

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
November 2006



**SCIENCE: SINGLE AWARD A (MODULAR)**  
**Energy and Electricity (Module 17)**

**346017**

Thursday 23 November 2006 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

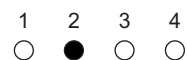
**Instructions**

- 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**

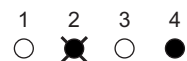
- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

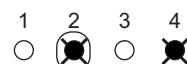


- Do **not** extend beyond the circles.

- 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.

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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.

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## FOUNDATION TIER

### SECTION A

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

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

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

Mark your choices on the answer sheet.

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### QUESTION ONE

We use symbols for the components in circuit diagrams.


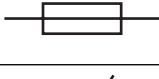

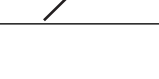
Match words from the list with the numbers **1–4** in the table.

**fuse**

**lamp**

**thermistor**

**variable resistor**

Symbol	Component
	<b>1</b>
	<b>2</b>
	<b>3</b>
	<b>4</b>

**QUESTION TWO**

The diagram shows the inside of a 3-pin plug.

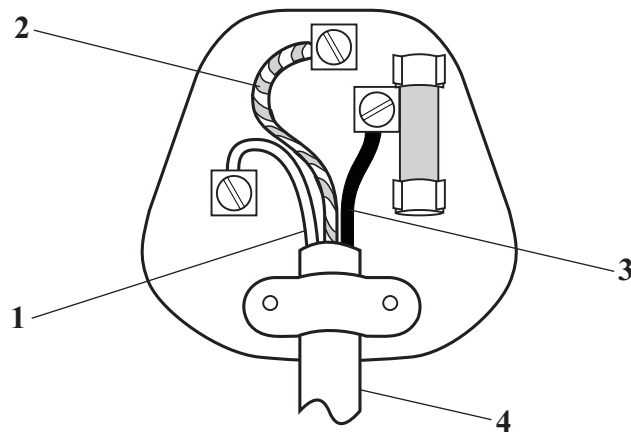
Match words from the list with the labels 1–4 on the diagram.

**blue plastic**

**brown plastic**

**green and yellow plastic**

**white plastic**



**Turn over for the next question**

**Turn over ►**

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**QUESTION THREE**

The table is about the resistance of different components.

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

**diode**

**filament lamp**

**LDR**

**thermistor**

<b>Resistance</b>	<b>Component</b>
its resistance decreases as light intensity increases	<b>1</b>
its resistance decreases as temperature increases	<b>2</b>
its resistance depends on the direction of the current flowing through it	<b>3</b>
its resistance increases as temperature increases	<b>4</b>

**QUESTION FOUR**

The various methods of producing electricity affect the environment in different ways.

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

**fossil fuels**

**hydroelectric schemes**

**nuclear fuels**

**wind farms**

Polluting gases are released into the air by using . . . **1** . . . .

Upland river valleys are dammed when building . . . **2** . . . .

Noise and visual pollution of hills and coasts can be caused by . . . **3** . . . .

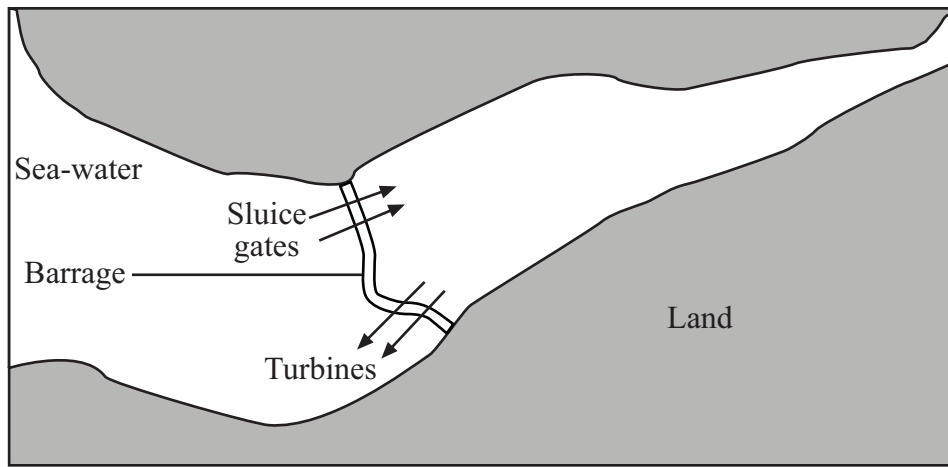
Dangerous radioactive waste is produced by using . . . **4** . . . .

**Turn over for the next question**

**Turn over ►**

**QUESTION FIVE**

The map shows a tidal barrage across an estuary.



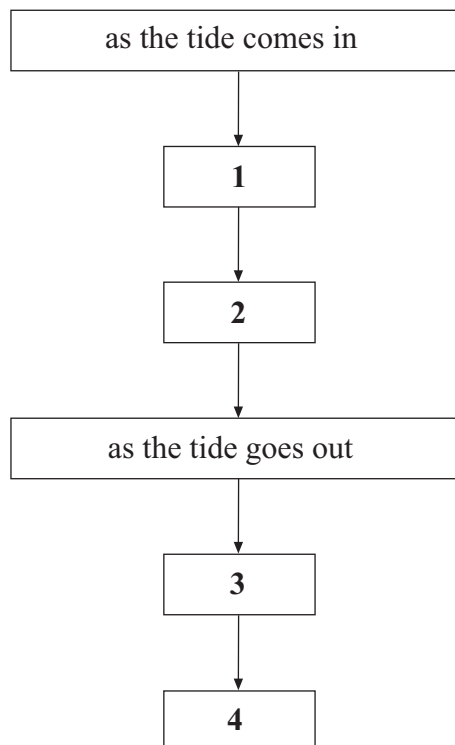
Match statements from the list with the boxes **1–4** in the flow chart, to explain how the barrage works.

**electricity is generated**

**water flows through the sluice gates**

**water flows through the turbines**

**water is trapped behind the barrage**



**Turn over for the next question**

**Turn over ►**

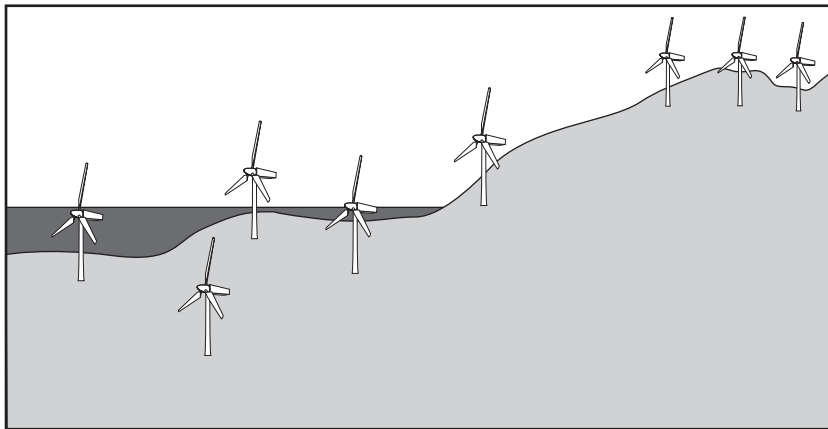
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**SECTION B**Questions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

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**QUESTION SIX**

The diagram shows a wind farm.

Which **two** statements about the use of wind farms are true?**Electricity can always be generated****No fuel is used****No sulphur dioxide is produced****Steam is produced****They cause no noise pollution**



**QUESTION SEVEN**

Fuses are often used with electrical appliances.

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

- P** if a fault causes too large a current to flow, the fuse causes a break in the circuit
- Q** the fuse is connected to the neutral terminal in a plug
- R** the fuse should have a lower value than the current which flows through the appliance when it is working normally
- S** the wire in the fuse melts when it gets too hot
- T** when the wire in the fuse melts, the circuit is completed

**Turn over for the next question**

**Turn over ►**

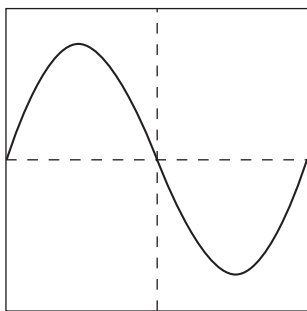
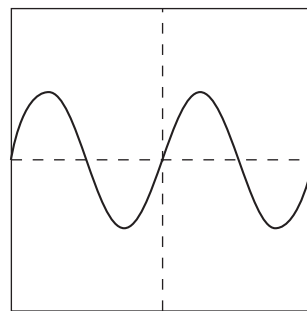
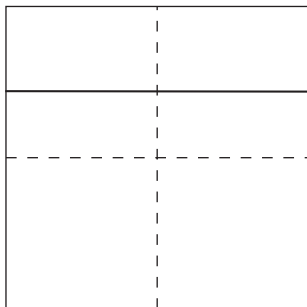
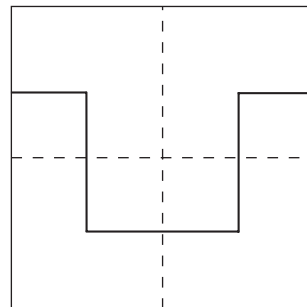
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**SECTION C**Questions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION EIGHT**Four different power supplies are connected in turn to an oscilloscope. The oscilloscope settings are not changed. The traces, **P**, **Q**, **R** and **S**, are shown below.**P****Q****R****S****8.1** Which of the traces shows the greatest peak voltage?

- A** P
- B** Q
- C** R
- D** S

8.2 Which trace shows a d.c. supply?





- A P
- B Q
- C R
- D S

8.3 Trace P represents a supply of frequency 60 Hz.

What is the frequency of supply Q?

- A 30 Hz
- B 60 Hz
- C 90 Hz
- D 120 Hz

8.4 Which component could produce, by itself, one of the traces shown?

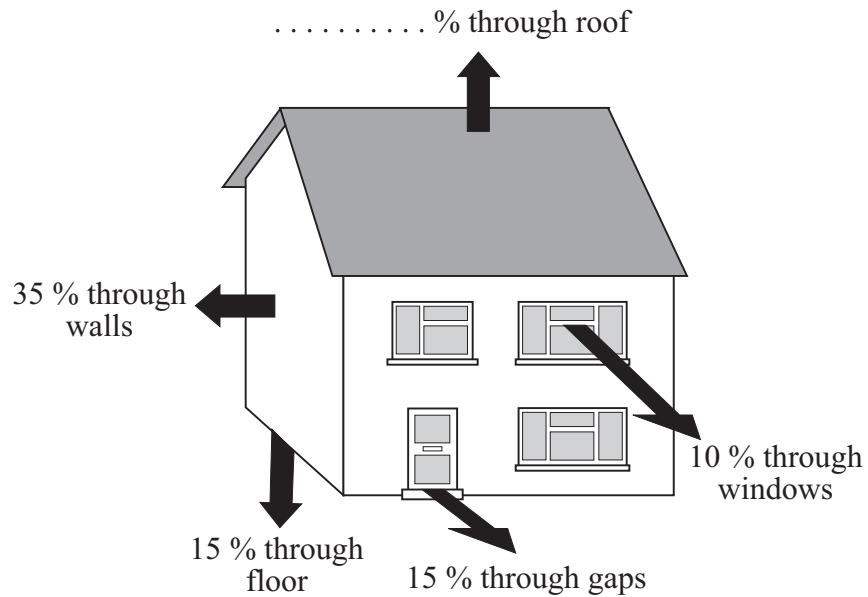
- A 
- B 
- C 
- D 

**Turn over for the next question**

**Turn over ►**

**QUESTION NINE**

The diagram shows the ways in which heat can be lost from a house.



**9.1** What percentage of heat is lost through the roof?

- A 15 %
- B 20 %
- C 25 %
- D 35 %

**9.2** Which of the following might **increase** the amount of heat lost through the roof?

- A Fitting black roof tiles
- B Fitting loft insulation
- C Fitting thicker roof tiles
- D Reducing the temperature in the house

**9.3** Warm air rises to the top of the house by . . .

- A conduction.
- B convection.
- C evaporation.
- D radiation.

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

$$\begin{array}{ccccc} \text{energy transferred} & = & \text{power} & \times & \text{time} \\ \text{(kilowatt - hour, kWh)} & & \text{(kilowatt, kW)} & & \text{(hour, h)} \end{array}$$

**9.4** To keep the house warm, the central heating system has to transfer 8 kilowatts.

The energy transferred in 8 hours is . . .

- A 1 Unit.
- B 8 Units.
- C 16 Units.
- D 64 Units.

**Turn over for the next question**

**Turn over ►**

**QUESTION TEN**

Magnetic fields can be used to produce electric currents.

**10.1** A coil of wire is part of a complete circuit.

Which object will induce a current in the coil when it is moved **into** the coil?

- A** A bar magnet
- B** A brass bar
- C** A copper bar
- D** An iron bar

**10.2** A coil of wire is part of a complete circuit.

Which object will induce a current in the coil when it is moved **out of** the coil?

- A** A bar magnet
- B** A brass bar
- C** A copper bar
- D** An iron bar

**10.3** The generator at a power station . . .

- A** has either a rotating coil or a rotating magnet.
- B** has neither a rotating coil nor a rotating magnet.
- C** must have a coil rotating in a magnetic field.
- D** must have a magnet rotating inside a coil.

**10.4** Read this part of a student's notebook.

*If a coil of wire cuts through a magnetic field then a potential difference is induced between the ends of the coil.*

*The size of this potential difference is greater when*

- *the area of the coil is greater*
- *the number of turns on the coil is greater*
- *the speed of the coil is greater*
- *the strength of the magnetic field is greater*

How many of the bullet points are correct?

- A** None of them
- B** Only two of them
- C** Only three of them
- D** All of them

**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.

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## HIGHER TIER

### SECTION A

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

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

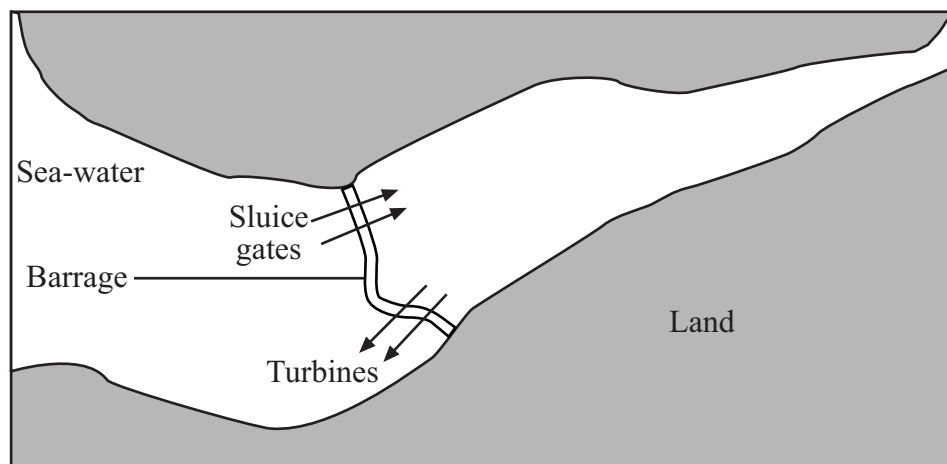
Use **each** answer only **once**.

Mark your choices on the answer sheet.

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#### QUESTION ONE

The map shows a tidal barrage across an estuary.



Match statements from the list with the boxes **1–4** in the flow chart, to explain how the barrage works.

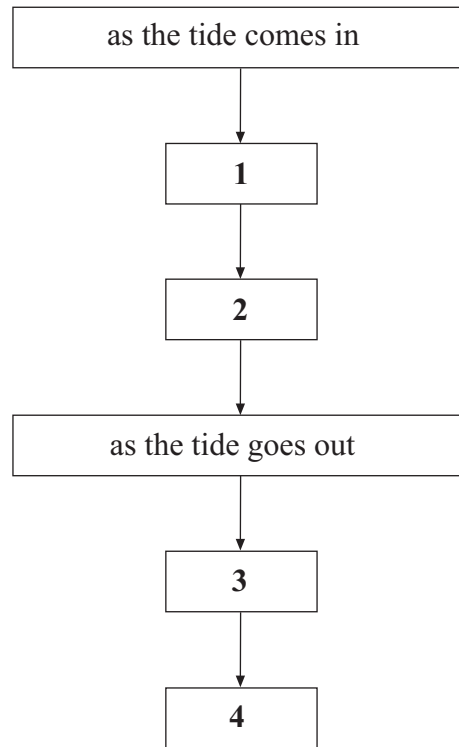
**electricity is generated**

**water flows through the sluice gates**

**water flows through the turbines**

**water is trapped behind the barrage**





**Turn over for the next question**

**Turn over ►**

**QUESTION TWO**

This question is about mains electricity.

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

**earth**

**live**

**neutral**

**positive**

In the mains electricity supply, the . . . **1** . . . terminal stays at close to zero volts with respect to . . . **2** . . . .

The . . . **3** . . . terminal alternates between . . . **4** . . . and negative potential difference with respect to the neutral terminal.

**Turn over for the next question**

**Turn over ►**

**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.

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**QUESTION THREE**

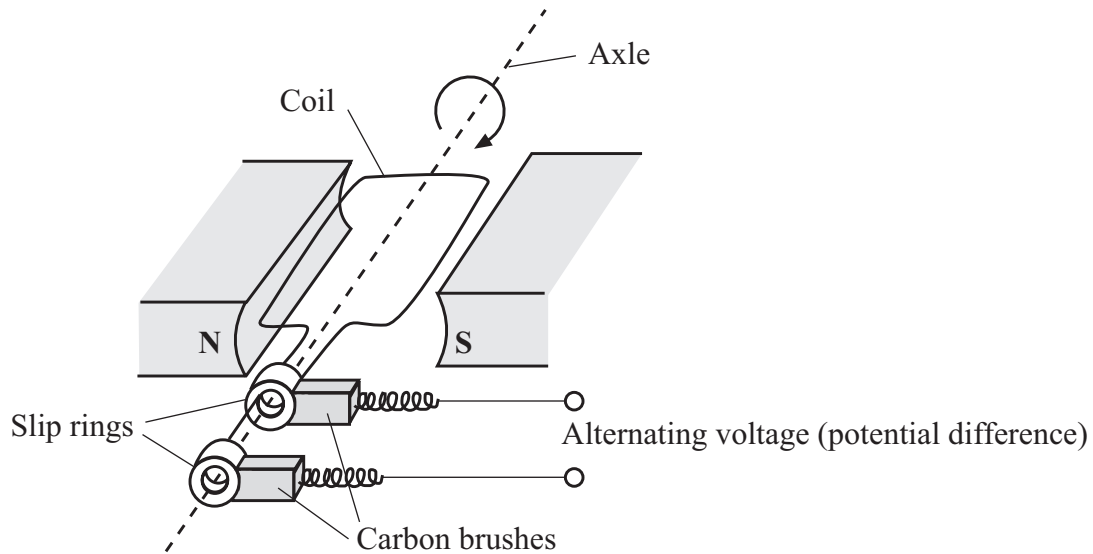
Fuses are often used with electrical appliances.

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- Q** the fuse is connected to the neutral terminal in a plug
- R** the fuse should have a lower value than the current which flows through the appliance when it is working normally
- S** the wire in the fuse melts when it gets too hot
- T** when the wire in the fuse melts, the circuit is completed

**QUESTION FOUR**

The diagram shows a simple generator.



Which **two** statements, **J**, **K**, **L**, **M** and **N**, are **false**?

- J** the brushes change a.c. to d.c.
- K** the slip rings prevent the wires from getting tangled up
- L** the stronger the magnetic field, the greater the voltage produced
- M** when the coil spins faster, the frequency of the electricity generated decreases
- N** the voltage produced increases if the number of turns on the coil is increased

**Turn over for the next question**

**Turn over ►**

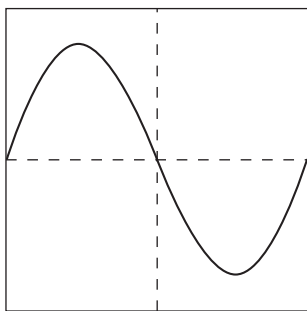
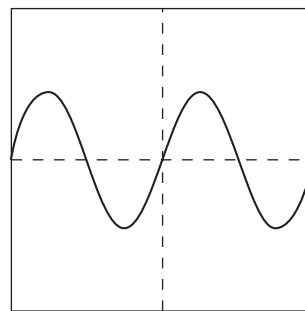
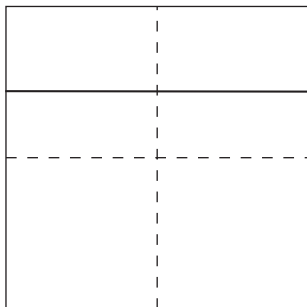
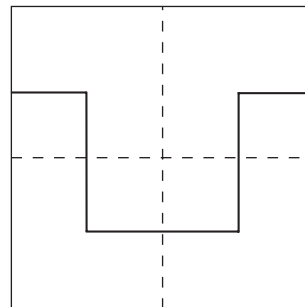
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**SECTION C**Questions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION FIVE**Four different power supplies are connected in turn to an oscilloscope. The oscilloscope settings are not changed. The traces, **P**, **Q**, **R** and **S**, are shown below.**P****Q****R****S****5.1** Which of the traces shows the greatest peak voltage?

- A** P
- B** Q
- C** R
- D** S

5.2 Which trace shows a d.c. supply?





- A P
- B Q
- C R
- D S

5.3 Trace P represents a supply of frequency 60 Hz.

What is the frequency of supply Q?

- A 30 Hz
- B 60 Hz
- C 90 Hz
- D 120 Hz

5.4 Which component could produce, by itself, one of the traces shown?

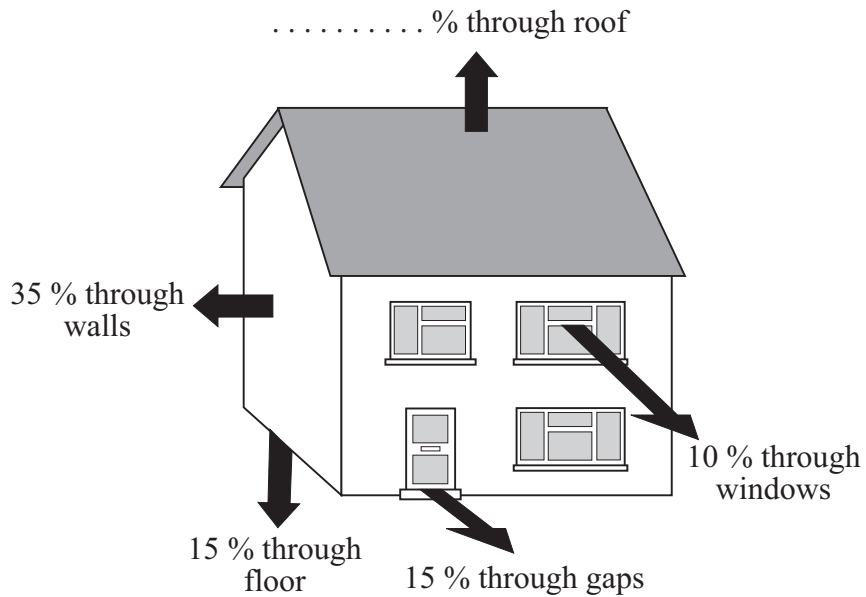
- A 
- B 
- C 
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**Turn over for the next question**

**Turn over ►**

**QUESTION SIX**

The diagram shows the ways in which heat can be lost from a house.



**6.1** What percentage of heat is lost through the roof?

- A 15 %
- B 20 %
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**6.2** Which of the following might **increase** the amount of heat lost through the roof?

- A Fitting black roof tiles
- B Fitting loft insulation
- C Fitting thicker roof tiles
- D Reducing the temperature in the house



**6.3** Warm air rises to the top of the house by . . .

- A conduction.
- B convection.
- C evaporation.
- D radiation.

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

$$\begin{array}{ccccc} \text{energy transferred} & = & \text{power} & \times & \text{time} \\ \text{(kilowatt - hour, kWh)} & & \text{(kilowatt, kW)} & & \text{(hour, h)} \end{array}$$

**6.4** To keep the house warm, the central heating system has to transfer 8 kilowatts.

The energy transferred in 8 hours is . . .

- A 1 Unit.
- B 8 Units.
- C 16 Units.
- D 64 Units.

**Turn over for the next question**

**Turn over ►**

**QUESTION SEVEN**

Magnetic fields can be used to produce electric currents.

**7.1** A coil of wire is part of a complete circuit.

Which object will induce a current in the coil when it is moved **into** the coil?

- A** A bar magnet
- B** A brass bar
- C** A copper bar
- D** An iron bar

**7.2** A coil of wire is part of a complete circuit.

Which object will induce a current in the coil when it is moved **out of** the coil?

- A** A bar magnet
- B** A brass bar
- C** A copper bar
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**7.3** The generator at a power station . . .

- A** has either a rotating coil or a rotating magnet.
- B** has neither a rotating coil nor a rotating magnet.
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7.4 Read this part of a student's notebook.

*If a coil of wire cuts through a magnetic field then a potential difference is induced between the ends of the coil.*

*The size of this potential difference is greater when*

- *the area of the coil is greater*
- *the number of turns on the coil is greater*
- *the speed of the coil is greater*
- *the strength of the magnetic field is greater*

How many of the bullet points are correct?

- A None of them
- B Only two of them
- C Only three of them
- D All of them

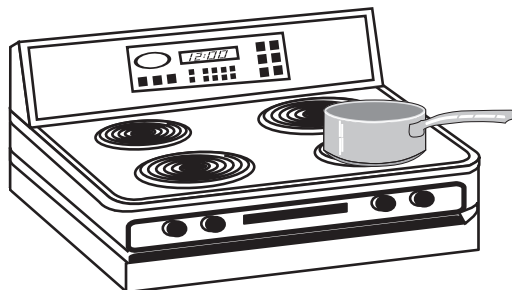
**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

The drawing shows a pan on the top of a cooker. The pan contains soup.

Some heat is lost through the metal walls of the pan to the surroundings.



- 8.1** The energy spreads through the soup by . . .
- A free electrons colliding with ions.
  - B heat rising.
  - C the soup contracting and falling as it is heated.
  - D the soup expanding and rising as it is heated.
- 8.2** The energy is transferred through the metal walls of the pan by . . .
- A free electrons colliding with ions.
  - B heated metal expanding and rising.
  - C infra red waves passing through the metal.
  - D the atoms gaining energy and moving faster through the metal.
- 8.3** The outer walls of the pan transfer energy to the surroundings by . . .
- A free electrons colliding with ions.
  - B infra red waves passing through the air.
  - C metal atoms gaining energy and escaping into the air.
  - D the air contracting and falling as it is heated.

- 8.4** The air in contact with the outer walls of the pan . . .
- A** contracts and falls because of its decreased density.
  - B** contracts and falls because of its increased density.
  - C** expands and rises because of its decreased density.
  - D** expands and rises because of its increased density.

**Turn over for the next question**

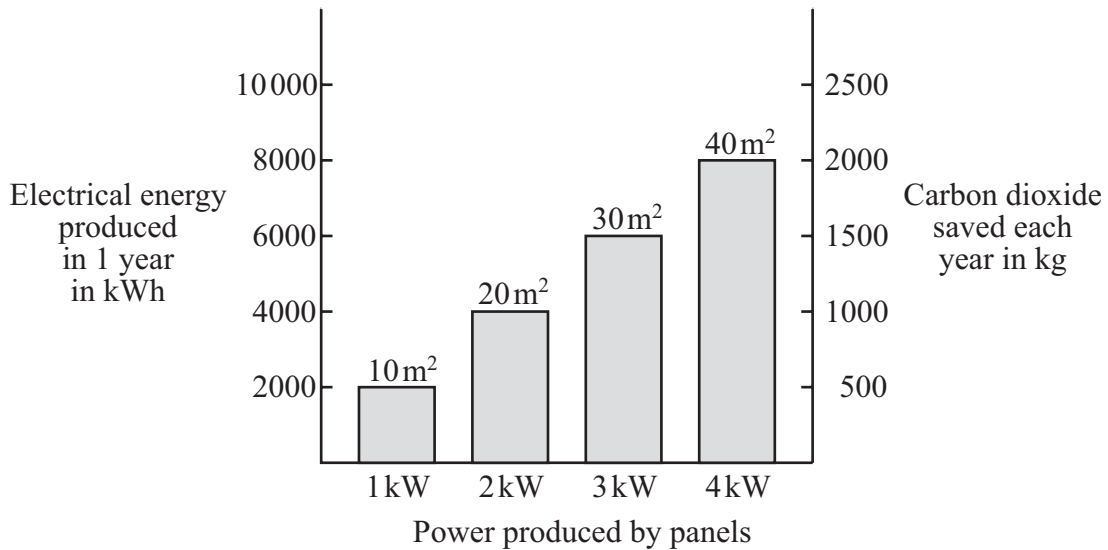
**Turn over ►**

**QUESTION NINE**

The chart gives information about solar cell panels used for producing electricity.

The chart shows:

- the area of the panels
- the power produced by the panels
- the electrical energy produced each year by using the panels
- the mass of carbon dioxide saved each year by using the panels.



**9.1** What is the minimum area of panel that would be needed to power a 2.5 kW heater?

- A 20 m<sup>2</sup>
- B 25 m<sup>2</sup>
- C 30 m<sup>2</sup>
- D 35 m<sup>2</sup>

**9.2** How much carbon dioxide could be saved each year by using panels with an area of 15 m<sup>2</sup>?

- A 500 kg
- B 750 kg
- C 1000 kg
- D 1750 kg

---

**9.3** What is the minimum area of panel that a household would need in order to produce 7000 kWh of electricity in a year?

**A** 20 m<sup>2</sup>

**B** 25 m<sup>2</sup>

**C** 30 m<sup>2</sup>

**D** 35 m<sup>2</sup>

**9.4** The average cost of electricity each year for a household is £325. The householder thinks about installing solar cell panels. A suitable system will cost £12 900.

What is the approximate payback time?

**A** 32 years

**B** 36 years

**C** 40 years

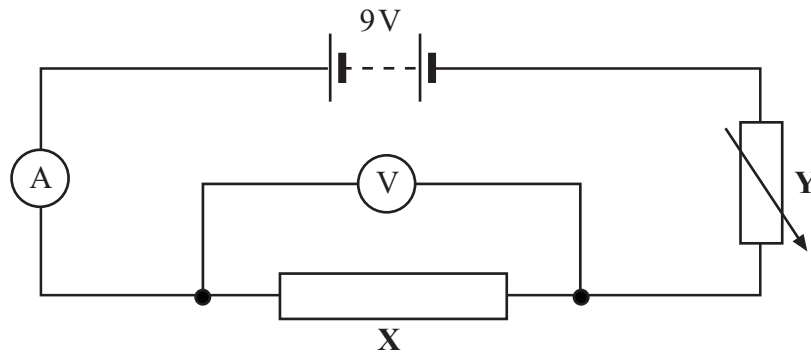
**D** 48 years

**Turn over for the next question**

**Turn over ►**

**QUESTION TEN**

Some students used the circuit shown below to determine the resistance of **X**. Component **Y** was adjusted to give a range of values.



When the potential difference across **X** was 6 V, the current flowing through it was 0.2 A.

**10.1** What was the resistance of **X**?

- A 0.75  $\Omega$
- B 3.33  $\Omega$
- C 6.00  $\Omega$
- D 30.00  $\Omega$

**10.2** The current through **X** remained at 0.2 A.

What was the resistance of component **Y**?

- A Half the resistance of **X**.
- B The same as the resistance of **X**.
- C Twice the resistance of **X**.
- D Four times the resistance of **X**.



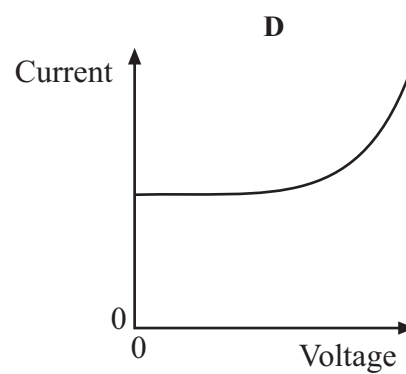
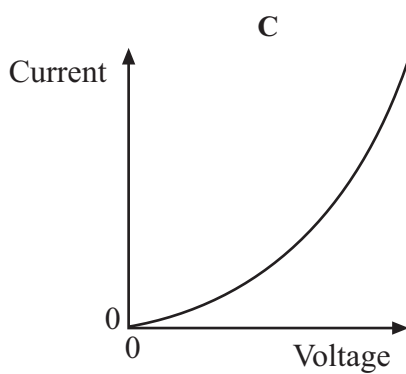
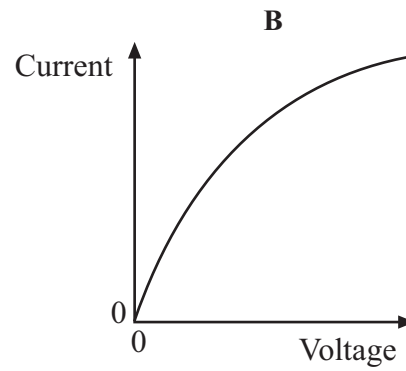
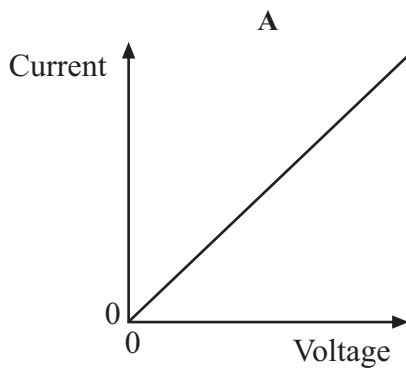
**10.3** The resistance of **Y** is increased.

How do the current flowing through **X** and the potential difference across **X** change?

	Current flowing through <b>X</b>	Potential difference across <b>X</b>
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	increases	decreases
<b>D</b>	increases	increases

**10.4** **X** is replaced by a filament lamp.

Which current-voltage graph, **A**, **B**, **C** or **D**, is correct for a filament lamp?



**END OF TEST**

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