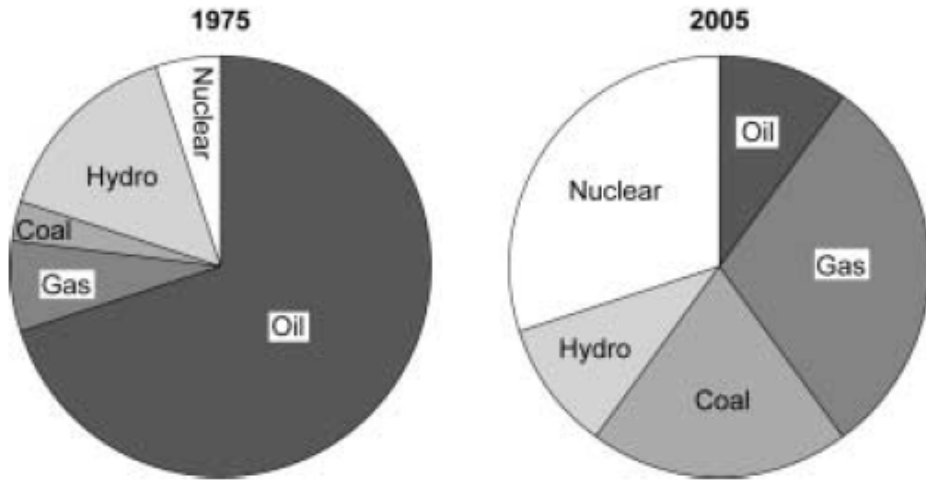


Q1. The pie charts show the relative proportions of electricity generated in Japan from different energy sources in 1975 and 2005.



(a) Describe and suggest a reason for **two** differences in the energy sources used in 2005 compared with 1975.

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(2)

(b) Mining for coal often releases large amounts of methane gas. Methane is both explosive and a greenhouse gas. At the Sihe coal mine in China the methane is diverted to a gas burning power station where it is used to generate electricity.

(i) A newspaper reported a scientist as saying:

If the concentration of greenhouse gases in the atmosphere doubles, the average temperature of the Earth will increase by up to 5 °C over the next 100 years.

What has been stated in the newspaper?

Draw a ring a round your answer.

a fact

a guess

a prediction

Give a reason for your answer.

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.....

(2)

(ii) Explain an environmental advantage of taking the methane gas from coal mines and using it to generate electricity.

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(2)

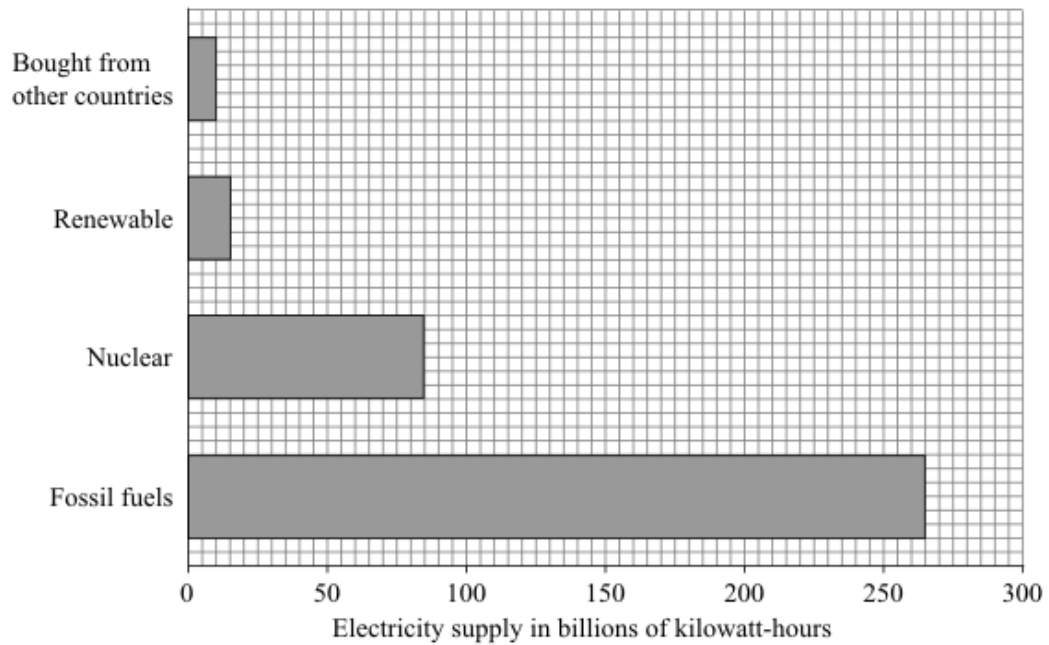
(c) The average person in Britain uses 1930 kWh of electricity each year. Many people in the world's poorest countries do not have access to electricity.

Giving examples, explain why electricity is essential for both improving public health and for modern communications.

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(3)
(Total 9 marks)

Q2. 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.

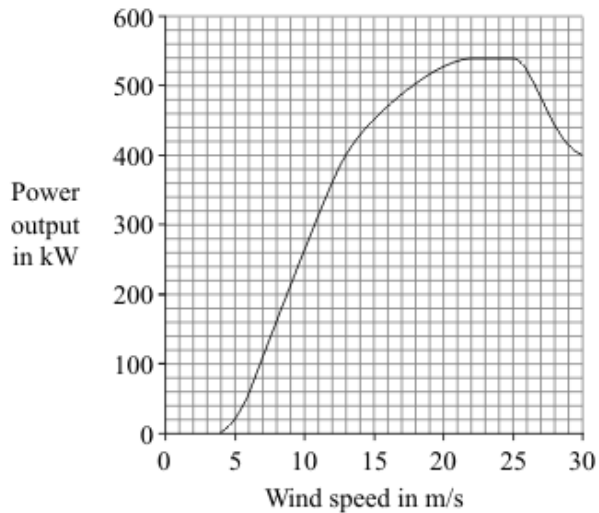
.....

.....

(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.

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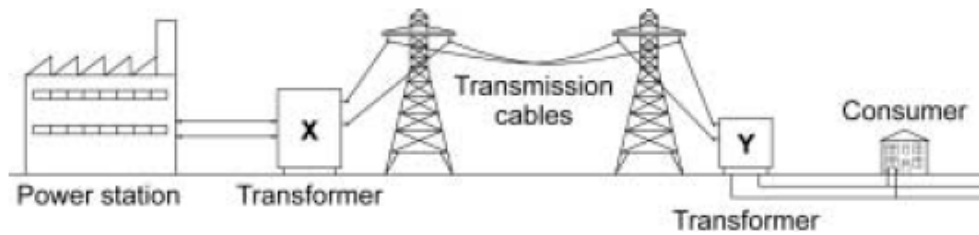
(3)

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

.....
.....

(1)
(Total 9 marks)

Q3. The diagram shows the National Grid system.



Transformers **X** and **Y** are an essential part of the National Grid system.

Explain why.

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(Total 4 marks)

Q4. (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.

.....
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.....
.....

(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)

Q5. 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.

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(3)
(Total 7 marks)

Q6. (a) (i) A student wrote "Coal traps energy from the Sun". Explain what the student means.

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.....

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(2)

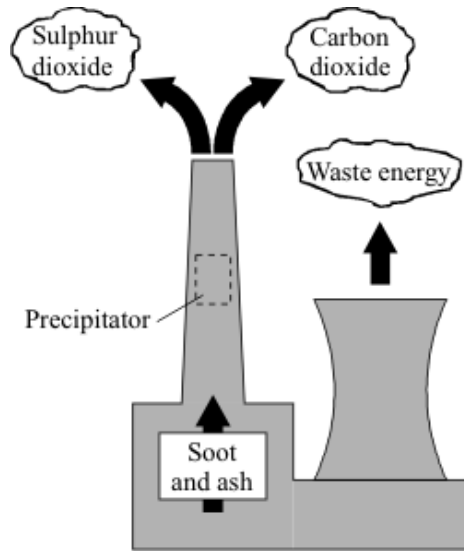
(ii) How is energy released from coal?

.....

.....

(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?

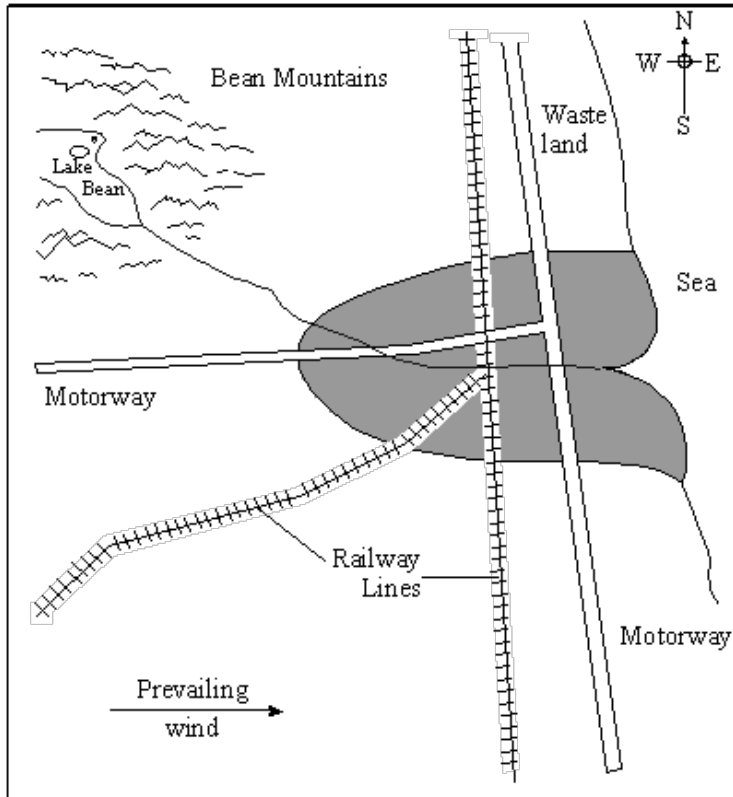
.....

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(1)

(Total 5 marks)

Q7. 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)

- M1.** (a) decrease in (proportion of) oil as reserves are decreasing 1
- increase in (proportion of) coal / nuclear / gas / as new reserves / more nuclear power stations built 1
- no marks are awarded for simply describing the differences*
- (b) (i) a prediction 1
- forecast based on scientific evidence 1
- (ii) less methane goes into the atmosphere 1
- accept air for atmosphere*
- therefore making global warming less rapid 1
- (c) idea that many devices transform electricity into other useful forms of energy 1
- example related to public health eg refrigeration / production of vaccines / X-ray machines 1
- example related to modern communications eg internet / telephones 1

[9]

- M2.** (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]

M3. transformer **X** reduces the current through the transmission cables

accept increases p.d. across the cables

1

this reduces the energy loss from the cables

1

which increases the efficiency of the distribution system

1

transformer **Y** is essential as it reduces the p.d. to a safe working value for consumers

1

[4]

M4. (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]

- M5.** (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]

- M6.** (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]

M7. To gain marks the candidate must

- | | | | |
|----|---|---------------------------------|-------|
| 1. | Select one option | Advantages) | Max 4 |
| 2. | State 8 valid advantages/disadvantages/relevant comparisons with either of the alternatives | Disadvantages) Comparisons) | Min 1 |
| | | If no A or D or C then | Max 4 |
| | | No option then | Max 4 |

Look for As, Ds for chosen scheme.
 Then for Cs compared with A/D for chosen scheme.

Below are listed some of the relevant mark scoring points.

| | Advantages | Disadvantages |
|------|--|--|
| Wind | Land available to North No pollution Close/low transmission costs No fuel costs Renewable energy resource | Initial cost Many windmills/much land Calm day problem Few long term jobs |
| Coal | Waste land to North Prevailing wind to East Good road/rail transport Close/low transmission costs Save coal industry Overall labour intensive | Pollution Initial costs Fuel costs Non-renewable energy Resource |

| | | |
|---------------|-----------------------------|--|
| Hydroelectric | No pollution | Possible drought |
| | Mountains/lake/river nearby | Distant/transmission costs |
| | No fuel costs | Few jobs created |
| | Renewable energy source | Possible expensive underground transmission cable |
| | | Construction of dam affects environment |

[8]

