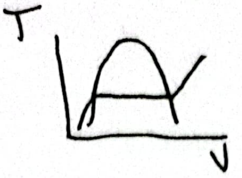

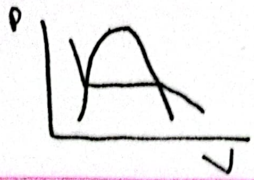

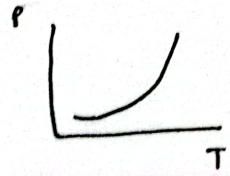

$\text{Total Energy} = K.E + P.E + U$
$= \frac{1}{2}mv^2 + mgh + U$

$\Delta U = Q - W$
$\Rightarrow W \rightarrow$ -ive : Work done on system
$\Rightarrow W \rightarrow$ +ive : Work done by system
$\Rightarrow q \rightarrow$ +ive : absorb (endothermic)
$\Rightarrow q \rightarrow$ -ive : release (exothermic)

$V_{Total} = V_{liq} + V_{vap}$
$= m_{liq} v_f + m_{vap} v_g$

$x = \frac{m_{vap}}{m}$

$v_f < v < v_g$
$\Rightarrow$ Two-phase

Specific Volume: $v = \frac{V}{m}$ Sp. Density $= \frac{m}{V} = \frac{1}{v} \Rightarrow \rho = \frac{m}{V}$

$P \propto \frac{1}{V}$ $P \propto T$
$V \propto T$

$v_{fg} = v_g - v_f$
$v = v_f + x v_{fg}$

$Z = \frac{Pv}{RT}$

$\Rightarrow Pv = ZRT$ $\begin{cases} Z = 1 : \text{ideal gas} \\ Z \neq 1 : \text{non-ideal gas} \end{cases}$

$\begin{cases} Z < 1 \rightarrow \text{attractive force} \\ Z > 1 \rightarrow \text{repulsive force} \end{cases}$

$P_r = \frac{P}{P_c}$ $T_r = \frac{T}{T_c}$

$\left. \begin{matrix} T >> T_c \\ P << P_c \end{matrix} \right\}$ nearly ideal gas
$P \rightarrow P_c$: non-ideal gas

$Pv = RT$
$PV = mRT = n\bar{R}T$
$R = \frac{\bar{R}}{m}$

$n = \frac{m}{M}$

$P\dot{V} = \dot{m}RT = \dot{n}\bar{R}T$

$\dot{V} = \frac{\Delta V}{dt} = \frac{\Delta V}{\Delta t}$

CL: $v < v_f$
$P > P_{sat}$
$T < T_{sat}$
$v < v_f$
$h < h_f$
$u < u_f$

SV: $v > v_g$
$P < P_{sat}$
$T > T_{sat}$
$v > v_g$
$h > h_g$
$u > u_g$

$\{0 \leq x \leq 1\}$ only in two-phase or saturated state

$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y - y_1}{x - x_1}$