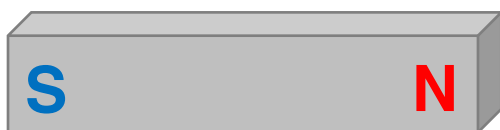


Activity 1: Getting Equipped

Students are studying connections between electricity and magnetism. They want to explore if either a stationary magnet or a moving magnet can induce (or cause) current in a nearby loop of wire. They have four pieces of equipment at their disposal and need to determine the function of each. In this activity, you will help them match the equipment with its function.



Bar magnet



Computer display
and current sensor

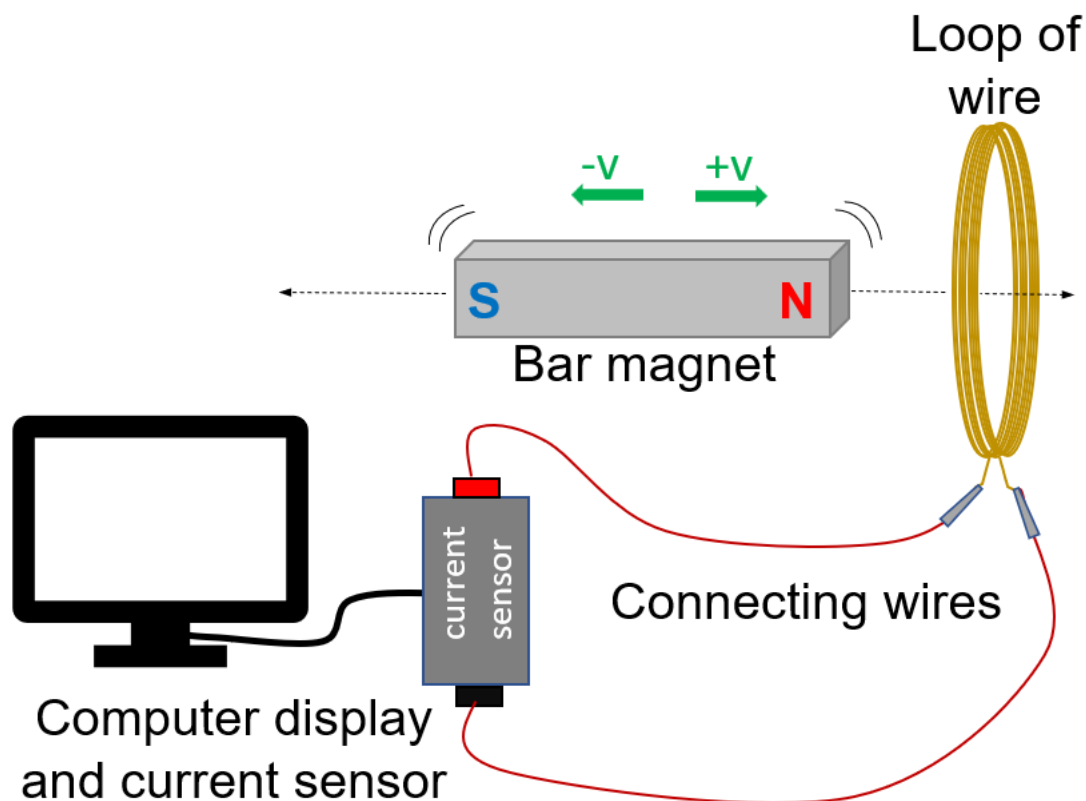
Loop of
wire



Connecting wires

Activity 2: Collecting Some Data

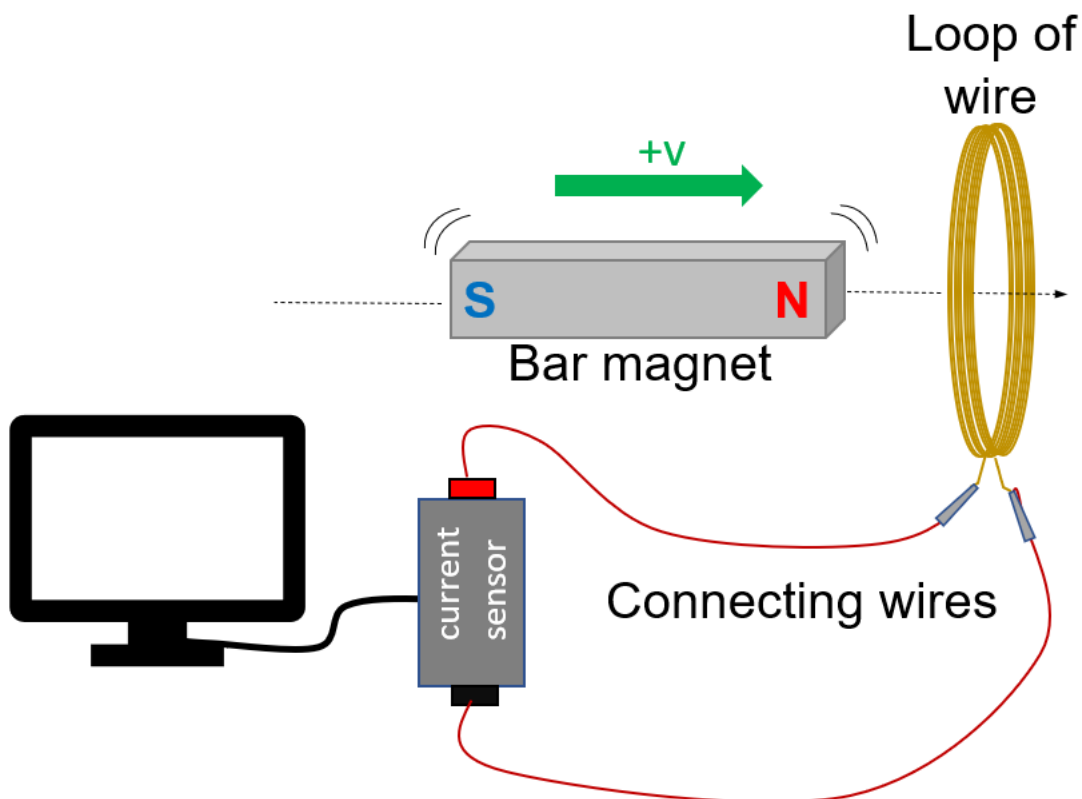
Students wanted to explore if a stationary or moving magnet could induce a current in a loop of wire. They created the setup shown and collected the data displayed in the table.



Trial	Velocity of Magnet (cm/s)	Velocity of Loop of Wire (cm/s)	Current Detected in Wire?
1	0	0	No
2	+20	0	Yes
3	- 20	0	Yes
4	0	+20	Yes
5	+20	-20	Yes
6	+20	+20	No

Activity 3: Committing to a Cause

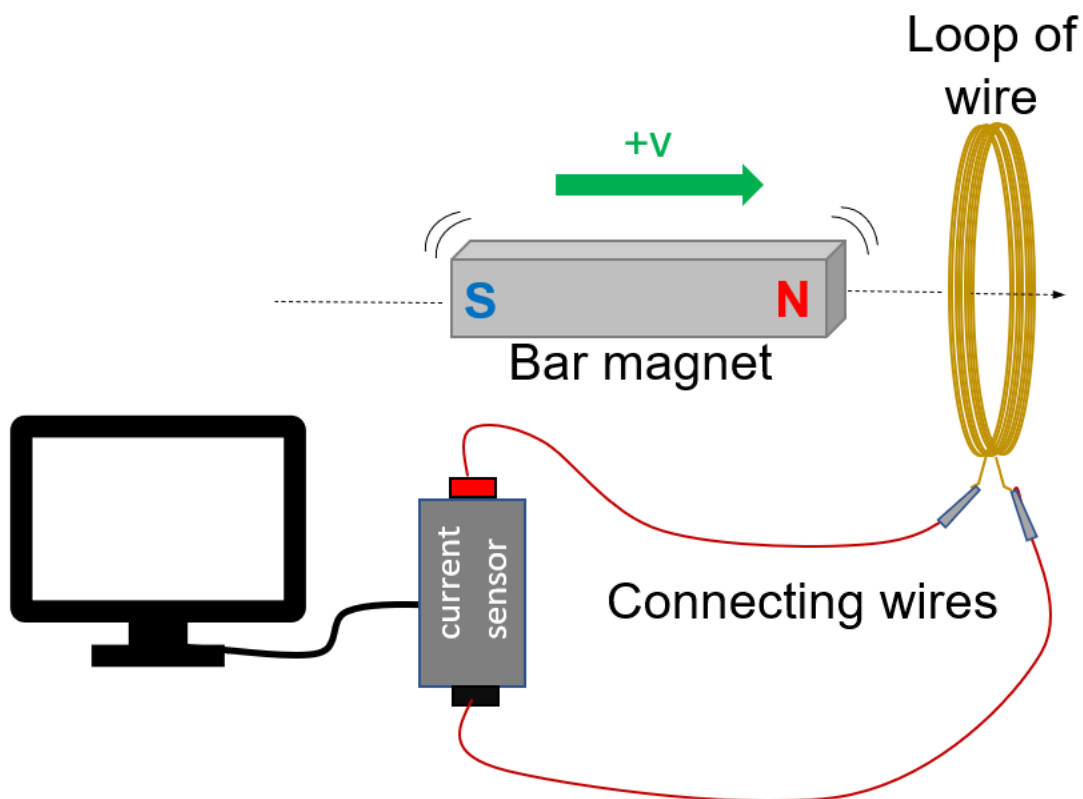
After being absent for a lab investigation, a student reviewed the magnetic induction data collected by his lab group during the previous class. His group's experimental set-up and data table are shown.



Trial	Velocity of Magnet (cm/s)	Diameter of Loop (cm)	Maximum Induced Current in Wire (mA)
1	+20	10	0.1
2	+40	10	0.2
3	+60	10	0.3
4	+60	20	1.2
5	+60	30	2.7

Activity 4: Getting Loopy

Students decided to see if changing the number of loops affects the current induced in the wires when a bar magnet moves toward it. They kept the speed of the bar magnet constant and kept the loop stationary. Their setup is shown. The table below shows the data they collected and their estimated uncertainty for the current measurement.



Trial	Number of Loops	Maximum Induced Current (mA)
1	10	0.1 ± 0.1
2	20	0.2 ± 0.1
3	50	0.4 ± 0.1
4	100	1.1 ± 0.1
5	200	2.3 ± 0.1

Activity 5: Putting It All Together 1

The class put together their investigations and developed a complex relationship for factors that affect the amount of induced current in a loop by moving a magnet into or out of the loop. The relationship is shown at the right.

$$I = \frac{N \left[\frac{\Delta B}{\Delta t} \right] A}{R}$$

In the equation, **I** is the induced current, **N** is the number of loops of wire, **$\Delta B/\Delta t$** is the rate of change of the magnetic field, **A** is the area of any one of the loops, and **R** is the electrical resistance of the wire.

In this activity, you will identify an investigation that the students could do to demonstrate that induced current depends on each of the variables given in this relationship.

Activity 6: Putting It All Together 2

The class put together their investigations and developed a complex relationship for factors that affect the amount of induced current in a loop by moving a magnet into or out of the loop. The relationship is shown at the right.

$$I = \frac{N \left[\frac{\Delta B}{\Delta t} \right] A}{R}$$

In the equation, **I** is the induced current, **N** is the number of loops of wire, **$\Delta B/\Delta t$** is the rate of change of the magnetic field, **A** is the area of any one of the loops, and **R** is the electrical resistance of the wire.

In this activity, you will use the investigations performed by the students and the summary equation developed in class to complete a paragraph describing how current is induced in a loop of wire.