

587.

Problem 43.5 (RHK)

When an electron moves through a medium at a speed exceeding the speed of light in that medium, it radiates electromagnetic waves (the Cerenkov effect). We have to find the minimum speed that an electron must have in a liquid of index of refraction 1.54 in order to radiate.



Solution:

The speed of electromagnetic waves in a medium of index of refraction n is given in terms of the speed of electromagnetic waves in vacuum, c , as

$$v = \frac{c}{n}.$$

The minimum speed that an electron must have in a liquid of index of refraction 1.54 in order to radiate will be

$$v = \frac{3 \times 10^8}{1.54} \text{ m s}^{-1} = 1.95 \times 10^8 \text{ m s}^{-1}.$$