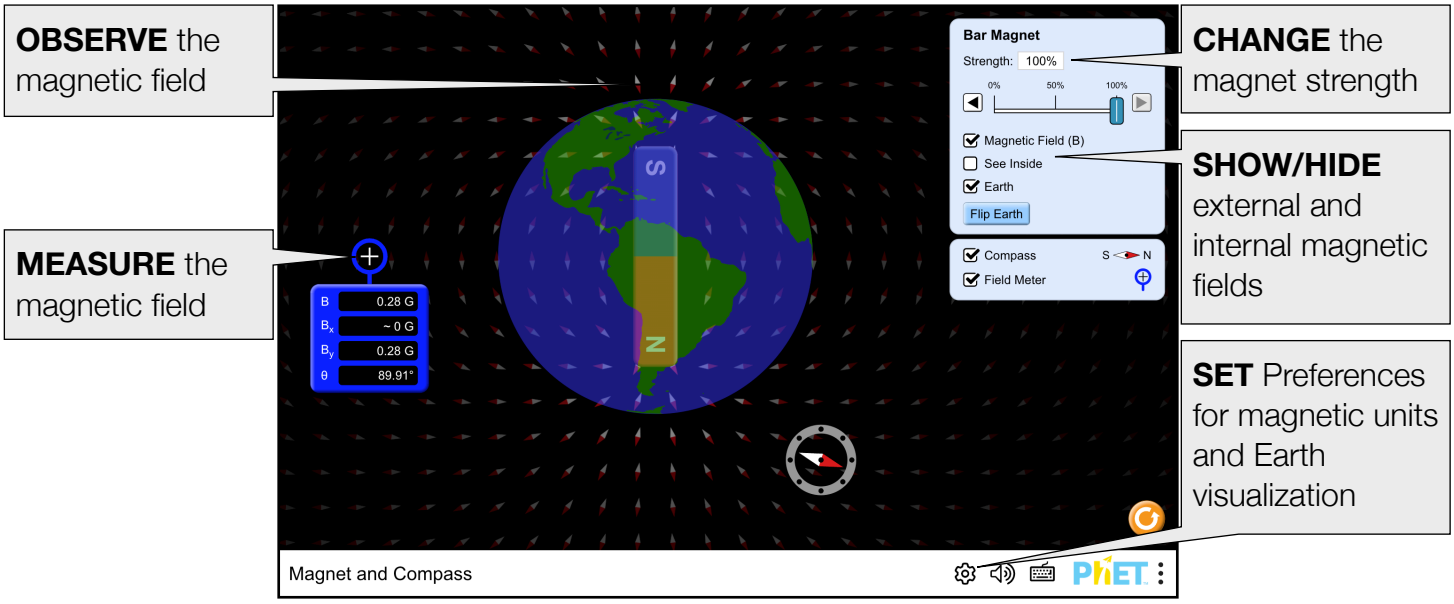
PhET Tips for Teachers

Magnet and Compass

The ***Magnet and Compass*** simulation allows students to explore the interactions between a compass and bar magnet. Vary the magnet's strength and see how things change both inside and outside and use the field meter to measure how the magnetic field changes.



Model Simplifications

- The Field Meter appears to be in front of the magnet, but measures inside of it. It is layered on top to ensure that the readouts are always visible.
- When the Earth is displayed over the bar magnet, the magnetic south pole aligns with the geographic north pole. However, the geographic and magnetic poles are not perfectly aligned.
- The Earth image is a schematic overlay to illustrate why compasses point north. It does not change the underlying model. The Field Meter and Compass still measure the adjustable bar magnet's field (set by the Strength slider), not real Earth field data, so readings won't match a real-world magnetometer.
- The Compass needle displays the direction of the magnetic field and behaves like a real compass. The needle aligns with the field over time and exhibits inertia, angular velocity, angular acceleration, and wobble. However, when measuring on top of the bar magnet, the compass immediately aligns with the field.

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 Magnet and Compass, if you only want to display magnetic values in Tesla (`magneticUnits=T`), and mute the audio by default (`audio=muted`) use:

https://phet.colorado.edu/sims/html/magnet-and-compass/latest/magnet-and-compass_all.html?magneticUnits=T&audio=muted

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To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/magnet-and-compass/latest/magnet-and-compass_all.html?locale=es&magneticUnits=T&audio=muted

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

Query Parameter and Description	Example Links
⚙ `magneticUnits` - specifies magnetic units, `T` for Tesla or `G` for gauss (default).	`magneticUnits=T`
⚙ `addEarthCheckbox` - when `true`, adds a checkbox to the Bar Magnet screen to display the Earth over the magnet. Default is `true`.	`addEarthCheckbox=false`
⚙ `earthHemisphere` - when Earth is checked, displays `eastern` or `western` (default) hemisphere.	`earthHemisphere=eastern`
⚙ `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)
⚙ `colorProfile` - changes simulation colors for easier projection.	`colorProfile=projector`
`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

Sample Challenge Prompts

- Predict the direction of the magnetic field for different locations around the bar magnet.
- Describe what happens to the magnetic field as you move further away from the magnet.
- Compare the earth's magnetic field to a bar magnet.

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