Kittel. 3.

The Lennard Jones Potential is given by

$U(R) = \frac{A}{R^{12}} - \frac{B}{R^6}$, but it's customary to write

$U(R) = 4\varepsilon\left[\frac{\sigma^{12}}{R^{12}} - \frac{\sigma^6}{R^6}\right]$, find ε, σ, show they are uniquely determined and explain the (~~significance~~ advantage) of this expression.

Trivially solving for σ, ε: $\begin{cases} 4\varepsilon\sigma^{12} = A \\ 4\varepsilon\sigma^6 = B \end{cases}$,

$\frac{A}{B} = \sigma^6$, $\boxed{\sigma = \left(\frac{A}{B}\right)^{1/6}, \quad \varepsilon = \frac{1}{4}\frac{B^2}{A}}$

The advantage of this approach is that the single parameter $\left(\frac{\sigma}{R}\right)^6$ allows one to easily see this potential algebraically is quadratic.

Kittel claims that σ, ε can be obtained ~~for~~ from gas phase data, so these values are independent of the lattice type or any other solid-state-specific properties.