

**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  $9.11 \times 10^{-31} \text{ kg}$  and electronic charge is  $1.6 \times 10^{-19} \text{ C}$ .*

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

Thus, the speed of electrons is:

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

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