

GIVEN & FIND

- (a) Water @ $P = 5.0 \text{ bar}$, $S = 3.1407 \text{ kJ/kg}\cdot\text{K}$, find $h \text{ (kJ/kg)}$
 (b) Water @ $P = 7.0 \text{ bar}$, $u = 2767.2 \text{ kJ/kg}$, find $S \text{ (kJ/kg}\cdot\text{K)}$
 (c) R134a @ $T = -20^\circ\text{C}$, $x = 0.8$, find $S \text{ (kJ/kg}\cdot\text{K)}$
 (d) NH_3 @ $T = 32^\circ\text{C}$, $S = 4.9544 \text{ kJ/kg}\cdot\text{K}$, find $u \text{ (kJ/kg)}$
 → locate state on $T-v$ and $T-s$ diagrams

ASSUMP

$$\Delta P_F = \Delta K_F = 0$$

EQN

$$\Delta U = Q - W$$

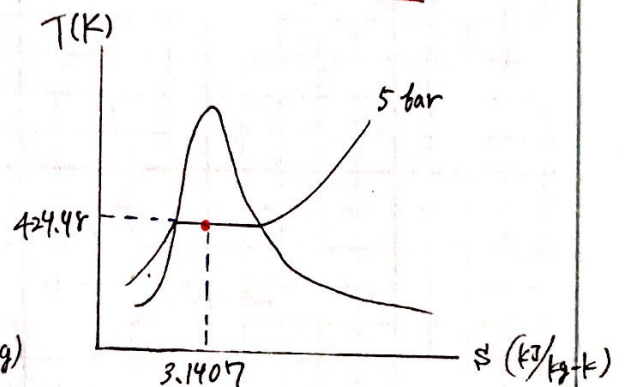
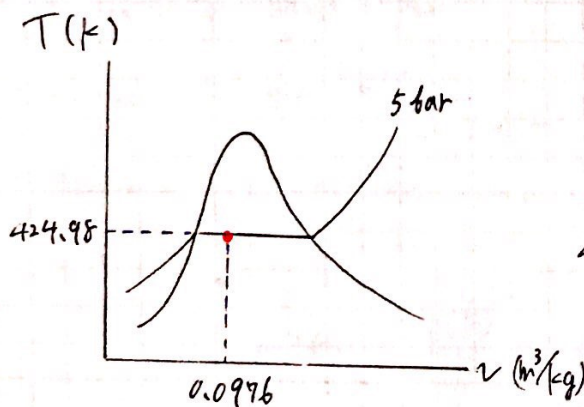
SOLN

$$(a) \quad x = \frac{S - S_f|_{P=5}}{S_g|_{P=5} - S_f|_{P=5}} = \frac{3.1407 - 1.8604}{6.8207 - 1.8604} \approx 0.2581$$

$$v = v_f|_{P=5} + (v_g|_{P=5} - v_f|_{P=5})x = 0.0010925 + (0.37481 - 0.0010925)(0.2581) \\ \approx 0.09755 \text{ m}^3/\text{kg}$$

$$h = h_f|_{P=5} + (h_g|_{P=5} - h_f|_{P=5})x = 640.09 + (2748.1 - 640.09)(0.2581) \\ = 1184.17 \text{ kJ/kg}$$

$$\boxed{h = 1180 \text{ kJ/kg}}$$

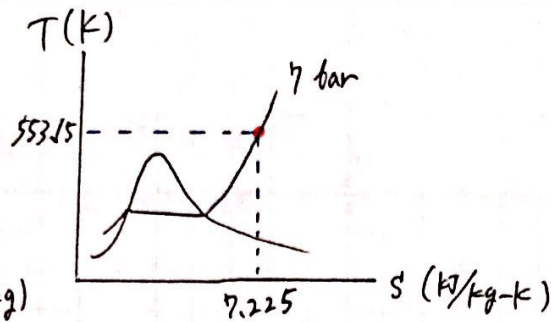
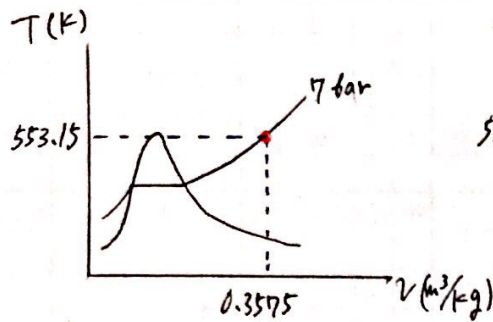


$$(b) \quad u > u_g|_{P=7} \Rightarrow \text{SHV state}$$

$$\text{from table @ } u = 2767.2 \text{ kJ/kg}$$

$$v = 0.35750 \text{ m}^3/\text{kg}$$

$$\boxed{S = 7.22500 \text{ kJ/kg}\cdot\text{K}}$$



(C)

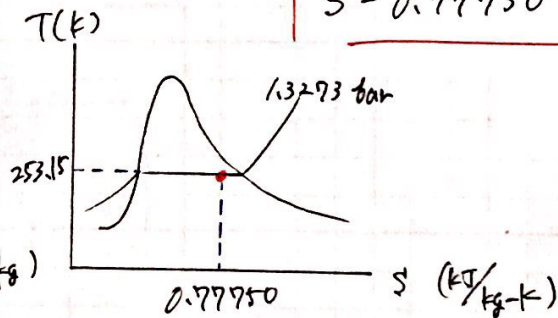
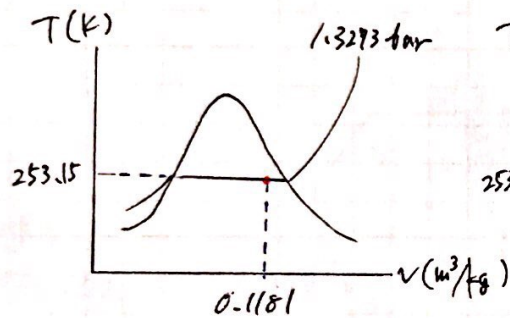
$$v = v_f|_{T=-20} + (v_g|_{T=-20} - v_f|_{T=-20})(0.8)$$

$$= 0.00073623 + (0.004739 - 0.00073623)(0.8) \cong 0.1181 \text{ m}^3/\text{kg}$$

$$s = s_f|_{T=-20} + (s_g|_{T=-20} - s_f|_{T=-20})(0.8)$$

$$= 0.10464 + (0.94571 - 0.10464)(0.8) = 0.777496 \text{ kJ/kg-K}$$

$$s = 0.77750 \text{ kJ/kg-K}$$



cd) $s = s_g|_{T=32} \Rightarrow$ saturated vapor

$$v = v_g|_{T=32} = 0.10422 \text{ m}^3/\text{kg}$$

$$u = u_g|_{T=32} = 1338.9 \text{ kJ/kg}$$

