

IV Characteristics of Devices

Physics 225 – Week 5 Activity

LEARNING OBJECTIVES

This lab connects with all five learning objectives presented in the course learning outcomes.

BEFORE, DURING, AFTER

1. Before the experiment, read this document and finish the prelab on Blackboard.
2. During the experiment, take notes in your lab notebook.
3. After the experiment, collaborate with your team on the post-lab report.

RESEARCH QUESTIONS

This goal of this activity is to distinguish between light bulbs, resistors, and light-emitting diodes (LEDs) by analyzing the current-voltage dependence of each device. You should examine the following research questions:

- ① How does the current through each device depend on applied voltage?
- ② Is each device polar or nonpolar? (That is, does direction matter?)
- ③ What is the defining feature of an IV curve for each device?
- ④ Does the IV curve for a light bulb depend on its temperature? If so, how?

RESOURCES

Lab documents:

Materials list and safety notes:

https://drive.google.com/open?id=10STV9HgFC0rJCmFHEITtUAmM_-eDbuTW

Recommended web resources:

Free online textbook section about Ohm's law, discusses resistors and diodes.

https://cnx.org/contents/eg-XcBxE@16.7:p9_fR1dC@5/9-4-Ohm-s-Law

Video: GetToKnowScience, auto-captioned, 12m. The first 8 minutes of this video is a nice walkthrough of I-V curves for resistors, lightbulbs, and diodes.

<https://www.youtube.com/watch?v=UlxBKfnG1co>

EXPLORE QUALITATIVELY

①② Use two multimeters and look for general behavior of current and voltage across each type of device. Record your observations. Your goal is to answer the first two research questions qualitatively.

SAFETY NOTE: Be careful when applying voltages to polar devices. If you get no current, swap directions.

EXPLORE QUANTITATIVELY

③ Generate I-V curves for each type of device. Include a full range of data: positive and negative data points.

SAFETY NOTE: Be careful when taking data for polar devices. If a polar device is in reverse, you will measure 0 current. Measure a few “zero current” data points at low voltages (<0.5 V), then swap directions.

Remember to include error bars on data points. Your goal is to distinguish quantitatively between each type of device. Fits may be useful.

④ Consider how you can quantify the effect of the lightbulb’s temperature. Can you identify any temperature-based behavior in your data?

DELIVERABLES

As a group, use the Lab Work Submission form to finish the post-lab activity. Save your work as a PDF file, and then submit it on Blackboard.