

NAME:

SCHOOL:.....

DATE:

ELECTROSTATICS

INSTRUCTIONS TO CANDIDATES

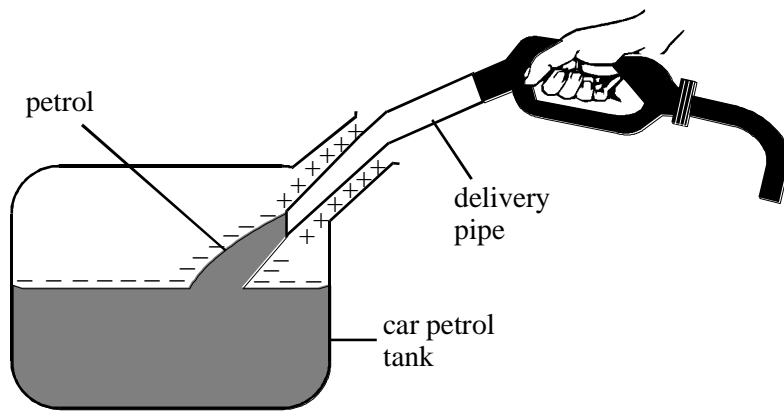
Answer **ALL** questions in this paper in the spaces provided.

1. (a) Electrostatic charges can be produced by the process of friction.
- (i) Which charged particle is transferred from one material to the other in this process?

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(1)

- (ii) When petrol is pumped through pipes, electrostatic charges can build up.



Explain why this is dangerous.

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(2)

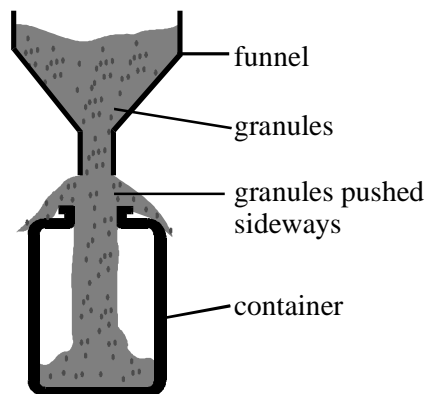
(iii) What can be done to prevent the build up of electrostatic charges?

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(1)

(b) The diagram shows coffee granules being poured through a funnel into a container. As the granules move through the funnel they gain an electrostatic charge. This causes some of the granules to miss the container.



Explain, in terms of charges, why some of the granules are pushed out sideways and miss the container.

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(2)
(Total 6 marks)

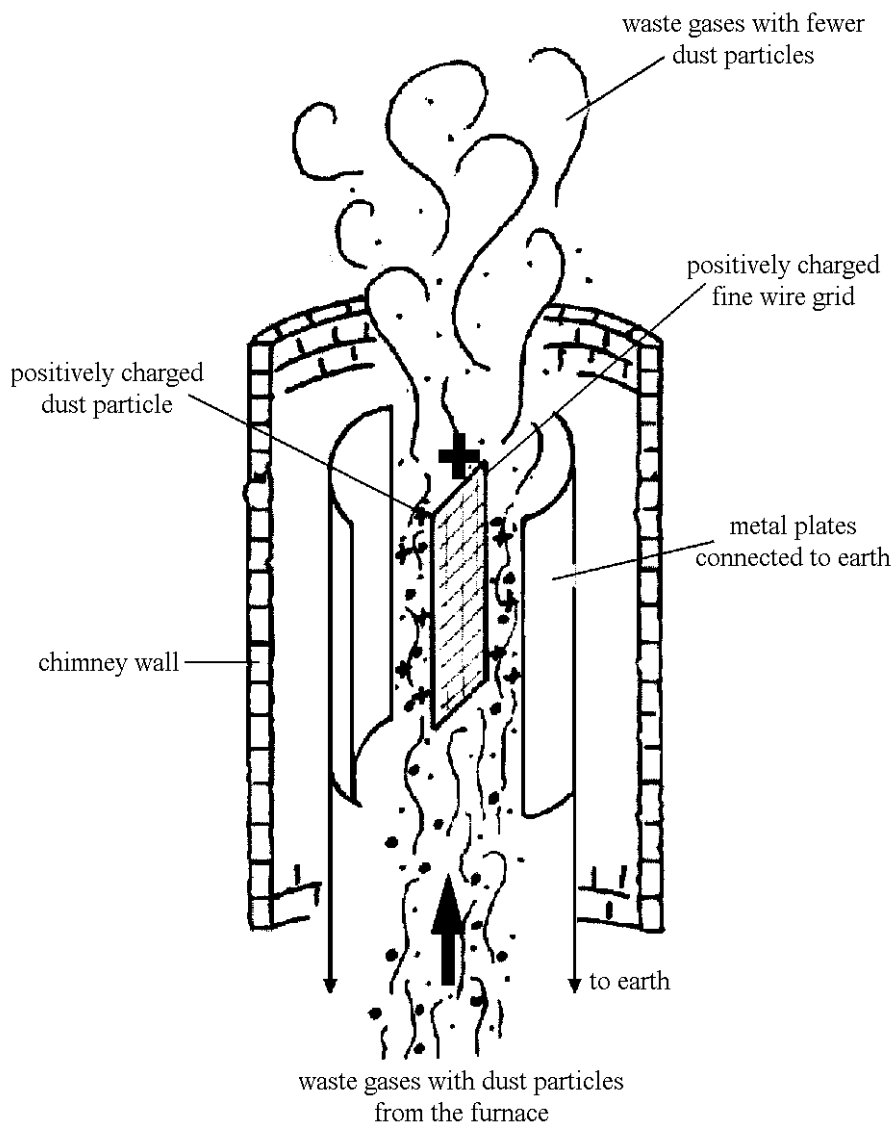
2. (a) Use words from the box to complete the passage below.

attract	electrons	electrostatic	friction	protons
		repel		

When Jacquie takes off her woollen jumper she hears a crackling sound and sees small flashes of light. It is thought that the between her jumper and blouse is producing charges. The jumper becomes positively charged because are being removed from it. Because the jumper and blouse have opposite charges they each other and this makes it difficult for the jumper to be removed.

(4)

- (b) The diagram shows the inside of a simple electrostatic precipitator. This is a device for removing dust from the waste gases in chimneys of factories and power stations. As the dust particles move up past the fine wire grid they gain a positive charge.



- (i) Show, with an arrow, the direction of movement of the positively charged particles between the grid and the earth plate.

(1)

(ii) Explain why the positively charged particles move in the direction you have shown.

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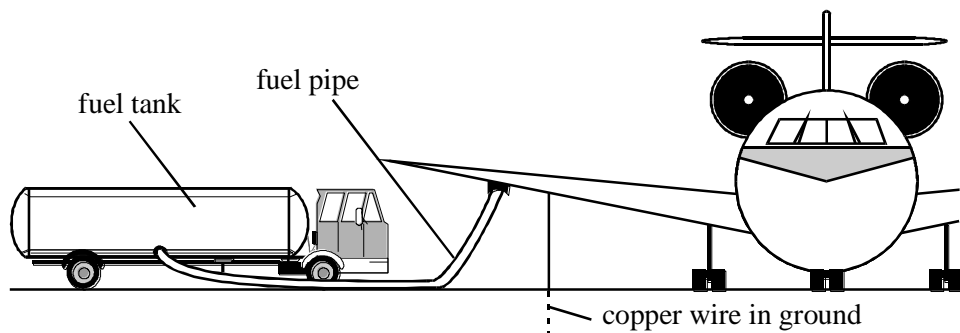
(2)

(iii) From time to time the earthed metal plates are hit with a hammer.
Suggest a reason for this.

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(1)
(Total 8 marks)

3. Electrostatic charge is important when aircraft are refuelled.



(a) Electrostatic charge can build up as fuel is pumped through the fuel pipe.
Explain how this happens.

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(2)

(b) Why is the build up of electrostatic charge on the aircraft dangerous?

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(1)

(c) During refuelling a copper wire is attached between the wing and the ground. How does this prevent the build-up of electrostatic charge on the wing?

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(2)

(Total 5 marks)

4. (a) Tick **two** boxes to show the best electrical conductors.

plastic

copper

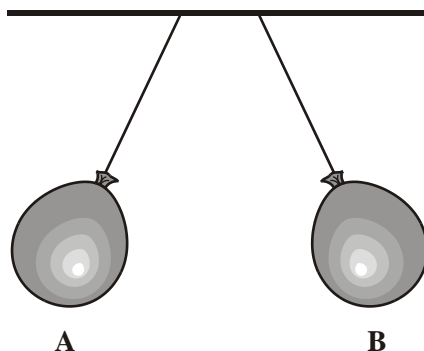
glass

water

silver

(2)

(b) The diagram shows two charged balloons hanging from a support on nylon threads.



(i) Draw one arrow on each balloon to show the directions of the forces which make the balloons move apart.

(2)

(ii) Balloon **A** is positively charged.

What is the sign of the charge on balloon **B**?

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Explain your answer.

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(2)

(iii) One way of charging a balloon is by rubbing it on a woollen jumper.

An aluminium rod held in the hand cannot be charged in this way.

Explain why not.

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(2)

(c) (i) State **two** ways in which static electricity can be put to good use.

1

2

(2)

(ii) State **two** ways in which static electricity can be harmful or annoying.

1

2

(2)

(Total 12 marks)

5. (a) Jason holds a polythene rod and rubs it with a dry cloth.
The rod becomes electrically charged.

(i) Describe what happens when he holds the charged rod near some small pieces of paper.

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(2)

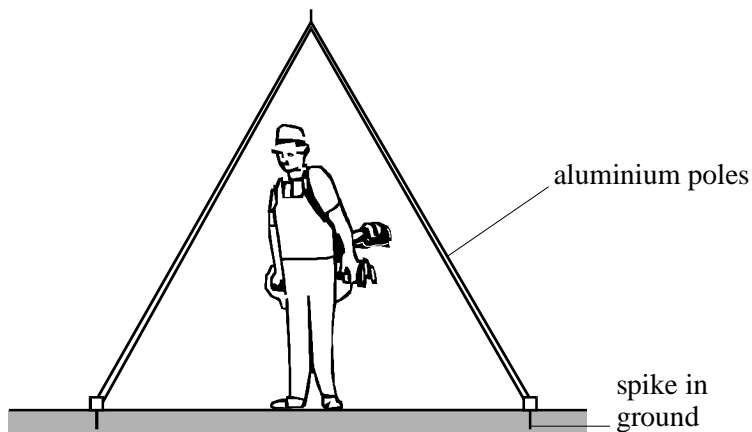
(ii) He holds other rods made from different materials and rubs them with the same cloth.

Complete the table by placing a tick in the correct column for each material to show whether it is found to be charged or not.

Material	Charged	Not Charged
polythene	✓	
copper		
steel		
plastic		

(2)

(b) A device to protect a golfer from lightning is shown.



Explain how the aluminium poles stop lightning from striking the golfer.

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(2)
(Total 6 marks)

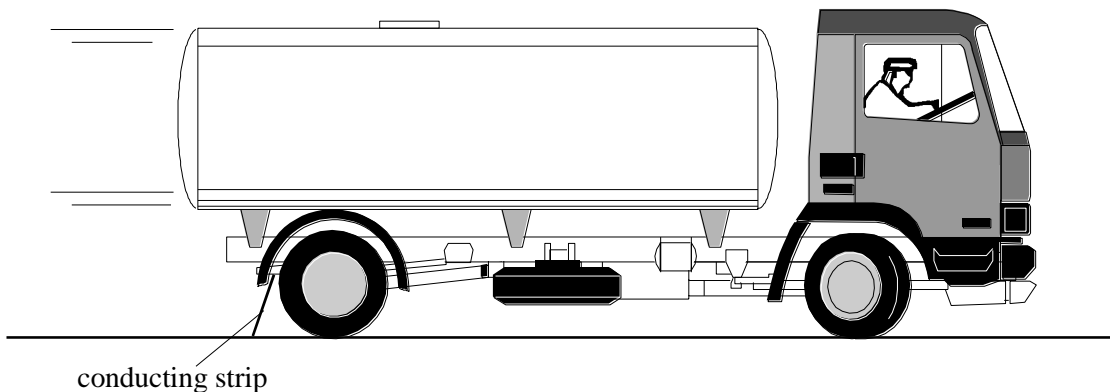
6. (a) A perspex ruler is rubbed with a cloth.
The ruler becomes positively charged.

Explain how it becomes positively charged.

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(2)

(b) Static electricity can be dangerous.



For safety reasons, some oil and petrol tankers are fitted with a conducting strip. When the tanker is moving, it is important that the conducting strip is in contact with the ground.

Explain how the conducting strip increases safety.

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(3)
(Total 5 marks)

7. (a) An aircraft in flight becomes charged.
The aircraft tyres are made of rubber that conducts electricity.
Suggest what happens to the charge on the aircraft when it lands.

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(2)

- (b) The charge on an aircraft is 2.0×10^{-4} C.
 It passes through the tyres in 0.5 s.
 Calculate the current in the tyres when the charge is passing through them.

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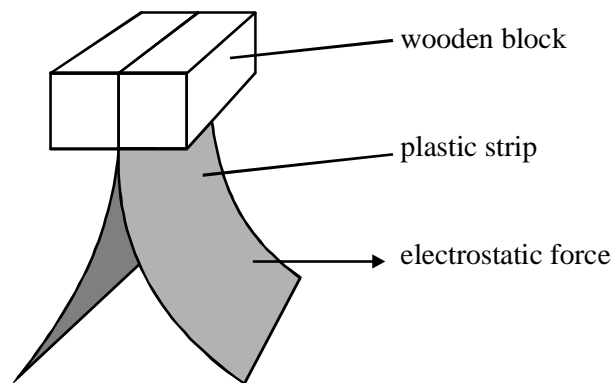
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(3)
 (Total 5 marks)

8. When two thin strips of plastic are rubbed with a duster they move away from each other. The arrow shows the electrostatic force on one of the strips.



- (a) Draw an arrow to show the direction of the electrostatic force on the other strip. (1)

- (b) Compare the sizes of the electrostatic forces on the strips. (1)
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(c) Explain why the strips move away from each other.

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.....

(2)

(d) (i) What particles are transferred between materials when an object becomes charged by rubbing?

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(1)

(ii) These particles carry a negative charge. What is the sign of the charge on objects that lose these particles?

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Give a reason for your answer.

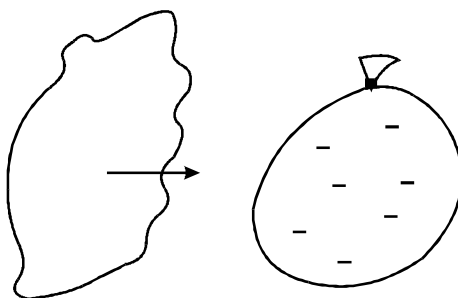
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(1)

(Total 6 marks)

9. (a) After a balloon is rubbed with a duster, the two attract each other.



(i) Draw an arrow that shows the electrostatic force on the balloon.

(1)

(ii) Explain, in terms of charges, why the balloon and the duster attract each other.

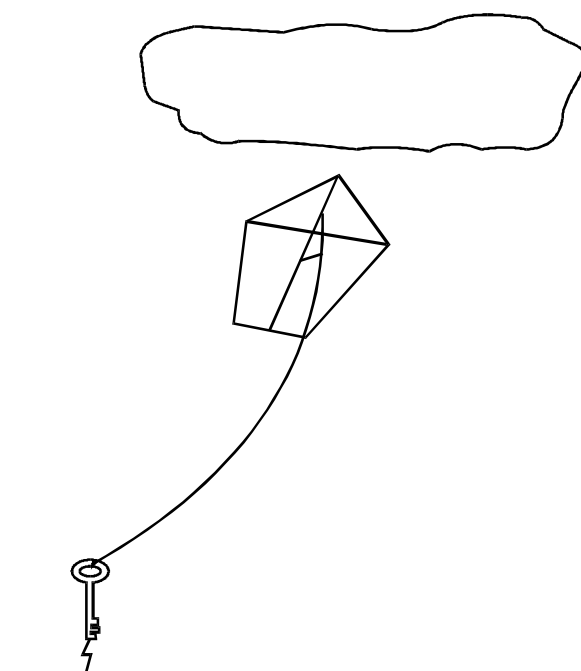
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(2)

(b) When Benjamin Franklin was trying to find out about electricity, he flew a kite under a thunder cloud.

He tied a metal key to the bottom of the kite string.

A spark passed from the metal key to the ground.



Franklin thought that electricity was a fluid that could move through things.

(i) What evidence did he have that electricity can move?

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(1)

(ii) Where did he think the electricity came from?

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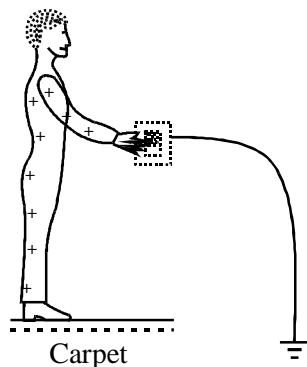
(1)

(iii) How would we now explain how electricity travelled along the kite string?

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(1)
(Total 6 marks)

10. (a) A man becomes positively charged by walking across a nylon carpet.



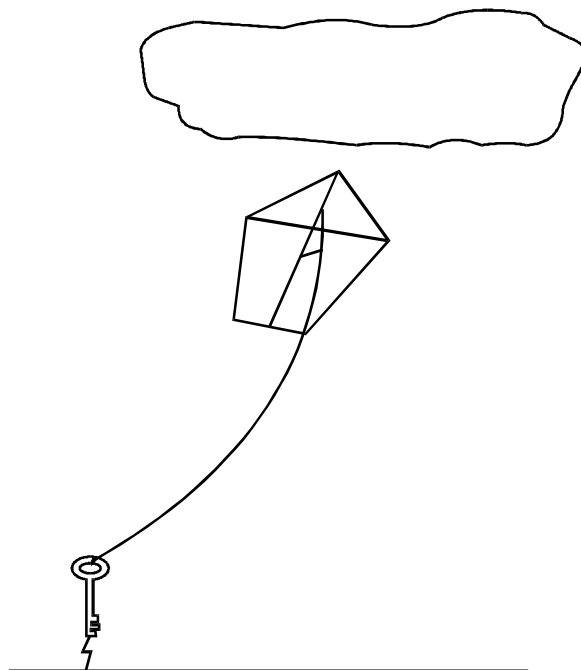
When he touches an earthed light switch, he feels a shock as he loses excess charge.

Explain how he loses the excess charge.

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(2)

- (b) Benjamin Franklin flew a kite in a thunderstorm. He tied a metal key to the bottom of the kite string. A spark passed from the key to the ground.



He thought that electricity was a fluid that could pass through objects.
Since then we have discovered that atoms contain charged particles.

How would we now explain the flow of electricity through the wet kite string and the metal key?

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(3)
(Total 5 marks)