AQA GCSE SCIENCE A (PHYSICS)

PHYSICS



EXAM QUESTION PACK

UNIT P1a OBJECTIVE TEST PHY1AP PAPERS

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2012

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Tuesday 6 November 2012 Afternoon Session

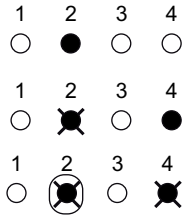
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 16 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

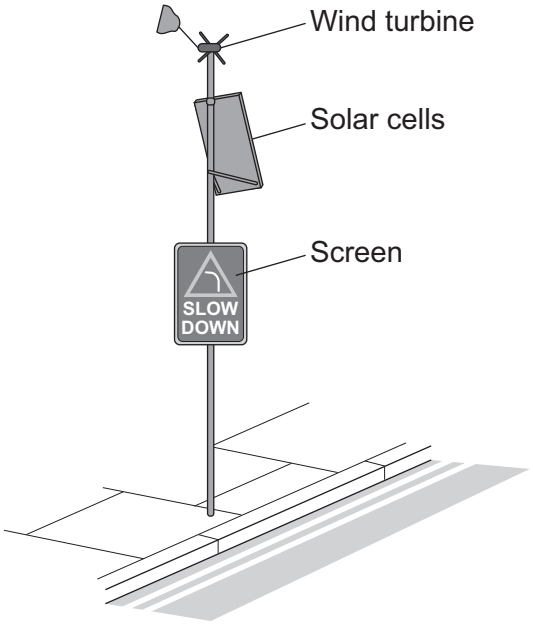
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows an electronic road sign.



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

A electrical

B thermal

C light

D kinetic

The useful energy output from the screen is . . . **1** . . . energy.

The energy input to the wind turbine is . . . **2** . . . energy.

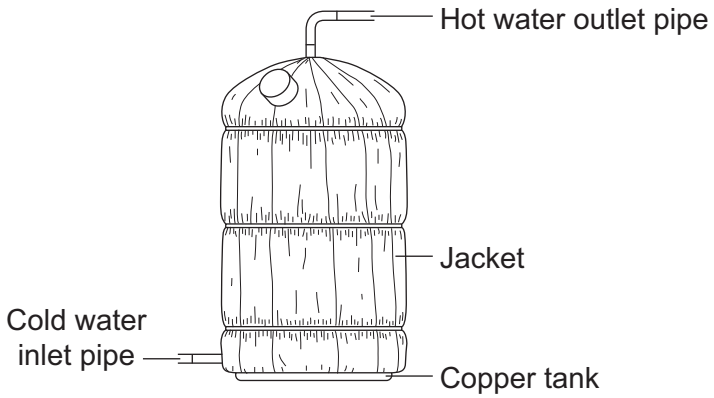
The useful energy output from the solar cells is . . . **3** . . . energy.

The wasted energy output from the road sign is . . . **4** . . . energy.

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QUESTION TWO

The diagram shows a jacket fitted to a hot water tank.



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

A conduction

B convection

C insulation

D radiation

Heat will travel through the copper wall of the tank by . . . **1** . . . .

The jacket helps to keep the water warm because the fibreglass inside the jacket provides . . . **2** . . . .

The hot water outlet is at the top of the tank because hot water will rise to the top by . . . **3** . . . .

Heat is lost from the surface of the tank by . . . **4** . . . .

Turn over for the next question

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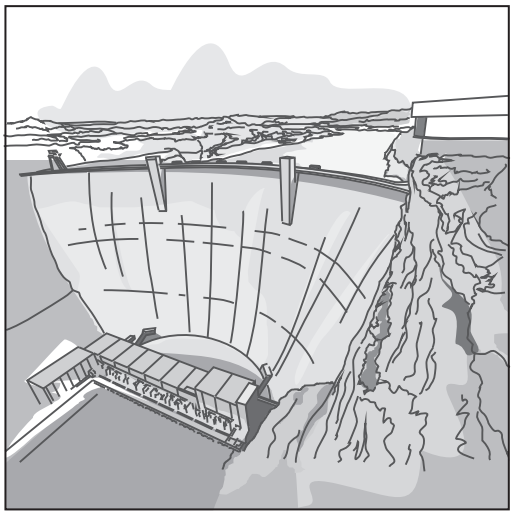
QUESTION THREE

Some people feel strongly about the environment. They may protest against the location of new power stations.

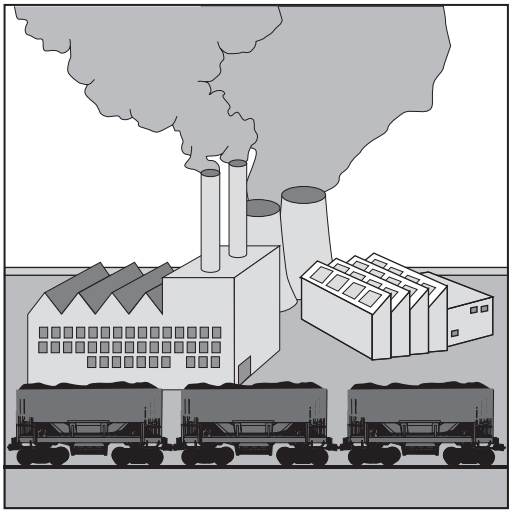
The diagrams show four types of power station.



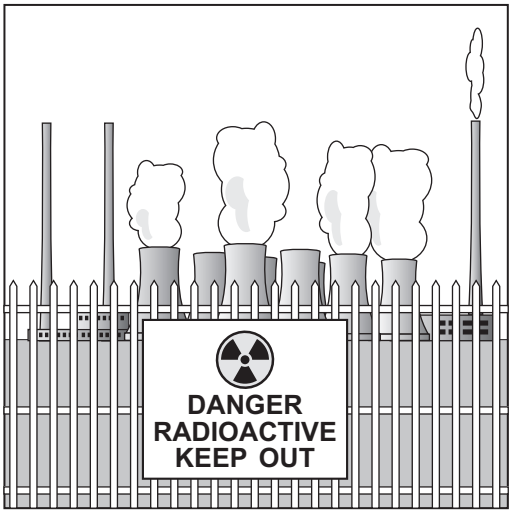
1



2



3



4

The statements, **A**, **B**, **C**, and **D**, were made by different groups of protesters.

Match the protesters' statements, **A**, **B**, **C**, and **D**, with the power stations **1**–**4**.

A Don't flood our farmland.

B Don't let turbines kill our birds.

C Nuclear waste causes cancer.

D Stop releasing polluting gases.

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QUESTION FOUR

Various energy sources can be used to generate electricity.

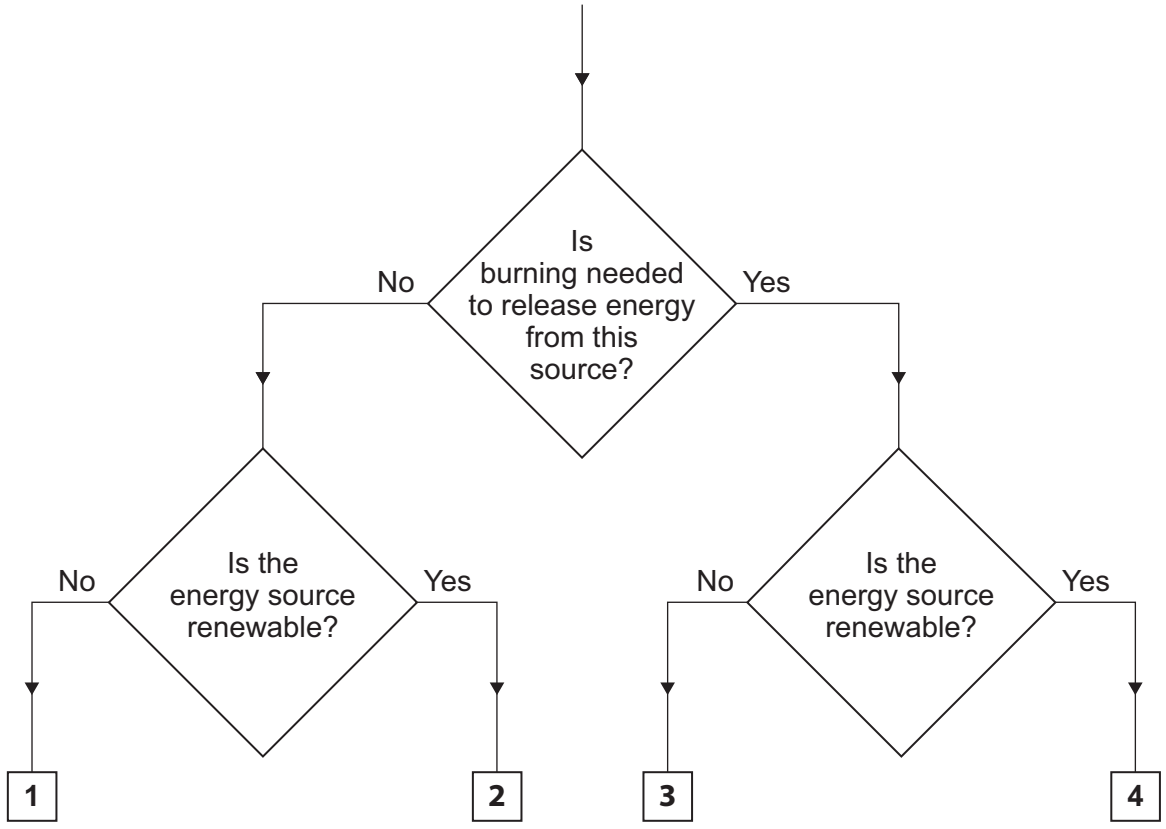
Match energy sources, **A**, **B**, **C**, and **D**, with the numbers **1**–**4** in the flow chart.

A falling water

B oil

C plutonium

D wood

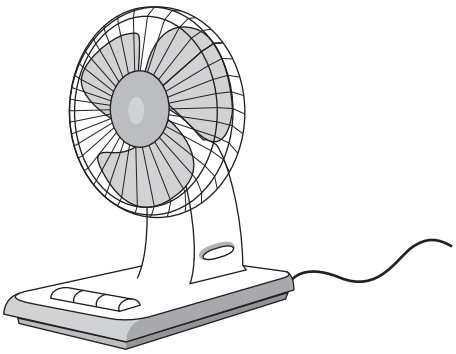


Turn over for the next question

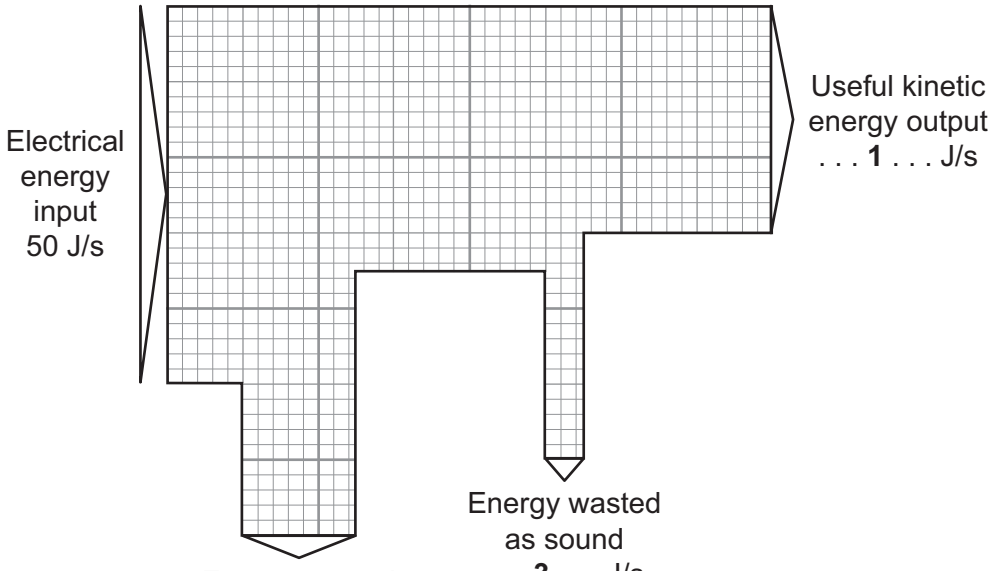
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QUESTION FIVE

The diagram shows an electric fan.



The Sankey diagram gives the energy transformations for the fan.



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

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

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

A 0.6

B 5

C 15

D 30

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Turn over for the next question

Section Two

Questions **SIX** to **NINE**.

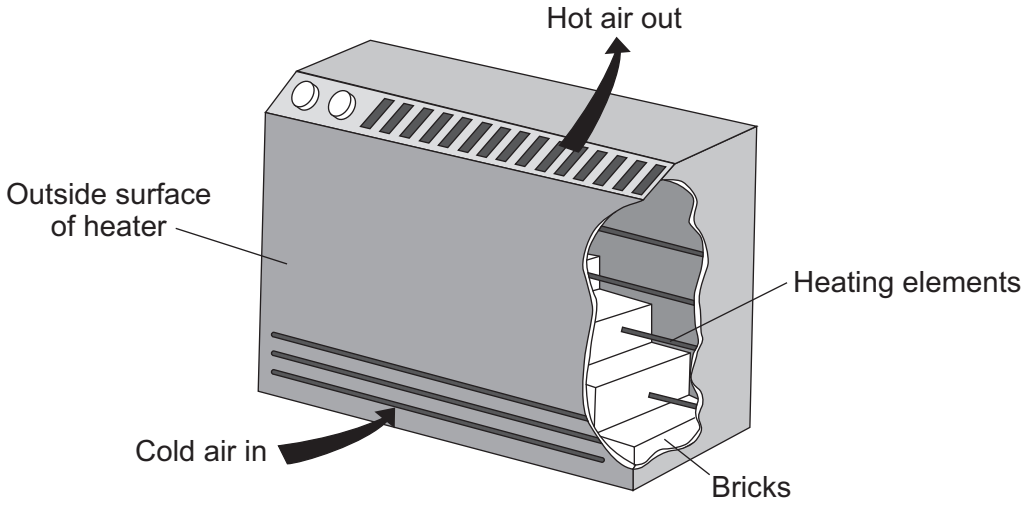
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The diagram shows the construction of one type of heater. The bricks inside the heater warm up during the night when electricity is cheaper. The bricks then emit heat (thermal energy) during the day.



6A The bricks warm up because they . . .

1 absorb heat.

2 insulate heat.

3 radiate heat.

4 reflect heat.

6B The diagram shows the main thermal energy transfer of the heater as it warms the room.

By what process does this heater transfer most of its energy to all parts of a room?

1 conduction from the bricks

2 conduction from the outside surface of the heater

3 convection currents in the air

4 radiation from the outside surface of the heater

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6C To give out the most heat by radiation, what would be the best outside surface for the heater?

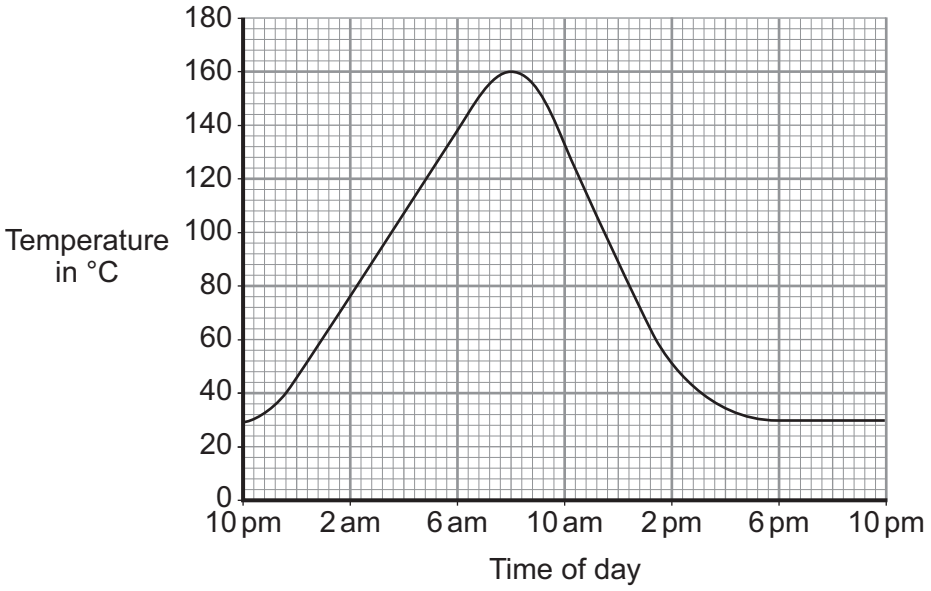
1 dark, matt

2 dark, shiny

3 light, shiny

4 light, matt

6D The graph shows how the temperature of the bricks changes during a 24-hour period.



At what time did the bricks reach their highest temperature?

1 8 am

2 10 am

3 6 pm

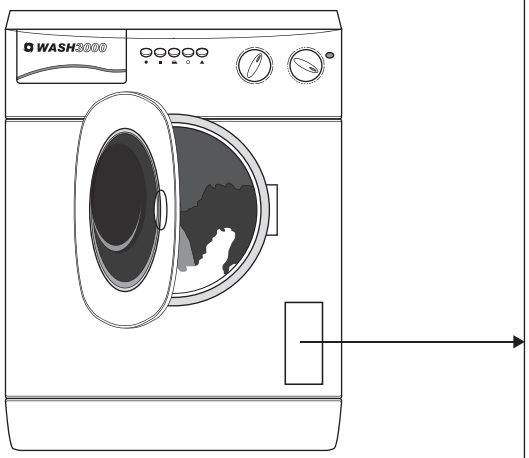
4 10 pm

Turn over for the next question

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QUESTION SEVEN

The energy label gives information about the washing machine shown in the diagram.



Energy	Washing machine
Manufacturer	
Model	
More efficient A	A
B	
C	
D	
E	
F	
G	
Less efficient	
Energy consumption kWh/Cycle (based on standard test results for 50°C cotton cycle)	0.9
Washing performance A: higher G: lower	A B C D E F G
Spin drying performance A: higher G: lower	A B C D E F G
Spin speed (rpm)	1400
Capacity (cotton) kg	5.0
Water comsumption / l	55
Noise (dB(A) re 1 pW) Washing	5.2
Noise (dB(A) re 1 pW) Spinning	7.0

7A The energy label states that this washing machine has an efficiency rating of **A**.

A different washing machine has an efficiency rating of **C**.

This means the A-rated washing machine . . .

1 uses the same amount of energy for each wash cycle as the C-rated washing machine.

2 uses more energy for each wash cycle than the C-rated washing machine.

3 wastes more energy for each wash cycle than the C-rated washing machine.

4 wastes less energy for each wash cycle than the C-rated washing machine.

7B Washing machines do **not** transfer all of the supplied energy into useful forms of energy.

Information on the energy label suggests that some energy is wasted as . . .

1 heat.

2 light.

3 kinetic energy.

4 sound.

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7C The A-rated washing machine is used for 300 standard washing cycles per year.

How much energy does this number of cycles transfer?

1 270 kWh

2 1500 kWh

3 2700 kWh

4 3600 kWh

7D A large family uses the A-rated washing machine for 500 standard washing cycles in a year.

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

1 kilowatt-hour of electricity costs 12 p.

How much does the washing machine cost to run for that year?

1 £40.00

2 £41.60

3 £54.00

4 £60.00

Turn over for the next question

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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 of the paper towels after five minutes was 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
Handheld mini fan	45.6	45.4	45.2	45.3	45.3
Hairdryer	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 device 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.

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

The students were told to display their results on graph paper.

To show which device was best at drying the paper 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 hairdryer because the mean mass of water lost in five minutes was highest.

2 the hairdryer because it produces hot air.

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

4 the handheld mini fan because the mean mass of water lost in five minutes was lowest.

Turn over for the next question

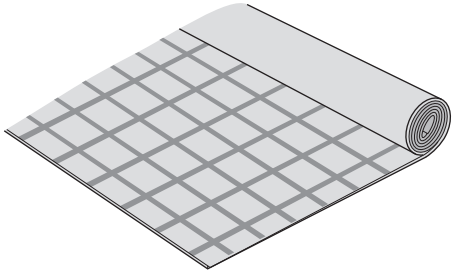
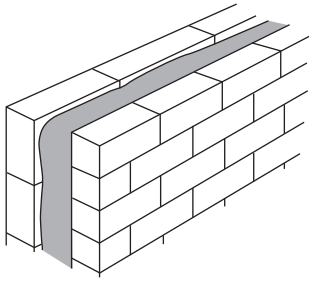
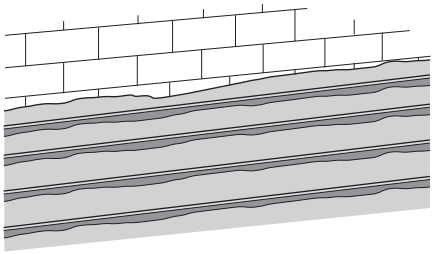
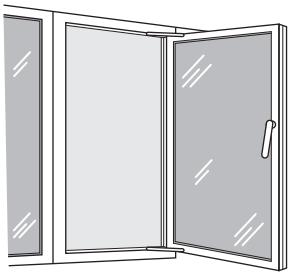
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QUESTION NINE

Energy costs rising

Many householders are worried about the rising cost of energy.

The drawings are from a magazine article on how to reduce the cost of home heating by using insulation.

Carpeting the floor  Saving per week for each square metre **25p**	**Putting foam in wall cavities**  Saving per week for each square metre **20p**
Insulating the loft  Saving per week for each square metre **10p**	**Fitting double-glazed windows**  Saving per week for each square metre **24p**

9A All the methods of insulation shown in the diagrams use materials that . . .

1 are good emitters of thermal radiation.

2 prevent warm air from rising.

3 trap air.

4 are warm.

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9B A student is asked to explain why the savings in the magazine article may not be correct for different houses.

The student makes three points:

- not all double glazing is equally good
- not all insulation in lofts is the same depth
- the difference between the outside temperature and the inside temperature of different houses is not constant.

Which one of the following statements is correct?

1 Only the student's first point is correct.

2 Only the student's first two points are correct.

3 All three of the student's points are correct.

4 None of the student's points is correct.

9C An energy-saving expert suggests how to reduce the heating bill for a house. She says that having foam put in the wall cavity will reduce the heating bill more than having double glazing fitted.

Her statement is correct because . . .

1 foam insulation is cheaper than double glazing.

2 more heat is lost through each square metre of window compared with each square metre of wall.

3 the area of the walls is much greater than the area of the windows.

4 the windows are not always shut.

9D The Government wants to encourage energy-saving. There will be several advantages to the environment if people use less energy.

Which of the following will be the most important advantage to the environment?

1 It will be more important to develop renewable energy technology.

2 Less energy will need to be transformed from fossil fuels.

3 Less energy will need to be transformed from renewable resources.

4 People will save money on their fuel bills.

END OF TEST

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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**.

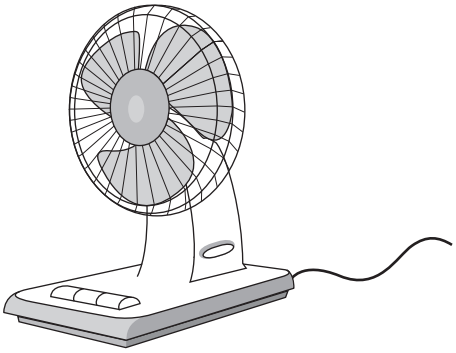
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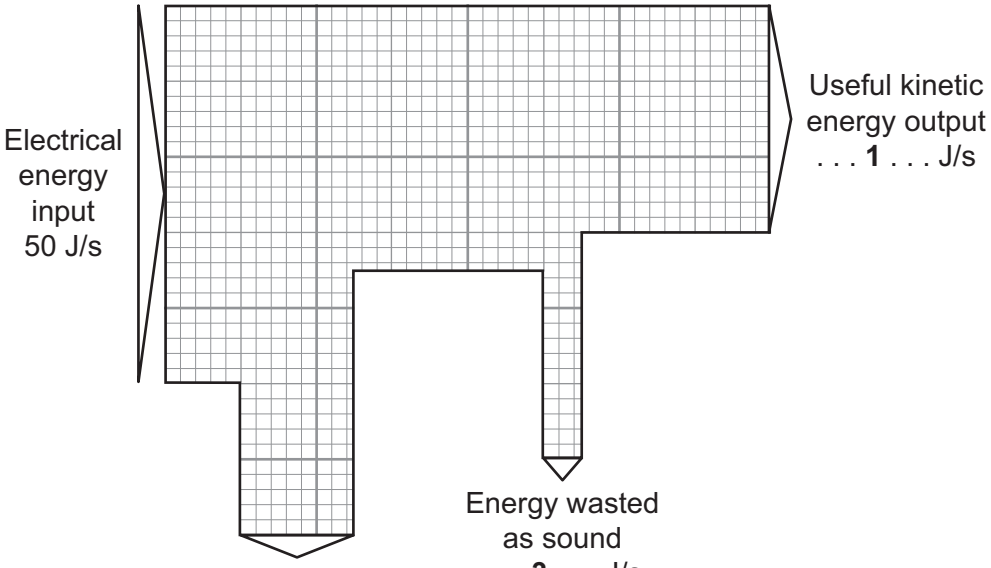
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QUESTION ONE

The diagram shows an electric fan.



The Sankey diagram gives the energy transformations for the fan.



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

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

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

A 0.6

B 5

C 15

D 30

QUESTION TWO

This question is about some of the energy sources used to generate electricity.

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

A coal

B hydroelectric

C nuclear

D wind

	Feature
1	Has the highest decommissioning cost
2	The supply is not reliable
3	No fuel costs, and can be used to meet sudden demands for electricity
4	Transformation of chemical energy to heat energy

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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

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

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3B The tests are repeated to . . .

1 check for systematic errors.

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

The students were told to display their results on graph paper.

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

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

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Turn over for the next question

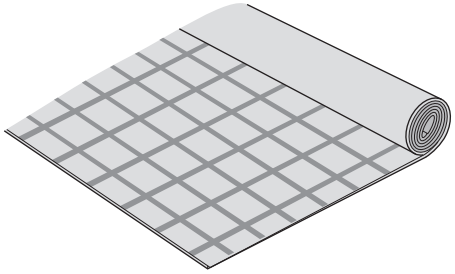
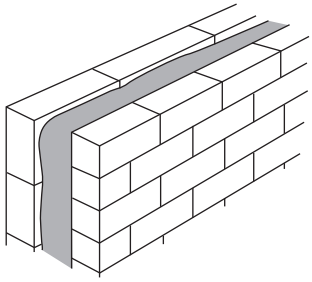
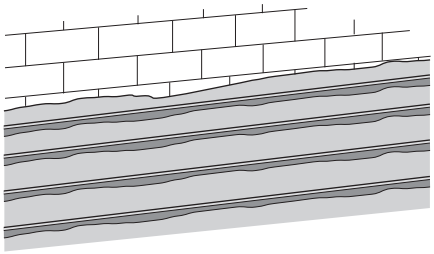
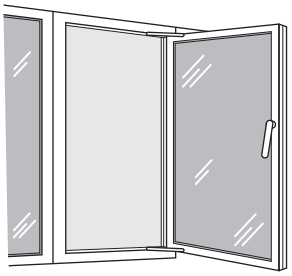
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QUESTION FOUR

Energy costs rising

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4A All the methods of insulation shown in the diagrams use materials that . . .

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4B A student is asked to explain why the savings in the magazine article may not be correct for different houses.

The student makes three points:

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4D The Government wants to encourage energy-saving. There will be several advantages to the environment if people use less energy.

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1 It will be more important to develop renewable energy technology.

2 Less energy will need to be transformed from fossil fuels.

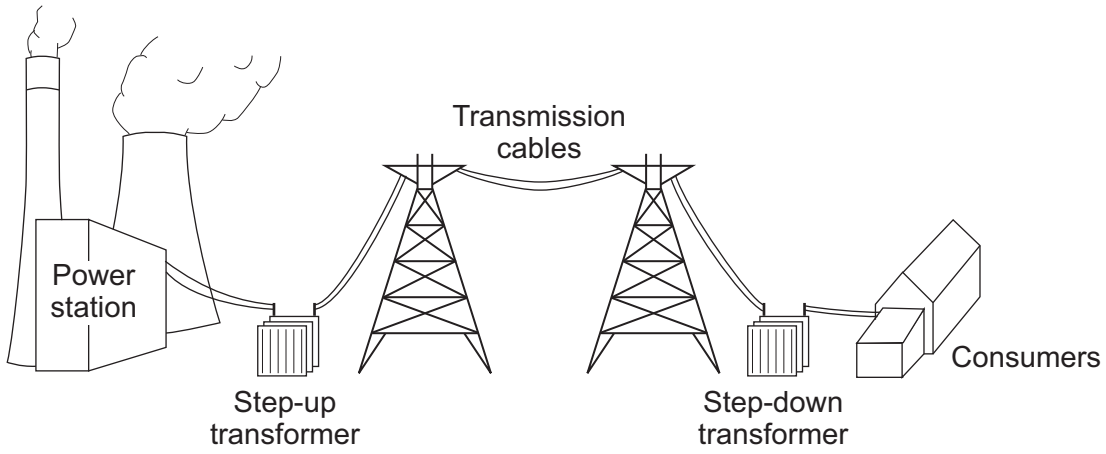
3 Less energy will need to be transformed from renewable resources.

4 People will save money on their fuel bills.

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QUESTION FIVE

The diagram shows how electricity is distributed from a coal-fired power station to consumers.



5A Which row in the table shows what happens at the step-up transformer?

	Current	Voltage
1	decreased	decreased
2	decreased	increased
3	increased	decreased
4	increased	increased

5B The purpose of the step-up transformer is to . . .

1 allow the electricity to travel further.

2 increase the speed of the electricity through the cables.

3 reduce energy losses from the cables.

4 reduce vibrations in the cables.

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5C Which type of power station adds the least amount of polluting gases to the atmosphere?

1 coal

2 gas

3 nuclear

4 oil

5D What process produces the heat in a nuclear power station?

1 combustion

2 fission

3 fusion

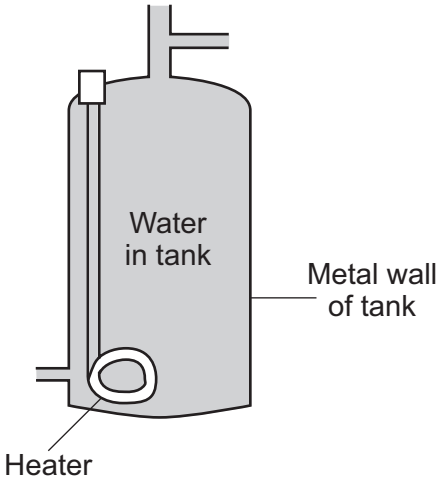
4 transmission

Turn over for the next question

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QUESTION SIX

Many homes have hot-water tanks. An electric heater may be used to heat the water. Some heat (thermal energy) is lost through the metal walls to the surroundings.



6A The energy spreads through the water by . . .

1 heated water contracting and falling.

2 heated water expanding and rising.

3 heat rising.

4 the movement of free electrons.

6B The energy is transferred through the metal walls by . . .

1 heated water expanding and rising.

2 infra red waves passing through the metal.

3 the atoms gaining energy and moving faster through the metal.

4 the movement of free electrons.

6C The outside of the metal walls of the tank transfer energy to the surroundings by . . .

1 heated air contracting and falling.

2 infra red waves passing through the air.

3 metal atoms gaining energy and escaping into the air.

4 the movement of free electrons.

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6D The air in contact with the outside of the metal walls . . .

1 contracts and falls due to decreased density.

2 contracts and falls due to increased density.

3 expands and rises due to decreased density.

4 expands and rises due to increased density.

Turn over for the next question

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QUESTION SEVEN

Read this summary of a report on future energy supplies.

- By 2020, the UK should get 20% of its electricity from wind power.
- Thousands of wind turbines will need to be erected.
- Very large wind turbines should be erected out at sea.
- More nuclear power stations will need to be built.

7A Which of the following statements describes an advantage of wind power over nuclear power?

1 Wind power does not make any dangerous waste.

2 Wind power puts less carbon dioxide into the atmosphere.

3 Wind power puts less sulfur dioxide into the atmosphere.

4 Wind turbines do not cause pollution during their manufacture.

7B Large wind turbines may be erected far out at sea because . . .

1 there is less air pollution than on land.

2 there is no danger to wildlife.

3 they cause less visual pollution than on land.

4 the wind speed is constant.

7C Why does a nuclear power station take up less space than a wind farm producing the same amount of energy?

1 The nuclear power station produces less electricity than a wind farm.

2 The energy in the wind is more spread out than the energy in nuclear fuels.

3 Nuclear power stations are usually built near the coast.

4 Nuclear power stations produce radioactive waste which must be contained.

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7D Which of the following statements describes an advantage of nuclear power over wind power?

1 Electricity can be produced from nuclear power at any time and in any weather.

2 Fuel costs for nuclear power are very low.

3 Nuclear power does not cause atmospheric pollution.

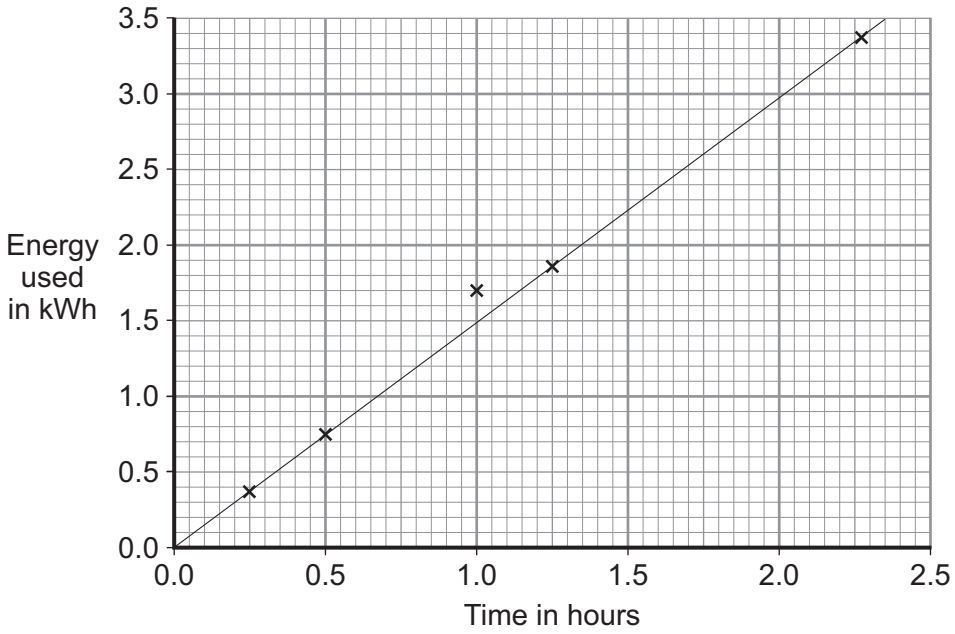
4 Nuclear power does not damage river estuaries.

Turn over for the next question

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QUESTION EIGHT

The graph shows the amount of energy an electric fire uses plotted against the time for which the fire is switched on.



8A The unit of energy on the graph is the kilowatt-hour (kWh).

Energy is usually measured in . . .

1 joules.

2 joules per second.

3 watts.

4 watts per second.

8B The point on the graph at the time of one hour could be anomalous.

This means that the value of the energy . . .

1 was measured with too little precision.

2 was measured with too much precision.

3 does not fit the general pattern.

4 has a systematic error.

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8C The graph shows that . . .

1 the energy used decreases with time.

2 the energy used is directly proportional to the time.

3 the energy used is inversely proportional to the time.

4 the energy used halves when the time is doubled.

8D What is the power of the electric fire?

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

1 1.5 W

2 6.7 W

3 1500 W

4 6700 W

Turn over for the next question

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QUESTION NINE

A notice in an office says:

Leaving your computer on standby overnight uses as much energy as microwaving six frozen meals

Switch your computer OFF

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

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

Electricity costs 12 p per kilowatt-hour.

9A The instructions on a frozen meal say: 'Cook in an 850 W microwave oven for 6 minutes'.

Approximately how much would it cost to cook 6 of these meals, if they are cooked one at a time?

1 6p

2 £1.02

3 £3.66

4 £36.72

9B A computer monitor in an office has a power rating of 300 W. Normal office hours are 9 am to 5 pm.

A sensible estimate of the energy wasted if the monitor is on overnight at full power is . . .

1 4.8 kWh

2 7.2 kWh

3 4800 kWh

4 7200 kWh

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9C The 300 W computer monitor can be switched to standby. The standby power is 3 W.

How much money is saved each hour by switching the monitor from full power to standby?

1 less than 1p

2 3.6p

3 33p

4 36p

9D It is estimated that in Britain 15 million televisions are left on standby power for 20 hours per day. The European Parliament has passed a law to help to reduce this problem.

Which of the following is most likely to have been included in the law?

1 decrease the price of televisions

2 make it compulsory for television owners to switch off their television sets when not in use

3 set a 1 W limit on standby power for all televisions

4 set a 1 W limit on standby power for all new televisions

END OF TEST

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There are no questions printed on this page

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GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2012 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from aqa.org.uk

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

November 2012

Foundation Tier

Question	Key		
One	**A**	electrical	**3**
	B	thermal	**4**
	C	light	**1**
	D	kinetic	**2**
Two	**A**	conduction	**1**
	B	convection	**3**
	C	insulation	**2**
	D	radiation	**4**
Three	**A**	Don't flood our farmland	**2**
	B	Don't let turbines kill our birds	**1**
	C	Nuclear waste causes cancer	**4**
	D	Stop releasing polluting gases	**3**
Four	**A**	falling water	**2**
	B	oil	**3**
	C	plutonium	**1**
	D	wood	**4**
Five	**A**	0.6	**4**
	B	5	**3**
	C	15	**2**
	D	30	**1**

	A	**B**	**C**	**D**
Six	**1**	**3**	**1**	**1**
Seven	**4**	**4**	**1**	**3**
Eight	**3**	**2**	**3**	**1**
Nine	**3**	**3**	**3**	**2**

GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

November 2012

Higher Tier

Question	Key		
One	**A**	0.6	**4**
	B	5	**3**
	C	15	**2**
	D	30	**1**
Two	**A**	coal	**4**
	B	hydroelectric	**3**
	C	nuclear	**1**
	D	wind	**2**

	A	B	C	D
Three	**3**	**2**	**3**	**1**
Four	**3**	**3**	**3**	**2**
Five	**2**	**3**	**3**	**2**
Six	**2**	**4**	**2**	**3**
Seven	**1**	**3**	**2**	**1**
Eight	**1**	**3**	**2**	**3**
Nine	**1**	**1**	**2**	**4**

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http://www.aqa.org.uk/umsconversion

GCSE SCIENCE

AQA

Unit : PHY1AP **PHYSICS UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG12

06-NOV-12

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions ONE to NINE Choose one response 1 - 4 for each of the parts A - D

QUESTION ONE		1	2	3	4
1A	0.6	○	○	○	○
1B	5	○	○	○	○
1C	15	○	○	○	○
1D	30	○	○	○	○

QUESTION TWO		1	2	3	4
2A	coal	○	○	○	○
2B	hydroelectric	○	○	○	○
2C	nuclear	○	○	○	○
2D	wind	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	electrical	○	○	○	○
1B	thermal	○	○	○	○
1C	light	○	○	○	○
1D	kinetic	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	conduction	○	○	○	○
2B	convection	○	○	○	○
2C	insulation	○	○	○	○
2D	radiation	○	○	○	○

QUESTION THREE

		1	2	3	4
3A	Don't flood our farmland.	○	○	○	○
3B	Don't let turbines kill our birds.	○	○	○	○
3C	Nuclear waste causes cancer.	○	○	○	○
3D	Stop releasing polluting gases.	○	○	○	○

QUESTION FOUR

		1	2	3	4
4A	falling water	○	○	○	○
4B	oil	○	○	○	○
4C	plutonium	○	○	○	○
4D	wood	○	○	○	○

QUESTION FIVE

		1	2	3	4
5A	0.6	○	○	○	○
5B	5	○	○	○	○
5C	15	○	○	○	○
5D	30	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
June 2012

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Friday 22 June 2012 Afternoon Session

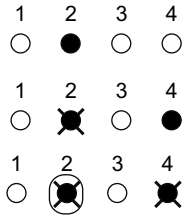
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 16 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

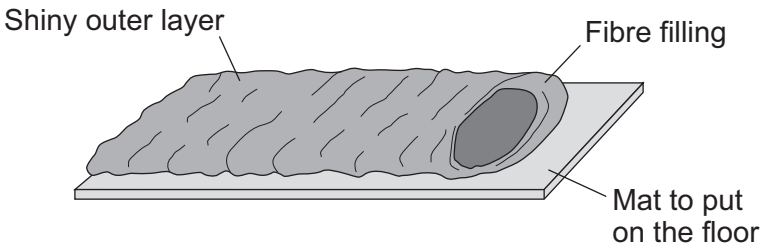
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a sleeping bag on a mat. The mat is made from expanded polystyrene foam. The sleeping bag is designed to keep people warm when sleeping in a tent.



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

A conduction

B convection

C insulation

D radiation

The mat on the floor reduces heat loss by . . . **1** . . . .

The shiny outer layer of the sleeping bag reduces heat loss by . . . **2** . . . .

The fibre filling of the sleeping bag reduces heat loss by conduction and by . . . **3** . . . .

The mat and the fibre filling are designed to improve . . . **4** . . . .

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QUESTION TWO

Many devices transform electrical energy into other forms of energy.

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

A kinetic

B light

C sound

D thermal

The useful output from an electric drill is . . . **1** . . . energy.

The useful output from a radio is . . . **2** . . . energy.

The useful output from a toaster is . . . **3** . . . energy.

The useful output from a torch is . . . **4** . . . energy.

Turn over for the next question

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QUESTION THREE

The flow chart shows how a nuclear power station produces electricity for the National Grid.

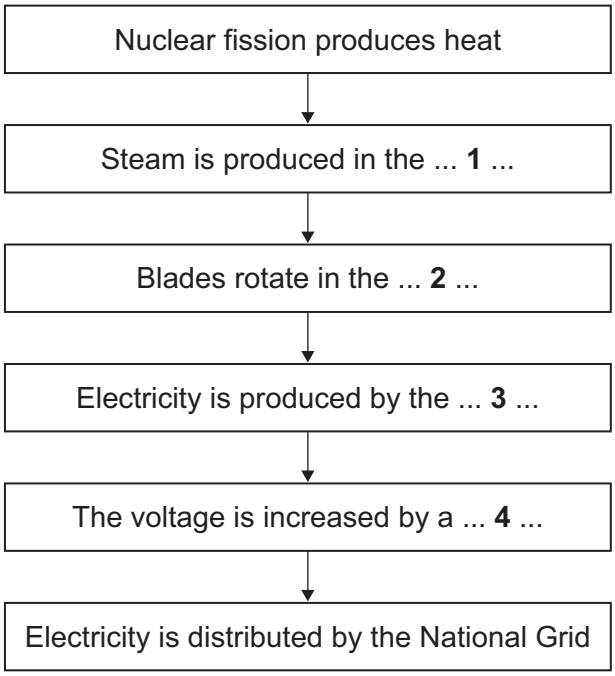
Match words, **A**, **B**, **C** and **D**, with the numbers **1**–**4** on the flow chart.

A boiler

B generator

C transformer

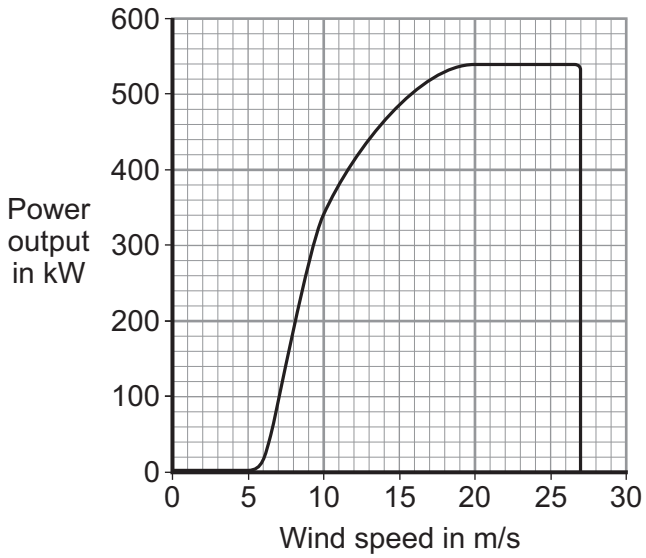
D turbine



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QUESTION FOUR

The graph shows how the power output of a wind turbine varies with the wind speed.



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

A 5

B 27

C 340

D 540

The minimum wind speed required to generate electricity is . . . **1** . . . m/s.

The maximum power output of the wind turbine is . . . **2** . . . kW.

At a wind speed of 10 m/s, the power output is . . . **3** . . . kW.

The turbine has a safety device that reduces the power output when the wind speed reaches . . . **4** . . . m/s.

Turn over for the next question

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QUESTION FIVE

Power stations involve energy transfers.

Match power stations, **A**, **B**, **C** and **D**, with the useful energy transfers **1**–**4** in the table.

A coal-fired

B geothermal

C hydroelectric

D wind farm

1	chemical → heat (thermal energy) → kinetic → electrical
2	gravitational potential → kinetic → electrical
3	heat (thermal energy) → kinetic → electrical
4	kinetic → electrical

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Turn over for the next question

Section Two

Questions **SIX** to **NINE**.

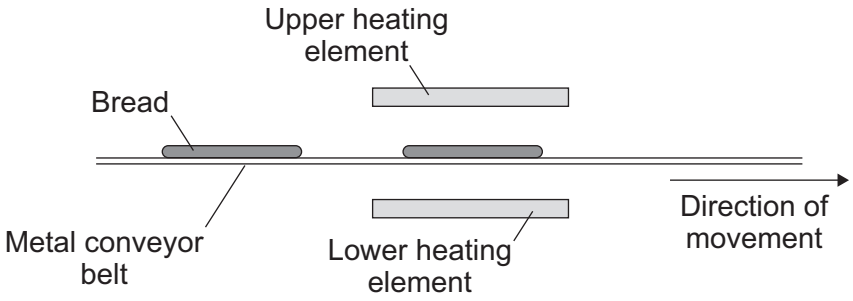
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

Busy restaurants toast bread using a conveyor toaster. Pieces of bread move on a metal conveyor belt between two heating elements.



6A What type of heat transfer browns the bread on the upper side?

1 conduction and convection

2 convection only

3 convection and radiation

4 radiation only

6B To make the toast browner, the controls on the toaster should be altered to . . .

1 provide less heat to the heating elements.

2 reverse the direction of the conveyor belt.

3 slow down the conveyor belt.

4 speed up the conveyor belt.

6C As the surface of the toast becomes darker, the surface will . . .

1 absorb more heat.

2 radiate less heat.

3 reflect more heat.

4 transmit less heat.

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6D The toaster has a power of 1.8 kilowatts and operates for 30 minutes.

How much energy is transferred?

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

1 0.54 kWh

2 0.60 kWh

3 0.90 kWh

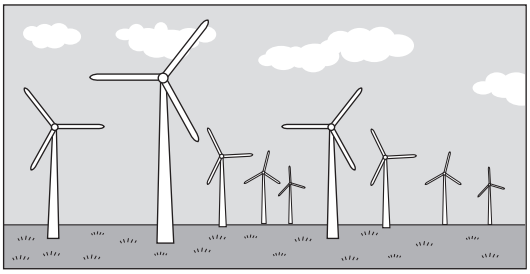
4 5.40 kWh

Turn over for the next question

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QUESTION SEVEN

Many new wind farms are being built in the UK.



Scientists state that the turbine blades attract insects. During the day, when birds eat the insects, many birds are killed by the blades. At night, when bats eat the insects, many bats are killed by the blades.

Some colours attract insects better than other colours. Research has been carried out into the number of insects attracted by different colours. Turbine blades could then be painted so that fewer bats and birds are killed.

Cards, painted different colours, were set out in a field at the base of a turbine. The researchers counted the number of insects attracted to each card.

7A What type of variable was the colour of the card?

1 continuous

2 control

3 dependent

4 independent

7B The results were recorded in a table. An example is given below.

Colour of card	Number of insects attracted

What is the best way of displaying the results?

1 bar chart

2 line graph

3 pie chart

4 scattergram

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7C The chart shows the results.

Largest number of insects attracted ⟶				**Smallest number attracted**
yellow	white	light grey	red	purple

To make birds and bats safer, what would be the best colour to paint the turbine blades?

1 light grey

2 purple

3 white

4 yellow

7D The issue of birds and bats being killed by wind turbine blades is . . .

1 an economic issue.

2 an environmental issue.

3 a political issue.

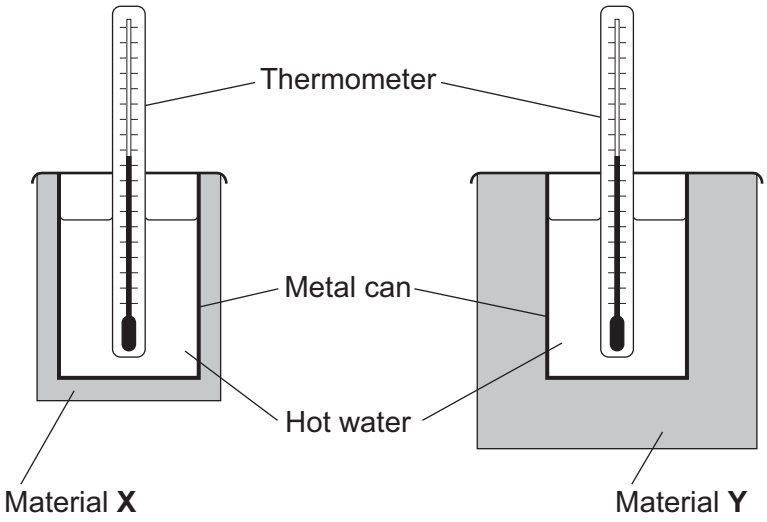
4 a scientific issue.

Turn over for the next question

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QUESTION EIGHT

A student compared the insulating properties of two different materials, **X** and **Y.** She set up the apparatus as shown below. She filled each can with hot water.



She measured the temperature of the water in each can at the start and again after 10 minutes.

These are the results.

	Starting temperature of the water	Temperature of the water after 10 minutes
Can insulated by material **X**	95 °C	78 °C
Can insulated by material **Y**	95 °C	85 °C

8A The test was **not** fair because she used . . .

1 the same amount of water.

2 the same starting temperature.

3 different thicknesses of material.

4 identical cans.

8B What was the average rate of temperature fall for the water in the can insulated by material **X**?

1 8.5 °C per minute

2 7.8 °C per minute

3 1.7 °C per minute

4 1.0 °C per minute

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8C Which material is the better thermal insulator?

1 Material **X** because the temperature fall is smaller.

2 Material **Y** because the temperature fall is bigger.

3 We cannot say, because the results are not valid.

4 We cannot say, because the results are not precise enough.

8D Heat (thermal energy) passes through the walls of the can by . . .

1 conduction only.

2 convection only.

3 radiation only.

4 conduction and convection.

Turn over for the next question

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QUESTION NINE

In 2009, the UK government introduced a car 'scrappage' scheme. The scheme was introduced to help car manufacturers. A person with a car that was at least 10 years old could scrap it and claim up to £2000 towards the cost of a new car.

9A The new cars were generally more efficient than the old scrapped cars.

A more efficient car . . .

1 pollutes the atmosphere more than a less efficient car.

2 has a bigger engine than a less efficient car.

3 travels faster than a less efficient car.

4 uses less fuel per kilometre than a less efficient car.

9B Another benefit of the car scrappage scheme was that the new cars produced less carbon dioxide (CO_2) per kilometre than the scrapped cars.

Carbon dioxide is a . . .

1 greenhouse gas and contributes to the ozone layer.

2 greenhouse gas and contributes to global warming.

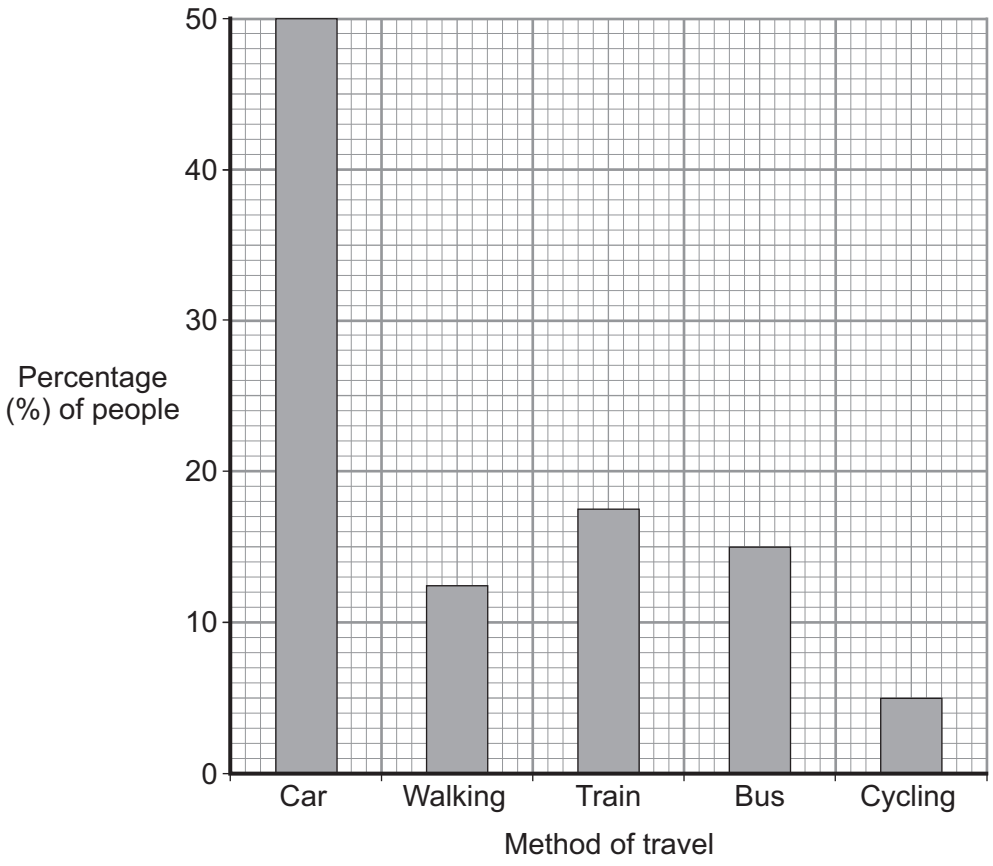
3 radioactive gas and contributes to acid rain.

4 radioactive gas and contributes to radioactive waste.

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People in the UK travel to work by different methods.

The bar chart shows the percentage of people using each method.



9C The data has been shown as a bar chart.

It could also have been shown as a . . .

1 pie chart.

2 Sankey diagram.

3 scattergram.

4 straight line graph.

9D What percentage of people in the UK use a method of travel to work that does **not** contribute to global warming?

1 5.0 %

2 12.5 %

3 17.5 %

4 82.5 %

END OF TEST

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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

Power stations involve energy transfers.

Match power stations, **A**, **B**, **C** and **D**, with the useful energy transfers **1**–**4** in the table.

A coal-fired

B geothermal

C hydroelectric

D wind farm

1	chemical → heat (thermal energy) → kinetic → electrical
2	gravitational potential → kinetic → electrical
3	heat (thermal energy) → kinetic → electrical
4	kinetic → electrical

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QUESTION TWO

This question is about the advantages and disadvantages of different energy resources that can be used to produce electricity.

Match words, **A**, **B**, **C** and **D**, with the advantages and disadvantages **1**–**4** in the table.

A coal

B nuclear

C tides

D wind

	Advantage	Disadvantage
1	no polluting gases produced	unpredictable supply of energy
2	no polluting gases produced	radioactive waste produced
3	plentiful supply of fuel	produces acid rain
4	no fuel needed	may destroy habitats of wading birds

Turn over for the next question

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Section Two

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

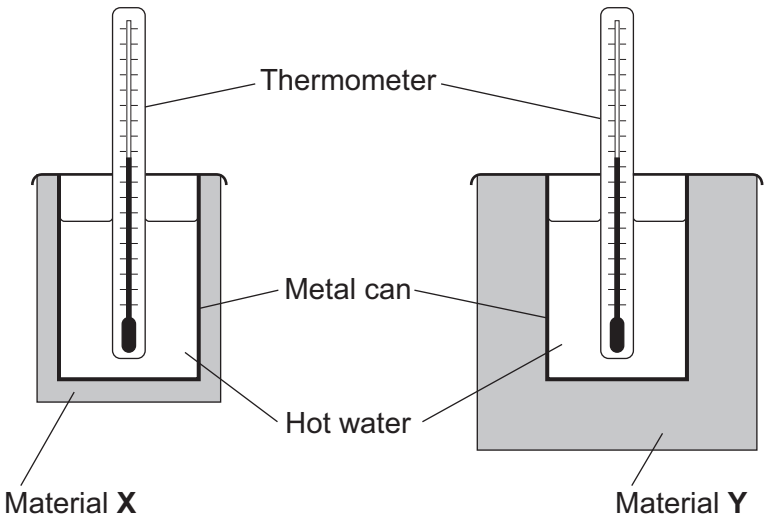
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

A student compared the insulating properties of two different materials, **X** and **Y.** She set up the apparatus as shown below. She filled each can with hot water.



She measured the temperature of the water in each can at the start and again after 10 minutes.

These are the results.

	Starting temperature of the water	**Temperature of the water after 10 minutes**
Can insulated by material **X**	95 °C	78 °C
Can insulated by material **Y**	95 °C	85 °C

3A The test was **not** fair because she used . . .

1 the same amount of water.

2 the same starting temperature.

3 different thicknesses of material.

4 identical cans.

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3B What was the average rate of temperature fall for the water in the can insulated by material **X**?

1 8.5 °C per minute

2 7.8 °C per minute

3 1.7 °C per minute

4 1.0 °C per minute

3C Which material is the better thermal insulator?

1 Material **X** because the temperature fall is smaller.

2 Material **Y** because the temperature fall is bigger.

3 We cannot say, because the results are not valid.

4 We cannot say, because the results are not precise enough.

3D Heat (thermal energy) passes through the walls of the can by . . .

1 conduction only.

2 convection only.

3 radiation only.

4 conduction and convection.

Turn over for the next question

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QUESTION FOUR

In 2009, the UK government introduced a car 'scrappage' scheme. The scheme was introduced to help car manufacturers. A person with a car that was at least 10 years old could scrap it and claim up to £2000 towards the cost of a new car.

4A The new cars were generally more efficient than the old scrapped cars.

A more efficient car . . .

1 pollutes the atmosphere more than a less efficient car.

2 has a bigger engine than a less efficient car.

3 travels faster than a less efficient car.

4 uses less fuel per kilometre than a less efficient car.

4B Another benefit of the car scrappage scheme was that the new cars produced less carbon dioxide (CO_2) per kilometre than the scrapped cars.

Carbon dioxide is a . . .

1 greenhouse gas and contributes to the ozone layer.

2 greenhouse gas and contributes to global warming.

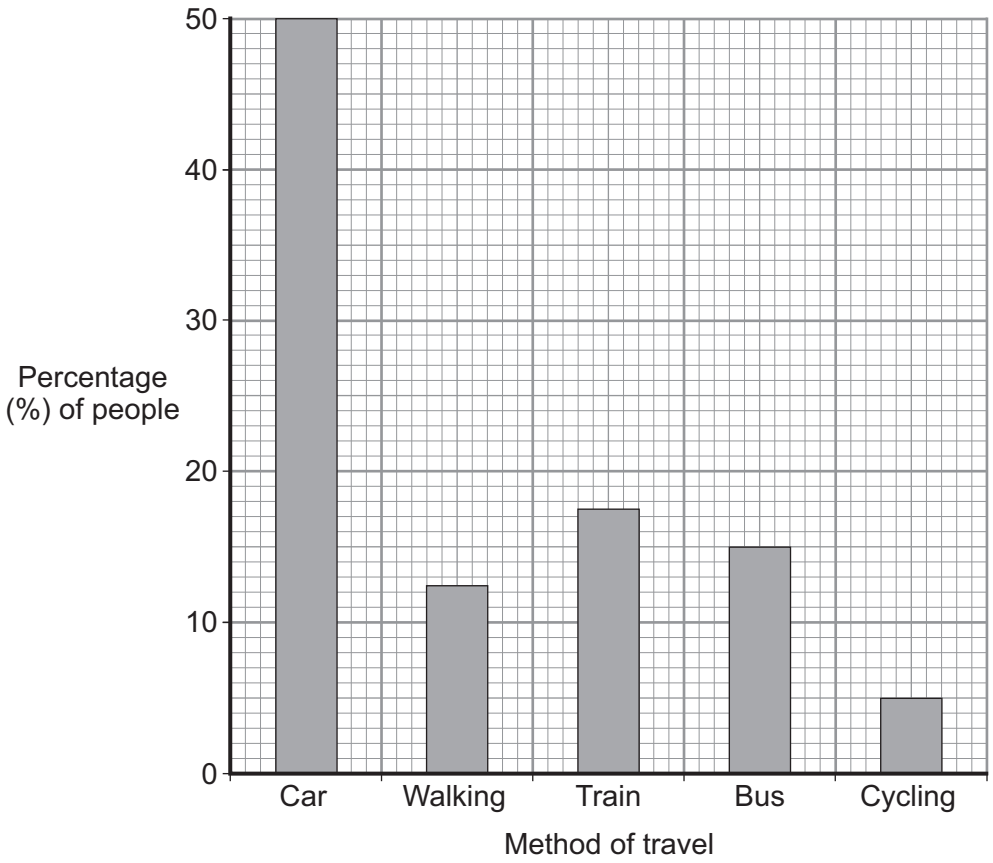
3 radioactive gas and contributes to acid rain.

4 radioactive gas and contributes to radioactive waste.

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People in the UK travel to work by different methods.

The bar chart shows the percentage of people using each method.



4C The data has been shown as a bar chart.

It could also have been shown as a . . .

1 pie chart.

2 Sankey diagram.

3 scattergram.

4 straight line graph.

4D What percentage of people in the UK use a method of travel to work that does **not** contribute to global warming?

1 5.0 %

2 12.5 %

3 17.5 %

4 82.5 %

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QUESTION FIVE

Offshore wind farms are used to generate electricity.

5A What is the main form of wasted energy in a wind turbine?

1 electrical

2 heat (thermal energy)

3 kinetic

4 light

5B A single wind turbine supplying 360 kW of electricity can power 300 homes.

What is the average power consumption per home?

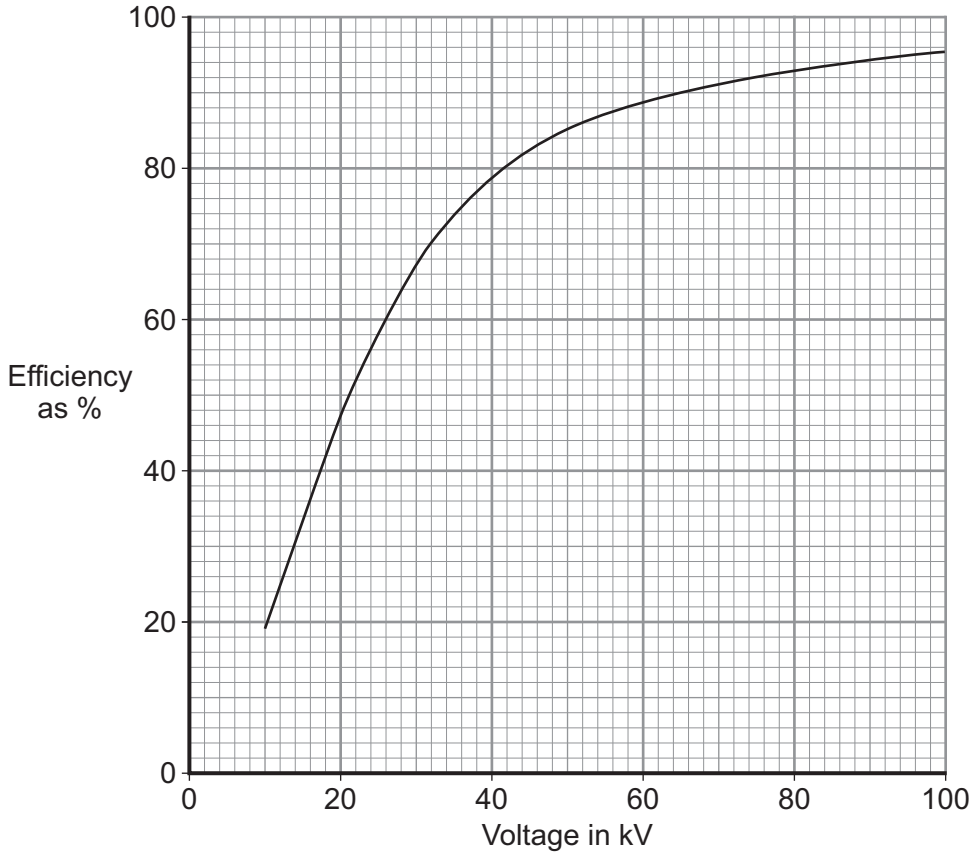
1 108 watts

2 120 watts

3 1080 watts

4 1200 watts

5C Cables under the sea are used to transmit electricity from offshore wind farms to the mainland. The graph shows how the efficiency of the transmission depends on the voltage.



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What is the efficiency at 32 kilovolts?

1 14 %

2 32 %

3 65 %

4 70 %

5D On the mainland, electricity is transmitted using the National Grid.
A power station supplies 1500 MJ of energy each second to the National Grid.
The efficiency of the National Grid is 0.9.

How much energy is received each second by consumers?

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

1 135 MJ

2 249 MJ

3 1350 MJ

4 1485 MJ

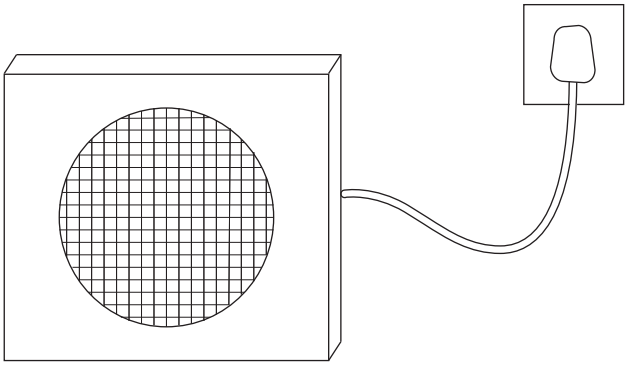
Turn over for the next question

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QUESTION SIX

The picture shows part of a leaflet about the 'Ceramic heater'.

Ceramic Heater

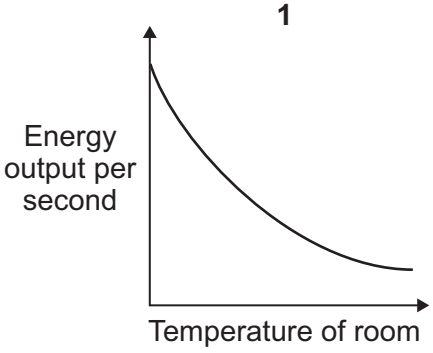


The ceramic heater is a new type of heater. Although smaller than nearly all other domestic heaters, it is very efficient, economical and safe. It can heat a room in minutes.

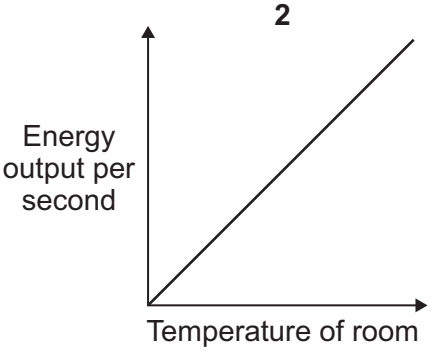
It works by using a powerful fan to pull air through a ceramic heating element. This heating element automatically reduces its power output as the temperature increases. The ceramic heater has a **maximum** energy output of 1000 joules per second.

6A Which graph shows how the energy output from the *Ceramic heater* varies with the temperature of the room?

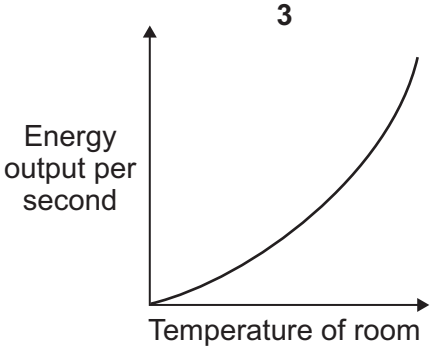
1



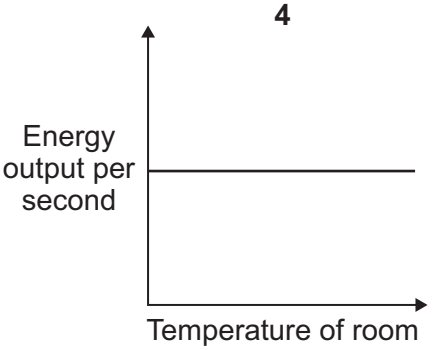
2



3



4



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6B In five hours, the *Ceramic heater* transfers 3.8 kWh of electrical energy to heat (thermal energy).

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

During this time, the average power output of the *Ceramic heater* is . . .

1 240 W

2 480 W

3 380 W

4 760 W

6C The air in the room is heated mainly by convection.

Which row of the table correctly shows what happens to the air in the room as it is being heated?

	Density of air	**Movement of air**
1	decreases	falls
2	increases	rises
3	decreases	rises
4	increases	falls

6D Heat (thermal energy) is transferred through the metal casing of the heater.

Metals are good thermal conductors because they have . . .

1 free electrons that can move through the metal.

2 atoms that can move through the metal.

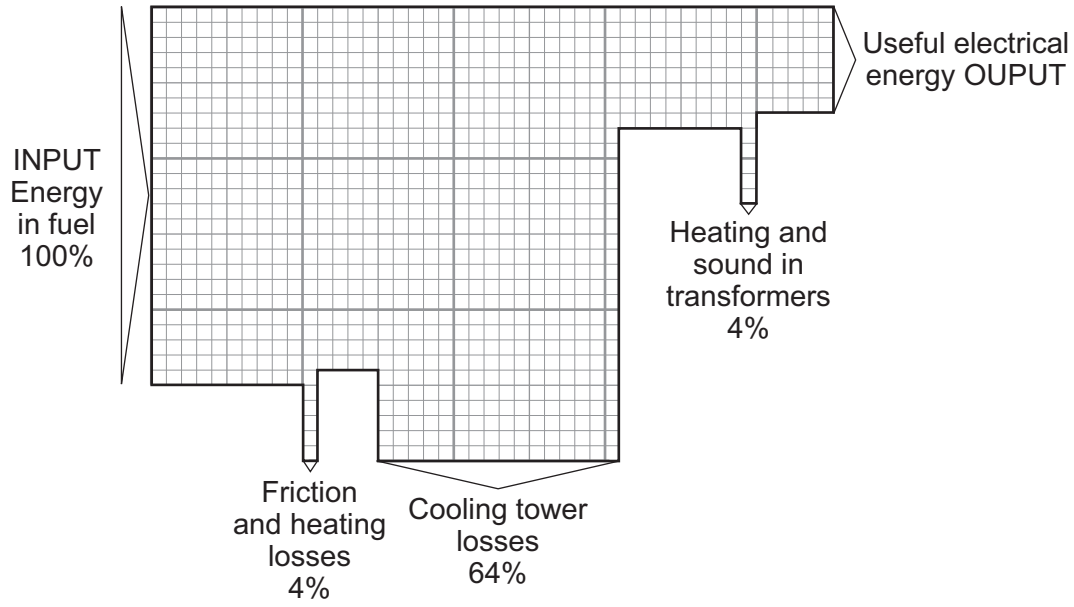
3 ions that can move through the metal.

4 particles that are far apart.

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QUESTION SEVEN

The Sankey diagram shows the energy changes in a coal-fired power station.



7A What is the efficiency of this power station as a producer of electrical energy?

1 0.28

2 0.32

3 0.68

4 0.72

7B The cooling tower energy losses are mainly in the form of heat (thermal energy).

The energy transferred from the cooling tower is no longer useful because . . .

1 the energy is highly concentrated, making it difficult to control.

2 the energy cannot be transformed into any other type of energy.

3 the energy becomes spread out and more difficult to transform to other forms.

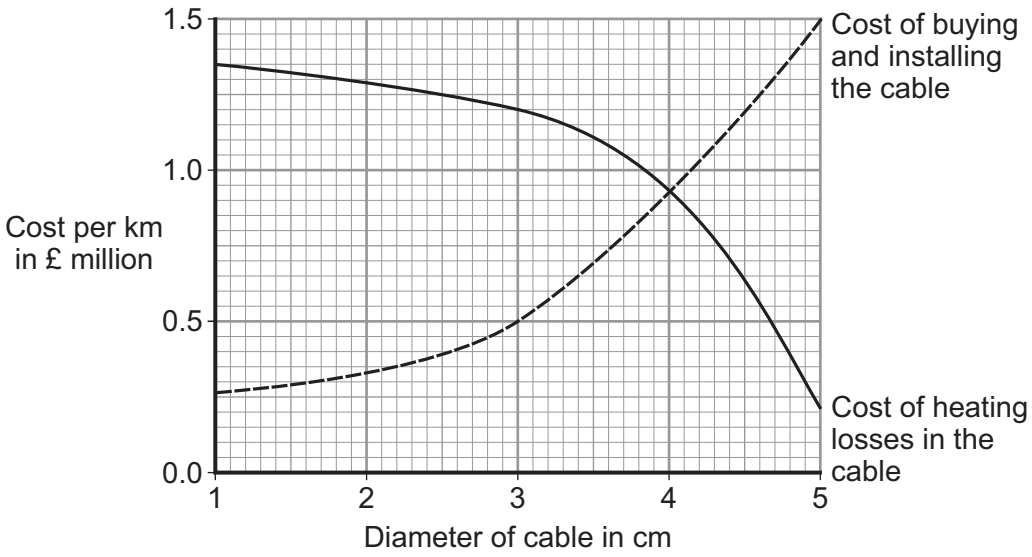
4 the energy causes global warming and climate change.

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After the electricity has been generated, it is sent along overhead cables. When deciding on how thick these cables should be, two costs have to be considered:

- the cost of buying and installing the cable
- the cost of the energy lost because the cable heats up when the electric current passes through it.

The graph shows how these two costs vary with the thickness of the cable.



7C What is the total cost per km if a cable of diameter 3 cm is used?

1 £0.5 million

2 £0.7 million

3 £1.2 million

4 £1.7 million

7D To keep energy losses in the cable to a minimum, electricity is transmitted at . . .

1 high current, high voltage.

2 high current, low voltage.

3 low current, high voltage.

4 low current, low voltage.

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QUESTION EIGHT

The table gives information for two types of lamp. Both lamps have the same maximum brightness.

	Filament lamp	Energy-saving lamp
Power rating	100 W	20 W
Lifetime	1000 hours	15 000 hours
Cost to buy	50 p	£3.00

Electricity costs 15 p per kWh

8A Each lamp is used for 500 hours per year.

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

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

How much does it cost to use the lamps for a year?

	Filament lamp	Energy-saving lamp
1	£7.50	£1.50
2	£15.00	£3.00
3	£7.50	£4.50
4	£50.00	£10.00

8B A filament lamp is used for its lifetime.

How much money could have been saved over this time if an energy-saving lamp had been bought and used instead of a filament lamp?

1 £9.00

2 £9.50

3 £12.00

4 £12.50

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8C Filament lamps reach maximum brightness almost immediately after switching on. Energy-saving lamps can take several minutes to reach maximum brightness after switching on.

In which one of the following applications could an energy saving lamp be a suitable replacement for a filament lamp?

1 traffic lights

2 emergency lighting

3 car headlights

4 shop lighting

8D The UK government has recently banned the manufacture of tungsten filament lamps.

This is because tungsten filament lamps . . .

1 cannot use green electricity from renewable sources.

2 cost too much to produce.

3 produce too much light pollution.

4 waste too much energy.

Turn over for the next question

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QUESTION NINE

This question is about different ways of generating electricity.

9A The table gives data for the cost of generating electricity in different types of power station.

Type of power station	Building and operating costs in pence per kWh	Fuel costs in pence per kWh	Total cost in pence per kWh
Coal	1.3	1.2	2.5
Gas	0.7	1.5	2.2
Woodchip	5.9	0.8	6.7
Nuclear	1.8	0.4	2.2
Wave	6.6	0.0	6.6
Wind	3.7	0.0	3.7

Which one of the following is correct?

1 Electricity generated from fossil fuels is always the cheapest.

2 The fuel cost for all renewable sources is zero.

3 The most expensive electricity comes from renewable sources.

4 Wind power stations produce the cheapest electricity.

9B The total cost per kilowatt-hour of electricity from a wind-powered station is more than the total cost of electricity per kilowatt-hour from a gas-powered station.

By what percentage would the **fuel** cost of gas have to increase to make the **total** costs the same?

1 15 %

2 41 %

3 68 %

4 100 %

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9C Fossil fuel power stations release polluting gases into the atmosphere. The government has suggested a carbon tax because of this. This tax would add 0.8 p/kWh to coal prices and 0.4 p/kWh to gas prices.

Which type of power station would produce the cheapest electricity if a carbon tax was added?

1 coal

2 gas

3 nuclear

4 wind

9D The table shows that electricity produced from the wind costs more than electricity produced by nuclear power stations.

This is an unfair comparison because . . .

1 each wind turbine has a low output so hundreds of turbines are needed to produce as much electricity as a nuclear power station.

2 wind farms are usually built on high ground or offshore and are unsightly and noisy.

3 nuclear power stations have high decommissioning costs compared to those of a wind farm.

4 wind farms have high operating costs due to the high cost of maintaining a large number of turbines.

END OF TEST

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GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2012 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

June 2012

Foundation Tier

Question			Key
One	**A**	conduction	**1**
	B	convection	**3**
	C	insulation	**4**
	D	radiation	**2**
Two	**A**	kinetic	**1**
	B	light	**4**
	C	sound	**2**
	D	thermal	**3**
Three	**A**	boiler	**1**
	B	generator	**3**
	C	transformer	**4**
	D	turbine	**2**
Four	**A**	5	**1**
	B	27	**4**
	C	340	**3**
	D	540	**2**
Five	**A**	coal-fired	**1**
	B	geothermal	**3**
	C	hydroelectric	**2**
	D	wind farm	**4**

	A	**B**	**C**	**D**
Six	**4**	**3**	**1**	**3**
Seven	**4**	**1**	**2**	**2**
Eight	**3**	**3**	**3**	**1**
Nine	**4**	**2**	**1**	**3**

GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

June 2012

Higher Tier

Question	Key		
One	**A**	coal-fired	**1**
	B	geothermal	**3**
	C	hydroelectric	**2**
	D	wind farm	**4**
Two	**A**	coal	**3**
	B	nuclear	**2**
	C	tides	**4**
	D	wind	**1**

	A	B	C	D
Three	**3**	**3**	**3**	**1**
Four	**4**	**2**	**1**	**3**
Five	**2**	**4**	**4**	**3**
Six	**1**	**4**	**3**	**1**
Seven	**1**	**3**	**4**	**3**
Eight	**1**	**2**	**4**	**4**
Nine	**3**	**4**	**3**	**3**

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M12

22-JUN-12

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	coal-fired	○	○	○	○
1B	geothermal	○	○	○	○
1C	hydroelectric	○	○	○	○
1D	wind farm	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	coal	○	○	○	○
2B	nuclear	○	○	○	○
2C	tides	○	○	○	○
2D	wind	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	conduction	○	○	○	○
1B	convection	○	○	○	○
1C	insulation	○	○	○	○
1D	radiation	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	kinetic	○	○	○	○
2B	light	○	○	○	○
2C	sound	○	○	○	○
2D	thermal	○	○	○	○

QUESTION THREE

		1	2	3	4
3A	boiler	○	○	○	○
3B	generator	○	○	○	○
3C	transformer	○	○	○	○
3D	turbine	○	○	○	○

QUESTION FOUR

		1	2	3	4
4A	5	○	○	○	○
4B	27	○	○	○	○
4C	340	○	○	○	○
4D	540	○	○	○	○

QUESTION FIVE

		1	2	3	4
5A	coal-fired	○	○	○	○
5B	geothermal	○	○	○	○
5C	hydroelectric	○	○	○	○
5D	wind farm	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
March 2012

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Thursday 1 March 2012 Morning Session

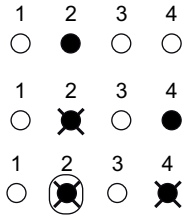
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 16 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

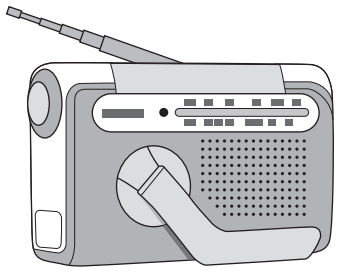
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a clockwork radio.



Turning the handle winds up a spring. When the spring unwinds, it turns a small generator.

The generator provides the energy to operate the radio.

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

A elastic potential (strain)

B electrical

C kinetic

D sound

When the spring is wound up, energy is stored as . . . **1** . . . energy.

When the spring unwinds, the stored energy is transformed into . . . **2** . . . energy.

As the generator turns, it produces . . . **3** . . . energy.

The loudspeaker in the radio gives out . . . **4** . . . energy.

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QUESTION TWO

Different power stations use different energy sources.

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

A gas-fired power stations

B nuclear power stations

C oil-fired power stations

D wood-burning power stations

A liquid fossil fuel is used in . . . **1** . . . .

A renewable fuel is used in . . . . **2** . . . .

The smallest contribution to global warming is made by . . . **3** . . . .

The shortest start-up time is for . . . **4** . . . .

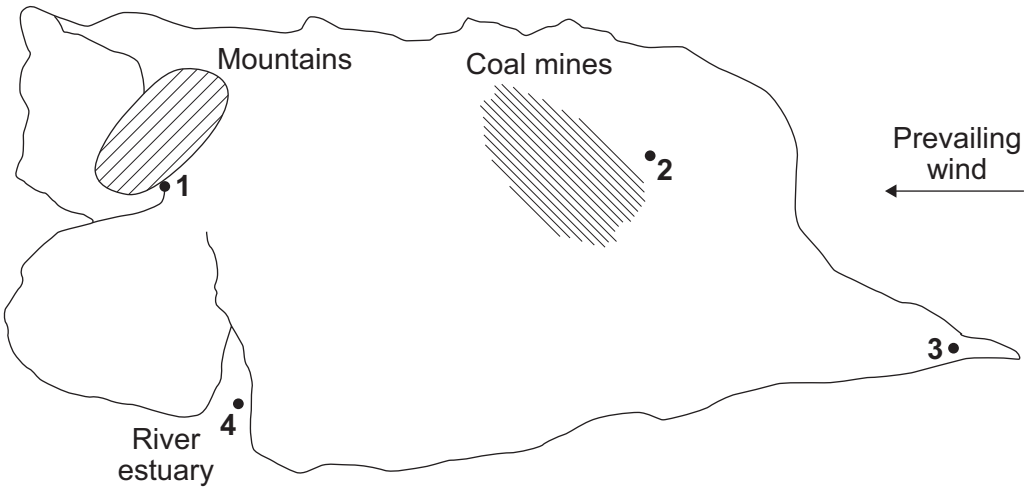
Turn over for the next question

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QUESTION THREE

The map shows some features of a large island.

It also shows four places, **1**, **2**, **3** and **4**, where electricity could be generated.



Match energy sources, **A**, **B**, **C** and **D**, with the labels **1**–**4** on the map.

A falling water (hydroelectric)

B fossil fuel

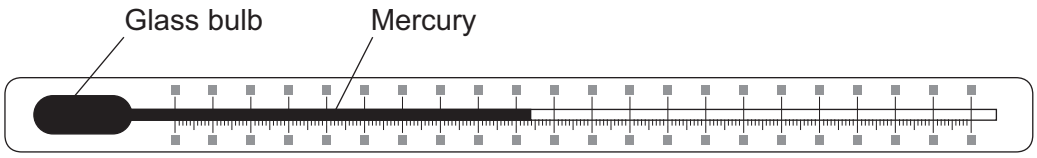
C tides

D wind

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QUESTION FOUR

The diagram shows a mercury-in-glass thermometer. It is used to measure the temperature at different places in a room.



Match words, **A**, **B**, **C**, and **D**, with the numbers **1**–**4** in the sentences about thermal energy (heat).

A conductor

B convector

C insulator

D radiator

Mercury is a metal, so it is a good . . . **1** . . . .

The temperature may be different at different places in the room because air is a good . . . **2** . . . .

The shiny surface of the mercury makes it a poor . . . **3** . . . .

The glass bulb must be made very thin because glass is a good . . . **4** . . . .

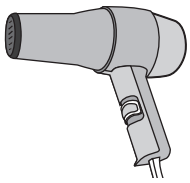
Turn over for the next question

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QUESTION FIVE

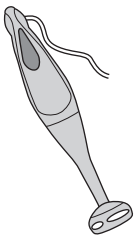
The diagrams show four electrical appliances. Each appliance is designed to produce useful energy but some energy is wasted.

A



Hairdryer

B



Hand whisk

C

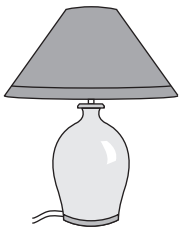
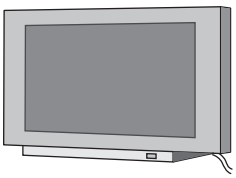


Table lamp

D



Television

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

	Designed to produce . . .	**Also produces wasted . . .**
1	thermal energy (heat) and kinetic energy	sound energy
2	kinetic energy	sound energy and thermal energy (heat)
3	light energy	thermal energy (heat)
4	light energy and sound energy	thermal energy (heat)

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Turn over for the next question

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Section Two

Questions **SIX** to **NINE**.

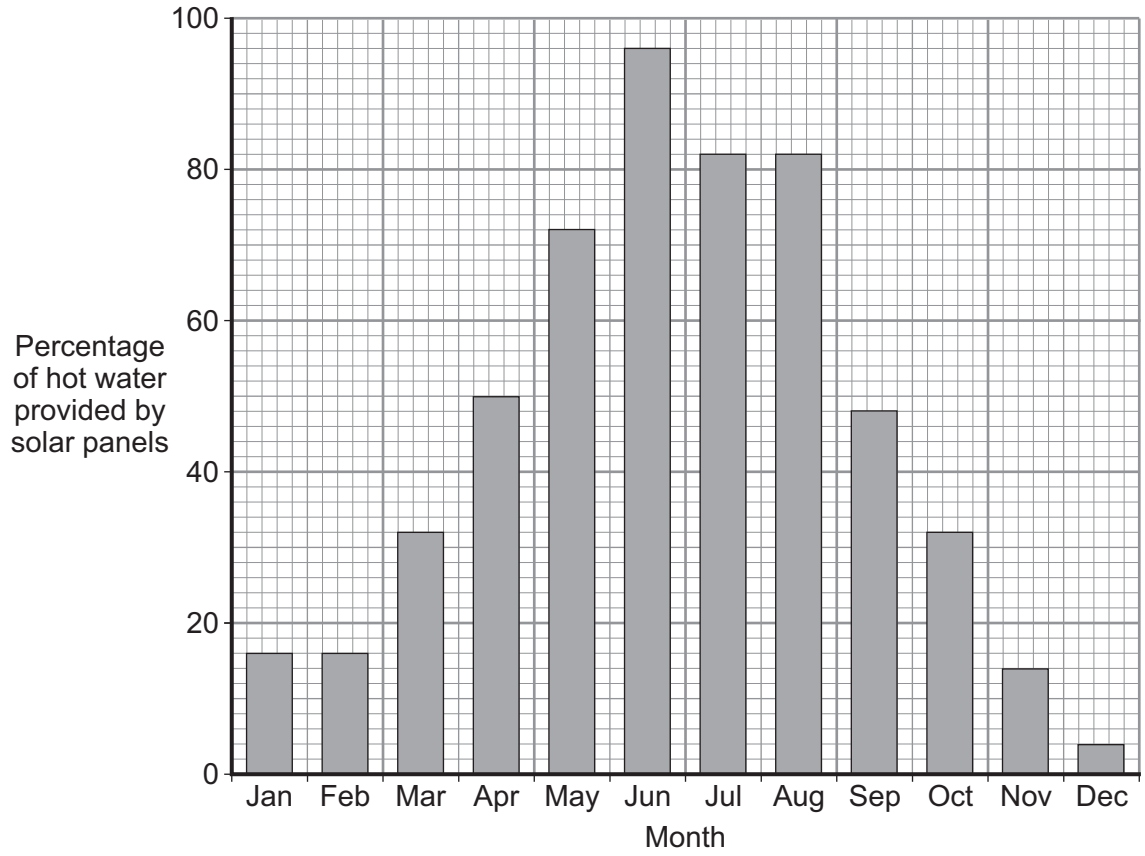
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

Manufacturers claim that 60 % of a household's annual hot water can be provided by solar panels. The graph shows the typical percentages of hot water provided by solar panels throughout the year.



6A The data is shown as a bar chart.

This is because one of the variables is . . .

1 a control variable.

2 a categoric variable.

3 a dependent variable.

4 an independent variable.

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6B In which month do the solar panels provide the lowest percentage of hot water?

1 January

2 February

3 June

4 December

6C What is the highest percentage (%) of hot water provided by the solar panels in any month?

1 60

2 72

3 96

4 100

6D One type of solar panel transfers 80 J of energy to heat the water from every 200 J of energy that falls on it.

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

What is the efficiency of this solar panel?

1 0.4

2 0.8

3 2.5

4 120

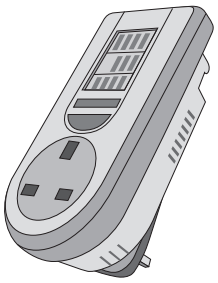
Turn over for the next question

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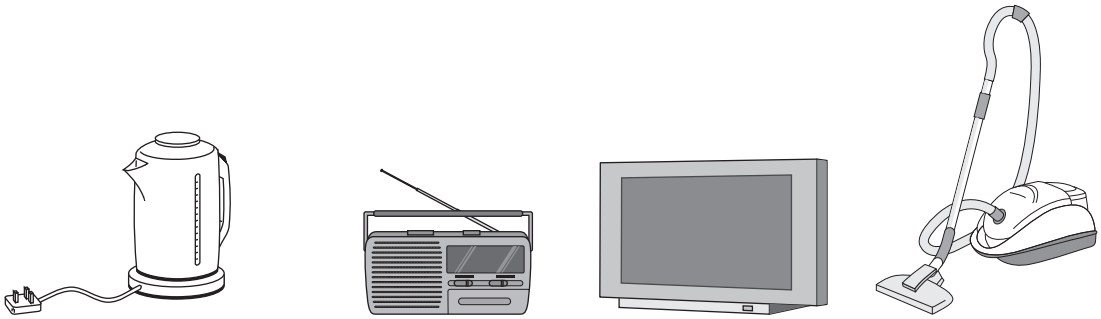
QUESTION SEVEN

The diagram shows a device for measuring the electrical energy used by domestic appliances.

The device is plugged into an electrical socket. The domestic appliance is then plugged into the device.



7A The diagrams show some domestic appliances.



Kettle
2 kW

Radio
6 W

Television
200 W

Vacuum cleaner
0.1 kW

Which appliance will use the most electrical energy when switched on for 5 minutes?

1 kettle

2 radio

3 television

4 vacuum cleaner

7B The device can also show the cost of electricity used by a domestic appliance.

The user must enter some information into the device.

What information needs to be entered?

1 the current that the appliance uses

2 the length of time for which the appliance is connected

3 the mains voltage that is being used

4 the cost of one unit of electrical energy

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7C The kettle uses 8 kWh of electrical energy in one week.

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

1 kWh of electrical energy costs 16 p.

What is the cost of this electrical energy?

1 20 p

2 12.8 p

3 £1.28

4 £20

7D It is important that we should use less electrical energy because . . .

1 electrical energy will run out in the future.

2 generating electricity can pollute the environment.

3 waste electrical energy can cause electric shocks.

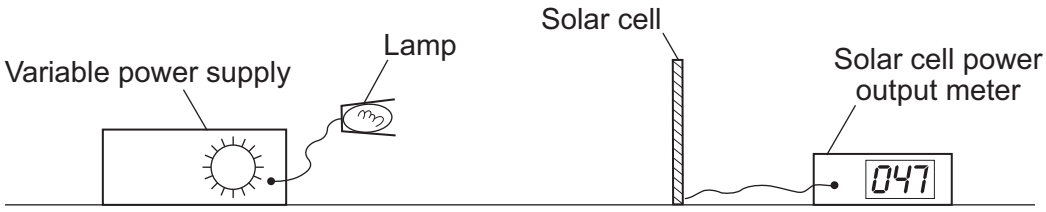
4 we can store electrical energy for future use.

Turn over for the next question

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QUESTION EIGHT

A scientist measured the electrical power output from a solar cell as the intensity of light falling on it changed. The intensity was changed using a variable power supply. The investigation was carried out in a darkened room.



8A Which row in the table is a correct description of the variables?

	Independent variable	Dependent variable
1	intensity of light	power output from solar cell
2	power output from solar cell	intensity of light
3	distance from lamp to solar cell	power output from solar cell
4	intensity of light	distance from lamp to solar cell

8B The control variable was the distance from the . . .

1 power supply to the lamp.

2 power supply to the solar cell.

3 lamp to the solar cell.

4 solar cell to the solar cell power output meter.

8C The distance from the lamp to the solar cell was measured with a ruler. The scale on the ruler was divided into centimetres.

If the scale on the ruler had been divided into millimetres instead of centimetres, the measurement of the distance would have been more . . .

1 precise.

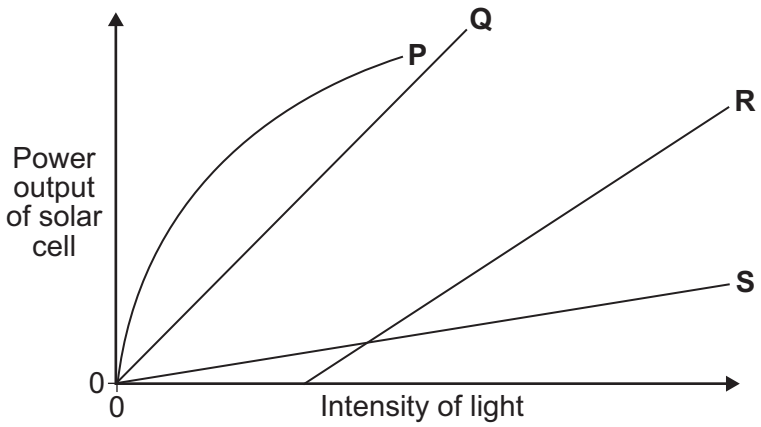
2 reliable.

3 valid.

4 variable.

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8D Four different solar cells, **P**, **Q**, **R** and **S**, were investigated using the apparatus. The results of the investigations are shown in the graph.



Which solar cell does **not** give a power output in low light intensity?

1 **P**

2 **Q**

3 **R**

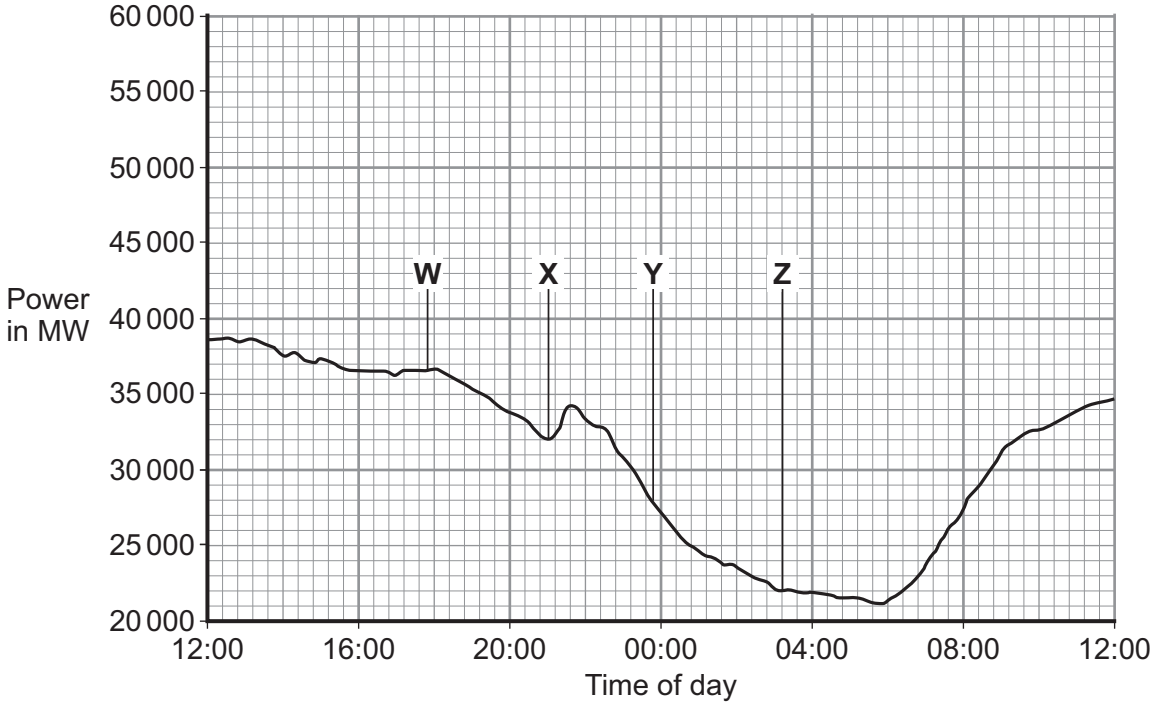
4 **S**

Turn over for the next question

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QUESTION NINE

The graph shows how the electrical power supplied by the National Grid varied during one day.



9A At one point, a World Cup football match on the television finished. Millions of people switched on their electric kettles to make a cup of tea.

Which point on the graph shows the time at which the kettles were switched on?

1 **W**

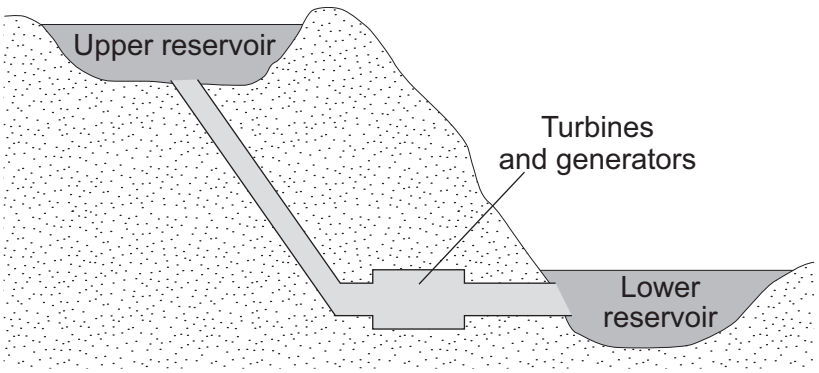
2 **X**

3 **Y**

4 **Z**

9B The National Grid has to be able to cope with sudden surges in demand. One way of doing this is to use a pumped storage system.

The diagram shows a pumped storage system.



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During times of low demand, electricity is used to pump water up from the lower reservoir to the upper reservoir.

At which point on the graph is this most likely to be happening?

1 **W**

2 **X**

3 **Y**

4 **Z**

9C Electrical energy cannot be stored directly in large quantities.

In what form is energy stored in the pumped storage system?

1 chemical

2 gravitational potential

3 kinetic

4 thermal

9D Which row in the table shows a correct advantage **and** a correct disadvantage of a pumped storage system?

	Advantage	**Disadvantage**
1	short start-up time	can lead to loss of habitat for wildlife
2	no fossil fuels are used	long start-up time
3	short start-up time	fuel costs are very high
4	no fossil fuels are used	fuel costs are very high

END OF TEST

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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**.

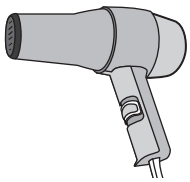
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

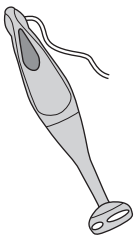
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A



Hairdryer

B



Hand whisk

C

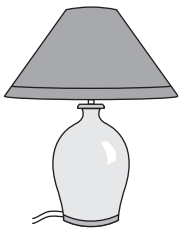
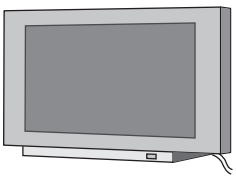


Table lamp

D



Television

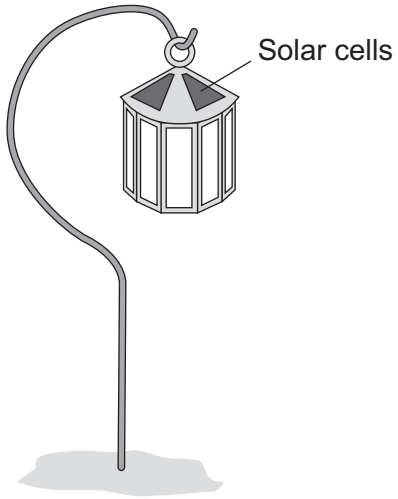
Match appliances, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the table.

	Designed to produce . . .	**Also produces wasted . . .**
1	thermal energy (heat) and kinetic energy	sound energy
2	kinetic energy	sound energy and thermal energy (heat)
3	light energy	thermal energy (heat)
4	light energy and sound energy	thermal energy (heat)

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QUESTION TWO

A garden light has panels of solar cells that collect energy from the Sun. The energy is transformed for storage in rechargeable batteries. The stored energy is used to power the lamp when it is dark.



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

A chemical energy to electrical energy

B electrical energy to chemical energy

C electrical energy to light energy

D light energy to electrical energy

	Where and when the transformation takes place
1	in the batteries during darkness
2	in the batteries during daylight
3	in the lamp during darkness
4	in the solar cells during daylight

Turn over ▶

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Section Two

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

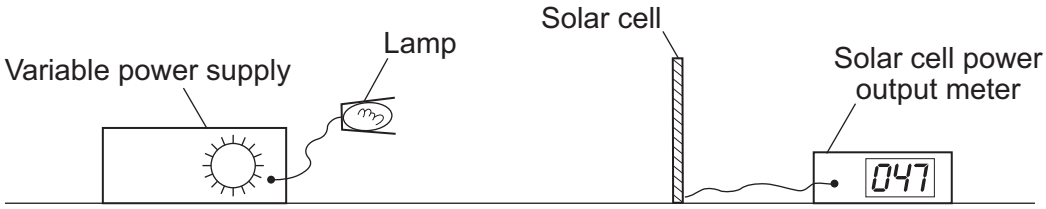
Each of these questions has four parts.

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

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QUESTION THREE

A scientist measured the electrical power output from a solar cell as the intensity of light falling on it changed. The intensity was changed using a variable power supply. The investigation was carried out in a darkened room.



3A Which row in the table is a correct description of the variables?

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3C The distance from the lamp to the solar cell was measured with a ruler. The scale on the ruler was divided into centimetres.

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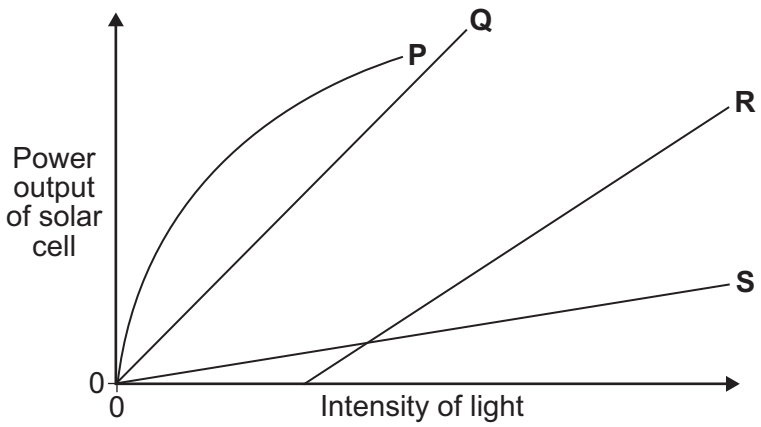
1 precise.

2 reliable.

3 valid.

4 variable.

3D Four different solar cells, **P**, **Q**, **R** and **S**, were investigated using the apparatus. The results of the investigations are shown in the graph.



Which solar cell does **not** give a power output in low light intensity?

1 **P**

2 **Q**

3 **R**

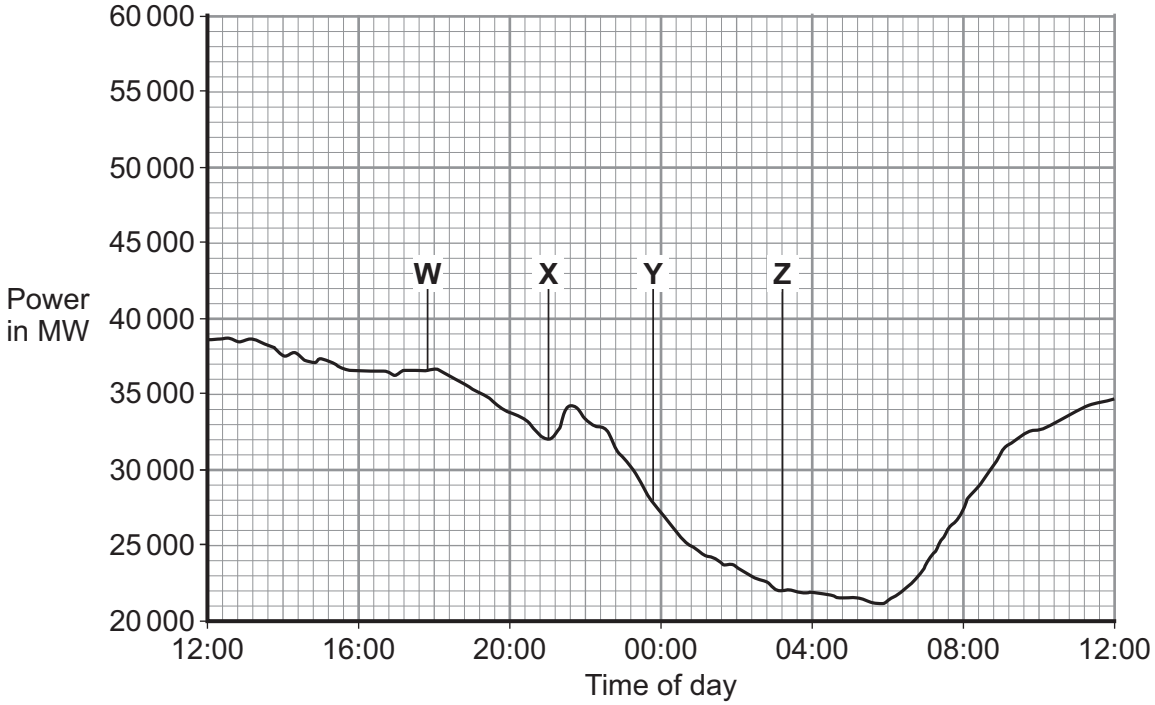
4 **S**

Turn over for the next question

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QUESTION FOUR

The graph shows how the electrical power supplied by the National Grid varied during one day.



4A At one point, a World Cup football match on the television finished. Millions of people switched on their electric kettles to make a cup of tea.

Which point on the graph shows the time at which the kettles were switched on?

1 **W**

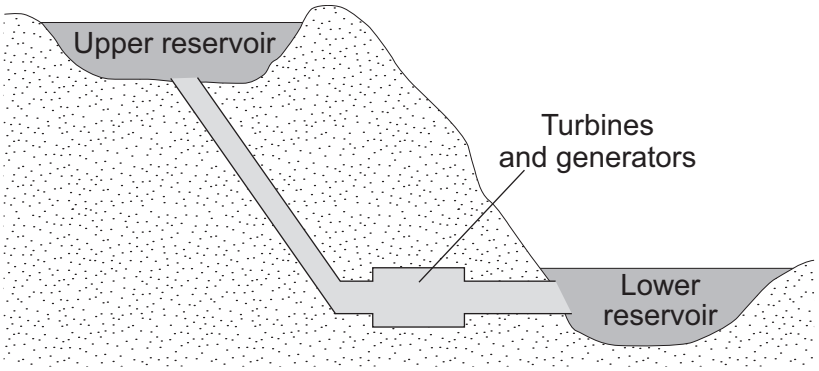
2 **X**

3 **Y**

4 **Z**

4B The National Grid has to be able to cope with sudden surges in demand. One way of doing this is to use a pumped storage system.

The diagram shows a pumped storage system.



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During times of low demand, electricity is used to pump water up from the lower reservoir to the upper reservoir.

At which point on the graph is this most likely to be happening?

1 **W**

2 **X**

3 **Y**

4 **Z**

4C Electrical energy cannot be stored directly in large quantities.

In what form is energy stored in the pumped storage system?

1 chemical

2 gravitational potential

3 kinetic

4 thermal

4D Which row in the table shows a correct advantage **and** a correct disadvantage of a pumped storage system?

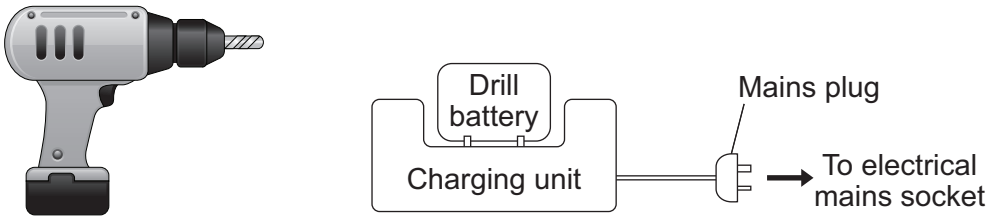
	Advantage	**Disadvantage**
1	short start-up time	can lead to loss of habitat for wildlife
2	no fossil fuels are used	long start-up time
3	short start-up time	fuel costs are very high
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Turn over for the next question

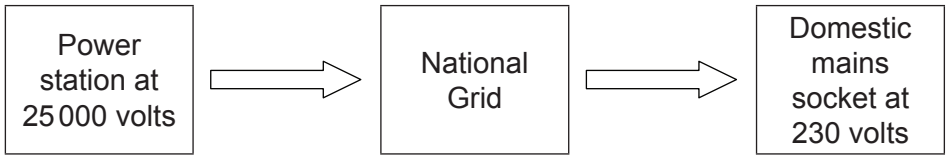
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QUESTION FIVE

The diagram shows a cordless drill. The drill is powered by a 24-volt battery, which must be charged before the drill can be used. The battery is plugged into a charging unit, and the charging unit is connected to an electrical mains socket. The mains voltage is 230 volts.



5A The flow diagram shows how electricity is delivered to the mains socket from a power station.



The process of getting electricity from the power station to a domestic mains socket involves . . .

1 step-up transformers only.

2 step-down transformers only.

3 step-up and step-down transformers.

4 no transformers.

5B A manufacturer makes several statements about a 24-volt cordless drill compared to a 230-volt mains-operated drill.

Which of the following statements about the cordless drill are true?

J It is safer because there are no trailing cables to trip over.

K There is less risk of severe electrical shock because it operates at a lower voltage and current.

L When charged, it can be used in remote locations where there is no electricity supply.

1 **J** and **K** only

2 **K** and **L** only

3 **J** and **L** only

4 **J**, **K** and **L**

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5C The drill can produce a maximum of 72 watts continuous power for 6 minutes before it starts to overheat.

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

The energy transferred by the drill during this time is . . .

1 0.0072 kWh

2 0.0432 kWh

3 7.2 kWh

4 432 kWh

5D A workman uses several different electrical tools to complete a job. The total cost of the electricity is 6.4 p.

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

1 kWh of electrical energy costs 16 p

How much electrical energy do the tools transfer?

1 0.25 kWh

2 0.40 kWh

3 2.50kWh

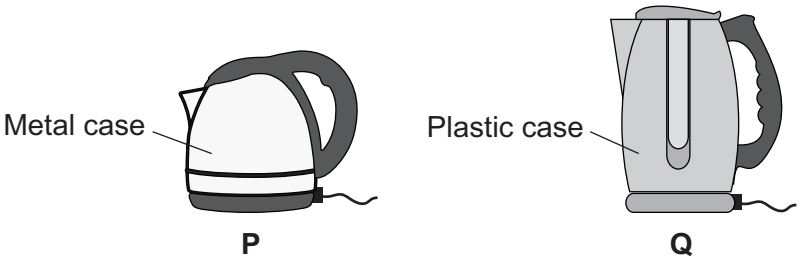
4 4.00kWh

Turn over for the next question

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QUESTION SIX

A student carried out a test to compare two kettles, **P** and **Q**. The kettles had the same power rating.



He heated one litre of water in each kettle until the water boiled.
Every 30 seconds, he measured:

- the total energy input to each kettle
- the temperature of the water.

These are the results for kettle **P**.

Time in s	0	30	60	90	120	150
Total energy input in kJ	0	45	90	135	180	225
Water temperature in °C	16	44	65	81	92	100

6A From these results, which of the following is directly proportional to the time?

1 total energy input

2 water temperature

3 both total energy input and water temperature

4 neither total energy input or water temperature

6B The water in kettle **Q** took a shorter time to boil than the water in kettle **P**.

This was because . . .

1 less energy was lost from kettle **Q**, making it less efficient than kettle **P**.

2 less energy was lost from kettle **Q**, making it more efficient than kettle **P**.

3 more energy was lost from kettle **Q**, making it less efficient than kettle **P**.

4 more energy was lost from kettle **Q**, making it more efficient than kettle **P**.

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6C In kettles, heat is transferred through the water by convection currents.

In convection, the water around the heating element . . .

1 contracts, becomes less dense and falls.

2 contracts, becomes more dense and rises.

3 expands, becomes less dense and falls.

4 expands, becomes less dense and rises.

6D The metal case is better than the plastic case at transferring thermal energy.

This is because . . .

1 convection currents are harder to set up in plastics than in metals.

2 there are free electrons in metals but not in plastics.

3 infra red radiation can pass through metals more easily than through plastics.

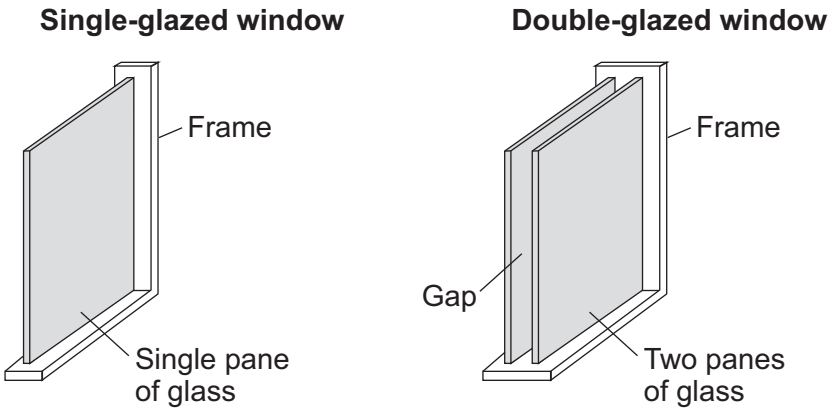
4 atoms can move more easily through metals than through plastics.

Turn over for the next question

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QUESTION SEVEN

The diagrams show two types of window.



7A A double-glazed window consists of two panes of glass with a gap between.

The gap between the two panes of glass helps to reduce the rate of heat loss by . . .

1 conduction and radiation.

2 conduction and convection.

3 convection and radiation.

4 conduction, convection and radiation.

7B The rate of heat loss from a double-glazed window depends on . . .

1 the area of the pane of glass only.

2 the thickness of glass only.

3 the width of the gap only.

4 all of the above.

7C The average rate of heat loss from a single-glazed window is 500 W.

Replacing this window with a double-glazed window reduces the average rate of heat loss to 300 W.

What is the percentage reduction in heat loss when this is done?

1 33 %

2 40 %

3 60 %

4 67 %

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7D The yearly energy bill for a house with single-glazed windows is £1200.

After being fitted with double-glazing, the yearly energy bill is reduced to £1000.

The cost of installing the double-glazing is £3600.

What is the payback time?

1 1.6 years

2 3.0 years

3 3.6 years

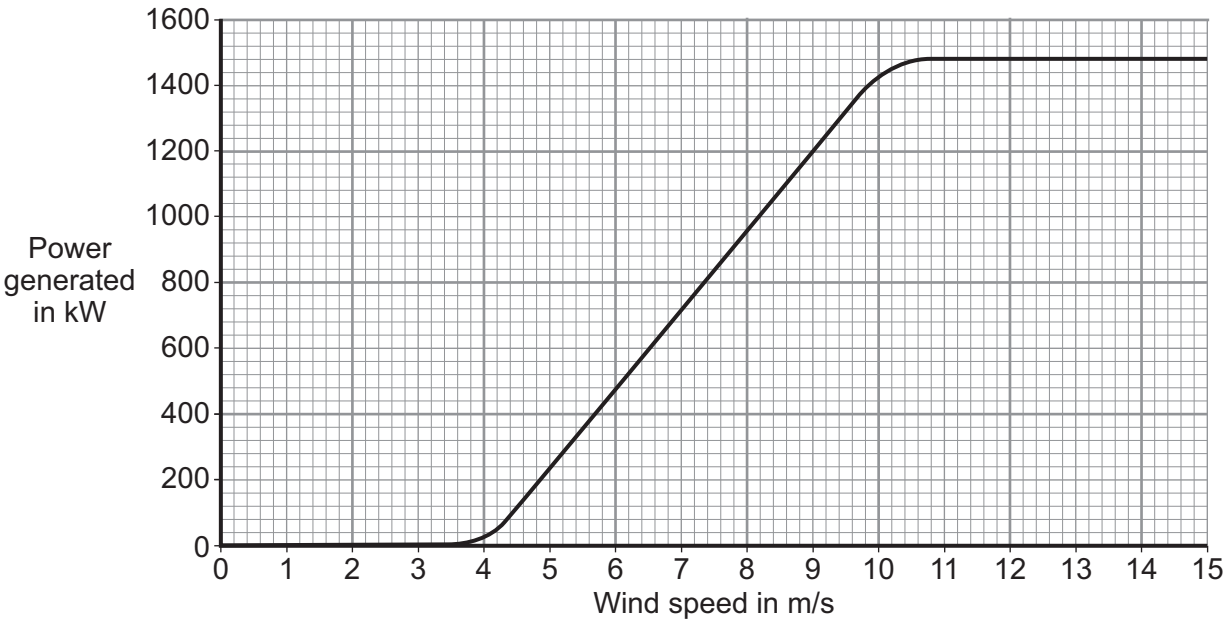
4 18 years

Turn over for the next question

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QUESTION EIGHT

The graph shows how the power generated by a wind turbine varies with wind speed.



8A The graph shows that . . .

1 the wind speed has a maximum value of 15 m/s.

2 the wind turbine shuts down at a wind speed of 15 m/s.

3 the wind speed has a minimum value of 3.5 m/s.

4 the wind turbine does not work at speeds below 3.5 m/s.

8B The wind turbine transfers 6000 kWh of energy in 5 hours.

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

What was the average wind speed?

1 6.4 m/s

2 9.0 m/s

3 10.5 m/s

4 15.0 m/s

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8C The Thanet Offshore wind farm was opened in 2010. It has 100 turbines, each 380 feet high. The wind farm cost £780 million to build. The scheme has many critics.

Which of the following statements is a legitimate criticism?

1 Wind-generated electricity now powers 3 million homes in the UK.

2 Wind farms use a renewable source and, when working, do not contribute to global warming.

3 Wind farms must be backed up by more reliable energy sources such as coal or nuclear.

4 In the next decade, it is expected that 30 % of the UK's electricity will be generated from wind.

8D A wind farm sends its electricity to the National Grid.

To transmit the electricity using the National Grid, with a minimum of energy loss, the electricity has to be transmitted at . . .

1 low voltage and low current.

2 low voltage and high current.

3 high voltage and low current.

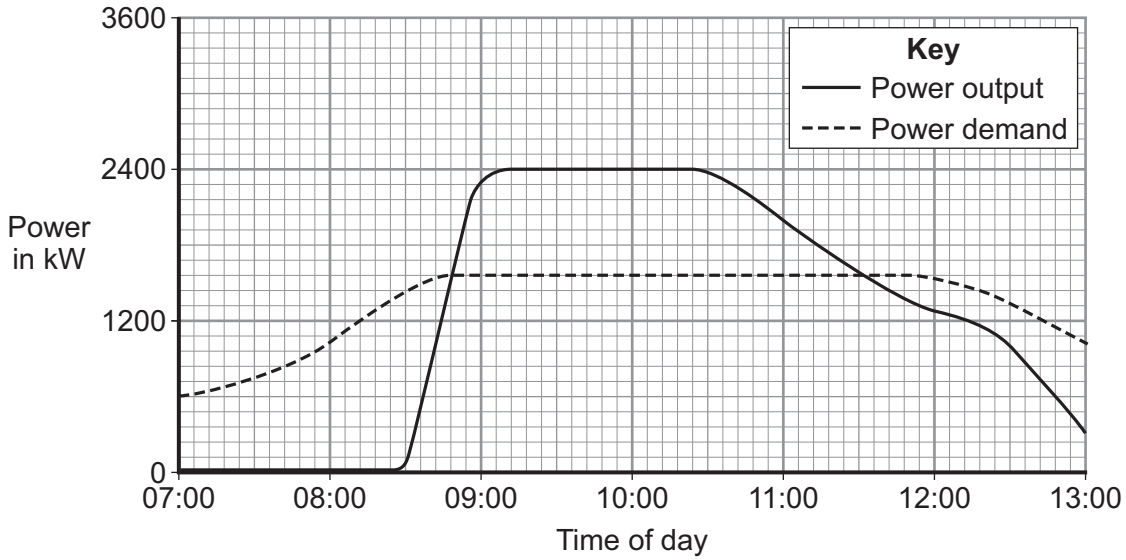
4 high voltage and high current.

Turn over for the next question

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QUESTION NINE

The graph shows how the power output of a tidal power station varies over a 6-hour period. It also shows the power demand.



9A For how many hours is the power demand greater than the power output?

1 1.30

2 2.75

3 3.25

4 6.00

9B The average power demand per house is 1200 watts.

What is the maximum number of houses that this tidal power station could supply at this level of demand?

1 500

2 1000

3 1500

4 2000

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9C Europe's only tidal power station is in France. This produces an average output of 2000 MWh of electricity per day.

1 MWh = 1 000 000 Wh

The maximum number of houses that can be supplied by this tidal power station is 25 000.

How much electricity does an average house use each day?

1 0.08 kWh

2 12.5 kWh

3 80 kWh

4 80 000 kWh

9D There are very few suitable sites in the UK for tidal power stations.

The difference in height between high tide and low tide must be . . .

1 big, so that the number of habitats of wading birds destroyed is kept to a minimum.

2 big, so that the gravitational potential energy stored at high tide is as large as possible.

3 small, so that the kinetic energy of the water flowing through the turbines is small.

4 small, so that the decommissioning costs are as low as possible.

END OF TEST

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There are no questions printed on this page

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GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2012 Examination – March Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2012

Foundation Tier

Question	Key		
One	**A**	elastic potential (strain)	**1**
	B	electrical	**3**
	C	kinetic	**2**
	D	sound	**4**
Two	**A**	gas-fired power stations	**4**
	B	nuclear power stations	**3**
	C	oil-fired power stations	**1**
	D	wood-burning power stations	**2**
Three	**A**	falling water (hydroelectric)	**1**
	B	fossil fuel	**2**
	C	tides	**4**
	D	wind	**3**
Four	**A**	conductor	**1**
	B	convector	**2**
	C	insulator	**4**
	D	radiator	**3**
Five	**A**	Hairdryer	**1**
	B	Hand whisk	**2**
	C	Table lamp	**3**
	D	Television	**4**

	A	**B**	**C**	**D**
Six	**2**	**4**	**3**	**1**
Seven	**1**	**4**	**3**	**2**
Eight	**1**	**3**	**1**	**3**
Nine	**2**	**4**	**2**	**1**

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2012

Higher Tier

Question	Key		
One	**A**	Hairdryer	**1**
	B	Hand whisk	**2**
	C	Table lamp	**3**
	D	Television	**4**
Two	**A**	chemical energy to electrical energy	**1**
	B	electrical energy to chemical energy	**2**
	C	electrical energy to light energy	**3**
	D	light energy to electrical energy	**4**

	A	B	C	D
Three	**1**	**3**	**1**	**3**
Four	**2**	**4**	**2**	**1**
Five	**3**	**4**	**1**	**2**
Six	**1**	**2**	**4**	**2**
Seven	**2**	**4**	**2**	**4**
Eight	**4**	**2**	**3**	**3**
Nine	**3**	**4**	**3**	**2**

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OTQ3

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 3G12

01-MAR-12

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Hairdryer	○	○	○	○
1B	Hand whisk	○	○	○	○
1C	Table lamp	○	○	○	○
1D	Television	○	○	○	○

QUESTION TWO		1	2	3	4
2A	chemical energy to electrical energy	○	○	○	○
2B	electrical energy to chemical energy	○	○	○	○
2C	electrical energy to light energy	○	○	○	○
2D	light energy to electrical energy	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A elastic potential (strain)	○	○	○	○
1B electrical	○	○	○	○
1C kinetic	○	○	○	○
1D sound	○	○	○	○

QUESTION TWO	1	2	3	4
2A gas-fired power stations	○	○	○	○
2B nuclear power stations	○	○	○	○
2C oil-fired power stations	○	○	○	○
2D wood-burning power stations	○	○	○	○

QUESTION THREE	1	2	3	4
3A falling water (hydroelectric)	○	○	○	○
3B fossil fuel	○	○	○	○
3C tides	○	○	○	○
3D wind	○	○	○	○

QUESTION FOUR	1	2	3	4
4A conductor	○	○	○	○
4B convector	○	○	○	○
4C insulator	○	○	○	○
4D radiator	○	○	○	○

QUESTION FIVE	1	2	3	4
5A Hairdryer	○	○	○	○
5B Hand whisk	○	○	○	○
5C Table lamp	○	○	○	○
5D Television	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2011

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Tuesday 15 November 2011 Morning Session

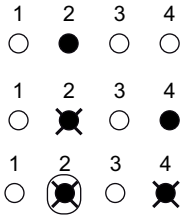
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 16 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

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

This question is about energy sources that are used to produce electricity.

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

A geothermal

B hydroelectric

C nuclear fuel

D wind

	Description
1	can be used only where there is a fast flow of water
2	is an unreliable energy source
3	uses heat produced under the ground
4	is a non-renewable energy source

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QUESTION TWO

A gym uses exercise bikes to generate electricity.



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

A chemical

B electrical

C heat (thermal energy)

D kinetic

The bike riders transform . . . **1** . . . energy from food into . . . **2** . . . energy of the pedals.

A generator produces . . . **3** . . . energy.

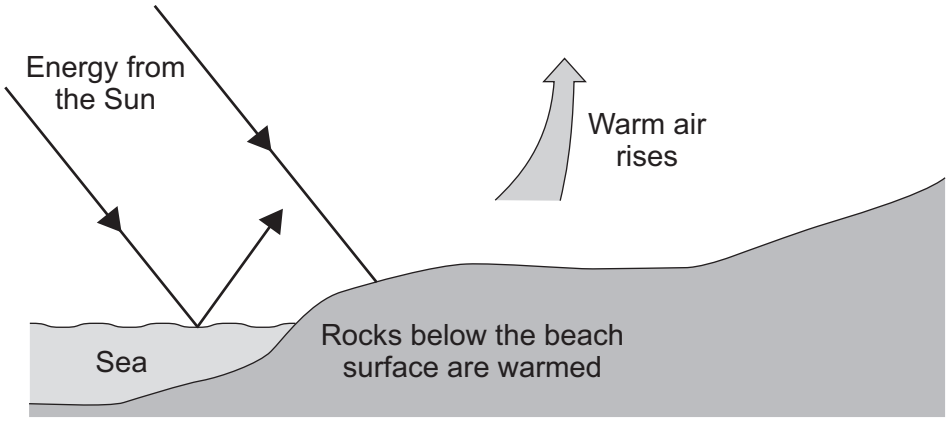
Some energy is wasted as . . . **4** . . . .

Turn over for the next question

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QUESTION THREE

The diagram shows some energy transfers at a warm sunny beach.



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

A conduction

B convection

C radiation

D reflection

Energy from the Sun is transferred through space by . . . **1** . . . .

Rocks below the beach surface are warmed up by . . . **2** . . . .

Warm air rises from the beach by . . . **3** . . . .

Energy, not absorbed by the sea, leaves the surface of the sea by . . . **4** . . . .

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QUESTION FOUR

The energy from various sources can be used to drive turbines in power stations.

Match power station types, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A coal-fired

B geothermal

C nuclear

D tidal

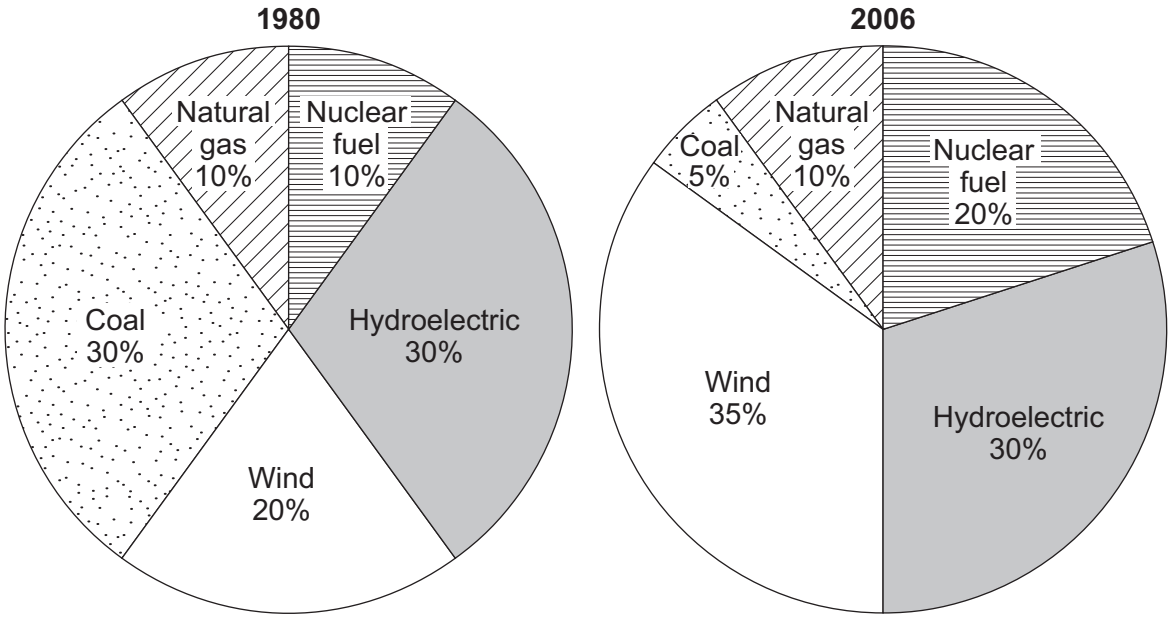
	The turbines are driven by . . .
1	moving water.
2	steam produced from water heated by burning a fuel.
3	steam produced from water heated by hot rocks.
4	steam produced from water heated by the fission of uranium.

Turn over for the next question

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QUESTION FIVE

The two pie charts show the relative proportions of energy sources used to generate electricity in a European country. One is for 1980; the other one is for 2006.



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

A coal

B natural gas

C nuclear fuel

D wind

	Between 1980 and 2006, the relative proportion of . . .
1	this non-renewable energy source decreased in use.
2	this non-renewable energy source doubled in use.
3	this non-renewable energy source was unchanged in use.
4	this renewable energy source had the greatest increase in use.

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Turn over for the next question

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Section Two

Questions **SIX** to **NINE**.

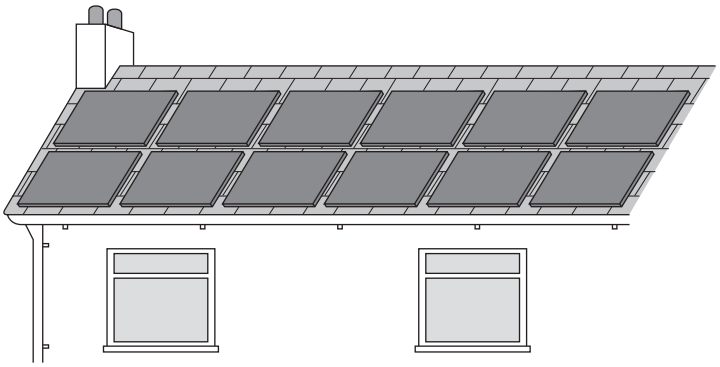
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The diagram shows a group of solar cells on the roof of a building.



6A The energy transformation in a solar cell is . . .

1 electrical to light.

2 electrical to heat.

3 heat to electrical.

4 light to electrical.

6B There are twelve 180 watt solar cells on the roof.

The maximum power output of the group of solar cells is . . .

1 15 W

2 15 kW

3 2160 W

4 2160 kW

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6C The solar cells will provide 1600 kilowatt-hours (kWh) of electrical energy per year.

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

Electricity from the mains supply costs 15 p per kWh

How much money will be saved per year by using the solar cells rather than the mains supply?

1 £2.40

2 £24

3 £240

4 £24 000

6D Energy from the solar cells is cheaper than energy from the mains supply because there are no . . .

1 fuel costs.

2 habitats destroyed.

3 polluting gases given off.

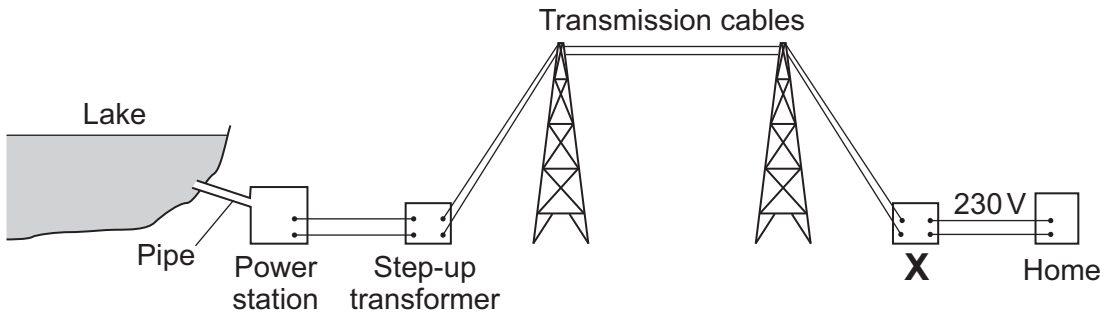
4 radioactive waste products.

Turn over for the next question

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QUESTION SEVEN

The diagram shows a hydroelectric power station connected to the National Grid.



7A The step-up transformer increases the . . .

1 current.

2 energy.

3 power.

4 voltage.

7B Using a step-up transformer . . .

1 makes the transmission cables warmer.

2 makes the electricity move faster.

3 reduces the energy loss in the transmission cables.

4 reduces the risk of electrocution.

7C The voltage across the transmission cables is 400 000 volts. Before the electricity can be used in homes, it is reduced to 230 volts. The device that does this is labelled **X** on the diagram.

Device **X** is a . . .

1 boiler.

2 generator.

3 step-down transformer.

4 thermal circuit breaker.

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7D Each second, the water taken from the lake supplies 4 200 000 joules of energy to the power station.

The power station produces 2 520 000 joules of electrical energy each second.

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

The efficiency of the power station is . . .

1 0.2

2 0.4

3 0.6

4 1.7

Turn over for the next question

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QUESTION EIGHT

A particular model of car has a choice of four different engines.

The fuel consumption and the carbon dioxide emissions were measured for each engine.

The table gives some data about the four engines, **P**, **Q**, **R** and **S**.

Car engine	Engine size in litres	Power in kilowatts (kW)	Fuel consumption in litres per 100 kilometres	Carbon dioxide (CO_2) emission in grams per kilometre
P	1.2	45	5.8	138
Q	1.2	52	5.8	138
R	1.4	60	6.3	150
S	1.6	78	6.9	164

8A Based on this data, which engine is the **least** fuel-efficient?

1 **P**

2 **Q**

3 **R**

4 **S**

8B To make a fair comparison of fuel consumption, the four engines should have been tested . . .

1 with different fuels.

2 at the same speed.

3 over different distances.

4 on the same day of the week.

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8C The tests were carried out under strict conditions. The conditions were set by an independent team of engineers.

This made sure that the results were . . .

1 biased in favour of the government.

2 biased in favour of the manufacturer.

3 biased in favour of the motorist.

4 unbiased.

8D In Britain, people who buy cars with low carbon dioxide emissions pay less road tax to the government.

This is because the government is concerned about . . .

1 economic issues.

2 environmental issues.

3 ethical issues.

4 social issues.

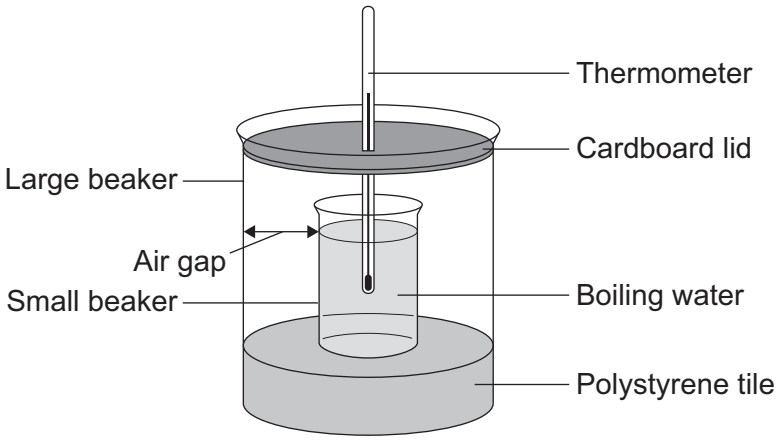
Turn over for the next question

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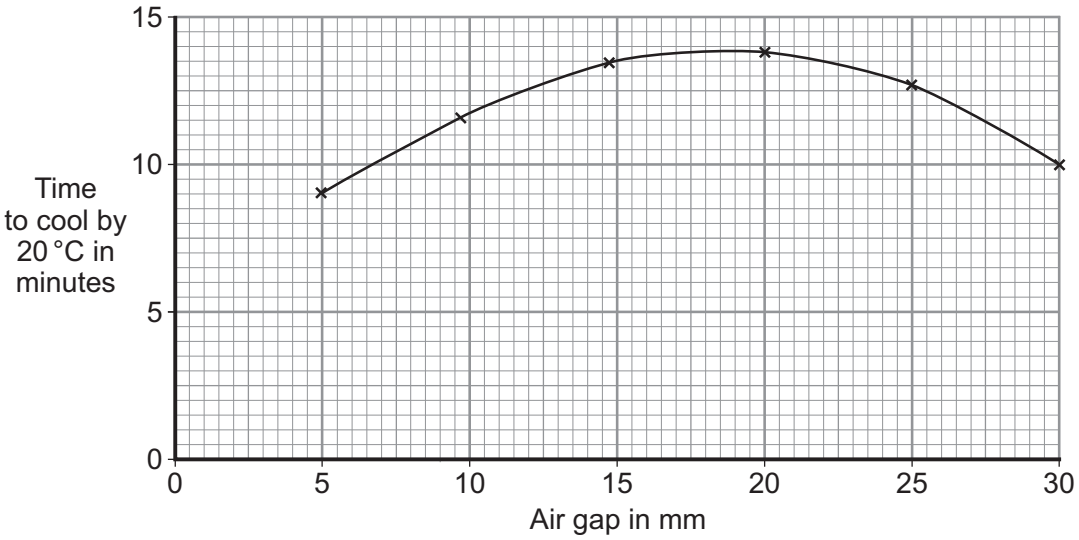
QUESTION NINE

A student wanted to find out if the width of the air gap in a double-glazed window affects the rate of heat transfer through the window.

He predicted that the wider the air gap, the lower the rate of heat transfer. To test his prediction, he set up the following experiment.



- He put a small beaker inside a large beaker.
- He put 80 cm^3 of boiling water into the small beaker.
- He put a cardboard lid on the large beaker.
- He used a stopwatch to measure the time taken for the water to cool by 20 °C.
- He measured the diameter of each beaker and calculated the width of the air gap.
- He used different sizes of large beaker to change the width of the air gap. Each time, he used the same small beaker and the same thermometer.
- He plotted his results on a graph.



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9A Which was the independent variable in the experiment?

1 the time taken for the water to cool by 20 °C

2 the size of the small beaker

3 the size of the cardboard lid

4 the width of the air gap

9B Which of these helped to make the test fair?

1 He used the same small beaker each time and changed the large beaker.

2 He used the same large beaker each time and changed the small beaker.

3 He changed the size of both beakers to keep the same width of air gap each time.

4 He changed the size of both beakers to change the width of air gap every time.

9C The results did not support the student's prediction.

What should he do to improve the reliability of the experiment?

1 join the points on the graph dot to dot

2 repeat each measurement and calculate the mean

3 use a more accurate stopwatch

4 use a more accurate thermometer

9D Which of these conclusions can be made from the student's results?

1 The rate of cooling is greatest when the air gap is between 15 mm and 22 mm.

2 The wider the air gap, the faster the water cools.

3 The narrower the air gap, the faster the water cools.

4 The rate of cooling is least when the air gap is between 15 mm and 22 mm.

END OF TEST

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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**.

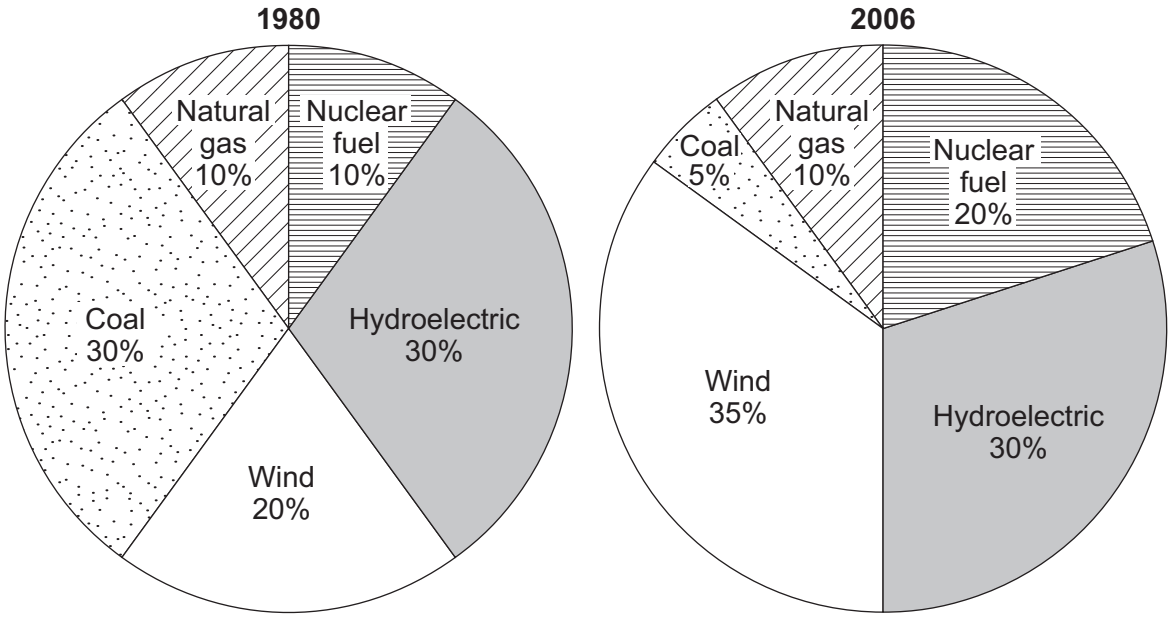
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The two pie charts show the relative proportions of energy sources used to generate electricity in a European country. One is for 1980; the other one is for 2006.



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

A coal

B natural gas

C nuclear fuel

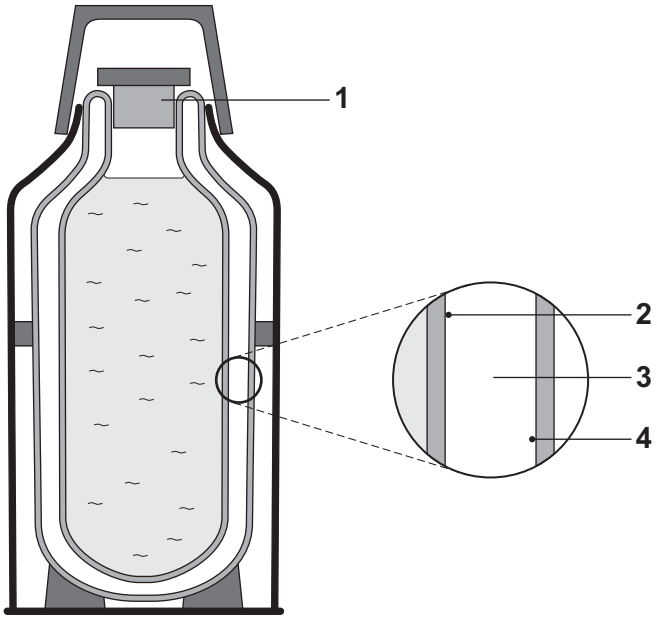
D wind

	Between 1980 and 2006, the relative proportion of . . .
1	this non-renewable energy source decreased in use.
2	this non-renewable energy source doubled in use.
3	this non-renewable energy source was unchanged in use.
4	this renewable energy source had the greatest increase in use.

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QUESTION TWO

The diagram shows a vacuum flask being used to keep a drink hot.



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

A stopper to reduce convection

B shiny surface to reflect radiation back into the drink

C shiny surface to reduce heat loss by radiation

D vacuum to reduce conduction and convection

Turn over for the next question

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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

A particular model of car has a choice of four different engines.

The fuel consumption and the carbon dioxide emissions were measured for each engine.

The table gives some data about the four engines, **P**, **Q**, **R** and **S**.

Car engine	Engine size in litres	Power in kilowatts (kW)	Fuel consumption in litres per 100 kilometres	Carbon dioxide (CO_2) emission in grams per kilometre
P	1.2	45	5.8	138
Q	1.2	52	5.8	138
R	1.4	60	6.3	150
S	1.6	78	6.9	164

3A Based on this data, which engine is the **least** fuel-efficient?

1 **P**

2 **Q**

3 **R**

4 **S**

3B To make a fair comparison of fuel consumption, the four engines should have been tested . . .

1 with different fuels.

2 at the same speed.

3 over different distances.

4 on the same day of the week.

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3C The tests were carried out under strict conditions. The conditions were set by an independent team of engineers.

This made sure that the results were . . .

1 biased in favour of the government.

2 biased in favour of the manufacturer.

3 biased in favour of the motorist.

4 unbiased.

3D In Britain, people who buy cars with low carbon dioxide emissions pay less road tax to the government.

This is because the government is concerned about . . .

1 economic issues.

2 environmental issues.

3 ethical issues.

4 social issues.

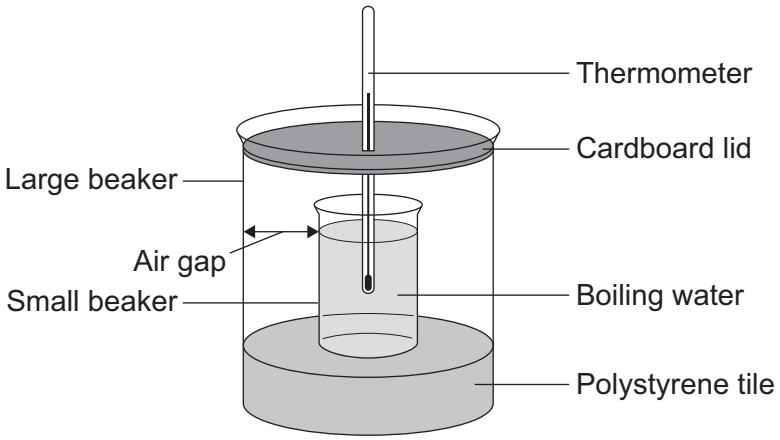
Turn over for the next question

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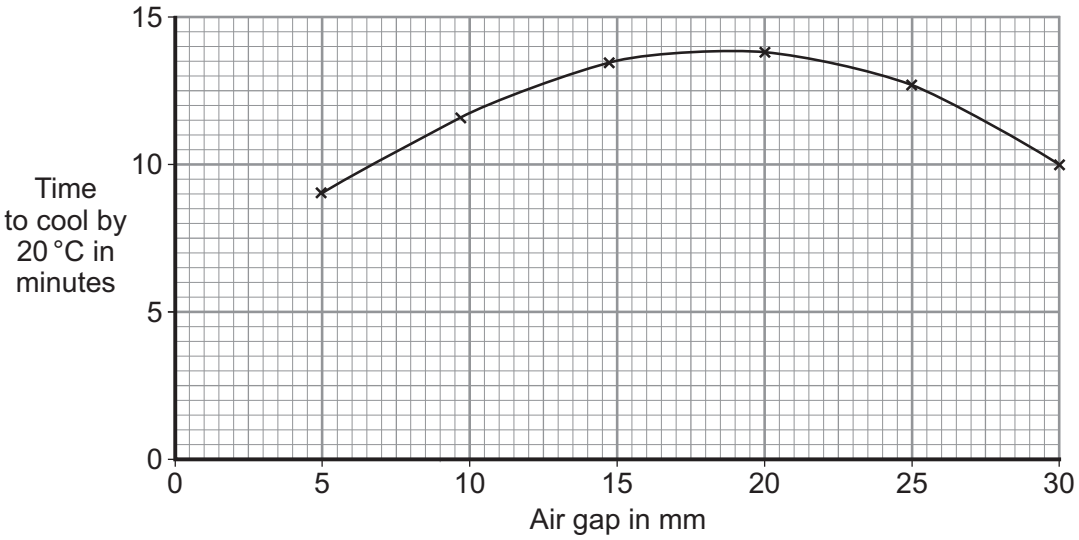
QUESTION FOUR

A student wanted to find out if the width of the air gap in a double-glazed window affects the rate of heat transfer through the window.

He predicted that the wider the air gap, the lower the rate of heat transfer. To test his prediction, he set up the following experiment.



- He put a small beaker inside a large beaker.
- He put 80 cm^3 of boiling water into the small beaker.
- He put a cardboard lid on the large beaker.
- He used a stopwatch to measure the time taken for the water to cool by 20 °C.
- He measured the diameter of each beaker and calculated the width of the air gap.
- He used different sizes of large beaker to change the width of the air gap. Each time, he used the same small beaker and the same thermometer.
- He plotted his results on a graph.



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4A Which was the independent variable in the experiment?

1 the time taken for the water to cool by 20 °C

2 the size of the small beaker

3 the size of the cardboard lid

4 the width of the air gap

4B Which of these helped to make the test fair?

1 He used the same small beaker each time and changed the large beaker.

2 He used the same large beaker each time and changed the small beaker.

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4C The results did not support the student's prediction.

What should he do to improve the reliability of the experiment?

1 join the points on the graph dot to dot

2 repeat each measurement and calculate the mean

3 use a more accurate stopwatch

4 use a more accurate thermometer

4D Which of these conclusions can be made from the student's results?

1 The rate of cooling is greatest when the air gap is between 15 mm and 22 mm.

2 The wider the air gap, the faster the water cools.

3 The narrower the air gap, the faster the water cools.

4 The rate of cooling is least when the air gap is between 15 mm and 22 mm.

Turn over for the next question

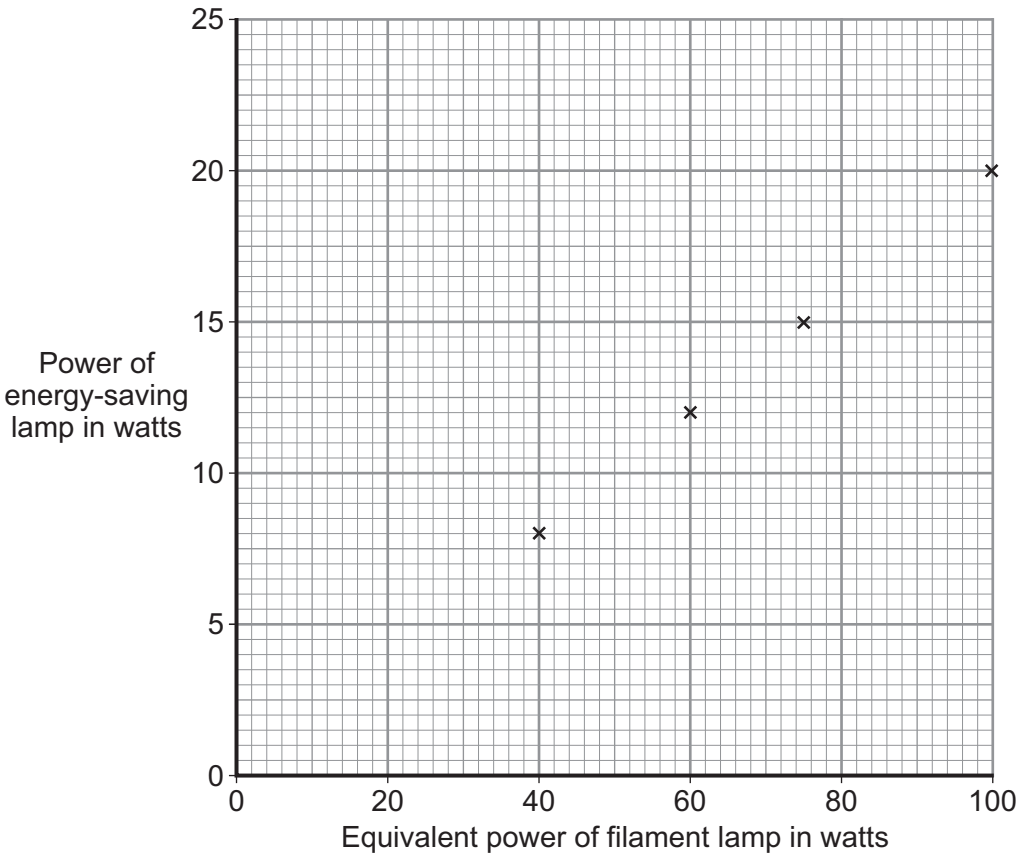
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QUESTION FIVE

A householder bought an energy-saving lamp. The following table was printed on the box.

Power of energy-saving lamp in W	Equivalent power of filament lamp in W
8	40
12	60
15	75
20	100

5A The graph shows the data given in the table.



To see if the power of the filament lamp is directly proportional to the power of the energy-saving lamp, you should . . .

1 draw a line of best fit and see if it passes through (0,0).

2 change the watts to kilowatts.

3 produce a bar chart.

4 use a different scale.

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5B Assume that the power of the filament lamp is directly proportional to the power of the energy-saving lamp.

What is the power of an energy-saving lamp that is equivalent to a 150 W filament lamp?

1 8 W

2 18 W

3 30 W

4 35 W

5C The efficiency of a 100 W filament lamp is 0.15.

What is the efficiency of a 20 W energy-saving lamp?

1 0.03

2 0.15

3 0.30

4 0.75

5D The government has decided to stop the sale of filament lamps. This is to save on the amount of fuel needed for making electricity.

Most energy-saving lamps contain toxic chemicals. Safety campaigners say that energy-saving lamps must be disposed of carefully.

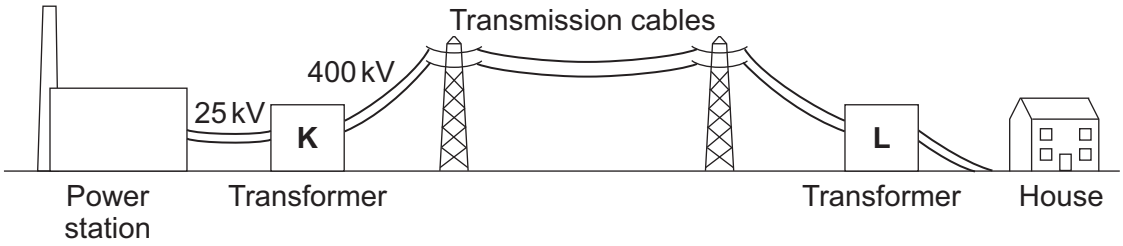
Which row in the table correctly describes the types of issue given above that concern the government and safety campaigners?

	The Government	**Safety campaigners**
1	environmental	economic
2	economic	environmental
3	ethical	social
4	social	ethical

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QUESTION SIX

Electricity is transmitted around the country through the National Grid.



6A The voltage from the power station is stepped up from 25 kV to 400 kV in transformer **K** so that . . .

1 the current decreases.

2 the current increases.

3 the current travels faster.

4 the current travels more slowly.

6B Increasing the voltage also . . .

1 increases energy losses from the cables.

2 makes the National Grid more efficient.

3 makes the National Grid safer.

4 means a step-down transformer is not needed.

6C Which row of the table shows what happens in transformer **L**?

	Current	**Voltage**
1	decreases	decreases
2	decreases	increases
3	increases	decreases
4	increases	increases

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6D The amount of electrical energy that a device transfers depends on . . .

1 the current flowing through the device only.

2 for how long the device is switched on only.

3 the power of the device only.

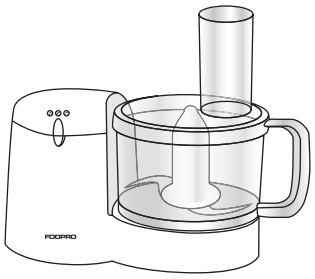
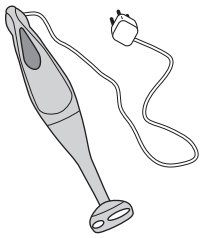
4 the power of the device and for how long it is switched on.

Turn over for the next question

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QUESTION SEVEN

A food mixer and a hand-held blender can both be used for making soup. The ingredients are cooked and then processed to produce a smooth soup. Processing is done by metal blades spinning in the soup.

	Food mixer	Hand-held blender
		
Power rating	500 W	300 W
Volume of soup	300–500 cm^3	Up to 2000 cm^3
Feature	Lid	No lid

7A Which one of the following describes advantages of using the hand-held blender rather than the food mixer for making soup?

1 The hand-held blender can mix smaller volumes of soup and does not splash.

2 The hand-held blender uses more power and may splash hot soup on the user.

3 The hand-held blender can mix larger volumes of soup and does not splash.

4 The hand-held blender uses less power and can mix larger volumes of soup.

7B How much more does it cost to use the food mixer for 1 hour rather than the hand-held blender?

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

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

Electricity costs 15 p per kilowatt-hour

1 3 p

2 4.5 p

3 7.5 p

4 30 p

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7C As the soup is being processed, it cools down.

Which soup will probably cool down the quickest?

1 the soup processed by the food mixer, because it has a lid that stops convection

2 the soup processed by the food mixer, because the container is made of plastic

3 the soup processed by the hand-held blender, because there is no lid to stop convection

4 the soup processed by the hand-held blender, because the soup is not as hot

7D The processed soup is put into a saucepan and reheated.

Heat is transferred through the soup because the soup at the bottom of the saucepan . . .

1 contracts, becomes less dense and falls.

2 expands, becomes more dense and falls.

3 contracts, becomes more dense and rises.

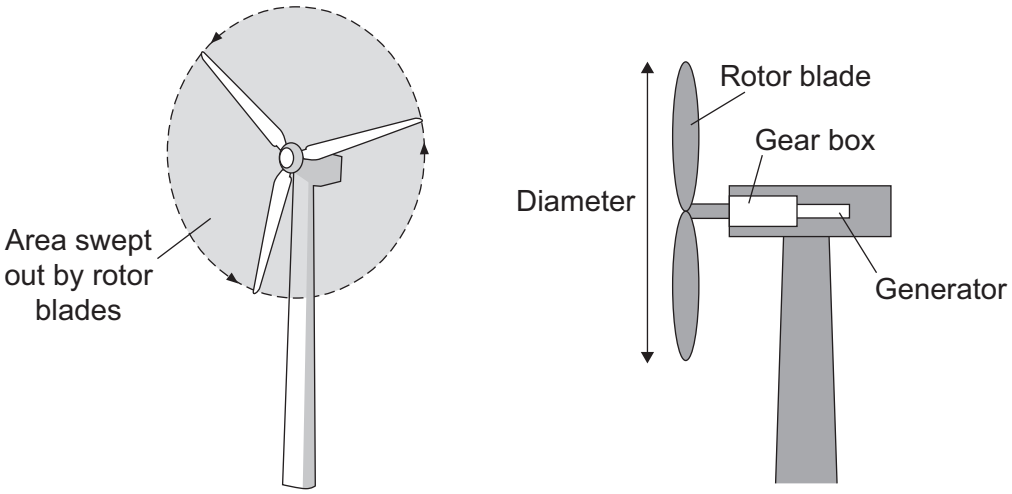
4 expands, becomes less dense and rises.

Turn over for the next question

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QUESTION EIGHT

A wind turbine is an electrical generator. The rotor blades are connected to the generator through a gear box.



8A Which is the correct energy transformation for the wind turbine generator?

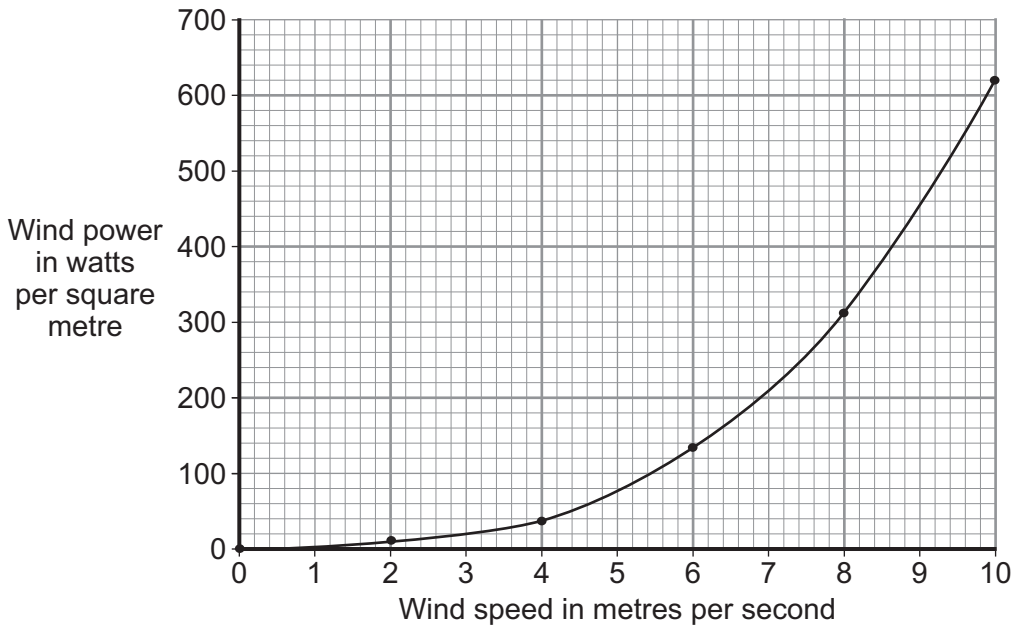
1 potential → electrical, thermal and sound

2 potential → kinetic, electrical and thermal

3 kinetic → electrical, thermal and sound

4 kinetic → chemical, electrical and thermal

8B The graph shows the power developed by the wind at different wind speeds. The power is measured in watts per square metre of area swept out by the rotor blades.



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What wind power is developed by a wind speed of 5.5 metres per second when the rotor blades sweep out an area of 5 square metres?

1 20 W

2 27.5 W

3 100 W

4 500 W

8C The table shows how the power output of a wind turbine changes with the diameter of the rotor blade.

Rotor blade diameter in metres (m)	Power output in kilowatts (kW)
1	0.4
2	1.6
3	3.6
4	6.4
6	14.4
8	25.6
10	40.0

Which of the following statements is correct?

1 decrease the rotor blade diameter and the power output increases

2 double the rotor blade diameter and the power output doubles

3 double the rotor blade diameter and the power output trebles

4 double the rotor blade diameter and the power output quadruples

8D A small wind turbine on the roof of a house has an average power output of 1 kW. The average demand for a household is 10 kW.

Large wind farms can produce an average power output of 5 MW.

One of the **disadvantages** of using wind farms to provide all the electricity for a large city is that . . .

1 wind farms develop far too much power for a large city.

2 large numbers of turbines are needed, taking up a lot of land.

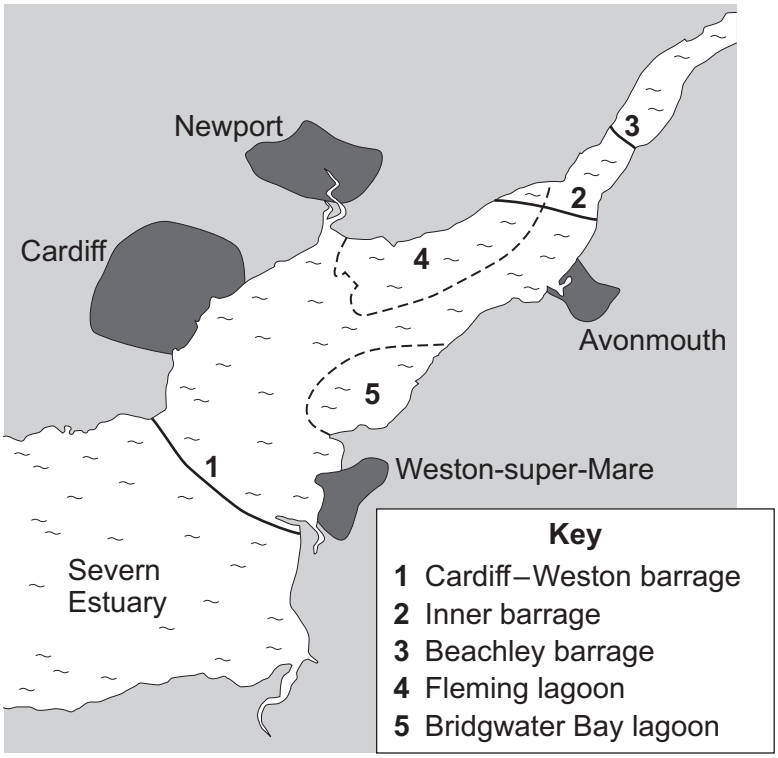
3 large numbers of turbines will produce a lot of carbon dioxide.

4 wind farms produce a lot of noise that is very harmful to birds.

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QUESTION NINE

The UK government is considering five schemes for generating electricity from the tides in the Severn estuary. Three of the schemes involve building a barrage across the estuary. The barrage would contain turbines and generators. The other two schemes would be lagoons, which enclose large areas of water, rather than having a barrier across the estuary.



9A The table gives some information about the five schemes.

	Estimated building cost in billions of £	Maximum power produced in millions of watts (MW)	Annual carbon dioxide emission savings in millions of tonnes
Cardiff–Weston barrage	21.0	8.64	7.2
Inner barrage	3.2	1.05	1.2
Beachley barrage	2.3	0.62	0.7
Fleming lagoon	4.5	1.36	1.0
Bridgwater Bay lagoon	3.8	1.36	1.1

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From the information in the table, which of the following statements is correct?

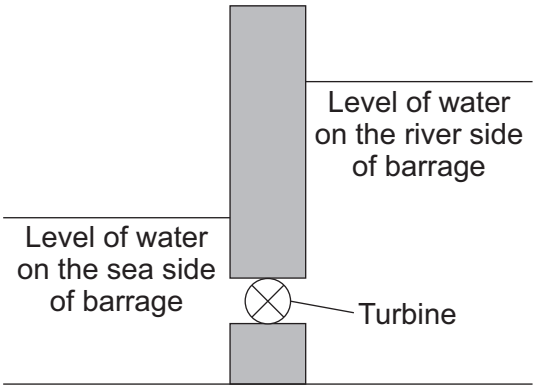
1 The Bridgwater Bay lagoon would produce the cheapest electricity and would be the cheapest to build.

2 The Beachley barrage would be the cheapest to build and would be the best at reducing global warming.

3 The Cardiff–Weston barrage would be the most expensive to build, would produce the most energy and would be the best at reducing global warming.

4 The Fleming lagoon would be the most expensive to build, would produce the most energy and would be the best at reducing global warming.

9B The diagram shows a section through a barrage.



As the tide comes in, water is trapped behind the barrage. Later, water is released to flow back through the turbine.

What is the main energy transformation as water is released to flow through the turbine?

1 electrical energy to gravitational potential energy

2 electrical energy to kinetic energy

3 gravitational potential energy to kinetic energy

4 kinetic energy to gravitational potential energy

Question 9 continues on the next page

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9C There are many arguments for and against the Cardiff – Weston barrage scheme.

Which row in the table of statements for and against the scheme gives two correct **environmental** issues?

	For the scheme	Against the scheme
1	It will increase the number of ships using Cardiff docks.	It will provide only a small percentage of the UK's electricity.
2	It will provide up to 1500 extra jobs.	It will cost many billions of pounds to build.
3	It will reduce the total harmful emissions from UK power stations.	It will destroy wildlife habitats and block fish migration routes.
4	It will reduce the amount of salt in the water in the Severn estuary.	It will attract more tourists to the area.

9D The UK uses about 360 terawatt-hours (TWh) of electricity each year. A barrage across the Severn estuary is expected to generate 18 TWh of electricity each year.

1 terawatt-hour is a very large unit of energy

What percentage of the UK's electricity would the barrage generate each year?

1 2 %

2 5 %

3 20 %

4 80 %

END OF TEST

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GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2011 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the students' responses.

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

November 2011

Foundation Tier

Question	Key		
One	**A**	geothermal	**3**
	B	hydroelectric	**1**
	C	nuclear fuel	**4**
	D	wind	**2**
Two	**A**	chemical	**1**
	B	electrical	**3**
	C	heat (thermal energy)	**4**
	D	kinetic	**2**
Three	**A**	conduction	**2**
	B	convection	**3**
	C	radiation	**1**
	D	reflection	**4**
Four	**A**	coal-fired	**2**
	B	geothermal	**3**
	C	nuclear	**4**
	D	tidal	**1**
Five	**A**	coal	**1**
	B	natural gas	**3**
	C	nuclear fuel	**2**
	D	wind	**4**

	A	**B**	**C**	**D**
Six	**4**	**3**	**3**	**1**
Seven	**4**	**3**	**3**	**3**
Eight	**4**	**2**	**4**	**2**
Nine	**4**	**1**	**2**	**4**

GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

November 2011

Higher Tier

Question	Key		
One	**A**	coal	**1**
	B	natural gas	**3**
	C	nuclear fuel	**2**
	D	wind	**4**
Two	**A**	stopper to reduce convection	**1**
	B	shiny surface to reflect radiation back into the drink	**4**
	C	shiny surface to reduce heat loss by radiation	**2**
	D	vacuum to reduce conduction and convection	**3**

	A	**B**	**C**	**D**
Three	**4**	**2**	**4**	**2**
Four	**4**	**1**	**2**	**4**
Five	**1**	**3**	**4**	**2**
Six	**1**	**2**	**3**	**4**
Seven	**4**	**1**	**3**	**4**
Eight	**3**	**4**	**4**	**2**
Nine	**3**	**3**	**3**	**2**

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http://www.aqa.org.uk/umsconversion

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG11

15-NOV-11

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	coal	○	○	○	○
1B	natural gas	○	○	○	○
1C	nuclear fuel	○	○	○	○
1D	wind	○	○	○	○

QUESTION TWO		1	2	3	4
2A	stopper to reduce convection	○	○	○	○
2B	shiny surface to reflect radiation back into the drink	○	○	○	○
2C	shiny surface to reduce heat loss by radiation	○	○	○	○
2D	vacuum to reduce conduction and convection	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A geothermal	○	○	○	○
1B hydroelectric	○	○	○	○
1C nuclear fuel	○	○	○	○
1D wind	○	○	○	○

QUESTION TWO	1	2	3	4
2A chemical	○	○	○	○
2B electrical	○	○	○	○
2C heat (thermal energy)	○	○	○	○
2D kinetic	○	○	○	○

QUESTION THREE	1	2	3	4
3A conduction	○	○	○	○
3B convection	○	○	○	○
3C radiation	○	○	○	○
3D reflection	○	○	○	○

QUESTION FOUR	1	2	3	4
4A coal-fired	○	○	○	○
4B geothermal	○	○	○	○
4C nuclear	○	○	○	○
4D tidal	○	○	○	○

QUESTION FIVE	1	2	3	4
5A coal	○	○	○	○
5B natural gas	○	○	○	○
5C nuclear fuel	○	○	○	○
5D wind	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
June 2011

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Tuesday 28 June 2011 Morning Session

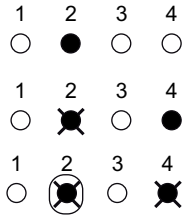
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 18 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

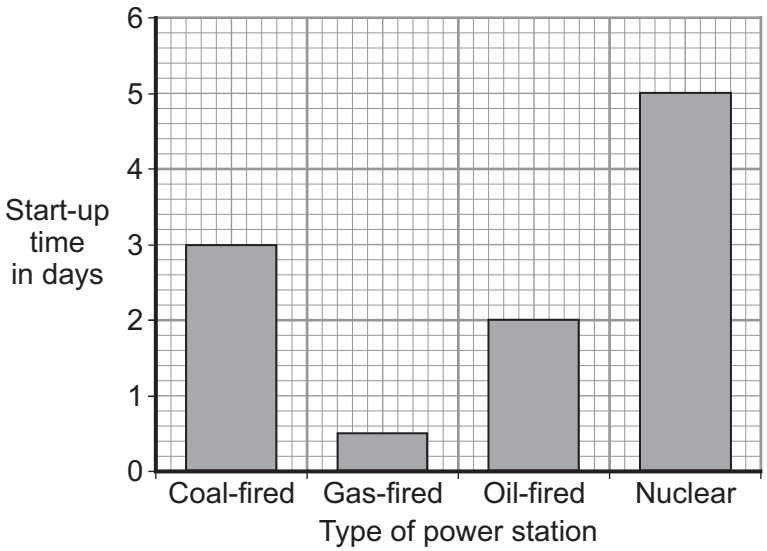
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The bar chart shows the start-up times for four types of power station.



Match the types of power station, **A**, **B**, **C**, and **D**, with the sentences **1**–**4** in the table.

A coal-fired

B gas-fired

C nuclear

D oil-fired

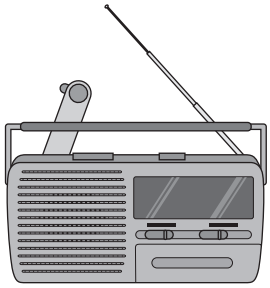
1	It has a start-up time of three days.
2	It could be used to meet an unexpected increase in demand.
3	It has the longest start-up time.
4	It uses a liquid fuel.

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QUESTION TWO

The diagram shows a wind-up radio. The radio has the following features:

- hand-turned generator
- rechargeable battery
- lamp.



Match types of energy, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A chemical

B electrical

C kinetic

D light

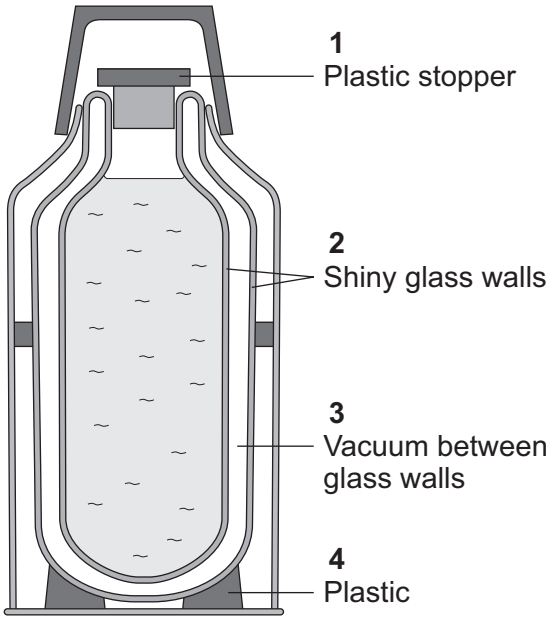
1	given out by the lamp
2	produced by the generator
3	stored in the battery
4	involved in turning the handle for the generator

Turn over for the next question

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QUESTION THREE

The diagram shows a vacuum flask that is used to keep liquids hot.



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

A prevents hot air from rising from the flask

B reduces heat loss by conduction through the base

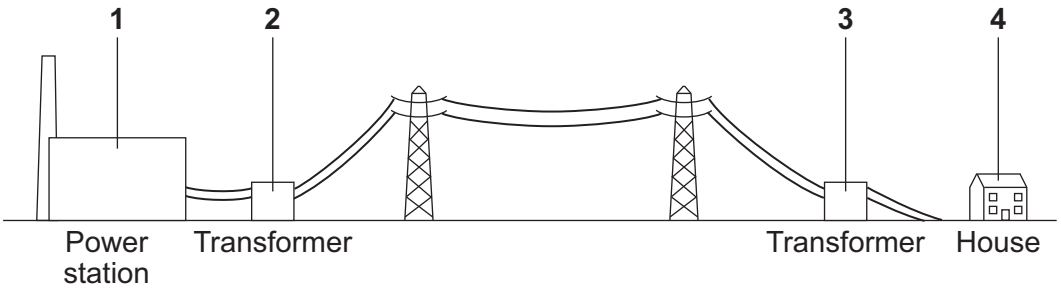
C reduces heat loss by radiation

D prevents heat loss by conduction and convection

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QUESTION FOUR

The diagram shows part of the National Grid.



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

A This is where the electricity is being generated.

B This is where the electricity is being used.

C This is where the voltage is decreased.

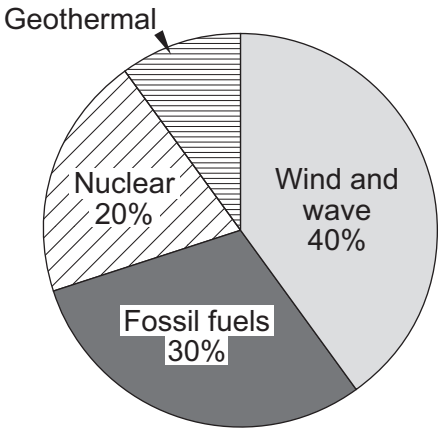
D This is where the voltage is increased.

Turn over for the next question

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QUESTION FIVE

The pie chart shows how a country's electricity demands are met using different energy sources.



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

A 10 %

B 20 %

C 40 %

D 50 %

The percentage of electricity generated from non-renewable sources is . . . **1** . . . .

The percentage of electricity generated from geothermal sources is . . . **2** . . . .

The percentage of electricity generated using a source that produces radioactive waste is . . . **3** . . . .

The percentage of electricity generated using the kinetic energy of the source directly is . . . **4** . . . .

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Turn over for the next question

Section Two

Questions **SIX** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The following is an extract from a newspaper in 2008.

Renewable energy projects at risk

The 'credit crunch' is making it difficult for companies to borrow money for large building projects.

6A Which of the following energy sources is renewable?

1 coal

2 nuclear

3 oil

4 tides

6B The newspaper reported that groups of people around the country were protesting about plans to build wind farms. The protestors said that wind farms are noisy and a danger to birds.

The reasons for the protests are . . .

1 economic.

2 environmental.

3 ethical.

4 political.

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6C Some wind energy companies had to delay their building plans because of the difficulty in raising money.

The reason for the delay was . . .

1 economic.

2 environmental.

3 ethical.

4 political.

6D There was a sharp fall in the price of oil towards the end of 2008.

Despite this fall, there were no suggestions that any new oil-fired power stations should be built.

This was because . . .

1 oil reserves are decreasing.

2 oil-fired power stations produce radioactive waste.

3 oil-fired power stations produce waste heat.

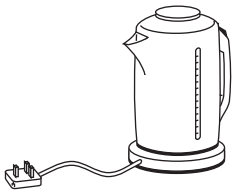
4 oil is difficult to transport.

Turn over for the next question

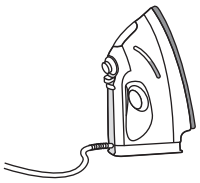
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QUESTION SEVEN

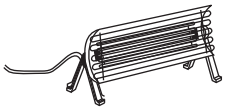
The diagrams show four electrical heating devices.



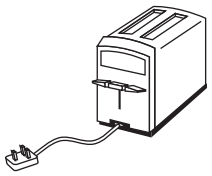
2 kW
Kettle



500 W
Iron



1 kW
Fire



0.5 kW
Toaster

7A Which two devices transform energy at the same rate?

1 the kettle and the iron

2 the iron and the toaster

3 the toaster and the fire

4 the fire and the kettle

7B The kettle is used for a total of 2 hours.

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

How much energy does the kettle transfer?

1 1 kWh

2 4 kWh

3 1000 kWh

4 4000 kWh

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7C The fire is switched on for two hours and transfers 2 kWh of energy.

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

Electricity costs 14 p per kWh

What is the cost of using the electric fire for two hours?

1 7 p

2 14 p

3 28 p

4 56 p

7D The kettle casing is made of plastic.

A plastic kettle is more efficient than a metal kettle because . . .

1 plastic is an electrical insulator.

2 plastic is a thermal insulator.

3 plastic has a higher density than metal.

4 plastic is cheaper than metal.

Turn over for the next question

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QUESTION EIGHT

Some dairy farmers have installed electrical generators that run on methane gas.

- Methane gas is produced from rotting vegetation and animal waste.
- On farms, the rotting process takes place in a digester.
- Methane produced in this way is a biofuel called biogas.
- Burning methane produces carbon dioxide and water.
- The electrical generators can be installed in a farm building.

8A Methane is called a biofuel because . . .

1 it is a renewable fuel.

2 it comes from living things.

3 it produces carbon dioxide and water.

4 it is made in a digester.

8B Farmers have been encouraged to install their own biogas generators because . . .

1 this would reduce the amount of fuel used in power stations.

2 this would reduce the amount of animal waste produced.

3 biogas is a non-renewable fuel.

4 this would use less electricity.

8C A farmer's weekly electricity bill using the mains supply is £290. The biogas generator costs £15 000 to install.

The biogas generator provides all of the farmer's electricity.

What is the pay-back time?

1 1.0 years

2 4.3 years

3 5.2 years

4 52 years

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8D It would have been cheaper for the farmer to install a wind turbine generator.

What is the advantage of the biogas generator over the wind turbine generator?

1 It uses a renewable energy source.

2 It produces water.

3 It can work all the time.

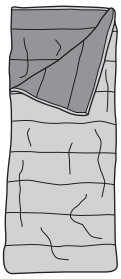
4 It does not require any space.

Turn over for the next question

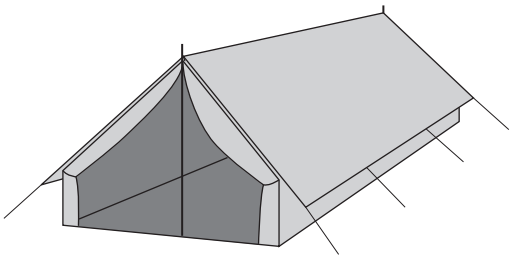
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QUESTION NINE

Some students are going camping. They will use sleeping bags in a tent.



Sleeping bag



Tent

9A The students have different makes of sleeping bag. They investigated which sleeping bag would keep them warmest.

- They placed a hot water bottle in each sleeping bag for an hour.
- They measured the temperature of the water in the hot water bottle at the start and after one hour.
- They calculated the fall in temperature of the water.

Why did they use hot water bottles in their investigation?

1 because people use hot water bottles to keep warm in bed

2 to see whether a sleeping bag would warm up its user

3 to represent a real person using the sleeping bag

4 to see what would happen if the sleeping bag got wet inside

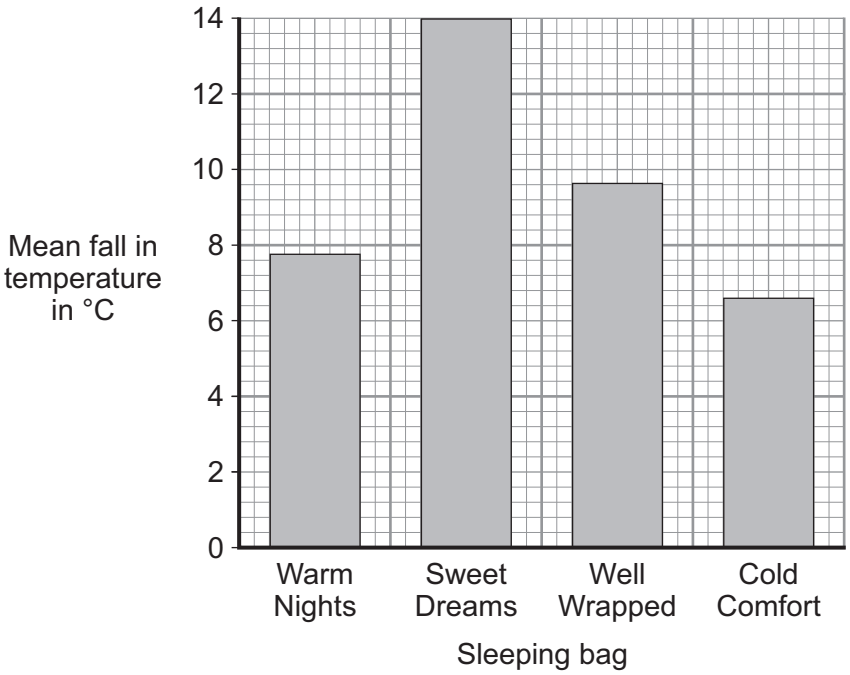
The students carried out the investigation three times.

The results of their investigation are given in the table.

	Temperature of water in °C			
Name of sleeping bag	**At start**	**After one hour 1st time**	**After one hour 2nd time**	**After one hour 3rd time**
Warm Nights	60.0	53.5	51.0	52.5
Sweet Dreams	60.0	48.5	42.0	47.5
Well Wrapped	60.0	51.0	49.5	50.5
Cold Comfort	60.0	54.5	52.5	53.0

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9B The students plotted a bar chart of their results.



From this chart, which sleeping bag would keep a person warmest at night?

1 Warm Nights

2 Sweet Dreams

3 Well Wrapped

4 Cold Comfort

9C The students thought the 42.0 °C result for the Sweet Dreams sleeping bag was anomalous.

What does *anomalous* mean?

1 It does not fit the pattern of the other results.

2 It is the only reliable result.

3 It was not as precise as the other results.

4 It is the smallest value in the table.

Question 9 continues on the next page

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9D The students repeated the experiment for the Sweet Dreams sleeping bag.

Their results are shown in the table.

	Temperature of water in °C			
Name of sleeping bag	**At start**	**After one hour 1st time**	**After one hour 2nd time**	**After one hour 3rd time**
Sweet Dreams	60.0	48.5	48.0	47.5

What is the mean fall in temperature, in °C, for this sleeping bag?

1 51.0

2 48.0

3 12.0

4 11.5

END OF TEST

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There are no questions printed on this page

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**.

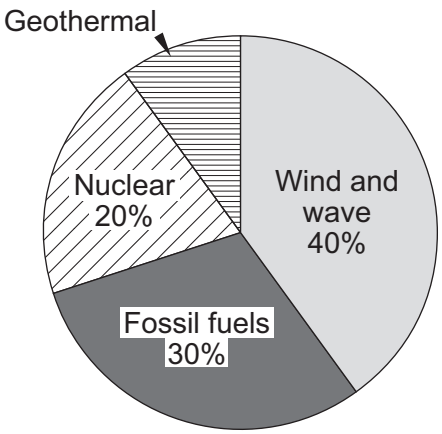
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The pie chart shows how a country's electricity demands are met using different energy sources.



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

A 10 %

B 20 %

C 40 %

D 50 %

The percentage of electricity generated from non-renewable sources is . . . **1** . . . .

The percentage of electricity generated from geothermal sources is . . . **2** . . . .

The percentage of electricity generated using a source that produces radioactive waste is . . . **3** . . . .

The percentage of electricity generated using the kinetic energy of the source directly is . . . **4** . . . .

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QUESTION TWO

This question is about four electrical devices.

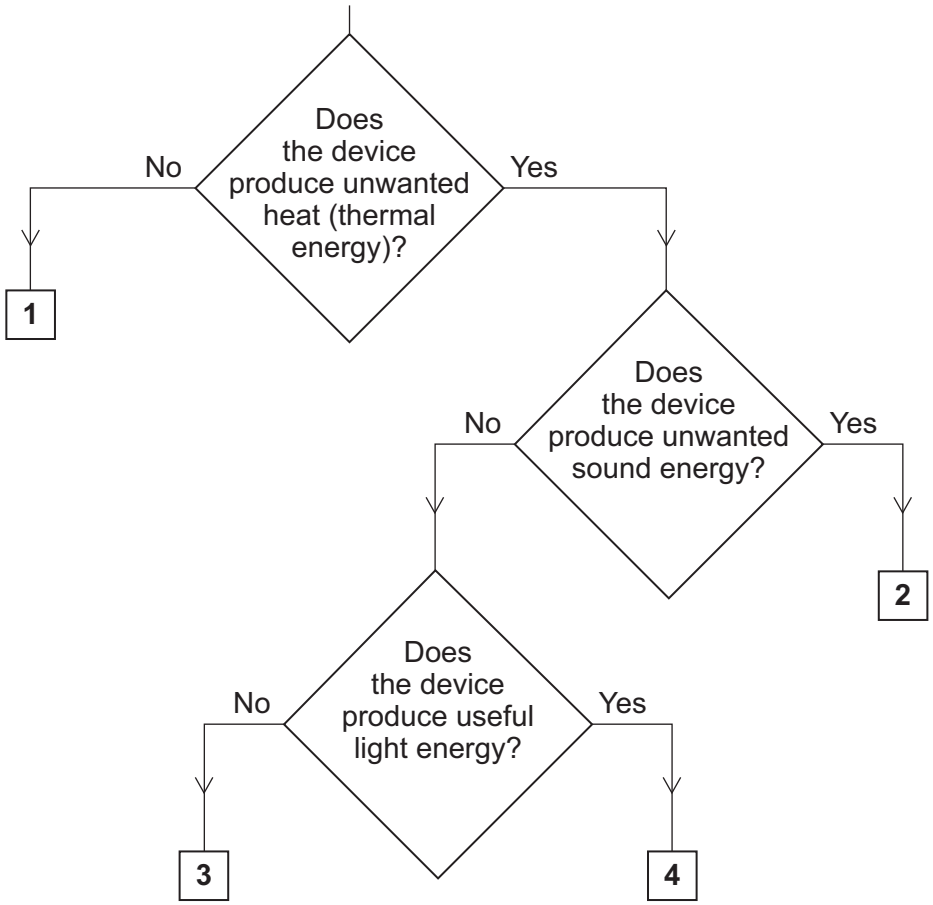
Match the devices, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the flow chart.

A food mixer

B iron

C radio

D television



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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 dairy farmers have installed electrical generators that run on methane gas.

- Methane gas is produced from rotting vegetation and animal waste.
- On farms, the rotting process takes place in a digester.
- Methane produced in this way is a biofuel called biogas.
- Burning methane produces carbon dioxide and water.
- The electrical generators can be installed in a farm building.

3A Methane is called a biofuel because . . .

1 it is a renewable fuel.

2 it comes from living things.

3 it produces carbon dioxide and water.

4 it is made in a digester.

3B Farmers have been encouraged to install their own biogas generators because . . .

1 this would reduce the amount of fuel used in power stations.

2 this would reduce the amount of animal waste produced.

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4 this would use less electricity.

3C A farmer's weekly electricity bill using the mains supply is £290. The biogas generator costs £15 000 to install.

The biogas generator provides all of the farmer's electricity.

What is the pay-back time?

1 1.0 years

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3D It would have been cheaper for the farmer to install a wind turbine generator.

What is the advantage of the biogas generator over the wind turbine generator?

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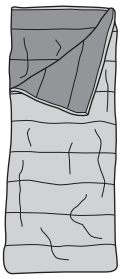
4 It does not require any space.

Turn over for the next question

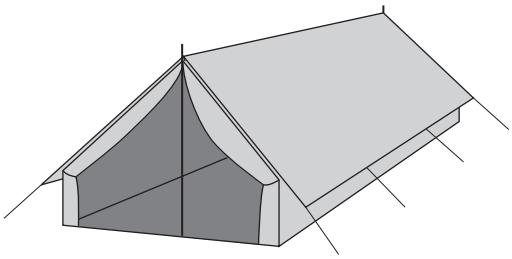
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QUESTION FOUR

Some students are going camping. They will use sleeping bags in a tent.



Sleeping bag



Tent

4A The students have different makes of sleeping bag. They investigated which sleeping bag would keep them warmest.

- They placed a hot water bottle in each sleeping bag for an hour.
- They measured the temperature of the water in the hot water bottle at the start and after one hour.
- They calculated the fall in temperature of the water.

Why did they use hot water bottles in their investigation?

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2 to see whether a sleeping bag would warm up its user

3 to represent a real person using the sleeping bag

4 to see what would happen if the sleeping bag got wet inside

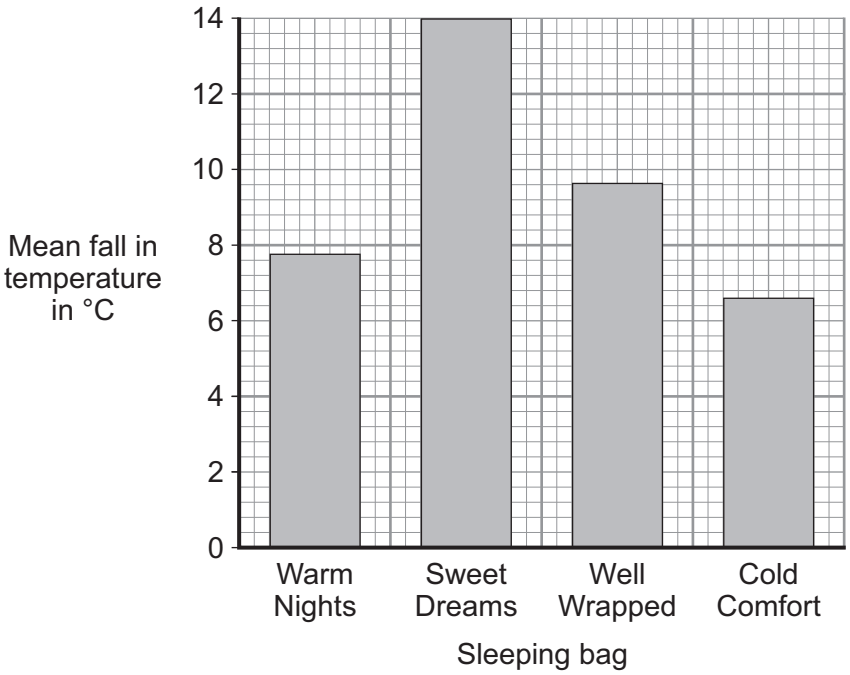
The students carried out the investigation three times.

The results of their investigation are given in the table.

	Temperature of water in °C			
Name of sleeping bag	**At start**	**After one hour 1st time**	**After one hour 2nd time**	**After one hour 3rd time**
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Well Wrapped	60.0	51.0	49.5	50.5
Cold Comfort	60.0	54.5	52.5	53.0

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4B The students plotted a bar chart of their results.



From this chart, which sleeping bag would keep a person warmest at night?

1 Warm Nights

2 Sweet Dreams

3 Well Wrapped

4 Cold Comfort

4C The students thought the 42.0 °C result for the Sweet Dreams sleeping bag was anomalous.

What does *anomalous* mean?

1 It does not fit the pattern of the other results.

2 It is the only reliable result.

3 It was not as precise as the other results.

4 It is the smallest value in the table.

Question 4 continues on the next page

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4D The students repeated the experiment for the Sweet Dreams sleeping bag.

Their results are shown in the table.

	Temperature of water in °C			
Name of sleeping bag	**At start**	**After one hour 1st time**	**After one hour 2nd time**	**After one hour 3rd time**
Sweet Dreams	60.0	48.5	48.0	47.5

What is the mean fall in temperature, in °C, for this sleeping bag?

1 51.0

2 48.0

3 12.0

4 11.5

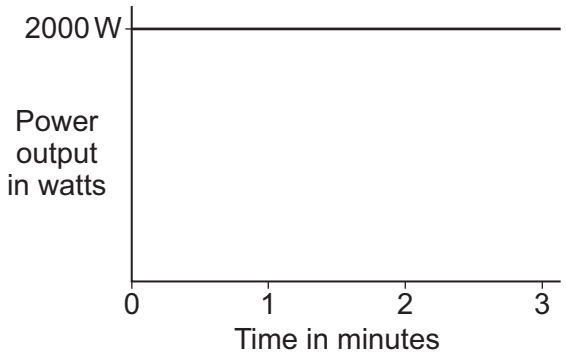
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Turn over for the next question

QUESTION FIVE

An electric kettle has a power rating of 2000 W. It can boil 1 litre of water in 3 minutes.

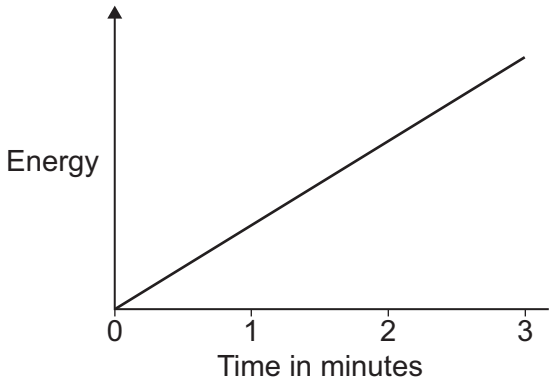
The graph shows how the power output of the kettle varies with time.



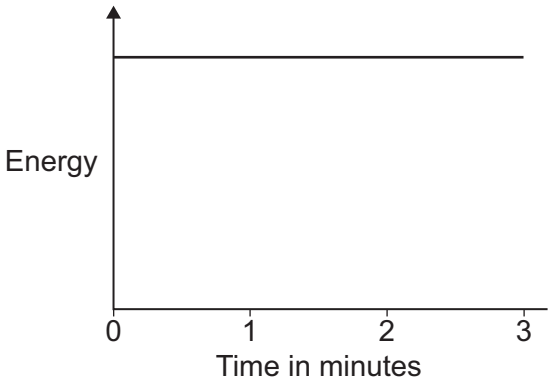
energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

5A Which graph shows how the energy transferred by the kettle varies with time?

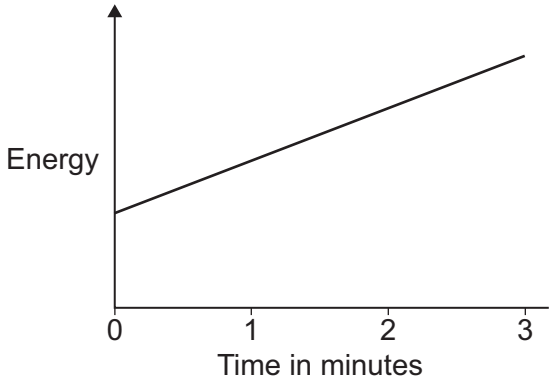
1



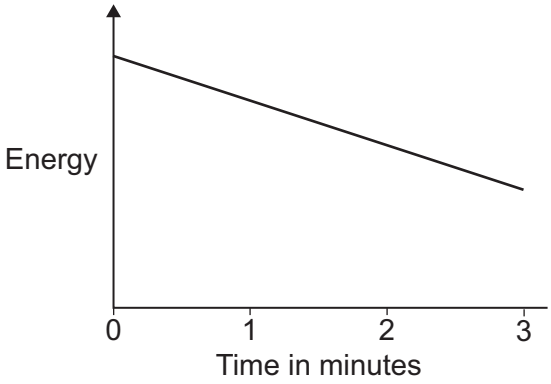
2



3



4



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5B The energy transferred to boil the water is . . .

1 0.1 kWh

2 0.5 kWh

3 0.6 kWh

4 0.8 kWh

5C The 2000 W kettle is replaced by a 1000 W kettle. This second kettle is used to boil 1 litre of water.

Which row in the table shows what happens when a 1000 W kettle is used instead of a 2000 W kettle?

	Energy used to boil the water	**Time taken to boil the water**
1	stays the same	increases
2	stays the same	decreases
3	increases	stays the same
4	decreases	increases

5D It costs £7.50 to use the 1000 W kettle for 3 months. During this time, 50 kWh of electrical energy are transferred by the kettle.

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

What is the cost per kilowatt-hour of electrical energy?

1 3.75 p

2 7.00 p

3 11.25 p

4 15.00 p

Turn over for the next question

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QUESTION SIX

Many people use a duvet on their beds to keep them warm at night.

Duvets contain fibres which trap small pockets of air. The pockets of air help to keep us warm because air is a poor thermal conductor. The fibres also reduce movement of the air. This reduces convection currents in the air.

6A Why is air a poor thermal conductor?

1 the air particles are close together

2 the air particles do not move

3 the air particles are far apart

4 there are no black surfaces in air

6B What causes convection currents?

1 warmed air expands, becomes more dense and falls

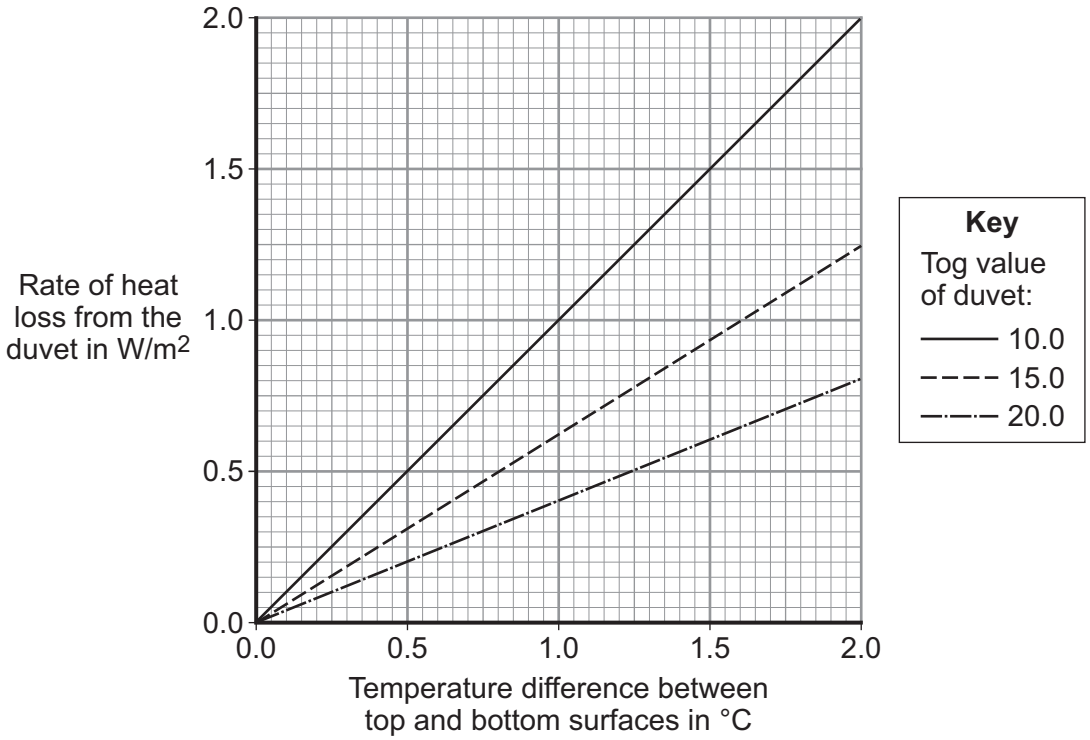
2 warmed air contracts, becomes less dense and rises

3 warmed air contracts, becomes more dense and rises

4 warmed air expands, becomes less dense and rises

The effectiveness of a duvet can be found by calculating the difference in temperature between the top and bottom surfaces of the duvet and the rate of heat loss from the duvet. The effectiveness of a duvet is measured in units called 'Togs'.

The graph shows how the rate of heat loss from three duvets varies with the temperature difference between top and bottom surfaces of each duvet.



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6C The graph shows that the rate of heat loss depends on . . .

1 the Tog value only.

2 the temperature difference only.

3 the area only.

4 the Tog value and the temperature difference.

6D Which of these Tog values would be the best for a duvet in a very cold climate?

1 5.0

2 10.0

3 15.0

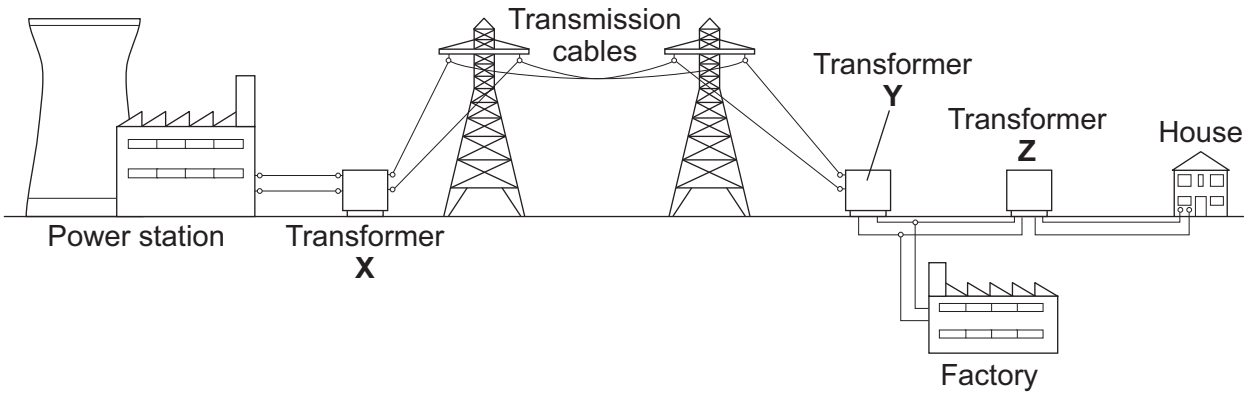
4 17.5

Turn over for the next question

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QUESTION SEVEN

Transformers are used in the National Grid.



7A Both step-up transformers and step-down transformers are used in the National Grid.

Which row in the table shows the correct types of transformer?

	Transformer X	Transformer Y	Transformer Z
1	step-up	step-down	step-up
2	step-up	step-up	step-up
3	step-up	step-down	step-down
4	step-up	step-up	step-down

7B Transformer **X** changes the voltage between the power station and the transmission cables. It also changes the current. These changes affect the efficiency of the transmission cables.

Which row in the table correctly describes the changes produced by transformer **X**?

	Voltage	Current	Efficiency of transmission
1	decreased	decreased	decreased
2	decreased	increased	increased
3	increased	decreased	increased
4	increased	increased	increased

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7C The table shows the percentage of energy wasted as heat and sound by four different transformers.

Which transformer has the highest efficiency?

Transformer	Percentage of energy supplied to transformer which is wasted as sound	Percentage of energy supplied to transformer which is wasted as heat
1	1.1	7.4
2	1.2	4.7
3	1.3	5.4
4	1.4	6.9

7D The amount of electricity that a device uses depends on the rate at which the device transforms energy and . . .

1 how long the device is switched on.

2 the current through the device.

3 the potential difference across the device.

4 the power of the device.

Turn over for the next question

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QUESTION EIGHT

The sources of energy used to generate electricity in the UK have changed over the years. The table gives information on the percentages of electrical energy consumed in the UK produced from various energy sources.

Year \ Energy source	Coal	Oil	Gas	Nuclear	Hydroelectric	Other renewables
1965	65.0	28.4	5.0	1.0	0.6	0.0
1985	33.7	35.0	23.6	7.0	0.7	0.0
2005	33.0	1.0	40.0	19.0	1.0	3.5

8A In 1965, what was the percentage of electrical energy produced from sources that released polluting gases into the atmosphere?

1 1.6

2 65.0

3 93.4

4 98.4

8B The UK government wants to build more nuclear power stations.

Which row in the table gives a valid reason for, and a valid reason against, building more nuclear power stations?

	For	Against
1	Nuclear power stations have a long start-up time.	Nuclear power stations produce radioactive waste.
2	The energy available from 1 kg of nuclear fuel is much bigger than from other fuels.	Nuclear power stations have high decommissioning costs.
3	Nuclear power stations have low decommissioning costs.	Nuclear power stations produce radioactive waste.
4	The energy source is renewable.	The energy available from 1 kg of nuclear fuel is much smaller than from other fuels.

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8C The figures for 2005 do not add up to 100 %.

This is likely to be because about 2.5 % . . .

1 of the energy was lost in the National Grid transmission cables.

2 of the electricity was exported to other countries.

3 of the electricity was imported from other countries.

4 of the energy was generated by wind farms.

8D Governments would like householders to replace older electrical appliances with new ones that are more efficient.

This would result in . . .

1 more electricity being generated from renewable sources and lower greenhouse gas emissions.

2 less electricity being generated from renewable sources and higher greenhouse gas emissions.

3 less energy being used and lower greenhouse gas emissions.

4 more energy being used and higher greenhouse gas emissions.

Turn over for the next question

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QUESTION NINE

Solar cells are used to produce electricity on a large scale in places such as Australia and California. They are not used on a large scale in the UK.

9A Which of the following statements about solar cells being used to produce electricity on a large scale is correct?

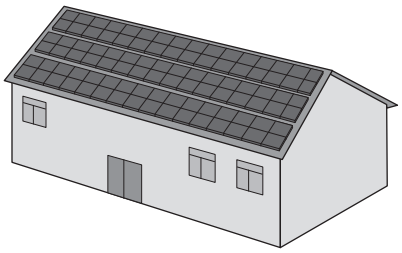
1 Solar cells need a large area of land because solar cells are not very efficient.

2 Solar cells need a large area of land because the Sun does not shine at night.

3 Solar cells need a small area of land because the Sun shines every day.

4 Solar cells need a small area of land because solar cells are very efficient.

9B The drawing shows an array of solar cells on the roof of a new village hall.



The solar cells produce more electricity than is needed by the hall.

The surplus electricity . . .

1 can be stored in the hall until it is needed.

2 can be stored in the solar cells until it is needed.

3 can be sold and transmitted by the National Grid.

4 is wasted energy and spreads out.

The amount of electricity produced each year by an array of solar cells depends on:

- the area of the array
- the angle of tilt of the array
- the direction that the array faces
- which part of the country the array is in.

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The map shows how much solar radiation, in kWh / m^2, falls on different parts of the UK each year.

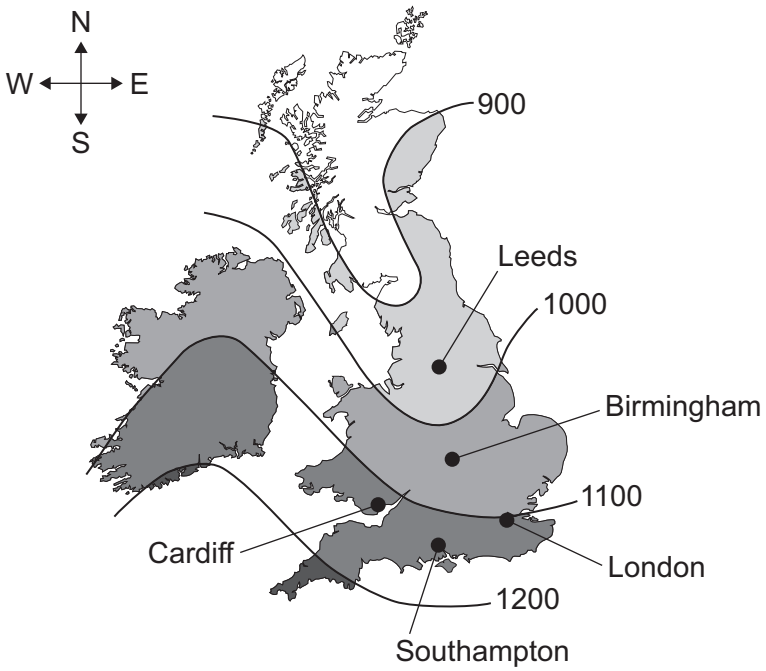


Table 1 gives figures for the annual solar radiation, in kWh / m^2, for London. The table also gives data for various angles of tilt and for various directions that an array faces.

Table 1

Angle of tilt of array to the horizontal	Direction that the array faces				
	South	South-west	West	North-west	North
30°	1042	997	886	762	709
45°	1023	968	829	666	621
60°	960	900	753	580	485
Vertical	724	684	565	427	360

9C Which row in **Table 2** gives the biggest amount of solar radiation?

Table 2

	Location	Angle of tilt in degrees	Direction that the array faces
1	Birmingham	30	South
2	Southampton	30	West
3	Leeds	60	West
4	Cardiff	30	South

Question 9 continues on the next page

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9D An array with an area of 20 m^2 is installed on a roof in London at an angle of 60°. The array faces south-west. The efficiency of the array is 0.2

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

What is the annual amount of electrical energy produced by the array?

1 3600 kWh

2 4500 kWh

3 18000 kWh

4 90000 kWh

END OF TEST

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GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2011 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

June 2011

Foundation Tier

Question	Key		
One	**A**	coal-fired	**1**
	B	gas-fired	**2**
	C	nuclear	**3**
	D	oil-fired	**4**
Two	**A**	chemical	**3**
	B	electrical	**2**
	C	kinetic	**4**
	D	light	**1**
Three	**A**	prevents hot air from rising from the flask	**1**
	B	reduces heat loss by conduction through the base	**4**
	C	reduces heat loss by radiation	**2**
	D	prevents heat loss by conduction and convection	**3**
Four	**A**	This is where the electricity is being generated.	**1**
	B	This is where the electricity is being used.	**4**
	C	This is where the voltage is decreased.	**3**
	D	This is where the voltage is increased.	**2**
Five	**A**	10%	**2**
	B	20%	**3**
	C	40%	**4**
	D	50%	**1**

	A	**B**	**C**	**D**
Six	**4**	**2**	**1**	**1**
Seven	**2**	**2**	**3**	**2**
Eight	**2**	**1**	**1**	**3**
Nine	**3**	**4**	**1**	**3**

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

June 2011

Higher Tier

Question	Key		
One	**A**	10%	**2**
	B	20%	**3**
	C	40%	**4**
	D	50%	**1**
Two	**A**	food mixer	**2**
	B	iron	**1**
	C	radio	**3**
	D	television	**4**

	A	B	C	D
Three	**2**	**1**	**1**	**3**
Four	**3**	**4**	**1**	**3**
Five	**1**	**1**	**1**	**4**
Six	**3**	**4**	**4**	**4**
Seven	**3**	**3**	**2**	**1**
Eight	**4**	**2**	**3**	**3**
Nine	**1**	**3**	**4**	**1**

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http://www.aqa.org.uk/umsconversion

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GCSE SCIENCE

AQA

Unit : PHY1AP **PHYSICS UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M11

28-JUN-11

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	10%	○	○	○	○
1B	20%	○	○	○	○
1C	40%	○	○	○	○
1D	50%	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	food mixer	○	○	○	○
2B	iron	○	○	○	○
2C	radio	○	○	○	○
2D	television	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	coal-fired	○	○	○	○
1B	gas-fired	○	○	○	○
1C	nuclear	○	○	○	○
1D	oil-fired	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	chemical	○	○	○	○
2B	electrical	○	○	○	○
2C	kinetic	○	○	○	○
2D	light	○	○	○	○

QUESTION THREE

		1	2	3	4
3A	prevents hot air from rising from the flask	○	○	○	○
3B	reduces heat loss by conduction through the base	○	○	○	○
3C	reduces heat loss by radiation	○	○	○	○
3D	prevents heat loss by conduction and convection	○	○	○	○

QUESTION FOUR

		1	2	3	4
4A	This is where the electricity is being generated.	○	○	○	○
4B	This is where the electricity is being used.	○	○	○	○
4C	This is where the voltage is decreased.	○	○	○	○
4D	This is where the voltage is increased.	○	○	○	○

QUESTION FIVE

		1	2	3	4
5A	10%	○	○	○	○
5B	20%	○	○	○	○
5C	40%	○	○	○	○
5D	50%	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

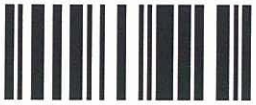
	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
March 2011

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Wednesday 2 March 2011 Morning Session

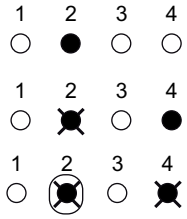
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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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 **FIVE**.

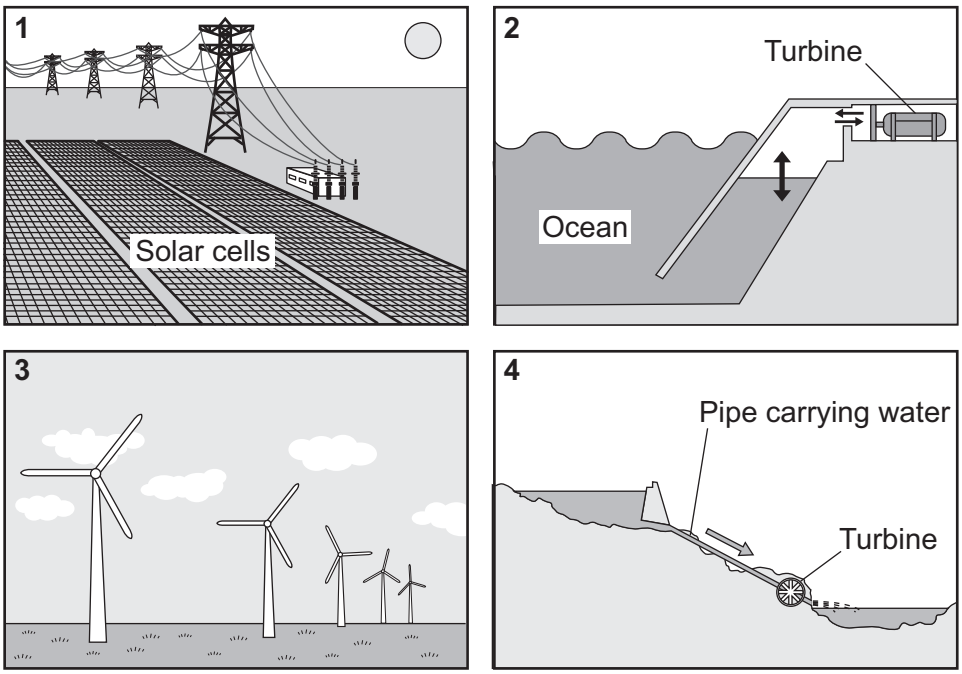
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagrams show four types of power station. Each power station uses a different energy source to produce electricity.



Match energy sources, **A**, **B**, **C** and **D**, with the power stations **1–4**.

A falling water

B sunlight

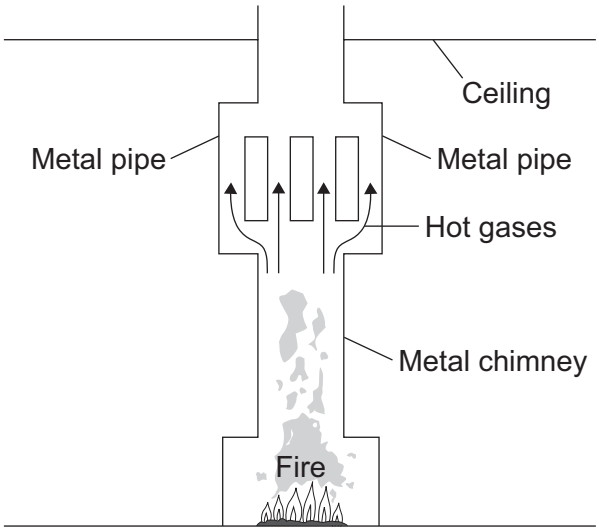
C waves

D wind

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QUESTION TWO

The diagram shows a special design of chimney inside a house.



The metal chimney divides into four thinner pipes. These thinner pipes join up again just below the ceiling.

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

A conduction

B convection

C insulation

D radiation

The chimney is made of metal and this helps to transfer heat by . . . **1**. . . .

Hot gases from the fire rise up the chimney by . . . **2** . . . .

The chimney is split into four pipes to increase the surface area.

The large surface area increases the rate of heat transfer from the metal surface by . . . **3** . . . .

The transfer of heat to the room is helped because there is no . . . **4** . . . on the outside of the metal chimney.

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QUESTION THREE

The picture shows a mobile phone.

The phone can be left switched on in ‘silent’ mode. In this mode, the phone vibrates when there is a call.



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

A electrical

B kinetic

C light

D sound

The output from the screen of the mobile phone is . . . **1** . . . energy.

When the phone is used, the loudspeaker produces . . . **2** . . . energy.

When the phone is used, the microphone produces . . . **3** . . . energy.

When a call is received in ‘silent’ mode, the mobile phone produces . . . **4** . . . energy.

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QUESTION FOUR

This question is about different types of power station.

Match power station types, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A coal-fired

B geothermal

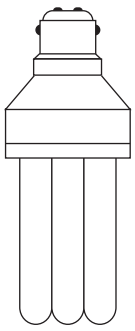
C nuclear

D wind farm

1	produces greenhouse gases
2	produces long-lasting radioactive waste
3	uses heat from underground
4	the energy source drives a turbine directly

QUESTION FIVE

The diagram shows a compact fluorescent lamp (CFL).



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

A economical

B efficient

C environmental

D ethical

Compared with a filament lamp, a CFL transforms less electrical energy to produce the same amount of light energy each second. This makes the CFL more . . . **1** . . . .

Over time, CFLs cost less to buy and use, making them more . . . **2** . . . than filament lamps.

CFLs contain mercury and their disposal causes . . . **3** . . . problems.

Society must decide whether or not it is . . . **4** . . . to use CFLs even if there is a possible hazard to health.

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Section Two

Questions **SIX** to **NINE**.

Each of these questions has four parts.

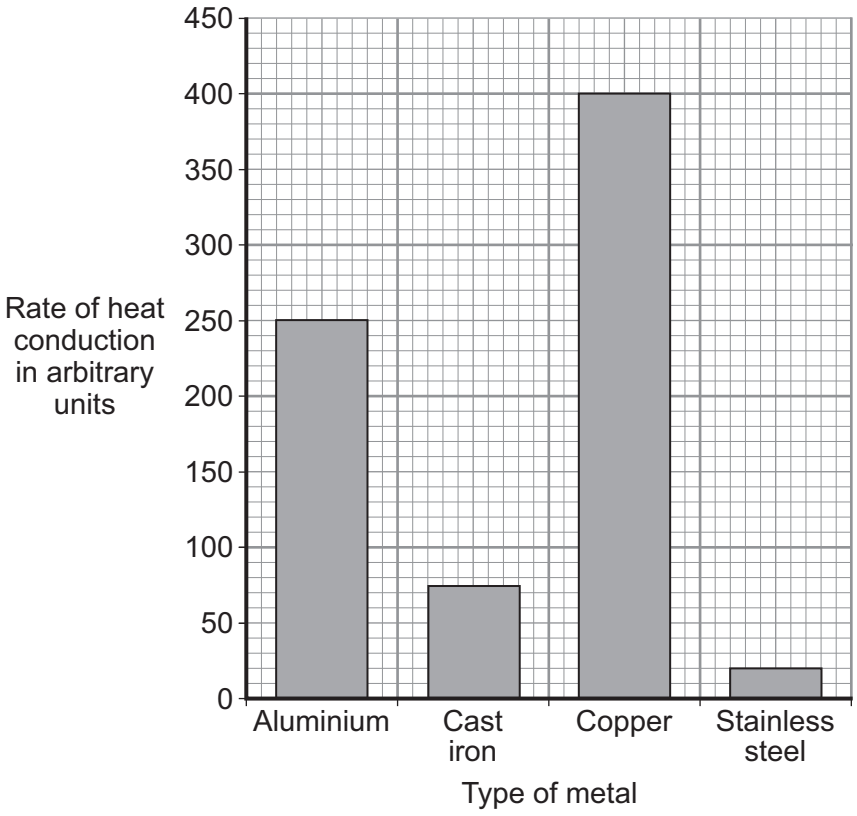
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION SIX

A manufacturer tested four different metals to find out how good the metals are at conducting heat.

The bar chart shows the results.



6A Why are the results shown on a bar chart rather than a line graph?

1 The rate of heat conduction is a categoric variable.

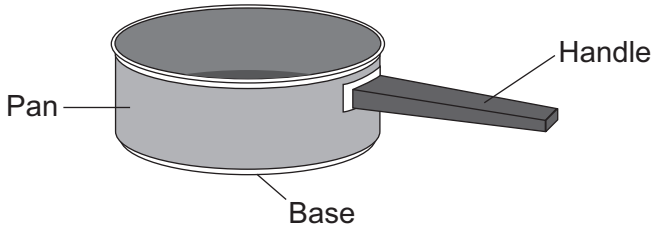
2 The rate of heat conduction is a continuous variable.

3 The type of metal is a categoric variable.

4 The type of metal is a continuous variable.

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The diagram shows the main parts of a saucepan.



6B In terms of conducting heat, which metal would be best for making the base of the saucepan?

1 aluminium

2 cast iron

3 copper

4 stainless steel

6C The pan and the handle of some saucepans are made from the same metal. The user of the saucepan does not want to burn their hand when they pick up the hot saucepan.

Which metal would be best to use for this type of saucepan?

1 aluminium

2 cast iron

3 copper

4 stainless steel

6D How is heat conducted through the handle?

1 Atoms move from one end of the handle to the other.

2 Conduction currents pass along the handle.

3 Energy is passed from atom to atom.

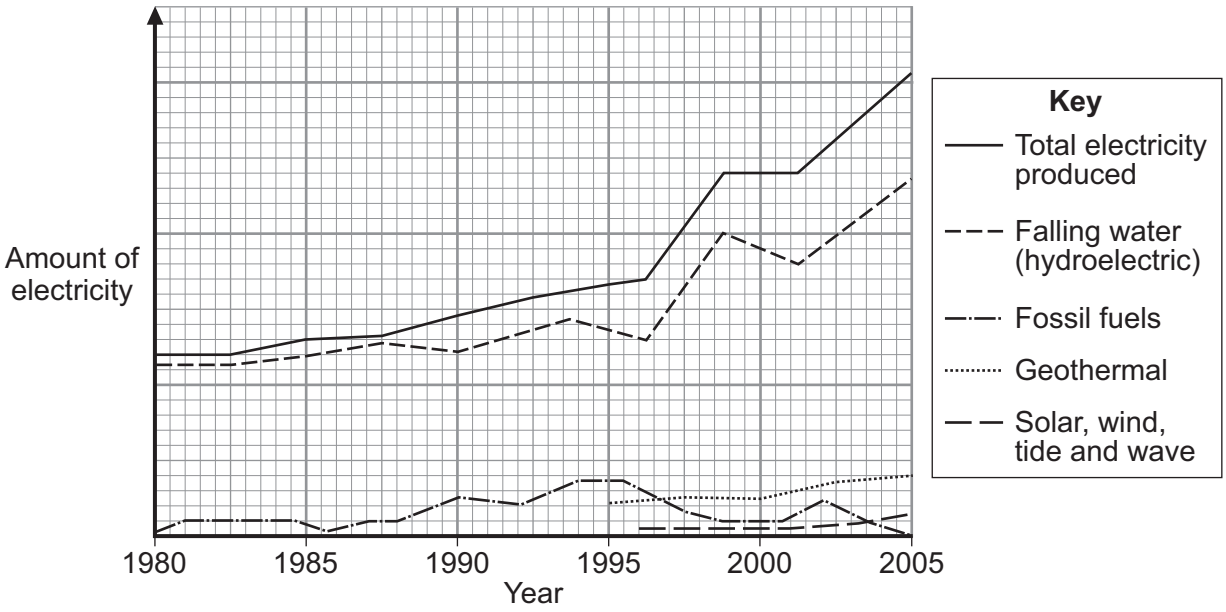
4 Waves of radiation pass along the handle.

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QUESTION SEVEN

Costa Rica is a country in Central America.

The graph shows how the sources used for generating electricity in Costa Rica have changed since 1980. It also shows how the total amount of electricity produced has changed.



7A Which of the following has been the main energy source since 1980?

1 falling water (hydroelectric)

2 fossil fuels

3 geothermal

4 solar, wind, tide and wave

7B Which energy source was first used in 1995?

1 falling water (hydroelectric)

2 fossil fuels

3 geothermal

4 solar, wind, tide and wave

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7C The graph shows . . .

1 a decrease in the total amount of electricity produced.

2 an increase in the total amount of electricity produced.

3 that the total amount of electricity produced has remained unchanged.

4 no clear trend in the total amount of electricity produced.

7D We can conclude from the graph that in producing electricity, Costa Rica . . .

1 does not produce much polluting gas.

2 does not use renewable energy sources.

3 has very few mountains.

4 uses mainly fossil fuels.

Turn over for the next question

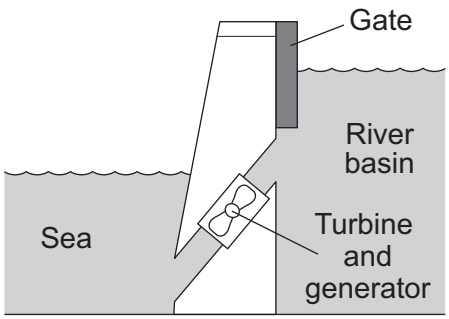
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QUESTION EIGHT

It is estimated that the total energy available from the world's tides could provide about 5 % of the electricity generated worldwide.

One method of using the energy of tides is to build a barrage across a river.

The diagram shows a tidal barrage.



Tide going out

- As the tide rises, the gate is opened to let seawater into the river basin.
- At high tide the gate is closed, trapping water in the river basin.
- As the tide goes out, the gate is opened and water flows through the turbine.

8A Which energy transformations take place as the water flows from the river basin through the turbine and the generator to the sea?

1 gravitational potential to electrical to kinetic

2 gravitational potential to kinetic to electrical

3 kinetic to electrical to gravitational potential

4 kinetic to gravitational potential to electrical

8B From the information above, one of the advantages of a tidal barrage over a wind farm is that it . . .

1 can be built anywhere.

2 generates electricity all the time.

3 has low building costs.

4 uses a predictable energy source.

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8C Environmentalists claim that one of the **disadvantages** of tidal power stations is that they . . .

1 cause noise pollution.

2 destroy the habitat of wading birds.

3 produce gases that pollute the atmosphere.

4 produce radioactive waste.

8D A cheaper way to use tidal energy is to use underwater currents to drive turbines. This is the same idea as a wind farm, but it works under water.

One report states that electricity generated by underwater currents would be four times as expensive as electricity generated by a wind farm.

The cost of electricity, from cheapest to most expensive, would be . . .

1 tidal barrage, underwater current, wind farm.

2 underwater current, wind farm, tidal barrage.

3 wind farm, tidal barrage, underwater current.

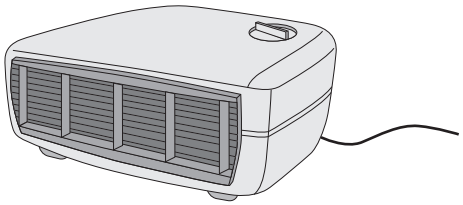
4 wind farm, underwater current, tidal barrage.

Turn over for the next question

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QUESTION NINE

A fan heater is used to heat air and to move it around a room.



Fan heater

9A The fan heater usefully transforms electrical energy to . . .

1 kinetic and sound energy.

2 light and thermal energy.

3 sound and light energy.

4 thermal and kinetic energy.

9B Energy that is not usefully transformed by the fan heater is wasted as . . .

1 chemical energy.

2 kinetic energy.

3 sound energy.

4 thermal energy.

9C The fan heater moves hot air around the room.

This method of heat transfer is sometimes called forced . . .

1 conduction.

2 convection.

3 evaporation.

4 radiation.

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9D The fan heater transfers 3 kWh of energy as it warms a room.

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

Electricity costs 15p per kWh

What is the cost of this energy?

1 5p

2 45p

3 £5

4 £45

END OF TEST

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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**.

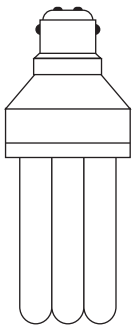
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a compact fluorescent lamp (CFL).



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

A economical

B efficient

C environmental

D ethical

Compared with a filament lamp, a CFL transforms less electrical energy to produce the same amount of light energy each second. This makes the CFL more . . . **1** . . . .

Over time, CFLs cost less to buy and use, making them more . . . **2** . . . than filament lamps.

CFLs contain mercury and their disposal causes . . . **3** . . . problems.

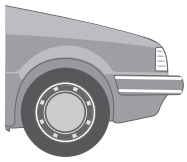
Society must decide whether or not it is . . . **4** . . . to use CFLs even if there is a possible hazard to health.

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QUESTION TWO

This question is about controlling some forms of radiation.

1



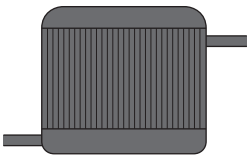
Car headlight has a shiny coating inside

2



Camera is matt black inside

3



Car radiator is painted matt black

4



Soil is covered with black plastic

Match statements, **A**, **B**, **C** and **D**, with diagrams **1**–**4**.

A is designed to increase the rate at which infra red radiation is absorbed

B is designed to increase the rate at which infra red radiation is emitted

C is designed to improve the ability to reflect visible light

D is designed to prevent the reflection of visible light

Turn over for the next question

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Section Two

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

Each of these questions has four parts.

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

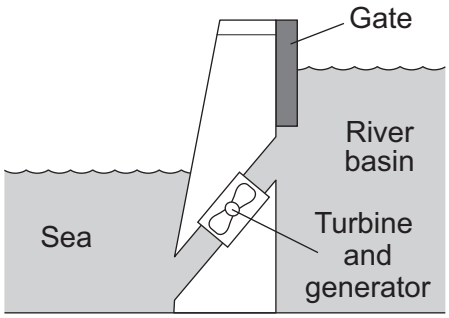
Mark your choices on the answer sheet.

QUESTION THREE

It is estimated that the total energy available from the world's tides could provide about 5 % of the electricity generated worldwide.

One method of using the energy of tides is to build a barrage across a river.

The diagram shows a tidal barrage.



Tide going out

- As the tide rises, the gate is opened to let seawater into the river basin.
- At high tide the gate is closed, trapping water in the river basin.
- As the tide goes out, the gate is opened and water flows through the turbine.

3A Which energy transformations take place as the water flows from the river basin through the turbine and the generator to the sea?

1 gravitational potential to electrical to kinetic

2 gravitational potential to kinetic to electrical

3 kinetic to electrical to gravitational potential

4 kinetic to gravitational potential to electrical

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3B From the information above, one of the advantages of a tidal barrage over a wind farm is that it . . .

1 can be built anywhere.

2 generates electricity all the time.

3 has low building costs.

4 uses a predictable energy source.

3C Environmentalists claim that one of the **disadvantages** of tidal power stations is that they . . .

1 cause noise pollution.

2 destroy the habitat of wading birds.

3 produce gases that pollute the atmosphere.

4 produce radioactive waste.

3D A cheaper way to use tidal energy is to use underwater currents to drive turbines. This is the same idea as a wind farm, but it works under water.

One report states that electricity generated by underwater currents would be four times as expensive as electricity generated by a wind farm.

The cost of electricity, from cheapest to most expensive, would be . . .

1 tidal barrage, underwater current, wind farm.

2 underwater current, wind farm, tidal barrage.

3 wind farm, tidal barrage, underwater current.

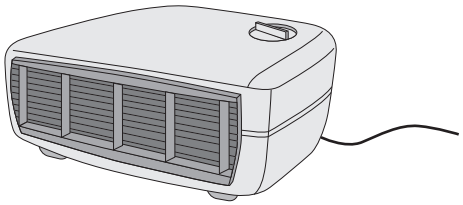
4 wind farm, underwater current, tidal barrage.

Turn over for the next question

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QUESTION FOUR

A fan heater is used to heat air and to move it around a room.



Fan heater

4A The fan heater usefully transforms electrical energy to . . .

1 kinetic and sound energy.

2 light and thermal energy.

3 sound and light energy.

4 thermal and kinetic energy.

4B Energy that is not usefully transformed by the fan heater is wasted as . . .

1 chemical energy.

2 kinetic energy.

3 sound energy.

4 thermal energy.

4C The fan heater moves hot air around the room.

This method of heat transfer is sometimes called forced . . .

1 conduction.

2 convection.

3 evaporation.

4 radiation.

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4D The fan heater transfers 3 kWh of energy as it warms a room.

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

Electricity costs 15p per kWh

What is the cost of this energy?

1 5p

2 45p

3 £5

4 £45

Turn over for the next question

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QUESTION FIVE

A 'hybrid' car can run on petrol stored in a tank or on electricity stored in a rechargeable battery.

5A When the battery is completely 'flat', it has no energy stored in it. The battery of car **X** is connected to the mains electrical supply and receives energy at a rate of 2000 W. It takes 6 hours to fully charge the battery.

How much electrical energy is needed to fully charge the battery of car **X**?

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

1 3 kWh

2 12 kWh

3 333 kWh

4 12 000 kWh

5B A different hybrid car, **Y**, needs a different amount of electrical energy to charge its battery. The total cost of this electrical energy is £3.

Mains electricity costs 15 pence per kWh.

How much electrical energy is needed to fully charge the battery of car **Y**?

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

1 0.2 kWh

2 12 kWh

3 20 kWh

4 45 kWh

5C When the battery of car **Y** is fully charged, it can travel 100 km using the energy stored in its battery. Travelling the same distance using its petrol engine would require five times as much energy.

What does this tell you about the efficiency of the two methods of propelling car **Y**?

1 The electric motor is more efficient than the petrol engine.

2 The petrol engine is more efficient than the electric motor.

3 The petrol engine and the electric motor have the same efficiency.

4 It is impossible to compare the efficiency.

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5D Some cars are all electric and have no petrol engine fitted.

Which statement about these cars is true?

1 They are not responsible for producing any atmospheric pollution.

2 They produce more atmospheric pollution than petrol-engine cars.

3 They produce no atmospheric pollution while being driven.

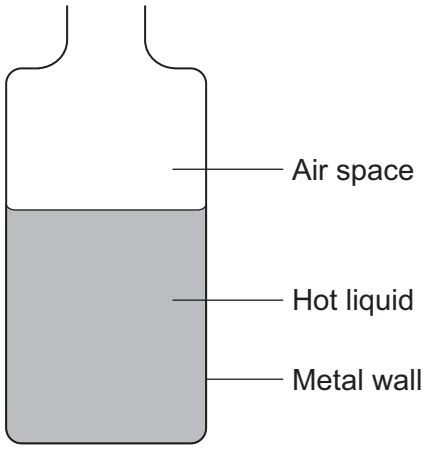
4 They produce no atmospheric pollution but a lot of noise pollution.

Turn over for the next question

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QUESTION SIX

The diagram shows a flask containing a hot liquid.



6A Heat is transferred through the air space above the hot liquid.

The air particles just above the hot liquid . . .

1 contract to become smaller.

2 expand to become bigger.

3 move further apart, making the air less dense.

4 move closer together, making the air denser.

6B Heat is transferred through the metal wall because . . .

1 convection currents are set up in the metal.

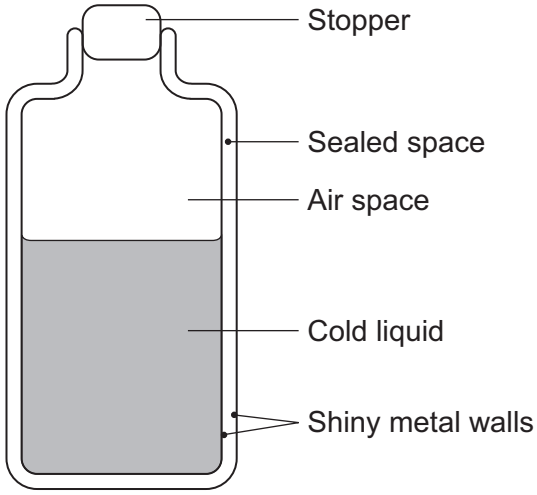
2 the metal contains electrons that are free to move within the metal.

3 the particles in the liquid vibrate and collide with their neighbours.

4 the shiny metal is a good emitter of radiation.

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The diagram shows another flask containing a cold liquid. This flask has two shiny metal walls with a sealed space between them.



6C What should the sealed space contain in order to keep the liquid cold for the longest time?

1 some air

2 some polystyrene

3 a vacuum

4 some water

6D The shiny metal walls help to keep the liquid cold for a long time.

This is because shiny surfaces are good . . .

1 absorbers of infra red radiation.

2 emitters of infra red radiation.

3 reflectors of infra red radiation.

4 transmitters of infra red radiation.

Turn over for the next question

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QUESTION SEVEN

The table is taken from an advert for low-energy lamps.

Save up to 80 % of your electricity bill by switching to low-energy lamps		
Filament lamp	**Equivalent low-energy lamp**	**Power saving**
60 W	12 W	80 %
60 W	15 W	
100 W	20 W	80 %
100 W	24 W	76 %

7A A householder changes from using a 60 W filament lamp to using a 15 W low-energy lamp.

What is the percentage power saving made?

1 20 %

2 45 %

3 75 %

4 80 %

A 20 W low-energy lamp provides the same amount of light each second as a 100 W filament lamp.

7B The efficiency of a 100 W filament lamp is 0.15.

What is the efficiency of the 20 W low-energy lamp?

1 0.03

2 0.15

3 0.30

4 0.75

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7C How much money is saved over 200 hours by replacing a 100 W filament lamp with a 20 W low-energy lamp?

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

Electricity costs 15p per kWh

1 48p

2 60p

3 £2.40

4 £3.00

7D A householder is considering changing all her filament lamps for low-energy lamps. However, she says that the table in the advert does not contain enough information for her to know how much money she will save.

She needs to know . . .

1 how much each lamp costs and how long it lasts.

2 how long each lamp lasts and how much electricity costs per kWh.

3 how much electricity costs per kWh and how much each lamp costs.

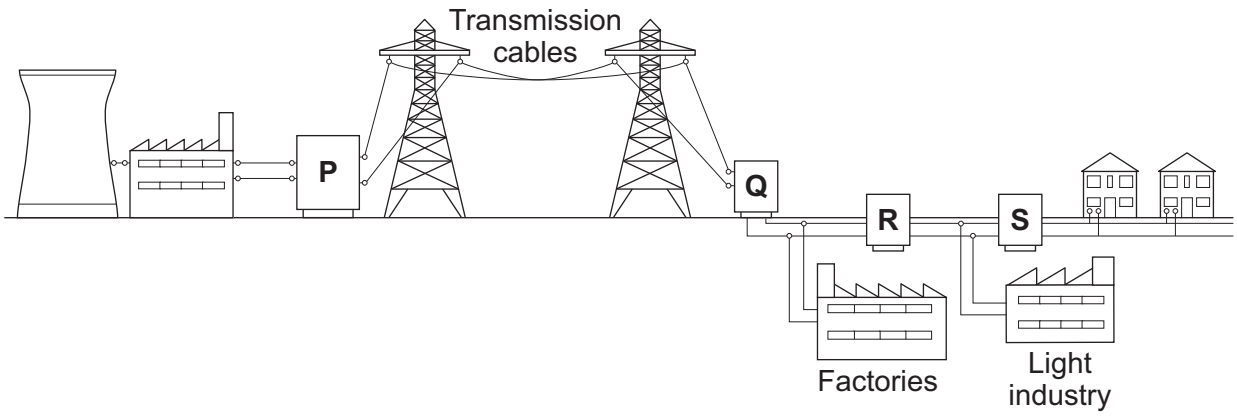
4 how much each lamp costs, how long each lamp lasts and how much electricity costs per kWh.

Turn over for the next question

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QUESTION EIGHT

The diagram shows a power station supplying electricity to the National Grid. There are four transformers in the system, labelled **P**, **Q**, **R** and **S**.



8A Which row in the table correctly describes each transformer?

	P	Q	R	S
1	step up	step down	step down	step down
2	step down	step up	step up	step up
3	step up	step down	step up	step down
4	step up	step up	step down	step down

8B The voltage across the overhead transmission cables is very high.

The best explanation for this is that . . .

1 it allows thinner cables to be used and the energy loss from the cables is reduced.

2 the energy loss from the cables is reduced and it allows the distance between pylons to be reduced.

3 the distance between the pylons can be reduced and thicker cables can be used.

4 it allows the current to travel more slowly and thicker cables can be used.

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8C Changing the voltage between the power station and the transmission cables using transformer **P** also changes the current flowing and the efficiency of distribution.

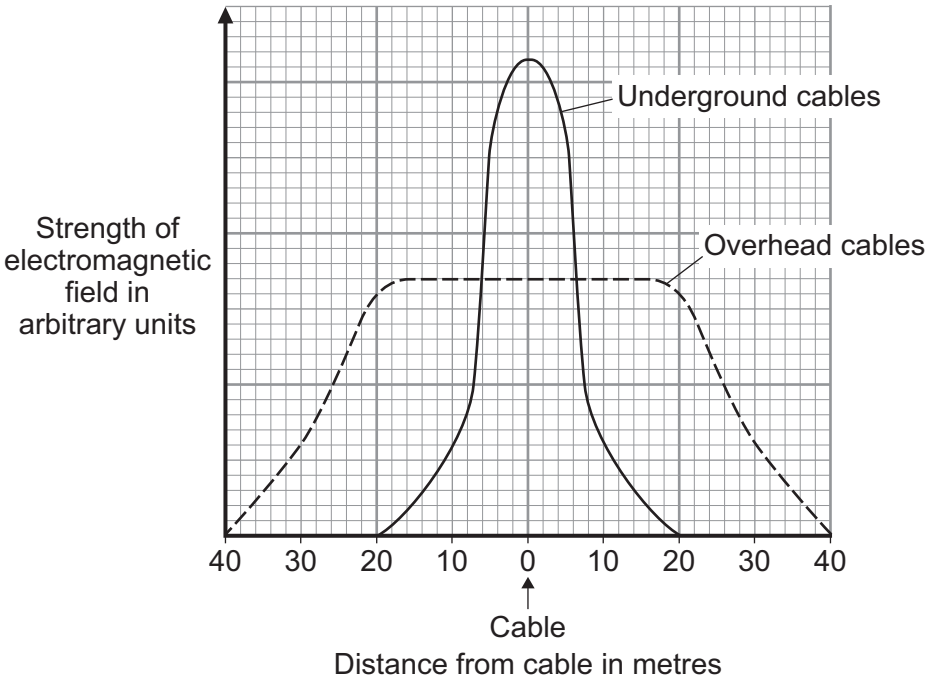
Which row of the table correctly shows these changes?

	Voltage	Current	Efficiency
1	increases	increases	increases
2	decreases	decreases	increases
3	decreases	decreases	decreases
4	increases	decreases	increases

8D Transmission cables can either be suspended from pylons above ground or they can be buried underground.

An electromagnetic field is produced when an electric current flows through a cable. Some people think that these fields can cause a health risk.

The graph shows how the strength of the electromagnetic field varies with distance from the cable for both overhead cables and underground cables.



Which of the following conclusions could be made from the graph?

1 When you are within 5 metres of the cable, the possible risk to health is bigger with an underground cable.

2 The possible health risk from overhead cables falls to zero when you are 20 metres away.

3 The biggest possible health risk from overhead cables occurs when you are 40 metres away.

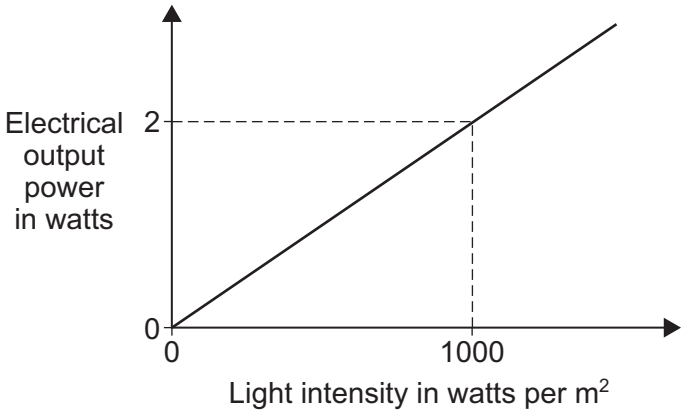
4 Between 10 and 40 metres away, the biggest possible health risk is from underground cables.

Turn over ▶

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QUESTION NINE

The diagram shows the electrical output power of a typical solar cell as the light intensity on it changes. The solar cell has a surface area of 100 cm^2.



9A The graph shows that . . .

1 the output power is directly proportional to the light intensity.

2 the output power decreases as the light intensity increases.

3 as the light intensity decreases the output power increases.

4 the output power is not affected by the light intensity.

9B The output power of the solar cell is directly proportional to the area of the cell exposed to light.

A similar solar cell has an area of 50 cm^2. The light intensity was 1000 watts per metre^2.

What is the output power of this solar cell?

1 0 watts

2 1 watt

3 2 watts

4 4 watts

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A satellite in space uses solar energy as its power source.
The satellite needs 3 kJ of energy per second.
One square metre of solar cells on the satellite produces 250 joules of energy per second.

9C What area of solar cells is needed to power the satellite?

1 12 m^2

2 83 m^2

3 300 m^2

4 400 m^2

9D The efficiency of the solar cells is 0.2

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

Considering the total energy requirement of the satellite, how much solar energy falls on the solar cells each second?

1 15 J

2 600 J

3 15 kJ

4 600 kJ

END OF TEST

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There are no questions printed on this page

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There are no questions printed on this page

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Version 1.0: 01/04/2011

GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2011 Examination – March Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461) / PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2011

Foundation Tier

Question			Key
One	**A**	falling water	**4**
	B	sunlight	**1**
	C	waves	**2**
	D	wind	**3**
Two	**A**	conduction	**1**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**3**
Three	**A**	electrical	**3**
	B	kinetic	**4**
	C	light	**1**
	D	sound	**2**
Four	**A**	coal-fired	**1**
	B	geothermal	**3**
	C	nuclear	**2**
	D	wind farm	**4**
Five	**A**	economical	**2**
	B	efficient	**1**
	C	environmental	**3**
	D	ethical	**4**

	A	**B**	**C**	**D**
Six	**3**	**3**	**4**	**3**
Seven	**1**	**3**	**2**	**1**
Eight	**2**	**4**	**2**	**4**
Nine	**4**	**3**	**2**	**2**

GCSE

SCIENCE A (4461) / PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2011

Higher Tier

Question	Key		
One	**A**	economical	**2**
	B	efficient	**1**
	C	environmental	**3**
	D	ethical	**4**
Two	**A**	. . . increase the rate at which infra red radiation is absorbed	**4**
	B	. . . increase the rate at which infra red radiation is emitted	**3**
	C	. . . improve the ability to reflect visible light	**1**
	D	. . . prevent the reflection of visible light	**2**

	A	B	C	D
Three	**2**	**4**	**2**	**4**
Four	**4**	**3**	**2**	**2**
Five	**2**	**3**	**1**	**3**
Six	**3**	**2**	**3**	**3**
Seven	**3**	**4**	**3**	**4**
Eight	**1**	**1**	**4**	**1**
Nine	**1**	**2**	**1**	**3**

GCSE SCIENCE

AQA

Unit : PHY1AP **PHYSICS UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 3G11

02-MAR-11

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	economical	○	○	○	○
1B	efficient	○	○	○	○
1C	environmental	○	○	○	○
1D	ethical	○	○	○	○

QUESTION TWO		1	2	3	4
2A	...increase the rate at which infra red is absorbed	○	○	○	○
2B	...increase the rate at which infra red is emitted	○	○	○	○
2C	...improve the ability to reflect visible light	○	○	○	○
2D	...prevent the reflection of visible light	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A falling water	○	○	○	○
1B sunlight	○	○	○	○
1C waves	○	○	○	○
1D wind	○	○	○	○

QUESTION TWO	1	2	3	4
2A conduction	○	○	○	○
2B convection	○	○	○	○
2C insulation	○	○	○	○
2D radiation	○	○	○	○

QUESTION THREE	1	2	3	4
3A electrical	○	○	○	○
3B kinetic	○	○	○	○
3C light	○	○	○	○
3D sound	○	○	○	○

QUESTION FOUR	1	2	3	4
4A coal-fired	○	○	○	○
4B geothermal	○	○	○	○
4C nuclear	○	○	○	○
4D wind farm	○	○	○	○

QUESTION FIVE	1	2	3	4
5A economical	○	○	○	○
5B efficient	○	○	○	○
5C environmental	○	○	○	○
5D ethical	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2010

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Thursday 11 November 2010 Afternoon Session

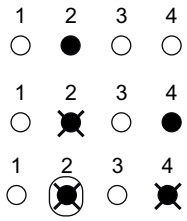
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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 16 of this booklet.

FOUNDATION TIER

Section One

Questions **ONE** to **FIVE**.

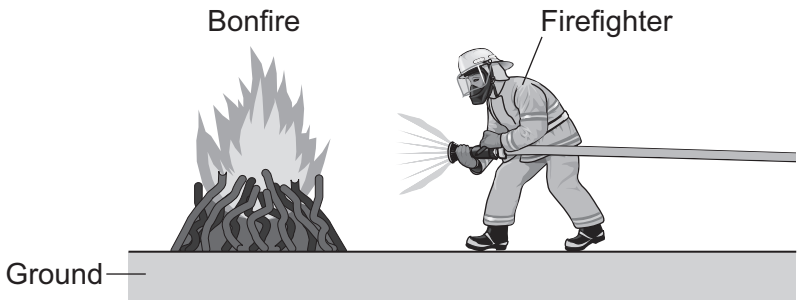
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The drawing shows a firefighter putting out a bonfire. The firefighter wears thick, woollen clothing. The clothing has a light-coloured, shiny surface.



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

A conduction

B insulation

C radiation

D reflection

Heat is transferred from the fire to the firefighter's clothing by . . . **1** . . . .

The ground underneath the fire will get hot when heat is transferred to it by . . . **2** . . . .

The thick, woollen clothing provides good heat . . . **3** . . . .

The light-coloured, shiny surface of the clothing provides good . . . **4** . . . of infra red.

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QUESTION TWO

This question is about generating electricity.

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

A gas

B geothermal

C moving water

D uranium

	Description
1	produces energy from fission
2	is used in hydroelectric schemes
3	energy from underground hot rocks
4	is burnt in some power stations

Turn over for the next question

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QUESTION THREE

An inventor has designed a way of charging a mobile phone battery as a person is walking. The charger unit contains a generator. The unit is strapped to a leg.



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

A chemical

B electrical

C heat

D kinetic

As the person walks, . . . **1** . . . energy from food is transformed to . . . **2** . . . energy of the moving legs.

The generator produces useful . . . **3** . . . energy.

Some energy is wasted as . . . **4** . . . .

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QUESTION FOUR

Power stations used to generate electricity affect the environment in different ways.

Match types of power station, **A**, **B**, **C** and **D**, with effects on the environment **1**–**4** in the table.

A coal-fired

B hydroelectric

C nuclear

D tidal barrage

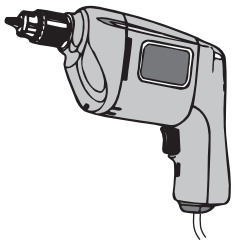
	Effect on environment
1	destroys the habitats of wading birds
2	produces waste that is radioactive
3	destroys large areas of farmland by flooding
4	produces gases that pollute the atmosphere

Turn over for the next question

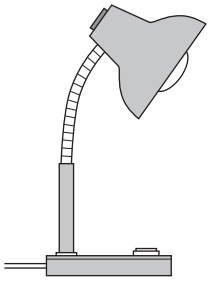
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QUESTION FIVE

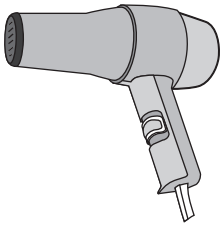
The diagrams show four electrical devices. The Sankey diagrams show the energy transformations involved in the four electrical devices.



A
Electric drill



B
Desk lamp



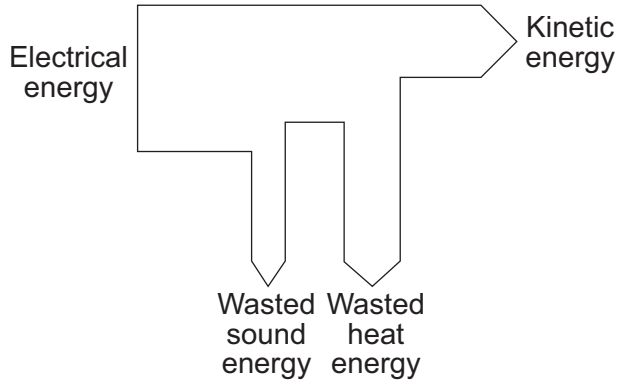
C
Hair dryer



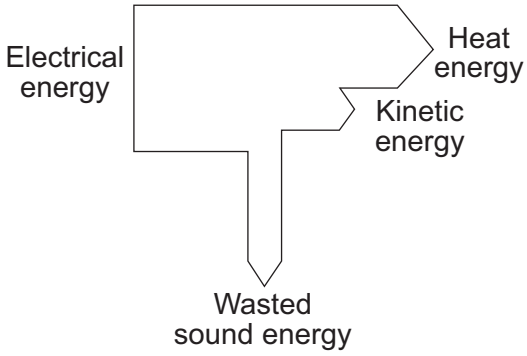
D
Television

Match devices, **A**, **B**, **C** and **D**, with the Sankey diagrams **1**–**4**.

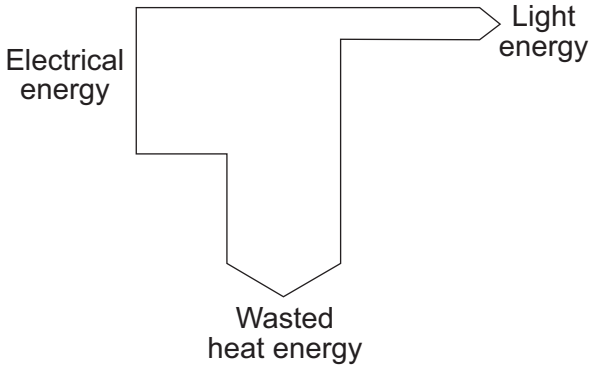
1



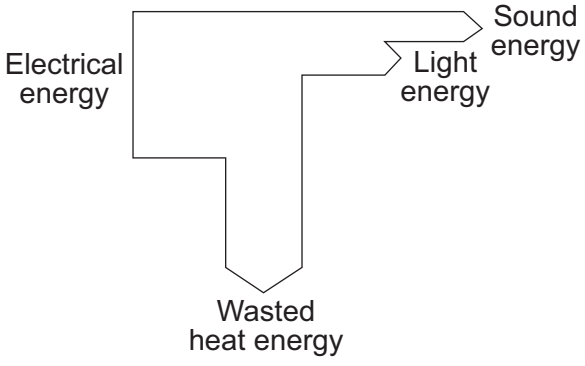
2



3



4



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Turn over for the next question

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Section Two

Questions **SIX** to **NINE**.

Each of these questions has four parts.

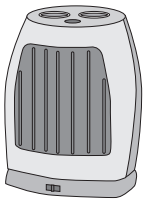
In each part choose only **one** answer.

Mark your choices on the answer sheet.

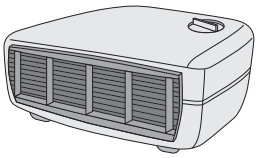
QUESTION SIX

The pictures show four different types of electric heater.

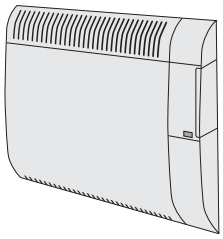
1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out



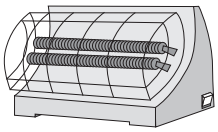
3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



400 W oil-filled panel heater
- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



2 kW radiant heater
- 2 heat settings



6A Which heater is the most powerful?

1 the ceramic heater

2 the fan heater

3 the oil-filled panel heater

4 the radiant heater

6B The fan heater is run on full power for 4 hours.

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

How much energy, in kWh, is transferred from the mains supply to the fan heater?

1 0.75

2 3.0

3 7.0

4 12.0

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6C In one week, the oil-filled panel heater used 10 kWh of electrical energy.

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

Electricity costs 14p per kWh

How much did it cost to run the oil-filled panel heater for the week?

1 £0.14

2 £1.40

3 £14.00

4 £140.00

6D Which of the following is an advantage of the fan heater compared with the other heaters?

1 The fan heater can make a room feel cooler in summer.

2 The fan heater has a power indicator light.

3 The fan heater has a safety overheat cut-out.

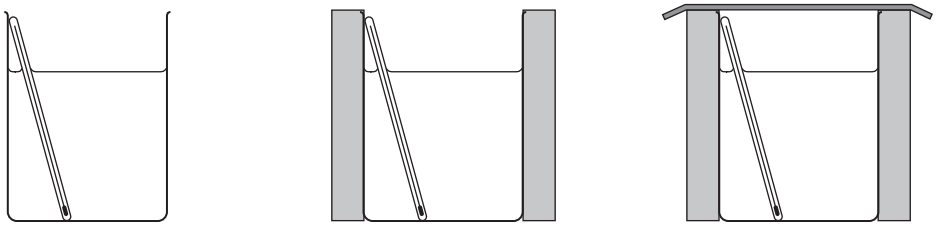
4 The fan heater has more than one heat setting.

Turn over for the next question

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QUESTION SEVEN

A student investigated the cooling of a hot liquid. She used three identical beakers that contained equal volumes of water. Two of the beakers were insulated and one beaker also had a lid. The water temperature in each beaker started at 90 °C.



No insulation | Insulation | Insulation and lid

She recorded the temperature decrease of the water in each beaker after 10 minutes.

Her results are shown in the table.

Method of insulation	Temperature decrease in °C
no insulation	30
insulation	25
insulation and lid	10

7A The method of insulation is a . . .

1 categoric variable.

2 continuous variable.

3 control variable.

4 ordered variable.

7B The best way to display the results in the table would be a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

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7C She repeated the experiment with a starting temperature of 70 °C instead of 90 °C.

The temperature decrease after 10 minutes was smaller than before in . . .

1 only the beaker with no insulation.

2 only the beaker with insulation.

3 only the beaker with insulation and lid.

4 all three beakers.

7D The lid stopped hot air rising.

This reduced heat loss by . . .

1 conduction only.

2 convection only.

3 radiation only.

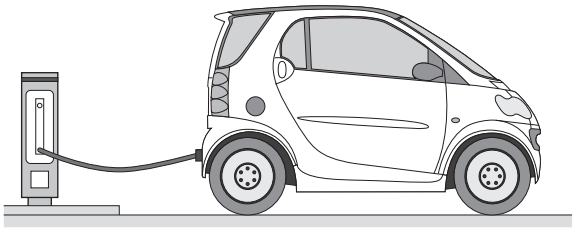
4 conduction, convection and radiation.

Turn over for the next question

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QUESTION EIGHT

A manufacturer is producing a new electric car. Batteries in the car store the energy needed for driving. These batteries need to be charged for 6 hours every night.



The manufacturer carried out four tests to find out how far the car can be driven after the batteries had been charged for 6 hours. All the tests were carried out under the same conditions, with the car being driven at the same speed.

8A Four tests were carried out. The distances travelled were measured and a mean was calculated.

Why is this better than simply carrying out a single test?

1 It decreases the validity of the results.

2 It makes the results more precise.

3 It makes sure that the results will be true for all road conditions.

4 It minimises the effect of random errors.

8B The table shows the results of the four tests.

Test number	Distance travelled in km
1	31
2	57
3	61
4	62

Which one of the results, **1**, **2**, **3** or **4**, appears to be anomalous?

8C How should the mean of the measurements be calculated?

1 Add all four results together and divide by four.

2 Add the highest and the lowest together and divide by two.

3 Ignore the anomalous result, add the other three results together and divide by three.

4 Ignore the anomalous result and take the middle value of the other three results.

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8D A person who bought the car found that the distance the car could travel on a single charge was a lot less than that stated by the manufacturer.

What could be the reason for this?

1 The batteries had been left on charge for more than 6 hours.

2 The distance recorder on the car lacked precision.

3 The meter that records the total distance travelled had not been set to zero.

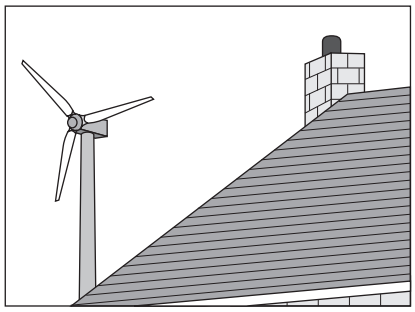
4 The owner did not control the same variables as the manufacturer.

Turn over for the next question

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QUESTION NINE

A householder is thinking about buying and installing a wind turbine on his roof.
The turbine costs £3000 to buy and install.



9A The householder estimates that the wind turbine would generate electricity worth an average of £1.50 each day.

What would be the pay-back time?

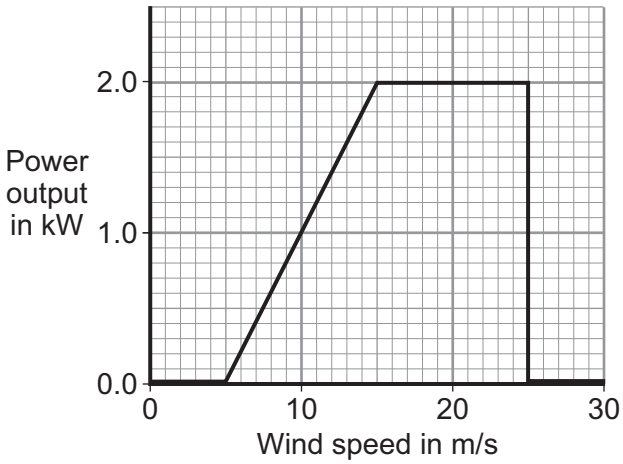
1 1000 days

2 2000 days

3 3000 days

4 4000 days

The graph shows how the power produced by the wind turbine changes with the wind speed.
The wind turbine shuts down at high wind speeds.



9B The maximum power output occurs when the wind speed reaches . . .

1 5 m/s

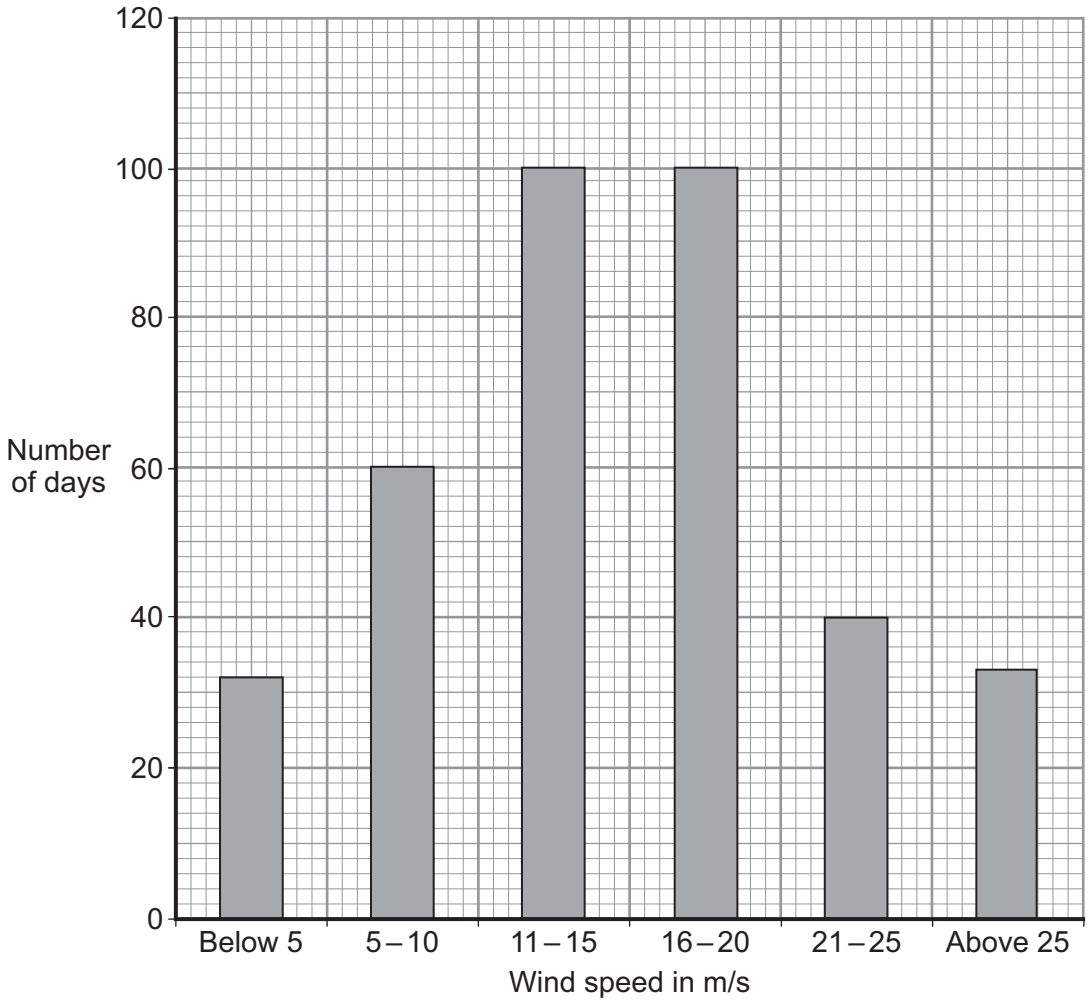
2 10 m/s

3 15 m/s

4 20 m/s

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9C The bar chart shows the wind speed at the house and the number of days in the year on which the wind has that speed.



For how many days in the year could the householder get some energy from the wind turbine?

1 160

2 260

3 300

4 330

9D The householder decides not to buy the wind turbine.

The most likely reason for his decision is that the wind turbine . . .

1 has fuel costs that are too high.

2 produces no greenhouse gases.

3 uses a non-renewable energy source.

4 uses an unreliable energy source.

END OF TEST

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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**.

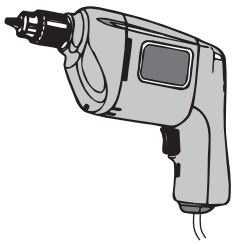
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

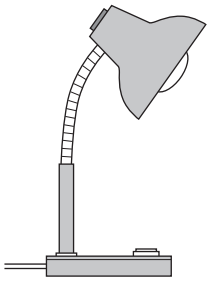
Mark your choices on the answer sheet.

QUESTION ONE

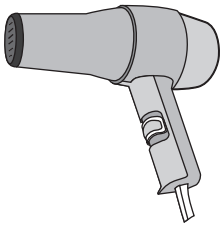
The diagrams show four electrical devices. The Sankey diagrams show the energy transformations involved in the four electrical devices.



A
Electric drill



B
Desk lamp



C
Hair dryer

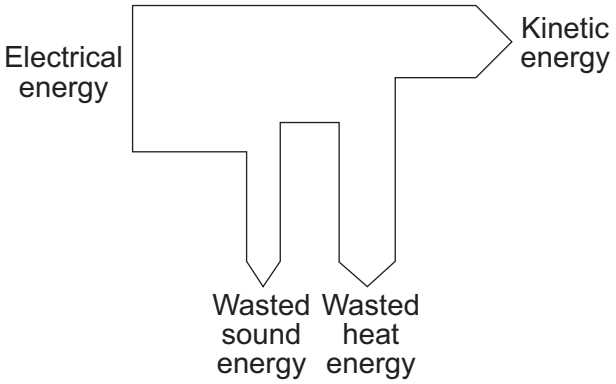


D
Television

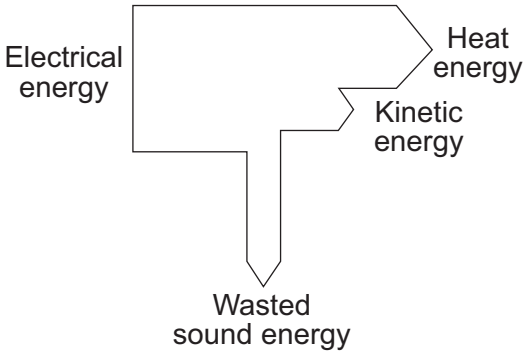
Match devices, **A**, **B**, **C** and **D**, with the Sankey diagrams **1**–**4**.

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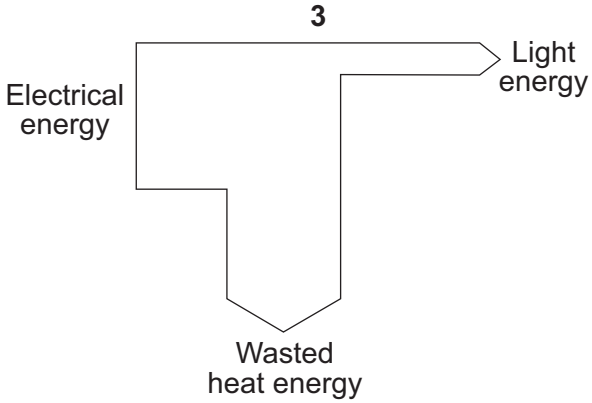
1



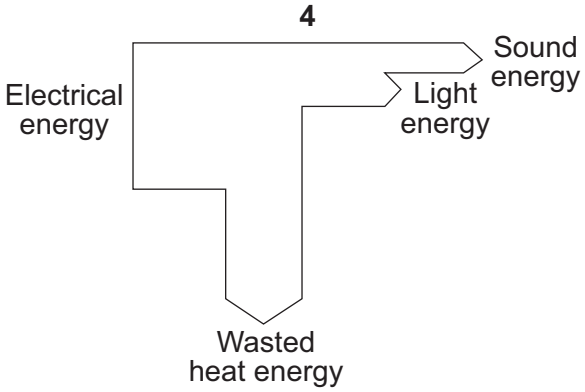
2



3



4



Turn over for the next question

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QUESTION TWO

The drawing shows a mobile phone. This phone also has a digital camera.



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

A electrical to light

B electrical to sound

C light to electrical

D sound to electrical

1	the useful energy transformation in the display screen
2	the useful energy transformation in the loudspeaker
3	the useful energy transformation in the microphone
4	the useful energy transformation in the digital camera

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Turn over for the next question

Section Two

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

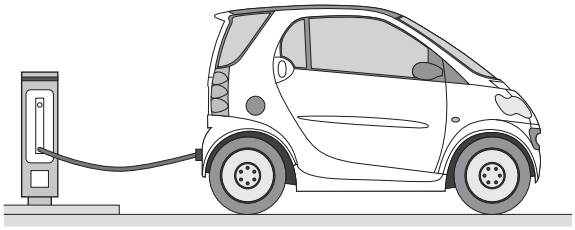
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION THREE

A manufacturer is producing a new electric car. Batteries in the car store the energy needed for driving. These batteries need to be charged for 6 hours every night.



The manufacturer carried out four tests to find out how far the car can be driven after the batteries had been charged for 6 hours. All the tests were carried out under the same conditions, with the car being driven at the same speed.

3A Four tests were carried out. The distances travelled were measured and a mean was calculated.

Why is this better than simply carrying out a single test?

1 It decreases the validity of the results.

2 It makes the results more precise.

3 It makes sure that the results will be true for all road conditions.

4 It minimises the effect of random errors.

3B The table shows the results of the four tests.

Test number	Distance travelled in km
1	31
2	57
3	61
4	62

Which one of the results, **1**, **2**, **3** or **4**, appears to be anomalous?

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3C How should the mean of the measurements be calculated?

1 Add all four results together and divide by four.

2 Add the highest and the lowest together and divide by two.

3 Ignore the anomalous result, add the other three results together and divide by three.

4 Ignore the anomalous result and take the middle value of the other three results.

3D A person who bought the car found that the distance the car could travel on a single charge was a lot less than that stated by the manufacturer.

What could be the reason for this?

1 The batteries had been left on charge for more than 6 hours.

2 The distance recorder on the car lacked precision.

3 The meter that records the total distance travelled had not been set to zero.

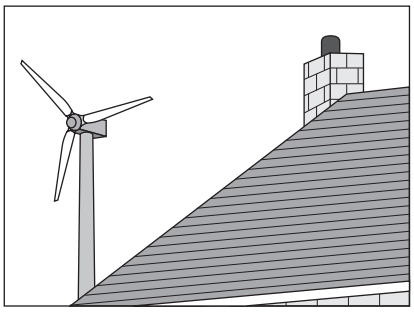
4 The owner did not control the same variables as the manufacturer.

Turn over for the next question

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QUESTION FOUR

A householder is thinking about buying and installing a wind turbine on his roof.
The turbine costs £3000 to buy and install.



4A The householder estimates that the wind turbine would generate electricity worth an average of £1.50 each day.

What would be the pay-back time?

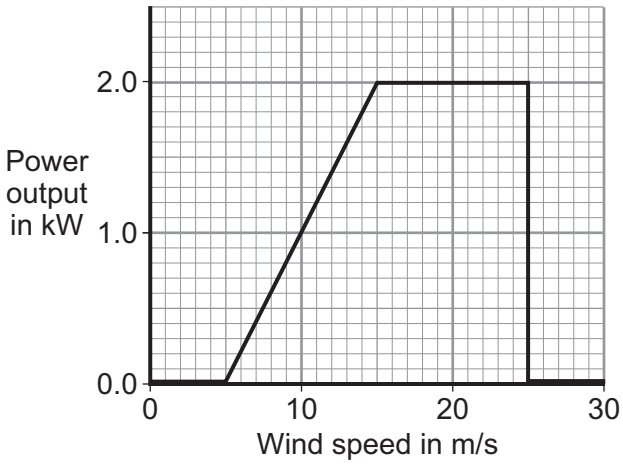
1 1000 days

2 2000 days

3 3000 days

4 4000 days

The graph shows how the power produced by the wind turbine changes with the wind speed.
The wind turbine shuts down at high wind speeds.



4B The maximum power output occurs when the wind speed reaches . . .

1 5 m/s

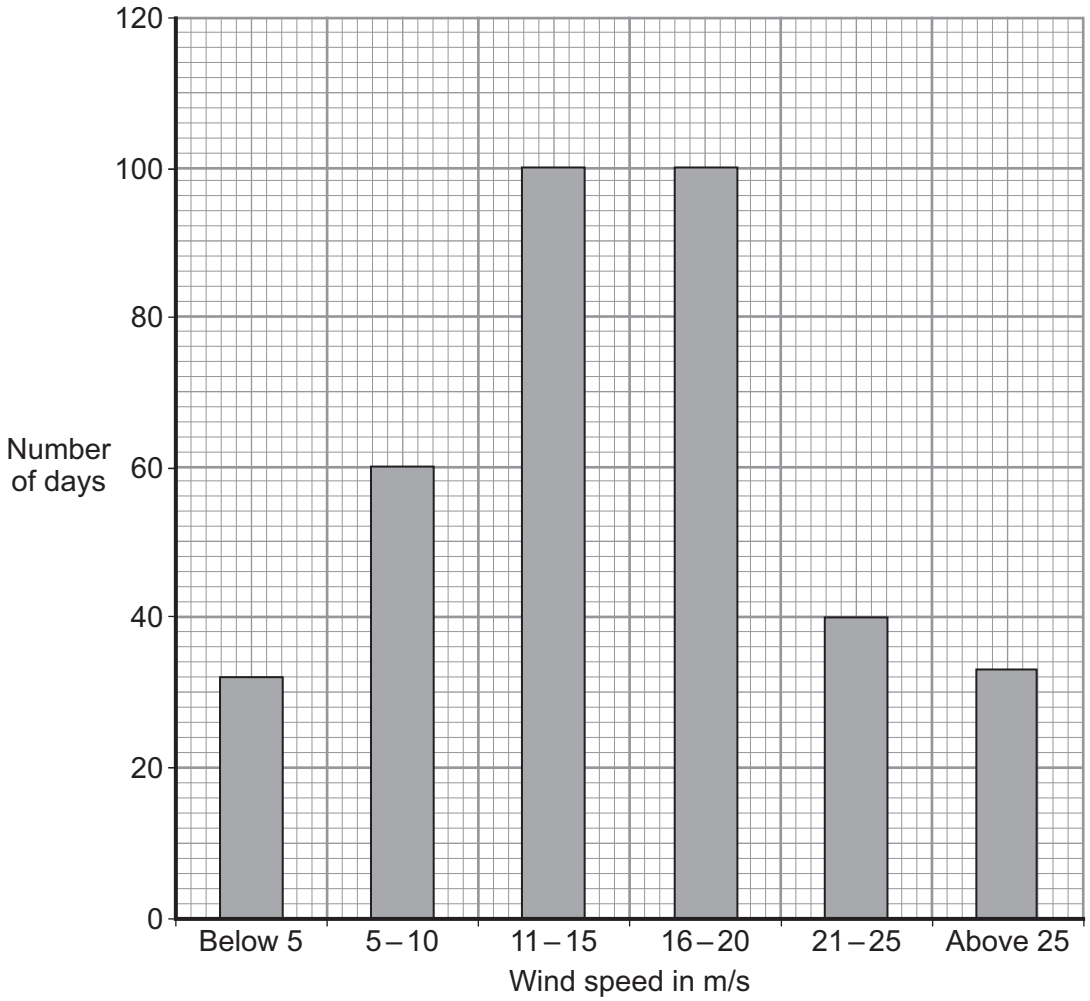
2 10 m/s

3 15 m/s

4 20 m/s

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4C The bar chart shows the wind speed at the house and the number of days in the year on which the wind has that speed.



For how many days in the year could the householder get some energy from the wind turbine?

1 160

2 260

3 300

4 330

4D The householder decides not to buy the wind turbine.

The most likely reason for his decision is that the wind turbine . . .

1 has fuel costs that are too high.

2 produces no greenhouse gases.

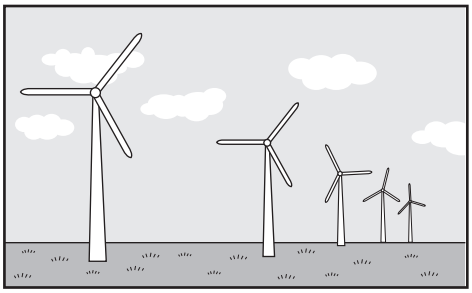
3 uses a non-renewable energy source.

4 uses an unreliable energy source.

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QUESTION FIVE

A wind turbine manufacturer investigates how the power output from a wind turbine depends on the height of the turbine blades above ground.



The results are shown in the table.

Height above ground in m	Power output in kW
10	0
30	160
40	190
50	220
60	250
70	280
80	305
90	310

5A In the table, the height of the turbine above ground is . . .

1 a categoric variable.

2 a control variable.

3 the dependent variable.

4 the independent variable.

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5B From the data, which of the following can be deduced?

1 Above a height of 90 m, the power output will not increase.

2 A height of 65 m would produce a power output of about 260 kW.

3 Doubling the height will always double the power output.

4 The minimum height needed to produce a power output is 20 m.

5C Which is the best way to display the pattern of the results for height and power output?

1 construct a pie chart

2 draw a bar chart

3 find the mean of all the power outputs and heights

4 plot a line graph of power output against height

5D The statement below appeared in a newspaper.

Huge expansion of wind power in the UK is to be launched, with turbines that will reach 260 metres into the sky!

What types of pollution are people most likely to complain about when wind farms are built?

1 carbon dioxide and noise

2 carbon dioxide and sulfur dioxide

3 sulfur dioxide and visual

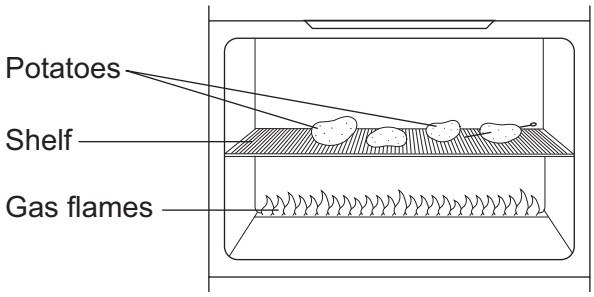
4 visual and noise

Turn over for the next question

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QUESTION SIX

The diagram shows some potatoes cooking on a shelf in a gas oven.



6A Heat is transferred from the gas flames to the potatoes.

The air particles just above the gas flames . . .

1 contract to become smaller.

2 expand to become bigger.

3 move apart, making the air less dense.

4 move together, making the air denser.

6B One of the potatoes has a metal skewer through it. This potato cooks fastest because heat is transferred through the skewer to the potato.

This heat transfer takes place because . . .

1 convection currents are set up in the metal.

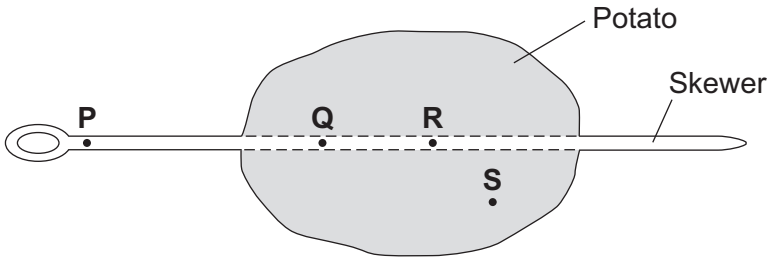
2 the metal contains electrons that are free to move within the metal.

3 the metal expands when heated.

4 the metal is a good emitter of radiation.

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6C The diagram shows the potato and skewer one minute after the potato is put into the oven.



Which of the four points, **P**, **Q**, **R** and **S**, will be the coolest?

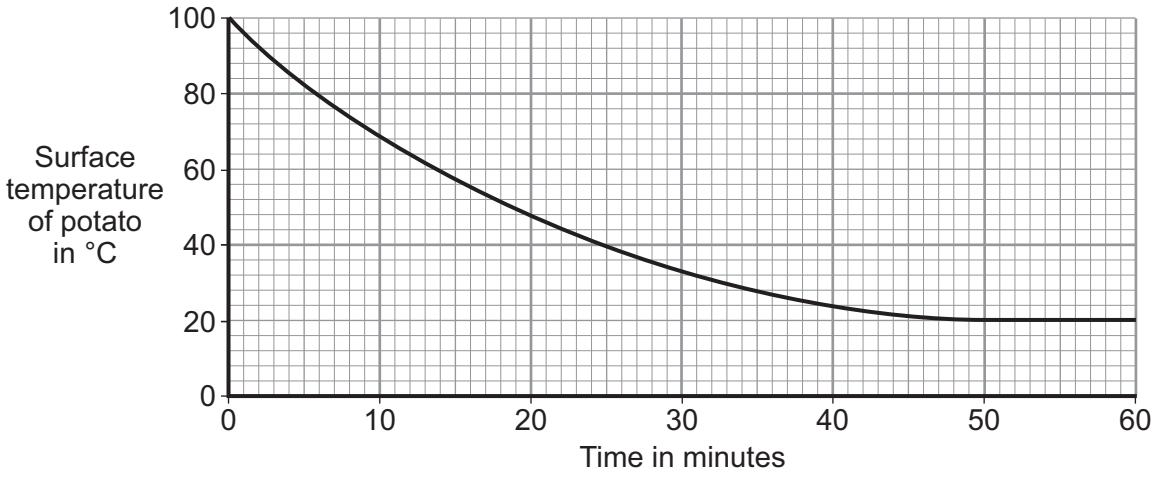
1 **P**

2 **Q**

3 **R**

4 **S**

6D The cooked potatoes are taken out of the oven and left to cool. The graph shows how the surface temperature of one potato changes as it cools.



At which of the following times is heat transferred from the potato at the fastest rate?

1 10 minutes

2 20 minutes

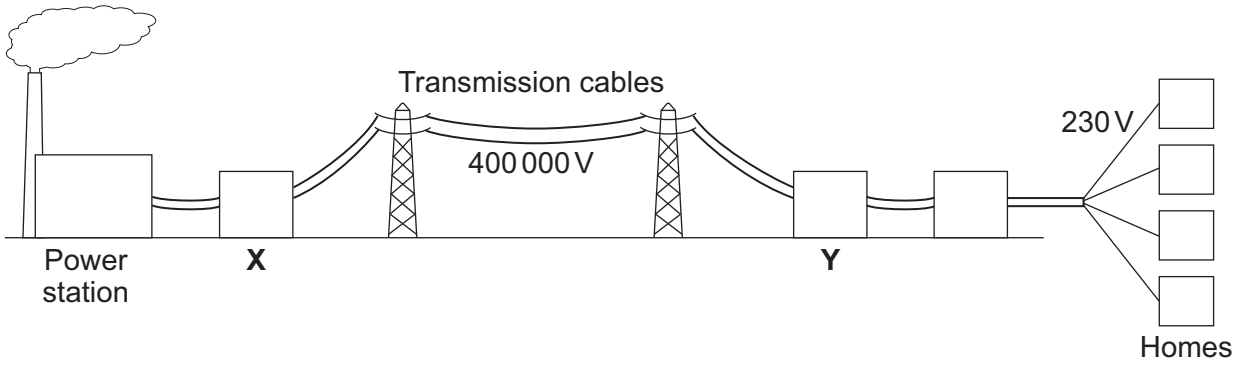
3 30 minutes

4 40 minutes

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QUESTION SEVEN

The diagram shows a power station connected to the National Grid. The National Grid distributes the electrical energy to homes.



7A Which row in the table correctly describes the transformers **X** and **Y**?

	X	Y
1	step-down	step-down
2	step-down	step-up
3	step-up	step-down
4	step-up	step-up

7B Why is the voltage (potential difference) across the transmission cables of the National Grid very high?

1 so that the electricity travels faster

2 so that the electric current is large

3 to make the transmission of electricity safe

4 to reduce energy loss from the cables

7C A transformer changes both the voltage and the current.

Which row in the table correctly describes the changes of current in transformers **X** and **Y**?

	X	Y
1	decrease	decrease
2	decrease	increase
3	increase	decrease
4	increase	increase

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7D In the power station, the boiler has an efficiency of 0.75. The turbine and generator system have an efficiency of 0.80.

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

For every 1000 J of energy supplied to the boiler, what is the useful output energy from the turbine and generator system?

1 600 J

2 750 J

3 800 J

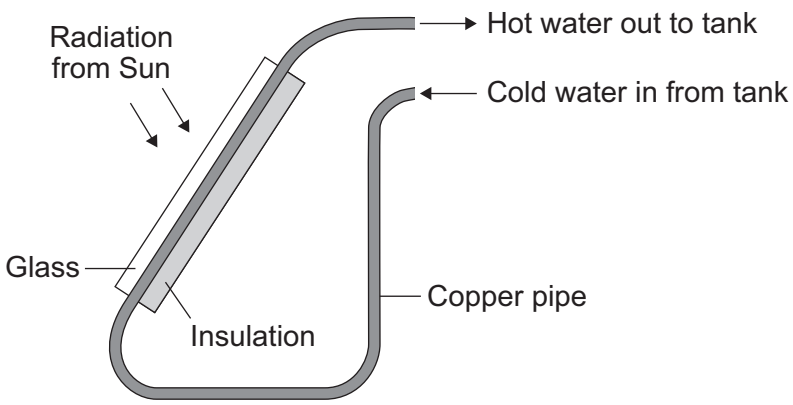
4 1670 J

Turn over for the next question

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QUESTION EIGHT

The diagram shows a solar panel fitted to the roof of a house.
The solar panel is used for heating water.



- The panel is 5 m long and 2 m wide.
- Each square metre of panel receives 0.6 kJ of solar energy each second when the Sun is shining.

8A The solar panel collects . . .

1 infra red radiation from the Sun and transforms it into electricity.

2 infra red radiation from the Sun and uses it to heat water.

3 light energy from the Sun and transforms it into electricity.

4 ultraviolet radiation from the Sun and uses it to heat water.

8B The total amount of solar energy, in kJ, collected by the panel in 5 hours when the Sun is shining is . . .

1 1 800

2 10 800

3 21 600

4 108 000

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8C The pipe inside the solar panel has a black surface because . . .

1 black surfaces are good reflectors of radiation.

2 black surfaces are good absorbers of radiation.

3 black surfaces are good emitters of radiation.

4 black surfaces stay hot for longer.

8D The hot water tank is placed higher than the solar panel.

This is because . . .

1 heated water contracts, and sinks.

2 heated water contracts, and rises.

3 heated water expands, and rises.

4 heated water expands, and sinks.

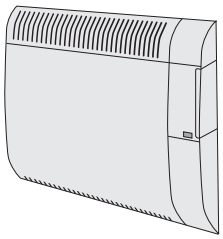
Turn over for the next question

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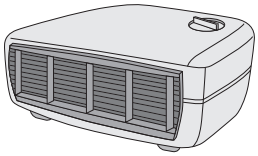
QUESTION NINE

The pictures show three different types of electric heater.

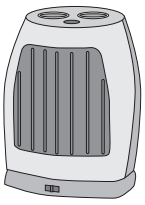
400 W oil-filled panel heater
- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out



9A Two 400 W oil-filled panel heaters are both switched on in an office.

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

How much energy, in kWh, is transferred from the mains to the heaters in 12 hours?

1 4.8

2 9.6

3 2400

4 4800

9B The cost of using the ceramic heater during one week was £6.00. During this week, the heater transferred 40 kWh.

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

What was the cost per kWh of the electricity?

1 1.50p

2 6.67p

3 £0.15

4 £6.67

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9C When the fan heater is working at less than full power, 2 kilojoules of energy are usefully transferred every second. The efficiency of the fan heater at this power is 0.95.

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

How many joules of electrical energy are supplied to the fan heater each second?

1 0.000475

2 0.475

3 2.1

4 2105

9D The fan heater cannot be 100% efficient.

Why is this?

1 The fan heater is the most powerful of the four heaters.

2 The fan heater does not have a safety overheat cut-out.

3 The fan heater makes a noise.

4 The fan heater's case becomes warm during use.

END OF TEST

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There are no questions printed on this page

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ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461) / Physics (4451)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2010 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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GCSE

SCIENCE A (4461) / PHYSICS (4451)

Objective Test Answer Key

PHY1A (Energy and Electricity)

November 2010

Foundation Tier

Question			Key
One	**A**	conduction	**2**
	B	insulation	**3**
	C	radiation	**1**
	D	reflection	**4**
Two	**A**	gas	**4**
	B	geothermal	**3**
	C	moving water	**2**
	D	uranium	**1**
Three	**A**	chemical	**1**
	B	electrical	**3**
	C	heat	**4**
	D	kinetic	**2**
Four	**A**	coal-fired	**4**
	B	hydroelectric	**3**
	C	nuclear	**2**
	D	tidal barrage	**1**
Five	**A**	electric drill	**1**
	B	desk lamp	**3**
	C	hair dryer	**2**
	D	television	**4**

	A	**B**	**C**	**D**
Six	**2**	**4**	**2**	**1**
Seven	**1**	**1**	**4**	**2**
Eight	**4**	**1**	**3**	**4**
Nine	**2**	**3**	**3**	**4**

GCSE

SCIENCE A (4461) / PHYSICS (4451)

Objective Test Answer Key

PHY1A (Energy and Electricity)

November 2010

Higher Tier

Question	Key		
One	**A**	electric drill	**1**
	B	desk lamp	**3**
	C	hair dryer	**2**
	D	television	**4**
Two	**A**	electrical to light	**1**
	B	electrical to sound	**2**
	C	light to electrical	**4**
	D	sound to electrical	**3**

	A	B	C	D
Three	**4**	**1**	**3**	**4**
Four	**2**	**3**	**3**	**4**
Five	**4**	**2**	**4**	**4**
Six	**3**	**2**	**4**	**1**
Seven	**3**	**4**	**2**	**1**
Eight	**2**	**4**	**2**	**3**
Nine	**2**	**3**	**4**	**3**

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG10

11-NOV-10

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Electric drill	○	○	○	○
1B	Desk lamp	○	○	○	○
1C	Hair dryer	○	○	○	○
1D	Television	○	○	○	○

QUESTION TWO		1	2	3	4
2A	electrical to light	○	○	○	○
2B	electrical to sound	○	○	○	○
2C	light to electrical	○	○	○	○
2D	sound to electrical	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	conduction	○	○	○	○
1B	insulation	○	○	○	○
1C	radiation	○	○	○	○
1D	reflection	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	gas	○	○	○	○
2B	geothermal	○	○	○	○
2C	moving water	○	○	○	○
2D	uranium	○	○	○	○

QUESTION THREE

		1	2	3	4
3A	chemical	○	○	○	○
3B	electrical	○	○	○	○
3C	heat	○	○	○	○
3D	kinetic	○	○	○	○

QUESTION FOUR

		1	2	3	4
4A	coal-fired	○	○	○	○
4B	hydroelectric	○	○	○	○
4C	nuclear	○	○	○	○
4D	tidal barrage	○	○	○	○

QUESTION FIVE

		1	2	3	4
5A	Electric drill	○	○	○	○
5B	Desk lamp	○	○	○	○
5C	Hair dryer	○	○	○	○
5D	Television	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
June 2010

Science A

Unit Physics P1a (Energy and Electricity)

Physics

Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Monday 28 June 2010 Morning Session

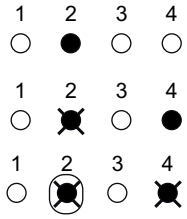
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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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 **FIVE**.

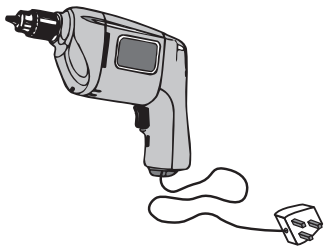
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

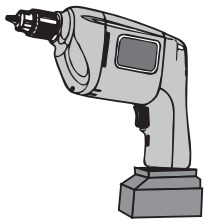
Mark your choices on the answer sheet.

QUESTION ONE

The diagrams show a mains electric drill and a cordless electric drill. The cordless drill has a rechargeable battery.



Mains electric drill



Cordless electric drill

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

A chemical energy

B electrical energy

C heat (thermal energy)

D kinetic energy

Drills are designed to produce . . . **1** . . . .

The drills also produce . . . **2** . . . and sound energy which are wasted.

Both drills use . . . **3** . . . to make their motors work.

The cordless drill has a battery that stores . . . **4** . . . .

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QUESTION TWO

This question is about the transfer of heat.

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

A conduction

B convection

C insulation

D radiation

The rate of heat loss from a hot object can be reduced by . . . **1** . . . .

Heat is transferred from the Sun to the Earth by . . . **2** . . . .

Heat is transferred through the air in a room mainly by . . . **3** . . . .

Heat is transferred along a metal bar by . . . **4** . . . .

QUESTION THREE

Various sources of energy can be used to produce electricity.

Match sources of energy, **A**, **B**, **C** and **D**, with the methods of producing electricity **1–4** in the table.

A fossil fuels

B hot rocks

C moving air

D sunlight

	Method of producing electricity
1	coal-fired power station
2	geothermal power station
3	solar cells
4	wind farm

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QUESTION FOUR

The use of various types of power station raises different environmental issues.

Match types of power station, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A gas-fired

B hydroelectric

C nuclear

D wind farm

	Environmental issue
1	large areas of land are flooded to form reservoirs
2	pollutes the atmosphere with carbon dioxide
3	produces radioactive waste
4	rotating blades may kill birds

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QUESTION FIVE

The table gives data for some energy sources used to generate electricity in the UK.

	Energy source	Generating cost in pence per kWh	Number of grams of carbon dioxide produced per kWh
A	Coal	2.6	1000
B	Gas	2.2	500
C	Hydroelectric (falling water)	3.4	20
D	Nuclear	3.5	5

Use the data in the table above to match energy sources, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

1	produces the cheapest electricity
2	is renewable
3	contributes least to global warming
4	contributes most to global warming

Turn over for the next question

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Section Two

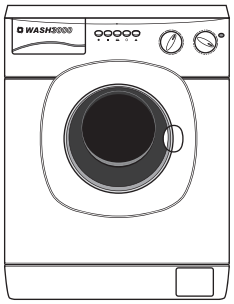
Questions **SIX** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX



An instruction booklet for a washing machine contains the following information.

Wash cycle	Average power during cycle	Time taken to run cycle
HOT	1.6 kW	2 hours
WARM	1.0 kW	$1\frac{1}{2}$ hours
COOL	0.8 kW	$1\frac{1}{2}$ hours

6A The washing machine is designed to transform electrical energy into heat (thermal energy) and . . .

1 chemical energy.

2 kinetic energy.

3 light energy.

4 sound energy.

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6B How much energy is transferred to the washing machine when it is used on the HOT wash cycle?

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

1 3.6 kWh

2 3.2 kWh

3 0.8 kWh

4 0.4 kWh

6C Why does it cost more to use the washing machine on the HOT cycle than on the WARM or COOL cycle?

1 The HOT cycle has the lowest average power.

2 The HOT cycle takes the shortest time to run.

3 More energy is transferred during the HOT cycle.

4 The WARM and COOL cycles both run for $1\frac{1}{2}$ hours.

6D The washing machine also has a FAST cycle setting. When used on this setting, 0.8 kWh of energy are transferred to the washing machine.

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

Electricity costs 15 p per kilowatt-hour (kWh).

How much does the washing machine cost to run on the FAST cycle?

1 £1.20

2 12 p

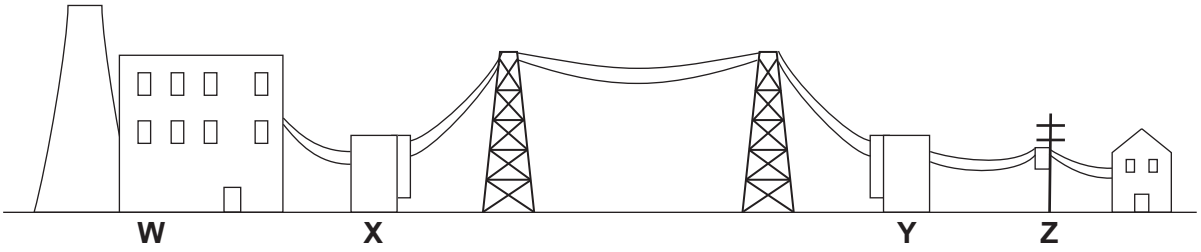
3 1.2 p

4 0.12 p

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QUESTION SEVEN

The diagram shows how electricity is transferred from a power station to consumers.



7A Which labelled part, **W**, **X**, **Y** or **Z**, is a step-up transformer?

1 **W**

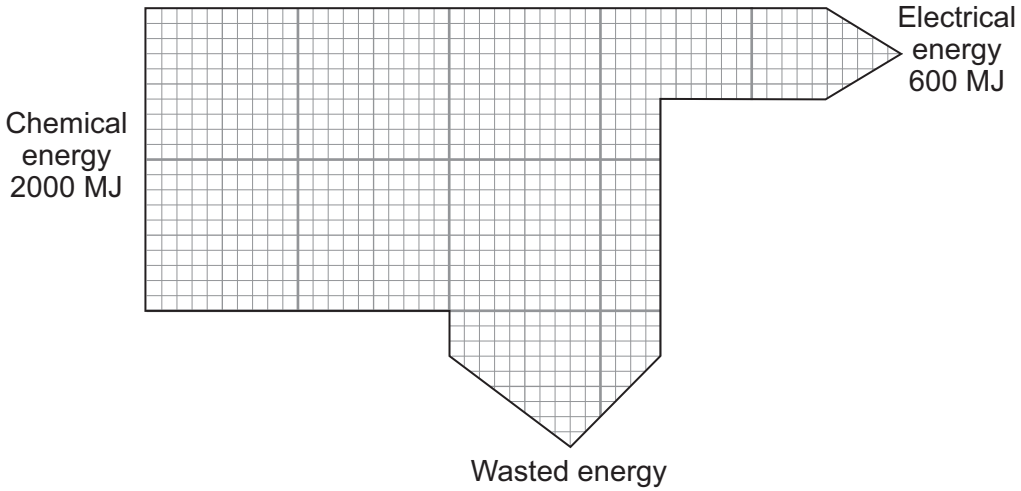
2 **X**

3 **Y**

4 **Z**

Fuel is burned in this power station.

The Sankey diagram shows the energy transformations for this power station.



7B How much energy is wasted?

1 30 MJ

2 600 MJ

3 1400 MJ

4 2600 MJ

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7C The efficiency of the power station can be calculated using this equation.

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

What is the efficiency of this power station?

1 0.30

2 0.33

3 0.60

4 0.70

7D What happens to the energy that is wasted?

1 It is transferred into useful energy.

2 It warms up the surroundings.

3 It is recycled.

4 It is stored until needed.

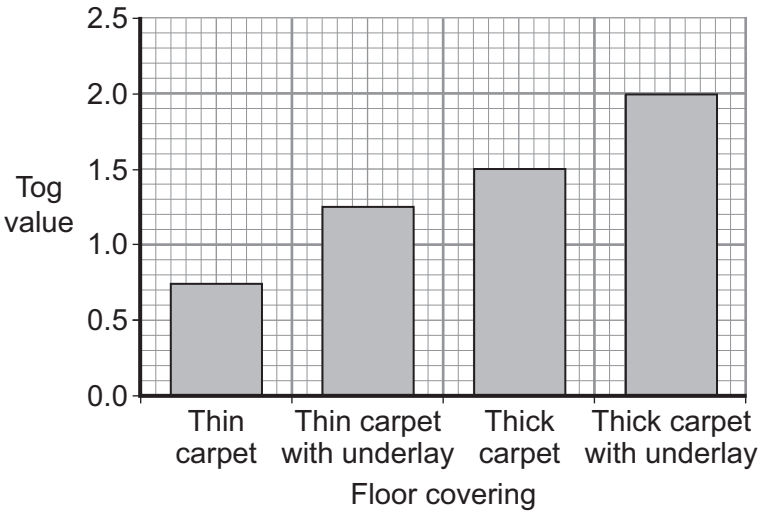
Turn over for the next question

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QUESTION EIGHT

Insulating materials have a 'tog value'. The better the insulation, the higher the tog value.

The bar chart shows the tog values of some floor coverings.



8A The data is plotted as a bar chart because . . .

1 both the tog value and the floor covering are categoric variables.

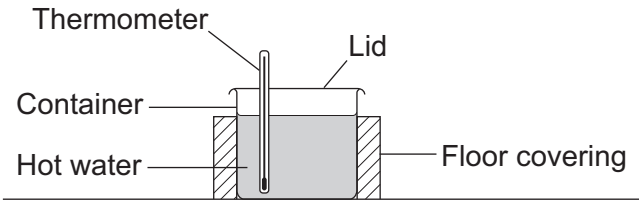
2 both the tog value and the floor covering are continuous variables.

3 the tog value is a categoric variable and the floor covering is a continuous variable.

4 the tog value is a continuous variable and the floor covering is a categoric variable.

An experiment was carried out to compare the insulating properties of different floor coverings.

- A container was wrapped in thin carpet.
- Hot water was placed in the container.
- A lid was put on the container.
- The temperature of the water was measured.
- The temperature was measured again after a certain time interval.
- The experiment was repeated with each of the other floor coverings.



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8B To make this experiment a fair test, which variables must be controlled?

1 mass of water and final temperature

2 time interval and final temperature

3 initial temperature, final temperature and the time interval

4 mass of water, initial temperature and time interval

8C Which row in the table correctly describes the variables in this experiment?

	Independent variable	**Dependent variable**
1	mass of water	final temperature
2	type of floor covering	mass of water
3	type of floor covering	final temperature
4	final temperature	type of floor covering

8D A householder buys a new carpet. The cost is £400. He estimates that he will save £140 on his heating bill each year.

How long will it be before the owner has recovered his £400?

1 less than 1 year

2 between 1 and 2 years

3 between 2 and 3 years

4 more than 3 years

Turn over for the next question

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QUESTION NINE

The UK government has decided that filament lamps must be replaced by energy-saving lamps. Some people want to continue using filament lamps. Below are some of the arguments for using each type of lamp.

Filament lamps	Energy-saving lamps
• Filament lamps cost only 42 p; energy-saving lamps are more expensive. • Filament lamps reach full brightness almost immediately; energy-saving lamps take a long time to warm up. • The extra heat given out from a filament lamp helps to warm the room.	• An 11 watt energy-saving lamp gives as much light as a 60 watt filament lamp. • Energy-saving lamps produce very little waste energy; filament lamps have an efficiency of only 0.1. • Energy-saving lamps are cheaper to use. • Energy-saving lamps last about 7 times longer than filament lamps.

9A Filament lamps are less efficient than energy-saving lamps.

This means that they . . .

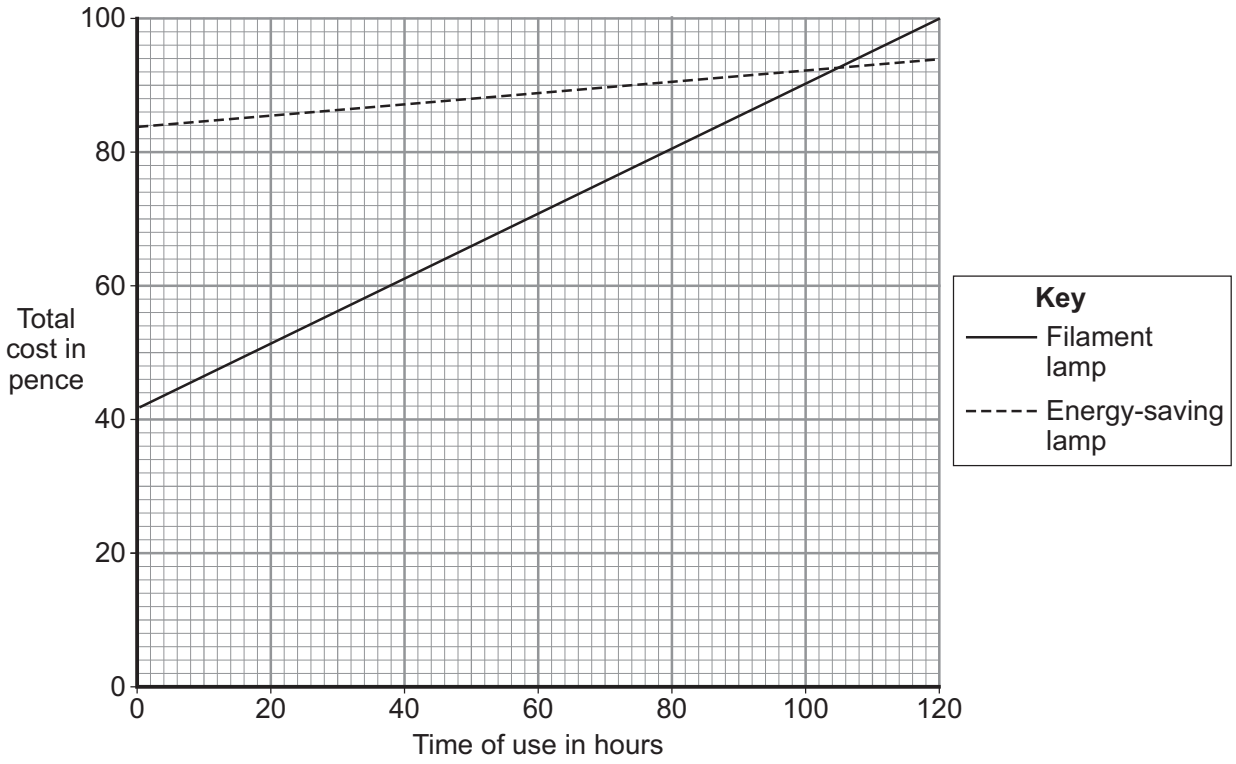
1 cost less.

2 do not last as long.

3 have a larger input power for the same light output.

4 reach full brightness straight away.

The graph shows the total cost of buying and using each type of lamp.



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9B The graph shows that the cost of buying an energy-saving lamp compared with buying a filament lamp is . . .

1 half as much.

2 twice as much.

3 the same.

4 four times as much.

9C An energy-saving lamp becomes more economical than a filament lamp after . . .

1 86 hours of use.

2 93 hours of use.

3 103 hours of use.

4 105 hours of use.

9D Supporters of filament lamps believe that the 'waste' heat from each lamp is used to heat their houses. They believe that this saves on their heating costs. They say that the total energy used to **light and heat** their houses would not be reduced by using energy-saving lamps.

To find out if they are correct, it is necessary to compare the costs . . .

1 in a small house using filament lamps and in a large house using energy-saving lamps.

2 in a small house using energy-saving lamps and in a large house using filament lamps.

3 using two identical houses with filament lamps in one and energy-saving lamps in the other.

4 using some filament lamps and some energy-saving lamps in the same house.

END OF TEST

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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 table gives data for some energy sources used to generate electricity in the UK.

	Energy source	Generating cost in pence per kWh	Number of grams of carbon dioxide produced per kWh
A	Coal	2.6	1000
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D	Nuclear	3.5	5

Use the data in the table above to match energy sources, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

1	produces the cheapest electricity
2	is renewable
3	contributes least to global warming
4	contributes most to global warming

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QUESTION TWO

Hydroelectric schemes use falling water to produce electricity.

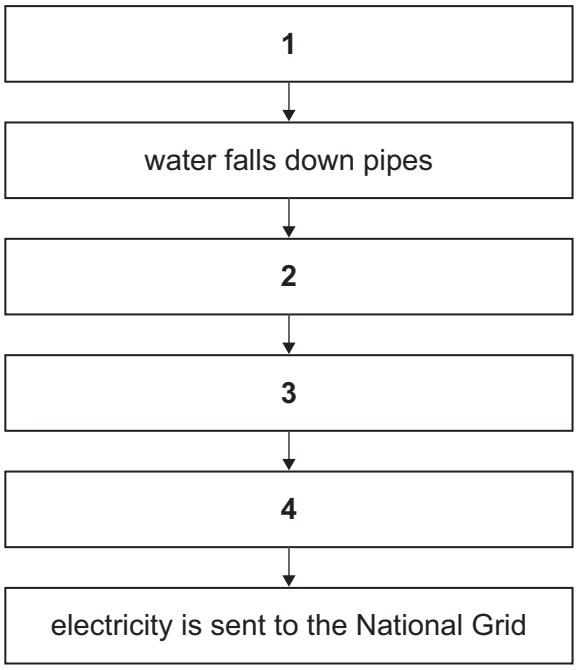
Match statements, **A**, **B**, **C**, and **D**, with the boxes **1–4** in the flow chart to show how a hydroelectric scheme works.

A electricity is produced

B moving water drives turbines

C turbines drive generators

D water collects in a reservoir



Turn over for the next question

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Section Two

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

Each of these questions has four parts.

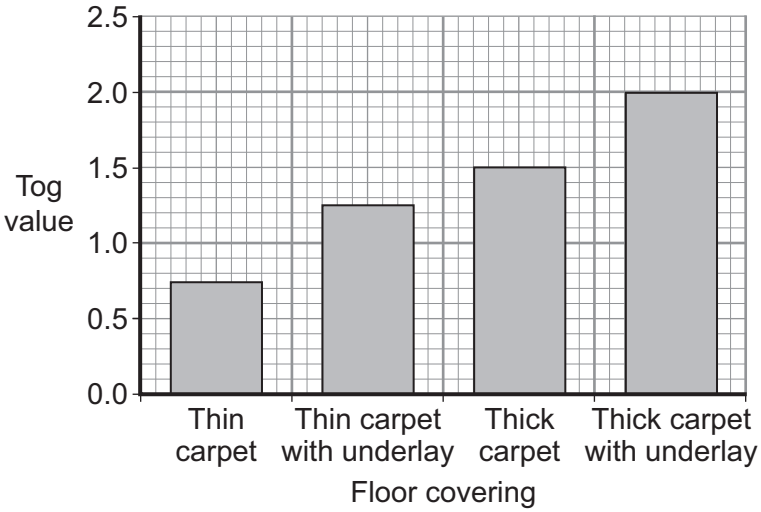
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

Insulating materials have a 'tog value'. The better the insulation, the higher the tog value.

The bar chart shows the tog values of some floor coverings.



3A The data is plotted as a bar chart because . . .

1 both the tog value and the floor covering are categoric variables.

2 both the tog value and the floor covering are continuous variables.

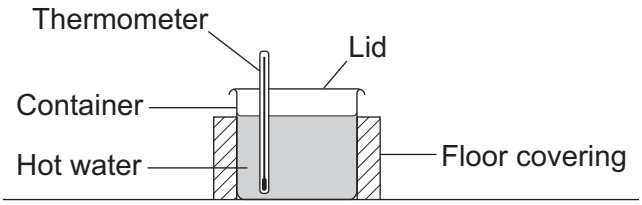
3 the tog value is a categoric variable and the floor covering is a continuous variable.

4 the tog value is a continuous variable and the floor covering is a categoric variable.

An experiment was carried out to compare the insulating properties of different floor coverings.

- A container was wrapped in thin carpet.
- Hot water was placed in the container.
- A lid was put on the container.
- The temperature of the water was measured.
- The temperature was measured again after a certain time interval.
- The experiment was repeated with each of the other floor coverings.

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3B To make this experiment a fair test, which variables must be controlled?

1 mass of water and final temperature

2 time interval and final temperature

3 initial temperature, final temperature and the time interval

4 mass of water, initial temperature and time interval

3C Which row in the table correctly describes the variables in this experiment?

	Independent variable	**Dependent variable**
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3	type of floor covering	final temperature
4	final temperature	type of floor covering

3D A householder buys a new carpet. The cost is £400. He estimates that he will save £140 on his heating bill each year.

How long will it be before the owner has recovered his £400?

1 less than 1 year

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QUESTION FOUR

The UK government has decided that filament lamps must be replaced by energy-saving lamps. Some people want to continue using filament lamps. Below are some of the arguments for using each type of lamp.

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This means that they . . .

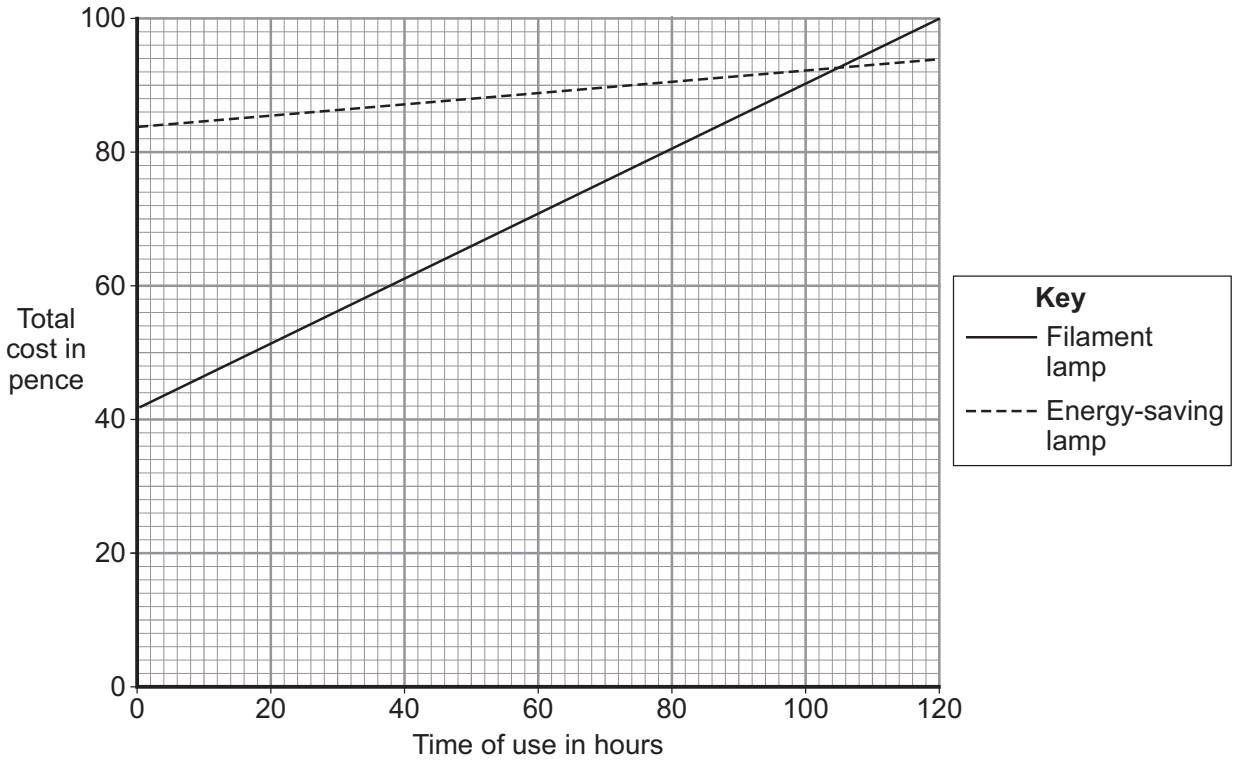
1 cost less.

2 do not last as long.

3 have a larger input power for the same light output.

4 reach full brightness straight away.

The graph shows the total cost of buying and using each type of lamp.



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4B The graph shows that the cost of buying an energy-saving lamp compared with buying a filament lamp is . . .

1 half as much.

2 twice as much.

3 the same.

4 four times as much.

4C An energy-saving lamp becomes more economical than a filament lamp after . . .

1 86 hours of use.

2 93 hours of use.

3 103 hours of use.

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4D Supporters of filament lamps believe that the 'waste' heat from each lamp is used to heat their houses. They believe that this saves on their heating costs. They say that the total energy used to **light and heat** their houses would not be reduced by using energy-saving lamps.

To find out if they are correct, it is necessary to compare the costs . . .

1 in a small house using filament lamps and in a large house using energy-saving lamps.

2 in a small house using energy-saving lamps and in a large house using filament lamps.

3 using two identical houses with filament lamps in one and energy-saving lamps in the other.

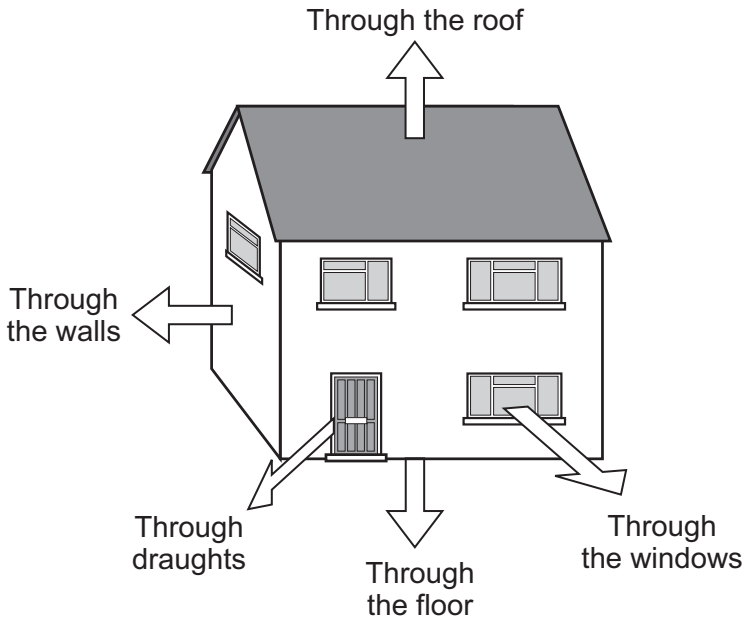
4 using some filament lamps and some energy-saving lamps in the same house.

Turn over for the next question

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QUESTION FIVE

The diagram shows the ways in which energy can be lost from a house.



5A This house is losing heat at a rate of 30 kW.

What power must be supplied by the central heating system to maintain a steady temperature?

1 less than 30 kW

2 30 kW

3 60 kW

4 more than 60 kW

5B One day, the central heating boiler uses 10 kWh of energy.

The efficiency of the central heating boiler is 0.9

How much of the energy from the fuel is usefully transferred?

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

1 1 kWh

2 9 kWh

3 10 kWh

4 11kWh

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5C What happens to the energy that is **not** usefully transferred?

1 It is stored in the boiler until needed.

2 It is turned mainly into sound energy.

3 It warms the air surrounding the house.

4 It leaves the house in the form of light energy.

5D In the UK, the government has ruled that central heating boilers must have an efficiency of at least 0.9

Why might the government wish to raise this figure above 0.9?

Because . . .

1 householders would have to pay more for their energy supplies.

2 it would help to conserve energy supplies.

3 it would help to protect the ozone layer.

4 more polluting gases would be produced.

Turn over for the next question

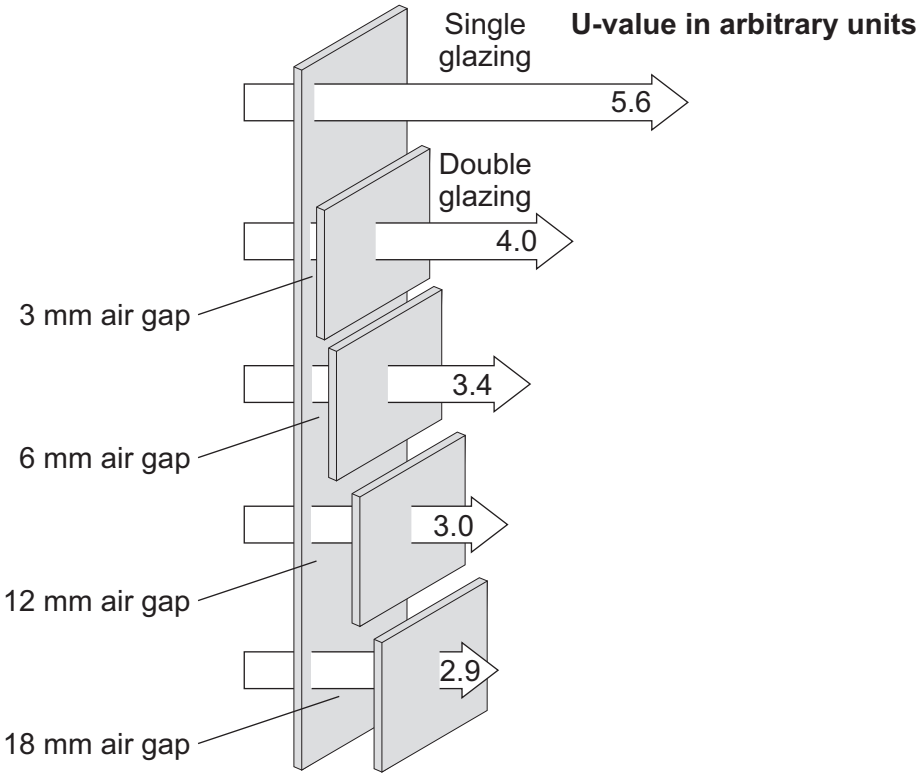
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QUESTION SIX

A double-glazing manufacturer published the results of some tests that his company had carried out on the effect of altering the air gap in double-glazed windows.

The diagram shows the effect of altering the width of the air gap.

The higher the U-value, the faster the rate at which heat will escape.



6A How does double glazing reduce the rate of loss of heat from a building?

1 The air trapped in the gap generates extra heat as it moves around.

2 The air trapped in the gap is a good insulator and reduces heat loss by conduction.

3 The air trapped in the gap is able to circulate by convection currents.

4 The air trapped in the gap stops heat from being radiated through the glass.

6B What happens to the U-value as the width of the air gap is increased?

1 It decreases by equal amounts with equal increases in width of the gap.

2 It decreases slowly at first and then more quickly.

3 It decreases quickly at first and then more slowly.

4 It decreases at first and then increases.

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6C You want to determine the U-value for a 7 mm air gap.

What is the best way to display the data to do this?

1 a bar chart

2 a line graph

3 a pie chart

4 a scattergram

6D Another double-glazing manufacturer says "I don't trust these figures, I think they used different thicknesses of glass for the different air gaps".

If this had been true, the test results would not have been valid because . . .

1 known systematic errors would not have been eliminated.

2 random errors would not have been eliminated.

3 measurements were not taken with sufficient precision.

4 measurements taken were affected by more than one independent variable.

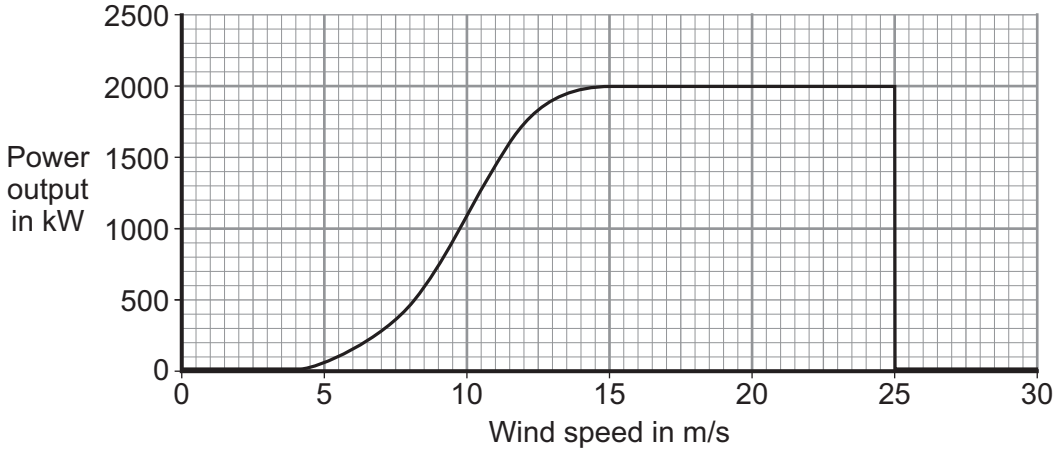
Turn over for the next question

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QUESTION SEVEN

A wind turbine can be used to produce electricity.

The graph shows how the power output of a particular turbine varies with wind speed.



The turbine is designed to operate best at a minimum wind speed of 15 m/s. This is called the rated wind speed.

7A How much energy would be transferred if the turbine operated at its rated wind speed for 2 hours?

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

1 2 kWh

2 4 kWh

3 2000 kWh

4 4000 kWh

7B The turbine will work only when the wind speed is above a value called the cut-in wind speed. The turbine shuts down when the wind speed reaches a certain value.

Which row in the table gives the correct wind speeds?

	Cut-in wind speed	Shut-down wind speed
1	4 m/s	15 m/s
2	9 m/s	20 m/s
3	4 m/s	25 m/s
4	13 m/s	25 m/s

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7C What happens to the energy of the wind at speeds lower than the cut-in speed and higher than the shut-down speed?

1 It will all be transformed into heat.

2 It will all be transformed into sound.

3 It will be stored in the turbine for future use.

4 It will stay as kinetic energy of moving air.

7D The efficiency of this turbine is 0.7

How many kilowatt-hours of wind energy would be needed to produce 10 kilowatt-hours of electrical energy?

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

1 7.0

2 9.3

3 10.7

4 14.3

Turn over for the next question

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QUESTION EIGHT

Worldwide, the demand for electrical energy is rising rapidly. Many countries are building new coal-fired power stations to help meet the demand.

The UK government is committed to reducing carbon emissions.

The government wants to generate 20% of the country's electricity from renewable sources by 2020.

8A What can UK electricity generating companies do to help achieve the government's aims?

1 close some coal, gas and oil-fired power stations

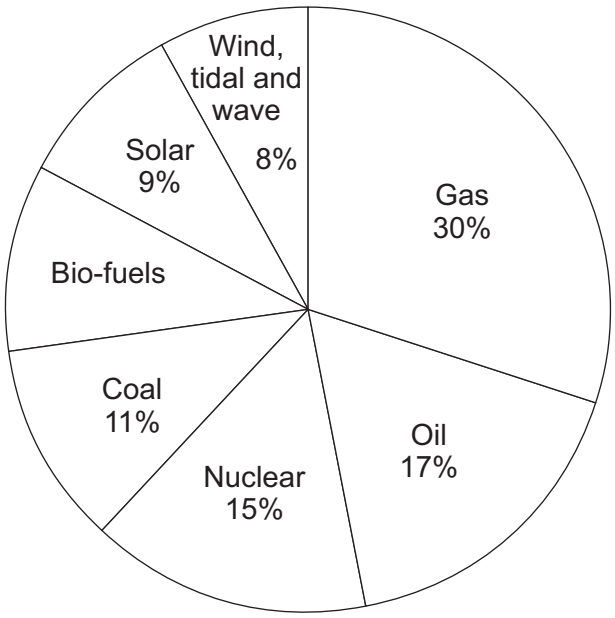
2 build more nuclear power stations

3 build more tidal and wave power stations

4 build more wind and nuclear power stations

By 2050, the ways in which electricity is generated in the UK will be very different from today's methods.

8B The pie chart shows the predicted percentages of different sources of energy that will be used to generate electricity in 2050.



What percentage of this energy will be provided by renewable sources?

1 17

2 27

3 42

4 58

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8C It is predicted that by 2050, many more power stations will use uranium as a fuel.

What is the main process by which uranium produces heat in a power station?

1 decay

2 fission

3 fusion

4 radiation

8D In 2008, 1500 wind turbines produced 1600 MW of power in the UK. It is predicted that by the year 2050, there will be 12 000 wind turbines providing a total of 60 000 MW.

The average output per wind turbine is predicted to increase by the year 2050.

The increase from the 2008 value would be . . .

1 1.1 MW

2 3.9 MW

3 5.0 MW

4 6.1 MW

Turn over for the next question

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QUESTION NINE

In a recent speech, a politician called for a European energy policy that gives sustainable, affordable and secure energy resources. The issues in the policy are given in the table.

	Policy issue
L	Break the dependency on fossil fuels, which are damaging the atmosphere
M	Guarantee realistic and stable costs to customers
N	Free citizens from dependence on unreliable energy suppliers

9A Which row in the table below describes correctly the issues in the energy policy?

	L	**M**	**N**
1	economic	environmental	political
2	environmental	economic	political
3	environmental	environmental	economic
4	economic	economic	environmental

9B The politician also stated that the electricity would be transferred by energy-efficient cables.

The cables would be *energy-efficient* so that . . .

1 energy would be created along the cables.

2 energy would be transformed along the cables.

3 energy loss in the cables would be kept to a minimum.

4 energy would be destroyed along the cables.

9C Part of the policy is to transfer electricity from renewable sources along a 'Super Grid'. This *Super Grid* could use transformers to achieve energy efficiency.

Just before the electricity entered the *Super Grid*, the transformer would . . .

1 decrease the voltage and decrease the current.

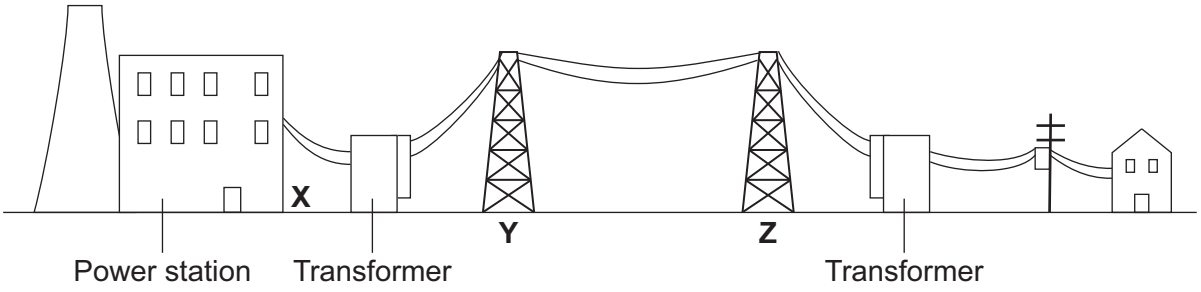
2 decrease the voltage and increase the current.

3 increase the voltage and decrease the current.

4 increase the voltage and increase the current.

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9D In the UK, electricity is transferred by the National Grid.



Which row in the table could give the correct voltages at **X**, **Y** and **Z**?

	X	Y	Z
1	25 kV	400 kV	25 kV
2	25 kV	400 kV	400 kV
3	400 kV	25 kV	25 kV
4	400 kV	400 kV	25 kV

END OF TEST

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Version 1:0: 26/07/10

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2010 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE
SCIENCE A (4461) / PHYSICS (4451)
Objective Test Answer Key
PHY1AP (Energy and Electricity)
June 2010
Foundation Tier

Question	Key		
One	**A**	chemical energy	**4**
	B	electrical energy	**3**
	C	heat (thermal energy)	**2**
	D	kinetic energy	**1**
Two	**A**	conduction	**4**
	B	convection	**3**
	C	insulation	**1**
	D	radiation	**2**
Three	**A**	fossil fuels	**1**
	B	hot rocks	**2**
	C	moving air	**4**
	D	sunlight	**3**
Four	**A**	gas-fired	**2**
	B	hydroelectric	**1**
	C	nuclear	**3**
	D	wind farm	**4**
Five	**A**	Coal	**4**
	B	Gas	**1**
	C	Hydroelectric (falling water)	**2**
	D	Nuclear	**3**

	A	**B**	**C**	**D**
Six	2	2	3	2
Seven	2	3	1	2
Eight	4	4	3	3
Nine	3	2	4	3

GCSE
SCIENCE A (4461) / PHYSICS (4451)
Objective Test Answer Key
PHY1AP (Energy and Electricity)
June 2010
Higher Tier

Question	*Key*		
One	**A**	Coal	**4**
	B	Gas	**1**
	C	Hydroelectric (falling water)	**2**
	D	Nuclear	**3**
Two	**A**	electricity is produced	**4**
	B	moving water drives turbines	**2**
	C	turbines drive generators	**3**
	D	water collects in a reservoir	**1**

	A	**B**	**C**	**D**
Three	4	4	3	3
Four	3	2	4	3
Five	2	2	3	2
Six	2	3	2	4
Seven	4	3	4	4
Eight	3	2	2	2
Nine	2	3	3	2

OTQ3

GCSE SCIENCE

AQA

Unit : PHY1AP **PHYSICS UNIT 1A**

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M10

28-JUN-10

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	Coal	○	○	○	○
1B	Gas	○	○	○	○
1C	Hydroelectric (falling water)	○	○	○	○
1D	Nuclear	○	○	○	○

QUESTION TWO		1	2	3	4
2A	electricity is produced	○	○	○	○
2B	moving water drives turbines	○	○	○	○
2C	turbines drive generators	○	○	○	○
2D	water collects in a reservoir	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A chemical energy	○	○	○	○
1B electrical energy	○	○	○	○
1C heat (thermal energy)	○	○	○	○
1D kinetic energy	○	○	○	○

QUESTION TWO	1	2	3	4
2A conduction	○	○	○	○
2B convection	○	○	○	○
2C insulation	○	○	○	○
2D radiation	○	○	○	○

QUESTION THREE	1	2	3	4
3A fossil fuels	○	○	○	○
3B hot rocks	○	○	○	○
3C moving air	○	○	○	○
3D sunlight	○	○	○	○

QUESTION FOUR	1	2	3	4
4A gas-fired	○	○	○	○
4B hydroelectric	○	○	○	○
4C nuclear	○	○	○	○
4D wind farm	○	○	○	○

QUESTION FIVE	1	2	3	4
5A Coal	○	○	○	○
5B Gas	○	○	○	○
5C Hydroelectric (falling water)	○	○	○	○
5D Nuclear	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
March 2010

Science A
Unit Physics P1a (Energy and Electricity)

Physics
Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Wednesday 3 March 2010 Morning Session

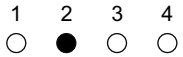
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

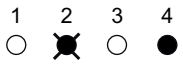
Time allowed
- 30 minutes

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.

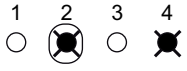
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown.



- 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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 16 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **FIVE**.

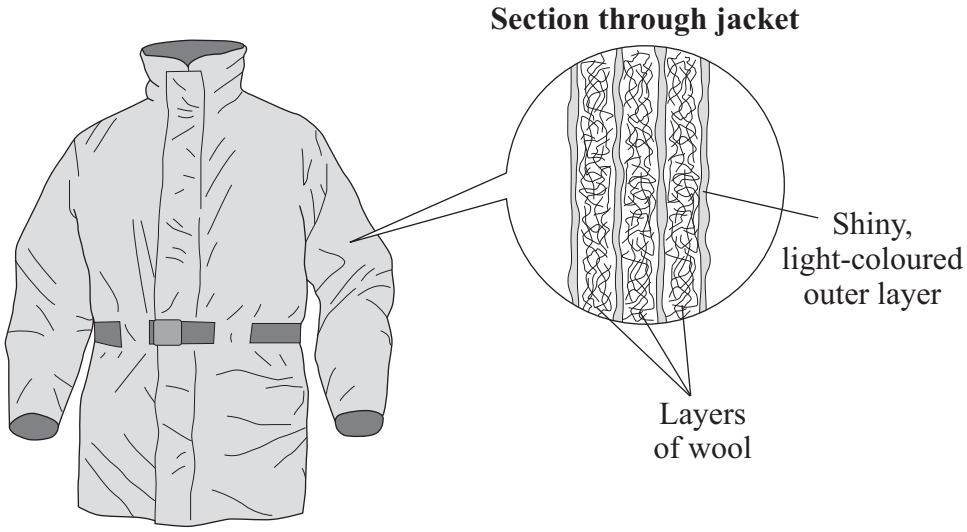
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a jacket designed to keep Arctic explorers warm.



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

A conduction

B convection

C insulation

D radiation

The shiny, light-coloured outer layer of the jacket reduces heat loss by . . . **1** . . . .

Using more layers of wool improves . . . **2** . . . .

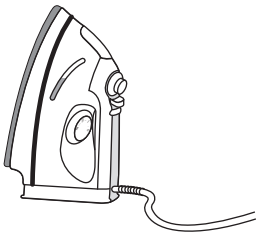
The air trapped in the wool cannot rise, which reduces heat loss by . . . **3** . . . .

Heat is transferred through a solid material by . . . **4** . . . .

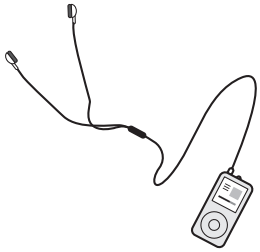
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QUESTION TWO

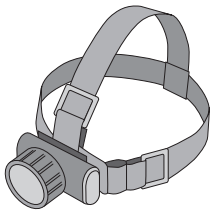
These devices transform electrical energy into other useful forms of energy.



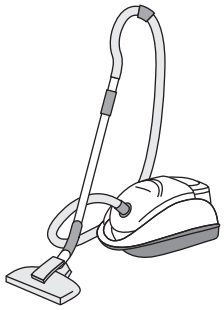
1
Iron



2
MP3 player



3
Head torch



4
Vacuum cleaner

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

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

Turn over for the next question

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QUESTION THREE

The table shows the power of four electrical appliances found in a home.

	Appliance	Power in watts
A	electric kettle	2000
B	electric oven	4000
C	electric shower	8000
D	flat-screen television	200

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

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

Each appliance is used for 3 minutes. The one that transfers the most energy is the . . . **1** . . . .

The appliance that has a power of 2 kW is the . . . **2** . . . .

The appliance that is **not** designed to produce heat (thermal energy) is the . . . **3** . . . .

The appliance that transfers electrical energy at half the rate of the shower is the . . . **4** . . . .

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QUESTION FOUR

This question is about nuclear power stations.

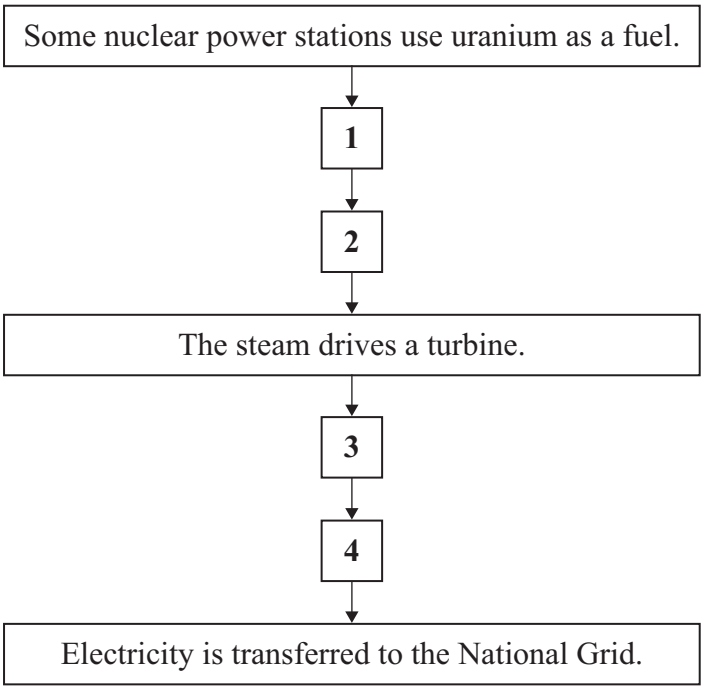
Match statements, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart to describe how nuclear power stations work.

A Electricity is produced.

B Fission of uranium produces heat.

C The heat is used to produce steam.

D The turbine drives a generator.



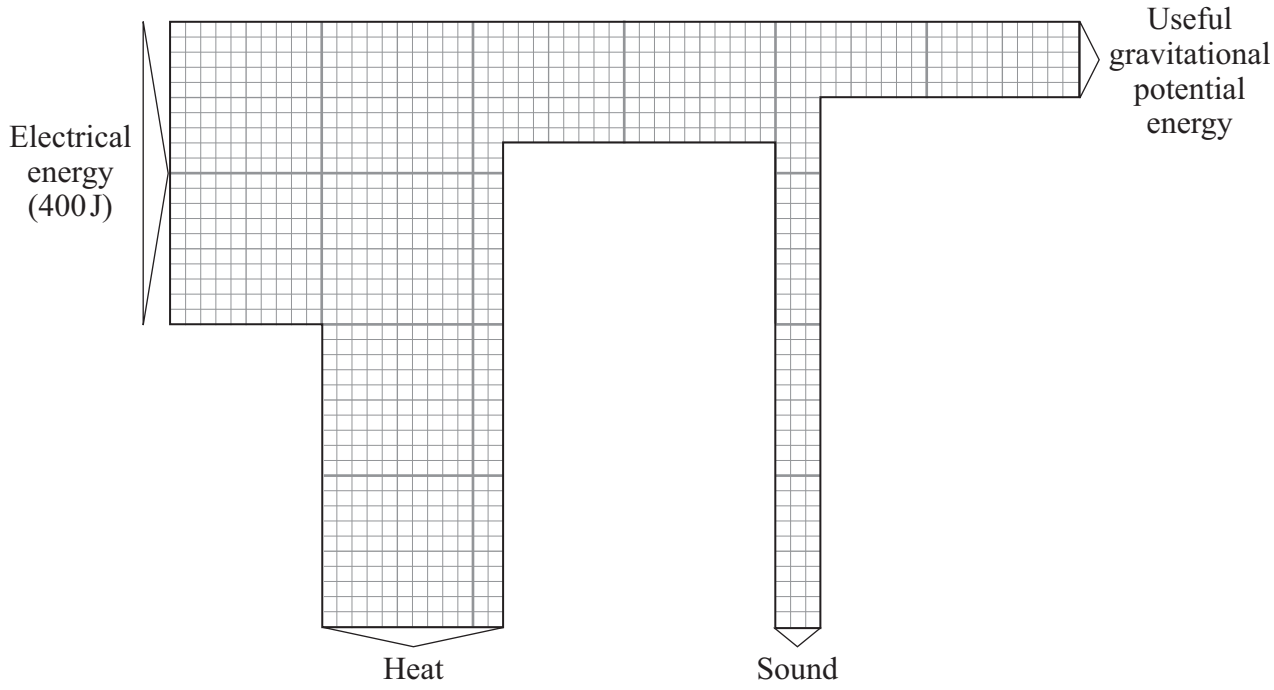
Turn over for the next question

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QUESTION FIVE

An electric motor is used to lift a weight.

The Sankey diagram shows the energy transformations that take place each second in the electric motor.



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

A 0.25

B 60

C 100

D 240

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

The useful gravitational potential energy gained each second is . . . **1** . . . J.

The heat (thermal energy) produced each second is . . . **2** . . . J.

The sound energy produced each second is . . . **3** . . . J.

The total energy wasted each second is 300 J. The efficiency of the electric motor is . . . **4** . . . .

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Turn over for the next question

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SECTION TWO

Questions **SIX** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

In the past fifty years, electricity has become the most important source of energy in the home.

6A Which of the following is a **disadvantage** of using electricity in the home compared with using natural gas or heating oil?

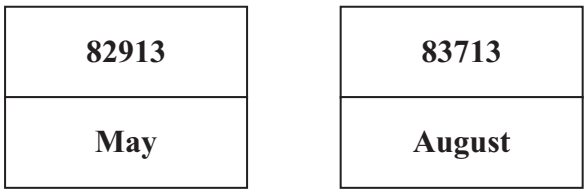
1 Electricity can be switched on and off easily.

2 Electricity can be transferred into many different types of energy.

3 Electricity cannot be stored in the home.

4 Devices using electricity can be moved from place to place easily.

The diagrams show the readings on a domestic electricity meter in May and August.



6B The electrical energy used between May and August is . . .

1 600 kWh

2 650 kWh

3 700 kWh

4 800 kWh

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6C During the next three-month period, the householder used 600 kWh.

Electricity costs 15 pence per kilowatt-hour.

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

What was the total cost of the electricity for this period?

1 £80

2 £90

3 £100

4 £110

6D Television advertisements encourage people to compare the prices charged by electricity companies. Many people change their electricity provider after they have looked at the websites.

People usually make this change for . . .

1 economic reasons.

2 environmental reasons.

3 ethical reasons.

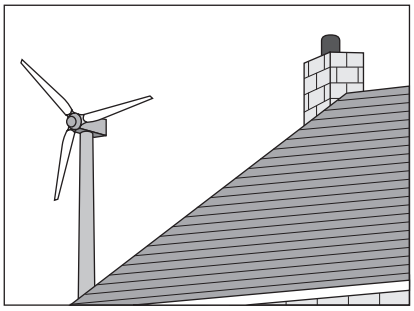
4 social reasons.

Turn over for the next question

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QUESTION SEVEN

A newspaper reports that small wind turbines for home use have a long pay-back time.



Energy experts say that the turbines produce less energy than householders expect.

7A Neighbours of people who have installed a wind turbine are most likely to be annoyed because they think that wind turbines . . .

1 are noisy and unsightly.

2 are unreliable.

3 have a long pay-back time.

4 produce less energy than expected.

7B The turbines do not produce power all of the time because the wind . . .

1 cannot reach the turbines.

2 is renewable.

3 is too noisy.

4 is unreliable.

7C A wind turbine for a house costs £1500. The manufacturer claims that householders can save £100 a year on electricity bills.

If this claim is correct, the pay-back time for the wind turbine is . . .

1 1.5 years.

2 15 years.

3 150 years.

4 1500 years.

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7D One householder does not believe the manufacturer's claim. He calculated that his wind turbine saved less than £10 a year on his electricity bill.

What is the likely reason for this?

1 The amount of electricity generated by the wind turbine is less than the manufacturer's claim.

2 The amount of electricity generated by the wind turbine is more than the manufacturer's claim.

3 The energy source is renewable.

4 The price of electricity has risen.

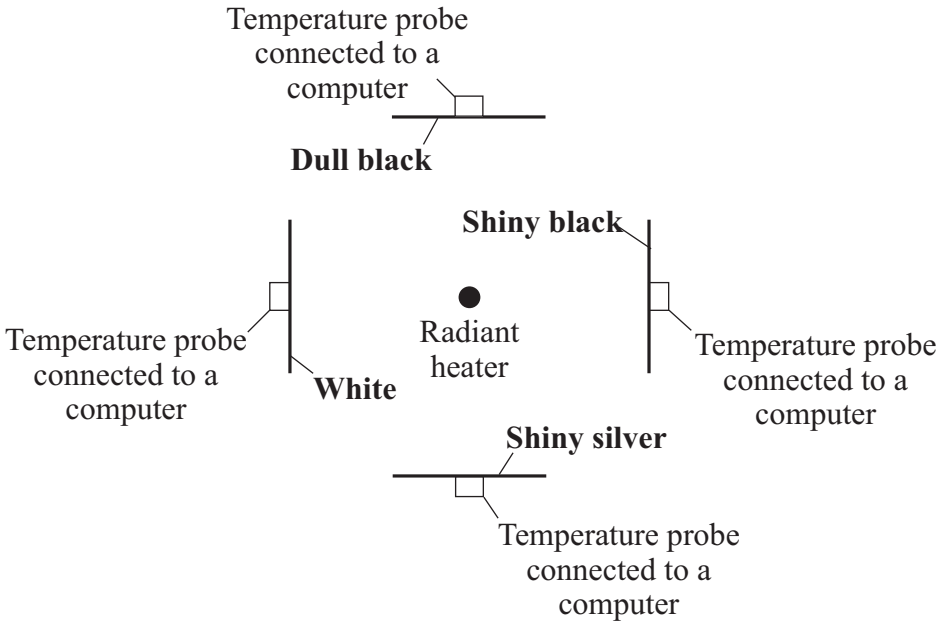
Turn over for the next question

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QUESTION EIGHT

In an experiment, a student placed four cards of equal thickness at equal distances from a radiant heater. The cards had different surfaces. Behind each card was a temperature probe connected to a computer.

The diagram shows a view of the experiment from above.



8A Which was the independent variable in this experiment?

1 the distance of the cards from the heater

2 the intensity of the heat

3 the surface of the cards

4 the thickness of the cards

8B Which was the dependent variable in this experiment?

1 the distance from the heater

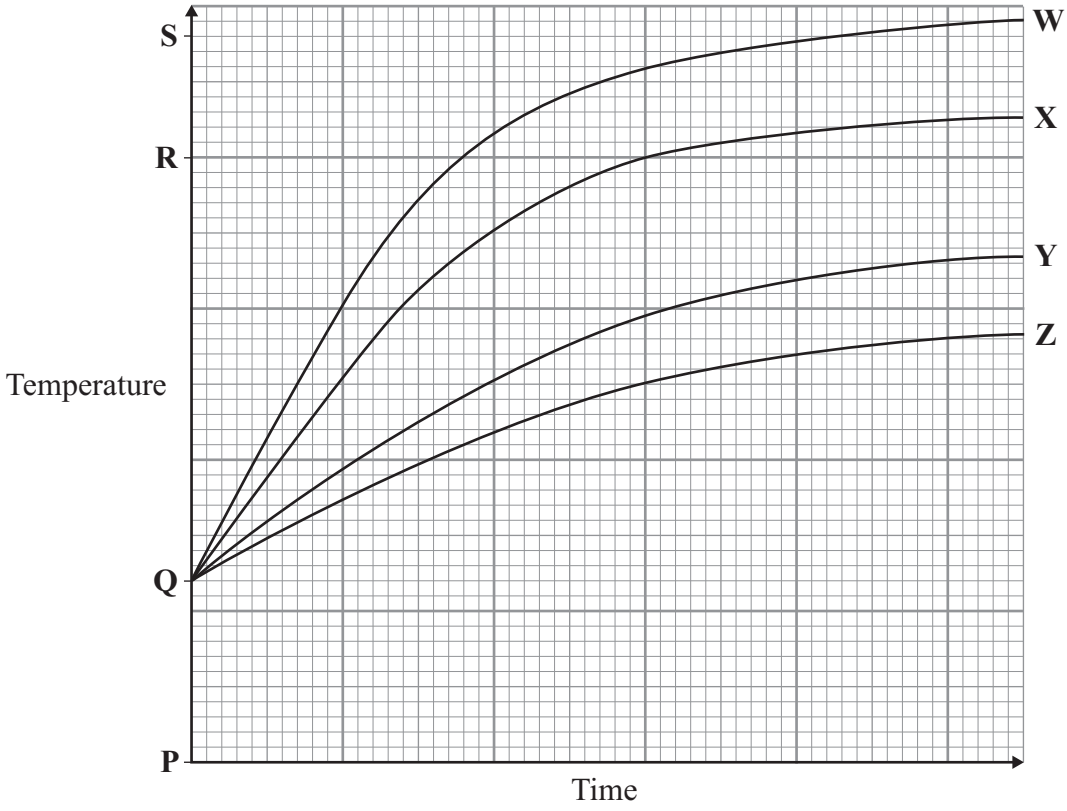
2 the intensity of the heat

3 the temperature of the cards

4 the thickness of the cards

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The computer display shows how the temperature of each card changes over a period of time.



8C Which line on the graph shows the temperature change of the dull black card?

1 **W**

2 **X**

3 **Y**

4 **Z**

8D Which point on the temperature axis shows room temperature?

1 **P**

2 **Q**

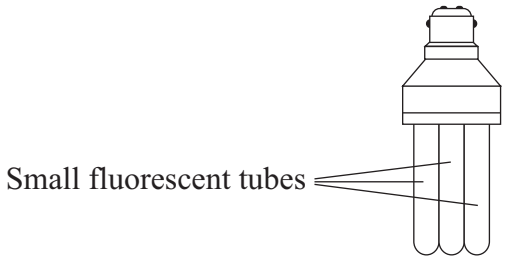
3 **R**

4 **S**

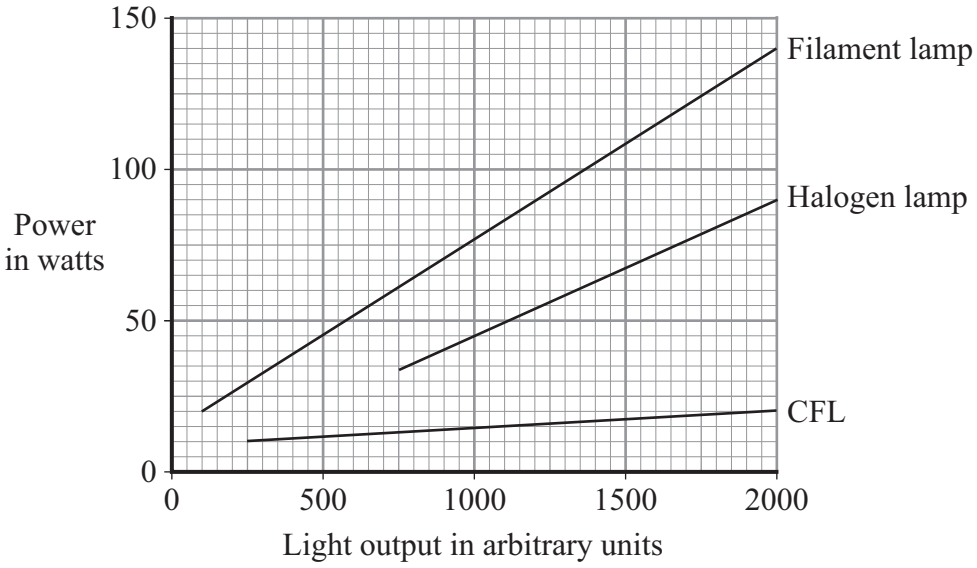
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QUESTION NINE

The diagram shows a compact fluorescent lamp (CFL).



The graph shows the electrical power of a CFL compared with a filament lamp and a halogen lamp.



9A How much power does a halogen lamp need in order to give an output of 1000 units of light?

1 40 watts

2 45 watts

3 50 watts

4 55 watts

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9B How many more watts of power would a filament lamp need, compared with a halogen lamp, to produce 2000 units of light?

1 40

2 50

3 70

4 120

9C What happens to the extra energy that the filament lamp uses compared with the halogen lamp?

The extra energy . . .

1 is stored in the filament of the lamp.

2 is transferred as heat to the surroundings.

3 is used to produce a chemical reaction in the lamp.

4 returns to the electricity supply.

9D In some countries, governments are making it compulsory to use CFLs rather than filament lamps.

What is the reason for this?

1 CFLs are more powerful than filament lamps.

2 CFLs can give out much more light than filament lamps.

3 CFLs can heat the room as well as light it.

4 CFLs save energy because they are more efficient.

END OF TEST

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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**.

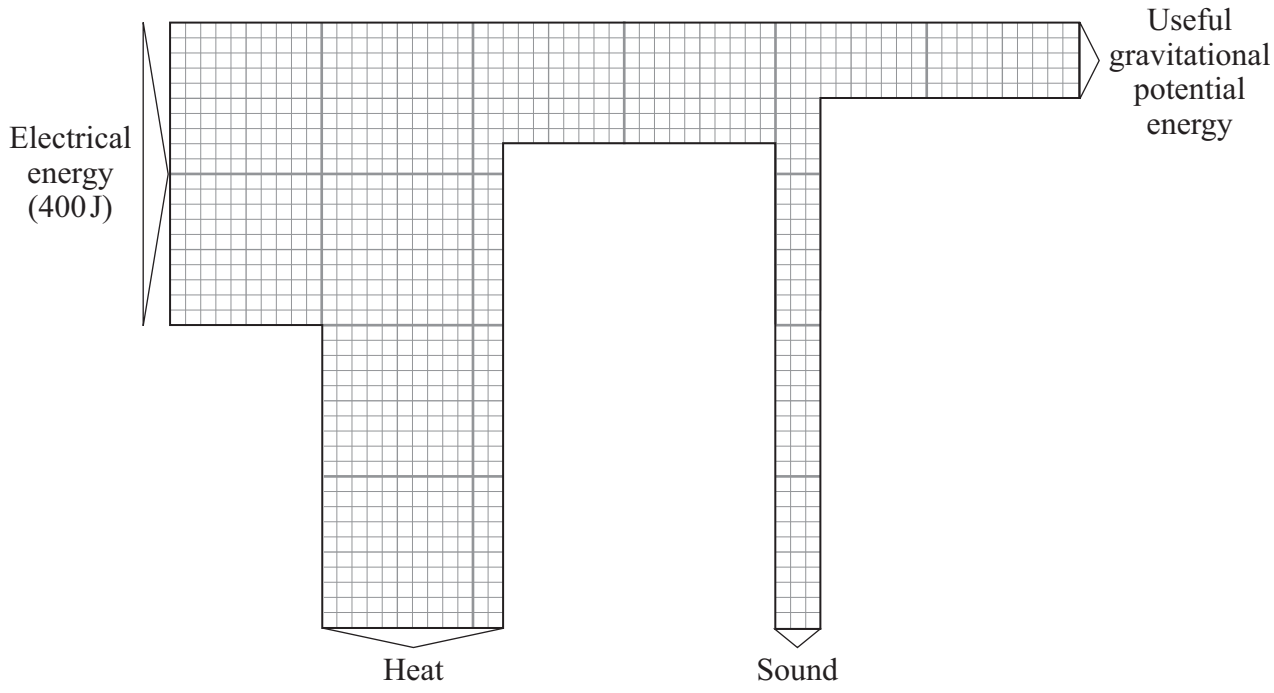
Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

An electric motor is used to lift a weight.

The Sankey diagram shows the energy transformations that take place each second in the electric motor.



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

A 0.25

B 60

C 100

D 240

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

The useful gravitational potential energy gained each second is . . . **1** . . . J.

The heat (thermal energy) produced each second is . . . **2** . . . J.

The sound energy produced each second is . . . **3** . . . J.

The total energy wasted each second is 300 J. The efficiency of the electric motor is . . . **4** . . . .

QUESTION TWO

This question is about useful energy transformations by different electrical devices.

Match devices, **A**, **B**, **C** and **D**, with the useful energy transformations **1–4** in the table.

A computer monitor

B loudspeaker

C microphone

D solar cell

	Useful energy transformations
1	electrical energy into light energy
2	sound energy into electrical energy
3	electrical energy into sound energy
4	light energy into electrical energy

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SECTION TWO

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

Each of these questions has four parts.

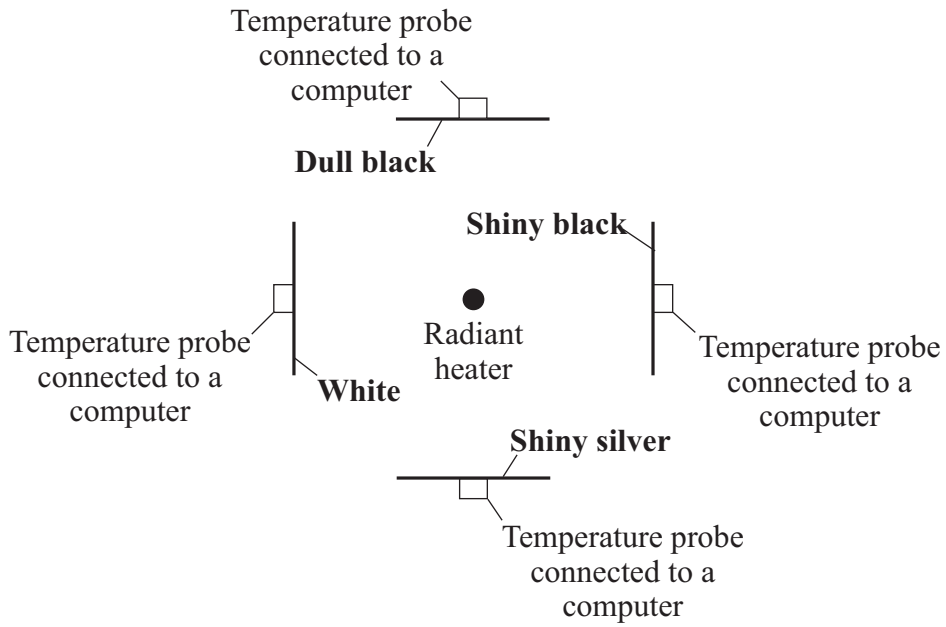
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

In an experiment, a student placed four cards of equal thickness at equal distances from a radiant heater. The cards had different surfaces. Behind each card was a temperature probe connected to a computer.

The diagram shows a view of the experiment from above.



3A Which was the independent variable in this experiment?

1 the distance of the cards from the heater

2 the intensity of the heat

3 the surface of the cards

4 the thickness of the cards

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3B Which was the dependent variable in this experiment?

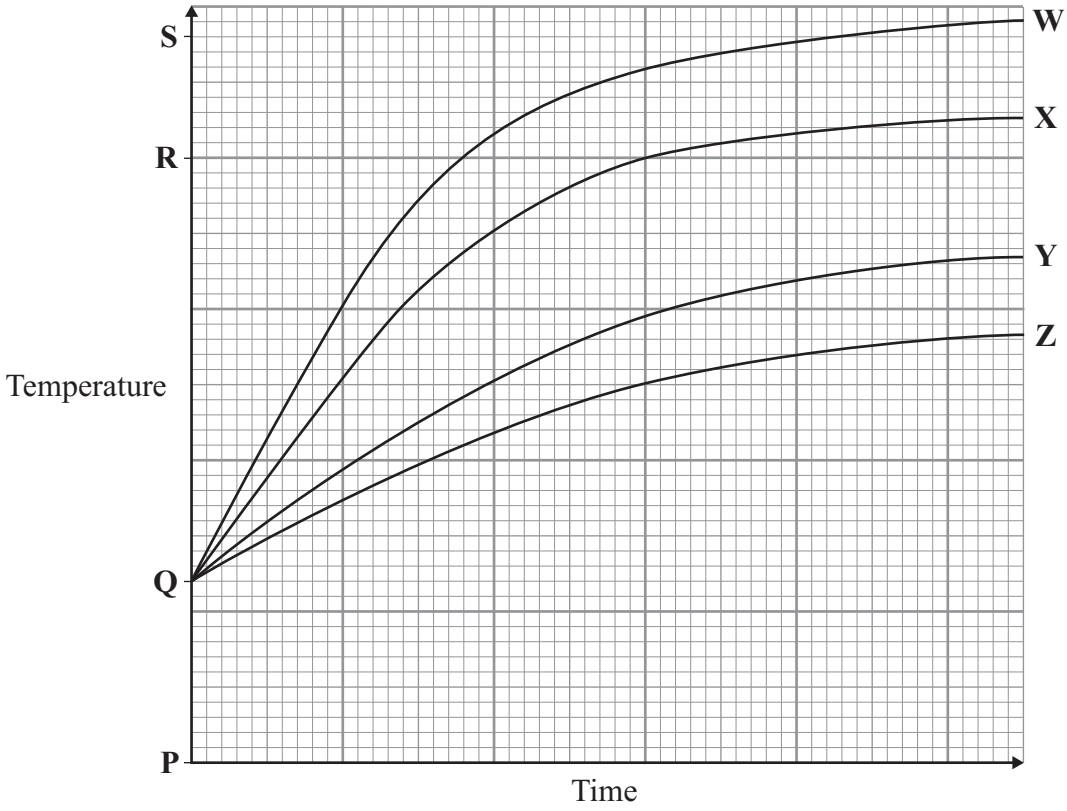
1 the distance from the heater

2 the intensity of the heat

3 the temperature of the cards

4 the thickness of the cards

The computer display shows how the temperature of each card changes over a period of time.



3C Which line on the graph shows the temperature change of the dull black card?

1 **W**

2 **X**

3 **Y**

4 **Z**

3D Which point on the temperature axis shows room temperature?

1 **P**

2 **Q**

3 **R**

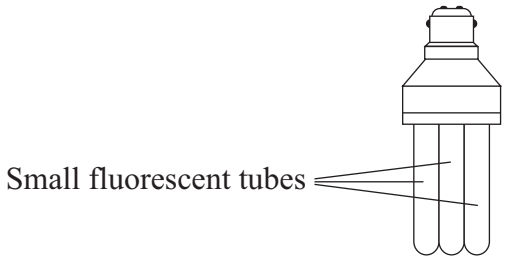
4 **S**

Turn over ▶

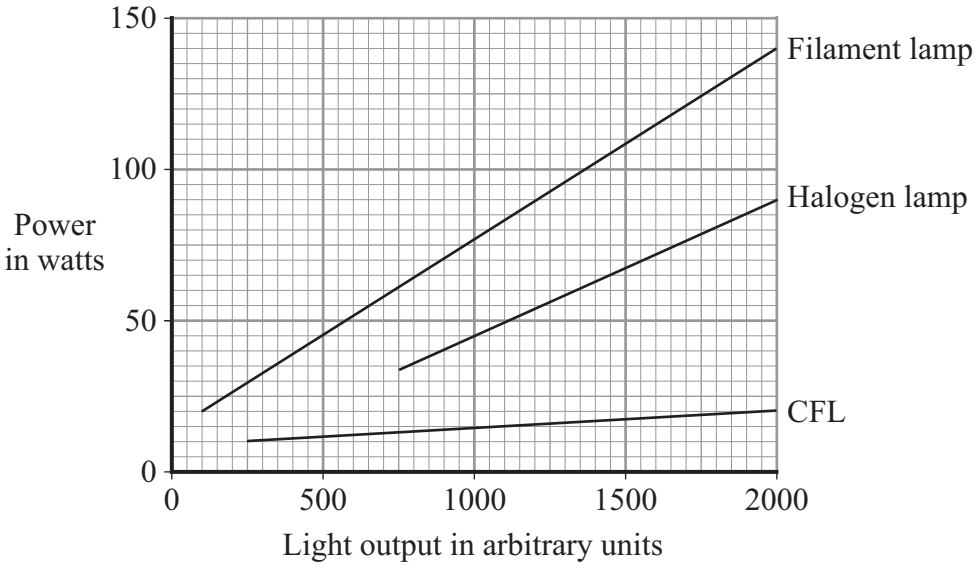
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QUESTION FOUR

The diagram shows a compact fluorescent lamp (CFL).



The graph shows the electrical power of a CFL compared with a filament lamp and a halogen lamp.



4A How much power does a halogen lamp need in order to give an output of 1000 units of light?

1 40 watts

2 45 watts

3 50 watts

4 55 watts

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4B How many more watts of power would a filament lamp need, compared with a halogen lamp, to produce 2000 units of light?

1 40

2 50

3 70

4 120

4C What happens to the extra energy that the filament lamp uses compared with the halogen lamp?

The extra energy . . .

1 is stored in the filament of the lamp.

2 is transferred as heat to the surroundings.

3 is used to produce a chemical reaction in the lamp.

4 returns to the electricity supply.

4D In some countries, governments are making it compulsory to use CFLs rather than filament lamps.

What is the reason for this?

1 CFLs are more powerful than filament lamps.

2 CFLs can give out much more light than filament lamps.

3 CFLs can heat the room as well as light it.

4 CFLs save energy because they are more efficient.

Turn over for the next question

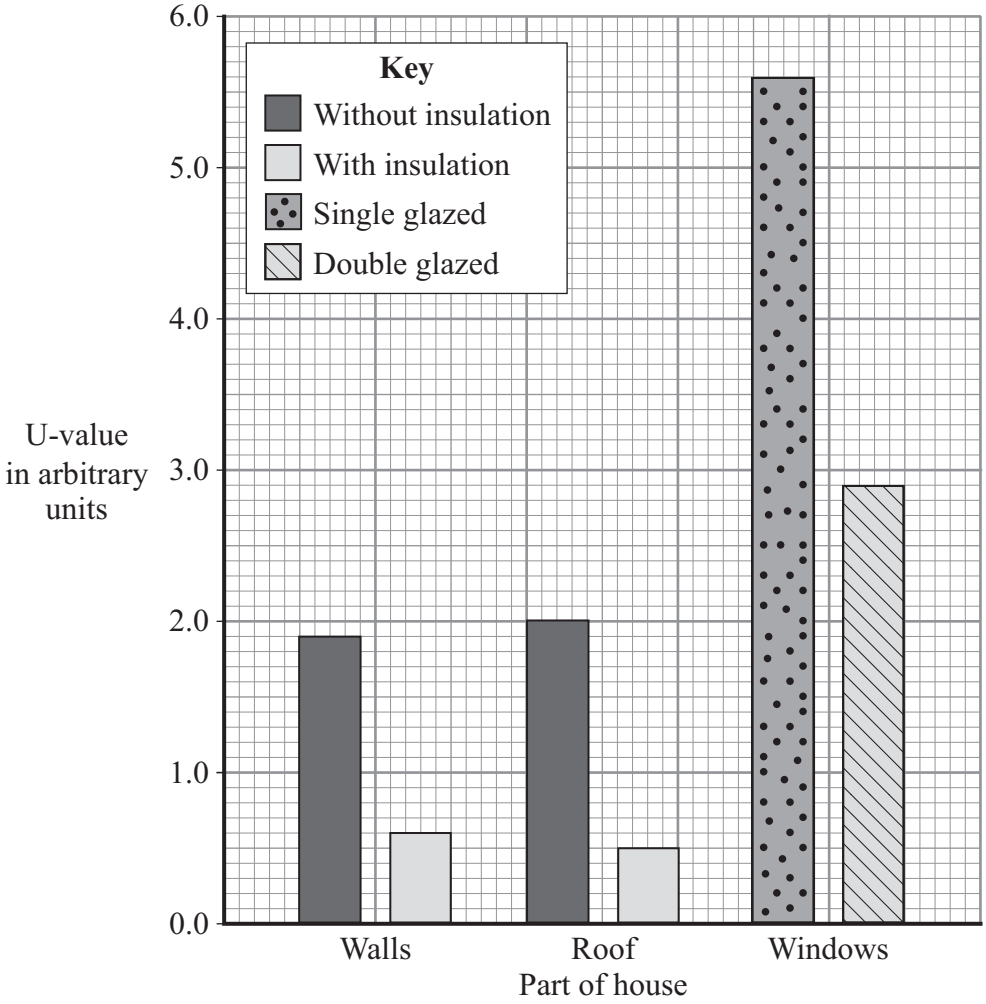
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QUESTION FIVE

Different parts of a house have different 'U-values'.

Figure 1 shows some U-values for the walls, the roof and the windows of a house with and without insulation.

Figure 1



5A The U-value for a cavity wall with insulation is different from the U-value of a cavity wall without insulation.

Using **Figure 1**, what is the percentage change in U-value when cavity wall insulation is fitted?

1 25 %

2 33 %

3 68 %

4 75 %

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5B Which of the following statements is correct?

1 Double-glazed windows have a higher U-value than single glazed windows.

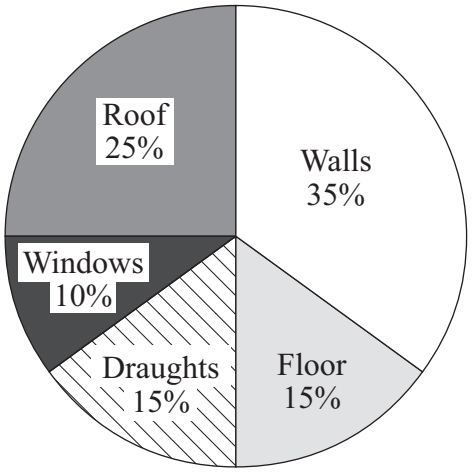
2 The higher the U-value, the higher the rate of loss of heat.

3 Putting insulation in the loft, halves the U-value of the roof.

4 U-values are always greater than 1.

Figure 2 shows the percentage of heat lost from different parts of a house **without** insulation.

Figure 2



A house that is **not** insulated loses heat at the rate of 2 kW.

5C According to **Figure 2**, the combined rate of loss of heat from draughts and through the floors is . . .

1 0.3 kW

2 0.6 kW

3 1.4 kW

4 1.7 kW

5D The rate of loss of heat through the walls, roof and windows of a house that is **not** insulated will be reduced by 50 % if insulation is installed.

What would be the rate of loss of heat from the house after this installation?

1 0.3 kW

2 0.7 kW

3 1.0 kW

4 1.3 kW

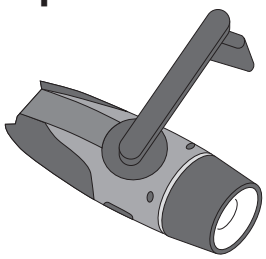
Turn over ▶

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QUESTION SIX

Read this advertisement for a wind-up torch.

Wind-up Torch



£19.99

This torch is always ready to go. Simply wind the handle for just 1 minute and this will power your torch for up to 2 hours of use.

The torch also has a mobile phone connection that will power mobile phones for up to 7 minutes of talk-time for every 1 minute of winding.

You won't have to scrabble around in the dark looking for your torch. The 1 minute of winding also powers a standby light for up to 2 months.

The wind-up torch is strong, splash-proof and eco-friendly.

6A The wind-up torch and a power station both generate electricity.

Which feature of the power station process is the equivalent of the torch's winding handle?

1 boiler

2 generator

3 steam

4 turbine

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6B The source of energy for the operator of the torch's winding handle is food.

Which of these forms of energy is **not** involved in the chain of useful energy transformations for the torch as it is wound up?

1 chemical

2 electrical

3 kinetic

4 thermal

6C What feature of the wind-up torch enables the advertisement to claim that it is eco-friendly?

1 It can be used to power mobile phones.

2 It has a standby light.

3 It is splash-proof.

4 It produces no waste products when in use.

6D A dog owner uses a conventional torch every night. The torch she uses is powered by 4 batteries. She has to replace the batteries every 3 months. The batteries cost 75p each.

If she bought this wind-up torch, how long would the pay-back time be?

1 between 6 months and 1 year

2 between 1 year and 1.5 years

3 between 1.5 years and 2 years

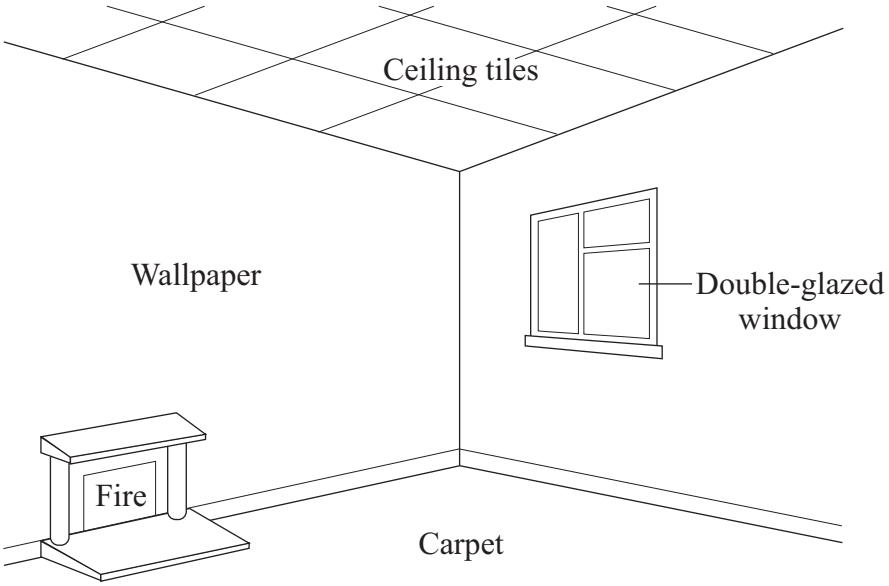
4 between 2 years and 2.5 years

Turn over for the next question

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QUESTION SEVEN

The diagram shows a room which is heated by an electric fire.



7A How does the thermal energy spread through the room?

The particles of air become . . .

1 closer together, making the heated air denser so that it falls.

2 closer together, making the heated air denser so that it rises.

3 further apart, making the heated air less dense so that it falls.

4 further apart, making the heated air less dense so that it rises.

7B Thermal energy is transferred through the glass of the windows mainly by . . .

1 convection of the air in contact with the glass.

2 infra red electromagnetic waves.

3 convection currents in the glass.

4 vibration of particles within the glass.

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7C The double glazing involves trapped air.

Trapped air reduces heat loss because . . .

1 air is a good conductor and the trapped air cannot move far.

2 air is a poor conductor and trapped air cannot move far.

3 air molecules are close together.

4 air molecules have free electrons.

7D The table gives temperatures inside and outside the room.

Which row in the table gives the greatest rate of heat loss from the room?

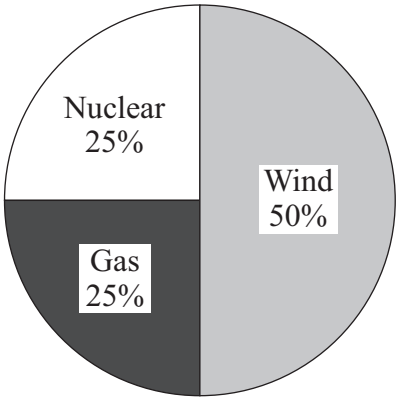
	Temperature inside in °C	**Temperature outside in °C**
1	16	−2
2	16	0
3	16	16
4	16	36

Turn over for the next question

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QUESTION EIGHT

An electricity company claims to generate its electricity from environmentally friendly energy sources. Its sources are shown below.



The table shows the cost of generating one kilowatt-hour of electricity using each energy source.

Energy source	Cost in pence per kilowatt-hour
Gas	2.2
Nuclear	2.2
Wind	3.6

8A The average cost per kilowatt-hour for the electricity company is . . .

1 2.5p

2 2.7p

3 2.9p

4 3.1p

8B How much of the company's electricity is produced by sources that do not release polluting gases?

1 25%

2 50%

3 75%

4 100%

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8C Pumped storage hydroelectric power stations have two reservoirs of water. One reservoir is at a high level, the other at a low level. Water can be released from the high reservoir to flow through turbines to the low reservoir. The turbines drive electrical generators. At night, when demand for electricity is low, water is pumped back to the high reservoir.

The electricity company buys a pumped storage hydroelectric power station.

When is the company likely to use this power station to generate electricity?

1 when the demand for electricity is low

2 when there is a sudden increase in demand for electricity

3 when the wind is blowing at a steady speed

4 when a constant increase in generating capacity is needed

8D The government wants 20% of all electricity to be generated from renewable sources by 2020. It is considering building more wind farms, tidal and wave-powered generators and nuclear power stations.

Why would a scientist consider this statement to be wrong?

1 Coal will continue to be available for another 200 years.

2 Nuclear energy should not be included as a renewable source.

3 The decision should be made by scientists, not politicians.

4 These renewable energy sources are not reliable.

Turn over for the next question

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QUESTION NINE

In the south of Spain, there is an electricity generator which is powered by the Sun.

- Mirrors reflect the Sun's radiation onto a container of water at the top of a tower.
- The water is changed to steam.
- The steam is used to turn a generator.

9A The main source of energy for this generator is . . .

1 infra red.

2 light.

3 microwave.

4 ultraviolet.

9B Which row in the table gives a correct advantage and disadvantage for this generator?

	Advantage	Disadvantage
1	It cannot be used continuously over a 24-hour period.	It has low running costs.
2	It has low running costs.	It produces atmospheric pollution.
3	It produces no atmospheric pollution.	It uses non-renewable energy.
4	It uses renewable energy.	It cannot be used continuously over a 24-hour period.

9C The electricity is transferred to a nearby city using overhead cables.

At the power station, a transformer is used to . . .

1 increase the current, decrease the power and reduce energy losses.

2 increase the energy, increase the power and reduce energy losses.

3 increase the power, decrease the current and reduce energy losses.

4 increase the voltage, decrease the current and reduce energy losses.

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The maximum output of the generator is 11 000 000 watts.

9D A typical household needs 2 kW of electrical power.

If the solar generator is working at 60 % of its maximum output, the number of typical households that could be supplied is . . .

1 3 300

2 198 000

3 3 300 000

4 198 000 000

END OF TEST

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There are no questions printed on this page

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Version 1:0: 09/04/10

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2010 Examination – March Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE
SCIENCE A (4461)/PHYSICS (4451)
Objective Test Answer Key
PHY1AP (Energy and Electricity)
March 2010
Foundation Tier

Question	Key		
One	**A**	conduction	**4**
	B	convection	**3**
	C	insulation	**2**
	D	radiation	**1**
Two	**A**	heat (thermal energy)	**1**
	B	light	**3**
	C	movement (kinetic energy)	**4**
	D	sound	**2**
Three	**A**	electric kettle	**2**
	B	electric oven	**4**
	C	electric shower	**1**
	D	flat-screen television	**3**
Four	**A**	Electricity is produced.	**4**
	B	Fission of uranium produces heat.	**1**
	C	The heat is used to produce steam.	**2**
	D	The turbine drives a generator.	**3**
Five	**A**	0.25	**4**
	B	60	**3**
	C	100	**1**
	D	240	**2**

	A	B	C	D
Six	**3**	**4**	**2**	**1**
Seven	**1**	**4**	**2**	**1**
Eight	**3**	**3**	**1**	**2**
Nine	**2**	**2**	**2**	**4**

GCSE
SCIENCE A (4461)/PHYSICS (4451)
Objective Test Answer Key
PHY1AP (Energy and Electricity)
March 2010
Higher Tier

Question	*Key*		
One	**A**	0.25	**4**
	B	60	**3**
	C	100	**1**
	D	240	**2**
Two	**A**	computer monitor	**1**
	B	loudspeaker	**3**
	C	microphone	**2**
	D	solar cell	**4**

	A	**B**	**C**	**D**
Three	**3**	**3**	**1**	**2**
Four	**2**	**2**	**2**	**4**
Five	**3**	**2**	**2**	**4**
Six	**4**	**4**	**4**	**3**
Seven	**4**	**4**	**2**	**1**
Eight	**3**	**3**	**2**	**2**
Nine	**1**	**4**	**4**	**1**

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 3G10

03-MAR-10

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	0.25	○	○	○	○
1B	60	○	○	○	○
1C	100	○	○	○	○
1D	240	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	computer monitor	○	○	○	○
2B	loudspeaker	○	○	○	○
2C	microphone	○	○	○	○
2D	solar cell	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A conduction	○	○	○	○
1B convection	○	○	○	○
1C insulation	○	○	○	○
1D radiation	○	○	○	○

QUESTION TWO	1	2	3	4
2A heat (thermal energy)	○	○	○	○
2B light	○	○	○	○
2C movement (kinetic energy)	○	○	○	○
2D sound	○	○	○	○

QUESTION THREE	1	2	3	4
3A electric kettle	○	○	○	○
3B electric oven	○	○	○	○
3C electric shower	○	○	○	○
3D flat-screen television	○	○	○	○

QUESTION FOUR	1	2	3	4
4A Electricity is produced.	○	○	○	○
4B Fission of uranium produces heat.	○	○	○	○
4C The heat is used to produce steam.	○	○	○	○
4D The turbine drives a generator.	○	○	○	○

QUESTION FIVE	1	2	3	4
5A 0.25	○	○	○	○
5B 60	○	○	○	○
5C 100	○	○	○	○
5D 240	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

General Certificate of Secondary Education
Foundation Tier and Higher Tier
November 2009

Science A
Unit Physics P1a (Energy and Electricity)

Physics
Unit Physics P1a (Energy and Electricity)

PHY1AP

F&H

Thursday 19 November 2009 Morning Session

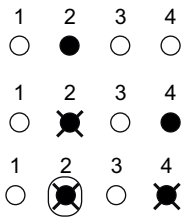
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

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.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 16 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **FIVE**.

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

This question is about heat transfer.

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

A conductors

B convectors

C radiators

D reflectors

Light, shiny surfaces are good . . . **1** . . . of heat.

Very hot objects are good . . . **2** . . . of heat.

Gases are good . . . **3** . . . of heat.

All metals are good . . . **4** . . . of heat.

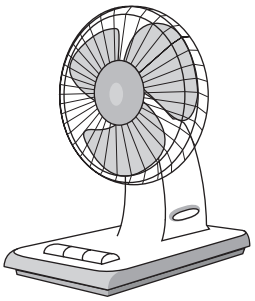
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QUESTION TWO

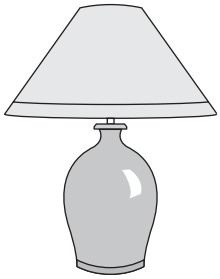
The diagrams show four electrical appliances.



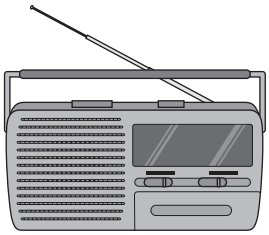
A
Toaster



B
Fan



C
Lamp



D
Radio

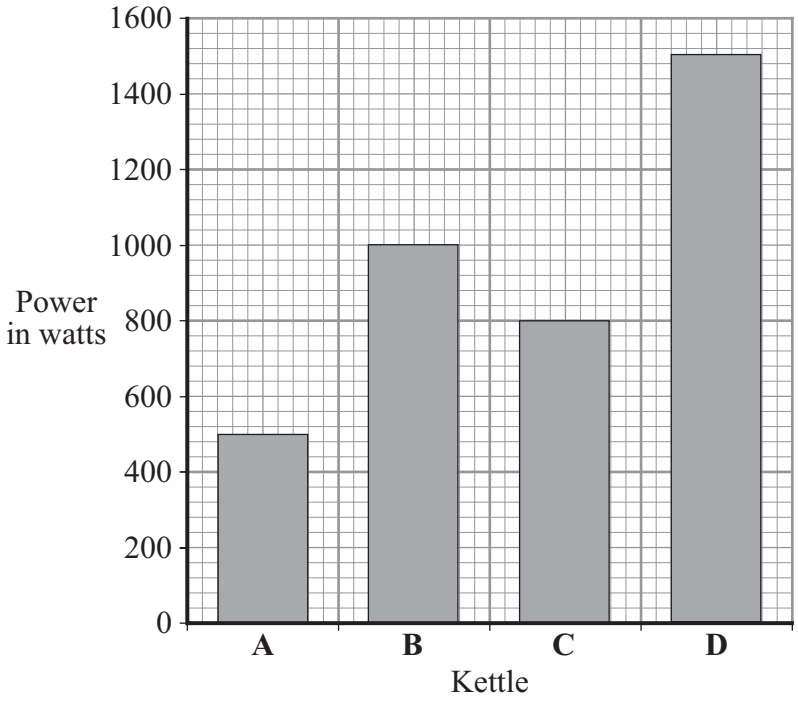
Match the appliances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

	Useful energy	**Wasted energy**
1	sound	heat
2	kinetic	heat and sound
3	light	heat
4	heat	light

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QUESTION THREE

The bar chart shows the power of four different electric kettles, **A**, **B**, **C** and **D**.



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

The kettle with the highest power is kettle . . . **1** . . . .

The kettle with a power of 800 W is kettle . . . **2** . . . .

The kettle with a power of 1 kW is kettle . . . **3** . . . .

Each kettle contains the same volume of water at 20 °C. The kettle that takes the longest time to boil the water is kettle . . . **4** . . . .

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QUESTION FOUR

The flow chart shows the steps involved in producing electricity in a coal-fired power station. It also shows the steps involved in transferring the electricity to the National Grid.

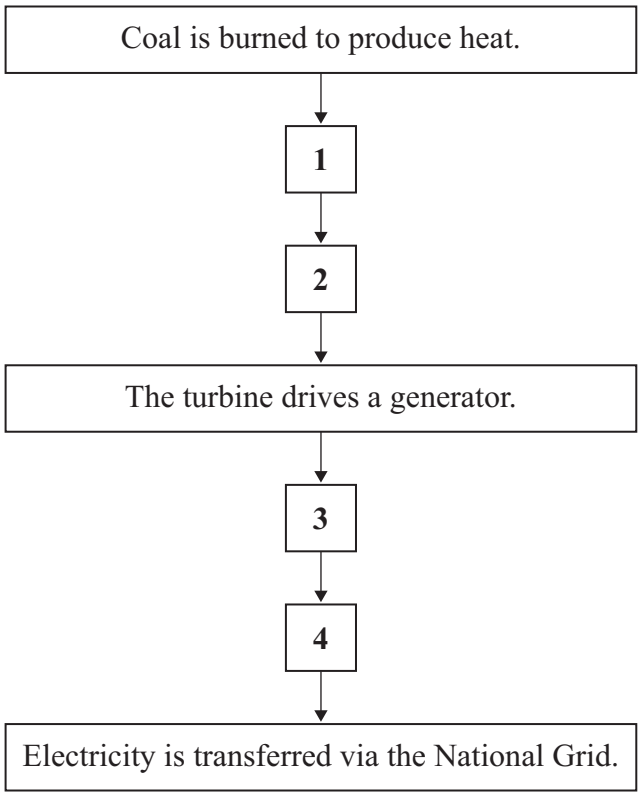
Match stages, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart.

A A step-up transformer increases the voltage.

B Steam drives a turbine.

C The generator produces electricity.

D Water is heated to produce steam.

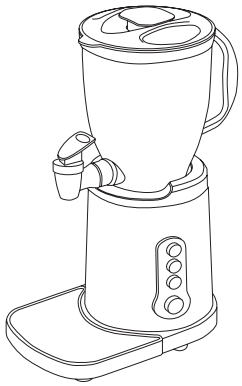


Turn over for the next question

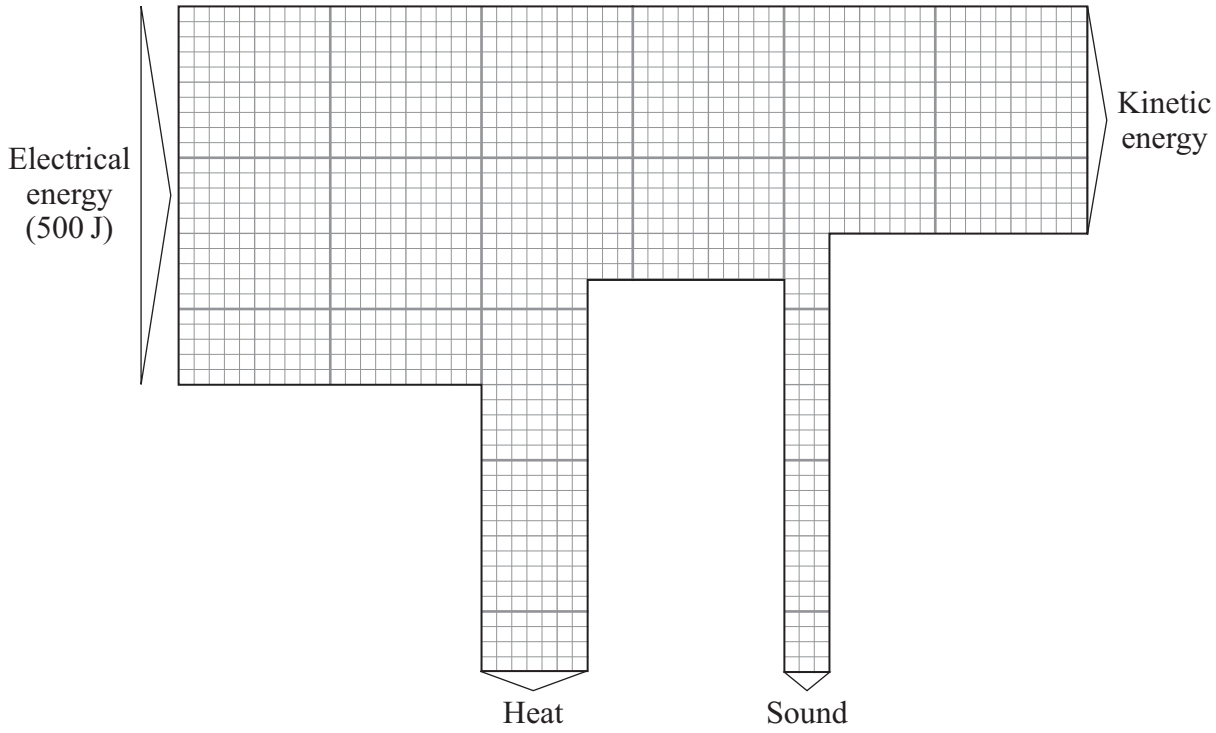
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QUESTION FIVE

The diagram shows a smoothie maker.



The Sankey diagram shows the energy transfers that take place each second in this smoothie maker.



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

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

A 0.6

B 140

C 200

D 300

The kinetic energy produced each second is . . . **1** . . . J.

The heat produced each second is . . . **2** . . . J.

The total energy wasted each second is . . . **3** . . . J.

The efficiency of the smoothie maker is . . . **4** . . . .

Turn over for the next question

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SECTION TWO

Questions **SIX** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

This question is about different ways of producing electrical energy.

6A Which of the following fuels used for producing electricity is **not** a fossil fuel?

1 coal

2 natural gas

3 oil

4 uranium

6B Which of the following is a renewable energy source?

1 coal

2 falling water (hydroelectric)

3 plutonium

4 uranium

6C Where is a geothermal power station most likely to be sited?

1 along a coastline

2 in hot countries

3 in large cities

4 near volcanoes

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6D Which of the following methods of producing electricity always causes atmospheric pollution?

1 burning fossil fuels

2 solar cells

3 nuclear energy

4 wind turbines

Turn over for the next question

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QUESTION SEVEN

Biodiesel is a biofuel.

- Biodiesel can be made from the waste products from the manufacture of chocolate.
- The chocolate waste products would otherwise be sent to landfill sites.
- Biodiesel can also be made from crops such as oilseed rape and palm trees.
- Biodiesel can be mixed with ordinary diesel and used to run vehicles.

7A It is better to make biodiesel from chocolate waste than from crops because this biodiesel . . .

1 can be mixed with ordinary diesel.

2 can be used to run vehicles.

3 makes use of a waste product.

4 requires the use of agricultural land.

7B Cars can run on different fuels.

- In the early 20th century, the Model T Ford car ran on ethanol, a biofuel.
- Large reserves of crude oil were discovered in America in the 1920s. As a result, cars were made to run on petrol.
- After World War II, oil from the Middle East was cheap, so cars continued to run on petrol.

What was the biggest influence in producing the change of fuel from ethanol to petrol?

1 environmental concerns

2 the price of the fuel

3 wars between countries

4 whether the fuel was renewable

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7C A farm is located on a hillside. There are no rivers or streams near the farm. The farmer wants to help the environment by generating his electricity from a renewable source.

Which of these sources is he most likely to choose?

1 a hydroelectric generator

2 a petrol generator

3 a wave generator

4 a wind generator

7D A renewable energy source is one that . . .

1 can be used again.

2 will not run out.

3 does not pollute the atmosphere.

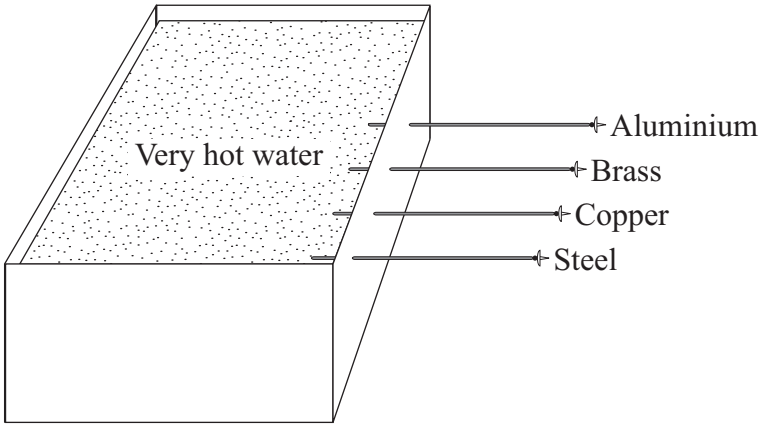
4 is always available.

Turn over for the next question

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QUESTION EIGHT

A student did an experiment to find out which of four metals is the best conductor of heat. He used rods of equal length and thickness. The student used wax to stick a drawing pin to the end of each rod. Very hot water was poured into the tank. The times taken for the wax to melt and the drawing pins to fall off were measured.



8A Which was the independent variable in the experiment?

1 the final temperature of the water

2 the initial temperature of the water

3 the length of the rods

4 the type of metal

8B Which of these is a control variable in the experiment?

1 the final temperature of the water

2 the length of the rods

3 the type of metal

4 the time taken for the drawing pin to fall off

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8C The table shows the student's results.

Which metal is the best conductor of heat?

	Metal	Time taken for the drawing pin to fall off in seconds
1	Aluminium	59
2	Brass	110
3	Copper	32
4	Steel	188

8D The student wanted to improve the results. He repeated the experiment twice and calculated the mean times for the drawing pins to fall off.

What has the student improved by doing this?

1 the calibration

2 the fairness

3 the precision

4 the reliability

Turn over for the next question

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QUESTION NINE

The table gives information about some ways of insulating a house.

Type of insulation	Cost of insulation	Savings per year	Pay-back time
Double glazing	£6000	£200	30 years
Cavity wall insulation	£500	£100	
Loft insulation		£90	3 years
Draught proofing	£100		10 years

9A What is the pay-back time for cavity wall insulation?

1 $\frac{1}{5}$ year

2 1 year

3 4 years

4 5 years

9B What would be the cost of loft insulation for this house?

1 £30

2 £90

3 £270

4 £540

9C Some methods of insulation involve trapped air.

Which methods of heat transfer are reduced by trapped air?

1 conduction and convection

2 conduction and radiation

3 convection and radiation

4 conduction, convection and radiation

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9D The government often gives grants for fitting insulation.

What is the main reason for the government doing this?

1 Fitting insulation helps to conserve energy resources.

2 Fitting insulation increases the value of the house.

3 Governments are trying to support double-glazing companies.

4 Governments make a lot of money out of selling insulation.

END OF TEST

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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**.

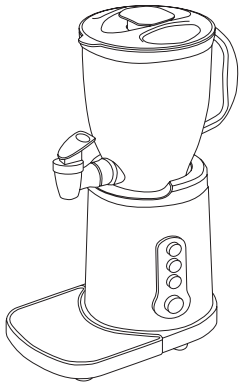
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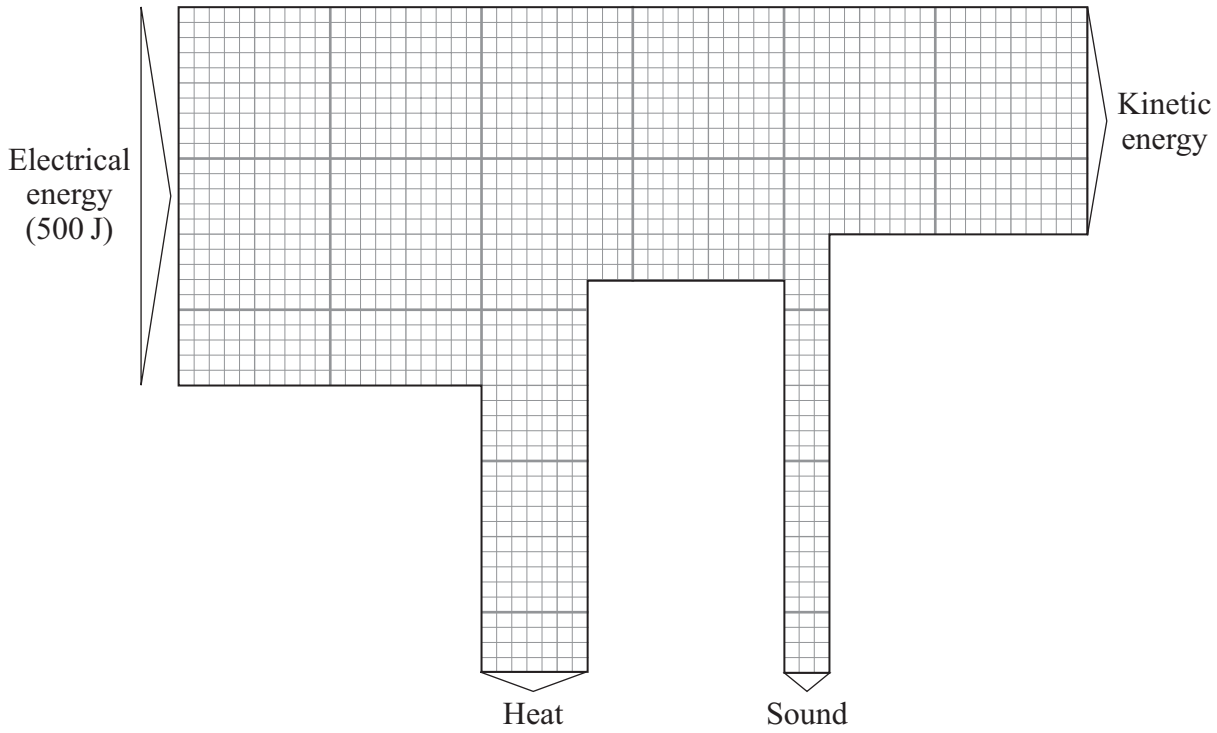
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QUESTION ONE

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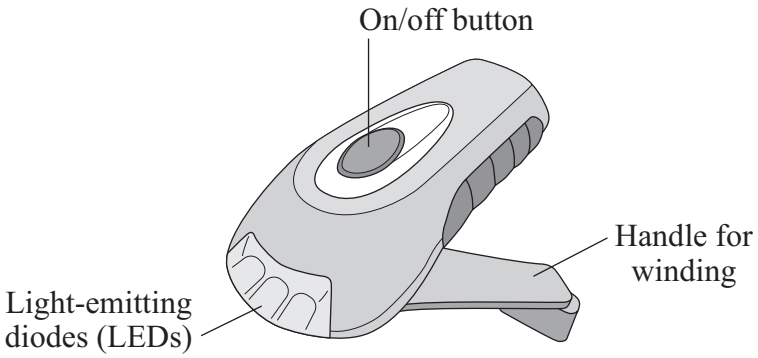
The efficiency of the smoothie maker is . . . **4** . . . .

Turn over for the next question

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QUESTION TWO

The diagram shows a torch which contains a rechargeable battery. The battery is recharged by winding the handle.



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

A chemical

B electrical

C kinetic

D light

When the user winds the handle, the useful energy transformation is from . . . **1** . . . energy to . . . **2** . . energy which is stored in the battery.

When the torch is switched on, the useful output from the battery is . . . **3** . . . energy and the useful output from the LEDs is . . . **4** . . . energy.

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Turn over for the next question

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SECTION TWO

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

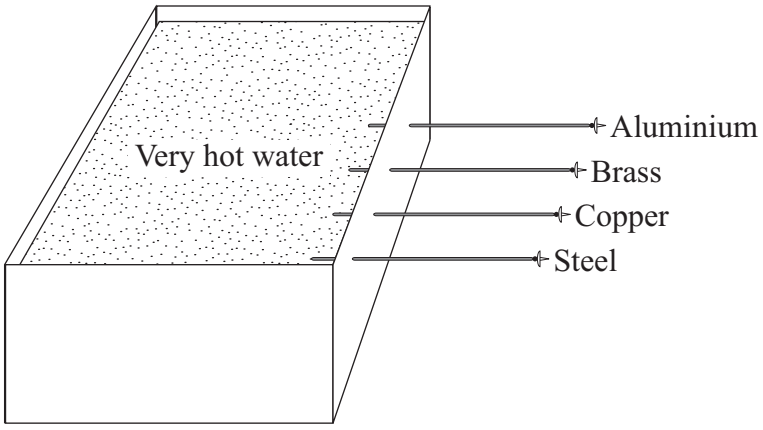
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QUESTION FOUR

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4A What is the pay-back time for cavity wall insulation?

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3 4 years

4 5 years

4B What would be the cost of loft insulation for this house?

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4C Some methods of insulation involve trapped air.

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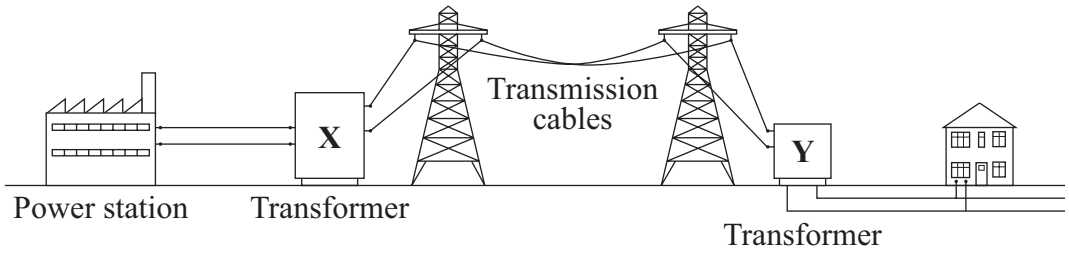
4 Governments make a lot of money out of selling insulation.

Turn over for the next question

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QUESTION FIVE

Power stations produce electricity and the National Grid distributes it to our homes and to factories.



5A Electricity is transferred along the transmission cables at high voltage so that . . .

1 fewer pylons need to be used.

2 less energy is lost in the cables.

3 the current in the cables is also high.

4 thicker cables can be used.

5B The two transformers, **X** and **Y**, are needed to . . .

1 change heat to electrical energy at **X** and electrical energy to heat at **Y**.

2 change the current at **X** to a higher value and the current at **Y** to a lower value.

3 change the voltage at **X** from ac to dc and the voltage at **Y** from dc to ac.

4 change the voltage at **X** to a higher value and the voltage at **Y** to a lower value.

5C Power stations use gas, coal, oil or uranium as the fuel.

Which of these fuels does **not** produce carbon dioxide when it is used?

1 coal

2 gas

3 oil

4 uranium

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5D A hydroelectric power station does not release carbon dioxide into the atmosphere.

Which row in the table gives a correct advantage and a correct disadvantage of hydroelectric power stations?

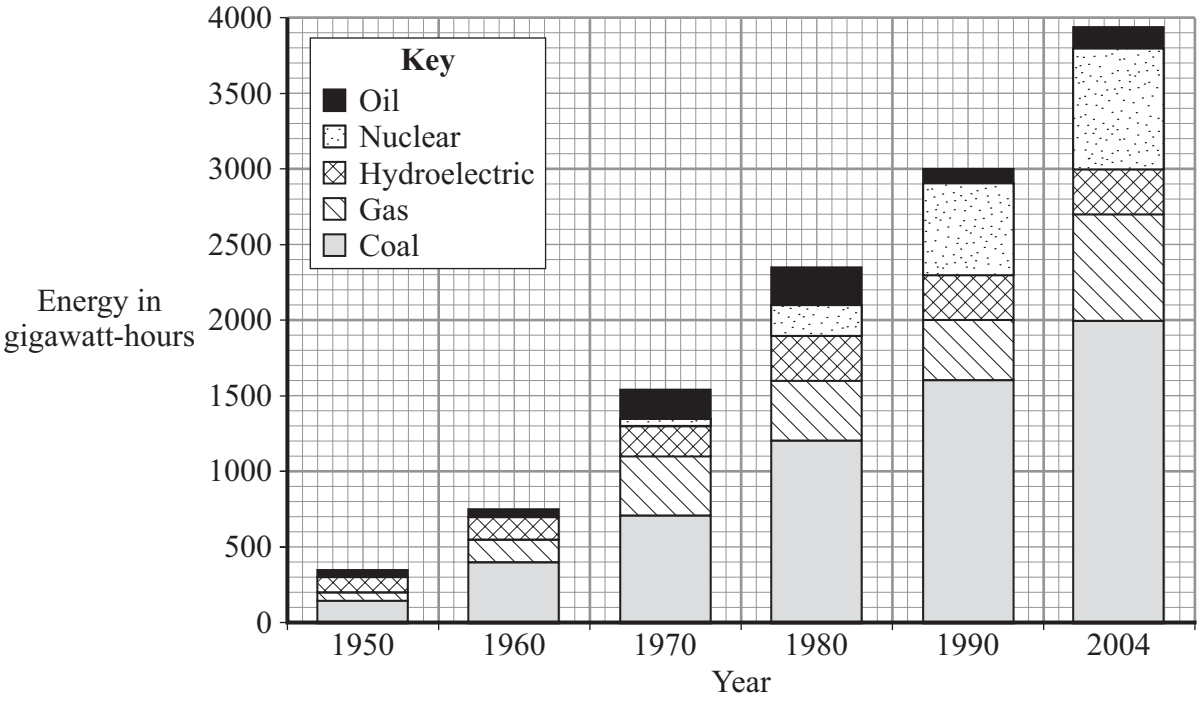
	Advantage	**Disadvantage**
1	Valleys are flooded to form large lakes.	The building costs are very high.
2	There are no fuel costs.	They take a long time to start up.
3	They can be started up quickly.	Habitats are flooded to make large lakes.
4	No wildlife habitats are destroyed during construction.	Valleys are flooded to produce large lakes.

Turn over for the next question

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QUESTION SIX

The bar chart shows the generation of electricity, in gigawatt-hours for a certain country, from five different energy sources between 1950 and 2004.



6A Of the following energy sources, which one produced the greatest amount of electricity in 1980?

1 gas

2 hydroelectric

3 nuclear

4 oil

6B In 1990, which of the following energy sources was producing approximately 600 gigawatt-hours of electricity?

1 coal

2 gas

3 hydroelectric

4 nuclear

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6C Which of the following useful energy transformations takes place in power stations using coal, oil, gas and uranium?

1 kinetic to chemical

2 chemical to heat

3 electrical to kinetic

4 heat to kinetic

6D In 2004, over 50% of the electricity was generated using coal as the fuel. The government of the country is committed to reducing carbon dioxide emissions.

Which row in the table shows how the energy sources used for generating electricity may change in the next 10 years?

	Increased use	**Decreased use**
1	coal and gas	hydroelectric and nuclear
2	wave and wind	coal and gas
3	gas and nuclear	coal and wind
4	tidal and wave	nuclear and wind

Turn over for the next question

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QUESTION SEVEN

This question is about different ways of generating electricity.

7A Some types of power station heat water to produce steam. The steam then drives a turbine connected to an electrical generator.

Which types of power station produce steam?

1 biomass, coal and nuclear

2 biomass, wind and wave

3 coal, nuclear and wave

4 gas, wind and wave

The table gives data for the cost of generating electricity in different types of power station.

Type of power station	Building and operating costs in pence per kWh	Fuel costs in pence per kWh	Total cost in pence per kWh
Biomass	5.9	0.8	6.7
Coal	1.3	1.2	2.5
Gas	0.7	1.5	2.2
Nuclear	1.8	0.4	2.2
Wave	6.6	0.0	6.6
Wind	3.7	0.0	3.7

7B Which one of the following is correct?

1 Electricity generated from fossil fuels is always the cheapest.

2 The fuel cost for all renewable sources is zero.

3 The most expensive electricity comes from renewable sources.

4 Wind power stations produce the cheapest electricity.

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7C Fossil fuel power stations release polluting gases into the atmosphere. The government has suggested a carbon tax because of this. This tax would add 0.8 p/kWh to coal prices and 0.4 p/kWh to gas prices.

Which type of power station would produce the cheapest electricity if a carbon tax was added?

1 coal

2 gas

3 nuclear

4 wind

7D The total cost per kilowatt-hour of electricity from a wind-powered station is more than the total cost of electricity per kilowatt-hour from a gas-powered station.

By what percentage would the **fuel** cost of gas have to increase to make the **total** costs the same? (Assume that no carbon tax has been added.)

1 15 %

2 41 %

3 68 %

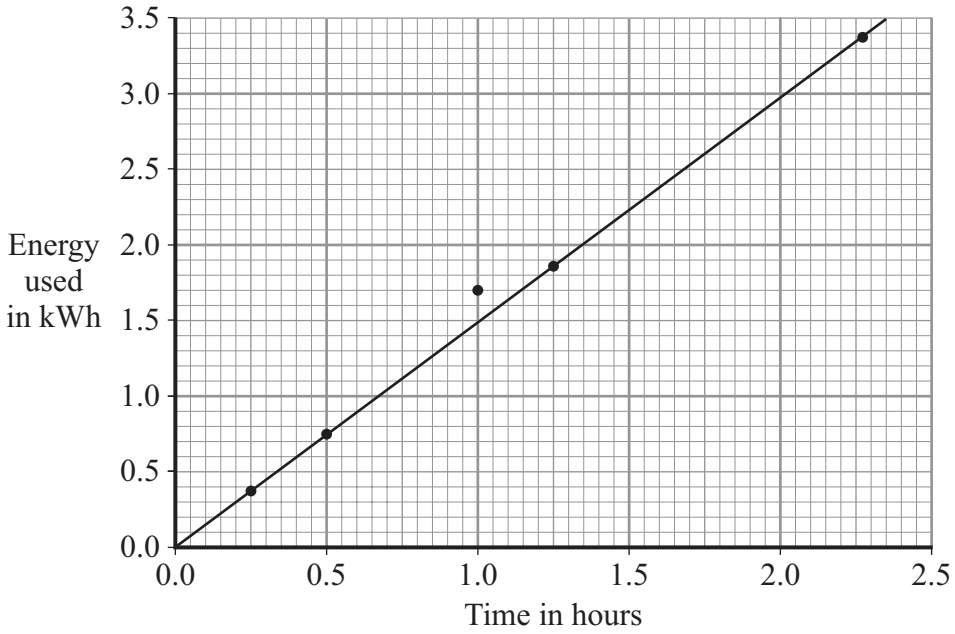
4 100 %

Turn over for the next question

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QUESTION EIGHT

The graph shows the amount of energy used by an electric fire plotted against the length of time it is switched on.



8A The unit of energy on the graph is the kilowatt-hour (kWh).

Energy is usually measured in . . .

1 joules.

2 joules per second.

3 watts.

4 watts per second.

8B The point on the graph at the time of one hour could be anomalous.

This means that the value of the energy . . .

1 was measured with too little precision.

2 was measured with too much precision.

3 does not fit the general pattern.

4 is subject to a systematic error.

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8C The graph shows that . . .

1 the energy used decreases with time.

2 the energy used is directly proportional to the time.

3 the energy used is inversely proportional to the time.

4 the energy used halves when the time is doubled.

8D What is the power of the electric fire?

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

1 1.5 W

2 6.7 W

3 1500 W

4 6700 W

Turn over for the next question

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QUESTION NINE

A notice in an office says:

Leaving your computer on standby overnight uses as much energy as microwaving six dinners

Switch it OFF

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

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

Electricity costs 12 p per kilowatt-hour.

9A The instructions on a frozen cottage pie say: 'Cook in an 850 W microwave oven for 6 minutes'.

Approximately how much would it cost to cook 6 cottage pies, if they are cooked one at a time?

1 6 p

2 £1.02

3 £3.66

4 £36.72

9B A computer monitor in an office has a power rating of 300 W. Normal office hours are 9 am to 5 pm.

A sensible estimate of the energy wasted if it is left on overnight at full power is . . .

1 4.8 kWh

2 7.2 kWh

3 4800 kWh

4 7200 kWh

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9C The 300 W computer monitor can be switched to standby. The standby power is 3 W.

How much money is saved each hour by switching the monitor from full power to standby?

1 less than 1 p

2 3.6 p

3 33 p

4 36 p

9D It is estimated that in Britain 15 million televisions are left on standby for 20 hours per day. The European Parliament has passed a law to help to reduce this problem.

Suggest which of the following would have been included in the law.

1 decrease the price of televisions

2 make it compulsory for television owners to switch off their television sets when not in use

3 set a 1 W limit on standby power for all televisions

4 set a 1 W limit on standby power for all new televisions

END OF TEST

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There are no questions printed on this page

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Version 1:0: 21/11/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2009 Examination – November Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

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Dr Michael Cresswell Director General

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

November 2009

Foundation Tier

Question			
One	**A**	conductors	**4**
	B	convectors	**3**
	C	radiators	**2**
	D	reflectors	**1**
Two	**A**	toaster	**4**
	B	fan	**2**
	C	lamp	**3**
	D	radio	**1**
Three	**A**	Kettle A	**4**
	B	Kettle B	**3**
	C	Kettle C	**2**
	D	Kettle D	**1**
Four	**A**	A step-up transformer increases the voltage.	**4**
	B	Steam drives a turbine.	**2**
	C	The generator produces electricity.	**3**
	D	Water is heated to produce steam.	**1**
Five	**A**	0.6	**4**
	B	140	**2**
	C	200	**3**
	D	300	**1**

	A	**B**	**C**	**D**
Six	**4**	**2**	**4**	**1**
Seven	**3**	**2**	**4**	**2**
Eight	**4**	**2**	**3**	**4**
Nine	**4**	**3**	**1**	**1**

GCSE
SCIENCE A (4461)/PHYSICS (4451)
Objective Test Answer Key
PHY1AP (Energy and Electricity)
November 2009
Higher Tier

Question	Key		
One	**A**	0.6	**4**
	B	140	**2**
	C	200	**3**
	D	300	**1**
Two	**A**	chemical	**2**
	B	electrical	**3**
	C	kinetic	**1**
	D	light	**4**

	A	**B**	**C**	**D**
Three	**4**	**2**	**3**	**4**
Four	**4**	**3**	**1**	**1**
Five	**2**	**4**	**4**	**3**
Six	**1**	**4**	**4**	**2**
Seven	**1**	**3**	**3**	**4**
Eight	**1**	**3**	**2**	**3**
Nine	**1**	**1**	**2**	**4**

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : BG09

19-NOV-09

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE		1	2	3	4
1A	0.6	○	○	○	○
1B	140	○	○	○	○
1C	200	○	○	○	○
1D	300	○	○	○	○

QUESTION TWO		1	2	3	4
2A	chemical	○	○	○	○
2B	electrical	○	○	○	○
2C	kinetic	○	○	○	○
2D	light	○	○	○	○

QUESTION THREE	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE	1	2	3	4
1A conductors	○	○	○	○
1B convectors	○	○	○	○
1C radiators	○	○	○	○
1D reflectors	○	○	○	○

QUESTION TWO	1	2	3	4
2A Toaster	○	○	○	○
2B Fan	○	○	○	○
2C Lamp	○	○	○	○
2D Radio	○	○	○	○

QUESTION THREE	1	2	3	4
3A Kettle A	○	○	○	○
3B Kettle B	○	○	○	○
3C Kettle C	○	○	○	○
3D Kettle D	○	○	○	○

QUESTION FOUR	1	2	3	4
4A A step-up transformer increases the voltage.	○	○	○	○
4B Steam drives a turbine.	○	○	○	○
4C The generator produces electricity.	○	○	○	○
4D Water is heated to produce steam.	○	○	○	○

QUESTION FIVE	1	2	3	4
5A 0.6	○	○	○	○
5B 140	○	○	○	○
5C 200	○	○	○	○
5D 300	○	○	○	○

QUESTION SIX	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

General Certificate of Secondary Education
June 2009

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

PHYSICS
Unit Physics P1a (Energy and Electricity)

Monday 22 June 2009 Morning Session

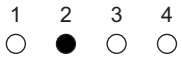
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

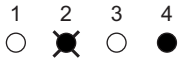
Time allowed: 30 minutes

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.

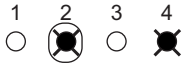
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 16 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **FIVE**.

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

This question is about useful electrical devices.

Match devices, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A fan

B lamp

C oven

D radio

1	an electrical device designed to produce sound energy
2	an electrical device designed to produce light energy
3	an electrical device designed to produce kinetic energy
4	an electrical device designed to produce heat (thermal energy)

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QUESTION TWO

Four students are discussing ways in which electricity could be generated in their home countries.

Match sources of energy, **A**, **B**, **C** and **D**, with the students' descriptions of their countries **1**–**4**.

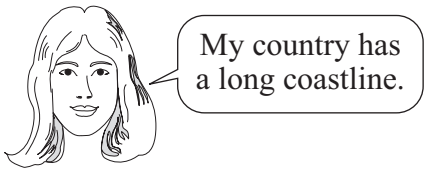
A falling water (hydroelectric)

B geothermal

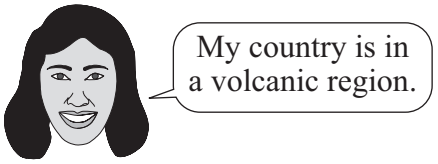
C solar

D wave

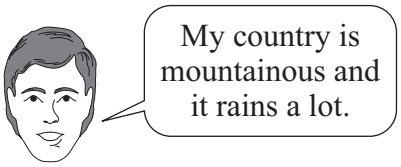
1



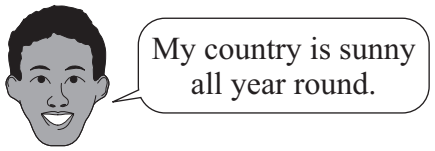
2



3



4

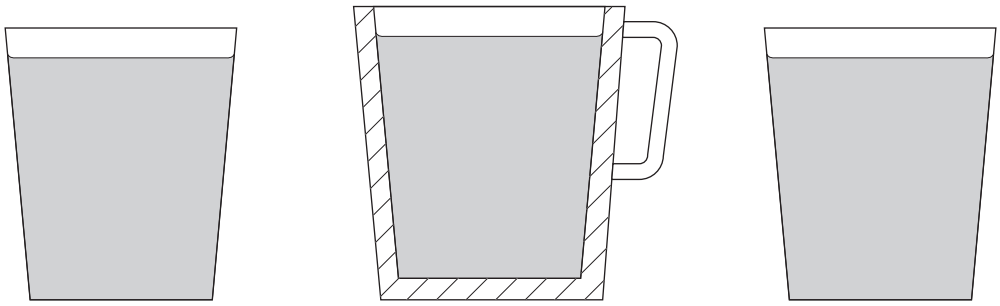


Turn over for the next question

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QUESTION THREE

The diagram shows three mugs containing hot tea. The second mug is in a plastic holder.



Metal mug | Metal mug in plastic holder | Plastic mug

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

A conduction

B convection

C insulation

D radiation

Putting a lid on a mug reduces heat loss by . . . **1** . . . .

Placing a mug in a plastic holder increases . . . **2** . . . .

Painting a mug so that it has a light, shiny surface decreases heat loss by . . . **3** . . . .

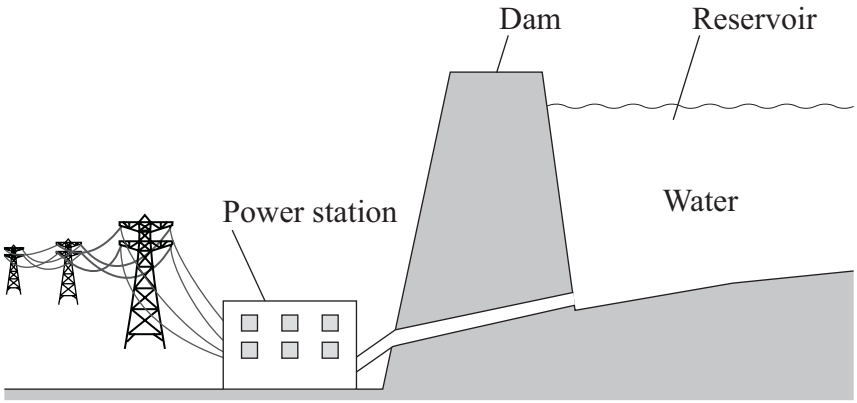
Using a plastic mug, rather than a metal one, reduces heat loss by . . . **4** . . . . .

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QUESTION FOUR

Useful energy can be obtained from falling water.

The diagram shows one way of doing this.



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

A electrical

B gravitational potential

C heat (thermal energy)

D kinetic

Large amounts of . . . **1** . . . energy are stored in the water in the reservoir.

Water flowing down from this reservoir has . . . **2** . . . energy which can turn a turbine.

The turbine can power a generator which produces useful . . . **3** . . . energy.

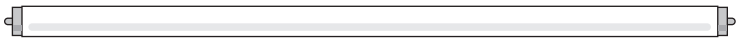
Some energy is wasted in the power station as . . . **4** . . . .

Turn over for the next question

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QUESTION FIVE

The diagram shows a fluorescent tube used for lighting. The inside of the tube is coated with a chemical which gives out light when supplied with energy.



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

A environmental

B efficient

C electrical

D economical

More of the . . . **1** . . . energy is transformed into light energy in the fluorescent tube than in a filament lamp.

This makes the fluorescent tube more . . . **2** . . . than a filament lamp.

A fluorescent tube costs less to run than a filament lamp, which makes the fluorescent tube more . . . **3** . . . .

The chemicals inside the fluorescent tube must be properly disposed of to prevent any . . . **4** . . . problem.

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Turn over for the next question

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SECTION TWO

Questions **SIX** to **NINE**.

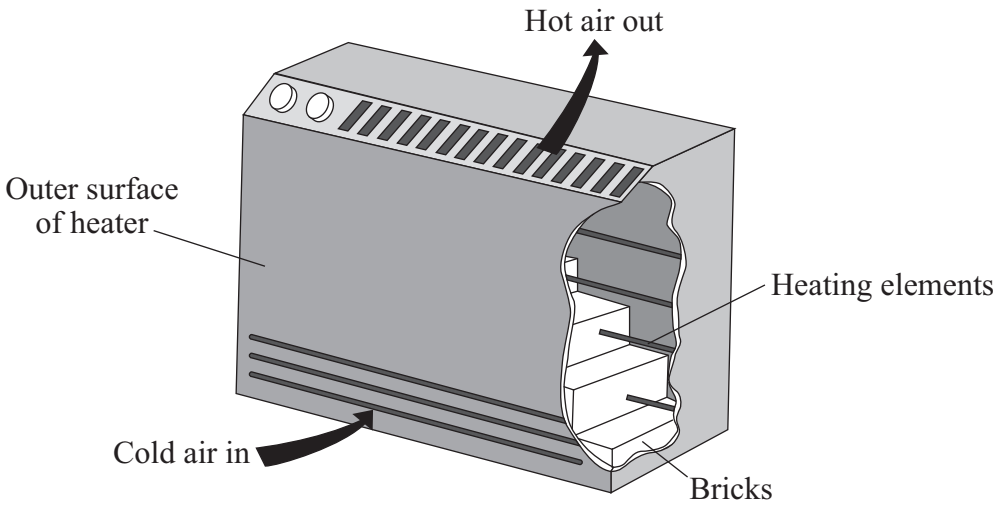
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

The diagram shows the construction of one type of heater. The bricks inside the heater warm up during the night when the cost of electricity is lower. The bricks then emit heat (thermal energy) during the day.



6A The bricks warm up because they . . .

1 absorb heat.

2 insulate heat.

3 radiate heat.

4 reflect heat.

6B The diagram shows the main thermal energy transfer of the heater as it warms the room.

By what process does this heater transfer most of its energy throughout a room in a house?

1 conduction from the bricks

2 conduction from the outside surface of the heater

3 convection currents in the air

4 radiation from the outside surface of the heater

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6C To give out the most heat, what would be the best outside surface for the heater?

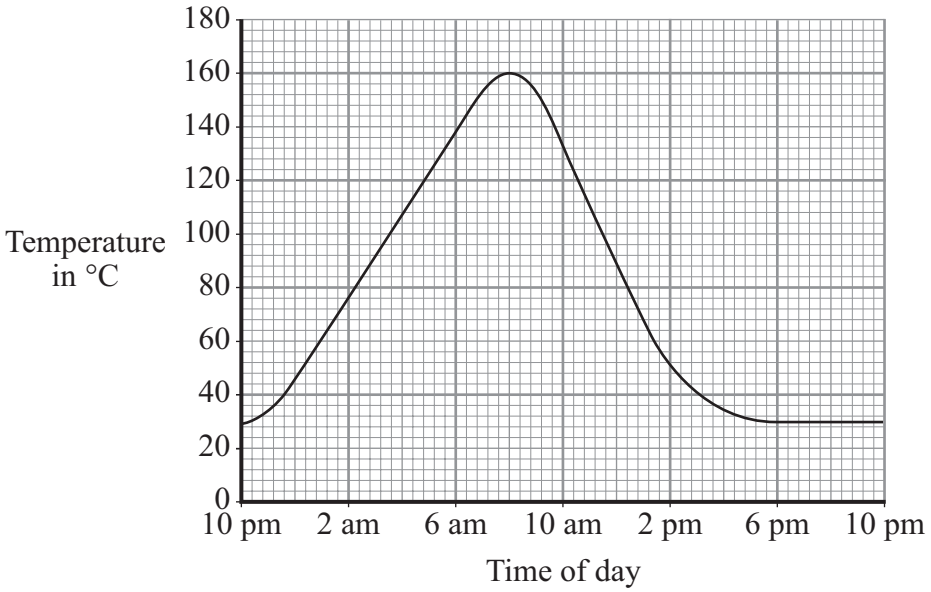
1 dark, matt

2 dark, shiny

3 light, shiny

4 light, matt

6D The graph shows how the temperature of the bricks changes during a 24-hour period.



At what time did the bricks reach their highest temperature?

1 8 am

2 10 am

3 6 pm

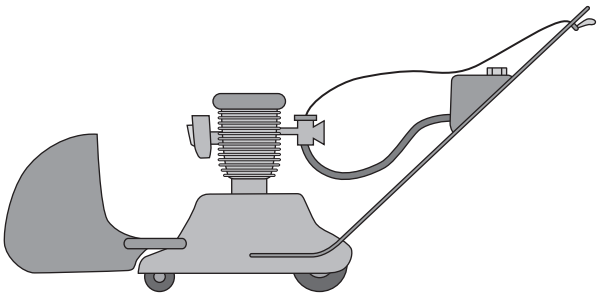
4 10 pm

Turn over ▶

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QUESTION SEVEN

The diagram shows a petrol-driven lawn mower.



7A The useful energy transformation is . . .

1 chemical energy to kinetic energy.

2 heat (thermal energy) to kinetic energy.

3 kinetic energy to chemical energy.

4 sound energy to heat (thermal energy).

7B The wasted energy is . . .

1 elastic potential.

2 heat only.

3 heat and sound.

4 sound only.

7C All wasted energy will eventually . . .

1 be destroyed.

2 be transferred to the surroundings.

3 cause the machine to overheat.

4 no longer exist anywhere.

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7D Another lawn mower is said to be more efficient than this one.

This is because . . .

1 it cuts the grass more quickly.

2 it leaves fewer loose grass clippings.

3 it cuts the grass shorter.

4 it uses less petrol.

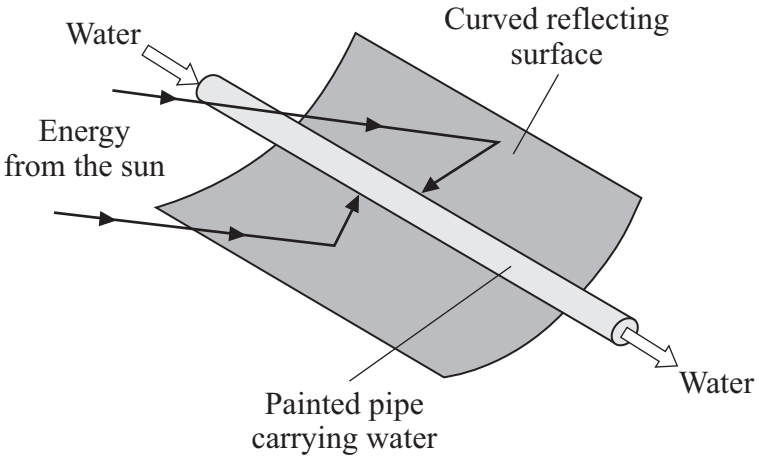
Turn over for the next question

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QUESTION EIGHT

Solar collectors absorb energy from the Sun to heat water.

The diagram shows part of a solar collector.



Two students thought that the colour of the pipe would affect the amount of energy the water absorbed.

They painted some test tubes different colours. Then they added 50 cm^3 of water to each test tube. They measured the temperature of the water at the start and then put the test tubes outside in a sunny place for two hours. They measured the final temperature of the water in each tube. Then they recorded the temperature rise of the water in each tube.

This is part of their results table.

Colour of paint	**Temperature rise in °C**
Silver	3
White	9
Unpainted	11
Yellow	16
Black	25

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8A Which was the categoric variable?

1 colour of paint

2 temperature rise

3 time left in sunshine

4 volume of water

8B Which was the dependent variable?

1 colour of paint

2 temperature rise

3 type of thermometer

4 volume of water

8C Which was the control variable?

1 colour of paint

2 final temperature

3 temperature rise

4 volume of water

8D How should the students display the results?

1 as a bar chart

2 as a line graph

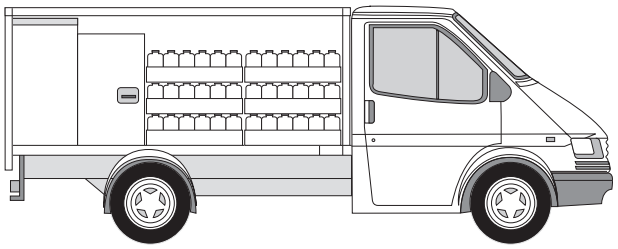
3 as a pie chart

4 as a scattergram

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QUESTION NINE

The diagram shows an electrically powered milk float.



In a milk float, batteries drive an electric motor.
A milk float travels 40 km a day.
The batteries are recharged overnight.

9A When the milk float is travelling along the road, the batteries transform . . .

1 electrical energy to kinetic energy.

2 kinetic energy to chemical energy.

3 chemical energy to electrical energy.

4 kinetic energy to electrical energy.

9B When charging the batteries, the battery charger transfers 1.5 kW of power for 5 hours.

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

The energy transferred to the batteries is . . .

1 0.3 kWh

2 3.3 kWh

3 7.5 kWh

4 75 kWh

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9C During a day, the electric motor usefully transfers 1600 kJ. The energy supplied to the electric motor is 4000 kJ.

What is the efficiency of the motor?

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

1 0.4

2 2.5

3 2400

4 5600

9D The milk float is said to be more 'environmentally friendly' than a petrol-driven vehicle.

This is because . . .

1 the batteries store energy.

2 it produces no harmful waste gases.

3 the batteries can be recharged many times.

4 the top speed is only 20 km/h.

END OF TEST

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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**

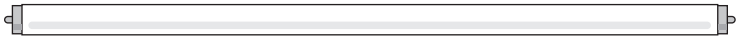
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1**–**4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a fluorescent tube used for lighting. The inside of the tube is coated with a chemical which gives out light when supplied with energy.



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

A environmental

B efficient

C electrical

D economical

More of the . . . **1** . . . energy is transformed into light energy in the fluorescent tube than in a filament lamp.

This makes the fluorescent tube more . . . **2** . . . than a filament lamp.

A fluorescent tube costs less to run than a filament lamp, which makes the fluorescent tube more . . . **3** . . . .

The chemicals inside the fluorescent tube must be properly disposed of to prevent any . . . **4** . . . problem.

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QUESTION TWO

This question is about energy resources that can be used to produce electricity.

Match words, **A**, **B**, **C** and **D**, with the pairs of statements **1**–**4** in the table.

A coal

B nuclear

C tides

D wind

	Advantage	Disadvantage
1	no polluting gases produced	unpredictable supply of energy
2	no polluting gases produced	radioactive waste produced
3	plentiful supply of fuel in Britain	produces acid rain
4	no fuel needed	may destroy habitats of wading birds

Turn over for the next question

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SECTION TWO

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

Each of these questions has four parts.

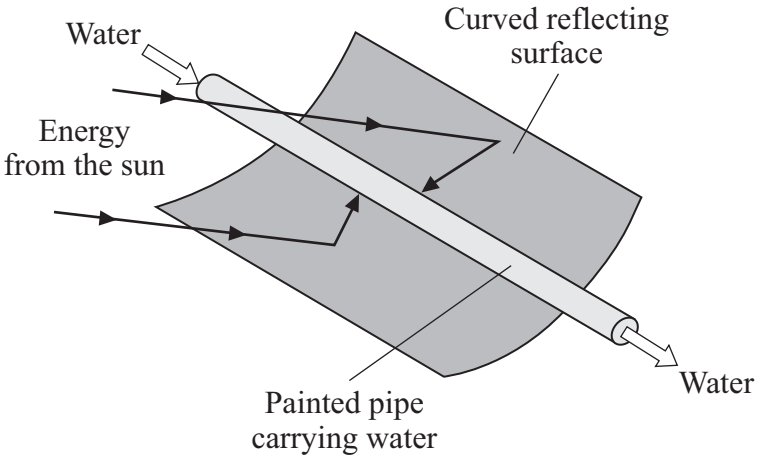
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

Solar collectors absorb energy from the Sun to heat water.

The diagram shows part of a solar collector.



Two students thought that the colour of the pipe would affect the amount of energy the water absorbed.

They painted some test tubes different colours. Then they added 50 cm^3 of water to each test tube. They measured the temperature of the water at the start and then put the test tubes outside in a sunny place for two hours. They measured the final temperature of the water in each tube. Then they recorded the temperature rise of the water in each tube.

This is part of their results table.

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White	9
Unpainted	11
Yellow	16
Black	25

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3A Which was the categoric variable?

1 colour of paint

2 temperature rise

3 time left in sunshine

4 volume of water

3B Which was the dependent variable?

1 colour of paint

2 temperature rise

3 type of thermometer

4 volume of water

3C Which was the control variable?

1 colour of paint

2 final temperature

3 temperature rise

4 volume of water

3D How should the students display the results?

1 as a bar chart

2 as a line graph

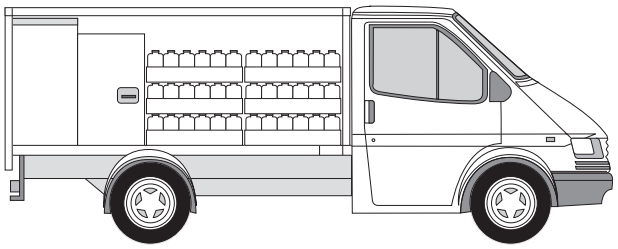
3 as a pie chart

4 as a scattergram

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QUESTION FOUR

The diagram shows an electrically powered milk float.



In a milk float, batteries drive an electric motor.
A milk float travels 40 km a day.
The batteries are recharged overnight.

4A When the milk float is travelling along the road, the batteries transform . . .

1 electrical energy to kinetic energy.

2 kinetic energy to chemical energy.

3 chemical energy to electrical energy.

4 kinetic energy to electrical energy.

4B When charging the batteries, the battery charger transfers 1.5 kW of power for 5 hours.

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

The energy transferred to the batteries is . . .

1 0.3 kWh

2 3.3 kWh

3 7.5 kWh

4 75 kWh

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4C During a day, the electric motor usefully transfers 1600 kJ. The energy supplied to the electric motor is 4000 kJ.

What is the efficiency of the motor?

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

1 0.4

2 2.5

3 2400

4 5600

4D The milk float is said to be more 'environmentally friendly' than a petrol-driven vehicle.

This is because . . .

1 the batteries store energy.

2 it produces no harmful waste gases.

3 the batteries can be recharged many times.

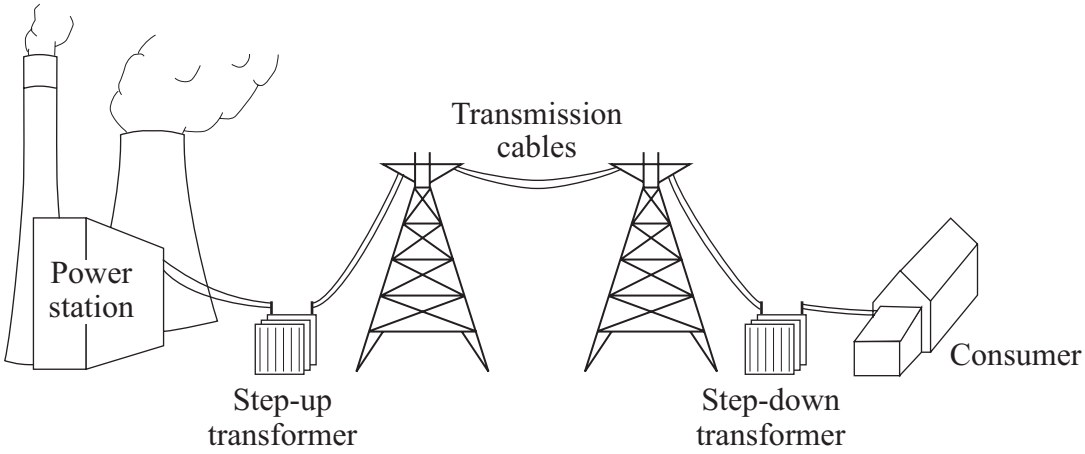
4 the top speed is only 20 km/h.

Turn over for the next question

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QUESTION FIVE

The diagram shows how electricity is distributed from a coal-fired power station to consumers.



5A Which row in the table shows what happens at the step-up transformer?

	Current	Voltage
1	decreased	decreased
2	decreased	increased
3	increased	decreased
4	increased	increased

5B The purpose of the step-up transformer is to . . .

1 allow the electricity to travel further.

2 increase the speed of the electricity through the cables.

3 reduce energy losses from the cables.

4 reduce vibrations in the cables.

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5C Which one of the following power stations has the shortest start-up time?

1 coal

2 gas

3 nuclear

4 oil

5D Which of these fuels undergoes nuclear fission to produce heat in a power station?

1 coal

2 gas

3 oil

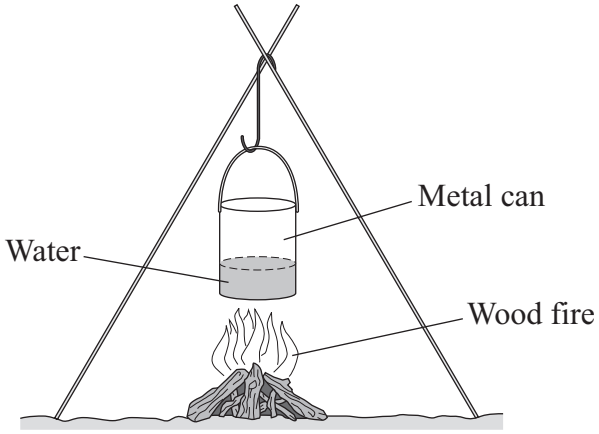
4 uranium

Turn over for the next question

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QUESTION SIX

On a camping trip, some students heated some water in a metal can.



6A Thermal energy is transferred through the metal walls of the can by . . .

1 convection currents in the metal.

2 free electrons gaining energy and moving quickly.

3 infra red radiation passing through the metal.

4 atoms moving through the metal.

6B Thermal energy spreads through the water by . . .

1 ions moving more quickly.

2 particles of water expanding, becoming less dense and rising.

3 particles of water contracting, becoming denser and falling.

4 the water expanding, becoming less dense and rising.

6C A lot of thermal energy is lost from the fire into the air by . . .

1 conduction only.

2 convection only.

3 mainly convection and radiation.

4 conduction, convection and radiation.

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6D The can and the water become hot.

The outer surface of the can transfers energy to the surroundings by . . .

1 infra red radiation passing through the air.

2 metal particles gaining energy and escaping.

3 the air contracting, becoming less dense and falling.

4 the air expanding, becoming denser and rising.

Turn over for the next question

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QUESTION SEVEN

The table compares data for two types of lamp.

	Filament lamp	Compact fluorescent lamp (CFL)
Cost	80p	£3.00
Efficiency	0.2	0.8
Expected life	1000 hours	8000 hours

7A People may decide **not** to buy CFLs because CFLs are . . .

1 more expensive to buy.

2 more efficient.

3 cheaper to run.

4 longer lasting.

7B A filament lamp with a power rating of 100 W gives 2000 units of light.

What power rating would a CFL need to provide 2000 units of light?

1 8000 W

2 20 W

3 25 W

4 25 kW

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

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

Electricity costs 15 p per kWh

7C What will be the cost of using a 100 W filament lamp during its expected life?

1 £1.50

2 £15.00

3 £150.00

4 £1500.00

7D In its lifetime, a security light is used for 15 000 hours.

How much would you expect to spend on buying CFLs for the security light in that time?

1 £5.63

2 £6.00

3 £12.00

4 £45.00

Turn over for the next question

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QUESTION EIGHT

This question is about the energy available from various fuels.

The table shows the amount of energy that 1 kg of different fuels can produce when the fuel energy is transformed.

Fuel	Energy available in MJ per kg
Uranium	70 million
Hydrogen	115
Gas	50
Oil	45
Coal	20
Wood	15

1 MJ = 1 million joules

8A What mass of coal, in kg, would provide the same amount of energy as 1 kg of uranium?

1 0.29

2 3.5

3 0.29 million

4 3.5 million

8B Which three fuels are non-renewable?

1 coal, gas and wood

2 coal, gas and uranium

3 gas, oil and wood

4 gas, uranium and wood

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8C Coal is burned at a rate of 100 kg per second in a power station. The overall efficiency of the power station is 0.3.

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

What is the energy output per second, in MJ, of this power station?

1 600

2 1400

3 1500

4 6700

8D A factory gets all of its energy by burning oil.

Only half of the energy from burning oil is transformed into useful energy.

For a working day, the energy required to run the factory is 10 800 MJ.

What is the mass of oil, in kg, needed each day?

1 24

2 48

3 240

4 480

Turn over for the next question

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QUESTION NINE

The following information is from a leaflet produced by a double-glazing company.

Change your single-glazed windows to our energy-efficient double glazed windows and save a massive £167 a year

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

9A The company assumes that energy costs 11p per kWh.

How much energy does the company claim would be saved each year by fitting its double-glazing?

1 15.2 kWh

2 1 520 kWh

3 1 837 kWh

4 183 700 kWh

9B Double glazing for a house costs £4000. A householder saves £200 in the first year after installing the double-glazing. Fuel prices rise steadily during that year.

The pay-back time is likely to be . . .

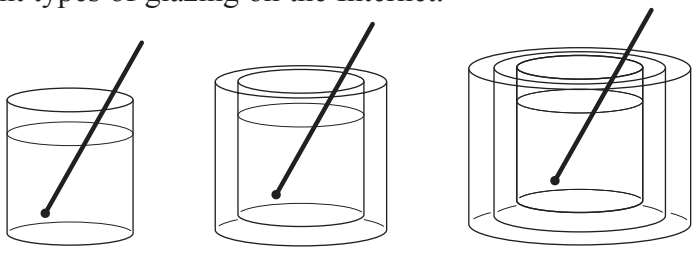
1 exactly 20 years.

2 more than 20 years if fuel prices continue to rise.

3 less than 20 years if fuel prices continue to rise.

4 less than 20 years if fuel prices fall steadily over the next few years.

9C Some students investigated the effectiveness of double and triple glazing. They let 100 cm^3 of boiling water cool in a glass beaker for 20 minutes. They repeated the cooling with the beaker placed inside another one and then inside two beakers. The students also looked up the U-value of different types of glazing on the Internet.



Single glazing | Double glazing | Triple glazing

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The results are shown in the table.

	Single glazing	Double glazing	Triple glazing
Temperature in °C after 20 minutes	68	81	88
U-value	1.0	0.5	0.3

Which of these conclusions should the students draw from their results?

1 Double glazing is more effective than triple glazing and a greater U-value means a larger heat loss.

2 Double glazing is more effective than triple glazing and a greater U-value means a smaller heat loss.

3 Triple glazing is more effective than double glazing and a smaller U-value means a larger heat loss.

4 Triple glazing is more effective than double glazing and a smaller U-value means a smaller heat loss.

9D One student stated that the investigation was not realistic. He said that:

- there is a difference between the area of a window and the surface area of the beakers
- the temperature difference across a window is different from the temperature difference across the beakers.

The table compares a window with the beakers in the experiment.

Which row in the table is correct?

	Surface area of window		Temperature difference across window	
	Compared with the beaker	**Effect on rate of heat transfer**	**Compared with the beaker**	**Effect on rate of heat transfer**
1	larger	slower	larger	slower
2	smaller	slower	larger	faster
3	larger	faster	smaller	slower
4	smaller	faster	smaller	faster

END OF TEST

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There are no questions printed on this page

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Version 1:0: 21/07/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2009 Examination – June Series

The blank answer sheet for this component can be found at the end of this document.

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This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

June 2009

Foundation Tier

Question	Key		
One	**A**	fan	**3**
	B	lamp	**2**
	C	oven	**4**
	D	radio	**1**
Two	**A**	falling water (hydroelectric)	**3**
	B	geothermal	**2**
	C	solar	**4**
	D	wave	**1**
Three	**A**	conduction	**4**
	B	convection	**1**
	C	insulation	**2**
	D	radiation	**3**
Four	**A**	electrical	**3**
	B	gravitational potential	**1**
	C	heat (thermal energy)	**4**
	D	kinetic	**2**
Five	**A**	environmental	**4**
	B	efficient	**2**
	C	electrical	**1**
	D	economical	**3**

	A	B	C	D
Six	**1**	**3**	**1**	**1**
Seven	**1**	**3**	**2**	**4**
Eight	**1**	**2**	**4**	**1**
Nine	**3**	**3**	**1**	**2**

GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

June 2009

Higher Tier

Question	Key		
One	**A**	environmental	**4**
	B	efficient	**2**
	C	electrical	**1**
	D	economical	**3**
Two	**A**	coal	**3**
	B	nuclear	**2**
	C	tides	**4**
	D	wind	**1**

	A	B	C	D
Three	**1**	**2**	**4**	**1**
Four	**3**	**3**	**1**	**2**
Five	**2**	**3**	**2**	**4**
Six	**2**	**4**	**3**	**1**
Seven	**1**	**3**	**2**	**2**
Eight	**4**	**2**	**1**	**4**
Nine	**2**	**3**	**4**	**3**

AQA

Unit : PHY1AP PHYSICS UNIT 1A

Centre :

Candidate Number : **UCI :**

Candidate Name :

Series : 6M09

22-JUN-09

For completion by the Examination Invigilator. **Please fill this circle if the candidate is absent:** ○

HIGHER TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	environmental	○	○	○	○
1B	efficient	○	○	○	○
1C	electrical	○	○	○	○
1D	economical	○	○	○	○

QUESTION TWO

		1	2	3	4
2A	coal	○	○	○	○
2B	nuclear	○	○	○	○
2C	tides	○	○	○	○
2D	wind	○	○	○	○

QUESTION THREE

	1	2	3	4
3A	○	○	○	○
3B	○	○	○	○
3C	○	○	○	○
3D	○	○	○	○

QUESTION FOUR

	1	2	3	4
4A	○	○	○	○
4B	○	○	○	○
4C	○	○	○	○
4D	○	○	○	○

QUESTION FIVE

	1	2	3	4
5A	○	○	○	○
5B	○	○	○	○
5C	○	○	○	○
5D	○	○	○	○

QUESTION SIX

	1	2	3	4
6A	○	○	○	○
6B	○	○	○	○
6C	○	○	○	○
6D	○	○	○	○

QUESTION SEVEN

	1	2	3	4
7A	○	○	○	○
7B	○	○	○	○
7C	○	○	○	○
7D	○	○	○	○

QUESTION EIGHT

	1	2	3	4
8A	○	○	○	○
8B	○	○	○	○
8C	○	○	○	○
8D	○	○	○	○

QUESTION NINE

	1	2	3	4
9A	○	○	○	○
9B	○	○	○	○
9C	○	○	○	○
9D	○	○	○	○

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FOUNDATION TIER

Instructions on how to complete this answer sheet are given on the question paper. Please make sure you follow them carefully.

Questions **ONE** to **NINE** Choose one response **1 - 4** for each of the parts **A - D**

QUESTION ONE

		1	2	3	4
1A	fan				
1B	lamp				
1C	oven				
1D	radio				

QUESTION TWO

		1	2	3	4
2A	falling water (hydroelectric)				
2B	geothermal				
2C	solar				
2D	wave				

QUESTION THREE

		1	2	3	4
3A	conduction				
3B	convection				
3C	insulation				
3D	radiation				

QUESTION FOUR

		1	2	3	4
4A	electrical				
4B	gravitational potential				
4C	heat (thermal energy)				
4D	kinetic				

QUESTION FIVE

		1	2	3	4
5A	environmental				
5B	efficient				
5C	electrical				
5D	economical				

QUESTION SIX

	1	2	3	4
6A				
6B				
6C				
6D				

QUESTION SEVEN

	1	2	3	4
7A				
7B				
7C				
7D				

QUESTION EIGHT

	1	2	3	4
8A				
8B				
8C				
8D				

QUESTION NINE

	1	2	3	4
9A				
9B				
9C				
9D				

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature								

General Certificate of Secondary Education
March 2009

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

PHYSICS
Unit Physics P1a (Energy and Electricity)

Wednesday 4 March 2009 Morning Session

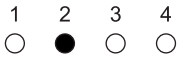
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

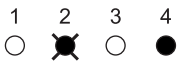
Time allowed: 30 minutes

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.

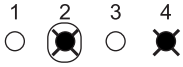
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 16 of this booklet.

FOUNDATION TIER

SECTION ONE

Questions **ONE** to **FIVE**.

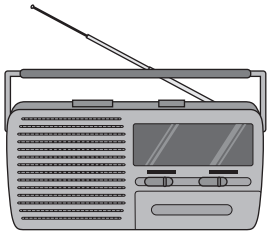
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

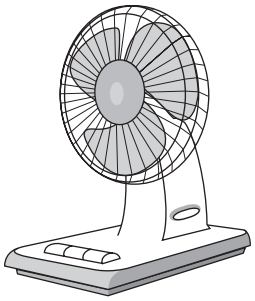
This question is about useful energy transformations in domestic appliances.



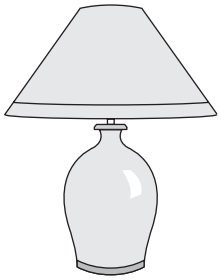
A
Radio



B
Toaster



C
Fan



D
Lamp

Match appliances, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

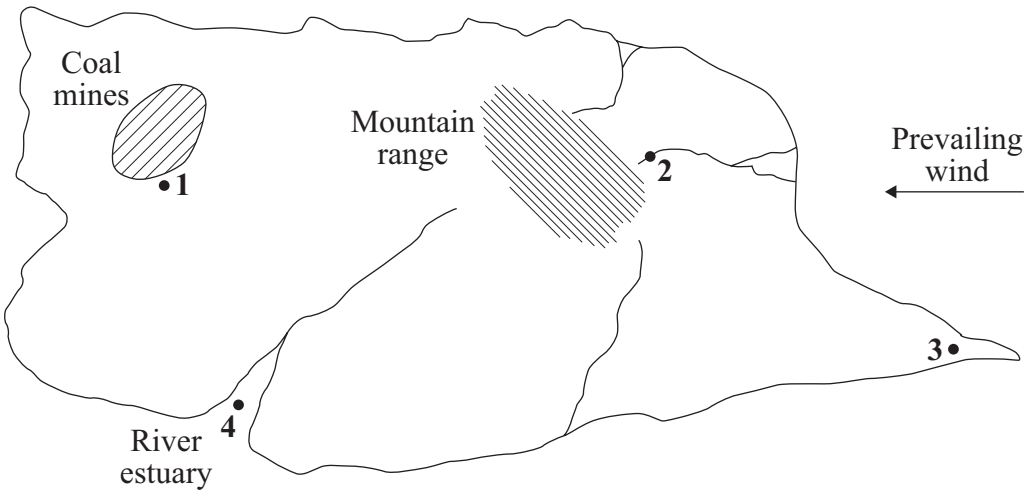
	Useful energy transformations
1	electrical to heat
2	electrical to kinetic
3	electrical to light
4	electrical to sound

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QUESTION TWO

The map shows some features of a large island.

It also shows four places, **1**, **2**, **3** and **4**, where electricity could be generated.



Match energy sources, **A**, **B**, **C** and **D**, with the labels **1–4** on the map.

A falling water (hydroelectric)

B fossil fuel

C tides

D wind

Turn over for the next question

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QUESTION THREE

Some people feel strongly about the environment. They can use posters to protest against the location of new power stations.



Match energy sources, **A**, **B**, **C**, and **D**, with the protesters' posters **1–4**.

A fossil fuels

B nuclear

C tides

D wind

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QUESTION FOUR

Various energy sources can be used to generate electricity.

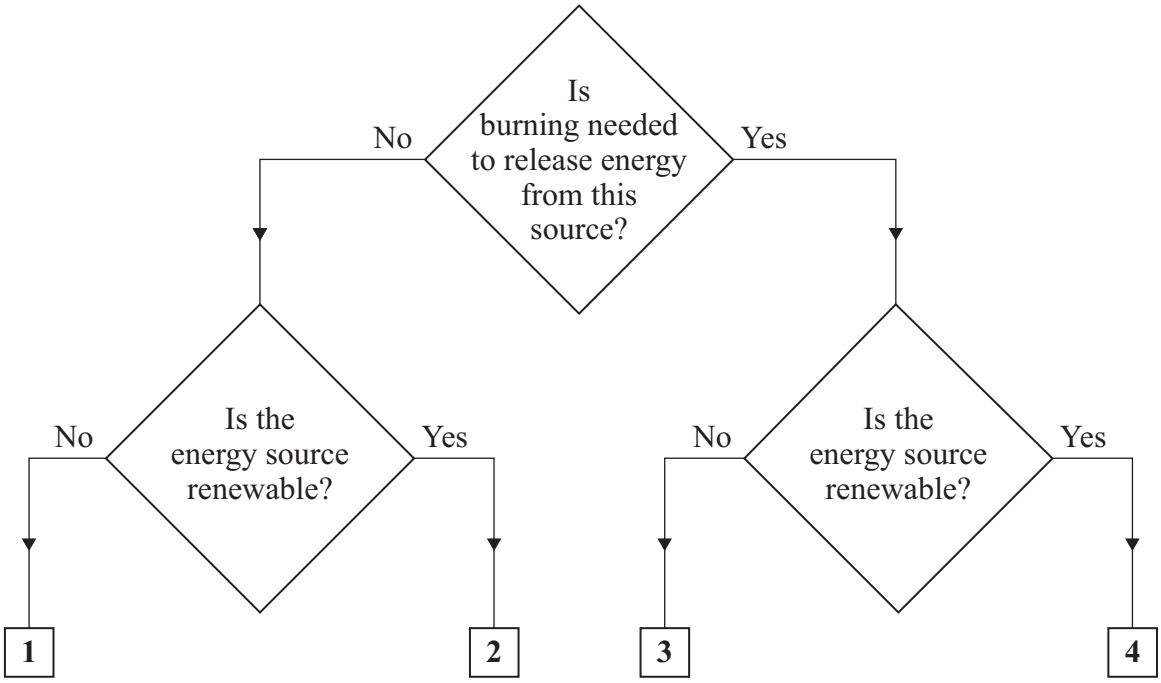
Match energy sources, **A**, **B**, **C**, and **D**, with the numbers **1–4** in the flow chart.

A coal

B biofuel

C geothermal

D uranium

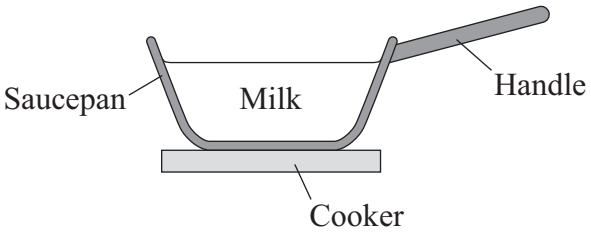


Turn over for the next question

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QUESTION FIVE

The diagram shows a saucepan of hot milk on a cooker.



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

A conduction

B convection

C insulation

D radiation

Heat is transferred from the cooker to the milk.

The heat is transferred from the cooker through the saucepan by . . . **1** . . . .

Heat is transferred through the milk by . . . **2** . . . .

The saucepan is shiny to reduce heat loss by . . . **3**. . . .

The handle of the saucepan is made of plastic. The plastic acts as . . . **4** . . . .

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Turn over for the next question

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SECTION TWO

Questions **SIX** to **NINE**.

Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SIX

This question is about the use of energy in cars that use petrol.

6A A car engine transfers kinetic energy.

The kinetic energy is transformed from . . .

1 chemical energy.

2 electrical energy.

3 light energy.

4 sound energy.

6B Car makers are producing engines that are more efficient.

Compared with a less efficient engine of the same power, a more efficient engine always . . .

1 has a higher top speed.

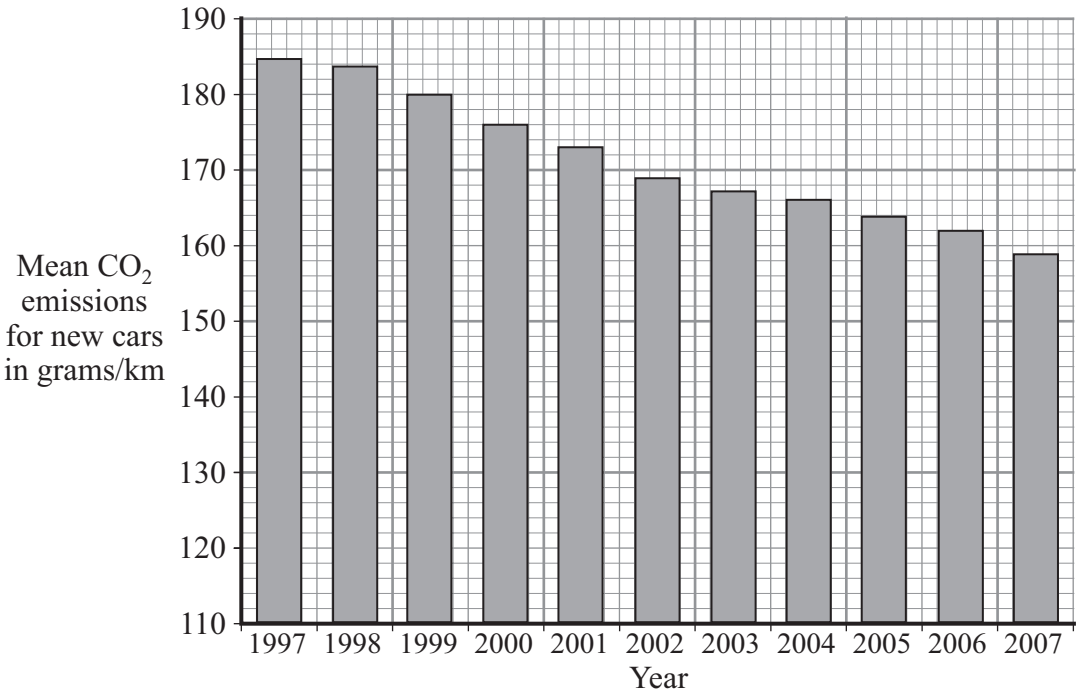
2 has a lower top speed.

3 uses less petrol.

4 uses more petrol.

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Cars release harmful gases into the atmosphere. The mean amount of carbon dioxide (CO_2) emitted by new cars for every kilometre driven has changed. The display shows how these emissions have changed since 1997.



6C The display is called a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

6D The display shows that between 1997 and 2007, the amount of carbon dioxide released per kilometre by new cars has . . .

1 steadily increased.

2 steadily decreased.

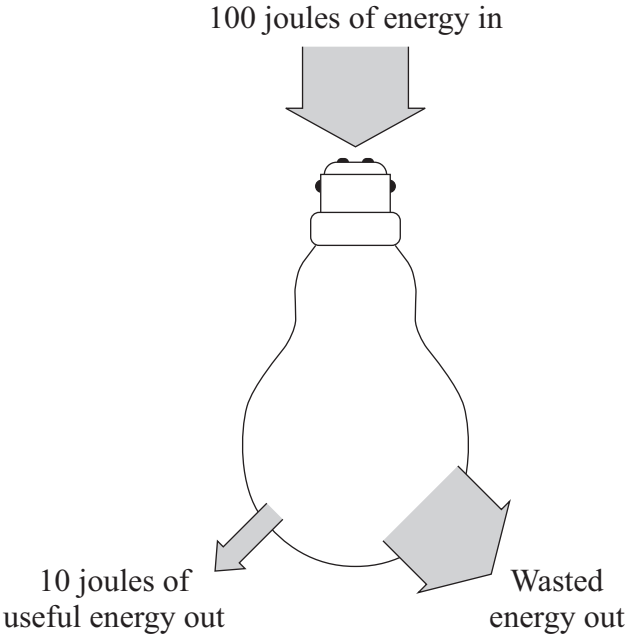
3 decreased and then increased.

4 stayed the same.

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QUESTION SEVEN

The diagram shows a tungsten filament lamp and the energy used by the lamp in one second.



7A How many joules of energy are wasted each second?

1 10

2 80

3 90

4 100

7B What type of wasted energy is produced by the lamp?

1 electrical

2 heat

3 light

4 sound

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7C What happens to the wasted energy?

1 It is transformed into useful energy.

2 It is destroyed.

3 It spreads out and becomes easier to use.

4 It spreads out and becomes more difficult to use.

7D What is the efficiency of the lamp?

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

1 0.1

2 0.8

3 0.9

4 1.0

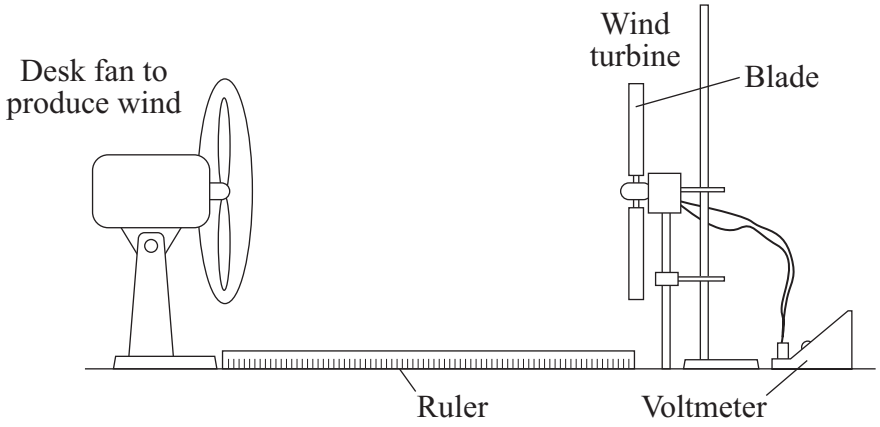
Turn over for the next question

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QUESTION EIGHT

A student investigated a model wind turbine.

The diagram shows the apparatus he used.



8A He noticed that most real wind turbines have three blades. He thought that a model wind turbine with three blades would give the best output.

This thought is known as a . . .

1 conclusion.

2 phenomenon.

3 fair test.

4 prediction.

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8B The student wanted to know if the output of the model wind turbine depends on the number of blades.

Which row of the table shows the correct combination of variables?

	Independent variable	Dependent variable	Control variables
1	wind speed	number of blades	distance from fan to turbine, angle of blades to wind, voltage
2	wind speed	voltage	distance from fan to turbine, angle of blades to wind, number of blades
3	number of blades	voltage	distance from fan to turbine, angle of blades to wind, wind speed
4	number of blades	wind speed	distance from fan to turbine, angle of blades to wind, voltage

8C The student took each of his measurements three times and then calculated a mean.

His reason for this was to improve the . . .

1 reliability.

2 sensitivity.

3 validity.

4 calibration.

8D When he had completed his measurements, the student wanted to display his results.

He chose a bar chart because one of the variables was . . .

1 continuous.

2 controlled.

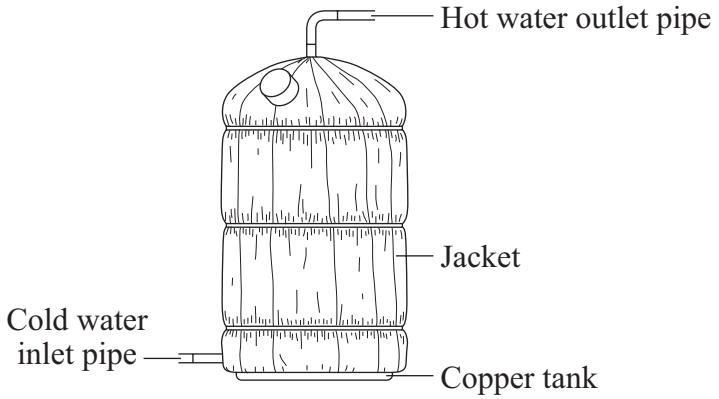
3 discrete.

4 independent.

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QUESTION NINE

The diagram shows a hot water cylinder. The cylinder contains an electric heater.



9A A jacket is wrapped round the cylinder to keep the water warm. The jacket contains trapped air.

Trapped air reduces heat loss by . . .

1 conduction only.

2 conduction and radiation.

3 conduction and convection.

4 conduction, convection and radiation.

9B If a jacket is not fitted, it would be best to have a shiny surface for the cylinder rather than a dark matt one.

This is because dark matt surfaces are . . .

1 good conductors.

2 poor conductors.

3 good radiators.

4 poor radiators.

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9C The heater has a power of 3000 W. The heater is switched on for 6 hours.

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

How many kilowatt-hours of energy does the heater use?

1 0.5

2 18

3 500

4 18 000

9D A household receives an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 2000 kWh. Electricity costs 10 p per kWh.

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

How much was the bill?

1 £200

2 £600

3 £20 000

4 £60 000

END OF TEST

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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**.

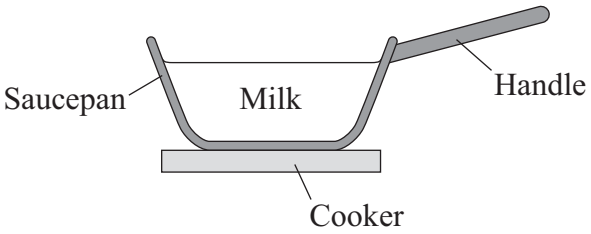
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a saucepan of hot milk on a cooker.



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

A conduction

B convection

C insulation

D radiation

Heat is transferred from the cooker to the milk.

The heat is transferred from the cooker through the saucepan by . . . **1** . . . .

Heat is transferred through the milk by . . . **2** . . . .

The saucepan is shiny to reduce heat loss by . . . **3**. . . .

The handle of the saucepan is made of plastic. The plastic acts as . . . **4** . . . .

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QUESTION TWO

This question is about power stations and the distribution of electricity.

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

A generator

B grid

C transformer

D turbine

In most power stations, steam is used to drive a . . . **1** . . . .

Electricity is produced at a power station by a . . . **2** . . . .

The voltage of the electricity is stepped up by a . . . **3** . . . .

Electricity is transferred from the power station to our homes by the national . . . **4** . . . .

Turn over for the next question

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SECTION TWO

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

Each of these questions has four parts.

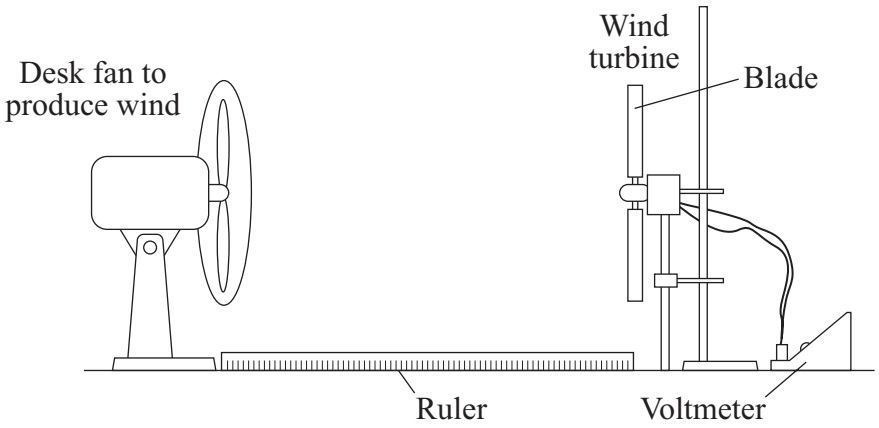
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

A student investigated a model wind turbine.

The diagram shows the apparatus he used.



3A He noticed that most real wind turbines have three blades. He thought that a model wind turbine with three blades would give the best output.

This thought is known as a . . .

1 conclusion.

2 phenomenon.

3 fair test.

4 prediction.

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3B The student wanted to know if the output of the model wind turbine depends on the number of blades.

Which row of the table shows the correct combination of variables?

	Independent variable	Dependent variable	Control variables
1	wind speed	number of blades	distance from fan to turbine, angle of blades to wind, voltage
2	wind speed	voltage	distance from fan to turbine, angle of blades to wind, number of blades
3	number of blades	voltage	distance from fan to turbine, angle of blades to wind, wind speed
4	number of blades	wind speed	distance from fan to turbine, angle of blades to wind, voltage

3C The student took each of his measurements three times and then calculated a mean.

His reason for this was to improve the . . .

1 reliability.

2 sensitivity.

3 validity.

4 calibration.

3D When he had completed his measurements, the student wanted to display his results.

He chose a bar chart because one of the variables was . . .

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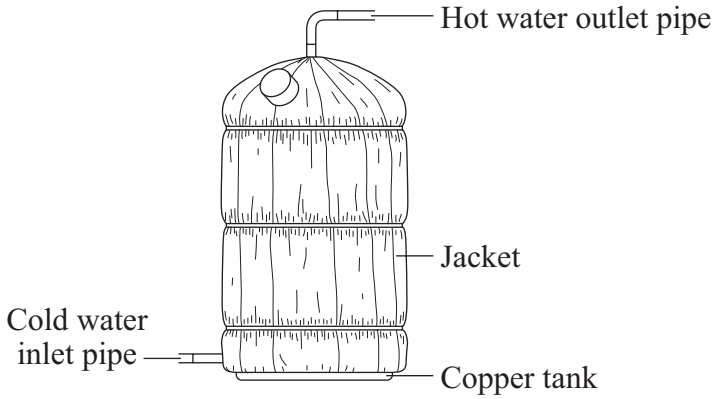
3 discrete.

4 independent.

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QUESTION FOUR

The diagram shows a hot water cylinder. The cylinder contains an electric heater.



4A A jacket is wrapped round the cylinder to keep the water warm. The jacket contains trapped air.

Trapped air reduces heat loss by . . .

1 conduction only.

2 conduction and radiation.

3 conduction and convection.

4 conduction, convection and radiation.

4B If a jacket is not fitted, it would be best to have a shiny surface for the cylinder rather than a dark matt one.

This is because dark matt surfaces are . . .

1 good conductors.

2 poor conductors.

3 good radiators.

4 poor radiators.

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4C The heater has a power of 3000 W. The heater is switched on for 6 hours.

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

How many kilowatt-hours of energy does the heater use?

1 0.5

2 18

3 500

4 18 000

4D A household receives an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 2000 kWh. Electricity costs 10 p per kWh.

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

How much was the bill?

1 £200

2 £600

3 £20 000

4 £60 000

Turn over for the next question

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QUESTION FIVE

A double-glazed window is made up of two sheets of glass with a gap between them.

This gap may be filled with air or a gas such as argon.

The table gives some information from a double-glazing manufacturer.

Better insulators have lower U-values.

Type of double glazing	U-value for different gap widths				
	6 mm	8 mm	10 mm	12 mm	14 mm
Reflective glass, argon filled	2.0	2.1	1.5	1.3	1.2
Reflective glass, air filled	2.5	2.1	1.8	1.6	1.5
Plain glass, argon filled	3.1	2.9	2.8	2.7	2.6
Plain glass, air filled	3.3	3.1	3.0	2.9	2.8

5A What is the general effect of increasing the gap width?

1 The bigger the gap, the better the window is at insulating.

2 The bigger the gap, the worse the window is at insulating.

3 There is no change in the window's ability to insulate.

4 Some types of window become better at insulating and others become worse.

5B One of the four types of double-glazing contains a result that does not fit the general pattern.

Which type of double-glazing is this?

1 reflective glass, argon filled

2 reflective glass, air filled

3 plain glass, argon filled

4 plain glass, air filled

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5C Which one of these statements is true for the data for the 6 mm gap width?

1 The type of glass is more important for insulation than the type of filling.

2 The type of filling is more important for insulation than the type of glass.

3 The type of filling and the type of glass are equally important for insulation.

4 It is impossible to tell from the data whether the type of filling or the type of glass is more important for insulation.

5D What can you conclude about argon from the data in the table?

1 It has a higher density than air.

2 It has a higher U-value than air.

3 It has a lower freezing point than air.

4 It is a worse conductor than air.

Turn over for the next question

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QUESTION SIX

This question is about energy sources.

6A Look at this list of energy sources for power stations.

Biomass **Coal** **Falling water (hydroelectric)** **Nuclear**

Hydroelectric is the odd one out because it is . . .

1 the only renewable energy source.

2 the only non-renewable energy source.

3 the only energy source that is not used to produce steam.

4 the only energy source that is used to produce steam.

6B Which one of the following lists contains only **one** energy source that costs nothing?

1 biomass, gas, solar, tidal

2 geothermal, hydroelectric, wave, wind

3 coal, hydroelectric, solar, wave

4 coal, gas, nuclear, wind

6C Which of the sequences shows what happens in a fossil fuel power station?

1 electricity → generator → steam → turbine

2 steam → generator → turbine → electricity

3 steam → turbine → generator → electricity

4 electricity → generator → steam → generator

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6D At present, gas-fired power stations emit fewer harmful gases than coal-fired power stations. Britain's gas reserves are running out. Gas for power stations is imported from Europe. The government has decided to build a new coal-fired power station.

What is the most likely reason for this?

1 Britain's coal reserves will never run out.

2 It is easier to transport coal than gas.

3 Britain would not have to rely so much on imported gas.

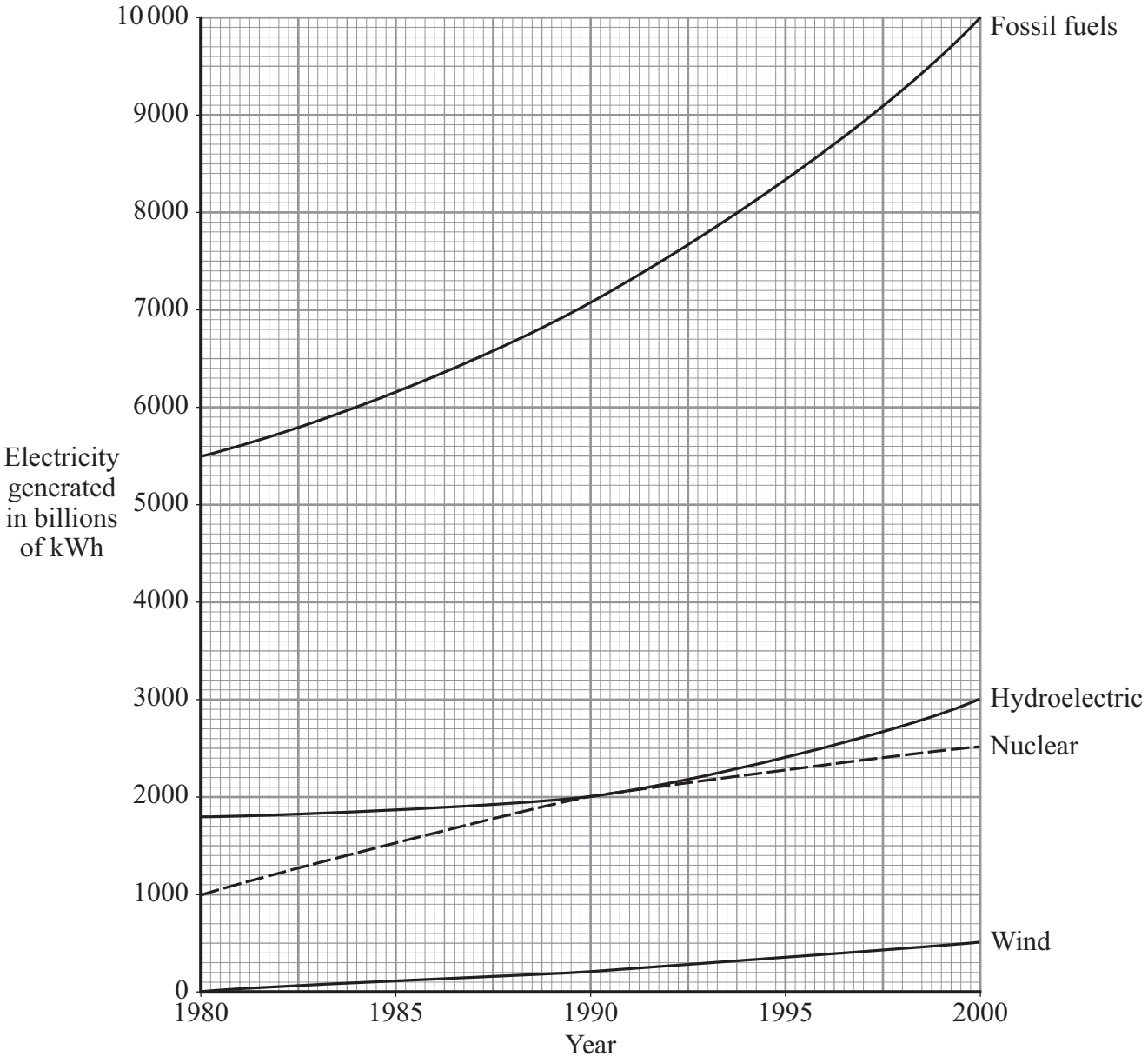
4 The government intends to stop all fossil fuel use by 2020.

Turn over for the next question

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QUESTION SEVEN

The graph shows how much electricity has been generated worldwide from four different energy sources, from 1980 to 2000.



7A Which source has shown the smallest increase in electricity generation between 1990 and 2000?

1 fossil fuels

2 falling water (hydroelectric)

3 nuclear

4 wind

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7B In 2000, about what percentage of the total electricity was generated by hydroelectricity, nuclear and wind?

1 38 %

2 42 %

3 55 %

4 60 %

7C By 2030, the amount of electricity generated from hydroelectricity, nuclear and wind is likely to be 5 times greater than in 1990.

In 2030, the amount of electricity generated from these three sources, in billions of kWh, will be . . .

1 10 500.

2 11 000.

3 20 500.

4 21 000.

7D Some energy sources can be used to drive turbines directly.

Which two energy sources **cannot** be used to drive turbines directly?

1 nuclear and fossil fuel

2 hydroelectric and fossil fuel

3 nuclear and wind

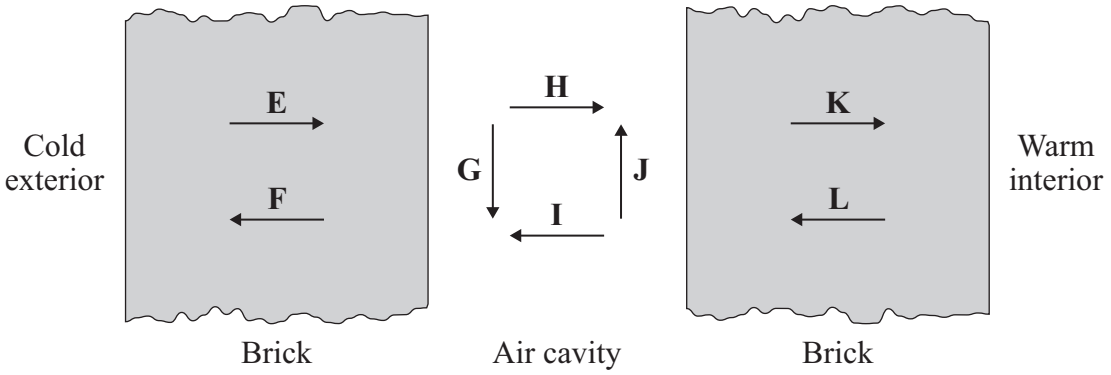
4 hydroelectric and nuclear

Turn over for the next question

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QUESTION EIGHT

The diagram shows a section through the cavity wall of a house. The arrows indicate the directions by which heat transfer might take place.



8A Which arrows represent the process of heat transfer called conduction?

1 **E**, **H** and **K**

2 **H** and **I**

3 **L**, **I** and **F**

4 **J** and **G**

8B Conduction in metals is the transfer of heat by . . .

1 the movement of free electrons.

2 the heated substance expanding and rising.

3 the heated substance contracting and rising.

4 the heated substance expanding and falling.

8C Which arrows represent the process of heat transfer called convection?

1 **E**, **H** and **K**

2 **H** and **I**

3 **L**, **I** and **F**

4 **J** and **G**

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8D Convection is the transfer of heat by . . .

1 the movement of free electrons.

2 the heated substance expanding and rising.

3 the heated substance contracting and rising.

4 the heated substance expanding and falling.

Turn over for the next question

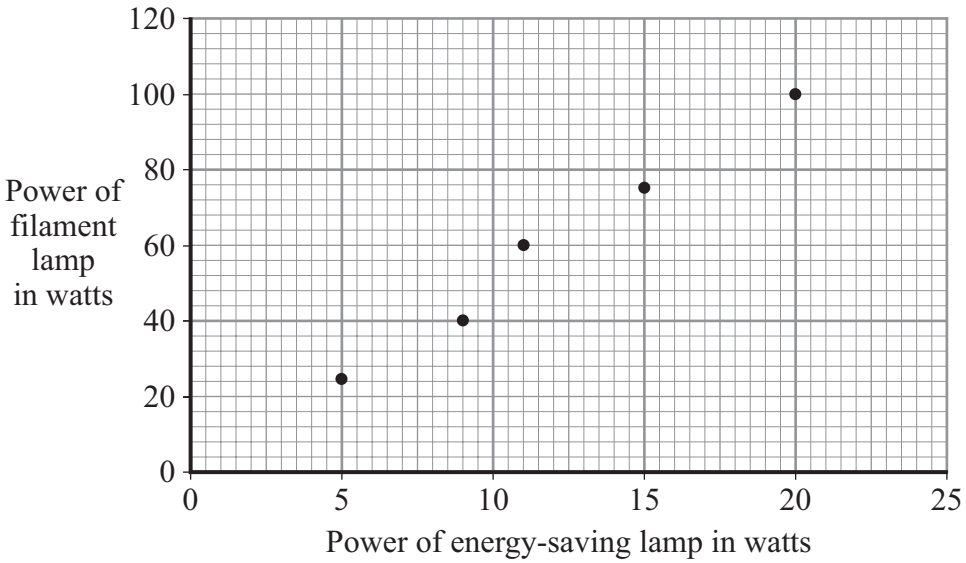
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QUESTION NINE

A householder bought an energy-saving lamp. She found the following table printed on its packaging.

Power of energy-saving lamp in W	Equivalent power of filament lamp in W
5	25
9	40
11	60
15	75
20	100

The graph shows the data.



9A To see if the power of the filament lamp is directly proportional to the power of the energy-saving lamp, you should . . .

1 draw a line of best fit.

2 draw a straight line of best fit and see whether it passes through (0,0).

3 plot more points and see whether a straight line is produced.

4 produce a bar chart and see whether there is a positive relationship.

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

9B A 25 W lamp transforms 25 joules of electrical energy each second.

The efficiency of a 25 W energy-saving lamp is 0.6

How much energy does it waste each second?

1 10.0 J

2 15.0 J

3 41.2 J

4 62.5 J

9C The efficiency of a 100 W filament lamp is 0.15

From the data in the table on page 30, what is the approximate efficiency of the 20 W energy-saving lamp?

1 0.03

2 0.15

3 0.30

4 0.75

9D The government has recommended that the sale of filament lamps should be stopped.

Why is this?

1 to give shops new products to sell

2 to use less fuel for generating electricity

3 to make electricity cheaper to buy

4 to give householders brighter lamps

END OF TEST

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There are no questions printed on this page

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Version 1:0: 03/04/09

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A (4461)

Specification A

PHY1AP, PH1ASF & PH1ASH

Mark Scheme

2009 Examination – March Series

STEMUP.CO.UK

This component is an objective test for which the following list indicates the correct answers used in marking the candidates' responses.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2009

Foundation Tier

Question	Key		
One	**A**	radio	**4**
	B	toaster	**1**
	C	fan	**2**
	D	lamp	**3**
Two	**A**	falling water (hydroelectric)	**2**
	B	fossil fuel	**1**
	C	tides	**4**
	D	wind	**3**
Three	**A**	fossil fuels	**4**
	B	nuclear	**2**
	C	tides	**3**
	D	wind	**1**
Four	**A**	coal	**3**
	B	biofuel	**4**
	C	geothermal	**2**
	D	uranium	**1**
Five	**A**	conduction	**1**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**3**

	A	**B**	**C**	**D**
Six	**1**	**3**	**1**	**2**
Seven	**3**	**2**	**4**	**1**
Eight	**4**	**3**	**1**	**3**
Nine	**3**	**3**	**2**	**1**

GCSE

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2009

Higher Tier

Question	Key		
One	**A**	conduction	**1**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**3**
Two	**A**	generator	**2**
	B	grid	**4**
	C	transformer	**3**
	D	turbine	**1**

	A	**B**	**C**	**D**
Three	**4**	**3**	**1**	**3**
Four	**3**	**3**	**2**	**1**
Five	**1**	**1**	**1**	**4**
Six	**3**	**4**	**3**	**3**
Seven	**4**	**1**	**4**	**1**
Eight	**3**	**1**	**4**	**2**
Nine	**2**	**1**	**4**	**2**