Spirit of Innovation
STEAM Resources

Science
Year Three
Forces & Magnets
Forces behind flight

Links

Working scientifically

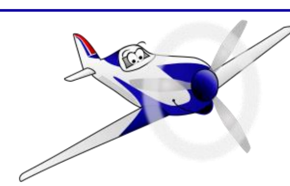
- Asking relevant questions and using different types of scientific enquiries to answer them
- Setting up simple practical enquiries, comparative and fair tests
- Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units
- Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions
- Identifying differences, similarities or changes related to simple scientific ideas and processes
- Using straightforward scientific evidence to answer questions or to support their findings

Forces & Magnets

- Compare how things move on different surfaces
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance
- Observe how magnets attract or repel each other and attract some materials and not others
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials
- Describe magnets as having two poles
- Predict whether two magnets will attract or repel each other, depending on which poles are facing

Resources

- Newspaper
- Sticky tape
- Scissors
- Marker pens
- Tape measure
- Stop watch
- Steel needle
- Petra dish or similar
- Bar and horseshoe magnets
- 2 Hoops
- Labels REPEL & ATTRACT
- Digital camera/phone
- Water
- Compass
- Pilot Seat Design Sheet (Download)
- Magnet worksheet (Download)
- Materials worksheet (Download)
- Forces PowerPoint (Download)
- Compass PowerPoint (Download)



Skills

- Working as a pair
- Working in a team
- Discussing ideas
- Collaboration and compromise
- Make predictions and give reasons
- Planning and designing
- Measuring accurately
- Recording data
- Report back findings

Questions

- How do aeroplanes fly?
- If an aeroplane is heavy how does it stay in the air?
- What are the forces that effect an aeroplane?
- How can you design a light but strong chair?
- How can you ensure the pilot will be able to fit in the chair?
- Can you build a light, strong chair on a limited budget in a set time scale?
- What do you already know about magnets?
- What happens when you put the South poles together?
- What happens when you put the South pole next to the North pole?
- Are all materials magnetic?
- Are all metals magnetic?

Activity

Activity One
In small groups
(50 – 60 mins)

The aim of a design engineer is to create a produce that suits many requirements. When designing aircrafts, it is essential that the engineers stick to given sizes and weights.

Split the class into teams of three or four, each team nominate a pilot.

In these teams of three or four, pupils need to design and make a pilot's seat out of sticky tape and newspaper. The chair needs to fit their pilot's measurements and be strong enough to take their weight.

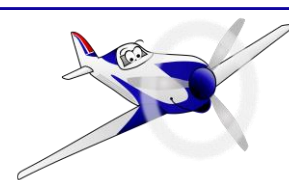
Time will need to be given to the teams in order for them to work out how to create strength from the newspaper. Before starting on their chair designs.

Using a design sheet (Download) teams measure the pilot and draw up their plans for a strong, but light weight seat.

As a whole class bring all chairs together for the 'test.' Discuss with the pupils where the forces are acting on the seat, using a marker pen draw these on using arrows.

Rank the seats in order of strength and then suitability, evaluate why specific designs were better than others.

Activity Two
In small groups
(30 - 40 mins)



Repeat the above activity, but with the addition of budget and time.

Using the same or different groups, pupils need to make another chair. This time they will be designing using their knowledge from Activity One's appraisal, however, they will have two new design constraints: budget and time.

Design a strong, lightweight chair that fits the pilot: only using (x) number of newspapers and (x) roll(s) of sticky tape in 30 mins.

As a whole class bring all chairs together for the 'test.' Just as in Activity One, discuss with the pupils where the forces are acting on the chairs, using a marker pen draw these on using arrows.

Rank the chairs in order of strength and then suitability, evaluate why specific designs were better than others. Ask the pupils to compare their experience of designing and building both chairs; did the limited budget and time scale effect their designs? *If so, how?*

Explain to the pupils that engineers have to design, test and redesign every day to ensure that their design ideas meet the brief of strength, size, weight, cost and safety. Getting things right often takes a few attempts, but you learn something new each time.

FAIL: First **A**ttempt **I**n **L**earning

Activity Three
In pairs
(30 - 40 mins)

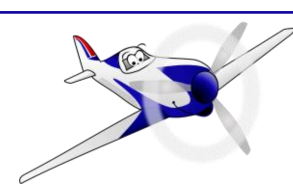
Pupils will learn best about magnets by exploring, observing, and experimenting. Let them discover how magnets behave towards each other in a variety of different combinations. Discover that magnets have 2 poles and that same poles repel whilst opposite poles attract.

After a time of experimenting, see if the pupils are able to predict which combination of magnets will repel and which will attract. (Download) Pupils to use bar and horseshoe magnets to see if they are correct.

⚠Never
Place a magnet near a computer, TV, watch, clock, video, or credit card. It may damage them!

Activity Four
Whole Class/Small Groups
(30 - 40 mins)

Do not use a magnet at this stage of the session. Teacher to prepare a variety of everyday materials; encourage pupils' ideas and predictions on which of these everyday materials will be magnetic. Discuss each material with the class and let them suggest whether it will be repelled or attracted to a magnet. Ask questions such as; Is it just metal things that are attracted to magnets? Are all metal items magnetic? Why not? Once the class have discussed their predations, sort the everyday items into two labelled hoops – Magnetic and Non-Magnetic.



*Teacher to take a photo of each hoop.

In smaller groups carefully test each material with a magnet to see if they are attracted or repelled. Using the 2 hoops again, and based on their findings, place the materials in the labelled hoops. Were their previous prediction correct? Record their findings (Download) and report their findings back to the class.

Class to look at their original predictions and report on their findings.
Were they the same?
Why were they different?
What have you discovered?

⚠**Never!**
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Activity Five
Whole Class/Small Groups
(30 - 40 mins)

By now pupils should understand that magnets have 2 poles and that opposite poles attract and like poles repel.

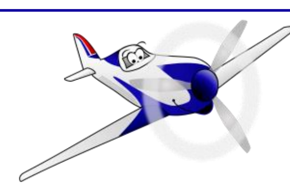
Next, they will go on to learn that the world itself is a giant magnet! Using the PowerPoint (Compass PowerPoint) Teacher to explain how the Earth has an iron core that is like a giant magnet hidden beneath the surface. Explain how this core produces a magnetic field that has two poles the Magnetic South Pole and the Magnetic North Pole.

Teacher to describe how a compass is one of the best tools for navigation, location and direction. Explain how people use them to find their way, whether hiking, sailing or flying.

Show the class that inside a compass there is a tiny needle. Teacher to point out that the needle is a very small magnet. Remind them, that like all magnets one end of the needle is North and the other is South.

The North end of the needle is attracted to the **Magnetic South Pole**. But just to confuse you! The Magnetic South Pole is what we on Earth call the North Pole!

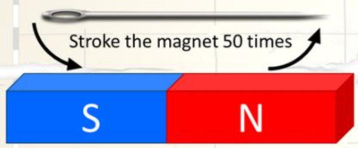
** Option make a compass.*

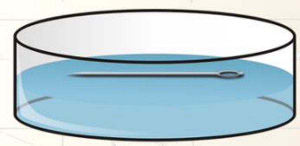


How to Make Your Own Compass

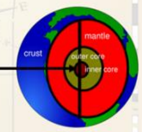
You Will Need:
Bar magnet
Steel needle
Small dish
Water

What to do:
1. Fill a small dish with water.
2. With the needle pointing towards north over the bar magnet, stroke the magnet in this circular motion 50 times .
3. Place the needle carefully on the top of the water – to let it rest on the surface tension





Why does it work?
Because the needle is magnetised, it is attracted to the Earth's magnetic field. This field is also know as the **magnetosphere**, it is created by the churning molten **iron** core in the centre of the Earth.



The Earth acts just like a bar magnet, with the **South** end of this imaginary bar magnet located near **Earth's North Pole**. As opposites attract the needle is always drawn towards the North Pole (Magnetic South.)