The generalised partition function

- How is the average energy, $\langle E \rangle$, calculated from the probabilities of being in the various microstates P_i and the energies of the various microstates P_i

- Explain what two types of constraints are introduced on extensive thermodynamic variables when constructing thermodynamic states from the various microstates in phase space.

- Complete the following sentence: We can determine the probability of being in any given microstate by...

- Write down the function for which we are finding the constrained minimum and the two constraints on this function

The generalised partition function

- Write down the extended function whose unconstrained optimum is found in order to find the required constrained optimum.

- Write down the partial derivative of the function you have just written down with respect to P_j.

- Explain why the derivative of $f = \sum_i P_i$ with respect to P_j is equal to one.

- Give an expression for the derivative of $g = \sum_i \lambda B_i P_i$ with respect to P_j.

The generalised partition function

- Give an expression for the derivative of $h = \sum_i P_i \ln P_i$ with respect to P_j.

- Explain (by making reference to the results that you have written down to the previous questions) why the probability of being in a microstate is given by: $P_j = \frac{e^{-\sum_k \lambda_k B_j^{(k)}}}{e^{\Psi}}$

- Give an expression for the generalised partition function and explain how this is derived.