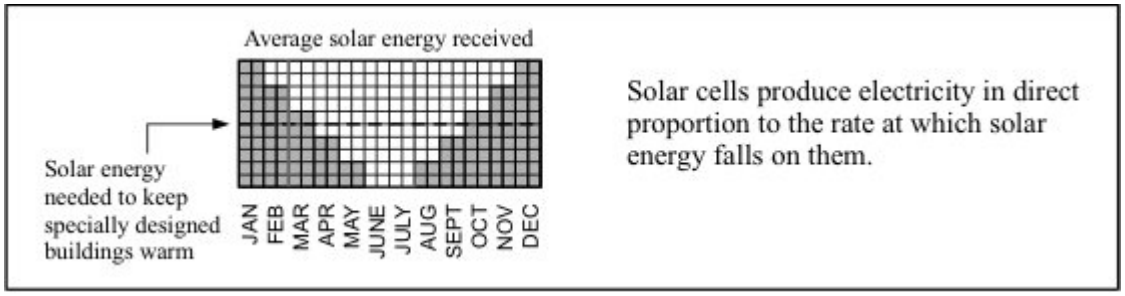
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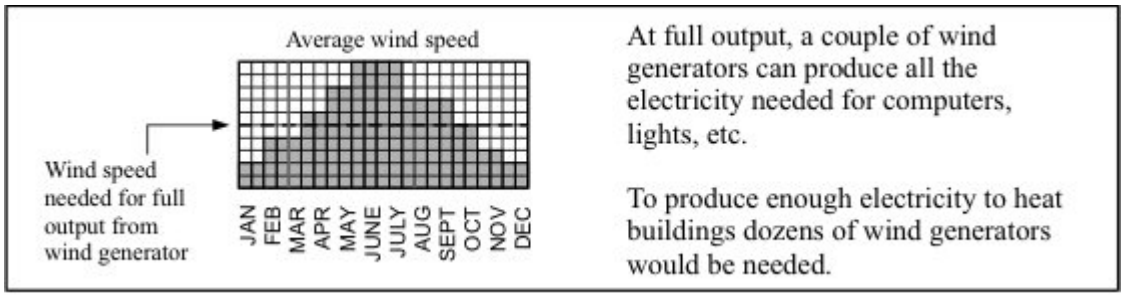
Antarctica is a huge land mass surrounding the Earth's south pole. It is covered in a very thick layer of ice and is the only remaining large area of the Earth's surface that has not been affected very much by humans.



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

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- 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)

_____

_____

_____

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(Total 10 marks)

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