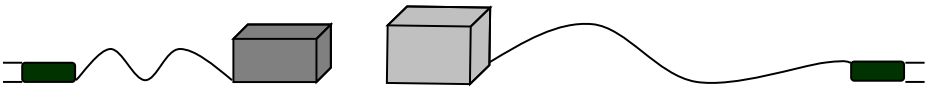
PHOTOELECTRIC EFFECT

NAME_____



INTRODUCTION:

In this lab you will investigate the photoelectric effect. The equipment used in this experiment is similar to that used in the original experiment. It consists of a photoelectric tube, a light source, and a high-voltage source connected to the tube. By using filters, different frequency light (i.e., different energy *photons*) is allowed to reach the phototube. This produces photoelectrons to be emitted with different energies. When the voltage is adjusted to just stop the emitted electrons (the *photocurrent*), the maximum energy of the photoelectrons can be determined. A voltmeter is hooked up to the phototube to allow for this *stopping voltage* determination.

PROCEDURES:

1. Place the mercury vapor source right up against the photocell opening making sure no stray light enters the window.

2. Place the red filter in the holder over the photocell opening thereby allowing only light of that wavelength onto the cell. Note: The photocurrent should decrease as well.

3. Slowly adjust the voltage knob until you *just* drop the current to zero. Be observant because you don't want to miss the first voltage to stop the photoelectrons. Record this voltage as the stopping potential V_o in the table below.

4. Reset the voltage knob back to zero and replace the red filter with the next higher frequency (lower wavelength) filter and proceed as above.

5. Repeat for the remaining filters.

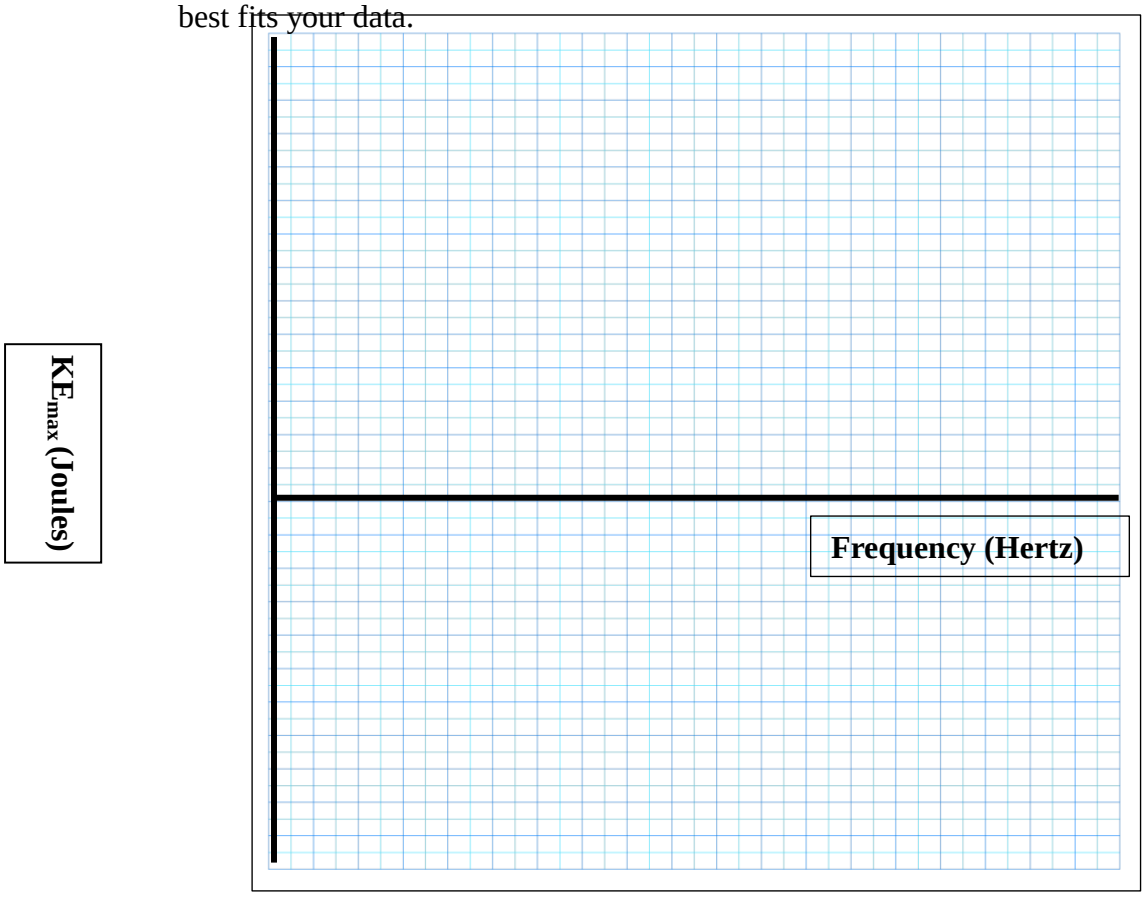
DATA & RESULTS:

Filter Color	Wavelength (m)	Frequency (Hz)	Stopping Potential (V)	Energy (J)

1. Calculate the frequency of the light incident on the photocell for each filter using $\mathbf{c = \lambda f}$. *Show a sample calculation.*

2. Determine the **energy** associated with each stopping voltage by multiplying the stopping voltage by the charge of a single electron. *Show a sample calculation.*

3. Plot a graph of **KE_{max}** (y-axis) **vs frequency** (x-axis). Draw the straight line that best fits your data.



4. What is the value and significance of the line that intersects the x-axis at a point other than 0,0?

5. Choose two points *on your best-fit line* and *show your calculation* of the slope (with units) of the line. What is the significance of the slope?

6. Photographic darkrooms use red safelights while black-and-white prints and some special black-and-white films, such as X-ray film, are processed. The safelights can be used because they do not further expose the film or paper. Why are safelights red?