Chap 20 P30

a) $\Delta E = Q - W_{by\ gas}$

$W =$ Area under PV curve

$= \frac{1}{2}$ base x height

$W = \frac{1}{2} \cdot (4 m^3) \times (6 kPa)$

$= 12\ kPa\ m^3 = 12 \times 1000 \frac{N}{m^2} \cdot m^3 = 12000\ J$

For a closed cycle like this one

$\Delta E = 0$

$Q = W_{by\ gas} = 12{,}000\ J$

↳ This means 12,000 more joules flowed <u>into</u> than <u>out of</u> the system

If the cycle is reversed

$W_{by\ gas} = -12{,}000\ J$ $\quad Q = -12{,}000 J$

Then 12,000 more joules flowed <u>out of</u> than <u>into</u> the system

P38

This is the same

$$\cancel{\Delta E^{\circ}} = Q - W$$

W = Area = base x height

$$\text{Area} = (3V_i - V_i) \times (3P_i - P_i)$$

a) $W_{\text{by gas}} = \text{Area} = 4P_iV_i$

b) $Q = 4P_iV_i$

c) $P_iV_i = nRT_i$

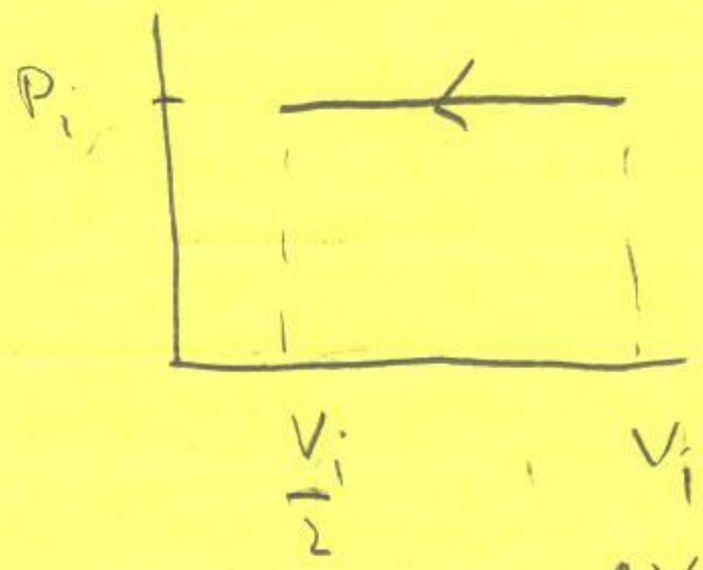
$$Q = 4(nRT_i) \qquad 0^{\circ}C$$

$$Q = 4(1\text{mol})\left(8.31 \frac{J}{\text{mol}\,^{\circ}K}\right)(273\,^{\circ}K)$$

$$\boxed{Q = 9075\,J}$$

P. 58

a)



ΔV negative

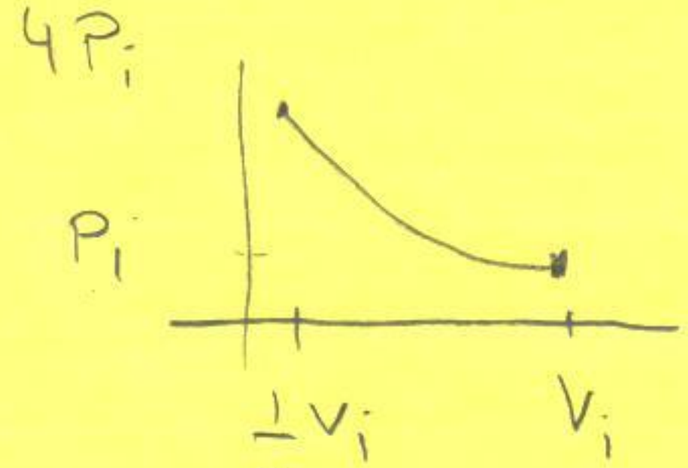
$W_{\text{by gas}} = -(\text{area}) = -(\text{base}) \times \text{height}$

$= -\left(\frac{V_i}{2}\right)(P_i) = -\frac{P_i V_i}{2}$

$W_{\text{on gas}} = \frac{P_i V_i}{2}$

b)

Isobaric



$PV = nRT$ ← T is constant for "isothermal"

$V \propto \frac{1}{P}$

So $V_f = \frac{1}{4} V_i$

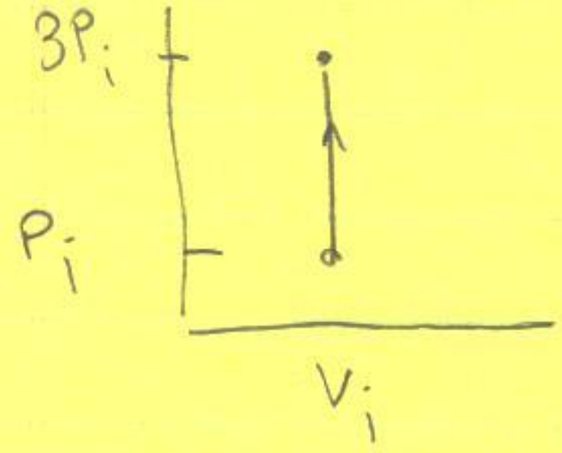
$W_{\text{by gas}} = nRT \ln \frac{V_f}{V_i}$

$nRT = P_i V_i$

$\ln \frac{1}{4} = -\ln 4$

$W_{\text{by gas}} = P_i V_i \ln \frac{\frac{1}{4} V_i}{V_i} = P_i V_i \ln \frac{1}{4} = -P_i V_i \ln 4$

$$W_{\substack{on\\gas}} = +P_i V_i \ln 4$$

c) 

$$W = P\Delta V = 0$$

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