3.6 If $\Omega = CU$ for some constant $C$, then

$$S = k \ln \Omega = \frac{f}{2} Nk \ln U + k \ln C$$

$$\left(\frac{\partial S}{\partial U}\right)_N = \frac{f}{2} Nk \frac{1}{U} = \frac{1}{T} \quad \text{by Eqs 3.10}$$

$$\Rightarrow U = \frac{f}{2} NkT \quad \text{which we recognize as Eqs 1.23, a version of the equipartition theorem.}$$

The formula for $\Omega$ cannot be valid when $U$ is very small because if $U$ becomes small enough, then $\Omega < 1$, which would be nonsense.