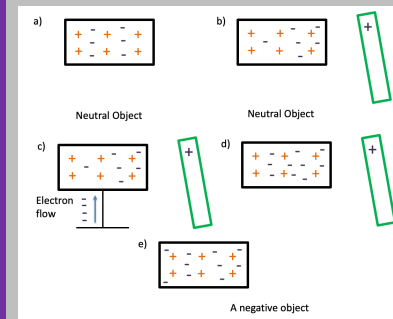
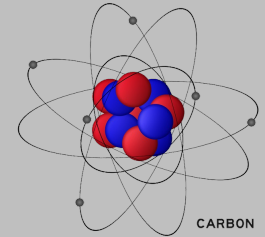
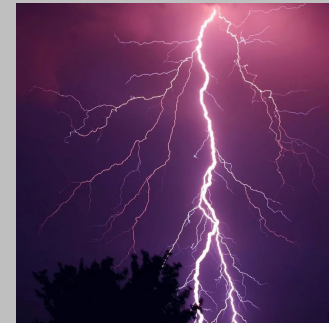
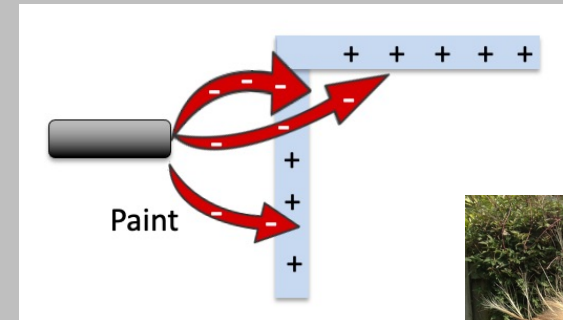


Electric Charge and the Electrical Structure of Matter

- Atomic Structure Review
- Law of Electric Charges
- Static Electricity and the Electrostatic Series
- Lightning
- Charging Objects – Friction, Contact, and Induction
- Grounding
- Electrostatic Applications



Preview File

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- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
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Electricity

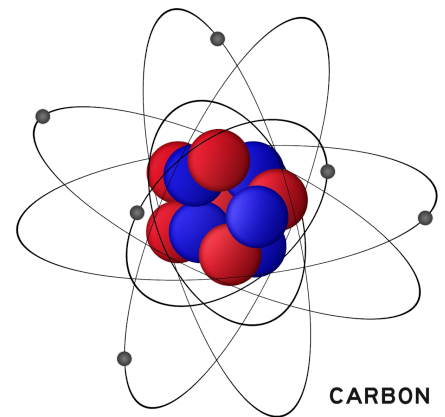
What is it made of?

Where does it come from?



Atomic Structure Review

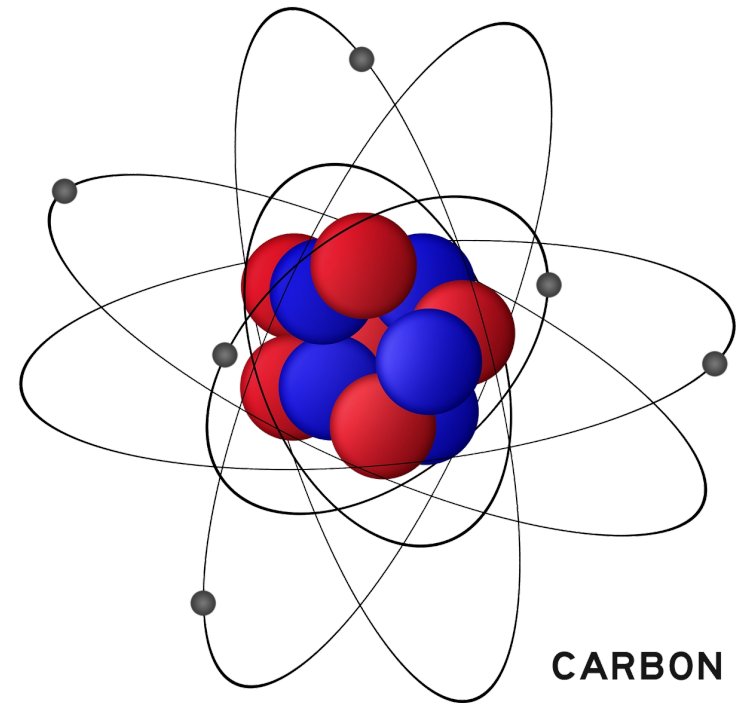
- In the middle of each atom is a nucleus
- The nucleus contains two elementary particles - protons and neutrons
- _____



Electricity

- Electrons are negative particles which can move from atom to atom

- _____



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Charged Objects

- Static electricity is the imbalance of positive and negative charges
- Atoms that lose electrons have more +’ve charges (protons) than –’ve charges (electrons) - positively charged
- _____

Stealing or Giving Away Electrons

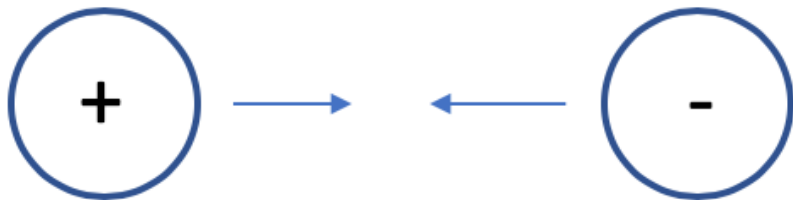
- _____
- One substance will steal the electrons from the other
- The more rubbing, the more electrons move



Law of Electric Charges

- Law 1: Opposites attract: Two things with opposite, or different charges (a positive and a negative) will attract or pull towards each other.

- _____



Law 1 – Opposites Attract

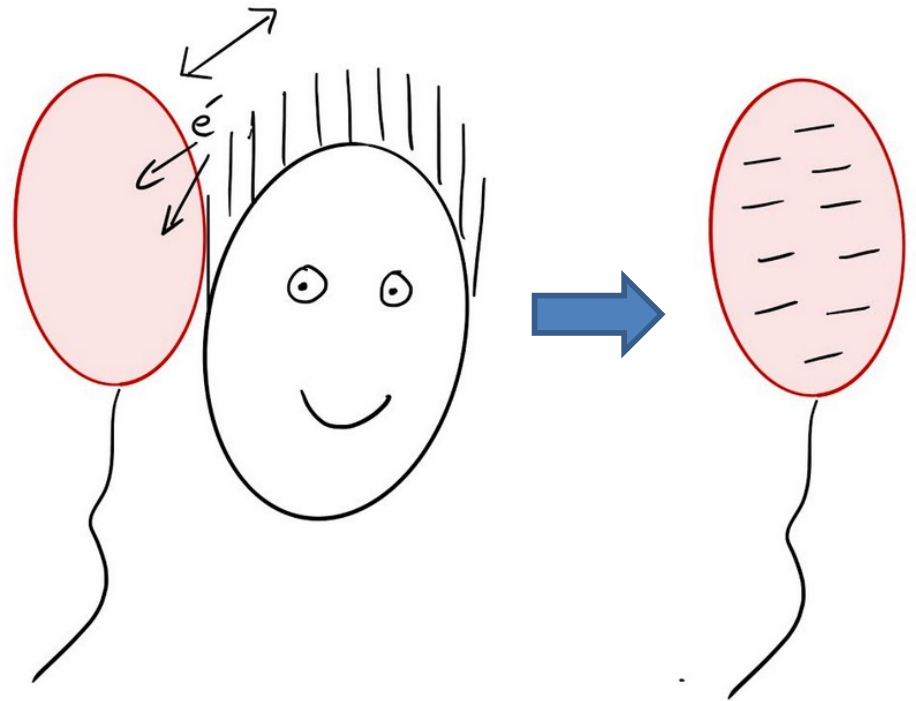


Law 2 – Likes Repel

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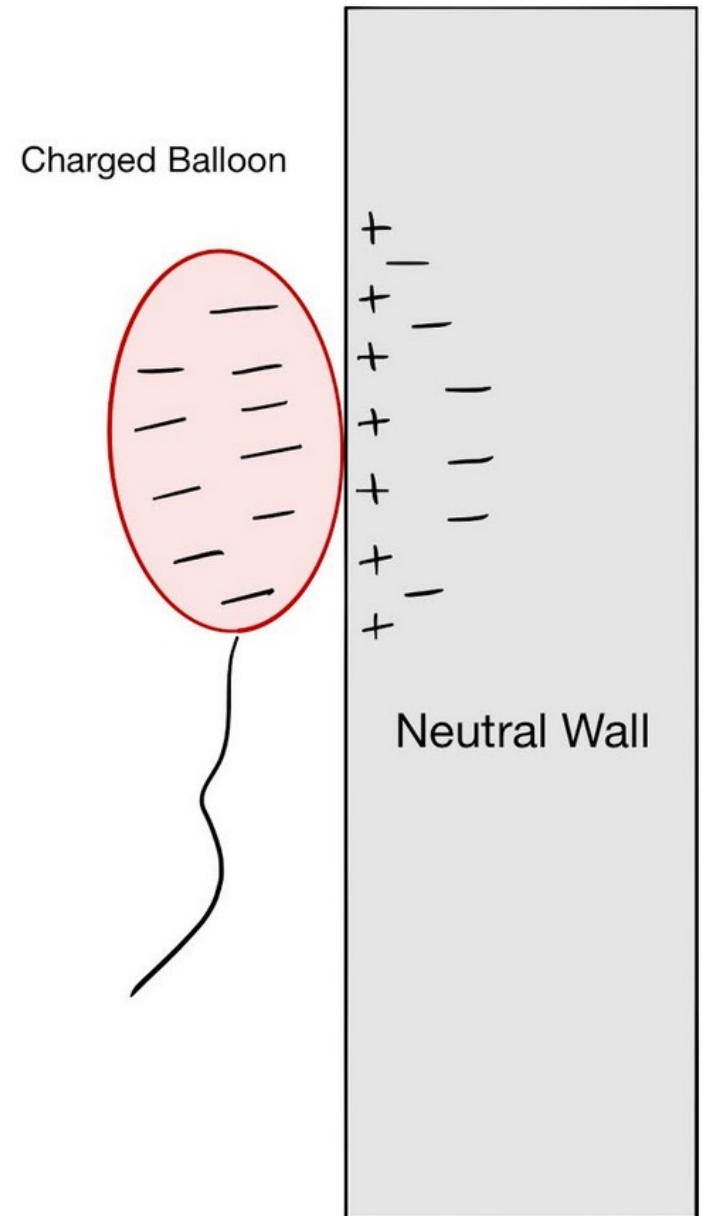
Why Does a Neutral Wall Attract a Balloon?

If you charge a balloon by rubbing it on your hair, it picks up extra electrons and gains a negative charge.



The Result

- Holding it near a neutral wall will make the negative charges in the wall move away because like charges repel
 - The positively charged protons cannot move
- _____
- Since like charges attract, the balloon sticks to the wall



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Static and Hair

- When you rub against something, electrons can jump to the other object from you
- This creates a positive charge all around your body including the hairs on your head
- Like charges repel and since the hairs are all positively charged, they start to repel each other so that they can get as far from each other as possible
- _____



The Electrostatic Series

- An electrostatic series is an arrangement of materials based on how strongly they hold their electrons
- _____
- Materials higher on the series will give up their electrons to the ones below if rubbed together

Material	Strength of Hold on Electrons
Glass	Weak  Strong
Human Hair	
Wool	
Rubber	
Foam	
Plastic Bags	
Ebonite	

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Sparks and Lightning

- If there are enough positive charges on one object and enough negative charges on the surface of the other object, _____
- This is what happens when you touch metal and receive a shock and when lightning occurs

Lightning

Becomes very
“negative”



Becomes very
“positive”

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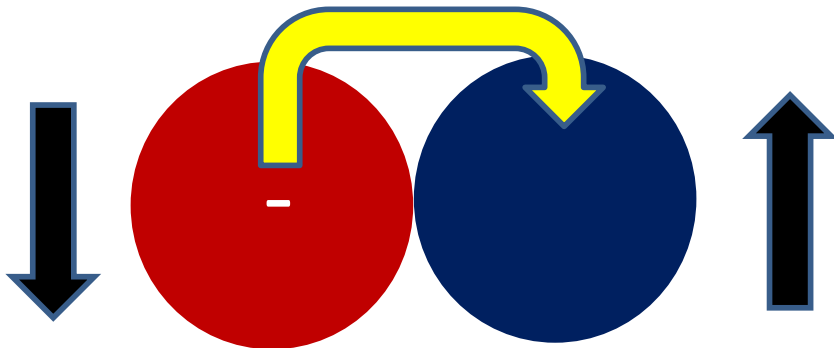
Charging Objects

We'll be discussing the three main ways an object can become charged

- 1) Friction
- 2) Contact
- 3) Induction

Friction

- _____
- This causes both surfaces to obtain a different charge as one will lose electrons while the other gains
- This is seen when we rub our feet long the carpet then touch a doorknob
- The friction between your feet and the carpet creates a build-up of electrons on you



Contact Transfer

- Contact is common and is the cause of static shocks
- Contact transfer occurs when a charged object is brought into contact with (or very close to) a differently charged object (includes neutral objects)
- _____



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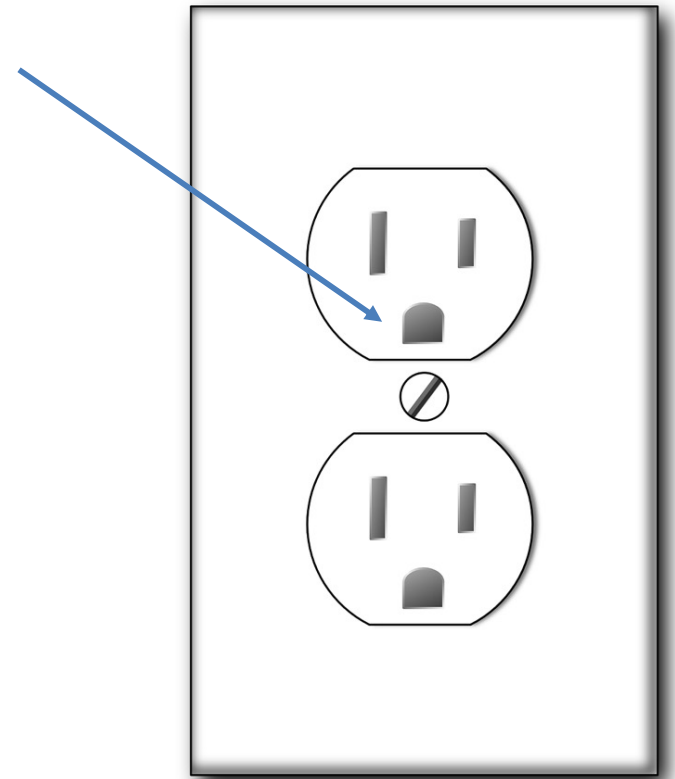
Grounding

- _____
- It is called “grounding” because the process involves connecting the charged object to the ground directly or via a conductor
- The process is also called “discharging”



Grounding

- _____
- It takes the excess electrical buildup and sends it into the ground
- Grounding works because the earth (ground) has so many electrons that no matter how many are added or taken it is still essentially a neutral object



Grounding Examples

- Static discharge can be dangerous, therefore, precautions must be taken to reduce the build-up of electrons
- Ex:
 - Fueling stations: static electricity can ignite the fuel and cause explosions
 - Surgeons wear protective booties to prevent static buildup - _____



Induction

- An electric charge is transferred from one substance to another without direct contact

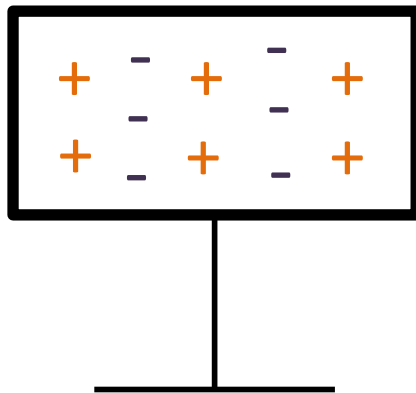
- _____

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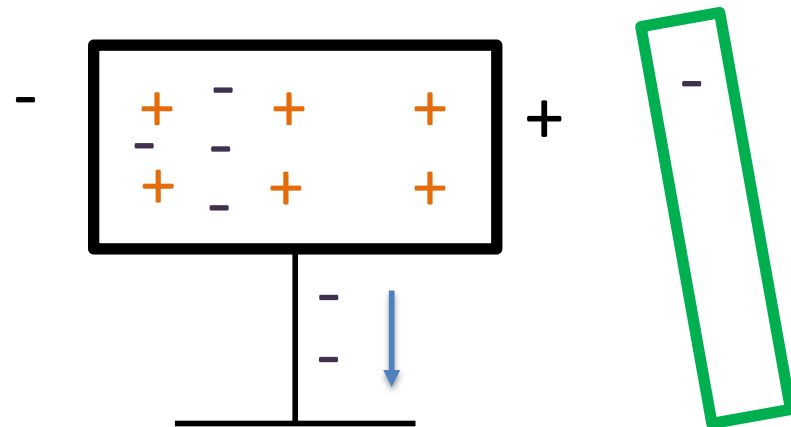
Charging by induction

- To charge the neutral object, the neutral object MUST be grounded using a conducting wire

- _____



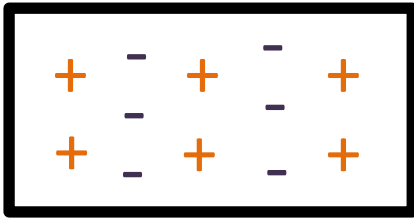
Neutral Object



Induced Charge

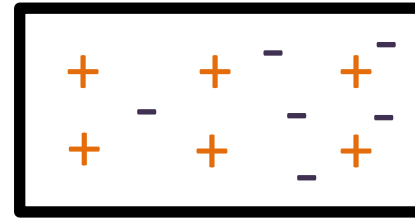
**Charging by induction using a
positive rod**

a)

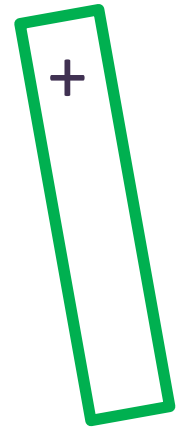


Neutral Object

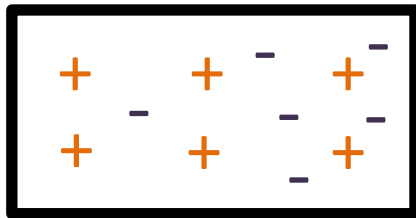
b)



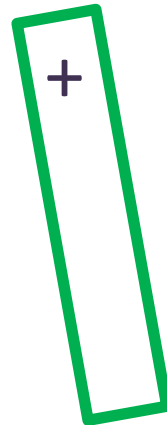
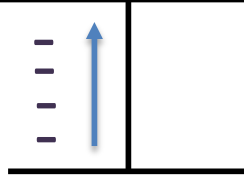
Neutral Object



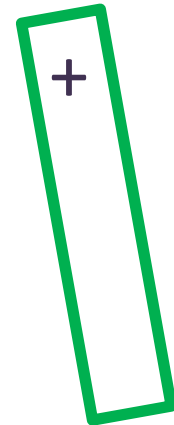
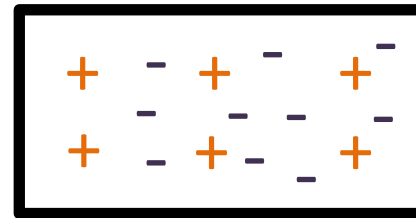
c)



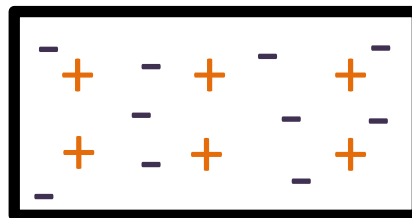
Electron
flow



d)



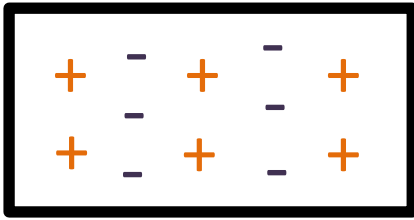
e)



A negative object

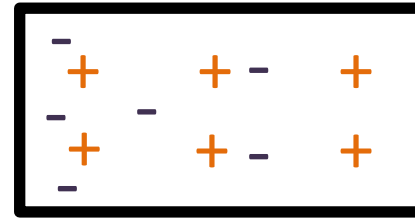
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a)

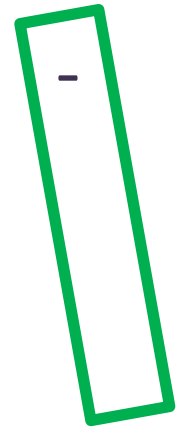


Neutral Object

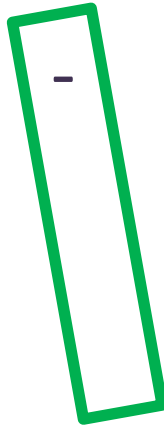
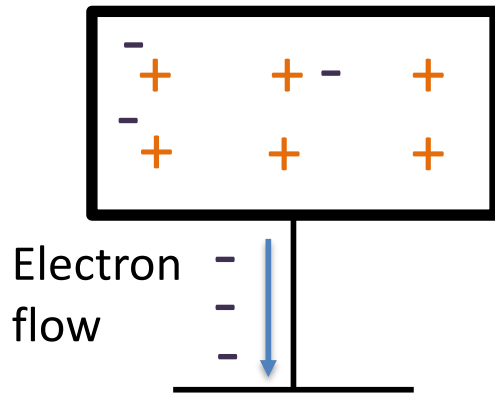
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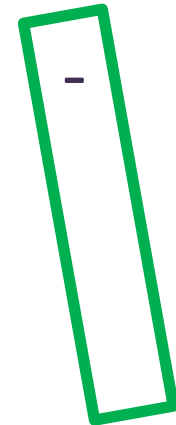
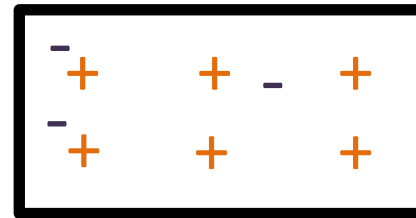
Neutral Object



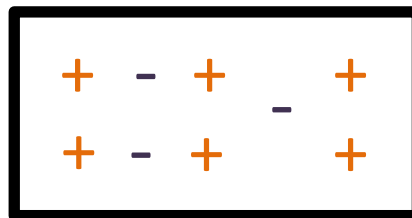
c)



d)



e)



A positive object

Create a Comparison Chart

- Use a chart to compare the following topics covered so far
 - Charging by friction
 - Charging by contact
 - Charging by induction
- Your chart should have the following headings for each topic

Topic	How it's charged	Charge it receives relative to charged exposed to	Does the altered charged last?
<i>From above</i>	<i>Describe how the object becomes charged.</i>	<i>Is the charge the object receives the same, or opposite to the object that gave it that charge?</i>	<i>When the object is isolated will it retain the charge it was given?</i>

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Waste gases without
smoke particles



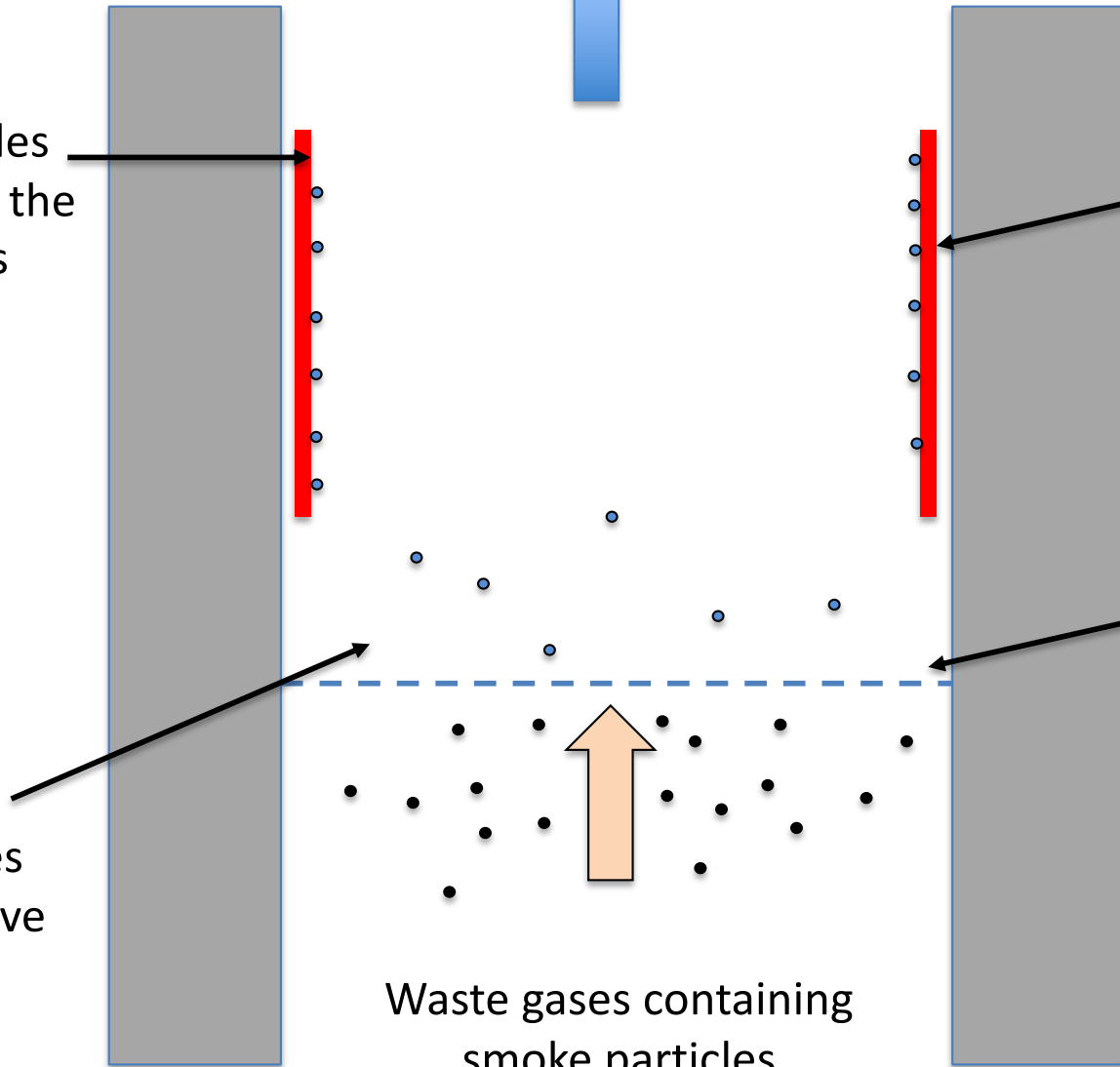
1. Smoke particles
are attracted to the
collecting plates

Positively charged
collecting plates

Negatively charged
metal grid

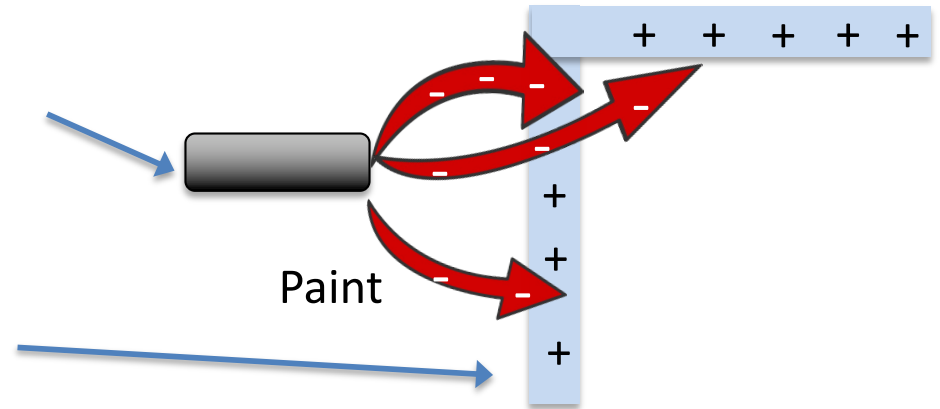
1. Smoke articles
pick up a negative
charge

Waste gases containing
smoke particles



Electrostatic Spray Painting

- _____
- The object to be painted is either neutral or oppositely charged
- The paint is attracted to the object
- Paint goes on evenly and very little is lost



Lightning and your car

Why is your car a good place to be during a lightning storm?

- a) It has rubber tires
- b) It has a metal exterior
- c) It's warm and comfy



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