

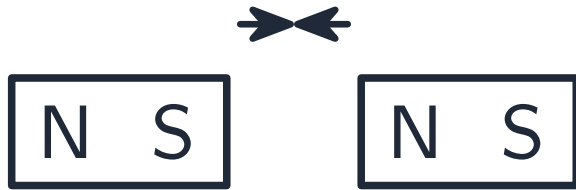
Exercise walk-through

4.1

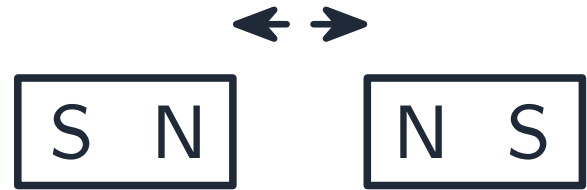
Simple phenomena of magnetism

IGCSE Physics

Read the poles and predict the interaction



N–S attract



N–N repel

Like poles repel; unlike poles attract. Attraction can also occur between a magnet and unmagnetised iron.

Induced magnetism explains attraction

A north pole approaches iron

The nearer end of the iron becomes a south pole; the far end becomes north. Attraction follows between the nearer unlike poles.

Test the claim

Attraction alone does not prove the iron was already a permanent magnet. Repulsion between identified poles is stronger evidence.

Iron, steel, nickel and cobalt are magnetic materials in this syllabus. Copper, plastic and wood are classed as non-magnetic.

Temporary and permanent magnets

Soft iron

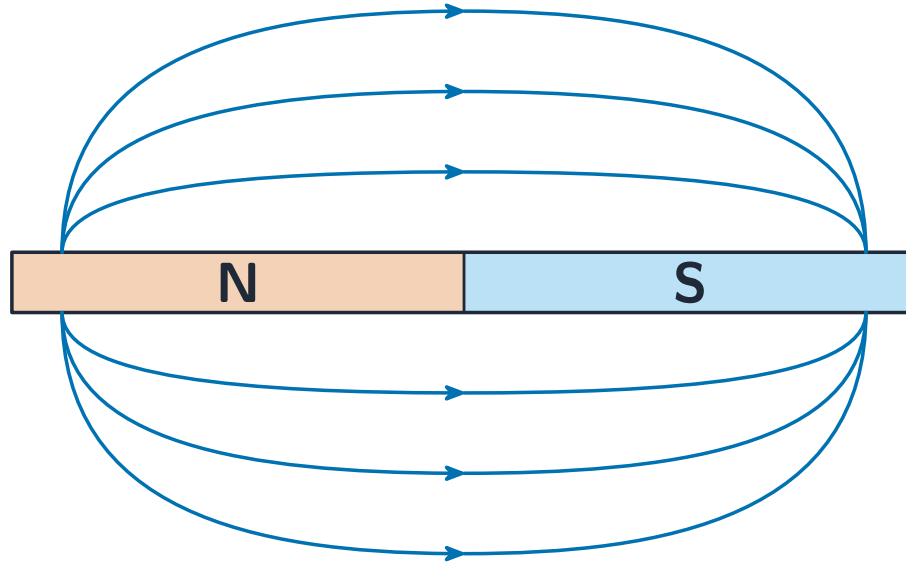
Easy to magnetise and loses most magnetism quickly. Suitable for a relay core that should release when current stops.

Steel

Retains magnetism and is suitable for a permanent magnet, such as a magnetic catch.

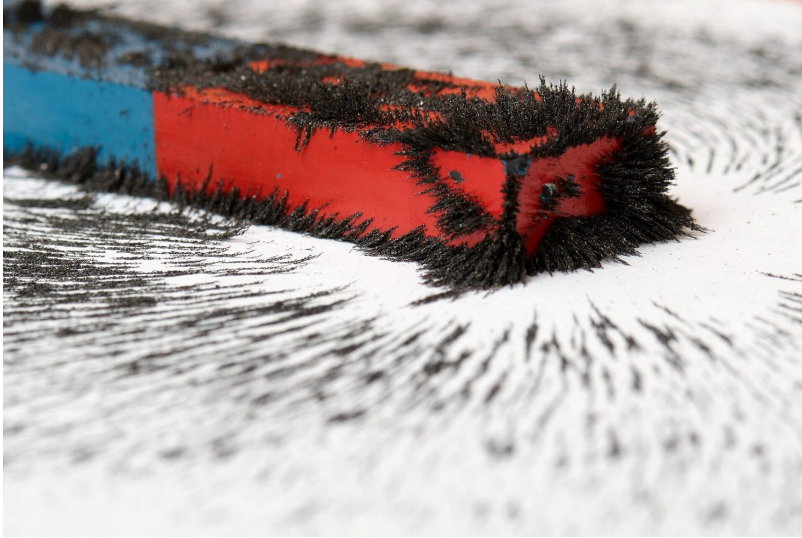
Do not claim every core loses all magnetism instantaneously or that steel is the only possible permanent-magnet material.

Field direction and relative strength



Outside the magnet, lines run N to S. A compass north-seeking pole points along the local field; closer lines indicate a stronger field.

What iron filings reveal



Read the real example

Filings align to show a pattern. They do not supply arrows: a plotting compass is needed to determine field direction.

Maciej J. Mrowinski, CC BY-SA 4.0. The diagram and photograph describe the same field in different ways.

Exercises 2.1·2.2

2.1 State what happens when the N pole of one magnet is brought near the N pole of another. [1]

2.2 State which is better for a permanent magnet: soft iron or steel. [1]

Exercises 2.1·2.2

2.1 State what happens when the N pole of one magnet is brought near the N pole of another. [1]

2.1

- they repel (push apart)
-

2.2 State which is better for a permanent magnet: soft iron or steel. [1]

2.2

- steel

Exercise 3.1

3.1 Magnetic field lines around a bar magnet point:

[1]

☐

A from S to N outside the magnet

B from N to S outside the magnet

C into both poles

D out of both poles

Exercise 3.1

3.1 Magnetic field lines around a bar magnet point:

[1]

☐

A from S to N outside the magnet

B from N to S outside the magnet

C into both poles

D out of both poles

3.1 B

- field lines run from N to S outside the magnet

Exercise 3.2 (a)

3.2 A piece of soft iron is placed next to a magnet.

(a) Explain why the iron becomes magnetised.

[2]

Exercise 3.2 (a)

3.2 A piece of soft iron is placed next to a magnet.

(a) Explain why the iron becomes magnetised.

[2]

(a) the magnet's field induces magnetism in the iron

- the near end gains the opposite pole, so the two attract

Exercise 3.2 (b)

3.2 A piece of soft iron is placed next to a magnet.

(b) State why soft iron, not steel, is used for the core of an electromagnet. [2]

Exercise 3.2 (b)

3.2 A piece of soft iron is placed next to a magnet.

(b) State why soft iron, not steel, is used for the core of an electromagnet. [2]

(b) soft iron magnetises and demagnetises easily

- so the electromagnet can be switched on and off (loses its magnetism when the current stops)

Exercise 3.3

3.3 Describe how you could show the magnetic field pattern of a bar magnet using iron filings. [2]

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3.3

- place paper over the magnet and sprinkle iron filings on top
- tap gently – the filings line up along the field lines, showing the pattern