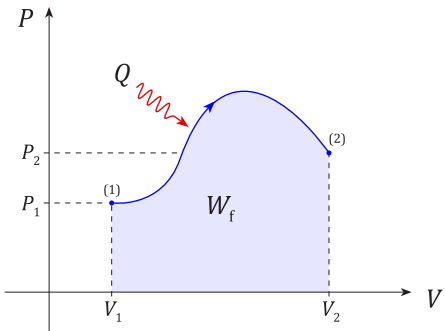
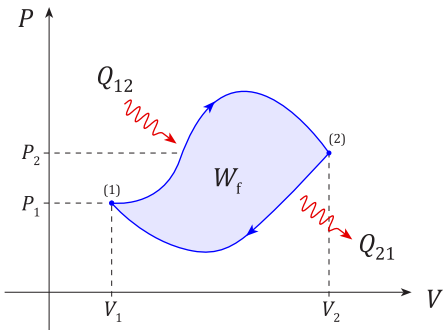
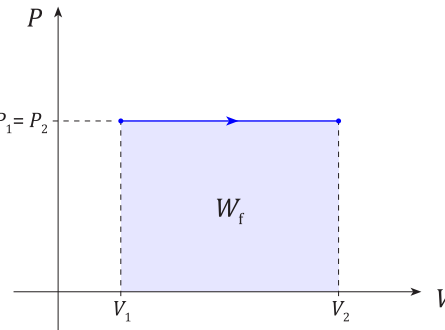
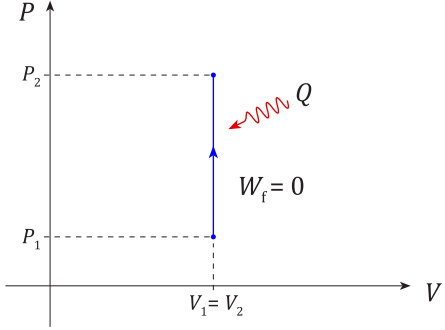


SISTEMAS FECHADOS E ESTACIONÁRIOS (Sistemas de qualquer natureza e fase)

Processo (quase-estático)	Trabalho de Fronteira (W_f)	Calor (pela 1ª Lei da Termodinâmica)	Diagrama P-V
QUALQUER	$W_f = - \int_{v_1}^{v_2} P dV$ $\delta W_f = -P dV$ $w_f = - \int_{v_1}^{v_2} P dv$ $\delta w_f = -P dv$	$Q = \Delta U - W$ $\delta Q = dU - \delta W$ $q = \Delta u - w$ $\delta q = du - \delta w$ $W = W_f + W_{\text{outros}}$ $W_{\text{outros}} = W_{\text{eixo}} + W_{\text{ele}} + \dots$	
CÍCLICO ($\Delta U = 0$)	$W_f = - \oint P dV$	$\Delta U_{\text{ciclo}} = 0 \Rightarrow Q = -W$ se $W_{\text{outros}} = 0$ então $Q = -W_f$	
ISOBÁRICO ($P = \text{const.}$) ($dP = 0$)	$W_f = -P \Delta V$	$Q = \Delta H - W_{\text{outros}}$ $q = \Delta h - w_{\text{outros}}$ se $W_{\text{outros}} = 0$ então $Q_P = \Delta H$ $q_P = \Delta h$	
ISOCÓRICO ($V = \text{const.}$) ($dV = 0$)	$W_f = 0$	$Q = \Delta U - W_{\text{outros}}$ $q = \Delta u - w_{\text{outros}}$ se $W_{\text{outros}} = 0$ então $Q_V = \Delta U$ $q_V = \Delta u$	

<p>"LINEAR"</p> <p>$\left(\frac{\Delta P}{\Delta V} = \text{const.}\right)$</p>	$W_f = -\frac{P_1 + P_2}{2} \Delta V$ $= -P_m \Delta V$	$Q = \Delta U - W_f - W_{\text{outros}}$	
---	---	--	--

SISTEMAS FECHADOS E ESTACIONÁRIOS (Gases ideais ou perfeitos, $U = f(T)$)

Processo (quase-estático)	Trabalho de Fronteira (W_f)	Calor (pela 1ª Lei da Termodinâmica)	Diagrama P-V
<p>ISOTÉRMICO</p> <p>$(T = \text{const.})$ $(dT = 0)$</p> <p>$(PV = \text{const.})$</p>	$W_f = mRT \ln \frac{V_1}{V_2}$ $P_1 V_1 = P_2 V_2 = mRT$ $\frac{V_2}{V_1} = \frac{P_1}{P_2}$	$\Delta U = 0 \Rightarrow$ $Q = -W$ <p>se</p> $W_{\text{outros}} = 0$ <p>então</p> $Q = -W_f$	
<p>ADIABÁTICO</p> <p>$(Q = 0)$</p> <p>$(PV^k = \text{const.})$</p>	$W_f = \frac{P_2 V_2 - P_1 V_1}{k - 1}$ $W_f = \frac{mR(T_2 - T_1)}{k - 1}$ $W_f = \Delta U$ $k = \frac{C_P}{C_V} > 1$	$Q = 0$	
<p>POLITRÓPICO</p> <p>$(PV^n = \text{const.})$</p> <p>$n = 0 \Rightarrow$ isobárico $n = 1 \Rightarrow$ isotérmico $n = k \Rightarrow$ adiabático $n = \infty \Rightarrow$ isocórico</p>	<p>$(n \neq 1)$</p> $W_f = \frac{P_2 V_2 - P_1 V_1}{n - 1}$ $W_f = \frac{mR(T_2 - T_1)}{n - 1}$ <p>$(n = 1)$</p> $W_f = mRT \ln \frac{V_1}{V_2}$	$Q = \Delta U - W$	