A thermodynamic power cycle receives energy by heat transfer from an incompressible body of mass *m* and specific heat *c* with an initial temperature of T_H. The cycle discharges energy by heat transfer to another incompressible body of mass *m* and specific heat *c* that is initially at a lower temperature T_C (where $T_C < T_H$). There are no other heat transfers. Work is developed by the cycle until the temperature of each of the two bodies is the same at T_f.

(i) Draw a schematic of the system and clearly label all of the relevant features. Include in your figure the cycle and the two masses. Include your system boundary as a dashed line and use arrows to indicate all relevant heat and work interactions. Label which side of the system is initially hot and which side is initially cold. (10 points)

(ii) Starting from the laws of thermodynamics derive a symbolic expression for the amount of work W that is done by the power cycle. Your result should only be in terms of m, c, T_H, T_C, and T_f. Do not just write down an expression, clearly show all work that leads to your final result. (30 points)

(iii) Starting from the laws of thermodynamics derive a symbolic expression for the final temperature of the two bodies T_f. Your result should only be in terms of m, c, T_H, T_C, and σ where σ is the entropy production. Again, clearly show all work that leads to your final result. (30 points)

(iv) Derive a symbolic expression for the *maximum* amount of work that can be generated W_{max}. Show all work and justify your reasoning with a sentence or two. (20 points)

(v) If you increase the amount of irreversibilities in the power cycle does the final temperature T_f increase, decrease, or stay the same? In addition to using any analytical expressions provide a physical justification for your response with a sentence or two. (10 points)