Answer on Question #61169-Physics-Molecular physics | Thermodynamics

State the principle of equipartition of energy.

Answer

In a system in thermal equilibrium, on the average, an equal amount of energy will be associated with each independent energy state. This law states specifically that a system of particles in equilibrium at absolute temperature T will have an average energy of $\frac{1}{2}kT$ associated with each degree of freedom. In addition, any degree of freedom contributing potential energy will have another $\frac{1}{2}kT$ associated with it. For a system of s degrees of freedom, of which t have associated potential energies, the total average energy of the system is $\frac{1}{2}(s+t)kT$.

Write a relation between number of degrees of freedom f, number of particles constituting the system p and the total number of constraints c.

Answer

$$f = 3p - c$$

Calculate the degrees of freedom for (i) single atom, (ii) diatomic molecule.

Solution

(i) $p = 1, c = 0$.

$$f = 3(1) - 0 = 3$$

(ii) $p = 2, c = 1$.

$$f = 3(2) - 1 = 5$$