Prelab of Hertz Critical Potential Tube

After reading the theory and formulas for this experiment, please complete the following questions to be collected at the beginning of the class.

Define the following items:

V_o_____

V_A_____

V_i_____

V_e_____

Explain in briefly your own words the meaning of the following:

Critical Potential_____
_____
_____

Ionization Energy_____
_____
_____

Energy level_____
_____
_____

Work Function_____
_____
_____

Restate in your own words what the following equations indicates:

$V_e = V_A + V_o$
_____
_____
_____

Equipment for the Experiment:

Hertz Console
2 Multimeters
Oscilloscope (analog)
Agilent Power supply 15V-2A
2 BNC-Banana Plug connector
2 PASCO Voltage sensors
Ruler
Many Banana Plug cables

<u>Demo with spectral tube:</u>
1 He spectral lamp
2 Ne spectral lamp
spectroscopes

Analysis of Hertz Console:

For each graph, take note on the multimeters what your V_M and V_{A_max} voltage values are.

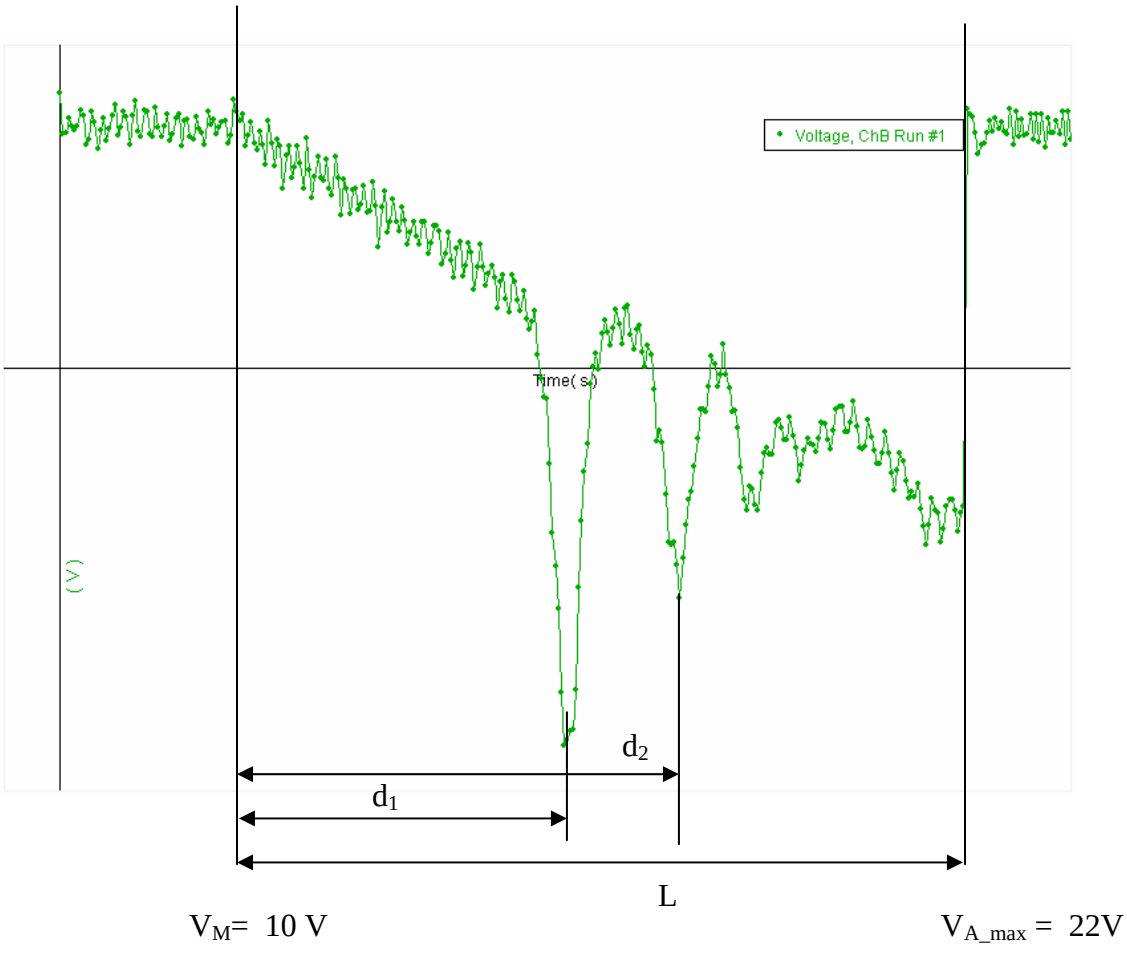

Figure 1: Schematic graph from the Hertz console for Neon as seen in Pasco.

Above is a PASCO graph generated by the Hertz console for Neon. The drop in signal indicates when you hit the start button for "Slow Scan" on the console. This point marks the initial (mark) voltage V_M. The end of scan is reached when the signal returns to its original value. This point marks the maximum acceleration voltage V_{A_max} . Record V_M and V_{A_max} from the multimeter reading – in our case: V_M = 10V and V_{A_max} = 22V. On the print-out of the graph, measure the distance, L in mm, between V_M and V_{A_max} with a ruler. Calculate the calibration factor for each scan.

$$V_{CAL} = \frac{V_{A\_max} - V_M}{L}$$

From your data:

- Determine the voltage for each peak on your graph as shown in Figure 1. Compare t
- Complete Table 01: The Evaluation of the Critical Potentials, V_e
  Note: the V_e' stands for V_e of different levels → V_e^1, V_e^2, V_e^3, ….
- Complete Table 02: The Derivation of Energy Levels, E_n
- Complete Table 03 for relevant n: The Derivation of Possible Transition, ΔE_n
- Derive the excitation energy and wavelength (nm) to the first excited state.

Questions for the Demo with the spectral line tubes for Ne, He:

- What are the spectral lines (colors) you see in the Neon-tube?
- What is the spectral lines (colors) you see in the He-tube?
- Derive the photon energy for these colors and compare these numbers with your data from table 03.

Lab report:

Include a purpose, an introduction including theory and relevant calculations, all graphs, data, tables and calculations. Please answer questions and write a short conclusion mentioning your results and discussing possible sources of error. Also indicate any suggestions to improve this experiment.