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# MAGNETISM

## The invisible force field protecting the Earth

DID you know a magnetic field surrounds the Earth?

The geomagnetic field, as it is sometimes called, is an invisible shield that protects our planet from dangerous elements.

It is also known as the 'magnetosphere'.

Do you remember when we talked about Earth's spheres in the November 22, 2021, edition of *The Wonder Weekly*?

There is the lithosphere, the hydrosphere, the cryosphere and the atmosphere, among many others.

While it sits at the outer edges of Earth's atmosphere, it is believed the magnetosphere's power begins at the Earth's core.

Effectively there is a giant magnet within the Earth, and just like any magnet it has a north and south pole.

The inner and outer core of the Earth is made up of iron and nickel.

The inner core is a solid metal ball, and the outer core is a liquid form of the metals.

The two cores spin and create magnetism.

Magnetism is caused by the motion of electric charges.

Every substance is made up of atoms.

Each atom contains electrons, which spin around

the core of an atom and their movement creates electric charges.

In most substances equal numbers of electrons spin in opposite directions, which reduces their magnetism.

But in substances such as iron, nickel, and cobalt, most of the electrons spin in the same direction.

This makes the atoms in these substances strongly magnetic.

Scientists call these metallic elements 'ferromagnetic'.

You can make objects containing these substances, a sewing needle for example, into temporary magnets.

To do this the magnetic object must enter the magnetic field of an existing magnet.

When you rub a magnet along a needle it becomes magnetised.

We know that all magnets have a north and south pole.

The magnetic force from a magnet flows from the north pole to the south pole, and

it creates a magnetic field around a magnet.

Have you ever tried to push two magnets together?

If you try to push them together at the north poles they repel.

The same thing happens if you attempt to push two south poles together.

But the north and the south poles are attracted to each other.

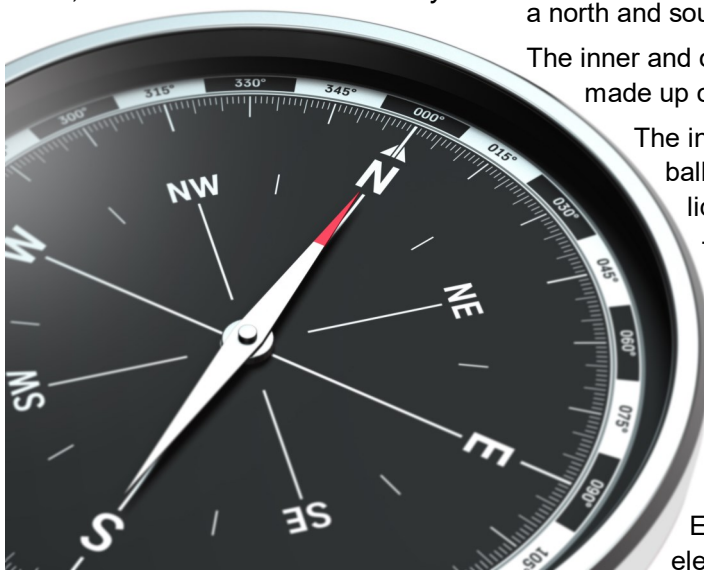
When you rub a sewing needle (which is generally made of iron and carbon, and plated in nickel) in one direction 20-30 times on a magnet, the atoms in the needle line up in one direction.

The force generated by this process creates a magnetic field.

A needle that has been made into a temporary magnet can be used as a simple compass.

You might like to try an experiment to test this.

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# Navigation aids

**WHILE** humans cannot detect the Earth's magnetic field without a compass, some animals have the ability to sense and use it to navigate.

This sense is called 'magnetoreception', and is present in a wide array of creatures, from bacteria to birds.

Possibly the best known example is the pigeon.

While most scientists agree pigeons use magnetic sensors to help them navigate, there have been a few different theories about where those sensors are located.

One theory is that pigeons have magnetic proteins in their eyes and in cells which run from their eyes to their brains.

Some believe pigeons use tiny magnetic particles of iron oxide, known as 'magnetite', in their beaks.

Another theory is signals are being sent to the birds' brains come from a part of the inner ear called the lagena.

Scientists also believe pigeons use environmental clues - odours, sound and the position of the Sun to find their way.

The longest recorded flight by a homing pigeon is more than 11,500km.

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## Explosions of energy from the Sun

It is lucky we have the a magnetic field and atmosphere to protect us from solar flares and solar wind.

Solar flares occur when magnetic energy, or electromagnetic radiation, from the Sun is blasted into space.

This sudden explosion of energy includes bright light, heat, X-rays, UV radiation, gamma rays and radio waves.

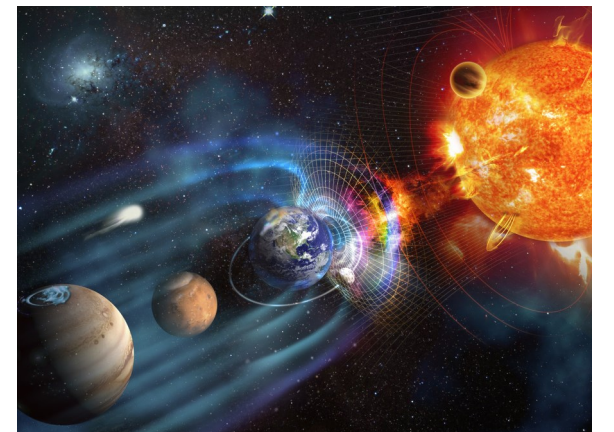
Solar flares can be so powerful that the radiation released can interfere with GPS signals and radio communications on Earth.

Solar wind is a continuous stream of charged protons, electrons and plasma shot out of the Sun at hypersonic speed - more than 750 kilometres per second.

Most of these particles are deflected by the magnetosphere, but some make it through and disrupt the oxygen and nitrogen in the atmosphere.

This causes the beautiful light display we know as an aurora.

You probably know the aurora we often see in Tasmania is called the Aurora Australis, or Southern Lights.



## Use the force in this magnetic challenge

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All you need is a bowl of water, a sewing needle, a magnet, and something to float your magnetised needle on - a leaf will generally do the job, or you could cut out a round piece of wax paper or polystyrene.

We suggest you ask for help from an adult family member.

If you don't own a magnet, you can magnetise your needle by rubbing the blunt end against your hair 50 to 100 times.

Once magnetised, place your needle in the water on top of your flotation device.

Floating the needle allows it to align with the Earth's magnetic field, which will pull at the opposite poles of the needle.

If your experiment works, one end of the needle will be pointing north, and the other south.

The southern pole of your needle will be attracted to the Earth's magnetic North Pole, and vice versa.



But how do you know which end is north and which is south?

Perhaps you can give that some thought, and see what solutions you can come up with.

Children's University Tasmania members can earn hours in their passport for this challenge, at the discretion of their school/centre coordinators.

The Earth's magnetic field or magnetosphere acts as a massive invisible and very important bubble around our planet.

It protects the Earth from solar radiation, which is the energy from the Sun, and without it our planet would overheat.

It also protects us from solar wind and solar flares.

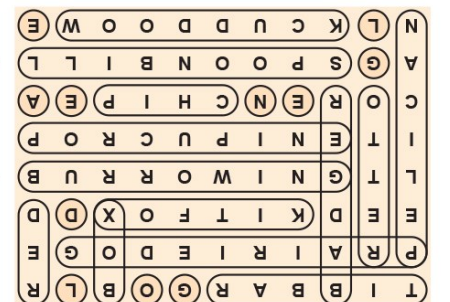
## North American Animals

# WORDSEARCH

### DID YOU KNOW?

Eagles beaks and talons are made of the same substance (keratin) as human hair and fingernails.

MYSTERY WORD: GOLDEN EAGLE



The words on the list which are in capital letters are hidden somewhere in this puzzle. Find and circle them. When you have found all the words, the letters you have left will give you the answer to this question . . . Apart from the bald eagle, what is the only other eagle that breeds in North America? The solution is above.

BADGER	T	I	B	B	A	R	G	O	B	L	R
BOX turtle											
brown PELICAN	P	R	A	I	R	I	E	D	O	G	E
BURROWING owl	E	E	D	K	I	T	F	O	X	D	D
CHIPmunk											
jack RABBIT	L	T	G	N	I	W	O	R	R	U	B
KIT FOX											
OTTER	I	T	E	N	I	P	U	C	R	O	P
PORCUPINE											
PRAIRIE DOG	C	O	R	E	N	C	H	I	P	E	A
RED squirrel	A	G	S	P	O	O	N	B	I	L	L
SPOONBILL											
WOOD DUCK	N	L	K	C	U	D	D	O	O	W	E