Energy Questions Part 3

35 Questions

Name: _____

Class: _____

Date: _____

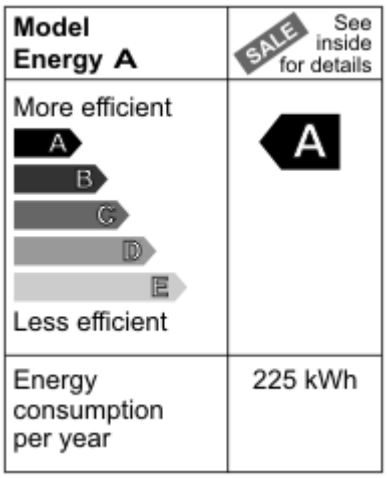
Time:

Marks:

Comments:

Q1.

The diagram shows the label from a new freezer.



(a) An old freezer has an energy consumption per year of 350 kWh.

Use the equation in the box to calculate the extra cost of using the old freezer for one year compared with using a new 'A' rated freezer.

total cost = number of kilowatt-hours × cost per kilowatt-hour

Assume 1 kilowatt-hour (kWh) of energy costs 12 p.

Show clearly how you work out your answer.

_____

_____

Extra cost per year = £ _____

(2)

(b) The price of the new freezer was reduced in a sale.

Reducing the price reduces the payback time for replacing the old freezer from 12 years to 9 years.

Calculate, in pounds, how much the new freezer was reduced in the sale.

Show clearly how you work out your answer.

_____

_____

Price reduced by = £ _____

(2)

(c) An advertisement in a shop claims that:

'Replacing an old freezer with a new 'A' rated freezer will benefit the environment.'

Do you agree that replacing the freezer will benefit the environment?

Answer yes or no. _____

Explain the reasons for your answer.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q2.

(a) In winter, energy is transferred from the warm air inside a house to the air outside.

(i) What effect will the energy transferred from the house have on the air outside?

_____

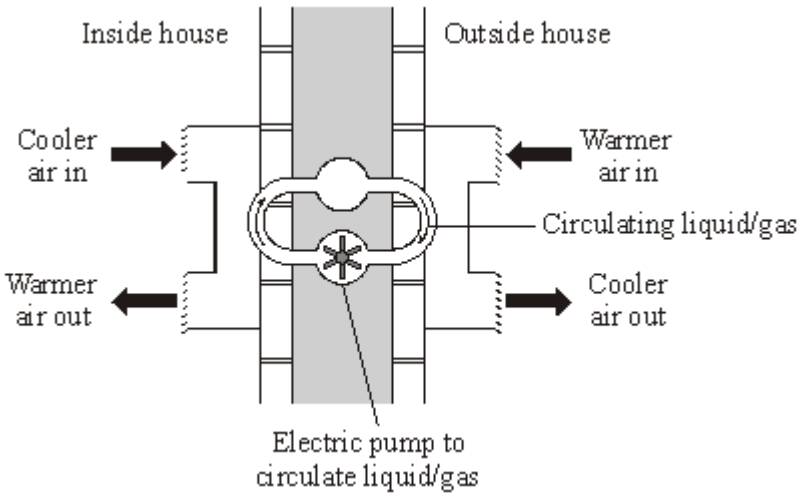
(1)

(ii) What would happen to the energy transfer if the temperature inside the house were reduced? Assume the temperature outside the house does not change.

_____

(1)

(b) To increase energy efficiency, a householder installs a heat exchanger to an outside wall of the house. The heat exchanger uses heat from the air outside to warm the inside of the house. The diagram shows the idea of the heat exchanger.



Physics Through Applications edited by J Jardine et el (OUP, 1989), copyright © Oxford University Press, reprinted by permission of Oxford University Press.

(i) Why does the heat exchanger cost money to run?

_____

(1)

(ii) The heat exchanger is cost effective in reducing energy consumption. Explain why.

_____

_____

_____

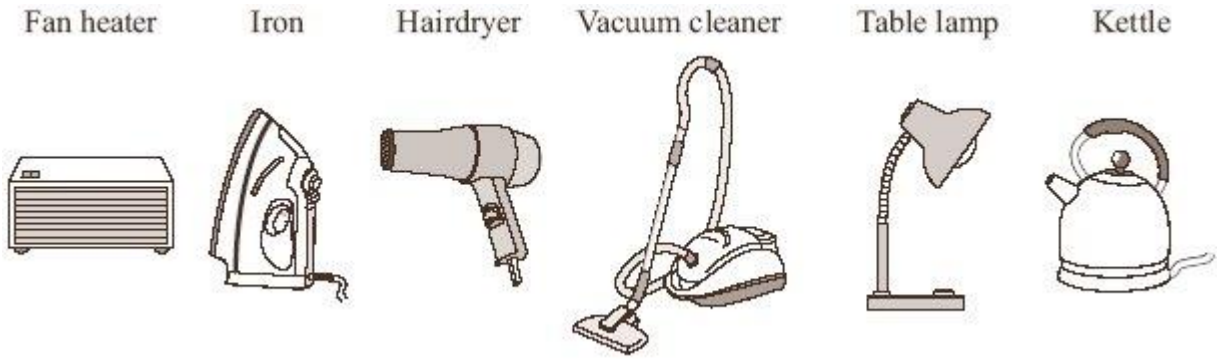
_____

(2)

(Total 5 marks)

Q3.

The pictures show six different household appliances.



(a) Four of the appliances, including the fan heater, are designed to transform electrical energy into heat.

Name the other **three** appliances designed to transform electrical energy into heat.

1. _____

2. _____

3. _____

(3)

(b) Complete the following sentence using **one** of the words from the box.

chemical	**heat**	**kinetic**	**sound**

Energy that is not usefully transformed by the fan heater is wasted as

_____ energy.

(1)

(c) The table gives information about two different fan heaters.

	Useful energy transferred each second in joules	**Wasted energy transferred each second in joules**
Fan heater **L**	1200	10
Fan heater **M**	1200	20

Complete the following sentence by drawing a ring around the line in the box that is correct.

Fan heater **L**	is more efficient than has the same efficiency as is less efficient than	fan heater **M**.

(1)
(Total 5 marks)

Q4.

(a) Different energy sources are used to generate electricity.

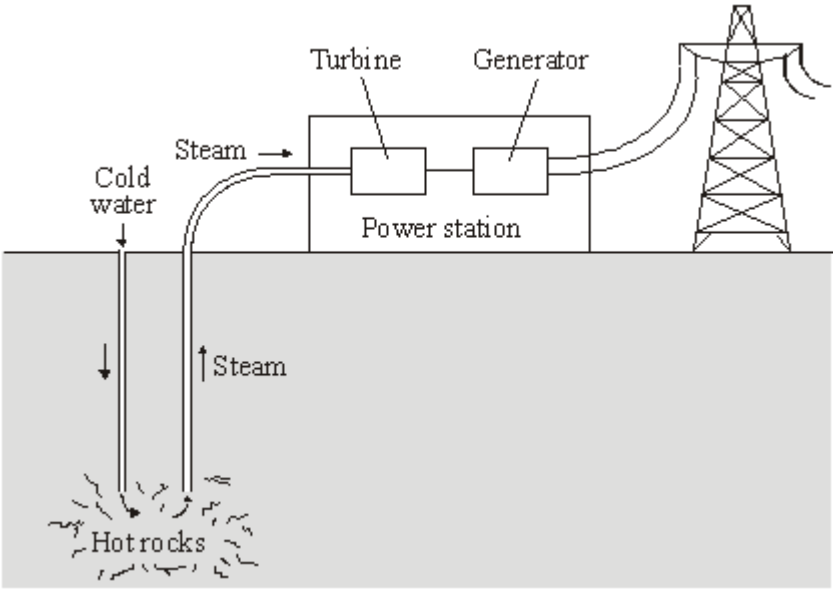
Which **two** of the energy sources in the box are likely to be used up first?

Draw a ring around each of your answers.

gas	**oil**	**Sun**	**tides**	**waves**	**wind**

(2)

(b) The diagram shows a geothermal power station. Hot rocks in the Earth's crust heat water to produce steam. The steam is used to drive turbines that turn electrical generators.



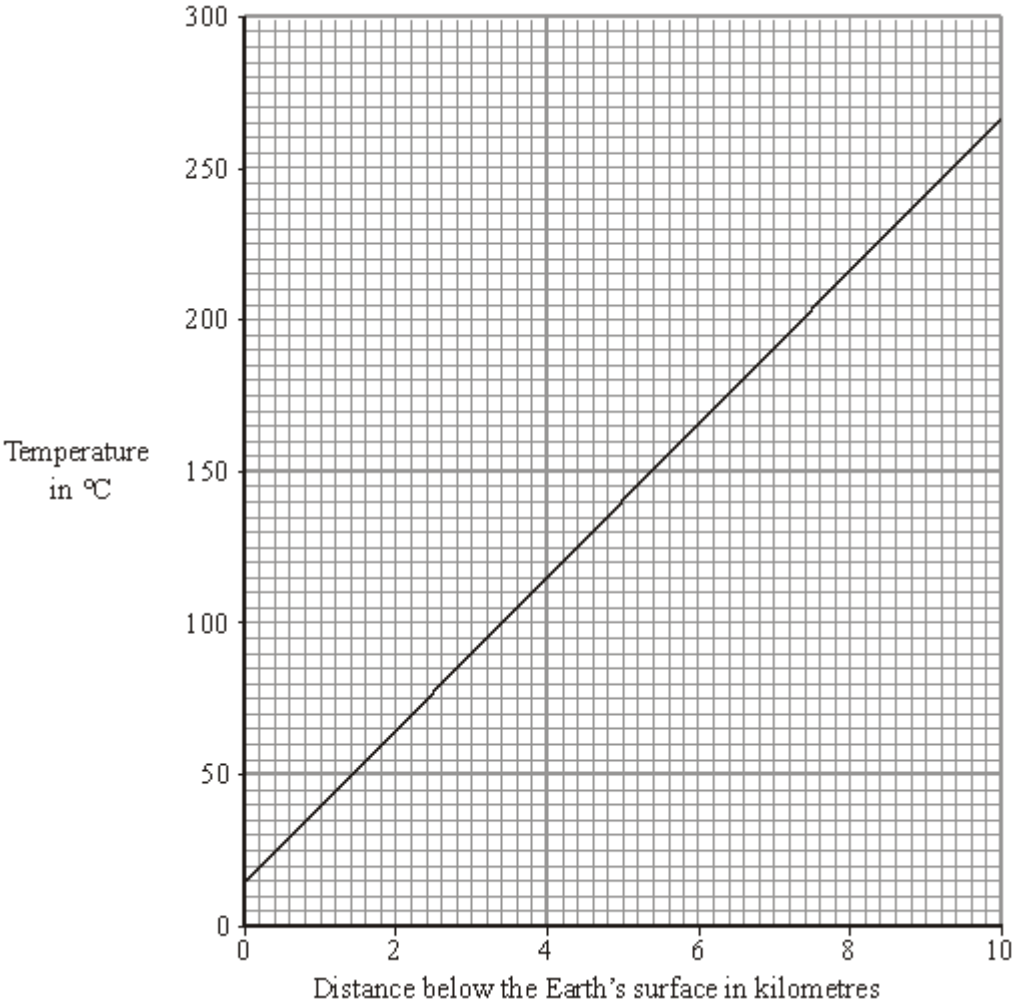
How is the way in which a geothermal power station generates electricity the same as the way in which a coal burning power station generates electricity?

_____

_____

(1)

(c) The graph shows how the temperature of the rocks in the Earth's crust depends on how far the rocks are below the Earth's surface.



Estimate the temperature of the rocks 5 kilometres below the Earth's surface.

Show clearly how you have used the graph to get your answer.

_____

_____

Temperature = _____ °C

(2)

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

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

_____

_____

(1)

(Total 6 marks)

Q5.

(a) Solar energy is a *renewable* energy source that can be used to generate electricity.

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

_____

(1)

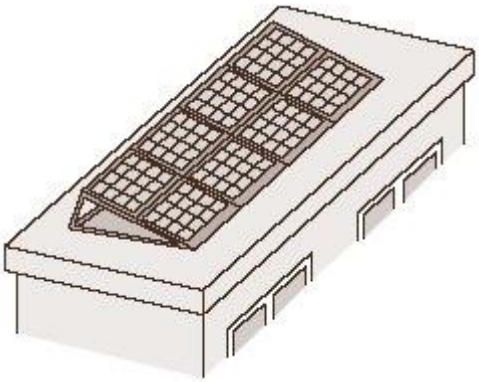
(ii) Name **two** further renewable energy sources used to generate electricity.

1. _____

2. _____

(1)

(b) A householder uses a bank 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 m^2 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.

_____

_____

_____

_____

(2)

(ii) The bank of solar cells used by the householder has an area of 8 m^2.

The efficiency of the solar cells is 0.15

Calculate the average **maximum** electrical energy available from the bank of solar cells each second in June.

Show clearly how you work out your answer.

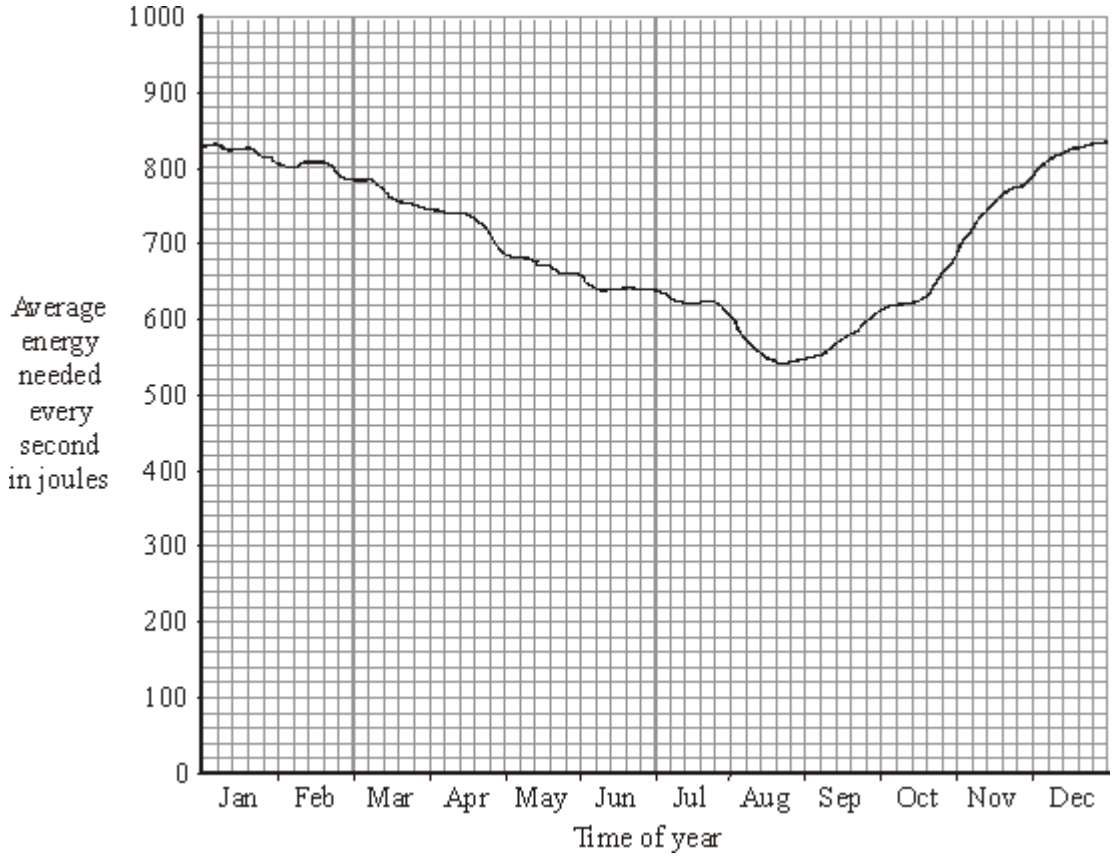
_____

_____

Maximum energy = _____ joules/second

(3)

(c) The graph shows how the householder's electrical energy needs change over one year.



Why would it be advisable for the householder to remain connected to the National Grid?

_____

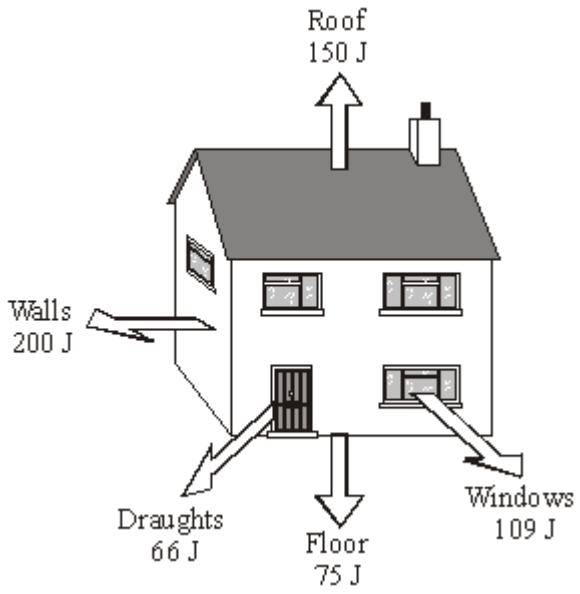
_____

(1)

(Total 8 marks)

Q6.

(a) The diagram shows how much heat is lost each second from different parts of an uninsulated house.



(i) Each year, the house costs £760 to heat.

How much money is being wasted because of heat lost through the roof?

Show clearly how you work out your answer.

_____

_____

(2)

(ii) Insulating the loft would cut the heat lost through the roof by 50 %.

The loft insulation has a payback time of $1\frac{1}{2}$ years.

How much did the loft insulation cost to buy?

_____

Cost of loft insulation = £ _____

(1)

(b) What happens to the wasted energy?

_____

_____

(1)

(Total 4 marks)

Q7.

(a) The picture shows a new washing machine.

Complete the following sentence using **one** of the words in the box.

kinetic	**light**	**sound**

A washing machine is designed to transform electrical energy into heat and

_____ energy

(1)

(b) The instruction booklet for the washing machine contains the following information.

Wash cycle	Average power during cycle	Time taken to run cycle
HOT	1.5 kW	2 hours
COOL	1.1 kW	1½ hours
FAST	1.0 kW	¾ hour

(i) Use the following equation to calculate the energy transferred, in kilowatt-hours, to the washing machine during the HOT wash cycle. Show how you work out your answer.

energy transferred = power × time

_____

_____

Energy transferred = _____ kWh

(2)

(ii) Why does it cost more to use the washing machine on the HOT cycle than on the COOL or FAST cycle?

_____

_____

(1)

(iii) Before buying a washing machine, a householder researched several makes to find out which washing machine was the most energy efficient.

Write down **one** way that he could have done this research.

_____

_____

(1)

(Total 5 marks)

Q8.

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 aswoodchip and straw, can be used to generate electricity.
- Plants for bio-fuels use up carbon dioxideas they grow.
- Farmers get grants to grow plants forbio-fuels.
- Electricity generated from bio-fuels can besold at a higher price than electricity generated from burning fossilfuels.
- Growing plants for bio-fuels offers newopportunities 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.

_____

_____

_____

_____

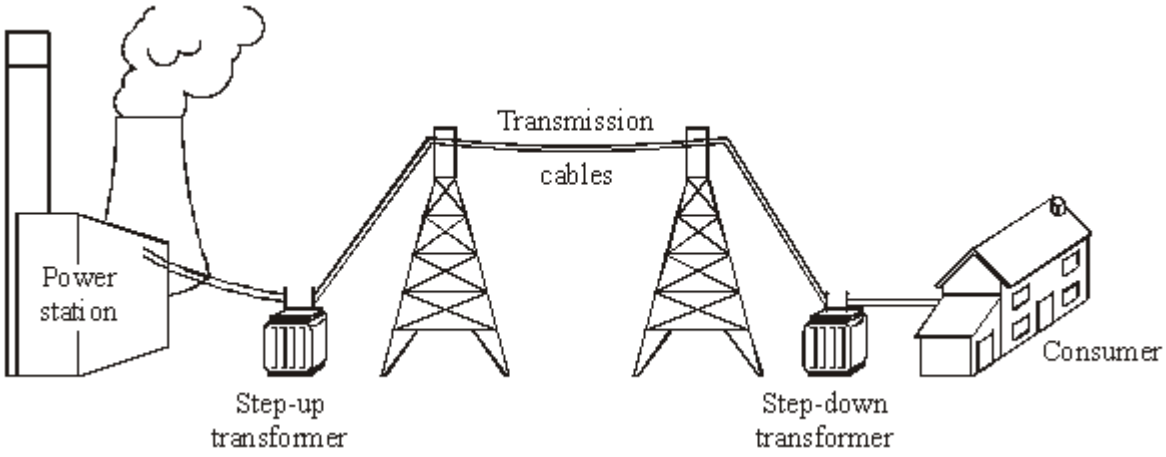
_____

_____

(3)
(Total 7 marks)

Q9.

The diagram shows how electricity gets from power stations to consumers.



(a) Complete the following sentences by drawing a ring around the correct line in each box.

(i) The network of cables and transformers linking power stations to consumers

is called the national

grid
line
network

(1)

(ii)

A step-up transformer

decreases voltage
increases current
increases voltage

(1)

(iii)

Electricity is supplied to consumers' homes at

230 V
25 000 V
400 000 V

(1)

(iv)

Making the current in the cables smaller will

increase
make no difference to
reduce

the energy lost in the cables.

(1)

(b) Transformers always waste some energy.

(i) What effect does the waste energy from a transformer have on the air around the transformer?

_____

(1)

(ii) Which **one** of the following describes the efficiency of a transformer?

Draw a ring around your answer.

always 100 % **less than 100 %** **more than 100%**

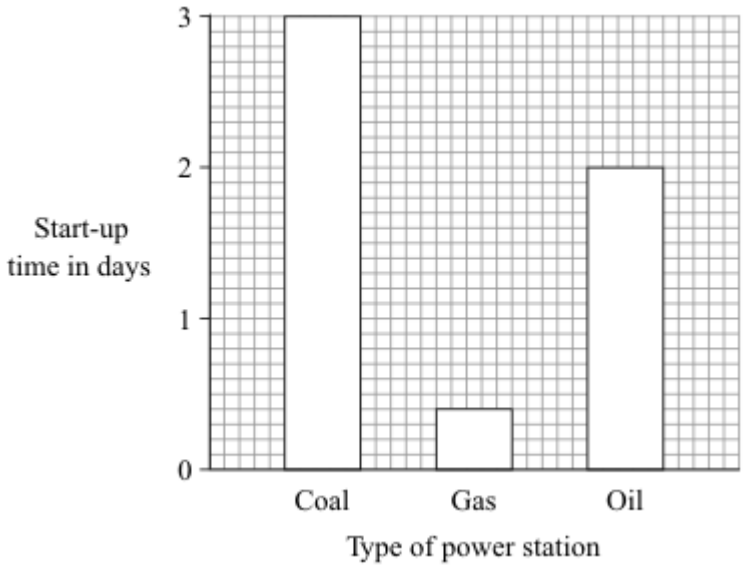
(1)

(Total 6 marks)

Q10.

Much of the world's electricity is generated in power stations that burn fossil fuels.

(a) The bar chart shows the start-up times for the three types of fossil fuel power station.



Which of these power stations would take the longest to start generating electricity?

_____

(1)

(b) Which **two** of the following statements are good reasons for using fossil fuels to generate electricity?

Put a tick (✓) in the box next to each of your choices.

Supplies of fossil fuels are limited.	☐
Fossil fuels can be used to generate electricity at any time.	☐
Fossil fuels are non-renewable.	☐
A few large power stations can generate the electricity for a million homes.	☐
Burning fossil fuels produces carbon dioxide.	☐

(2)

(c) Electricity can be generated using energy from the wind.

(i) Why does a wind-powered generator **not** produce carbon dioxide?

_____

_____

(1)

(ii) Which form of energy is transferred from the wind to generate electricity?

Draw a ring around your answer.

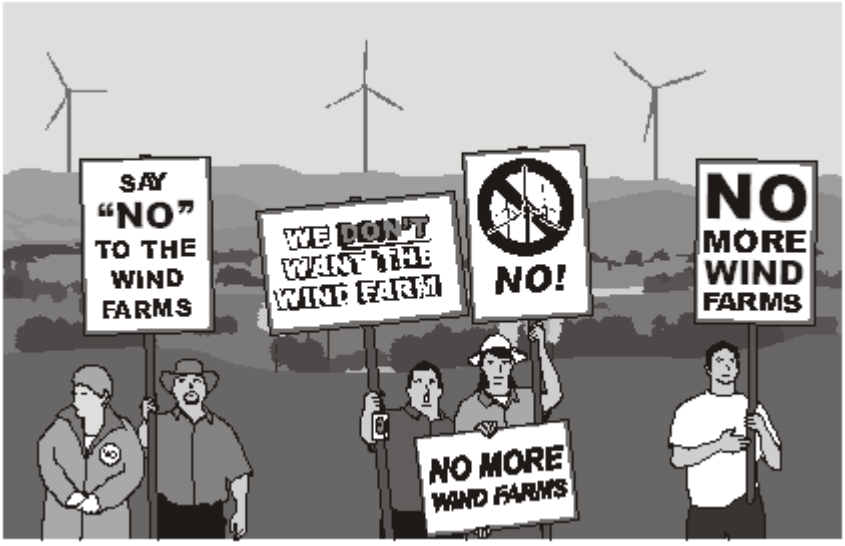
heat **kinetic** **light** **sound**

(1)

(iii) Many people say that wind-powered generators are a good idea because:

"**when the wind blows they generate electricity"**
"they produce no pollution"
"they generate electricity cheaply"

But not everyone wants more wind-powered generators to be built.



What reasons may be given by the people who think that wind-powered generators are **not** a good idea?

_____

_____

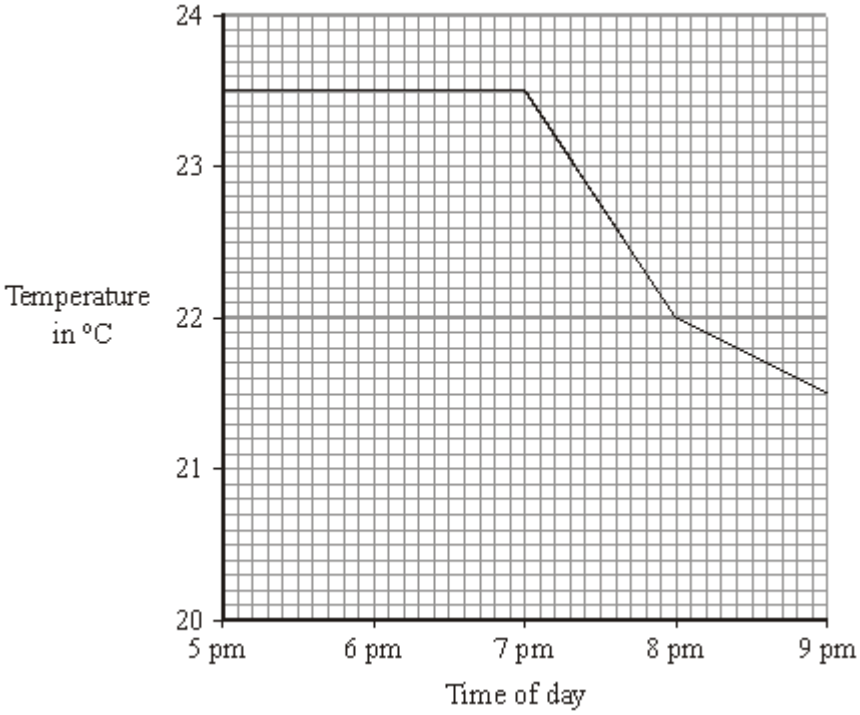
_____

_____

(2)
(Total 7 marks)

Q11.

(a) The graph shows the temperature inside a flat between 5 pm and 9 pm. The central heating was on at 5 pm.



(i) What time did the central heating switch off?

_____

(1)

(ii) Closing the curtains reduces heat loss from the flat.

What time do you think the curtains were closed?

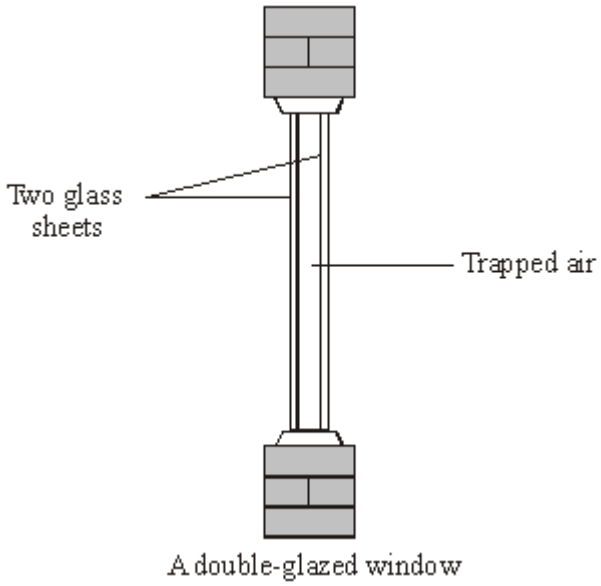
_____

Give a reason for your answer.

_____

(2)

(b) Less heat is lost through double-glazed windows than through single-glazed windows.



Complete the following sentences by choosing the correct words from the box. Each word may be used once or not at all.

conduction	**conductor**	**convection**	**evaporation**	**insulator**	**radiation**

Air is a good _____ . When trapped between two sheets of

glass it reduces heat loss by _____ and _____

(3)

(c) The table gives information about three types of house insulation.

Type of insulation	**Cost to install**	**Money save each year on heating bills**	**Payback time**
Double glazing	£4000	£200	20 years
Loft insulation	£300	£100	3 years
Cavity wallinsulation	£600	£150	

(i) Use the information in the table to calculate the payback time for cavity wall insulation.

_____

(1)

(ii) Explain why people often install loft insulation before installing double glazing or cavity wall insulation.

_____

_____

_____

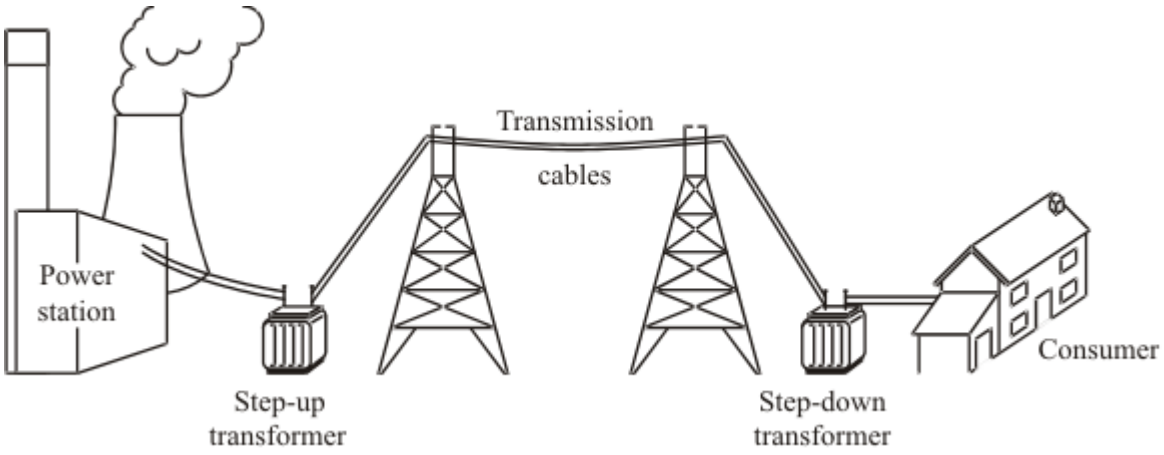
_____

(2)

(Total 9 marks)

Q12.

The diagram shows how electricity is distributed from power stations to consumers.



(a) (i) What name is given to the network of cables and transformers that links power stations to consumers?

_____

(1)

(ii) What does a step-up transformer do?

_____

(1)

(iii) Explain why step-up transformers are used in the electricity distribution system.

_____

_____

_____

_____

(2)

(b) Most of the world's electricity is generated in power stations that burn fossil fuels.

State **one** environmental problem that burning fossil fuels produces.

_____

_____

(1)

(c) Electricity can be generated using energy from the wind. A company wants to build a new wind farm. Not everyone thinks that this is a good idea.

(i) What arguments could the company give to persuade people that a wind farm is a good idea?

_____

_____

_____

_____

(2)

(ii) What reasons may be given by the people who think that wind farms are **not** a good idea?

_____

_____

_____

_____

(2)

(Total 9 marks)

Q13.

(a) The table gives information about some ways of reducing the energy consumption in a house.

Method ofreducing energy consumption	**Installation cost in £**	**Annual saving on energy bills in £**
Fit a newhot water boiler	1800	200
Fit a solarwater heater	2400	100
Fitunderfloor heating	600	50

Fitthermostatic radiator valves	75	20

Which way of reducing energy consumption is most cost effective over a 10-year period?

To obtain full marks you must support your answer with calculations.

_____

_____

_____

_____

_____

_____

(3)

(b) Explain why using an energy-efficient light bulb instead of an ordinary light bulb reduces the amount of carbon dioxide emitted into the atmosphere.

_____

_____

_____

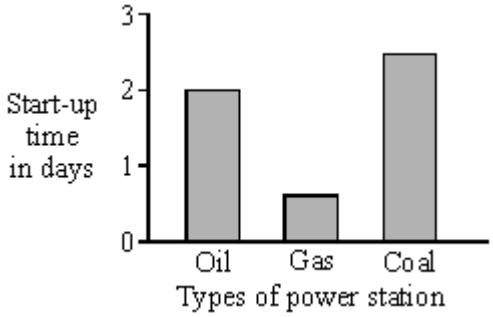
_____

(2)

(Total 5 marks)

Q14.

(a) The bar chart shows the start-up time for different types of fuel-burning power stations.



Which type of power station would be the quickest to start producing electricity?

_____

(1)

(b) A fuel-burning power station is more reliable than a wind generator at producing electricity. Explain why.

_____

_____

_____

_____

(2)

(c) Fuel-burning power stations may produce air pollution. Why does a wind generator not produce any air pollution?

_____

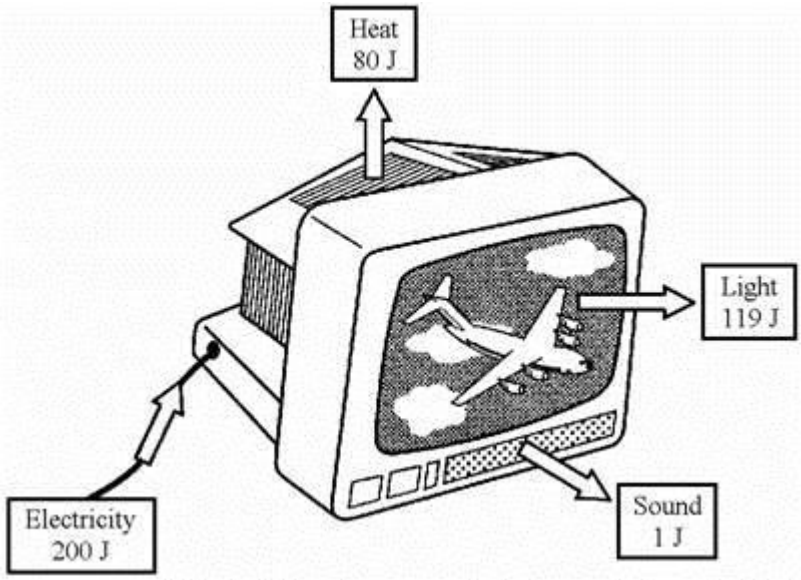
_____

(1)

(Total 4 marks)

Q15.

(a) The drawing shows the energy transferred each second by a television set.



(i) What form of energy is transferred as waste energy by the television set?

_____

(1)

(ii) What effect will the waste energy have on the air around the television set?

_____

(1)

(iii) Calculate the efficiency of the television set.

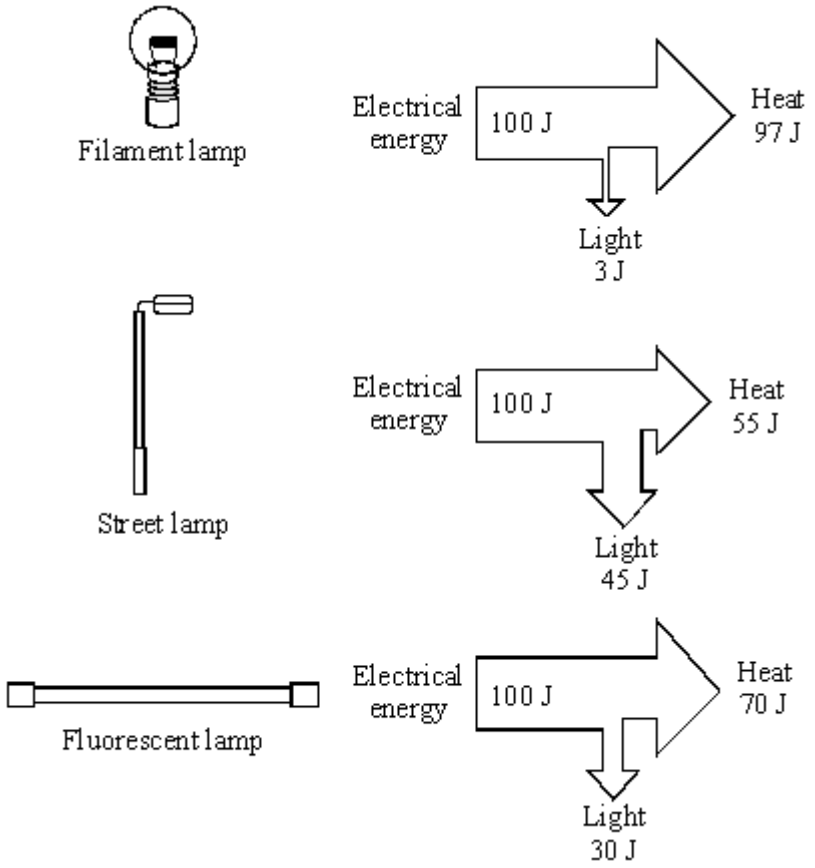
_____

_____

Efficiency = _____

(2)

(b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.



Which type of lamp is the most efficient?

_____

Give a reason for your choice.

_____

_____

(2)

(Total 6 marks)

Q16.

(a) In Britain most power stations burn fuel to produce heat. The diagram shows the stages by which the heat is transferred into electrical energy.
Complete the diagram by filling in the missing word.

Water heated to produce steam	→	Steam turns a turbine	→	Turbine turns a coil in a _____	→	Electricity is produced

(1)

(b) A fuel burning power station uses 2000 joules of fuel energy to generate 600 joules of electrical energy. The rest of the fuel energy is wasted as heat.

(i) For every 600 joules of electrical energy generated, how much fuel energy is

wasted as heat?

_____

_____

(1)

(ii) Calculate the efficiency of the power station.
Show clearly how you work out your answer.

_____

_____

efficiency = _____

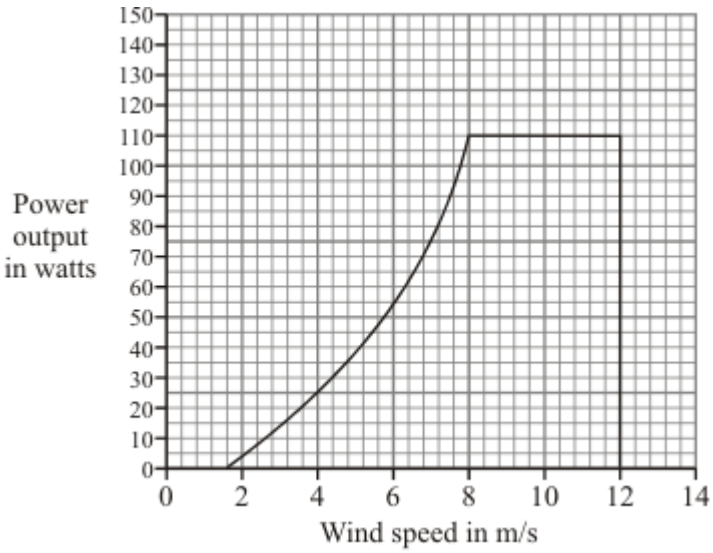
(2)

(c) List **A** gives three energy resources used to generate electricity. List **B** gives environmental problems that may be caused by using different energy resources. Draw a straight line from each energy resource in List **A** to the environmental problem it may cause in List **B**. Draw **three** lines only.

List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
	Produces a lot of noise
Tides	
	Produces the gas sulphur dioxide
Falling water (hydroelectricity)	
	Floods land used for farming or forestry

(3)

(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



(i) What is the maximum power produced by the generator?

_____ watts

(1)

(ii) The generator is designed to stop if the wind speed is too high.

At what wind speed does the generator stop working?

_____ m/s

(1)

(iii) Give **one** disadvantage of using a wind generator to charge a battery.

_____

_____

(1)

(Total 10 marks)

Q17.

(a) Explain how energy is produced in the Sun.

_____

_____

_____

_____

(3)

(b) Read the following article that appeared in a magazine.

"Conservation of energy is important in today's society. Energy sources, such as oil and coal, which have been used for the development of an industrial society, cannot be relied upon as heavily in the future. Renewable energy sources cannot provide such large quantities of energy for society without causing problems."

(i) Give **two** reasons why oil should not be relied on as a major source of energy for the future.

1. _____

_____

2. _____

_____

(2)

(ii) Energy from the wind is a renewable energy resource. State **three** problems which may arise if the wind were to be used to meet the energy requirements of a large industrial city in Britain.

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

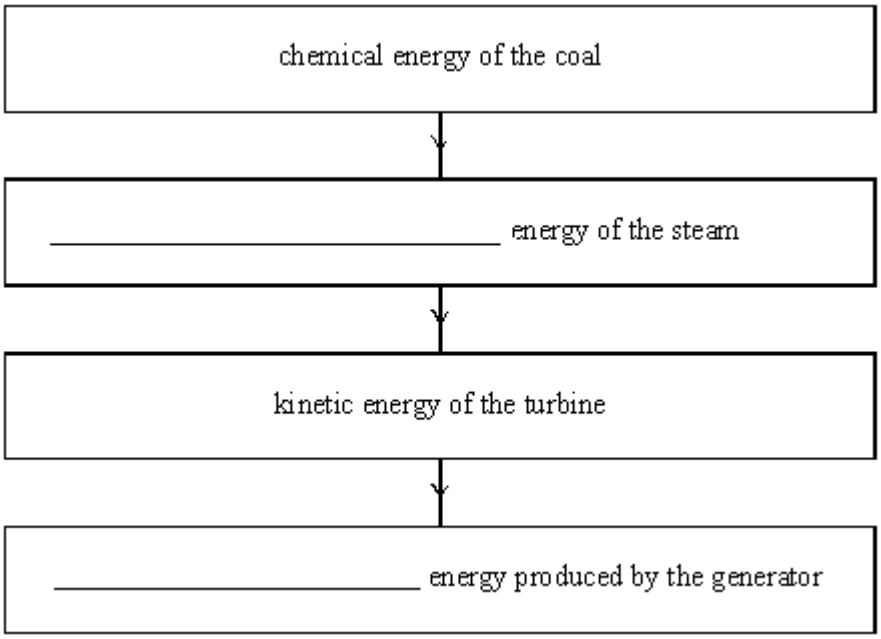
(3)

(Total 8 marks)

Q18.

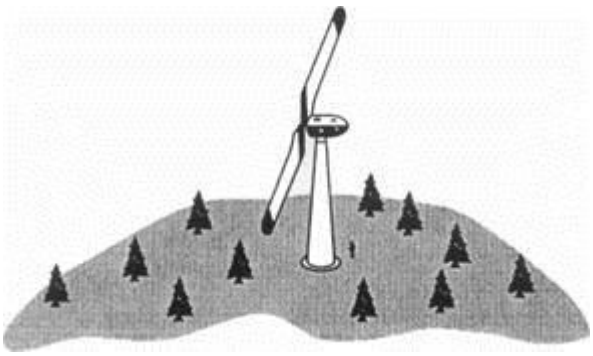
(a) Most electricity in Britain is generated by coal fired power stations.

Complete the sequence of useful energy transfers which take place in the power station.



(1)

(b) The diagram shows a wind turbine which is used to produce electricity using energy from the wind.



(i) What is the source of energy which creates winds?

_____

(1)

(ii) Explain the advantage of using a wind turbine to produce electricity.

_____

_____

_____

(2)

(Total 4 marks)

Q19.

(a) A swimming pool has a wave making machine. The diagram shows the water wave pattern for 3 seconds.

(i) How many water waves are shown in the diagram?

_____

(1)

(ii) What is the frequency of the water waves?

_____

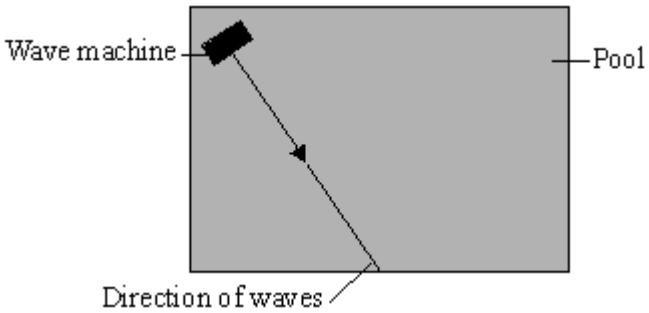
(1)

(iii) Which **one** of the units below is used to measure frequency? Underline your answer.

hertz joule watt

(1)

(b) The diagram shows the direction of the waves across the pool. The waves reflect off the side of the pool.

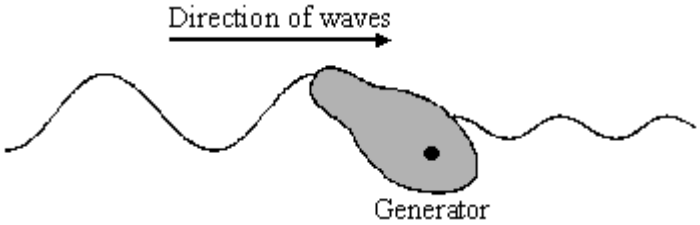


Draw a line on the diagram to show the direction of the waves after they hit the side of the pool.

(1)

(c) The swimming pool is used to test a model of an electricity generator. The waves make the floating generator move up and down. This energy is transferred to

electricity.



(i) In the following sentence, cross out the **two** lines that are wrong in the box.

The diagram shoes that the amplitude of the waves

gets larger
stays the same
gets smaller

as the waves pass the generator.

(1)

(ii) What type of energy does the generator transfer to electricity?

_____

(1)

(iii) Energy from ocean waves could be used to generate electricity. Would this be a renewable or non-renewable energy resource?

_____

(1)

(Total 7 marks)

Q20.

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

_____

_____

_____

(2)

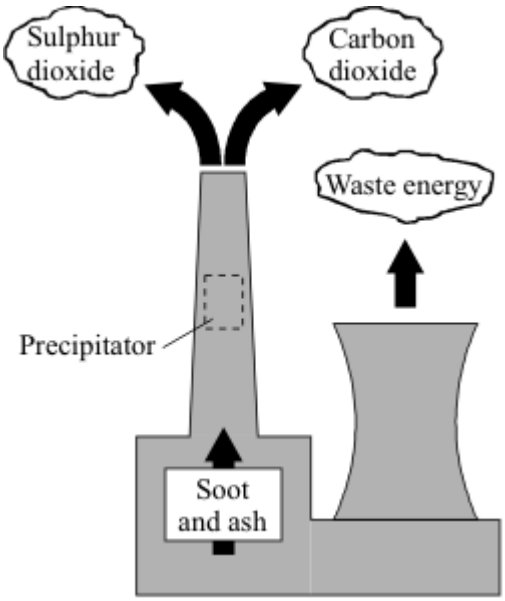
(ii) How is energy released from coal?

_____

_____

(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?

_____

_____

(1)

(Total 5 marks)

Q21.

(a) Electricity can be generated using different energy resources.

(i) Draw lines to link each way of producing electricity to a statement about an energy resource.

Method of producing electricity	Energy resource statements
Tidal barrage	Produces only a small amount of electricity
Solar panel	Is built across a river estuary
Wind turbine	Produces a lot of unwanted noise
Nuclear power station	Rough seas are needed
Wave machine	The waste is very dangerous

(4)

(ii) Which **one** of these methods of producing electricity uses a non-renewable energy resource?

_____

(1)

(b) The wind is a renewable energy resource.

(i) **One** of the following statements describes the source of energy that creates a wind. Tick the box next to the correct statement.

The Earth turning on its axis. ☐

The gravity pull of the Moon. ☐

Heat from the Sun. ☐

(1)

(ii) Complete the sentence by choosing the correct word from the box.

heat	kinetic	sound

A wind turbine transfers _____ energy to electrical energy.

(1)

(iii) A wind turbine does not produce electricity all of the time. Why not?

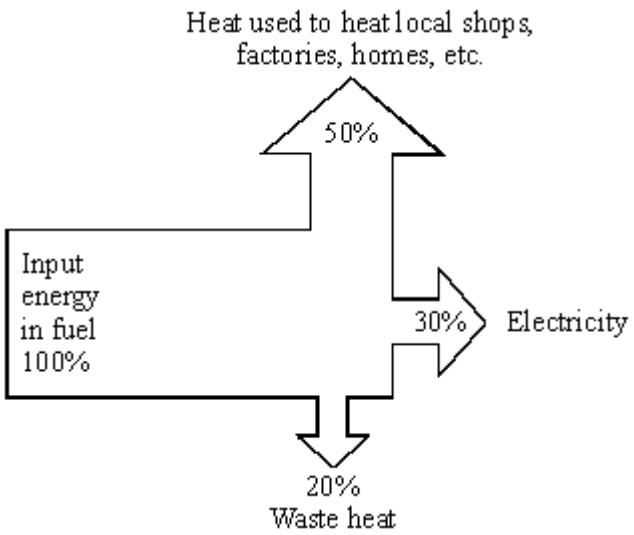
_____

(1)

(Total 8 marks)

Q22.

In a traditional power station 30% of the energy input is usefully transferred to electricity, the rest is wasted as heat. The diagram shows the energy transfers in a combined heat and power (CHP) station.



Explain why replacing traditional power stations by CHP stations may be beneficial to the environment.

_____

_____

_____

_____

(Total 2 marks)

Q23.

(a) Coal, gas, oil and wood are all examples of fuels.

(i) What are fuels?

_____

(1)

(ii) Write the names of these fuels in the table below to show which are renewable and which are non-renewable.

RENEWABLE FUELS	NON-RENEWABLE FUELS

(2)

(b) The list below shows energy resources which are not fuels.

geothermal **nuclear** **solar** **tides** **wind**

Write the names of the energy resources in the table below to show which are renewable and which are non-renewable.

RENEWABLE FUELS	NON-RENEWABLE FUELS

(2)

(c) Why is it better to use more renewable energy resources rather than non-renewable resources?

_____

_____

_____

_____

(2)

(Total 7 marks)

Q24.

Complete the following sentences.

A TV set is designed to transfer electrical energy into _____

energy and _____ energy.

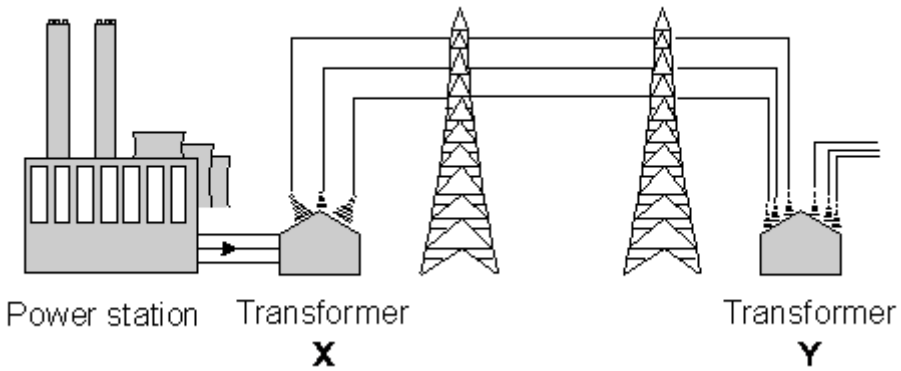
A hair dryer is designed to transfer electrical energy into _____

energy and _____ energy.

(Total 4 marks)

Q25.

The outline diagram below shows part of the National Grid. At **X** the transformer increases the voltage to a very high value. At **Y** the voltage is reduced to 240 V for use by consumers.



(i) At **X** a transformer increases the voltage. What happens to the current as the voltage is increased?

_____

(1)

(ii) Why is electrical energy transmitted at very high voltages?

_____

_____

(1)

(iii) The transformer at **Y** reduces the voltage before it is supplied to houses. Why is this done?

_____

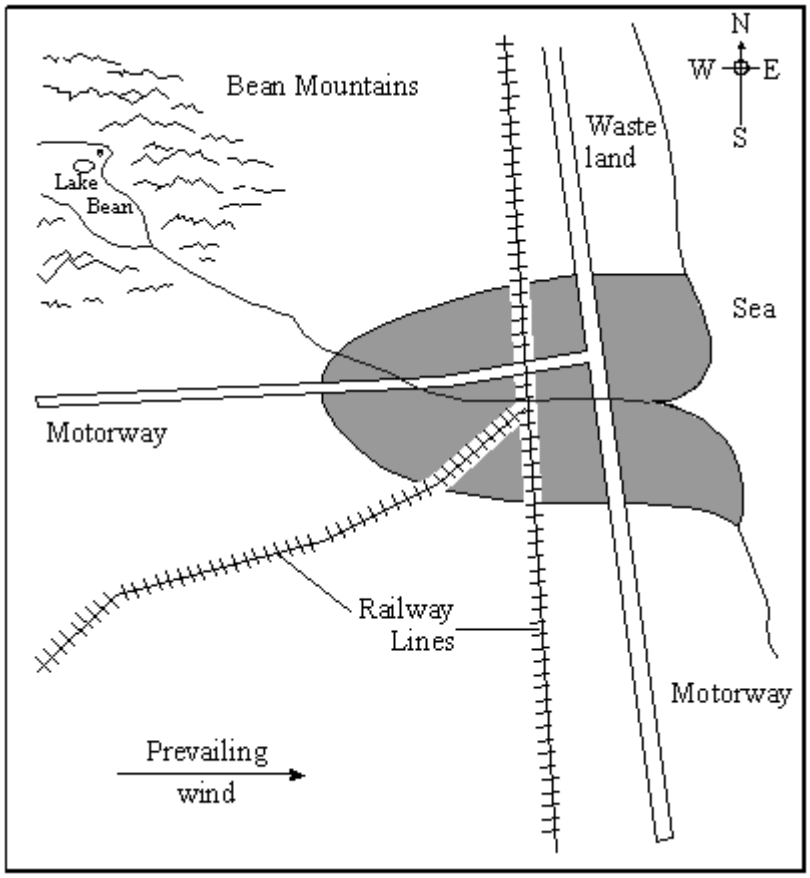
_____

(1)

(Total 3 marks)

Q26.

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.

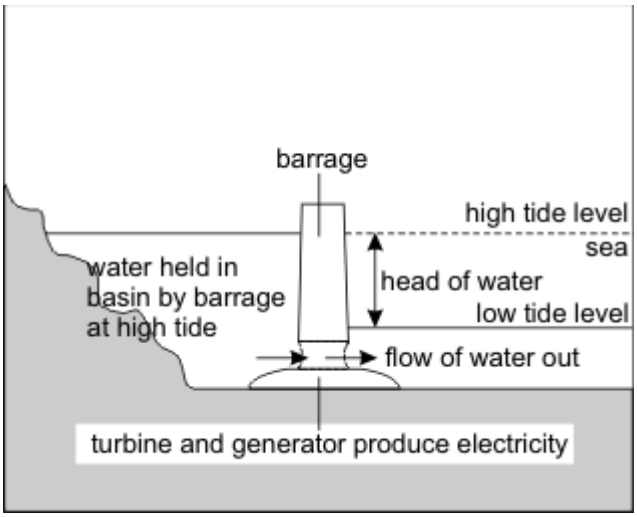
The choice is between a coal fired power station, wind turbines and a hydroelectric scheme.

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)

Q27.

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.

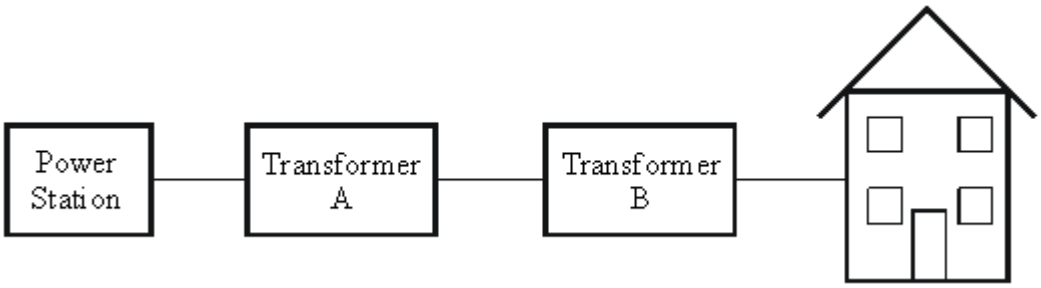
(6)
(Total 8 marks)

Q28.

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)

Q29.

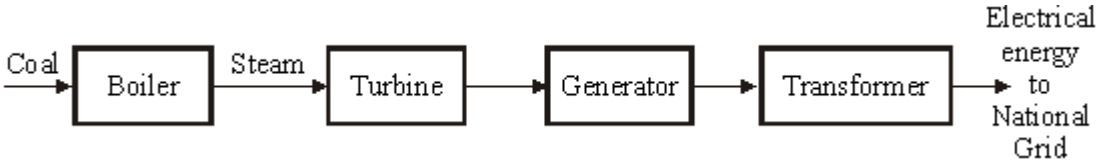


Transformer A produces a very high voltage to transmit the electrical energy through the National Grid.
Explain why electrical energy is transmitted at a very high voltage.

(Total 3 marks)

Q30.

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)

Q31.

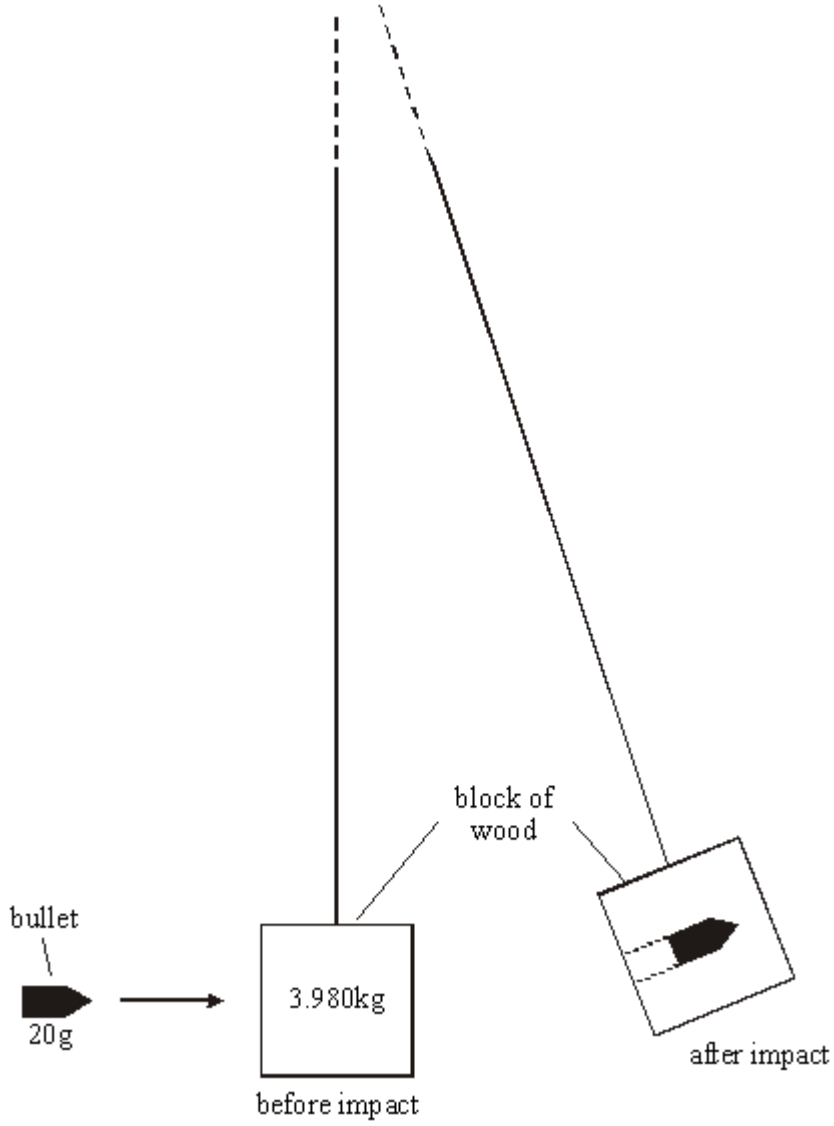
(a) When an object is moving it is said to have momentum.
Define momentum.

_____

_____

(1)

(b) The diagram below shows one way of measuring the velocity of a bullet.



A bullet is fired into a block of wood suspended by a long thread.
The bullet stops in the wooden block.
The impact of the bullet makes the block swing.
The velocity of the wooden block can be calculated from the distance it swings.

In one such experiment the block of wood and bullet had a velocity of 2 m/s **immediately after** impact. The mass of the bullet was 20 g and the mass of the wooden block 3.980 kg.

(i) Calculate the combined mass of the block of wood and bullet.

_____ Mass _____

(1)

(ii) Calculate the momentum of the block of wood and bullet **immediately after** impact.

_____

_____

_____

_____

_____ Momentum _____

(3)

(iii) State the momentum of the bullet **immediately before** impact.

_____

(1)

(iv) Calculate the velocity of the bullet **before** impact.

_____

_____

_____

_____ Velocity _____ m/s

(3)

(v) Calculate the kinetic energy of the block of wood and bullet **immediately after** impact.

_____

_____

_____

_____ Kinetic energy _____ J

(3)

(vi) The kinetic energy of the bullet before the impact was 1600 joules. This is much greater than the kinetic energy of the bullet and block just after the impact.
What has happened to the rest of the energy?

_____

_____

_____

_____

(1)

(Total 13 marks)

Q32.

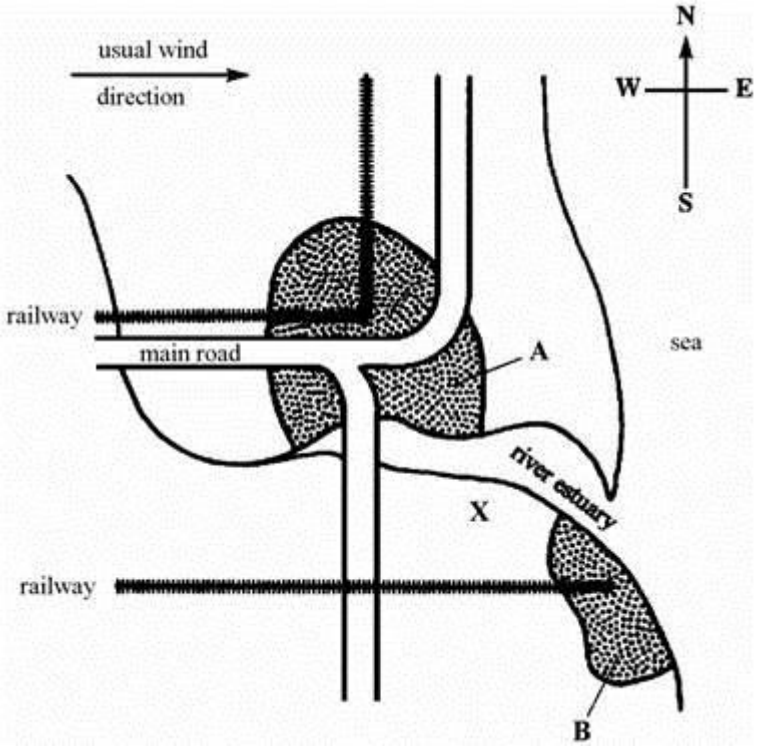
The map below shows the position of two towns, **A** and **B**, on the banks of a large river estuary.

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.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

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

_____

Explain the reason for your choice.

_____

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q33.

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

_____

_____

_____

_____

_____

_____

_____

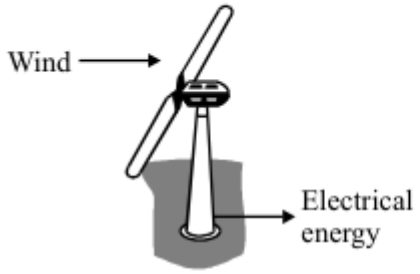
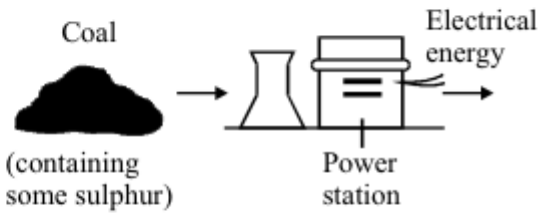
_____

(Total 4 marks)

Q34.

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

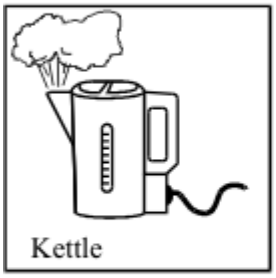
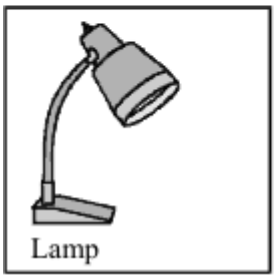
source to generate electricity in the UK.

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
 Kettle	heat
 Radio	light
 Lamp	sound

(2)
(Total 6 marks)

Q35.

Use of renewable sources of energy is expected to increase. The table shows the comparative costs of producing I 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 _____ _____ _____

(Total 6 marks)

Mark schemes

Q1.

(a) £15

*allow **1** mark for use of 125 (kWh)*

*allow **1** mark for an answer 1500*

*allow **both** marks for 1500 pence / p*

*allow **1** mark for correct calculation of annual cost for either freezer (£27 and £42)*

2

(b) £45

or their (a) × 3

*allow **1** mark for correct use of 3*

*allow **1** mark for 12 – 9 = 3*

2

(c) <u>any</u> **two** from:

the marks are for the explanation

yes **plus** explanation

- less electricity / energy needed / used

  accept less energy wasted

- less (fossil) fuels burned

  accept a named fossil fuel
  *do **not** accept conserving (fossil) fuels*

- less polluting gases emitted

  accept a named polluting gas / greenhouse gases / carbon emissions / reduce global warming
  accept an answer in terms of nuclear fuel
  eg less nuclear fuel required (1)
  less nuclear waste (1)

2

or <u>no</u> **plus** explanation

- old freezer must be disposed of

- hazardous chemicals inside freezer

  accept CFC gases

- *(*lot of*)* energy used in producing new freezer

[6]

Q2.

(a) (i) makes it warmer / raises the temperature

accept produces convection (current)

accept makes it less dense

1

(ii) reduced **or** slows down

1

(b) (i) electrical energy (to run the pump) must be paid for

accept electricity for electrical energy

accept electricity is needed for the pump

accept it uses electricity

accept because of the pump

1

(ii) more useful (heat) energy is transferred into the house than the energy used to operate the pump

or reduced cost of heating the house is greater than the cost of running the (electrical) pump

or costs little to run compared to the savings made

*accept for **1** mark*

reduces energy bills

***or** reduced fuel costs / heating costs owtte*

*do **not** accept it's cheap*

2

[5]

Q3.

(a) iron

1

hairdryer

1

kettle

answers can be in any order

1

(b) sound

1

(c) is more efficient than

1

[5]

Q4.

(a) gas

1

oil

1

(b) (both) use steam to drive a turbine

accept (both) use turbines to drive generators

*do **not** accept both have a turbine /generator / use steam must describe a step in the process*

accept heat / thermal energy transformed to kinetic / electrical energy

1

(c) 140 (°C)

correct answer only

*allow **1** mark for method clearly shown on graph*

accept a cross or other indication at correct position on the line

accept correct description

accept even if numerical answer is incorrect

2

(d) any **one** from:

*do **not** accept answers purely in terms of disadvantages of other methods except for fossil fuels are running out*

- very large energy source / reserves
- no polluting / harmful <u>gases</u> produced

  accept named gas CO_2 SO_2 NO_x
  accept reduces harmful carbon emissions
- reduces carbon emissions

  accept does not contribute to global warming
- no fuel needed
- energy is free
- can generate energy for a long time

  accept energy available for a long time
- renewable (energy source)
- fossil fuels are running out

  accept it saves fossil fuels / non-renewable
  accept reduces the amount of fossil fuels being burnt
  accept a named fossil fuel

  Better for the environment / environmentally friendly insufficient

  it is cheaper is insufficient

1

[6]

Q5.

(a) (i) replaced <u>faster than it is used</u>

accept replaced as quick as it is used

accept 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(*)
  *(*)do **not** accept water / oceans*
  accept OTEC

- fall of water
  accept hydroelectric

- biomass

- geothermal
  accept a named biomass / biofuel eg wood

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) 864
*an answer of 108 gains **2** marks*
*allow **1** mark for using 720 value <u>only</u> from table*
*allow **2** marks for answers 852, 816, 768, 825*
*allow **1** mark for answers 106.5, 102, 96, 103 (.125)*

3

(c) the solar cells will not meet demand at all times of the year / day
accept to maintain a constant supply of electricity / energy

or to make up the shortfall in energy required at certain times of the year

or to be able to sell surplus electricity (to the National Grid)
accept to provide energy at night
*do **not** accept because it's cloudy on it's own*

1

[8]

Q6.

(a) (i) £190
nb mention idea of cost per J in £ will come to an approx figure full credit given
*allow **1** mark for showing that the energy loss through the roof is ¼ of the total energy loss ie 150 / 600*

2

(ii) £142.50
allow ecf 50 % of their (a)(i) × 1.5 ie their (a)(i) × 0.75

1

(b) transferred to surroundings / atmosphere

or becomes spread out

1

[4]

Q7.

(a) kinetic

accept movement

1

(b) (i) 3 (kWh)

allow 1 mark for selecting the correct information

1

(ii) transfers more energy

accept transform or use for transfer

accept electricity for energy

*allow higher (average) power **and** switched on for more time*

2

(iii) any **one** from:

- use the internet
- brochures
- reading adverts
- visiting shops
- recommendation from friends / plumbers

1

[5]

Q8.

(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 <u>gases</u>

  *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]

Q9.

(a) (i) grid
accept any way of indicating correct answer

1

(ii) increases voltage
accept any way of indicating correct answer

1

(iii) 230 V
accept any way of indicating correct answer

1

(iv) reduce
accept any way of indicating correct answer

1

(b) (i) increases the temperature
accept make it hotter / heat goes into the air
accept convection currents
accept sensible comment eg sound energy / it buzzes
ignore pollutes the air

1

(ii) less than 100%

1

[6]

Q10.

(a) coal

1

(b) fossil fuels can be used to generate electricity at any time

if more than 2 boxes ticked, mark incorrect boxes first

1

a few large power stations can generate the electricity for a million homes

1

(c) (i) no fuel is burnt

accept a named fuel
accept nothing is burnt
accept does not use (fossil) fuel

1

(ii) kinetic

1

(iii) any **two** from:

- cause noise pollution
- cause visual pollution

accept causes pollution for 1 mark

- need concrete for bases
- new roads / infrastructure needed
- may interfere with TV / radio / mobile phone signals
- dangerous to birds
- do not generate all of the time
  accept generates only when the wind blows
  *do **not** accept 'generate when the wind blows'*
- need a lot of generators
  *do **not** accept 'take up a lot of space / land'*
- high initial / capital costs
- reduces house prices

2

[7]

Q11.

(a) (i) 7pm

accept 19.00 / 1900

1

(ii) 8pm

accept 20.00 / 2000

1

temperature drops more slowly

accept heat for temperature accept line is less steep

1

(b) insulator

1

conduction *

1

convection *

** answers can be either way around*

1

(c) (i) 4 (years)

1

(ii) it is the cheapest / cheaper / cheap

*do **not** accept answers in terms of heat rising or DIY*

1

has the shortest / shorter payback time

*do **not** accept short payback time*

1

[9]

Q12.

(a) (i) national grid

1

(ii) increases voltage / potential difference

accept decrease current

accept step-up / boosts the voltage

*do **not** accept increases energy / power / current*

ignore reference to voltage going through

1

(iii) any **two** from:

- reduce current

  ignore increased voltage / pd

- reduces energy loss / power loss (from cables)

  accept reduces heat loss

  *do **not** accept stops energy loss*

- increases efficiency (of distribution)

2

(b) any **one** from:

- produces pollutant gases

accept produces carbon dioxide / sulfur dioxide / nitrogen oxides
accept global warming / greenhouse effect / carbon emissions / air pollution / acid rain
ignore ozone layer
*do **not** accept carbon monoxide*

- produces solid waste / ash / smoke
  accept global dimming
  ignore produces pollution

1

(c) (i) any **two** from:
any two valid points gains the marks

- using renewable energy
  accept don't use up non-renewable / fossil fuels
  accept named fuels
- non-renewable fuels can be used for other processes
- no pollutant gases produced
  accept the opposite of (b)
  ignore no pollution
- land can still be used for farming
  ignore economic issues

2

(ii) any **two** from:

- cause <u>noise</u> pollution
- cause <u>visual</u> pollution
  accept spoils the landscape
  accept sunlight flicker
- may interfere with TV / radio / mobile phone signals
- need to put in new infrastructure
  accept new roads needed
- not reliable owtte
- dangerous to birds
- lots of concrete needed for the bases
  or
  producing cement is environmentally damaging
  accept reduces house prices
  ignore any references to cost / jobs / number required
  ignore takes up a lot of land
  accept reference to obstruction of shipping etc. if clear reference tooffshore wind farm

2

[9]

Q13.

(a) four calculations correctly shown

200 × 10 – 1800 = £200
100 × 10 – 2400 = –£1400
50 × 10 – 600 = –£100
20 × 10 – 75 = 125

*accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly shown **or** showing each saving × 10 of all four calculations = 1 mark answers in terms of savings as a percentage of installation cost **may** score savings mark only*

2

hot water boiler

correct answers only

1

(b) less electricity / energy to be generated / needed from power stations

accept less demand

1

reduction in (fossil) fuels being burnt

accept correctly named fuel

accept answer in terms of:
fewer light bulbs required because they last longer (1 mark)
less energy used / fuels burnt in production / transport etc. (1 mark)

ignore reference to CO_2 or global warming

ignore reference to conservation of energy

1

[5]

Q14.

(a) gas

1

(b) fuel burning stations produce electricity at any time / all the time

accept fuel available all the time

1

wind generator can only produce when the wind is strong enough

accept it's not always windy

1

(c) no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke

*do **not** accept wind is natural / environmentally friendly / renewable*
*answer must be in terms of wind, **not** negative of fuel burning*

specific examples of gases CO_2, SO_2,
acid rain and greenhouse gases can be accepted
ozone negates credit

1

[4]

Q15.

(a) (i) heat

1

(ii) temperature increases **or** (cause) convection (currents)

accept gets warmer
accept gets hotter

1

(iii) 60% **or** 0.6

60 without % scores 1 mark
0.6 with a unit scores 1 mark
60 with incorrect unit scores 1 mark

or correct substitution $\frac{120}{200}$ *for 1 mark*

2

(b) street

1

more (energy transferred as) light or less (energy transferred as) heat or useful energy output the highest

can only score this mark if first mark scored

all efficiencies calculated correctly score 2nd mark point

1

[6]

Q16.

(a) generator

accept dynamo
accept alternator

1

(b) (i) 1400

ignore units

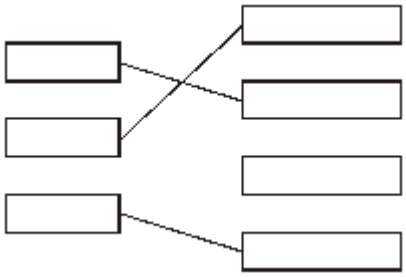
1

(ii) 0.3 or 30%

*any incorrect unit penalise **1** mark*
*allow **1** mark for the correct use of 600*
***or** 0.3% **or** 30*

2

(c) **1** mark for each correct link



if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect

3

(d) (i) 110

no tolerance

1

(ii) 12

no tolerance

1

(iii) wind speed may be too low to operate the generator

accept wind may not always blow
accept power depends on wind speed
accept does not generate if wind speed is too high
accept does not generate if wind speed is above 12 (m/s)
accept does not generate if wind speed is below 1.6 (m/s)
accept it is unreliable
*do **not** accept answers referring to cost only*

1

[10]

Q17.

(a) hydrogen converted to helium

1

(nuclear) fusion

1

((small) loss in mass) which is converted to large amount of energy

1

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

it is running out/ takes millions of years/finite

***not** non renewable*
*allow acid rain **do not** allow waste*

pollution **or** problem with CO_2 production

allow a specific example

more responsible to use fossil fuels for (important) chemical functions

2

(ii) any **three** from

need lots of land for generators **or** many generators needed

generators may not be conveniently located

uncertainty of supply

accept the wind may not always blow

social resistance **or** visual pollution

noise pollution

high initial costs

(possible) interference with (local) radio and TV signals

3

[8]

Q18.

(a) internal **or** thermal **or** heat **or** kinetic **or** movement

electrical

*both answers required for **one** mark*

1

(b) (i) Sun **or** solar

*do **not** accept sunshine*

1

(ii) any **one** of the follow:

- wind turbines produce no (gaseous) pollutants
- wind turbines use renewable energy
- wind turbines produce no (solid) waste
- reduced running costs

*do **not** allow safety*

1

a supporting statement **or** comparison **or** explanation

1

[4]

Q19.

(a) (i) 3

1

(ii) 1

accept a definition of frequency ignore units

1

(iii) hertz

1

(b) straight line in correct direction

judge by eye (from 'a' of waves to 's' of across) ignore arrow

accept equal angles shown on waves

1

(c) (i) gets smaller

1

(ii) kinetic

accept movement

1

(iii) renewable

1

[7]

Q20.

(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

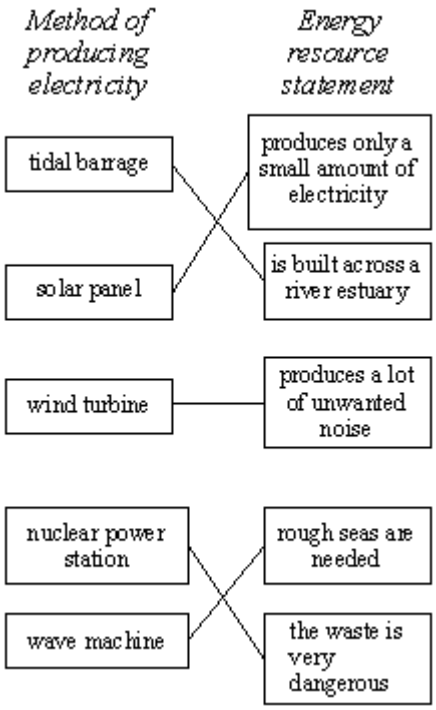
*accept traps heat **or** energy*

1

[5]

Q21.

(a) (i) correct links shown



4

*1 link for **1** mark*

*2 links for **2** marks*

*3 links for **3** marks*
4 *links for **3** marks*
5 *links for **4** marks*
*do **not** credit if more than one link*
*goes to **or** from any box*

(ii) nuclear (power station)
*do **not** accept power station*

1

(b) (i) heat from the Sun

1

(ii) kinetic

1

(iii) insufficient wind (to turn turbine)
accept wind does not always blow
*do **not** allow it does not always work or it is switched off*
*do **not** accept wind in wrong direction*

1

[8]

Q22.

any **one** from:
*basic idea of reduced use of fuels to heat homes **or** offices **or** shops for **1st** mark*

less (heat) energy wasted (to the environment)

reduced demand for fuels to heat homes etc
simply re-quoting figures gets no credit

1

any **one** from:
*idea of less pollution for the **2nd** mark*

<u>reduced</u> (air) pollution
*do **not** accept no pollution*

fewer power stations required **or** less electricity needs to be produced

less (fossil) fuels being burnt (in power stations)

reduced greenhouse effect

reduced global warming

1

[2]

Q23.

(a) (i) sources of energy
for 1 mark

(ii) wood coal
oil

gas

all correct gains 2 marks
3 correct gains 1 mark

3

(b) geothermal nuclear
tides
wind
solar

all correct gains 2 marks
4 correct gains 1 mark

2

(c) non-renewable fuels cause pollution (or reverse)
conserve/limit use of coal/gas/oil;
so supplies last longer/renewable sources can be replaced

any 2 from 4 for 1 mark each

2

[7]

Q24.

light;
sound;
heat;
kinetic/movement

for 1 mark each

[4]

Q25.

(i) reduces

for 1 mark

1

(ii) less heat/energy/power wasted (in power lines)

for 1 mark

1

(iii) for safety

for 1 mark

1

[3]

Q26.

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 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]

Q27.

(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]

Q28.

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]

Q29.

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]

Q30.

(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
CO_2* (*sequential (i))

for 1 mark each

2

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

Q31.

(a) product of mass and velocity

1

(b) (i) 4kg or 4000g

1

(ii) M = 8kgm/s or Ns

for 3 marks

else M = 8

for 2 marks

else M – mv or 4 × 2

for 1 mark

3

(iii) 8 kgm/s (watch e.c.f.)

1

(iv) v = 400

for 3 marks

else v = 8/0.02

for 2 marks

else M – mv, v – M/m or 8 = 0.02v

for 1 mark

3

(v) ke = 8

for 3 marks

else ke = 1/2 (4×2^2)

for 2 marks

else ke = 1/2 (mv^2)

for 1 mark

3

(vi) transferred to heat and sound
or does work against wood/pushing wood aside/deforming bullet

1

[13]

Q32.

(a) m*ust 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]

Q33.

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 SO_2 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]

Q34.

(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]

Q35.

*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]