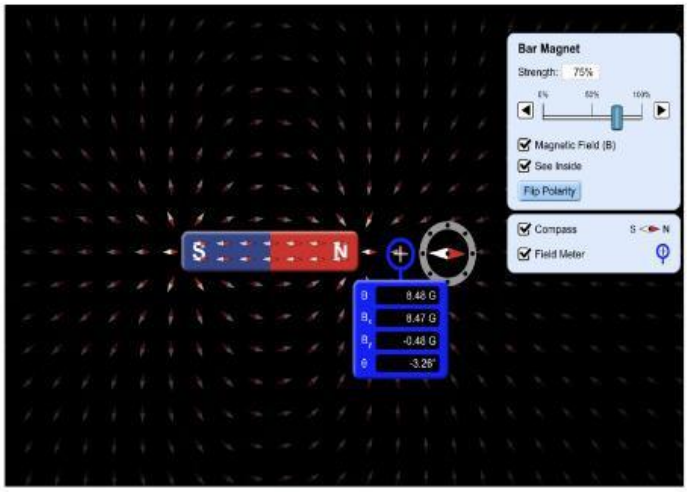
Click on the electromagnetic induction simulation and then click on the bar magnet tab

Part 1: Bar magnets

Set the simulation up as shown exactly to the right and then answer the questions as you play around with the simulation.



1. Take the compass and slowly drag the compass around the magnet in a circular motion. In what direction do the magnetic field lines point outside the magnet?

2. Click the flip polarity button. What happened to both the poles of the magnet and the direction of the magnetic field lines?

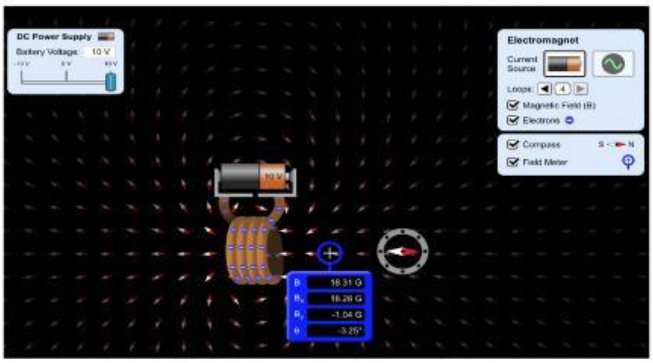
3. Click the See inside button. In what direction do the magnetic dipoles point inside the magnet?

4. Think about your response to question 3. If you were to cut the magnet above into four small magnetic pieces, what would you notice about the poles of each of these pieces?

5. Click on the magnetic field meter to measure the strength of the magnetic field at different points around the magnet. Where **around the magnet** is the magnetic field the strongest? You must not touch the magnet with the field meter.

Part 2: Go to [electromagnetic induction simulation] and click on Bar Electromagnet tab

6. Set up your simulation exactly as shown to the right. Drag the compass around the electromagnet in a circular motion. What do you notice about the electromagnet?



7. Change the number of loops of the electromagnet. What do you notice about the magnetic field strength as you change the number of loops?

8. As you slowly increase the voltage of the battery from 0 volts to 10 volts, what do you notice about the flow of electrons in the coil?

9. How does the motion of the electrons in the coil change when you switch the voltage from -5 Volts to +5 Volts?

10. Change your current source from the battery to the AC Power supply given by the green wave icon. How did the direction of electron flow for the battery compare to the direction of electron flow when hooked up to the AC Power supply?

11. When hooked up to the AC power supply, how does the movement of electrons in the wire relate to the strength and direction of the magnetic field produced by the electromagnet?

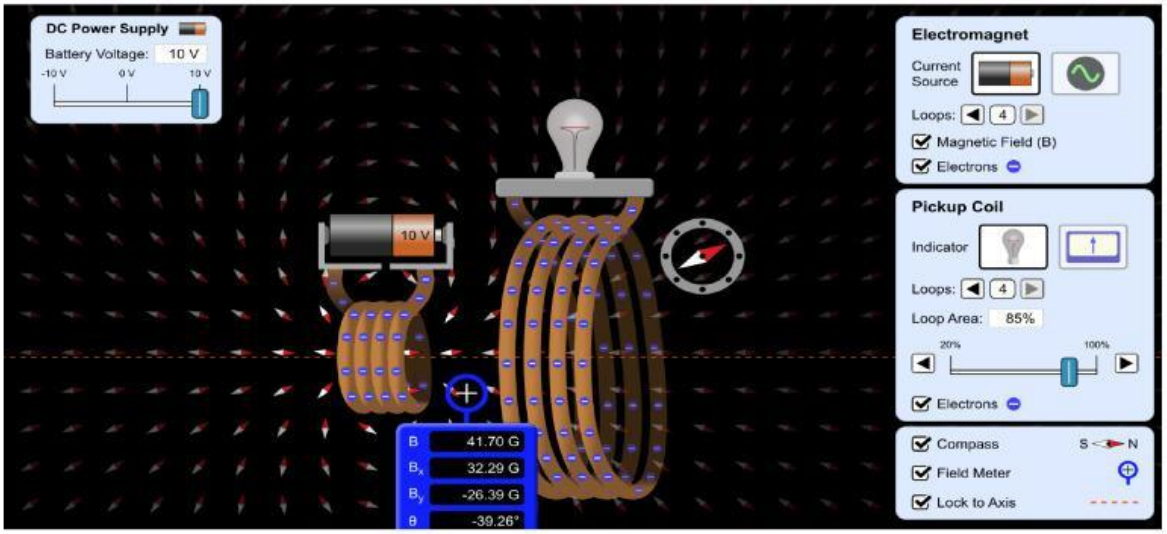
12. Use the simulation to rank the electromagnets from weakest to strongest.

Number of turns	Voltage of battery in volts	Strength of Electromagnet
1	**5**	
4	**5**	
1	**10**	
4	**10**	

13. Based on what you have learned about electromagnets, what factors are necessary in order to create a strong electromagnet?

Part 3: Go to electromagnetic induction simulation and click on the transformer tab

The concept of **electromagnetic induction** is used in various applications such as motors, generators, and transformers. Set up the simulation as shown.

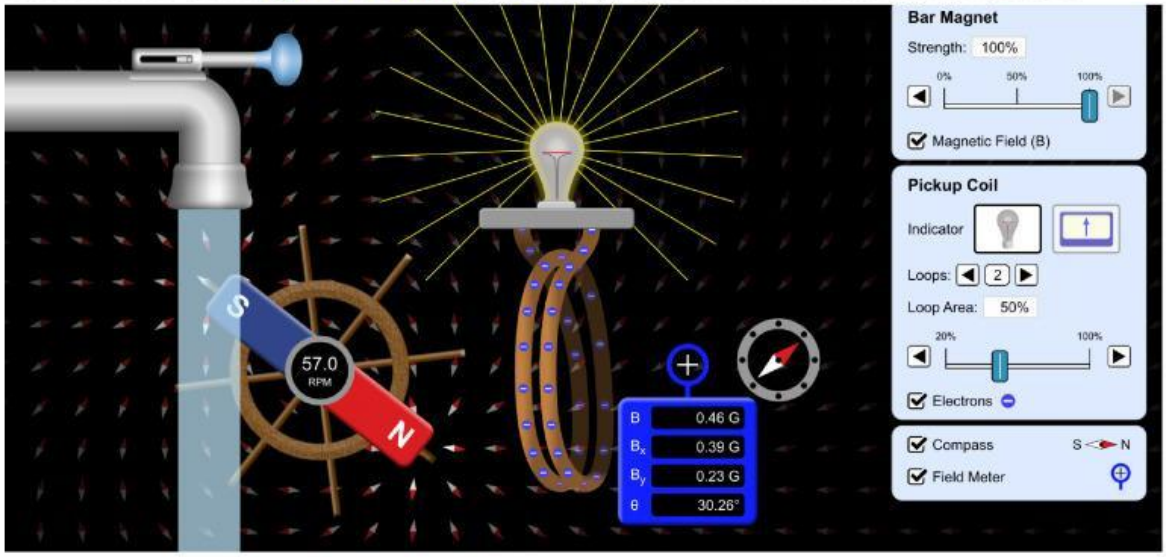


14. The electromagnet on the left is generating a magnetic field that is passing through the secondary loops that attach to the lightbulb on the right. However, it is seen that the bulb does not light up. Use the simulation to figure out how to light up the bulb and then pick the statement that best explains why the bulb did not light up when set up as shown.

15. The purpose of this tab is to show the function of a transformer. A transformer is a device that is used to transfer the power produced from a generator safely into our homes by stepping down the voltage. Looking at the number of coils attached to the lightbulb above, explain what can be done to step down the voltage passing through the bulb?

16. Select the AC Current power source and run the simulation. Was it necessary to move the electromagnet in order to induce a current in the secondary coils? Explain

Part 3: Click on the generator tab and set up the simulation as shown below.



After playing with the simulation, explain how a generator works in three steps

Step 1:

Step 2:

Step 3:

In summary:

Part 4: Click on the **Motor simulation** and explain how a motor works in four steps

Step 1:

Step 2:

Step 3:

Step 4:

In summary: