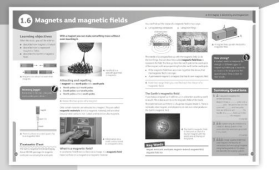
1.6 Magnets and magnetic fields



Physics KS3 NC link:

- magnetic poles, attraction and repulsion
- magnetic fields by plotting with compass, representation by field lines
- Earth's magnetism, compass, and navigation
- non-contact forces: forces between magnets
- using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about changes in systems.

Working Scientifically NC link:

- make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.

Band	Outcome	Checkpoint	
		Question	Activity
Developing	Describe features of a magnet (Level 3).	A, 1	Starter 2, Main
	Draw the magnetic field lines around a bar magnet (Level 4).		Starter 2, Main
	State the Earth has a magnetic field (Level 4).	2	Main, Plenary 1
	Record the shape of field lines round a magnet (Level 4).		Main
Secure	Describe how magnets interact (Level 5).	1, 3	Starter 2
	Describe how to represent magnetic fields (Level 6).	B, 1	Starter 2, Main
	Describe the Earth's magnetic field (Level 5).	2	Main, Plenary 1
	Draw field lines round a magnet in detail (Level 6).		Main
Extending	Explain how magnets can be used (Level 7).	1, 4	Homework
	Compare magnetic field lines and a magnetic field (Level 7).	2	Starter 1, Main
	Explain how a compass works (Level 7).	1, 2	Main, Plenary 1, Plenary 2
	Suggest improvements to an experiment to observe field lines around a magnet (Level 7).		Main

Literacy
Students use scientific terminology correctly when describing magnetic fields and materials.

APP
Students use models when explaining the abstract concept of magnetism (AF1), and communicate observations relating magnetic fields using appropriate diagrams (AF3).

Key Words
magnet, north pole, south pole, magnetic material, magnetic field, magnetic field lines

Answers from the student book

In-text questions	**A** north and south **B** use a compass/iron filings
Activity	**How strong?**

Type of magnet	Distance between paperclip and magnet to get it to float (cm)

Summary Questions	**1** north, south, repel, attract, compass, magnetic field (6 marks) **2** A compass needle always points in a north–south direction. The compass needle lines up in the Earth's magnetic field (which does not change). (2 marks) **3** The game instructions and scoring system should include (6 marks): Clear list of instructions. Using magnets to pick up or guide things. Correct use of north/south poles in the game. Scoring system linked to completion/difficulty. Linking scoring system to magnetic field strength/attraction/repulsion. Correct use of magnetic field strength/attraction/repulsion in scoring system.

kerboodle

Starter	Support/Extension	Resources
Changing fields (15 min) Attach a paperclip to thread and fix the thread firmly to the bench using sticky tape. Use a clamp stand to hold a magnet above the paperclip so it levitates with 3–5 cm between the paperclip and magnet. Students predict the effect of sliding different materials between the paperclip and magnet. Show that sliding non-magnetic materials between the paperclip and magnet has no effect, but magnetic materials disrupt the field so the paperclip falls.	**Extension**: Students suggest reasons for their observations using scientific terminology.	
What is a magnet? (15 min) Snowballing activity where students describe magnets in two or three sentences individually, then share ideas in small groups to come up with one description. Demonstrate field lines around a magnet using iron filings. This can be shown in 3-D if enough iron filings are used. (Ferrofluids can be used to show the 3-D nature of magnetic fields, if available.) Use students' ideas and the demonstration to identify the main features of a magnet (e.g., it attracts certain materials, it attracts/repels other magnets).	**Support**: Provide a list of true/false statements about magnets and magnetic fields. **Extension**: Make certain key words taboo in their description, for example, magnetic, north, and south.	
Main	**Support/Extension**	**Resources**
Drawing magnetic fields (30 min) Students are generally familiar with the concept of magnets and magnetic fields, but a short recap will aid students in their understanding of more abstract concepts. Demonstrate the difference between a magnet and a magnetic material, and their effect on a compass. Discuss the nature of the Earth's magnetic field, and explain that most magnets held close to an object have stronger fields than Earth, which is why compasses point towards a nearby magnet. Students can suggest the properties of the materials used to make a compass needle (magnetic, magnet, or non-magnetic) and the outer casing. Students then carry out a short practical where they use a compass to plot field lines around a bar magnet, and investigate field lines for magnets of different shapes. They then answer the questions that follow.	**Support**: The support sheet provides students with a step-by-step guide on drawing field lines around a bar magnet using a compass. **Extension**: Students predict the shapes of magnetic fields for different-shaped magnets.	**Practical**: Drawing magnetic fields
Plenary	**Support/Extension**	**Resources**
Which way does it point? (10 min) Students choose the correct words to explain how a compass works when filling in the gaps on the interactive resource.	**Extension**: Students should compare the strength of the Earth's magnetic field with a bar magnet.	**Interactive**: Which way does it point?
Navigating with magnets (10 min) Show a video clip from the Internet of migrating birds or homing pigeons. Students suggest how they can navigate. Discuss different theories (bird brains have sensors that respond to the Earth's magnetic field or their eyes respond to directional sunlight). Suggest why people need to use a compass to navigate.	**Extension**: Students suggest other ways to navigate if a compass is not available, or factors that can disrupt a bird's navigational system.	
Homework		
Students investigate magnets at home, finding as many uses as possible for permanent magnets and identifying magnetic materials around the home. Then write a paragraph explaining why magnets are used in these cases.		