

Question.

An electron beam in television tube consists of electrons accelerated from rest through a potential difference of about 20,000V. What is the speed of the electron? Ignore realistic effects.

Solution

The electric field accelerates the electron beam. Acquired kinetic energy E_k equals work A done by field: $E_k = A$;

Energy and work are given by the formulas: $E_k = \frac{m \cdot v^2}{2}$; $A = e \cdot U$;

Equate these values: $\frac{mv^2}{2} = eU$;

Hence we obtain: $v = \sqrt{\frac{2eU}{m}} = \sqrt{\frac{2 \cdot 1.6 \cdot 10^{-19} \cdot 20000}{9.1 \cdot 10^{-31}}} = 83900(m/s)$

Answer: 83900 m/s.