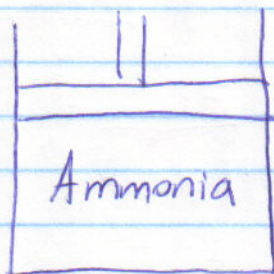


Quiz 5

8.60



$$\begin{array}{l} \text{State 1} \\ P_1 = 1200 \text{ kPa} \\ T_1 = 60^\circ\text{C} \end{array}$$

$$\begin{array}{l} \text{State 2} \\ T_2 = -20^\circ\text{C} \end{array}$$

Given $W_2 = 600 \text{ kJ}$, Reversible, Insulated.

Find V_1

Solution

State 1 From tables

$$v_1 = 0.12378$$

$$u_1 = 1404.8$$

$$h_1 = 1553.3$$

$$s_1 = 5.2357$$

Reversible:

$$TdS = \delta Q$$

$$= 0 \quad (\text{insulated})$$

δ

$$S_2 = S_1 = 5.2357$$

State 2

$$T_2 = -20^\circ\text{C}, \quad S_2 = 5.2357$$

Can find state 2. ✓ for $T = -20^\circ\text{C}$

Tables tell us $s_f < S_2 < s_g$, so we are in the vapour dom

$$x = \frac{S - S_f}{S_g} = \frac{5.2357 - 0.3657}{5.2498} = 0.9277$$

$$u_2 = u_f + x u_{fg} = 1211.93 \text{ kJ/kg}$$

$$v_2 = v_f + x v_{fg} = 0.57838 \text{ m}^3/\text{kg}$$

First Law:
 ^{insulated} for control mass

$$dU = \cancel{\delta Q} - \delta W$$

$$u_2 - u_1 = -\delta W = -600 \text{ kJ}$$

$$m(u_2 - u_1) = -600$$

$$m = \frac{-600}{1211.93 - 1404.8} \text{ kg} = 3.111 \text{ kg}$$

$$V_1 = m v_1 = 0.385 \text{ m}^3$$