

12.1 Magnetic Fields

Name: _____ Class: _____ Date: _____

Total: 8 marks

Objective

Build the skills to answer exam questions on **magnetic fields**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ The magnetic field

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

■ Field lines

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

■ Finding the direction

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

2 Practice

2.1 State two things that can produce a magnetic field. [1]

2.2 State whether magnetic field lines are open or closed. [1]

2.3 State why isolated magnetic poles (monopoles) are never found. [1]

3 Exam-style questions

3.1 Magnetic field lines [1]

- **A** start and end on charges
 - **B** form closed loops
 - **C** are always straight
 - **D** do not exist
-

3.2 A magnetic field can be produced by [1]

- **A** a stationary charge
 - **B** a moving charge
 - **C** a neutral atom at rest
 - **D** none of these
-

3.3 A bar magnet is cut in half.

(a) State what each half becomes. [1]

(b) Explain your answer in terms of magnetic poles. [2]

4 Go further

- work through the **12.1 Magnetic Fields** lesson on the **Learn** page;
- read the **Magnetism and Electromagnetic Induction** section of the AP Physics 2 handout on the **Know** page.

Solutions

2.1 magnets and moving charges (currents).

2.2 closed (loops).

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

3.1 B.

3.2 B.

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