Q- Ohmic heating raises the temperature of a tungsten filament to the point that electrons begin to "boil" off. A high voltage power supply establishes an accelerating potential difference of 900 V between the filament and a circular metal disk located 2.0cm away. The disk diameter is 1.0cm. Assuming the electrons begin at rest, what is their velocity when they strike the disk?

The electric potential at a point in an electric field is the amount of work done to bring a unit positive test charge from infinity to that point. Actually, it means the electrostatic potential energy stored per unit charge. Thus, the potential energy of a charge Q at a point of potential V is given by Q*V.

Potential difference is a more meaningful term. This is the difference in electrostatic potential energy of unit charge between the two points. Thus, if the potential difference between two points is V then the difference in the potential energy of an electron at the two points will be eV, where e is the magnitude of electronic charge.

The electrons are accelerating due to the electric field and the electrostatic potential energy of electrons will convert into their kinetic energy. Thus, applying the law of conservation of energy we can write

Gain in kinetic energy = Loss in electrostatic potential energy

Or $\frac{1}{2}m_e(v_2^2 - v_1^2) = e * \Delta V$

Or $\frac{1}{2}m_e(v - 0) = e * \Delta V$

Or $v = \sqrt{\frac{2e\,\Delta V}{m_e}} = \sqrt{\frac{2*1.6*10^{-19}*900}{9.11*10^{-31}}} = 1.78 * 10^7$ m/s

Hence the velocity of the electrons will be $1.78*10^7$ m/s