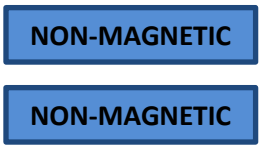
CONCEPT: HOW MAGNETS WORK

● Long ago we found metals that would attract/repel each other. Found on island of Magnesia → named _____.

- Most common are iron (Fe), cobalt (Co), nickel (Ni), but not all Fe/Co/Ni are magnetic.
- Electrical Forces only between CHARGED materials → Magnetic Forces only between MAGNETIC materials:



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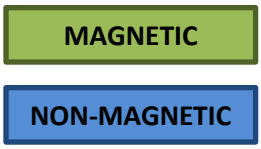

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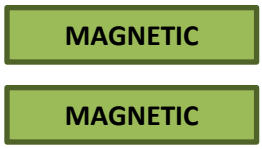

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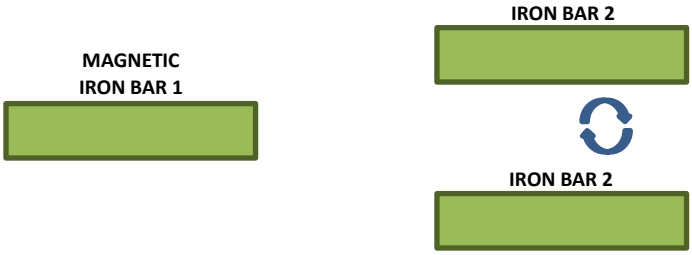
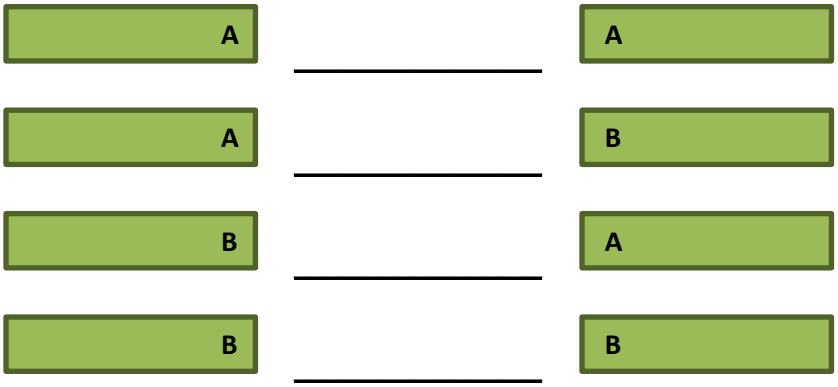
● Electrical Forces can be ATTRACTIVE or REPULSIVE → Same with Magnetic Forces, depending on ENDS:



→ Because one end behaves differently from another there must be 2 types of ends, aka Magnetic POLES

- In Electricity, positive & negative charges → In Magnetism, _____ & _____ POLES.



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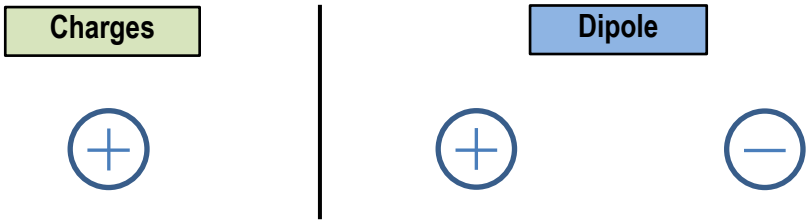
→ In Electricity, opposites charges ATTRACT → In Magnetism, opposite poles **[ATTRACT | REPEL].**

CONCEPT: MAGNETIC FIELDS AND MAGNETIC DIPOLES

● Remember: Electric Charges produce ELECTRIC Fields **(E)** *from* **+** *to* **–** charges:



- Similarly, Magnets produce _____ Fields **(B)**, but in loops

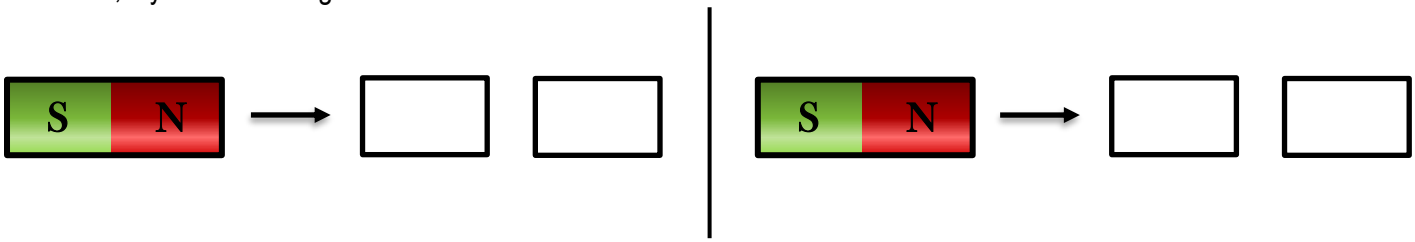
directed from _____ to _____ **(**on the outside**):**

- Everything* is High to Low → Positive to Negative, North to South

● One KEY difference: Single charges can exist alone → called Electric _____.

- Magnets CANNOT have just one Pole → Magnetic monopoles cannot exist, only _____.

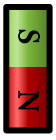
● Therefore, if you CUT a Magnet in half:



EXAMPLE: Suppose both magnets below are fixed in place, but each can rotate about its own central axis. They are initially held in the positions shown below.

(a) If you release the bottom magnet only, what would its new orientation look like?

(b) If you release both magnets simultaneously, what would their new orientations look like?



CONCEPT: COMPASSES AND EARTH'S MAGNETIC FIELD

● Remember: Magnets have "ends" or POLES called NORTH and SOUTH. But how do you know which is North/South?

- The end of the Magnet that points to the Earth's NORTH is labeled the _____ POLE of the Magnet.

- This is how COMPASSES work: The "end" of the Magnetic Needle that points to Earth's North is labeled NORTH.

● Remember: Magnetic Forces only exist between two _____. Therefore:

1) If the Magnetic Needle in compasses are attracted to the Earth, the Earth must be a _____.
2) Opposites attract, so if Compass' **North** points to Earth's **North**, Earth's **North** must be its Magnetic _____.

→ Earth's "North" = GEOGRAPHIC _____ = MAGNETIC _____.

- Because of this, the NORTH Pole of a Compass Needle is sometimes called "_____-SEEKING"

→ ANY Magnet's North points [IN DIRECTION OF | OPPOSITE TO] the Magnetic Field around it.

- In the Southern Hemisphere, the Compass' _____ Pole will point to the Earth's _____.

EXAMPLE: The green magnet below is fixed in place. Many small compasses are placed around it. Draw the approximate orientation of the magnetic needles in the compasses, using an arrow to indicate the North direction.