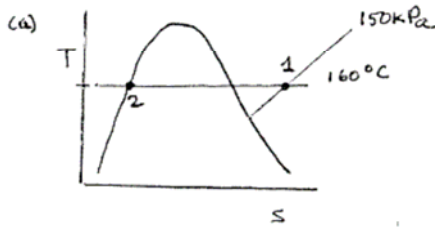


PROBLEM 6.14

One kilogram of water contained in a piston-cylinder assembly, initially at 160°C, 150 kPa, undergoes an isothermal compression process to saturated liquid. For the process, $W = -471.5 \text{ kJ}$. Determine for the process,

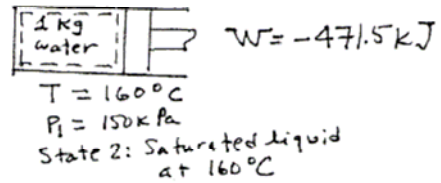
- (a) the heat transfer, in kJ.
 - (b) the change in entropy, in kJ/K.
- Show the process on a sketch of the $T-s$ diagram.

ANALYSIS:



(b) $\Delta U + \Delta KE + \Delta PE = Q - W$
 $\Rightarrow Q = W + \Delta U$
 $\Rightarrow Q = W + m(u_2 - u_1)$
 Table A-4, $u_1 = 2595.2 \text{ kJ/kg}$
 Table A-2, $u_2 = 674.86 \text{ kJ/kg}$
 $\therefore Q = -471.5 + (1 \text{ kg})(674.86 - 2595.2) \frac{\text{kJ}}{\text{kg}}$
 $= -2391.84 \text{ kJ}$

SCHEMATIC & GIVEN DATA:



ENGR. MODEL: Ignore changes in kinetic and potential energy.

(c) Table A-4, $s_1 = 7.4665 \frac{\text{kJ}}{\text{kg} \cdot \text{K}}$
 Table A-2, $s_2 = 1.9427 \frac{\text{kJ}}{\text{kg} \cdot \text{K}}$
 $\therefore \Delta S = 1 \text{ kg}(1.9427 - 7.4665) \frac{\text{kJ}}{\text{kg} \cdot \text{K}}$
 $= -5.5238 \frac{\text{kJ}}{\text{K}}$

