# Magnetic Field Lines

**Area:** Electricity and Magnetism

**Topic:** Magnetic Fields and Forces

**Concept:** Magnetic Fields

Exhibit

## ***Definition***

*Permanent Magnet*

- A material that can either be easily magnetized or can create its own magnetic field. This group is made up of ferromagnetic metals and like iron, nickel, and cobalt.

*Magnetic Field Demonstrator*

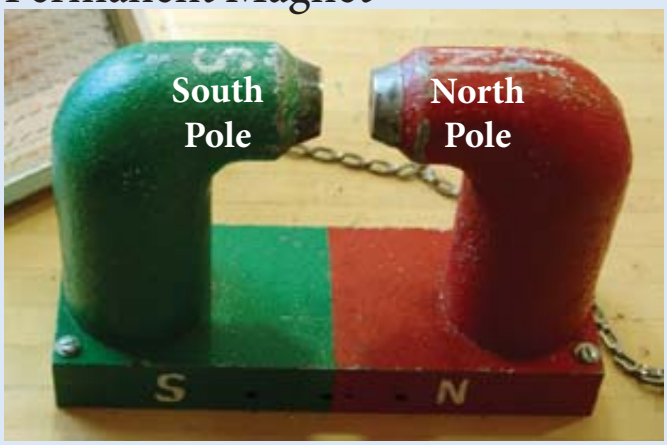
- An ordered arrangement of 196 small iron rods that are free to rotate so that they can align themselves along the direction of the *magnetic field* ($\vec{B}$), like a compass needle that shows you the direction of Earth's North Pole.

## *Identification*

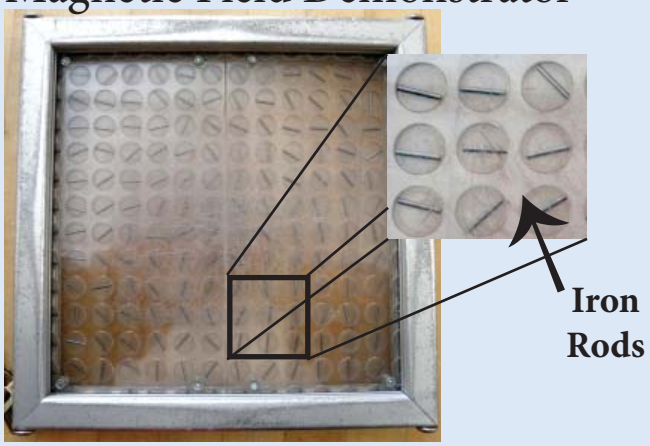
- The large green and red Permanent Magnet
- The 6" x 6" Magnetic Field Demonstrator

→*By design:* The Magnetic Field Demonstrator <u>will not</u> fit between the magnet's poles.

Permanent Magnet




Magnetic Field Demonstrator

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## ***Definition***

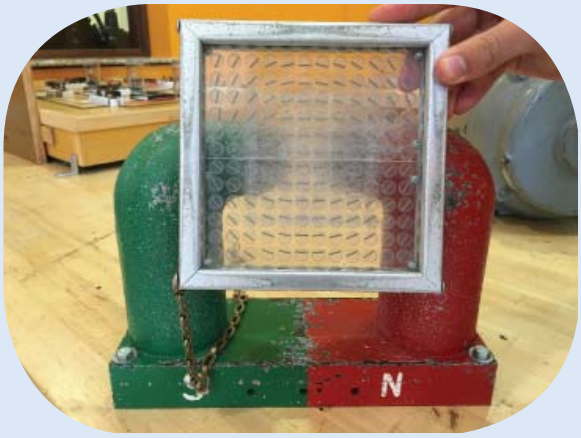
*Magnetic Field* ($\vec{B}$)

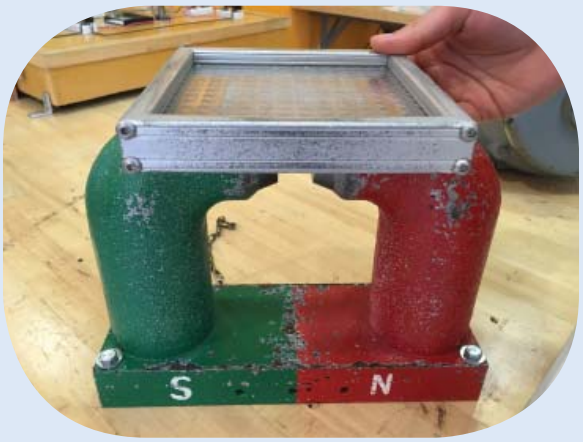
- The magnetic field ($\vec{B}$) is defined as a vector with both direction and magnitude (strength) that varies with both position and distance from a magnetic pole.

- In this case, the magnetic field of the magnet exerts a force on the iron rods within the Demonstrator which causes them to align with the magnetic field.

## *Experiment 1*

- Take the Magnetic Field Demonstrator and center it in front of **or** on top of the poles of the permanent magnet.
- You may need to shake or jiggle the Demonstrator to see the pattern.

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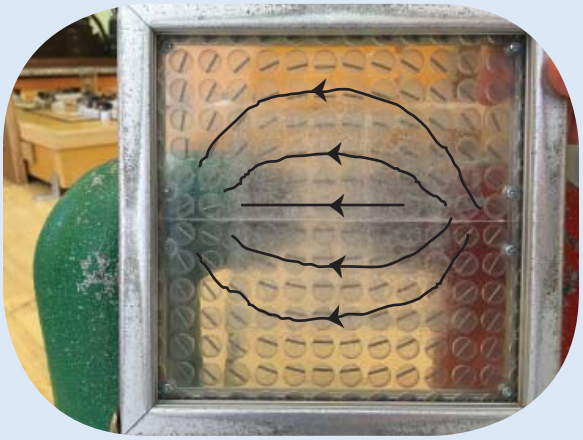
## *Definition*

*Magnetic Field Lines*

- There are **no** actual magnetic field **'lines'** in space. However, one can draw lines from the north pole to the south pole of a magnet to represent the direction of the magnetic force at every point in space. This is represented by following the direction the iron rods take within the Demonstrator.

## *What do you observe?*

- The iron rods should line themselves up to form a "football" shape.
- The relative strength and direction of the magnetic field ($\vec{B}$) can be observed by looking at the orientation the iron rods make while bridging the poles of the magnet.
- The farther away an iron rod is from either pole, the weaker the magnetic field.



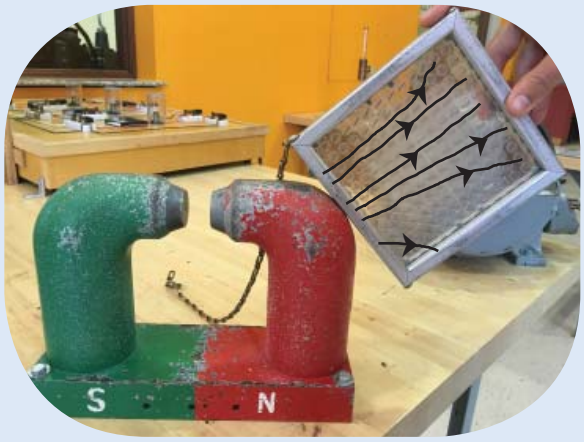
## *Experiment 2*

- Take the Magnetic Field Demonstrator and center it on top of both poles of the permanent magnet, (vertically).
- You may need to shake or jiggle the Demonstrator to see the pattern.


- Explain what you observe!
  - → The magnetic field lines look like arches.
  - → Why?

## *Experiment 3*

- Take the Magnetic Field Demonstrator and slide it vertically along the top edge to one of the permanent magnet's corners.
- You may need to shake or jiggle the Demonstrator to see the pattern.




- Explain what you observe!
  - → The magnetic field lines look like rays or parts of arches.
  - → Why?

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A magnet influences every point in space around it and we call this influence a *magnetic field* ($\vec{B}$). The magnetic field is know as a vector with both direction and magnitude (strength), that varies with both position and distance from a magnetic pole.

This exhibit helps demonstrate the influence of a magnetic field from a permanent magnet. It also shows that the relative magnetic field strength is the strongest between the poles and gets weaker the farther you are from either pole.

# Magnetic Field Lines

**Museum Feedback Form:**