✓ ①

12-09-13

&C ✓ FINAC EXAM study Tool:

Tool components

(A) links 12-02-13

and 12-09-13

LIST OF CH 34, 35, 36

Test3 compliments

(includes CH18)

see 11-20-13

see #4, Test3 ⟷ #65, CH18 ← (B) study Test 3: see #65, CH18

CH18 problem +

CH. 34, 35, 36 compliments

(C.) Resourcer for CH 19, 20:

(i) PAST LECTURE notes

Links LIST (send ASAP)

STARTED 12-9-13 → (ii) new MATERIAL

new MATERIAL for CH 19, 20:

WED 12-11-13 } CH 19

FRI 12-13-13 } 20

NOTE: CH 34, 35, 36, 18
ALREADY COVERED
within FINAL
Exam tool: A, B.

12-09-13 **FINAL EXAM:**

new FLOW CHART for CHAPTERS with MULTIPLE TOPICS: compare and get COMPLIMENT to TEST 3.

T3 → see LINKS and REVIEW MATERIAL FOR TEST 3: see 12-02-13

T3 CH	on TEST 3, TOPIC	on FINAL [COMPLIMENT]
34	2 converging lens	lens-MIRROR, MAGNIFIER, TELESCOPE
35	BASIC 2 SOURCE interference	2 slit interference, THIN FILMS
36	one-slit DIFFRACTION (sec. 36.2)	Intensity of one-slit DIFFRACTION (36.3); sec 36.4 (#20, 22)

FINAL EXAM review:

CH 19 — see 643 Physics 4C

$W = \int P\,dV$

1ST LAW $dQ = dU + dW$

$U = n\frac{f}{2}R \cdot T$

$\Delta U = n\frac{f}{2}R\Delta T$, f = # degrees of freedom

Special processes:

- Adiabatic $(dQ = 0)$
- constant volume
- P = constant
- T = constant

$C_p = C_v + R$

$\Delta Q = 0 = \Delta U + W$

$\Rightarrow W = -\Delta U$

Adiabatic: $W = -nC_v\Delta T$

$P_1V_1^{\gamma}$ = constant

$= \frac{nC_v}{R}(P_1V_1 - P_2V_2)$

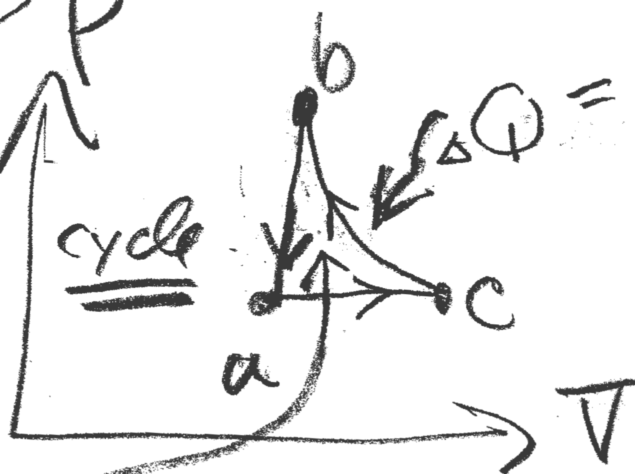
$C_v = \frac{f}{2} \cdot R$

$= \frac{1}{\gamma - 1} \cdot (P_1V_1 - P_2V_2)$

masteringphysics.com

ch19:

#46 ⟷ see #5, ch20



Work = area

(a) $W_{b\to a} = 0$

$W_{a\to c} = p_a\cdot(V_c - V_a)$

$\boxed{\text{see comment next PAGE}}$ $= p_c\cdot(V_c - V_a)$

$= p_cV_c - p_aV_a = nR\Delta T$

$W_{c\to b} = -nC_v(T_b - T_c)$

$= -(3)\frac{5}{2}R\cdot(600-492)$

$W_{TOTAL} = W_{a\to c} + W_{c\to b}$

= area within BORDER

$\boxed{R = 8.31 \frac{J}{K\cdot mol}}$

Given: $C_p = 29.1 \frac{J}{mol\cdot K} \Rightarrow C_v = C_p - R = 20.8 = \frac{5}{2}R$

From table 19.1: diatomic gas

$$C_V = \frac{f}{2} \cdot R$$

↓

$$20.8 = \frac{f}{2} \cdot R \leftarrow 8.31 \text{ NUMERICALLY.}$$

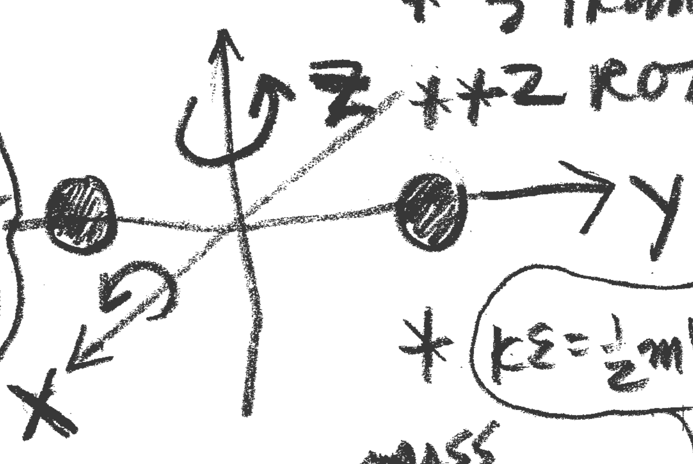
solve for f: $\boxed{f \approx 5}$

$C_V = \frac{5}{2}R \rightarrow C_P = \frac{7}{2}R$.

5 degrees of freedom.

* 3 TRANSLATION;

** 2 ROTATIONAL.



** $\frac{1}{2} \cdot I_x \cdot \omega_x^2 + \frac{1}{2} \cdot I_y \cdot \omega_y^2$

* $KE = \frac{1}{2} m v_x^2 + \frac{1}{2} m v_y^2 + \frac{1}{2} m v_z^2$

$m = 2 \cdot m_A \leftarrow$ MASS OF ATOM

(46.)

$$W_{a\to c} = P \cdot \Delta V$$

BUT since $PV = nRT$

$$P \cdot \Delta V = nR\Delta T$$

$$W_{a\to c} = nR\Delta T$$

$$= nR(T_c - T_a)$$

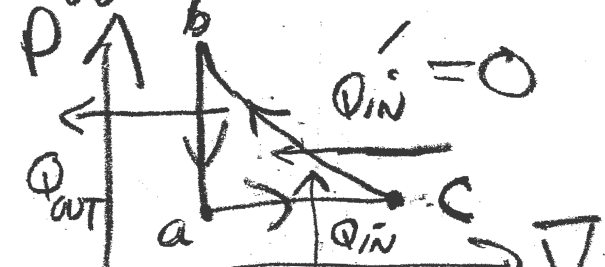
PART (a) WHAT IF? (A.) e = efficiency (CH 20)

$$e = \frac{W_{TOTAL}}{Q_{IN}}$$

$Q_{IN}' = 0$ (ADIABATIC),

$\Delta Q_{a\to c} = Q_{IN} = \Delta U + W = nC_p\Delta T$

$\Delta T = T_c - T_a$; $C_p = C_V + R$



Note: Derivation:

$$PV = nRT$$

If P = constant

$$\Delta(PV) = P\cdot\Delta V = nR\Delta T$$

$$P\cdot\Delta V = W$$

Δ internal energy

$$\Delta Q = \Delta U + W$$

$$\Delta Q = nC_v\Delta T + nR\Delta T$$

$$\boxed{U \propto T}$$

$$\Delta Q = n(C_v + R)\cdot\Delta T$$

$$= nC_p\cdot\Delta T$$

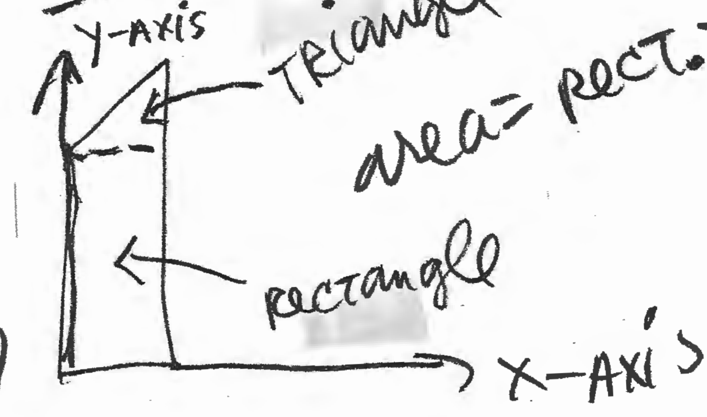
$$\Delta U \propto \Delta T$$

$$\rightarrow C_p = \boxed{C_v + R}$$

CH19

#4.

TRAPEZOID

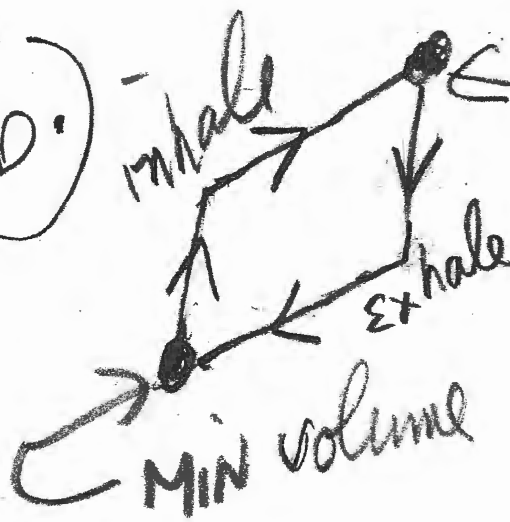


area = RECT. + TRI.

a.

USE area = area RECT. + area TRI.

b.



$$P_{MAX} V_{MAX} = n R T_{MAX}$$

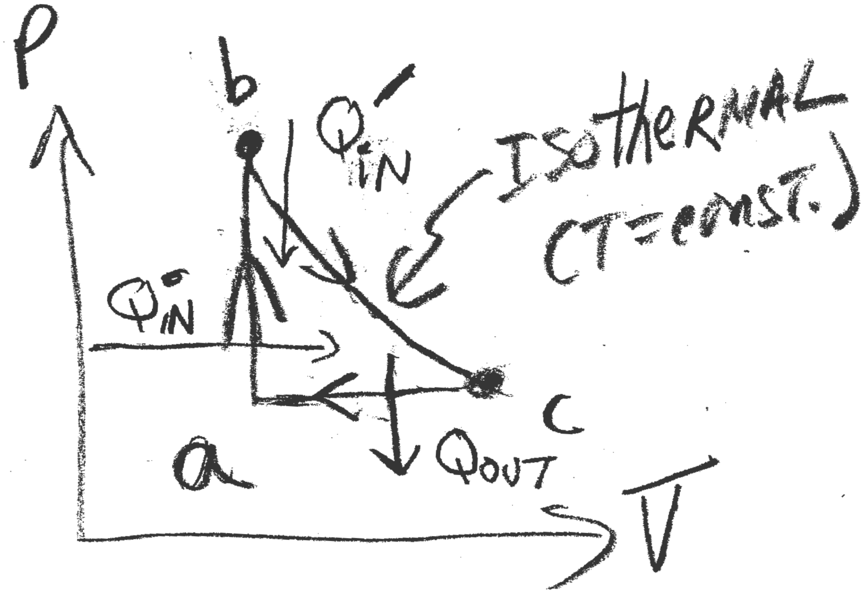
$$n_{MAX} = \frac{P_{MAX} V_{MAX}}{T_{MAX} R}$$

On Final, I COULD ASK:

What is the MAXIMUM MOLES TRANSFERRED from IN TO OUTSIDE LUNGS: answer $n_{MAX} - n_{MIN}$

CH19 Review

#47.



(a.) $V_c = ?$

$$\frac{P_c V_c}{\cancel{T_c}} = \frac{P_b V_b}{\cancel{T_b}}$$

$\rightarrow V_c$

(b.) $T_c = \dfrac{P_c V_c}{nR}$; $\underbrace{T_b = T_c}_{\text{Isothermal}}$;

$$T_a = \frac{P_a \cdot V_a}{nR} < T_c = T_b$$

11

C.

$$\Delta Q = \Delta U + W$$

$$\Delta Q_{ab} = \Delta U + 0$$

$$\Delta V = 0$$

$$\Delta Q_{ab} = n C_V \Delta T = n C_V (T_b - T_a)$$

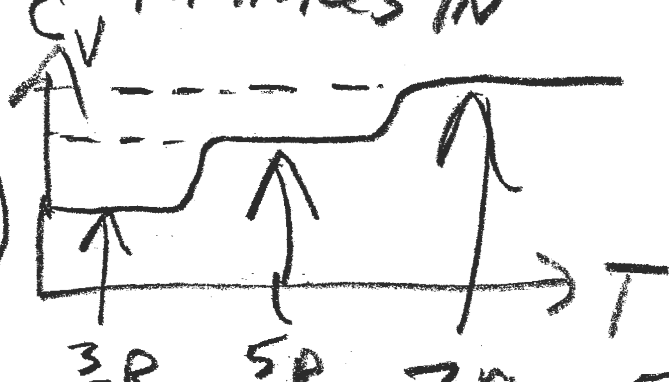
$$C_V = \frac{f}{2} R.$$

$f = ?$ (DIATOMIC gas $-H_2$)

Go to sec. 18.4 → fig 18.19

COMPARE GRAPH with temperatures in PART (a.)

FROM GRAPH, FIND f.



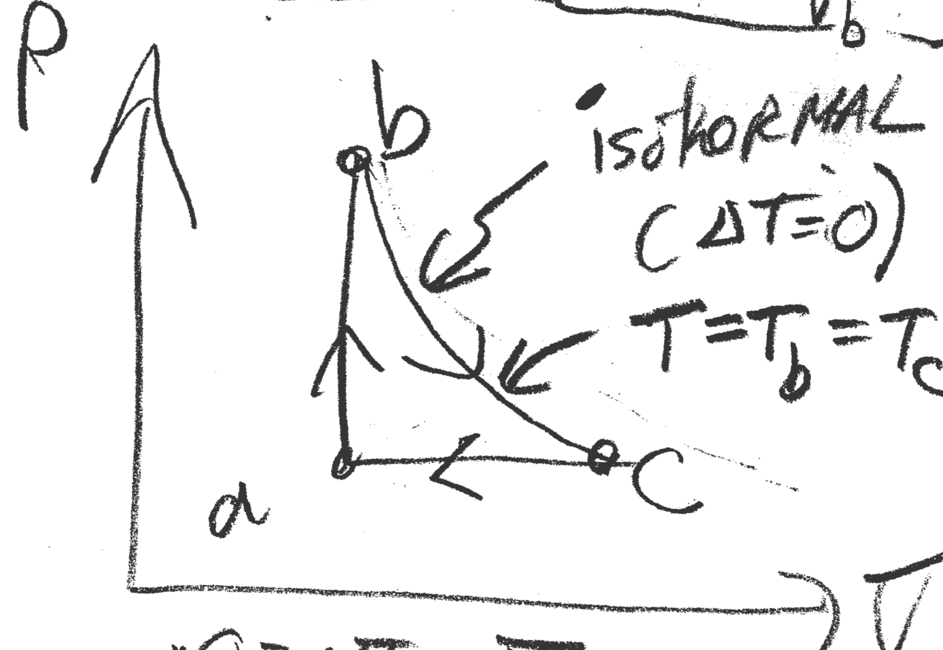
$\frac{3}{2}R$ $\frac{5}{2}R$ $\frac{7}{2}R$

$f=3$ $f=5$ $f=7$

Isothermal:
$\Delta Q = \Delta U + W$

$\Delta Q_{bc} = 0 + W$, since $U \propto T$, $\Delta U \propto \Delta T$

$\Delta Q_{bc} = W = nRT \ln \frac{V_c}{V_b}$



$\Delta Q = \Delta U + W$

$$\Delta Q_{ca} = n c_p \cdot \Delta T$$
$$= n(c_v + R) \cdot \Delta T$$
$$= n(c_v + R) \cdot (T_a - T_c) < 0$$

$c_v = \frac{f}{2} R$; $f = 3, 5$ or 7 see fig 18.19

(d) - convenient table

Signs

	$a \to b$	$b \to c$	$c \to a$		
ΔQ	+	+	—		
ΔU	+	0	—		
W	0	+	—		

NOTE: $\Delta Q_{cycle} = \Delta U_{cycle} + W_{cycle}$

$\boxed{\Delta Q_{cycle} = W_{cycle}}$

$$\Delta Q_{cycle} = 0 + W_{cycle} > 0$$

EXPRESSIONS: 14

(47) (d)

		$a \to b$	$b \to c$	$c \to a$
PART (c)	ΔQ	$nc_v(T_b - T_a)$	$nRT \ln \frac{V_c}{V_b}$	$nc_p(T_a - T_c)$
PART (d)	ΔU	$nc_v(T_b - T_a)$	0	$nc_v(T_a - T_c)$
	W	0	$nRT \ln \frac{V_c}{V_b}$	* $nR(T_a - T_c)$

$$\Delta Q = \Delta U + W$$

* NOTE:

BOYLE'S LAW

$c \to a$ (P = CONST.) $W = P \cdot \Delta V = nR\Delta T$

ALSO:

$$W = \Delta Q - \Delta U$$

$$= nc_p \cdot \Delta T - nc_v \cdot \Delta T$$

$$= n \cdot R \cdot \Delta T \text{ SINCE } c_p - c_v = R$$

47, CH 19

WHAT IF?

i) $e = ?$ CH 20

efficiency

$$e = \frac{W}{\Delta Q_{ab} + \Delta Q_{bc}} = \frac{W}{Q_{IN}\,(\text{TOTAL})}$$

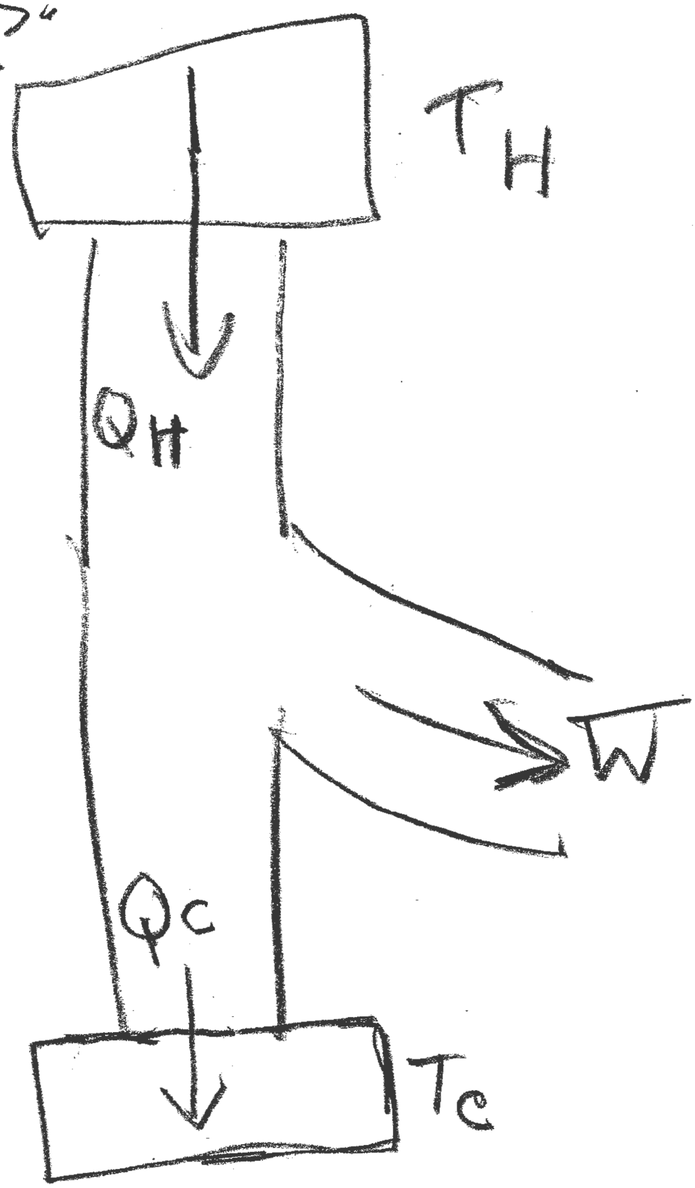
ii)

compare e (PART i)
with e of CARNOT
Engine operating
between 2 appropriate
Temperatures:

$$e_C = 1 - \frac{T_c}{T_h} = 1 - \frac{T_a}{T}$$

CH 20 Review

A. Engines:



real engine → $e = \frac{W}{Q_H} = 1 - \frac{|Q_C|}{|Q_H|}$

Carnot Engine → $e_C = 1 - \frac{T_C}{T_H}$ (BEST!)

CH20 Review

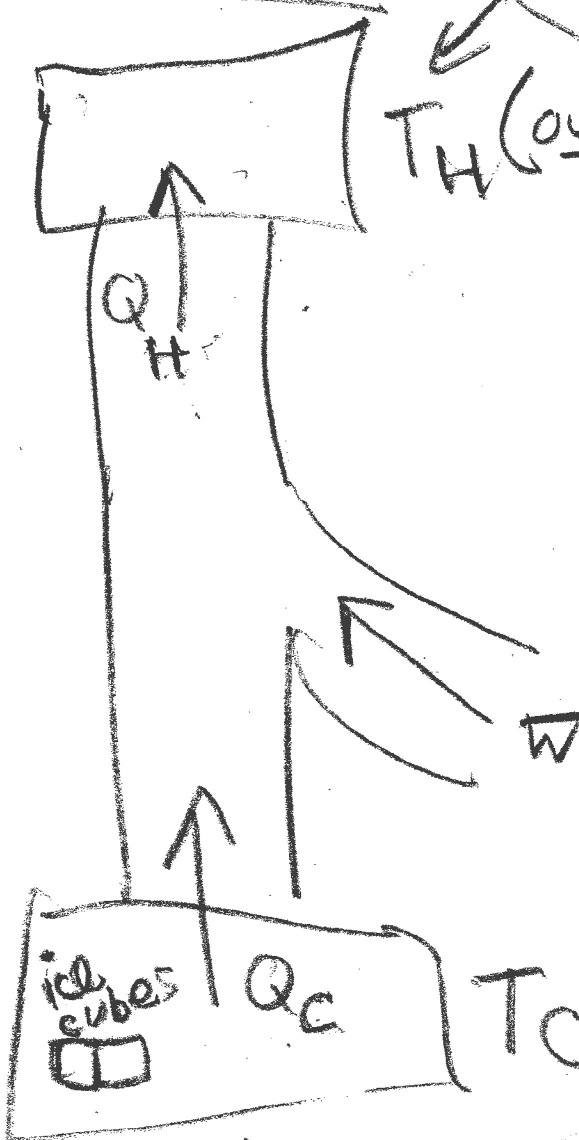
B. Refridgerators!

8., 11.:

$\underline{K} = \frac{|Q_c|}{W}$

refrigerators

fridge



Temp. of kitchen

T_H (outside fridge in kitchen)

T_C (inside fridge or freezer)

$W + |Q_c| = |Q_H|$

$$K = \frac{|Q_c|}{W} = \frac{|Q_c|}{|Q_H| - |Q_c|} = \frac{T_C}{T_H - T_C}$$

GENERAL — CARNOT

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16. $Q_C = m \cdot L_f$ = energy freeze water.

$W + |Q_c| = |Q_H|$

(a) $\boxed{Q_H = ?}$ $K = \frac{Q_c}{W} = \boxed{\frac{T_c}{T_H - T_C}} \rightarrow$ FIND W.

$* \; |Q_H| = W + |Q_c|$

CH20:

(18)

16. b. $\overline{W} = ?$

$$\overline{W} = |Q_H| - |Q_C|$$

CH20:

5. → see class notes:

see # 46, CH.19

CH20

26. use L_V.

$$\Delta Q = m \cdot L_V, \quad m = 0.140\,kg$$

$\Delta S = ?$

ASSUME $T_{BOILING} = 4.216K$

26.

$$\Delta S_{He} = \frac{\Delta Q}{T} = \frac{mL_v}{4.216K}$$

Follow up:

Assume process is

* reversible. What is the change in entropy ΔS_{Env} for environment?

Helium

$\uparrow \Delta Q$

environment

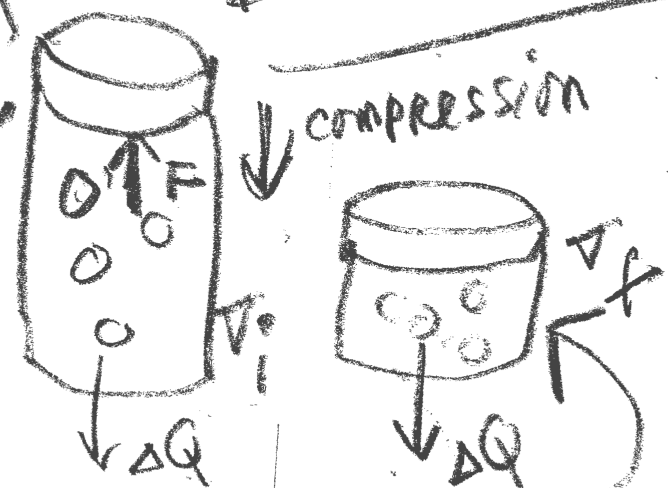
* $\Delta S_{He} + \Delta S_{Env} = 0$

$\Rightarrow \Delta S_{Env} = -\Delta S_{He}$

27.

Isothermal compression:

T = CONSTANT



$n = 3$

$W = -1900\,J$

work on gas.

$\Delta S = ?$

PREDICTION: LESS DISORDER $\Leftarrow$ $\boxed{\Delta S < 0}$

$T = 19\,^{\circ}C = (19 + 273)\,K = 292\,K$

$$\Delta S = \frac{\Delta Q}{T} = \boxed{\frac{-1900\,J}{292\,K}}$$

$$\Delta Q = \underbrace{\Delta U}_{0} + W$$

$$\Delta Q = W = nRT \ln \frac{V_f}{V_i}$$

$$\Delta S = \frac{\Delta Q}{T}$$

$$\Delta S = nR \ln \frac{V_f}{V_i}$$

WHAT IF? #27, CH 20:

<u>FIND</u> $\frac{V_f}{V_i}$.

$$\Delta S = \frac{-1900\,J}{292\,K} = nR\ln\frac{V_f}{V_i}$$

$$\frac{-1900\,J}{(nR)\cdot 292\,K} = \ln\frac{V_f}{V_i}$$

$$e^{-\alpha} = \frac{V_f}{V_i}$$

$$\alpha = \frac{1900\,J}{(nR)\cdot 292\,K}$$