FINAL EXAM REVIEW

12-9-13

P2A

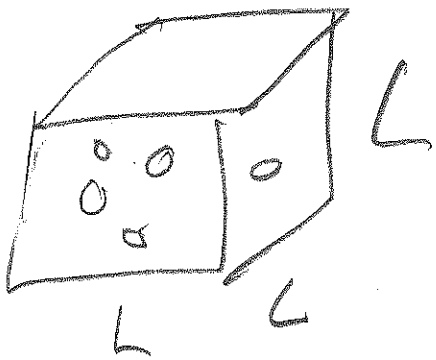
Mastering site:

stats. showed low hits # 25 - CH15

CH15 = gases.

CH 15: FINAL EXAM review

25 ?



L = ? when volume has: $N = 6 \times 10^9$ molecules

$P \cdot V = nRT$

$\Rightarrow V = \frac{nRT}{P}$

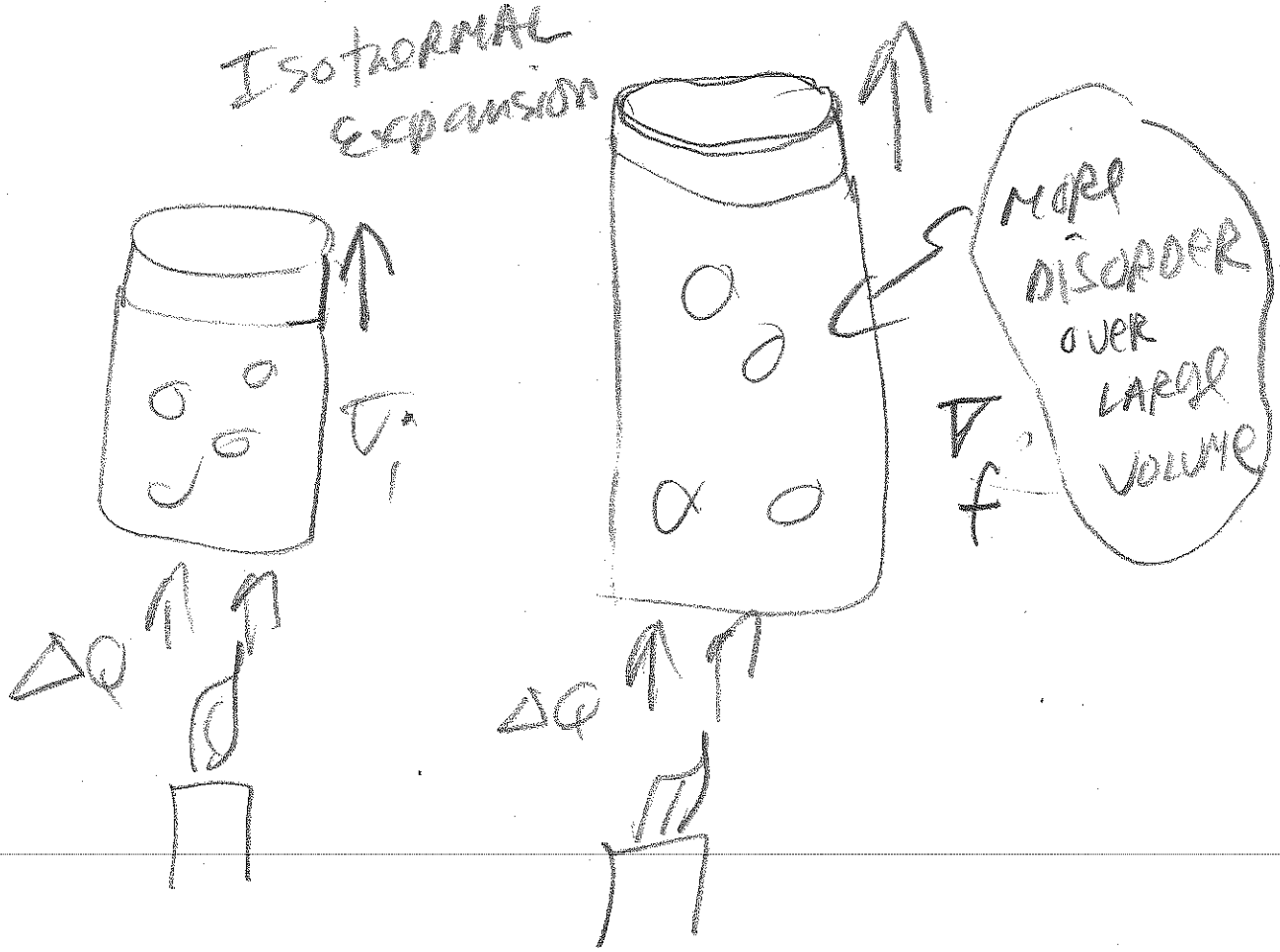
$n = \frac{N}{N_A}$ $\quad N_A = 6.02 \times 10^{23}$

$T = 273K$

$P = 1.013 \times 10^5 Pa$

$V = L^3 \rightarrow L = \sqrt[3]{\frac{nRT}{P}} = \left(\frac{nRT}{P}\right)^{\frac{1}{3}}$

p531 Entropy

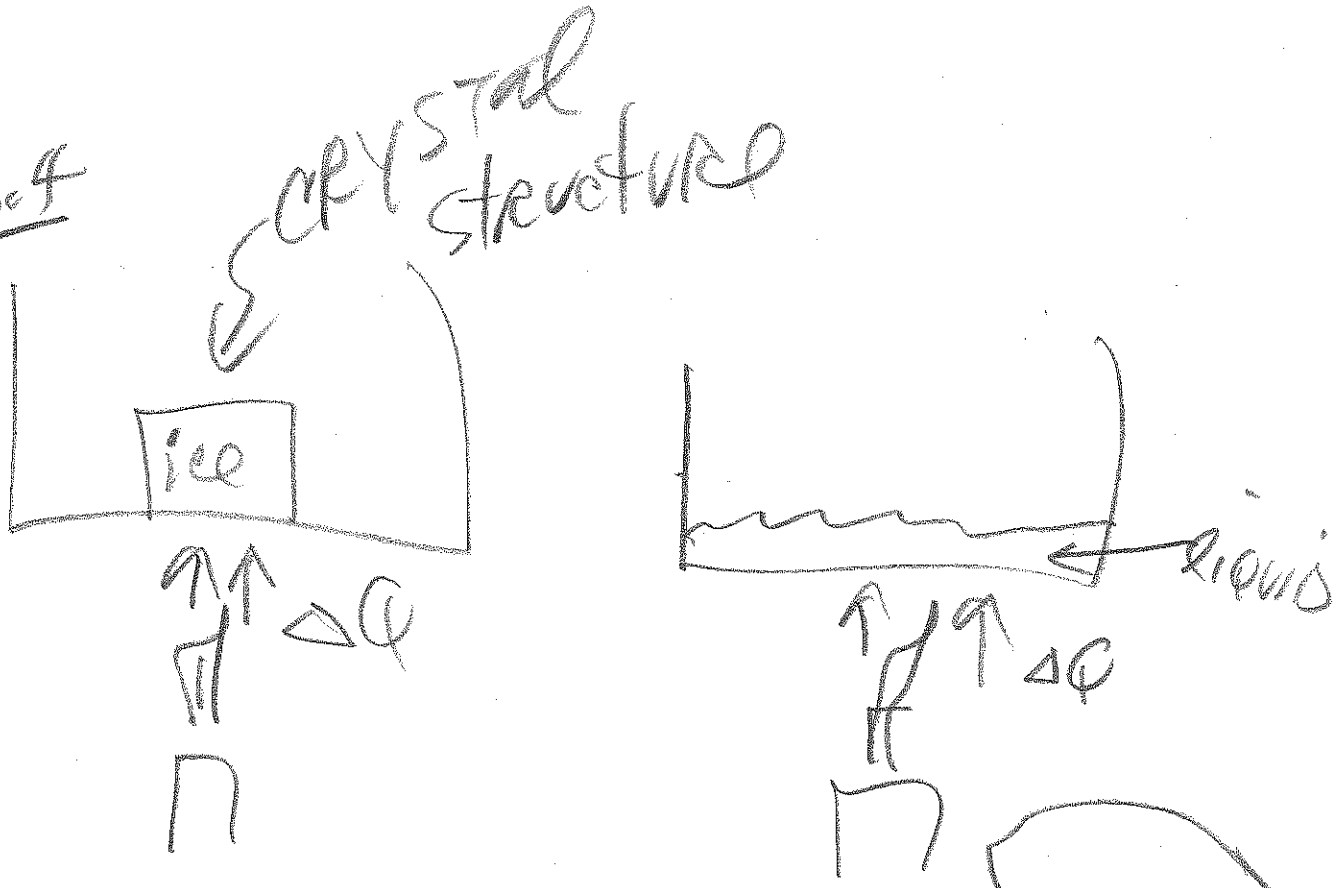


$$\Delta Q = W = p \cdot \Delta V = \frac{nRT \cdot \Delta V}{V}$$

$$\frac{nRT}{V}$$

$$\rightarrow \frac{\Delta V}{V} = \frac{\Delta Q}{nRT} \rightarrow \Delta S = \frac{\Delta Q}{T}$$

Ex 16.4

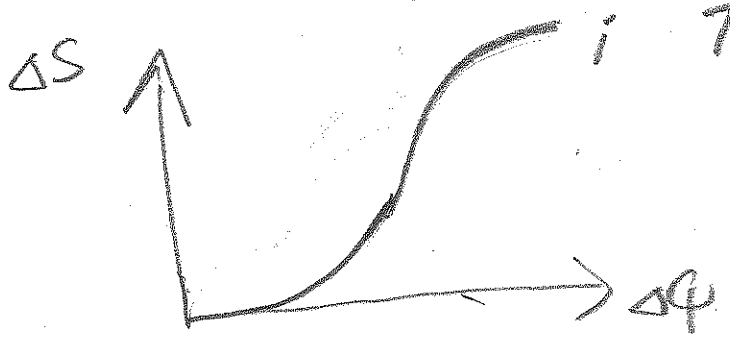


$$\Delta S = \frac{\Delta Q}{T} = \frac{m \cdot L_f}{T}$$

(T = constant)

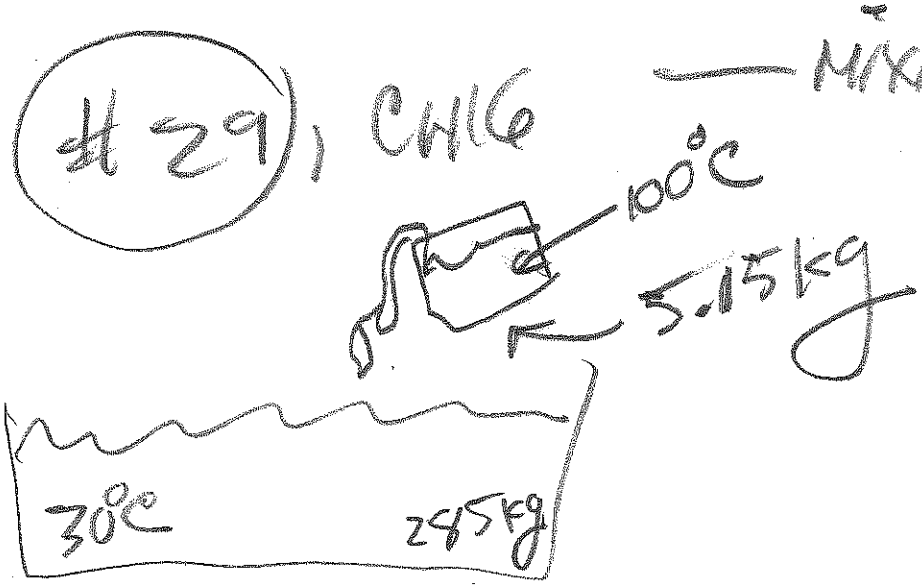
see p533 SUMMARY

ASO: $\Delta S = \sum_i \frac{\Delta Q_i}{T_i}$ when the temperature is not constant.



Final Exam Review

#29) CH1C6 — Mixing problem



(a) irreversible

(b.) CH14 Final Exam review included:

CH14

$$|\text{Heat LOST}| = |\text{Heat gained}|$$

(HOT LIQUID) (COOLER LIQUID)

$$|m_w C_w (T_f - 100)| = |m_{cw} C_w (T_f - 30)|$$

$$m_w C_w (100 - T_f) = m_{cw} C_w (T_f - 30)$$

(b)

$C_w = 1000 \text{ cal/kg}^\circ\text{C}$

$(5.15)(1000)(100 - T_f) = 285 \cdot (1000) \cdot (T_f - 30)$

$515000 - 5150T_f = 285000T_f - 8550000$

$9065000 = 290150T_f$

$\boxed{31.24^\circ\text{C} = T_f}$

(c) $\Delta S_w + \Delta S_{cw} > 0$ (prediction)

According to 2nd Law of thermodynamics

see 16.7 — p535 (BOLD)

$\Delta S_{TOTAL} \geq 0$ (i) $\Delta S_{TOTAL} > 0$ (ii) $\Delta S_{TOTAL} = 0$

(i) $\Delta S_{TOTAL} > 0$

PROCESSES ARE

IRREVERSIBLE (Real WORLD)

(ii) $\Delta S_{TOTAL} = 0$

PROCESSES

↑ Idealization ARE REVERSIBLE (IMPOSSIBLE)

(C.) $\Delta S_w = ?$ (HOT WATER)

$\Delta Q = m_w C_w \cdot (100 - 31.24)$

$\Delta S_w \neq \frac{\Delta Q}{T}$ WHICH T? USE AVERAGE T!

$\Delta S_w = \frac{\Delta Q}{T_{AV}} = \frac{-m_w \cdot C_w \cdot (68.76)}{273 + \left(\frac{131.24}{2}\right)}$

$$\Delta S_{cw} \neq \frac{\Delta Q}{T}$$

$$\Delta S_{cw} = \frac{\Delta Q}{T_{AV}} = \frac{m_{cw} c_w (1.24)}{273 + \left(\frac{30+31.24}{2}\right)}$$

$$\Delta S_{TOTAL} = \frac{-m_w c_w (68.76)}{273 + 65.62} + \frac{m_{cw} c_w (1.24)}{273 + 30.62}$$

$$\Delta S_{TOTAL} = \frac{-(5.15)(1000)(68.76)}{338.62} + \frac{(285)(1000)(1.24)}{303.62}$$

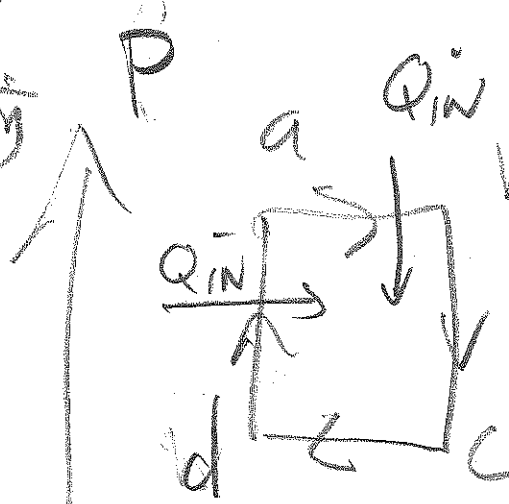
$\Delta S_{TOTAL} > 0$ by inspection (or calculation)

dn 11

8.a

BOOK VERSION

(A)



$\Delta Q_{a\to b} = nC_p \cdot \Delta T$

$= nC_p \cdot (T_b - T_a)$

NOTE:

$T_b = \frac{nR}{P_b V_b}$

$C_p = C_v + R$

$\Delta Q_{d\to a} = \frac{3}{2} nR(T_a - T_d)$ ← ?

$= nC_v \cdot \Delta T \Rightarrow C_v = \frac{3}{2}R$

Using CH 15 →

$$\frac{P_d V_d}{T_d} = \frac{P_a V_a}{T_a} = nR$$

$Q_{IN(TOTAL)} = Q_{d\to a} + Q_{a\to b}$

GET $T_d = \frac{nR}{P_d V_d}$; $T_a = \frac{nR}{P_a V_a}$

1 ATM $= 1.013 \times 10^5 P_a$

CONVERT!

(B.) $d \to a$ and $a \to b$

(C.) $\Delta Q_{out} = \Delta Q_{b\to c} + \Delta Q_{c\to d}$

$\Delta Q_{b\to c}$

$= n C_v \cdot \Delta T$ ← $T_b = \frac{nR}{P_b V_b}$

$= \frac{3}{2} nR(T_c - T_b) < 0$

Note: $C_v = \frac{3}{2}R$

$T_c = \frac{nR}{P_c V_c}$

ALSO $\Delta Q_{c\to d}$
$= nC_p \Delta T = n C_p (T_d - T_c)$
where $C_p = C_v + R$.

(D.) $b \to c$ and $c \to d$.

(E.) W = area of rectangle

(F) $\varepsilon = \frac{W}{Q_{in}\ (\text{TOTAL})}$