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, $\mu_e = 0.1$ $m^2/V\text{-}s$. Thus

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

$$= (10^{24}\ m^{-3})(1.602\ \text{x}\ 10^{-19}\ C)(0.1\ m^2/V\text{-}s)$$

$$= 1.6 \text{ x } 10^4\ (\Omega\text{-m})^{-1}$$