Answer on Question #55881-Physics-Electromagnetism

1 The electron beam in a television tube consists of electrons accelerated from rest through a potential difference of about $U = 20\ 000V$. What is the speed of the electrons? (Ignore relativistic effects). Electron rest mass is $m_e = 9.11 \cdot 10^{-31}\ kg$ and electronic charge is $e = 1.6 \cdot 10^{-19}\ C$.

8.4×107 m/s

3.8×106 m/s

6×106 m/s

4.7×107 m/s

Solution

Kinetic energy of electron accelerated from rest is equal to its potential energy change.

$$\frac{m_e v^2}{2} = eU.$$

The speed of the electron is

$$v = \sqrt{\frac{2eU}{m}} = \sqrt{\frac{2 \cdot 1.6 \cdot 10^{-19} \cdot 20\ 000}{9.11 \cdot 10^{-31}}} = 8.4\ \cdot\ 10^7 \frac{m}{s}.$$

Answer: $\mathbf{8.4\ \cdot\ 10^7 \frac{m}{s}}$.