Resistivity of Si

To get a feel for the resistivity of Si, consider three cases: (1) intrinsic Si ($n_o = p_o = n_i$); (2) n-type Si with $N_d = 1x10^{18}$; and (3) p-type Si with $N_a = 1x10^{17}$. In the first case

$$\sigma = q(n_o\mu_e + p_o\mu_h)$$
$$= 1.6x10^{-19}\ C\ x\ 1x10^{10}\ cm^{-3}\ x\ (1500 + 600)\ cm^2\ V^{-1}\ sec^{-1}$$
$$= 3.36x10^{-6}\ (\Omega - cm)^{-1}$$

Therefore the resistivity is $\rho = 1/\sigma = 3x10^5\ \Omega$-cm. In the second case $n_o = 1 \times 10^{18}$ so $p_o = 100$, which is completely negligible. $\sigma = 1.6x10^{-19} \times 1x10^{18} \times 1500 = 240\ (\Omega\text{-cm})^{-1}$ so $\rho = 4.2x10^{-3}\ \Omega$-cm. Finally, in the third case $p_o = 1x10^{17}$ so $n_o = 1000$, which is again negligible. Then $\sigma = 9.6\ (\Omega\text{-cm})^{-1}$ and $\rho = 0.1\ \Omega$-cm.