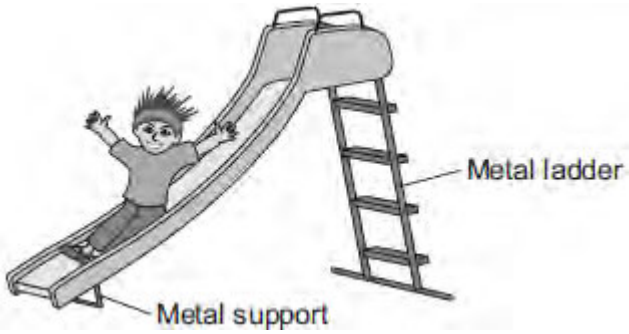
Q1. The figure below shows a slide in a children's playground.



(a) A child of mass 18 kilograms goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N / kg

.....

.....

.....

Decrease in gravitational potential energy = ... J

(2)

(b) The slide is made of plastic.

(i) The child becomes electrically charged when he goes down the slide.

Explain why.

.....

.....

.....

.....

(2)

(ii) Going down the slide causes the child's hair to stand on end.

What conclusion about the electrical charge on the child's hair can be made

from this observation?

.....

.....

Give a reason for your answer.

.....

.....

(2)

(iii) Why would the child **not** become electrically charged if the slide was made from metal?

.....

.....

(1)
(Total 7 marks)

Q2. A pupil did an experiment following the instructions below.

1. Take a polythene rod (AB), hold it at its centre and rub both ends with a cloth.

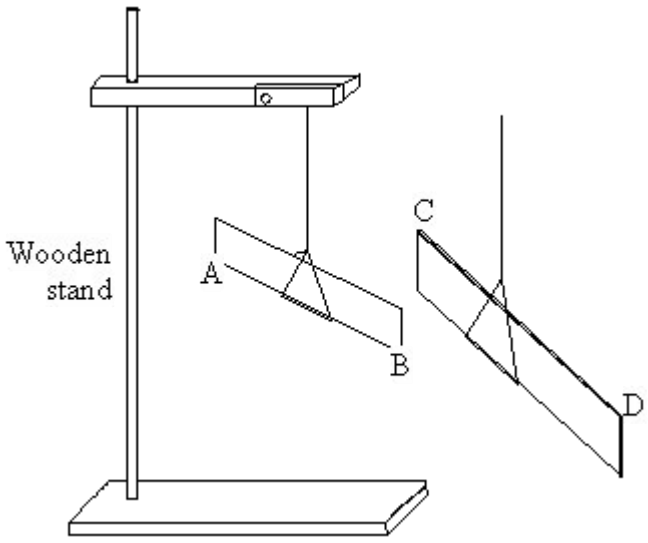
2. Suspend the rod, without touching the ends, from a stand using a stirrup and nylon thread.

3. Take a perspex rod (CD) and rub it with another cloth.

4. Without touching the ends of the perspex rod bring each end of the perspex rod up to, but without touching, each end of the polythene rod.

5. Make notes on what is observed.

The diagram below shows how the apparatus is to be set up.



(a) When end C was brought near to end B they attracted each other.

(i) Explain why they attracted each other.

.....

.....

(ii) What would happen if end C were brought near end A?

.....

(3)

(b) The experiment was repeated with two polythene rods.

(i) Describe what you would expect the pupil to observe as the end of one rod was brought near to the end of the other.

.....

.....

(ii) Explain your answer.

.....

.....

(2)

(c) Explain, in terms of electron movement, what happened as the rods were rubbed with the cloths.

.....

.....

.....

.....

.....

(3)
(Total 8 marks)

Q3. 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)

(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 millicoulombs
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)

(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?

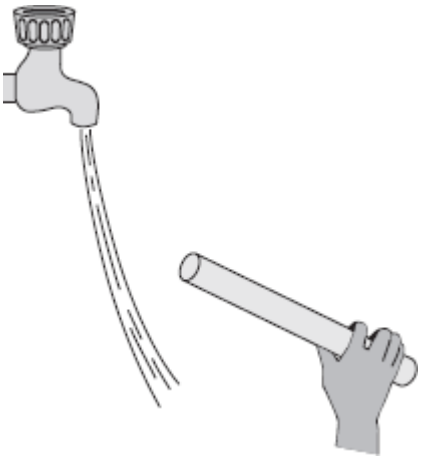
Give a reason for your answer.

.....

.....

(1)
(Total 4 marks)

Q4. (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. ☐

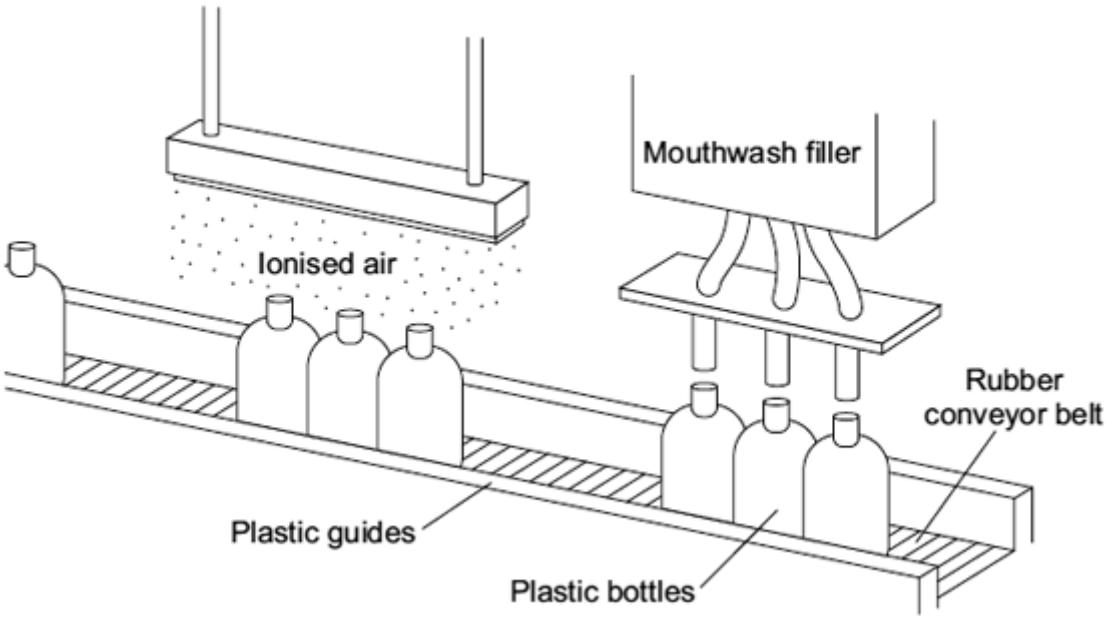
The negative charge in the water is repelled by the rod and the positive charge is attracted. ☐

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

(1)

(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.

(i) Explain why the plastic bottles become charged.

.....

.....

.....

.....

(2)

(ii) What is an ion?

.....

.....

(1)

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

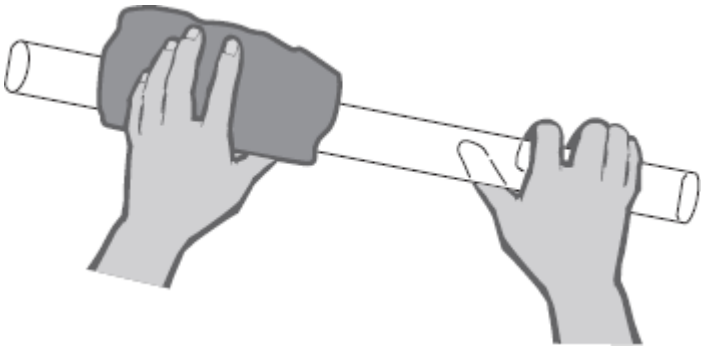
Give a reason why.

.....

.....

(1)
(Total 5 marks)

Q5.(a) The diagram shows a polythene rod being rubbed with a woollen cloth.



The polythene rod becomes negatively charged.

Explain how this happens.

.....

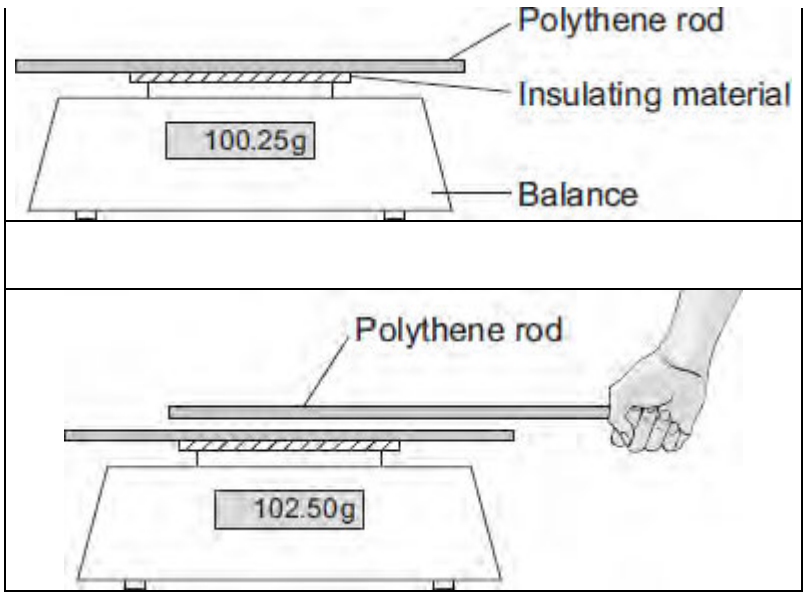
.....

.....

.....

(2)

(b) A student put the charged polythene rod on to a balance. The rod was separated from the metal pan of the balance by a thin block of insulating material.
The student then held a second charged polythene rod above, but **not** touching, the first rod. The reading on the balance increased.



(i) Explain why the reading on the balance increases.

.....

.....

.....

.....

(2)

(ii) The student observed that the nearer the two rods are to each other, the bigger the increase in the balance reading.

What should the student conclude from this observation?

.....

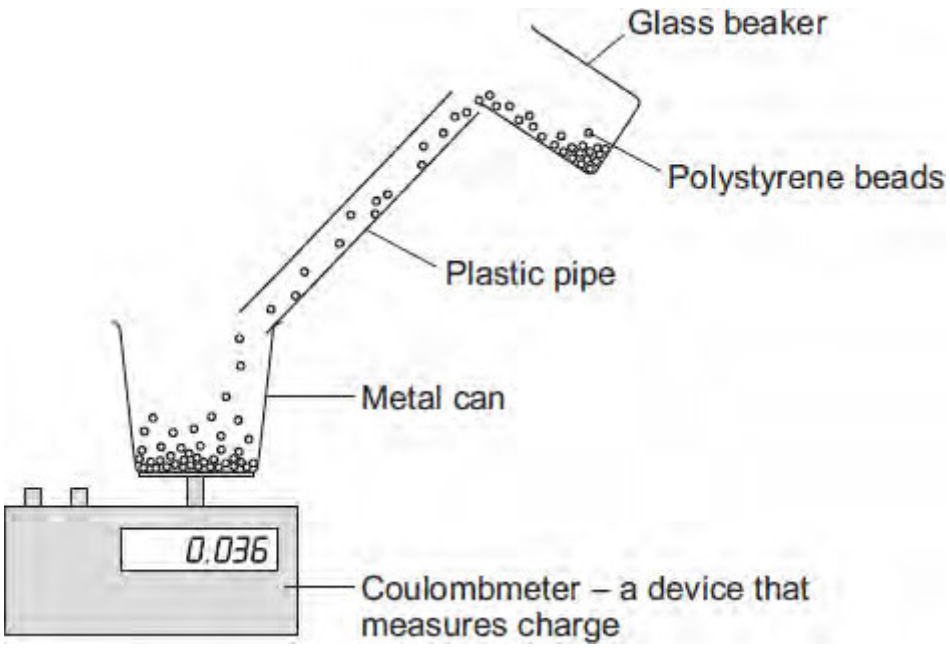
.....

.....

.....

(2)
(Total 6 marks)

Q6.(a) Fine powders poured through a pipe can become charged. The diagram shows the apparatus used by a student to investigate this effect.



The student poured 75 cm^3 of polystyrene beads down the pipe. The beads fell into a metal can and the charge on them was measured directly using a coulombmeter.

The student repeated this twice more, but each time used 75 cm^3 of beads of a different size.

(i) When they fell through the pipe, the polystyrene beads became negatively charged.

Explain how this happened.

.....

.....

.....

.....

.....

.....

(3)

(ii) Give **one** control variable in the student's investigation.

.....

.....

(1)

(b) The results obtained by the student are shown in the table.

Diameter of polystyrene beads in mm	Charge in microcoulombs
1.0	0.080
2.0	0.044
3.0	0.012

(1 000 000 microcoulombs = 1 coulomb)

(i) Describe the connection between the size of the polystyrene beads and the total charge on the beads.

.....

.....

(1)

(ii) Explain how these results might be different if the student had used a shorter pipe.

.....

.....

.....

.....

(2)

(c) In industry, powders are often pumped through pipes. If the static charge caused a spark, the powder could ignite and cause an explosion.

(i) Is an explosion more likely to happen when pumping very fine powders or when pumping powders that consist of much larger particles?

.....

Give a reason for your answer.

.....

.....

(1)

(ii) Suggest **one** way that the risk of an explosion could be reduced.

.....

.....

(1)

(d) The table gives the minimum ignition energy (MIE) value for a number of fine powders.
The MIE is the minimum amount of energy required to cause a fine powder to ignite.

Type of powder	MIE in millijoules
Coal dust	60.00
Aluminium powder	10.00
Cornstarch dust	0.30
Iron powder	0.12

The MIE values for different substances are all measured in the same way and under the same conditions of pressure and temperature.

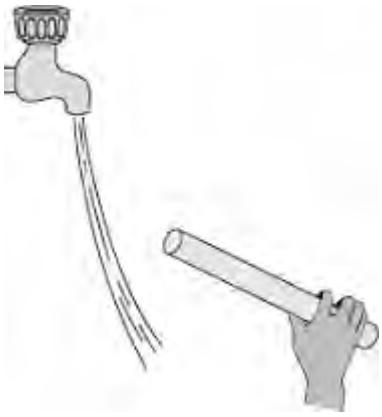
Why is this important?

.....

.....

(1)
(Total 10 marks)

Q7.(a) The diagram shows a negatively charged plastic rod held near 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. ☐

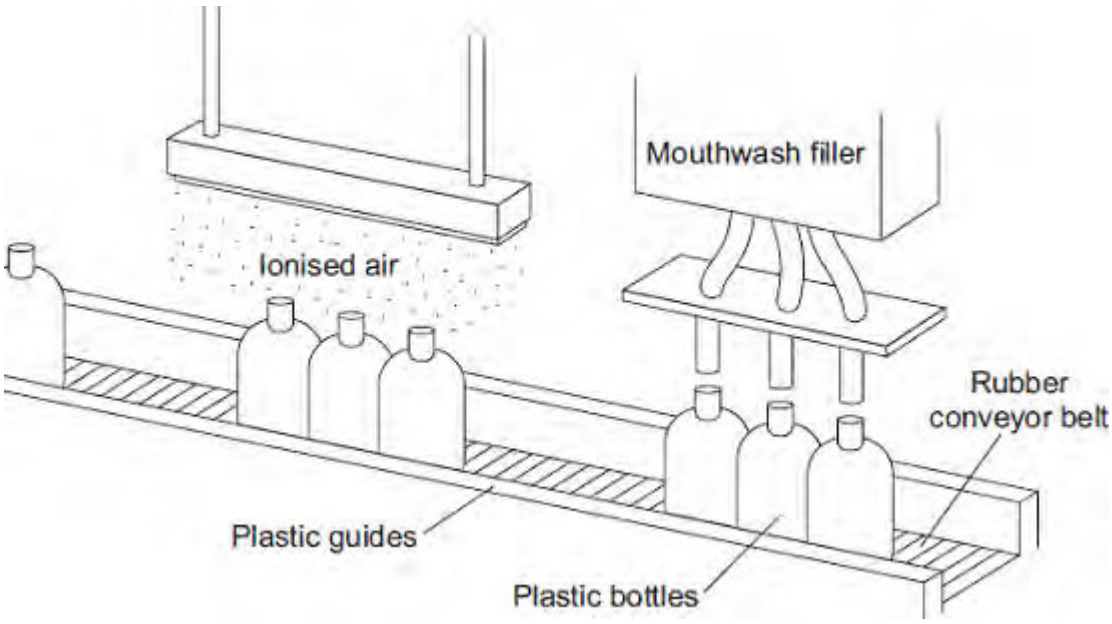
The negative charge in the water is repelled by the rod and the positive charge is attracted to the rod. ☐

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

(1)

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

As the bottles go towards the filler, the bottles move around on the conveyor 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 an answer to the problem. Before the bottles reach the dfiller, the bottles pass through a stream of ionised air. The ions in the air neutralise the charge on the bottles.

(i) Explain why the plastic bottles became charged.

.....

.....

.....

.....

(2)

(ii) What happens to the structure of an atom to change the atom into an ion?

.....

.....

(1)

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

.....

.....

(1)
(Total 5 marks)