



## Investigating magnetic metals

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Harry is a materials scientist. He investigates the properties of materials and how to develop new and interesting materials. He has specialised in metals and his research has led to the development of different types of steel, with special properties. Some have been used to make the rails that trains run on in the Channel Tunnel.

Steel is made from iron, which in turn is obtained by heating iron ore to very high temperatures to produce molten iron. To make iron stronger, impurities are removed. This is achieved by heating the iron in a furnace, while blowing oxygen through the molten metal. Impurities are burned

off and a small amount of carbon is added. The resulting metal is an iron alloy commonly known as steel, which is much stronger than the original iron.

Some steels can have traces of other metals added to them to make another alloy. For example, adding chromium produces hardened steel and, at the right mixture, can make stainless steel which is resistant to rusting.

Harry's work uses computer models and the production of test metals to make super-strong steels.

### Introduction to Inspiring Scientists

Inspiring Scientists is a series of resources to help develop your students' understanding and awareness of science and the diversity of scientists. This resource forms part of a collection of ten ethnic minority scientists in the UK who are leaders in their field of scientific research. The resources for each scientist are divided into three academic levels: primary, secondary and post-16.

Each resource is accompanied by an activity worksheet, scientist's timeline and a video profile.

### Learning outcomes

- Understand that some metals are magnetic and some are not.
- Practice teamwork skills by working collaboratively.
- Develop practical skills by investigating magnetic and non-magnetic materials and recording results.
- Identify common metals that are magnetic.

# Investigating magnetic metals

Magnets will attract ferrous metals, which refers to iron, or a metal which contains iron. Steel is a ferrous metal as it contains iron along with carbon. Metals such as aluminium, or gold will not be attracted to a magnet.

Some metals can become a magnet, depending on their atomic structure. To show how a material can become a magnet, take a piece of ferrous metal (long steel nail) and gently draw one pole of a permanent magnet along its length many times in one direction only. Over time the nail will become magnetised.

Most magnets in school will be made from iron, as it is effective and relatively inexpensive to produce. Super-strong magnets are made using alloys containing exotic metals such as neodymium. They are very strong and so can be used in small devices such as earphones and mobile telephones (compare old-fashioned headphones with modern earphones).

To demonstrate magnetism at work, ask your students to work in teams to investigate a range of metals to check if they are attracted by a magnet or not. Give each team a range of metallic objects that are safe to handle and ask the teams to inspect the objects and make predictions of whether they are magnetic or not.

Note that many modern coins have a steel core which makes them magnetic.

## Activity toolbox

- Activity sheet;
- Bar magnets;
- Copper wire or pipe;
- Paper clips;
- Aluminum foil;
- Drink cans (aluminum and stainless steel);
- Iron or steel nail; and
- Any other metallic objects, such as jewellery.

## Suggested sequence of events

Timing: 45/60 minutes

- Lead a class discussion to recall prior learning of the topic.
- Play the video profile and encourage students to record their own notes (running time approximately 5 minutes).
- Lead a class discussion on how some metals are magnetic and some are not.
- Brief class on the activity.
- Activity.

## Homework ideas

### Magnetic memories

Think about the experiment you did today and write a diary entry describing the experiment and what you did in. Remember to include the equipment you used, the results and draw a diagram to show the method. Also say if the results surprised you or not.

### Extra reading?

Look out for primary science or fiction books on this subject to use during class time. Why not try *Can you feel the force?* by Richard Hammond shortlisted for the Royal Society Young People's Book Prize?

## ACTIVITY

# Investigating magnetic metals

You have been given a range of objects that may or may not be magnetic. Work as a team to investigate which ones are.

With your team, inspect each object and make a prediction on whether it is magnetic or not. Do this for each object and make sure your team agrees.

Once you have made your predictions, it is time to investigate using the bar magnet that your teacher will give you. Check every object and record if your prediction was correct.

### Prediction

Magnetic

Not magnetic

### Result

Magnetic

Not magnetic