Physics 30: Unit 5 Lab Exam

Scona Science Club

December 20th, 2022

PRACTICE ONLY

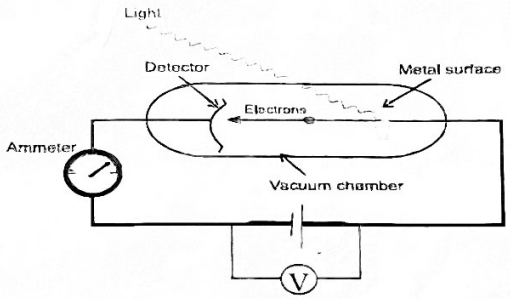
1 Question Paper

Scona Physics 30 *Do not write on the lab sheet* *Unit 5 Lab 1 - Exam*

UNIT 5 LAB 1 - EXAM

Photoelectric Effect Lab

Using the modified photocell shown, light is directed towards a sodium metal surface, causing photocurrent to be created.
The back voltage is then adjusted until the current goes to zero.



The wavelength of the incident light is varied, and the minimum potential difference required to stop the photocurrent is measured.

The following data was obtained:

When using 400 nm light, the minimum potential difference to stop the current was 800 mV
When using 350 nm light, the minimum potential difference to stop the current was 1600 mV
When using 300 nm light, the minimum potential difference to stop the current was 2200 mV
When using 250 nm light, the minimum potential difference to stop the current was 2800 mV

The objective of this experiment is to determine Planck's constant and the work function of the photocathode using graphical analysis.

WRITE-UP

a) Draw and fill in a table summarizing the data collected.

b) Using the principles of physics, show that incident frequency and stopping voltage have a linear (not direct) relationship.

c) Draw and fill in a table for incident frequency and stopping voltage.
Show a sample calculation for the first column below the table.

Hint: Use one simple equation from the formula sheet to convert from wavelength to frequency.

d) Using graphing paper, graph the relationship between stopping voltage and incident frequency.

Determine the slope (including units).
Determine the x- or y-intercept (including units).

If **extra time**, then do not graph the data. Instead, use the graph provided.

Note: If you are regular time and are stuck, you can also use this provided graph.

e) Using the significance of the slope, determine Planck's constant.

Then, using the significance of the x- or y-intercept, determine the work function of the metal.

f) Determine the percent error for Planck's constant.

If the accepted value for calcium's work function is 2.9 eV, then determine the percent error for the work function.

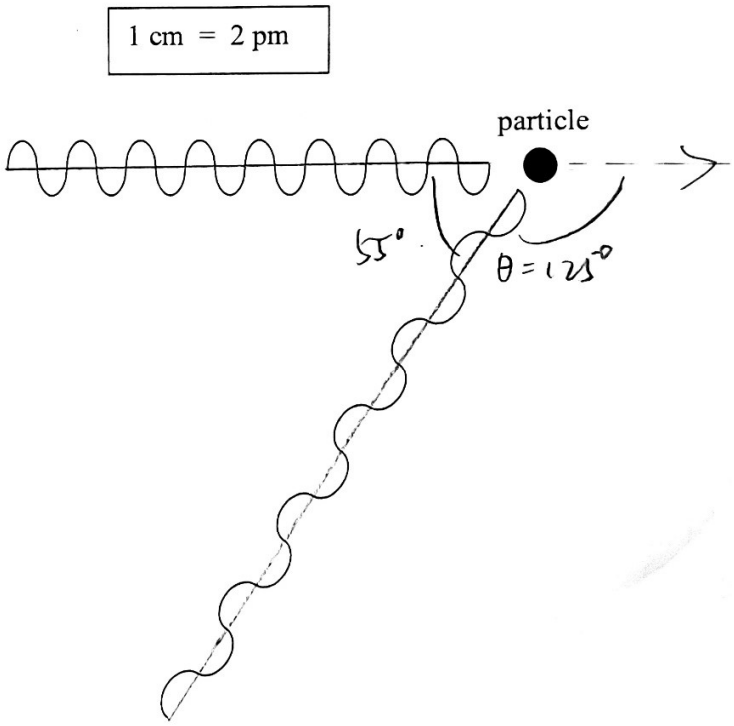
$$\%\ error = \left|\frac{difference}{accepted}\right| \times 100\%$$

2 Bonus Question (HINT. $\Delta\lambda = \frac{h}{mc}(1 - \cos\delta)$)

Bonus

An x-ray photon collides with a stationary particle and is deflected, as shown in the diagram given.

By making appropriate measurements and using the given scale, determine the mass of the particle that was hit by the x-ray.



3 Solution

- To view written solutions, please contact the Scona physics dept. for a copy, thank you!