Answer on Question 62486, Physics, Other

Question:

An electron in a cathode-ray-tube accelerates from $10800\ m/s$ to $4.8 \cdot 10^6\ m/s$ over $2.23\ cm$.

a) How long does the electron take to travel this distance?

b) What is its acceleration?

Solution:

a) We can find the time that the electron take to travel this distance from the kinematic equation:

$$d = \frac{v_i + v_f}{2} t,$$

here, d is the distance, v_i is the initial velocity of the electron, v_f is the final velocity of the electron, t is the time.

Then, from this formula we can calculate the time:

$$t = \frac{2d}{v_i + v_f} = \frac{2 \cdot 0.0223\ m}{10.8 \cdot 10^3\ \frac{m}{s} + 4.8 \cdot 10^6\ \frac{m}{s}} = 9.27 \cdot 10^{-9}\ s.$$

b) We can find the acceleration of the electron from another kinematic equation:

$$v_f = v_i + at,$$

$$a = \frac{v_f - v_i}{t} = \frac{4.8 \cdot 10^6\ \frac{m}{s} - 10.8 \cdot 10^3\ \frac{m}{s}}{9.27 \cdot 10^{-9}\ s} = 5.17 \cdot 10^{14}\ \frac{m}{s^2}.$$

Answer:

a) $t = 9.27 \cdot 10^{-9}\ s$.

b) $a = 5.17 \cdot 10^{14}\ \frac{m}{s^2}$.