LP 14 Machines thermiques réelles

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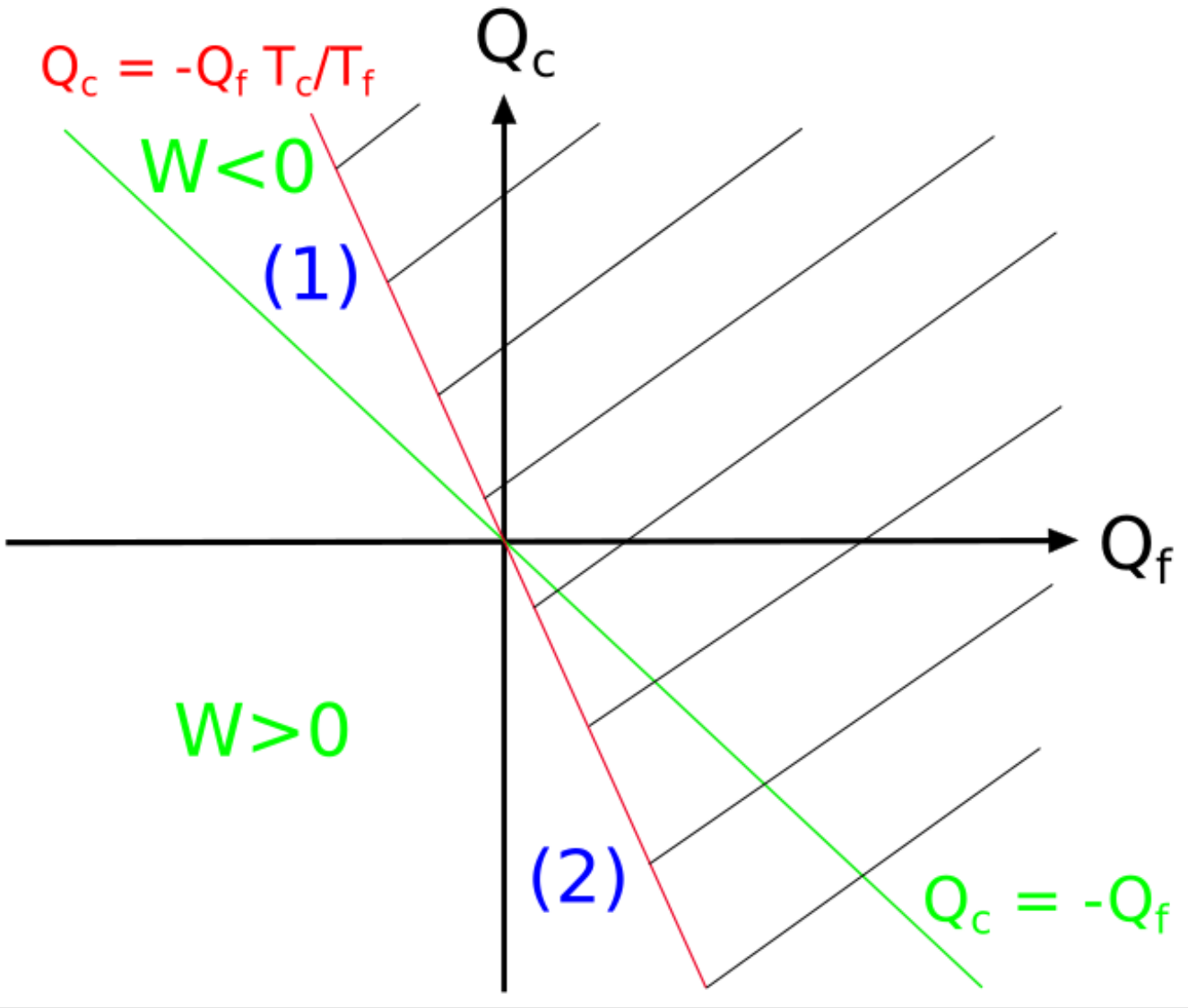
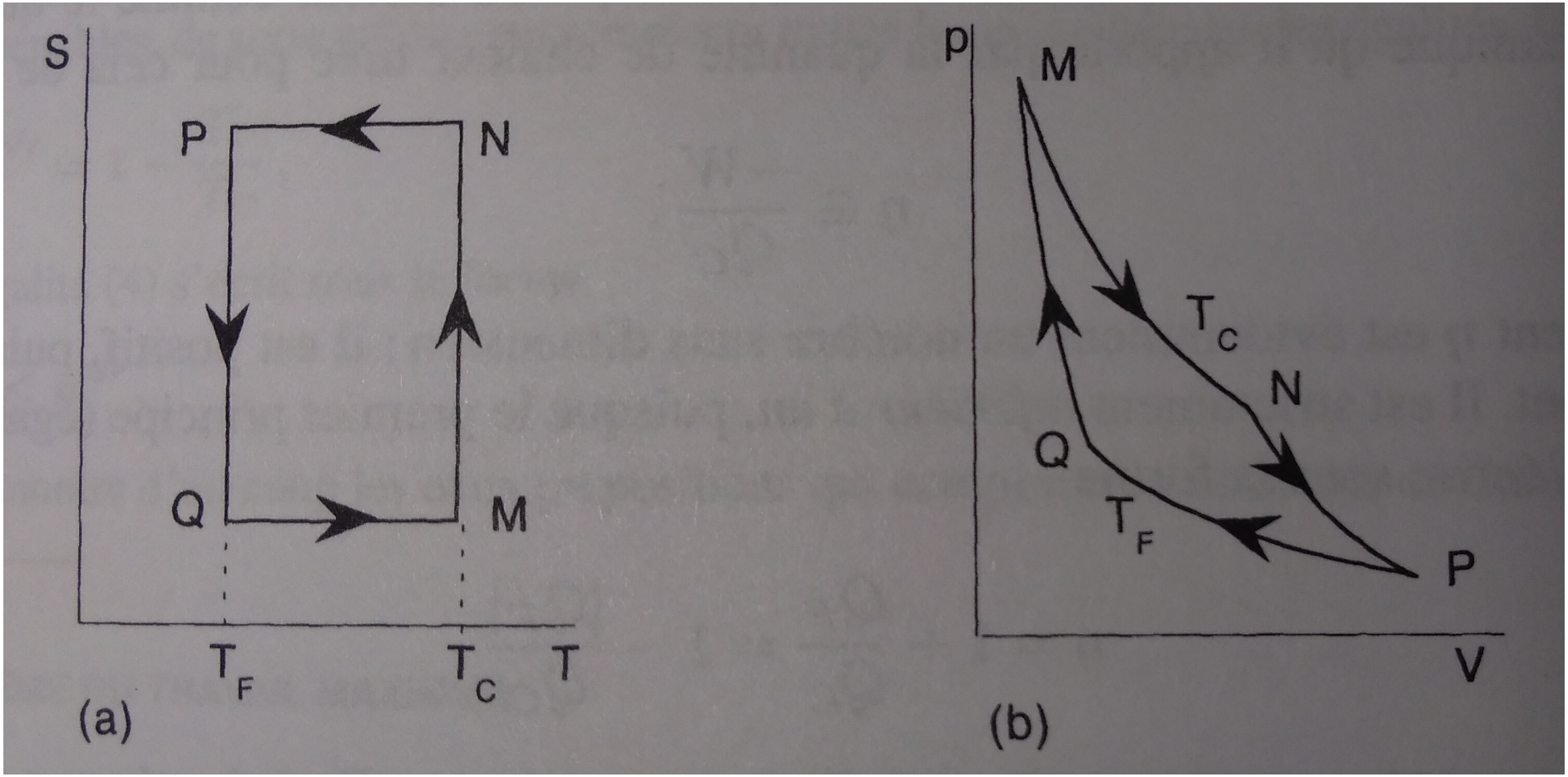
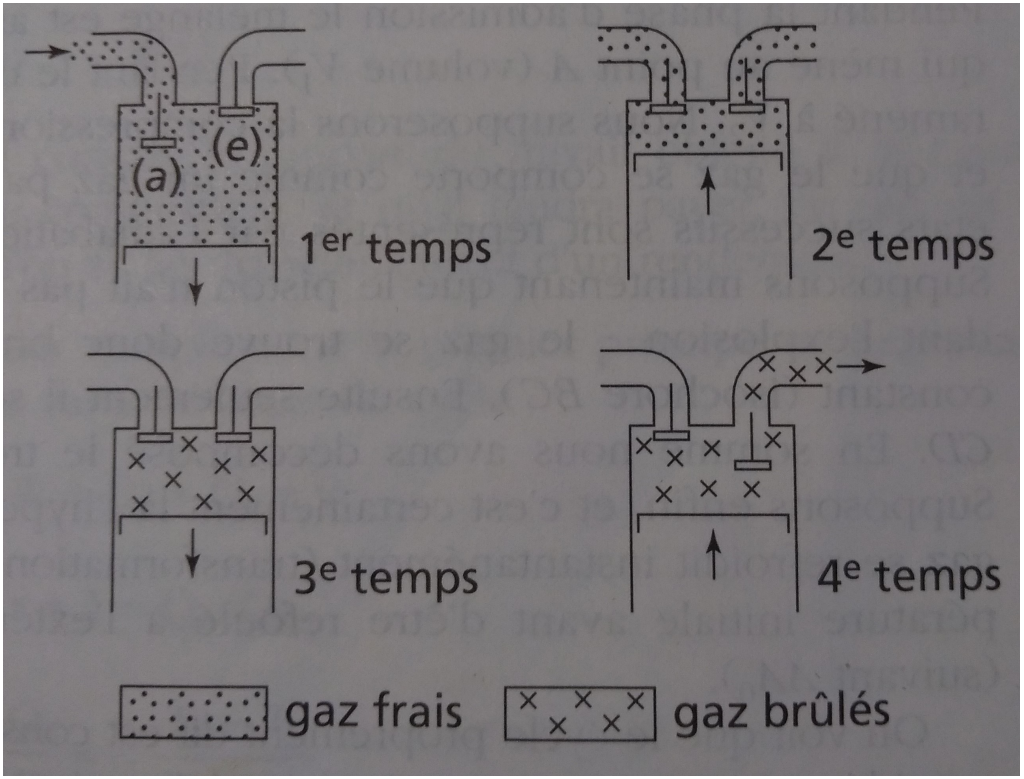
Diagramme de Raveau

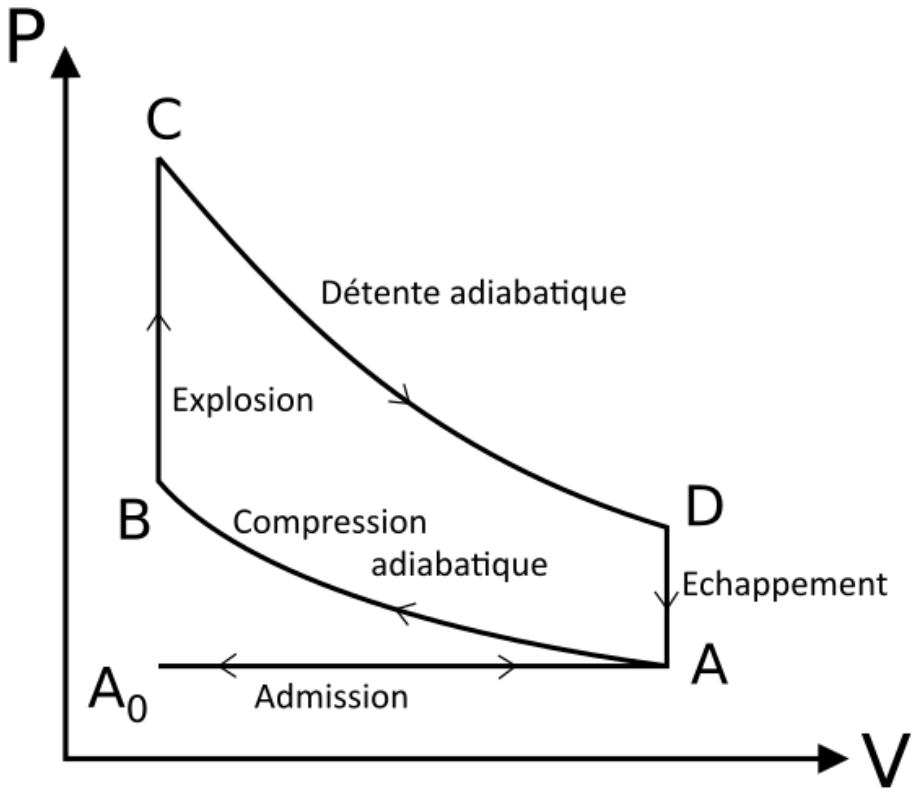


Cycle de Carnot

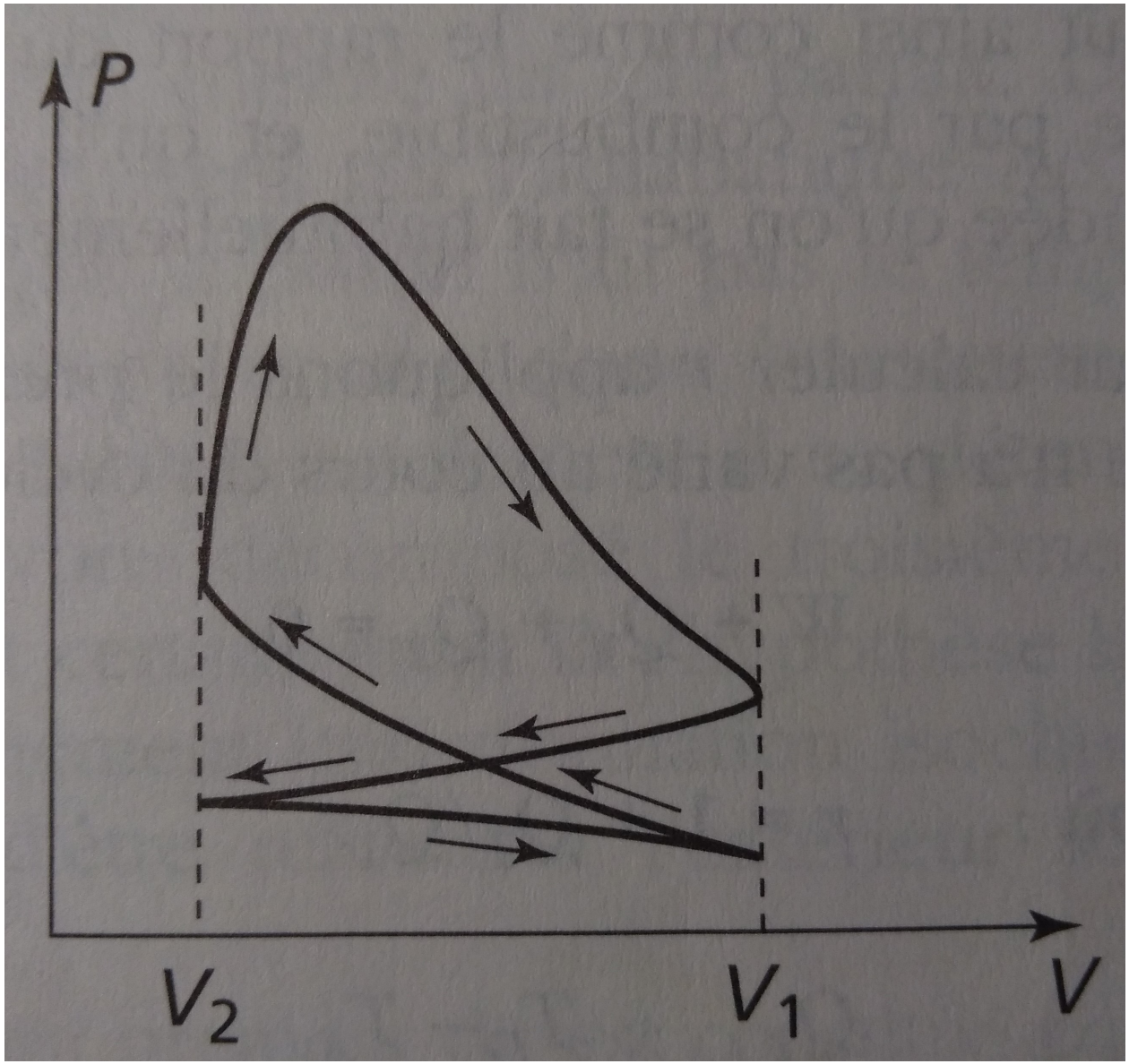


Moteur à explosion

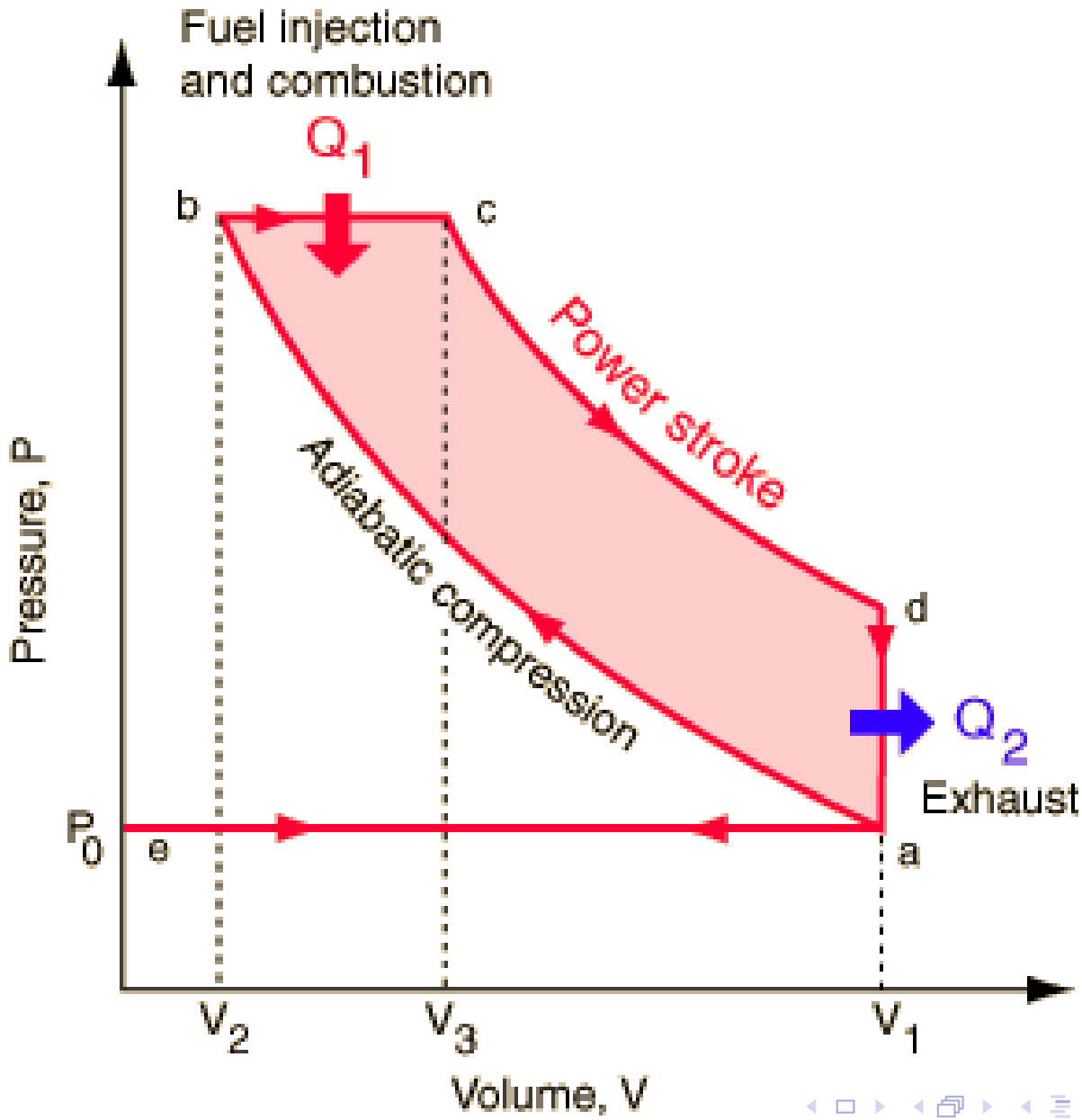




Cycle de Beau de Rochas



Cycle diesel



Calcul du rendement pour le cycle diesel

$$Q_1 = mC_p(T_C - T_B) \quad \text{et} \quad Q_2 = mC_v(T_A - T_D) \tag{1}$$

$$\eta = 1 + \frac{Q_1}{Q_2} = 1 + \frac{C_v}{C_p}\frac{T_A - T_D}{T_C - T_B} = 1 + \gamma^{-1}\frac{T_A - T_D}{T_C - T_B} \tag{2}$$

On a deux adiabatiques réversibles

$$\frac{T_A}{T_B} = \left(\frac{V_A}{V_B}\right)^{1-\gamma} = a^{1-\gamma} \quad \text{et} \quad \frac{T_D}{T_C} = \left(\frac{V_D}{V_C}\right)^{1-\gamma} = b^{1-\gamma} \tag{3}$$

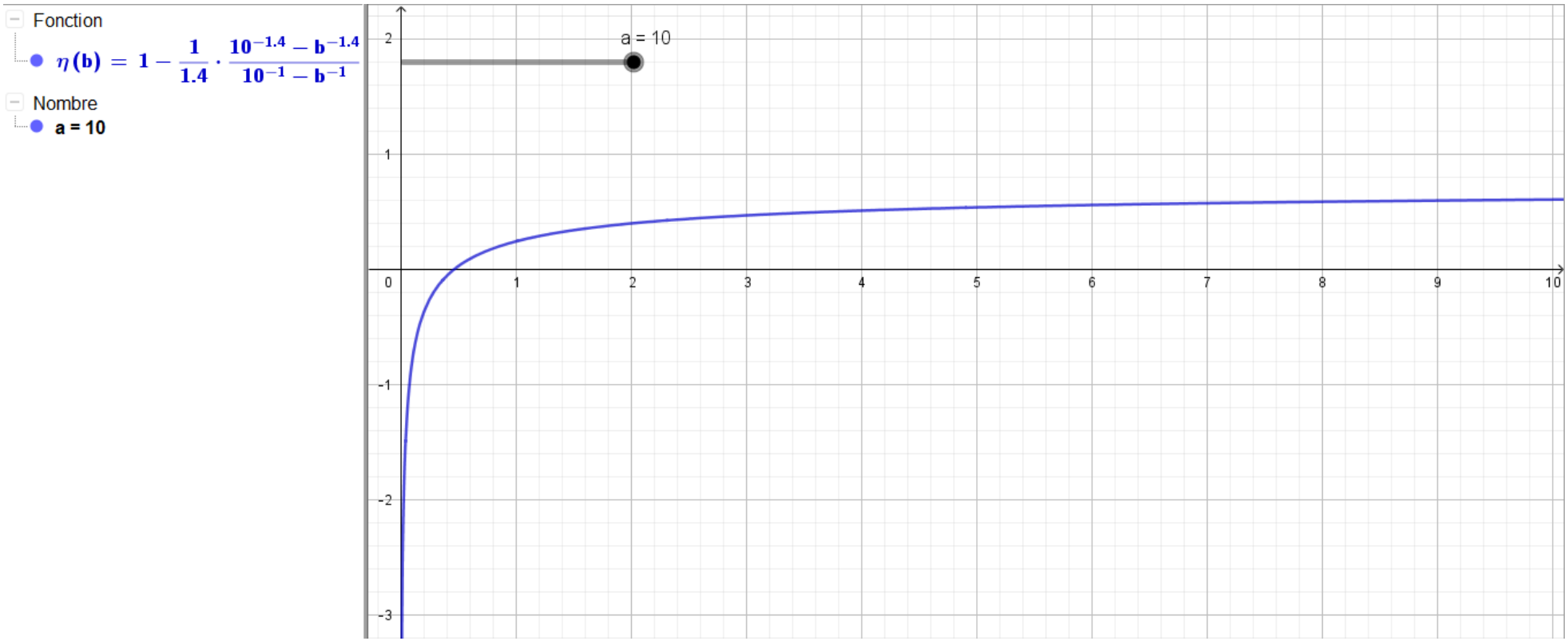
et une isobare : $\frac{V}{T} = \text{cste}$

$$\frac{V_C}{T_C} = \frac{V_B}{T_B} \Rightarrow \frac{T_B}{T_C} = \frac{V_B}{V_C} = \frac{b}{a} \text{ puisque } V_D = V_A \tag{4}$$

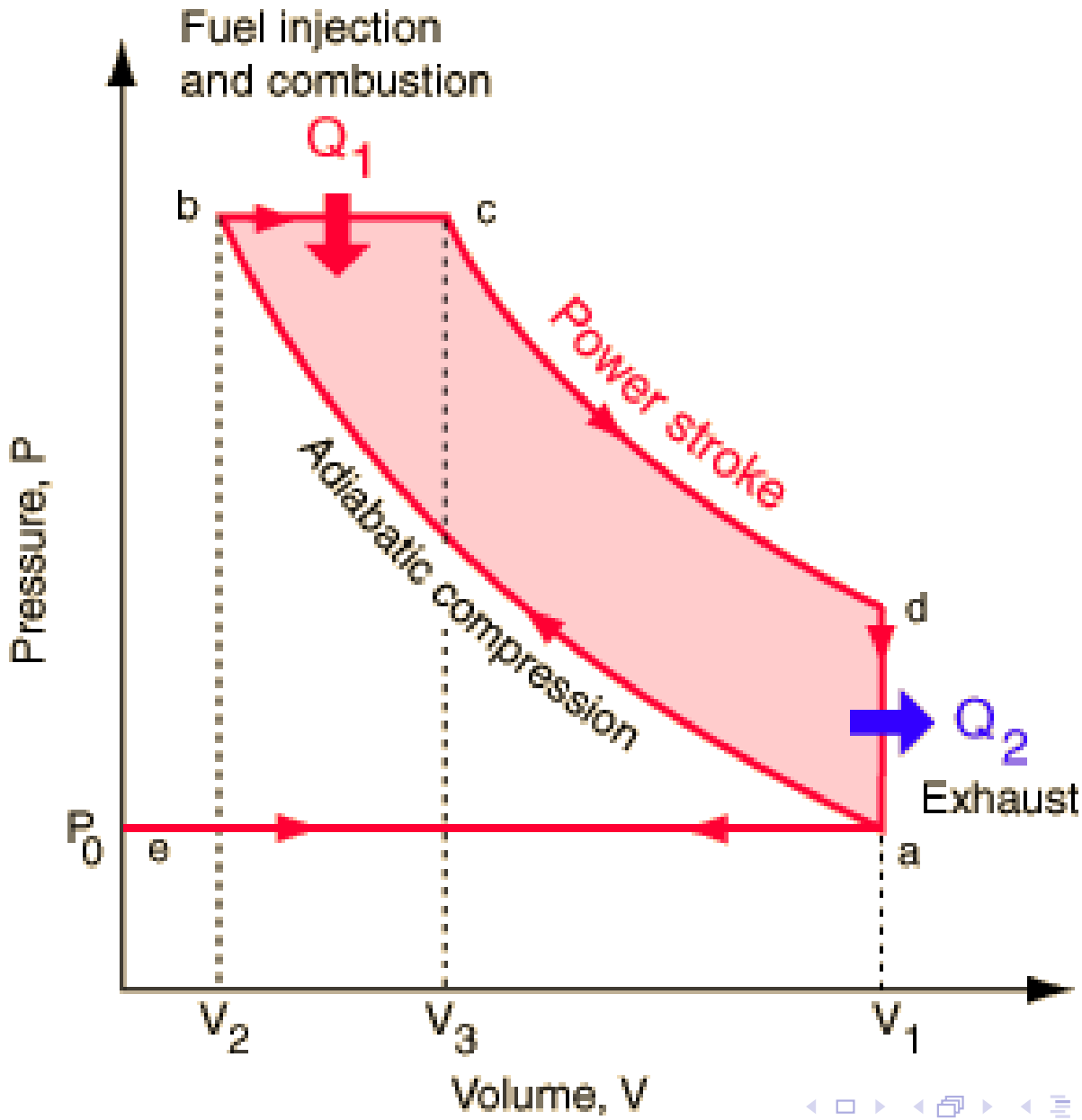
on obtient alors finalement

$$\rightarrow \frac{T_A - T_D}{T_C - T_B} = \frac{T_B a^{1-\gamma} - T_C b^{1-\gamma}}{T_C - T_B} = \frac{b\,a^{-\gamma} - b^{1-\gamma}}{1 - b/a} = -\frac{a^{-\gamma} - b^{-\gamma}}{a^{-1} - b^{-1}} \tag{5}$$

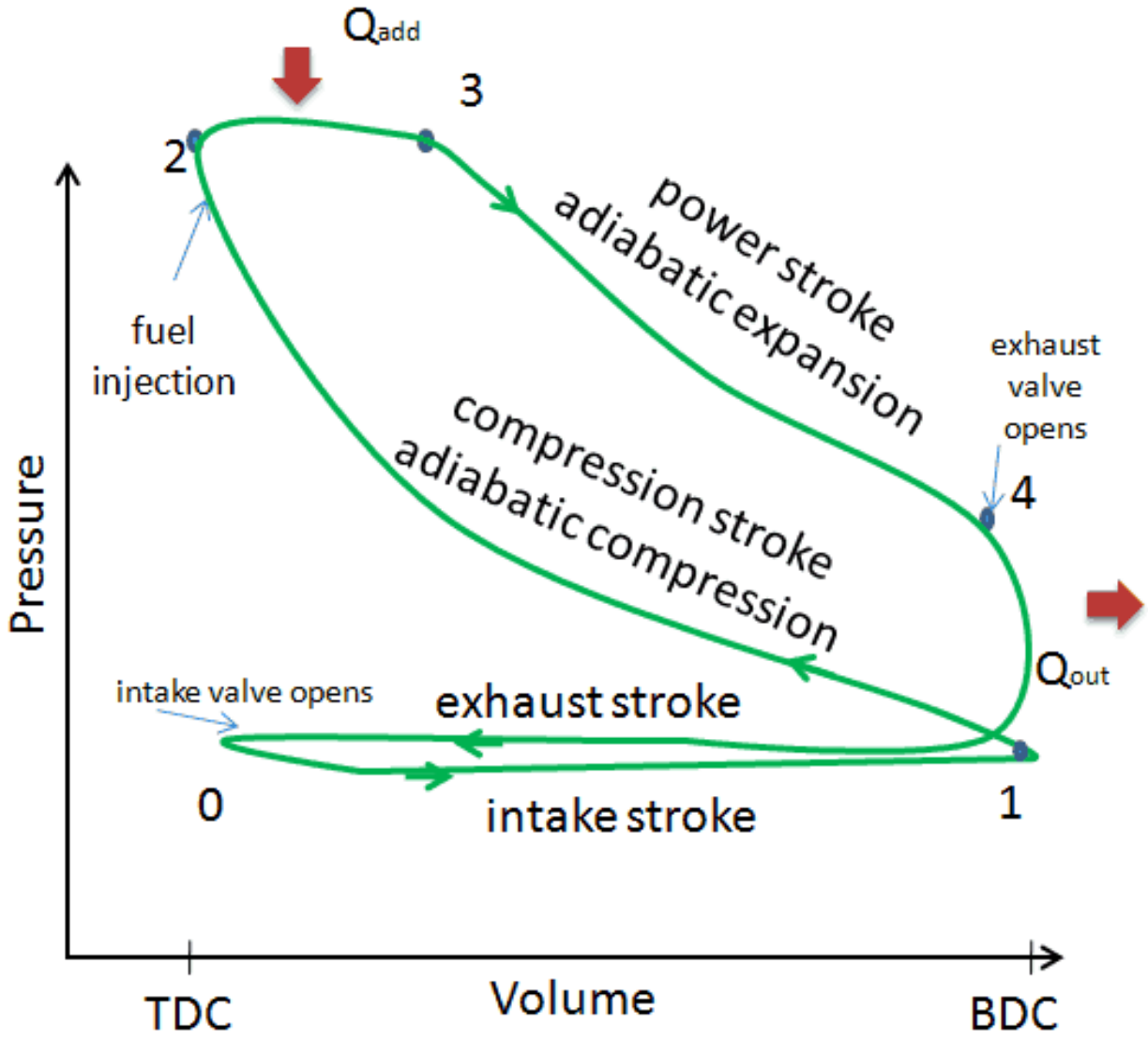
Rendement théorique diesel, pour $a = 10$ et $\gamma = 1,4$



Cycle diesel



Allure du cycle réel



Quel moteur choisir ?

Machine frigorifique