### What is a Magnet?

A magnet is something that can attract metal or another magnet. A magnet can also repel another magnet.

<table>
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<tr>
<th>Bar magnet</th>
<th>Horseshoe magnet</th>
<th>Magnetic materials</th>
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### Properties of magnets:
- Magnets have two opposite poles: north and south.
- If divided, each part of a magnet will also have a north and south pole (you can never make an unpaired pole).
- Magnets exert forces on other magnets, called “Magnetic forces”.
- Opposite poles attract (North attracts South).
- Like poles repel (North repels North, etc).

### Permanent and Temporary Magnets

**Iron makes the best temporary magnets.**

**Only lodestone and magnetite are permanent magnets.**

**Permanent magnet** – a magnet that retains its magnetism and does not need to be “recharged.” Lodestone and magnetite are the only two permanent magnetic substances.

**Temporary magnet** – a magnet that occurs when near a permanent magnet, but loses its magnetism away from the permanent magnet; many metals can be temporary magnets.

### Electromagnets

**Electromagnet** – a magnet made from electricity. When electricity moves it causes magnetism.

**Best use of an electromagnet** – we can turn it on and off. Toasters, doorbells: any job needing a force on command needs an electromagnet.

**Strengthening an electromagnet** –
- Increase electricity
  - more batteries or stronger battery;
- Increase number of coils
  - actually adds electricity, too.
- Add iron to the core (center of electromagnet)
  - the iron amplifies the electromagnetic field.

**Second best use of an electromagnet** – we can control how much force we need by increasing or decreasing the electricity.

### How do Magnets Work?

**Spinning electrons cause magnetism.**

**Permanent magnets** – all of the electrons in an atom are spinning the same way and the little electromagnets add up.

**Temporary magnets** – the electrons can switch to spin in the same way when near a magnet, but will fall back after the magnet leaves.

### Magnetic Fields

**Magnetic Field** – the area in which a magnet or piece of metal feels the force of another magnet.

**Rules for magnetic fields** –
- drawn from North pole to South pole;
- closer or more arrows = stronger field.
- any magnet will react in a magnetic field.
- every magnet creates a magnetic field.

The magnet of a compass reacts to the Earth’s magnetic field to point to **magnetic north** (in Canada), not **true north** (the North Pole).
You move a 25 N object 4 meters. Find the work you did.

You move a 3N object 15 meters. Find work.

You push on a 35 N object for 3 seconds. Find work.

You move a 4 N object 10 meters. Find work.

Then find power if it is done in 5 seconds.

An 5 kg object is 6 meters up a hill. Find potential energy.

A 10 kg boat is moving 3 m/s. Find kinetic energy.

A rock is thrown 0.8 meters into the air. Find how fast it was thrown.

You do 25 J of work to move a 4 N object 5 meters. Find your efficiency.