1) Helium gas and Krypton gas are mixed in a large container and allowed to equilibrate. Helium has a lower atomic mass than Krypton. Select the true statement about each of the following molecular properties. Treat each as a monatomic ideal gas.

a) Which atoms have the larger average kinetic energy?
   - **Helium**
   - **Krypton**
   - same average kinetic energy
   - not enough info

b) Which atoms have the larger average speed?
   - **Helium**
   - **Krypton**
   - same average speed
   - not enough info

2) A fixed amount of monatomic ideal gas at \(2 \times 10^5 \text{ Pa}\) and 50°C occupies a volume of 0.05 m\(^3\).
   a) The gas is compressed to a final pressure of \(3 \times 10^5 \text{ Pa}\) and volume of 0.02 m\(^3\). Determine its final temperature.

b) Determine the entropy change of the gas.
3) Three (3) units of energy are to be distributed between 4 particles. (The energy units are indistinguishable and the particles are distinguishable.)
a) How many basic states are there (i.e. how many ways are there to distribute 3 energy units between 4 particles)?

b) What is the ratio of the probability that just one particle has all the energy to the probability that just one particle has none of the energy?

c) BONUS CHALLENGE
These 4 particles with 3 units of energy are isolated from their environment and allowed to come to thermal equilibrium. Another system consisting of 12 particles with 9 units of energy is also isolated from the environment and allowed to come to thermal equilibrium. Which system is at a higher temperature? (Assume that thermal equilibrium means the same thing for such a small number of particles and energy as it does for macroscopic systems.)