Surname		Other Names	
Centre Number			Candidate Number								
Candidate Signature											

General Certificate of Secondary Education
Spring 2004

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Wednesday 3 March 2004 Morning Session

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

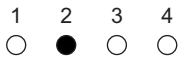
You may use a calculator.

Time allowed: 30 minutes

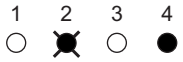
Instructions
- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title "Energy and Electricity" printed on it.
- Attempt **one Tier only**, **either** the Foundation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

Instructions for recording answers

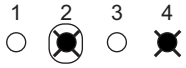
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 table gives the symbols of some components used in circuit diagrams.

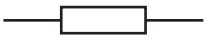
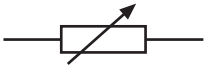
Match words from the list with the numbers **1–4** in the table.

fuse

resistor

thermistor

variable resistor

Component	Symbol
1	
2	
3	
4	

QUESTION TWO

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

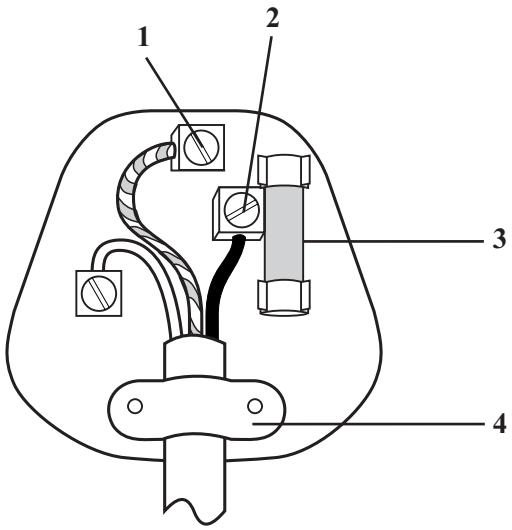
Match words from the list with the labels **1–4** on the diagram.

cable grip

earth terminal

fuse

live terminal



TURN OVER FOR THE NEXT QUESTION

QUESTION THREE

The table is about the resistance of different components.

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

diode

filament lamp

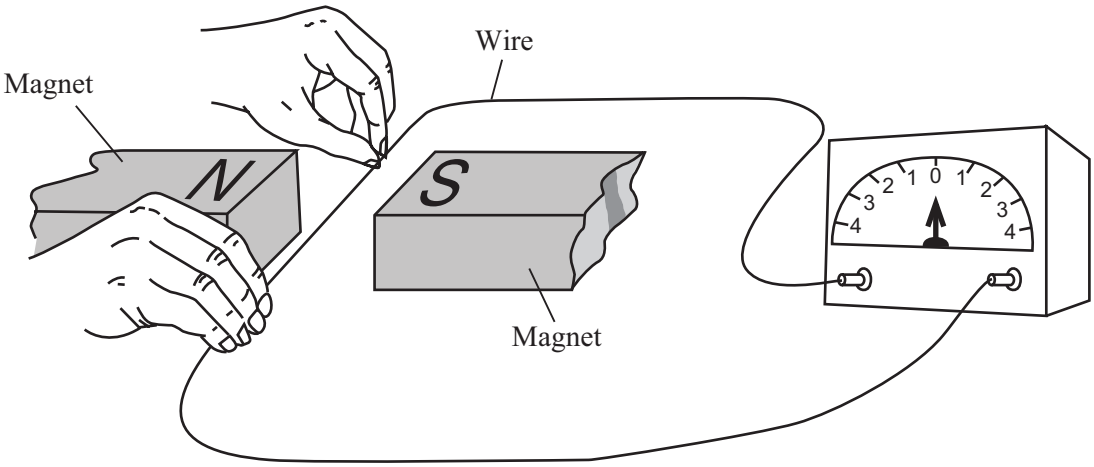
LDR

thermistor

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

QUESTION FOUR

The diagram shows a wire between the poles of a magnet.
The apparatus is often used to show how electricity may be produced.



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

current

magnetic field

potential difference (voltage)

wire

The . . . . . **1** . . . . . is moved downwards.

It passes through the . . . . . **2** . . . . . .

A . . . . . **3** . . . . . is induced between its ends.

If the wire is part of a circuit, a . . . . . **4** . . . . . flows.

QUESTION FIVE

Different types of power station affect the environment in different ways.

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

may cover farmland and forest with water

often on hills and can be unsightly

produces harmful waste gases

produces radioactive waste

Effect on the environment	Type of power station
1	coal-fired
2	hydroelectric
3	nuclear
4	wind farm

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

Solar cells produce electricity from the Sun's radiation.

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

P **electricity from solar cells is more expensive than electricity from non-rechargeable batteries**

Q **electricity from solar cells is used to heat water in panels on house roofs**

R **solar cells are often the best source of electricity in remote locations**

S **solar cells are often used in calculators**

T **solar cells will not work on cloudy days**

QUESTION SEVEN

Fuses are often used with electrical appliances.

Which **two** of the following statements, **P**, **Q**, **R**, **S** and **T** are **not** correct?

P **if a fault causes too large a current to flow, the fuse causes the circuit to break**

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 broken**

SECTION C

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

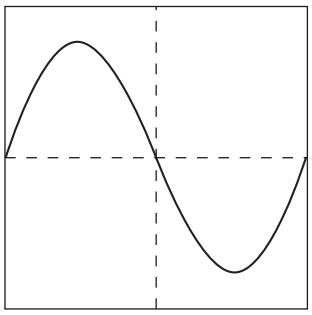
Each of these questions has four parts.

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

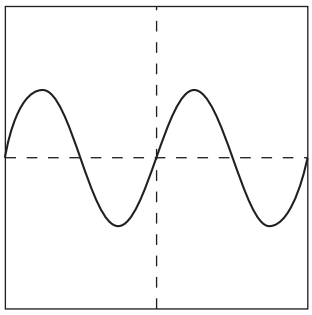
Mark your choices on the answer sheet.

QUESTION EIGHT

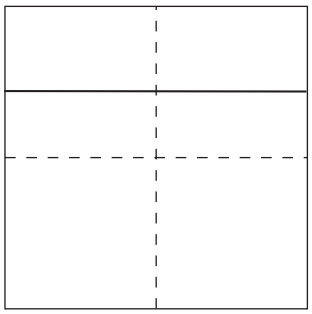
Four different power supplies, **P**, **Q**, **R** and **S**, are connected in turn to an oscilloscope.
The oscilloscope settings are not changed.
The traces are shown below.



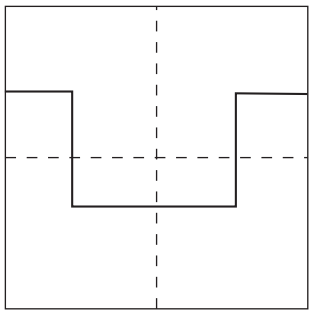
P



Q



R



S

8.1 Which of the power supplies has the greatest peak voltage?

A **P**

B **Q**

C **R**

D **S**

8.2 Which trace shows a d.c. supply?

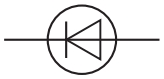
A **P**

B **Q**

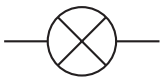
C **R**

D **S**

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

A 

B 

C 

D 

8.4 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

TURN OVER FOR THE NEXT QUESTION

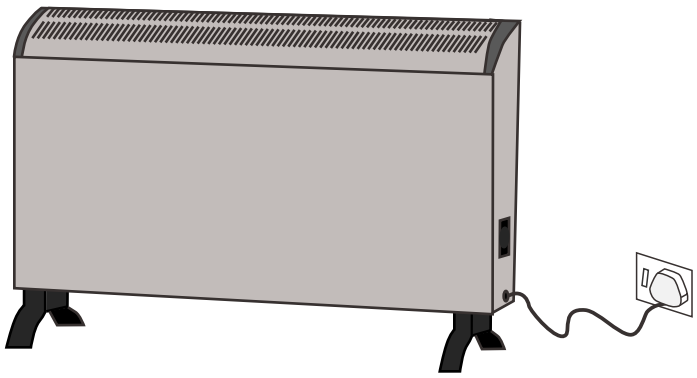
QUESTION NINE

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

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

total cost = number of Units × cost per Unit

The electrical heater shown in the diagram is rated at 3000 W.



9.1 During one day the heater was used for 6 hours.

How many Units of electricity were used?

A 18

B 300

C 500

D 18 000

9.2 Another heater is rated at 2.4 kW. It is used for 30 minutes.

How many Units of electricity are used?

A 1.2

B 7.2

C 72

D 4320

9.3 Each Unit of electricity costs 8 p.

How much does it cost to run a 100 W lamp for 40 hours?

A 20 p

B 32 p

C £ 3.20

D £ 320

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

During the day the following appliances are used:

a 100 W lamp for 10 hours
a 1.5 kW vacuum cleaner for 2 hours
a 2 kW kettle for 0.5 hours
a 3 kW heater for 4 hours

What will the reading on the electricity meter be at the end of the day?

A 67511

B 68510

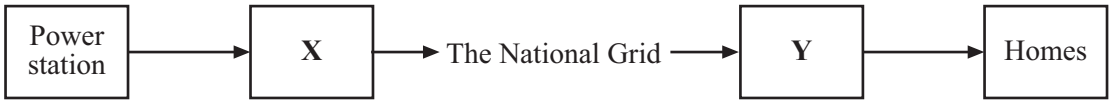
C 68544

D 69543

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

The diagram shows how electricity is transferred from a power station to homes.



10.1 The generator at the power station . . . . .

A can have a rotating magnet or a rotating coil to produce a.c.

B must have a coil rotating in a magnetic field to produce a.c.

C must have a magnet rotating inside a coil to produce a.c.

D produces only d.c.

10.2 The devices labelled **X** and **Y** are . . . . .

A circuit breakers.

B motors.

C transformers.

D turbines.

10.3 The device labelled **X** is used to . . . . .

A change a.c. to d.c.

B change d.c. to a.c.

C decrease the voltage.

D increase the voltage.

10.4 The device labelled **Y** is used to . . . . .

A change a.c. to d.c.

B change d.c. to a.c.

C decrease the voltage.

D increase the voltage.

END OF TEST

NO QUESTIONS APPEAR ON THIS PAGE

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.

The Foundation Tier starts 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

Different types of power station affect the environment in different ways.

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

may cover farmland and forest with water

often on hills and can be unsightly

produces harmful waste gases

produces radioactive waste

Effect on the environment	Type of power station
1	coal-fired
2	hydroelectric
3	nuclear
4	wind farm

QUESTION TWO

Convection currents are formed when liquids are heated.

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

decreases

increases

is unchanged

rises

When liquids are heated the particles gain kinetic energy.

The space between the particles in the liquid. . . . . **1** . . . . . so the density of the liquid . . . . . **2** . . . . . .

The warm liquid . . . . . **3** . . . . . .

The total mass of the liquid . . . . . **4** . . . . . .

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

Fuses are often used with electrical appliances.

Which **two** of the following statements, **P**, **Q**, **R, S** and **T**, are **not** correct?

P **if a fault causes too large a current to flow, the fuse causes the circuit to break**

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 broken**

QUESTION FOUR

This question is about some of the energy sources that are used to generate electricity.

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

P **gas-fired power stations can be started up more quickly than coal-fired power stations**

Q **gas-fired power stations cause more atmospheric pollution than coal-fired power stations**

R **power stations using renewable energy sources can never provide a constant supply of electricity**

S **the capital cost of power stations using renewable energy sources is often higher than for gas-fired power stations**

T **the fuel for nuclear power stations costs more per Unit of electricity produced than the fuel for oil-fired power stations**

TURN OVER FOR THE NEXT QUESTION

SECTION C

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

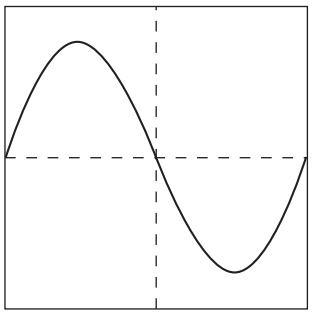
Each of these questions has four parts.

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

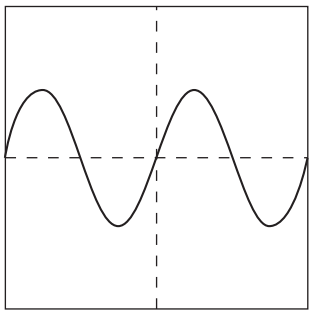
Mark your choices on the answer sheet.

QUESTION FIVE

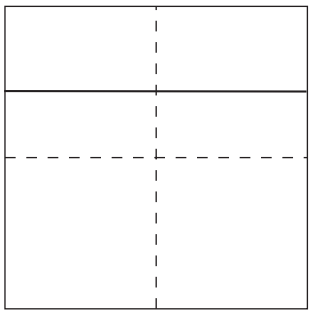
Four different power supplies, **P**, **Q**, **R** and **S**, are connected in turn to an oscilloscope.
The oscilloscope settings are not changed.
The traces are shown below.



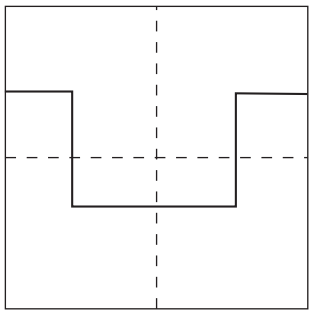
P



Q



R



S

5.1 Which of the power supplies has the greatest peak voltage?

A **P**

B **Q**

C **R**

D **S**

5.2 Which trace shows a d.c. supply?

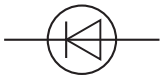
A **P**

B **Q**

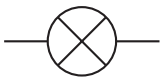
C **R**

D **S**

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

A 

B 

C 

D 

5.4 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

TURN OVER FOR THE NEXT QUESTION

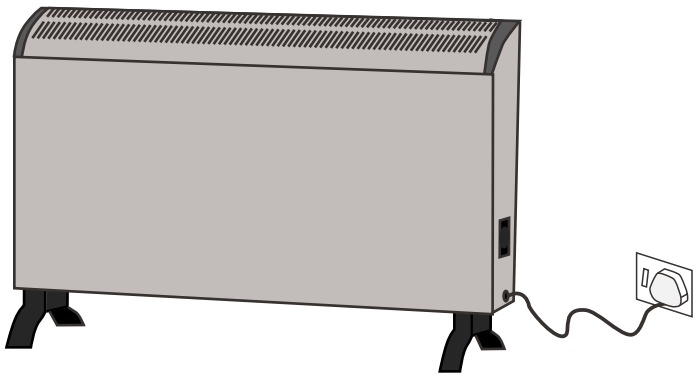
QUESTION SIX

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

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

total cost = number of Units × cost per Unit

The electrical heater shown in the diagram is rated at 3000 W.



6.1 During one day the heater was used for 6 hours.

How many Units of electricity were used?

A 18

B 300

C 500

D 18 000

6.2 Another heater is rated at 2.4 kW. It is used for 30 minutes.

How many Units of electricity are used?

A 1.2

B 7.2

C 72

D 4320

6.3 Each Unit of electricity costs 8 p.

How much does it cost to run a 100 W lamp for 40 hours?

A 20 p

B 32 p

C £ 3.20

D £ 320

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

During the day the following appliances are used:

a 100 W lamp for 10 hours
a 1.5 kW vacuum cleaner for 2 hours
a 2 kW kettle for 0.5 hours
a 3 kW heater for 4 hours

What will the reading on the electricity meter be at the end of the day?

A 67511

B 68510

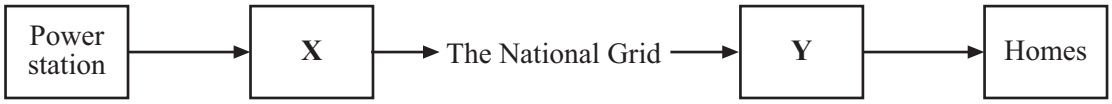
C 68544

D 69543

TURN OVER FOR THE NEXT QUESTION

QUESTION SEVEN

The diagram shows how electricity is transferred from a power station to homes.



7.1 The generator at the power station . . . . .

A can have a rotating magnet or a rotating coil to produce a.c.

B must have a coil rotating in a magnetic field to produce a.c.

C must have a magnet rotating inside a coil to produce a.c.

D produces only d.c.

7.2 The devices labelled **X** and **Y** are . . . . .

A circuit breakers.

B motors.

C transformers.

D turbines.

7.3 The device labelled **X** is used to . . . . .

A change a.c. to d.c.

B change d.c. to a.c.

C decrease the voltage.

D increase the voltage.

7.4 The device labelled **Y** is used to . . . . .

A change a.c. to d.c.

B change d.c. to a.c.

C decrease the voltage.

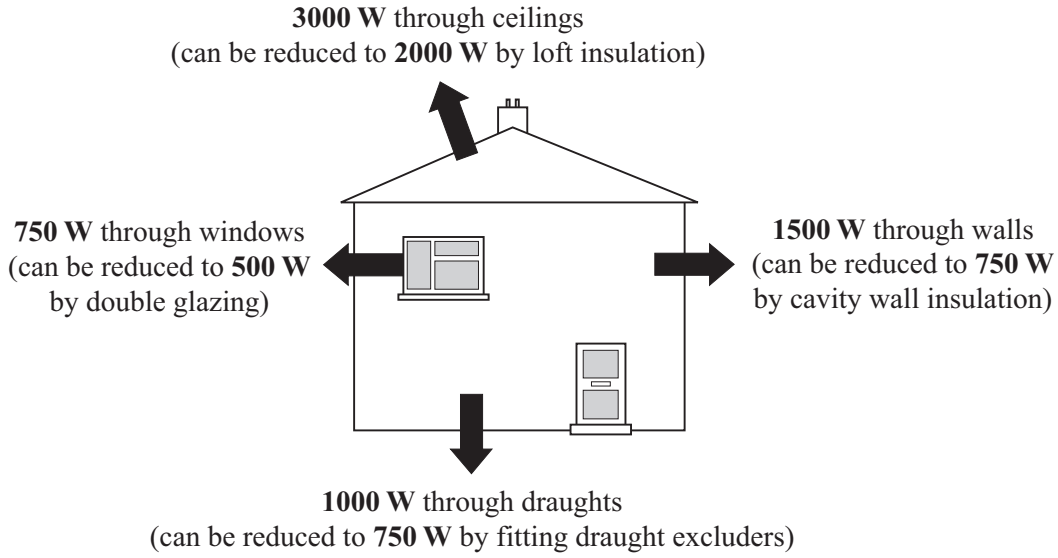
D increase the voltage.

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

The diagram shows some of the ways that heat can be lost from the inside of a house. It also shows how these heat losses may be reduced.
The table shows the cost of reducing the heat loss, how much money can be saved and the pay-back time.



Way of reducing heat loss	Cost	Money saved per year	Pay-back time
cavity wall insulation	£675		5 years
double glazing	£2250	£45	50 years
draught excluders	£15	£45	
loft insulation	£360	£180	2 years

8.1 How much money is saved each year if cavity wall insulation is fitted?

A £135

B £670

C £680

D £3375

8.2 What is the pay-back time if draught excluders are fitted?

A 3 months

B 4 months

C 3 years

D 4 years

8.3 The house owner spends £375 on **two** ways of reducing heat loss.

By what percentage can they expect the total heat loss to be reduced?

A 20%

B 31%

C 44%

D 69%

8.4 Which way of reducing heat loss gives the greatest reduction as a percentage of the total heat loss?

A Cavity wall insulation

B Double glazing

C Draught excluders

D Loft insulation

QUESTION NINE

The table gives four different energy sources and the estimated costs, per Unit, of generating electricity for each one.
Use the information in the table to help you answer the questions below.

Energy source	Building cost	Fuel cost	Operating cost	Decommissioning cost
Coal	2.0p	0.3p	0.7p	0.1p
Gas	2.3p	1.1p	0.3p	0.1p
Nuclear	4.2p	0.4p	0.7p	2.5p
Wind	2.8p	zero	0.9p	0.2p

9.1 Which of the following is the correct order (cheapest first) for the total cost of producing one Unit of electricity?

A Coal, gas, wind, nuclear

B Gas, coal, nuclear, wind

C Nuclear, wind, gas, coal

D Wind, gas, coal, nuclear

9.2 Considering only costs, which type of power station would be the best to run continuously to meet a steady demand?

A Coal

B Gas

C Nuclear

D Wind

9.3 Which type of power station is the best for meeting short surges in demand for electricity?

A Coal

B Gas

C Nuclear

D Wind

9.4 Electricity from wind farms costs more to produce than electricity from fossil fuel power stations. This is mainly because wind generators . . . . .

A are usually on hills and are unsightly.

B destroy farmland and forests, which may result in compensation payments to land owners.

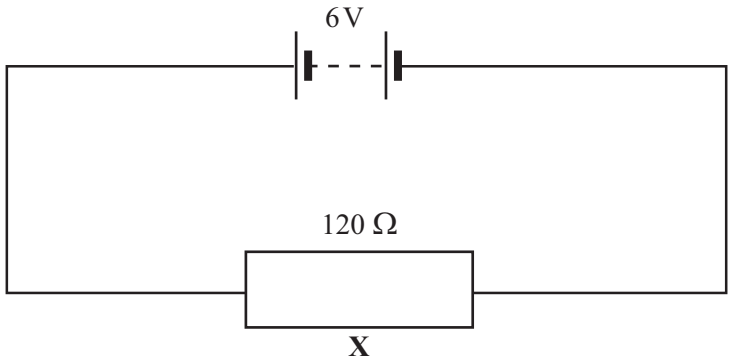
C have higher de-commissioning costs.

D use a dilute energy source and therefore need hundreds of wind turbines to produce as much electricity as a fossil fuel power station.

TURN OVER FOR THE NEXT QUESTION

QUESTION TEN

A 120 ohm resistor, **X**, is connected to a 6 volt battery as shown in the diagram.



10.1 The battery consists of 1.5 V cells connected in series. The number of cells needed is . . . . .

A 2

B 3

C 4

D 9

10.2 What current flows through **X**?

A 0.05 A

B 20 A

C 114 A

D 720 A

10.3 Another 120 ohm resistor is connected in series with **X**.

The current now flowing through **X** is . . . . .

A less than half the current flowing when only **X** was connected.

B half the current flowing when only **X** was connected.

C the same as the current flowing when only **X** was connected.

D twice the current flowing when only **X** was connected.

10.4 The second resistor is now connected in parallel with **X**, instead of in series.

The current flowing through **X** is now . . . . .

A less than half the current flowing when only **X** was connected.

B half the current flowing when only **X** was connected.

C the same as the current flowing when only **X** was connected.

D twice the current flowing when only **X** was connected.

END OF TEST

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