19.5 For aluminum, we want to compute the Debye temperature, $\theta_{\mathrm{D}}$, given the expression for $A$ in Equation 19.2 and the heat capacity at 15 K . First of all, let us determine the magnitude of $A$, as

$$
\begin{gathered}
A=\frac{C_{v}}{T^{3}} \\
=\frac{(4.60 \mathrm{~J} / \mathrm{mol}-\mathrm{K})(1 \mathrm{~kg} / 1000 \mathrm{~g})(26.98 \mathrm{~g} / \mathrm{mol})}{(15 \mathrm{~K})^{3}} \\
=3.68 \times 10^{-5} \mathrm{~J} / \mathrm{mol}-\mathrm{K}^{4}
\end{gathered}
$$

As stipulated in the problem statement

$$
A=\frac{12 \pi^{4} R}{5 \theta_{\mathrm{D}}^{3}}
$$

Or, solving for $\theta_{D}$

$$
\begin{gathered}
\theta_{\mathrm{D}}=\left(\frac{12 \pi^{4} R}{5 A}\right)^{1 / 3} \\
=\left[\frac{(12)(\pi)^{4}(8.31 \mathrm{~J} / \mathrm{mol}-\mathrm{K})}{(5)\left(3.68 \times 10^{-5} \mathrm{~J} / \mathrm{mol}-\mathrm{K}^{4}\right)}\right]^{1 / 3}=375 \mathrm{~K}
\end{gathered}
$$

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