

Answer on Question #45983, Physics, Electromagnetism

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

Change in potential energy of electron will be equal to its kinetic energy change.

Electron starts from the rest, so:

$$q_e U = \frac{m_e v_e^2}{2}$$

where $m_e = 9.11 \cdot 10^{-31}$ kg – electron rest mass; $q_e = 1.6 \cdot 10^{-19}$ C - is electron charge; $U = 20000V$ - potential difference; v_e – electron's speed;

Thus, the speed of electrons is:

$$v_e = \sqrt{\frac{2q_e U}{m_e}} = \sqrt{\frac{2 \cdot 1.6 \cdot 10^{-19} C \cdot 20000 V}{9.11 \cdot 10^{-31} kg}} \approx 8.4 \cdot 10^7 m/s$$

Answer: the speed of electrons is: $v_e \approx 8.4 \cdot 10^7 m/s$