



MathsNET

A joined up approach to
teaching and learning
mathematics

Reservoirs and thermodynamic potentials

- What makes reservoirs a special kind of phase?
- Give an expression for the infinitesimal dH , where H is the enthalpy.
- What are the values of the following partial derivatives: $\left(\frac{\partial H}{\partial P}\right)_S$ and $\left(\frac{\partial H}{\partial S}\right)_P$
- Give an expression for the infinitesimal dF , where F is the Helmholtz free energy.
- What are the values of the following partial derivatives: $\left(\frac{\partial F}{\partial V}\right)_T$ and $\left(\frac{\partial F}{\partial T}\right)_V$

Reservoirs and thermodynamic potentials

- Gibbs free energy** The Gibbs free energy is defined as $G = H - TS$, where H is the enthalpy. Use what you have learnt from the video to find an expression for the infinitesimal dG and the values of $\left(\frac{\partial G}{\partial P}\right)_T$ and $\left(\frac{\partial G}{\partial T}\right)_P$

- Grand potential** The Grand potential is defined as $\Omega = E - TS - \sum_i \mu_i n_i$. Use what you have learnt from the video to find an expression for the infinitesimal $d\Omega$. You will need to use an extended form of the first and second laws of thermodynamics: $dE = TdS - PdV + \sum_i \mu_i dn_i$. Use the expression you derived to find values for $\left(\frac{\partial \Omega}{\partial V}\right)$, $\left(\frac{\partial \Omega}{\partial T}\right)$ and $\left(\frac{\partial \Omega}{\partial \mu_i}\right)$