

Charges and static

EDEXCEL TOPIC 11 – STATIC ELECTRICITY. PHYSICS ONLY

Electric fields

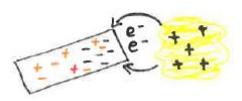
Dangers

Uses

The further apart the objects, the weaker the force.

Like charges	Repel
Unlike charges	Attract

Electrostatic forces
Two electrically charged objects brought close together exert a force
 Force created causes objects to move by electrostatic attraction or repulsion.



Negatively charged materials	Gain electrons
Positively charged materials	Lose electrons

Conductor	<i>Electrical charge moves easily through a material</i>	EG: metal
Insulator	<i>Electrical charge cannot move easily through a material</i>	EG: plastic, rubber

Everyday situations	<i>Refuelling petrol stations, aeroplanes or cars</i>	Static builds up as fuel moves along pipes due to friction. Sparks can cause fuel to ignite, causing a fire or explosion.
	<i>Aeroplanes flying in air</i>	Friction between the air particles and the plane causes electrons to transfer and static to build up. Communication equipment can be affected.

Static dischargers are used on planes to remove charge.

Earthing	<i>A conductor removes excess electrons by connecting the charged object to the ground.</i>	The metal strip provides an easy route for electrons to travel between the object and the ground. Removing the charge that could make a spark.
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Insulators can be charged by friction.
 Static charge
An electric charge that cannot move
 Caused by friction which transfers electrons

Shocks	<i>A spark jumps between a charged object and conductor.</i>	Walking on carpet causes friction. Electrons transfer to the person and charge builds up. When the person touches a metal object, the electrons conduct away, making a spark.
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Lightning	<i>A really big spark due to a large p.d. created.</i>	Ice and rain drops bump together inside storm clouds. Friction causes the top of the cloud to become positively charged and the bottom negatively charged. Electrons travel between cloud and ground.
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Charged comb picks up pieces of paper
Attraction between the charged comb and the uncharged pieces of paper due to induction.

Uses of Static
Laser printer, filters in chimneys, electrostatic paint sprayers

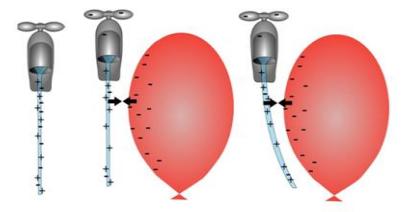
Charged balloon sticks to a wall
Attraction between the charged balloon and the uncharged wall due to induction.

Electrostatic induction
Attraction between a charged and uncharged object.
 Charges on the surface of an object can move slightly.

Rubbing a balloon causes transfer of electrons to balloon due to friction.

Balloon is now negatively charged.

Balloon moves towards wall.



Charges in wall separate due to negative charges on balloon repelling negative charges in wall surface.

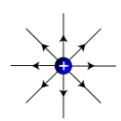
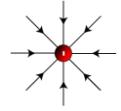
Leaving positive charges in wall surface attracting negatively charged balloon.

Insecticide sprayers
Attraction between charged insecticide and uncharged plant.
 Charges on the surface of the plant move slightly, same charges are repelled opposite charges are attracted by the charged insecticide particles.

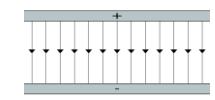
Electric fields
Created around any electrically charged object
 A region around a charged object where, if a second charged object is placed inside the region, a force is exerted on both charges.

Electric fields
Help to explain electrostatic events like attraction by induction.
 A statically charged object generates an electric field. The field interacts with other electric fields of nearby electrons in other objects.

Shape and direction of electric fields	<i>Always at right angles to a charged object's surface</i>	Electric field lines point away from a positive charge on a positive charge
	<i>The closer the lines the stronger the field</i>	Electric field lines point towards a negative charge on a positive charge.



Electric field between parallel plates	<i>Opposite charged plates that are parallel</i>	Field is a uniform field. The strength is evenly spaced and is the same everywhere.
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A non-contact force.

Two electrically charged objects brought close together exert a force
Force created causes objects to move by electrostatic attraction or repulsion.

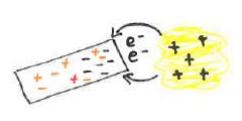
	Repel
	Attract

Refuelling petrol stations, aeroplanes or cars
Static builds up as fuel moves along pipes due to friction. Sparks can cause fuel to ignite, causing a fire or explosion.

Aeroplanes flying in air
Friction between the air particles and the plane causes electrons to transfer and static to build up. Communication equipment can be affected.

Static dischargers are used on planes to remove charge.

	Gain electrons
	Lose electrons



	Electrical charge moves easily through a material	EG: metal
	Electrical charge cannot move easily through a material	EG: plastic, rubber

A conductor removes excess electrons by connecting the charged object to the ground.
The metal strip provides an easy route for electrons to travel between the object and the ground. Removing the charge that could make a spark.

Insulators can be charged by friction.

An electric charge that cannot move
Caused by friction which transfers electrons

A spark jumps between a charged object and conductor.
Walking on carpet causes friction. Electrons transfer to the person and charge builds up. When the person touches a metal object, the electrons conduct away, making a spark.

A really big spark due to a large p.d. created.
Ice and rain drops bump together inside storm clouds. Friction causes the top of the cloud to become positively charged and the bottom negatively charged. Electrons travel between cloud and ground.

Attraction between the charged comb and the uncharged pieces of paper due to induction.

Attraction between the charged balloon and the uncharged wall due to induction.

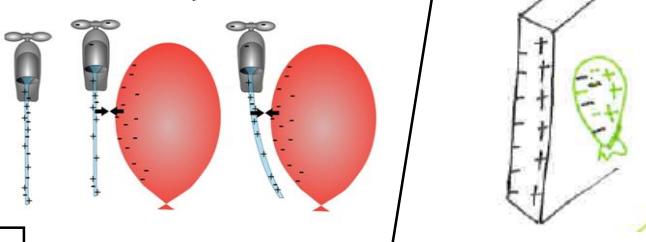
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Balloon is now negatively charged.

Balloon moves towards wall.

Charges in wall separate due to negative charges on balloon repelling negative charges in wall surface.

Leaving positive charges in wall surface attracting negatively charged balloon.



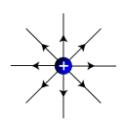
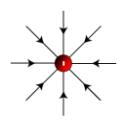
Attraction between a charged and uncharged object.
Charges on the surface of an object can move slightly.

Attraction between charged insecticide and uncharged plant.
Charges on the surface of the plant move slightly, same charges are repelled opposite charges are attracted by the charged insecticide particles.

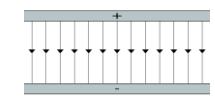
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Help to explain electrostatic events like attraction by induction.
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Opposite charged plates that are parallel
Field is a uniform field. The strength is evenly spaced and is the same everywhere.



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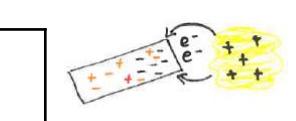
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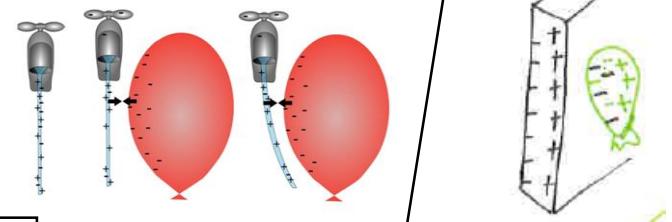
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Electrostatic forces

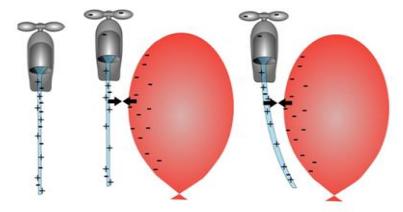


Static charge

Electrostatic induction



Insecticide sprayers



Conductor

Insulator

Electric fields

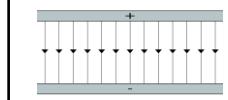
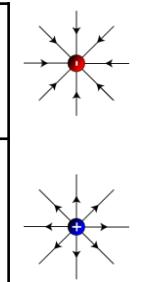
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Electric field between parallel plates

Shocks

Lightning

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Everyday situations

Earthing

Static dischargers

Charges and static

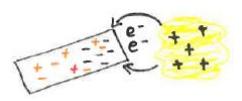
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Static dischargers



Insulators can

Rubbing a balloon

Balloon is

Balloon moves

Charges in wall

Leaving positive

