19.5 For aluminum, we want to compute the Debye temperature, θ_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

$$A = \frac{C_v}{T^3}$$

$$= \frac{(4.60\ \text{J/mol-K})(1\ \text{kg/1000 g})(26.98\ \text{g/mol})}{(15\ \text{K})^3}$$

$$= 3.68 \times 10^{-5}\ \text{J/mol-K}^4$$

As stipulated in the problem statement

$$A = \frac{12\pi^4 R}{5\theta_D^3}$$

Or, solving for θ_D

$$\theta_D = \left(\frac{12\pi^4 R}{5A}\right)^{1/3}$$

$$= \left[\frac{(12)(\pi)^4(8.31\ \text{J/mol-K})}{(5)(3.68 \times 10^{-5}\ \text{J/mol-K}^4)}\right]^{1/3} = 375\ \text{K}$$