What potential difference is needed to accelerate an electron from rest to a speed of $1.6 \cdot 10^6 \frac{m}{s}$?

Solution.

$$|q| = 1.6 \cdot 10^{-19} C, m = 9.1 \cdot 10^{-31} kg, \upsilon_1 = 0, \upsilon_2 = 1.6 \cdot 10^6 \frac{m}{s};$$

$$U - ?$$

Change the kinetic energy of the electron is equals the work of the electric field on the electron transport:

$$\Delta W = A.$$

Change the kinetic energy of the electron:

$$\Delta W = W_2 - W_1;$$

$$W_1 = \frac{m\upsilon_1^2}{2};$$

$\upsilon_1 = 0$, then $W_1 = 0$ - an electron at rest.

$$W_2 = \frac{m\upsilon_2^2}{2};$$

$$\Delta W = \frac{m\upsilon_2^2}{2} - 0 = \frac{m\upsilon_2^2}{2}.$$

The work of the electric field on the electron transport:

$$A = |q|U.$$

$$\Delta W = A.$$

$$\frac{m\upsilon_2^2}{2} = |q|U;$$

The potential difference:

$$U = \frac{m\upsilon_2^2}{2|q|}.$$

$$U = \frac{9.1 \cdot 10^{-31} \cdot (1.6 \cdot 10^6)^2}{2 \cdot 1.6 \cdot 10^{-19}} = 7.28(V).$$

Answer: $U = 7.28V$.