HW 8/7 p489 Problems 26, ~~27~~
(skip H!)
Online - Various Gas expansion

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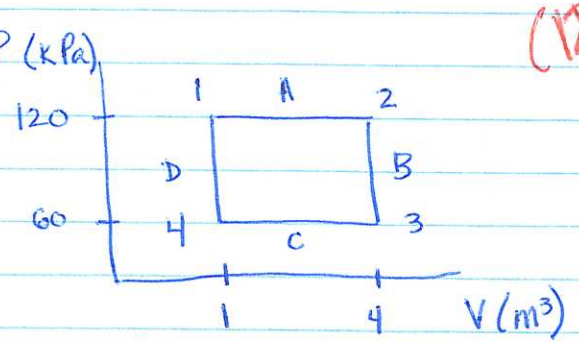
p489 - Problems (12)

26) cyclic process

n = 1 mol




a) Work done each segment?

A: $W = -P\Delta V = -(120\times10^3 Pa)(4m^3 - 1m^3)$
$= -3.6\times10^5 J$

Won gas

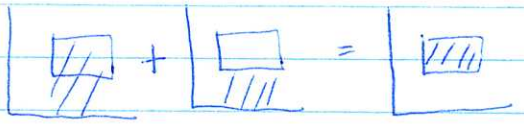
B: $W = -P\Delta V = 0J$

C: $W = -P\Delta V = -(60\times10^3 Pa)(1m^3 - 4m^3)$
$= 1.8\times10^5 J$

(2)

D: $W = 0J$

b) net Work

(1) Won 

$W_{net} = \Sigma W_A$
$= -3.6\times10^5 J$
$+ 1.8\times10^5 J$

$= -1.8\times10^5 J$

c) Work by gas? $+1.8\times10^5 J$

d) Temp each corner? $PV = nRT$

$$T_1 = \frac{P_1 V_1}{nR} = \frac{(120\times10^3\,Pa)(1\,m^3)}{1\,mol\,(8.31\,J/mol\,K)} = 1.44\times10^4\,K$$

$$T_2 = \frac{P_2 V_2}{nR} = \frac{(120\times10^3\,Pa)(4\,m^3)}{1\,mol\,(8.31\,J/mol\,K)} = 5.78\times10^4\,K$$

$$T_3 = \frac{P_3 V_3}{nR} = \frac{(60\times10^3\,Pa)(4\,m^3)}{1\,mol\,(8.31\,J/mol\,K)} = 2.89\times10^4\,K$$ (2)

$$T_4 = \frac{P_4 V_4}{nR} = \frac{(60\times10^3\,Pa)(1\,m^3)}{1\,mol\,(8.31\,J/mol\,K)} = 7220\,K$$

e) Thurmal energy each corner?

$$U_1 = \frac{3}{2} nRT_1 = \frac{3}{2}(1\,mol)(8.31\,\tfrac{J}{mol\,K})(1.44\times10^4\,K)$$

$$= 1.8\times10^5\,J$$

$$U_2 = \frac{3}{2} nRT_2 = \frac{3}{2}(1\,mol)(8.31\,\tfrac{J}{mol\,K})(5.78\times10^4\,K)$$

$$= 7.2\times10^5\,J$$ (2)

$$U_3 = \frac{3}{2} nRT_3 = \frac{3}{2}(1\,mol)(8.31\,\tfrac{J}{mol\,K})(2.89\times10^4\,K)$$

$$= 3.6\times10^5\,J$$

$$U_4 = \frac{3}{2} nRT_4 = \frac{3}{2}(1\,mol)(8.31\,\tfrac{J}{mol\,K})(7220\,K)$$

$$= 9.0\times10^4\,J$$

f) change in internal energy

$\Delta U_A = U_2 - U_1 = 7.2\times10^5 J - 1.8\times10^5 J = 5.4\times10^5 J$

$\Delta U_B = U_3 - U_2 = 3.6\times10^5 J - 7.2\times10^5 J = -3.6\times10^5 J$

$\Delta U_C = U_4 - U_3 = 9.0\times10^4 J - 3.6\times10^5 J = -2.7\times10^5 J$

(2)

$\Delta U_D = U_{f1} - U_4 = 1.8\times10^5 J - 9.0\times10^4 J = 9.0\times10^4 J$

g) heat during each step $\Delta U = Q + W$

$Q_A = \Delta U_A - W_A = 5.4\times10^5 J - (-3.6\times10^5 J)$
$= 9.0\times10^5 J$

$Q_B = \Delta U_B - W_B = -3.6\times10^5 J - 0J$
$= -3.6\times10^5 J$

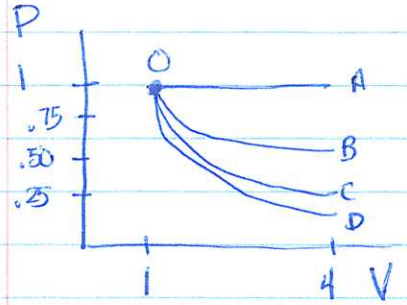
(2)

$Q_C = \Delta U_C - W_C = -2.7\times10^5 J - 1.8\times10^5 J$
$= -4.5\times10^5 J$

$Q_D = \Delta U_D - W_D = 9.0\times10^4 J - 0J$
$= 9.0\times10^4 J$

h) SKIP! .18

- Online - Various Gas Expansion




a) which curve is isobaric?

A

b) What happens to temp during isobaric?

$PV = nRT$ $\uparrow V$ $\uparrow T$

- temp increases

c) which curve is isothermal

C

(1)

d) which curve is adiabatic D

e) Graphically, the work along path in PV plot ____.

- is area under curve from $V_0$ to $V_f$