Static Electricity!

Electric Charge

- There are two types of electric charge
  - **Positive (+)**
  - **Negative (-)**

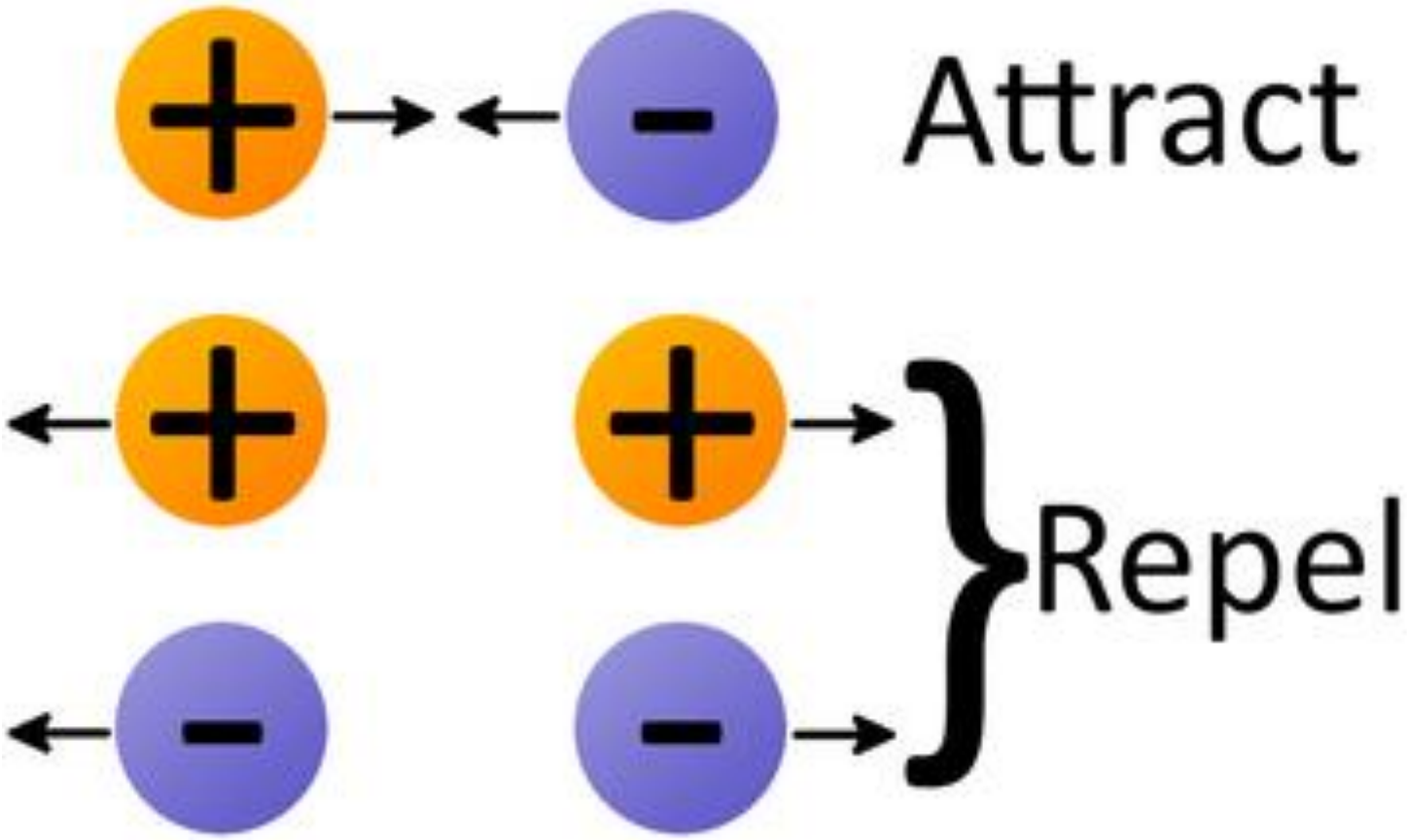
Electric Charge

- Like charges **repel**

Electric Charge

- Opposite charges **attract**

Electric Charge



How are these charges achieved?

- **Remember:**
  - Charges are neither **created nor destroyed**; they are **transferred** from one body to another
    - Only **electrons** move!

Think back to ions!

How are these charges achieved?

- **Remember:**
  - You charge an object by creating an **imbalance** in the number of positive and negative charges

What is static electricity?

- Why is it called static? Didn't we just say the electrons move?
  - This is true! The electrons did move…

What is static electricity?

- Why is it called static? Didn't we just say the electrons move?
  - BUT they have now been **transferred** and remain on the **surface** of the materials involved

What is static electricity?

- Why is it called static? Didn't we just say the electrons move?
  - No longer moving = **static**

We'll be coming back to this later

Electrons flowing = dynamic electricity

What is static electricity?

- Definition:
  - The **temporary** movement of **electrons** from one substance to another
    - Causing items to be **charged** (positive or negative)

Remember: substances are normally **neutral**

Why do the electrons move?

- In other words, how does charging happen?
  - **Friction**
  - **Conduction**
  - **Induction**

1) Friction

- Two **neutral** objects are rubbed against each other
- One object **takes electrons from the other**

1) Friction

- Result:
  - Material taking electrons = **becomes negative**
  - Material giving up electrons = **becomes positive**

Static Charge by **Friction**

Objects *(like the atoms that make them up)* are normally **neutral**.

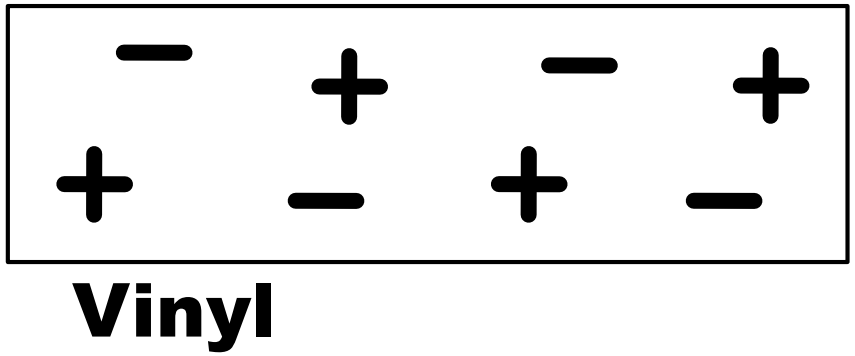
A piece of vinyl and a wool cloth are both made of atoms.

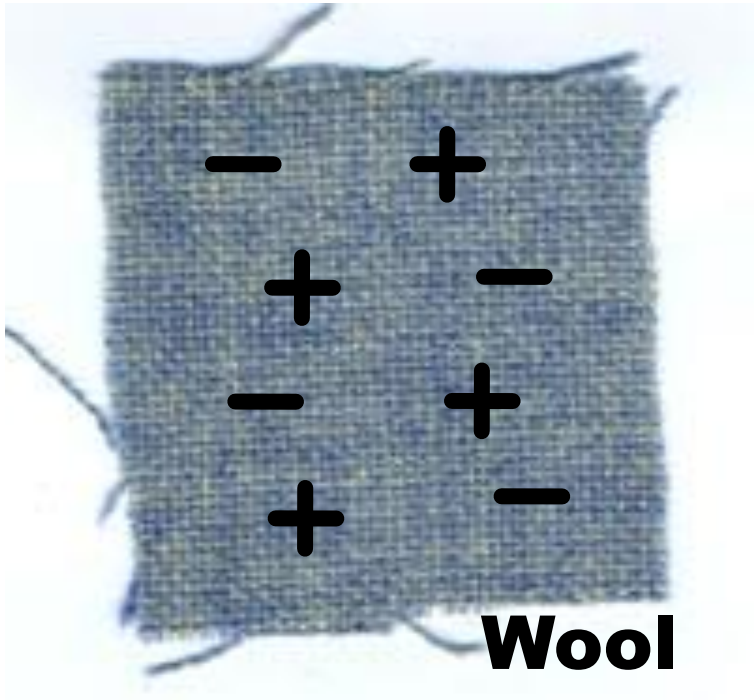
Vinyl

Wool

Static Charge by **Friction**

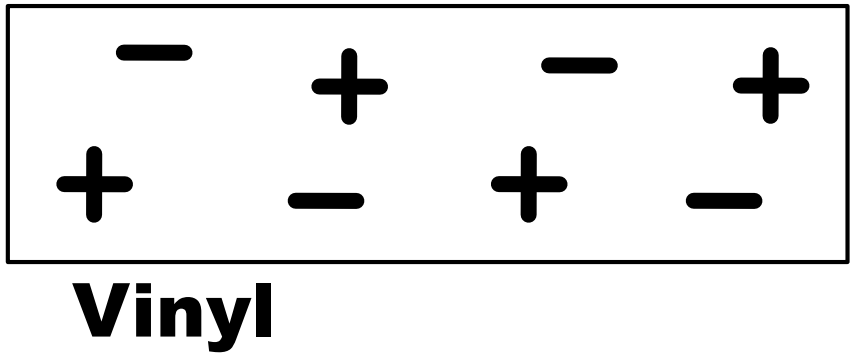
Normally neutral, they each contain an **equal number** of positive and negative charges.

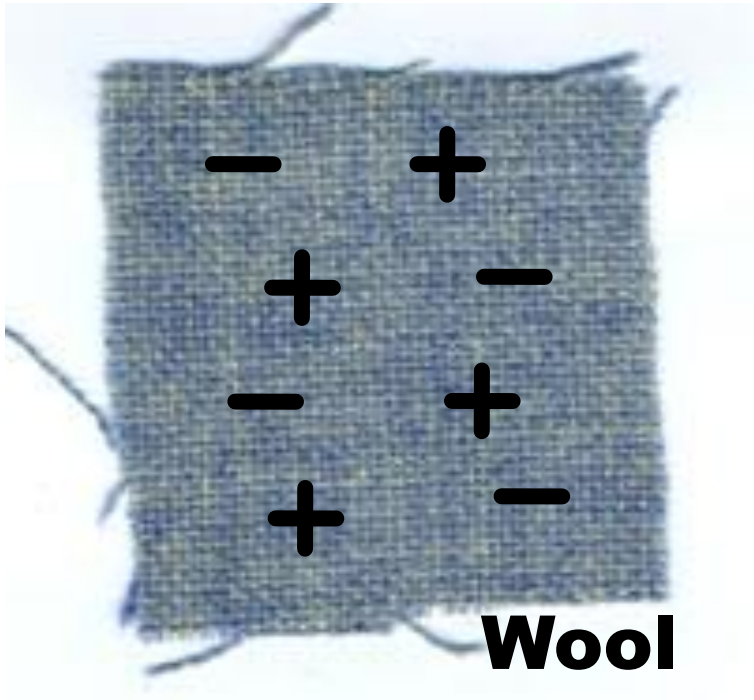




Static Charge by **Friction**

When rubbed together (***friction***), many **electrons** are **transferred** from the wool onto the vinyl.





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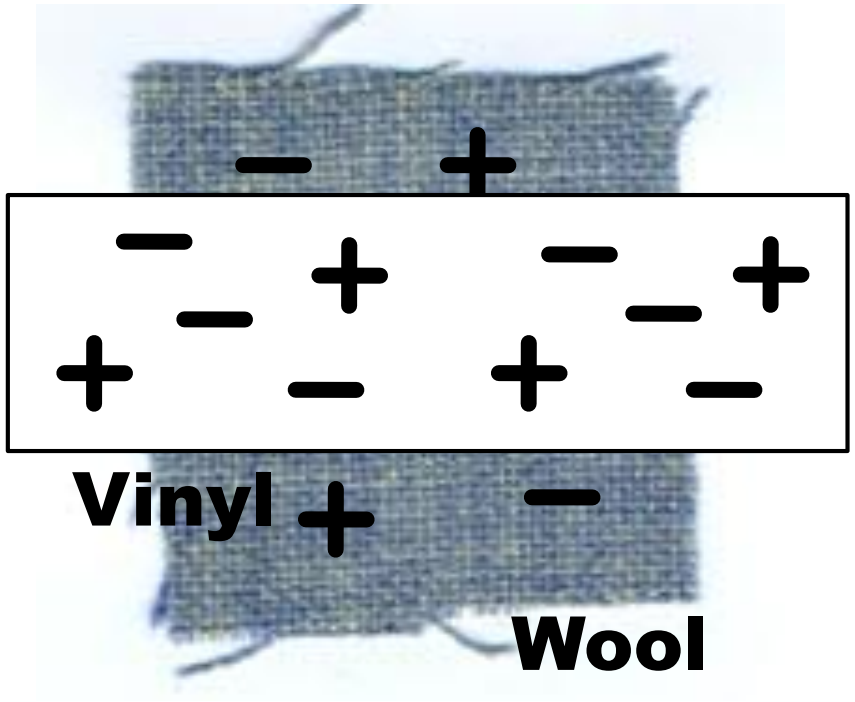

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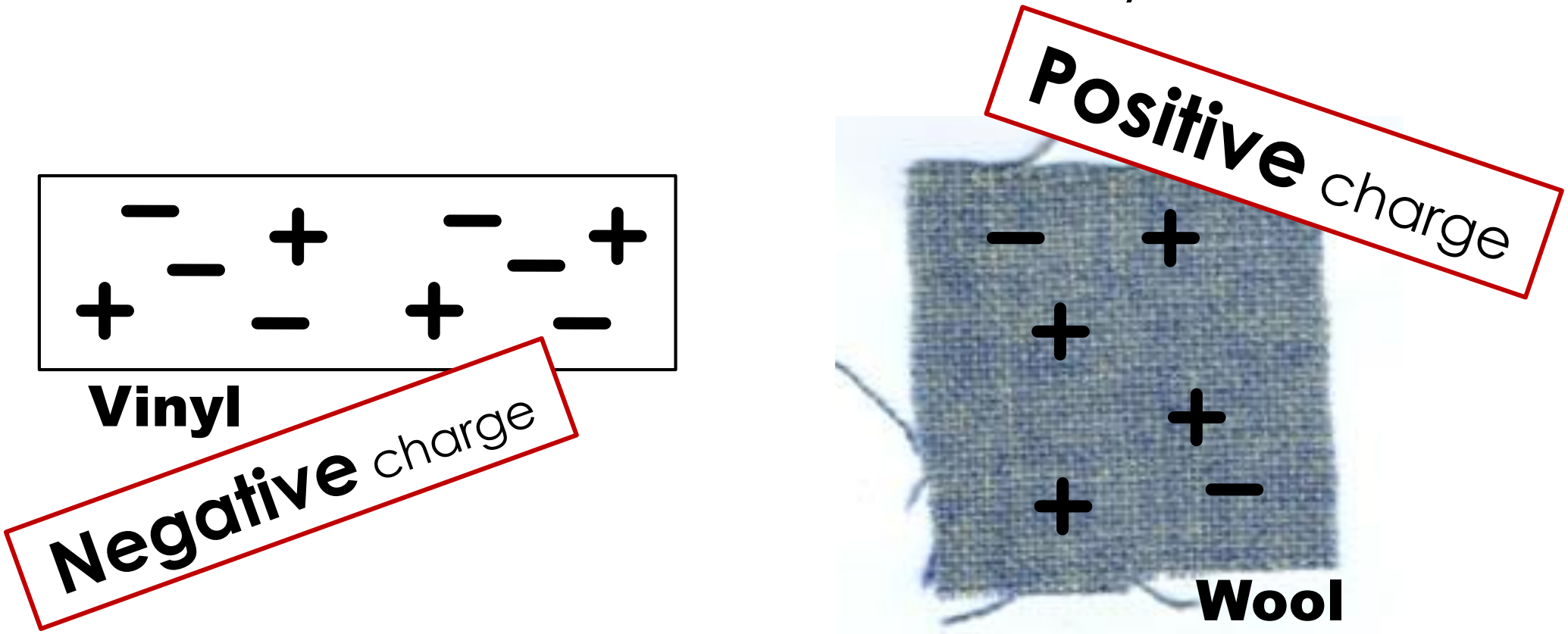


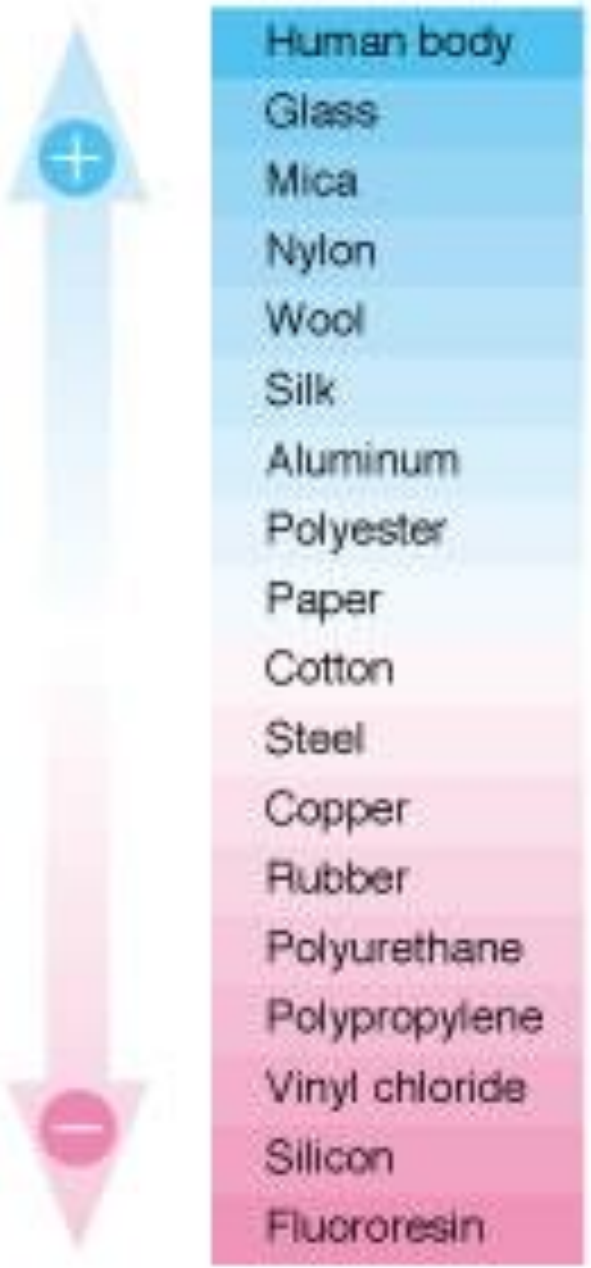
How do we know which one will become negative/positive?

- Lucky for us other people have put together a list!
  - We call this the **Triboelectric Series** or Electrostatic Series

Triboelectric Series

- The material closer to the ⊖ will **gain electrons** (become negatively charged)

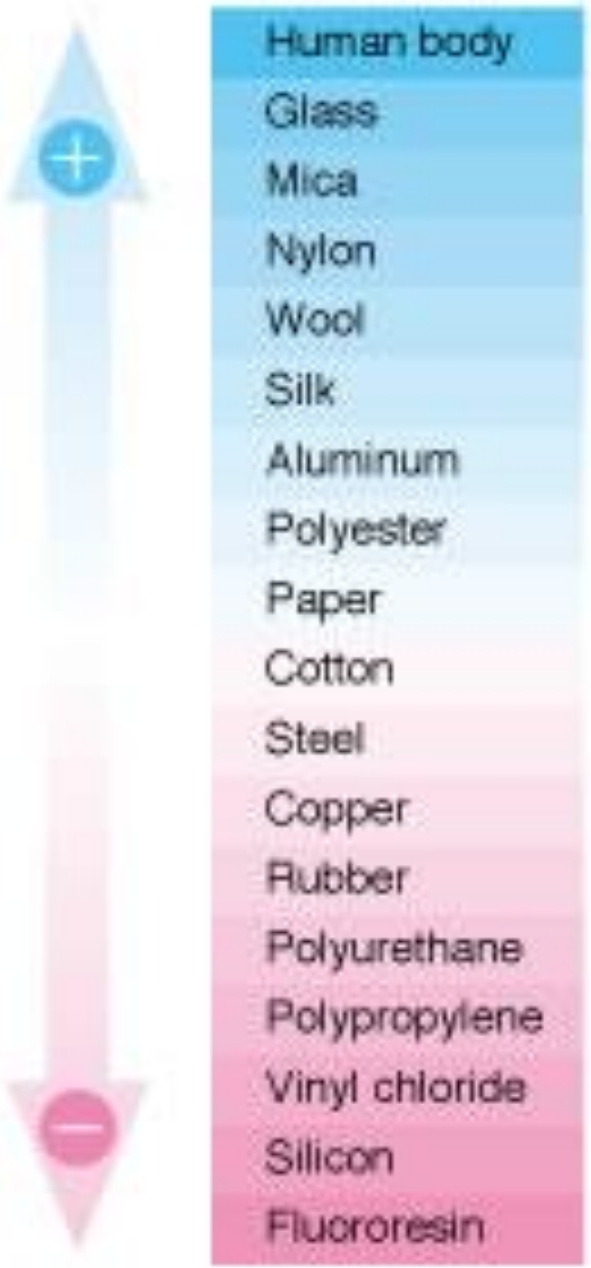
No, you don't have to memorize this! But…



Triboelectric Series

You should know:

- Plastic will always become **negative** (gain electrons)
- Glass will always become **positive** (give electrons)



Triboelectric Series

- Example 1:
  - If I rub a piece of vinyl with wool, what will the charge be on each?

    Vinyl = negative

    Wool = positive

Triboelectric Series

- Example 2:
  - If I rub a piece of glass with wool, what will the charge be on each?

Glass = positive

Wool = negative

2) Conduction

- A **charged** object is touched to a **neutral** object
  - The charged object gives **half of its charges** to the neutral object

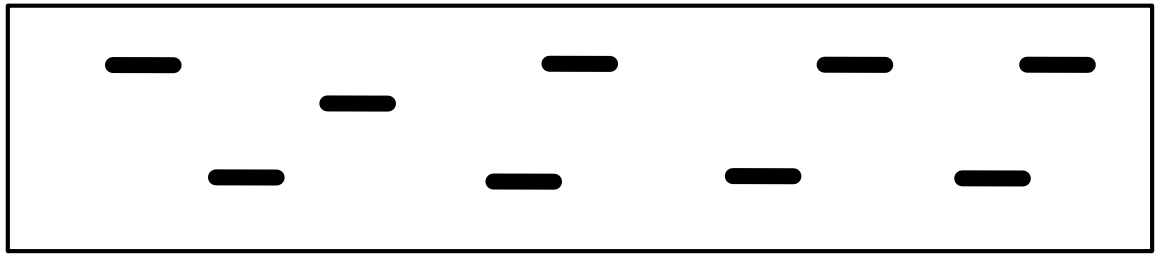
2) Conduction

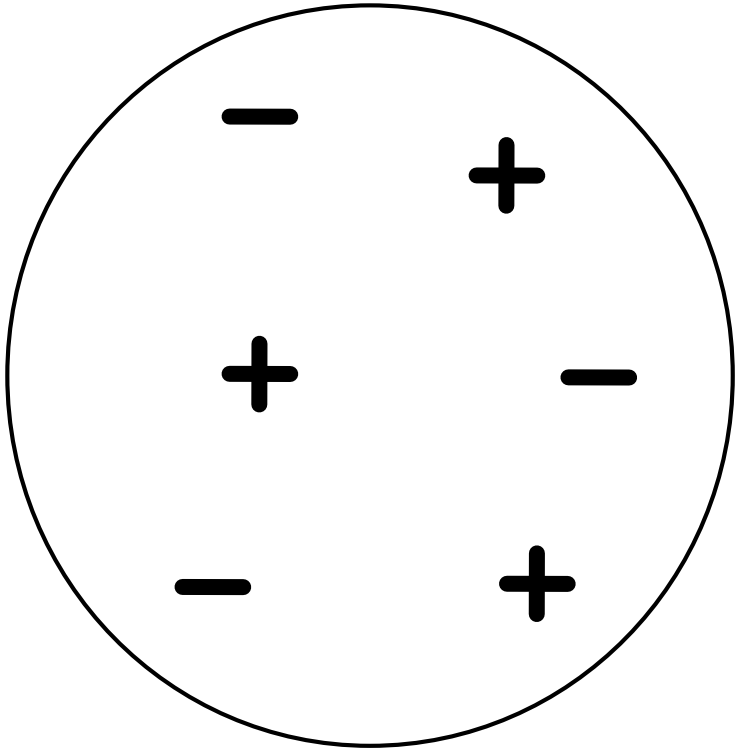
- Result:
  - Both objects = **same charge**
    - The charge on each object is **weaker** than the original charge on the first object

Static Charge by **Conduction**

Neutral Object

Charged Object

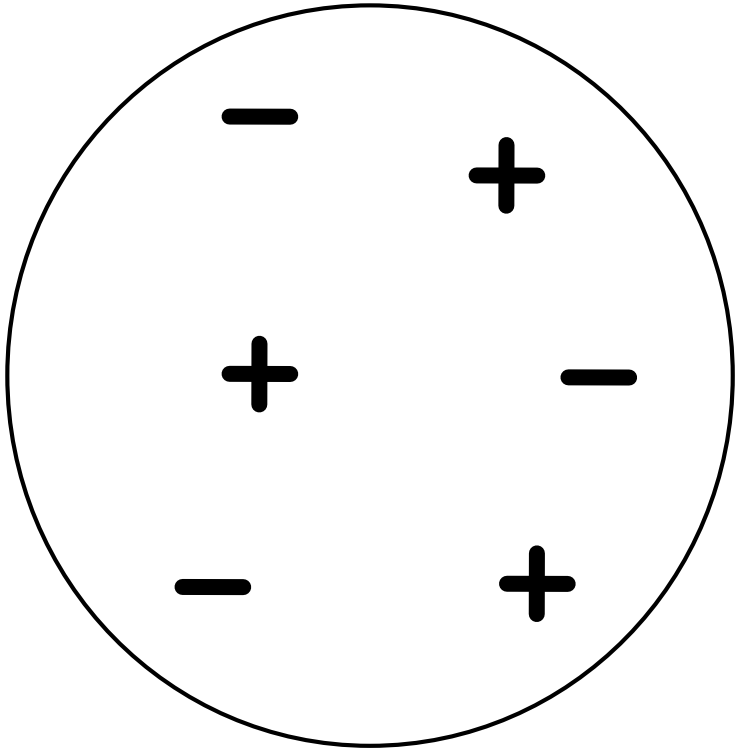




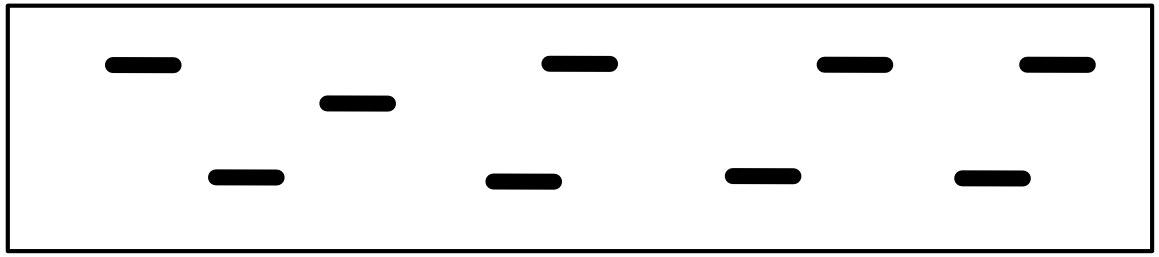
Charged object touches a neutral object

Static Charge by **Conduction**

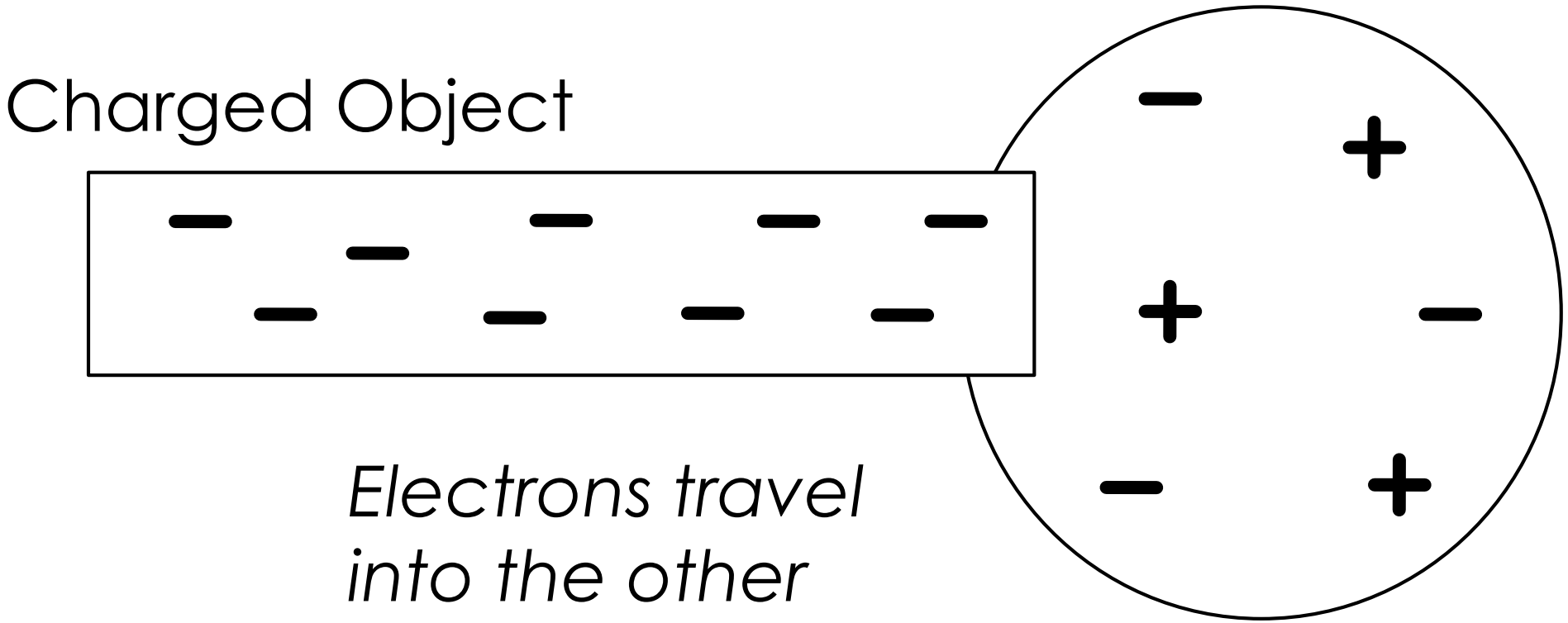
Neutral Object



Charged Object



Static Charge by **Conduction**

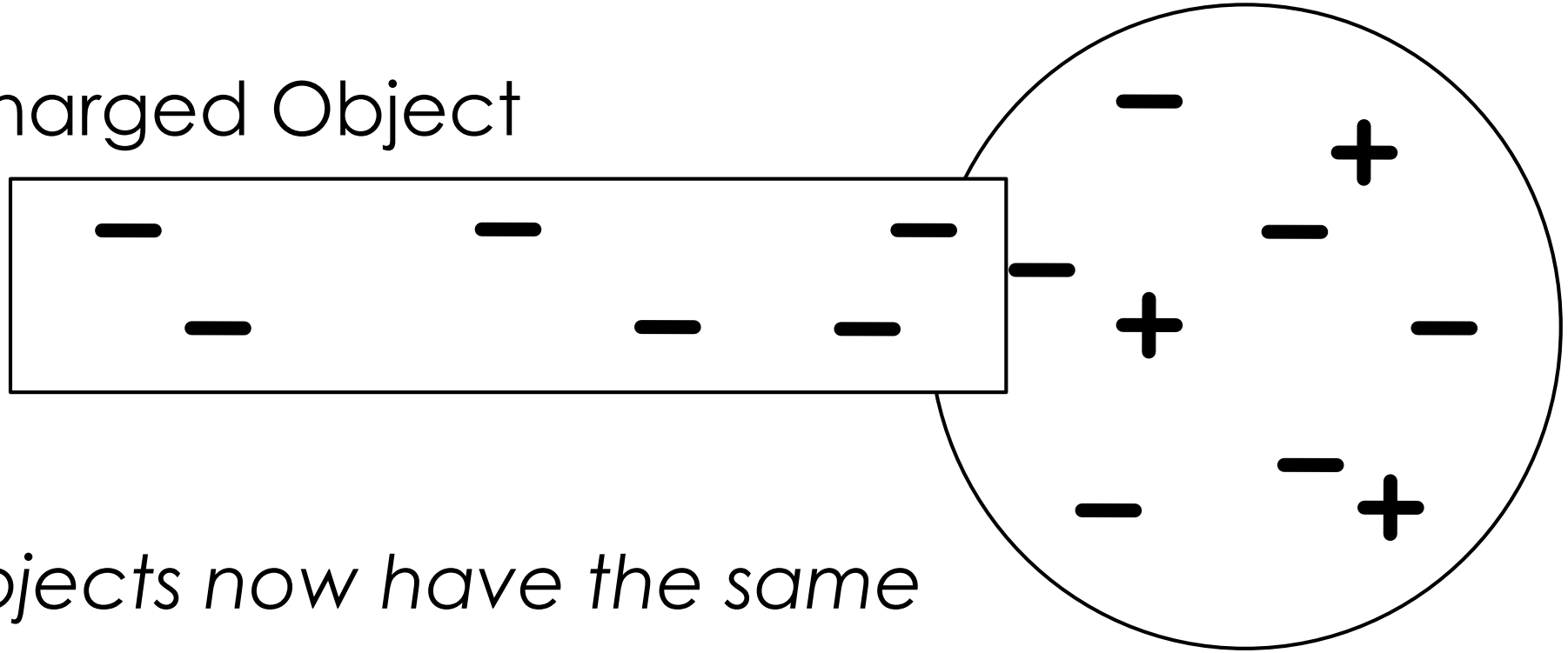


Electrons travel into the other object

Static Charge by **Conduction**

Now, also Charged

Charged Object



Both objects now have the same charge

3) Induction

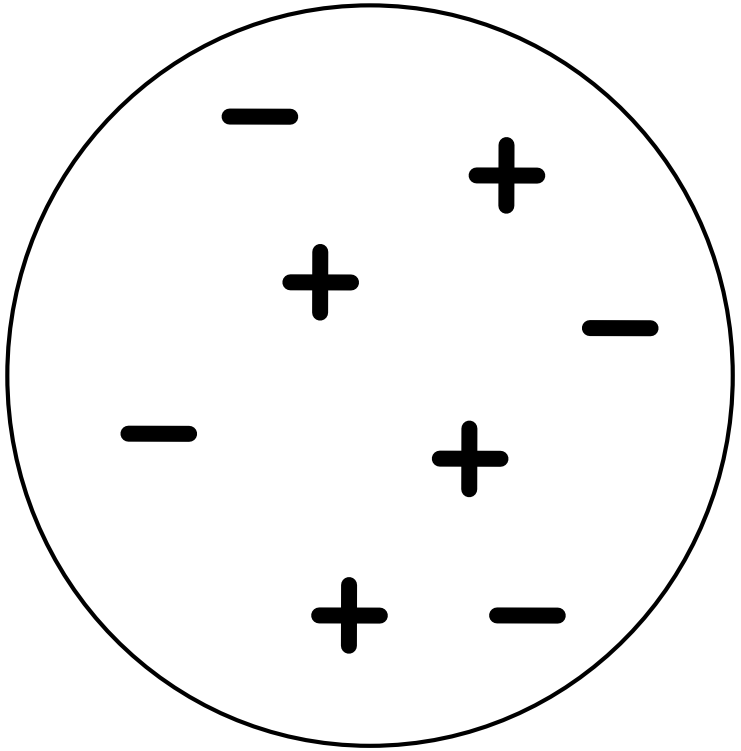
- A **charged** object is brought close to a **neutral** object (they do **NOT** touch)

3) Induction

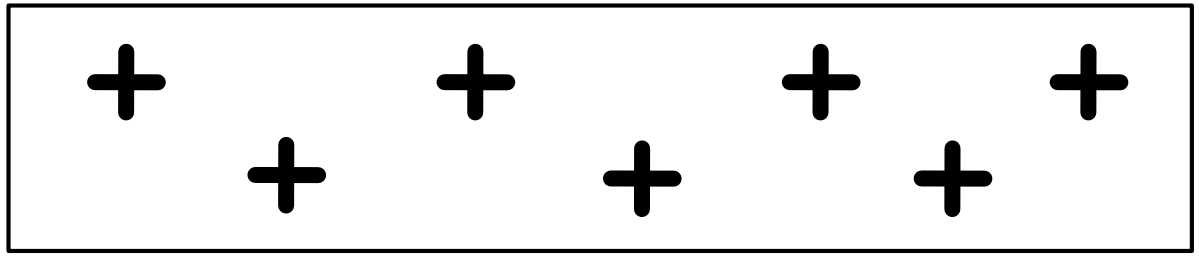
- Result:
  - The charged object causes the **charges** in the neutral object to **rearrange themselves**
    - The neutral object is still **neutral** but has a positive and negative pole (one side is positive, one side is negative)

Static Charge by **Induction**

Neutral Object



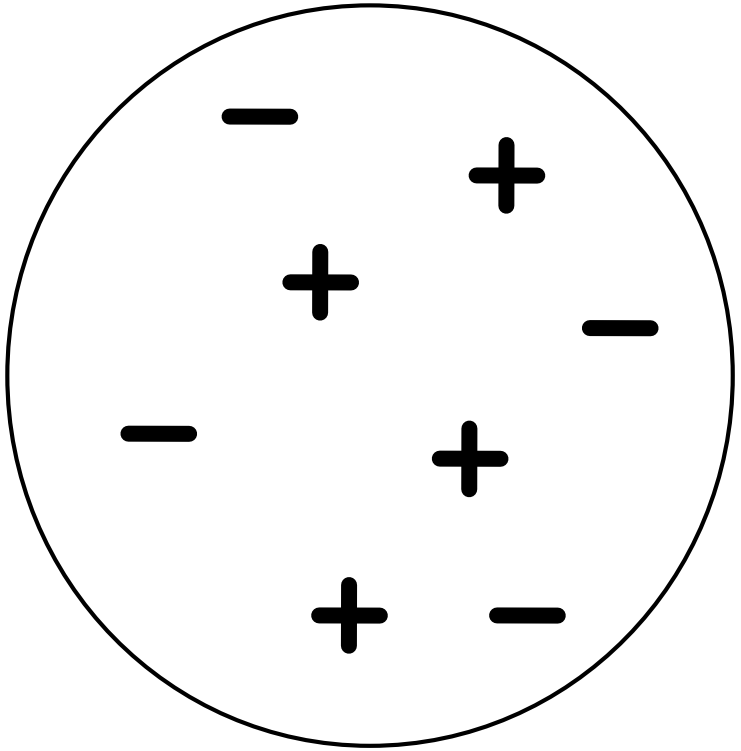
Charged Object



Charged object brought near a neutral object

Static Charge by **Induction**

Neutral Object



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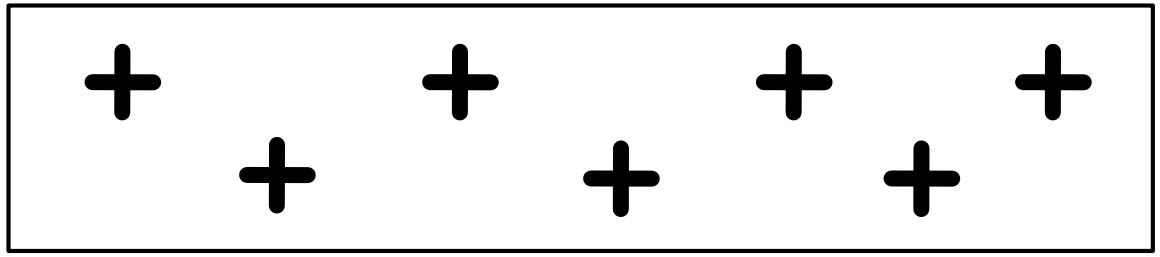
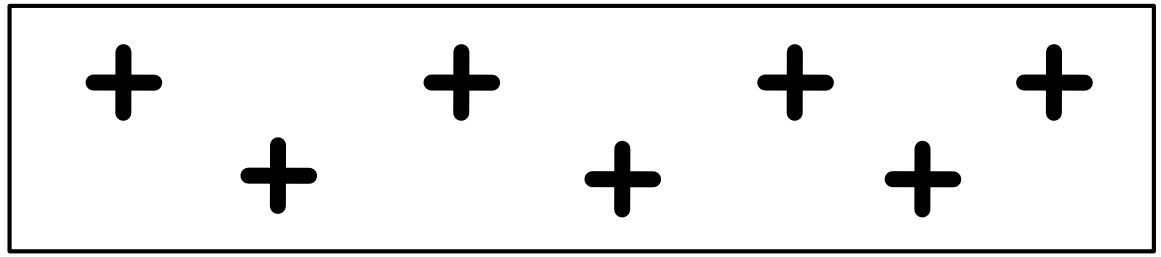


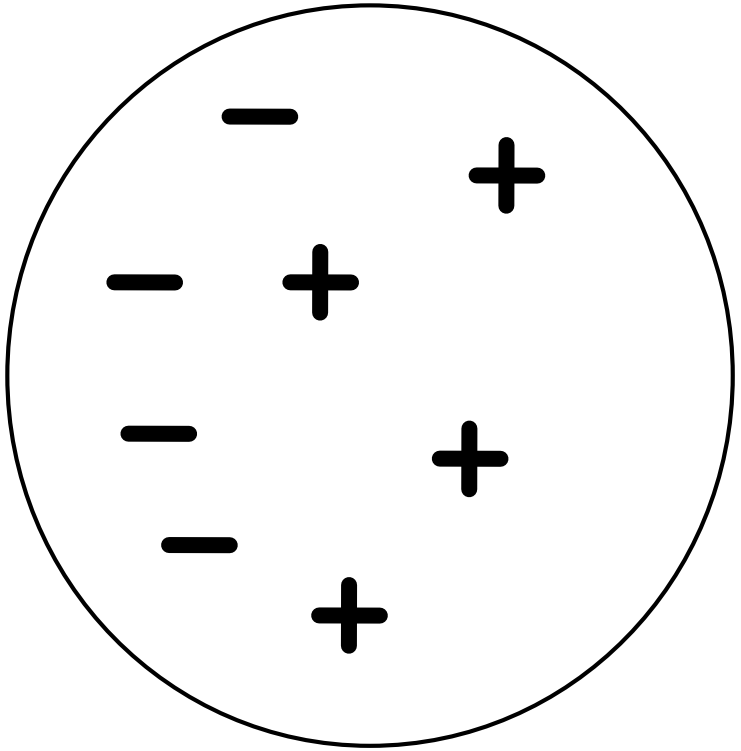
Charged object brought near a neutral object

Static Charge by **Induction**

Neutral Object

Charged Object





Charged object brought near a neutral object

Charges shift within the neutral object

(Sides temporarily charged)

Method	Before Charging	Charging Process	Result
Friction	Both objects are **neutral**	Objects are **rubbed** on one another	Objects take on **opposite charges** (one is +, other is –)
Conduction	Object "A" is charged Object "B" is neutral	Charged object **touches** neutral object	Objects take on **same charge**, which is **weaker than original charge.**
Induction	Object "A" is charged Object "B" is neutral	Charged object is **brought close** to neutral object	Object "B"'s charges are **re-arranged.** Object "A" stays charged

Examples

Friction? Induction? Conduction?