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 x 10⁴ (Ω - m)⁻¹ = (8.7 x 10²³ m⁻³)(1.602 x 10⁻¹⁹ C)
$$\mu_e$$

+ (8.7 x 10²³ m⁻³)(1.602 x 10⁻¹⁹ C) μ_h

which reduces to

$$0.639 = \mu_e + \mu_h$$

Whereas, for the extrinsic GaSb

2.3 x 10⁵ (
$$\Omega$$
 - m)⁻¹ = (7.6 x 10²² m⁻³)(1.602 x 10⁻¹⁹ C) μ_e
+ (1.0 x 10²⁵ m⁻³)(1.602 x 10⁻¹⁹ C) μ_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 $\mu_h = 0.14 \text{ m}^2/\text{V-s}$.

Excerpts from this work may be reproduced by instructors for distribution on a not-for-profit basis for testing or instructional purposes only to students enrolled in courses for which the textbook has been adopted. Any other reproduction or translation of this work beyond that permitted by Sections 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful.