

# STATIC ELECTRICITY 1

**Q:1** During car journeys, the driver will often become electrostatically charged. This is more noticeable on dry days than on damp, humid days.

(a) Explain what happens to cause the driver to become charged.

---

---

---

(2 marks)

(b) Scientists were asked to find out if the build up of charge on the driver depends on the type of material the driver's clothes are made from. The results of the investigation are given in the table.

<b>Material</b>	<b>Humidity</b>	<b>Temperature in °C</b>	<b>Charge on the driver in millicoulombs</b>
Nylon	48 %	18	3.0 to 3.2
Wool	48 %	18	2.4 to 2.5
Cotton	48 %	18	1.4 to 1.7

Humidity is a measure of how much water vapour the air can hold.

(i) Why was it important that the scientists controlled the humidity?

---

---

(1 mark)

(ii) Does the data in the table show that the charge on the driver would always be less if they were to wear cotton clothing?

Give a reason for your answer.

---

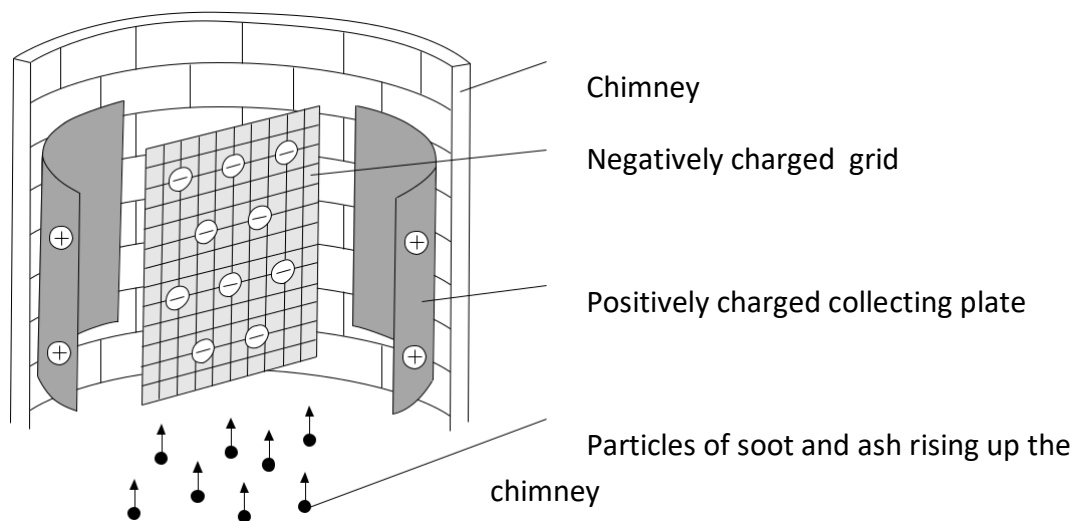
---

---

(1 mark)

**Q:2** (a) Burning coal produces soot, ash and waste gases.

The diagram shows an electrostatic precipitator used to separate the particles of soot and ash from the waste gases.



Explain how the electrostatic precipitator separates the particles of soot and ash from the waste gases.

---

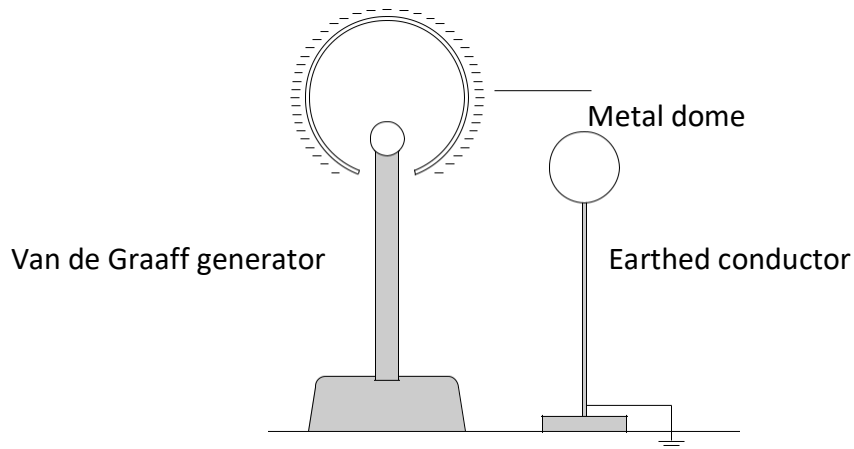
---

---

---

(3 marks)

(b) The diagram shows a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain what must happen to cause a spark to jump from the dome of the generator to an earthed conductor nearby.

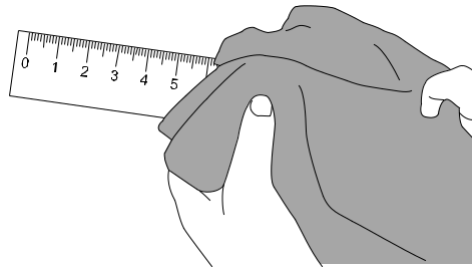
---

---

---

(2 marks)

**Q3)** A plastic ruler is rubbed with a cloth.



The ruler becomes negatively charged.

(a) (i) Complete the following sentence by drawing a ring around the correct line in the box.

The ruler becomes negatively charged because it has

- |                  |
|------------------|
| gained electrons |
| lost neutrons .  |
| lost protons     |

(1 mark)

(a)(ii) How could you show that the ruler is charged?

---

---

(1 mark)

(b) People often become electrostatically charged as they get out of a car. This happens because their clothing rubs against the car seat.

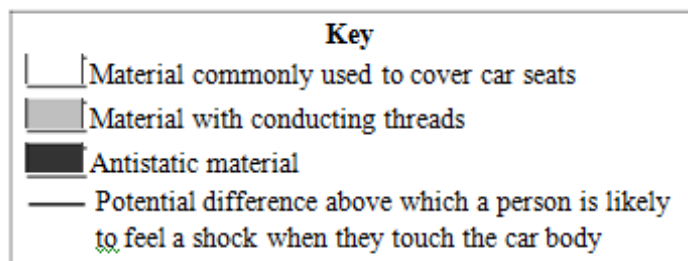
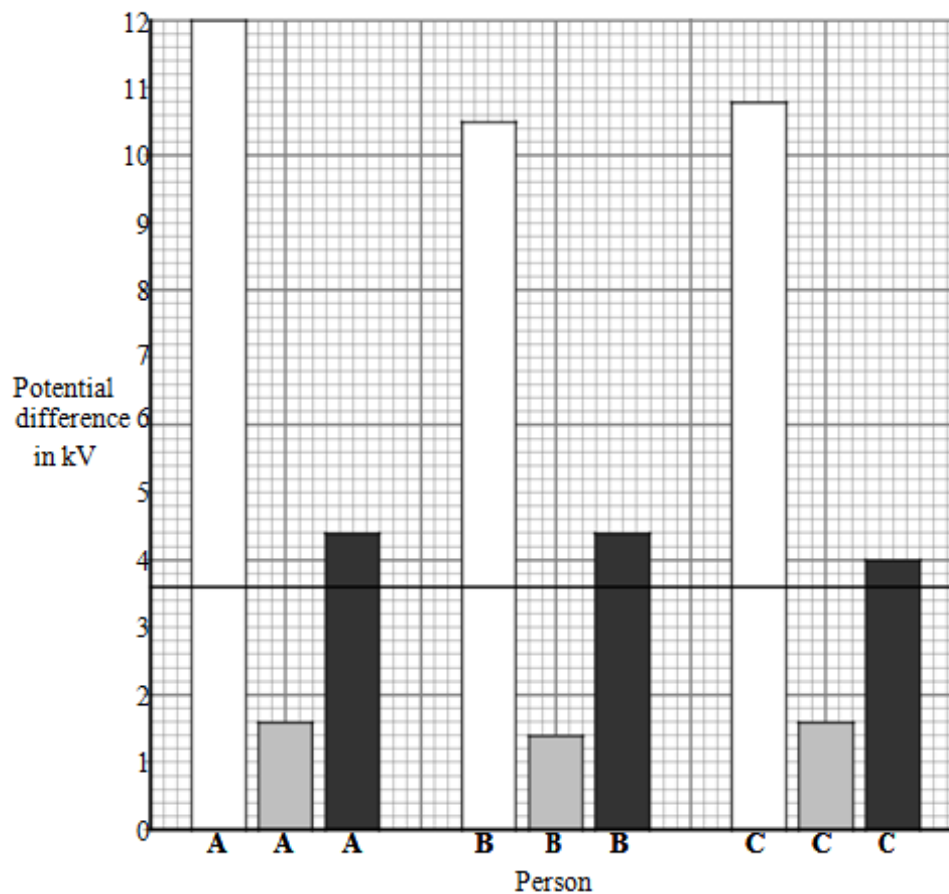
A scientist was asked to find out whether the amount of charge on a person depended on the type of material which covered the car seat.

Three people, A, B and C, were used to test three different types of seat covering.

In each test, the person got out of the car and stood on a thick sheet of plastic.

The scientist then measured the potential difference between the person and the car body.

The results of the investigation are displayed in the bar chart.



**Question 2 continues on the next page**

(b)(i) Explain why the measurement was made with the person standing on a thick sheet of plastic.

---

---

---

(2 marks)

(b)(ii) To make this a fair test, the three people, A, B and C, each wore the same type of clothing.

Suggest a reason why this was important.

---

---

(1 mark)

(b)(iii) The smallest scale division on the voltmeter was 0.1 kV. Suggest why, from the data, it was not necessary to increase the precision of the potential difference measurements.

---

---

(1 mark)

(b)(iv) Explain why this investigation may cause a manufacturer to change the material used to cover car seats.

---

---

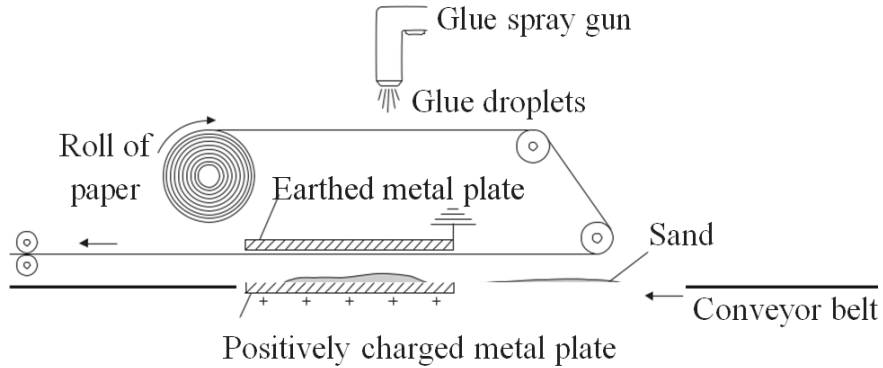
---

---

(2 marks)

**Q:4** Static electricity can be both useful and a nuisance.

(a) The diagram shows a method of producing sandpaper using static electricity.



Glue is sprayed onto a moving strip of paper. As the glue leaves the spray gun, the glue breaks up into tiny negatively charged droplets which coat the paper. The sticky paper passes between two metal plates. Sand moving on a conveyor belt also passes between the metal plates.

(a)(i) Explain the advantage of having all the droplets of glue negatively charged.

---

---

(2 marks)

(a)(ii) Explain why the sand moves towards the sticky paper.

---

---

---

(2 marks)

(b) People often experience an electric shock when getting out of a car.

This happens because charge is generated as they move around on the car seats.

On a warm dry day, the potential difference between a driver and the car increases to 10 000 volts. As the driver goes to touch the car door, a spark jumps the air gap, transferring 20 joules of energy between the driver and the car.

Use the equation in the box to calculate the initial charge on the driver.

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

Show clearly how you work out your answer and give the unit.

---

---

---

Charge = \_\_\_\_\_

(3 marks)

TOTAL MARKS=23