NAME:
AME 20231
Thermodynamics
Examination 1
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14 February 2012

1. (10) Argon, Ar, exists at $T = 165.9\ K$, $P = 4.87\ MPa$. Find its specific volume via
   (a) the ideal gas law, and
   (b) the compressibility charts.

2. (10) For H_2O, determine the specific property at the indicated state. Locate the state on a sketch of the $T - v$ diagram.
   (a) $P = 300\ kPa$, $v = 0.5\ m^3/kg$, Find T, in $^\circ C$.
   (b) $P = 1.5\ MPa$, $T = 410\ ^\circ C$. Find v.

3. (40) A cylinder/piston assembly, see Fig. 1, contains 0.5 kg of air, modeled as an ideal gas, at 100 kPa and volume 0.48 m^3. It is heated so that its volume doubles. Atmospheric pressure is 100 kPa, and the cylinder cross sectional area is 0.06 m^2. The piston has a mass of 184 kg. Gravitational acceleration is 9.8 m/s^2.
   (a) What is the final pressure of the air?
   (b) Determine the initial and final temperature of the air.
   (c) Show the process on a sketch of the $P - v$ diagram.
   (d) What is the work done by air during the process?

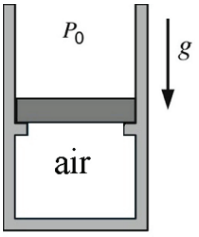

Figure 1: Schematic for piston-cylinder problem.

4. (40) A mass, 0.1 kg, of ammonia, NH_3, initially at $T_1 = 0\ ^\circ C$, $x_1 = 0.1$ isothermally expands to state 2 where $P_2 = 200\ kPa$.
   (a) Find the initial total volume.
   (b) Find the final total volume.
   (c) Accurately sketch the total process in the $P - v$, $T - v$, and $P - T$ planes. Label each state in your sketch giving numerical values for P, T, v. Include the vapor dome in its correct position.
   (d) Find the total work done in the process.