

16. According to Eq. 42-6,

$$P(E_F + \Delta E) = \frac{1}{e^{(E_F + \Delta E - E_F)/kT} + 1} = \frac{1}{e^{\Delta E/kT} + 1} = \frac{1}{e^x + 1}$$

where  $x = \Delta E/kT$ . Also,

$$P(E_F - \Delta E) = \frac{1}{e^{(E_F - \Delta E - E_F)/kT} + 1} = \frac{1}{e^{-\Delta E/kT} + 1} = \frac{1}{e^{-x} + 1} .$$

Thus,

$$P(E_F + \Delta E) + P(E_F - \Delta E) = \frac{1}{e^x + 1} + \frac{1}{e^{-x} + 1} = \frac{e^x + 1 + e^{-x} + 1}{(e^{-x} + 1)(e^x + 1)} = 1 .$$

A special case of this general result can be found in problem 13, where  $\Delta E = 63 \text{ meV}$  and  $P(E_F + 63 \text{ meV}) + P(E_F - 63 \text{ meV}) = 0.090 + 0.91 = 1.0$ .