

PHYSICS VIRTUAL LAB THE PHOTOELECTRIC EFFECT

OBJECTIVE:

Colorado's PhET Photoelectric Effect Simulation.

In this simulation of a photoelectric effect experiment, light of a particular frequency shines on a metal plate. If the energy of the photons is larger than the work function of the metal, electrons are ejected.

Your task is to create a graph that will allow you to find the value of Planck's constant.

PROCEDURE:

1. Select the metal (Sodium).
2. Select the incident light and copy the frequency and the kinetic energy maximum values on the data table.
3. Convert the kinetic energy from eV to Joules.
4. If the electrons are ejected, move the Retarding Voltage cursor until the current stops flowing (red meter shows zero). Write down this voltage under Stopping Voltage.
5. Repeat the procedure (steps 1-4) for Zinc & Copper.

DATA TABLES

Sodium

Incident Light	Frequency (Hz)	KE _{max} (eV)	KE _{max} (J)	Stopping Potential (V)
Yellow 578 nm				
Green 546 nm				
Violet 436 nm				
Ultraviolet 365 nm				
Ultraviolet 254 nm				

Zinc

Incident Light	Frequency (Hz)	KE _{max} (eV)	KE _{max} (J)	Stopping Potential (V)
Yellow 578 nm				
Green 546 nm				
Violet 436 nm				
Ultraviolet 365 nm				
Ultraviolet 254 nm				

Copper

Incident Light	Frequency (Hz)	KE _{max} (eV)	KE _{max} (J)	Stopping Potential (V)
Yellow 578 nm				
Green 546 nm				
Violet 436 nm				
Ultraviolet 365 nm				
Ultraviolet 254 nm				

Analysis. Items to Include.

1. Which variables do you need to plot in order to experimentally determine Planck's constant?
2. Using EXCEL plot your graph clearly labeling the variables and units on each axis.
3. What value does the y-intercept represent?
4. Use your graph to find the experimental value for Planck's constant. Show all your work.
5. The accepted value of Planck's constant is 6.63×10^{-34} J/Hz. Calculate the percent error for each of your graphs.
6. If you graph the frequency versus the stopping potential what quantity do you obtain by calculating the slope of the line? Justify your answer by showing the equation of the slope and the units obtained.
7. Produce a graph of frequency versus the stopping potential for one of the three metals and find the slope.