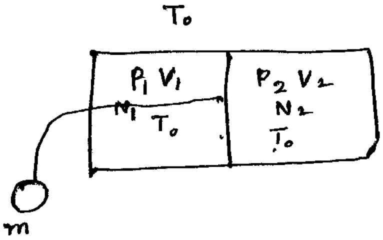


$P_1 > P_2$

When the partition moves to the right it does work by lifting the mass m. Let this done quasistatistically. Then W.D. in an intermediate state is

$V'P = N_1 R T_0$
$(V - V')P' = N_2 R T_0$

$$\Delta W_{by} = \int_{V_1}^{V_f} dV'(P - P') = RT_0 \int_{V_1}^{V_f} \left[\frac{N_1\, dV'}{V'} - \frac{N_2\, dV'}{V - V'}\right]$$

$$= RT_0 \left[N_1 \ln \frac{V_f}{V_1} + N_2 \ln \frac{V - V_f}{V - V_1}\right]$$

$$F_i = -N_1 R T_0 \ln \frac{V_1}{N_1} + -N_2 R T_0 \ln \frac{V - V_1}{N_2} + (N_1 + N_2) f(t)$$

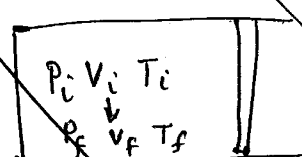
$$F_f = -N_1 R T_0 \ln \frac{V_f}{N_1} - N_2 R T_0 \ln \frac{V - V_f}{N_2} + (N_1 + N_2) f(t)$$

$$F_f - F_i = -N_1 R T_0 \ln \frac{V_f}{V_1} - N_2 R T_0 \ln \frac{V - V_f}{V - V_1} = -\Delta W_{by} = \underline{\Delta W_{on}}$$

In general $\Delta F = F_f - F_i \leq \Delta W_{on}$ if not done quasi statically.

~~Example 2~~

Consider



P_e outside pressure

1 mole of perfect gas

Movable piston

Adiabatic walls

$P_i V_i = R T_i \qquad P_f V_f = R T_f \quad ; \quad U = \frac{3}{2} R T$

$\Delta Q = 0 \qquad$ Thus $dU = \Delta W_{on} = U_f - U_i$

$$= \frac{3}{2} R \left[P_f V_f - P_i V_i\right]$$

$$S = \frac{5}{2} R \ln V + \frac{3}{2} R \ln P + \text{Const}$$