

Electric Charge

PHY 114-01

Fall 2026

Welcome!

- Sit next to at least one person to work with
- Think: what do you already know about electric charge?

Announcements and Reminders

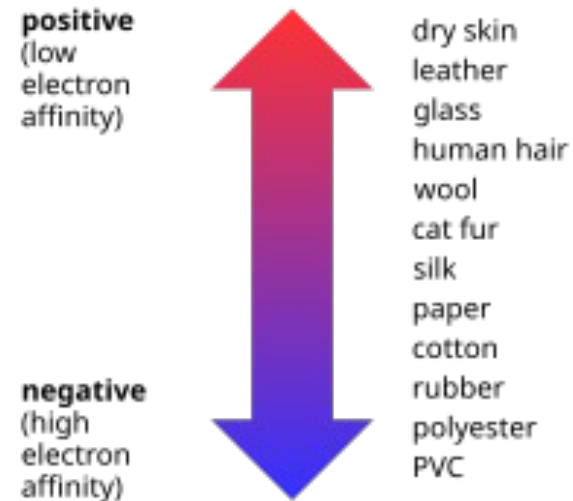
- Set up your homework account with Physics LE
- Try out the practice assignment, HW0 due 9/11
- Find relevant links and information on the course website
- <https://annaliw.github.io/courses/P114-F26.html>
- Announcements on Canvas
- Email me if you have any difficulties! awangholtzen@umassd.edu
- Labs and recitations start next week

What do you know about electric charge?



Triboelectric effect

- Electric charge transfer from one object to another when they come into contact or slide against each other.
- Causes static electricity
- Two types of charge:
 - Excess charge carrier
 - Deficit charge carrier



Attract, repel, or no effect?

If I transfer charge from one object to another using the triboelectric effect, will those objects then

- A. Attract each other
- B. Repel each other
- C. Have no effect on each other
- D. I have no idea!

Forces from charged objects

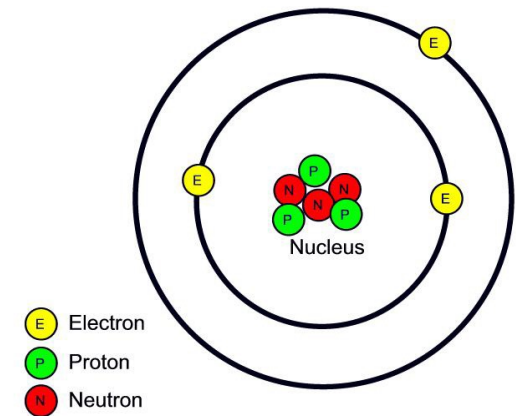
Based on observations with charged objects:

- Excess charge objects repel excess charge objects
- Deficit charge objects repel deficit charge objects
- Excess and deficit charge objects attract

- Charged objects can exert some kind of force on each other
- Opposites attract! (Likes repel)

Where does charge come from?

- In a material, electrons can be pulled off but the nucleus stays behind.
- Electrons are defined as negative charge
 - Deficit of the charge carrier makes a positively charged object
 - Excess charge carrier makes a negatively charged object

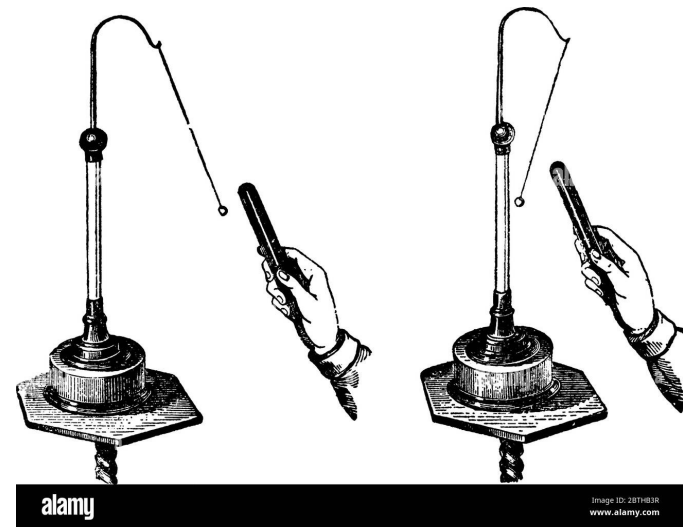
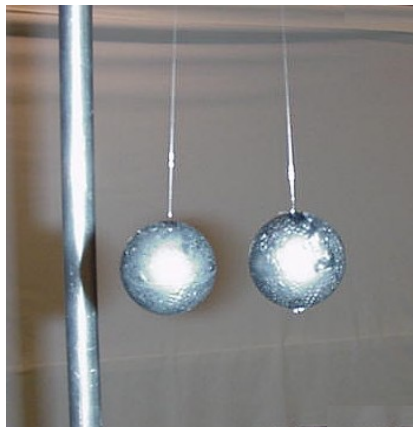


Facts about electric charge

- The unit of charge is Coulombs (C)
- Electric charge is quantized at 1.602×10^{-19} C
- There are two types of charge, positive and negative
- Charge magnitude is independent of type
 - The smallest unit of negative charge is the electron, -1.602×10^{-19} C
 - The smallest unit of positive charge is the proton, $+1.602 \times 10^{-19}$ C
- Charge is conserved in a closed system
 - E.g. the universe
 - A closed system would include the object losing the charge and the object gaining the charge

Concept Check

Three pithballs are suspended from thin threads. Various objects are then rubbed against other objects (nylon against silk, glass against polyester, etc.) and each of the pithballs is charged by touching them with one of these objects. In each case, be sure to discuss why you chose the answer you did.



Concept Check

Three pithballs are suspended from thin threads. Various objects are then rubbed against other objects (nylon against silk, glass against polyester, etc.) and each of the pithballs is charged by touching them with one of these objects. In each case, be sure to discuss why you chose the answer you did.

A. In one set of experiments, it is found that pithballs 1 and 2 repel each other and that pithballs 2 and 3 repel each other. From this we can conclude that

- a. 1 and 3 carry charges of opposite sign.
- b. 1 and 3 carry charges of equal sign.
- c. all three carry the charges of the same sign.
- d. one of the objects carries no charge.
- e. we need to do more experiments to determine the sign of the charges.

- Like charges repel!
 - 1 and 2 repel $\rightarrow$ 1 and 2 must be like charges
 - 2 and 3 repel $\rightarrow$ 2 and 3 must be like charges
- By the associative property:
 - If 1 is like 2 and 2 is like 3, then 1 must be like 3
- 1, 2, and 3 are all the same type of charge (C)

B. In a second set of experiments, it is found that pithballs 1 and 2 attract each other and that pithballs 2 and 3 repel each other. From this we can conclude that

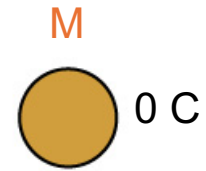
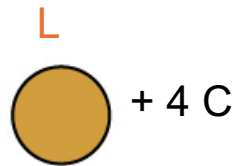
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- Opposite charges attract and like charges repel
 - 1 and 2 attract $\rightarrow$ 1 and 2 must be opposite charges
 - 2 and 3 repel $\rightarrow$ 2 and 3 must be like charges
- 1 and 3 must be opposite charges (A)

New fact about charge

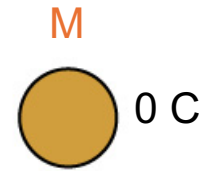
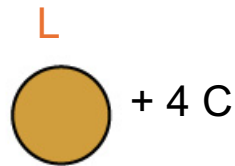
- Charges want to be in equilibrium.
- This means that charges will distribute equally whenever possible.

Two identical metal balls **L** and **M** initially have charge 4 C and 0 C, respectively, as shown below. What is the charge on **M** after you let **L** touch **M** and set them apart?



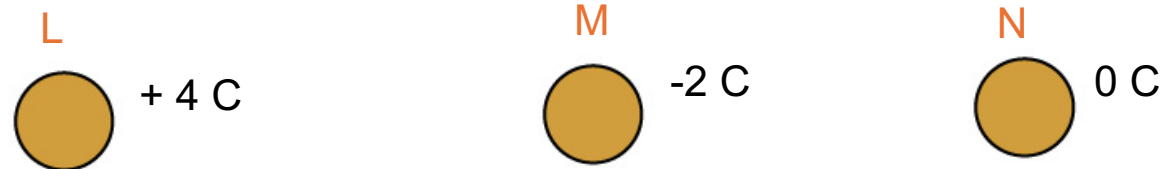
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- B. 2 C
- C. 0.5 C
- D. 0 C
- E. None of the above

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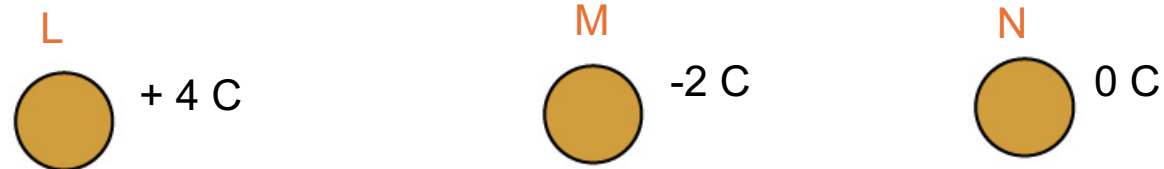
- A. 4 C
- B. 2 C
- C. 0.5 C
- D. 0 C
- E. None of the above

Three identical metal balls **L**, **M** and **N** initially have charge 4 C, -2 C and 0 C, respectively, as shown below. What is the charge on **N** after you let **L** first touch **M**, and then remove **L** and let **M** touch **N**?



- A. 4 C
- B. 2 C
- C. 0.5 C
- D. 0 C
- E. None of the above

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