

## Statistical Physics Homework 06

April 9, 2026

**12-8** Two *distinguishable* particles are to be distributed among nondegenerate energy levels 0,  $\varepsilon$ , and  $2\varepsilon$  such that the total energy  $U = 2\varepsilon$ .

- (a) What is the entropy of the assembly?
- (b) If a distinguishable particle with zero energy is added to the system, show that the entropy of the assembly is increased by a factor of 1.63.

**12-12** Consider a gas consisting of one kilomole of helium atoms at standard temperature and pressure. Calculate the degeneracy  $g(\varepsilon)$  for the energy level  $\varepsilon = (3/2)k_B T$  (take  $\gamma_s = 1$ ). What is the approximate ratio of  $g(\varepsilon)$  to the number of atoms  $N$ ?

**13-1** Use the method of Lagrange multipliers to solve the following problems;

- (a) A rectangle has a base  $x$  and a height  $y$ , where  $x + y = 8$ . Find the values of  $x$  and  $y$  that give the maximum area.
- (b) Find the area of the largest rectangle that can be inscribed in the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

What percentage of the area of the ellipse does the rectangle occupy?