12.4: Earth as a Magnet

Figure 18.3.1

Did you ever use a compass like the one in this picture? Even if you've never used a compass, you probably know that the needle of a compass always points north. That's because a compass needle is magnetized, so it is attracted by a magnet.

Q: What magnet attracts a compass needle?

A: A compass needle is attracted by magnet Earth. It always points north because Earth acts as a giant magnet.

Earth's Magnetic Poles

Imagine a huge bar magnet passing through Earth's axis, as in the Figure below. This is a good representation of Earth as a magnet. Like a bar magnet, Earth has north and south magnetic poles. A **magnetic pole** is the north or south end of a magnet, where the magnet exerts the most force.

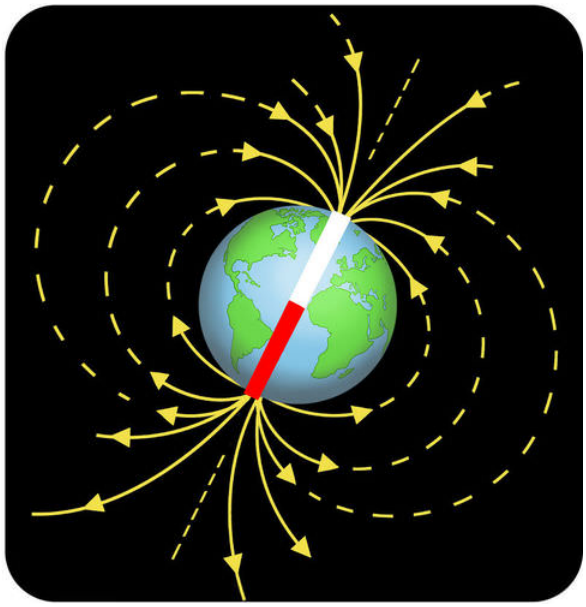

Figure 18.3.2

Two North Poles

Although the needle of a compass always points north, it doesn't point to Earth's north geographic pole. Find the north geographic pole in the Figure below. As you can see, it is located at 90° north latitude. Where does a compass needle point instead? It points to Earth's north magnetic pole, which is located at about 80° north latitude. Earth also has two south poles: a south geographic pole and a south magnetic pole.

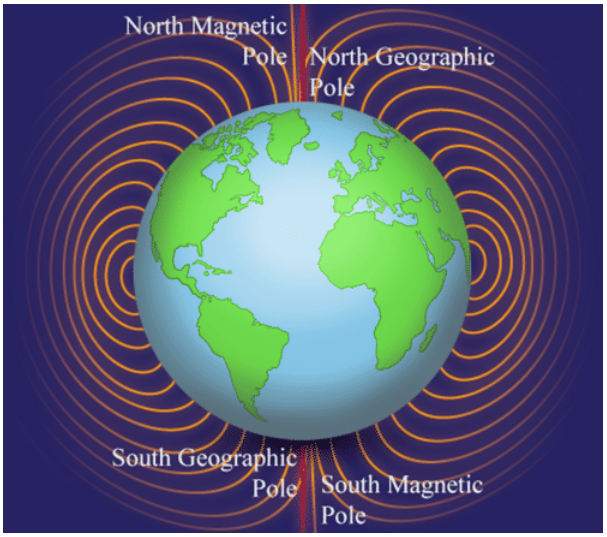

Figure 18.3.3

Q: The north end of a compass needle points toward Earth's north magnetic pole. The like poles of two magnets repel each other, and the opposite poles attract. So why doesn't the north end of a compass needle point to Earth's south magnetic pole instead?

A: The answer may surprise you. The compass needle actually does point to the south pole of magnet Earth. However, it is called the north magnetic pole because it is close to the north geographic pole. This naming convention was adopted a long time ago to avoid confusion.

Earth's Magnetic Field

Like all magnets, Earth has a magnetic field. Earth's magnetic field is called the **magnetosphere**. You can see a model of the magnetosphere in the Figure below. It is a huge region that extends outward from Earth in all directions. Earth exerts magnetic force over the entire field, but the force is strongest at the poles, where lines of force converge.

Launch the PLIX Interactive below to learn more about how a compass utilizes the Earth's magnetic field and observe what happens to a compass as you change positions on Earth:

Summary

- Earth acts as a giant magnet with magnetic poles and a magnetic field over which it exerts magnetic force.
- Earth has north and south magnetic poles like a bar magnet. Earth’s magnetic poles are not the same as the geographic poles.
- Earth’s magnetic field is called the magnetosphere. It is strongest at the poles.

Review

1. How does Earth act as a bar magnet?
2. The compass in a car shows that the car is moving north. Does this mean that the car is moving toward 90° north latitude? Why or why not?
3. Describe the magnetosphere.

Additional Resources

Study Guide: Magnetism Study Guide

Real World Application: Sly as a Fox, What Will Happen When Earth's Poles Flip?

Videos: