The effective bandwidth of any monochromator (m/c) is given by \( \Delta \lambda_{\text{eff}} = w D^{-1} \).

For (echellelette) gratings, \( D^{-1} \) is constant with changing \( \lambda \): \( D^{-1} = \frac{d}{nF} \).

However, for prisms, \( D^{-1} \propto \lambda \Rightarrow D = \frac{1}{\lambda} \).

That is, linear dispersion decreases with increasing \( \lambda \), as shown in Fig. 7-17(b) (p. 158).

Therefore, to keep \( \Delta \lambda_{\text{eff}} \) constant for a prism m/c, the slit width \( w \) must be progressively narrowed as \( \lambda \) increases.

2. Skoog 7-5

(a) \( \lambda_{\text{max}} = \frac{2.90 \times 10^3}{T} \) (in K, \( \lambda_{\text{max}} \) in \( \mu m \)) (Wien's Law)

\( \lambda_{\text{max}} = \frac{2.90 \times 10^3}{2870} = 1.01 \mu m = 1010 \mu m \)

vs. \( \lambda_{\text{max}} = \frac{2.90 \times 10^3}{3000 \, K} = 0.967 \mu m = 967 \mu m \)

(b) Stefan's Law

\( E_T = \left( \frac{5.69 \times 10^{-8} \, W}{m^2 \, K^4} \right) (2870)^4 \, K^4 = 3.86 \times 10^6 \, Wm^{-2} \)

\( E_T = \left( \frac{5.69 \times 10^{-8} \, W}{m^2 \, K^4} \right) (3000)^4 \, K^4 = 4.61 \times 10^6 \, Wm^{-2} \)