**Class\_\_\_\_\_\_ Student ID\_\_\_\_\_\_\_\_\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Instructor\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pre-class Assignment Grade\_\_\_\_\_\_\_\_\_\_\_ Final Grade\_\_\_\_\_\_\_\_\_\_**

**Experiment: Determining Planck's Constant Using the Photoelectric Effect**

**I. Pre-Lab**

1. Please briefly derive the relationship between the light frequency *ν* and the corresponding cutoff voltage *U*0 in this experiment.
2. The measured value of the photocurrent in the experiment may differ from the theoretical value. What are the possible causes of this discrepancy? How can this effect be eliminated when measuring the cutoff voltage?

**II. Experimental Phenomena and Raw Data Recording**

（Aperture diameter = 2 mm）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Wavelength *λ*（nm） | 365.0 | 404.7 | 435.8 | 546.1 | 577.0 |
| Frequency *ν* (× 1014Hz) | 8.216 | 7.410 | 6.882 | 5.492 | 5.196 |
| Stopping voltage *U*c（V） |  |  |  |  |  |

（Aperture diameter = 4 mm）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Wavelength *λ*（nm） | 365.0 | 404.7 | 435.8 | 546.1 | 577.0 |
| Frequency *ν* (× 1014Hz) | 8.216 | 7.410 | 6.882 | 5.492 | 5.196 |
| Stopping voltage *U*c（V） |  |  |  |  |  |

（Aperture diameter = 8 mm）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Wavelength *λ*（nm） | 365.0 | 404.7 | 435.8 | 546.1 | 577.0 |
| Frequency *ν* (× 1014Hz) | 8.216 | 7.410 | 6.882 | 5.492 | 5.196 |
| Stopping voltage *U*c（V） |  |  |  |  |  |

|  |  |
| --- | --- |
| **Instructor**  **Signature** |  |

**III. Data Processing**

(Measure the cutoff voltage *U*0 corresponding to each light frequency *v* using three different aperture diameters. Determine the linear relationship between the two. Use the least squares method and graphical method to obtain the experimental value of Planck's constant *h*, and calculate the relative error compared to the standard value:

*h*0 = 6.626×10-34J•s

**IV. Experimental Conclusion and Phenomenon Analysis**

(Analyze the sources of experimental error, and compare the advantages and disadvantages of each data processing method mentioned above.)

**V. Discussion Questions**

1. Please explain what the work function A is and how it can be determined from the linear relationship between the cutoff voltage *U*0​ and the light frequency *v*.
2. Discuss whether the work function A is the same for different metal materials and provide an explanation.
3. Discuss whether the *U*0−*v* linear relationship is the same for different metal materials and provide an explanation.
4. Please explain what dark current, background current, and anode reverse current are, the reasons for their occurrence, and how each affects the measurement of cutoff voltage *U*0​ using the "zero current method."