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Student number

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Name \_\_\_\_\_

Date \_\_\_\_\_

Attempt/Time taken \_\_\_\_\_

# GCSE PHYSICS

Topic Paper: 2.1 Current, potential difference and resistance  
Part 1

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Time allowed: 45 minutes

## Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

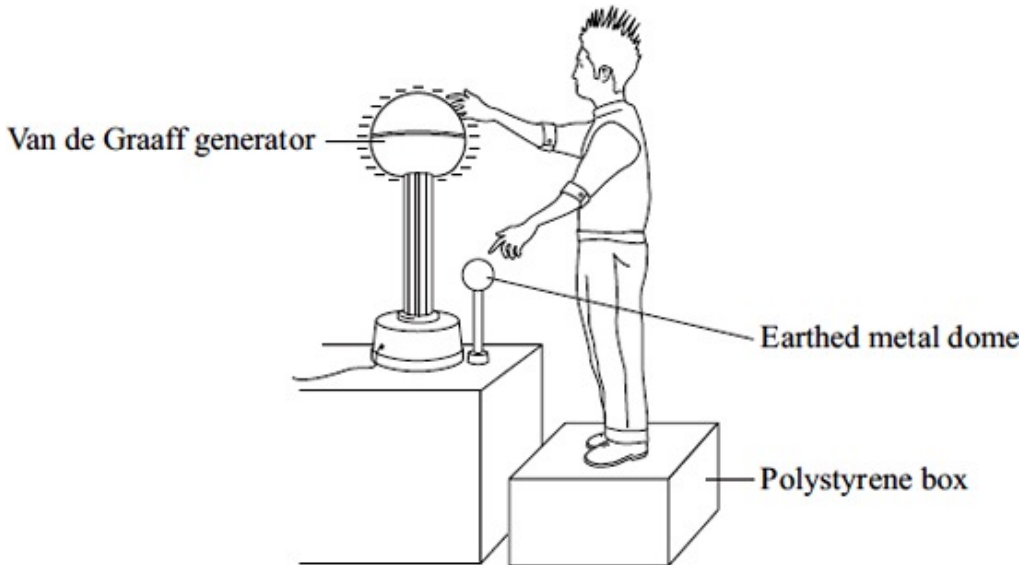
## Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.



**42 Marks**

- Q1.** (a) The diagram shows a student touching the metal dome of a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain why the student's hair stands on end when the generator is switched on.

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.....  
.....

(2)

- (b) When the potential difference between the student and a nearby earthed metal dome reached 15 kV, a spark jumped between the student and the earthed dome. The spark transformed 30 mJ of energy into heat, light and sound. (1 mJ = 0.001 J)

Use the equation in the box to calculate the charge carried by the spark.

$\text{energy transformed} = \text{potential difference} \times \text{charge}$
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.....  
.....

Charge transferred = ..... coulombs

(2)

- (c) What name is given to the rate of flow of charge?

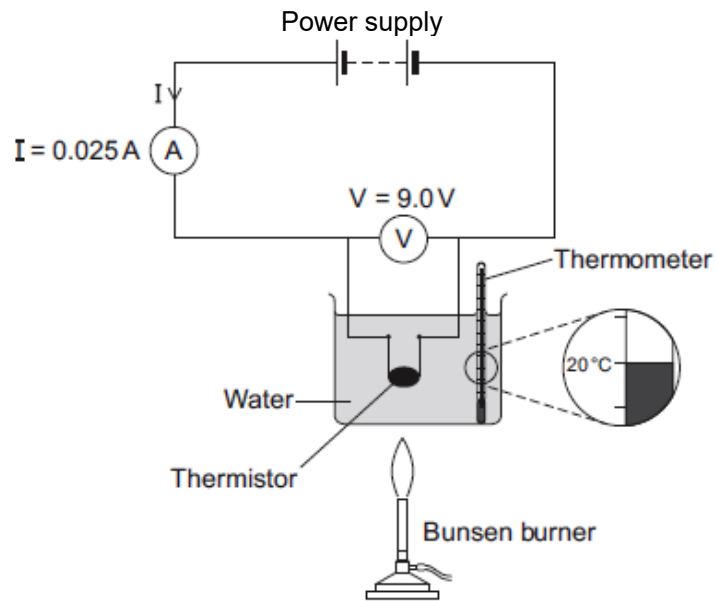
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(1)

(Total 5 marks)

- Q2. (a) **Figure 1** shows the apparatus used to obtain the data needed to calculate the resistance of a thermistor at different temperatures.

**Figure 1**



- (i) In the box below, draw the circuit symbol for a thermistor.



(1)

- (ii) Use the data given in **Figure 1** to calculate the resistance of the thermistor at 20 °C.  
Use the correct equation from the Physics Equations Sheet.

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.....

Resistance = ..... ohms

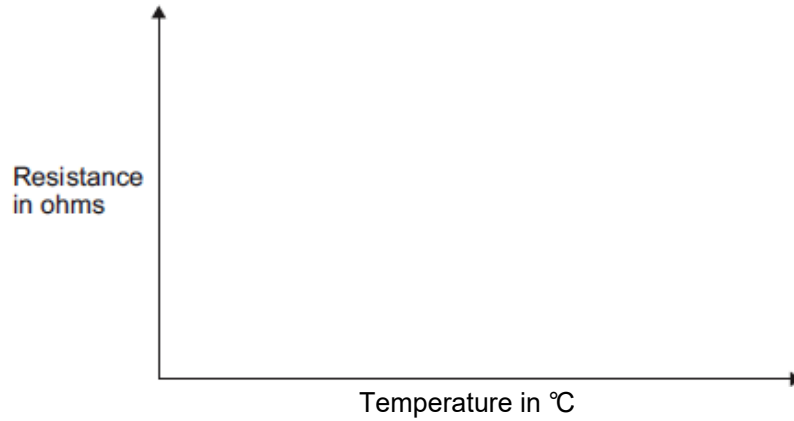
(2)



(iii) **Figure 2** shows the axes for a sketch graph.

Complete **Figure 2** to show how the resistance of the thermistor will change as the temperature of the thermistor increases from 20 °C to 100 °C.

**Figure 2**



(1)

(iv) Which **one** of the following is most likely to include a thermistor?

Tick (✓) **one** box.

An automatic circuit to switch a plant watering system on and off.

An automatic circuit to switch an outside light on when it gets dark.

An automatic circuit to switch a heating system on and off.

(1)

(b) The ammeter used in the circuit has a very low resistance.

Why is it important that ammeters have a very low resistance?

.....

.....

(1)



- (c) The table below gives the temperature of boiling water using three different temperature scales.

Temperature	Scale
100	Celsius ( $^{\circ}\text{C}$ )
212	Fahrenheit ( $^{\circ}\text{F}$ )
80	Ré aumur ( $^{\circ}\text{Re}$ )

Scientists in different countries use the same temperature scale to measure temperature.

Suggest **one** advantage of doing this.

.....  
.....  
.....

(1)

- (d) A student plans to investigate how the resistance of a light-dependent resistor (LDR) changes with light intensity.

The student starts with the apparatus shown in **Figure 2** but makes three changes to the apparatus.

One of the changes the student makes is to replace the thermistor with an LDR.

Describe what other changes the student should make to the apparatus.

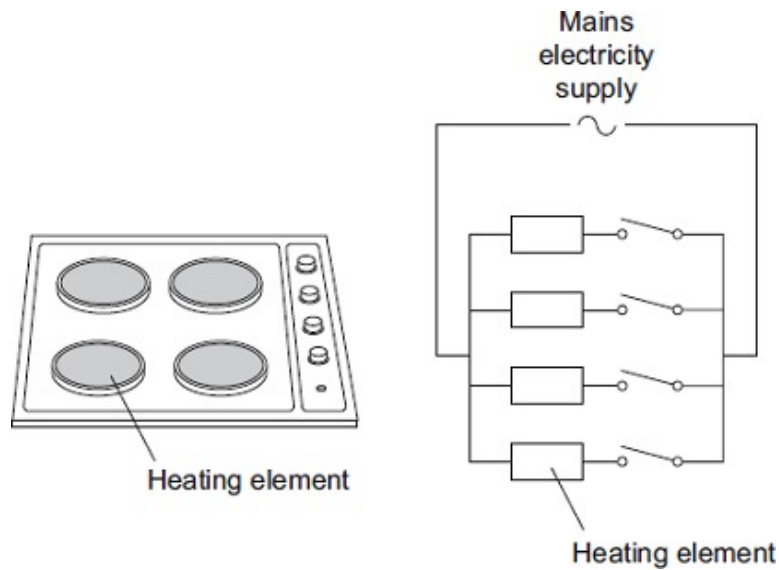
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(2)

(Total 9 marks)



**Q3.** The picture shows an electric cooker hob. The simplified circuit diagram shows how the four heating elements connect to the mains electricity supply. The heating elements are identical.



When all four heating elements are switched on at full power the hob draws a current of 26 A from the 230 V mains electricity supply.

(a) Calculate the resistance of one heating element when the hob is switched on at full power.

Use the correct equation from the Physics Equations Sheet.

Give your answer to 2 significant figures.

.....  
.....  
.....

Resistance = .....  $\Omega$

(3)



- (b) The table gives the maximum current that can safely pass through copper wires of different cross-sectional area.

Cross-sectional area in mm <sup>2</sup>	Maximum safe current in amps
1.0	11.5
2.5	20.0
4.0	27.0
6.0	34.0

- (i) The power sockets in a home are wired to the mains electricity supply using cables containing 2.5 mm<sup>2</sup> copper wires. Most electrical appliances are connected to the mains electricity supply by plugging them into a standard power socket.

It would **not** be safe to connect the electric cooker hob to the mains electricity supply by plugging it into a standard power socket.

Why?

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(2)

- (ii) Describe the structure of the cable that should be used to connect the electric cooker hob to the mains electricity supply.

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(3)



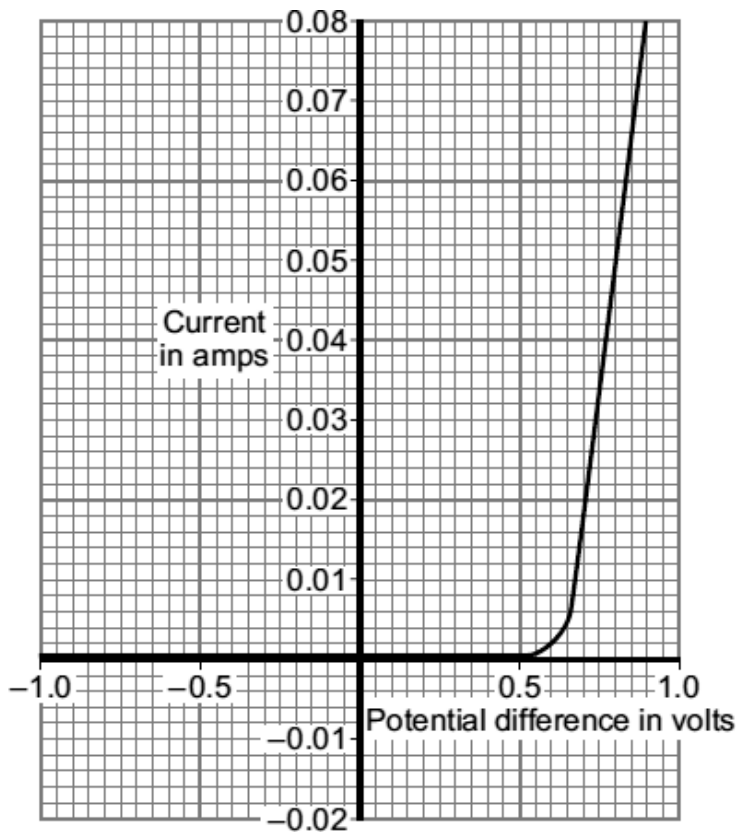
(c) Mains electricity is an alternating current supply. Batteries supply a direct current.

What is the difference between an alternating current and a direct current?

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(2)  
(Total 10 marks)

**Q4.** The current–potential difference graph for one type of electrical component is drawn below.

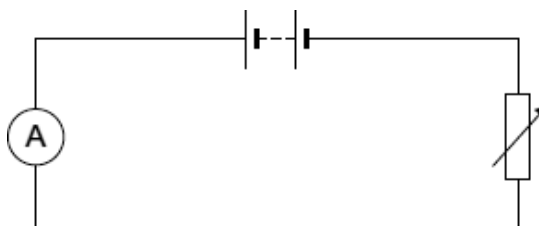


(a) What is the component?

.....

(1)

(b) Complete the diagram to show a circuit that can be used to obtain the data needed to plot the graph. Use the correct circuit symbol for each component that you add to the diagram.



(2)





- (c) (i) What is the current through the component when the potential difference across the component is 0.8 volts?

Current ..... amps

(1)

- (ii) Use the equation in the box to calculate the resistance of the component when the potential difference across it is 0.8 volts.

potential difference = current × resistance

Show clearly how you work out your answer.

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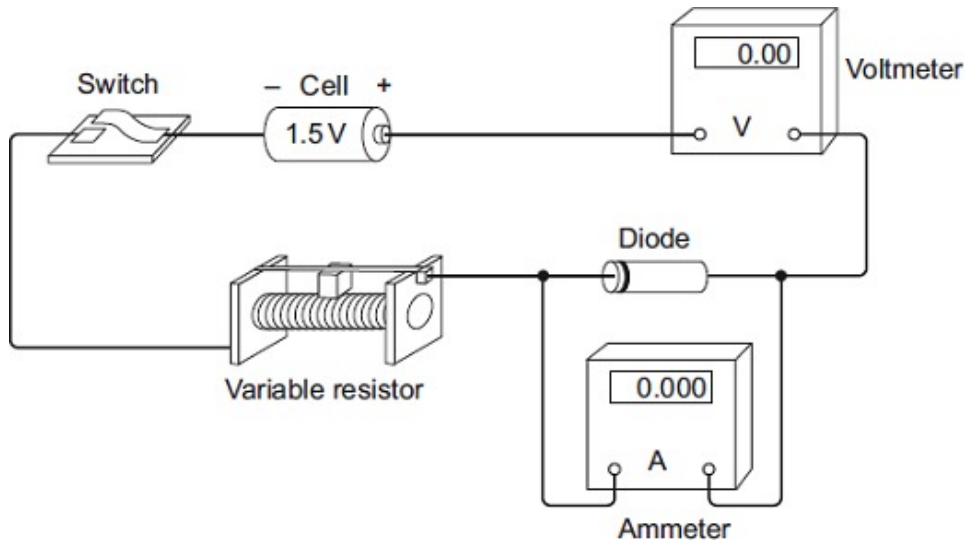
Resistance = ..... Ω

(2)

(Total 6 marks)

**Q5.**

- (a) A student set up the circuit shown in the diagram. The student uses the circuit to obtain the data needed to plot a current - potential difference graph for a diode.



- (i) Draw, in the boxes, the circuit symbol for a diode and the circuit symbol for a variable resistor.

**Diode**

**Variable resistor**

(2)



(ii) The student made two mistakes when setting up the circuit.

What **two** mistakes did the student make?

1 .....

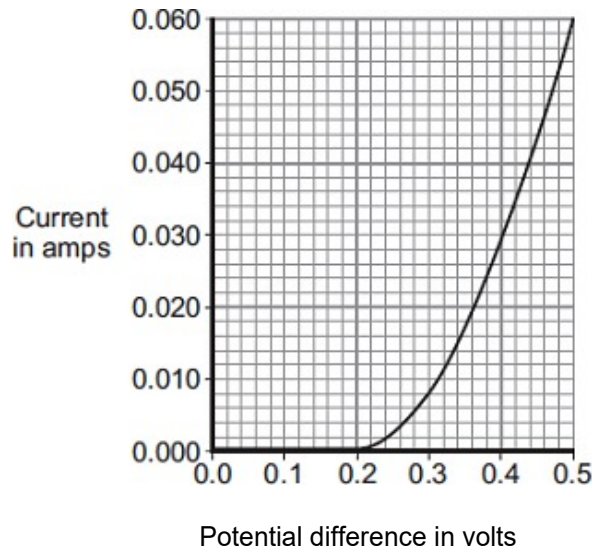
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2 .....

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(2)

(b) After correcting the circuit, the student obtained a set of data and plotted the graph below.



(i) At what potential difference did the diode start to conduct an electric current?

..... V

(1)

(ii) Use data from the graph to calculate the resistance of the diode when the potential difference across the diode is 0.3 V.

Use the correct equation from the Physics Equations Sheet.

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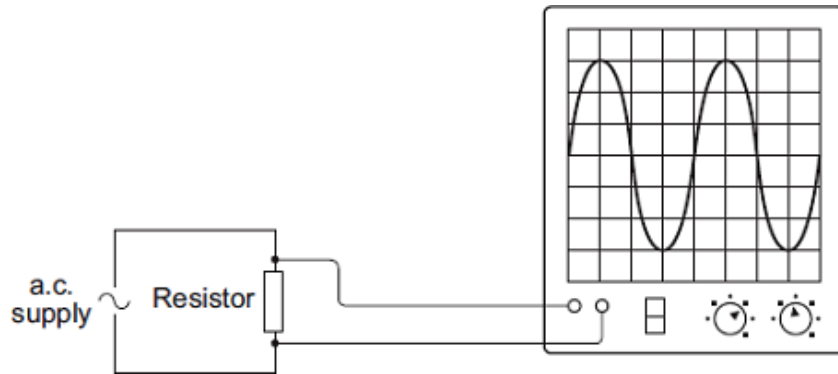
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Resistance = ..... ohms

(3)



- (c) The diagram shows the trace produced by an alternating current (a.c.) supply on an oscilloscope.



Each horizontal division on the oscilloscope screen represents a time of 0.01s.

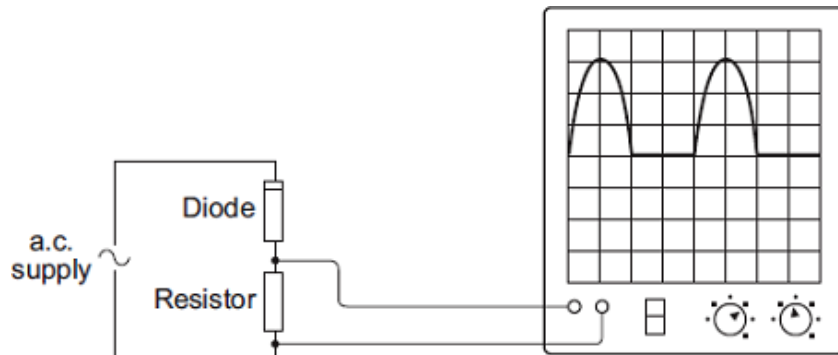
- (i) Calculate the frequency of the a.c. supply.

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 .....  
 .....

Frequency = ..... hertz

(2)

- (ii) A diode is now connected in series with the a.c. power supply.



Why does the diode cause the trace on the oscilloscope screen to change?

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(2)  
 (Total 12 marks)