

### Question 37066

*Walter Light Wave and Percy Photon decide to have a race. Walter runs the entire race in air while Percy slogs his way through crown glass. If Walter beats Percy by  $1.34 \times 10^{-6}$  s, how long was the race?*

A light wave and a photon are essentially the same thing due to the light dualism.

The difference in the travel time is due to the different refraction indices,  $n_W = 1$  for air (Walter) and  $n_P = 1.52$  for the crown glass (Percy). The speed of a photon in a given medium is  $v = \frac{c}{n}$ .

We are given information that  $t_P - t_W = 1.34 \times 10^{-6}$  s.

If the length of the race is  $L$ , the travel times can be calculated as  $t = \frac{L}{v} = \frac{Ln}{c}$ .

This way the equation for time difference transforms into  $\frac{L(n_P - n_W)}{c} = 1.34 \times 10^{-6}$  s.

From this we can work out  $L = \frac{(1.34 \times 10^{-6} \text{ s}) \times c}{(n_P - n_W)}$ .

Using the numerical values,

$$L = \frac{(1.34 \times 10^{-6} \text{ s}) \times 3 \times 10^8 \frac{\text{m}}{\text{s}}}{(1.52 - 1.00)} \approx 773.08 \text{ m}.$$

**Answer:** about 773 m.