**Magnets: what patterns can a magnetic field make?**

**Levels:** 3-4  
**NoS achievement aims:** Understanding about science, Investigating in science   
**Contextual strands:** Physical world   
**Topic:** Magnetism

**Rationale**

The lines of a magnetic field arc from one pole.

Students can learn to recognise that there may be more than one reason for the patterns they see in their investigations. By considering the limitations of their own investigative method, students become aware of how scientists attempt to make sure that there can be only one explanation of a phenomenon.

**What you need**

* A set of charm compasses: 6–10 compasses per group. Check that all charm compasses point in the same direction before you hand them to students.
* Two bar magnets per group.
* One set of iron filings or iron sand in salt shakers per group.
* One sheet of OHP transparency per group.
* An illustration of the activity exploration process described below.
* A globe of Earth with magnetic poles labelled.

**Focus**

* What is a magnetic field?
* How can we detect magnetic fields we can’t see?
* What sorts of things do magnets affect?
* How do magnetic fields interact with each other?
* Can the way we undertake investigations affect the results we get? For example, turning on a light to observe animal behaviour at night.
* Why do people sometimes sleep on magnetic mattresses?
* Why do people sometimes wear magnetic beads?

**Exploration**

**Part A**

1. Divide the class into research groups (numbers depend on equipment availability).  
2. Issue one magnet and one charm compass to each group, and say, “We are going to attempt to draw a map of the invisible magnetic field.”  
3. Ask students to place the magnet on the bench and move the compass slowly around the magnet, observing the direction of the needle. Draw and discuss any pattern that they notice.  
4. Now issue the remaining compasses and ask the students to place them so that the needles form a loop (the ‘north’ of one compass needle joins the ‘south’ of the next).  
5. Ask the question, “Has this mapped the real pattern of the magnetic field?”  
6. Ask the students to move any of the compasses in the loop and observe what it does to the rest of the compass needles.  
7. Questions to discuss: “Do the compasses we are using to map the magnetic field affect the field? ” “What evidence do you have to support your idea?” “How do you think a compass could (or couldn’t) affect the magnet’s field?”  
8. Ask the students to take away the magnet and look at the arc of compasses. Ask them to explain what they observe.

**Part B**

9. Issue the second magnet and ask students to place them south-to-north and about 5cm apart.  
10. Ask them to move around **one** compass in the gap between the magnets. What is the field doing?  
11. Try the same, but with magnets north-to-north. Is the pattern the same?

**Part C**

12. Issue the iron filings and OHP transparencies (ask the students not to get iron filings on the magnet because they are hard to get off).  
13. Ask the students to place the transparency over the magnets and to lightly sprinkle the iron filings over them. Observe any patterns they see. Pour the filings back in the shaker and repeat, trying different arrangements of the magnets.

**Part D**

14. Finally, put a compass under the transparency and sprinkle iron filings over it.  
15. Question to discuss: “What does this tell you about what a compass needle is, and why it points north?”

Note: See activity resources below for illustrations of the activity exploration process.

**Reflection**

* How did your first method of mapping the magnetic field distort the field?
* What explanations did you suggest to explain what you saw when one of the compasses was moved or the magnet was removed? Was there only one explanation?
* What do you think scientists might do if they discovered that their method of measuring something actually changed the thing they were measuring?
* Did any of the charm compasses seem stuck or broken?
* If the compasses are not broken, can you explain why they reacted differently to the other compasses?

**Activity resources**

Magnet Photographs illustrating the activity exploration process