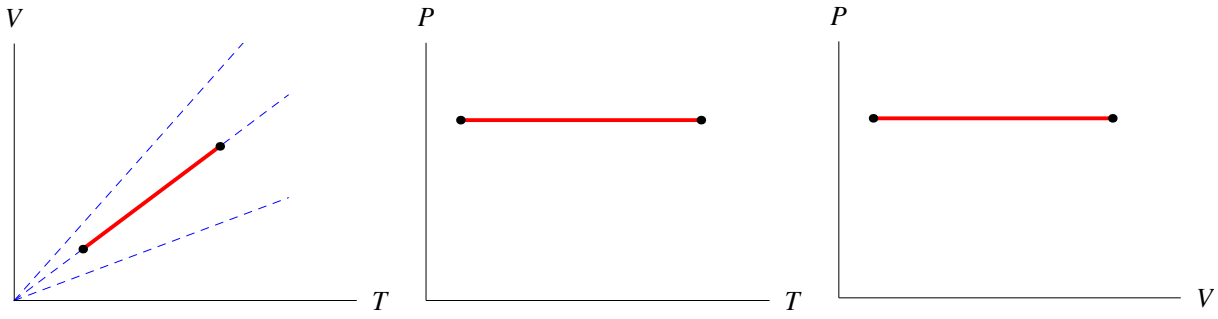
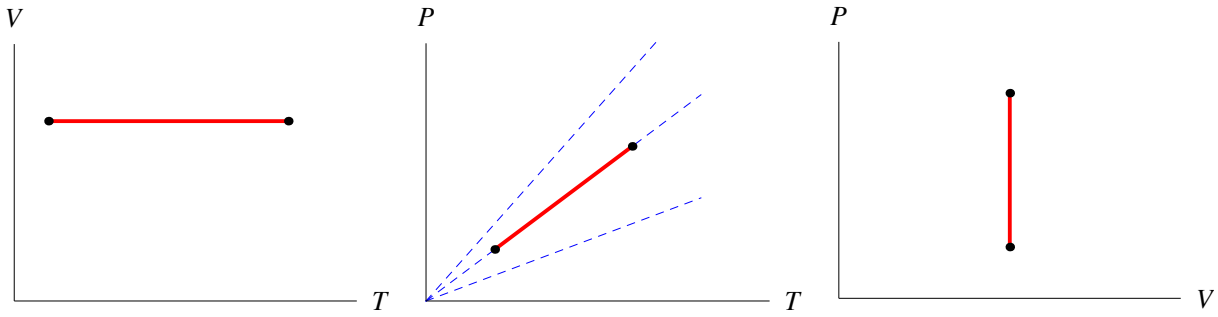
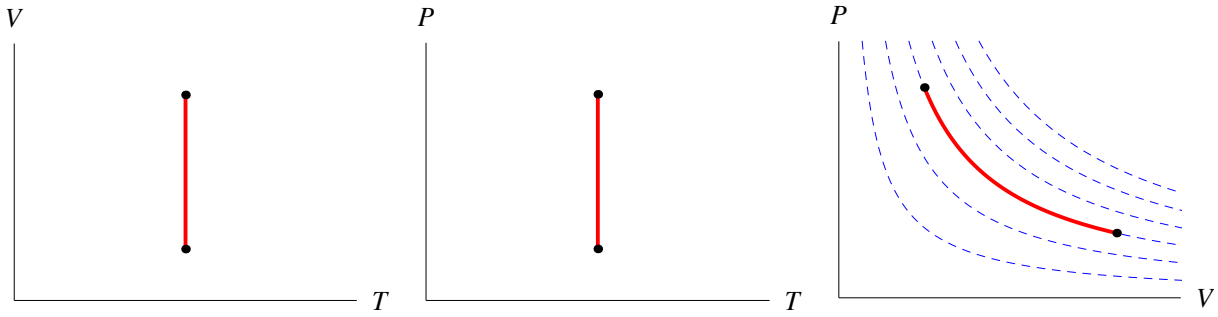
(Jacques) Charles' Law — Constant Pressure (isobaric)



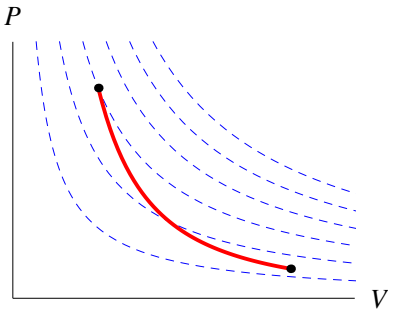
(Joseph-Louis) Gay-Lussac's Law — Constant Volume (isovolumetric, isochoric)

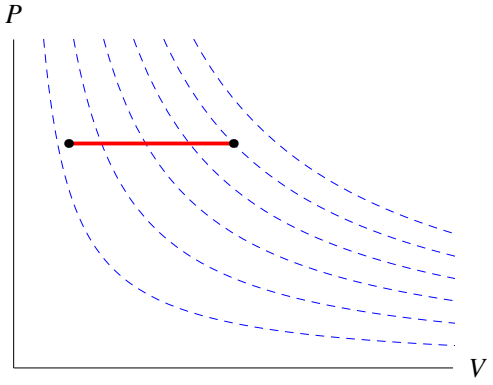


(Robert) Boyle's Law — Constant Temperature (isothermal)



Adiabatic — $Q = 0$





Isobaric Process (Charles' Law)

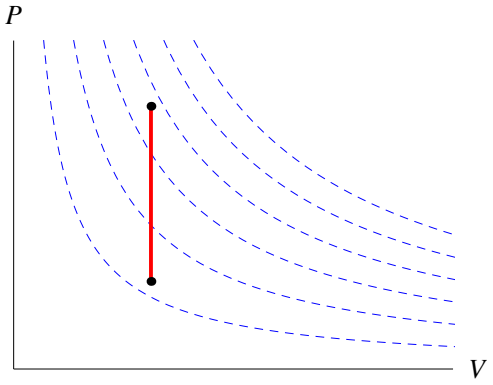
$P_1 = P_2 = \text{constant}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2} = \text{constant}$

$W = P\Delta V$

$\Delta E^{\text{int}} = \frac{3}{2} nR\Delta T = \frac{3}{2} P\Delta V$

$Q = \frac{5}{2} P\Delta V$



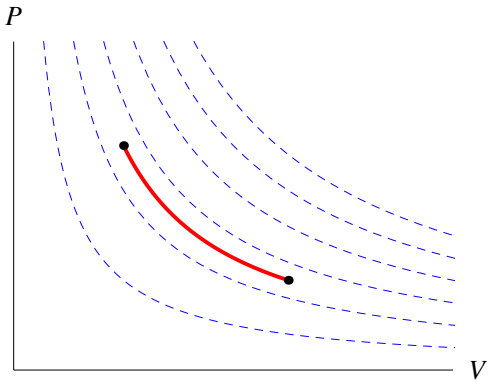
Isovolumetric Process (Gay-Lussac's Law)

$V_1 = V_2 = \text{constant}$

$\frac{P_1}{T_1} = \frac{P_2}{T_2} = \text{constant}$

$W = 0$

$Q = \Delta E^{\text{int}} = \frac{3}{2} nR\Delta T$



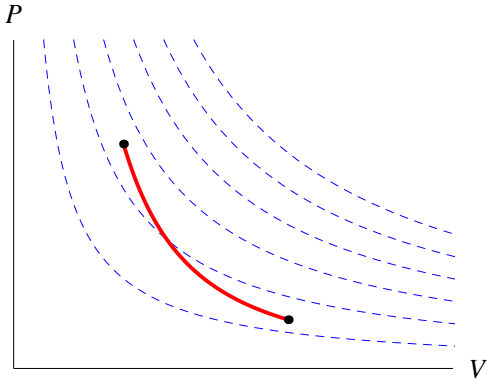
Isothermal Process (Boyle's Law)

$T_1 = T_2 = \text{constant}$

$P_1 V_1 = P_2 V_2 = \text{constant}$

$\Delta E^{\text{int}} = \frac{3}{2} nR\Delta T = 0$

$Q = W = nRT \ln \frac{V_2}{V_1}$



Adiabatic Process

$Q = 0$

$P_1 V_1^{5/3} = P_2 V_2^{5/3} = \text{constant}$

$T_1 V_1^{2/3} = T_2 V_2^{2/3} = \text{constant}$

$W = -\Delta E^{\text{int}} = -\frac{3}{2} nR\Delta T$

$$R = 8.31 \frac{\text{J}}{\text{mol} \cdot \text{K}} = 0.082 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} = 1.99 \frac{\text{cal}}{\text{mol} \cdot \text{K}}$$