

CIRCUITS DAY 4: LAB: I–V CURVES — RESISTOR VS BULB

CED 11.3 · Skills 3.A/2.D · FRQ: ED · bounded investigation

RETRIEVAL — NO DEMO

An element is ohmic when its resistance remains constant over the tested conditions. Predict the I–V graph for (a) a fixed resistor and (b) a bulb that heats: **both straight / resistor straight and bulb curved / both curved**.

QUESTION AND PREDICTION

Question: How does the relationship between current and potential difference differ for a resistor and a bulb?

Evidence standard: use graph shape and the ratio V/I , not brightness alone.

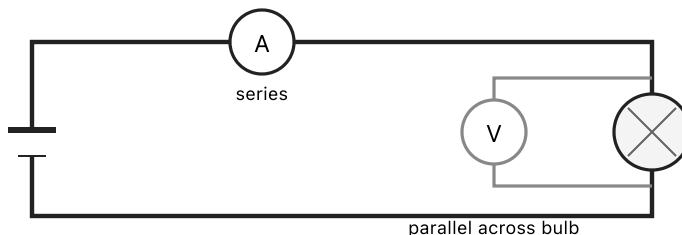
Prediction: Sketch both expected I–V shapes and explain what heating should do to bulb resistance.



SUPPLIES AND SAFETY

DC supply, fixed resistor, flashlight bulb, two digital multimeters, switch, and leads. Sim fallback: PhET *Circuit Construction Kit: DC*, with *Advanced Options* → *Add Real Bulbs* enabled so the bulb is non-ohmic.

Safety: bulbs can become hot. Keep current within the equipment rating; switch power off before changing connections.

DESIGN WITHIN THESE CONSTRAINTS**REQUIRED METER ARRANGEMENT FOR EACH DEVICE**

- The ammeter must be in series and the voltmeter must be across the tested device.
- Collect at least six paired V, I measurements for each device over the same safe voltage range.
- Switch power off before replacing the resistor with the bulb.
- Use a consistent rule for when each reading is recorded; note any brightness change.

Your procedure: choose the voltage range, number/order of settings, settling rule, and whether to repeat trials. Write an ordered procedure that makes the two data sets comparable.

Teacher checkpoint before power: explain both meter connections and the current limit. Never place an ammeter directly across the source.

RAW DATA

Fixed resistor

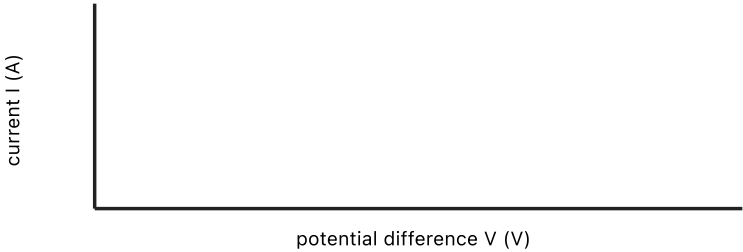
Trial	V (V)	I (A)	V/I (Ω)
1			
2			
3			
4			
5			
6			
7			
8			

Bulb

Trial	V (V)	I (A)	V/I (Ω)
1			
2			
3			
4			
5			
6			
7			
8			

GRAPH

PLOT I VERTICALLY AND V HORIZONTALLY



Use one scale for both devices. Include units, a legend, and a best-fit line or smooth curve.

Resistor slope: choose two well-separated points on the best-fit line. Calculate $\Delta I/\Delta V$, then find $R = 1/\text{slope}$.

ANALYSIS AND CLAIM

1. Is the resistor ohmic over the tested range? Cite graph shape and V/I evidence.

2. Is the bulb ohmic over the tested range? Compare at least two V/I values.

3. Explain the bulb graph using filament temperature and resistivity.

4. State one measurement limitation and how it could affect the graph.

Claim: answer the investigation question in one sentence.

Evidence: cite the resistor slope/ R and the bulb's changing slope or V/I .

Reasoning: connect constant or changing resistance to $V = IR$.

Required lab record: prediction, checked circuit, raw tables, graph, slope calculation, and evidence-based conclusion.