44. (a) We denote the configuration with n heads out of N trials as $(n; N)$. We use Eq. 21-18:

$$W(25;50) = \frac{50!}{(25!)(50-25)!} = 1.26 \times 10^{14} \ .$$

(b) We use the result of problem #43: $\mathcal{N}_{\text{total}} = 2^{50} = 1.13 \times 10^{15}$.

(c) The percentage of time in question is equal to the probability for the system to be in the central configuration:

$$p(25;50) = \frac{W(25;50)}{2^{50}} = \frac{1.26 \times 10^{14}}{1.13 \times 10^{15}} = 11.1\% \ .$$

(d) We use $W(N/2, N) = N!/[(N/2)!]^2$, $\mathcal{N}_{\text{total}} = 2^N$ and $p(N/2; N) = W(N/2, N)/\mathcal{N}_{\text{total}}$. The results are as follows: For $N = 100$, $W(N/2, N) = 1.01 \times 10^{29}$, $\mathcal{N}_{\text{total}} = 1.27 \times 10^{30}$, and $p(N/2; N) = 8.0\%$.

(e) Similarly, for $N = 250$, we obtain $W(N/2, N) = 9.25 \times 10^{58}$, $\mathcal{N}_{\text{total}} = 1.61 \times 10^{60}$, and $p(N/2; N) = 5.7\%$.

(f) As N increases the number of available microscopic states increase as 2^N, so there are more states to be occupied, leaving the probability less for the system to remain in its central configuration.