



Exampro GCSE Physics

Generating Electricity Self Study Questions
Higher Tier

Name:

Class:

Author:

Date:

Time: 81

Marks: 81

Comments:

Q1. (a) In the UK, over 70% of the electricity is generated in power stations that burn fossil fuels.

(i) Explain **one** effect that burning fossil fuels has on the environment.

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(2)

(ii) Give **one** way the effect on the environment described in part (a)(i) could be reduced. Assume the amount of fossil fuels burnt stays the same.

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(1)

(b) Electricity can also be generated in a pumped storage hydroelectric power station.

An advantage of pumped storage hydroelectric power stations is the short start-up time they have.

(i) What is the importance of the short start-up time?

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(1)

(ii) Give **one** other advantage of a pumped storage hydroelectric power station.

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(1)

(c) Read the extract below from a newspaper article.

In the future it may not be possible to have constant electricity. Families will have to get used to using power when it is available.

(i) In the UK, the proportion of electricity generated using wind turbines is due to increase a lot. Some opponents of wind turbines think this increase will cause big fluctuations in the electricity supply.

Suggest **one** reason why this may be true.

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(1)

(ii) Between 2002 and 2008 the amount of electricity used for lighting in homes in the UK decreased.

Suggest **one** reason why.

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(1)

(Total 7 marks)

Q2. About half of the UK's electricity is generated in coal-burning power stations and nuclear power stations.

(a) Coal-burning power stations and nuclear power stations provide a reliable way of generating electricity.

What is meant by a *reliable way of generating electricity*?

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(1)

(b) Over the next few years, most of the older nuclear power stations in the UK will be closed down, and the process of decommissioning will start.

What does it mean to *decommission* a nuclear power station?

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(1)

- (c) Climate change has been strongly linked to the emission of carbon dioxide. Many governments around the world are committed to reducing carbon dioxide emissions.

Generating electricity can increase carbon dioxide emissions.

The companies generating electricity could reduce carbon dioxide emissions.

Give **two** ways the companies could do this.

1

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2

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(2)

- (d) Electricity is distributed from power stations to consumers along the National Grid.

The voltage across the overhead cables of the National Grid needs to be much higher than the output voltage from the power station generators.

Explain why.

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(3)

(Total 7 marks)

- Q3.** (a) Solar energy is a *renewable* energy source used to generate electricity.

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

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(1)

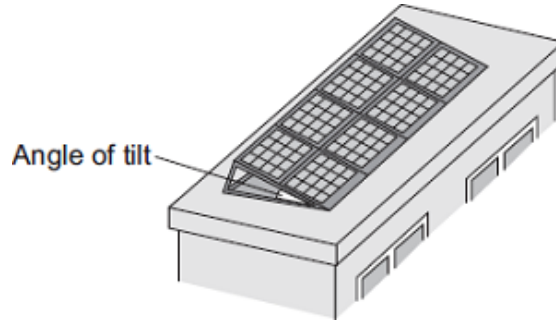
- (ii) Name **two** other renewable energy sources used to generate electricity.

1

2

(1)

- (b) A householder uses panels 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.

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(2)

- (ii) The total area of the solar cell panels used by the householder is 5 m².

The efficiency of the solar cells is 0.18.

Use the equation in the box to calculate the average **maximum** electrical energy available from the solar cell panels each second in June.

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

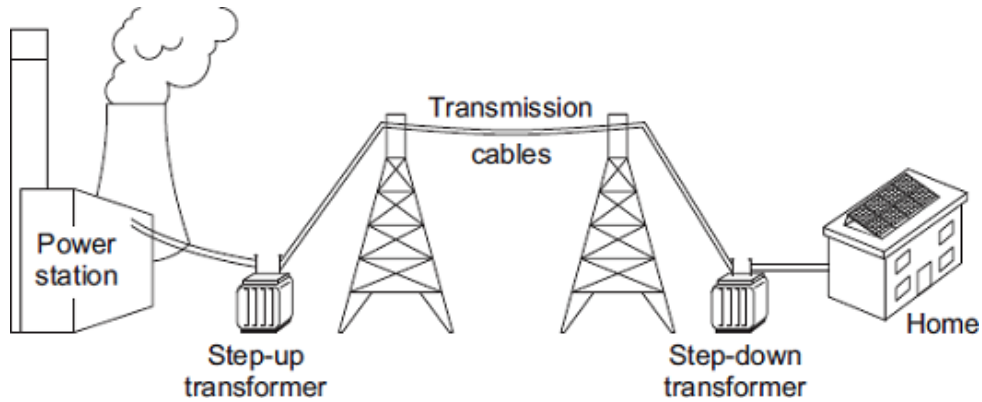
Show clearly how you work out your answer.

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Maximum energy = joules/second

(3)

- (c) The diagram shows part of the National Grid.



- (i) Even though the householder uses solar cells to generate electricity for his home, the home stays connected to the National Grid.

Give **one** reason why the householder should stay connected to the National Grid.

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(1)

- (ii) The step-up transformer increases the efficiency of the National Grid.

Explain how.

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(2)

(Total 10 marks)

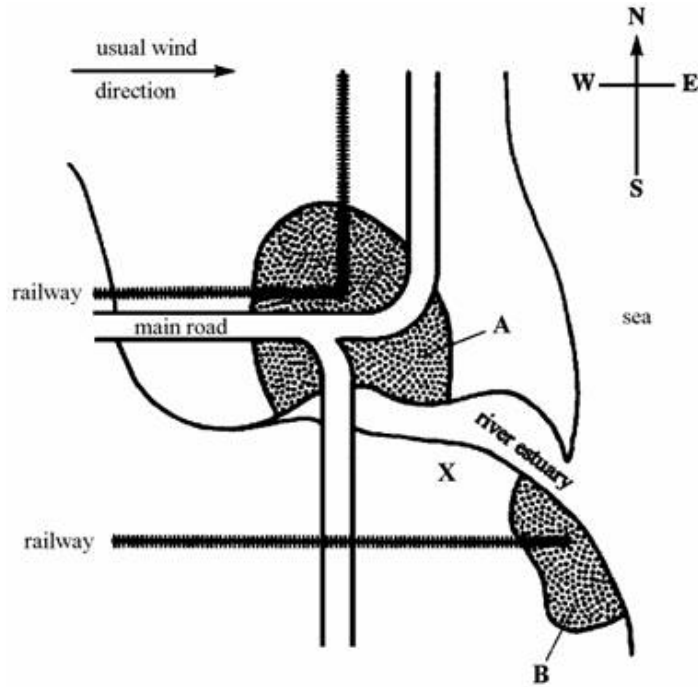
Q4. The map below shows the position of two towns, **A** and **B**, on the banks of a large river estuary.

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.

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(6)

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

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Explain the reason for your choice.

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(3)
(Total 9 marks)

Q5. (a) Nuclear fuels and the wind are two of the energy sources used to generate electricity in the UK.

Explain the advantages of using energy from nuclear fuels to generate electricity rather than using energy from the wind.

Include in your answer a brief description of the process used to generate electricity from nuclear fuels.

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(4)

- (b) In the UK, most electricity is generated in power stations that emit carbon dioxide into the atmosphere. The impact of these power stations on the environment could be reduced by the increased use of 'carbon capture' technology.

Describe how 'carbon capture' would prevent the build-up of carbon dioxide in the atmosphere.

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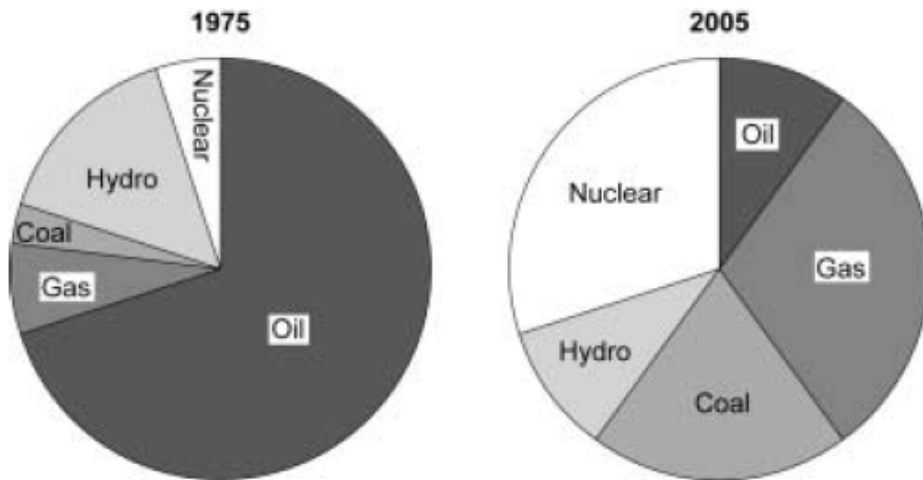
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(2)
(Total 6 marks)

- Q6.** 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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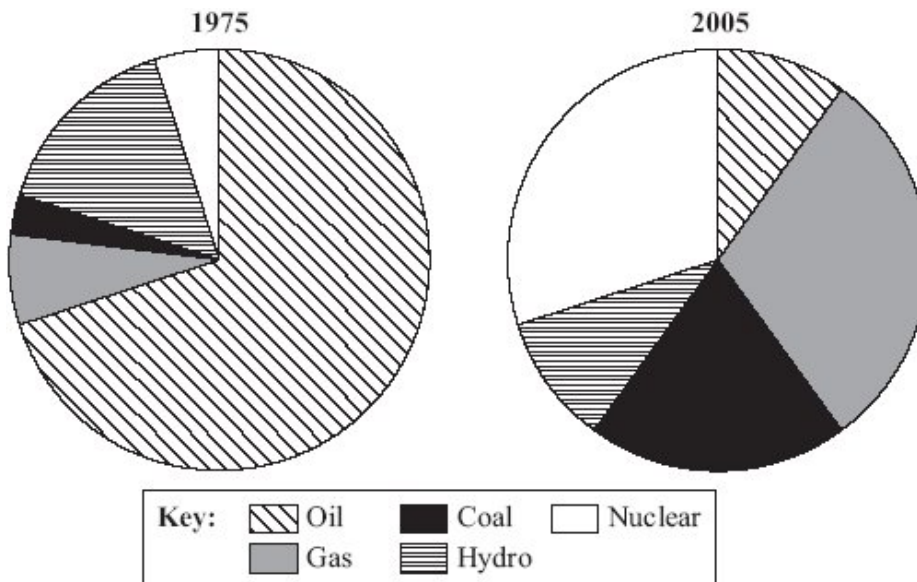
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(3)
(Total 9 marks)

- Q7.** 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.

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(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?

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(1)

(ii) Explain how the heat released from a nuclear fuel is used to generate electricity in power stations.

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(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

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2

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(2)

(iv) Nuclear power stations create dangerous waste.

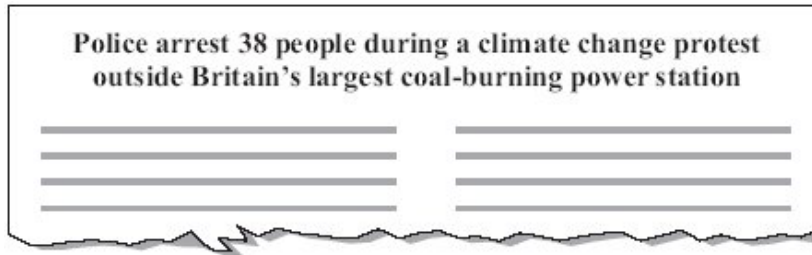
Why is the waste from a nuclear power station dangerous?

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(1)

(c) A headline from a newspaper article is shown below.



Explain the possible link between *climate change* and *coal-burning power stations*.

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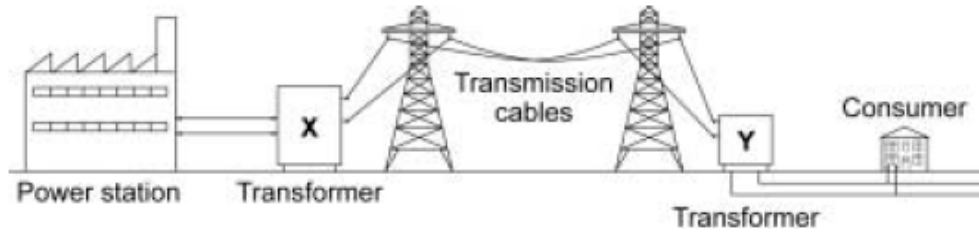
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(2)
(Total 9 marks)

Q8. 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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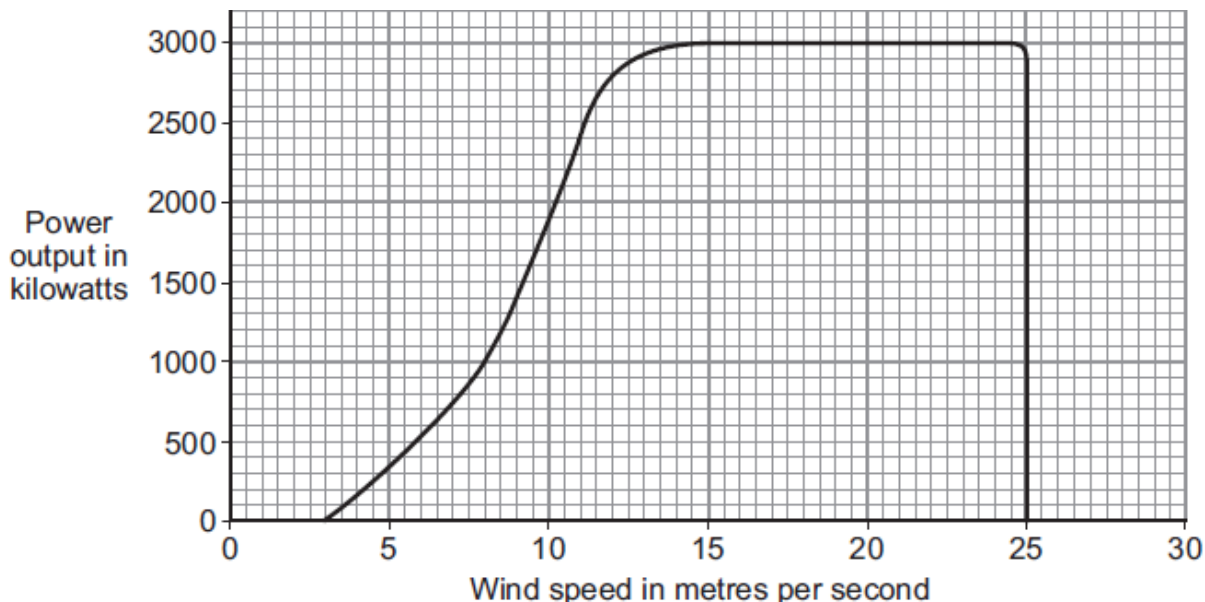
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(Total 4 marks)

Q9. The world's biggest offshore wind farm, built off the Kent coast, started generating electricity in September 2010.

(a) The graph shows how wind speed affects the power output from one of the wind turbines.



In one 4-hour period, the wind turbine transfers 5600 kilowatt-hours of electrical energy.

Use the equation in the box and the data in the graph to calculate the average wind speed during this 4-hour period.

$$\text{energy transferred} = \text{power} \times \text{time}$$

Show clearly how you work out your answer.

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Average wind speed = m/s

(3)

(b) The wind turbines are linked to the National Grid by underwater cables.

(i) What is the National Grid?

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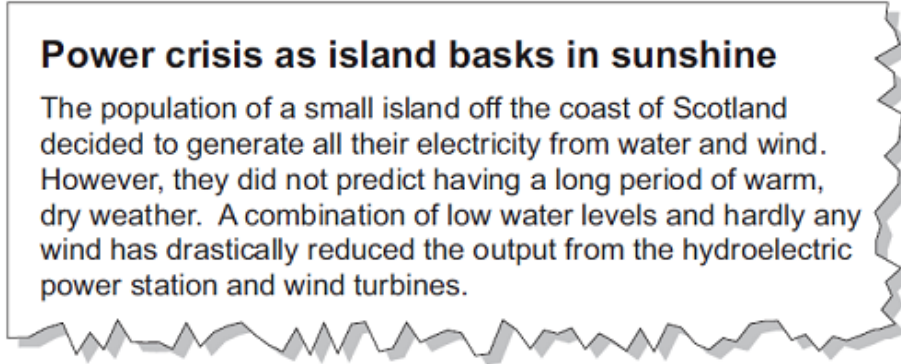
(1)

(ii) How is the National Grid designed to reduce energy losses during transmission?

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.....

(1)

(c) Read this extract from a newspaper.



Explain **one** way in which the islanders could try to ensure that a similar power crisis does **not** happen in the future.

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(2)
(Total 7 marks)

Q10. Over the next 15 years, some of the older nuclear power stations will be closed down, and the process of *decommissioning* will start. In the same period, several countries plan to build a number of new nuclear power stations.

(a) (i) What does it mean to *decommission* a nuclear power station?

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(1)

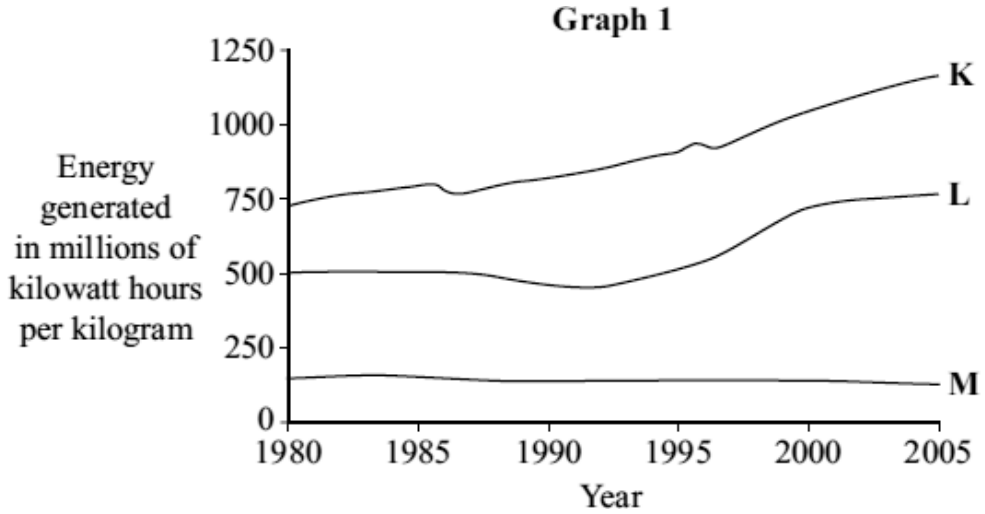
(ii) How does *decommissioning* affect the overall cost of electricity generated using nuclear fuels?

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(1)

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

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



(i) Compare the efficiency of the three types of power station, **K**, **L** and **M**, between 1980 and 2005.

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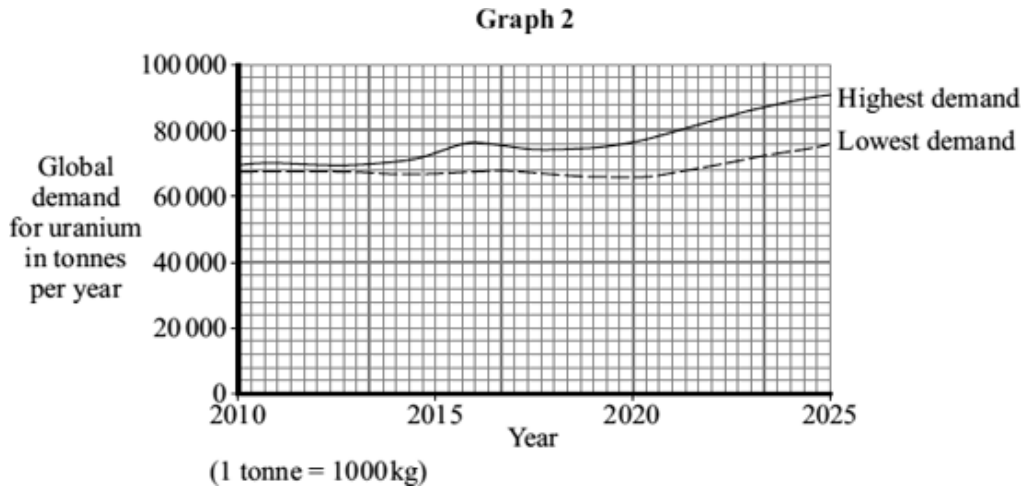
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(2)

Graph 2 shows two different predictions for the global growth in uranium demand over the next 15 years.



(ii) Suggest reasons why it is **not** possible to predict accurately how much uranium will be needed in 2025.

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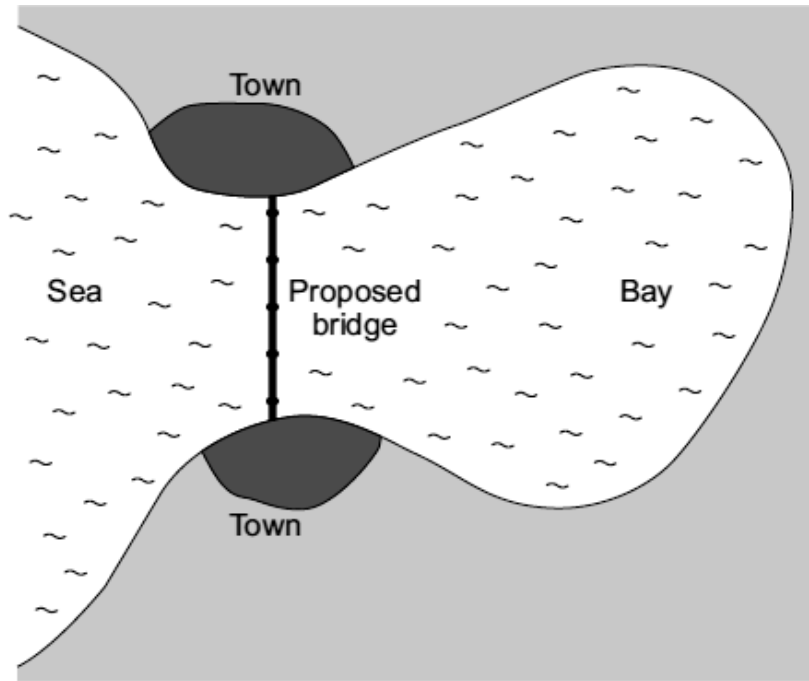
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(2)
(Total 6 marks)

Q11. 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

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Reason 2

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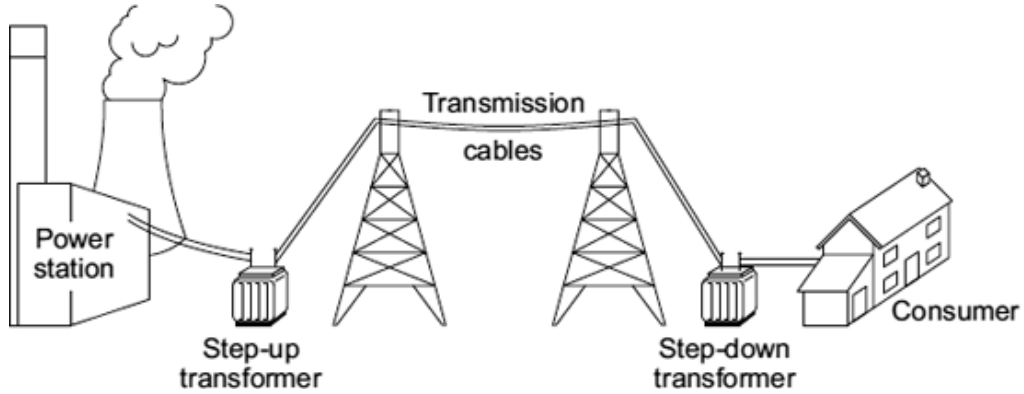
Reason 3

.....

(3)

- (b) Even with the proposed bridge, the two towns will need to stay connected to the National Grid.

The diagram shows part of the National Grid.



- (i) Give **one** reason why the towns need to stay connected to the National Grid.

.....
.....

(1)

- (ii) Explain how the step-up transformer increases the efficiency of the National Grid.

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

(2)

(Total 7 marks)

M1. (a) (i) produces carbon dioxide / nitrogen oxides
accept greenhouse gases
ignore pollutant gases 1

that (may) contribute to global warming
accept causes global warming
damages ozone layer negates this mark
accept alternative answers in terms of: sulfur dioxide / nitrogen oxides causing acid rain 1

(ii) carbon capture / storage
answer must relate to part (a)(i)
collecting carbon dioxide is insufficient

or

plant more trees

or

remove sulfur (before burning fuel) 1

(b) (i) (power station can be used) to meet surges in demand
accept starts generating in a short time
can be switched on quickly is insufficient 1

(ii) can store energy for later use
accept renewable (energy resource)
accept does not produce CO₂ / SO₂ / pollutant gases 1

(c) (i) turbines do not generate at a constant rate
accept wind (speed) fluctuates
accept wind is (an) unreliable (energy source) 1

(ii) any **one** from:

- energy efficient lighting (developed / used)
use less lighting is insufficient
- increased energy cost (so people more likely to turn off)
accept electricity for energy
- more people becoming environmentally aware

1

[7]

- M2.** (a) any **one** from:
- energy / source is constant
 - energy / source does not rely on uncontrollable factors
accept a specific example, eg the weather
 - can generate all of the time
will not run out is insufficient
- 1

- (b) (dismantle and) remove radioactive waste / materials / fuel
accept nuclear for radioactive
knock down / shut down is insufficient
- 1

- (c) any **two** from:
- reduce use of fossil fuelled power stations
accept specific fossil fuel
accept use less fossil fuel
 - use more nuclear power
accept build new nuclear power stations
 - use (more) renewable energy sources
accept a named renewable energy source
*do **not** accept natural for renewable*
 - make power stations more efficient
 - (use) carbon capture (technology)
*do **not** accept use less non-renewable (energy) sources*
- 2

- (d) (by increasing the voltage) the current is reduced
- 1

this reduces the energy / power loss (from the cable)
accept reduces amount of waste energy
accept heat for energy
*do **not** accept stops energy loss*

1

and this increases the efficiency (of transmission)

1

[7]

- M3.** (a) (i) replaced faster than it is used
accept replaced as quick as it is used
accept it will never run out
*do **not** accept can be used again*
- 1

(ii) any **two** from:
two sources required for the mark

- wind
- waves
- tides
- fall of water
do not accept water / oceans
accept hydroelectric
- biofuel
accept a named biofuel eg wood
- geothermal

1

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

- increases from 20° to 30°
- reaches maximum value at 30°
- then decreases from 30°
- same pattern for each month
accept peaks at 30° for both marks
accept goes up then down for 1 mark
ignore it's always the lowest at 50°

2

(ii) 648

an answer of 129.6 gains 2 marks
allow 1 mark for using 720 value only from table
allow 2 marks for answers 639, 612, 576, 618(.75)
allow 1 mark for answers 127.8, 122.4, 115.2, 123.75

3

(c) (i) (sometimes) electricity demand may be greater than supply (of electricity from the system)

accept cloudy weather, night time affects supply

or

can sell (excess) electricity (to the National Grid)

1

(ii) decreases the current

accept increases the voltage

1

reducing energy loss (along cables)

accept less heat / thermal energy lost / produced

1

[10]

M4. (a) *must give one advantage and one disadvantage of each to get 4 marks and 2 further scoring points*

Advantages and disadvantages relevant to:

(1) health risk

(5) cost

(6) environmental factors

(7) transport/ storage

e.g. common coal / nuclear – high cost of building both

anti-nuclear examples

nuclear fuel transported on roads/rail in region

possible effects on public health in surrounding area

high cost of de-commissioning

long life very active waste materials produced

how waste materials stored safely for a long time

anti-coal examples

unsightly

pollution

supplies of fuel limited

acid rain

non-renewable

pro-nuclear examples

fuel cheap

no foreseeable fuel shortage

pro-coal examples

safe

reliable

large coal reserves

disposal of solid waste is easier

to max 6

6

(b) choice 0 marks

any three valid reasons each with explanation, which may or may not be comparisons with other fuel

But

at least two of which must be relevant to this site

3

[9]

M5. (a) *answers must be in terms of nuclear fuels*

concentrated source of energy

idea of a small mass of fuel able to generate a lot of electricity

1

that is able to generate continuously
accept it is reliable
or can control / increase / decrease electricity generation
idea of available all of the time / not dependent on the weather
ignore reference to pollutant gases

1

the energy from (nuclear) fission

1

is used to heat water to steam to turn turbine linked to a generator

1

(b) carbon dioxide is not released (into the atmosphere)

1

but is (caught and) stored (in huge natural containers)

1

[6]

M6. (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

accept air for atmosphere

1

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]

M7. (a) decrease in oil

PLUS

any **one** from:

- increase in (proportion of) coal
- increase in (proportion of) nuclear
- increase in (proportion of) gas
must have decrease in (proportion of) oil and increase in (proportion of) coal / nuclear / gas

1

(b) (i) (nuclear) fission
accept fission
*do **not** accept any answer that looks like fusion*

1

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

1

steam turns turbine which drives generator

1

(iii) any **two** from:

- produces no pollutant gases
accept named gas or greenhouse gases
accept no atmospheric pollution
accept harmful for pollutant
accept does not contribute to global warming
*do **not** accept no pollution on its own*
*do **not** accept better for the environment unless qualified*
- it is reliable **or** can generate all of the time
- concentrated energy source **or** produces a lot of energy from a small mass
- produces only small volume of (solid) waste
- fossil fuels will last longer
accept a named fossil fuel
accept fossil fuels are running out
*do **not** accept fossil fuels are non-renewable unless qualified*
- will need to buy less fuel from other countries
accept no new fossil fuel power stations needed
*do **not** accept it is cheap*
*do **not** accept import less electricity*

2

(iv) it is / can be radioactive
do **not** accept answers in terms of kills cells / cancer

or emits radiation (from the nuclei)
accept emits gamma (rays)

1

(c) coal (burning) power stations / burning coal produces carbon dioxide
they refers to coal-burning power stations
accept sulfur dioxide / nitrogen oxides for CO₂

1

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

mention of ozone layer negates this mark
do **not** accept CO₂ warms atmosphere

1

[9]

M8. 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]

M9. (a) 9

allow **2** marks for power = 1400 (kW)
if a subsequent calculation is shown award **1** mark only

or
allow **1** mark for correct substitution and transformation

$$\text{power} = \frac{5600}{4}$$

allow **1** mark for using a clearly incorrect value for power to read a
corresponding correct value from the graph

3

(b) (i) system of cables and transformers
both required for the mark
ignore reference to pylons
inclusion of power stations / consumers negates the mark
wire(s) is insufficient 1

(ii) (uses step-up transformer to) increase pd / voltage
accept (transfers energy / electricity at) high voltage
or
(uses step-up transformer to) reduce current
accept (transfers energy / electricity at) low current
ignore correct references to step-down transformers 1

(c) build a power station that uses a non-renewable fuel or biofuel
accept a named fuel
eg coal or wood
or
buy (lots of) petrol / diesel generators 1

stockpile supplies of the fuel
accept fuel does not rely on the weather
or
fuel provides a reliable source of energy
accept as an alternative answer idea of linking with the National Grid (1)
and taking power from that when demand exceeds supply (1)
or
when other methods fail
or
when it is needed
answers in terms of using other forms of renewables is insufficient 1

[7]

M10. (a) (i) (dismantle and) remove radioactive waste / materials / fuels
accept nuclear for radioactive
*do **not** accept knock down / shut down* 1

(ii) increases it
*do **not** accept it has a negative effect* 1

- (b) (i) *if efficiency is not mentioned it must be implied
answers in terms of energy
generated only gains no credit*

K most efficient

or

M least efficient

*accept **K** and / or **L** are more efficient than **M***

1

(efficiency) of **K** and **L** increases, (efficiency) of **M** (almost) constant /
slightly reduced

all 3 power stations must be mentioned to get this mark

1

- (ii) any **two** from:

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

2

[6]

- M11.** (a) (i) tidal / tides

*do **not** accept water / waves*

1

(ii) any **three** from:

- shorter journey time
accept easier to go from town to town
accept less petrol / fuel used
- less pollution from traffic
accept CO₂ / carbon emissions reduced
- energy source is free
- energy source / tides are predictable
- produces less / no pollutant gases (than fuel burning power stations)
accept no CO₂ / greenhouse gases produced
accept air pollution for pollutant gases
- conserves supplies of fossil fuels
- uses renewable energy (to generate electricity)
- provides employment
- no visual / noise pollution
less harm to the environment is insufficient
the electricity is cheaper is insufficient
*do **not** accept produces no radioactive waste*
the pollution mark scores twice only if it is clear one reference is to
traffic and the other is to electricity generation

3

- (b) (i) (sometimes) electricity demand may be greater than supply (of electricity from the system)
accept in case turbines / generators fail
or
can sell (excess) electricity (to the National Grid)

1

- (ii) decreases the current
accept increases the voltage

1

reducing energy loss (along cables)
accept less heat / thermal energy lost / produced

1

[7]

