Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
November 2007

ASSESSMENT and QUALIFICATIONS ALLIANCE

SCIENCE A **PHY1A**
Unit Physics P1a (Energy and Electricity)

PHYSICS
Unit Physics P1a (Energy and Electricity)

Thursday 22 November 2007 Morning Session

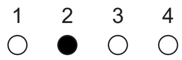
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

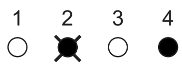
Time allowed: 30 minutes

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 ‘Energy and Electricity’ printed on it.
- Attempt **one Tier only, either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

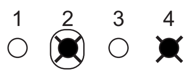
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



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



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



Information
- The maximum mark for this paper is 36.

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

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

FOUNDATION TIER

SECTION ONE

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

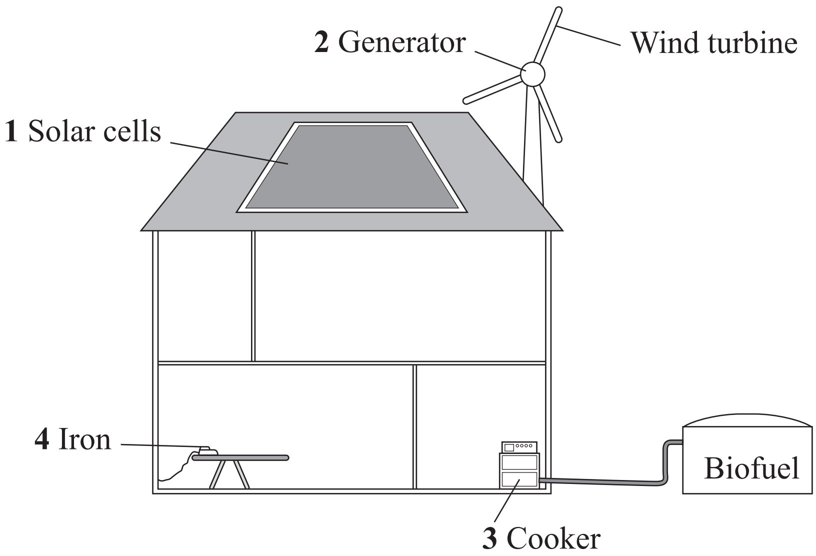
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows an eco-friendly house.



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

A chemical energy to heat

B electrical energy to heat

C light energy to electrical energy

D kinetic energy to electrical energy

QUESTION TWO

The drawing shows a skier.

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

A conduction

B convection

C insulation

D radiation

The skier's jacket is padded to provide good . . . **1** . . . .

His jacket has a shiny surface to reduce heat loss by . . . **2** . . . .

His gloves are made from wool to reduce heat loss from his hands by . . . **3** . . . .

When he breathes out, the warm air in his breath rises by . . . **4** . . . .

Turn over for the next question

QUESTION THREE

The energy resource used to generate electricity depends on the location.

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

A nuclear

B solar

C tides

D wind

Generators sited on hills in the UK are most likely to use . . . **1** . . . .

A power station that includes a barrage across an estuary uses . . . **2** . . . .

The best energy resource to use in a submarine which has to spend months under water is . . . **3** . . . .

The best energy resource to recharge the batteries on a motorway sign is . . . **4** . . . .

QUESTION FOUR

The table gives information about some methods of conserving energy in a house.

	Method of conserving energy	**Installation cost in £**	**Yearly saving in energy bills in £**
1	loft insulation	110	60
2	jacket around hot water tank	10	18
3	cavity wall insulation	500	50
4	thermostatic radiator valves	75	15

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

A the method that costs most to install

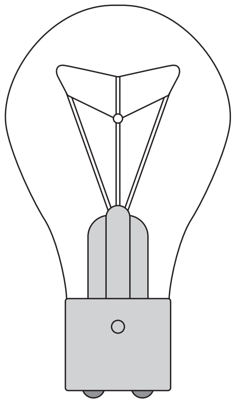
B the method that conserves most energy

C the method that pays for itself in less than one year

D the method that takes five years to pay for itself

QUESTION FIVE

The diagram shows a lamp.



The lamp has a power of 100 watts (W).
It gives out light at a rate of 5 watts.

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

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

A 0.05

B 5

C 95

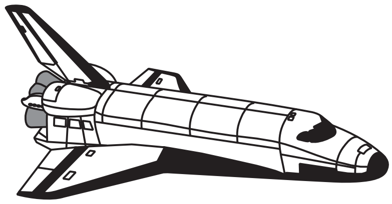
D 100

1	amount of energy supplied to the lamp each second in joules
2	amount of energy transferred as light each second in joules
3	amount of energy wasted each second in joules
4	efficiency of the lamp

Turn over ▶

QUESTION SIX

The diagram shows the space shuttle returning to Earth. As it moves towards Earth, it moves faster.



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

A gravitational potential energy

B kinetic energy

C light energy

D thermal energy

As the shuttle moves towards Earth, it loses . . . **1** . . . .

When the shuttle moves faster, it gains . . . **2** . . . .

When the shuttle enters the Earth's atmosphere, there is a lot of friction. This makes the tiles covering the shuttle glow red. As a result, the shuttle gives off a lot of . . . **3** . . . and a little . . . **4** . . . .

Turn over for the next question

Turn over ▶

SECTION TWO

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

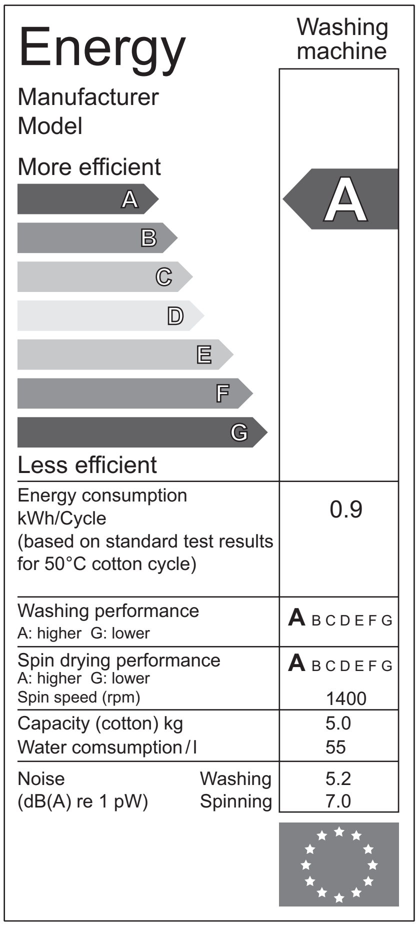
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION SEVEN

The energy label gives information about a washing machine.



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

Another washing machine has an efficiency rating of **C**.

This means that the washing machine described by this label . . .

1 uses less energy for each wash cycle than 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.

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

1 heat.

2 light.

3 kinetic energy.

4 sound.

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

$$\boxed{\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}}$$

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

1 kilowatt-hour of electricity costs 12 p.

How much does the washing machine cost to run each year?

1 £40

2 £41.60

3 £54

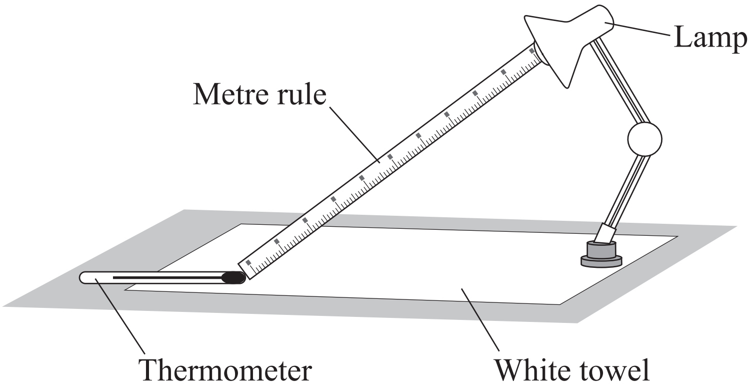
4 £60

Turn over ▶

QUESTION EIGHT

A student investigated the heat output from four different makes of lamp, **W**, **X**, **Y** and **Z**. Each lamp had the same power.

The diagram shows the apparatus she used.



- She recorded the initial temperature shown by the thermometer.
- She then switched on lamp **W**.
- Five minutes later, she recorded the final temperature shown by the thermometer.
- She repeated this procedure for lamps **X**, **Y** and **Z**.

The table shows her results.

Lamp	Initial temperature in °C	Final temperature in °C
W	17	27
X	18	26
Y	20	28
Z	22	29

8A What kind of variable was the make of lamp?

1 categoric

2 continuous

3 dependent

4 ordered

8B Which of these was **not** a control variable in this investigation?

1 make of lamp

2 distance of thermometer from lamp

3 length of time the lamp was switched on

4 the white towel

8C Which lamp caused the largest rise in temperature in the thermometer?

1 **W**

2 **X**

3 **Y**

4 **Z**

8D Which lamp seems to be the most efficient in producing light?

1 **W**

2 **X**

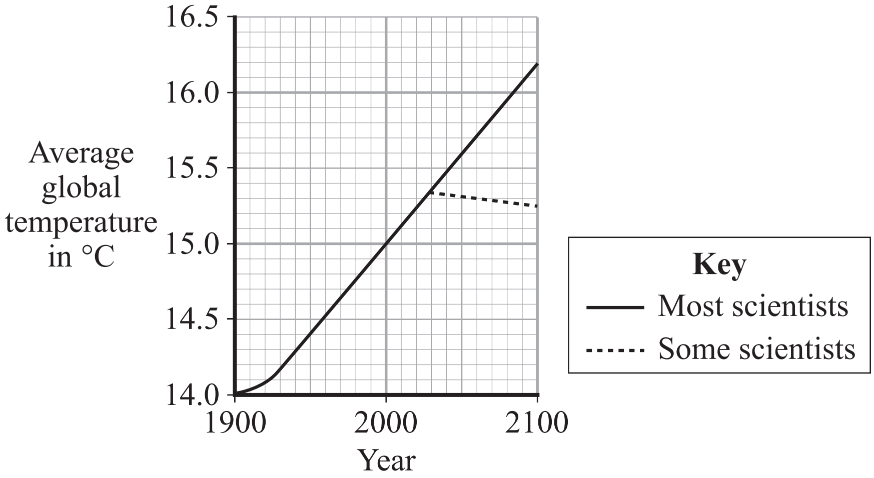
3 **Y**

4 **Z**

Turn over for the next question

QUESTION NINE

The graph shows how average global temperatures have changed between 1900 and 2000.
It also shows how different scientists expect global temperatures to change up to the year 2100.



9A The average temperature rise per year between 1900 and 2000 was . . .

1 0.005 °C

2 0.01 °C

3 0.15 °C

4 15.0 °C

9B The shape of the graph between 1900 and 2000 is firmly based on . . .

1 data.

2 a prediction.

3 a hypothesis.

4 a theory.

9C Most scientists are convinced that global temperatures will continue to rise steadily because of . . .

1 increasing concentrations of carbon dioxide in the atmosphere.

2 increasing concentrations of radioactive materials in the atmosphere.

3 increasing radiation from the Sun.

4 regular changes to Earth's orbit.

9D Some scientists have predicted lower global temperatures.

The different predictions of the two groups of scientists are most likely due to . . .

1 the sensitivity of their measuring equipment.

2 the amount of their experience.

3 their academic status.

4 the large number of factors that may affect global temperatures.

END OF TEST

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

HIGHER TIER

SECTION ONE

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

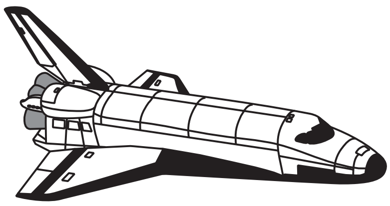
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows the space shuttle returning to Earth. As it moves towards Earth, it moves faster.



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

A gravitational potential energy

B kinetic energy

C light energy

D thermal energy

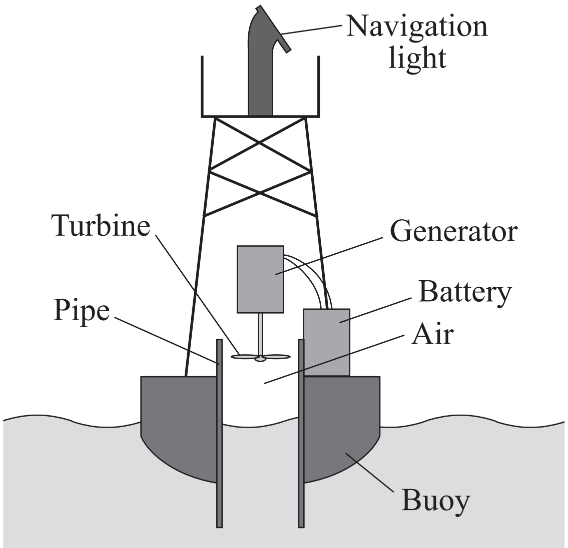
As the shuttle moves towards Earth, it loses . . . **1** . . . .

When the shuttle moves faster, it gains . . . **2** . . . .

When the shuttle enters the Earth's atmosphere, there is a lot of friction. This makes the tiles covering the shuttle glow red. As a result, the shuttle gives off a lot of . . . **3** . . . and a little . . . **4** . . . .

QUESTION TWO

The diagram shows a wave energy device.



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

A battery

B buoy

C generator

D turbine

Waves move the . . . **1** . . . up and down. This movement causes air to move both in and out of the pipe.

Movement of the air turns the . . . **2** . . . . This turns the . . . **3** . . . which produces electricity.

The electricity is used to charge the . . . **4** . . . .

Turn over for the next question

SECTION TWO

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

Each of these questions has four parts.

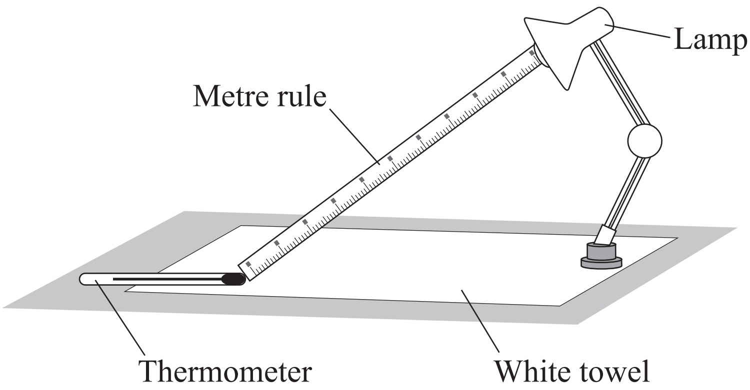
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION THREE

A student investigated the heat output from four different makes of lamp, **W**, **X**, **Y** and **Z**. Each lamp had the same power.

The diagram shows the apparatus she used.



- She recorded the initial temperature shown by the thermometer.
- She then switched on lamp **W**.
- Five minutes later, she recorded the final temperature shown by the thermometer.
- She repeated this procedure for lamps **X**, **Y** and **Z**.

The table shows her results.

Lamp	Initial temperature in °C	Final temperature in °C
W	17	27
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3A What kind of variable was the make of lamp?

1 categoric

2 continuous

3 dependent

4 ordered

3B Which of these was **not** a control variable in this investigation?

1 make of lamp

2 distance of thermometer from lamp

3 length of time the lamp was switched on

4 the white towel

3C Which lamp caused the largest rise in temperature in the thermometer?

1 **W**

2 **X**

3 **Y**

4 **Z**

3D Which lamp seems to be the most efficient in producing light?

1 **W**

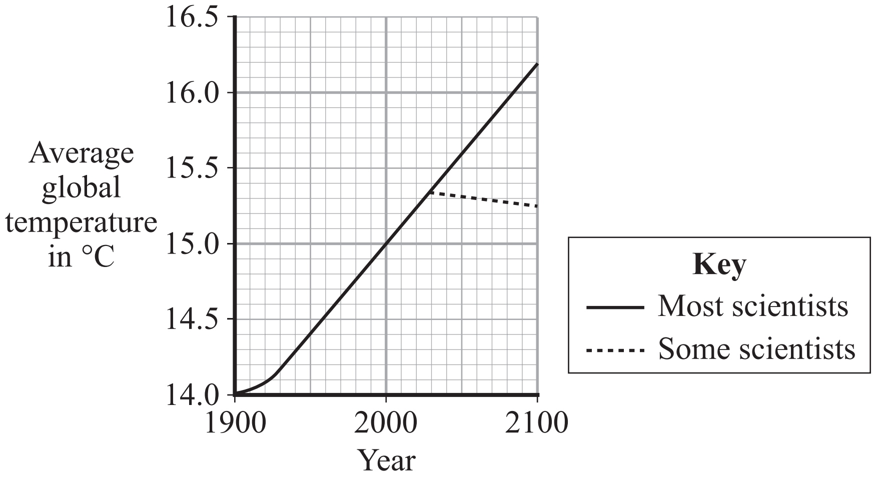
2 **X**

3 **Y**

4 **Z**

QUESTION FOUR

The graph shows how average global temperatures have changed between 1900 and 2000.
It also shows how different scientists expect global temperatures to change up to the year 2100.



4A The average temperature rise per year between 1900 and 2000 was . . .

1 0.005 °C

2 0.01 °C

3 0.15 °C

4 15.0 °C

4B The shape of the graph between 1900 and 2000 is firmly based on . . .

1 data.

2 a prediction.

3 a hypothesis.

4 a theory.

4C Most scientists are convinced that global temperatures will continue to rise steadily because of . . .

1 increasing concentrations of carbon dioxide in the atmosphere.

2 increasing concentrations of radioactive materials in the atmosphere.

3 increasing radiation from the Sun.

4 regular changes to Earth's orbit.

4D Some scientists have predicted lower global temperatures.

The different predictions of the two groups of scientists are most likely due to . . .

1 the sensitivity of their measuring equipment.

2 the amount of their experience.

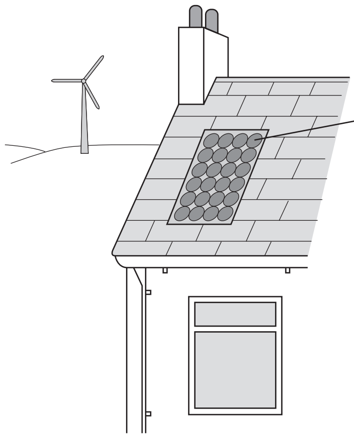
3 their academic status.

4 the large number of factors that may affect global temperatures.

Turn over for the next question

QUESTION FIVE

A house on a Scottish island uses solar cells to produce some of the electricity needed for lights and for pumping water.



The panel of solar cells cost £300 and has a maximum output of 33 W.

On average, over 24 hours, it produces $\frac{1}{8}$ of its maximum output.

5A How many kilowatt-hours of electricity does the panel of solar cells produce, on average, each 24 hours?

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

1 0.004125

2 0.099

3 0.792

4 356.4

5B The panel of solar cells has an expected life of 10 000 days.

What is the cost of the panel for each day of its life?

1 0.03 p

2 0.3 p

3 3.0 p

4 30 p

5C Most of the electricity for the house is produced by a wind generator.

The solar cells are also used . . .

1 because they produce electricity at such a low cost per kilowatt-hour.

2 because they may produce electricity at times when there is no wind.

3 because they will produce electricity all the time.

4 because they produce electricity at times when it is most likely to be needed.

5D Which of the following sentences about solar cells is true?

1 Electricity from solar cells is used to heat water in panels on house roofs.

2 Solar cells use a **non**-renewable energy source.

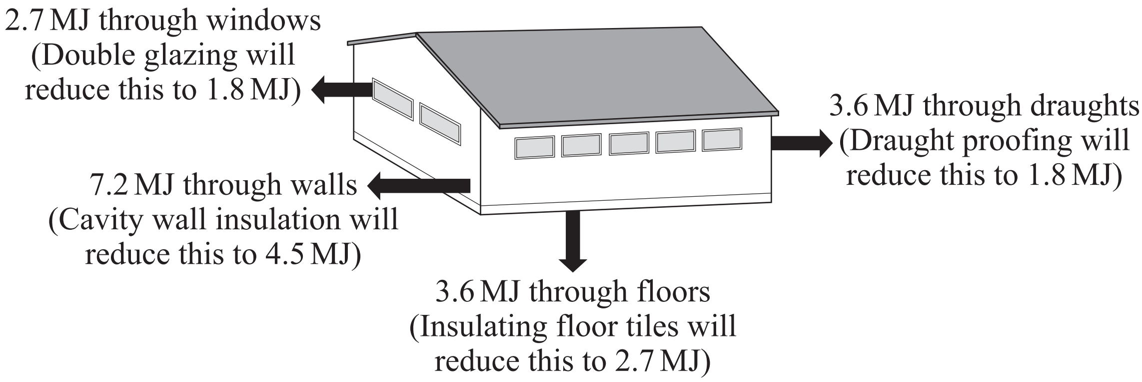
3 Solar cells will **not** work on cloudy days.

4 Solar cells transform light energy to electrical energy.

Turn over for the next question

QUESTION SIX

The diagram shows some of the ways in which heat is transferred from the inside of a workshop, and how improvements can reduce the losses. The figures are for the average loss per hour on a cold winter's day.



The table gives the cost of the improvements and how much they will save each year.

Improvement	Cost	Saving each year
Cavity wall insulation	£ 900	£ 345
Double glazing	£ 3000	£ 115
Draught proofing	£ 150	£ 230
Insulating floor tiles	£ 600	£ 115

6A Which improvement will result in the largest reduction in heat transfer?

1 cavity wall insulation

2 double glazing

3 draught proofing

4 insulating floor tiles

6B The improvements are designed to reduce energy transfer through different parts of the workshop.

Which improvement reduces the transfer through its part of the workshop by the largest proportion?

1 cavity wall insulation

2 double glazing

3 draught proofing

4 insulating floor tiles

6C On a cold winter's day, what is the approximate total heat loss from the **uninsulated** workshop in an eight-hour period?

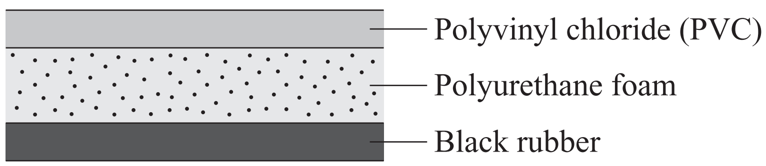
1 140 MJ

2 150 MJ

3 160 MJ

4 170 MJ

6D The diagram shows a cross-section through the insulating floor tiles.



Which feature makes these tiles good heat insulators?

1 Air is trapped in the polyurethane foam.

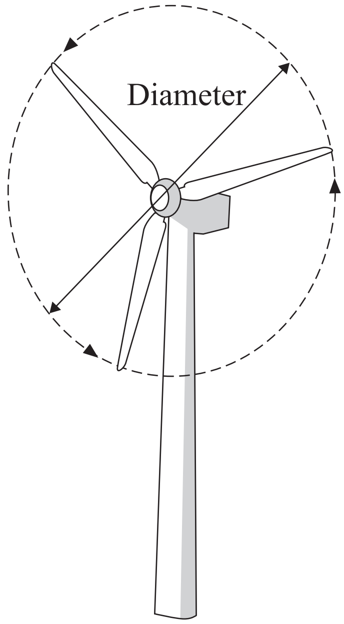
2 Black rubber is a good emitter of thermal radiation.

3 They are made of three different materials.

4 They are on the floor so the heat movement by convection does not affect them.

QUESTION SEVEN

The electrical power output from a wind turbine depends on the diameter of the turbine and on the wind speed.



Turbine diameter in metres	Electrical power output in watts for a wind speed of 6 metres per second
2	60
3	135
4	240
5	375
6	540

7A Which conclusion about the electrical power output is correct for this data?

1 It increases in direct proportion to the diameter.

2 It increases in inverse proportion to the diameter.

3 It increases in inverse proportion to the radius.

4 It increases in direct proportion to the square of the diameter.

7B The power output of a wind turbine . . .

1 is constant all the year round.

2 is greater in summer than winter.

3 varies on a monthly cycle.

4 varies throughout the year.

7C An advantage of wind turbines compared with a hydroelectric power station is that . . .

1 their dismantling cost is low.

2 there is no output of polluting gases during their construction.

3 they have no visual impact on their surroundings.

4 they work equally well in any location.

7D A disadvantage of wind turbines compared with a hydroelectric power station is that . . .

1 many hundreds are needed to produce the same power output.

2 their total atmospheric pollution in use is greater.

3 their total fuel costs are higher.

4 they use a non-renewable energy source.

Turn over for the next question

QUESTION EIGHT

Transformers are used in the National Grid.

8A Two types of transformer are used in various parts of the National Grid.

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

	Between generators and power lines	**Between power lines and substation**	**Between substation and people's homes**
1	step-down	step-down	step-up
2	step-down	step-up	step-up
3	step-up	step-down	step-down
4	step-up	step-up	step-down

8B Transformers alter the potential difference across the power lines and the current through the power lines. These changes affect the efficiency of the power lines.

Which row in the table is correct?

	Potential difference across power lines	**Current through power lines**	**Efficiency of transmission**
1	decreased	decreased	decreased
2	decreased	increased	increased
3	increased	decreased	increased
4	increased	increased	increased

8C 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

8D The amount of electricity that a device transforms 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.

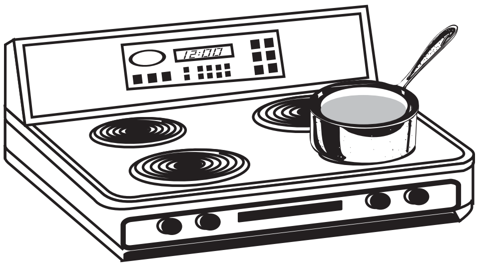
4 the power of the device.

Turn over for the next question

Turn over ▶

QUESTION NINE

The diagram shows a saucepan on a hotplate.
The saucepan contains soup.
Some heat (thermal energy) is lost through the metal walls of the saucepan to the surroundings.



9A The energy spreads through the soup by . . .

1 free electrons colliding with ions.

2 heat rising.

3 the soup contracting and falling as it is heated.

4 the soup expanding and rising as it is heated.

9B The energy is transferred through the metal walls of the saucepan by . . .

1 free electrons colliding with ions.

2 heated metal expanding and rising.

3 infra red waves passing through the metal.

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

9C The outer walls of the saucepan transfer energy to the surroundings by . . .

1 free electrons colliding with ions.

2 the air contracting and falling as it is heated.

3 infra red waves passing through the air.

4 metal atoms gaining energy and escaping into the air.

9D The air in contact with the outer walls of the saucepan . . .

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.

END OF TEST

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