# Response functions



- How is the constant volume heat capacity, $C_V$, defined:

- Show that $\frac{C_v}{T} = \left(\frac{\partial S}{\partial T}\right)_V$

- Is the Gibbs free energy minimised at equilibrium or maximised at equilibrium (justify your answer).

- Use your answer to to the previous question to explain why $\delta E > T\delta S - P\delta V$.

# Response functions



- Use the result from the previous question to show, by expanding $\delta E$ using the Taylor series, that $\left(\frac{\delta^2 E}{\delta S^2}\right)_V > 0$ and $\left(\frac{\delta^2 E}{\delta V^2}\right)_S > 0$.

- Hence, show that $C_v$ must be greater than zero

- Give the definition of the isoentropic compressibility, $\kappa_s$.

- Show that $\kappa_s = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_S$

# Response functions

- Explain why the isoentropic compressibility must be positive