

Homework 20 (Due Thursday, May 3rd)

1. (a) Show that the variance in the fluctuation of energy is

$$\overline{(\Delta E)^2} = \left[T \left(\frac{\partial P}{\partial T} \right)_V - P \right]^2 kTV\kappa_T + C_V kT^2$$

Hint: $(\partial E/\partial V)_T = T(\partial S/\partial V)_T - P$

(b) Using the result above show that for a monatomic classical ideal gas

$$\frac{\overline{(\Delta E)^2}}{\bar{E}^2} = \frac{2}{3N}$$

2. Show that

$$\overline{(\Delta T \Delta S)} = -\overline{(\Delta P \Delta V)}$$

by calculating the term on each side of this equation.