1. a. $dU = TdS - PdV \Rightarrow dS = \frac{dU + PdV}{T} = \frac{R}{V}dV + \frac{C_v}{T}dT$

$\xi_2 \Rightarrow dS = \frac{R}{V}dV \quad \Delta S = R \ln \frac{V_2}{V_1}$

$V_1 = \frac{nRT}{P_1} = \frac{1 \times 0.08206 \times 300}{10} = 2.46 \quad V_2 = 4.92$

$\Delta S = R\ln 2 = 5.7631\ J/K$

b. $q = 0 \Rightarrow \Delta S = 0$

c. $\xi_3 \Rightarrow \Delta S = C_v \ln \frac{T_2}{T_1}$

$= 1.5R \ln \frac{1}{2} = -8.6447\ J/K$

Date. No.

3.2. a. free expansion → temparature remains const (ΔT = 0)

$q = 0$, $\Delta U = 0$, $\Delta H = 0$, $W = 0$,

ΔS: 상태함수 → 가역으로 만들어 ΔS를 구함

$\hookrightarrow q = nRT \ln \frac{V_2}{V_1} \rightarrow \Delta S = nR \ln \frac{V_2}{V_1}$

$= 1 \times R \ln 3 = 9.1344\ J/K$

b. $W = 0$

$q = \Delta U = C_V(400-300) = 1247 J\ J$

$\Delta H = C_p(400-300) = 2078.6\ J$

$\Delta S = \int_{300}^{400} \frac{C_V}{T} dT = C_V \ln \frac{4}{3} = 3.58788\ J/K$

c. $\Delta U = 0$, $\Delta H = 0$

$q = w = RT \ln \frac{V_2}{V_1} = R(400) \ln 3 = 3653.75\ J$

$\Delta S = nR \ln 3 = 9.1344\ J/K$

d. 등압

$\Delta U = C_V(300-400) = -1247.17\ J$

$q = \Delta H = C_p(300-400) = -2078.6\ J$

$w = q - \Delta U = -831.44\ J$

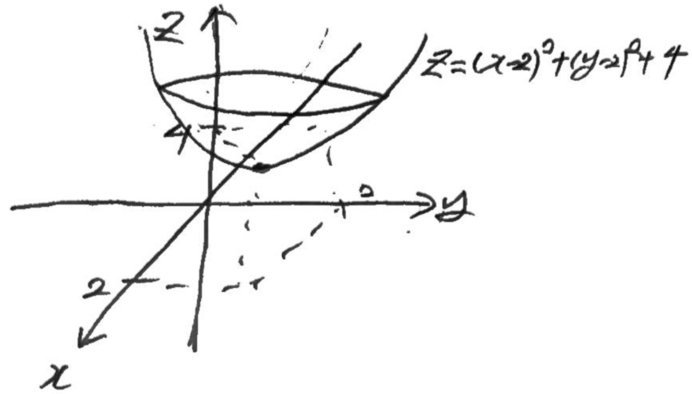
$V_2 = \frac{300}{400} V_1 = \frac{3}{4} V_1$

$\Delta S = R \ln \frac{V_2}{V_1} + C_V \ln \frac{T_2}{T_1}$

$= R \ln \frac{3}{4} + C_V \ln \frac{3}{4} = -5.9798\ J/K$

5. (a) $\frac{\partial z}{\partial x} = 2(x-2) = 0 \Rightarrow x = 2$

$\frac{\partial z}{\partial y} = 2(y-2) = 0 \Rightarrow y = 2$



$x=2, y=2$

$\rightarrow z = 4$

at $(2,2,4) \Rightarrow$ minimum value $= 4$

(b) $y = 1-x$

$z = f(x,y) = (x-2)^2 + (y-2)^2 + 4$

$\Rightarrow z = f(x,y) = (x-2)^2 + (-1-x)^2 + 4$

$\frac{\partial z}{\partial x} = 2(x-2) - 2(-1-x)$

$= 2x-4+2+2x = 4x-2 = 0$

$x = \frac{1}{2}, y = \frac{1}{2}, z = (\frac{1}{2}-2)^2 + (\frac{1}{2}-2)^2 + 4$ minimum!!

$= \frac{17}{2}$ $\quad \therefore \frac{17}{2}$

(c) $L = (x-2)^2 + (y-2)^2 + 4 + \lambda(x+y-1)$

$\frac{\partial L}{\partial x} = 2(x-2) + \lambda = 0 \rightarrow 2x + \lambda = 4$

$\frac{\partial L}{\partial y} = 2(y-2) + \lambda = 0 \rightarrow 2y + \lambda = 4$ $\rightarrow x - y = 0$

$\frac{\partial L}{\partial \lambda} = x+y-1 = 0 \rightarrow x+y = 1$

$x = \frac{1}{2}, y = \frac{1}{2}, \lambda = 3$

$z = (\frac{1}{2}-2)^2 + (\frac{1}{2}-2)^2 + 4$ minimum!!

$= \frac{17}{2}$ $\quad \therefore \frac{17}{2}$

$S = (1.3805\ldots \times 10^{\ldots})(6.718 \times 10^{\ldots}) = 8.7\ldots$

1. the temperature remain constant $\Rightarrow \Delta U = 0,\ q = w$

$$dS = \frac{P\,dV}{T} = \frac{nR}{V}\,dV \Rightarrow \underline{\Delta S = nR\ln\left(\frac{V_2}{V_1}\right)}$$

a. $A, B \Rightarrow V_2 = 2V_1$

$$\Rightarrow \Delta S = R\ln 2 + R\ln 2 = \underline{2R\ln 2}$$

b. $\Delta S = 2R\ln 2 + R\ln 2 = \underline{3R\ln 2}$

c. [illegible] A 몰 → equilibrium $\Rightarrow \underline{\Delta S = 0}$

d. A 2몰 + A 1몰

A 2몰, V	A' 1몰, V

$\longrightarrow$

A 2몰 $\to 2V \times \frac{2}{3}$
A' 1몰 $\to 2V \times \frac{1}{3}$

~~total~~ $= 2V$

$$\Delta S = \underbrace{2R\ln\frac{\frac{4}{3}V}{V}}_{\text{for A}} + \underbrace{R\ln\frac{\frac{2}{3}V}{V}}_{\text{for A}'} = R\ln\frac{16}{9} + R\ln\frac{2}{3}$$

$$= \underline{R\ln\frac{32}{27}}$$