

Background

We've already learned that a current produces a magnetic field, as described by the Biot-Savart Law and Ampère's Law. Michael Faraday, somewhat weak mathematically but a great experimenter, was the one who determined that magnetic fields, in turn, produce currents. More specifically, a *changing* magnetic flux in the vicinity of a conducting loop will produce current in that loop.

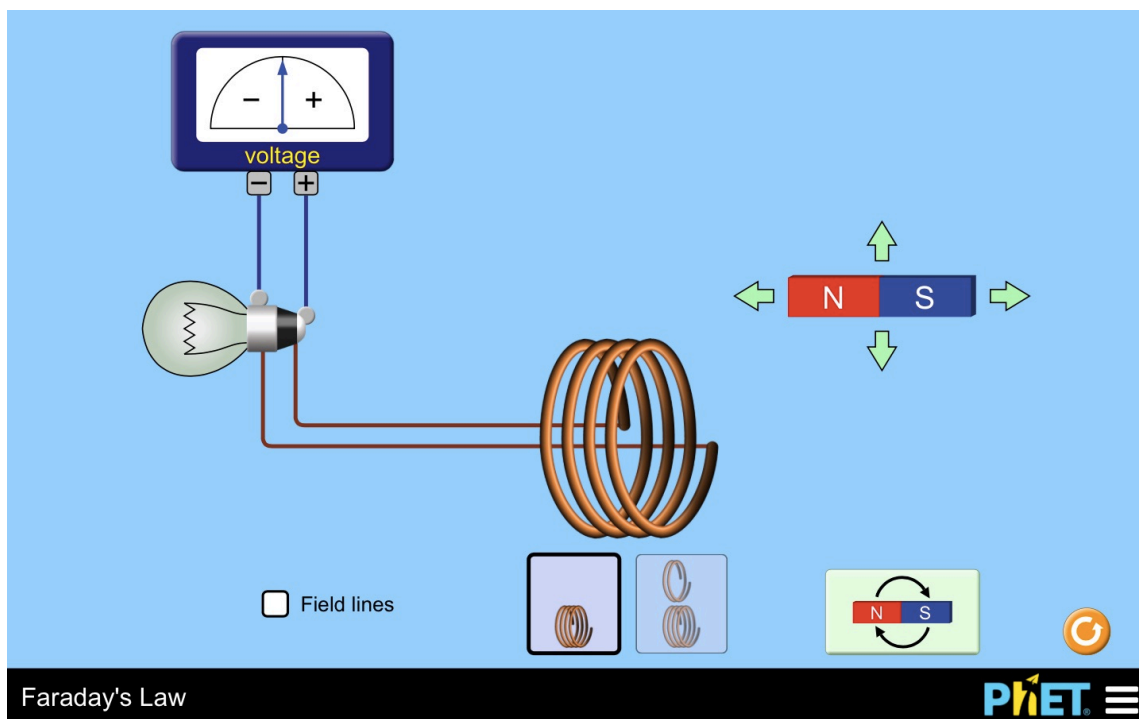
This PhET activity lets you experiment with these ideas.

Objectives

To understand the qualitative relationships between magnetic flux (field lines through an area), changing magnetic flux, and current induced in a conducting loop.

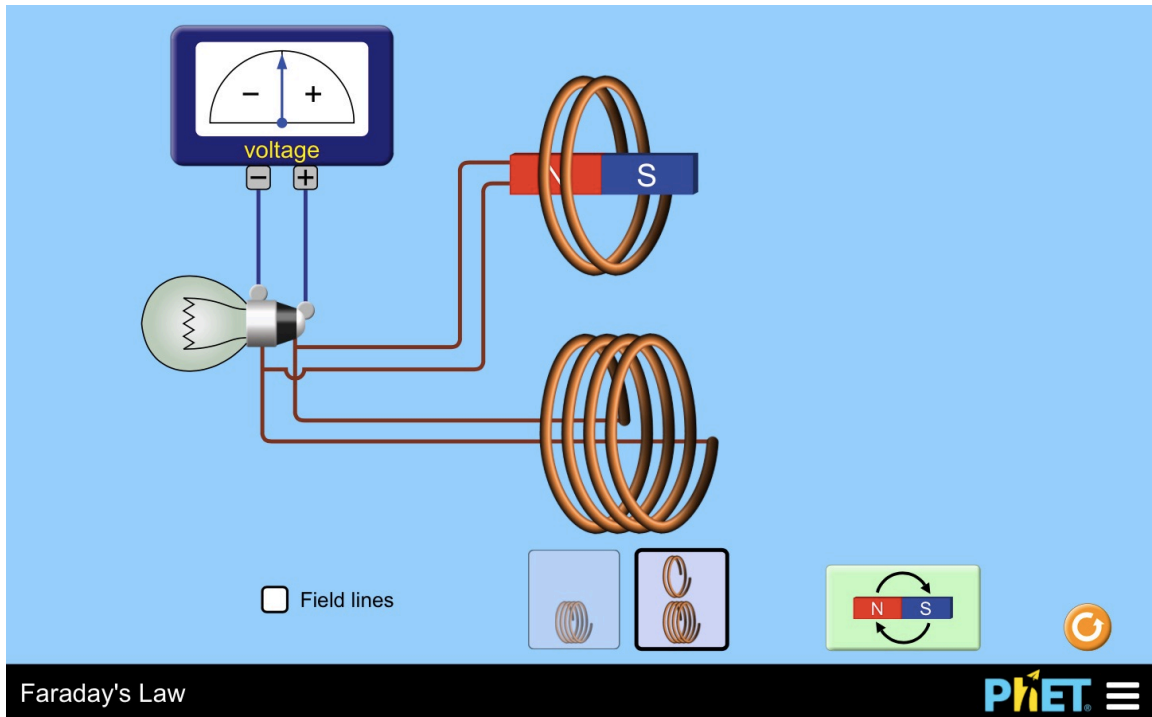
Procedure

- Go to the PhET page at https://phet.colorado.edu/sims/html/faradays-law/latest/faradays-law_en.html, or go to the PhET page at <https://phet.colorado.edu> and navigate to the HTML5 version of the Faraday's Law simulation.



- Magnetic fields
 - When the simulation first launches, a red-blue bar magnet is shown (see above). Based on what you already know about the magnetic fields of magnets, visualize what the magnetic field of this bar magnet looks like, including what general shape the field lines have, and which direction the magnetic field is oriented in the area around the magnet.
 - Now, click the "Field lines" checkbox. Were your predictions confirmed? Draw the magnetic field lines for the magnet in the diagram above.

3. Magnetic flux
 - a. The coil of wire in the center of the screen encompasses an area through which magnetic field lines pass, so there is a *magnetic flux* through those coils. With the magnet stationary, is this magnetic flux producing any flow of current or potential difference? _____
 - b. Click on the magnet to move it around on the screen some. What effect does the moving magnet have on the amount of *magnetic flux* in the coils of the circuit?
 - c. What corresponding effect does this have on the flow of current, or potential difference?
 - d. Move the magnet around in a variety of ways. Identify as many ways as you can find of *increasing* the potential created, and list them here. Consider using other buttons in the simulation in your investigation.



- e. If you haven't already, click on the icon that produces two loops of conducting wire as shown here. Which conducting loop most readily allows an electric potential to be produced?

4. Lenz's Law

- a. Reset the simulation so that a single magnet, with field lines visible is shown. With that magnet on the right side of the screen and in line with the coil, move it the magnet so that it approaches but doesn't enter the area of the coil.
- i. Which direction is the magnetic field pointing as the magnet approaches the coil?
 - ii. Which direction is the magnetic flux as the magnet approaches the coil?
 - iii. Is the flux *increasing* or *decreasing* as the magnet approaches the coil?
 - iv. As the magnet approaches the coil, which direction is the current induced in the coil flowing (according to the voltmeter): up in front and down in back, or up in back and down in front?

