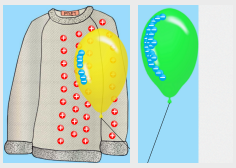
Balloons and Static Electricity

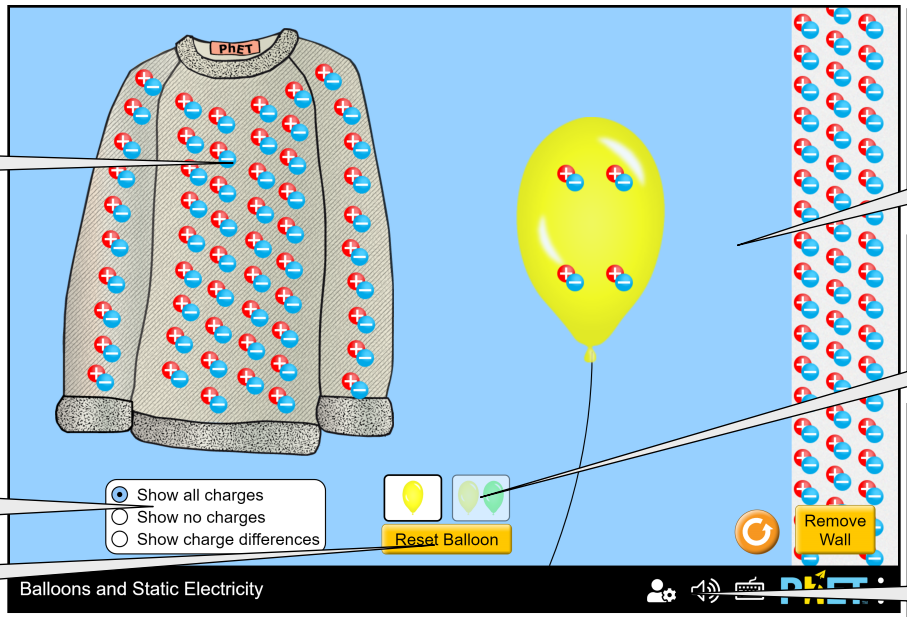
The ***Balloons and Static Electricity*** simulation allows students to flexibly explore static electricity concepts such as transfer of charge, induction, attraction, repulsion, and grounding.

MOVE the balloon on the sweater to accumulate charges

VIEW all charges, no charges, or differences



RETURN balloons to neutral state



OBSERVE what happens when charged balloon is close to a wall

EXPERIMENT with one or two balloons

ACCESS sim controls (sound on/off, keyboard shortcuts) or add features (extra sounds)

Insights into Student Use

- During interviews, many students implicitly believed that the balloons were helium-filled (and therefore experienced a buoyant force). To avoid this assumption, the strings holding the balloons have been given a little slack.

Model Simplifications

- The positive and negative charges are meant to give a relative idea of charge. It is important to help students understand that electrons are transferred or relocated, but not the protons.
- “Show all charges” will display all of the charges in the underlying model, not the actual number of charges in the real world.
- Uncharged balloons will stay wherever they are placed. The buoyant force acting on the balloons is intentionally not modeled in this simulation, so that students do not conflate the idea of the buoyant force on the balloon with the electric forces on the balloon.
- When the simulation starts up, the balloon is uncharged and has no horizontal forces acting on it. If the uncharged balloon is placed on the wall, it will remain in contact with the wall. However, the balloon is not stuck to the wall. If displaced slightly, the uncharged balloon will not experience attraction to the wall, and as a result will remain where it was placed. Once the balloon is charged, it begins to experience electrical attraction and repulsion, and then its position is determined by the outcome of the forces acting on it.
- The wall behaves has a dielectric.

Customization Options

Query parameters allow for customization of the simulation, and can be added by appending a '`?`' to the sim URL, and separating each query parameter with a '`&`'. The general URL pattern is:
`…html?queryParameter1&queryParameter2&queryParameter3`

For example, in Balloons and Static Electricity, if you want to mute audio (`audio=muted`), and disable pan and zoom (`supportsPanAndZoom=false`) use:
https://phet.colorado.edu/sims/html/balloons-and-static-electricity/latest/balloons-and-static-electricity_all.html?audio=muted&supportsPanAndZoom=false

To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/balloons-and-static-electricity/latest/balloons-and-static-electricity_all.html?locale=es&audio=muted&supportsPanAndZoom=false

⚙ Indicates this customization can be accessed from the Preferences menu within the simulation.

Query Parameter and Description	Example Links
`locale` - specify the language of the simulation using ISO 639-1 codes. Available locales can be found on the simulation page on the Translations tab. Note: this only works if the simulation URL ends in "_all.html".	`locale=es` (Spanish) `locale=fr` (French)
⚙ `audio` - if muted, audio is muted by default. If disabled, all audio is permanently turned off.	`audio=muted` `audio=disabled`
`allowLinks` - when `false`, disables links that take students to an external URL. Default is `true`.	`allowLinks=false`
`supportsPanAndZoom` - when `false`, disables panning and zooming using pinch-to-zoom or browser zoom controls. Default is `true`.	`supportsPanAndZoom=false`

Suggestions for Use

Lecture Demo

- Have students rub a balloon on a sweater, and sketch what they think is happening to the charges. Compare to the simulation.

Sample Challenge Prompts

- Predict what happens when a charged balloon is moved closer to the neutral wall. Draw a picture.
- After rubbing the balloon on the sweater, how does the charge on the balloon compare to the charge on the sweater? What happens to the positive charges? What happens to the negative charges? Draw a picture.
- Remove the wall, and use two balloons to explore attraction and repulsion. How do the +/- symbols help you decide whether something attracts or repels?
- Explain how a balloon can be strongly or weakly attracted to the sweater.

Inclusive Features

Sound and Sonification

- A “popping” sound plays each time you collect a charge from the sweater to the balloon. Each additional charge collected plays at a higher pitch from the previous one.
- A series of pleasant tonal blips play in the pentatonic scale as the charged balloon causes movement of the negative charges in the wall.
- A sound that sounds similar to a slide whistle plays when the charged first balloon is released and floats toward the positive charges in the sweater or wall. It rises higher and higher in pitch as it gets closer to the sweater or wall. A lower pitched slide whistle plays when the second charged balloon is released.
- See the Sound Features Video for more useful tips on how concepts and sound are integrated in this sim. See the published Sound Design Documentation for more details on all sounds in this simulation.

Interactive Description

- This simulation features interactive description to support non-visual access, delivered only while using screen reader software. See the Introduction to Interactive Description video for more info on how to use this feature.
- Teachers can access the A11y View here to decide if this sim's interactive description meets their instructional needs. *Reminder: A11y View is not intended for student use and will not provide a good experience for learners using screen reader software.*

See the simulation page for all supported inclusive features.

See all published activities for Balloons and Static Electricity here.
For more tips on using PhET sims with your students, see Tips for Using PhET.