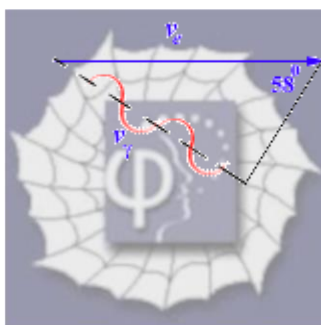


157.

Problem 20.61 (RHK)

The speed of light in water is $2.25 \times 10^8 \text{ m s}^{-1}$ (about three-fourths the speed in vacuum). A beam of high-speed electrons emits Cerenkov radiation in water, the wave front being a cone of angle 58.0° . We have to find the speed of electrons in the water.



Solution:

A beam of high-speed electrons from a betatron emits Cerenkov radiation in water. Let the speed of electrons be v_e . The wave front of the Cerenkov radiation forms a cone of angle 58° . From the diagram we note that the speed of radiation v_γ ($2.25 \times 10^8 \text{ m s}^{-1}$) and the speed of electrons v_e are related as

$$\frac{v_\gamma}{v_e} = \sin 58^\circ = 0.848.$$

Therefore,

$$v_e = \frac{2.25 \times 10^8}{0.848} \text{ m s}^{-1} = 2.65 \times 10^8 \text{ m s}^{-1}.$$

