Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature							

General Certificate of Secondary Education
March 2007

SCIENCE: SINGLE AWARD A (MODULAR) 346017
Energy and Electricity (Module 17)

Wednesday 7 March 2007 Morning Session

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

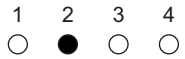
You may use a calculator.

Time allowed: 30 minutes

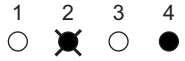
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Energy and Electricity' printed on it.
- Attempt **one Tier only**, **either** the Foundation 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

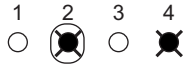
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 16 of this booklet.

FOUNDATION TIER

SECTION A

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

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

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

Mark your choices on the answer sheet.

QUESTION ONE

Circuit diagrams use symbols to represent components.

Match words from the list with the symbols **1–4**.

battery

cell

resistor

variable resistor

1 **2** **3** **4**

QUESTION TWO

The diagram shows a metal casserole dish and its contents. It is being heated on the top of a stove.

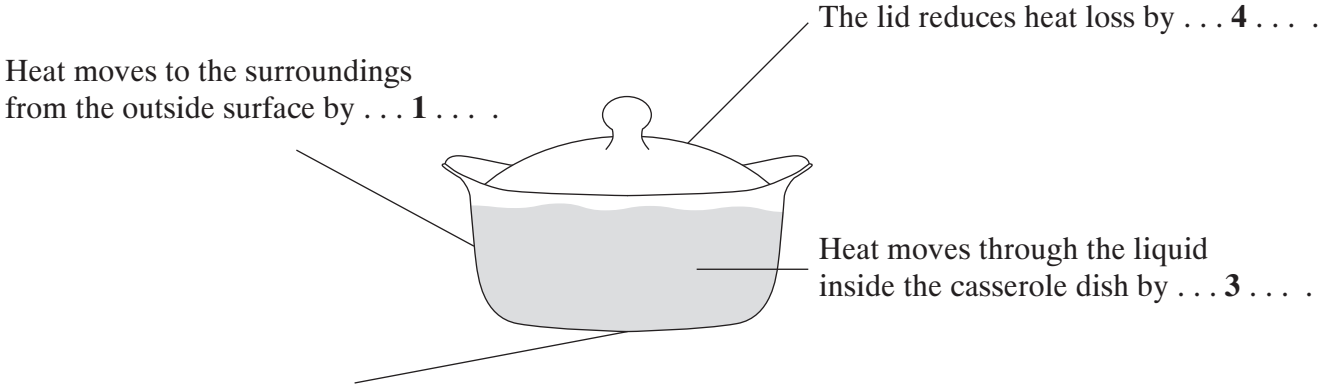
Match words from the list with the numbers **1–4** in the sentences.

conduction

convection

evaporation

radiation



Turn over for the next question

QUESTION THREE

An electric kettle is filled with water and plugged into the mains supply.

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

current

potential difference

power

resistance

The mains supply has a . . . **1** . . . of 230 volts.

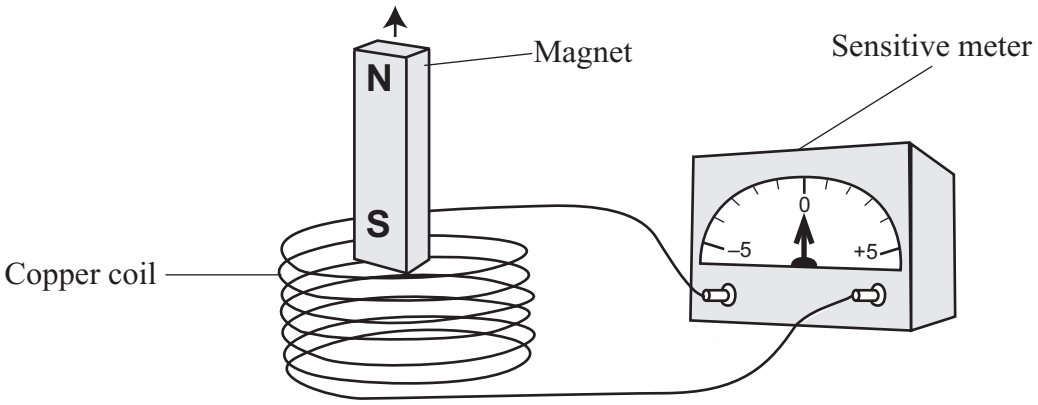
When it is hot, the heating element has a . . . **2** . . . of about 25 ohms.

The . . . **3** . . . through the heating element is 9 amps.

The kettle transfers about 2000 watts of . . . **4** . . . .

QUESTION FOUR

You can produce an electric current with the apparatus shown in the diagram.



When the magnet is moved upwards, the pointer on the meter moves from zero to the right.

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

moves further

moves to the left

moves to the right

points to 0

When the magnet is moved downwards, the pointer on the meter . . . **1** . . . .

If the magnet does not move, the pointer on the meter . . . **2** . . . .

If the magnet is moved more quickly, the pointer on the meter . . . **3** . . . .

The magnet is turned upside down. The magnet is now moved downwards.

The pointer on the meter . . . **4** . . . .

Turn over for the next question

QUESTION FIVE

In a circuit, the resistance of a component can change.

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

diode

filament lamp

LDR

thermistor

Description of resistance	Component
its resistance decreases when its temperature increases	**1**
its resistance decreases when the light intensity increases	**2**
its resistance increases when its temperature increases	**3**
its resistance is very high in the reverse direction	**4**

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

Satellites use solar cells instead of non-rechargeable batteries.

Which **two** statements are the main reasons why solar cells are used?

batteries contain chemicals that would pollute space

it is not practical to replace batteries on a satellite

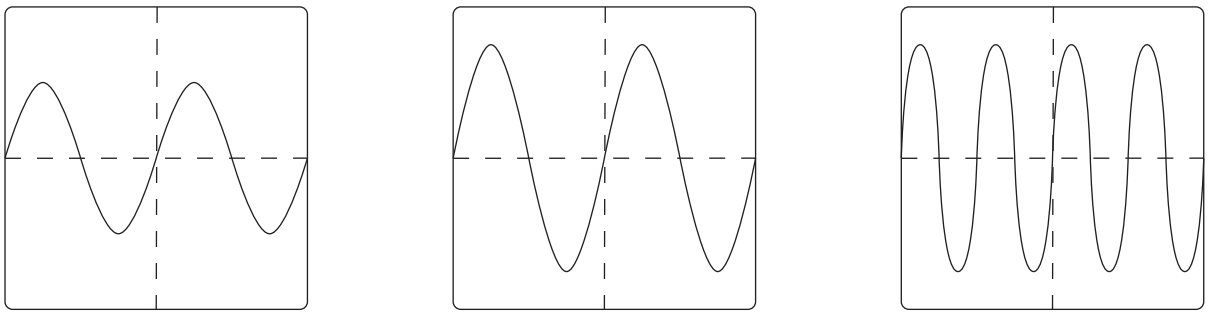
satellites need a lot of power

solar cells are very cheap

there is an almost continuous supply of solar energy in space

QUESTION SEVEN

The diagrams show the traces produced when three different a.c. supplies, **G**, **H**, and **J**, were connected to an oscilloscope. The settings of the oscilloscope were not changed. Time is on the horizontal axis.



G **H** **J**

Which **two** statements are correct?

G has the same frequency as H

G has the same peak voltage as H

G has the same peak voltage as J

H has the same frequency as J

H has the same peak voltage as J

Turn over for the next question

SECTION C

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

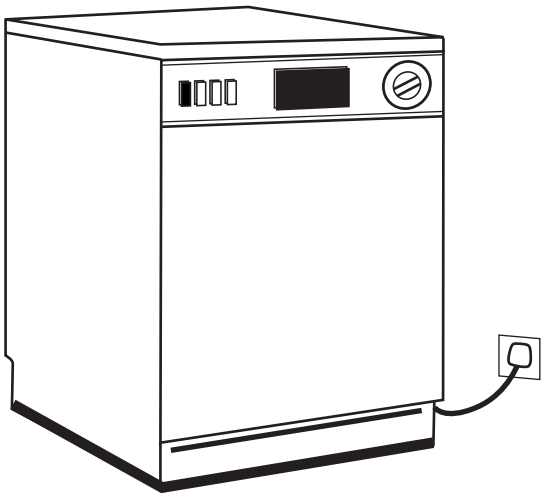
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

A dishwasher is designed to transfer electrical energy to useful energy. Some energy is wasted.



8.1 The dishwasher is designed to transfer electrical energy usefully as . . .

A movement and sound.

B movement and heat.

C movement, sound and heat.

D sound and heat.

8.2 Which one of these wastes energy in the dishwasher?

A Drying the dishes

B Heating the water

C Rinsing the dishes

D Vibrating the dishwasher

8.3 All the energy transferred to the dishwasher eventually goes to the surroundings.

When this happens, the energy . . .

A can easily be used for other transfers.

B cleans the dishes.

C disappears.

D is too spread out to be useful.

8.4 Another design of dishwasher is more efficient.

The more efficient dishwasher . . .

A makes the dishes cleaner.

B transfers less energy.

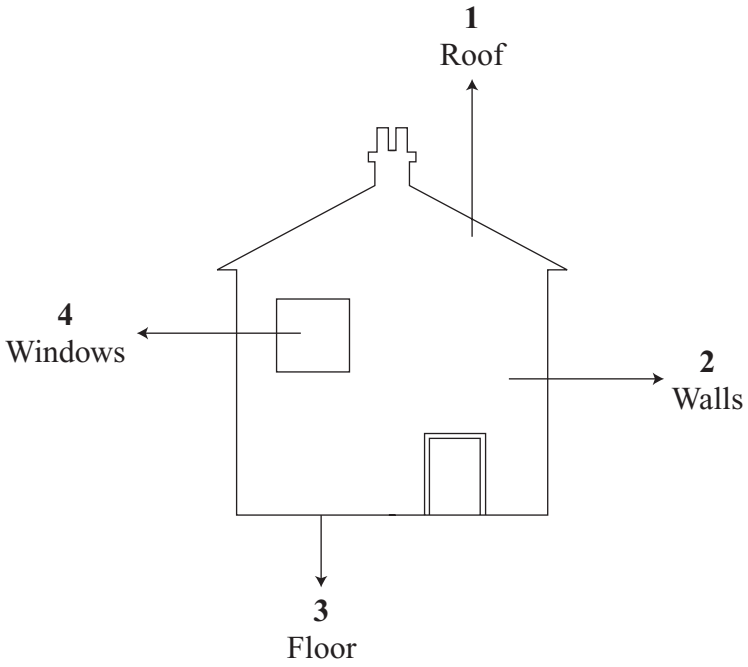
C washes the dishes more quickly.

D wastes a smaller proportion of the energy supplied to it.

Turn over for the next question

QUESTION NINE

The diagram shows the main energy losses from a house.



9.1 Energy passes through a roof tile by . . .

A conduction.

B convection.

C radiation.

D conduction, convection and radiation.

9.2 The energy loss through the roof can be reduced by fitting loft insulation. The insulating material has an effect on the heat transfer from the house by both conduction and convection.

Which row in the table is correct for the loft insulation?

	Effect on heat transfer by conduction	**Effect on heat transfer by convection**
A	Decreased because the material is a good insulator	Decreased because the air in the material is trapped
B	Decreased because the material is a good insulator	Increased because the air in the material is trapped
C	Increased because the material is a good insulator	Decreased because the air in the material is trapped
D	Increased because the material is a good insulator	Increased because the air in the material is trapped

9.3 Energy loss from the house can be reduced by laying carpets.

This reduction in energy loss is mainly because . . .

A a carpet is a poor conductor.

B a carpet is warm.

C a carpet reduces convection.

D a carpet reduces radiation.

9.4 The table shows the cost of insulating different parts of a house and the reduction in total energy loss achieved by each type of insulation.

Which type of insulation, **A**, **B**, **C** or **D**, is the most cost-effective?

	Type of insulation	**Installation cost**	**Percentage reduction in total energy loss from house**
A	Double-glazing	£6000	5
B	Floor insulation	£320	8
C	Loft insulation	£300	20
D	Wall cavity insulation	£1000	24

Turn over for the next question

QUESTION TEN

Generators are used to produce electricity.

10.1 The box shows part of a student's notebook.

Electricity can be generated by:

- *rotating a coil of wire in a magnetic field*
- *rotating a magnet inside a coil of wire*
- *rotating two coils of wire next to each other*
- *rotating two magnets next to each other*

How many of these points are correct?

A None of them

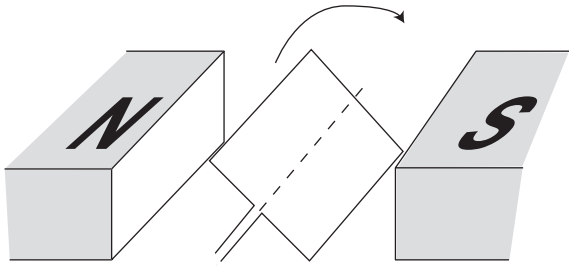
B Only the first two

C Only the last two

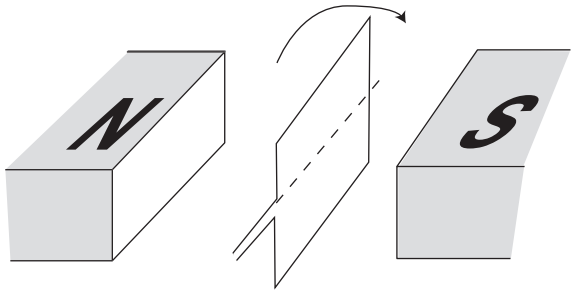
D All of them

10.2 A coil of wire rotates between the poles of a magnet. The diagram shows four positions of the coil.

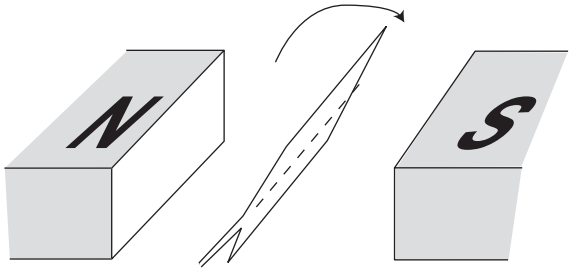
In which position, **A**, **B**, **C** or **D**, will the potential difference induced across the coil be greatest?



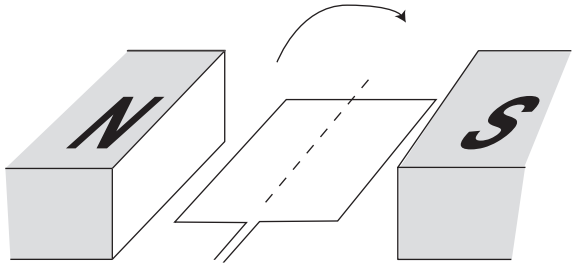
Position **A**



Position **B**



Position **C**



Position **D**

10.3 Which action will **not** increase the potential difference produced by a generator?

A Increasing the area of the coil

B Increasing the distance between the coil and the magnet

C Increasing the speed of rotation

D Increasing the strength of the magnetic field

10.4 A potential difference is induced across the ends of a coil.

This causes a current in the coil if the coil . . .

A is made of an insulating material.

B is made of a magnetic material.

C is part of a complete circuit.

D is stationary.

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 words from the list with the numbers.

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

Mark your choices on the answer sheet.

QUESTION ONE

In a circuit, the resistance of a component can change.

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

diode

filament lamp

LDR

thermistor

Description of resistance	Component
its resistance decreases when its temperature increases	**1**
its resistance decreases when the light intensity increases	**2**
its resistance increases when its temperature increases	**3**
its resistance is very high in the reverse direction	**4**

QUESTION TWO

This question is about some of the energy sources that we can use to generate electricity.

In the table, the column headed **Reliability** indicates whether electricity can always be supplied when it is needed.

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

coal

nuclear fuel

water behind a dam (hydroelectricity)

wind

Energy source	Capital cost of equipment (per kWh)	Fuel cost (per kWh)	Decommissioning cost (per kWh)	Reliability
1	high	low	high	good
2	high	zero	medium	good
3	medium	medium	low	good
4	high	zero	low	poor

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.

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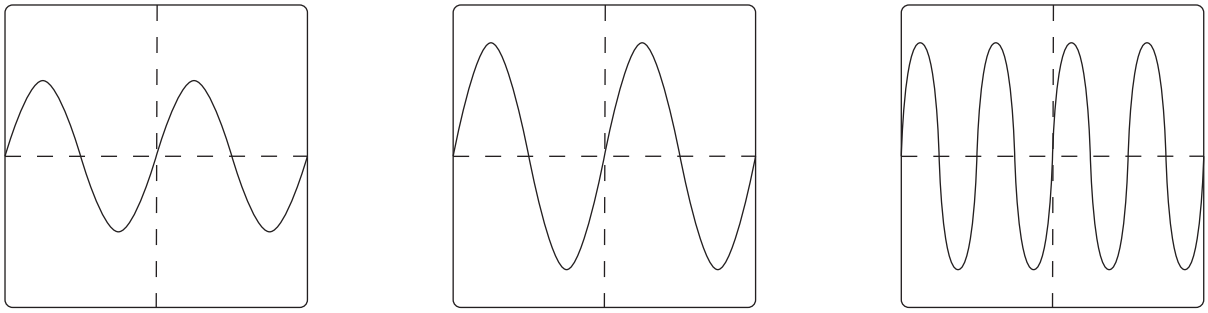
QUESTION THREE

The diagrams show the traces produced when three different a.c. supplies, **G**, **H**, and **J**, were connected to an oscilloscope. The settings of the oscilloscope were not changed. Time is on the horizontal axis.



G **H** **J**

Which **two** statements are correct?

G has the same frequency as H

G has the same peak voltage as H

G has the same peak voltage as J

H has the same frequency as J

H has the same peak voltage as J

QUESTION FOUR

Resistors are used in electrical circuits.

When the temperature of a resistor remains constant, which **two** statements are correct?

the current can only flow in one direction

the current is directly proportional to potential difference

the current is directly proportional to resistance

the current is directly proportional to temperature

the resistance remains constant

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.

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QUESTION FIVE

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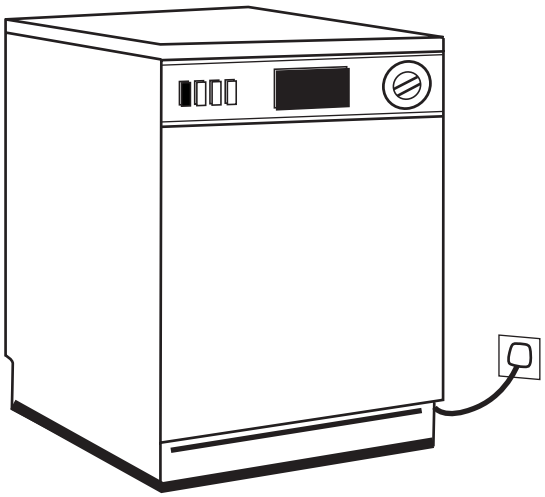

5.1 The dishwasher is designed to transfer electrical energy usefully as . . .

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B movement and heat.

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5.2 Which one of these wastes energy in the dishwasher?

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When this happens, the energy . . .

A can easily be used for other transfers.

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5.4 Another design of dishwasher is more efficient.

The more efficient dishwasher . . .

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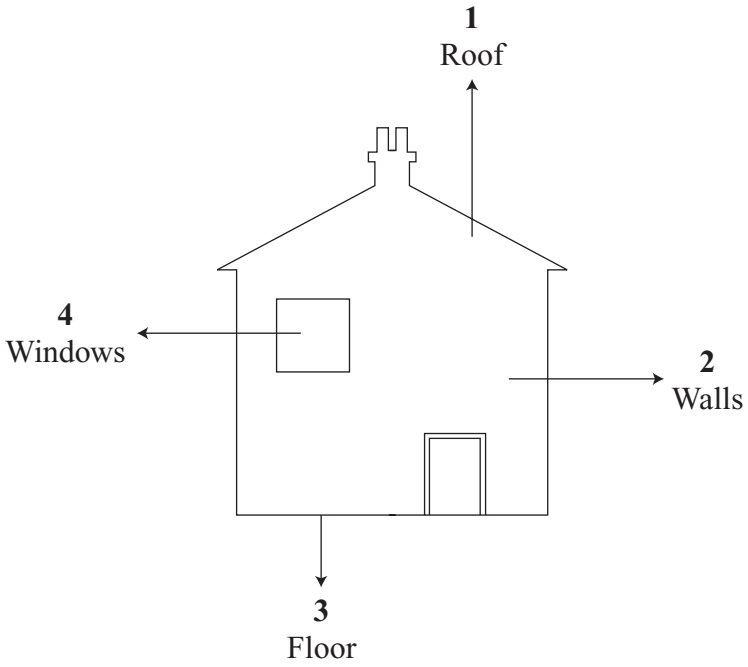
Turn over for the next question

QUESTION SIX

The diagram shows the main energy losses from a house.



6.1 Energy passes through a roof tile by . . .

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Turn over for the next question

QUESTION SEVEN

Generators are used to produce electricity.

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Electricity can be generated by:

- *rotating a coil of wire in a magnetic field*
- *rotating a magnet inside a coil of wire*
- *rotating two coils of wire next to each other*
- *rotating two magnets next to each other*

How many of these points are correct?

A None of them

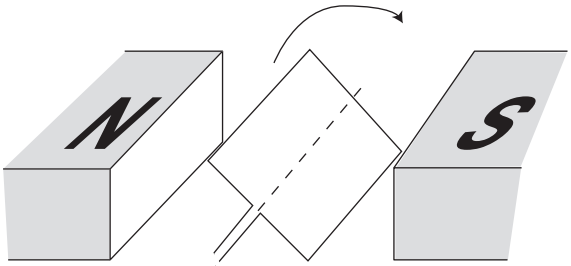
B Only the first two

C Only the last two

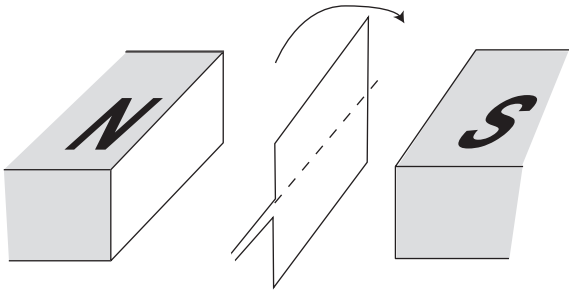
D All of them

7.2 A coil of wire rotates between the poles of a magnet. The diagram shows four positions of the coil.

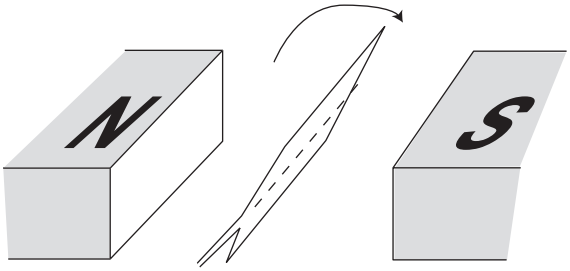
In which position, **A**, **B**, **C** or **D**, will the potential difference induced across the coil be greatest?



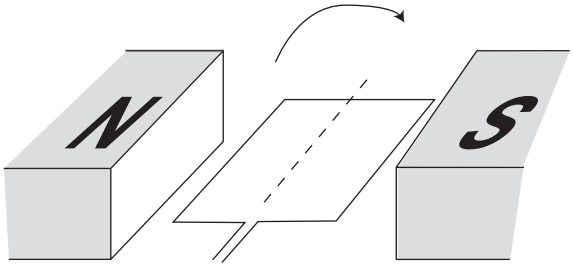
Position **A**



Position **B**



Position **C**



Position **D**

7.3 Which action will **not** increase the potential difference produced by a generator?

A Increasing the area of the coil

B Increasing the distance between the coil and the magnet

C Increasing the speed of rotation

D Increasing the strength of the magnetic field

7.4 A potential difference is induced across the ends of a coil.

This causes a current in the coil if the coil . . .

A is made of an insulating material.

B is made of a magnetic material.

C is part of a complete circuit.

D is stationary.

Turn over for the next question

QUESTION EIGHT

Various types of power station are used to generate electricity.

8.1 In some countries, where it is usually very sunny, solar energy is used to generate electricity. One design of power station uses mirrors to reflect heat radiation from the Sun. This is used to heat oil to a temperature of about 400 °C.

Suggest how hot oil is used to drive the turbines.

A It is allowed to flow from a high level to a low level.

B It is burned to heat water to make steam.

C It is passed through pipes and heats water to make steam.

D It is pumped through the turbines.

8.2 One type of power station uses a tidal barrage. One disadvantage is that it does not give a constant output. This is because the state of the tide varies during each day.

The height of the tide also varies . . .

A on a monthly cycle only.

B on a yearly cycle only.

C on both a monthly and a yearly cycle.

D randomly.

8.3 The time to start up power stations varies according to the fuel used.

Starting with the shortest time for start-up, which order is correct?

A	coal	oil	natural gas	nuclear
B	oil	nuclear	natural gas	coal
C	natural gas	oil	coal	nuclear
D	oil	coal	natural gas	nuclear

8.4 The electricity from some power stations is used during the night to pump water uphill into lakes. Later, the water is released and used to drive turbines.

What is the reason for this?

A At night the electricity is cheaper to produce.

B At night the demand for electricity is less and the water stores energy until it is needed.

C It prevents the lakes from becoming empty.

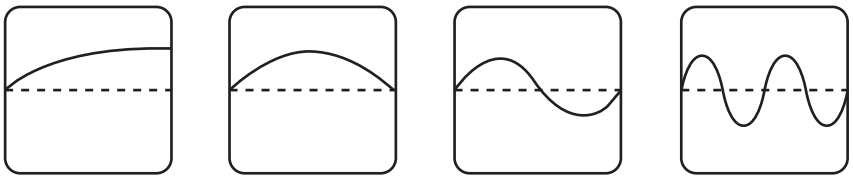
D There is a high demand for electricity at night and water can be released to meet the demand.

Turn over for the next question

QUESTION NINE

The mains electricity is usually an a.c. supply of about 230 V, frequency 50 Hz.

9.1 Each of these oscilloscope traces corresponds to 0.01 seconds.



Which trace, **A**, **B**, **C** or **D**, shows the 50 Hz mains supply?

9.2 The live and neutral mains wires carry the current.

Which statement is correct?

A The live and neutral voltages both alternate relative to earth.

B The live wire always has a positive voltage relative to earth.

C The neutral wire has a voltage close to zero relative to earth.

D The neutral wire has a voltage which is negative relative to earth.

9.3 Why are mains supplies a.c.?

A A fuse will operate with a.c., but not with d.c.

B The voltage can be changed easily, using transformers.

C They are generally much safer than d.c. mains supplies.

D They produce more energy than d.c. for the same voltage.

9.4 Why are a.c. supplies transmitted from power stations to local substations at very high voltages?

A High voltage transmission is safer than low voltage transmission.

B Local transformers can reduce the voltage to that needed by consumers.

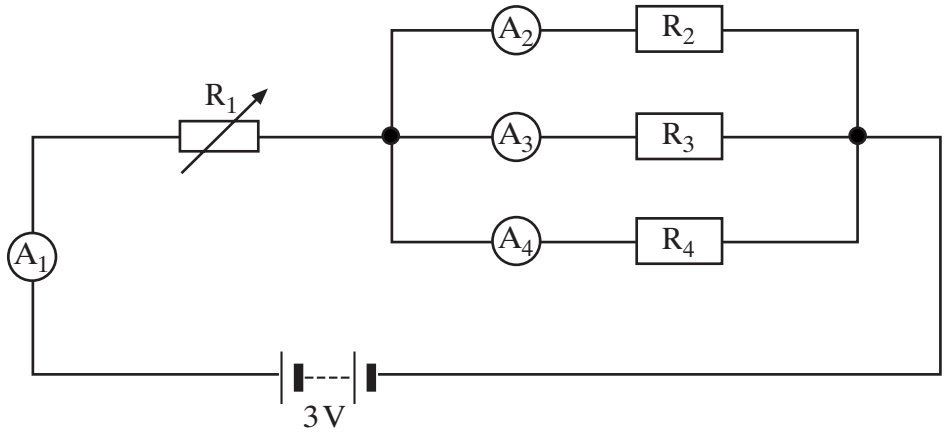
C Power stations produce electricity at very high voltages.

D The higher the voltage, the less energy is wasted in transmission.

Turn over for the next question

QUESTION TEN

The diagram shows a circuit including four resistors labelled R_1 to R_4 and four ammeters labelled A_1 to A_4.



The current flowing through A_1 is 3.2 A and through A_2 is 0.8 A.

10.1 What may ammeters A_3 and A_4 read?

	A_3	**A_4**
A	0.8 A	0.8 A
B	0.8 A	1.6 A
C	1.6 A	1.6 A
D	1.6 A	3.2 A

10.2 Across which two resistors is the potential difference certain to be the same?

A R_1 and R_2

B R_1 and R_3

C R_1 and R_4

D R_2 and R_4

The variable resistor is adjusted, and the reading on A_1 changes from 3.2 A to 1.6 A.

10.3 Ammeter A_2 now reads . . .

A 0.4 A

B 0.8 A

C 1.2 A

D 1.6 A

10.4 Which of the following statements correctly describes the changes in the potential differences when the variable resistor is altered in this way?

A The potential difference across R_1 is less and the potential difference across the other resistors is unchanged.

B The potential difference across R_1 is unchanged but the potential difference across the other resistors is less.

C The potential difference across R_1 is greater and the potential difference across the other resistors is less.

D The potential differences across all the resistors are unchanged.

END OF TEST

There are no questions printed on this page