## PHY 292F – WAVES AND PARTICLES DEPARTMENT OF PHYSICS, UNIVERSITY OF TORONTO

## **TUTORIAL #7**

TUTORIAL DATE: Thursday 5 November 2009

- 1. In a Scrabble game, there are a total of 98 tiles. Of these, there are 12 E, 6 N, 3 G, 4 S, 2 C and 9 I tiles.
  - a) If you picked 6 Scrabble tiles at random, what is the probability that they would spell ENGSCI (in the correct order)?
  - b) How many distinct ways can the six letters, E, N, G, S, C, and I, be arranged (e.g. how many different microstates are there for this macrostate)?
  - c) What is the probability of picking the letters E, N, G, S, C, I in any order?
- 2. Use Stirling's approximation to derive an approximate formula for the multiplicity of a two-state paramagnet. In your derivation, remember to clearly state the approximations you made and justify why they could be made. Simplify this formula in the limit  $N_{\downarrow} << N$  to obtain  $\Omega \approx (N e/N_{\downarrow})^{N_{\downarrow}}$ . Explain why this case  $(N_{\downarrow} << N)$  could be described as the "low temperature" limit for the two-state paramagnet.
- 3. Problem 2.22 on page 66 of Schroeder.
- 4. Problem 2.30 on page 77 of Schroeder.