

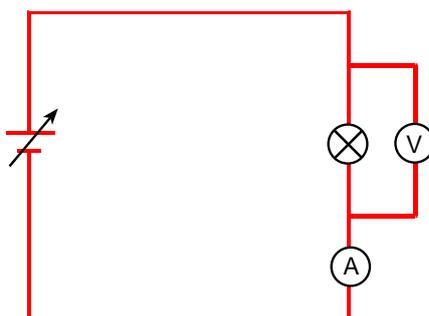
TAP 115- 2: The filament lamp: The relationship between power and applied potential difference

Power dissipation in the filament lamp

How does the electrical power dissipation in a filament lamp vary with the potential difference across it? Remember that the filament has to heat up to a very high temperature before it gives off any light. The filament resistance changes with temperature, and so with the applied potential difference. In this activity you will find out how the power consumption is related to the applied pd

Requirements

- ✓ 4 mm leads
- ✓ stopwatch
- ✓ filament lamp 12 V, 24 W
- ✓ 2 of digital multimeter
- ✓ power supply, 0–12 V dc



What you have to do

1. Set up the circuit shown.
2. Select 0 V on your power supply before switching on the power supply. Switch on the power supply and adjust to a value between 0 V and the maximum voltage rating of the bulb. Warning: you must not exceed the voltage rating of your bulb. Ask for help if in doubt.
3. Record the ammeter and voltmeter readings.
4. Repeat for different potential differences (use at least 6 different voltages between 0 V and 12 V).
5. Record your results in the table, or enter them directly into a spreadsheet.
6. Take steps to check your readings.

Potential difference V / V	Current I / A	Power P / W	Resistance R / Ω

Using your results

Plot a graph of power against voltage. By what factor does the power increase when the voltage doubles? Can you explain this?

Alternative method using a joulemeter

Instead of using an ammeter and voltmeter, connect a filament bulb in a lamp holder to the joulemeter which measures the power dissipated in the lamp.

Reset the joulemeter if applicable. Select 0 V on your power supply. You will select different voltages each time. Warning: you must not exceed the voltage rating of your bulb. Ask for help if in doubt.

Switch on the power supply and adjust to the value required. Switch on the stop clock and reset the joulemeter at the same time. Record the voltmeter reading and also ensure the voltage remains constant. Switch off after 30 seconds or longer, record the time and the joulemeter reading.

Repeat for different voltages (potential differences).

Practical advice

For the first version of this experiment you may like to use smoothing units, if available. However purchase is not justified for this occasional use. Similarly, the alternative method is only for those who already own joulemeters.

The experiment itself is very easy but students should be encouraged to check their readings.

Alternative method using a joulemeter: Many joulemeters come with dual ranges and a scaling of the reading. Most students will not have used a digital joulemeter and will need careful supervision. There is a class joulemeter on the market, but that requires 9–12 V.

External references

This activity is taken from Advancing Physics Chapter 2, 140E