Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

General Certificate of Secondary Education
June 2008

SCIENCE A **PHY1AP**
Unit Physics P1a (Energy and Electricity)

PHYSICS
Unit Physics P1a (Energy and Electricity)

Monday 23 June 2008 Morning Session

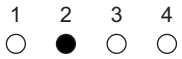
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

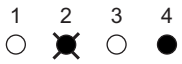
Time allowed: 30 minutes

Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Physics Unit 1a' printed on it.
- Attempt **one Tier only, either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

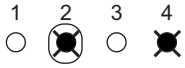
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- Do **not** extend beyond the circles.
- If you want to change your answer, **you must** cross out your original answer, as shown:



- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:



Information
- The maximum mark for this paper is 36.

Advice
- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **SIX**.

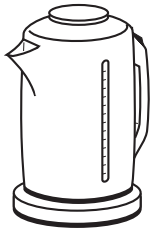
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

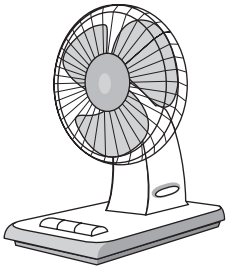
Mark your choices on the answer sheet.

QUESTION ONE

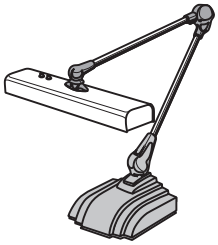
These devices transform electrical energy into other useful forms of energy.



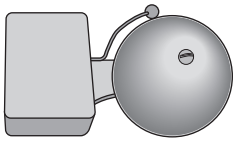
1
Kettle



2
Fan



3
Reading lamp



4
Bell

Match the useful forms of energy, **A**, **B**, **C** and **D**, with the devices numbered **1–4**.

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

QUESTION TWO

The flow chart shows how one type of power station produces electricity for the National Grid.

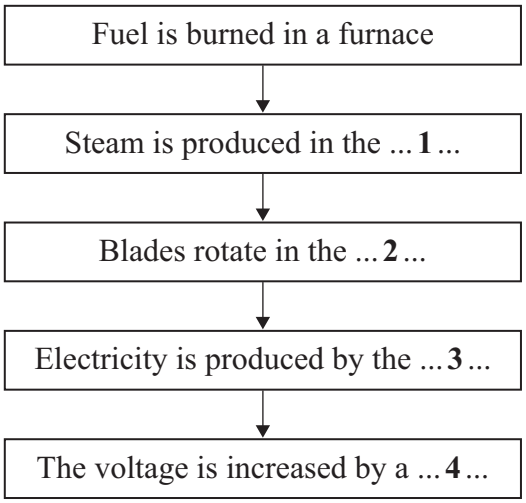
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** on the flow chart.

A boiler

B generator

C transformer

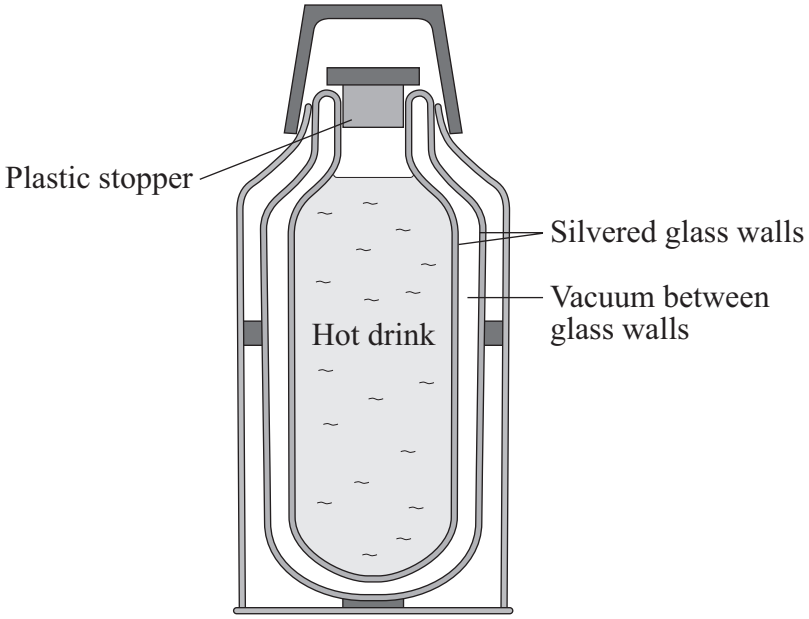
D turbine



Turn over for the next question

QUESTION THREE

The diagram shows a vacuum flask.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A conduction

B convection

C insulation

D radiation

The stopper prevents hot air from rising out of the flask.

This reduces heat loss by . . . **1** . . . .

Plastic is used for the stopper because it has good . . . **2** . . . properties.

This means that the plastic reduces heat loss by . . . **3** . . . .

The silvered glass walls reduce heat loss by . . . **4** . . . .

QUESTION FOUR

This question is about generating electricity.

Match the energy sources, **A**, **B**, **C** and **D**, with the descriptions **1–4** in the table.

A coal

B wind

C sunlight

D nuclear fuel

1	a renewable energy source used to drive turbines on land or offshore
2	a fuel that is burnt in power stations
3	a source used in power stations that have high decommissioning costs
4	an energy source used in solar power stations

Turn over for the next question

QUESTION FIVE

Different energy sources are used to generate electricity. Each energy source has its own problems.

Match the ways of producing electricity, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A power stations using fossil fuels

B power stations using nuclear fuels

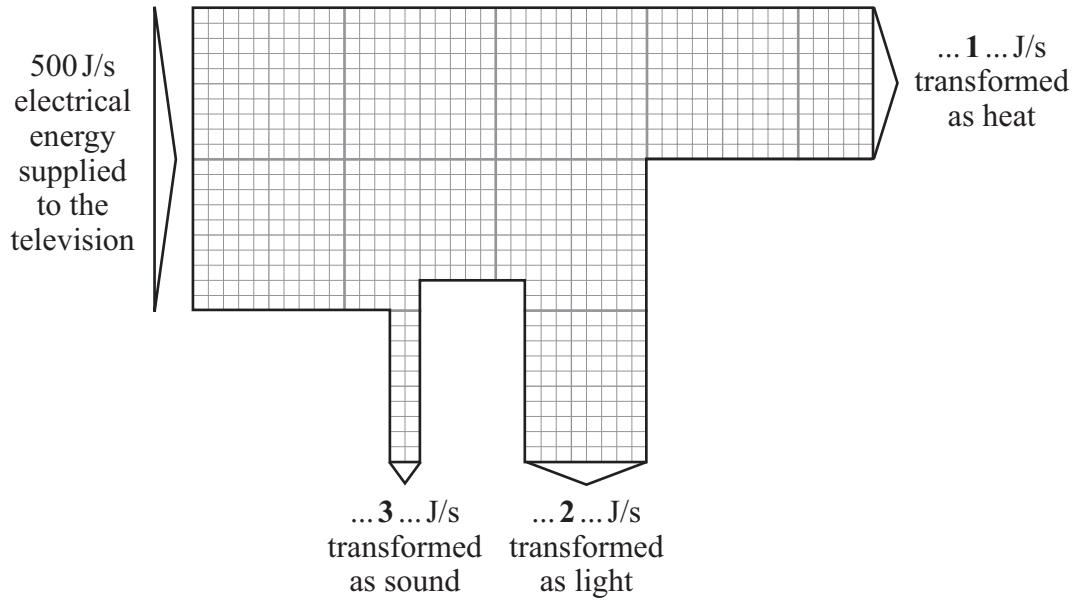
C solar cells

D wind turbines

1	give off polluting gases
2	useful for applications in remote regions or for small-scale uses
3	waste remains radioactive for a very long time
4	can be unsightly and cause noise pollution

QUESTION SIX

The Sankey diagram shows the energy flow for a television.



The efficiency of the television is ... **4** ...

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

Match figures, **A**, **B**, **C** and **D**, with the numbers **1–4** on the diagram.

A 0.50

B 50

C 200

D 250

Turn over for the next question

SECTION TWO

Questions **SEVEN** to **NINE**.

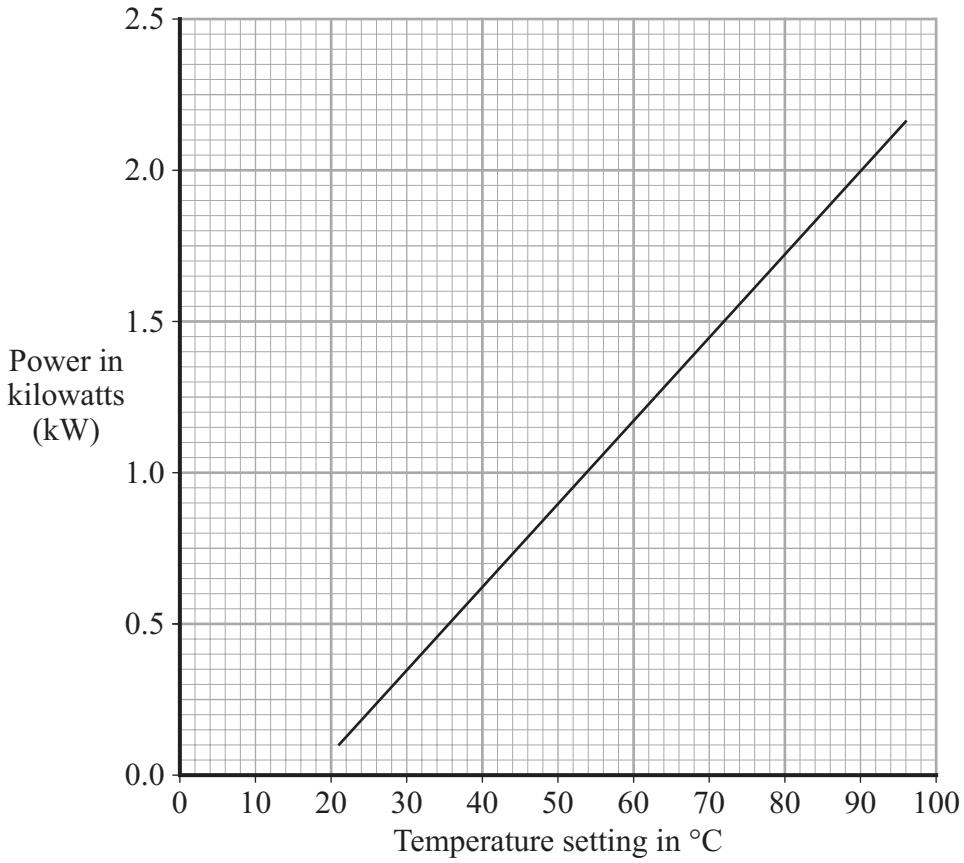
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION SEVEN

The graph shows how the power of a washing machine changes when it is set to different temperatures.



7A What relationship does the graph show?

1 As the temperature setting increases, the power increases.

2 As the temperature setting increases, the power decreases.

3 As the temperature setting decreases, the power increases.

4 There is no relationship.

7B Which of the following, according to the graph, is the power for a temperature setting of 90 °C?

1 1.90 kW

2 1.95 kW

3 2.00 kW

4 2.10 kW

7C Which of the following, according to the graph, is the temperature needed for 1.5 kW of power?

1 70 °C

2 71 °C

3 72 °C

4 75 °C

7D A washing machine programme uses a power of 1.5 kW and takes 2 hours to complete the wash.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

How many kilowatt-hours of energy will it use?

1 0.50

2 0.75

3 3.00

4 3.50

Turn over for the next question

QUESTION EIGHT

Some students investigated how effective three different devices were at drying things. They added water to a paper towel until the mass of the paper towel was 45.6 g. They then hung the paper towel in front of one of the devices. After five minutes, they measured the mass of the paper towel again.

The test was carried out three times and the mean mass calculated.

The whole procedure was repeated with the other devices, using identical paper towels.

Their results are shown below.

		Mass after 5 minutes in grams			
Device used	**Mass at start in grams**	**1st test**	**2nd test**	**3rd test**	**Mean**
No device	45.6	45.5	45.4	45.6	45.5
Hand held mini fan	45.6	45.4	45.2	45.3	45.3
Hair dryer	45.6	41.2	41.0	41.1	41.1
Desk fan	45.6	43.7	43.6	43.8	43.7

8A The size of the paper towels, their mass at the start and the distance of the dryer from the towels are . . .

1 independent variables.

2 dependent variables.

3 control variables.

4 discrete variables.

8B The tests are repeated to . . .

1 check for systematic errors.

2 improve the reliability of the experiment.

3 see if the devices have an effect.

4 improve the precision of the tests.

8C The students calculated the mean mass of water lost at the end of five minutes for each device.

To show which device was best at drying the towels, the students should plot . . .

1 a line graph of the mean mass of water lost against the device used.

2 a bar chart of the mean mass of water lost against the time.

3 a bar chart of the mean mass of water lost against the device used.

4 a line graph of the mean mass of water lost against the time.

8D The results show that the device that dried the paper towels best was . . .

1 the hair dryer because the mean mass of water lost after five minutes was highest.

2 the hair dryer because it produces hot air.

3 the desk fan because it had the largest fan blades.

4 the hand held mini fan because the mean mass of water lost after five minutes was lowest.

Turn over for the next question

QUESTION NINE

The table shows data about some energy sources used to generate electricity in the UK in 2004.

The figures in the table take into account the construction of the power station.

Energy source	Percentage of UK electricity generation	Carbon dioxide produced per kWh in grams	Construction cost in £ million	Generating cost in pence per kWh	Typical generating capacity in MW
Coal	33	1000	560	2.6	1600
Gas	40	500	300	2.2	650
Nuclear	19	5	1500	3.5	900
falling water (Hydroelectric)	1	10–30	140	3.5	55
Wind	0.4	4.6	1.3	3.3	3

9A An electricity company sells its electricity at 10 pence per kilowatt-hour (kWh).

Which energy source would the company prefer to use to make the biggest profit on its generating cost?

1 coal

2 gas

3 nuclear

4 hydroelectric

9B Which energy source has the greatest effect on global warming for every kilowatt-hour (kWh) of electricity produced?

1 coal

2 gas

3 nuclear

4 wind

9C UK reserves of coal and gas are running out. Coal and gas can be provided from other countries.

Why might this be a good idea?

1 Transport costs for the fuel would be higher.

2 The UK would extend the life of its fossil fuel power stations.

3 The price of coal and gas would be out of the control of the UK.

4 The UK has the ability to develop hydroelectric and wind power stations.

9D The UK government wants to generate 10% of the country's electricity from renewable energy sources by 2010.

Which type of energy source that is renewable would you recommend in terms of generating cost?

1 gas

2 hydroelectric (falling water)

3 nuclear

4 wind

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION ONE

Questions **ONE** and **TWO**.

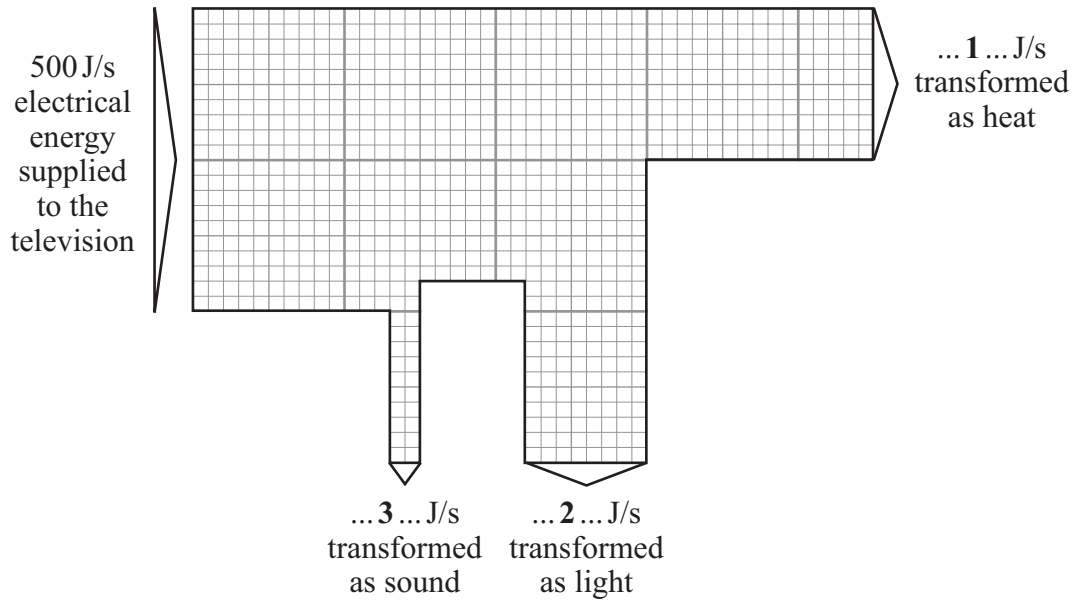
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

The Sankey diagram shows the energy flow for a television.



The efficiency of the television is ... **4** ...

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

Match figures, **A**, **B**, **C** and **D**, with the numbers **1–4** on the diagram.

A 0.50

B 50

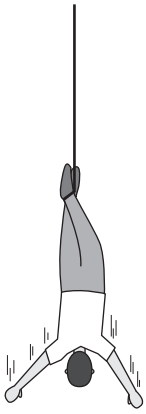
C 200

D 250

Turn over for the next question

QUESTION TWO

During a bungee jump, energy is transformed.



Match energy types, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A gravitational potential energy

B heat (thermal energy)

C kinetic energy

D elastic potential energy

At the top of the jump there is . . . **1** . . . .

As the bungee jumper falls, he gains . . . **2** . . . .

During the fall, energy is wasted as . . . **3** . . . .

As the bungee cord is stretched, it gains . . . **4** . . . .

Turn over for the next question

SECTION TWO

Questions **THREE** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

Some students investigated how effective three different devices were at drying things. They added water to a paper towel until the mass of the paper towel was 45.6 g. They then hung the paper towel in front of one of the devices. After five minutes, they measured the mass of the paper towel again.

The test was carried out three times and the mean mass calculated.

The whole procedure was repeated with the other devices, using identical paper towels.

Their results are shown below.

		Mass after 5 minutes in grams			
Device used	**Mass at start in grams**	**1st test**	**2nd test**	**3rd test**	**Mean**
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Hair dryer	45.6	41.2	41.0	41.1	41.1
Desk fan	45.6	43.7	43.6	43.8	43.7

3A The size of the paper towels, their mass at the start and the distance of the dryer from the towels are . . .

1 independent variables.

2 dependent variables.

3 control variables.

4 discrete variables.

3B The tests are repeated to . . .

1 check for systematic errors.

2 improve the reliability of the experiment.

3 see if the devices have an effect.

4 improve the precision of the tests.

3C The students calculated the mean mass of water lost at the end of five minutes for each device.

To show which device was best at drying the towels, the students should plot . . .

1 a line graph of the mean mass of water lost against the device used.

2 a bar chart of the mean mass of water lost against the time.

3 a bar chart of the mean mass of water lost against the device used.

4 a line graph of the mean mass of water lost against the time.

3D The results show that the device that dried the paper towels best was . . .

1 the hair dryer because the mean mass of water lost after five minutes was highest.

2 the hair dryer because it produces hot air.

3 the desk fan because it had the largest fan blades.

4 the hand held mini fan because the mean mass of water lost after five minutes was lowest.

Turn over for the next question

QUESTION FOUR

The table shows data about some energy sources used to generate electricity in the UK in 2004.

The figures in the table take into account the construction of the power station.

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Coal	33	1000	560	2.6	1600
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falling water (Hydroelectric)	1	10–30	140	3.5	55
Wind	0.4	4.6	1.3	3.3	3

4A An electricity company sells its electricity at 10 pence per kilowatt-hour (kWh).

Which energy source would the company prefer to use to make the biggest profit on its generating cost?

1 coal

2 gas

3 nuclear

4 hydroelectric

4B Which energy source has the greatest effect on global warming for every kilowatt-hour (kWh) of electricity produced?

1 coal

2 gas

3 nuclear

4 wind

4C UK reserves of coal and gas are running out. Coal and gas can be provided from other countries.

Why might this be a good idea?

1 Transport costs for the fuel would be higher.

2 The UK would extend the life of its fossil fuel power stations.

3 The price of coal and gas would be out of the control of the UK.

4 The UK has the ability to develop hydroelectric and wind power stations.

4D The UK government wants to generate 10% of the country's electricity from renewable energy sources by 2010.

Which type of energy source that is renewable would you recommend in terms of generating cost?

1 gas

2 hydroelectric (falling water)

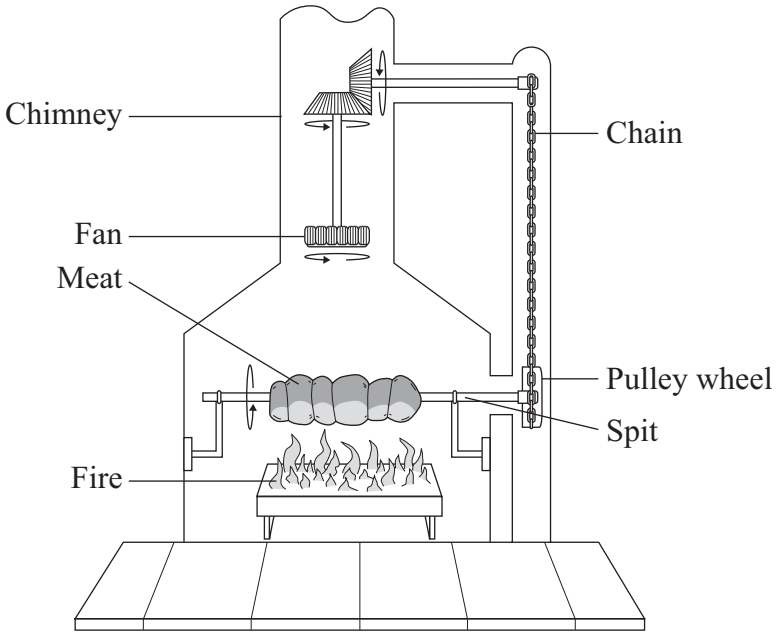
3 nuclear

4 wind

Turn over for the next question

QUESTION FIVE

The diagram shows a device called a spit-roast. The meat is both turned and cooked by the energy from the fire.



5A The fan turns because energy is transferred to it by . . .

1 combustion.

2 conduction.

3 convection.

4 radiation.

5B The surface of the meat darkens as it cooks.

As a result of this, the meat . . .

1 absorbs energy from convection currents less rapidly.

2 absorbs energy from convection currents more rapidly.

3 absorbs energy in the form of radiation more easily.

4 stays hot for longer after it has been removed from the spit.

5C Heat is transferred through the meat mainly by . . .

1 conduction.

2 convection.

3 convection and radiation.

4 radiation.

5D As the spit turns, some kinetic energy will be transformed and wasted as . . .

1 chemical energy.

2 sound energy.

3 light energy.

4 electrical energy.

Turn over for the next question

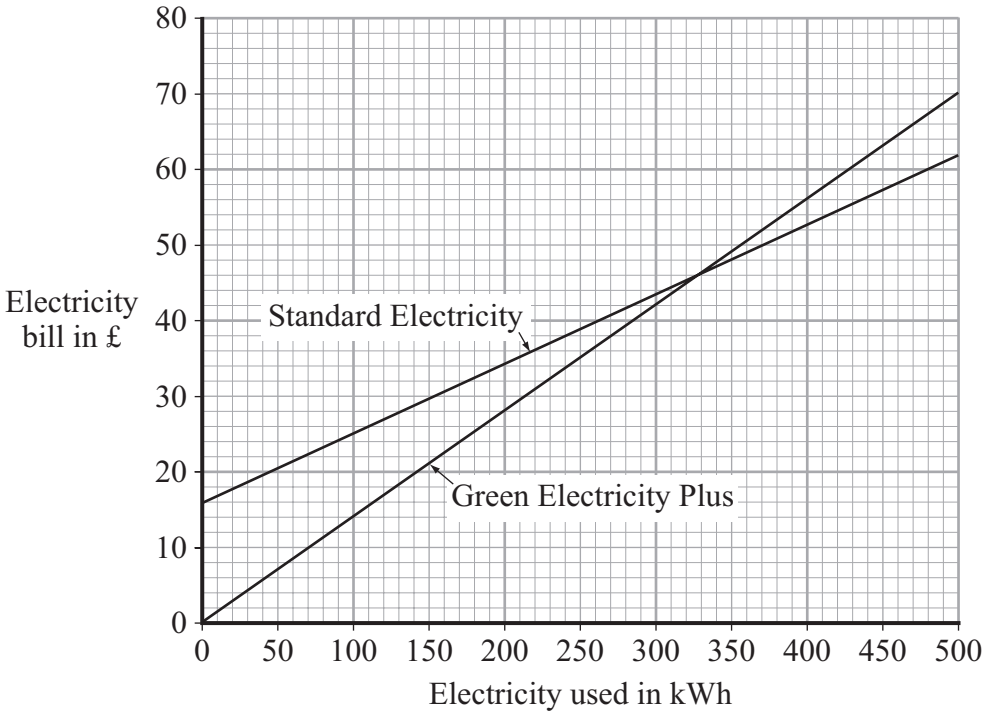
QUESTION SIX

An electricity company has two ways of charging for electricity – Standard Electricity and Green Electricity Plus.

The fixed charge is an additional charge added every three months to the bill sent to customers buying Standard Electricity.

Way of charging	Cost per kilowatt-hour	Fixed charge for three months
Standard Electricity	9 p	£16.25
Green Electricity Plus	14 p	£0

The graph shows how the electricity bill changes with the number of kilowatt-hours of electricity used in three months for the two ways of charging.



6A The graph shows that . . .

1 the Green Electricity Plus way is cheaper if the customer uses 400 kilowatt-hours.

2 the Standard Electricity way is cheaper if the customer uses 325 kilowatt-hours.

3 the Standard Electricity way is cheaper if the customer uses 200 kilowatt-hours.

4 the Green Electricity Plus way is cheaper if the customer uses 150 kilowatt-hours.

6B The electricity company claims that electricity sold under the Green Electricity Plus payment plan is electricity that has been generated from non-polluting sources.

The electricity will be generated from . . .

1 renewable sources.

2 coal.

3 nuclear fuels.

4 oil.

6C The diagram shows part of a Green Electricity Plus bill.

Green Electricity Plus

First meter reading	Second meter reading	No. of kWh used
35785		

Cost per kWh – 14p TOTAL COST £19.04

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

What is the second meter reading?

1 35649

2 35772

3 35798

4 35921

6D The Green Electricity Plus way is advertised as having *no fixed charge*. This may make a customer think that their electricity bills will be less.

To decide whether the bill will actually be smaller, the customer should . . .

1 trust the advertisement.

2 check on an independent website.

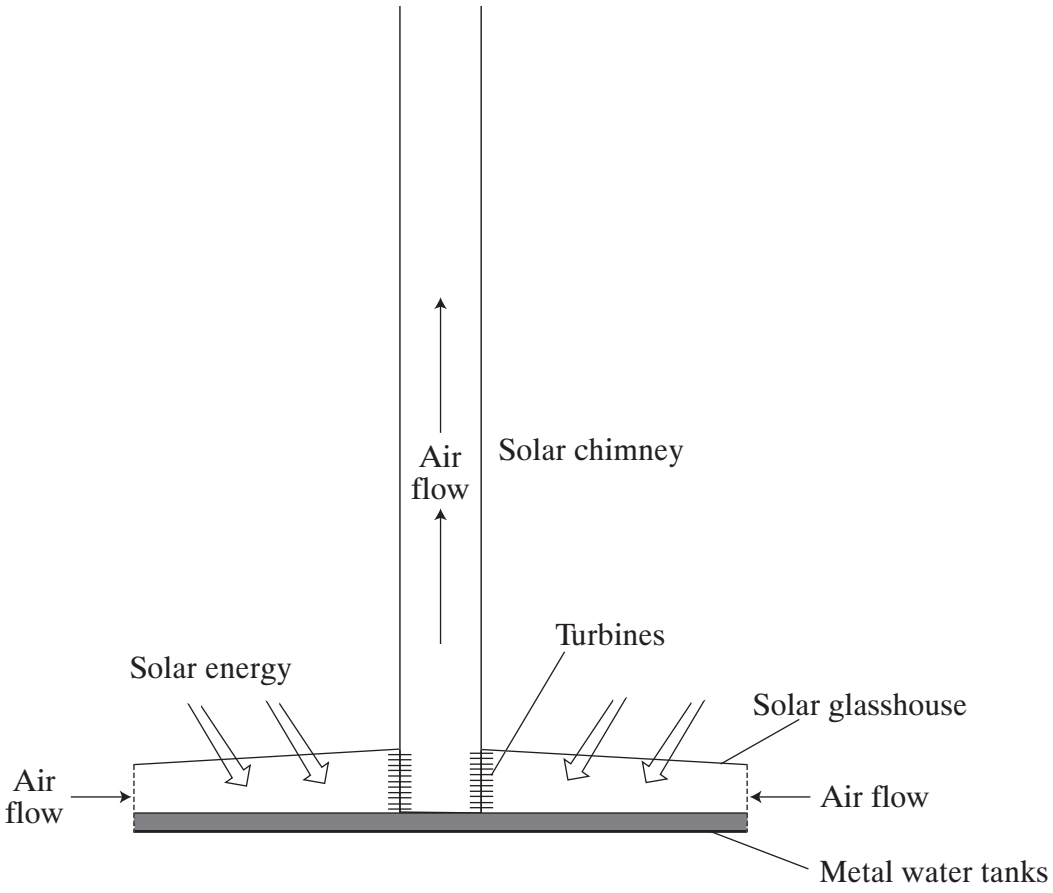
3 switch to the Green Plus way.

4 ask a company salesman.

QUESTION SEVEN

The diagram shows a giant solar chimney which is planned to generate electricity in Australia. It will be over 1000 m high and the base will be surrounded by a solar glasshouse with an area of 4 million m^2.

The average daylight solar input at the site is 0.25 kW/m^2.



7A Why will the air flow up the chimney?

1 It will be sucked up by radiation.

2 The air at the bottom is less dense than the cooler air at the top.

3 The air conducts heat from the bottom to the top.

4 The air conducts heat from the top to the bottom.

7B Why is it necessary for the solar glasshouse to be so large?

1 Noise from the turbines will be absorbed by the large volume of air.

2 Solar energy is dilute, so a large area is needed for high electricity output.

3 It is easier to support large sheets of glass.

4 There are no fuel costs, so capital costs are unimportant.

7C What is the likely purpose of the metal water tanks?

1 to ensure that the air in the glasshouse stays moist

2 to reduce the electrical output to safe levels

3 to reduce the level of noise from the turbines

4 to store heat to allow electrical generation at night

7D Australia expects to open a new coal-fired power station. Its power input will be 2250 MW.

How much more powerful is the input of the coal-fired power station compared with the input of the proposed solar chimney power station?

(1 MW = 1000 000 W; 1 kW = 1000 W)

1 0.44 times as powerful

2 2.25 times as powerful

3 4.40 times as powerful

4 22.50 times as powerful

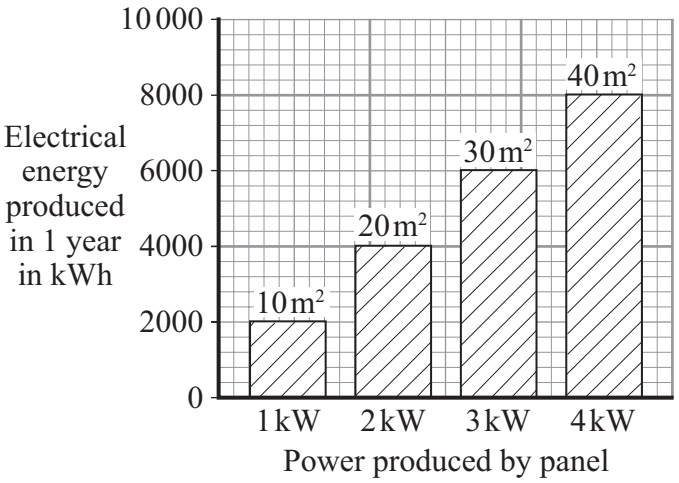
Turn over for the next question

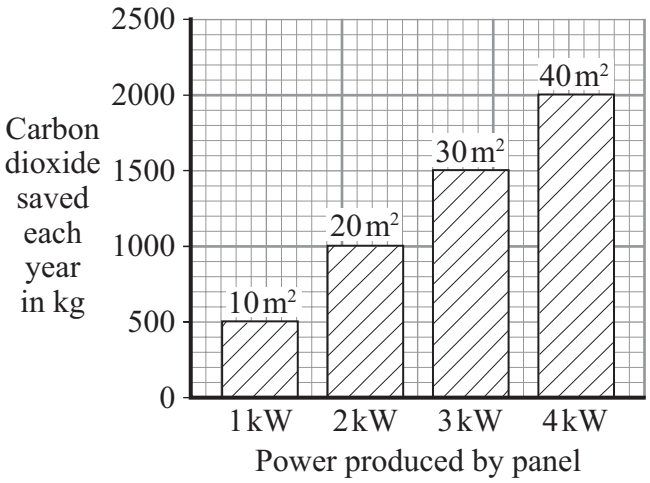
QUESTION EIGHT

The graphs in this question give information about solar cell panels used for producing electricity.

The graphs show:

- the area of the panels in m^2
- the power produced by the panels in kW
- the electrical energy produced each year by using the panels in kWh
- the mass of carbon dioxide saved each year by using the panels in kg.





8A Solar cells do not produce polluting gases.

How much carbon dioxide could be saved each year by using a 15 m^2 panel?

1 500 kg

2 750 kg

3 1 000 kg

4 1 750 kg

8B What area of panel would be needed to power a 2500 W heater?

1 20 m^2

2 25 m^2

3 30 m^2

4 35 m^2

8C Electricity supplied from the National Grid costs 8 p per kilowatt-hour.

A householder is considering installing solar cell panels. The household uses 4000 kWh of electricity each year. The cost of installing a solar cell panel is £6400 per kW.

What is the payback time?

1 4 years

2 8 years

3 40 years

4 400 years

8D Senegal is a poor, developing country. It has no large power stations. Small, local schemes for generating power are used.

Solar cell panels are used to generate electricity for pumping water from wells in remote locations.

The main reason for using solar cell panels in such locations is that . . .

1 low voltage from the solar cells is safer than high voltage power supplies.

2 solar cells are cheap to make.

3 solar cells provide a constant supply of electricity.

4 the location is a long distance from other electricity supplies.

Turn over for the next question

QUESTION NINE

Electricity can be generated in various ways. Power stations use fossil fuels (coal, oil and gas) or nuclear fuels. No new nuclear power stations have been built in the UK for some years.

9A Which one of the following is a valid argument for using nuclear power stations?

1 For maximum efficiency, they have to be sited on the coast.

2 They have high decommissioning costs.

3 They use a renewable energy source.

4 They do **not** produce gases that pollute the atmosphere.

9B Some people argue that we should make more use of wind power instead of nuclear or fossil fuel power stations.

Which statement supports this view?

1 Fossil fuels and nuclear power stations are needed when the wind drops.

2 Large wind farms can be unsightly and noisy.

3 Wind farms have zero fuel costs.

4 Wind farms use large areas of land.

9C

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

Using 1 tonne of uranium in a nuclear power station produces 160 000 000 kWh of energy.

How long could 1 tonne of uranium keep a 2000 MW nuclear power station running?

(1 MW = 1000 kW)

1 0.0125 hours

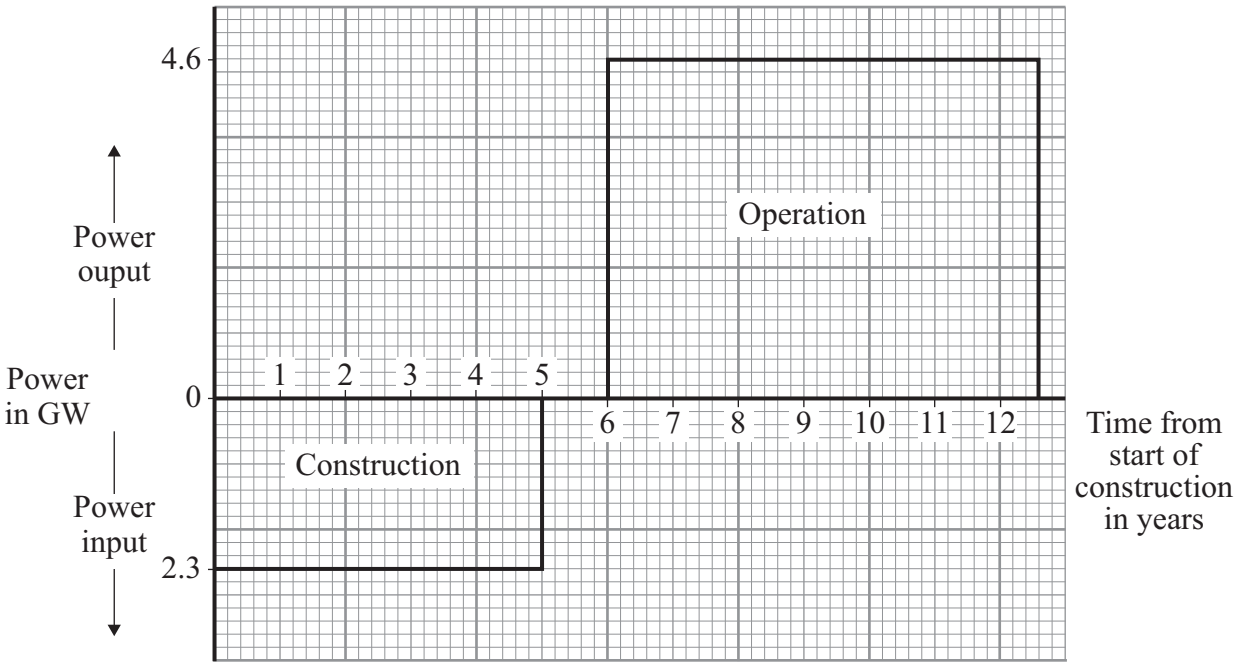
2 12.5 hours

3 80 hours

4 80 000 hours

9D Nuclear power stations take a long time to build. Power is used in their construction and initial fuel processing. This and the power produced by the station are shown in the graph.

The area under the graph represents the energy used or produced in GWh.



How many years from the start of construction will it be before the power station produces more energy than was used to build it?

1 2.5 years

2 7.5 years

3 8.0 years

4 8.5 years

END OF TEST

There are no questions printed on this page