## Reservoirs and thermodynamic potentials hathematics MathsNET A joined up approach to teaching and learning potential shathematics

• 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  $\left(\frac{\partial F}{\partial T}\right)_V$ 





• Gibbs free energy The Gibbs free energy is defined as G = H - TS, where H is the entropy. 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 dG. 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  $\left(\frac{\partial \Omega}{\partial \mu_i}\right)$