An electron having energy 20 eV collides with a hydrogen atom in the ground state. As a result of the collision, the atom is excited to a higher energy state and the electron is scattered with reduced velocity. The atom subsequently returns to its ground state with emission of radiation of wavelength 1.216×10^{-7} m. Find the velocity of the scattered electron.

The energy lost by the electron in exciting the hydrogen atom equals the energy corresponding to $\lambda = 1.216 \times 10^{7}$ m

$$h\nu = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3.0 \times 10^{8}}{1.216 \times 10^{-7}}$$

$$= 16.36 \times 10^{-19} \text{ J}$$

Now, the initial energy of electron = 20 eV = 32×10^{-19} J.
Hence, the kinetic energy of the scattered electron,

$$E = 32 \times 10^{-19} \text{ J} - 16.36 \times 10^{-19} \text{ J} = 15.64 \times 10^{-19} \text{ J}$$

The velocity v of the scattered electron is given by $\frac{1}{2} mv^2 = E$

or $$v = \left(\frac{2E}{m}\right)^{1/2} = \left(\frac{2 \times 15.64 \times 10^{-19}}{9.11 \times 10^{-31}}\right)^{1/2}$$

$$= 1.86 \times 10^{6} \text{ ms}^{-1}$$