18.30 (a) This germanium material to which has been added 10^{24} m⁻³ As atoms is *n*-type since As is a donor in Ge. (Arsenic is from group VA of the periodic table--Ge is from group IVA.)

(b) Since this material is *n*-type extrinsic, Equation 18.16 is valid. Furthermore, each As atom will donate a single electron, or the electron concentration is equal to the As concentration since all of the As atoms are ionized at room temperature; that is $n = 10^{24}$ m⁻³, and, as given in the problem statement, $\mu_e = 0.1$ m²/V-s. Thus

$$\sigma = n | e | \mu_e$$

= (10²⁴ m⁻³)(1.602 x 10⁻¹⁹ C)(0.1 m²/V-s)
= 1.6 x 10⁴ (Ω-m)⁻¹

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