MAGNETISM DAY 2: LAB L12.1: FIELD MAPPING — MAGNETS & OERSTED

CED 12.1 · Skills 3.A/1.A · FRQ: ED · guided investigation

RETRIEVAL — NO DEMO

A vertical wire carries current out of the page. Draw one compass needle east of the wire. Should the wire-field contribution point **north / south / east / west**?

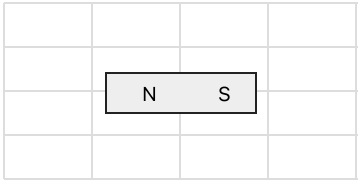
INVESTIGATION QUESTION

What field-line patterns are supported by compass headings around (1) a bar magnet and (2) a vertical current-carrying wire?

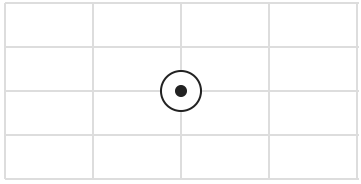
Required evidence: labeled compass headings, two completed maps, and a current-reversal comparison.

PLAN THE TWO MAPPING REGIONS

BAR MAGNET MAP



VERTICAL-WIRE MAP



wire passes through the grid

Hot-wire safety: use a current-limited supply and short pulses. Switch current off before moving the wire or changing connections.

NOTES / REASONING

PROCEDURE

1. Tape the bar-magnet grid in place and mark the magnet's N and S ends.
2. At each chosen grid point, place the compass away from other magnets and record the direction of its north-seeking end.
3. Remove the magnet. Secure the straight wire vertically through the center of the second horizontal grid.
4. With $I = 0$, record the background compass heading at each point you will use.
5. Pulse $I = 5.0\ \mathrm{A}$ in the marked direction. Record the current-on heading at the same points.
6. Reverse the current and repeat several positions. Compare each deflection with the zero-current baseline.

Before collecting data: identify the wire's current direction with • or ×, the compass end you will read, and the maximum on-time for one pulse.

A compass reads the vector sum of the source field and the room's background field. Reversing current reverses the wire's contribution; the absolute compass heading need not rotate exactly 180°.

RAW COMPASS RECORD

Bar magnet

Point	Location	Heading
A		
B		
C		
D		
E		
F		
G		
H		

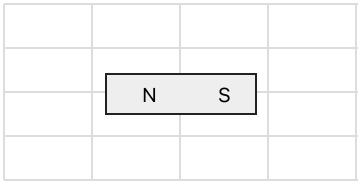
Vertical wire

Point	I=0	+I	–I
A			
B			
C			
D			
E			
F			
G			
H			

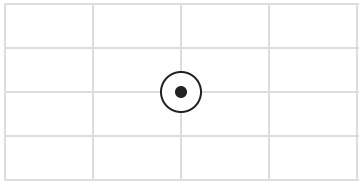
DRAW THE MAPS

USE EACH COMPASS HEADING AS A LOCAL TANGENT

BAR MAGNET MAP



VERTICAL-WIRE MAP



wire passes through the grid

Add arrows; do not connect lines across a region where the measured headings disagree.

Direction reversal: describe how the wire-field contribution changes when current reverses.

ANALYSIS AND CLAIM

1. Where is the bar-magnet field strongest according to the map? Cite the compass pattern or line spacing.

2. Does the wire map support radial lines or circular lines? Cite headings at two positions.

3. Explain why two magnetic field lines cannot cross at one point.

4. Compare the +I and –I trials after accounting for the I=0 baseline.

Claim: state the field pattern for each source.
Evidence: cite at least four compass headings from each map.
Reasoning: connect each heading to a tangent direction and to the grip rule or bar-magnet model.

Required lab record: safety limit, raw headings, two maps, reversal comparison, and evidence-based claim.