63. We adapt the discussion of §21-7 to 3 and 5 particles (as opposed to the 6 particle situation treated in that section).

(a) The least multiplicity configuration is when all the particles are in the same half of the box. In this case, using Eq. 21-18, we have

$$W = \frac{3!}{3!\,0!} = 1 \quad .$$

(b) Similarly for box B, $W = 5!/(5!\,0!) = 1$ in the "least" case.

(c) The most likely configuration in the 3 particle case is to have 2 on one side and 1 on the other. Thus,

$$W = \frac{3!}{2!\,1!} = 3 \quad .$$

(d) The most likely configuration in the 5 particle case is to have 3 on one side and 2 on the other. Thus,

$$W = \frac{5!}{3!\,2!} = 10 \quad .$$

(e) We use Eq. 21-19 with our result in part (c) to obtain

$$S = k \ln W = \left(1.38 \times 10^{-23}\right) \ln 3 = 1.5 \times 10^{-23} \text{ J/K} \; .$$

(f) Similarly for the 5 particle case (using the result from part (d)), we find $S = k \ln 10 = 3.2 \times 10^{-23}$ J/K.