SPH4C – Magnetism and Magnetic Fields

Unit #1 – Electricity and Magnetism

Magnetite

*As early as 600 B.C, the Greeks discovered that a certain type of iron ore, later known as **lodestone**, or **magnetite**, was able to attract other small pieces of iron. Lodestone consists mainly of iron oxide, a mineral that was first found near Magnesia, in Greece, hence the term "magnetism."*

Magnetite

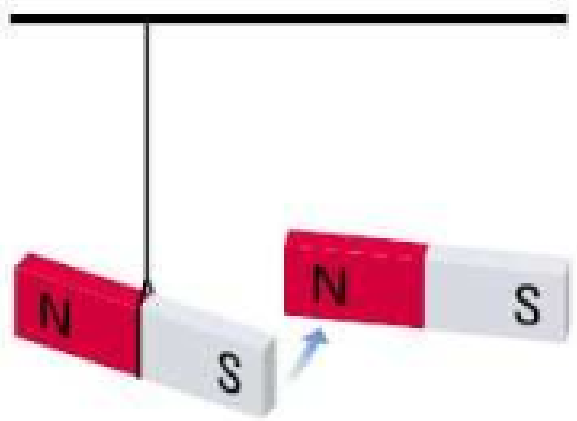
When pivoted and allowed to rotate freely, a piece of lodestone would come to rest in a north-south position. Because of this property, lodestone was widely used in navigation. Today, however, lodestone is hardly ever used for its magnetic property. Artificial magnets are made from various alloys of iron, nickel, and cobalt.

Magnetic Forces

When the N-pole of one magnet is brought near the N-pole of another freely swinging magnet, the magnets repel each other, as shown. Similarly, two S-poles repel each other. On the other hand, N-poles and S-poles always attract each other. These observations lead to the ***law of magnetic poles****.*

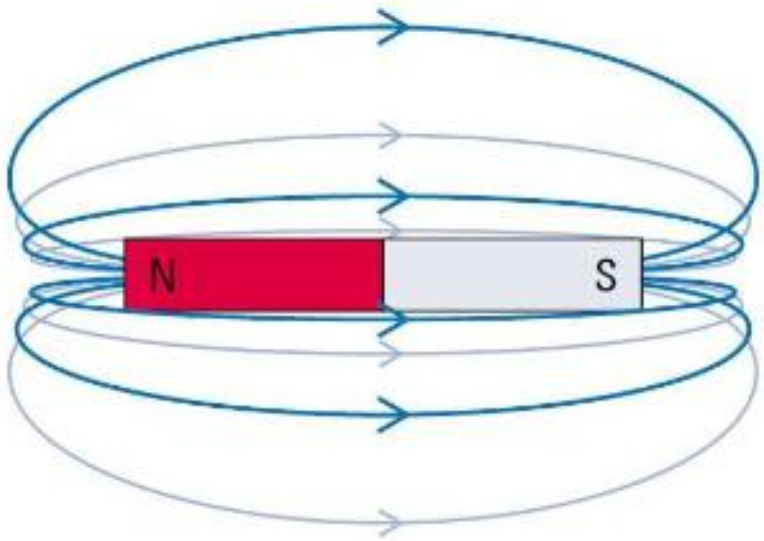
LAW OF MAGNETIC POLES

1. Similar magnetic poles repel.
2. Opposite magnetic poles attract.



Magnetic Fields

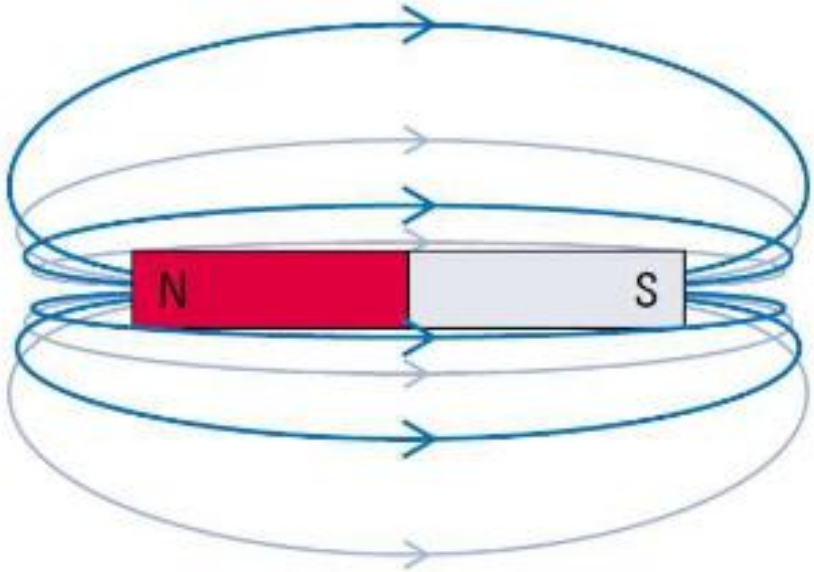
As you know, when a N-pole and a S-pole are brought close to each other, they begin to attract even before they touch. A ***magnetic field*** *is the three-dimensional region of space surrounding a magnet that will exert a force on magnetic objects. Magnetic fields are invisible and are more intense at the poles.*



Magnetic Fields

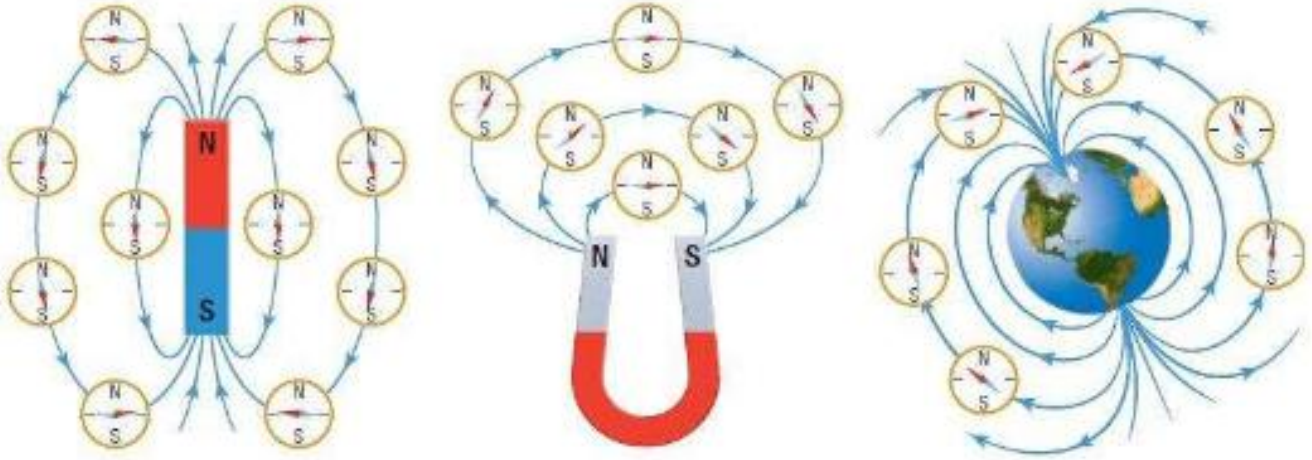
MAGNETIC FIELD

- 3-D space around a magnet that exerts a force on magnetic objects
- is invisible
- is more intense at the poles



Magnetic Field Lines

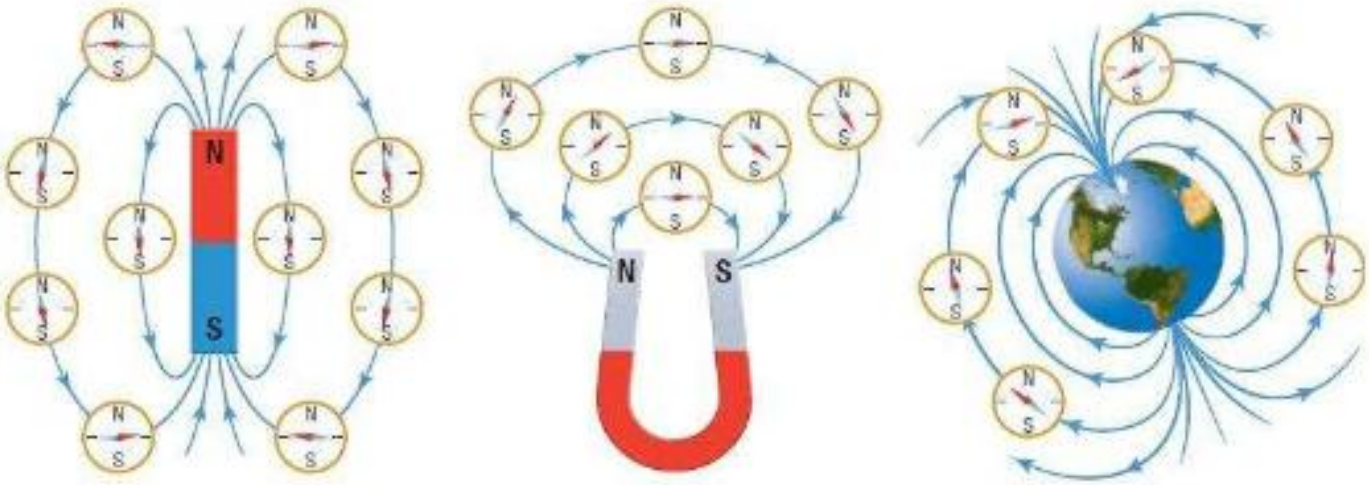
A magnetic field is represented by a series of lines around a magnet, showing the path the N-pole of a small test compass would take if it were allowed to move freely in the direction of the magnetic force. These magnetic field lines have several unique properties.



Magnetic Field Lines

Magnetic field lines:

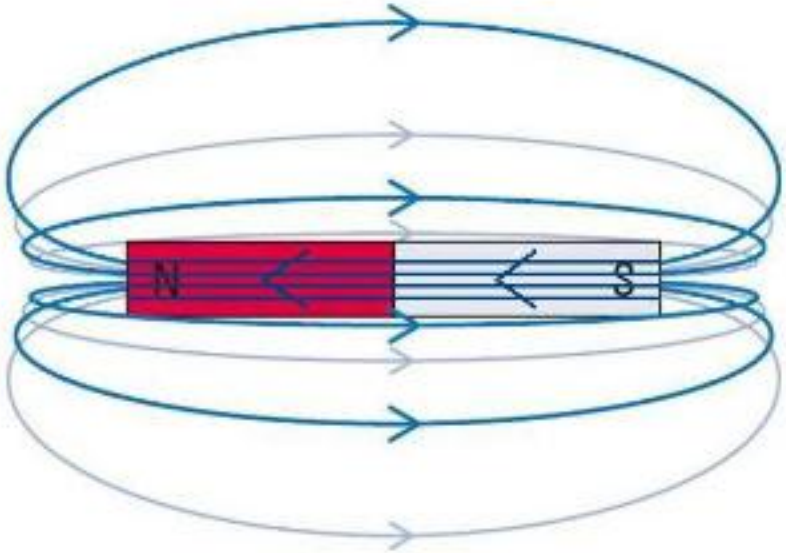
- *always point from N to S outside a magnet and S to N inside (i.e. they form a closed loop),*
- *never cross one another, and*
- *are closer together where the magnetic field is stronger (poles).*



Magnetic Field Lines

MAGNETIC FIELD LINES

- point from N to S outside and S to N inside (i.e. form a closed loop)
- never cross one another
- are closer together where the magnetic field is stronger (i.e. the poles)

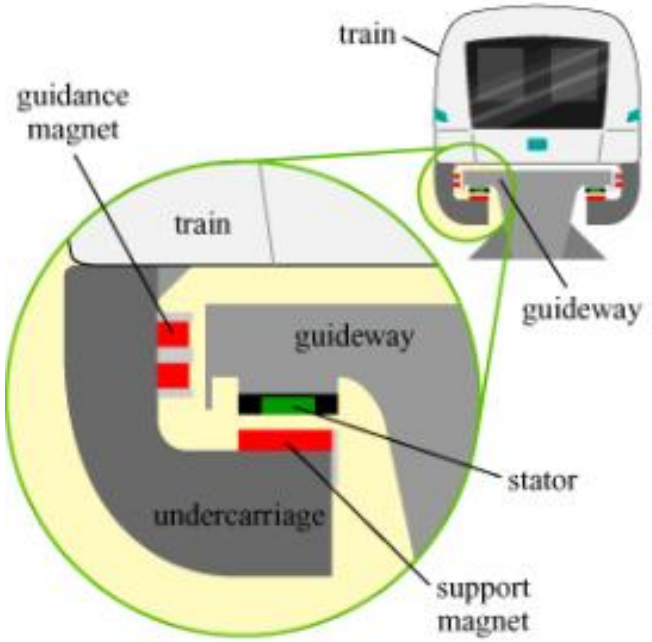


Magnetic Fields

The north pole of a compass points north. What does this indicate about Earth's geographic north? geographic south?

Applications

Many technologies, such as Maglev trains, particle accelerators, and magnetic resonance imaging (MRI) systems, use magnetic fields. The Maglev train, for example, uses magnetic fields for both levitation and forward motion. The bottom of the train is attracted upward toward the bottom of the track. The forward motion is caused by both attraction and repulsion forces between the track and the train.



Another Application

A magnetic resonance imaging (MRI) system uses incredibly strong magnetic fields to produce very detailed images of the inside of the human body. These detailed images provide doctors with important information that can be used to diagnose a disease or provide information for surgery. MRI scans can even detect cancerous cells before they become tumours.

More Applications

Magnetic fields are also found in many technologies that we use daily. Magnets can hold pictures on the side of a refrigerator; magnets inside electric motors help the motors spin; electric bells use magnets to ring at the end of your class; and the hard drive in your computer stores information using magnetic fields.

Northern Lights

In the northern parts of the northern hemisphere, magnetic fields cause the northern lights or aurora borealis. Charged particles, such as electrons and protons, streaming from the Sun spiral in toward these poles, and collide with atoms in the upper atmosphere. These energized atoms then give off energy in the form of visible light with a variety of colours. Sometimes large solar storms cause the auroras to increase and result in the disruption of our communications systems for hours or even days.

Navigation

Even living creatures can use magnetic fields to their benefit. Spiny lobsters migrate over hundreds of kilometres. Scientists suspected that the spiny lobsters used Earth's magnetic field to guide their way. They removed some lobsters and placed them in a tank where the scientists could change the magnetic field. With the magnetic field changed, the lobsters changed their path. Other animals, like birds, also use the magnetic field of Earth to help navigate while migrating.

A video.....

- https://youtu.be/hFAOXdXZ5TM

Activity for today

- Go to explorelearning.com and complete the Magnetism Gizmo that I have added to the class
- Make sure to answer the 5 MC questions. I'll count this as a mark !!