**ACTIVITY: Investigating magnetism**

**Activity idea**

In this activity, students explore magnetism through a series of simple activities – they are prompted to think like scientists through the use of questioning.

By the end of this activity, students should be able to:

* formulate questions related to magnetism and design relevant investigations
* make predictions based on the evidence of their inquiries
* create explanations for some of the properties of magnets based on their own investigations.

[Background information for teachers](#30j0zll)

[Student instructions](#1fob9te)

**Background information for teachers**

Magnetism is an engaging context for science learning – it is fascinating, and investigating the properties of magnets is a great activity for building curiosity. The aim of this series of activities is to prompt students to shift from simply playing and observing to scientifically investigating magnets and magnetism.

These are the key science understandings explored in this series of activities:

* Magnets can be used to make some things move without being touched – magnetism does not need contact to apply a force.
* Materials vary in how they respond to magnetism – magnetic objects are those that are attracted to magnets, and most of these contain iron.
* Magnets have two poles and will either push or pull other magnets.
* The space where magnetic force can be felt is called a magnetic field, and we can feel and see the effect of this force.
* A magnetic field, although invisible, can be demonstrated using indirect evidence.
* We can represent the lines of magnetic force by using a diagram.

The science of magnetism can be further explored in the article [Introducing magnetism](https://www.sciencelearn.org.nz/resources/2562-introducing-magnetism) and the PLD session [Exploring magnetism](https://www.sciencelearn.org.nz/resources/2549-exploring-magnetism).

***Teacher tips***

Moving students from simply playing with magnets to developing their science capabilities and understandings about magnetism can be achieved by thinking about the types of questions posed throughout the activities. As teachers, we can model relevant and appropriate questioning techniques for our students. In turn, this will support students to develop their own questions. The questions that are most useful to support the development of the [science capabilities](http://scienceonline.tki.org.nz/Science-capabilities-for-citizenship/Introducing-five-science-capabilities) have been incorporated into the activities.

There are four activities designed to stand alone or to be carried out as a part of a larger investigation. All the activities can be carried out by students of any age. However, the activities increase in their complexity from A–D in terms of the opportunities provided to foster scientific thinking. As students become more scientifically literate, their thinking can be extended through the use of prompting questions. For example, activity C offers scope for more complex investigations, and activity D offers a wonderful opportunity to build students’ confidence and capability to turn the abstract concept of an invisible force into a more concrete image – a diagram.

The activities can be carried out as a whole class, in groups or individually and can be altered to suit the needs of the students in the class. For example, activity A uses a written table to sort ideas and to classify magnetic versus non-magnetic objects and materials. For younger students, it may be more appropriate to provide containers so they can physically sort the objects rather than writing into the table.

With younger students, whole-class, teacher-led discussions might be most appropriate whereas older students may be able to carry out some of the activities independently.

Using class brainstorms and discussions to create word walls and keyword lists will help students with any writing you may require them to do. The activities also provide opportunities for measurement, counting, classifying and oral language.

For activity D, iron sand or iron filings can be used:

* For safety, iron filings must be contained so they cannot cause injury. Containers of iron filings, designed for this purpose, can be purchased online or can be home-made.
* Iron sand doesn’t need to be contained but gets very messy. Once it sticks to a magnet, it is very hard to remove, so if you choose to use loose iron sand, cover the magnets in glad wrap to prevent the iron in the sand from sticking and use paper in between the sand and the magnets.

The compasses used are magnetic field detection compasses, also available for purchase online. You can also use an ordinary compass and move it around the magnet or [make your own compass](https://www.sciencelearn.org.nz/resources/2203-making-a-weather-vane-and-compass) to use.

**Student instructions**

**A: What things are magnetic?**

***What you need***

* Variety of differently shaped or sized magnets
* Variety of different materials – plastic, cloth, metals, wood, paper, chalk, rock etc.

***What to do***

1. What do you know about magnets?
* What are magnets?
* Where do we find magnets at home? In school?
* What are magnets used for?
* What questions do you have?
1. Look at the objects you have been given.
* What do you think will happen if something is magnetic?
* What are your criteria for testing to see if objects are magnetic or not?
* Predict which ones you think will be magnetic and which ones won’t be.
* Discuss your reasons for making those predictions.
* Fill in the first two columns of the table below,
1. Try to attract the different materials using one of the magnets.
* Discuss your observations and fill in the last two columns of the table below.
* Compare your predictions with what you actually found. Was there anything that surprised you about your results?
* Was there anything that the magnetic materials had in common?
* What did the non-magnetic objects have in common?
* Discuss how you can tell if something is magnetic or not and share with the class or with another group. Did everyone agree?
* What questions do you have?

***Exploring further***

* Do you get the same results using the other magnets? What does that tell you about magnetism?
* Are there any other observations you can make about the magnetic force?
* Have you any other ideas or questions about the magnetic force?

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| **Name of the object** | **Predicting: record what you think** **– is it magnetic?** | **Testing: record what you observe****– is it magnetic?** | **Was your prediction correct?** |
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**B: Magnet versus magnet**

***What you need***

* Variety of differently shaped or sized magnets – including at least two bar magnets

***What to do***

* + - 1. Use the bar magnets to answer these questions:
* What happens if you push two bar magnets together?
* What happens if you turn one of them around?
* What happens if you turn both of them around?
* Can you feel the magnetic force? What does it feel like? Is it stronger or weaker in different positions?
* What does the magnetic force do to other magnets?
* Are there any patterns you can see with the way the magnetic force behaves?
* What do you think might be causing the force?
* What are your questions about what you observe?
	+ - 1. Look at the other magnets and discuss these questions:
* How do you think they will behave when you move them together?
* Do the same things with the other magnets as you did with the bar magnets. Does the magnetic force feel the same?
* Do the magnetic forces and magnets behave in the same way? Why do you think this is?
* Are there any other observations you can make about the magnetic force?
* What are your ideas or questions about magnetic forces?

**C: Exploring magnetic forces**

***What you need***

* Variety of differently shaped or sized magnets
* Playing cards
* Kitchen sponges
* Ruler
* Paperclips

***What to do***

1. Put a playing card in between two magnets and hold up the magnets. In your group, answer these questions:
* What happened?
* What is holding the card in place?
1. Add more cards between the magnets.
* How many cards will the magnets hold up? Is there a limit?
* What do you think is happening?
* What questions do you have?
1. Can you find a way to block the magnetic force and stop the magnets holding the cards up? Explain what you found out.
2. Replace the cards with a kitchen sponge and answer these questions:
* Does the sponge make a difference?
* What happens if you use more than one sponge? How many sponges will the magnets hold?
* What is the maximum distance between the magnets that will still hold the sponge(s)?
* What questions do you have?
* Try to explain your observations.
1. Look at a range of different magnets and discuss these questions:
* Predict which one is the strongest. Why do you think it is the strongest?
* Design and carry out an investigation to test your prediction.
* Describe what you did and describe what you observed.
* Was your prediction correct?

***Exploring further***

* Using the strongest magnet and some paperclips, design and carry out an investigation to see where the limit of the magnetic field is, if there is one.
* Does the weakest magnet have a magnetic field that goes the same distance? Make a prediction and then test to see if you are right.
* Make games that use magnets – fishing a paperclip on a string with a magnet, racing magnet cars by using repulsion to drive the cars.
* Create a competition to see if there is any way to make a magnet stronger.
* What do you think might happen if you join more magnets together? Will it make a stronger magnet?

**D: Looking at the magnetic field**

***What you need***

* Variety of differently shaped or sized magnets
* Iron filings or iron sand
* Small compasses

***What to do***

1. Sprinkle the iron sand or put the container of iron filings onto a piece of white paper. Lie this over the top of a bar magnet. Gently shake the paper or tap the iron filings container. Answer these questions:
* What do you observe?
* What do you think is happening?
* What questions do you have?
1. Draw a diagram of the pattern in the iron filings/sand.
2. Do the same for some of the other types of magnets you have and answer these questions:
* What do you notice about the patterns?
* What are the similarities and differences between them for different magnets?
* Do all magnets make patterns in the iron, and are the patterns predictable?
* What are your questions?
1. Put more than one magnet under the paper.
* Look at the patterns created when you have two magnets repelling each other.
* Look at the patterns created when you have two magnets attracting each other.
1. Draw the patterns you see, think about what questions you have and discuss what you think the patterns on your diagram(s) show.
2. Put a set of small compasses around a bar magnet and look carefully at the compass needles.
* What do you notice?
* What could that mean?
* Is there a way of adding this new information to you diagram?
* Do the compasses work around all the magnets in the same way?

***Exploring further***

* Compare and discuss the force lines created by other types of magnets interacting with each other.
* Investigate whether the lines of force alter when an object is in the force field. Does it matter if the object is magnetic or not?
* Using the small compasses and a ruler, design an investigation to detect how far the magnetic field extends.