AME 20231, Thermodynamics
Examination 1
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1. (10) H_2O has $x = 0.5$, $v = 0.003568$ m^3/kg. Find P and T. Give an accurate sketch of its location in the $P - v$, $T - v$, and $P - T$ planes, including the vapor dome.

2. (10) H_2O has $P = 150$ kPa, $T = 580°$C. Find v. Give an accurate sketch of its location in the $P - v$, $T - v$, and $P - T$ planes, including the vapor dome.

3. (10) Give an accurate estimate of the gauge and absolute pressure at the bottom of St. Mary's Lake on the Notre Dame campus at its deepest point on an ordinary day. You will need to estimate some geometric parameters for St. Mary's Lake; reasonable estimates are sought.

4. (35) H_2O has state 1 at the triple point and is all liquid. It undergoes an isochoric process that takes it to $P_2 = 5000$ kPa. It undergoes a polytropic expansion with $n = 1$ that takes it to the triple point pressure at state 3. It then returns isobarically to its original state at the triple point. Find T_1, T_2, T_3 and the net work per unit mass of the cycle. Give an accurate sketch of the process in the $P - v$, $T - v$, and $P - T$ planes. Include the vapor dome.

5. (35) N_2 is at $T_1 = 100$ K, $P_1 = 100$ kPa. It is isothermally compressed to $P_2 = 600$ kPa. It is then isochorically compressed to $P_3 = 3000$ kPa. a) Assuming an ideal gas, find T_3 and ${}_1w_3$. b) Assuming a non-ideal gas and using Table B.6.2, find T_3 and ${}_1w_3$. c) Give an accurate sketch of the process in the $P - v$, $T - v$, and $P - T$ planes. Include the vapor dome.