Study Guide: Magnetism

Lesson 1: "Properties of Magnets"

Magnets are objects that attract, or pull on certain objects. Magnets are attracted mainly to iron and steel, because steel is made with iron. Magnets pull on iron and steel because of the property of **magnetism**.

There are two kinds of magnets. Magnets made in factories that you might find on your refrigerator are called **permanent magnets**. Permanent magnets are hard to make, but they can last for a long time as long as the magnet is treated carefully and not damaged. A **temporary magnet** does not keep its magnetism for a long time. Both permanent and temporary magnets must be made from objects that are attracted to magnets, like iron or steel.

All magnets have **poles**. When you hang a magnet so that it can spin freely, one end will always point north. This is the magnet's north-seeking pole, or **north pole**. If you think of a compass, south is the opposite direction from north, so the other end of the magnet will point south. This is the magnet's south-seeking pole, or **south pole**.

If you bring a magnet's north pole near the north pole of another magnet, the magnets will want to push away, or **repel**, one another. The same will happen if you put two south poles near each other. If you bring a magnet's north pole near the south pole of another magnet, the magnets will **attract**, or pull toward, each other. If you remember anything about magnets, remember this:

Unlike (opposite) poles attract;
Like poles repel.

- **magnet***: an object that* ***attracts,*** *or pulls on, certain materials, mainly iron and steel*
- **magnetism***: the property of attracting certain materials*
- **property***: a certain feature or characteristic of an object*
- **pole***: one end of a magnet*
- **north pole***: the end of a magnet that points north when hanging freely*
- **south pole***: the end of a magnet that points south when hanging freely*

Lesson 2: Maglev Trains

A **maglev** train uses magnetism to rise into the air and move. Maglev is short for **mag**netic **lev**itation. When a maglev train moves along the track, it does not create **friction** because the train is not touching the track. This allows the train to move as fast as 300 miles per hour. The current fastest maglev in the world can travel 361 miles per hour. It could get you from Ayer to Philadelphia, Pennsylvania in under an hour, but it would take you about five hours by car.

Because there is no friction, maglev trains are very quiet. They also create less pollution because they are powered by electricity and do not burn fuels as they move on the track. Maglev trains can be found in places like Japan, China, and Europe. There are plans to build them in other countries too, including the U.S.

- ***Permanent*** *means that something lasts forever. A* ***permanent magnet*** *will last a long time as long as it isn't damaged.*
- ***Temporary*** *means that something doesn't last forever. A* ***temporary magnet*** *loses the property of magnetism after a while.*

- ***Levitation*** *means floating*
- ***Friction*** *is the force that slows things down when they rub against each other. It's how a car's brakes work and why your hands get warm when you rub them together.*

Lesson 3: Force Fields

If you dip a bar magnet into a pile of paper clips, most of the paper clips will stick to the poles. This is because magnets are strongest at their poles. By sprinkling little pieces of iron around a magnet, you can see the **lines of force**. These lines show the pattern of the magnet's **magnetic field**. Like the paper clips, most of the iron filings will stick to the poles. The magnetic field spreads out in all directions around the magnet.

Properties of Magnets

1. **A magnet attracts objects made of iron.**
2. **The force of a magnet is strongest at its poles.**
3. **Like poles of two magnets repel (push away) from each other.**
4. **Unlike poles of two magnets attract (pull toward) each other.**

Lesson 4: Earth as a Magnet

Lodestone is a magnetic rock found in Earth's crust. It will attract pieces of iron to it. There are several stories of how lodestone was found. One is that 2,000 years ago a shepherd in Turkey stepped on some lodestone and the nails in his shoes were attracted to it. The Greeks discovered 1,000 years ago that lodestone points in a north-south direction when it hangs freely. Later, Chinese sailors used this idea to make a compass.

Earth is a giant magnet. Scientists believe that the center of Earth is made mostly of iron, and that the spinning of Earth has made this iron magnetic. Like a regular magnet, Earth has north and south poles. These magnetic poles are different from the poles that mark the invisible **axis** (or line) that Earth rotates on. So Earth has two sets of poles: magnetic and geographic north, and magnetic and geographic south.

Magnets are affected by Earth's magnetic field. This is why a compass works. The magnetized needle of the compass points to the magnetic north pole (which is really the south pole of Earth's magnet, but we call it magnetic **north** because it is located in the north.)

Earth's magnetism is what causes the **northern** and **southern lights**. These are called **auroras**. Auroras appear because particles of matter flying through space are trapped in Earth's magnetic field, and they are brightest at the poles. Auroras appear as bright green, red, yellow, or blue lights in the sky.

- **lines of force**: *the lines that form a pattern that show the size and shape of a magnetic field around a magnet*
- **magnetic field**: *the space in which the force of a magnet can act*

- **lodestone**: *naturally magnetic rock found in Earth's crust*
- **compass**: *a magnetized needle that is allowed to swing freely to show direction*
- **aurora**: *light displays seen in the sky near Earth's magnetic poles; also called Northern or Southern lights.*