

The definition of a partition function  $Z$  is:

$$Z = \sum_i e^{-\frac{E_i}{kT}}$$

Where  $E_i$  is the energy of state  $i$ ,  $k$  is the Boltzmann's constant and  $T$  is the temperature. The summation is done over all states.

In our case:

$$i = 2$$

$$E_1 = 0$$

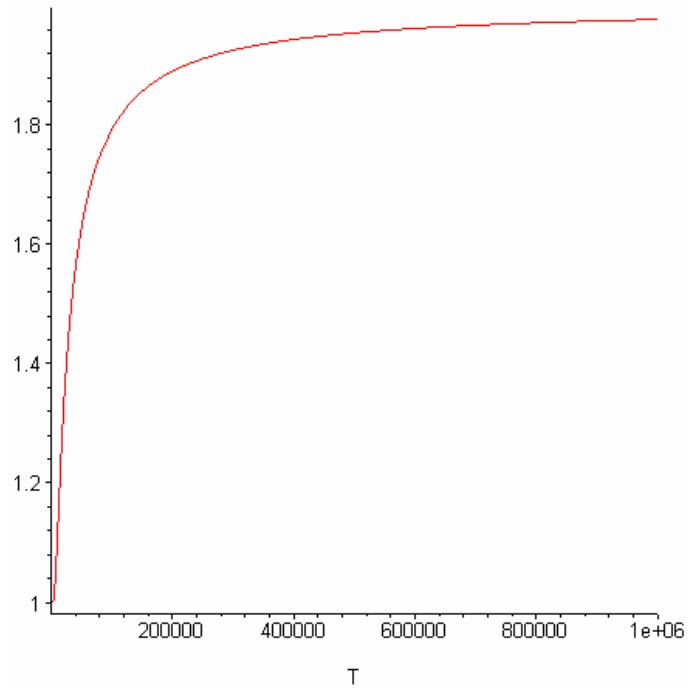
$$E_2 = 2eV$$

$$k = 8.62 \times 10^{-5} \frac{eV}{^{\circ}K}$$

Thus:

$$Z = 1 + e^{-\frac{2}{8.62 \times 10^{-5} T}} = 1 + e^{-\frac{23202}{T}}$$

And it looks like:



Numerical values at certain temperatures:

$$Z(300) = 1 + e^{-\frac{23202}{300}} = 1$$

$$Z(3000) = 1 + e^{-\frac{23202}{3000}} = 1.00044$$

$$Z(30000) = 1 + e^{-\frac{23202}{30000}} = 1.46144$$

$$Z(300000) = 1 + e^{-\frac{23202}{300000}} = 1.92558$$