NAME:
AME 20231, Thermodynamics
Examination 2
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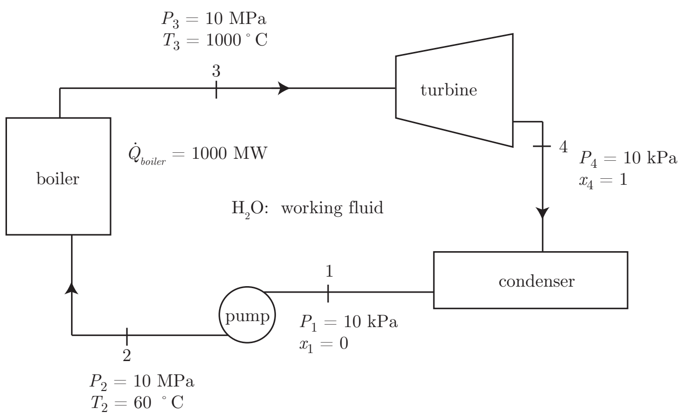
1. (40) Consider the Rankine cycle below. Find



   (a) the mass flow rate (kg/s),
   (b) the work rate done by the turbine (kW),
   (c) the work rate required to power the pump (kW),
   (d) the overall thermal efficiency,
   (e) a correctly oriented sketch, including the vapor dome and appropriate numerical values of P and v, of the cycle on a $P - v$ diagram,

2. (30) A chamber with initial volume $V_1 = 1$ m^3 contains air at $P_1 = 100$ kPa, $T_1 = 300$ K. The air is constrained by a piston attached to a *linear spring*. The air is heated to $T_2 = 3000$ K, $P_2 = 200$ kPa. Find the heat transfer ${}_1Q_2$ assuming air is a
   (a) calorically perfect ideal gas, (use Table A.5),
   (b) calorically imperfect ideal gas (use Table A.7.1).
   (c) Give a one-sentence, qualitative, physics-based interpretation as to why one estimate is different than the other.

3. (30) A 1 kg block of silver and a 1 kg block of gold are within in a closed, thermally insulated chamber. The silver has initial temperature $T_S(0) = 1000$ K, and the gold has initial temperature $T_G(0) = 300$ K. The two blocks come to a thermal equilibrium so that they have same final temperature.
   (a) Find the equilibrium temperature.
   (b) Taking as a crude model for the heat transfer rate *from* silver to gold

$$\dot{Q} = \left(0.001\ \frac{\text{kW}}{\text{K}}\right)(T_S - T_G),$$

   find the time constant of equilibration.