

# Magnetism

**OBJECTIVES:** The learner will:

- Define the following terms: ferromagnetic, soft ferromagnetic, hard ferromagnetic, compass, magnetic field, magnetic lines of force, angle of declination.
- Describe some of the similarities that exist between electricity and magnetism.
- Explain how a compass works.
- State the Law of Magnetic Poles.
- State some important properties of magnetic lines of force.
- Apply an understanding of magnetism to common experiences and practical applications.
- Discuss important uses of magnets in different technological applications

**OUTLINE OF CONTENT:**

- I. Magnetism defined
- II. Earth's Magnetic field

## Key Concepts

Similarities which scientists observed between electricity and magnetism led them to suggest that magnetic properties are possibly the result of forces between electric charges in motion.

Substances which can be induced to become magnetized in a magnetic field are called **ferromagnetic**. **Soft ferromagnetic** materials become demagnetized spontaneously when removed from a magnetic field. **Hard ferromagnetic** materials can retain their magnetism, making them useful in the production of permanent magnets.

### Grades K-2 What is a Magnet?

- A **compass** is a magnet which can align itself within the earth's magnetic field.
- The Earth is a big magnet with a North Pole (where Santa lives) and the South Pole (where the penguins live)
- A magnet contains a north-seeking pole (north pole) and a south-seeking pole (south pole). (The possibility of having a single monopole is being investigated.)
- Similar magnetic poles repel. Opposite magnetic poles attract. (*Law of Magnetic Poles*)
- The strength of a magnet is strongest at the poles of a magnet.

**Grades 3-5 Magnetic lines of force:** are a way of representing a magnetic field.

- A **magnetic field** is a region in space where a magnetic force can be detected.
- By convention, magnetic lines of force point from north to south outside a magnet (and from south to north inside a magnet).
- Magnetic lines of force form complete loops. They never cross.
- The magnetic poles of the earth are not located at the geographic poles. The angle between the geographic North Pole and the magnetic "north" pole is called the **magnetic declination**.

**Extra stuff:**

The earth's magnetic field moves very slightly over long periods of time. Plate tectonics may help to account for this phenomenon.

Ore bodies in the Earth can influence the strength of the Earth's magnetic field.

The units for magnetic field strength are the weber/m<sup>2</sup>, called the tesla. More familiar units representing the same thing are N/(A.m)

**Lab:**

Split students into groups of 4 students per group.

Give each group a pair of magnets, paperclips, iron filings, other magnetic "stuff" and a Compass (we will use Geomags)

- 1) Investigate how to find a magnetic substance (let them investigate different items in the room)
- 2) Investigate Law of Poles by trying to connect your magnet with partner
- 3) Investigate that magnetic force can be transferred through metal (attach metal items to magnet)
- 4) Learn how to FIND North and South on any magnet by having the students put one end of the magnet up to the compass. If the red end of the compass (the one that points North) is attracted to the magnet that is the North end of the magnet (South end of the compass). If the red compass needle is pushed away that is the South end of the magnet. Why? The red, North pointing compass end, is actually the South pole of the magnet. Opposites attract, likes repel...

**CLOSURE:**

- 1) What things are magnetic?
- 2) Is all metal magnetic?
- 3) Do all people have a magnetic field? Why?



- 4) Draw what you think happens to electrons in a wire when a magnet is passed next to it?