Name: _____ **Date:** _____

Determination of Planck's Constant

Pre-lab :
Write out a definition for each term below.

- Photoelectrons-
- Work function of a metal-
- Cutoff frequency-
- Planck's constant-

Background:
Characteristics of the photoelectrons are:

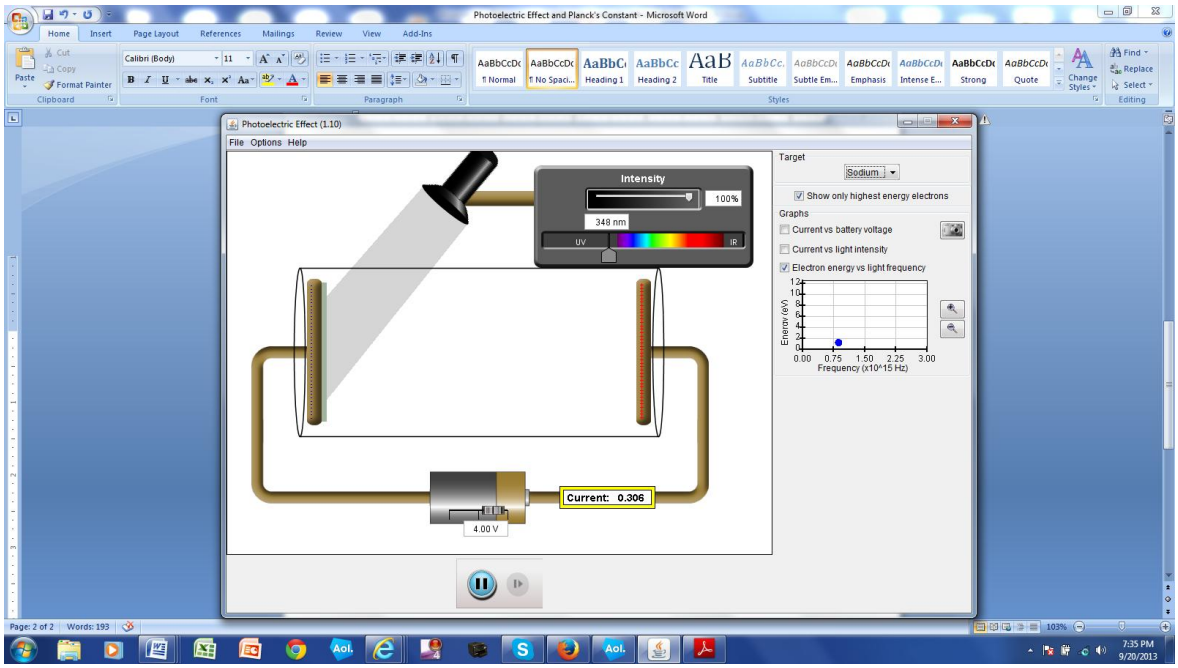
- The rate at which photoelectrons are emitted from the surface is directly proportional to the intensity of the light falling on the emitting surface.
- The maximum kinetic energy of the ejected photoelectrons does not depend on the intensity of the light, but is does depend on the frequency; for a monochromatic beam of light, the maximum kinetic energy of the electrons increases linearly with the frequency of the light.
- For a particular metal there is a definite cutoff frequency (or the threshold frequency) below which no photoelectrons are emitted
- There is no detectable time lag between the impinging of light on the surface of the metal and the emission of the photoelectrons.

Lab Activity – Online Simulation

Open up the University of Colorado, PhET "Photoelectric effect" simulation
https://phet.colorado.edu/en/simulation/photoelectric

Spend a few minutes familiarizing yourself with the controls of the simulation before you begin the lab below.

Finding Planck's constant:



1. Choose the target (the cathode) from the panel at the right side.

2. Slide the source intensity to the maximum (100%).

3. Click "show only highest energy electrons" button.

4. Change the battery voltage using the button at the bottom to any number above the zero and try to adjust the wavelength of light falling on the cathode until you see a current value of zero. Record the wavelength and the battery voltage values as shown in the table below.

5. Calculate the maximum Kinetic Energy by multiplying the charge of the electron by the Battery voltage (or the cut-off voltage).

6. Find the frequency of the light incident on the cathode by using the equation

$$\nu = \frac{c}{\lambda} = \frac{3 \times 10^8}{\lambda}.$$

Material	**Wavelength ($x10^{-9}$m)**	**Battery Voltage (cut-off voltage) (Volt)**	**KE_{max}(e.$V_{stopping}$) (eV)**	**Frequency (ν)**
Sodium				
Zinc				
Copper				
Platinum				
Calcium				

7. Plot a graph of ($KE_{Maximum}$) vs. frequency (**ν**)

8. Find Planck's constant from the slope of the graph, where.

$KE_{max} = h\nu - \phi$
But,
$\phi = 0$
Then,
$h = KE_{max}/ \nu$
Which represents the slope of the graph

9. Find the % error.