Magnets and induced magnetism

Student activity • observation and reasoning

YEAR 11 / LESSON 79 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

What evidence distinguishes a permanent magnet from a material attracted by a magnet?

Test labelled material samples and compare temporary induction with retained magnetism using low-strength school bar magnets.

Equipment

- Two low-strength bar magnets, labelled smooth material samples and paperclips
- Soft-iron and magnetically hard sample strips

Use low-strength school magnets, not small powerful rare-earth magnets. Keep magnets and clips out of mouths and away from sensitive devices or medical implants according to device guidance. Move poles slowly to avoid pinching; use smooth strips, not sharp nails. Staff arrange an observation-only role where needed.

Course coverage: Shared Physics / Double Award: 6.2, 6.3, 6.5. Attraction, repulsion, hard and soft magnetic materials.

Plan, model or apparatus sketch

Draw the particle, pressure or magnetic-field model and label directions and quantities.

Method and reasoning

Read the whole sequence before starting

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1. In ten groups of three, test a low-strength bar magnet with labelled smooth samples of iron, steel, aluminium, copper, wood and plastic. Record attraction without assuming that every metal is magnetic.

2. Bring known north and south poles of two bar magnets towards one another slowly, without allowing them to snap together. Record attraction and repulsion for the four pole combinations.

3. Check whether a smooth soft-iron strip can lift a paperclip before contact with a magnet. Bring a magnet near one end and observe whether the far end can now attract the clip.

4. Remove the magnet well away and observe whether the clip remains supported. Compare with a known magnetically hard steel sample, noting any residual magnetism instead of assuming complete loss.

5. Explain magnetic induction and compare materials that magnetise and demagnetise readily with those that retain magnetism. Do not treat every steel alloy as identical.

6. Explain why repulsion by a known pole is stronger evidence of a magnet than attraction alone. Distinguish this magnetic test from electric-charge tests.

Cleanup

- Count clips and samples, store magnets with the recommended keepers and clear benches.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Soft iron generally magnetises and demagnetises readily; magnetically hard materials retain magnetisation more strongly. Actual samples may have residual magnetism. Attraction alone does not identify a permanent magnet because induced magnetism can also cause attraction.

Test	Observation	Explanation
Material attraction		
Like / unlike poles		
Iron with magnet nearby		
Iron after magnet removed		
Hard material comparison		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Are all metals strongly attracted to a bar magnet?

2. Which poles repel?

3. What is induced magnetism?

4. What does magnetically soft mean?

5. Does every steel sample behave identically?

6. Why is repulsion useful evidence?