Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Spring 2003

SCIENCE: DOUBLE AWARD (MODULAR) 346010
SCIENCE: PHYSICS (MODULAR)
Electricity (Module 10)

Wednesday 5 March 2003 Morning Session

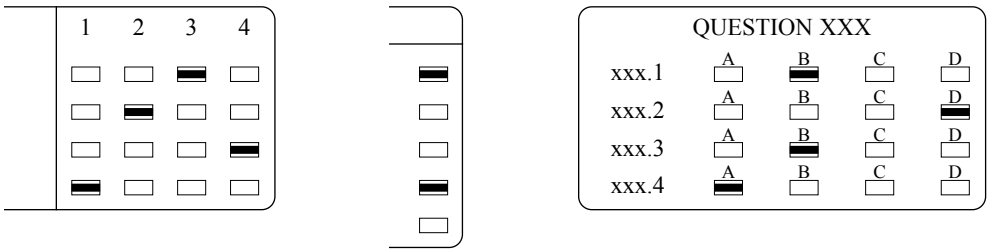
In addition to this paper you will require:
- an HB pencil and a rubber;
- an answer sheet.

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 "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.

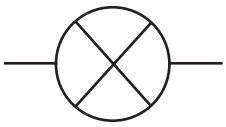
Use **each** answer only **once**.

Mark your choices on the answer sheet.

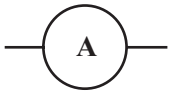
QUESTION ONE

Symbols are used in circuit diagrams.

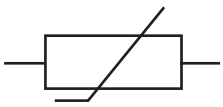
Match the names from the list with each of the symbols **1–4**.



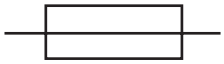
1



2



3



4

ammeter

fuse

lamp

thermistor

QUESTION TWO

This question is about the 3-pin plug used with the mains electricity supply.

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

earth

live

neutral

rating

A fuse with the correct . . . . . **1** . . . . . should always be used.

The blue wire is attached to the . . . . . **2** . . . . . terminal.

The green/yellow wire is attached to the . . . . . **3** . . . . . terminal.

The brown wire is attached to the . . . . . **4** . . . . . terminal through the fuse.

QUESTION THREE

The diagram shows one way in which electricity can be generated.

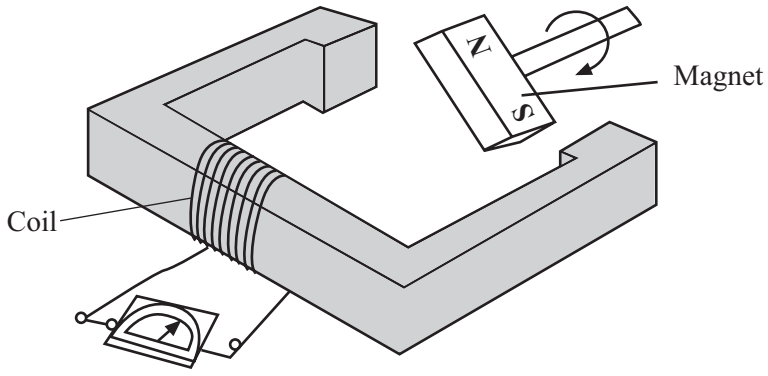
Match the words in the list with each of the spaces **1–4** in the sentences.

coil

current

field

magnet



The . . . . . **1** . . . . . is rotated.

This causes a changing magnetic . . . . . **2** . . . . . .

A voltage is induced across the . . . . . **3** . . . . . , causing a . . . . . **4** . . . . . in the circuit.

QUESTION FOUR

This question is about an electric iron.

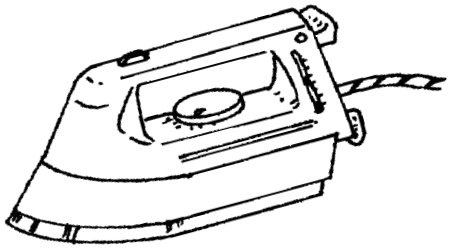
Match the quantities in the list with each of the spaces **1–4** in the sentences.

4 amps

50 hertz

230 volts

920 watts



The electric iron uses the mains supply of . . . . . **1** . . . . . .

The mains supply has a frequency of . . . . . **2** . . . . . .

The power rating of the iron is . . . . . **3** . . . . . .

The current taken by the iron is . . . . . **4** . . . . . .

QUESTION FIVE

Photocopiers form a picture by using static electricity.

The boxes explain how a photocopier works.

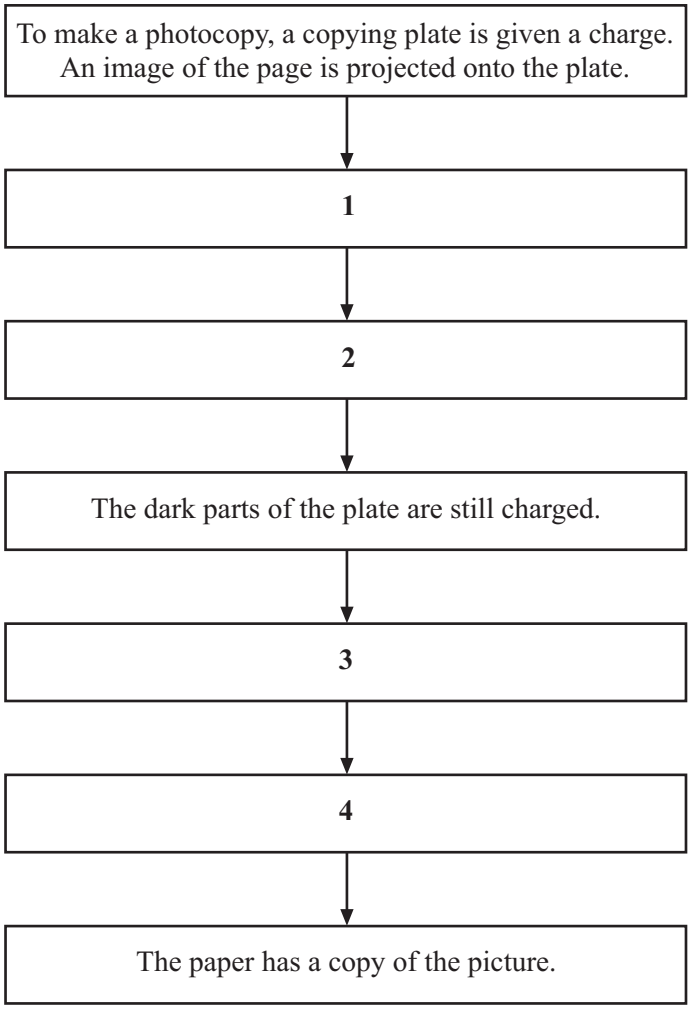
Choose sentences **P**, **Q**, **R** and **S** from the list to fill the boxes **1–4**.

P **Dark patches on the plate attract particles of black powder.**

Q **Light on the plate makes electrical charges leak away.**

R **The plate has light and dark patches from the image.**

S **The powder is transferred to the paper.**



SECTION B

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

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

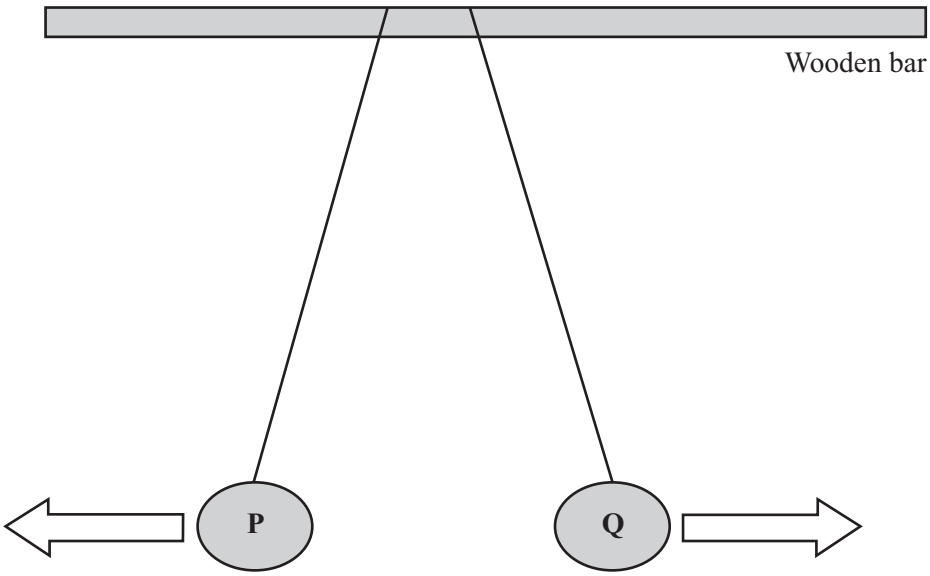
Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

Electrically charged objects exert a force on other objects.

The diagram shows two polystyrene balls labelled **P** and **Q**. They are pushing each other apart.

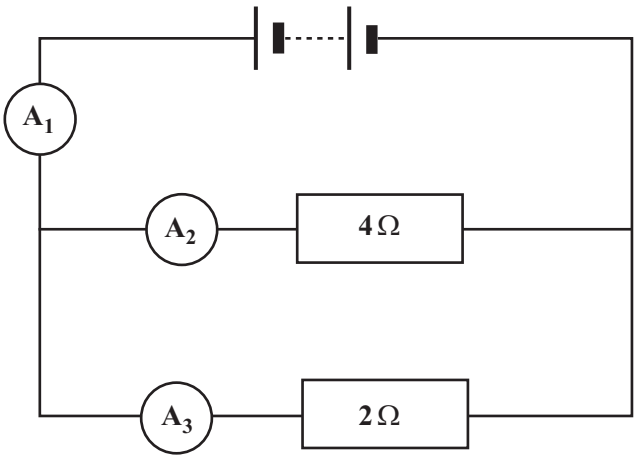


Which **two** lines in the table describe how **P** and **Q** might be charged?

	Charge on P	**Charge on Q**
1	uncharged	uncharged
2	negative	negative
3	positive	positive
4	negative	positive
5	negative	none

QUESTION SEVEN

The circuit has three identical ammeters, $\mathbf{A_1}$, $\mathbf{A_2}$ and $\mathbf{A_3}$.



Which **two** statements, **J**, **K**, **L**, **M** or **N**, are correct?

J **all the ammeters have the same reading**

K **the reading on ammeter A_3 is greater than that on A_2**

L **the reading on ammeter A_2 is greater than that on A_3**

M **the reading on ammeter A_2 is identical to that on A_3**

N **the reading on ammeter A_1 is the sum of the readings on A_2 and A_3**

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.

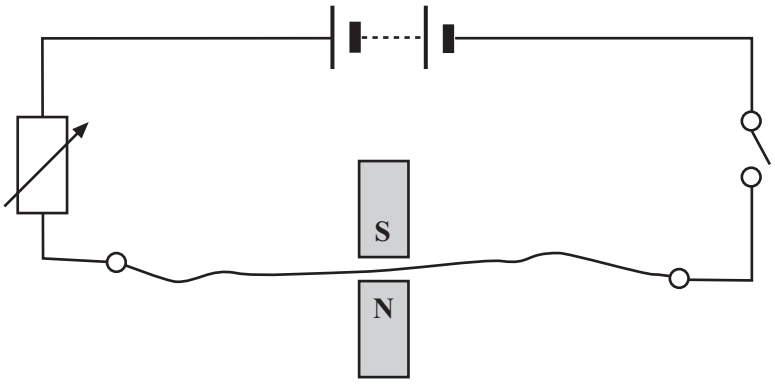
Mark your choices on the answer sheet.

QUESTION EIGHT

When a wire carrying a current is placed in a magnetic field, the wire moves.

The diagram shows a wire in a circuit. Magnets are placed on either side of the wire.

When the current is switched on, the wire moves up.



8.1 This experiment is repeated with an increased current.

What happens to the wire now?

A It moves down

B It moves exactly as before

C It moves further upwards than before

D It moves more slowly than before

8.2 The current can be increased in several ways.

Which of these would **never** make the current bigger?

A Adding more cells

B Adjusting the variable resistor

C Shortening the wire

D Using stronger magnets

8.3 The original experiment is repeated, but the current is now made to flow in the opposite direction.

How does the wire move now?

A It moves down

B It moves exactly as before

C It moves more quickly than before

D It moves more slowly than before

8.4 How can the current be reversed?

A By reversing the battery

B By reversing the magnetic poles

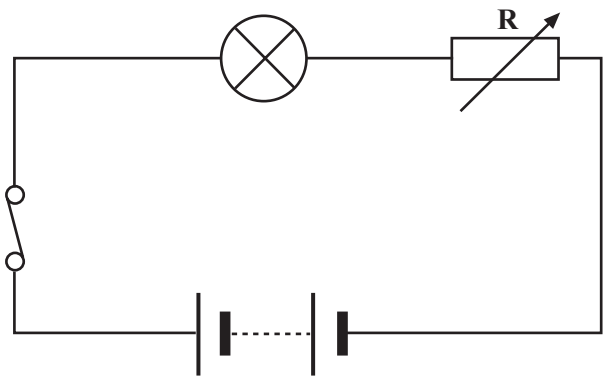
C By reversing the switch

D By reversing the variable resistor

TURN OVER FOR THE NEXT QUESTION

QUESTION NINE

The circuit shows a lamp of resistance 6 ohms, connected in series with a variable resistor **R**, a battery and a switch. When we set **R** to zero and close the switch, the current through the lamp is 2 A.



9.1 What is the potential difference (voltage) across the battery?

A 0.33 V

B 3 V

C 12 V

D 24 V

9.2 The battery is now changed to one of 10 V and **R** is increased from zero to exactly the same resistance as the lamp.

What will be the new potential difference (voltage) across the lamp?

A 5 V

B 6 V

C 10 V

D 20 V

9.3 **R** is now increased gradually from zero.

The resistance of the lamp will . . . . .

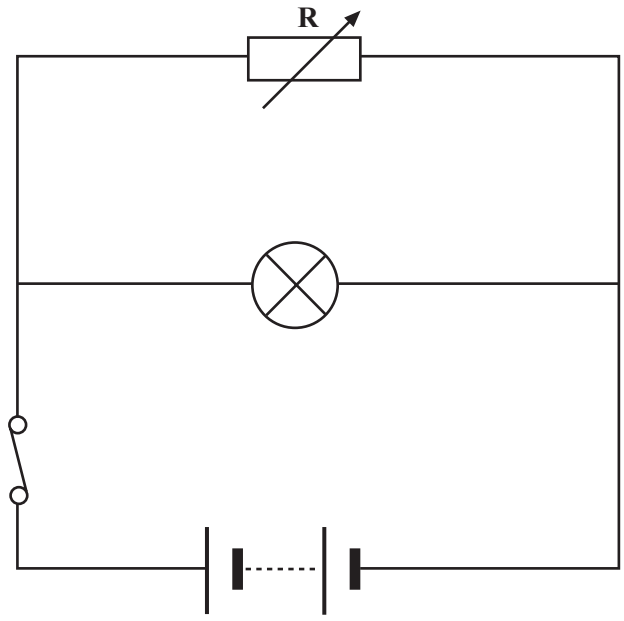
A fall because the current in the lamp will be higher.

B fall because the lamp will get cooler.

C rise because the lamp will get hotter.

D stay the same because the battery voltage is constant.

9.4 The circuit is now changed, so that the variable resistance **R** is in parallel with the lamp.



What will be the potential difference (voltage) across the lamp?

A Double that across the battery

B Half that across the battery

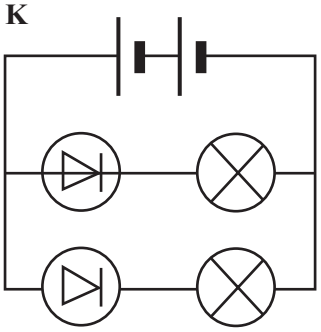
C It depends on the value of **R**

D The same as that across the battery

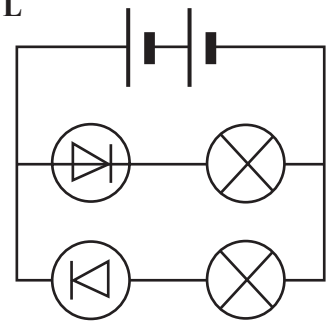
QUESTION TEN

All the cells, lamps and diodes in these circuits are identical. Decide which lamps light in the different arrangements before you answer the questions.

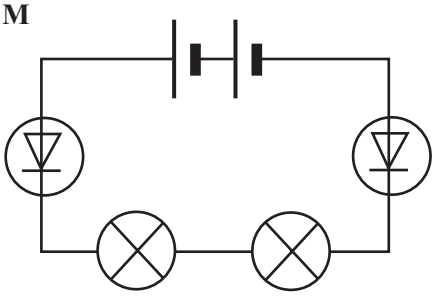
K



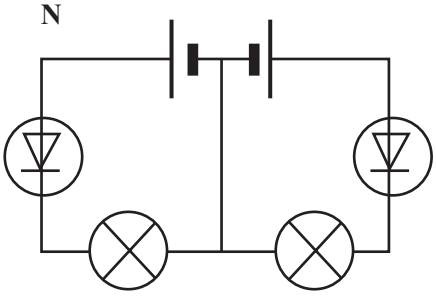
L



M



N



10.1 Neither lamp lights in . . . . .

A circuit **K** only.

B circuits **K**, **L** and **M**.

C circuits **M** and **N**.

D circuit **M** only.

10.2 Only one lamp lights in . . . . .

A circuit **K** only.

B circuits **K** and **M**.

C circuits **L** and **N**.

D circuit **L** only.

10.3 Both lamps light in . . . . .

A circuit **K** only.

B circuits **K** and **N**.

C circuits **L** and **M**.

D circuit **M** only.

10.4 In which circuit do the cells run down most quickly?

A Circuit **K**

B Circuit **L**

C Circuit **M**

D Circuit **N**

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

Photocopiers form a picture by using static electricity.

The boxes explain how a photocopier works.

Choose sentences **P**, **Q**, **R** and **S** from the list to fill the boxes **1 – 4**.

P **Dark patches on the plate attract particles of black powder.**

Q **Light on the plate makes electrical charges leak away.**

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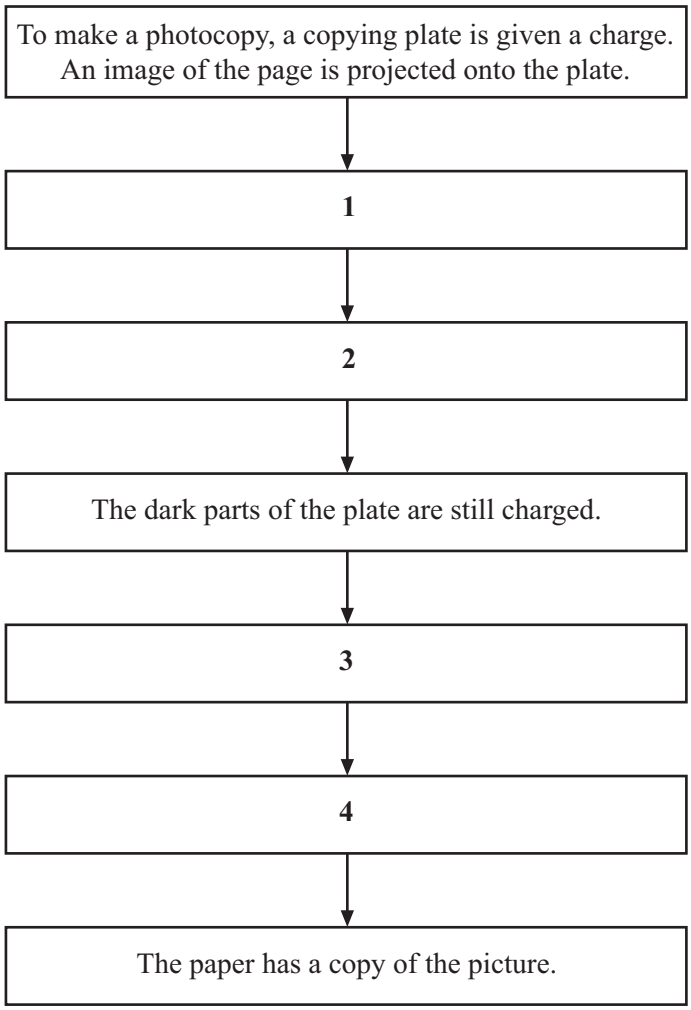


TURN OVER FOR THE NEXT QUESTION

QUESTION TWO

An electric current is a flow of charge.

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

electrodes

electrons

insulators

ions

	Property
1	these do not allow charged particles to flow through them
2	these are used to attract charged particles during electrolysis
3	these always have a negative charge
4	these may have a negative charge or a positive charge

SECTION B

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

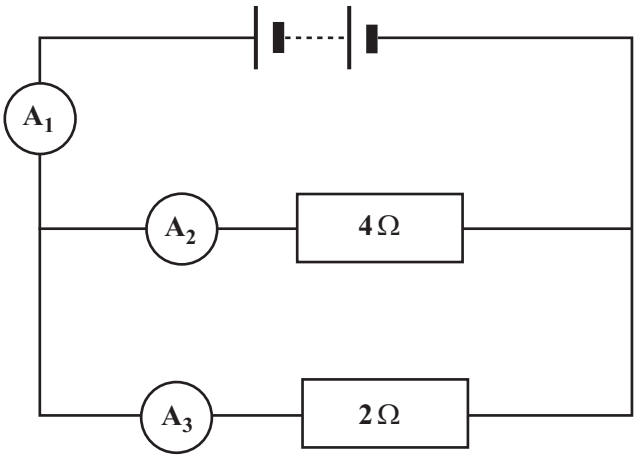
In these questions choose the best **two** answers.

Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION THREE

The circuit has three identical ammeters, $\mathbf{A_1}$, $\mathbf{A_2}$ and $\mathbf{A_3}$.



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M **the reading on ammeter A_2 is identical to that on A_3**

N **the reading on ammeter A_1 is the sum of the readings on A_2 and A_3**

QUESTION FOUR

An electric heater has this information printed on the back.

230 volts	**50 Hz**
2000 watts	

Which are the **two** correct conclusions from this information?

the current through the heater is about 0.1 A

the heater must be earthed

the heater transfers 2000 J of energy every second

the heater will not work if the voltage drops to 220 V

the resistance of the heater is about 26.5 Ω

SECTION C

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

Each of these questions has four parts.

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

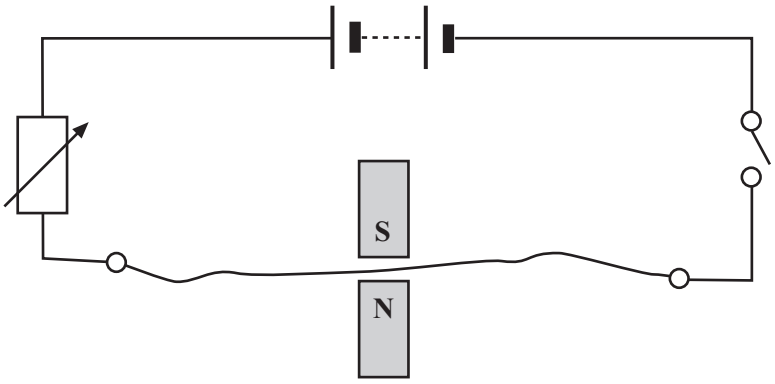
Mark your choices on the answer sheet.

QUESTION FIVE

When a wire carrying a current is placed in a magnetic field, the wire moves.

The diagram shows a wire in a circuit. Magnets are placed on either side of the wire.

When the current is switched on, the wire moves up.



5.1 This experiment is repeated with an increased current.

What happens to the wire now?

A It moves down

B It moves exactly as before

C It moves further upwards than before

D It moves more slowly than before

5.2 The current can be increased in several ways.

Which of these would **never** make the current bigger?

A Adding more cells

B Adjusting the variable resistor

C Shortening the wire

D Using stronger magnets

5.3 The original experiment is repeated, but the current is now made to flow in the opposite direction.

How does the wire move now?

A It moves down

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C It moves more quickly than before

D It moves more slowly than before

5.4 How can the current be reversed?

A By reversing the battery

B By reversing the magnetic poles

C By reversing the switch

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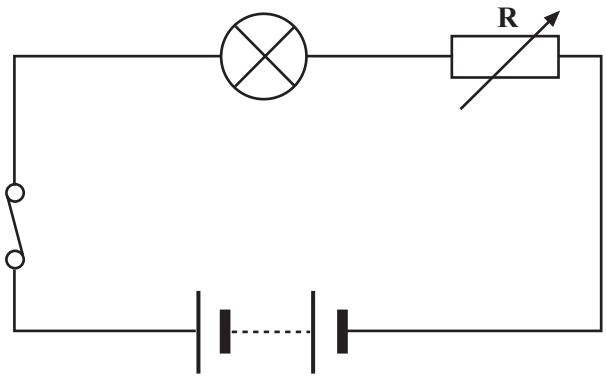
TURN OVER FOR THE NEXT QUESTION

QUESTION SIX

The circuit shows a lamp of resistance 6 ohms, connected in series with a variable resistor **R**, a battery and a switch. When we set **R** to zero and close the switch, the current through the lamp is 2 A.



6.1 What is the potential difference (voltage) across the battery?

A 0.33 V

B 3 V

C 12 V

D 24 V

6.2 The battery is now changed to one of 10 V and **R** is increased from zero to exactly the same resistance as the lamp.

What will be the new potential difference (voltage) across the lamp?

A 5 V

B 6 V

C 10 V

D 20 V

6.3 **R** is now increased gradually from zero.

The resistance of the lamp will . . . . .

A fall because the current in the lamp will be higher.

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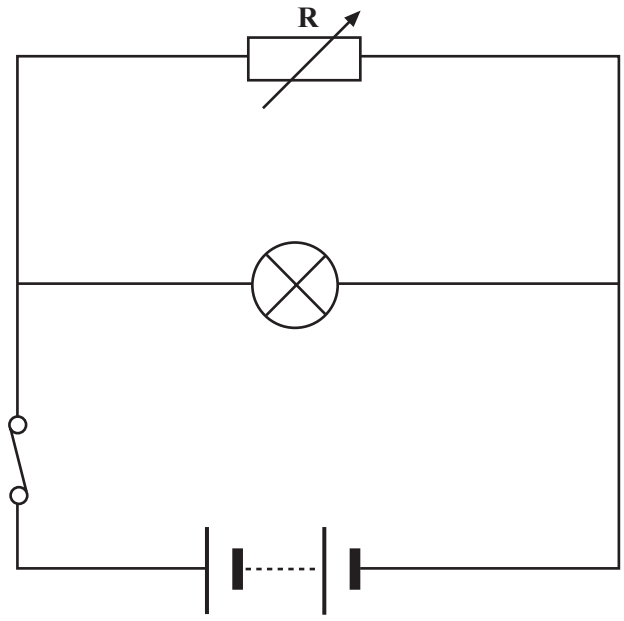
6.4 The circuit is now changed, so that the variable resistance **R** is in parallel with the lamp.



What will be the potential difference (voltage) across the lamp?

A Double that across the battery

B Half that across the battery

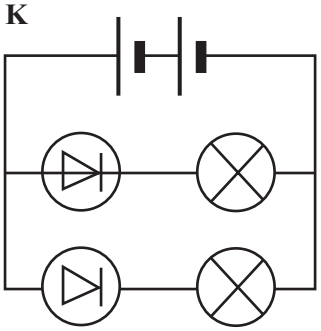
C It depends on the value of **R**

D The same as that across the battery

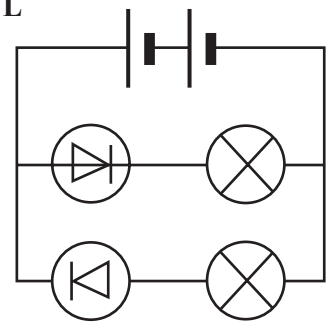
QUESTION SEVEN

All the cells, lamps and diodes in these circuits are identical. Decide which lamps light in the different arrangements before you answer the questions.

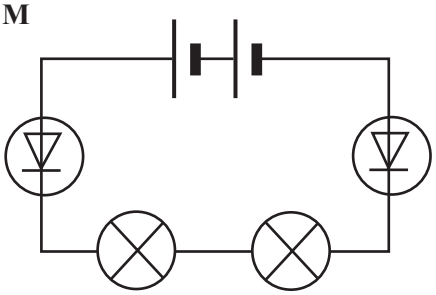
K



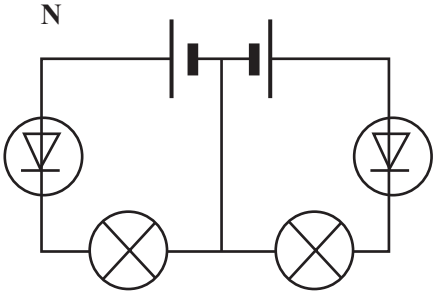
L



M



N



7.1 Neither lamp lights in . . . . .

A circuit **K** only.

B circuits **K**, **L** and **M**.

C circuits **M** and **N**.

D circuit **M** only.

7.2 Only one lamp lights in . . . . .

A circuit **K** only.

B circuits **K** and **M**.

C circuits **L** and **N**.

D circuit **L** only.

7.3 Both lamps light in . . . . .

A circuit **K** only.

B circuits **K** and **N**.

C circuits **L** and **M**.

D circuit **M** only.

7.4 In which circuit do the cells run down most quickly?

A Circuit **K**

B Circuit **L**

C Circuit **M**

D Circuit **N**

TURN OVER FOR THE NEXT QUESTION

QUESTION EIGHT

The wiring in an old house has not been checked for over 30 years. It uses the mains supply of 230 volts and still has a fuse box.

In this house, a socket is used wrongly. It has the following appliances connected to it.

Appliance	Power rating
Electric heater	2000 W
Electric iron	1000 W
CD player	50 W
Electric kettle	2500 W

8.1 All the appliances are switched on.

What is the total current delivered to the power point?

A 21.7 A

B 23.1 A

C 23.9 A

D 24.1 A

8.2 After 0.5 minutes, all the appliances stop working. This happens because the 20 A fuse in the fuse box, protecting the wiring in the power circuit, has melted.

The person repairing the fuse unwisely fits two parallel strands of 20 A fuse wire into the fuse holder.

This will result in . . . . .

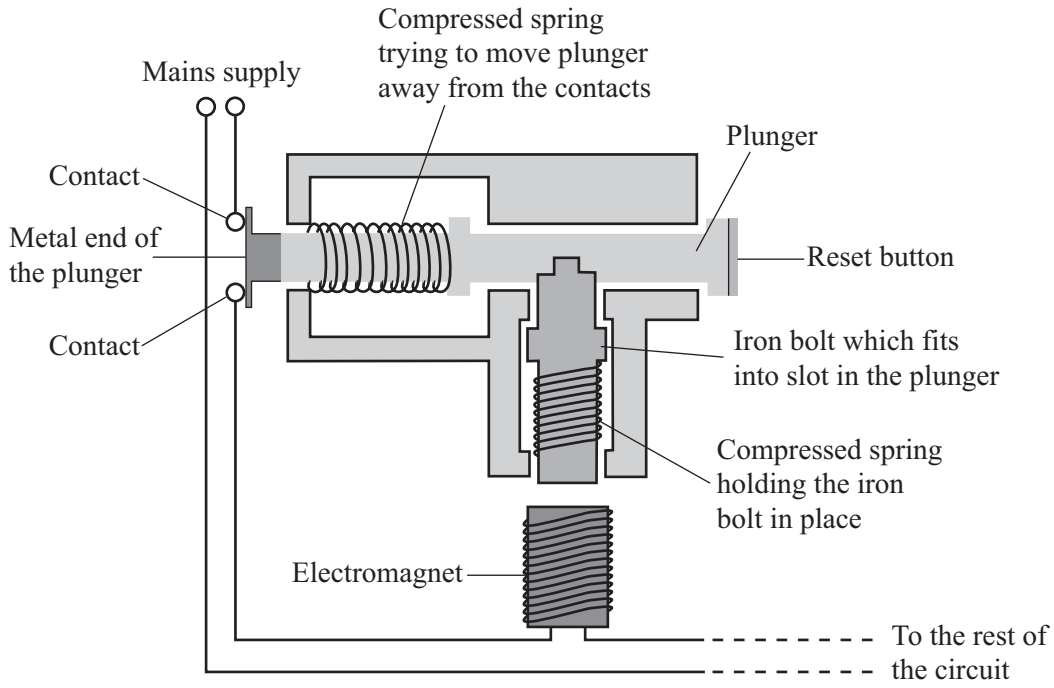
A half the correct current going to each appliance.

B the fuse melting more often, as fewer appliances can be used together than before.

C over-heating of the power circuit wiring, as more appliances can be used together.

D twice the correct current going to each appliance.

The fuse box has been replaced by circuit breakers in modern wiring systems. The diagram shows one type of circuit breaker.



8.3 This type of circuit breaker makes use of . . . . .

A induced current from a changing magnetic field.

B the magnetic effect of an electric current.

C the electrostatic force between charges.

D the transformer principle.

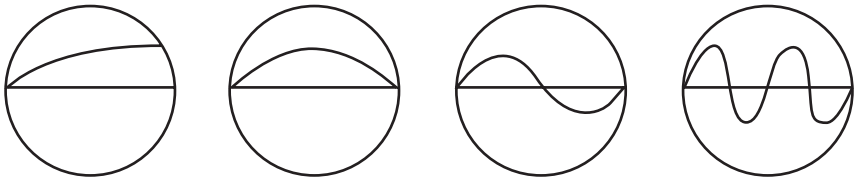
8.4 Which row of the table, **A**, **B**, **C** or **D**, describes the condition of the circuit breaker after it has switched off the current to the rest of the circuit?

	Plunger	**Iron bolt**
A	pushed forward closing contacts	pulled away from plunger slot
B	pushed forward closing contacts	holds plunger in the slot
C	pulled back opening contacts	holds plunger in the slot
D	pulled back opening contacts	pulled away from plunger slot

QUESTION NINE

Mains electricity is usually an a.c. supply of 230 V, frequency 50 Hz.

9.1 Each of the oscilloscope traces shown corresponds to 1/25 of a second.



A **B** **C** **D**

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 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 Which is a correct reason why a.c. mains supplies are generally used?

A A safety 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 sub-stations at very high voltages?

A High voltage transmission is safer than low voltage transmission

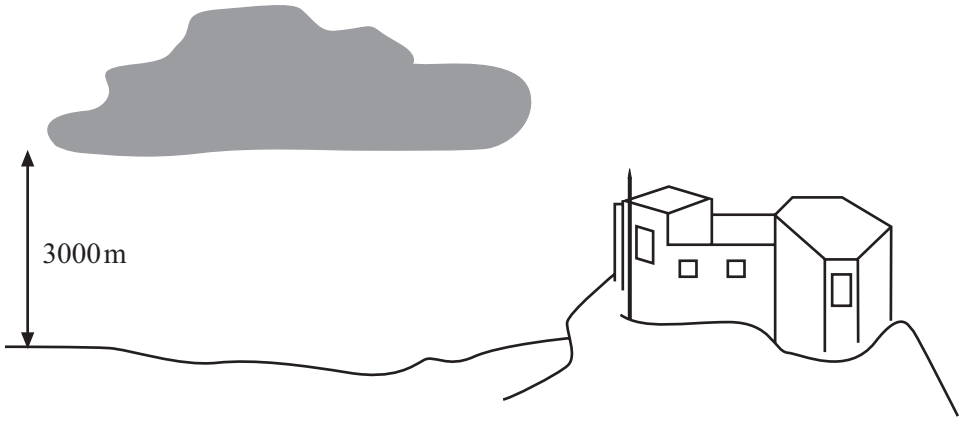
B Local transformers can reduce the voltage to that needed by consumers

C Power stations produce electricity at very high voltages

D The higher the voltage, the less energy is wasted

QUESTION TEN

A large thundercloud becomes charged with a negative charge of 20 coulomb (C) at its base.



10.1 There is a potential difference of 30 000 kilovolt (kV) between the base of the cloud and the ground.

(1 kilovolt (kV) = 1000 V; 1 kilojoule (kJ) = 1000 J)

How much energy is stored in this system?

A 600 kJ

B 1500 kJ

C 600 000 kJ

D 1 500 000 kJ

10.2 The thundercloud loses its negative charge to the ground in a series of steps, that occur very quickly, as the air becomes charged. A lightning flash is seen.

One lightning step can deliver an average current of 10 000 A lasting 0.0001 seconds.

How much charge is transferred in this step?

A 1 coulomb

B 10 coulomb

C 20 coulomb

D 100 000 000 coulomb

10.3 Any tall object connected to the ground provides an easier discharge path for the lightning strike.

Tall buildings are fitted with lightning conductors which can carry a large current to the earth during a lightning discharge.

The conductor consists of a spike on top of the building connected by a wire to a plate buried in the ground.

Which row, **A**, **B**, **C** or **D**, shows the best design for the conductor?

	Connecting wire	**Plate buried in the ground**
A	thick copper	metal
B	thin copper	plastic
C	thick plastic	carbon
D	thin steel	metal

10.4 The current is carried down the wire to earth by the movement of . . . . .

A atoms.

B electrons.

C ions.

D molecules.

END OF TEST