18.31 In order to solve for the electron and hole mobilities for GaSb, we must write conductivity expressions for the two materials, of the form of Equation 18.13—i.e.,

$$\sigma = n|e|\mu_e + p|e|\mu_h$$

For the intrinsic material

$$8.9 \times 10^4\ (\Omega\text{-m})^{-1} = (8.7 \times 10^{23}\ \text{m}^{-3})(1.602 \times 10^{-19}\ \text{C})\,\mu_e + (8.7 \times 10^{23}\ \text{m}^{-3})(1.602 \times 10^{-19}\ \text{C})\mu_h$$

which reduces to

$$0.639 = \mu_e + \mu_h$$

Whereas, for the extrinsic GaSb

$$2.3 \times 10^5\ (\Omega\text{-m})^{-1} = (7.6 \times 10^{22}\ \text{m}^{-3})(1.602 \times 10^{-19}\ \text{C})\,\mu_e + (1.0 \times 10^{25}\ \text{m}^{-3})(1.602 \times 10^{-19}\ \text{C})\,\mu_h$$

which may be simplified to

$$0.1436 = 7.6 \times 10^{-3}\,\mu_e + \mu_h$$

Thus, we have two independent expressions with two unknown mobilities. Upon solving these equations simultaneously, we get $\mu_e = 0.50\ \text{m}^2/\text{V-s}$ and $\mu_h = 0.14\ \text{m}^2/\text{V-s}$.