

7.1 Permanent and induced magnets, magnetic fields

Name: _____ Class: _____ Date: _____

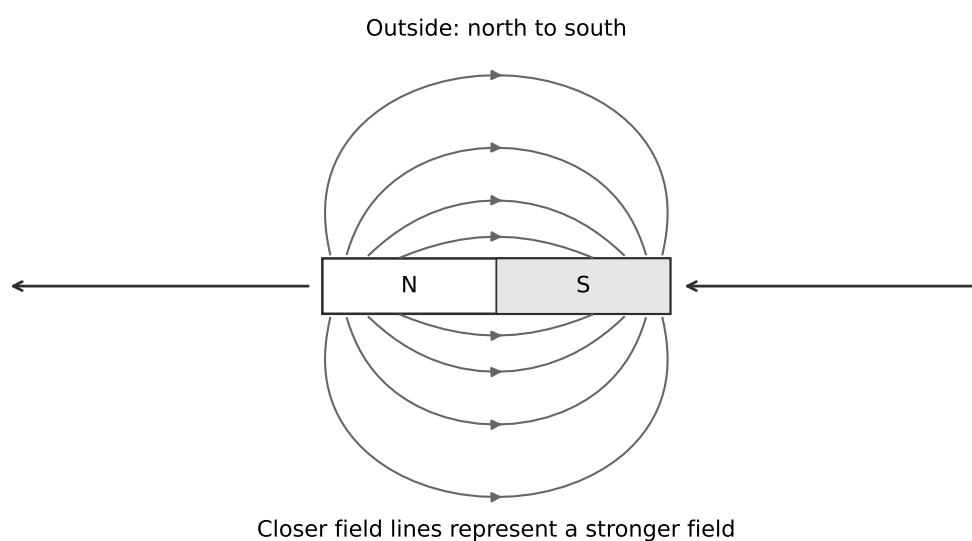
Total: 23 marks

KEY WORDS poles • permanent magnet • induced magnet
• magnetic field

Objective

State the pole rules, distinguish permanent from induced magnets, draw and plot magnetic fields, and explain the compass-Earth link. Original questions for spec statement 4.7.1.

1 Key knowledge and worked examples



Strongest at the poles; lines run $N \rightarrow S$ outside the magnet.

Fact	Statement
poles	where the force is strongest
like poles	repel
unlike poles	attract
force type	non-contact

- **Permanent magnet** : produces its own field.
- **Induced magnet** : becomes magnetised in an external field; attraction to the inducing magnet; loses most/all induced magnetism quickly when removed (soft iron loses it readily).
- **Magnetic materials**: iron, steel, cobalt, nickel. A magnet attracts initially unmagnetised samples; another magnet can attract or repel.
- Field direction = the force on a **north pole** placed there; lines run north → south outside the magnet.
- **Compass**: a small bar magnet; it aligns with the Earth's field – evidence the Earth has a magnetic field.

Plotting with a compass: place the plotting compass near the N pole; mark the needle tip and tail; move the compass so the tail sits on the last mark; repeat; join the dots into a smooth curve. Iron filings show the whole pattern at once.

2 Practice

2.1 Complete: like poles _____; unlike poles _____. [2]

2.2 Give the four magnetic materials. [2]

2.3 Describe how a compass needle behaves near a bar magnet, and what this shows about the Earth. [2]

3 Exam-style questions

3.1 A teacher demonstrates with two bar magnets.

- (a) Describe what happens when the N pole of one is brought near the S pole of the other, and name the force type. [2]
- (b) State two differences between a permanent magnet and an induced magnet. [2]
- (c) A steel paperclip hangs from a bar magnet. Explain why the paperclip can then pick up a second paperclip. [2]

3.2 A student plots the field of a bar magnet with a plotting compass.

- (a) Describe the method step by step. [3]
- (b) State where the field is strongest and how the diagram shows it. [2]
- (c) The student scatters iron filings instead. State one advantage and one limitation. [2]

3.3 Explain why a compass points north, and why it fails to give an accurate bearing near a large iron structure. [4]