Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
June 2003

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

Tuesday 24 June 2003 Morning Session

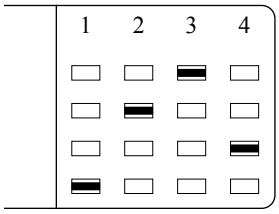
In addition to this paper you will require:
- an HB pencil and a rubber;
- an answer sheet.

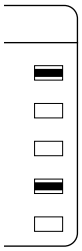
You may use a calculator.

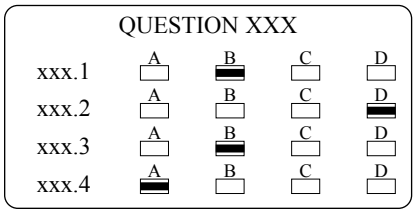
Time allowed: 30 minutes

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 and Electricity" printed on it.
- Attempt **one Tier only, either** the Foundation Tier **or** the Higher Tier.
- Answer **all** the questions for the Tier you are attempting.
- 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.
- Mark your responses on the separate answer sheet only. Rough work may be done on the question paper.
- Mark the best responses by using a thick pencil stroke to fill in the box. Use an HB pencil. Make sure the pencil stroke does **not** extend beyond the box. Do **not** use ink or ball-point pen. If you wish to change your answer, rub out your first answer completely.
  See below.

Examples:







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 rub 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

A CD player gets its energy from a battery. The battery supplies electrical energy.

The CD player transfers this electrical energy in different ways.

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

heat (thermal energy)

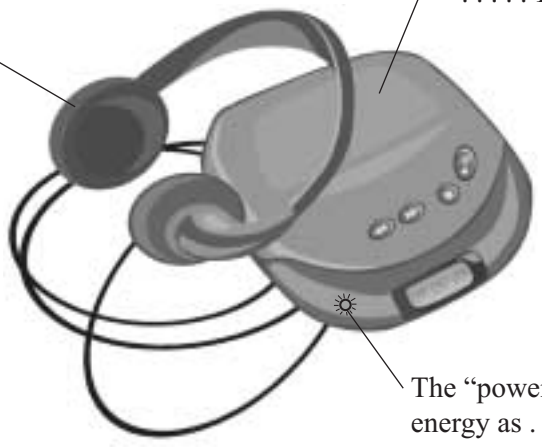
light

movement (kinetic energy)

sound

The earphones contain tiny loudspeakers. The loudspeakers transfer energy mainly as . . . . . **4** . . . . . .

An electric motor makes the CD go round. The motor transfers energy mainly as . . . . . **1** . . . . . .



The "power on" indicator transfers energy as . . . . . **2** . . . . . .

When the CD player is on, it becomes warm. This is because some energy is transferred as . . . . . **3** . . . . . .

QUESTION TWO

The photograph shows a wind turbine on a farm.

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

air

electricity

movement (kinetic energy)

sound

The turbine is driven by moving . . . . . **1** . . . . . .

The turbine transfers . . . . . **2** . . . . . to the generator.

The generator transfers energy to the farm as . . . . . **3** . . . . . .

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

TURN OVER FOR THE NEXT QUESTION

QUESTION THREE

Circuit diagrams use symbols to represent components.

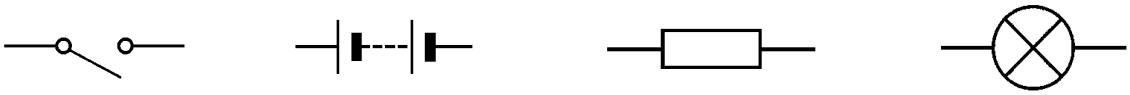
Match words from the list with each of the symbols **1–4**.

battery

lamp

resistor

switch



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

QUESTION FOUR

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

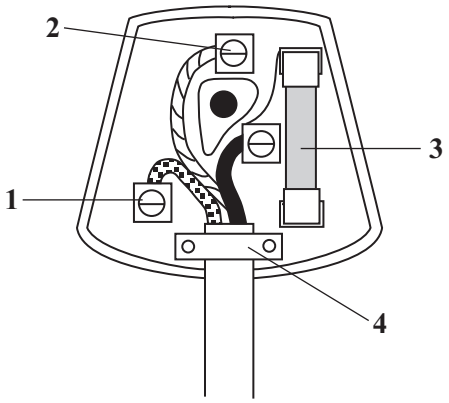
Match words from the list with each of the labels **1–4** on the diagram.

cable grip

earth pin

fuse

neutral pin



QUESTION FIVE

We can use renewable energy sources to generate electricity.

These energy sources do have disadvantages.

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

geothermal sites

solar cells

tidal barrages

wind farms

Energy source	Disadvantage
1	occur mainly in volcanic areas
2	destroy habitats of mud-living organisms
3	are usually on hills and may be unsightly
4	have a very high cost per Unit of electricity produced

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

When a wire carrying an electric current is placed in a magnetic field, it may experience a force.

What **two** things can be done to increase this force?

increase the current flowing through the wire

increase the resistance of the wire

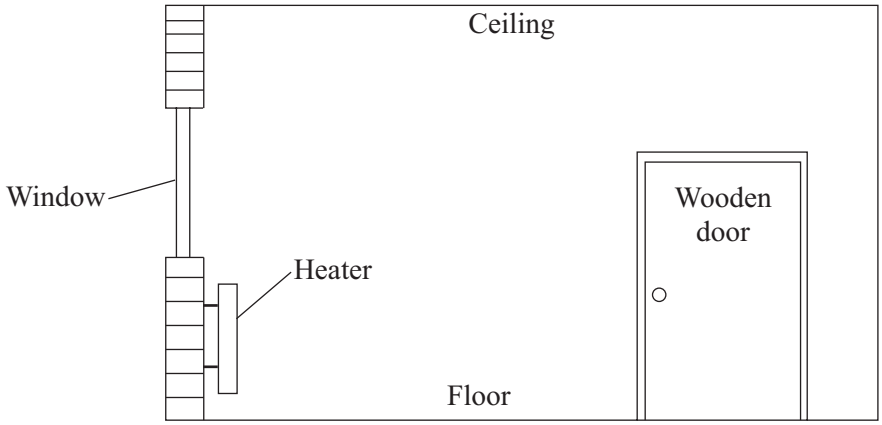
increase the strength of the magnetic field

reverse the current

reverse the magnetic field

QUESTION SEVEN

The diagram shows a room in a house.



Choose **two** things from the following list which would reduce the rate at which energy is lost from the room.

fit a metal door

fix shiny metal foil behind the heater

improve the ventilation in the room

increase the temperature in the room

lay a thick carpet on the floor

TURN OVER FOR THE NEXT QUESTION

SECTION C

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

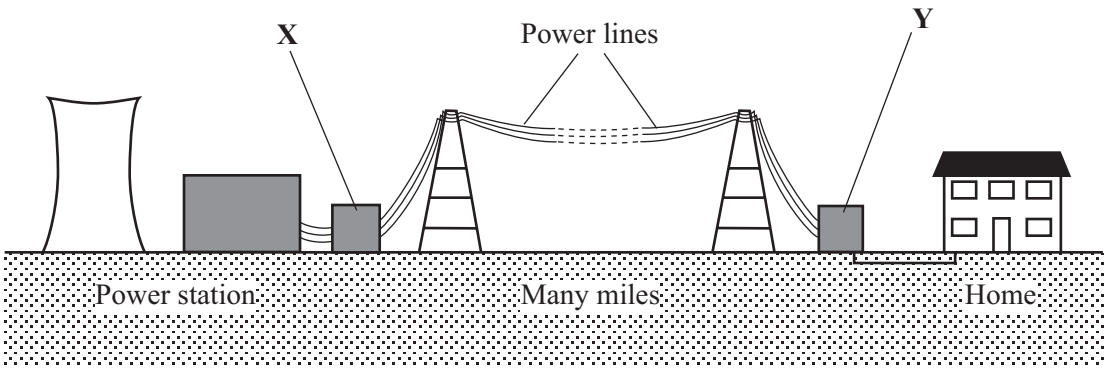
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows how electricity from power stations reaches our homes.



The voltage of the electricity is changed at points **X** and **Y**.

8.1 What is used to change the voltage?

A A circuit breaker

B A generator

C A motor

D A transformer

8.2 Which of the following statements is correct?

A The voltage is increased at both **X** and **Y**

B The voltage is increased at **X** and decreased at **Y**

C The voltage is decreased at **X** and increased at **Y**

D The voltage is decreased at both **X** and **Y**

8.3 The electric current used in **X** and **Y** . . . . .

A must be d.c.

B can be either a.c. or d.c.

C must be a.c.

D must be d.c. at **X** and a.c. at **Y**.

8.4 The power lines used to transmit electricity are called . . . . .

A the National Grid.

B nPower.

C Powergen.

D the World Wide Web.

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

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

9.1 During one day, a 2.5 kW appliance was used for 8 hours.

How many Units of electricity were used?

A 2.5

B 20.0

C 200.0

D 2000.0

9.2 During one day, a 3000 W appliance was used for 10 hours.

How many Units of electricity were used?

A 5

B 30

C 300

D 30 000

9.3 Each Unit of electricity costs 8 p.

How much does it cost to run a 500 W appliance for 4 hours?

A 16 p

B £1.60

C £10

D £160

9.4 The diagram shows the reading in Units on a household electricity meter at the start of a day.

0	**7**	**3**	**8**	**1**

During the day, the following appliances are used.

a 2 kW kettle for 30 minutes

a 100 W lamp for 20 hours

a 3 kW heater for 4 hours

a 1.5 kW oven for 2 hours

What is the reading on the electricity meter at the end of the day?

A 07363

B 07399

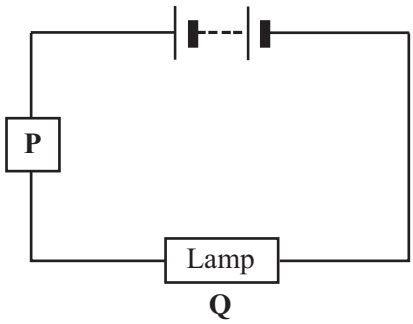
C 07458

D 09456

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

The diagram shows a device labelled **P** connected in series with a lamp labelled **Q**.



10.1 The current flowing through **P** is 0.4 A.

What is the current flowing through the lamp?

A Less than 0.4 A

B 0.4 A

C More than 0.4 A

D Not possible to say, unless its resistance is given

10.2 The voltage across the battery is 12 V.
The voltage across **P** is 4 V.

What is the voltage across the lamp?

A 0.4 V

B 8.0 V

C 12.0 V

D 16.0 V

10.3 What connections should be made to the lamp, to determine its resistance?

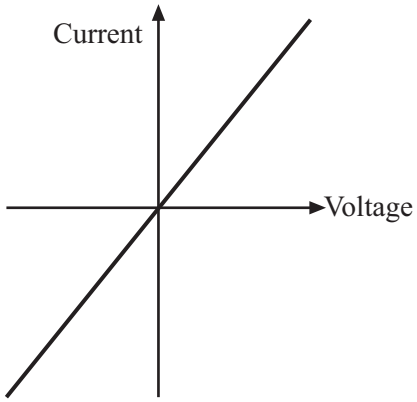
A An ammeter in parallel, and a voltmeter in parallel

B An ammeter in parallel, and a voltmeter in series

C An ammeter in series, and a voltmeter in parallel

D An ammeter in series, and a voltmeter in series

10.4 The graph shows how the current through **P** varies when the voltage across it is changed.



What is device **P**?

A A diode

B A filament lamp

C A fuse

D A resistor at constant temperature

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

We can use renewable energy sources to generate electricity.

These energy sources do have disadvantages.

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

geothermal sites

solar cells

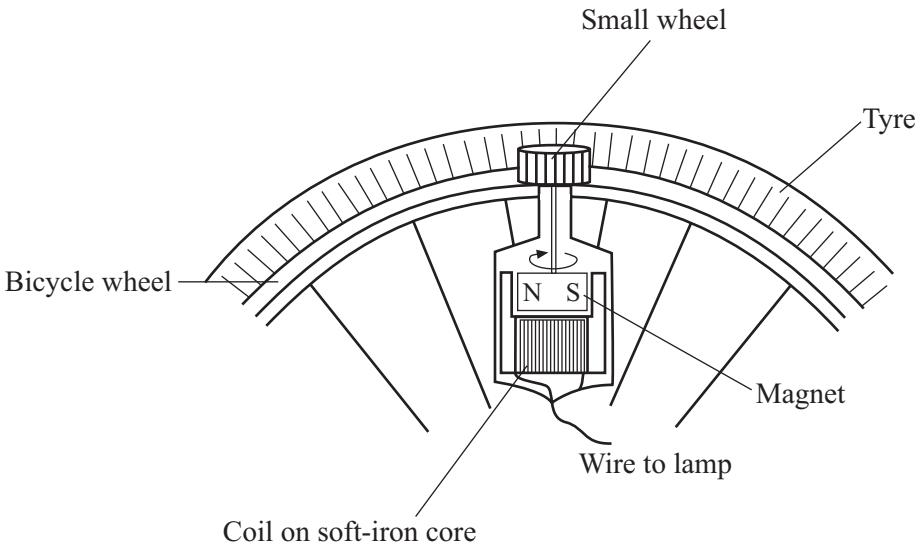
tidal barrages

wind farms

Energy source	Disadvantage
1	occur mainly in volcanic areas
2	destroy habitats of mud-living organisms
3	are usually on hills and may be unsightly
4	have a very high cost per Unit of electricity produced

QUESTION TWO

The diagram shows a bicycle dynamo.



The flow diagram is about how the dynamo works.

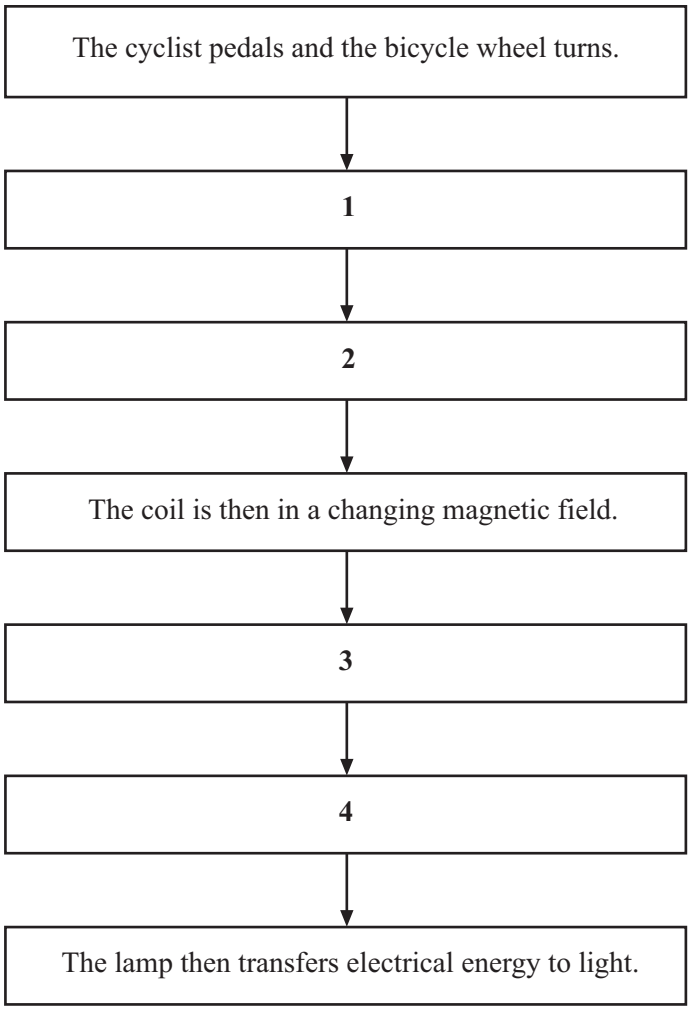
Choose sentences from the list to match boxes **1 – 4** in the flow diagram.

A voltage is induced across the coil.

The small wheel of the dynamo turns.

This spins the magnet near the coil.

This causes a current to flow.



TURN OVER FOR THE NEXT QUESTION

SECTION B

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

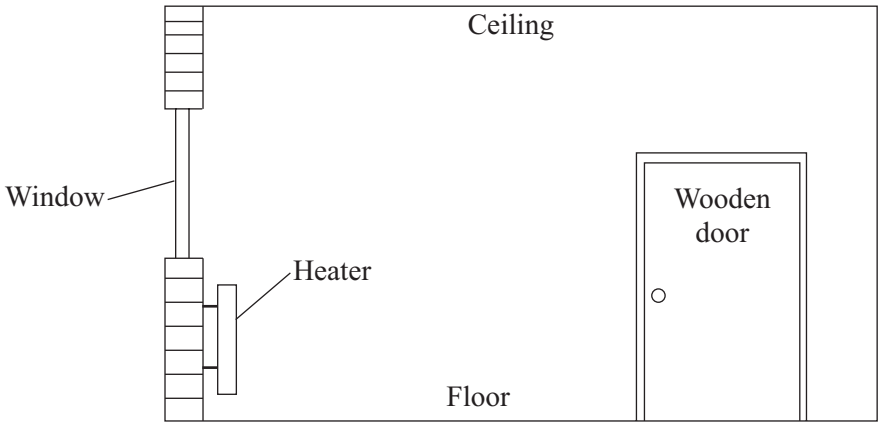
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

The diagram shows a room in a house.



Choose **two** things from the following list which would reduce the rate at which energy is lost from the room.

fit a metal door

fix shiny metal foil behind the heater

improve the ventilation in the room

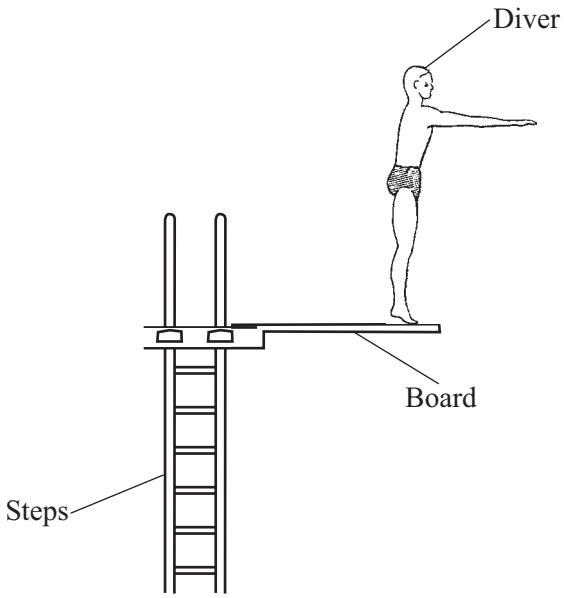
increase the temperature in the room

lay a thick carpet on the floor

QUESTION FOUR

A diver climbs some steps to a diving board.

The diagram shows the diver about to leave the diving board.



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

P	as the diver falls, gravitational potential energy is transferred to kinetic energy
Q	as the diver falls, kinetic energy is transferred to gravitational potential energy
R	the gravitational potential energy of the diver on the board is equal to the energy transferred to the diver when climbing the steps
S	the kinetic energy of the diver on the board is equal to the energy transferred to the diver when climbing the steps
T	when the diver hits the water, all the gravitational potential energy is regained

SECTION C

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

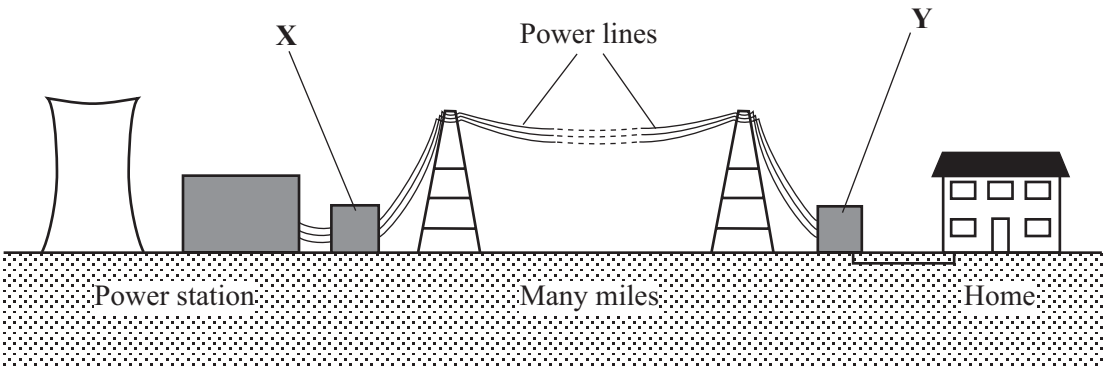
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram shows how electricity from power stations reaches our homes.



The voltage of the electricity is changed at points **X** and **Y**.

5.1 What is used to change the voltage?

A A circuit breaker

B A generator

C A motor

D A transformer

5.2 Which of the following statements is correct?

A The voltage is increased at both **X** and **Y**

B The voltage is increased at **X** and decreased at **Y**

C The voltage is decreased at **X** and increased at **Y**

D The voltage is decreased at both **X** and **Y**

5.3 The electric current used in **X** and **Y** . . . . .

A must be d.c.

B can be either a.c. or d.c.

C must be a.c.

D must be d.c. at **X** and a.c. at **Y**.

5.4 The power lines used to transmit electricity are called . . . . .

A the National Grid.

B nPower.

C Powergen.

D the World Wide Web.

TURN OVER FOR THE NEXT QUESTION

QUESTION SIX

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

6.1 During one day, a 2.5 kW appliance was used for 8 hours.

How many Units of electricity were used?

A 2.5

B 20.0

C 200.0

D 2000.0

6.2 During one day, a 3000 W appliance was used for 10 hours.

How many Units of electricity were used?

A 5

B 30

C 300

D 30 000

6.3 Each Unit of electricity costs 8 p.

How much does it cost to run a 500 W appliance for 4 hours?

A 16 p

B £1.60

C £10

D £160

6.4 The diagram shows the reading in Units on a household electricity meter at the start of a day.

0	**7**	**3**	**8**	**1**

During the day, the following appliances are used.

a 2 kW kettle for 30 minutes

a 100 W lamp for 20 hours

a 3 kW heater for 4 hours

a 1.5 kW oven for 2 hours

What is the reading on the electricity meter at the end of the day?

A 07363

B 07399

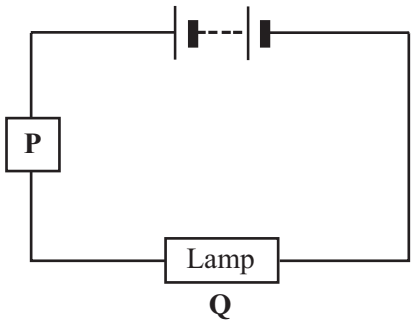
C 07458

D 09456

TURN OVER FOR THE NEXT QUESTION

QUESTION SEVEN

The diagram shows a device labelled **P** connected in series with a lamp labelled **Q**.



7.1 The current flowing through **P** is 0.4 A.

What is the current flowing through the lamp?

A Less than 0.4 A

B 0.4 A

C More than 0.4 A

D Not possible to say, unless its resistance is given

7.2 The voltage across the battery is 12 V.
The voltage across **P** is 4 V.

What is the voltage across the lamp?

A 0.4 V

B 8.0 V

C 12.0 V

D 16.0 V

7.3 What connections should be made to the lamp, to determine its resistance?

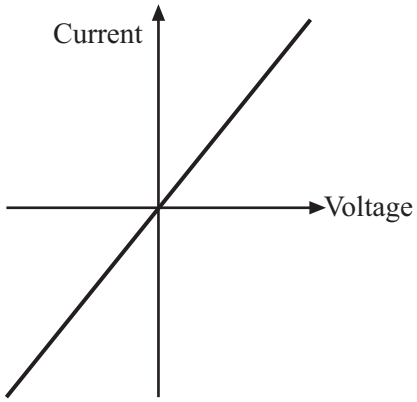
A An ammeter in parallel, and a voltmeter in parallel

B An ammeter in parallel, and a voltmeter in series

C An ammeter in series, and a voltmeter in parallel

D An ammeter in series, and a voltmeter in series

7.4 The graph shows how the current through **P** varies when the voltage across it is changed.



What is device **P**?

A A diode

B A filament lamp

C A fuse

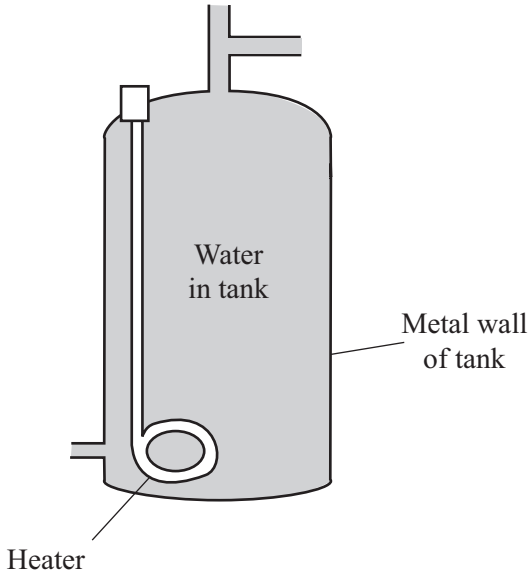
D A resistor at constant temperature

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

Many homes have hot-water tanks. An electric heater is used to heat the water.

Some heat (thermal energy) is lost through the metal walls to the surroundings.



8.1 The energy spreads through the water by . . . . .

A heated water contracting and falling.

B heated water expanding and rising.

C heat rising.

D the movement of free electrons.

8.2 The energy is transferred through the metal walls by . . . . .

A heated metal expanding and rising.

B infra red waves passing through the metal.

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

D the movement of free electrons.

8.3 The metal walls of the tank transfer energy to the surroundings by . . . . .

A heated air contracting and falling.

B infra red waves passing through the air.

C metal atoms gaining energy and escaping into the air.

D the movement of free electrons.

8.4 The air in contact with the metal walls . . . . .

A contracts and falls due to decreased density.

B contracts and falls due to increased density.

C expands and rises due to decreased density.

D expands and rises due to increased density.

TURN OVER FOR THE NEXT QUESTION

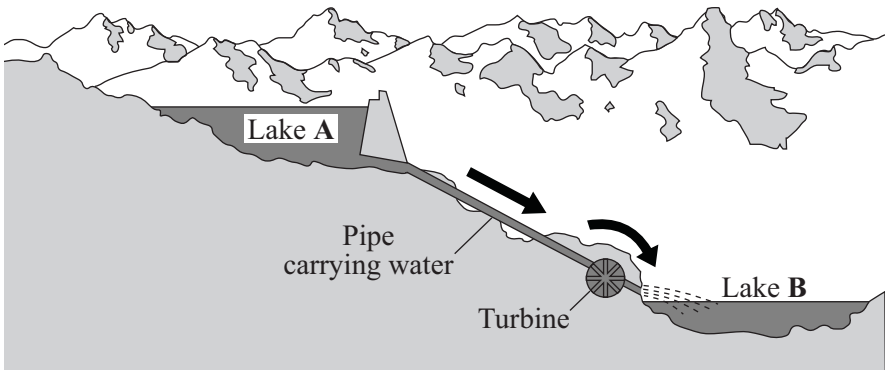
QUESTION NINE

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

Change in gravitational potential energy (joule, J) = weight (newton, N) × change in vertical height (metre, m)

On Earth, 1 litre of water weighs 10 N.

A hydroelectric power station uses two lakes, **A** and **B**.



9.1 When 6 litres of water fall from lake **A** to lake **B**, 1500 J are transferred.

How far has the water fallen?

A 2.5 m

B 25.0 m

C 250.0 m

D 2500.0 m

9.2 If the input power to the turbine is 1.5 kW, how long has it taken for the water to fall?

A 0.1 s

B 1.0 s

C 10.0 s

D 100.0 s

9.3 During the night, water can be pumped from the lower lake to the higher one.

This is useful because . . . . .

A the power station can then store the electricity generated, and use it at times of peak demand.

B the power station is unable to meet sudden demands, and generation costs are less at night.

C surplus electricity is generated elsewhere at night, and this is used to pump water to be stored.

D the demand is greater at night, and the water is needed at the top.

9.4 Another hydroelectric power station allows water to fall 20 m to the turbine.
Only 20% of the gravitational potential energy lost is transferred into electricity.

How many litres of water must fall in order to generate 4 kWh of electricity?

A 6000

B 72 000

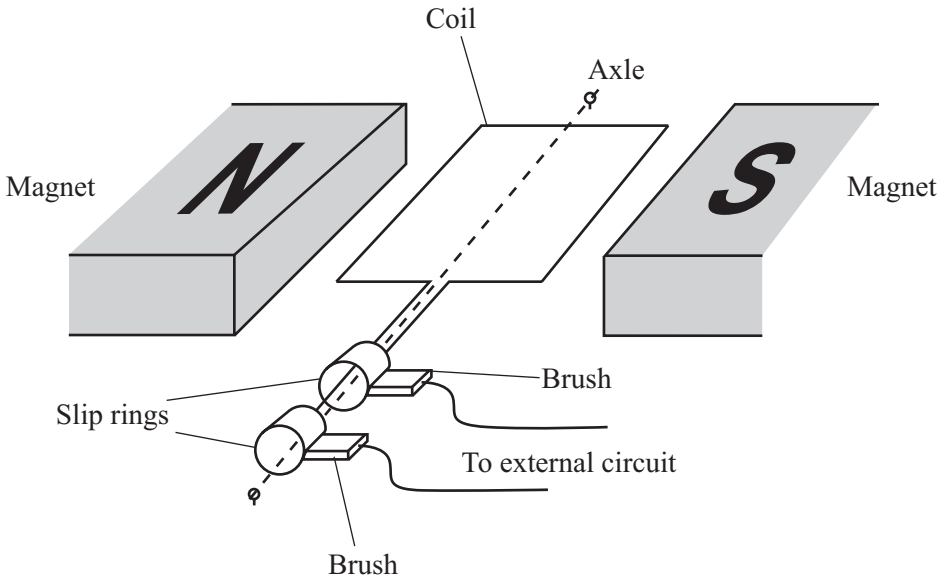
C 360 000

D 3 600 000

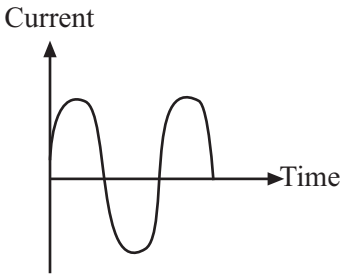
TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

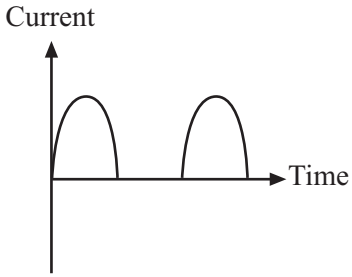
The diagram shows a generator.



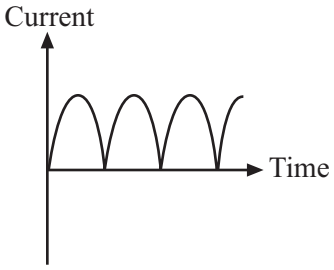
10.1 Which of the graphs shows how the current produced by the generator changes with time?



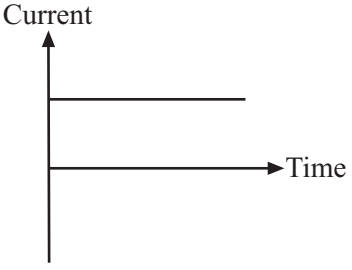
A



B



C



D

10.2 The coil rotates.

Which statement is **not** true?

A The coil cuts the magnetic field lines

B The coil experiences a changing magnetic field

C A voltage is induced across the end of the coil

D A voltage is induced in the slip rings

10.3 The slip rings . . . . .

A enable current to be fed into the coil.

B make sure that the current stays in the same direction.

C reverse the rotation of the coil every half turn.

D rotate with the coil.

10.4 Why are brushes used in a generator?

A To act as brakes to slow down the rotation of the coil

B To act as an insulator

C To carry current into the coil

D To enable current to be taken out of the coil

END OF TEST