Exercise 10-6

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$$PV + f(V) = AU \qquad C_V = \left(\frac{\partial U}{\partial T}\right)_V$$

$$C_V = \left(\frac{\partial}{\partial T}\left(\frac{PV + f(V)}{A}\right)\right)_V$$

$$= \frac{V}{A}\left(\frac{\partial P}{\partial T}\right)_V + \frac{P}{A}\left(\frac{\partial V}{\partial T}\right)_V + \frac{1}{A}\left(\frac{\partial f(V)}{\partial T}\right)_V$$

$$= \frac{V}{A}\left(\frac{\partial P}{\partial T}\right)_V \qquad = \frac{V}{A}\left(\frac{\partial S}{\partial V}\right)_T$$

Maxwell relation

$\lim_{T \to 0} C_V = \lim_{T \to 0} \frac{V}{A}\left(\frac{\partial S}{\partial V}\right)_T = 0$, as the change of S goes to zero as T goes to zero. (by the 3rd law)