Answer on Question #54744 – Chemistry – General chemistry

Question:

What is the wavelength in meters of an electron (mass = 9.1094 × 10-31 kg) that has been accelerated to 70.3% of the speed of light?

Solution:

The wavelength of a particle is given by equation:

$$\lambda = \frac{h}{mv}$$

Where

h is the Planck constant ($6.626070040(81)\times10^{-34}$ J·s),

m is the particle's rest mass,

v is the speed of particle.

So as electron has been accelerated to 70.3% of the speed of light, its speed is equal:

$$v = \frac{70.3 \cdot c}{100}$$

Where

c is the speed of light (3.00×10^{8} m/s)

So, the wavelength of an electron is:

$$\lambda = \frac{6.626070040(81) \times 10^{34} J \cdot s}{9.1094 \times 10^{-31} \times 70.3 \times 3 \times 10^{8}} = 0.3449 \times 10^{-9}\,(m)$$

Answer:

$$\lambda = 0.3449 \times 10^{-9}\,(m)$$