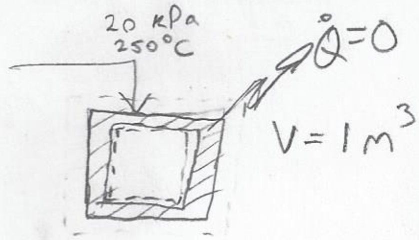
③

a)



Assume Not an ideal gas

CV: tank Assume $\dot{Q}=0$

System is closed

Not at steady State

The energy comes from the hot steam entering the tank

$M_{steam} = ?$

$$\frac{dm}{dt} = \dot{M}_{in}(t)$$

$$\int_0^m dm = \int_0^t \dot{m}_{in}(t)\,dt$$

$$\frac{d(m\hat{U})}{dt} = \sum \dot{M}_{in}\left[\hat{H}_{in} + \cancel{gh}^{\,0} + \cancel{\tfrac{1}{2}V^2}^{\,0}\right] - \cancel{\sum \dot{M}_{out}\left[\hat{H}_{out} + gh + \tfrac{1}{2}V^2\right]}^{\,0} + \cancel{\dot{Q}}^{\,0} + \cancel{\dot{W}_s}^{\,0}$$

$$m(t)\frac{d\hat{U}}{dt} = \dot{m}_{in}(t)\,\hat{H}_{in}$$

$\hat{H}_{in} = 2977.1\ kJ/kg$ $\frac{kg}{s}\cdot\frac{kJ}{kg}$

$\hat{V} = 12060\ \frac{cm^3}{g}$

$$12060\ \frac{cm^3}{g} \times \left(\frac{1m}{100cm}\right)^3 \times \frac{1000g}{kg}$$

$= 12.06\ m^3/kg$

$T = 250°C$

$M_{steam} = \hat{V}\ \frac{cm^3}{g}$

$\frac{1}{\hat{V}} = .0829\ \frac{kg}{m^3}\,(1\,m^3)$

$\frac{V}{\hat{V}} = M_{steam}$ $\frac{1\,m^3}{12.06\,m^3/kg} = \boxed{0.0829\ kg\ \text{Steam},\ T = 250°C}$

$$m = \int_0^t \dot{m}_{in}(t)\,dt$$

$$\left(\int_0^t \dot{m}_{in}(t)\,dt\right)\frac{d\hat{U}}{dt} = \dot{m}_{in}(t)\,\hat{H}_{in}$$

$$\cancel{\int_0^t \dot{m}_{in}(t)\,dt}\int_0^{\hat{U}} d\hat{U} = \hat{H}_{in}\cancel{\int_0^t \dot{m}_{in}(t)\,dt}$$

$$\hat{U} = \hat{H}_{in}$$

→