The symbol $\Omega$ represents the...

1. Microstate
2. Macrostate
3. Entropy
4. Multiplicity

Coin tossing is a way to model a simple

1. Einstein solid
2. Strand of DNA
3. Boltzmann gas
4. Paramagnet

The fundamental assumption of statistical mechanics is that in thermal equilibrium

1. Low energy microstates are more likely.
2. High energy macrostates are more likely.
3. All microstates are equally likely.
4. All macrostates are equally likely.

The number $10^{23}$ is best described as

1. A small number
2. A large number
3. A very large number
4. Avogadro’s number

Schroeder 2.2:

Suppose you flip 20 fair coins.

(a) How many possible outcomes (microstates) are there?

(b) What is the probability of getting the sequence HTHHTTTTHHHHHTHTT (in that order)?

(c) What is the probability of getting 12 heads and 8 tails (in any order)?
Schroeder 2.4:

Calculate the number of possible 5-card poker hands that can be dealt from a deck of 52 cards. A royal flush consists of (A,K,Q,J,10) of any suit. What is the probability of being dealt a royal flush?

Schroeder 2.5:

For an Einstein solid with the following values of $N$ and $q$, list all of the possible microstates, count them and verify that $\Omega = \frac{(q + N - 1)!}{q!(N - 1)!}$

(a) $N = 3$ and $q = 4$.
(b) $N = 4$ and $q = 3$.

Try drawing the possible arrangements using the same notation as Schroeder (dots and lines)

Schroeder 2.8:

Consider a system of 2 Einstein solids, $A$ and $B$, each containing 10 oscillators, sharing a total of 20 units of energy. Assume that the solids are weakly coupled, and that the total energy is fixed.

(a) How many different macrostates are available to this system?
(b) How many different microstates are available to this system?
(c) Assuming that this system is in thermal equilibrium, what is the probability of finding all the energy in $A$?
(d) What is the probability of finding exactly half of the energy in $A$?
(e) Under what circumstances would this system exhibit irreversible behaviour?

Schroeder 2.23:

Consider a 2-state paramagnet with $10^{23}$ dipoles with zero energy (equal number of up- and down-pointing dipoles).

(a) How many microstates are accessible to this system?
(Use Stirling's approximation)

(b) Suppose the microstate of this system changes a billion time a second. How many microstates will the system explore in 10-billion years (age of the universe)?

(c) Is it correct to say that, if you wait long enough, a system will eventually be found in every "accessible" microstate?

Schroeder 2.16:

Suppose you flip 1000 coins.

(a) What is the probability that you get exactly 500 heads and 500 tails?

(b) What is the probability of getting exactly 600 heads and 400 tails?