[tex40] **Equation of state and adiabate of an elastic band**

Experimentally one finds the following response functions of a band of elastic material

$$\left(\frac{\partial J}{\partial L}\right)_T = \frac{aT}{L_0}\left[1 + 2\left(\frac{L_0}{L}\right)^3\right], \quad \left(\frac{\partial J}{\partial T}\right)_L = \frac{aL}{L_0}\left[1 - \left(\frac{L_0}{L}\right)^3\right],$$

where J is the tension, L is the length, T is the temperature, and a, L_0 are constants. The heat capacity at constant length is $C_L = \text{const}$.

(a) Use this empirical information to reconstruct the equation of state $J(T, L)$.

(b) Calculate the response function $(\partial L/\partial T)_J$ and discuss its physical meaning.

(c) If the band is stretched adiabatically from length L_0 at temperature T_0 to length $2L_0$, what is the final temperature?