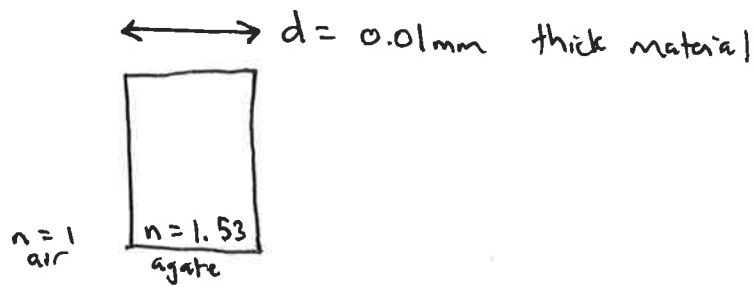


## ASQ vol 3 EX 21.2 (Optical path length)



$N_{\text{air}} = \#$  wavelengths of red light ( $\lambda_{\text{air}} = 700 \text{ nm}$ ) that fit into a length  $d$  of air

$$N_{\text{air}} = \frac{d}{\lambda_{\text{air}}} = \boxed{14.3}$$

$N_{\text{agate}} = \#$  wavelengths of red light ( $\lambda_{\text{agate}} = \frac{\lambda_{\text{air}}}{n_{\text{agate}}}$ ) that fit into a length  $d$  of agate.

$$= \frac{d}{\lambda_{\text{agate}}} = \boxed{21.9}$$

$$\Delta N = N_{\text{agate}} - N_{\text{air}} = \boxed{7.6}$$

The optical path length difference is

$$\lambda_{\text{air}} \Delta N = \lambda_{\text{air}} (N_{\text{agate}} - N_{\text{air}})$$

$$= \lambda_{\text{air}} \left( \frac{n_{\text{agate}} d}{\lambda_{\text{air}}} - \frac{n_{\text{air}} d}{\lambda_{\text{air}}} \right)$$

$$\boxed{\lambda_{\text{air}} \Delta N = (n_{\text{agate}} - n_{\text{air}}) d}$$