

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.1.3 NATIONAL AND GLOBAL ENERGY RESOURCES (PACK 3)

SCORE

/131

PERCENTAGE

%

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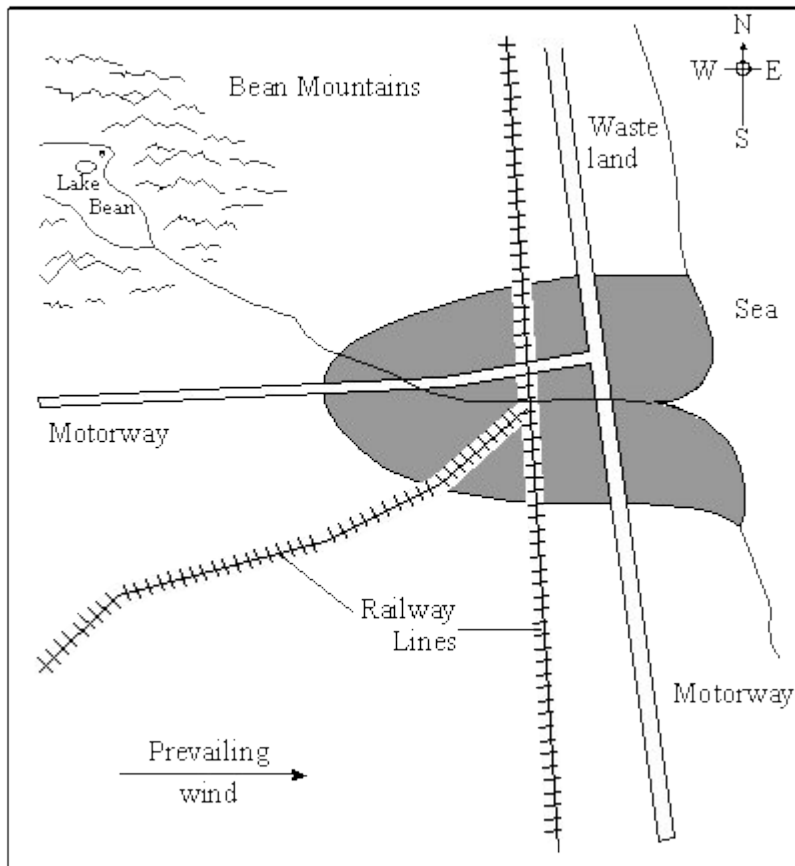
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Q1.

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.

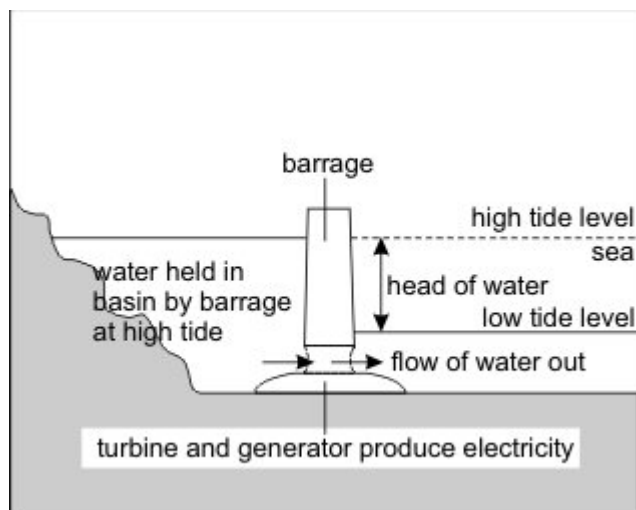
The choice is between a coal fired power station, wind turbines and a hydroelectric scheme.

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.



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)

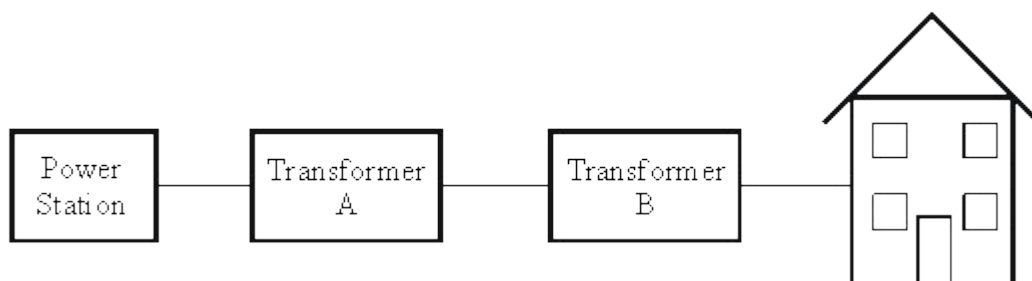
(Total 8 marks)

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.



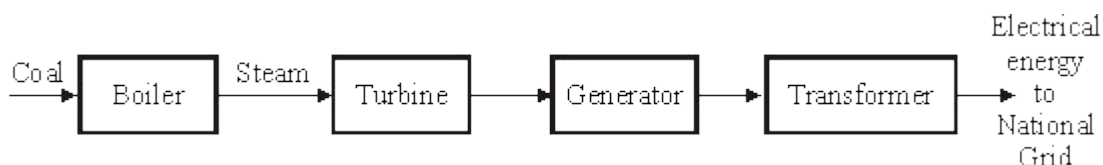
Transformer A produces a very high voltage to transmit the electrical energy through the National Grid.

Explain why electrical energy is transmitted at a very high voltage.

(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.

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.

(3)

(Total 9 marks)

Q7.

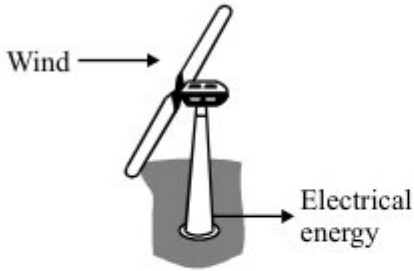
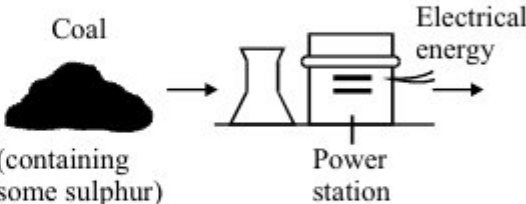
State and explain the advantages and disadvantages of using nuclear power stations to produce electricity.

(Total 4 marks)

Q8.

Electricity is a useful form of energy.

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

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

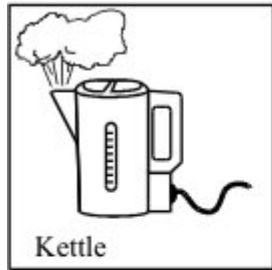
(4)

- (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**.

List A

Electrical device



List B

Useful energy transferred

heat

light

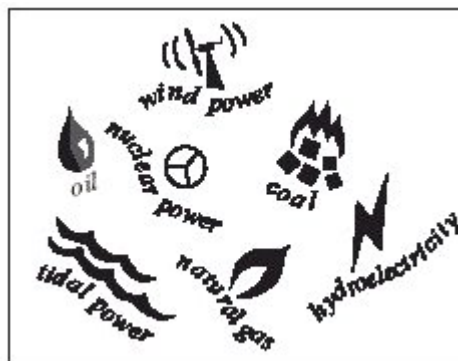
sound

(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

- (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 _____ _____	_____ _____

(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.

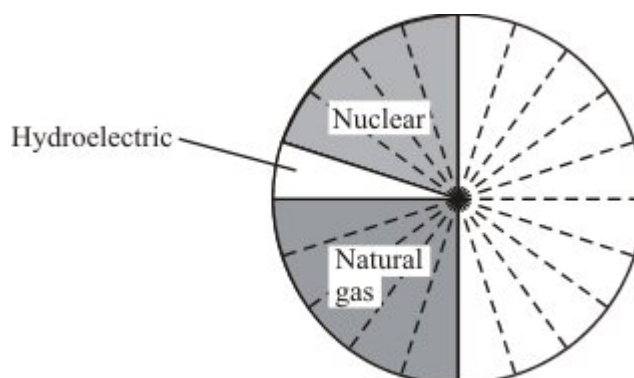
The table shows the main sources of energy used to generate electricity.

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?

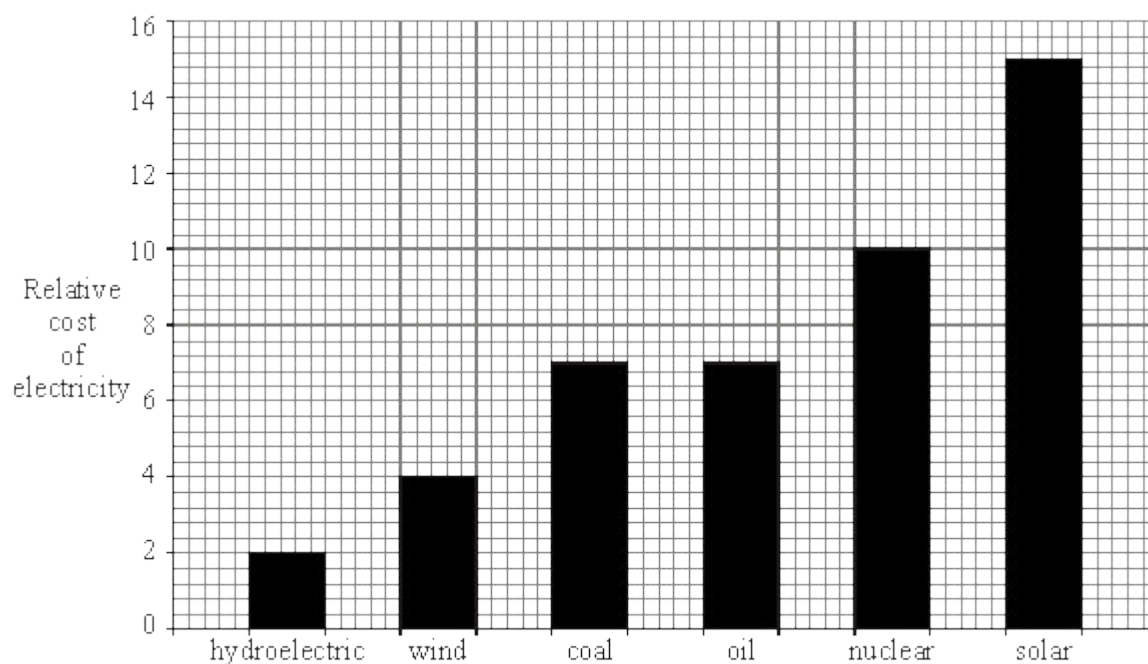
(1)

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

(1)

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)

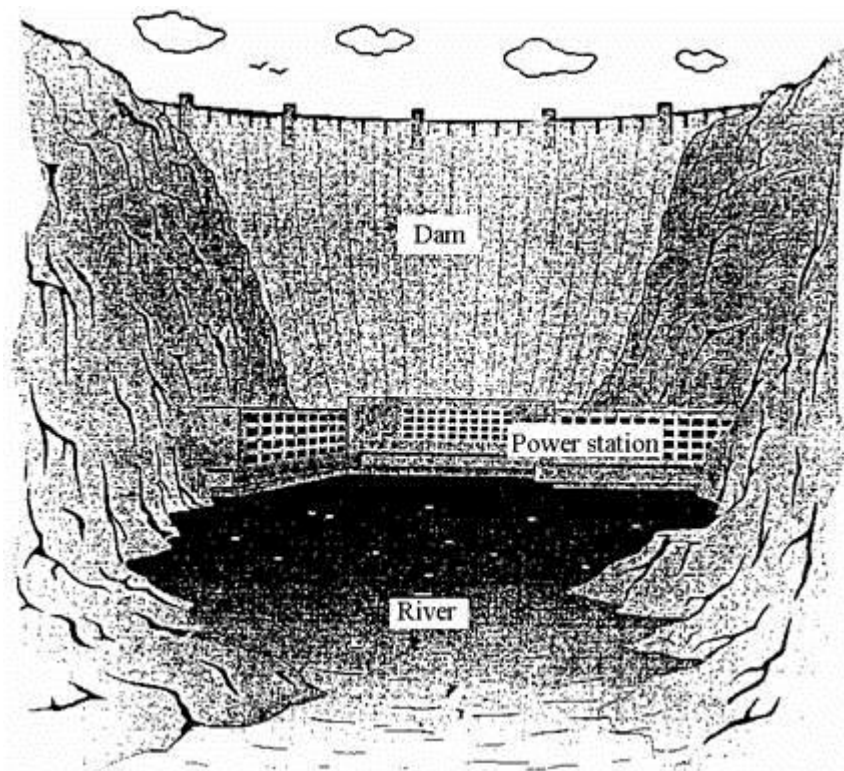
- (c) State and explain **one** situation where it is better to use solar energy, rather than any of the other energy sources, to generate electricity.

(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 _____

Disadvantage _____

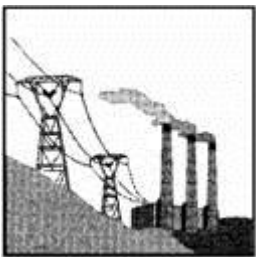
(4)
(Total 6 marks)

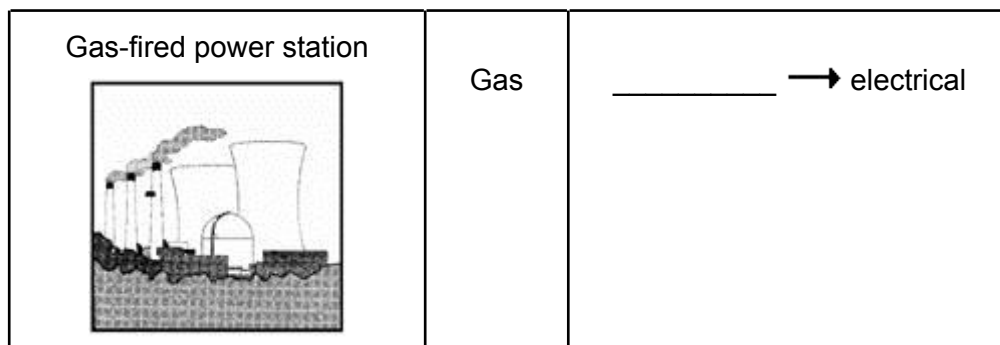
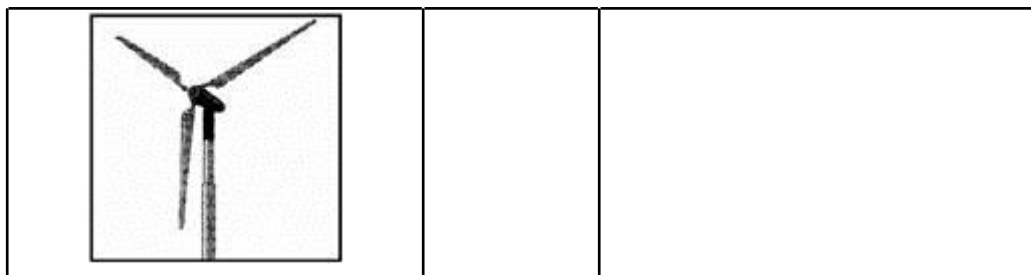
Q14.

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



(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)

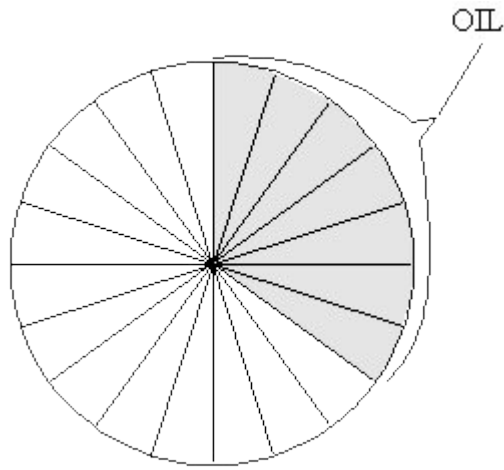
(Total 6 marks)

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.



(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)

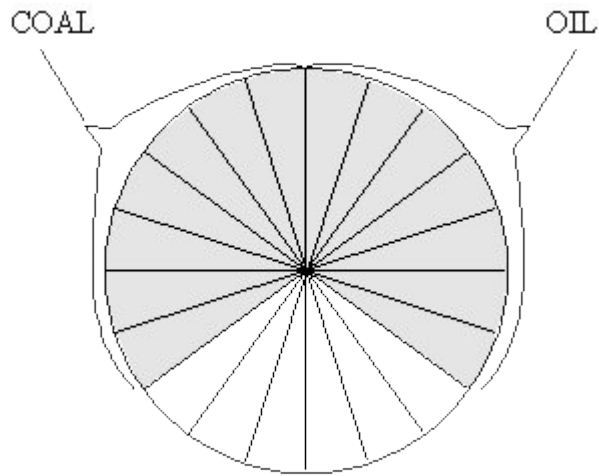
(Total 9 marks)

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.



(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)

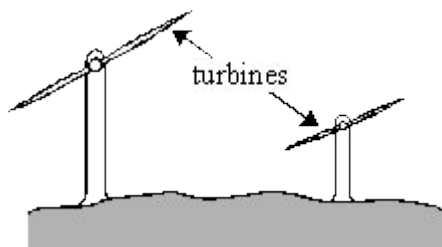
- (d) Explain why electricity is **not** included in the table of energy sources.

(1)

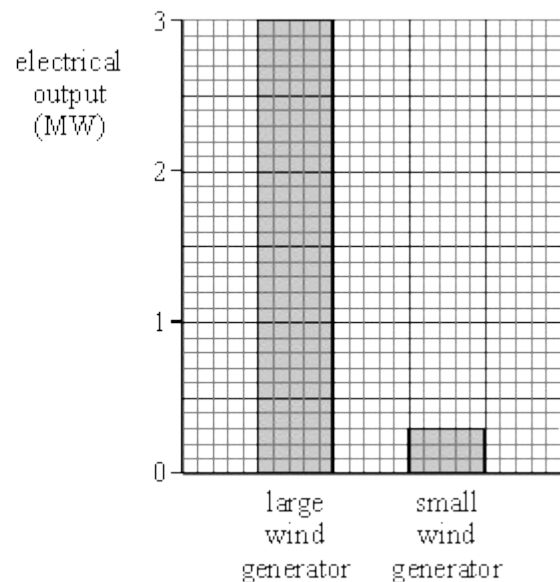
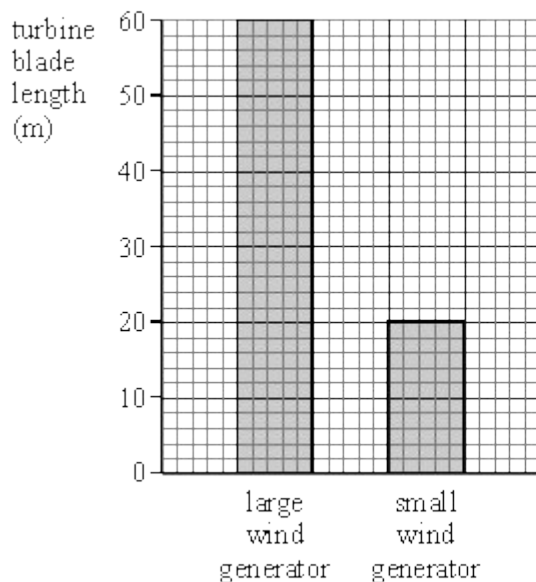
(Total 6 marks)

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.



Complete the following table.

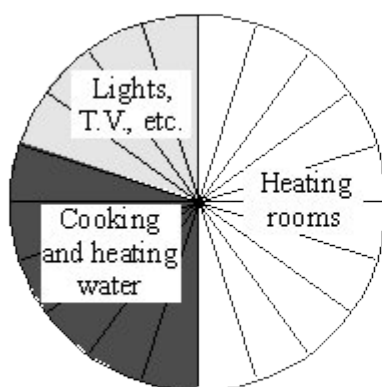
	LENGTH OF TURBINE BLADE (m)	ELECTRICAL OUTPUT (MW)
Large wind generator	60	
Small wind generator		

(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.

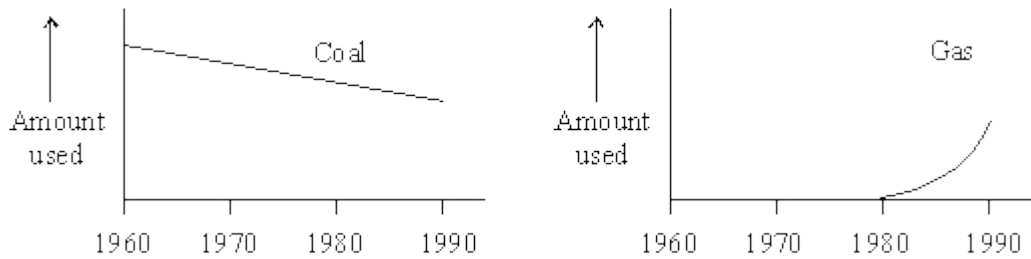


USE OF ENERGY	%
lights, T.V., etc.	20
cooking and heating water	
heating rooms	

(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.



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.

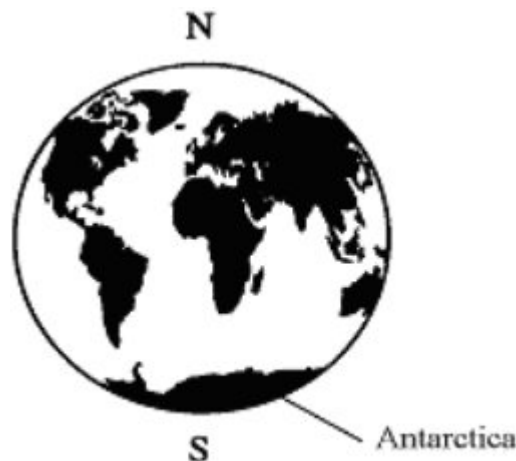
Why do you think they say this?

(3)

(Total 9 marks)

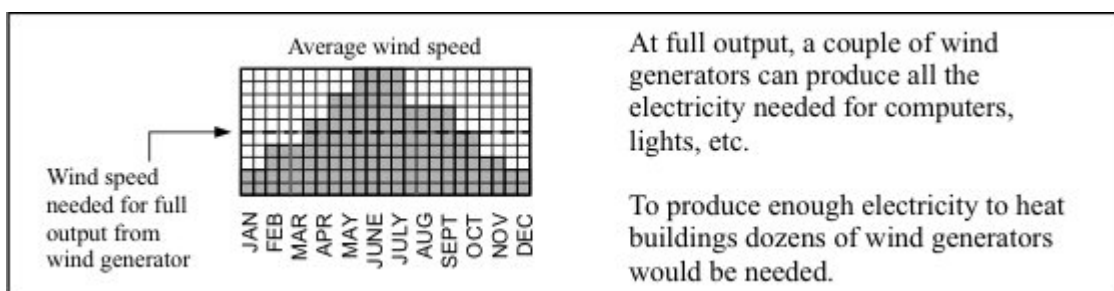
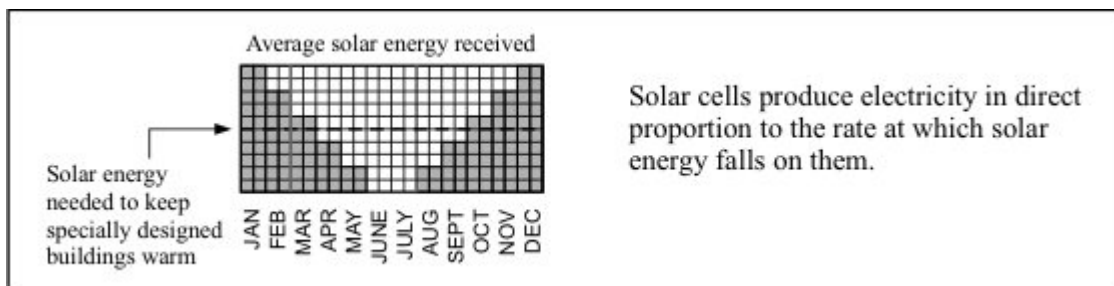
Q19.

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)

(Total 10 marks)

Mark schemes

Q1.

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) Min 1 Comparisons)
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 Mountains/lake/river nearby No fuel costs Renewable energy source	Possible drought Distant/transmission costs Few jobs created Possible expensive underground transmission cable Construction of dam affects environment

[8]

Q2.

- (a) 90% of 2.1011
2.16.1011

2

- (b) (i) Can be located anywhere
Continuous output
Sustain coal industry
any 2 for 1 mark each
- (ii) Low running cost
No atmospheric pollution
Gives calm coastal waters
any 2 for 1 mark each

- (iii) High installation costs – built in sea
 Coast environmental damage – wildlife disturbance
 Time dependence – need dropping tide
any 2 for 1 mark each
(1 for a valid disadvantage, 1 for reason)

6

[8]

Q3.

coal has chemical energy
 when burnt heat/energy produced longest
 used to boil water/make steam sequence
 used to turn turbine(s)
 which now have ke
 turbine(s) turn generator(s)
 (where (ke) transferred electrical energy)
 (or electrical energy produced)
any 5 for 1 mark each

[5]

Q4.

the higher the voltage the smaller the current
 small current gives small energy loss
 in the form of heat
 (or efficiency greater, or energy/heat losses low – gets 1)
for 1 mark each

[3]

Q5.

- (a) (i) much ash produced
 acid rain
 global warming/greenhouse effect
any 2 for 1 mark each

2

- (ii) landscaping/road building*
 removal of exhaust gases*
 use alternative source not producing
 CO₂* (*sequential (i))
for 1 mark each

2

- (b) (i) $E = 5 \times 10^8 \times 3600 \times 24 \text{ J/day}$
 $\times 4 \text{ (for 4 generators) (sequential on } P \times t) = 1.73 \times 10^{14} \text{ (J/day)}$

for 1 mark each

3

(ii) $2.66 \times 10^{10} \times 18\,829 = 4.86 \times 10^{14}$

for 1 mark each

2

(iii) Eff = output/input

Eff = 1.73/4.86

Eff = 0.36 or worked to a percentage

for 1 mark each

3

- (c) (i) boiler – heat to surroundings
turbine – not all steam energy used/heat/sound lost to surroundings
generator – heat in wires/coils/heat to surroundings
transformer – heat in wires/coils/heat to surroundings

any 1 for 1 mark

1

- (ii) energy spread out/diluted
as surroundings become warmer/energy lost as heat
difficult to use for further useful energy/transfers

any 2 for 1 mark each

2

[15]

Q6.

- (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]

Q7.

Read all the answer first. See below.

Mark the first two advantages and disadvantages (✓ or X) ignoring

neutral answers. Only allow a third advantage if there is only one disadvantage given. Only allow a third disadvantage if only one advantage is given.

max. 3 advantages (e.g. cheap fuel, good availability, saving fossil fuels, low running costs, reliable, more energy / kg, less fuel needed, no greenhouse gases emitted, no SO₂ causing acid rain)

max. 3 disadvantages (e.g. danger to health of local community, non renewable, high cost of decommissioning, long half life of waste materials, need for safe storage of waste, high cost of commissioning, danger involved in transporting fuel / waste)

max. 4 marks

[4]

Q8.

(a) **Using wind (advantage)**

any **one** from

can be used in remote locations

renewable

clean

accept does not cause pollution to the air / land

1

Using wind (disadvantage)

any **one** from

does not generate much (electrical) energy
many hundreds wind turbines would be needed

*accept many hundreds wind turbines would be needed **or**
too much land would be needed for wind farms **or** wind
energy is 'dilute'*

the wind is unreliable

*accept the wind does not blow all of the time **or** the wind is
not always strong enough*

noise / visual pollution

*do **not** accept just the word pollution*

1

Using coal (advantage)

any **one** from

can generate electricity all of the time

accept reliable electrical / energy supply

generates a lot of (electrical) energy

1

Using coal (disadvantage)

any **one** from

pollution by carbon dioxide / greenhouse gas

*accept slow start-up time **or** production of ash **or** difficult to
transport (coal) **or** there's not much coal left*

non renewable

pollution by sulphur dioxide acid rain

1

(b) all link lines correct

accept one link line correct for one mark

2

[6]

Q9.

(a) **(oil / natural gas / coal)**

*no marks are given for choosing the correct non-renewable
energy source*

burning releases carbon dioxide (1) greenhouse effect (1)

OR

allow 2 effects for 2 marks

burning (releases sulphur dioxide (1) acid rain (1)

OR

(nuclear power)

no marks given for choosing the correct non-renewable energy source

accidents can release very dangerous radioactive material (1)

produces waste that stays dangerously radioactive for thousands of years **or**
radioactive waste has to be stored safely for thousands of years (1)

accept the cost of installation and decommissioning is high

2

(b) any four from:

(wind power)

no marks are given for choosing the correct non-renewable energy source

- considered unsightly / visual pollution (1) very large areas of land (1)
- noisy for people living nearby / noise pollution (1)

(tidal power)

no marks are given for choosing the correct non-renewable energy source

- barrages / visual pollution (1)
- destroys the habitat of many living organisms (1)

(hydroelectricity)

no marks are given for choosing the correct non-renewable energy source

- damming / visual pollution (1)
- very large areas of land (1) flooding (1)

4

[6]

Q10.

*do **not** give any credit for renewable **or** non-renewable **or** installation **or** decommissioning costs*

fossil fuel advantage

1

a reliable source of energy

fossil fuel disadvantage

pollution by carbon dioxide /

accept causes acid rain
accept highest costs / more expensive than nuclear / more expensive than renewable

1

nuclear advantage

do not produce gases that increase the greenhouse effect **or** cause acid rain

accept nuclear is cheaper than fossil

1

nuclear disadvantage

accidents / waste can release very dangerous radioactive material radiation

*accept it produces waste that stays dangerously radioactive for thousands of years **or** radioactive waste has to be stored safely for thousands of years*

1

renewable advantage

there are no fuel costs

almost pollution free (apart from noise and visual)
accept cheaper than fossil

1

renewable disadvantage

not a reliable source of energy except for hydroelectric

accept (most) require large areas of land
accept visual / noise pollution

1

[6]

Q11.

(a) 20

accept twenty

1

(b) correct division 35/15

1

larger area labelled coal

accept smaller area labelled oil

1

(c) can be started up very quickly

1

(d) (i) carbon dioxide

1

(ii) sulphur dioxide

accept nitrogen oxide total

1

[6]

Q12.

- (a) any **two** from

reliable

accept it is not always windy

can be used as storage for surplus electricity

generates more electricity

accept would need hundreds of wind turbines to generate this electricity

takes less space is neutral

no noise pollution

*do **not** accept can be started up quickly*

2

- (b) advantage :

does not produce greenhouse gases / carbon dioxide / water

or acid rain / sulphur dioxide

1

disadvantage :

danger from radioactive materials if accidents **or** waste radioactive materials

accept slower start-up time

1

- (c) any **one** situation with a suitable explanation

satellite

weigh less **or** work for many years **or** remote

remote places on Earth pump water **or** operate phones **or** road signs / lights **or** weather stations **or** too expensive / impractical

calculators / watches small amount of electricity needed

2

[6]

Q13.

- (a) mark independently

(from) gravitational

accept potential

do not credit stored

1

(to) kinetic

accept movement

1

- (b) **advantage**

- * the current can be low (for the same power)
- * less energy **or** heat loss **or** power loss
 - accept the cables do not have to be (so) thick*
 - accept less cost to support higher (rather than heavier) cables*
 - accept aluminium can be used and aluminium is cheaper than copper*
 - do not credit efficient **or** cheaper*
 - do not credit no loss of energy*
 - do not credit electricity loss*

2

disadvantage

- * it is difficult to insulate high voltage
- * pylons have to be taller and so more expensive
 - ...to give a good separation between them and the ground /people/high vehicles*
 - or** ... to prevent/reduce the danger of electric shock **or** lethal*
 - do not credit dangerous*
 - do not credit get a shock*
 - do not credit reference to step down transformers **or** electromagnetic field*

2

[6]

Q14.

- (i) gravitational **or** potential
do not accept stored

1

light

credit solar

1

kinetic **or** movement

credit moving

1

chemical

1

- (ii) any **one** from

gas

coal

1

- (iii) any **one** from

oil

*do not accept petrol **or** paraffin*

peat **or** turf
nuclear

*credit coal **or** gas if not given as answer to part (ii)*
*do not accept wood **or** fossil fuel **or** chemical*

1

[6]

Q15.

- (a) sectors nearer to correct value than to 1% either side
coal 35%
nuclear 5%
gas 24%
moving water 1%

*each for 1 mark -
to a maximum of 3 marks
deduct 1 mark if sector left blank*

three sectors labelled correctly w.r.t. rank order of size
for 1 mark

4

- (b) (fossil) fuels (*allow* combustible/flammable/non renewable)

1

- (c) moving water/hydro
wind/waves/tides/solar (*allow* geothermal/
wood/biomass)

each for 1 mark

2

- (d) any indication that we get more (energy from nuclear sources)
gains 1 mark

but

5 times as much/more

gains 2 marks

2

[9]

Q16.

- (a) sectors closer to correct value than $\pm 1\%$ nuclear (5%)
gas 24% moving water 1%

*each for 1 mark
maximum of 2 marks*

3

*sectors labelled correctly w.r.t. rank order of size
for 1 mark*

But deduct 1 mark if not all sectors used

- (b) 5 × as much (do **not** credit simply more/4% more)
4 × as much

1

- (c) wind/waves/solar/tides
(allow geothermal/wood/biomass)

any one for 1 mark

1

- (d) *idea that*
electricity is a secondary/man made source/needs another
source to produce it

for 1 mark

1

[6]

Q17.

20 $\frac{3}{0.3}$

each for 1 mark

[3]

Q18.

- (a) cooking and heating water 30
heating rooms 50

each for 1 mark

2

- (b) coal
idea that amount used fell/declined/line goes down

gains 1 mark

but *idea that* fall/decline is steady/gradually/approx halved

gains 2 marks

gas

ideas that

amount used rose/increased

in/from 1980/more used before 1980/ref to 1980

as an important date/*rapid* increase in use

(*credit idea that* gas > coal from c.1990

in either part with 1 mark (to maximum 4)

each for 1 mark

max 4

- (c) • *less* carbon dioxide produced
- less change to weather/food production/gained
warming/water levels (no mark for "greenhouse gas" alone)
- no/less sulphur dioxide produced/coal produces sulphur dioxide
- less acid rain/damage to fish/buildings/trees/crops/animals/tumours etc
(do not credit reference to cost unless : cheaper so can spend more on environment)

*("It" used in an answer will refer to "gas") any 3 for 1 mark
each*

3

Q19.

ideas that

- direct solar radiation will provide enough energy to heat the (specially designed) buildings during the period Oct-Mar / summer
- solar cells will produce plenty of electricity in Oct-Mar / summer (when wind generators produce little)
- a couple of wind generators will produce all electricity needed (for all but heating) Apr-Oct / winter
- number required makes wind generators unsuitable for heating / buildings
- no solar energy in June and July / little in winter
- solar / wind have little effect on environment
- **or** cause no air pollution
- solar and wind complement each other
- **or** together provide energy all year
- fuel / gas / diesel can provide energy all the time / at any time
- fuel / gas / diesel needed for transport
- fuel / gas / diesel needed for heating in winter
- diesel has to be imported
- diesel likely to freeze
- gas wouldn't have to be imported
- drilling for gas difficult / harms environment
- but atmospheric pollution a global rather than local matter so any produced in Antarctic doesn't matter much

(deduct 1 mark (to min^m. zero) for incorrect claims about destroying ozone layer)

- gas produces less carbon dioxide (for the same energy released) than diesel*
- gas produces less sulphur dioxide (for the same energy released than diesel*

(* these ideas met by candidates in Q.16 so must be allowed, though not required)
any ten for 1 mark each