Magnetism

Activating Strategy

With a partner, take the list of everyday objects provided by the teacher and identify those objects that have or use magnets (show on board).

http://www.first4magnets.com/magnets-in-the-house-i75

ESSENTIAL QUESTION:

WHAT FACTORS AFFECT THE STRENGTH OF MAGNETIC FORCES?

STANDARD:

S8P5C. PLAN AND CARRY OUT INVESTIGATIONS TO IDENTIFY THE FACTORS (E.G., DISTANCE BETWEEN OBJECTS, MAGNETIC FORCE PRODUCED BY AN ELECTROMAGNET WITH VARYING NUMBER OF WIRE TURNS, VARYING NUMBER OR SIZE OF DRY CELLS, AND VARYING SIZE OF IRON CORE) THAT AFFECT THE STRENGTH OF ELECTRIC AND MAGNETIC FORCES.

A **magnet** is any material that attracts iron or materials containing iron.

~~Properties of Magnets Activity?~~

Properties of Magnets

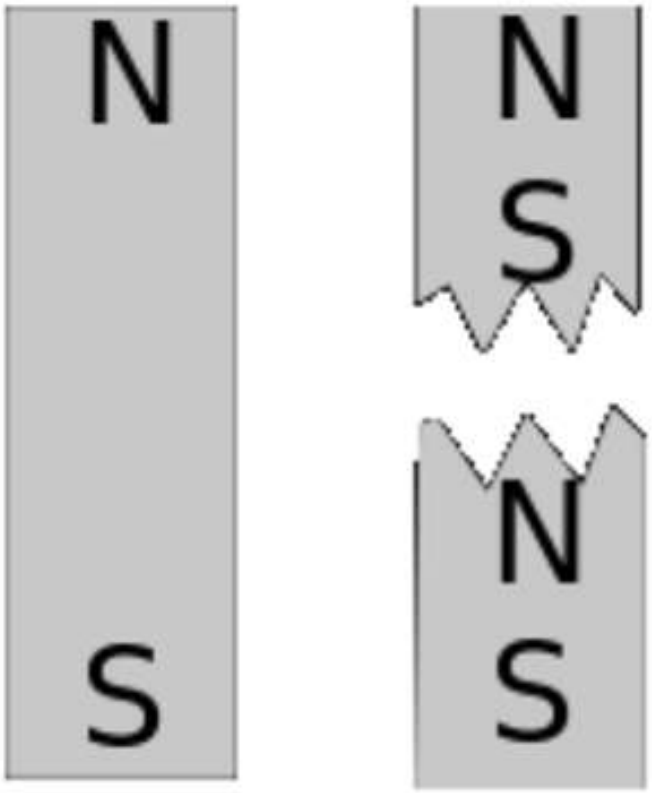
- All magnets have two poles
- Magnets exert forces on each other
- Magnets are surrounded by a magnetic field

All Magnets have Two Poles

- Each end of the magnet is called a magnetic pole
- One end of the magnet always ends up pointing to the north. It is called the north pole
- The opposite end of the magnet points to the south and is called the south pole
- Magnetic poles are always in pairs (one north, one south)

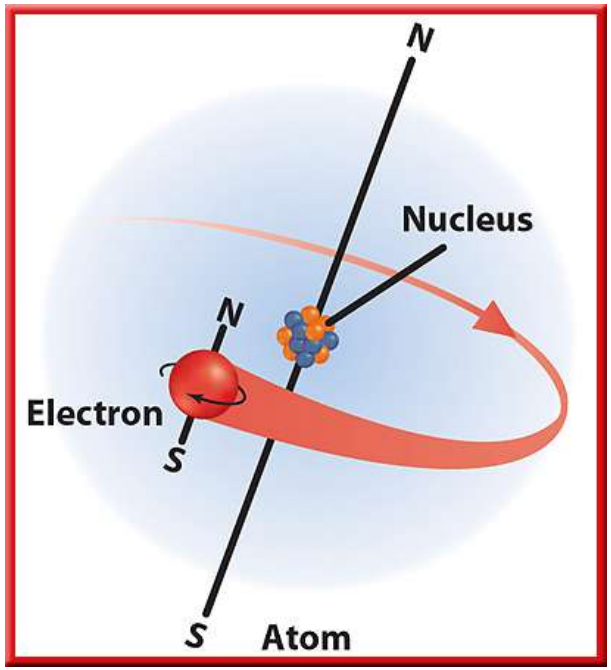
All Magnets have Two Poles

If a magnet is broke in half, each half gains a new pole



Magnets Exert Forces on Each Other

- As observed in the Properties of Magnets Activity, when you bring two magnets close together, the magnets exert a magnetic force on each other
- These magnetic forces result from electric charges in the magnets. Which is created by…



gaining or losing electrons

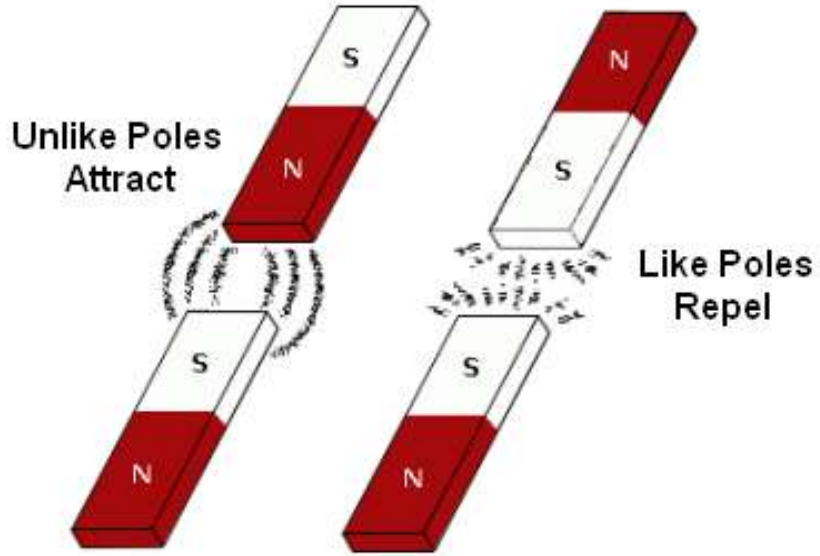
Magnets Exert Forces on Each Other

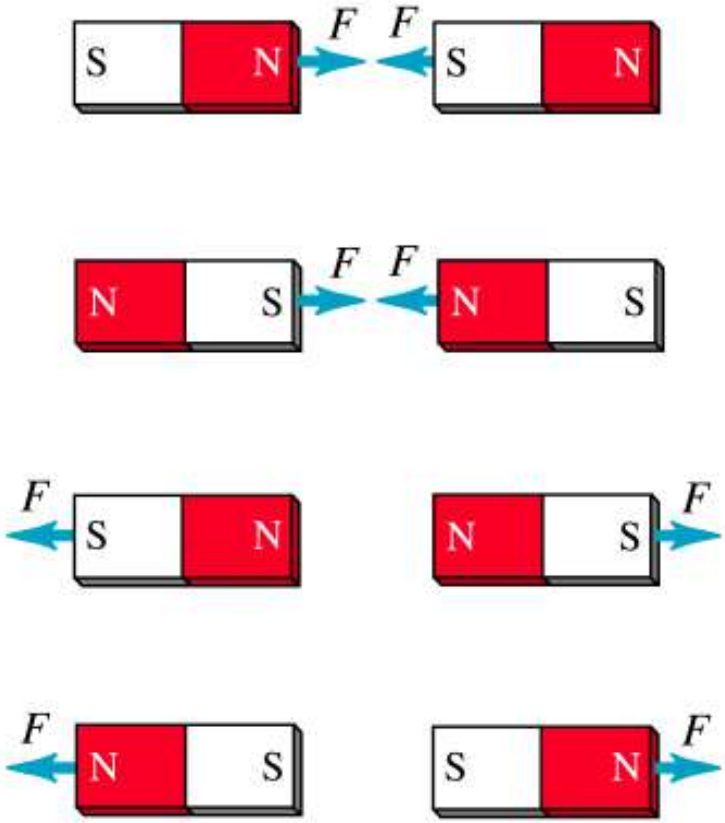
- The force can either push the magnets apart or pull them together
- The magnetic force between magnets depends on how the poles of the magnets line up. Like poles repel, and opposite poles attract

If spins align, attraction occurs, otherwise magnets repel

Attract

Repel





**Attract or Repel video from online textbook

~~Attract or Repel Activity~~

Each student will be given a paper magnet. When instructed, the student will find a partner based on the teacher's directions of "Attract" or "Repel"

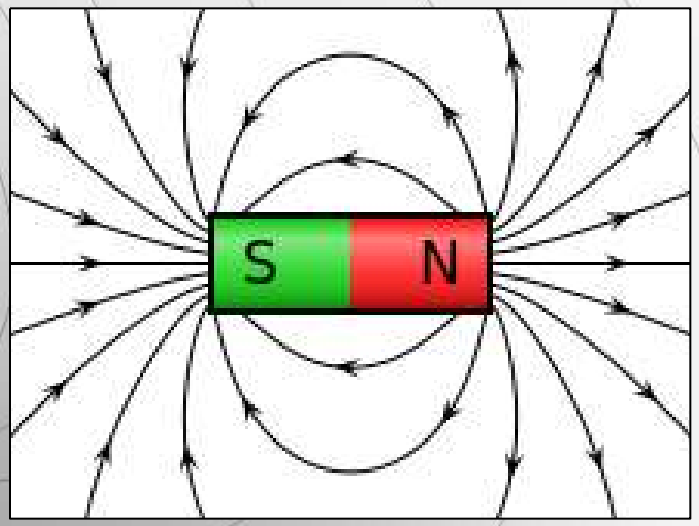
Distributed Summarizing

A magnet is similar to electric charges

because both exert forces on each other and are surrounded by a field.

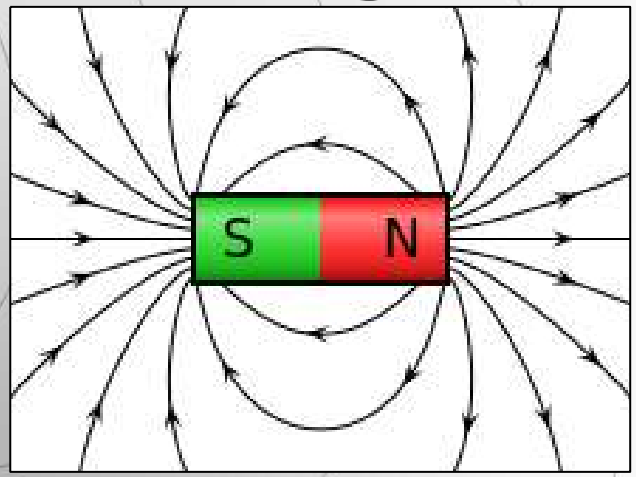
Magnets are surrounded by a Magnetic Field

- The shape of a magnetic field can be shown with lines drawn from the north pole of a magnet to the south pole as shown in the diagram below
- Magnetic field lines show <u>both the direction and the strength of a bar's magnetic field</u>



Magnets are surrounded by a Magnetic Field

- The closer together the lines, the stronger the field
- The lines around a magnet are closest together at the poles because that's where the magnetic force is strongest

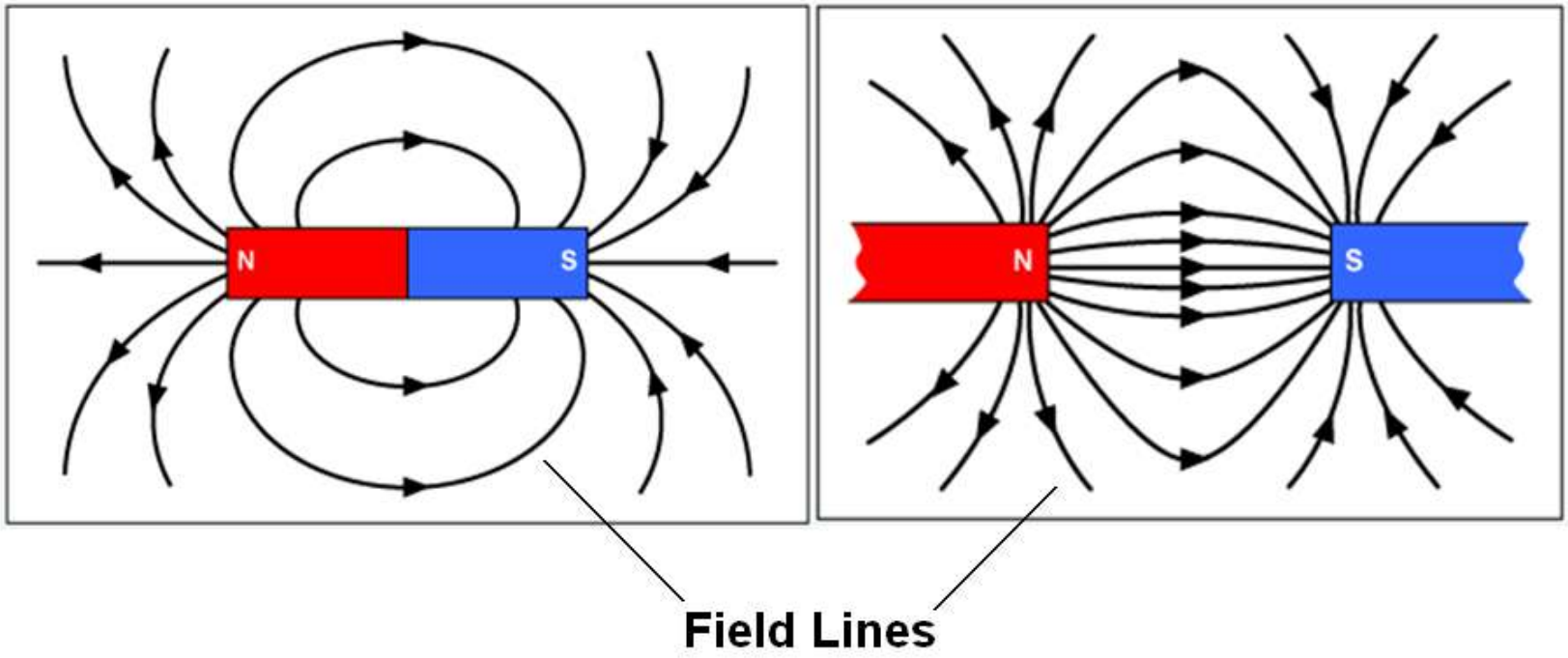


Opposites Attract

Field lines that curve toward each other show attraction.

TOP LEFT ON NOTES

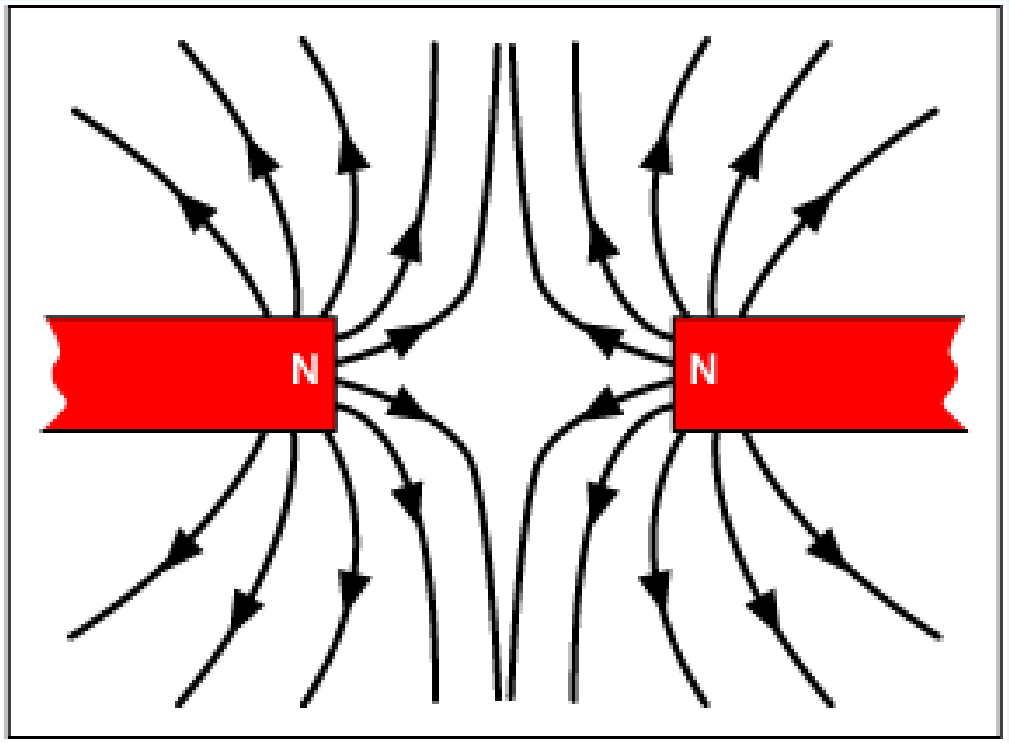
BOTTOM ON NOTES



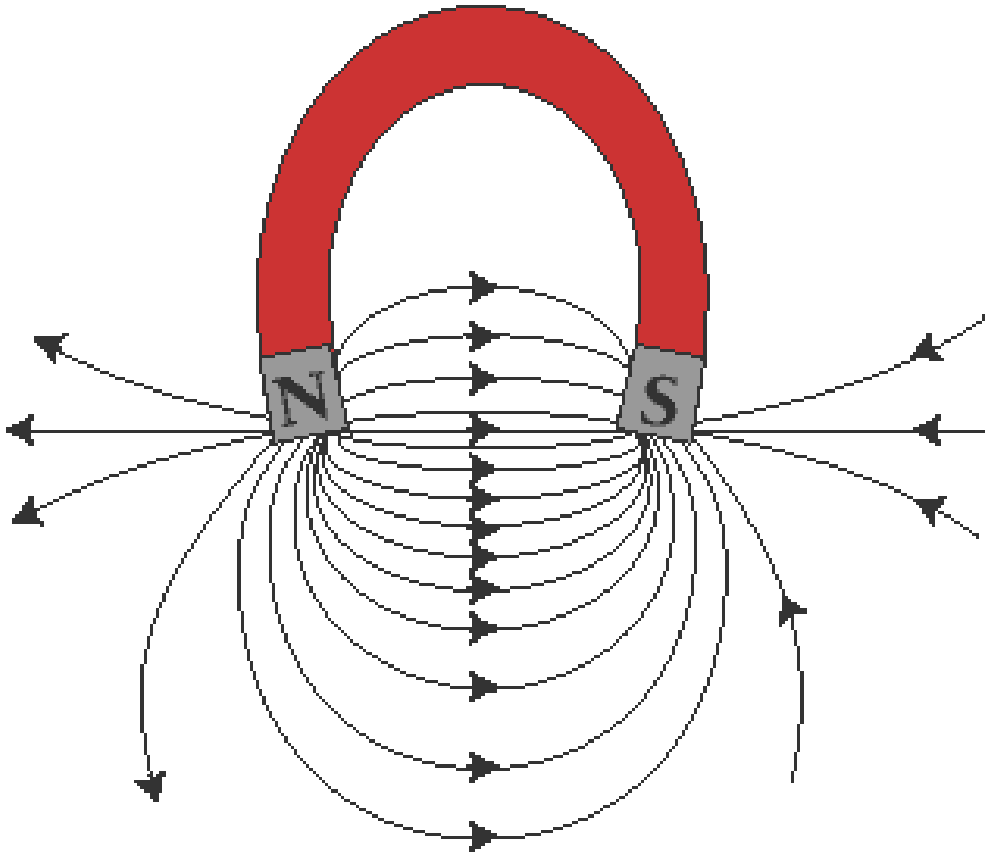
Likes Repel

Field lines that curve away from each other show repulsion.

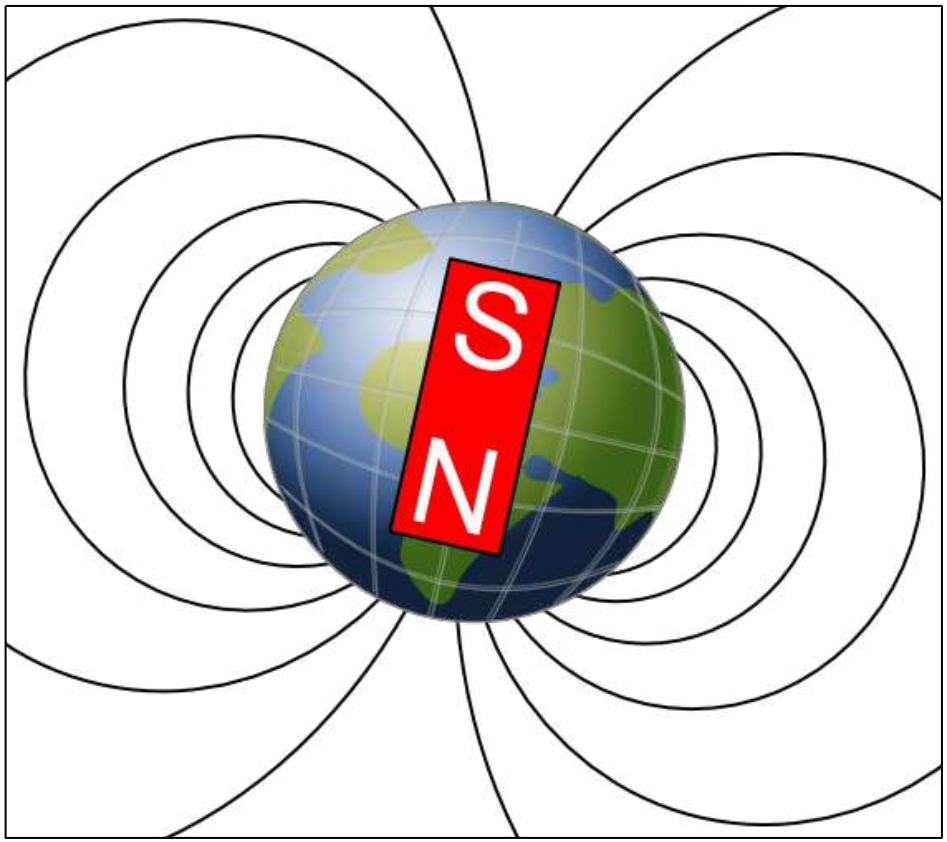
TOP RIGHT ON NOTES



Field Lines in a Horseshoe Magnet



The Earth behaves as if it has a bar magnet running through its center (due to molten iron and nickel in outer core). The poles of this imaginary magnet are located near Earth's geographic poles.



Earth's magnetic field protects Earth from charged particles emitted by the Sun.

Compasses

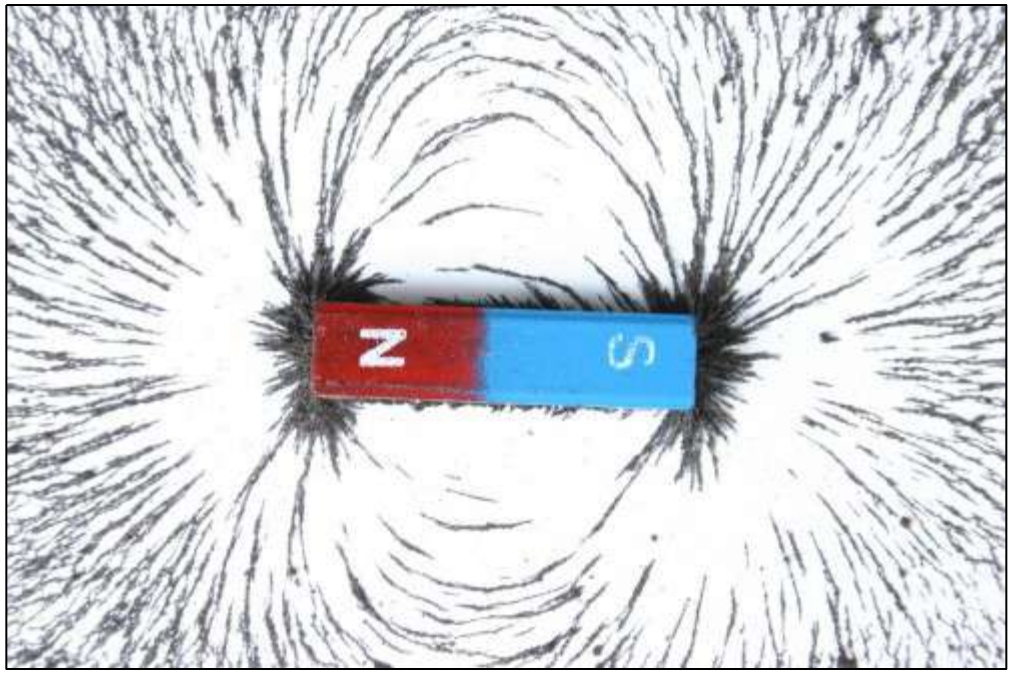
- The needle is a small magnet
- The Earth's magnetic field exerts a force on the needle, causing it to rotate.
- The fields line up with each other
- The compass needle does not point directly toward the poles of a magnet- instead, the needle aligns with field lines and points in the directions of the filed lines.

(p.128 figure 6/mini lab p. 129)

Magnets in Motion

Magnets are surrounded by a Magnetic Field

The shape of the magnetic field surrounding a magnet can be seen by observing the shape of iron filings when placed near a magnet



Examining the Magnetic Field- Iron Filings demo

Magnetic Fields

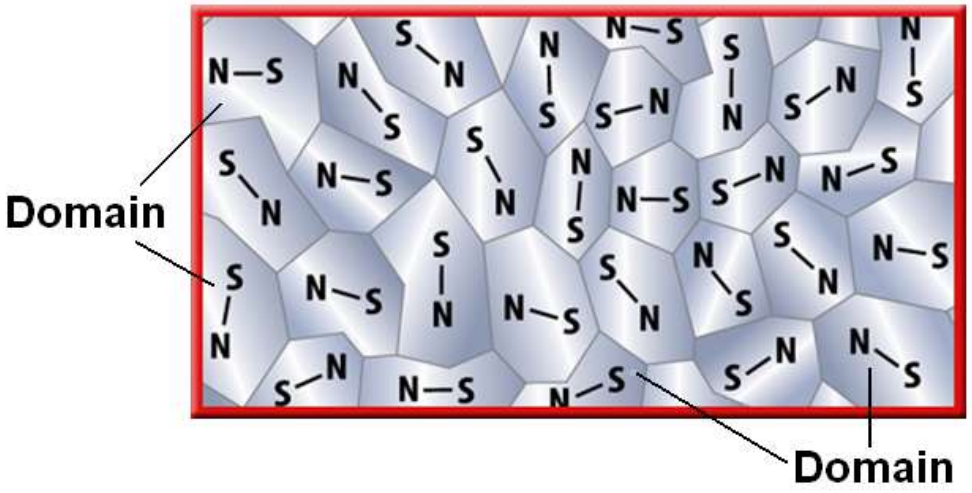
https://www.khanacademy.org/science/discoveries-projects/discoveries/magnetic-fields/p/magnet-and-iron-filings

The Cause of Magnetism

Whether a material is magnetic depends on the material's atoms

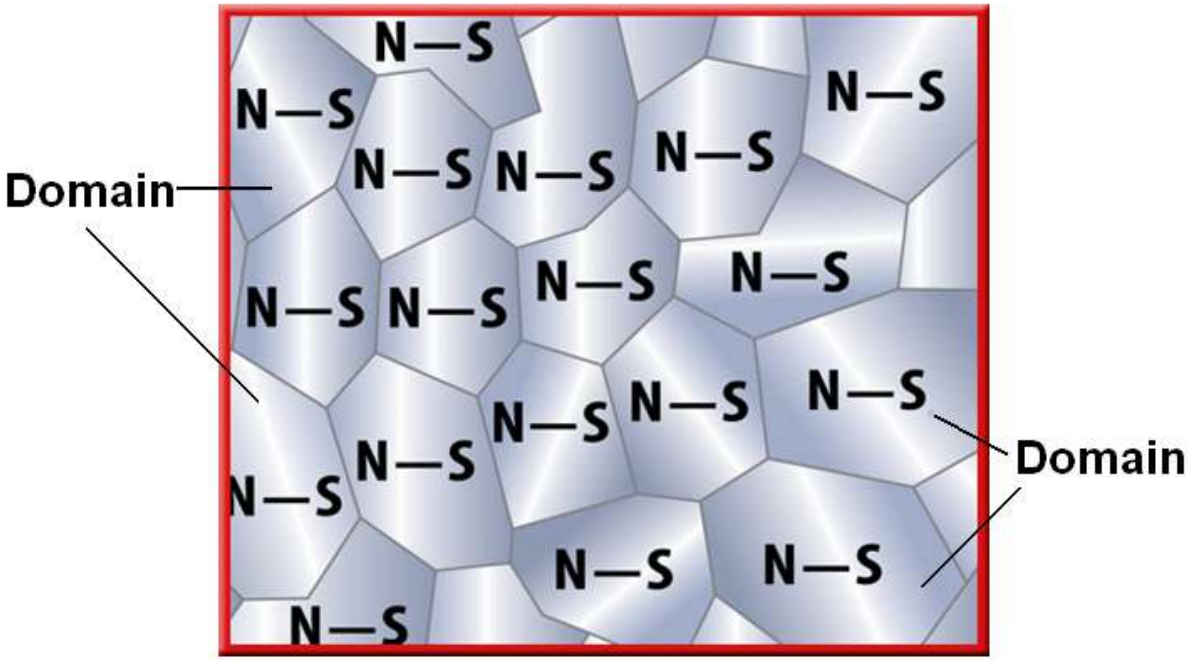
The Cause of Magnetism

- As electrons in atoms move around, a magnetic field is generated. The *atom* will then have a north and south pole.
- The atoms *group* together in tiny areas called domains. Each domain is like a tiny magnet.
- In most materials, such as copper and aluminum, the magnetic fields cancel each other out because the domains are randomly oriented (as shown below)



The Cause of Magnetism

- In materials such as iron, nickel, and cobalt (ferromagnetic elements), the north and south poles of the *atoms* in a domain line up and make a strong magnetic field (as shown in the diagram below)
- The arrangement of domains in an object determines whether the object is magnetic



~~Demonstrating a Magnetic Object Activity?~~

~~Making a Magnet Activity?~~

http://www.education.com/reference/article/magnetizing-metals/

Bill Nye: Magnetism

Re-Cap

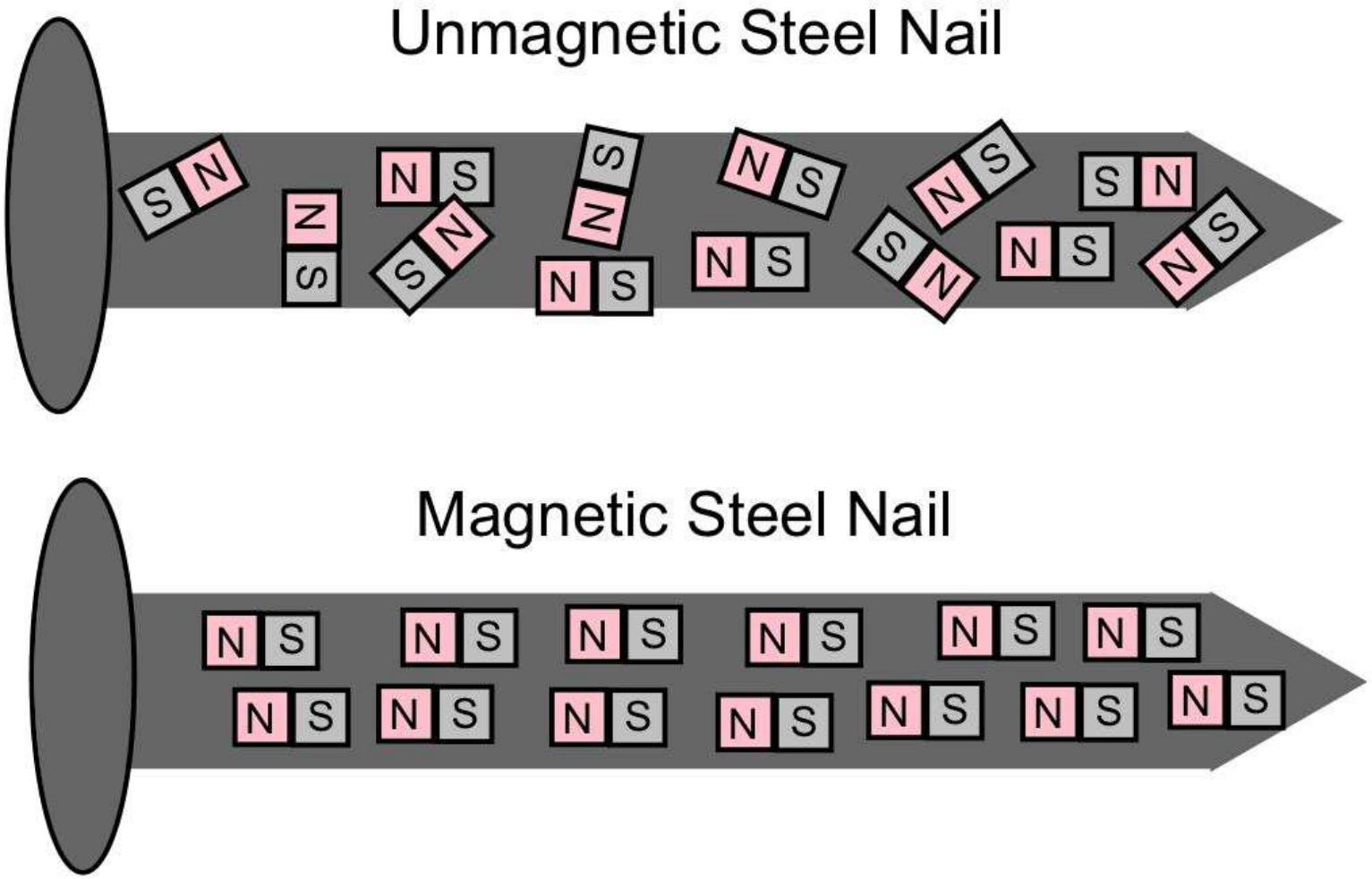
- All magnets have two poles, north and south.
- Magnets exert forces on each other, push or pull
  (like poles repel, opposite poles attract).
- Magnets are surrounded by a magnetic field.
- The magnetic force is the greatest at each pole of a magnet.
- What makes an object magnetic? How the groups of atoms (domains) are arranged:
  -domains are lined up- magnetic
  -domains are randomly oriented-
  unmagnetic

Temporary vs. Permanent Magnets

- A magnet that quickly loses its magnetic field after being removed from a magnetic field is a temporary magnet.
- Page 131 figure 9: the magnetic field of the bar magnet is strong enough to cause the nail's magnetic domains to line up. When you move the nail away, it's not longer magnetic.
- A magnet that remains a magnet after being removed from another magnetic field is a permanent magnet.
- Some magnetic materials can be made into permanent magnets by placing them in a very strong magnetic field- this causes the domains to align and stay aligned.

***Temporary magnet video from online text

The Cause of Magnetism



(if time, continue)

If the arrangement of domains in an object determines whether the object is magnetic, is there a way to demagnetize an object? If so, how?

Losing Alignment

- The domains of a magnet may not always stay lined up
- When domains move, the magnet is demagnetized, or loses it magnetic properties
- What are some ways you think a magnet might be demagnetized?

Losing Alignment

Ways to demagnetize (move domains)

- Dropping a magnet or hitting it too hard
- Putting the magnet in a strong magnetic field that is opposite to its own
- Increasing the temperature of a magnet (in higher temperatures, atoms vibrate faster so they may no longer line up)

Making Magnets

- You can make a magnet from something made of iron, cobalt, or nickel. You just need to line up the domains.
- You can magnetize an iron nail by dragging a magnet down it many times (in one direction)
- The domains in the nail line up with the magnetic field of the magnet. So, the domains in the nail become aligned.
- As more domains line up, the magnetic field grows stronger.

~~Summarizing Strategy~~

Wanted:
Mr. Magnet Poster