Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Spring 2005

ASSESSMENT and QUALIFICATIONS ALLIANCE

SCIENCE: DOUBLE AWARD A (MODULAR) 346009
PHYSICS A (MODULAR)
Energy (Module 09)

Wednesday 2 March 2005 Morning Session

In addition to this paper you will require:
- a black ball-point pen;
- an answer sheet.

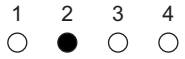
You may use a calculator.

Time allowed: 30 minutes

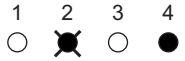
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title "Energy" printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** 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. Rough work may be done on the question paper.

Instructions for recording answers

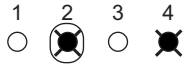
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 A

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

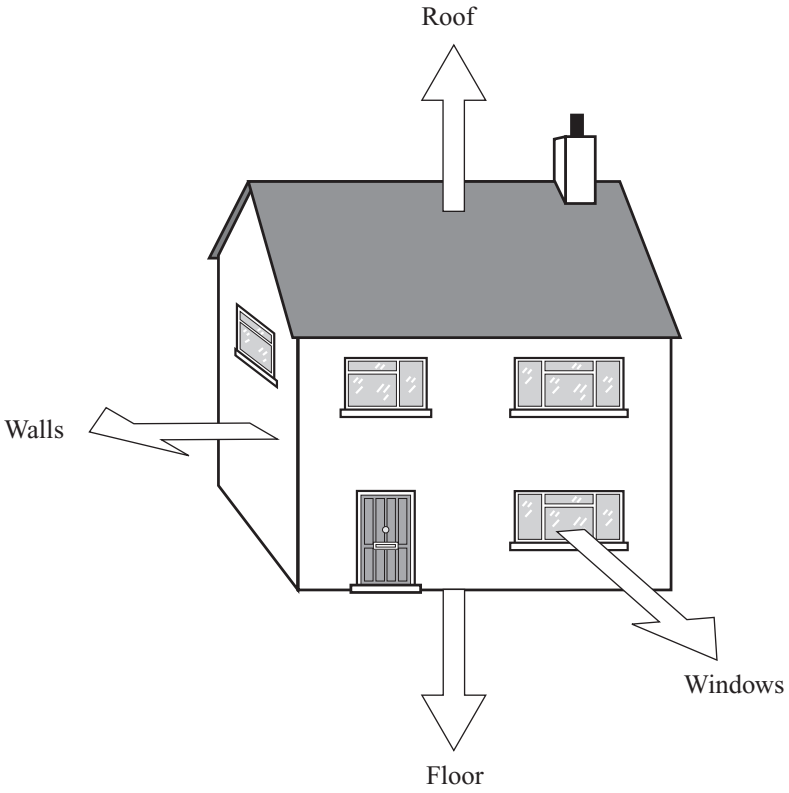
In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows places where heat is lost from a house.



Match words from the list with the numbers **1–4** in the sentences.

conduction

convection currents

loss of warm air

radiation

Heat spreads from the inside of a brick wall to the outside by . . . . . **1** . . . . . .

Heat spreads from downstairs to upstairs by . . . . . **2** . . . . . .

When the doors or windows are open, heat is removed by . . . . . **3** . . . . . .

The outside surfaces of a house lose heat by . . . . . **4** . . . . . .

QUESTION TWO

There are many devices which transfer energy.

Match the energy transfers in the list with the numbers **1–4** in the table.

electrical to gravitational potential

electrical to heat

kinetic (movement) to electrical

light to electrical

Energy transfer	Device
1	generator
2	passenger lift
3	solar cell
4	toaster

QUESTION THREE

This question is about four sources of energy which could be used in power stations.

Match words in the list with the numbers **1–4** in the sentences.

coal

gas

uranium

wood

Power stations using . . . . . **1** . . . . . produce radioactive waste.

Power stations using . . . . . **2** . . . . . produce the most carbon dioxide for each Unit of electricity produced.

Power stations using . . . . . **3** . . . . . can be started up most quickly.

Power stations using . . . . . **4** . . . . . have the advantage of using a renewable energy resource.

QUESTION FOUR

This question is about one way of producing electricity.

Match words in the list with the numbers **1–4** in the sentences.

generator

steam

turbine

water

In some volcanic areas hot . . . . . **1** . . . . . and steam rise to the surface.

The . . . . . **2** . . . . . can be used to drive a . . . . . **3** . . . . . .

Electricity is then produced by a . . . . . **4** . . . . . .

QUESTION FIVE

Heat can be transferred by radiation. The amount of heat transferred by an object depends on its surface.

The list shows places where transfer of heat is important.

Match the places in the list with the numbers **1–4** in the table.

back of an electric fire

fins at the back of a refrigerator

solar panel on a roof

survival bag used by a mountain rescue team

Place	Information about the surface
1	black so it absorbs as much heat radiation as possible
2	black so it gives out as much heat radiation as possible
3	shiny so it gives out as little heat radiation as possible
4	shiny inside so it reflects as much heat radiation as possible

TURN OVER FOR THE NEXT QUESTION

SECTION B

Questions **SIX** and **SEVEN**.

In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

This question is about electrical appliances which transfer energy.

Which **two** of the following statements **P**, **Q**, **R**, **S** and **T** are correct?

P **energy becomes less spread out after energy transfer**

Q **energy is always wasted during energy transfer**

R **the more energy that is wasted during transfer, the more efficient the appliance is**

S **useful energy and wasted energy both end up making the surroundings warmer**

T **wasted energy can always be used for further energy transfers**

QUESTION SEVEN

In Britain, most power stations use fuels as their source of energy.

Which **two** of the following fuels are **not** burnt to release their energy?

coal

gas

plutonium

uranium

wood

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

SECTION C

Questions **EIGHT** to **TEN**.

Each of these questions has four parts.

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

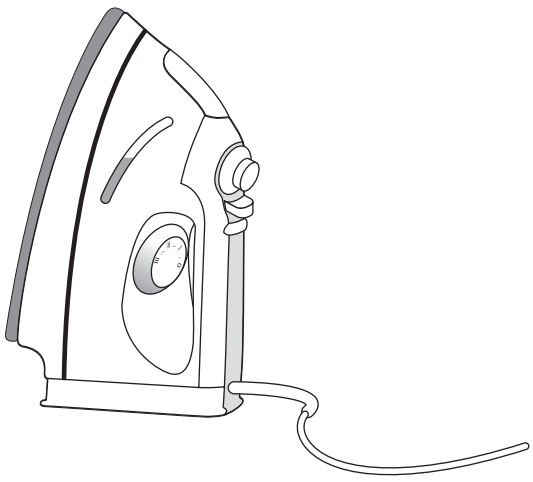
Mark your choices on the answer sheet.

QUESTION EIGHT

You may find the following formula useful when answering some parts of this question.

energy transferred (joule, J)	=	power (watt, W)	×	time (second, s)

The diagram shows an electric iron.



8.1 Which energy transfer takes place when the iron is used?

A Electrical energy to heat

B Electrical energy to kinetic energy

C Heat to electrical energy

D Heat to kinetic energy

8.2 The base of the iron radiates energy.

It will radiate **least** energy when the base is . . . . .

A at a high temperature and black.

B at a high temperature and shiny.

C at a low temperature and black.

D at a low temperature and shiny.

8.3 The power of the iron is 1.2 kW.

What is the maximum amount of energy that can be transferred by the iron in 1 hour?

A 72 J

B 4 320 J

C 72 000 J

D 4 320 000 J

8.4 When the iron is used, less than the calculated maximum amount of energy is transferred in 1 hour.

What is the most likely reason for this?

A Some energy is provided by the person doing the ironing

B The efficiency of the iron is more than 1 (100 %)

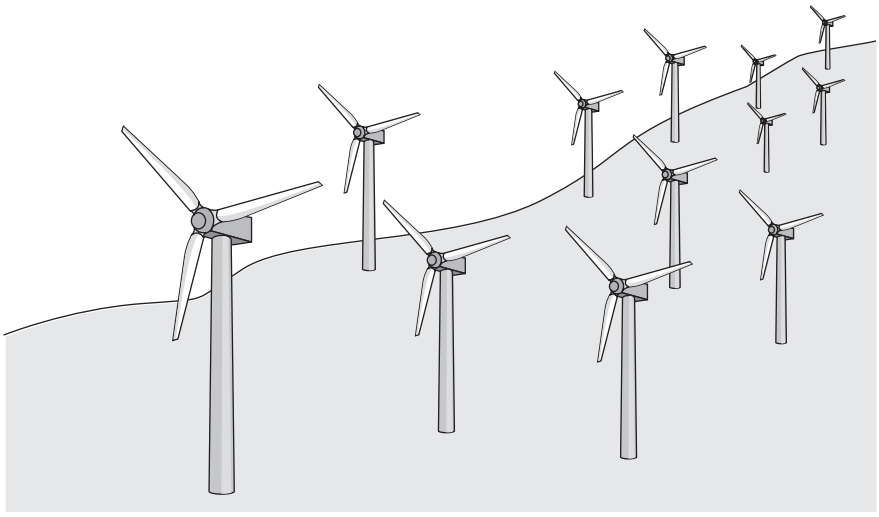
C The ironing board is covered with an insulator

D The iron switches off at times to keep it at the correct temperature

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

The diagram shows a group of wind generators which supply electricity to a small town.



9.1 A group of wind generators is called a wind . . . . .

A barrage.

B dam.

C farm.

D turbine.

9.2 Which type of energy is transferred from the wind to generate electricity?

A Gravitational potential

B Kinetic

C Sound

D Thermal

9.3 Where would you **not** expect to find a group of wind generators?

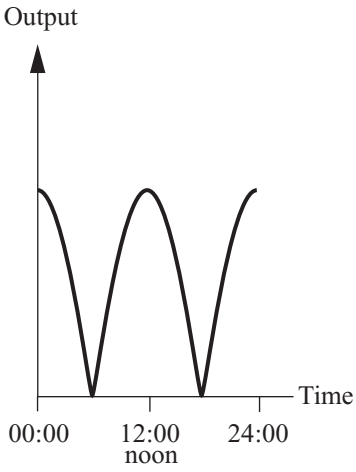
A In a town

B Offshore – out at sea

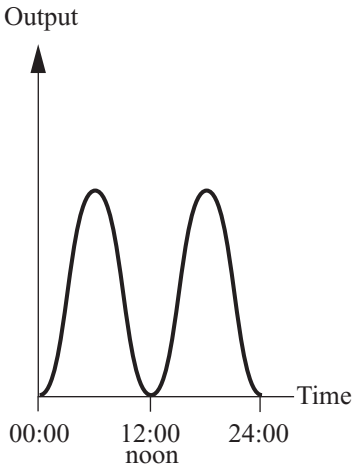
C On a coastal cliff

D On the top of a hill

9.4 Which graph is most likely to show the output from a wind generator over one day?



A



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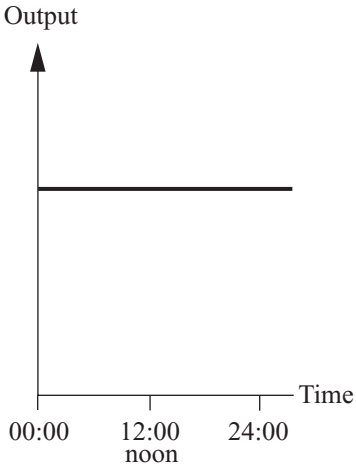

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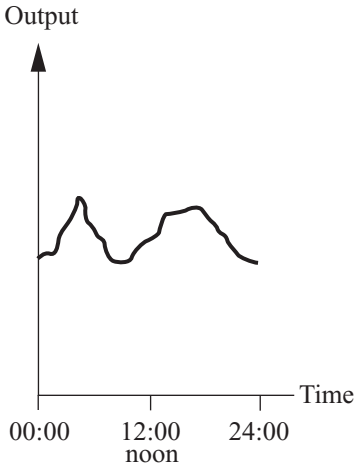


D

TURN OVER FOR THE NEXT QUESTION

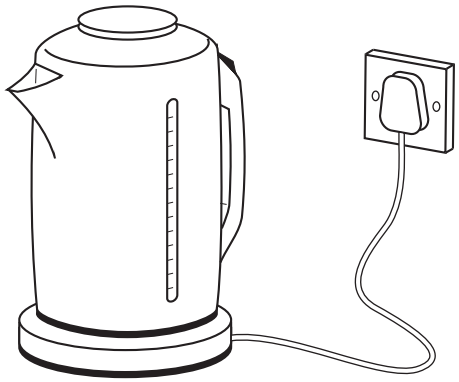
QUESTION TEN

You may find the following formulae useful when answering some parts of this question.

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

total cost = number of Units × cost per Unit

An electric kettle has a power rating of 2750 W.



10.1 What is the power of the kettle in kilowatts?

A 0.2750

B 2.750

C 27.50

D 275.0

10.2 In a week, the kettle was switched on for a total of 3 hours.

How many Units of electricity did the kettle use?

A 8.25

B 495

C 916.7

D 8250

10.3 In the next week, the kettle transferred 12.0 kWh of energy.
One Unit costs 9 p.

What is the cost of using the kettle for the week?

A 1.33 p

B 10.8 p

C £1.08

D £1.33

10.4 Not all of the electrical energy transferred is used to heat the water in the kettle.

Some of the energy is . . . . .

A lost to the surroundings.

B returned to the mains.

C stored for future use.

D used to increase the gravitational potential energy of the water.

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 A

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

In these questions match the words in the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

Heat can be transferred by radiation. The amount of heat transferred by an object depends on its surface.

The list shows places where transfer of heat is important.

Match the places from the list with the numbers **1–4** in the table.

back of an electric fire

fins at the back of a refrigerator

solar panel on a roof

survival bag used by a mountain rescue team

Place	Information about the surface
1	black so it absorbs as much heat radiation as possible
2	black so it gives out as much heat radiation as possible
3	shiny so it gives out as little heat radiation as possible
4	shiny inside so it reflects as much heat radiation as possible

QUESTION TWO

Thermal energy can be transferred in different ways.

Match words from the list with the numbers **1–4** in the sentences.

free electrons

ions

particles

waves

Convection currents in liquids and gases are the result of expansion caused by . . . . . **1** . . . . . moving faster in hotter regions.

Thermal radiation is energy transferred by . . . . . **2** . . . . . .

The hotter a metal is, the greater the kinetic energy of the vibrating . . . . . **3** . . . . . in the metal structure.

Kinetic energy is transferred to cooler parts of a metal by . . . . . **4** . . . . . diffusing through it.

TURN OVER FOR THE NEXT QUESTION

SECTION B

Questions **THREE** and **FOUR**.

In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

In Britain, most power stations use fuels as their source of energy.

Which **two** of the following fuels are **not** burnt to release their energy?

coal

gas

plutonium

uranium

wood

QUESTION FOUR

Which **two** statements can be used as arguments **against** nuclear power?

burning fossil fuels adds to global warming

nuclear waste disposal causes long-term environmental problems

the cost of decommissioning nuclear power stations is very high

the running costs of nuclear power stations are low

the supplies of nuclear fuel are almost inexhaustible

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

SECTION C

Questions **FIVE** to **TEN**.

Each of these questions has four parts.

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

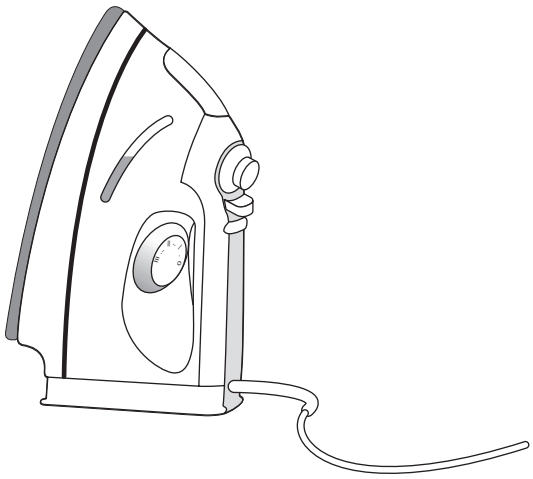
Mark your choices on the answer sheet.

QUESTION FIVE

You may find the following formula useful when answering some parts of this question.

energy transferred (joule, J)	=	power (watt, W)	×	time (second, s)

The diagram shows an electric iron.



5.1 Which energy transfer takes place when the iron is used?

A Electrical energy to heat

B Electrical energy to kinetic energy

C Heat to electrical energy

D Heat to kinetic energy

5.2 The base of the iron radiates energy.

It will radiate **least** energy when the base is . . . . .

A at a high temperature and black.

B at a high temperature and shiny.

C at a low temperature and black.

D at a low temperature and shiny.

5.3 The power of the iron is 1.2 kW.

What is the maximum amount of energy that can be transferred by the iron in 1 hour?

A 72 J

B 4 320 J

C 72 000 J

D 4 320 000 J

5.4 When the iron is used, less than the calculated maximum amount of energy is transferred in 1 hour.

What is the most likely reason for this?

A Some energy is provided by the person doing the ironing

B The efficiency of the iron is more than 1 (100 %)

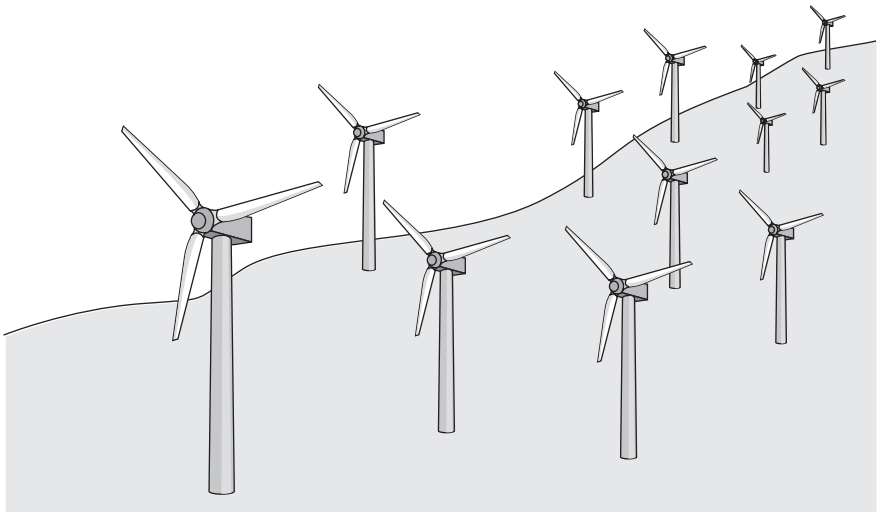
C The ironing board is covered with an insulator

D The iron switches off at times to keep it at the correct temperature

TURN OVER FOR THE NEXT QUESTION

QUESTION SIX

The diagram shows a group of wind generators which supply electricity to a small town.



6.1 A group of wind generators is called a wind . . . . .

A barrage.

B dam.

C farm.

D turbine.

6.2 Which type of energy is transferred from the wind to generate electricity?

A Gravitational potential

B Kinetic

C Sound

D Thermal

6.3 Where would you **not** expect to find a group of wind generators?

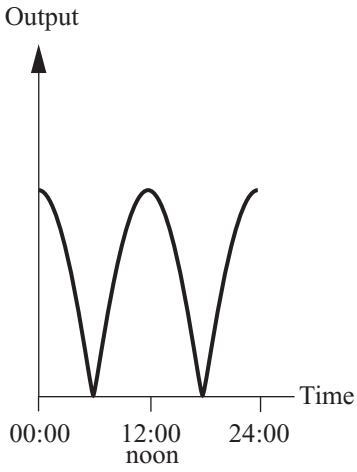
A In a town

B Offshore – out at sea

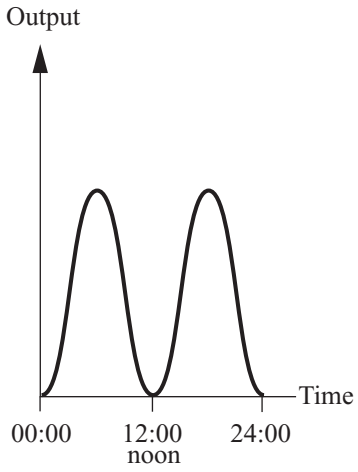
C On a coastal cliff

D On the top of a hill

6.4 Which graph is most likely to show the output from a wind generator over one day?



A



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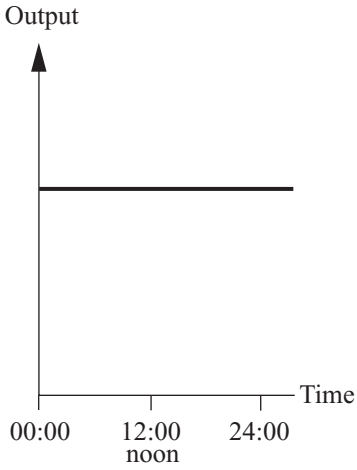

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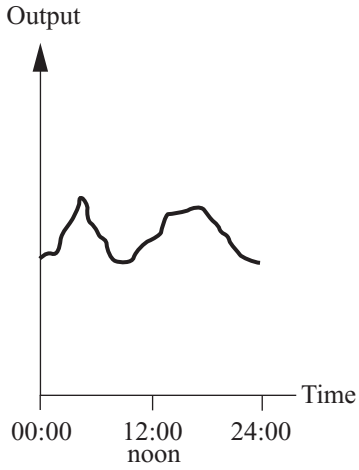


D

TURN OVER FOR THE NEXT QUESTION

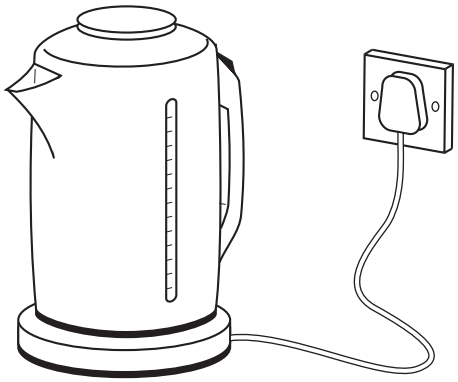
QUESTION SEVEN

You may find the following formulae useful when answering some parts of this question.

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

total cost = number of Units × cost per Unit

An electric kettle has a power rating of 2750 W.



7.1 What is the power of the kettle in kilowatts?

A 0.2750

B 2.750

C 27.50

D 275.0

7.2 In a week, the kettle was switched on for a total of 3 hours.

How many Units of electricity did the kettle use?

A 8.25

B 495

C 916.7

D 8250

7.3 In the next week, the kettle transferred 12.0 kWh of energy.
One Unit costs 9 p.

What is the cost of using the kettle for the week?

A 1.33 p

B 10.8 p

C £1.08

D £1.33

7.4 Not all of the electrical energy transferred is used to heat the water in the kettle.

Some of the energy is . . . . .

A lost to the surroundings.

B returned to the mains.

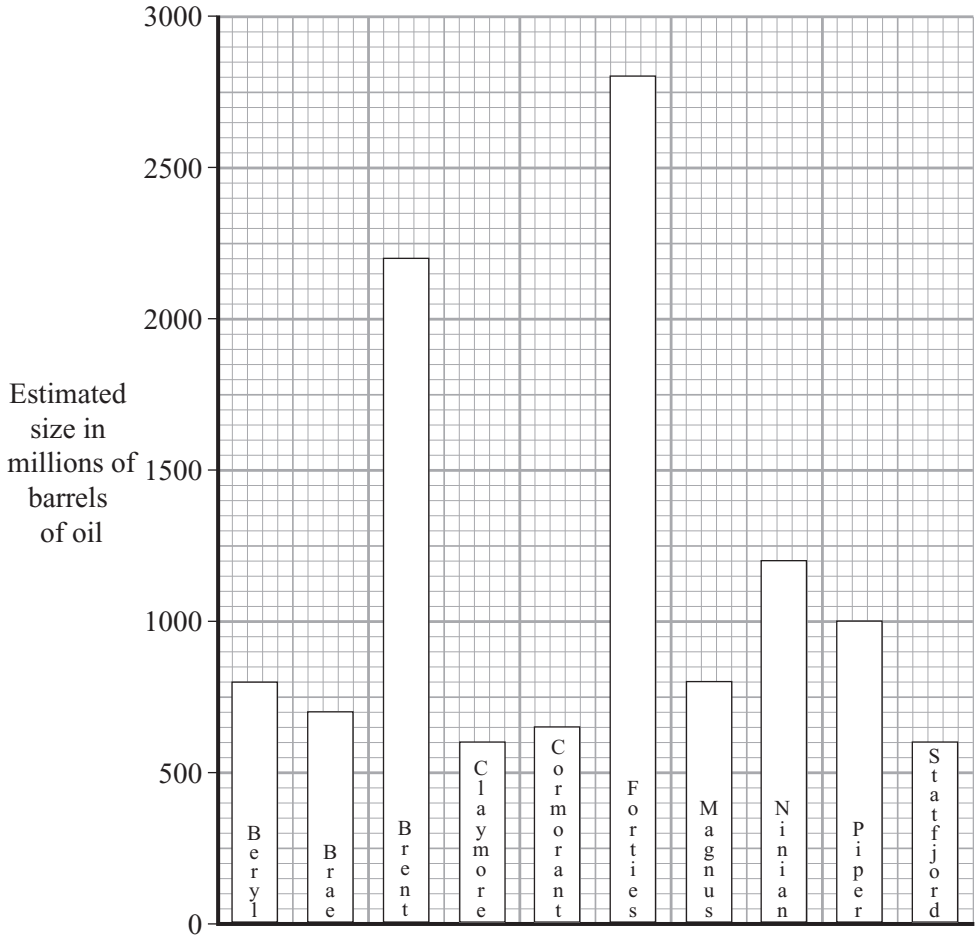
C stored for future use.

D used to increase the gravitational potential energy of the water.

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

The chart shows the estimated sizes of ten oilfields under the sea near the UK.



8.1 By how many times is the biggest field larger than the smallest field?

A 4.09

B 4.67

C 5.09

D 22.00

8.2 A wind farm would produce less electricity than an oil-fired power station built on the same area of land.

This is because . . . . .

A energy obtained from oil involves high capital costs.

B energy obtained from oil is more expensive.

C the wind is a dilute energy source.

D the wind is an unreliable source of energy.

8.3 The Forties Field has produced 80 million barrels of oil per year.

If production continues at this rate, for how long will this field produce oil?

A 15 years

B 21 years

C 35 years

D Over 40 years

8.4 What are the main advantages of gas-fired power stations over oil-fired ones?

A Although gas-fired power stations do not produce sulphur dioxide, they do produce more carbon dioxide

B The carbon and sulphur can be removed from oil before it is burnt

C Gas-fired power stations can be started up more quickly and they produce less carbon dioxide

D Gas-fired power stations use non-renewable fuel and produce no polluting gases

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

An African village is many miles away from a supply of mains electricity.
The Sun shines for at least a few hours nearly every day.
The villagers want a supply of electricity to pump up water from a well for a few hours each day.
The table shows the costs of two different ways of providing the electricity.

Way of providing electricity	Capital cost	Capital cost* (per kWh)	Fuel cost* (per kWh)	Maintenance cost* (per kWh)
Solar cells	£1000	20p	zero	zero
Petrol generator	£250	5p	20p	10p

(*These costs are averaged out over the 20 years that the equipment is expected to last.)

9.1 Which of the following statements is correct?

A The petrol generator has a higher capital cost

B The petrol generator has a higher capital cost per kWh

C The petrol generator has a higher total cost per kWh

D The petrol generator needs less maintenance

9.2 An advantage of the petrol generator is that . . . . .

A it is cheaper to set up the system in the first place.

B it is less likely to break down.

C it is quieter.

D it will cause less air pollution.

9.3 A **disadvantage** of using the solar cells to generate electricity in the African village is that . . . . .

A they have a low capital cost.

B they need no maintenance.

C they will not work during the night.

D they work out cheaper over a 20 year period.

9.4 If the same solar cells are used in the UK, they will produce only $\frac{1}{5}$ as much electricity during their 20 year life as they do in the African village.

How much more expensive is each Unit of electricity from the solar cells in the UK, than mains electricity at 8 p per Unit?

A 2.5 times more expensive

B 5 times more expensive

C 10 times more expensive

D 12.5 times more expensive

TURN OVER FOR THE NEXT QUESTION

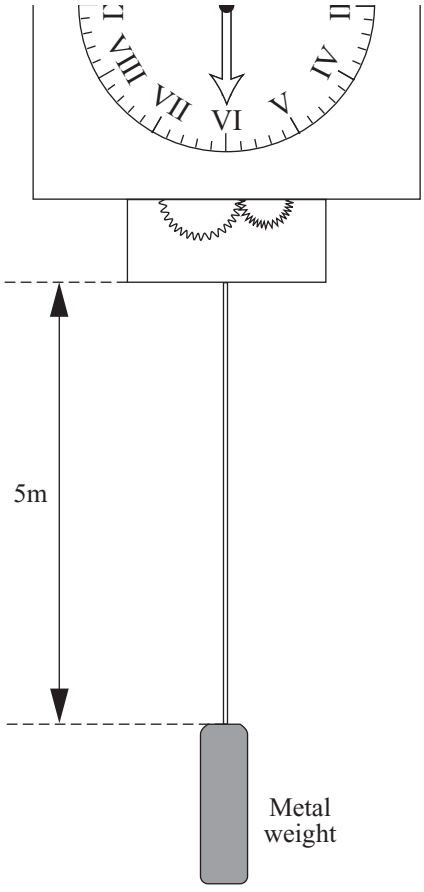
QUESTION TEN

You may find the following formulae useful when answering some parts of this question.

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

$$\underset{\text{(joule, J)}}{\text{energy transferred}} = \underset{\text{(watt, W)}}{\text{power}} \times \underset{\text{(second, s)}}{\text{time}}$$

A clock is driven by a metal weight of mass 10 kg (weight 100 N).
The metal weight is wound up by hand, in a short time, through a vertical height of 5 m.
It then falls back down over a much longer time.



10.1 Assuming that the efficiency of energy transfer is 1 (100 %), which line of the table is correct?

	Energy transferred by rise of metal weight	**Power transferred by fall of metal weight**
A	equal to energy supplied	greater than power supplied
B	equal to energy supplied	less than power supplied
C	greater than energy supplied	equal to power supplied
D	less than energy supplied	greater than power supplied

10.2 By how much does the metal weight's gravitational potential energy change when it is raised 5 m?

A 50 J

B 125 J

C 500 J

D 1250 J

Another, much larger, clock works in a similar way. However, the metal weight is raised automatically every day by an electric motor of efficiency 0.8 (80 %).
The metal weight transfers 1000 J as it falls back down.

10.3 When the metal weight is raised, what is the total electrical energy transferred?

A 800 J

B 800 W

C 1250 J

D 1250 W

10.4 This metal weight falls back down in 24 hours.

What power is transferred to the clock?

A 0.009 kWh

B 0.009 W

C 0.012 kWh

D 0.012 W

END OF TEST

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

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