(4C) 11-25-13

CH 20 REVIEW FOR FINAL

MASTERING: QUIZ CH 20

5 ✓	26
8	27 ✓
11	28
16	
20 ✓	41 ✓
22 ✓	43 ✓
24 ✓	
25	

✓ = done OR WILL DO.

(5.) Engines

(11.) (16.) Fridge = Engine in reverse

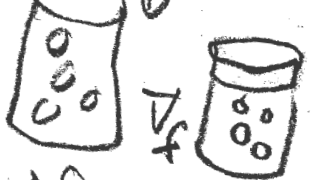
(22.) Entropy

(24.) Mixing and the 2nd Law: The entropy of universe is increasing.

(27.) Entropy changing via volume change @ constant Temp:

$\Delta S = \int \frac{\Delta Q}{T} = \int \frac{nR\,dV}{V} = nR \ln \frac{V_f}{V_i}$

$\Delta Q = P\,dV$ ($\Delta U = 0$)

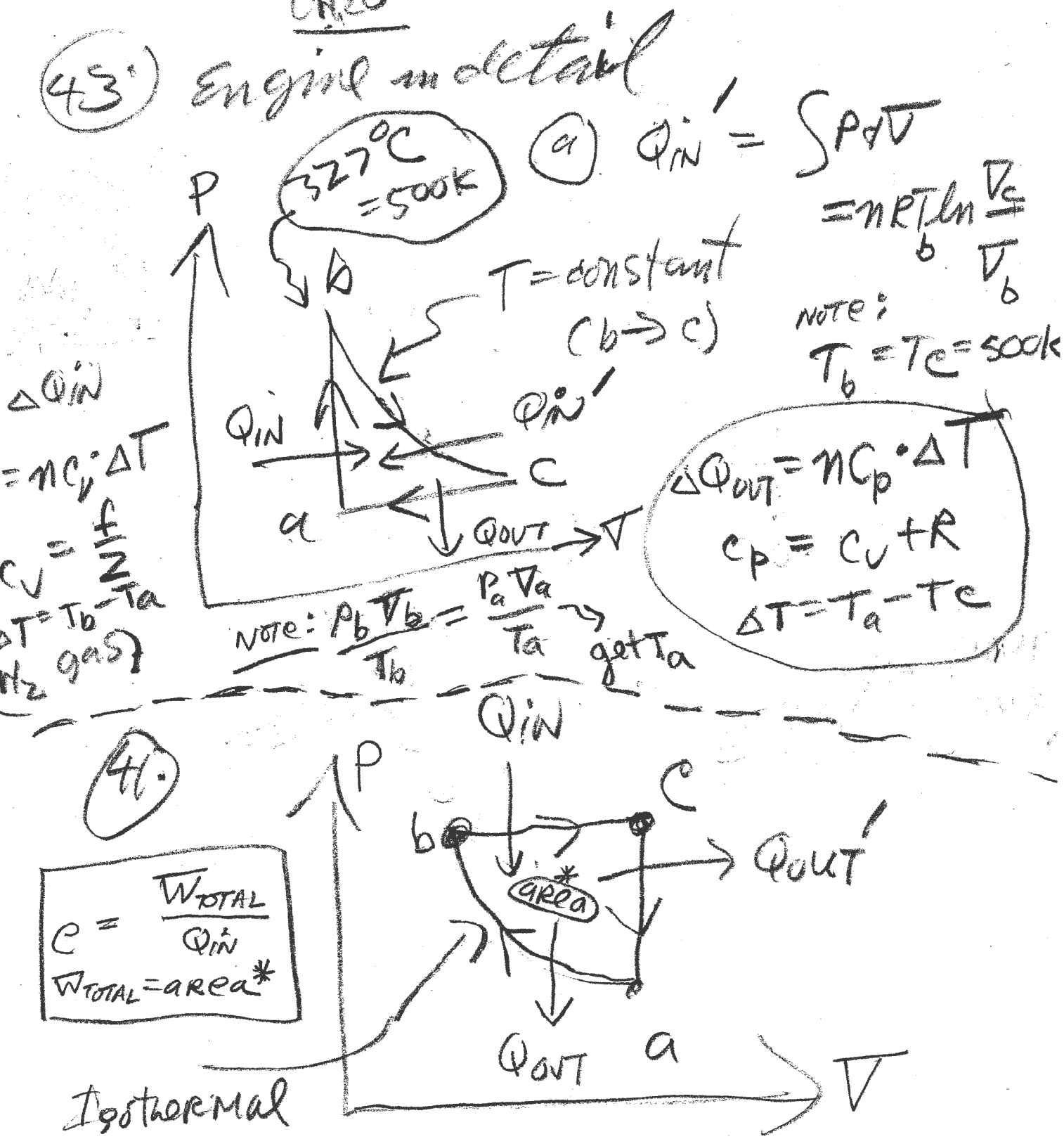


Isothermal

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

CH20

(43) Engine in detail



(41)

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

W_{TOTAL} = area*

(a) $\frac{P_b V_b}{T_b} = \frac{P_a V_a}{T_a} \rightarrow P_b V_b = P_a V_a$

SHOW this

SHOW ISOTHERMAL: a → b

$\Rightarrow T_b = T_a$

NOTES:

(43.)

$$e = \frac{W}{Q_{IN}^{(TOT)}}$$

$$Q_{IN(TOT)} = Q_{in} + Q_{in}'$$

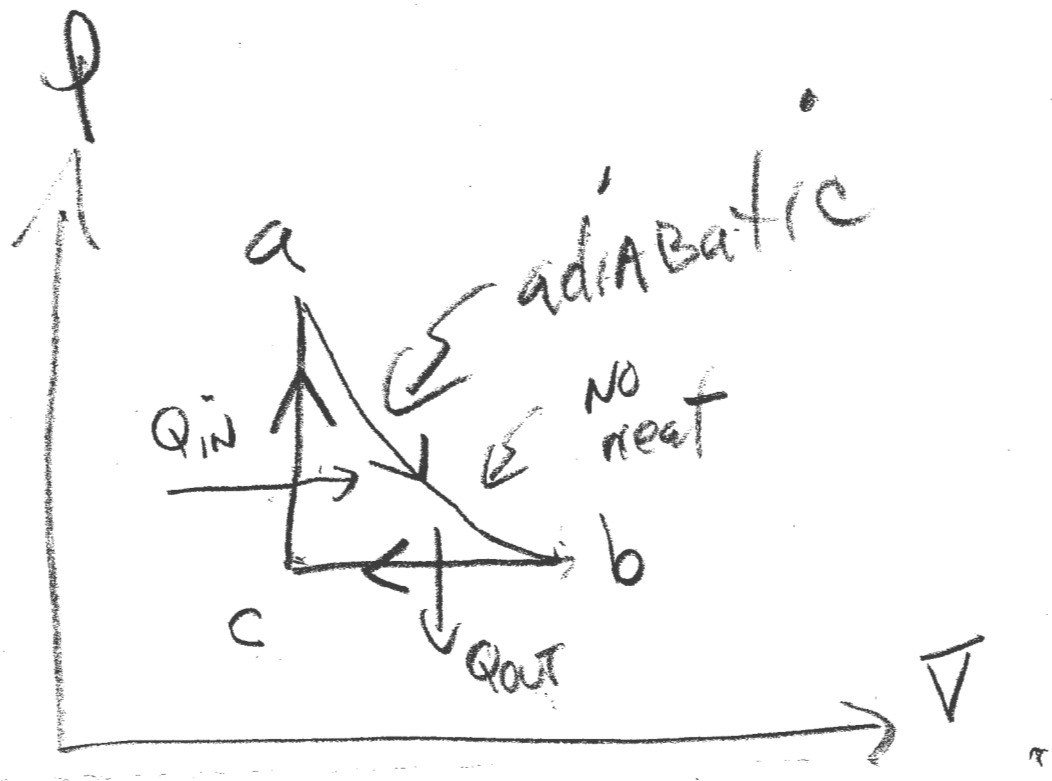
and $W = \text{area}$

(41.) $$e = \frac{W}{Q_{in}} = \frac{\text{area}}{Q_{in}}$$

area

CH20

(5.)



(a.) Find P_a.

$$P_a V_a^{\gamma} = P_b V_b^{\gamma} \quad (CW\,18)$$

Adiabatic (note: $V_a = V_c$)

(b)

$$\Delta Q = \Delta U + \overrightarrow{W}^{0} \quad (c \to a)$$

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

$Q_{IN} = \boxed{\Delta Q = nC_V \cdot \Delta T}$; $\Delta T = T_a - T_c$

Note: $P_a V_a = nRT_a$ and $P_c V_c = nRT_c$

CH 20:

5.

(c) $Q_{out} = ?$ $(b \to c)$

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

$$W = P \cdot \Delta V = n \cdot R \cdot \Delta T$$

$$Q_{out} = \Delta Q = \underbrace{\frac{f}{2} nR\Delta T}_{\Delta U} + nR\Delta T$$

$$Q_{out} = \Delta Q = n \cdot \left(\frac{f}{2} + 1\right) \cdot R \cdot \Delta T$$

$\Delta T = T_c - T_b$

We know T_c.

$\frac{P_b \cdot V_b}{T_b} = nR$; FIND T_b

NOTE:
$\Delta T < 0$.
$T_c - T_b < 0$.

CH 20

5. (d.)

$$W_{TOTAL} = ?$$

$$W_{cycle} = W_{TOTAL}$$

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

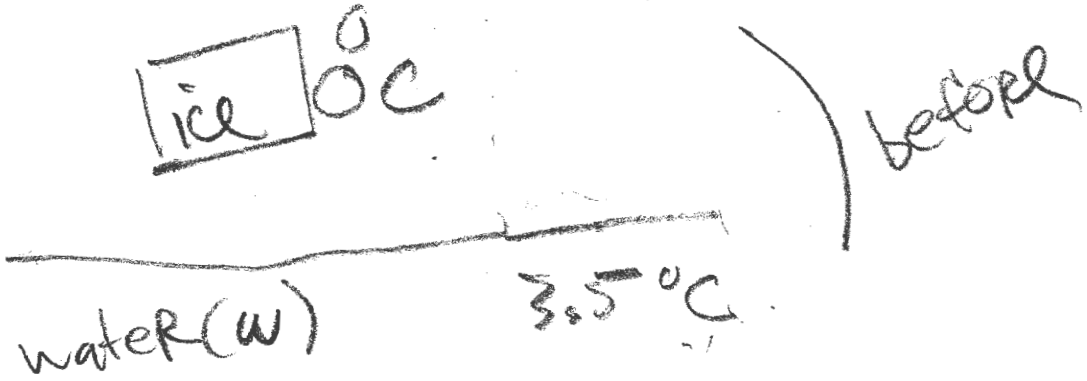
$$\downarrow$$

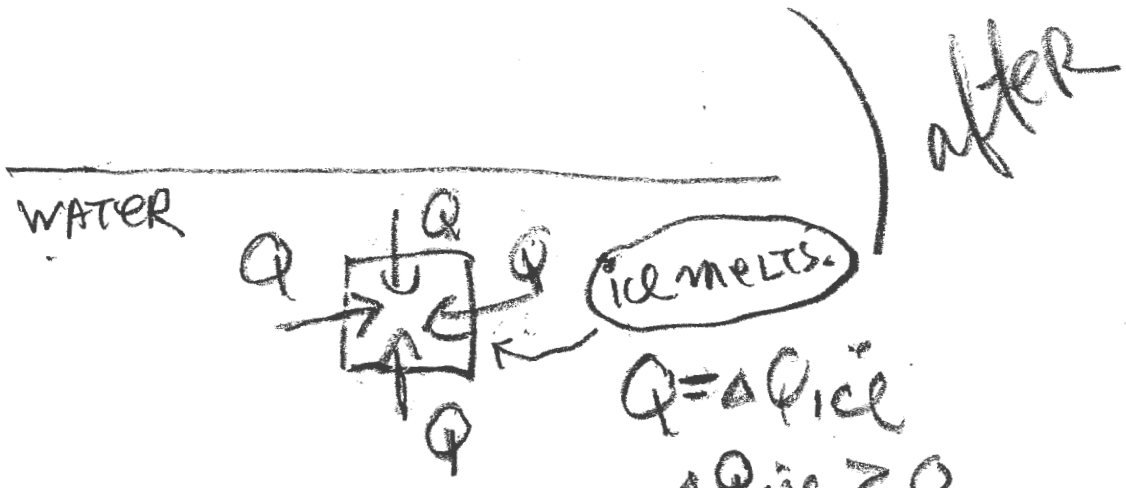
$$\Delta Q_{cycle} = 0 + W_{cycle}$$

$$W_{cycle} = W_{TOTAL} = Q_{IN} + Q_{OUT}$$

(e.) $$e = \frac{Q_{IN} + Q_{OUT}}{Q_{IN}}$$

(22.)





$Q = \Delta Q_{ice}$

$\Delta Q_{ice} > 0$

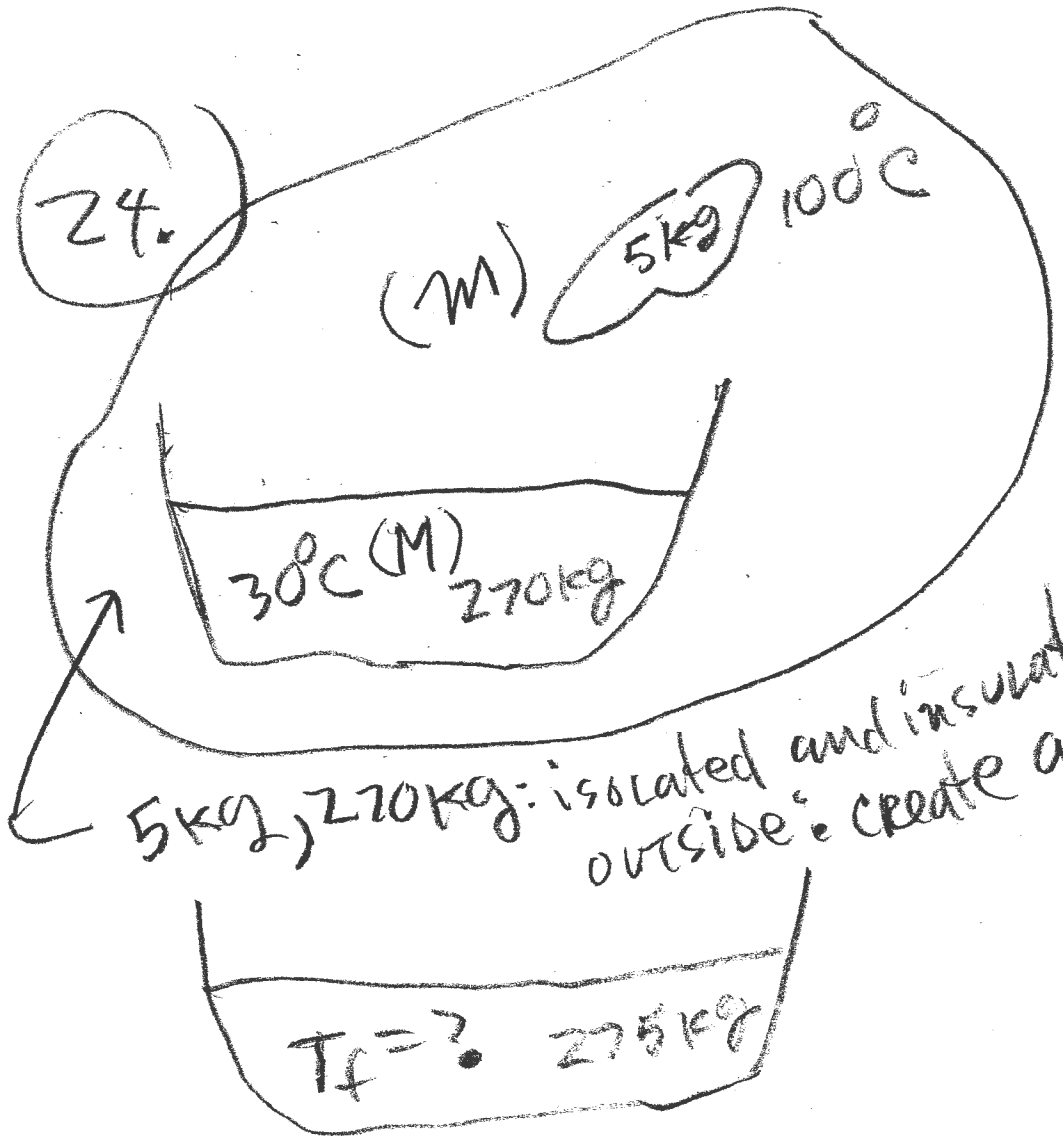
$$\Delta S_{total} = \frac{\Delta Q_{ice}}{T_{ice}} + \frac{\Delta Q_w}{T_w} > 0$$

$T_{ice} = 273K$ ← use

$T_w = 273 + 3.5 = 276.5K$

$\Delta Q_{ice} > 0$; $\Delta Q_w < 0 \Rightarrow \Delta Q_w = -\Delta Q_{ice}$

24.



(a) irreversible (but use a reversible path to get the SAME ΔS)

(b) $|\text{Heat lost}|^{5\text{ kg}} = |\text{Heat gained}|^{270\text{ kg}}$

$$mC_w(100 - T_f) = MC_w(T_f - 30)$$

FIND T_f: $30 < T_f < 100$

#24, CH20:

(c.) Assume 5kg and 270kg are isolated and create their own "universe".

$\Delta S_{TOTAL} > 0$ since

ΔS of universe increases in a universe governed by irreversible processes.

$$\Delta S_{TOTAL} = \int \frac{dQ}{T} + \int \frac{dQ}{T}$$

(note: $dQ = mc\,dT$)

5kg ↓ 270kg ↓

$$\Delta S_{TOTAL} = mC_w \ln\frac{T_f}{373} + mC_w \ln\frac{T_f}{303}$$

$303 < T_f < 373$

Show $\Delta S_{TOTAL} > 0$.