

Exercise walk-through

Magnetic Fields ■ 12.1

eXercise

You must be able to

- describe a **magnetic field** 磁场 $\vec{B}$ as a vector field from magnets and moving charges
- draw magnetic field lines, noting they form **closed loops** with no isolated poles
- use a compass or the right-hand rule to find the field direction around a magnet

Method — The magnetic field

$\vec{B}$ is a vector field, measured in tesla (T), produced by magnets and by moving charges (currents).

Method — Field lines

Magnetic field lines form **closed loops**, leaving the north pole and entering the south. There are **no isolated poles** (no magnetic monopoles).

Method — Finding the direction

A compass needle lines up with the field; the right-hand rule gives the field around a current.

Practice 2.1 ■ 1 mark

State two things that can produce a magnetic field.

Solution 2.1

Method: Field lines

Worked steps

magnets and moving charges (currents) **B1**.

Practice 2.2 ■ 1 mark

State whether magnetic field lines are open or closed.

Solution 2.2

Method: Field lines

Worked steps

closed (loops) **B1**.

Practice 2.3 ■ 1 mark

State why isolated magnetic poles (monopoles) are never found.

Solution 2.3

Method: Field lines

Worked steps

every magnet has both a north and a south pole; splitting it just makes two smaller magnets **B1**.

Exam-style 3.1 ■ 1 mark

Magnetic field lines

A start and end on charges

B form closed loops

C are always straight

D do not exist

Solution 3.1

Method: Field lines

A start and end on charges

B form closed loops 

C are always straight

D do not exist

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A magnetic field can be produced by

A a stationary charge

B a moving charge

C a neutral atom at rest

D none of these

Solution 3.2

A a stationary charge

B a moving charge



C a neutral atom at rest

D none of these

Worked steps

B.

Exam-style 3.3 ■ 1 mark

A bar magnet is cut in half.

- (a) State what each half becomes.
- (b) Explain your answer in terms of magnetic poles.

Solution 3.3

Method: Field lines

Worked steps

- (a) each half becomes a complete magnet with its own north and south pole **B1**.
- (b) magnetic poles always come in pairs — there are no monopoles — so a new pair of poles appears at the cut **B1** **B1**.