GIVEN Piston–Cylinder Assembly w/ NH_3

» 2 states

(1) $T_1 = -20°C$, $x = 50\% = 0.5$, P_1

↓ slowly heated ($\dot{Q}_{in}$)

(2) $p_2 = 6$ bar, $T_2 = 180°C$

» while heated the pressure p varies linearly w/ v ($\frac{m^3}{kg}$)

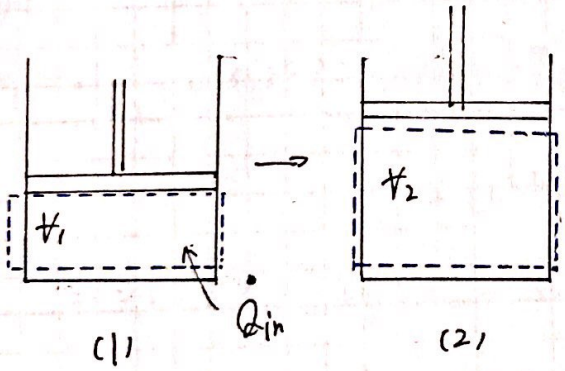
FIND (a) p-v diagram

(b) for NH_3, $\dot{Q}_{in}$ & $\dot{W}_{12}$

ASSUMP
- closed sys.
- Quasi equilibrium
- $\Delta PE = \Delta KE = 0$

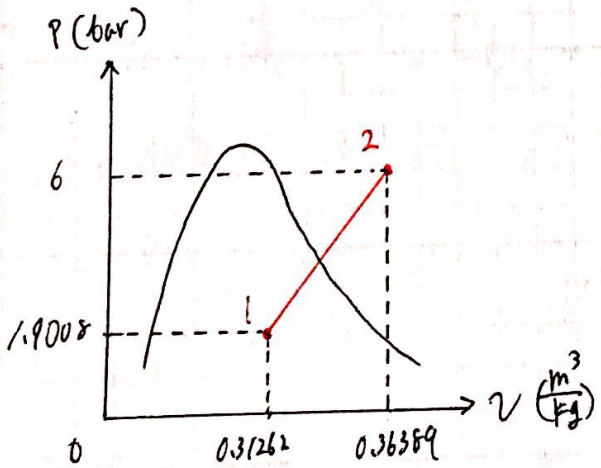
EQN
- $\frac{dm}{dt}_{sys} = \dot{m}_{in} - \dot{m}_{out}$
- $\Delta U = Q - W$
- $W = \int P dV$

FBD



SOLN

(a)



using saturation table @

$T_1 = -20°C$

$\begin{cases} v_f = 0.0015035 \frac{m^3}{kg} \\ v_g = 0.62373 \frac{m^3}{kg} \end{cases}$

thus, from quality, $x = 0.5$

$v = 0.5 v_f + 0.5 v_g$

$\cong 0.31262 \frac{m^3}{kg}$

and

$P_1 = 1.9008$ bar