

O Level Pure Physics Structured

Static Electricity Test 1.0

Q1

Fig.8.1 shows a negative charged metal plate X, an uncharged metal plate Y and a connection to earth. Plate X and Plate Y are on insulating stands.

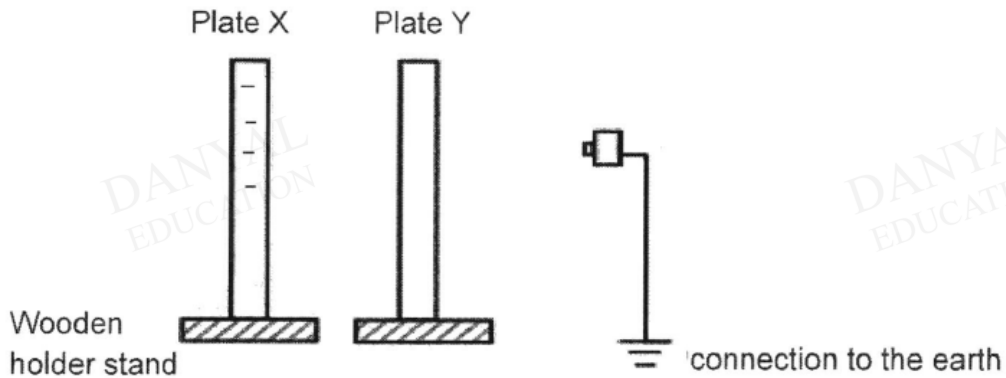


Fig. 8.1

- (a) Define electrostatic induction. [1]

- (b) With the aid of the items shown in Fig. 8.1, describe clearly the steps to attain a positive charged plate Y. [3]

- (c) Suggest the need for the holder stand to be wooden. [1]

Q2

When a balloon is rubbed on hair, the balloon becomes negatively charged. The balloon is shown in **Fig. 5.1**



Fig. 5.1

(a) Explain how rubbing causes the balloon to become negatively charged.

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..... [2]

(b) Explain why the hair is pulled towards the balloon.

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.....
..... [2]

(c) Explain why it is important that the balloon is made from an electrical insulator.

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.....
..... [1]

(d) State one example where static electricity is useful.

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..... [1]

Q3

Fig. 6.1 shows the print head for an inkjet printer. The inkjet from the ink gun is charged before it is ejected downwards.

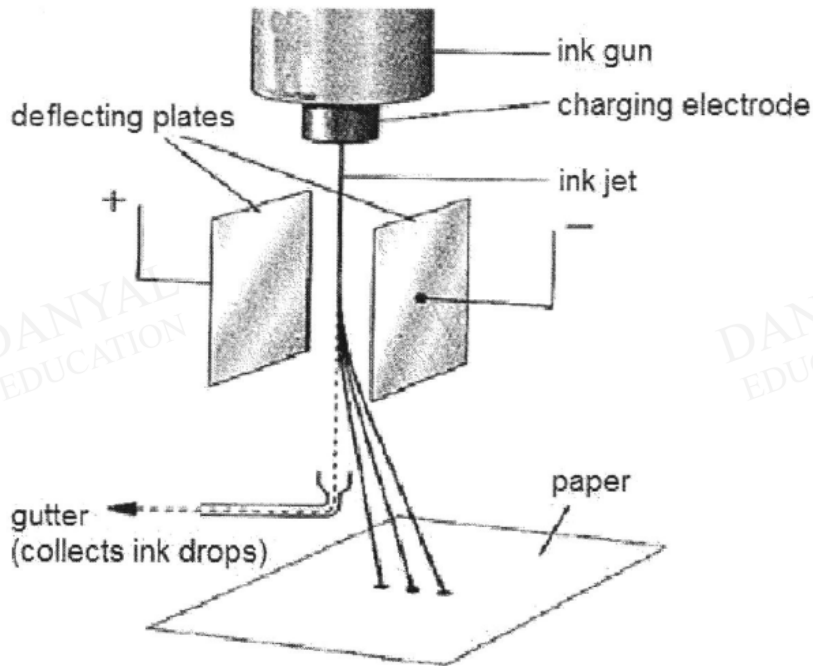


Fig. 6.1

(a) State the type of charge on the inkjet and explain your answer.

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.....[1]

(b) Explain why the ink particles form an even layer of coating on the paper.

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.....[1]

(c) Predict if an even layer of coating on the paper is more likely to be achieved by a printer in an air-conditioned room compared to a non air-conditioned room.

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.....[2]

Q4

a) Fig 11.1 shows a method of producing sandpaper using static electricity.

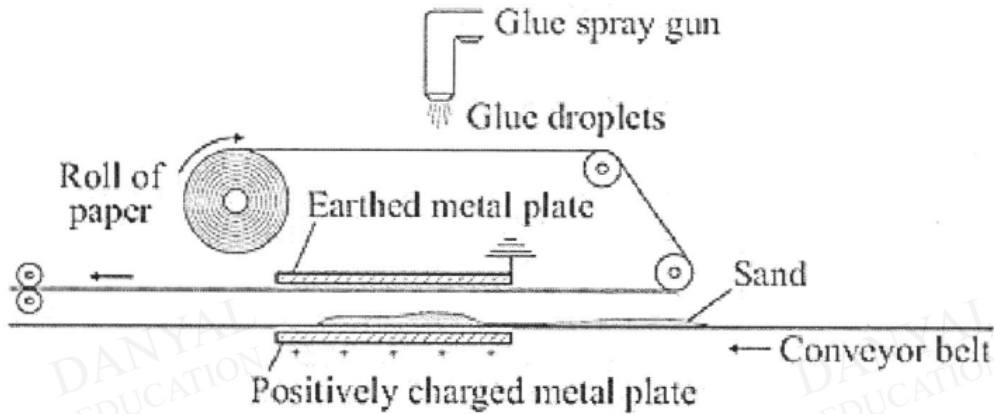


Fig 11.1

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.

(i) What is the advantage of having all the glue droplets with the same (negative) charge? [2]

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.....

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(ii) Explain why the sand moves towards the sticky paper. [2]

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.....

b) Thunderclouds contain charges. The buildup of charges on the clouds causes a large potential difference between the cloud and the ground.

(i) Explain, in terms of energy, what is meant by *potential difference* in this context. [2]

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.....

.....

(ii) There is a potential difference of 1000 MV between a cloud and earth. In a lightning discharge from the cloud to earth, a charge of 20 C passes. Calculate the energy involved in this discharge.

[2]

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Energy =

(iii) A lightning conductor is placed at the top of a building to help to reduce the chance of a lightning discharge. Describe how this is achieved.

[2]

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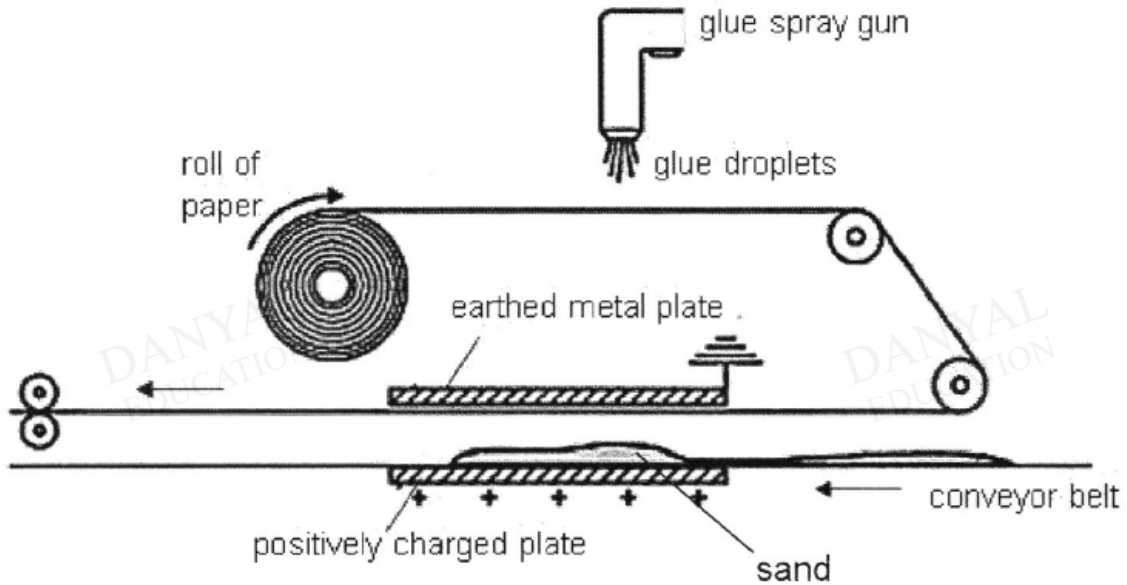
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Q5

The figure below 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) Explain the advantage of having all the droplets of glue negatively charged.

[2]

- (b) Explain why the sand moves towards the sticky paper.

[2]

Answers

Static Electricity Test 1.0

Q1

(a)	Electrostatic Induction is a process of causing charges to move in conductors without contact between the conductor and the charging body.	B1
(b)	1) Place plate X close to plate Y. 2) connect the contact of the wire that link to Earth to plate Y 3) remove the connect of the contact of the wire from plate Y. 4) move plate X away from Y	B1 B1 B1
(c)	Stand needs to be wooden so that charges will not flow away or to the plate	B1

Q2

5(a)	negative charge moves from hair/person/head to balloon electrons move from hair/person/head to balloon.	[1] [1]
MC	Only half the students got full credits. Many students were unfamiliar with the mechanism of charging by friction.	
5(b)	hair is positive(at end) opposite charges attracts	[1] [1]
MC	Generally fairly well-done. Quite a number of students did not obtained the full credit because they didn't state the physics principle that 'unlike charges attracts'.	
5(c)	charges/electrons <ul style="list-style-type: none"> • don't flow away • aren't conducted(to earth/person) stay on balloon/insulator	[1]
MC	This question is very poorly done. The charges that is built-up in this experiment is very small and will unlikely caused a spark or a large current to flow through the person if it was a conductor.	
5(d)	any sensible example e.g .photo-copier, electrostatic precipitator, flu ash removal, spray painting, printing, crop spraying, lightning fixes in atmosphere etc.	[1]
MC	Only about half the students were able to give an appropriate example. It is insufficient to mention painting instead of spray painting of objects.	

Q3

3a	Positive. Like positive charge on inkjet is repelled by positive charge on deflecting plate OR gets attracted to negative charge on deflecting plate.	B1
3b	Inkjet charges are alike and repel each other as like charges repel, thus spreading out with an even layer of coating. *Accept repel and not deflected	B1
3c	Yes it will be more likely to achieve an even layer of coating in an air-conditioned room. There will be less water molecule charges in the air to discharge/neutralise the inkjet charges.	B1 B1

Q4

11a)	(i) The droplets will repel [1] each other, resulting in even coating [1] of glue/sand on the paper.
	(ii) The sand becomes positively charged [1]. They are attracted to [1] the negatively charged paper as unlike charges attract.
b)	(i) Potential difference is the energy [1] in carrying a unit charge from the ground at zero potential to the charged cloud [1].
	(ii) $E = Q \times V$ $= 20 \times 1000 \times 10^6$ [1] $= 2 \times 10^{10} \text{ J}$ [1]
	(iii) There is a great potential difference between the cloud and the lightning conductor and this causes the air between to ionize [1]. The oppositely charged ionized air will discharge the charges in the cloud preventing the charges in the cloud to accumulate [1]. This reduces the potential difference between the cloud and the lightning conductor. Thus, the chance of lightning striking is much reduced.

Q5

- (a) The glue droplets will repel each other due to their like charges. The glue will be evenly coated on the paper. [1]
[1]
- (b) As the sand passes the positively charged plate, it becomes positively-charged. [1]
The positive charges on the sand are attracted to the electrons on the glue. [1]

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