Franck-Hertz

Preparatory questions

1. Considering that the energy of the first excited state of the mercury atom is about 5.0 eV above that of the ground state, what is the maximum energy that an electron with 4.0 eV of kinetic energy can impart to a mercury atom in a colision? Same question for a 6.0 eV electron.

2. Use Eq. (1) plus the tabulated values of the temperature dependence of the vapor pressure of Hg to prepare a graph of the theoretical mean free path of electrons in mercury vapor versus temperature. (Note that this equation includes all types of collisions including elastic ones and thus is shorter than the mean free path for inelastic collisions that excite the atom to the $^3P_1$ state.) If this equation applied for inelastic collisions only, what would be the temperature range over which you would do the experiment? Assume that the mercury vapor in the tube is in thermodynamic equilibrium with liquid mercury. You can google the table of vapor pressure of mercury (or find one in the lab).

3. Discuss how Fig. 2 in the writeup will be affected by varying each of the following parameters:

a. Temperature

b. Accelerating voltage

c . Reverse bias

4. What would you do in order to achieve the deepest minima in Fig. 2.