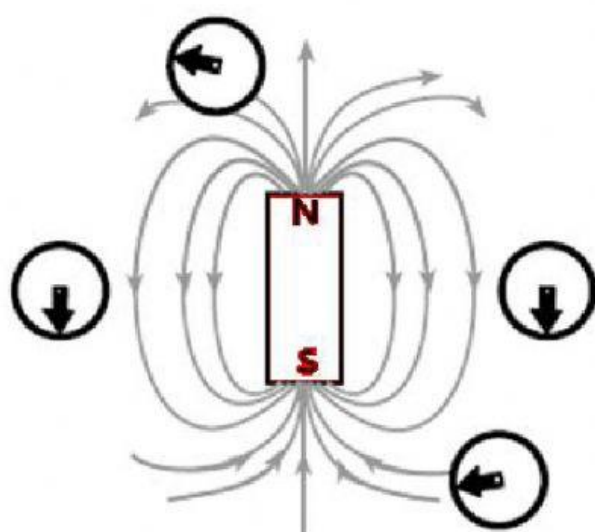
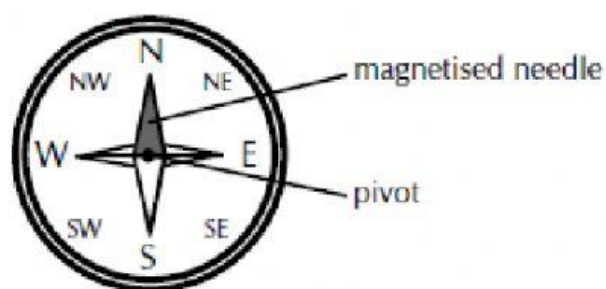


## Magnetism – Part 2

### *Ferromagnetism*

**Ferromagnetism** is a phenomenon shown by materials like iron, nickel or cobalt. These materials can form permanent magnets. They always magnetise so as to be attracted to a magnet, no matter which magnetic pole is brought toward the unmagnetised iron/nickel/cobalt.

A **compass** is an instrument which is used to find the direction of a magnetic field. A compass consists of a small metal needle which is magnetised itself and which is free to turn in any direction. Therefore, when in the presence of a magnetic field, the needle is able to line up in the same direction as the field.



The direction of the compass arrow is the same as the direction of the magnetic field

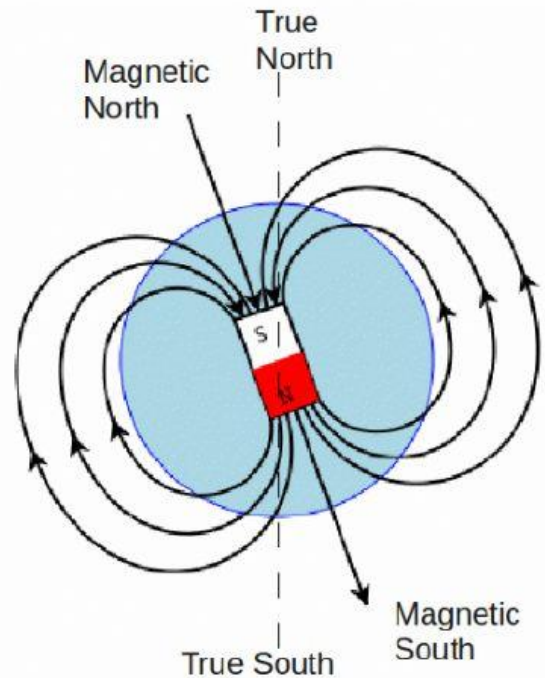
Compasses are mainly used in navigation to find direction on the earth. This works because the Earth itself has a magnetic field which is similar to that of a bar magnet (see the picture below). The compass needle aligns with the Earth's magnetic field direction and points north-south.

# The Earth's magnetic field

In the picture below, you can see a representation of the Earth's magnetic field which is very similar to the magnetic field of a giant bar magnet like the one on the right of the picture. The Earth has two **magnetic poles**, a north and a south pole just like a bar magnet.

In addition to the magnetic poles the Earth also has two **geographic poles**. The two geographic poles are the points on the Earth's surface where the line of the Earth's axis of rotation meets the surface.

- Earth is one large magnet - it has poles
- Like a magnet, the earth has a magnetic around it
- The magnetic field is a result of the electric current that is constantly circulating within the earth (possibly due to flowing liquid metals in the outer core)



- The earth also has 2 poles where the earth's axis of rotation meets the surface
- We call the geographic north pole

Hint: look at the diagram!



- The magnetic poles do not correspond exactly to the geographic poles
- Magnetic north pole of the earth attracts the magnetic north pole of a compass
- Therefore magnetic north is actually equivalent to a SOUTH pole on a bar magnet (because UNLIKE poles attract)

### Aurorae (pronounced Or-roar-ee)

Another effect caused by the Earth's magnetic field is the spectacular Northern and Southern Lights, which are also called the Aurora Borealis and the Aurora Australis respectively.

When charged particles from the solar wind reach the Earth's magnetosphere, they spiral along the magnetic field lines towards the North and South poles. If they collide with particles in the Earth's atmosphere, they can cause red or green lights which stretch across a large part of the sky and which is called the aurora.

Aurora borealis photographed in Alaska



## Summary

- Magnets have two poles -  and .
- Some substances can be easily magnetised.
- poles repel each other and  poles attract each other.
- The Earth also has a magnetic .
- A  can be used to find the magnetic  pole and help us find our direction.
- The Earth's magnetic field protects us from being bombarded by high energy charged particles which are emitted by the Sun.
- The  are an effect of the Earth's magnetic field.