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|---------------------|--|------------------|--|
| Surname | | Other Names | |
| Centre Number | | Candidate Number | |
| Candidate Signature | | | |

General Certificate of Secondary Education
Winter 2004



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

Thursday 18 November 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 “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:

| | | | |
|-----------------------|----------------------------------|-----------------------|-----------------------|
| 1 | 2 | 3 | 4 |
| <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |

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

- If you want to change your answer, **you must** cross out your original answer, as shown:

| | | | |
|-----------------------|----------------------------------|-----------------------|----------------------------------|
| 1 | 2 | 3 | 4 |
| <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |

- 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:

| | | | |
|-----------------------|----------------------------------|-----------------------|----------------------------------|
| 1 | 2 | 3 | 4 |
| <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |

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

Components in electrical circuits are represented by symbols.


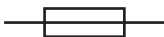
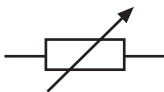
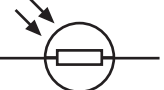
Match words from the list with the numbers **1–4** in the table.

fuse

LDR

thermistor

variable resistor

| Component | Symbol |
|-----------|---|
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

QUESTION TWO

Each part of a plug has a job to do.

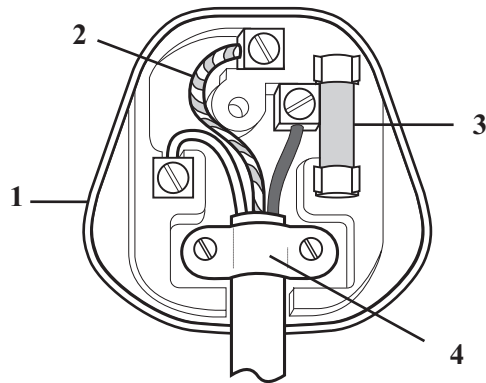
Match words from the list with the numbers 1–4 on the diagram.

connects metal case of appliance to earth

holds the cable firmly

insulates the plug

wire inside melts if current is too high



TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION THREE

A DVD player is connected to the mains supply.

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

current

frequency

potential difference (voltage)

power

The mains supply provides a **1** of 230 V.

The **2** of the supply is 50 Hz.

The DVD player transfers 28 W of **3**

A **4** of 0.12 A flows through the DVD player.

QUESTION FOUR

This question is about devices which do different jobs.

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

circuit breaker

motor

photocopier

smoke precipitator

| Device | How the device works |
|--------|---|
| 1 | uses electromagnetic effects to produce movement |
| 2 | uses electromagnetic effects to switch off a current when it is too large |
| 3 | uses electrostatics to attract black powder to a charged plate |
| 4 | uses electrostatics to clean waste gases given off at a power station |

QUESTION FIVE

Components in circuits have different resistances.

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

diode

filament lamp

LDR

thermistor

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

Turn over ►

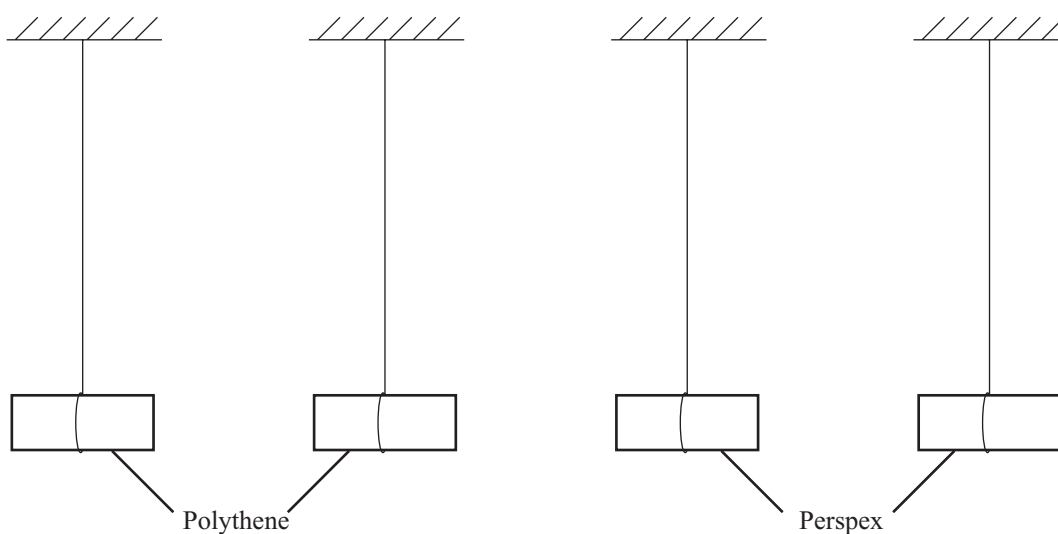
SECTION BQuestions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.

Mark your choices on the answer sheet.

QUESTION SIX

The diagram shows two polythene strips and two Perspex strips hanging freely from cotton threads. The strips are rubbed with a cloth and then brought up towards each other.

The two polythene strips repel each other, but a polythene strip attracts a Perspex one.

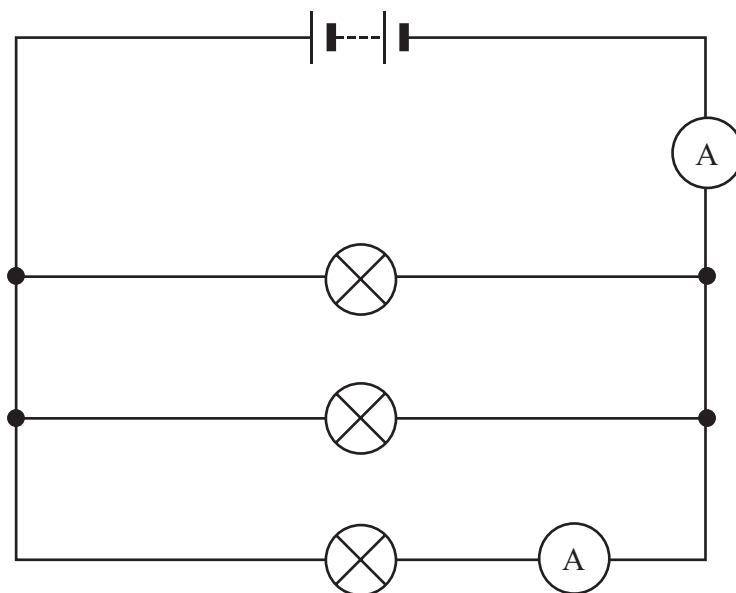


Which **two** of the statements **J**, **K**, **L**, **M** and **N** are correct?

- J** any of the strips will pick up tiny pieces of paper from a table
- K** the Perspex strips have the opposite charge to the polythene ones
- L** the rule being obeyed is that like charges attract and unlike charges repel
- M** the two Perspex strips will attract each other
- N** you would observe the same effects if you used copper and aluminium instead of polythene and Perspex

QUESTION SEVEN

The diagram shows a lighting circuit.



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

- P** the current through the battery is the sum of the currents through the lamps
- Q** the currents through both ammeters are the same
- R** the potential difference (voltage) across each lamp is the same
- S** the potential difference (voltage) of the battery is shared between the lamps
- T** the total resistance of the circuit is the sum of the resistances of each component

TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION CQuestions **EIGHT** to **TEN**.

Each of these questions has four parts.

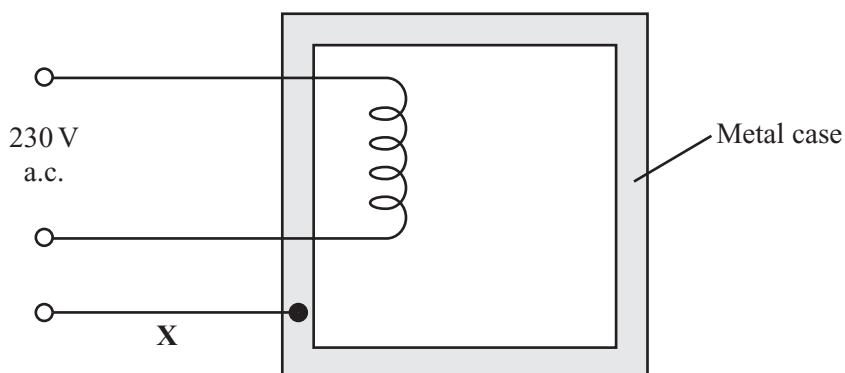
In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

The diagram shows an appliance with a metal case.

The three wires form the cable to the mains plug.

**8.1** What is the colour of wire **X**?

- A Blue
- B Brown
- C Green/yellow
- D Red

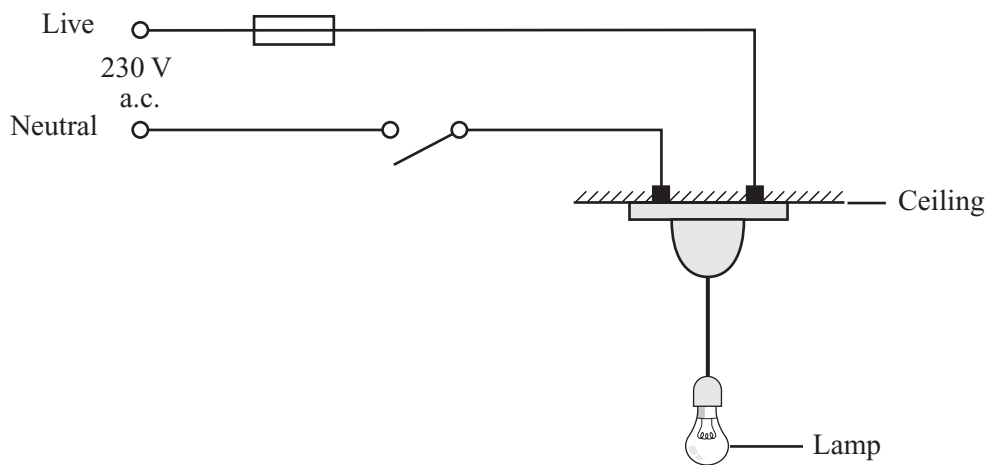
8.2 Why is a fuse included in the mains plug?

- A To break the circuit when there is a power cut
- B To prevent too large a current flowing
- C To protect anyone touching the plug
- D To provide a path to earth

8.3 A fuse should have a value

- A a lot less than the normal current taken by the appliance.
- B equal to the normal current taken by the appliance.
- C just greater than the normal current taken by the appliance.
- D much greater than the normal current taken by the appliance.

8.4 The lighting circuit shown in the diagram below is wired **incorrectly**.



What is wrong with the circuit?

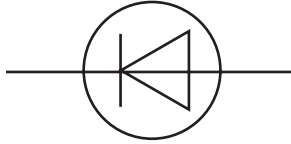
- A Both the switch and the fuse should be in the live wire
- B Both the switch and the fuse should be in the neutral wire
- C The fuse should be in a separate earth wire for safety
- D The switch should be in the live wire and the fuse should be in the neutral wire

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

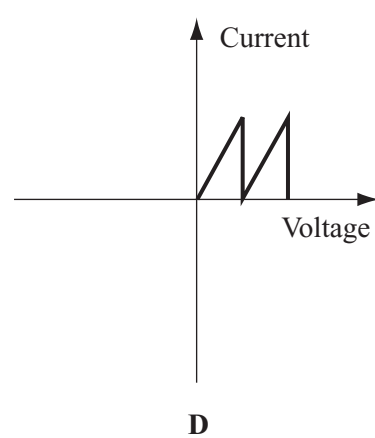
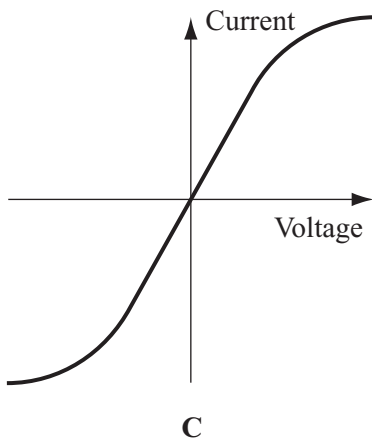
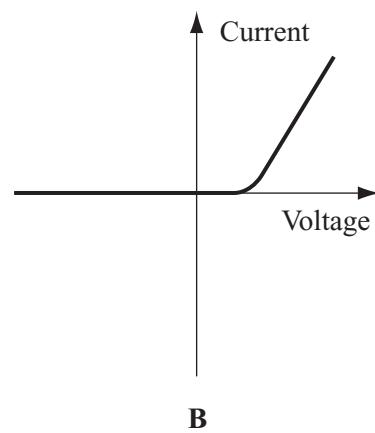
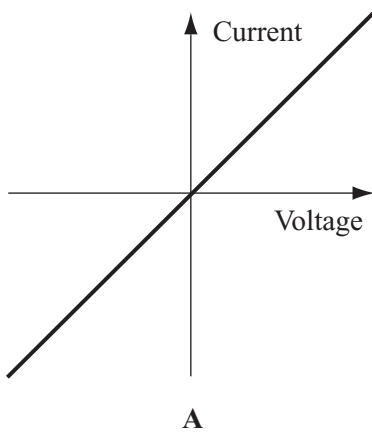
The diagram is the symbol for an electrical component.



9.1 What is the component?

- A** A diode
- B** An LED
- C** A thermistor
- D** A variable resistor

9.2 Which graph correctly shows how the current changes with the potential difference (voltage) across the component?

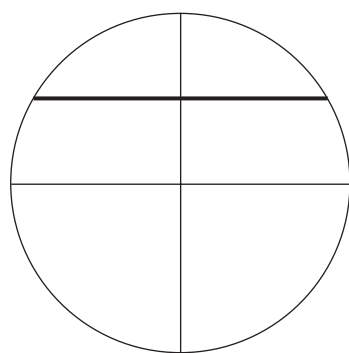


9.3 Which of these is a use of the component in circuits?

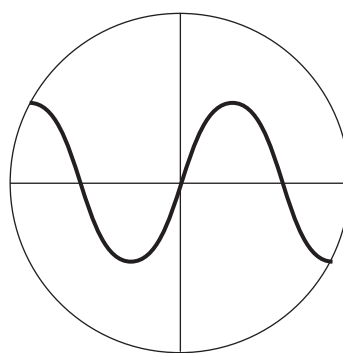
- A Measuring light intensity
- B Measuring temperature
- C Preventing current flowing in the wrong direction
- D Preventing too large a current flowing

9.4 The component is connected to an a.c. supply.

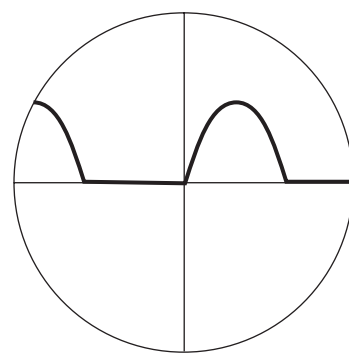
Which oscilloscope trace shows how the potential difference across the component changes?



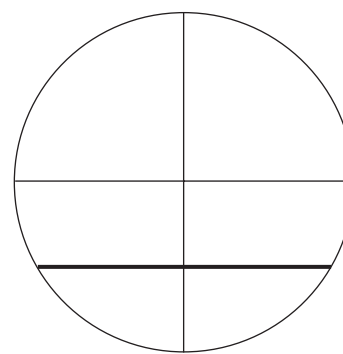
A



B



C



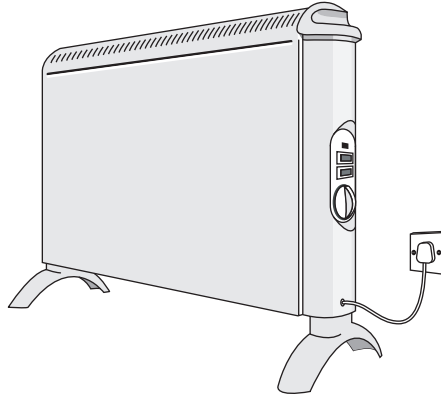
D

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

An electric heater works from the 230 V mains supply.
A current of 5 A flows through the heater element.



10.1 The mains electricity supply is 50 Hz.

This means that the current

- A always flows in the same direction.
- B changes direction 50 times each second.
- C changes direction 100 times each second.
- D has a potential difference of 50 V.

10.2 What is the power of the heater?

- A 46 W
- B 250 W
- C 1 150 W
- D 11 500 W

10.3 A fault occurs and the live wire touches the metal case of the heater.

Because the heater is earthed,

- A a large current flows to earth.
- B a large voltage flows to earth.
- C the earth wire melts.
- D the live wire melts.

10.4 How much energy is transferred by a 2 kW heater in one hour?

- A 120 J
- B 7 200 J
- C 120 000 J
- D 7 200 000 J

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

Components in circuits have different resistances.

Match words from the list with the descriptions **1–4** in the table.**diode****filament lamp****LDR****thermistor**

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

QUESTION TWO

An oscilloscope can be used to compare potential differences (voltages) from different electricity supplies. The oscilloscope settings are not changed.

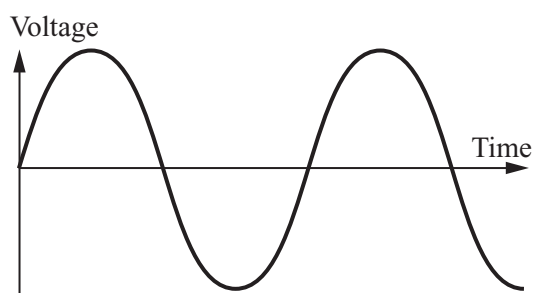
Match words from the list with the oscilloscope traces 1–4.

a 30 V battery

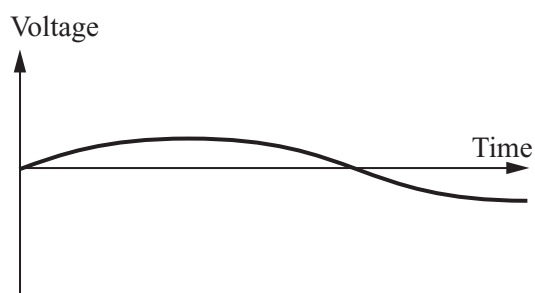
live terminal of the mains supply

model generator

two 30 V batteries in series



1



2



3



4

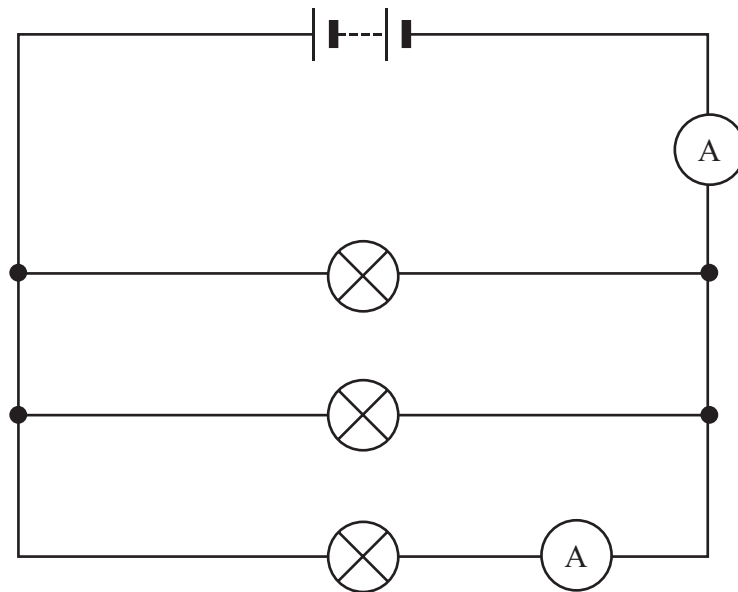
Turn over ►

SECTION BQuestions **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

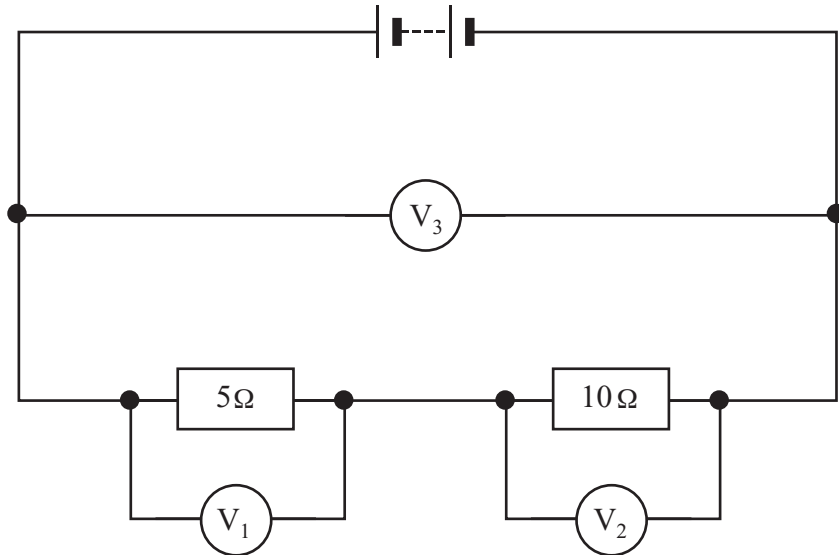
The diagram shows a lighting circuit.

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

- P** the current through the battery is the sum of the currents through the lamps
- Q** the currents through both ammeters are the same
- R** the potential difference (voltage) across each lamp is the same
- S** the potential difference (voltage) of the battery is shared between the lamps
- T** the total resistance of the circuit is the sum of the resistances of each component

QUESTION FOUR

Three identical voltmeters are connected in a circuit.



Which **two** statements are correct?

- the reading on V_2 is twice the reading on V_1**
- the reading on V_2 is three times the reading on V_1**
- the reading on V_3 is twice the reading on V_1**
- the reading on V_3 is three times the reading on V_1**
- the reading on V_3 is twice the reading on V_2**

TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION CQuestions **FIVE** to **TEN**.

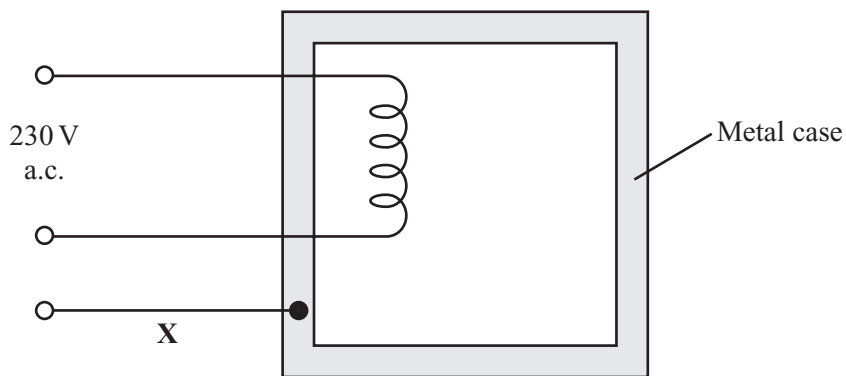
Each of these questions has four parts.

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

Mark your choices on the answer sheet.

QUESTION FIVE

The diagram shows an appliance with a metal case.
The three wires form the cable to the mains plug.



5.1 What is the colour of wire **X**?

- A Blue
- B Brown
- C Green/yellow
- D Red

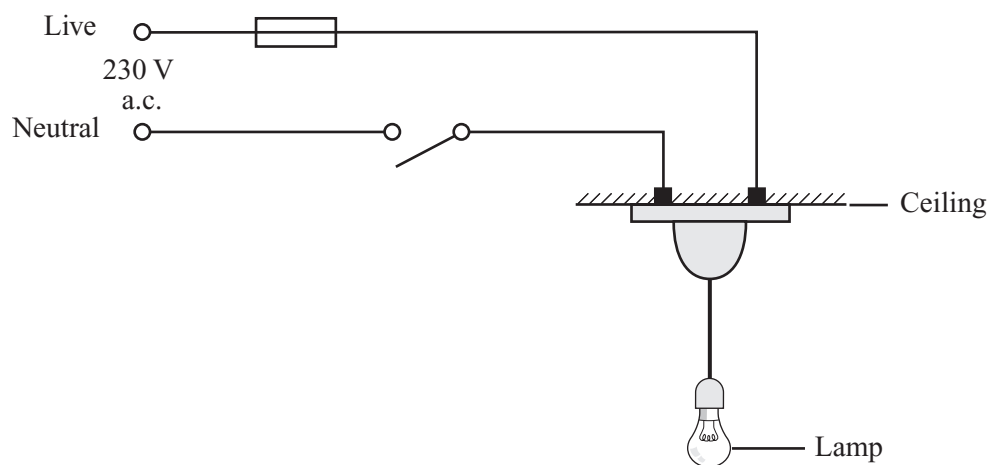
5.2 Why is a fuse included in the mains plug?

- A To break the circuit when there is a power cut
- B To prevent too large a current flowing
- C To protect anyone touching the plug
- D To provide a path to earth

5.3 A fuse should have a value

- A a lot less than the normal current taken by the appliance.
- B equal to the normal current taken by the appliance.
- C just greater than the normal current taken by the appliance.
- D much greater than the normal current taken by the appliance.

5.4 The lighting circuit shown in the diagram below is wired **incorrectly**.



What is wrong with the circuit?

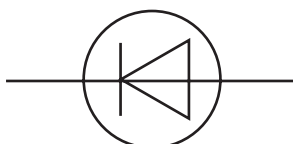
- A Both the switch and the fuse should be in the live wire
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- C The fuse should be in a separate earth wire for safety
- D The switch should be in the live wire and the fuse should be in the neutral wire

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SIX

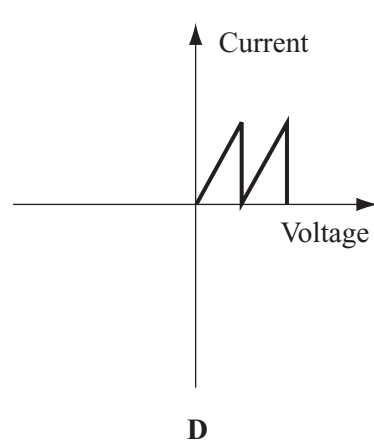
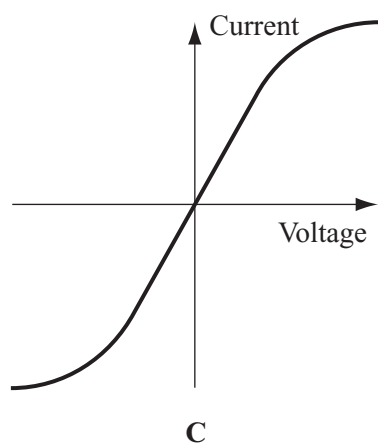
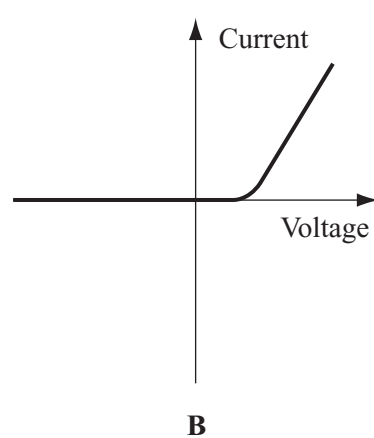
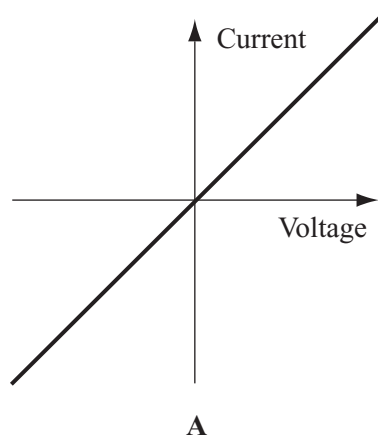
The diagram is the symbol for an electrical component.



6.1 What is the component?

- A** A diode
- B** An LED
- C** A thermistor
- D** A variable resistor

6.2 Which graph correctly shows how the current changes with the potential difference (voltage) across the component?

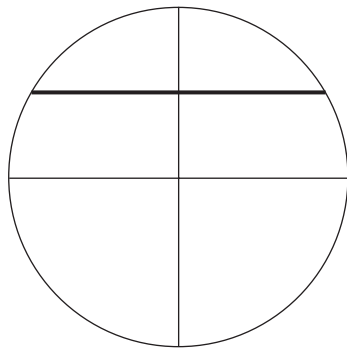


6.3 Which of these is a use of the component in circuits?

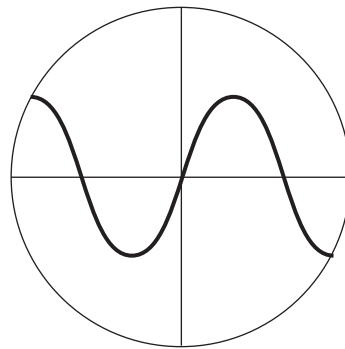
- A Measuring light intensity
- B Measuring temperature
- C Preventing current flowing in the wrong direction
- D Preventing too large a current flowing

6.4 The component is connected to an a.c. supply.

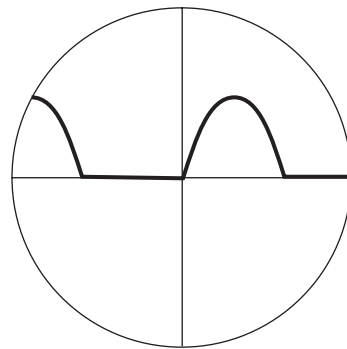
Which oscilloscope trace shows how the potential difference across the component changes?



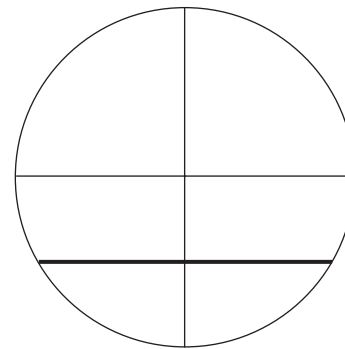
A



B



C



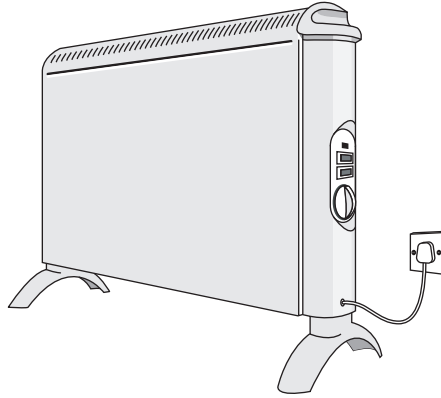
D

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION SEVEN

An electric heater works from the 230 V mains supply.
A current of 5 A flows through the heater element.



7.1 The mains electricity supply is 50 Hz.

This means that the current

- A always flows in the same direction.
- B changes direction 50 times each second.
- C changes direction 100 times each second.
- D has a potential difference of 50 V.

7.2 What is the power of the heater?

- A 46 W
- B 250 W
- C 1 150 W
- D 11 500 W

7.3 A fault occurs and the live wire touches the metal case of the heater.

Because the heater is earthed,

- A** a large current flows to earth.
- B** a large voltage flows to earth.
- C** the earth wire melts.
- D** the live wire melts.

7.4 How much energy is transferred by a 2 kW heater in one hour?

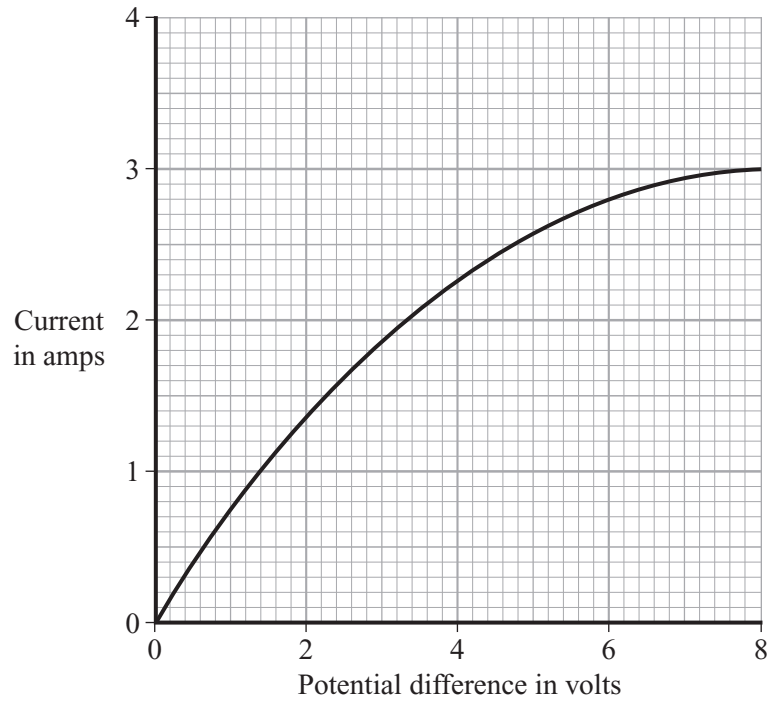
- A** 120 J
- B** 7 200 J
- C** 120 000 J
- D** 7 200 000 J

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION EIGHT

The graph shows how the current through a filament lamp changes with the potential difference (voltage) across it.



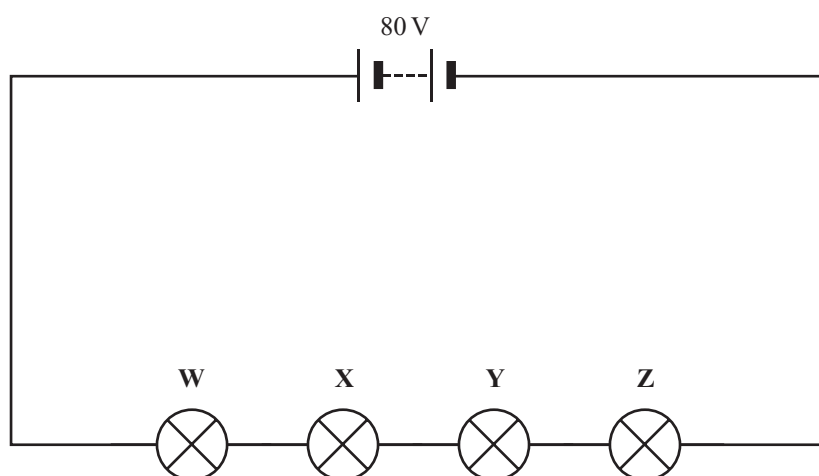
8.1 Why does the graph have this shape?

- A As the current increases, the filament gets hotter and its resistance decreases
- B As the current increases, the filament gets hotter and its resistance increases
- C As the voltage increases, the current decreases and the resistance of the filament decreases
- D As the voltage increases, the current decreases and the resistance of the filament increases

8.2 What is the resistance of the filament when the current through it is 2.8 A?

- A 0.47 Ω
- B 2.14 Ω
- C 8.80 Ω
- D 16.80 Ω

The diagram shows four identical lamps connected in series.
The resistance of each lamp is $5\ \Omega$ when it is lit normally in the circuit as shown.



8.3 What is the current flowing through lamp **Z**?

- A 0.25 A
- B 4 A
- C 8 A
- D 16 A

8.4 The power supply is changed for one providing 40 V.

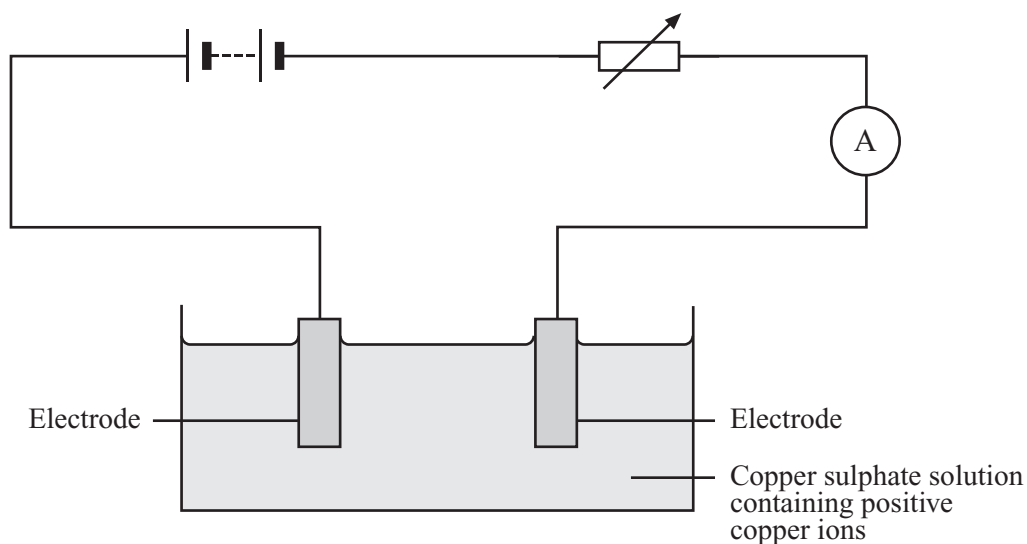
What is the total power transferred by the lamps now?

- A 40 W
- B 80 W
- C 100 W
- D 160 W

Turn over ►

QUESTION NINE

The diagram shows the electrolysis of copper sulphate solution.
Copper is deposited on one of the electrodes.



9.1 During electrolysis

- A copper atoms are attracted to the negative electrode.
- B copper atoms are attracted to the positive electrode.
- C copper ions are attracted to the negative electrode.
- D copper ions are attracted to the positive electrode.

A current of 1.5 A flowing for one hour deposits 1.8 grams of copper at the electrode.

9.2 How much electric charge is transferred when 1.5 A flows for one hour?

- A 15 C
- B 90 C
- C 3600 C
- D 5400 C

9.3 How much copper would be deposited by a current of 3 A flowing for 4 hours?

- A 1.8 g
- B 3.6 g
- C 7.2 g
- D 14.4 g

9.4 An industrial plant uses a current of 150 A during electrolysis.

How long does it take to deposit a kilogram of copper?

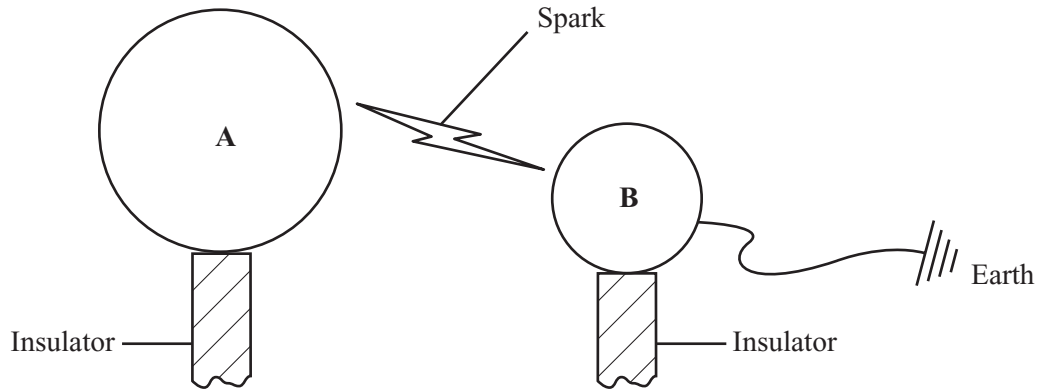
- A 1.0 hours
- B 5.6 hours
- C 27.8 hours
- D 55.6 hours

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

A and **B** are metal spheres. Sphere **A** stores a charge of 0.005 coulombs when 10 000 V are applied to it. It then discharges in a spark to sphere **B** which is connected to earth. The spark lasts 0.1 ms. (1 ms is one thousandth of a second.)



- 10.1** The reason that a spark eventually jumps from **A** to **B** is that
- A** a high enough current has built up between **A** and **B**.
 - B** a high enough potential difference (voltage) has built up between **A** and **B**.
 - C** a high enough resistance has built up between **A** and **B**.
 - D** the air has warmed up enough between **A** and **B**.
- 10.2** The spark would **not** occur if sphere **B** was made of plastic because then sphere **B** would
- A** be an insulator of heat.
 - B** be too easily charged by friction with the air.
 - C** have no free electrons to enable it to conduct.
 - D** have no free protons to enable it to conduct.
- 10.3** How much energy was transferred to sphere **A** before the discharge?
- A** 1 J
 - B** 50 J
 - C** 2 000 000 J
 - D** 100 000 000 J

10.4 How much current flowed in the spark?

- A** 1 A
- B** 50 A
- C** 2 000 000 A
- D** 100 000 000 A

END OF TEST