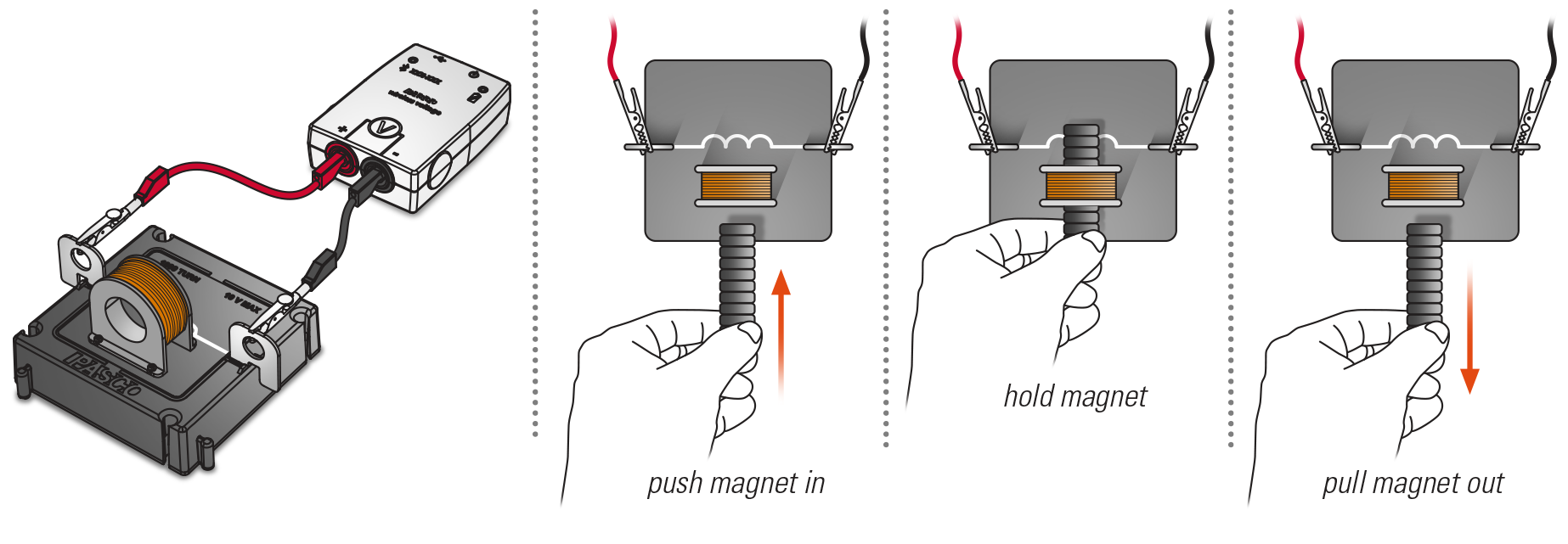
# **Investigation: Induction**

**Essential Question: How is an electrical current created in a wire with a magnet?**

Batteries are not the only method for creating an electric current. An electric current can also be generated with nothing more than a coil of wire and a magnet! In this investigation, you will explore what is required in order to generate a current and how the current behaves in a circuit when using a permanent magnet.

Part 1: Generating current



1. Open the experiment file and then connect the voltage sensor to your software.
2. Connect the voltage sensor to the coil.
3. Begin recording data. Move the north end of the magnet into the coil, hold it in the coil, and then move the magnet out of the coil, as shown in the diagram.
4. Repeat the experiment, but flip the magnet so that the south end of the magnet is inserted in the coil.
5. Repeat the experiment, but move the magnet in and out of the coil at different speeds.

Questions

1. Describe the voltage measured under the following conditions:
   * The north end of the magnet is moved into the coil.

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| 1Answer: A voltage peak is displayed (students may measure a positive or negative peak, depending on how they have the voltage sensor connected). |

* + The magnet is held in the coil.

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| 1Answer: No voltage is measured |

* + The north end of the magnet is moved out of the coil.

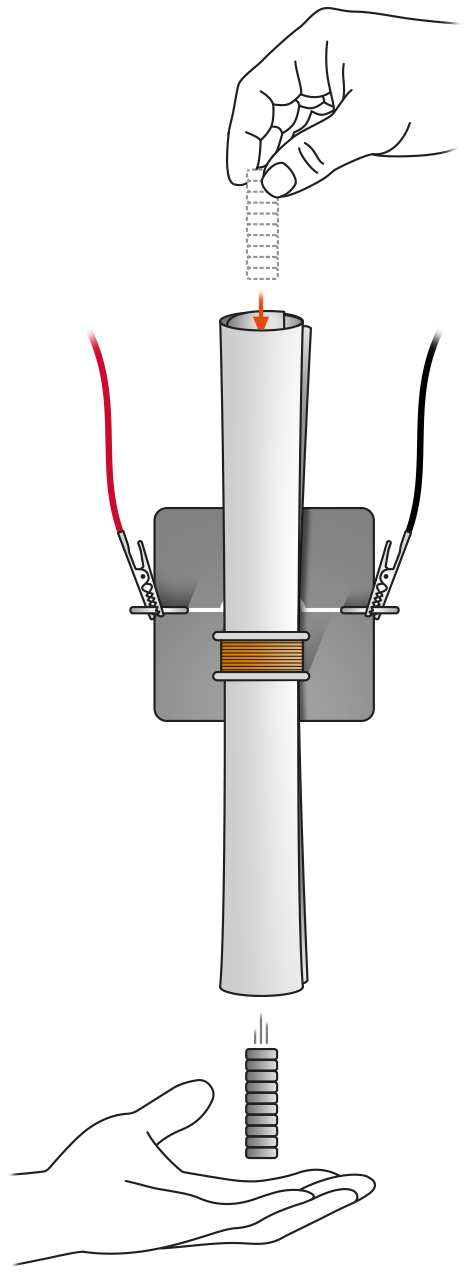
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| 1Answer: A voltage peak is measured in the opposite direction. |

1. What significant changes did you notice when you inserted the south end of the magnet?

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| 1Answer: The voltage peak was opposite of when the north end was inserted. |

1. What significant changes did you notice when you moved the magnet at a faster speed?

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| 1Answer: The voltage peak was larger. |

Part 2: Magnetic Flux

1. Hold the coil on its side, so that the hole faces downward.
2. Roll a piece of paper to create a tube and insert it in the coil.
3. Drop the stack of magnets in the tube and let it fall through the other end, catching the magnets as they fall through.

Questions

1. Determine the flux by measuring the area under the voltage versus time curve. Is the incoming flux significantly greater, less, or about the same as the outgoing flux? Why?

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| 1Answer: About the same. Flux is dependent on the magnetic field created by the magnets and the area of the coil. Both do not change when incoming and outgoing, so the flux stays the same. |

1. Is the incoming voltage peak significantly higher, lower, or about the same as the outgoing peak? Why?

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| 1Answer: The outgoing peak is higher since the magnet is moving faster as it leaves the coil, due to the acceleration due to gravity. |

1. Is the incoming peak in the same or opposite direction as the outgoing peak? Why?

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| 1Answer: In the opposite direction. The pole that is incoming is the same pole that is outgoing, which causes the voltage to go in the opposite direction, as seen in part 1. |

1. What could you change about the experiment to change the magnetic flux?

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| 1Answer: Use a different number of magnets. If available, you could also use a coil with a different area or different number of turns. |