Physics 2700H: Assignment III

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Problem 1. Five kg of water at $25\,°\text{C}$ is added to $10.0\,\text{kg}$ of water at $85\,°\text{C}$. After the mixture has reached equilibrium, how much has entropy changed? (Assume no energy is exchanged between the water and its surroundings.)

Solution 1.

Problem 2. The July 2023 Veritasium video about entropy, https://www.youtube.com/watch?v=DxL2HoqLbyA, introduces a Carnot engine within the first six minutes of the video. Draw on a PV diagram the cycle for this engine, with the bottom-right-most point labelled (a), and continue the cycle to points (b), (c) and (d). Identify which timestamps in the video correspond to the four points (a)... (d) and explain using a sentence per point why this is so.

Solution 2.

Problem 3. One mole of helium gas is initially at $P_0 = 1.0\,\text{atm}$ and $T_0 = 273\,\text{K}$.

(a) Compute the entropy change if the gas is heated at constant pressure to temperature $400\,\text{K}$.

(b) Starting again from the initial state (P_0, T_0), what is the entropy change if the gas expands isothermally to twice its original volume?

Solution 3.