

P7 Magnetism and electromagnetism

Physics Paper 2 | AQA Combined Science Trilogy | Key ideas to remember

Poles & fields

1 Magnets and induced magnetism



Unlike facing poles attract

Like poles repel; unlike poles attract.

Magnetic forces are non-contact and strongest at the poles.

Magnetic materials: iron, steel, cobalt, nickel. Not every metal is magnetic.

Permanent: retains its field. **Induced:** an external field magnetises it, causing attraction. Usually loses most/all magnetism quickly when the external field is removed.

Wires & coils

2 Fields and compass plotting

A **magnetic field** is a region where magnets or magnetic materials experience a magnetic force. Outside a bar magnet: **N → S**. Closer field lines mean stronger field. Lines never cross.

A compass is a small magnet. Its **north-seeking end** follows the field. Earth's field aligns it roughly towards geographic north, providing evidence about Earth's core.

Plot: fix the magnet on paper; mark the compass's N end. Move its S end to that mark, let it settle, mark the next N position. Repeat; join dots and add arrows. Use several starting points.

Keep nearby magnets/steel away. Filings show the pattern, but a compass gives direction.

Practical skills

3 Current, wires and solenoids



Dot: current out of page

Field anticlockwise

Cross: in → clockwise

Current produces a field: **concentric circles** around a straight wire. Right-hand grip: thumb = current; curled fingers = field direction.

Greater current → stronger field. Further from wire → weaker field. Reverse current → reverse field.

Solenoid: coil fields reinforce. Inside: strong, nearly uniform, parallel lines. Pattern resembles a bar magnet. Inside S → N; outside N → S.

4 Electromagnets and investigation

Electromagnet: current-carrying coil, usually with an iron core. The magnetised core strengthens the field; soft iron loses most magnetism when switched off.

Strengthen: increase current; add turns at fixed coil length/current; add iron. Reverse current to swap poles.

Investigate: count identical clips lifted. Change one factor; control current, turns, core, coil dimensions and pickup method as appropriate. Use an ammeter.

Repeat; calculate means. Use a current-limited low-voltage supply; switch off if warming. Clip count compares lifting strength, not field in tesla.

5 Higher: motor effect and force

A current-carrying conductor in an external magnetic field can experience a force perpendicular to both current and field.

Fleming's LEFT hand: thumb = force; first finger = field N → S; second finger = conventional current. All at right angles.

F = BIl for a conductor at right angles to the field. F: N; B: tesla (T); I: amperes (A); l: length **inside the field** in metres.

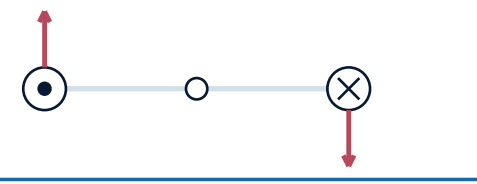
B = 0.20 T, I = 3 A, l = 0.50 m:

F = 0.20 × 3 × 0.50 = 0.30 N.

Convert cm → m and mT → T first.

Reverse current OR field: reverse force. Reverse BOTH: original force direction.

6 Higher: why a motor turns



Field right • end view • clockwise turn

Opposite currents cause opposite forces on the two coil sides. Their turning effect rotates the coil. Left: current out, force up. Right: current in, force down. Rotation is clockwise.

A split ring reverses current each half-turn to sustain rotation. Reverse the supply OR field to reverse rotation.