1. Simple harmonic oscillator

2. Combining two independent aspects of a system

3. 3D SHM

4. application to crystal vibrations

5. Rotator

6. Equipartition theorem

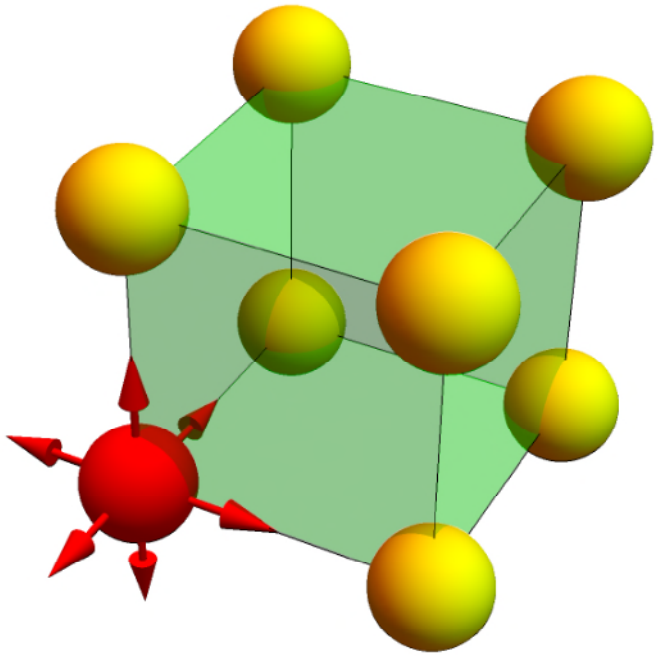
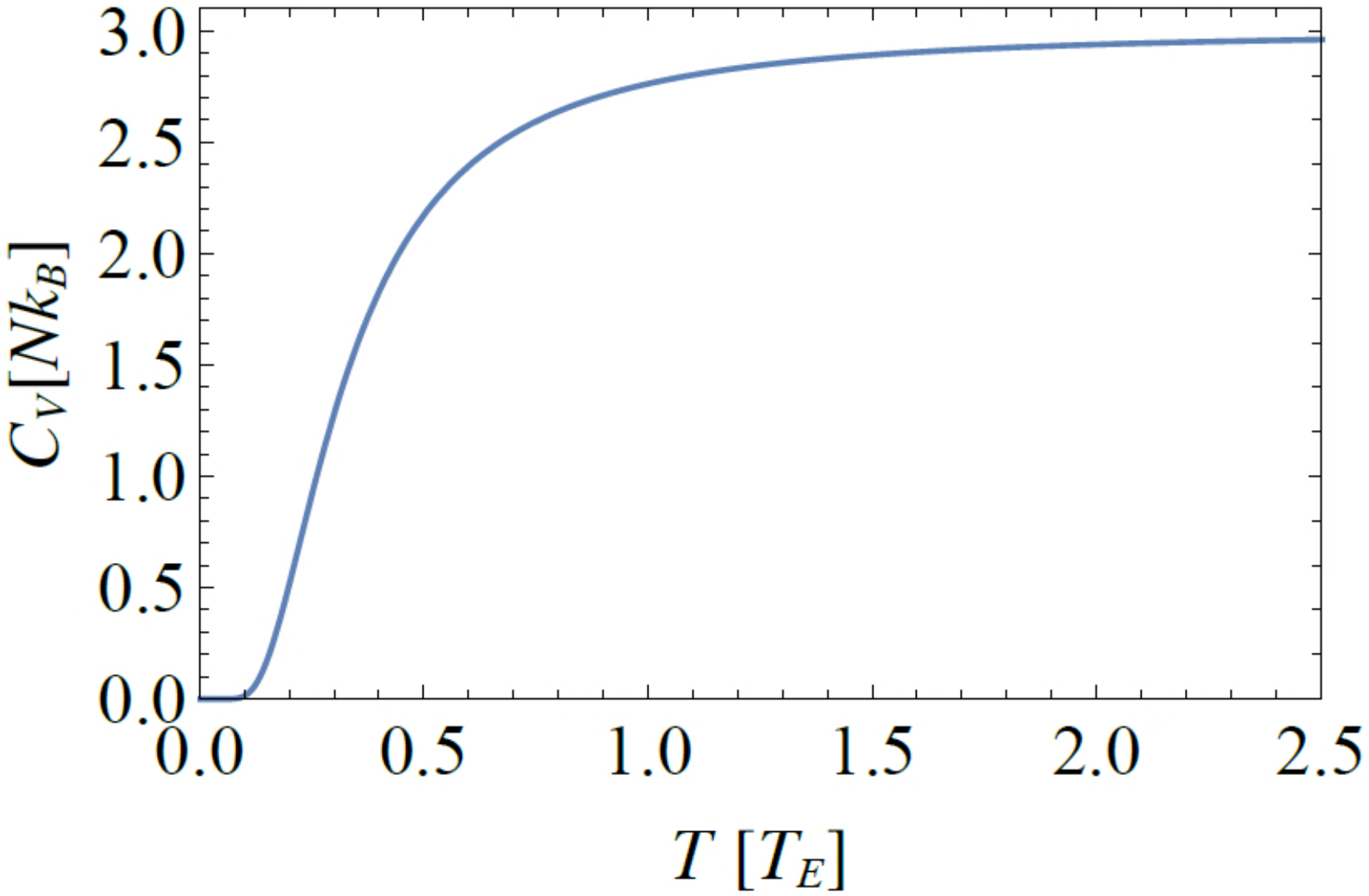


Diagram to illustrate the idea of an atom in a crystal vibrating around its equilibrium position. (Of course, all the atoms vibrate in practice, not just one!)



Heat capacity of a 3-dimensional crystal owing to vibrations, according to a simple model (the Einstein model) which only allows for one vibrational frequency.

Theorem 8.1 Equipartition theorem. *Each independent quadratic term in the Hamiltonian makes a contribution* $\frac{1}{2}k_{\mathrm{B}}T$ *to the mean internal energy in thermal equilibrium when the associated motion is highly excited.*