CH_4

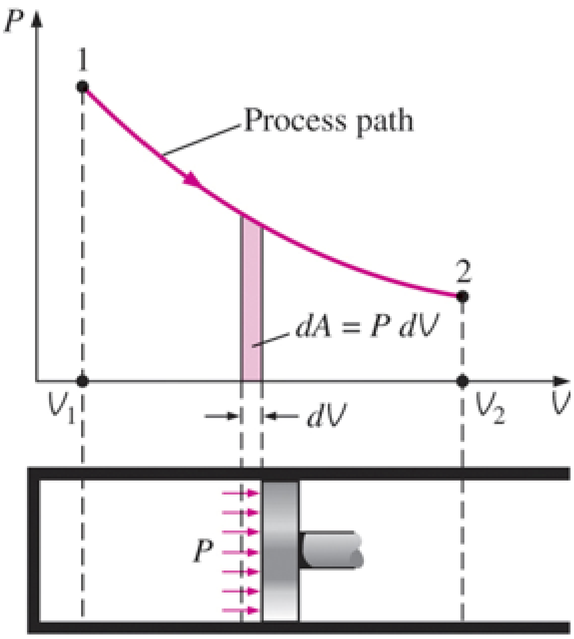
4.1 Moving Boundary Work

In a quasi-equilibrium manner

$$\delta W_b = F\mathrm{d}s = PA\mathrm{d}s = P\mathrm{d}V$$

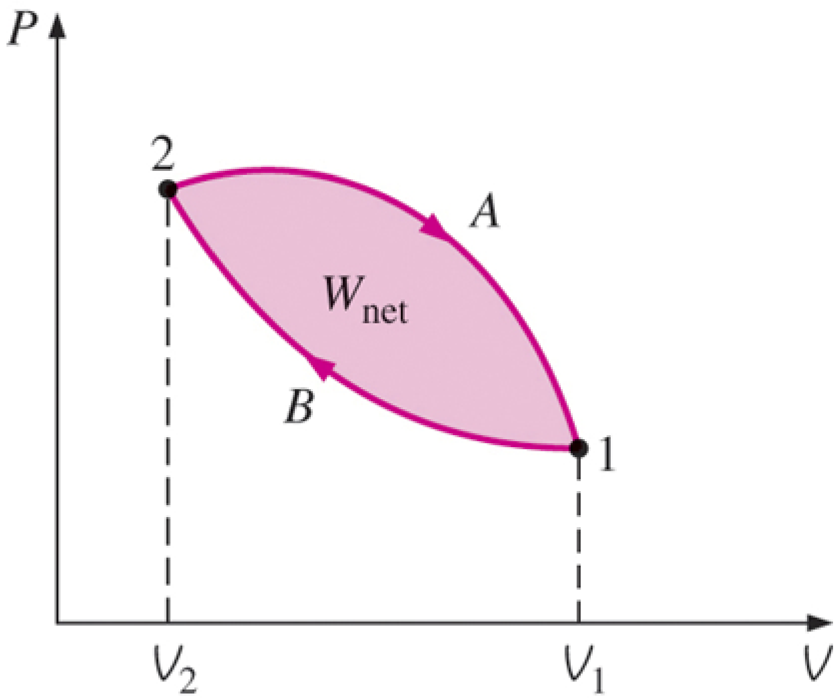
$$W_b = \int_1^2 P\mathrm{d}V$$

$$\text{Area} = A = \int_1^2 \mathrm{d}A = \int_1^2 P\mathrm{d}V$$



For a Cycle

$$W_{net} = W_{2-1} - W_{1-2}$$



Polytropic Process

$$PV^n = C$$

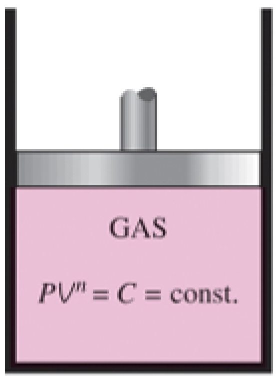
$$\Downarrow$$

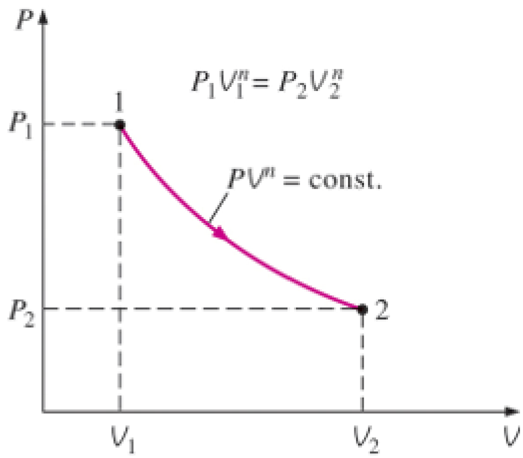
$$P = CV^{-n}$$

$$W_b = \int_1^2 P\mathrm{d}V = \int_1^2 CV^{-n}\mathrm{d}V = C\frac{V_2^{-n+1} - V_1^{-n+1}}{-n+1} = \frac{P_2V_2 - P_1V_1}{1-n}$$

when $n = 1$

$$W_b = \int_1^2 P\mathrm{d}V = \int_1^2 CV^{-1}\mathrm{d}V = PV\ln\frac{V_2}{V_1}$$





4.2 Energy Balance for Closed Systems

$$Q - W = \Delta E_{\text{system}}$$

4.3 Specific Heats

Definition: the energy required to raise the temperature of a unit mass of a substance by one degree

- c_v: specific heat at constant volume
- c_p: specific heat at constant pressure

$$c_v = (\frac{\partial h}{\partial T})_v$$

$$c_p = (\frac{\partial h}{\partial T})_p$$