

Lesson plan *Faraday's #2 using Faraday Law (Flash) and Electromagnet Lab(Java):*
Induction

50 minutes

Learning Goals:

Students will be able to:

- Identify equipment and conditions that produce induction
- Compare and contrast how both a light bulb and voltmeter can be used to show characteristics of the induced current
- Predict how the current will change when the conditions are varied.

Background:

We will have studied electricity and had an introduction to magnets. About three weeks before, we will have done the activity called Introduction to Magnets that I wrote using *Faraday's Electromagnet Lab*. There will be a class discussion about their current understanding. I will define induction and demonstrate induction in common ways using an overhead meter and also a light bulb as indicators. They will be using the *Pickup Coil*, *Transformer* and *Generator* tabs of the sim. When I did this activity last year, the Flash version was not online. Many students did not do well on the essay question and I think there were too many concepts introduced at once and I had a sub that day. This lesson starts with the Flash version after the demos (the sub did not do the demos last year). I also wrote myself the following note: I have been thinking about how I might get the students to reason about what is the underlying cause of induction. I think I will have a class discussion on the next day after the activity. I will project the sim as an aid. Using the Flash sim with the "Show Field lines" may help solve the issue.

Demo equipment: magnet, variety of coils, power supply, overhead galvanometer, little demo light bulb, generator model

Sim Introduction:

1. *Faraday Law*: Show that the magnet can be moved to the left of the coil.
2. *Faraday's Electromagnet Lab* I will demonstrate turning off the *Show Field*, *Compass*, *Field meter* and *Electrons* so the window looks like real lab equipment and relate the window to the demo equipment that I used.

Lesson:

After the discussion and demos, have the students use the lab sheet for guidance. The activity is planned for my honors physics students to take about 50 minutes.

Post Lesson: Clicker questions and Class discussion: Project *Faraday's Electromagnet Lab* (have *Faraday Law* minimized)

1. Guide the students to understand more about induction by using the *Transformer* and *Generator* windows. Talk about applications both of these. (In the college version, this is part of the student directions.)
2. Discuss what is causing the electrons to move (inducing the current) using the *Show Field* in both sims. My students have difficulty understanding how the fields interact. I may have them talk in pairs about what they think is happening and then write down their ideas. Then, we'll share. (In the college version, this is part of the student directions.)