

Charging by Contact and Induction

Section 10.2

A decorative graphic consisting of several horizontal lines of varying lengths and colors (teal, white, and light blue) extending from the right side of the slide towards the center.

1. The Laws of Electric Charge

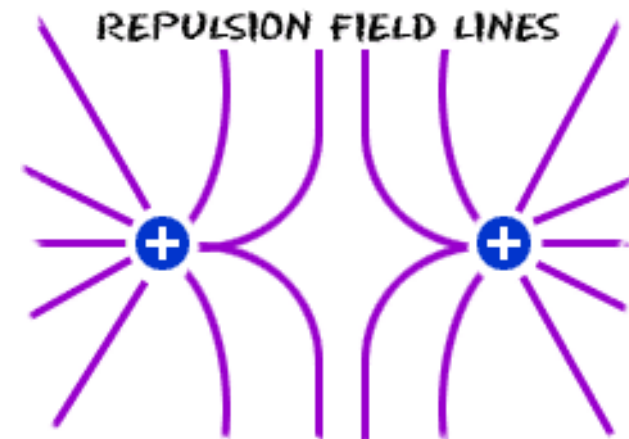
- A. Like charges repel each other.
- B. Opposite charges attract each other.
- C. Charged and neutral objects attract each other.

2a. The amount of electric force (either attraction or repulsion) between two objects depends on two factors: the amount of charge on each object, and the distance between the objects.

b. The greater the charge, the higher the force.

c. The greater the distance, the lower the force.

3. **Electric field** – The space around an object, where the effect of its charge can be felt by other objects.



Previously we have produced static charge using **friction**.

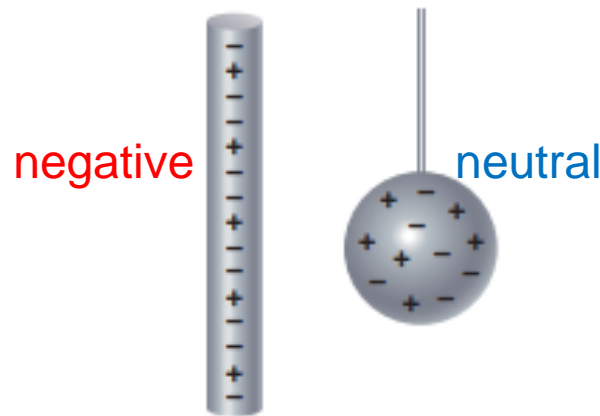
There are two more methods of producing static charge:

- contact
- induction

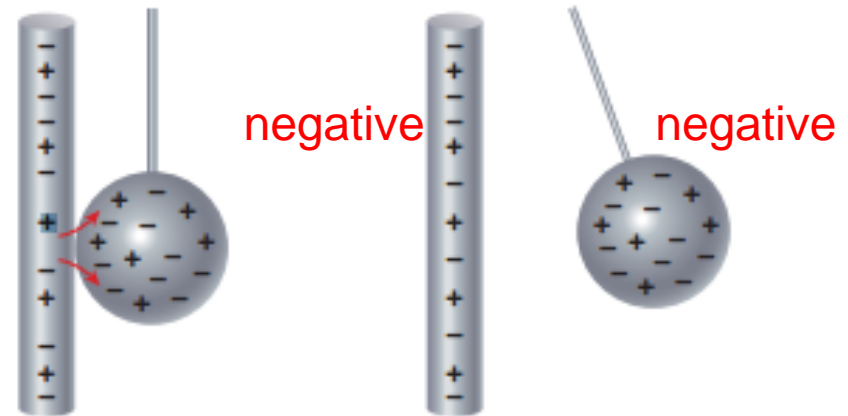
Charging by Contact...

- occurs when charged object **touches** a neutral object. This causes the neutral object to become charged too!

A Giving an Object a Negative Charge



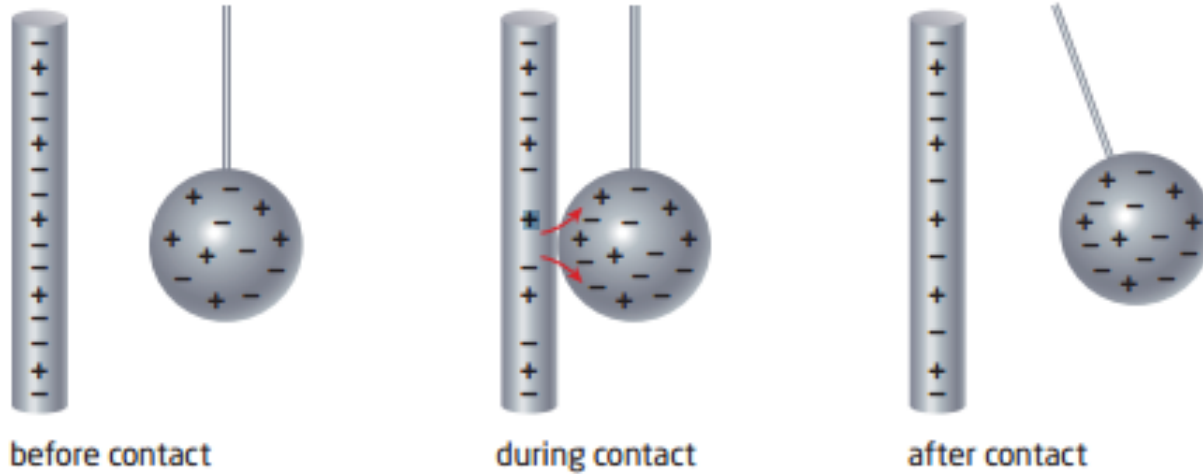
| | Rod | Sphere |
|---|----------|---------|
| + | 5 | 6 |
| - | 10 | 6 |
| | negative | neutral |



during contact

| | Rod | Sphere |
|---|----------|----------|
| + | 5 | 6 |
| - | 7 | 9 |
| | negative | negative |

A Giving an Object a Negative Charge



4. In Part A of the figure,

a. What was the charge of the rod **before** contact? **negative**

b. What happens **during** contact?

Negative charges move from the rod to the sphere

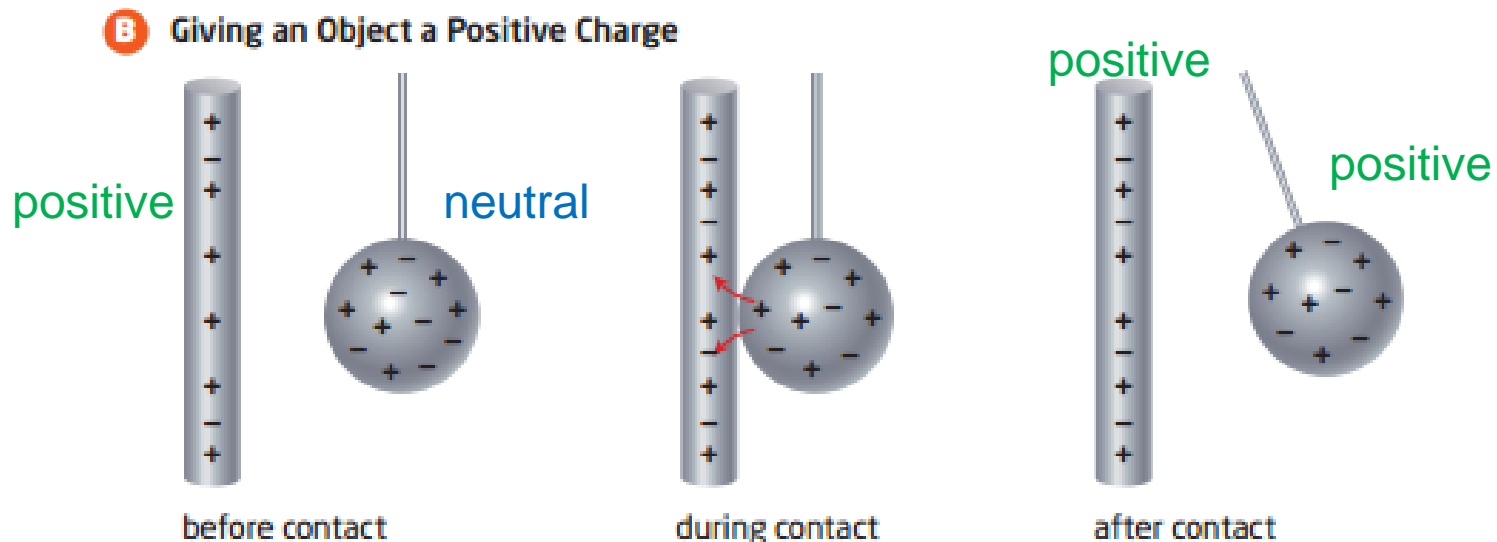
5. **After** contact, what is the charge of:

a. the sphere? **negative**

b. the rod? **still negative** (but less negative than before)

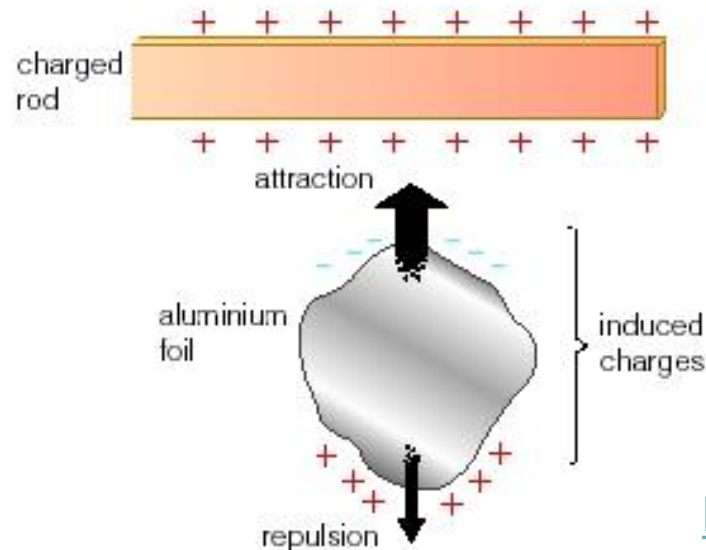
6. Describe what happens when a positive rod touches the neutral sphere.

The negative charges transfer from the sphere to the rod. The sphere becomes positive.



Charging by Induction

7. **Induced charge separation** – The movement or re-arrangement of electrons in a substance, caused by the electric field of a nearby object, **without direct contact** between the substance and the object.



<https://www.edumedia-sciences.com/en/media/742-electroscope>

8a. The sphere below is neutral. Draw 5 (+) charges and 5 (-) charges to show that it is neutral.

b. Describe what happens when a negatively-charged rod is brought near the neutral sphere.

The negative charges on the sphere are repelled to the opposite side. The side facing the rod becomes positive.



(a)



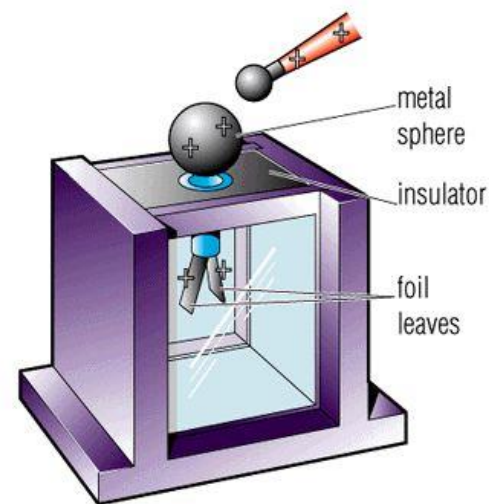
(b)

Detecting Static Charges

- **(9 & 10) Electroscope** – An apparatus that can be used to detect a static electrical charge



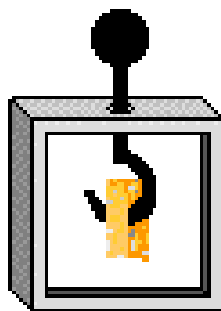
Pith ball electroscope



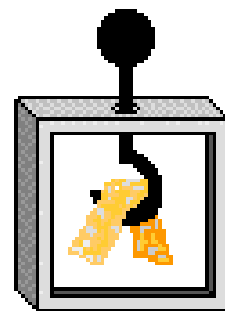
Metal leaf electroscope

11. The leaves of a metal leaf electroscope will spread away from each other when:

- A charged object is brought near the sphere, OR
- The electroscope itself becomes charged



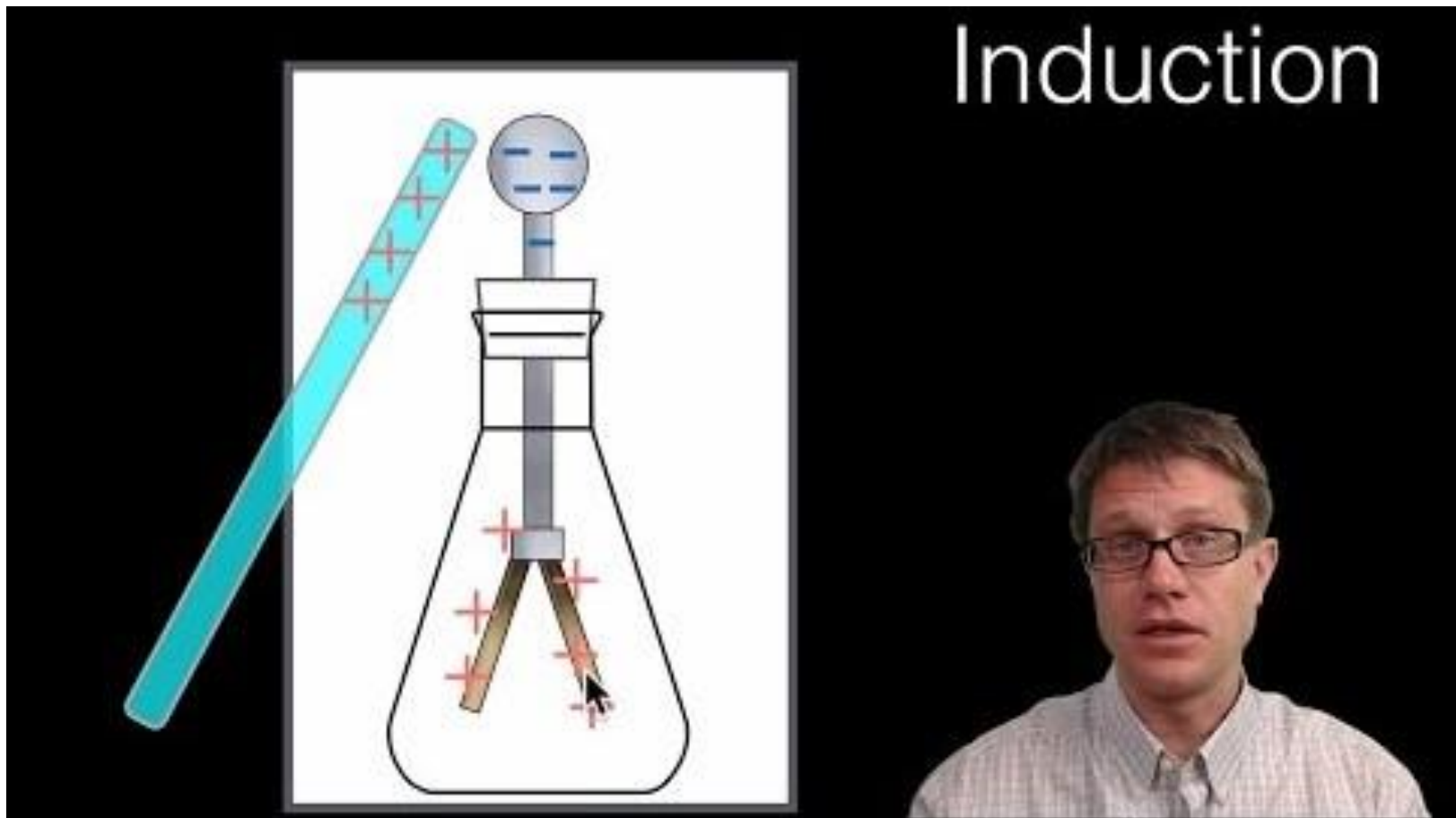
Relaxed Leaves
Neutral



Deflected Leaves
Charged

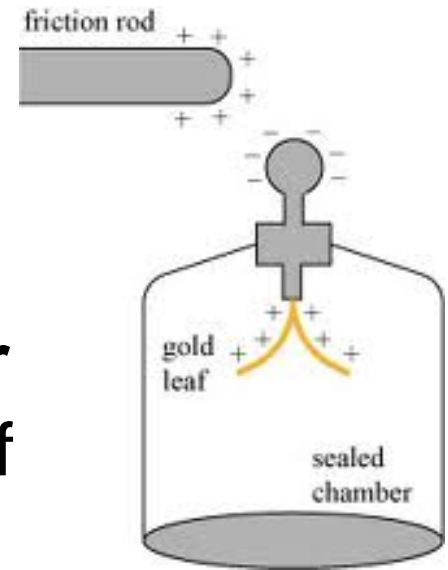
How the Metal Leaf Electroscope Works

<https://www.youtube.com/watch?v=dwJ-MM7yu4E>



How the Metal Leaf Electroscope Works

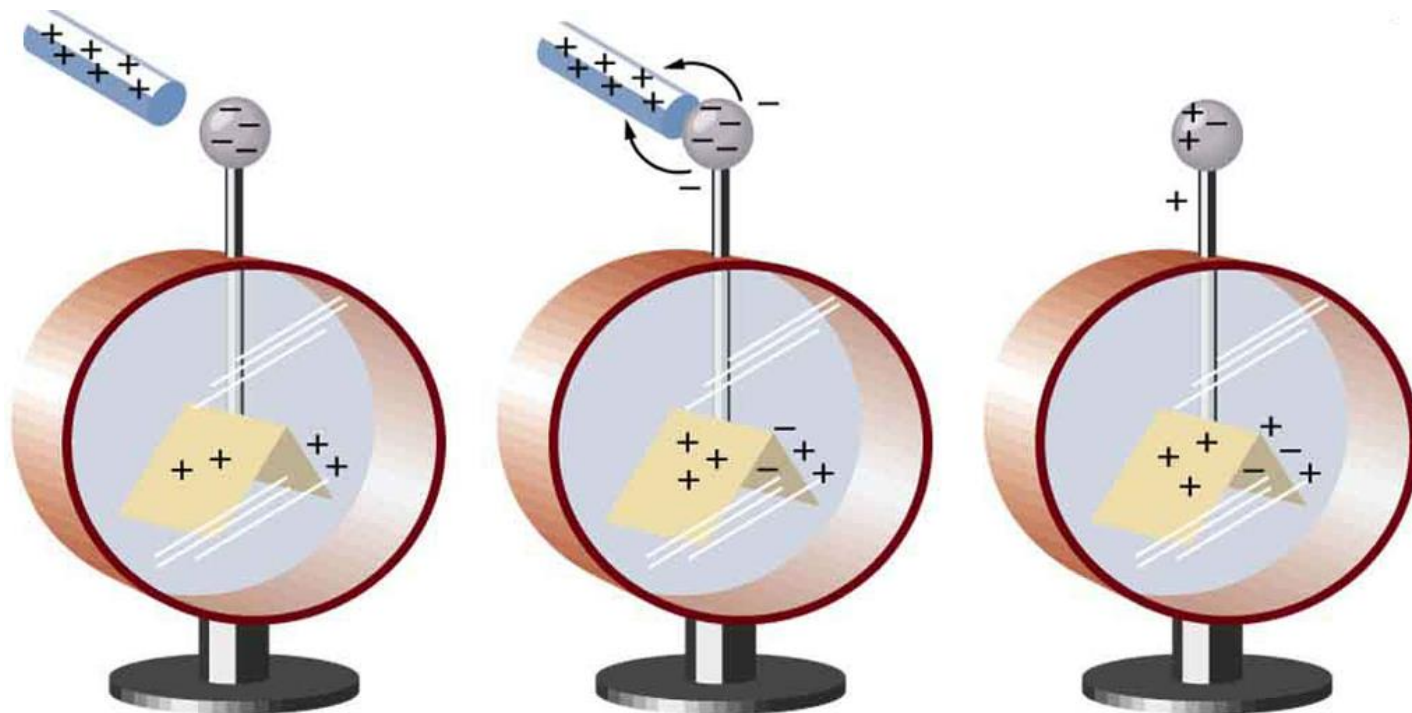
When a charged object is brought **near** the conducting sphere of a metal leaf electroscope, the leaves separate.



12a. When a positively-charged rod is brought towards the neutral sphere, the **negative** charges in the sphere are attracted to the top. This is an example of an **induced** charge separation.

b. The leaves then separate because they are coated with **like** charges.

13. If the positive rod actually **touched** the sphere, **negative** charges would flow from the **sphere** to the **rod**. This is an example of charging by **contact**.

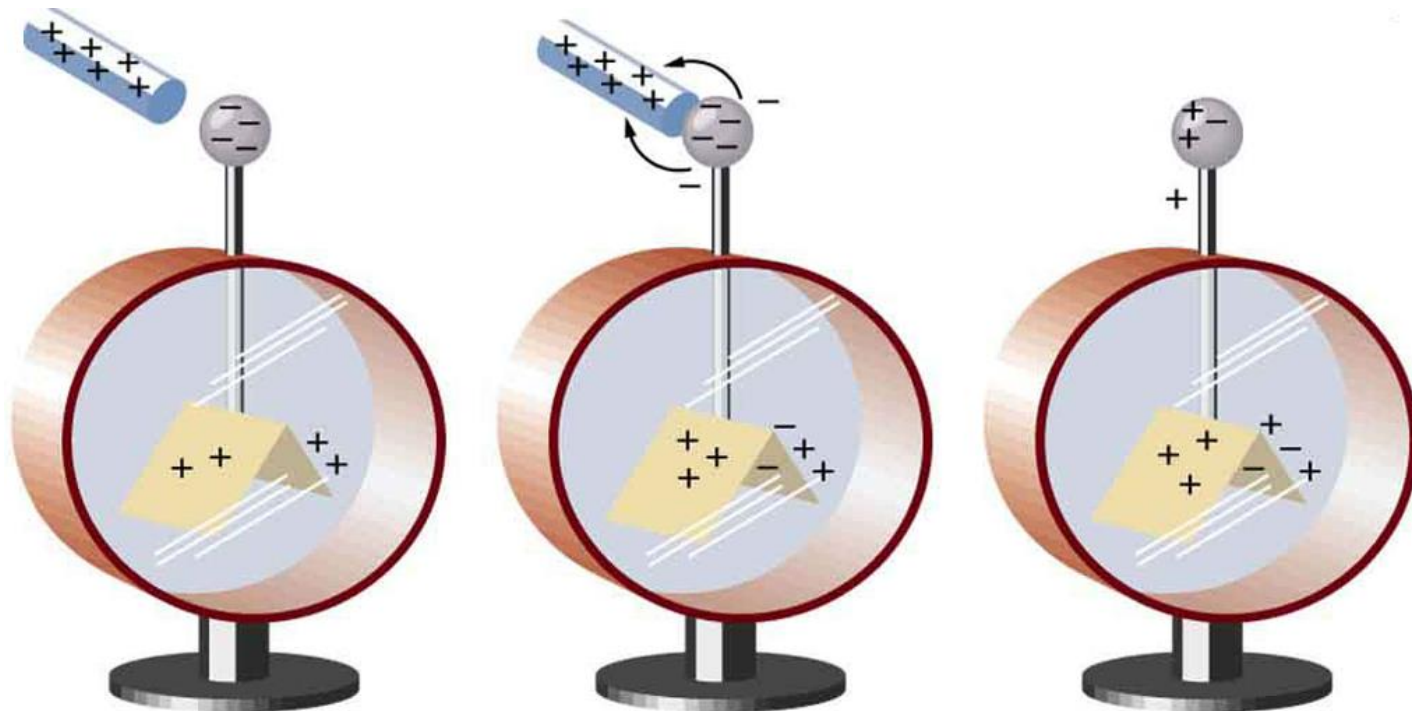


b. What charge would the electroscope have?

Positive

c. Would the leaves still stay separated?

Yes – the positive leaves would repel each other.



Summary

There are three methods of producing static charge:

- A. Friction** - Rubbing two neutral objects together
- B. Contact** - Touching a neutral object with a charged one
- C. Induction** - Bringing a charged object close to a neutral one

Homework

- p. 415 #1, 2
- p. 417 # 2-8