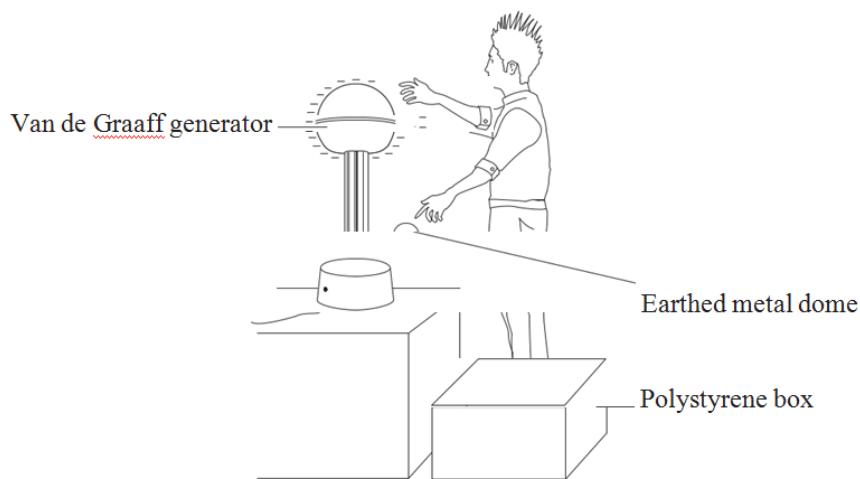


# STATIC ELECTRICITY 2

**Q:1** (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.

---

---

---

(2 marks)

(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.

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

---

---

---

Charge transferred ..... coulombs

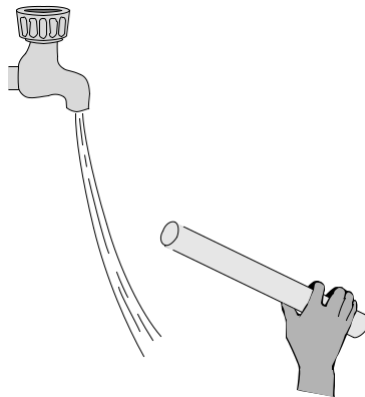
(2 marks)

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

---

(1 mark)

2 (a) The diagram shows a negatively charged plastic rod held close to a thin stream of water. The water is attracted towards the rod.



Which one of the following statements explains what is happening to the charge in the water?

Tick (☑) one box.

The positive and the negative charges in the water are attracted to the rod.

The positive and the negative charges in the water are repelled by the rod.

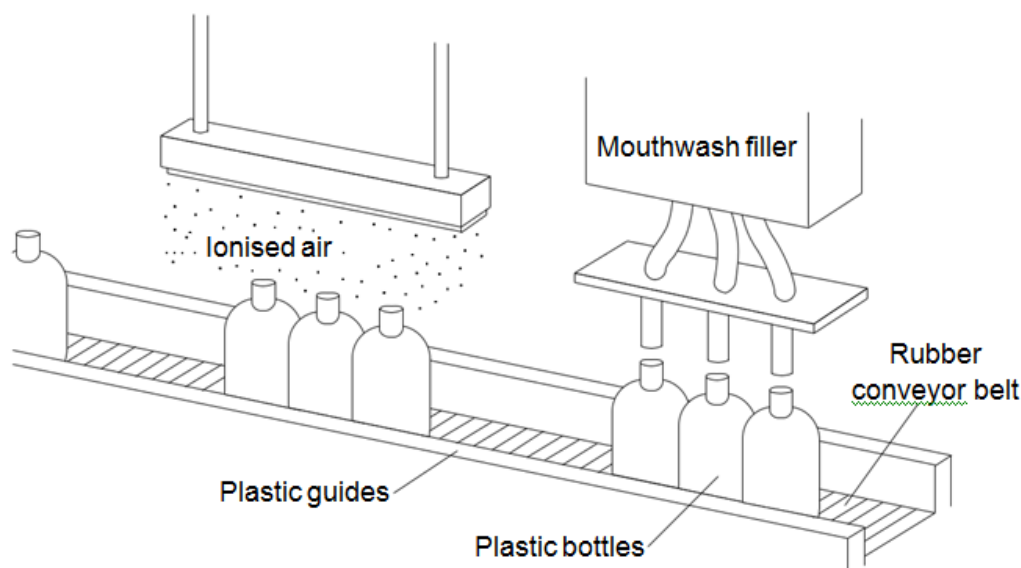
The negative charge in the water is repelled by the rod and the positive charge is attracted.

The negative charge in the water is attracted by the rod and the positive charge is repelled.

(1 mark)

(b) A company that produces bottles of mouthwash found a problem with the automatic filling system.

As the bottles go towards the filler, they move around on the conveyer belt and become electrostatically charged. This causes the stream of mouthwash to move sideways, missing the open top of the bottle.



The company came up with a solution to the problem. Before the bottles reach the filler, they pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

2 (b) (i) Explain why the plastic bottles become charged.

---

---

---

---

(2 marks)

(b) (ii) What is an ion?

---

---

(1 mark)

(b) (iii) Earthing the conveyor belt with a conducting wire would not have solved this problem. Give a reason why.

---

---

(1 mark)

**Q:3** 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 whether the build-up of charge on the driver depends on the type of material used to make the driver's clothes. The results of the investigation are given in the table.

Material	Humidity	Temperature in °C	Charge on the driver in <u>millicoulombs</u>
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)

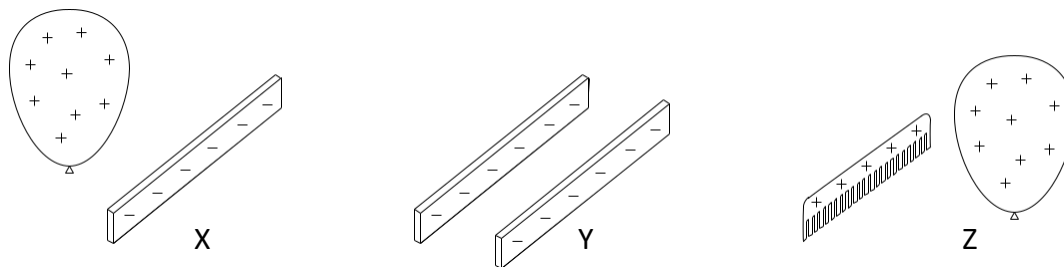
(ii) Does the data in the table show that the charge on the driver would always be less if they were to wear cotton clothing?

Give a reason for your answer.

---

(1 mark)

**Q:4** (a) The diagrams X, Y and Z show three pairs of charged objects. Each object is either positively charged or negatively charged.



(a)(i) In which diagram or diagrams do the objects repel each other?

---

(1 mark)

(a)(ii) In which diagram or diagrams do the objects attract each other?

---

(1 mark)

(b) The diagram shows a fuel tanker refuelling an aircraft. A static charge can build up as the fuel flows through the pipe to the aircraft. This can be dangerous.



Fuel tanker

(b)(i) Static charge could be dangerous in this situation.

Explain why.

---

---

---

(2 marks)

(b)(ii) Before refuelling, the aircraft and fuel tanker are joined to earth by a metal wire.

Which one of the following statements is the reason why this procedure reduces the danger?

Put a tick (☑) in the box next to your choice.

The charge will stay in the wire.

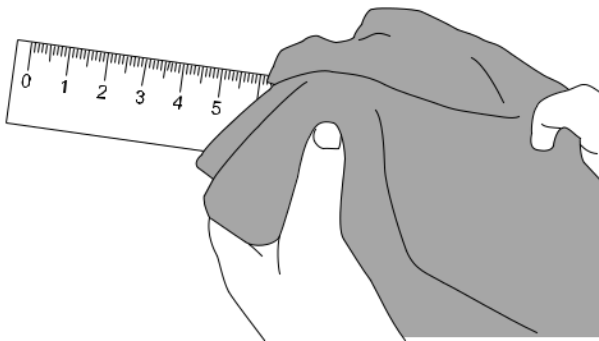
The charge will flow to earth.

The charge will move onto the aircraft.

The charge will move onto the fuel tanker.

(1 mark)

**Q:5** (a) 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.

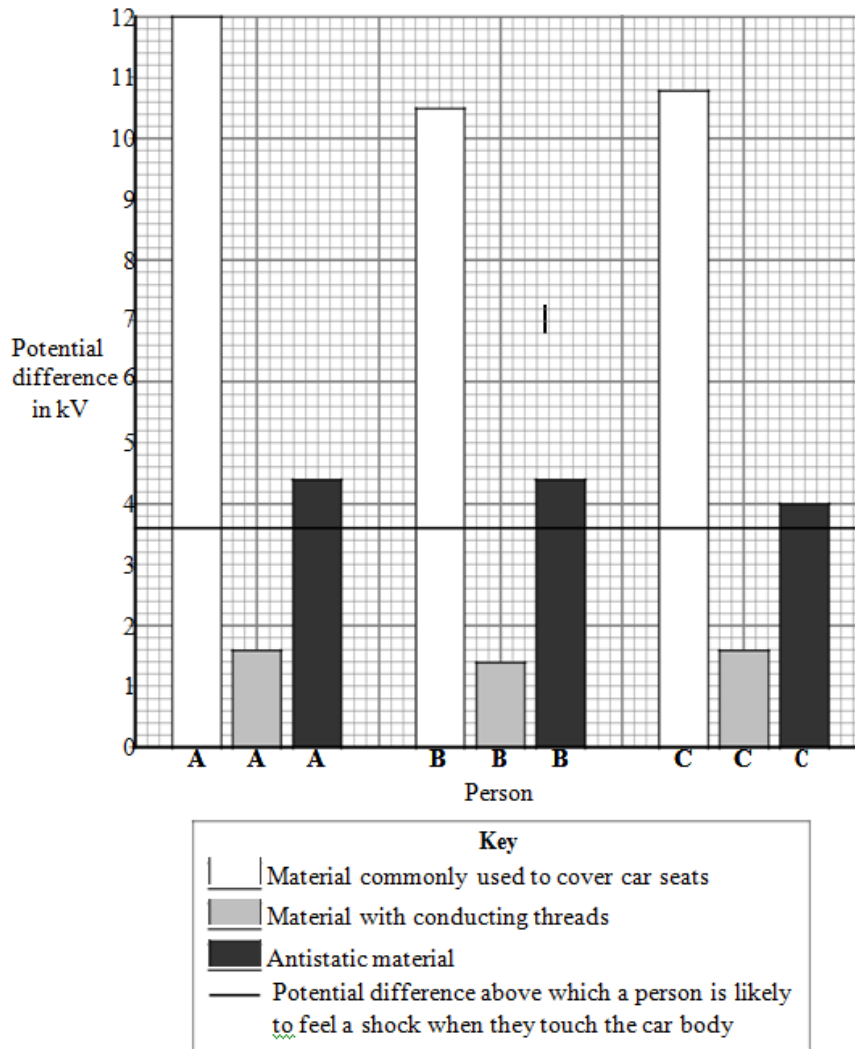
Three people, A, B and C, were used to test three different types of seat covering.

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.





(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)

TOTAL MARKS =27