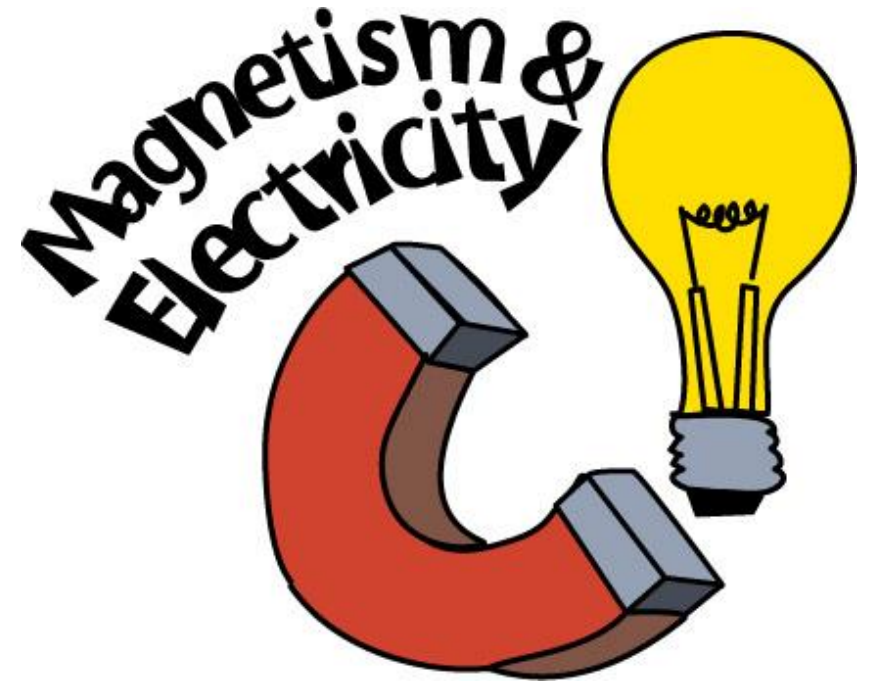


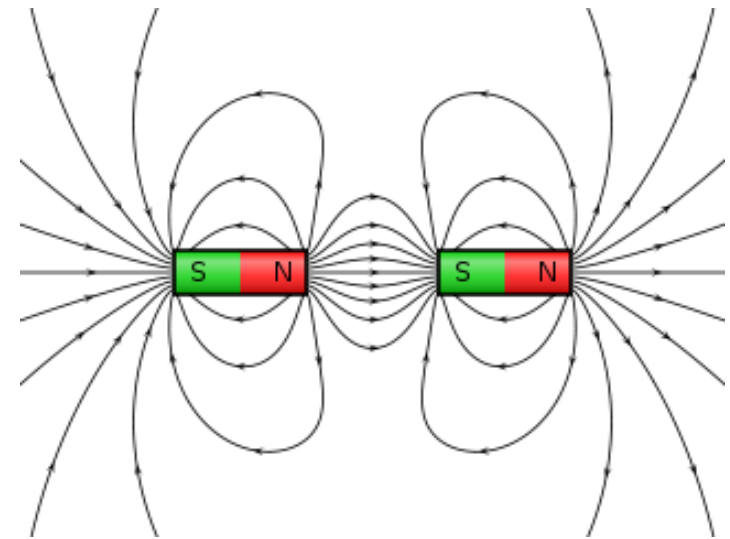
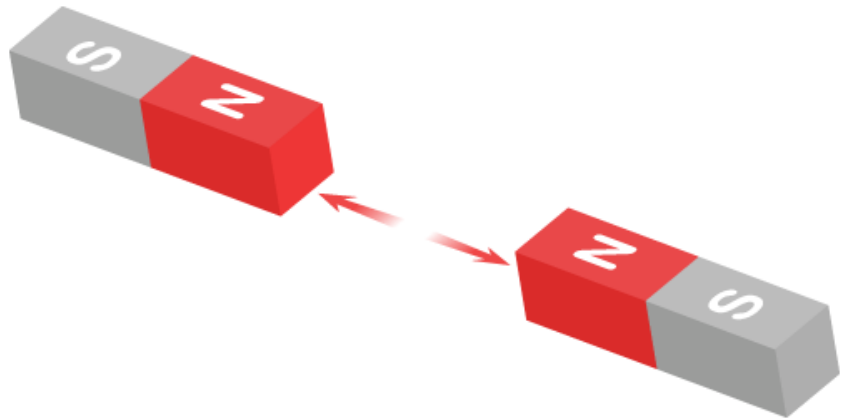
# Magnetism Ch 21



22.1 ***Magnetism is a force*** that acts at a distance

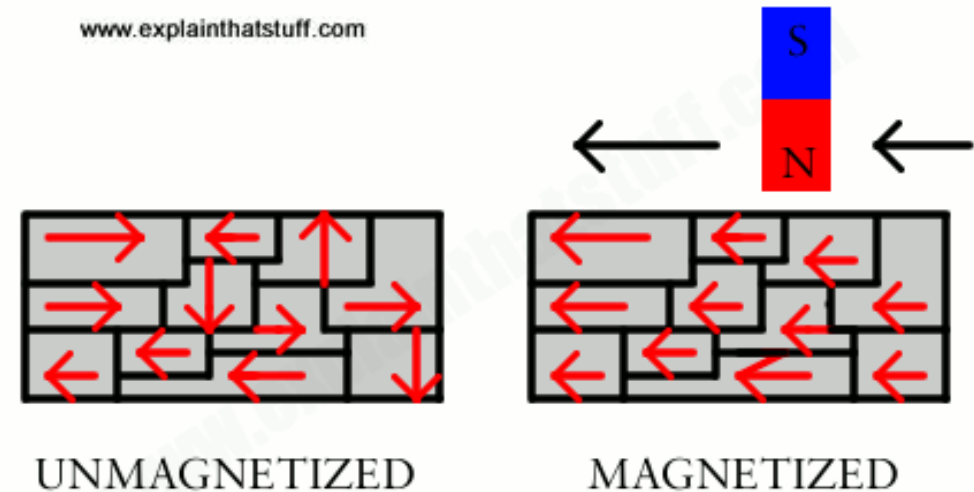
# Magnets attract & repel other magnets.

- The attraction between the north pole of a magnet and the south pole of another magnet is based on the magnetic field lines that go from the north to the south pole of a magnet.
  - 2 like poles repel each other
  - 2 unlike poles attract each other



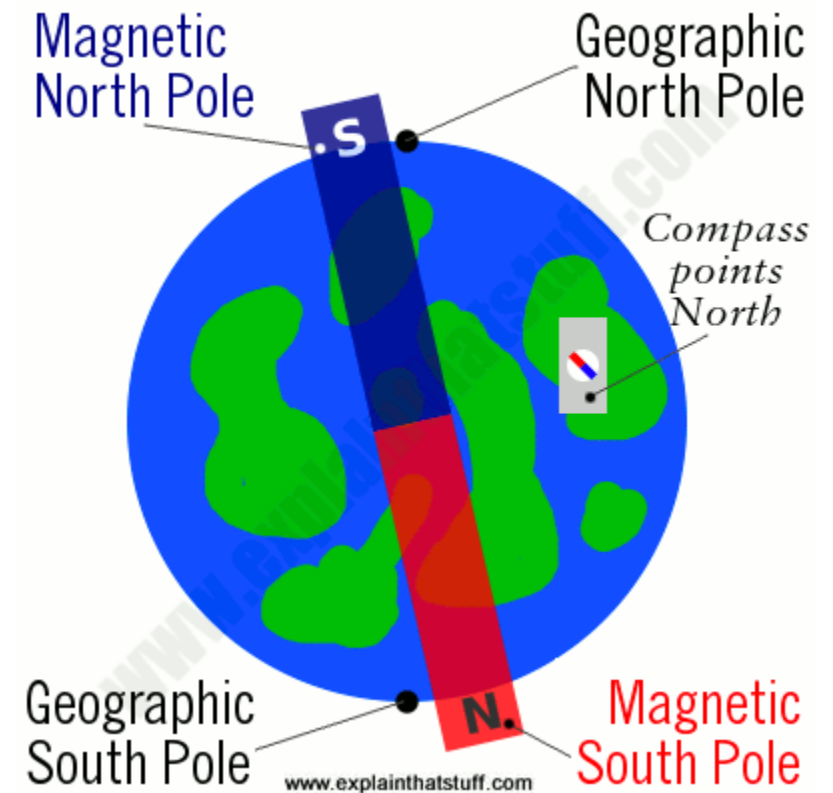
# Some materials are magnetic.

- Iron, nickel, cobalt, and a few other elements are magnetic
- Each element contains unpaired electrons that produce a small but strong magnetic field
- Atoms in a magnetic material align so that the small magnetic fields form a magnetic domain (***all pointing in the same direction***)
- When placed within a larger magnetic field, the magnetic domains align and the material becomes a magnet



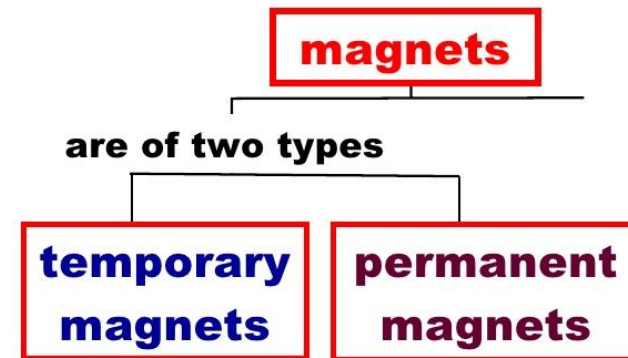
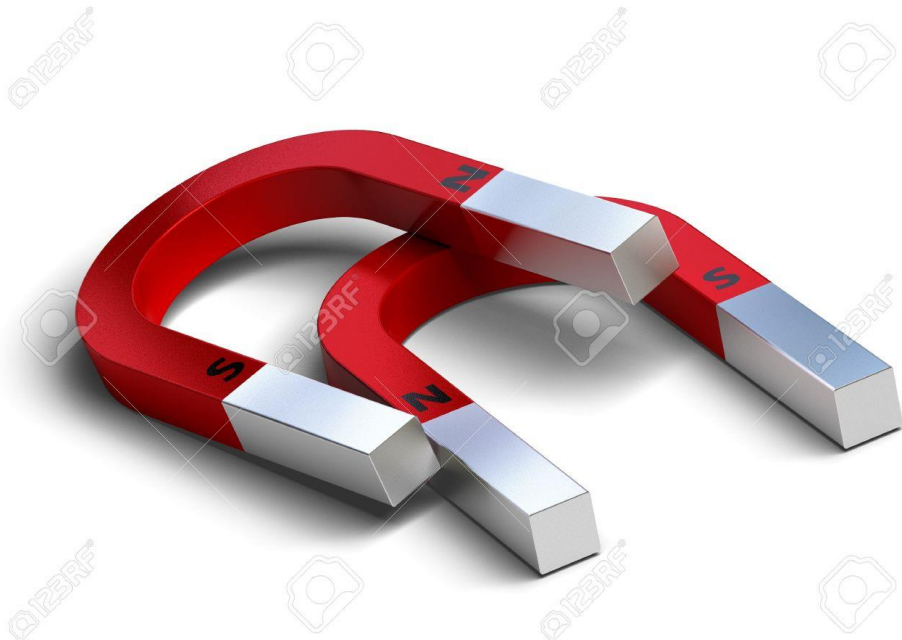
# Earth is a magnet because of the motion of its core ( it spins)

- The north pole of a suspended magnet always points in a northerly direction on Earth
- We call the direction that the north pole of the magnet points to “magnetic north”
- The magnetic north pole of Earth is actually the south pole of the Magnet formed by Earth



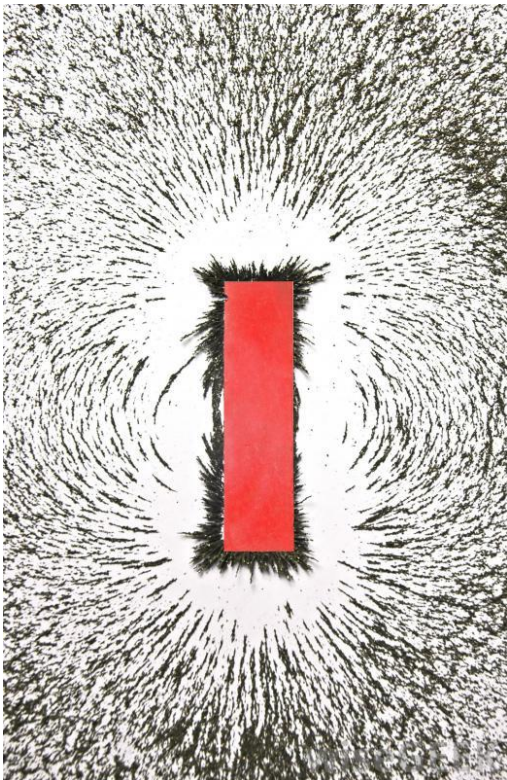
## 21.2 Current can produce Magnetism

- An electric current produces a magnetic field.
- Both permanent and temporary magnets result from the magnetic field formed from a moving electric charge



# Permanent Magnets

- Result from the spinning of unpaired electrons, which are electrically charged particles



## Permanent Magnets

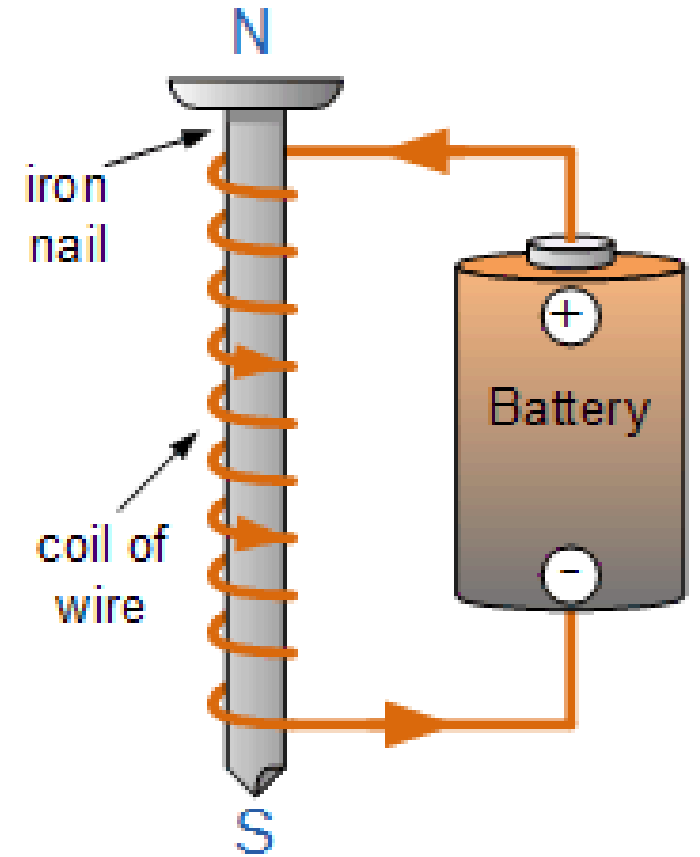
- Permanent magnets are those we are most familiar with, such as the magnets hanging onto our refrigerator doors. They are permanent in the sense that once they are magnetized, they retain a level of magnetism.



Virginia García Romero -CEIP El F

# Temporary Magnets

- Magnetic domains don't remain aligned
- They are known as electromagnets and are produced by electric current (moving charges)
- Coils of wire around an iron core creates a magnet as long as electric charge flows

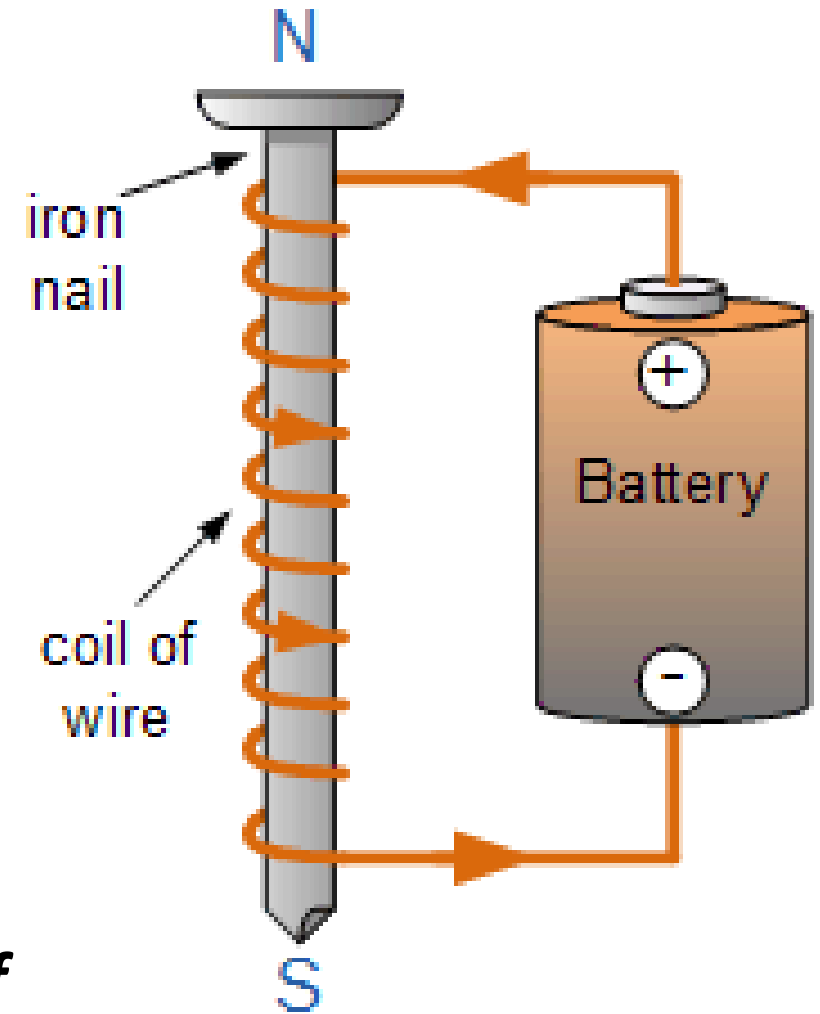




# Electromagnets

- *Electromagnetism occurs because an electric current in a wire produces a magnetic field*
- *You can increase the field strength of an electromagnet by adding more coils or by providing a stronger current*

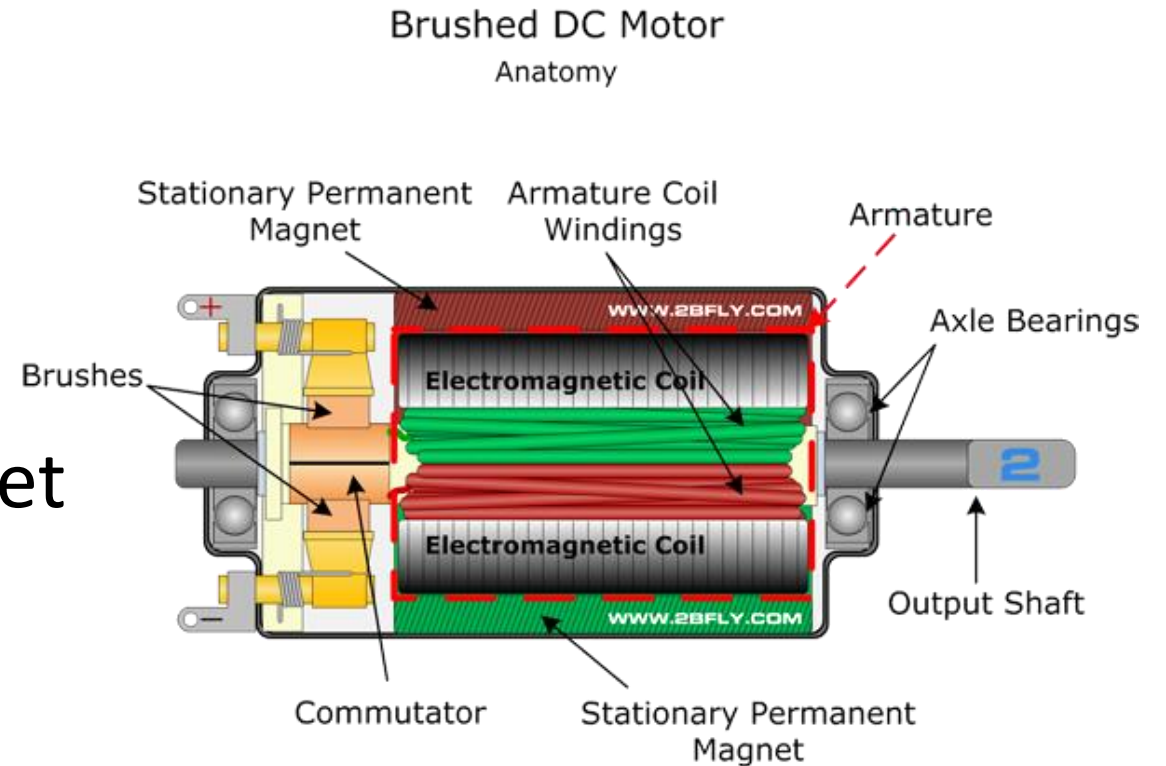
*\*Their magnetic fields can be turned on & off*



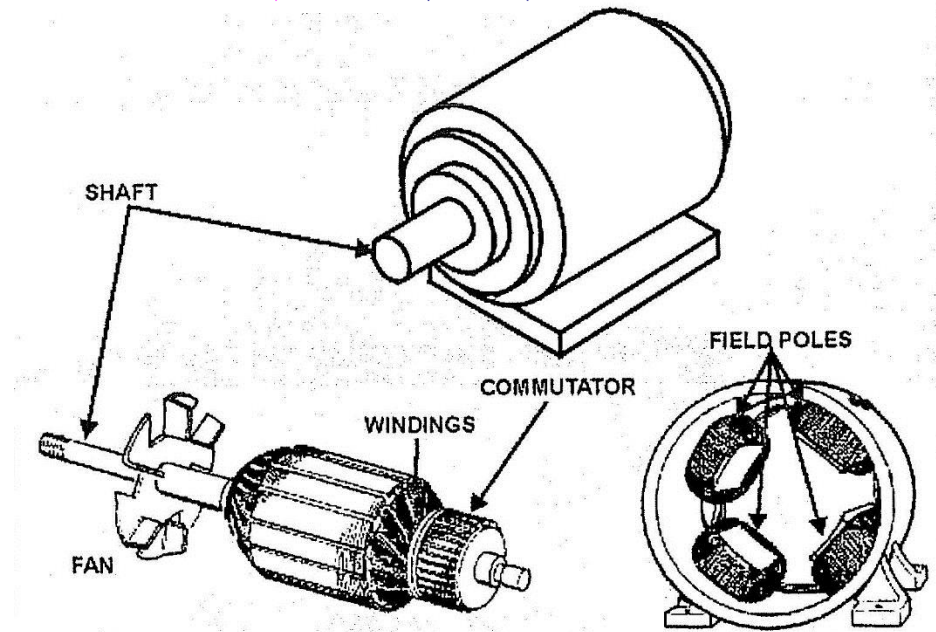
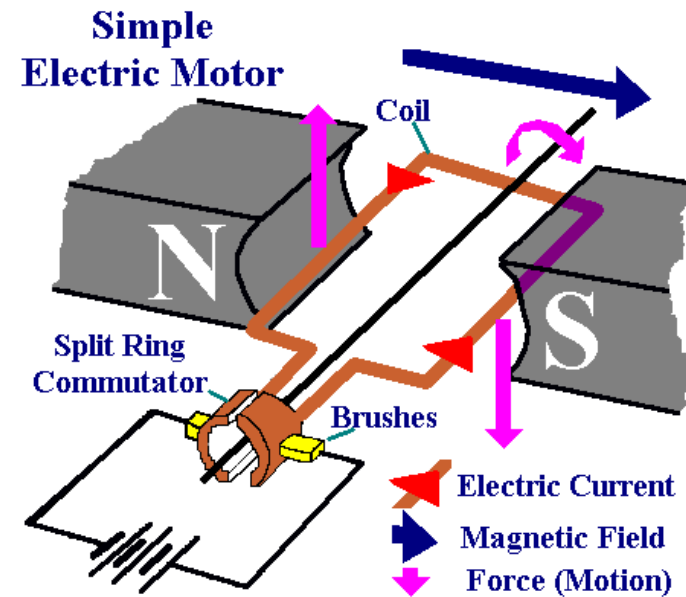


Motors use electromagnets to turn a shaft or to convert electrical energy into energy of motion.

- The basic parts of an electric motor are:
  - Voltage source
  - Shaft
  - Commutator
  - Electro-magnet
  - At least 1 additional magnet

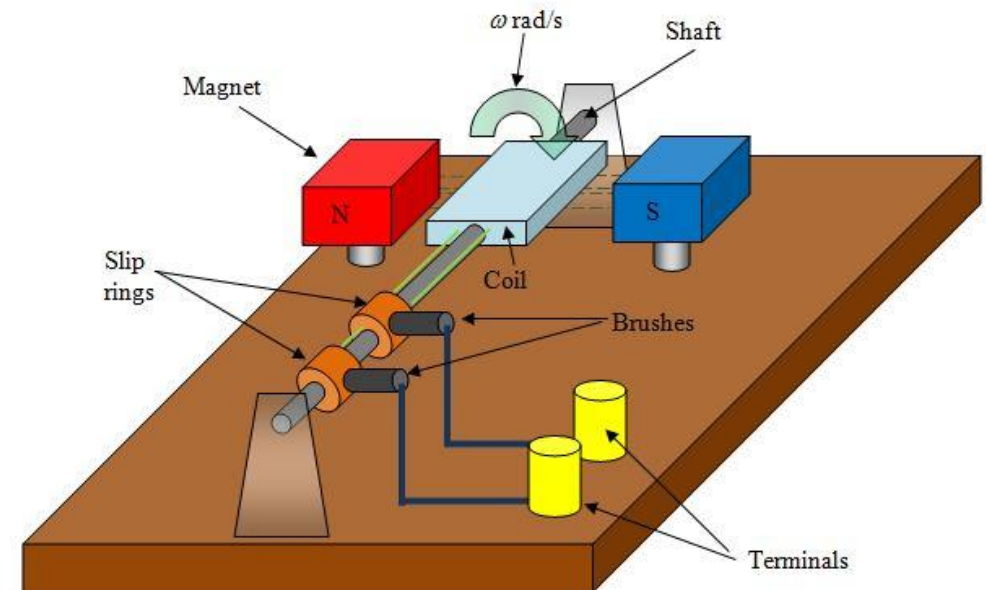


- Repulsion forces between the 2 magnets turn the shaft
- Commutator reverses the poles of the electromagnet when it starts to align poles with the permanent magnet
- This reversal renews the repulsion force and keeps the shaft moving



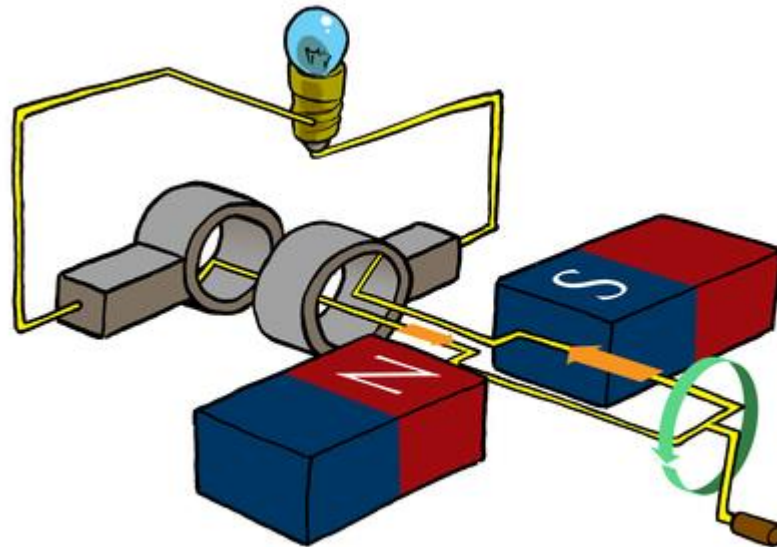
## 21.3 Magnetism can produce current.

- Magnets are used to generate electric current
- A generator rotates coils of wire inside a magnet to generate electric current



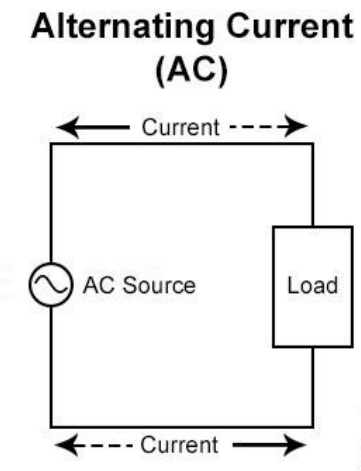
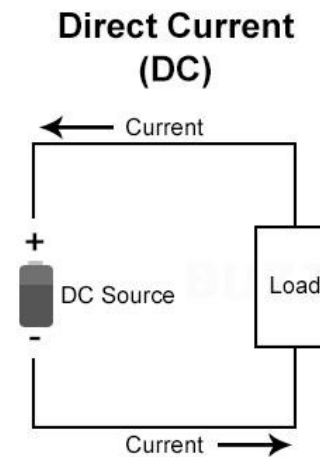
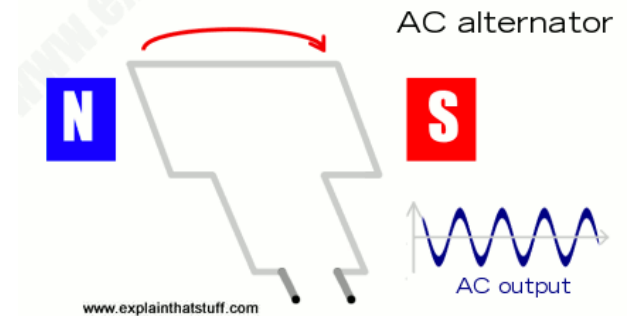
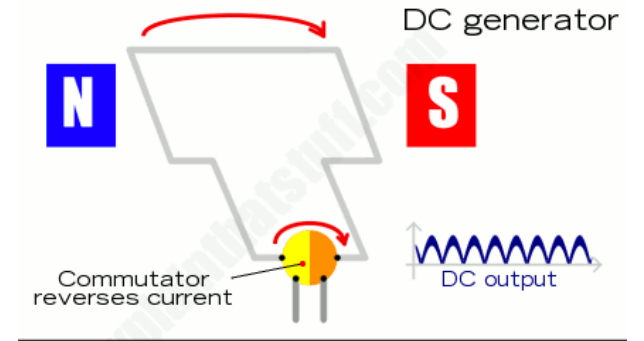
# A wire moving across magnetic field lines creates an electrical current.

- The magnet & the wire through which the current passes must be moving relative to each other. It doesn't matter which one moves so long as one of them moves.



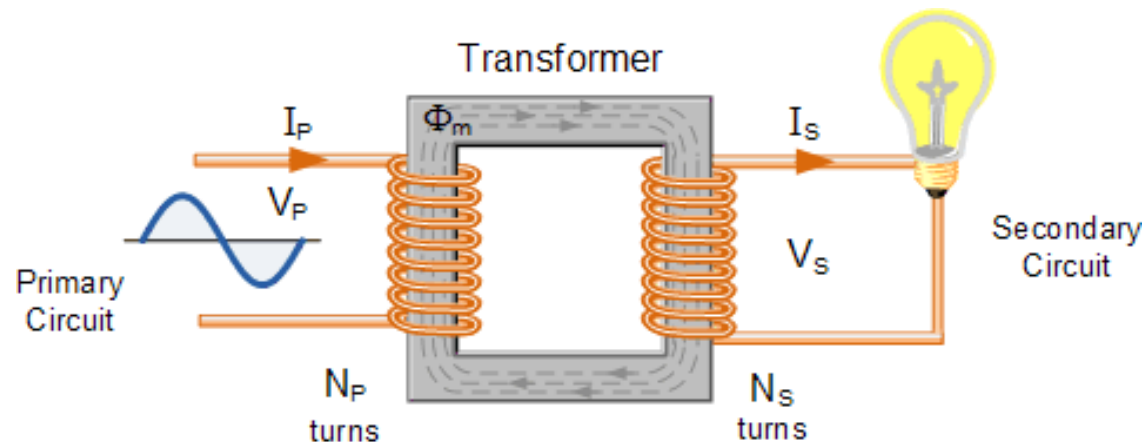
# Current

- The current produced can be:
  - Direct current (dc), which flows in one direction only
  - Alternating current (ac) which changes direction at regular intervals



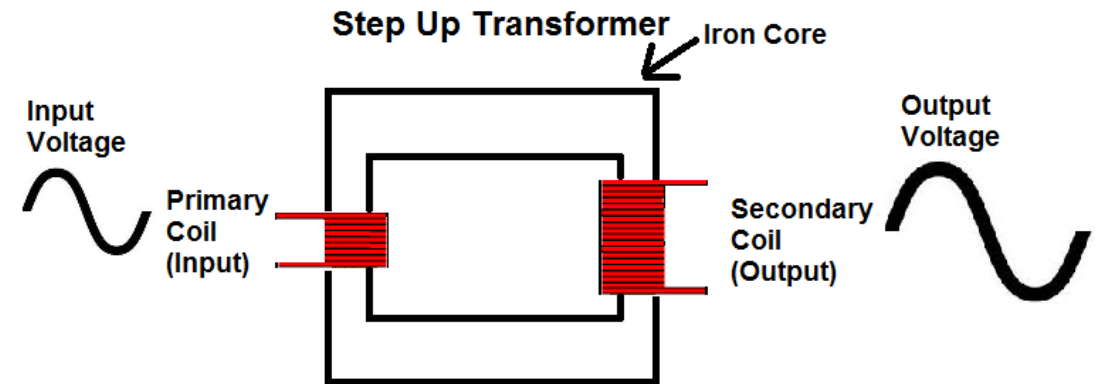
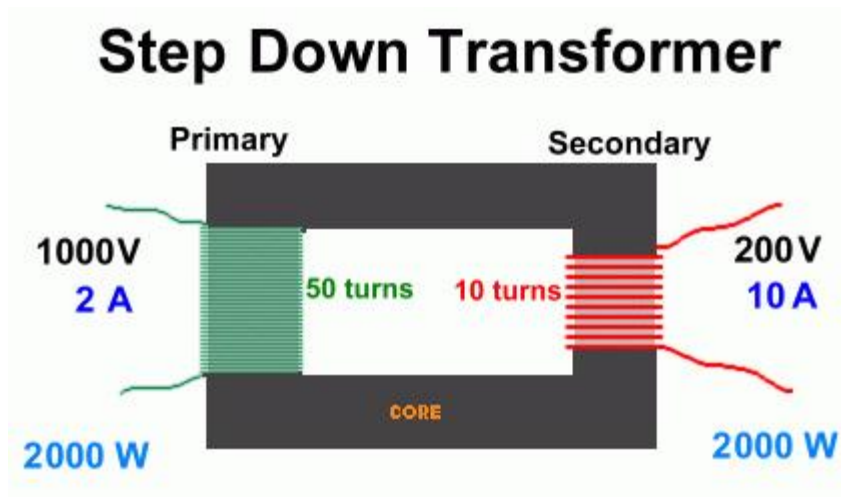
# Magnets are used to control voltage.

- ***A transformer either increases or decreases voltage***
  - 2 coils of wire are wrapped around an iron ring
  - Current through the 1<sup>st</sup> coil causes the ring to become an electromagnet
  - The electromagnet induces a current in the 2<sup>nd</sup> coil



# Transformer

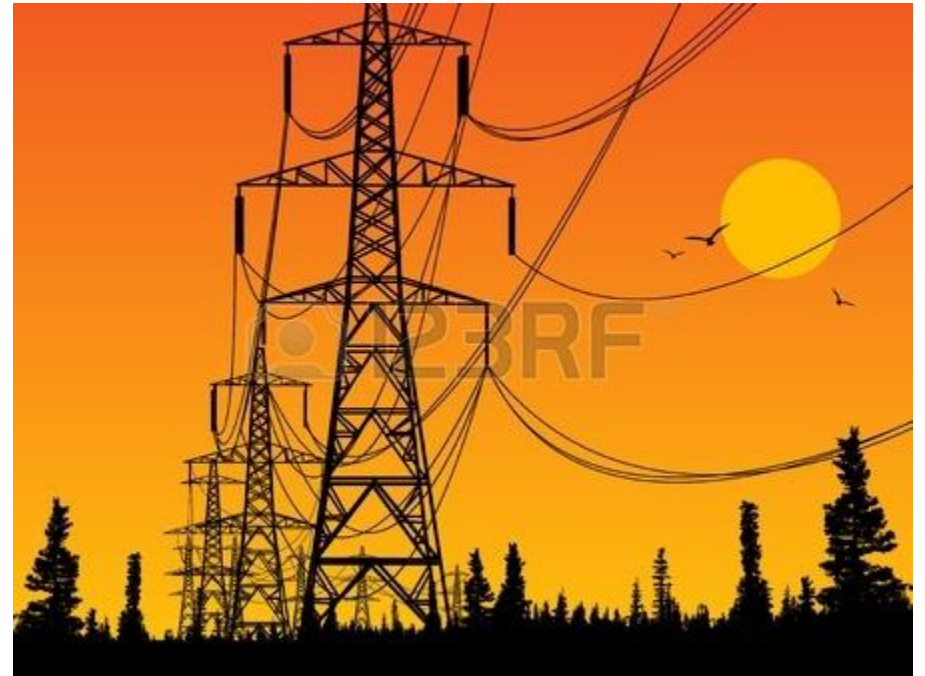
- If the 1<sup>st</sup> coil has more loops, the voltage decreases and the system is a ***step down transformer***
- If the 1<sup>st</sup> coil has fewer loops than the 2<sup>nd</sup> coil, the transformer is a ***step up transformer*** and the voltage increases





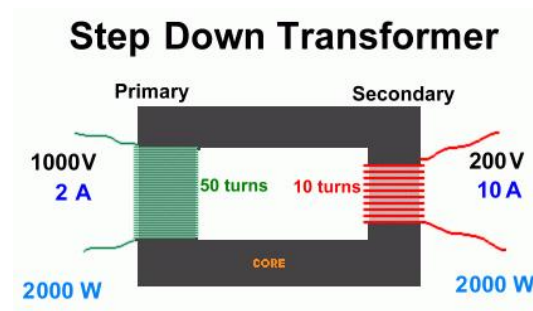
## *21.4 Coils of wire rotate within a magnetic field to produce current in a device called a generator.*

- Generators supply most of the world's electrical energy.
  - Electric power is not the electrical energy produced but a ***measure of the rate*** at which some other form of energy is converted to electrical energy
  - It is also the rate at which an appliance converts electrical energy into another form of energy, such as light or heat



# *Electric power is the rate at which electrical energy is generated*

- Most electrical energy is produced by generators
- The rate at which the chemical energy in fossil fuels or the kinetic energy of falling water is converted to electrical energy is electric power
- The current distributed from electrical generating plants is too great to be useful in homes & businesses. The current must pass through step down transformers before it is useful



Electric power can be measured.

- The unit used to measure power is the **watt**
- **Kilowatts** are often used to measure power in building because the watt is so small
- The amount of energy used is the product of the rate at which the energy is used (power) and the time over which it is used. Its unit is the **kilowatt-hour** (kWh)

***\*If you multiply voltage by current, you are finding the electrical power***

