

A neutron moving with a speed v strikes a hydrogen atom in ground state moving towards it with the same speed. Find the minimum speed of the neutron for which inelastic (completely or partially) collision may take place. The mass of neutron \approx mass of hydrogen $= 1.67 \times 10^{-27}$ kg.

Energy of the neutron is $\frac{1}{2} mv^2$.

The condition for inelastic collision is $\Rightarrow \frac{1}{2} mv^2 > 2\Delta E$

$$\Rightarrow \Delta E = \frac{1}{4} mv^2$$

ΔE is the energy absorbed.

Energy required for first excited state is 10.2 eV.

$$\therefore \Delta E < 10.2 \text{ eV}$$

$$\therefore 10.2 \text{ eV} < \frac{1}{4} mv^2 \Rightarrow v_{\min} = \sqrt{\frac{4 \times 10.2}{m}} \text{ eV}$$

$$\Rightarrow v = \sqrt{\frac{10.2 \times 1.6 \times 10^{-19} \times 4}{1.67 \times 10^{-27}}} = 6 \times 10^4 \text{ m/sec.}$$