

4.6: The Equivalence of Canonical and Microcanonical Ensembles

In a microcanonical ensemble the individual systems are all restricted, by definition, to have a given energy. In a canonical ensemble the individual systems are *allowed* to have any energy, from that of the ground state to that of an ionized plasma, but we have seen that (for large systems) they tend not to use this permission and instead they cluster within a narrow band of energies. We might expect, therefore, that a calculation performed in the microcanonical ensemble for systems at a given energy value, say 5 Joules, would give the same results as a calculation performed in the canonical ensemble for systems at whatever temperature corresponds to an average energy of 5 Joules.

If the canonical and microcanonical ensembles give the same results, why bother with the canonical ensemble? We will see soon (section 5.1) that calculations are much easier to perform in the canonical ensemble.

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