AP PHYSICS 2 LAB: PHOTOELECTRIC EFFECT	NAME:

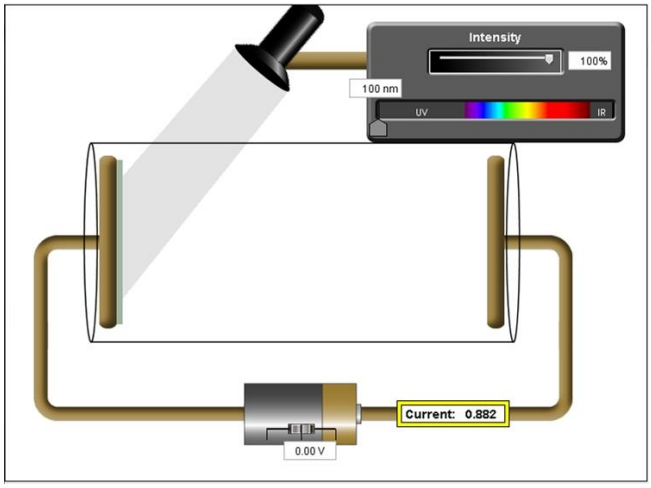
Google: PHET PHOTOELECTRIC EFFECT, run the simulation

1. Start with sodium for target material. Keep the voltage of the battery at 0. Change light intensity and/or light wavelength;
    a. Draw your observations (use arrows to represent the relative velocity of electrons)
    b. Record the magnitude of the electric current

Intensity: 100%

Wavelength: 100 nm

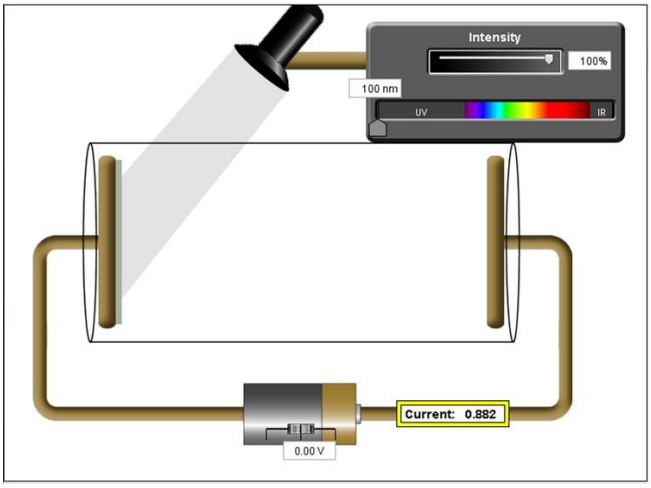
Electric current:



Intensity: 100%

Wavelength: 300 nm

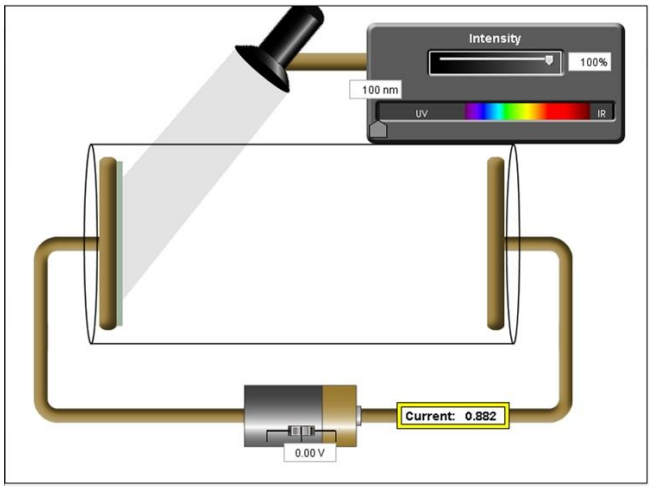
Electric current:



Intensity: 100%

Wavelength: 500 nm

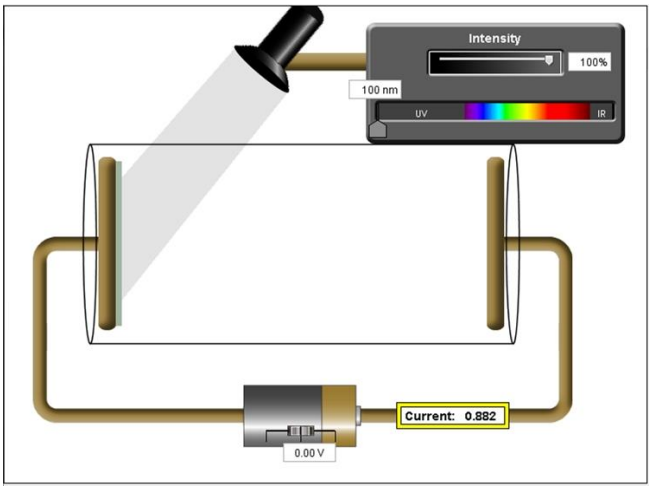
Electric current:



Intensity: 100%

Wavelength: 700 nm

Electric current:



- What is observed when intensity increases?
- What is observed when wavelength increases?
- What is observed when frequency increases?

2. The work function (ϕ):

Write an expression for the work function in terms of h, f, q, ΔV

a. Target: Sodium
b. Set the wavelength to 250 nm (closest to)
c. Move the switch of the battery to the point where electrons no longer reach the opposite plate (stopping voltage).
d. Find the frequency of the light
e. Find the work function in Joules and electron Volts.
f. Do the same for other materials (you may need to adjust the wavelength of light)

	Wavelength λ [nm]	Stopping voltage ΔV [V]	Frequency f [Hz]	Work Function ϕ [J]	Work Function ϕ [eV]
Sodium					
Zinc					
Copper					
Platinum					
Calcium					
?????					

3. Stopping Voltage (ϕ):

Write an expression for the stopping voltage in terms of h, f, q, ϕ

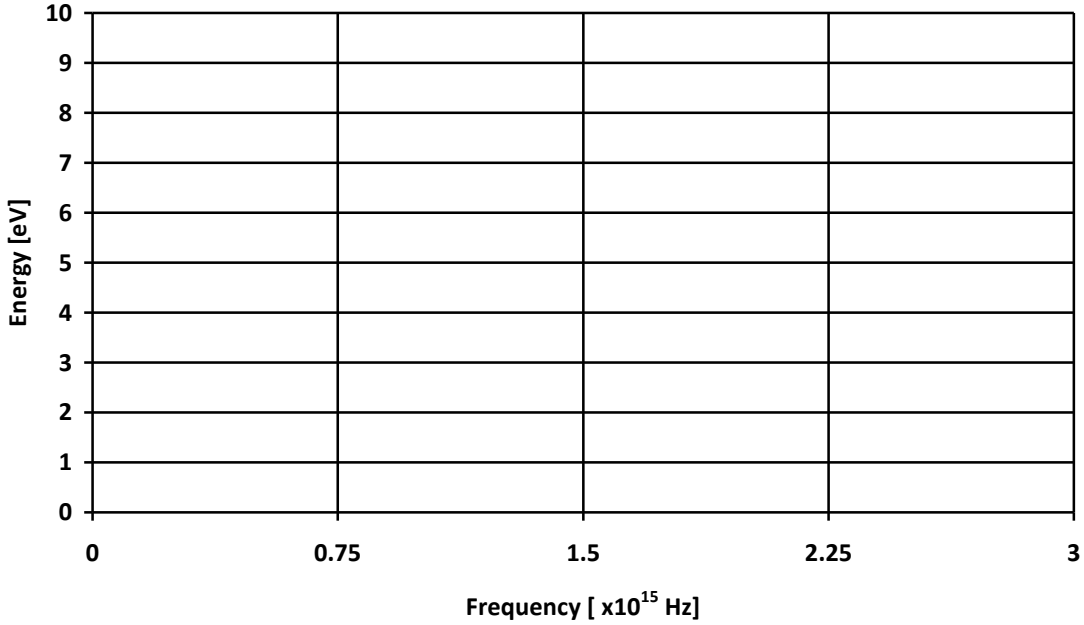
What would be the stopping potential if ultraviolet light of wavelength 250 nm were incident on the surface?

	f [Hz]	$h \cdot f/q$ [V]	ϕ/q [V]	Stopping voltage ΔV [V]
Sodium				
Zinc				
Copper				
Platinum				
Calcium				
?????				

4. Threshold frequency (Cutoff Frequency) – Graph

- Draw the Electron Energy vs. Light Frequency graph for all different targets (use different color pencils)
- Intensity: 100
- Voltage: 0.0 V
- Change the wavelength from 100 nm to 850 nm
- See the Electron Energy vs. Light Frequency graph to the right side of the screen

Electron Energy vs. Light Frequency



5. Threshold frequency (Cutoff Frequency)

Write an expression for the cutoff frequency in terms of h, ϕ

What would be the stopping potential if ultraviolet light of wavelength 250 nm were incident on the surface?

	Work Function ϕ [J]	Cutoff Frequency f [Hz]
Sodium		
Zinc		
Copper		
Platinum		
Calcium		
?????		

6. Kinetic energy

Write an expression for the kinetic energy in terms of q, and ΔV

Write an expression for the kinetic energy in terms of h, f, and ϕ

	Kinetic Energy KE_{max} [J]	Kinetic Energy KE_{max} [J]	% difference
Sodium			
Zinc			
Copper			
Platinum			
Calcium			
?????			

7. Which properties change when target material is changed?

8. Refer to the Electron Energy vs. Light Frequency graph:

- Shape of the graph:
- Using the expression y = mx + b, find a relationship [mathematical model] that relates, the Kinetic energy of the electron to the light frequency.

y	=	slope	·	x	+	intercept
	=		·		+	

9. Describe the additional graphs you can view in the simulations (draw the shape and describe the relationship with words)