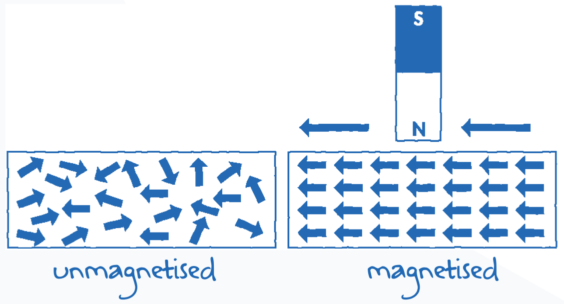
The Science behind the Show

Magnetism is an attractive force. Iron and steel are the only common materials that are attracted (pulled) towards a magnet. Nickel and cobalt, which are less common, are also attracted towards magnets. Most other metals are not magnetic.

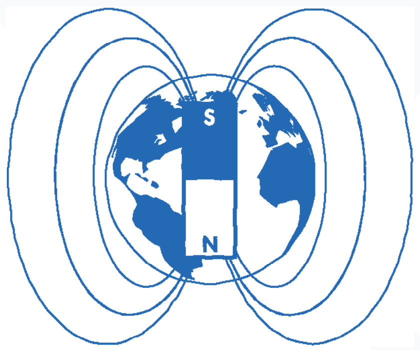
All magnets have two opposite poles; a North Pole and a South Pole. Like poles repel and opposites attract. Magnets come in a variety of shapes, for example bar magnets, horseshoe magnets and ring magnets. In each case there is a North and South Pole.

Every magnet has its own magnetic field. This is a region around the magnet where it exerts a force on magnetic materials. A magnetic field is stronger at the poles of a magnet and weaker along the sides between the poles.



Things are magnetic because of the domains inside them. Imagine that an iron bar has lots of little boxes (domains) inside it and each of these boxes has a miniature magnet inside. In a magnet and magnetic material, these boxes are all lined up in an ordered way with the north poles pointing in the same direction. It is this alignment that makes the iron bar magnetic. If the boxes were all pointing in different directions, the iron bar would not be magnetic.

A non-magnetic piece of iron can be turned into a magnet by stroking it with another magnet in one direction only. This lines all the magnetic boxes inside up so that they face the same direction. However, after a little while, they'll all move back to where they were to start with, making the iron non-magnetic again.



The earth is a giant magnet because it is packed with molten rocks rich in magnetic materials like iron. Just like a bar magnet, Earth's magnetic field stretches out into space, in a region called the magnetosphere.

The Northern Lights are caused by Earth's magnetic field. Energetic particles zooming in from the sun, known as the solar wind, interact with Earth's magnetic field, exciting gas in the atmosphere. The energy from this excitement produces different coloured lights in the sky. They happen at the north and south poles because this is where the magnetic field is the strongest.

Some Useful Links

www.csiro.au/en/Education/DIY-science
www.need.org/files/curriculum/guides/WondersOfMagnets.pdf

Scottish Charity Registration Number: SC003790
Generation Science, Harbourside House, 110 Commercial Street, Edinburgh, EH6 6NF

EDINBURGH INTERNATIONAL SCIENCE FESTIVAL
generation science
EDF ENERGY

MARVELLOUS MAGNETS

Welcome to Generation Science!

Brought to you by the Edinburgh International Science Festival, our shows and workshops spark pupils' curiosity and bring science to life.

What we do

Each show or workshop is fully equipped and delivered by trained science communicators. We create fun, interactive environments where everyone gets out of their seats and gets involved. Our inspiring demonstrations and engaging activities are linked to the Curriculum for Excellence, explaining key concepts in a unique and memorable way.

Event Description

In this interactive workshop, our storytellers take pupils on a journey through the wonderful world of magnets. They join Manus as he discovers the role of the earth's magnetic field in producing the brilliant Northern Lights.

Marvellous Magnets introduces concepts such as magnetic attraction and repulsion, fields and poles, while interactive supported play allows pupils to explore magnetic forces and their effect on the world around us.

Curriculum Links

Marvellous Magnets complements the following experiences and outcomes:

SCN0-07a: Through everyday experiences and play with a variety of toys and other objects, I can recognise simple types of forces and describe their effects.

SCN0-15a: Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes.

SCN1-08a: By exploring forces by magnets on other magnets and magnetic materials, I can contribute to the design of a game.

Learning Outcomes

- Explain that magnets have a north and a south pole
- Recall that like poles repel and opposite poles attract
- Identify that magnetic materials are often made from iron
- Describe that magnets have invisible magnetic fields around them which are strongest at the poles
- Recall that the Earth has a north and south pole and a magnetic field

The re-development of Generation Science teacher notes has been made possible by a grant from the **Texas Instruments Community Fund**

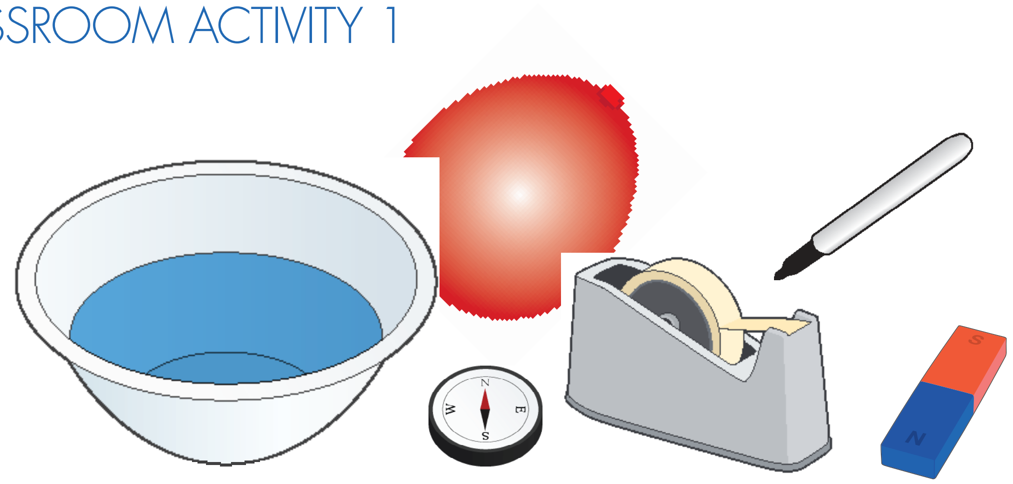
www.sciencefestival.co.uk/education

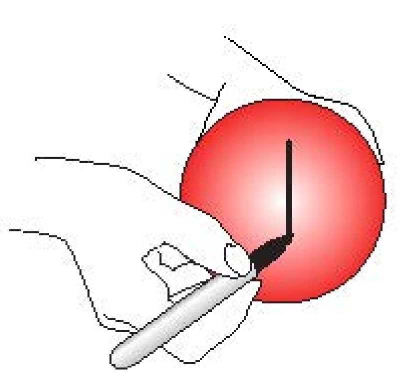
FOLLOW-UP CLASSROOM ACTIVITY 1

Balloon Compass

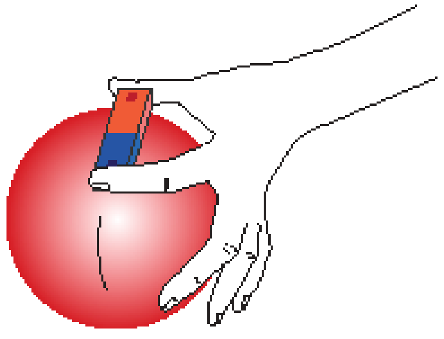
You will need:

- Bar magnet
- Balloon inflated with air
- Waterproof marker pen
- Bowl of water
- Sticky tape
- Compass

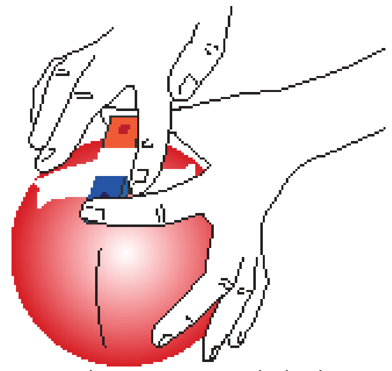




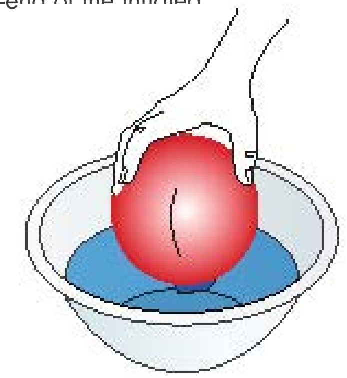
1. Using the waterproof marker pen, draw a short straight line across the round, top-end of the inflated balloon.



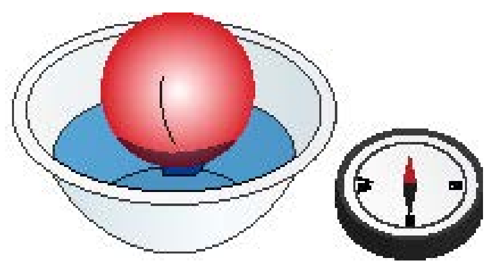
2. Hold the bar magnet against the side of the balloon so the north pole of the magnet lines up with the line you have drawn.



3. Use sticky tape to attach the bar magnet securely to the balloon.



4. Float the balloon in the middle of the bucket of water and observe what happens.



5. Use the compass to check which way the balloon is pointing.

Try again. Does the Balloon always point the same way?

Explanation

The bar magnet (like all other magnets) has a north and a south pole. If you allow a bar magnet to move freely by suspending it on a light string or by floating it in water, the bar magnet will move to align itself with the Earth's magnetic field. The north pole of the magnet will point to the Earth's magnetic north pole and the south pole of the magnet will point to the Earth's magnetic south pole.

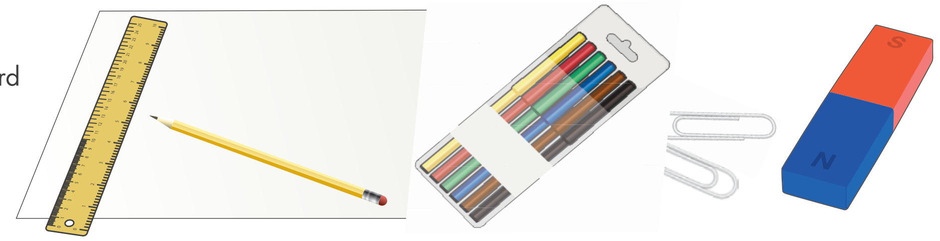
The Earth is a giant magnet, with north and south poles. The magnetic poles of the Earth do not match the geographic poles of the Earth. The magnetic north pole is located about 1,800 kilometres from the geographical north pole. A compass points toward the magnetic north pole and not the geographical 'true' north pole. Magnetic declination is the term used to describe the difference between the orientation of a compass and the geographical 'true' north pole.

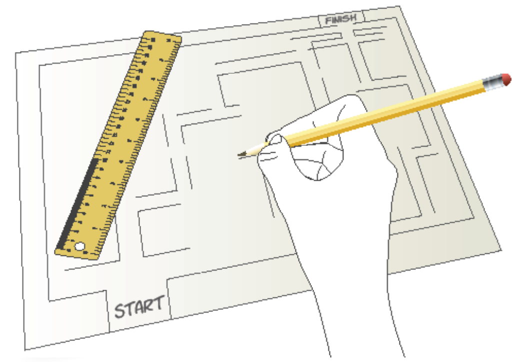
FOLLOW-UP CLASSROOM ACTIVITY 2

Magnet Maze

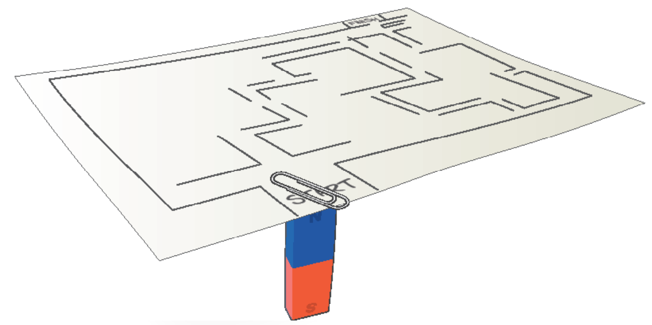
You will need:

- Large piece of card or cardboard
- Coloured pens or pencils
- Magnet
- Paperclips





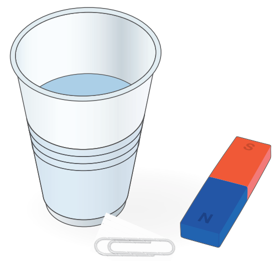
1. On the piece of cardboard, design and draw a maze. Make it as colourful and as complicated as you like. Make sure it has a clearly marked START and FINISH.



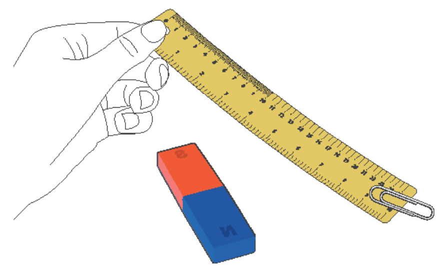
2. Place a paperclip at the START position and the magnet directly underneath the card and paperclip. Move your magnet around and see what happens. Can you guide the paperclip through the maze from start to finish successfully?

Is the magnet pushing or pulling the paperclip?

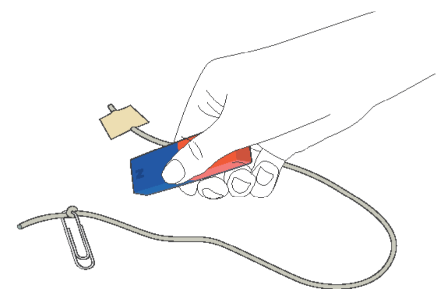
Extra Activities:



1. Can you rescue a paperclip from the bottom of a glass of water without getting your fingers wet?



2. Can you make a paperclip climb a ruler?



3. Using a paperclip tied to a piece of string whose other end has been stuck to a table, can you make a paperclip fly?

Explanation

A force is something that causes objects to move and magnetism is an example.

Magnets are attracted and stick to certain metals which are known as ferromagnetic metals and normally contain iron, nickel and cobalt. These metals do not have to be touching a magnet to have a pulling force on them; only somewhere within the magnet's magnetic field.

Magnets have two poles: a north and a south. Opposite poles on two magnets are attracted to each other and stick together. The same poles on two magnets repel each other. When a magnet or a metal object is placed in the magnetic field of another magnet, it will either be pulled towards that magnet if it is attracted to it, or pushed away if it repels it.