21: For n-type Si:

$$\phi_n = \chi + (E_c - E_{Fn}) = 4.01 + 0.21 = \underline{4.22\,eV}$$

$$n = N_c \exp\left[-\frac{E_c - E_{Fn}}{kT}\right] = N_d$$

$$\Rightarrow E_c - E_{Fn} = -kT \ln\left(\frac{N_d}{N_c}\right) = -(8.62 \times 10^{-5})(300) \ln\left(\frac{10^{16}}{2.8 \times 10^{19}}\right) = 0.21\,eV$$

$\phi_m > \phi_n$, Schottky contact $\begin{cases} \phi_m = 5.0\,eV \text{ for Au} \\ \phi_m = 4.25\,eV \text{ for Al} \end{cases}$