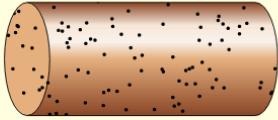


In **Resistance in a Wire**, students explore how changing the resistivity ( $\rho$ ), length (L), and area (A) of a wire affects its resistance (R).

**OBSERVE** how the size of the variable corresponds to its value

$$R = \frac{\rho L}{A}$$


**MEASURE** the resistance as  $\rho$ , L, and A change

**NOTICE** the direction of the current

resistance = 0.667 ohms

| $\rho$<br>resistivity     | L<br>length | A<br>area             |
|---------------------------|-------------|-----------------------|
| 0.50<br>$\Omega\text{cm}$ | 10.00<br>cm | 7.50<br>$\text{cm}^2$ |



**CONTROL** the resistivity, length, and area of the wire

Resistance in a Wire





**ACCESS** sim features (sound on/off, keyboard shortcuts)

## Model Simplifications

- The black dots in the wire represent impurities in the metal lattice. Materials with a high density of impurities have a higher probability of collision between the electrons and the cations in the lattice, which results in a larger resistivity.

## Suggestions for Use

### Sample Challenge Prompts

- What variables affect the resistance in the wire? How can you maximize/minimize its resistance?
- If the area of a wire is doubled, how does its resistance change? Explain.
- How does the resistivity relate to the resistance? Can the resistivity of a material be changed?
- Describe what happens to the flow of electrons when the wire becomes (a) longer or (b) thinner.

## Inclusive Features

### Sound and Sonification

- The pitch of the slider notes is proportional to the size of the resistance in the wire and not on specific slider positions. Try to achieve the same note (same resistance) with different slider positions.
- 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.

## 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 Resistance in a Wire, if you want to mute audio (`sound=muted`), and disable external links (`allowLinks=false`) use:

[https://phet.colorado.edu/sims/html/resistance-in-a-wire/latest/resistance-in-a-wire\\_all.html?sound=muted&allowLinks=false](https://phet.colorado.edu/sims/html/resistance-in-a-wire/latest/resistance-in-a-wire_all.html?sound=muted&allowLinks=false)

To run this in Spanish (`locale=es`), the URL would become:

[https://phet.colorado.edu/sims/html/resistance-in-a-wire/latest/resistance-in-a-wire\\_all.html?locale=es&sound=muted&allowLinks=false](https://phet.colorado.edu/sims/html/resistance-in-a-wire/latest/resistance-in-a-wire_all.html?locale=es&sound=muted&allowLinks=false)

| Query Parameter and Description                                                                                                                                                                                                                                      | Example Links                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <code>locale</code> - specify the language of the simulation using <a href="#">ISO 639-1</a> codes. Available locales can be found on the simulation page on the <a href="#">Translations tab</a> . Note: this only works if the simulation URL ends in “_all.html”. | <code>locale=es</code> (Spanish)<br><code>locale=fr</code> (French) |
| <code>sound</code> - if muted, audio is muted by default. If disabled, all audio is permanently turned off.                                                                                                                                                          | <code>sound=muted</code><br><code>sound=disabled</code>             |
| <code>allowLinks</code> - when <code>false</code> , disables links that take students to an external URL. Default is <code>true</code> .                                                                                                                             | <code>allowLinks=false</code>                                       |

See all published activities for Resistance in a Wire [here](#).

For more tips on using PhET sims with your students, see [Tips for Using PhET](#).