OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

P3.1 STATIC AND CHARGE

SCORE	PERCENTAGE
/80	%

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Gateway Physics A (9-1)

Static and charge

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **80**.
- The total number of marks may take into account some 'either/or' question choices.

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1 This question is about static electricity.

Bruno sometimes gets an electrostatic shock when he gets out of his car.

(i) As he gets out of the car he moves across the car seat.

Bruno becomes negatively charged.

Complete the sentence.

The car seat becomes _____ charged because it loses _____.

[1]

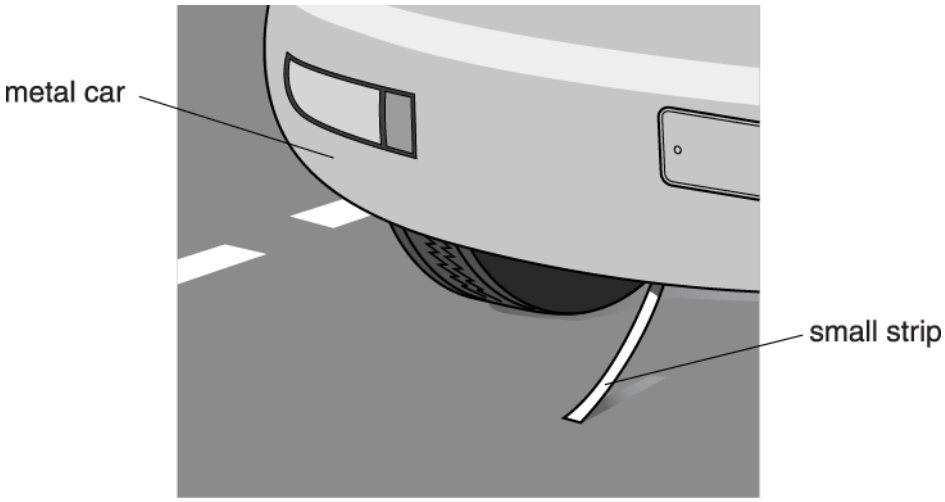
(ii) Bruno sprays the car seat with an antistatic spray.

Explain how this helps to reduce static electricity.

---

[1]

(iii) Bruno attaches a small strip to the back of his car.



This strip may reduce the chance of receiving an electrostatic shock but it is unreliable.

Explain why it is unreliable.

---

[1]

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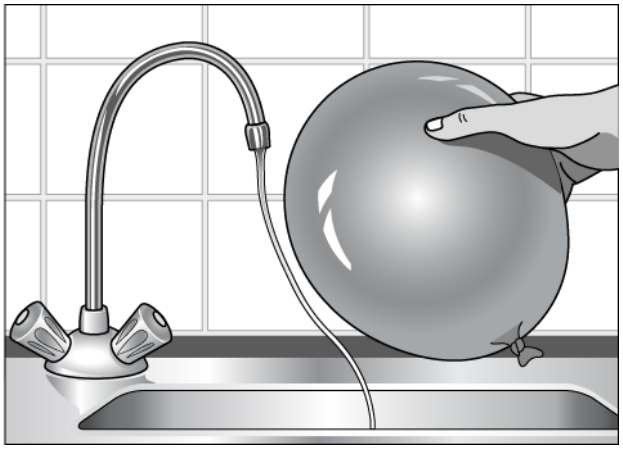
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2 This question is about static electricity.

Bruno rubs a balloon on a piece of material.

He puts the balloon next to a water tap.



The stream of water bends towards the balloon.

Use ideas about static electricity to explain why.

--- [3]

3

George uses a model to explain resistance:

Current in a conductor is the flow of charge carriers calledneutrons. The charge carriers collide with the atoms (ions) in the conductor. This explains electrical resistance. As the conductor gets hotter the resistance stays the same.

George has made **two** mistakes.

Describe the two mistakes he has made and write down the corrections.

---

[2]

4 Electrostatics can be useful or a nuisance.

Electrostatics can be useful for spray painting.

The way that different paint guns work can be described using diagrams and models.

Diagram of a normal paint gun

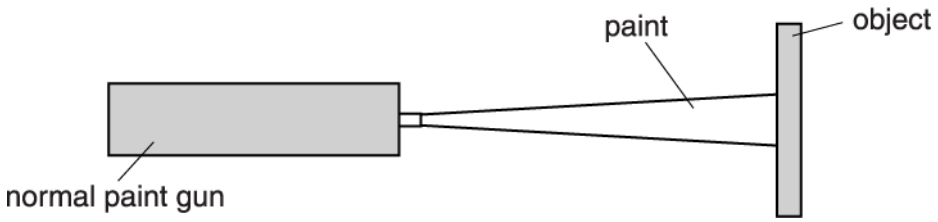
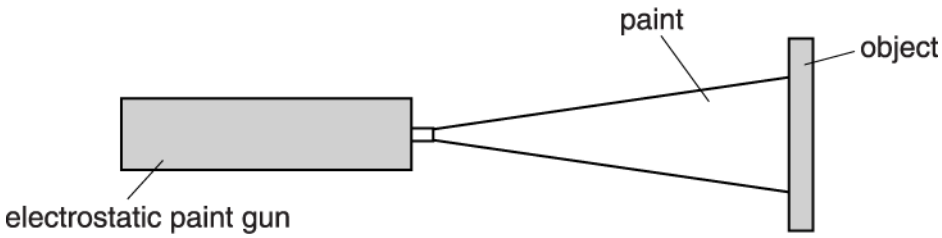


Diagram of an electrostatic paint gun



Use the diagrams to describe how and why the two paint guns work in different ways.

You may add more labels to the diagrams to help your description.

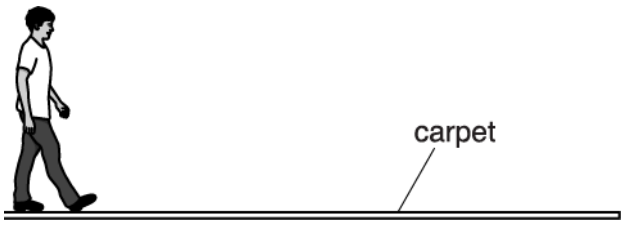
--- [3]

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5 Patrick walks on a nylon carpet.



He becomes negatively charged.

Describe how Patrick has become **negatively** charged.

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[2]

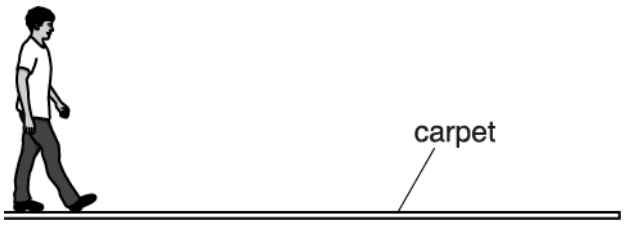
6 Electrostatic shocks can be a nuisance.

Describe how you can get electrostatic shocks.

---

[2]

7 Patrick walks on a nylon carpet.



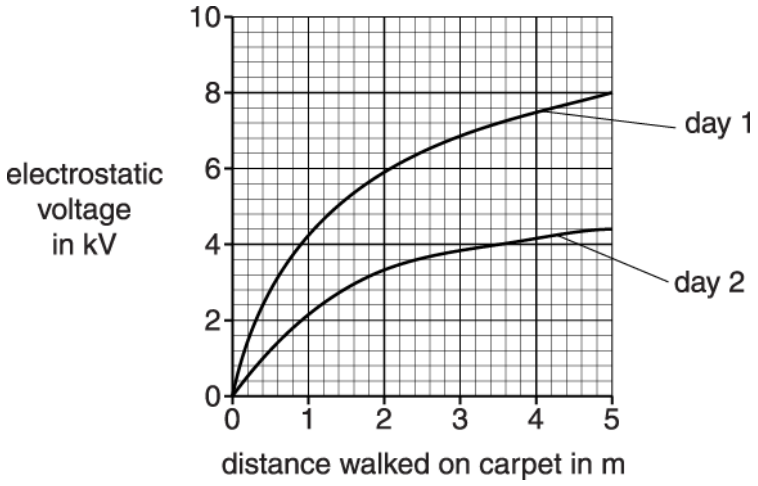
He becomes negatively charged.

His electrostatic voltage is measured when he walks on the carpet on different days.

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(i) Use the graph to explain what happens on day **1**.

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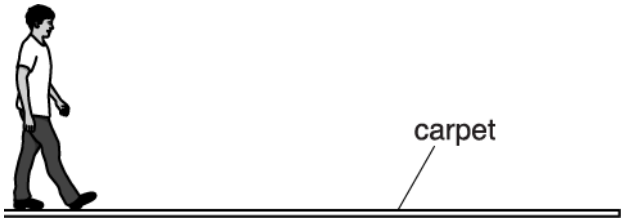
[2]

(ii) Suggest what is different on day **2**.

---

[1]

8(a) Patrick walks on a nylon carpet.



Patrick becomes charged.

Then he receives an electrostatic shock.

Describe how Patrick can become charged and suggest how he receives an electrostatic shock.

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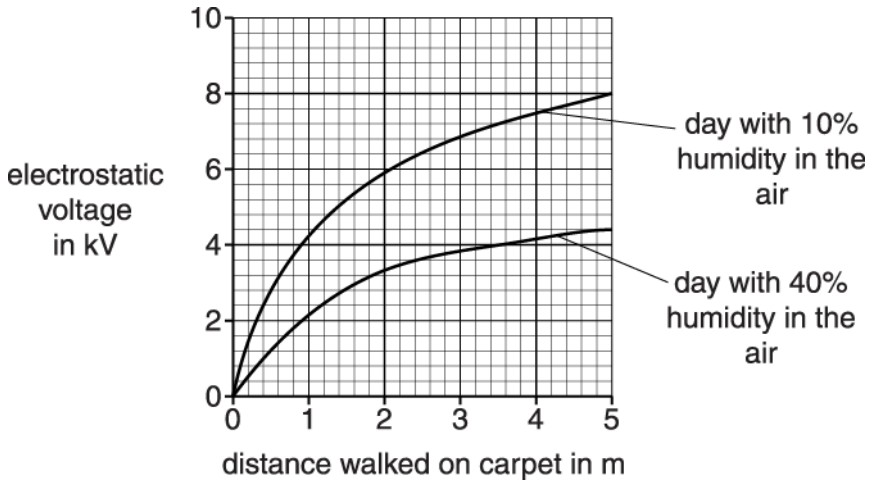
[2]

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(b) Patrick's electrostatic voltage is measured when he walks on the carpet on different days.



(i) Use the graph to describe what happens as Patrick walks along the carpet.

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[2]

(ii) Use the graph to compare the data for the two days.

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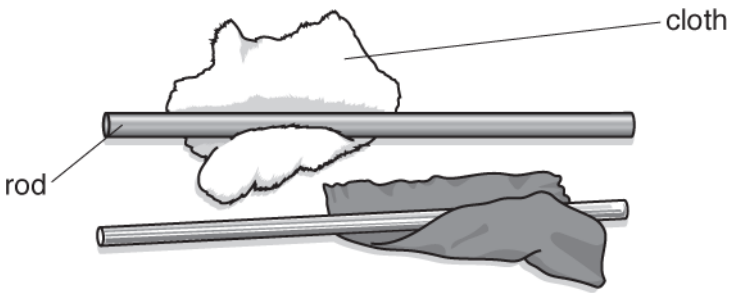
[1]

(iii) Draw a line on the graph to show what will happen to the electrostatic voltage when there is 20% humidity in the air.

[1]

9 Carlos investigates static electricity.

He rubs rods with different cloths.



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Carlos then uses the rods to pick up small pieces of paper.

Look at his results.

Rod material	Cloth material	Does it pick up paper?
plastic	nylon	yes
nylon	silk	yes
glass	artificial fur	yes
copper	steel wool	no

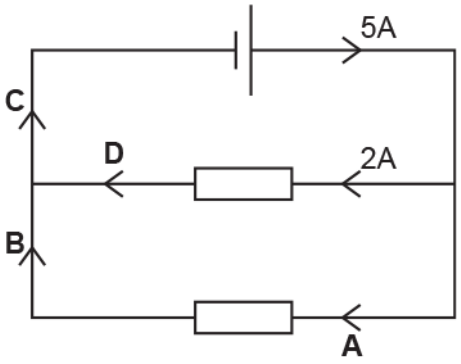
Explain his results and use these to describe why static electricity can be useful or a nuisance.



The quality of written communication will be assessed in your answer to this question.

[6]

10 This is a circuit.



Which letter **A**, **B**, **C** or **D** shows the part of the circuit that carries a current of 2 A?

Your answer [1]

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11

(i) A student has completed her homework on static electricity.

Look at her homework.

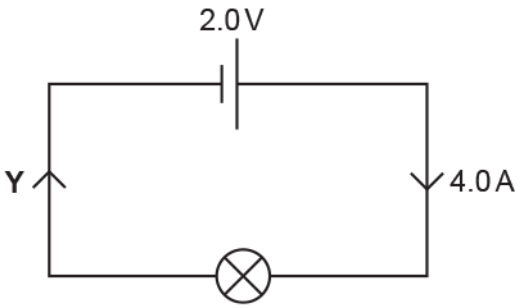
1 Static charge only builds up on insulators.
2 Opposite charges attract.
3 Like charges repel.
4 Only positive charges can move.

Identify the student's mistake and correct it.

---

[2]

(ii) When charges move, a current flows.



Write down the current flowing at point **Y** in the circuit.

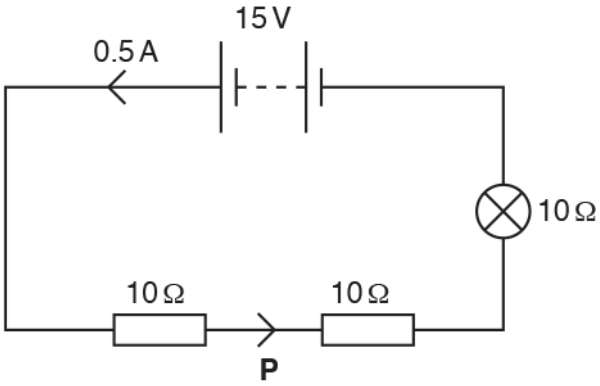
Answer = ... A **[1]**

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12 What is the current at point **P** in the circuit?



A 0.5 A

B 7.5 A

C 15.0 A

D 20.5 A

Your answer ☐ **[1]**

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13(a)

(i) Write down the conditions needed for charge to flow through a conductor.

---

[2]

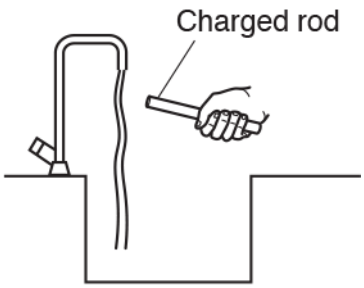
(ii) Calculate the charge that flows past a point in a circuit with a 5.0 A current for five minutes.

Answer = ... C **[4]**

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(b) This question is about electrostatic charges.

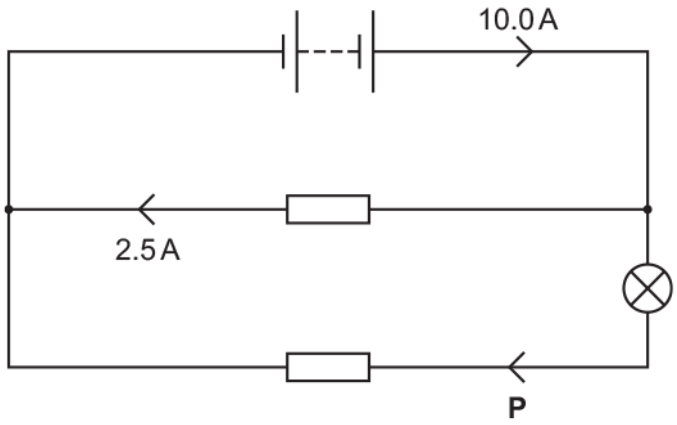
A charged rod is brought towards a gentle stream of water from a tap.



Explain how the charged rod affects the stream of water.

--- [3]

14 Look at the circuit diagram.



What is the current at point **P** in the circuit?

A 2.5 A

B 5.0 A

C 7.5 A

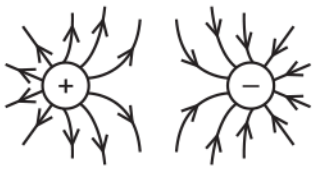
D 10.0 A

Your answer [ ] **[1]**

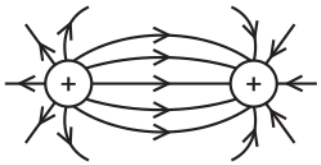
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15 Look at the field line diagrams for positive and negative charges.

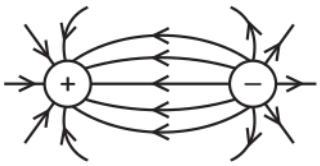
A



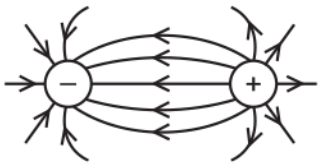
B



C



D



Which field line diagram is correct?

Your answer [ ] **[1]**

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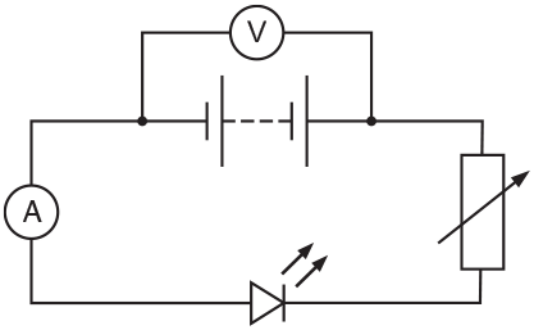
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16(a) A student investigates the electrical characteristics of a light emitting diode (LED).

The student builds a circuit to investigate how the current through an LED and the potential difference across it vary when the LED lights up.

Look at the circuit diagram.



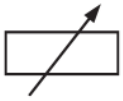
(i) The student has made **two** errors connecting the circuit.

Identify the errors.

1 _____

2 _____

[2]

(ii) What is the purpose of the component  in the circuit?

_____

[1]

(b) The student then connects the circuit correctly. He measures the current through the LED as 0.03 A when the potential difference across it is 3.0 V.

(i) Calculate the resistance of the LED.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[3]**

(ii) Calculate the charge which flows when this LED operates for 2.5 minutes.

Charge = ... C **[4]**

(iii) Calculate the energy transferred when this LED operates for 2.5 minutes.

Use the equation: energy transferred = charge × potential difference

Energy transferred = ... J **[2]**

17 Static electricity can be produced when two materials are rubbed together.

Which two types of material could cause static electricity to be produced?

A Two insulators

B Two conductors

C One insulator and one conductor

D A metal and a non-metal

Your answer ☐ **[1]**

18 What conditions are needed for charge to flow?

A A source of potential difference and two lamps.

B A complete circuit and two lamps.

C A complete circuit and a source of potential difference.

D A complete circuit and a source of resistance.

Your answer ☐ **[1]**

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19 Calculate the **charge** that flows when a current of 2.5 A flows for 30 seconds.

Charge = ... C **[3]**

20(a) A student investigates static electricity using a plastic ruler.

(i) Explain in terms of electrons why the plastic ruler is not normally charged.

---

[2]

(ii) Explain in terms of electrons why the ruler becomes charged when the student rubs it with a cloth.

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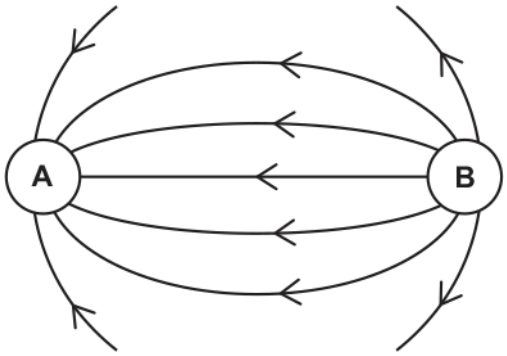
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(b) The diagram shows the electric field between two charges, **A** and **B**.



(i) State the charges of **A** and **B**.

Use the diagram to explain your answer.

---

[3]

(ii) Describe **one** similarity between the electric field line diagram and a magnetic field line diagram.

---

[1]

21 Calculate the charge flow when a current of 20 mA flows for 2000 s.

Use the equation: charge flow = current × time

A 40 C
B 100 C
C 40 000 C
D 100 000 C

Your answer ☐ **[1]**

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22(a) A student investigates static electricity using a plastic ruler.

(i) Explain in terms of electrons why the plastic ruler is not normally charged.

---

[2]

(ii) Explain in terms of electrons why the ruler becomes charged when the student rubs it with a cloth.

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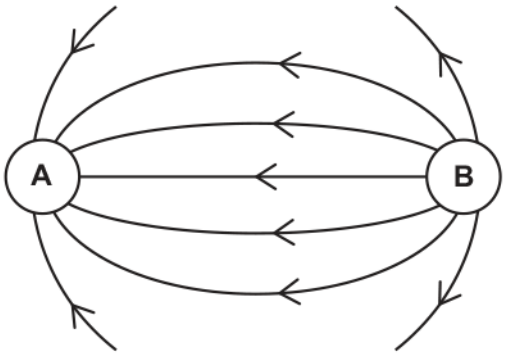
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(b) The diagram shows the electric field between two charges, **A** and **B**.



(i) State the charges of **A** and **B**.

Use the diagram to explain your answer.

---

[3]

(ii) Describe **one** similarity between the electric field line diagram and a magnetic field line diagram.

---

[2]

END OF QUESTION PAPER