Photoelectric Effect

Photoelectric Effect System

SE-6609

See complete experiment on page 387.

- Find Planck's Constant to within 5%
- Verify the stopping voltage is independent of intensity
- Find characteristics of photodiode

The Photoelectric Effect System is used to perform the photoelectric experiment, determining Planck's Constant to within 5%. This apparatus uses the conventional method of determining Planck's Constant. The metal plate in the photodiode is illuminated with various frequencies of light, selected from a mercury lamp using filters. The voltage is then adjusted to stop the photoelectric current. The stopping voltage is plotted vs. the frequency and Planck's Constant is determined from the slope of the graph.

The concept that the stopping voltage does not change with light intensity is tested using the various apertures that vary the light intensity by partially blocking the light.

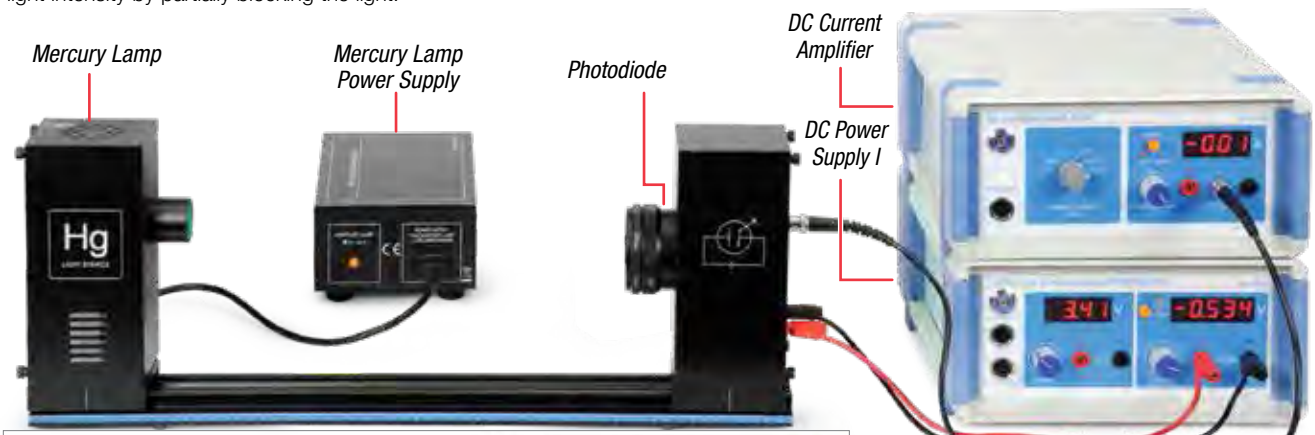
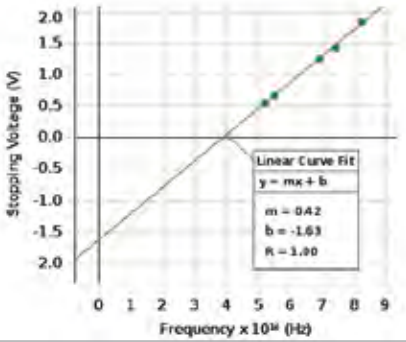


Table I: Photoelectric Effect with 4 mm Aperture

	Run #1 Frequency x 10^{14} (Hz)	Run #1 Stopping Voltage (V)
1	8.214	1.835
2	7.408	1.428
3	6.879	1.248
4	5.490	0.671
5	5.196	0.551



For the typical sample data shown, the graph of Stopping Voltage vs. Frequency gives a slope of 4.2 x 10^{-15} V·s. This results in a value for Planck's Constant of 6.7 x 10^{-34} J·s, which is 1.3% above the accepted value. This graph was generated using PASCO Capstone™ software and the 850 Interface.

Can be used with the 850 Interface (UI-5000, see p. 28) and PASCO Capstone

See the complete experiment on page 387.

Power Supply and Current Amplifier specs: See page 253.

The filters and the apertures are built into the front of the photodiode case, making it easy to keep clean and eliminating the need for a separate storage box. To change the aperture size in order to investigate the effect of different light intensities, simply pull outward on the aperture ring and rotate it to a different aperture. The filter wheel rotates independently of the aperture ring to select different frequencies of light. The wheel clicks into place, assuring that the filter is aligned with the aperture.

SE-6609 includes:

- Basic Photoelectric Effect (SE-6614)
- DC Current Amplifier (SE-6621)
- DC Power Supply I (SE-6615)

SE-6614 includes:

- Mercury Light Source with Hg Tube (SE-6608); *see page 297.*
- Photodiode enclosure with tube and track and cables

Specifications

Current Amplifier
Measuring Range: 10^{-8} to 10^{-13} A in six ranges

Voltage Output for Photoelectric Tube
Voltage Adjustment: –4.5 V to 0 V and –4.5 V to +30 V (two ranges); 4 digit display.

Photoelectric Tube
Spectral Response Range: 300–700 nm
Anode: nickel ring

Optical Filters
Five Filters with Central Wavelengths: 365.0, 404.7, 435.8, 546.1, and 578.0 nm

Order Information

Photoelectric Effect System SE-6609
If you already have the Power Supply and Amplifier, you will need:
Basic Photoelectric Effect Apparatus SE-6614
Replacement Parts:
Photoelectric Tube with Box Plate SE-6612

Photoelectric Effect

EX-5549A

Designed for use with either of the following:

- 850 Universal Interface
- 550 Universal Interface

Concepts:

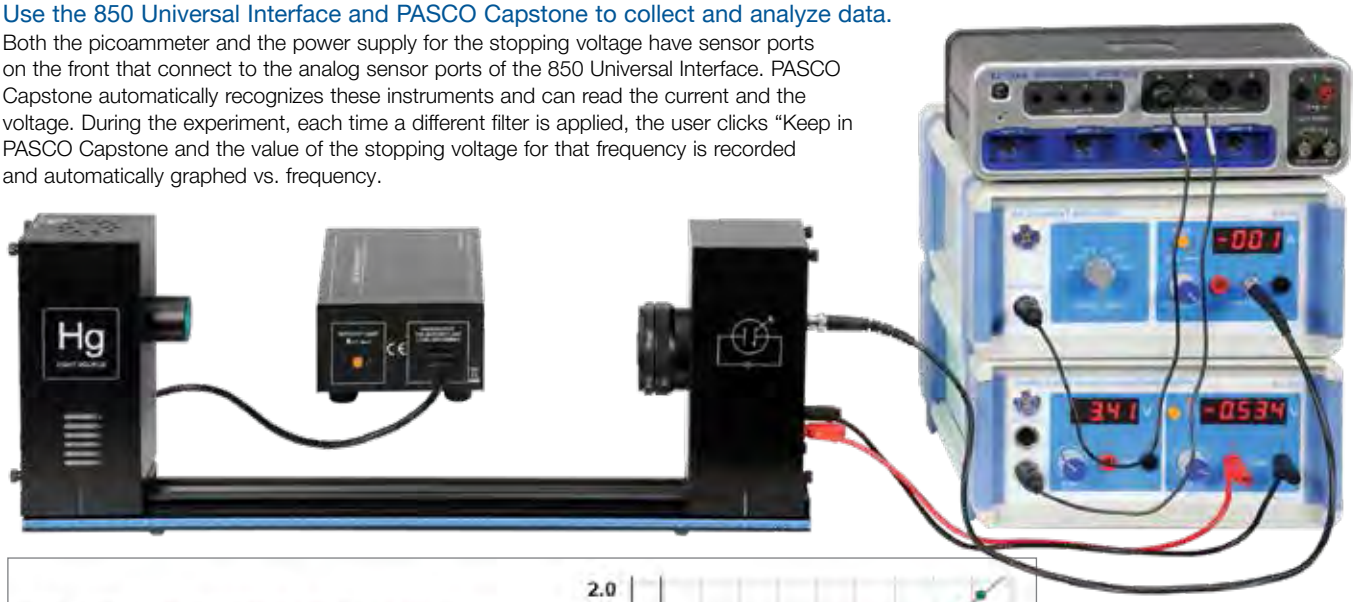
- Connects to the 850 Universal Interface for data collection in PASCO Capstone
- Find Planck's Constant to within 5%
- Verify that stopping voltage is independent of intensity
- Find characteristics of the photodiode

The Photoelectric Effect System is used to perform the photoelectric experiment, determining Planck's Constant to within 5%. This apparatus uses the conventional method of determining Planck's Constant. The metal plate in the photodiode is illuminated with various frequencies of light, selected from a mercury lamp using filters. The voltage is then adjusted to stop the photoelectric current. The stopping voltage is plotted vs. the frequency, and Planck's Constant is determined from the slope of the graph.

The concept that the stopping voltage does not change with light intensity is tested using the various apertures that change the light intensity by partially blocking the light.

Use the 850 Universal Interface and PASCO Capstone to collect and analyze data.

Both the picoammeter and the power supply for the stopping voltage have sensor ports on the front that connect to the analog sensor ports of the 850 Universal Interface. PASCO Capstone automatically recognizes these instruments and can read the current and the voltage. During the experiment, each time a different filter is applied, the user clicks "Keep in PASCO Capstone and the value of the stopping voltage for that frequency is recorded and automatically graphed vs. frequency.



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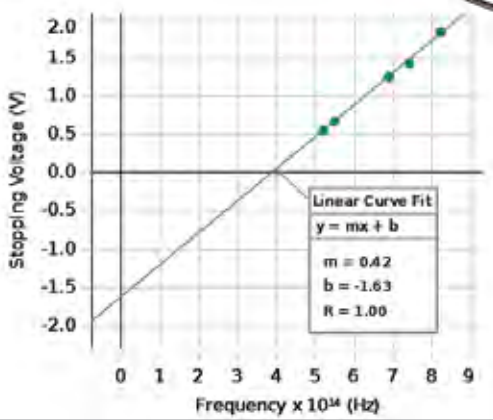

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Experiment Includes

• Photoelectric Effect Apparatus	SE-6614
• DC Current Amplifier	SE-6621
• Tunable DC Power Supply	SE-6615
• Cables for 850 Interface	

Download This Experiment

The FREE experiment files include instructions in Microsoft Word®, PASCO Capstone workbook files with sample data, and graphics. Download these experiments at **www.pasco.com/CapstoneExperiments**.

Order Information

Photoelectric Effect.....EX-5549A

Required:

550 or 850 Universal Interface .....pp. 28-30

PASCO Capstone Software.....pp. 72-75