

Poles of a magnet

4.7.1.1 · Magnetism and electromagnetism · revision notes

The poles of a magnet are the places where its magnetic forces are strongest. You need to describe how like and unlike poles affect each other, and the difference between a permanent magnet and an induced magnet. Expect 1 to 3 mark recall, 'describe' and 'explain' questions, often about magnets, nails or paper clips.

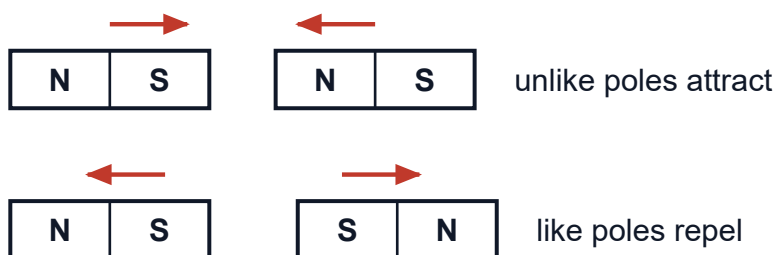
Key facts

- Poles: north (seeking) and south (seeking); forces are strongest at the poles
- Magnetic attraction and repulsion are non-contact forces
- Induced magnet: becomes a magnet only when placed in a magnetic field
- An induced magnet loses most or all of its magnetism quickly when removed from the field
- Like poles repel; unlike poles attract
- Permanent magnet: produces its own magnetic field
- Induced magnetism always causes attraction
- Magnetic materials: iron, steel, cobalt and nickel

Notes

Poles and forces

- Every magnet has two poles: a **north (seeking) pole** and a **south (seeking) pole**.
- The magnetic forces are **strongest at the poles**.
- When two magnets are brought close together, they exert a force on each other.
- **Like poles repel** (N and N, or S and S). **Unlike poles attract** (N and S).



The red arrows show the forces on each magnet.

- The magnets do not have to touch, so magnetic attraction and repulsion are **non-contact forces**.
- The forces get weaker as the magnets are moved further apart.

Permanent and induced magnets

- A **permanent magnet** produces its own magnetic field all the time, e.g. a steel bar magnet.
- An **induced magnet** is a material that becomes a magnet when it is placed in a magnetic field, e.g. an iron nail held near a bar magnet.
- Induced magnetism **always causes a force of attraction**.
- When it is taken out of the magnetic field, an induced magnet loses most or all of its magnetism quickly.
- Iron loses its induced magnetism quickly, which is why it is used for the core of an electromagnet that must switch off. Steel keeps its magnetism, so it is used for permanent magnets.

How to answer each type of question

State whether two magnets attract or repel

1 to 2 marks

Grade 3

1. Find which two poles are facing each other.
2. Like poles repel; unlike poles attract.
3. If one object is only a magnetic material (not a magnet), the answer is always attract.

Example. Two bar magnets, A and B, lie end to end on a table. The north pole of magnet A faces the south pole of magnet B.

- (a) State whether the magnets attract or repel each other.
- (b) Magnet B is turned round, so that its north pole faces magnet A. State whether the magnets now attract or repel.

Model answer. (a) Attract (1)

(b) Repel (1)

Describe the difference between a permanent and an induced magnet

2 to 4 marks

Grade 5

1. Say what a permanent magnet does: it produces its own magnetic field.
2. Say what an induced magnet is: a material that only becomes a magnet when it is in a magnetic field.
3. If asked what happens when the magnet is taken away, say the induced magnet loses (most of) its magnetism quickly.

Example. A bar magnet picks up an iron nail. A second iron nail hangs from the bottom of the first nail.

- (a) The first nail is an induced magnet. Describe the difference between a permanent magnet and an induced magnet. [2 marks]
- (b) The bar magnet is carefully pulled away from the top of the first nail. Suggest what happens to the second nail. Give a reason for your answer. [2 marks]

Model answer. (a) A permanent magnet produces its own magnetic field (1). An induced magnet only becomes a magnet when it is placed in a magnetic field (1).

(b) The second nail falls off (1) because the first nail loses (most of) its magnetism quickly when it is no longer in the magnetic field (1).

Don't lose marks

- ✗ Saying an induced magnet can repel a magnet: induced magnetism always causes attraction.
- ✗ Saying all metals are magnetic: copper, aluminium, gold and silver are not. Only iron, steel, cobalt and nickel are.
- ✗ Saying the forces are strongest in the middle of a magnet: they are strongest at the poles.
- ✗ Using attraction as proof that an object is a magnet.
- ✗ Calling the poles 'positive' and 'negative': magnetic poles are north and south.

More tips

Memory tricks

- Unlike poles attract, like poles repel: the same rule as for positive and negative electric charges.
- 'Attraction can fool you, repulsion proves it': only repulsion shows an object is a magnet.
- ICoNS: Iron, Cobalt, Nickel, Steel are the magnetic materials.
- 'Induced' means 'in a field': an induced magnet is only a magnet while it is in a magnetic field.

Exam technique

- Use the words 'attract' and 'repel'. Vague words such as 'react' or 'affect each other' do not get the mark.
- In 'describe the difference' questions, write about both types of magnet, not just one.
- If a question says an object becomes magnetised only while it is near a magnet, it is describing an induced magnet.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

State where a magnet's forces are strongest

The magnetic forces are strongest at the poles: the north (seeking) pole and the south (seeking) pole.

Grade 3

Predict attraction or repulsion between two poles

Like poles (N and N, or S and S) repel; unlike poles (N and S) attract.

Grade 4

Identify magnetic forces as non-contact forces

Magnets attract or repel each other without touching, so these are non-contact forces.

Grade 5

Describe the difference between permanent and induced magnets

A permanent magnet produces its own magnetic field; an induced magnet only becomes a magnet when it is placed in a magnetic field.

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