



MathsNET

A joined up approach to
teaching and learning
mathematics

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 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 δE 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 isentropic compressibility, κ_s .
- Show that $\kappa_s = -\frac{1}{V} \left(\frac{\partial V}{\partial P}\right)_S$



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- Explain why the isentropic compressibility must be positive