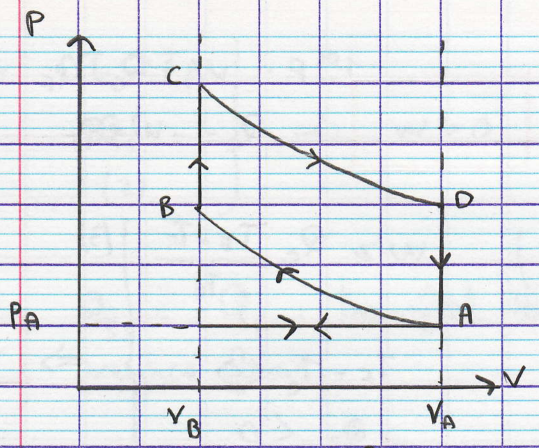
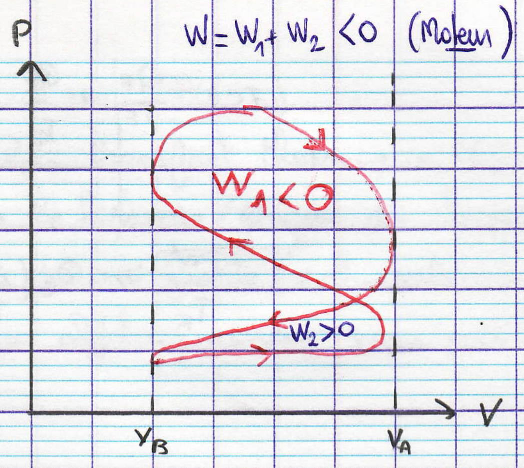


Cycle de Beau Rochas



Cycle Réel

voir ANNEXE

1er temps:

$A_0 \rightarrow A$ admission du mélange dans le cylindre

2e temps:

$A \rightarrow B$ compression du mélange isentropique

3e temps:

$B \rightarrow C$ Allumage / Explosion du Gaz
compression isochore
$C \rightarrow D$
détente isentropique

4e temps:

$D \rightarrow A$ Echappement isobare des gaz brûlés
refroidissement isochore $A \rightarrow A_0$

Définition: $\boxed{\alpha = \frac{V_A}{V_B} > 1}$ Taux de compression

Q: Exprimer ρ rendement du cycle de B de R en fonct° de α et de γ.

Rép : $p = \left|\dfrac{\text{grd utile}}{\text{grd coûteuse}}\right| = \dfrac{-W}{Q_C} = \dfrac{Q_C + Q_F}{Q_C} = 1 + \dfrac{Q_F}{Q_C}$

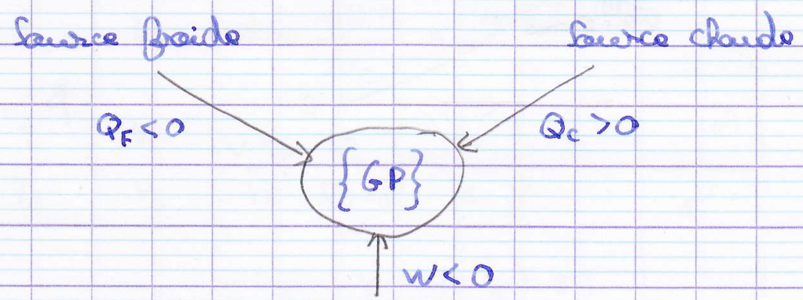
$Q_{AB} = Q_{CD} = 0$ car 2 adiabatiques

$Q_{BC} = Q_{BC,V} = \Delta U_{BC} = \Delta U_{GP,BC} = C_V(T_C - T_B) > 0$

$Q_{DA} = Q_{DA,V} = \Delta U_{DA} = \Delta U_{GP,DA} = C_V(T_A - T_D)$

1ère Loi de Joule

d : Puisqu'on a un moteur



$\hookrightarrow Q_C = Q_{BC} = C_V(T_C - T_B)$

$Q_F = Q_{DA} = C_V(T_A - T_D)$

$$\hookrightarrow \boxed{p = 1 + \frac{Q_F}{Q_C} = 1 + \frac{T_A - T_D}{T_C - T_B}}$$

* T° A → B adiabatique réversible d'1 GP

↳ Loi de Laplace :

$PV^{\gamma} = cte \rightarrow T.V^{\gamma-1} = cte = T_A V_A^{\gamma-1} = T_B V_B^{\gamma-1}$

$$\hookrightarrow \boxed{T_A = \left(\frac{V_B}{V_A}\right)^{\gamma-1} T_B = \alpha^{1-\gamma} T_B}$$

* T° C → D adiabatique réversible d'1 GP

$TV^{\gamma-1} = cte = T_C V_C^{\gamma-1} = T_D V_D^{\gamma-1}$

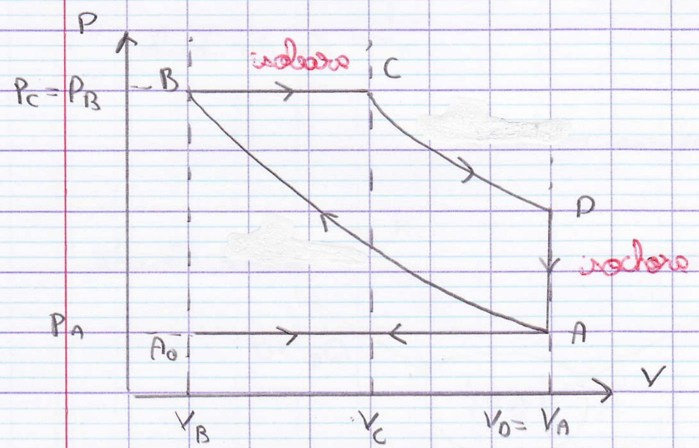
$$\hookrightarrow \boxed{T_D = T_C \left(\frac{V_C}{V_D}\right)^{\gamma-1} = T_C \left(\frac{V_B}{V_A}\right)^{\gamma-1} = T_C\, \alpha^{1-\gamma}}$$

$\hookrightarrow$ d'où $p = 1 + \dfrac{T_A - T_D}{T_C - T_B} = 1 + \alpha^{1-\gamma} \dfrac{T_B - T_C}{T_C - T_B}$

$$\boxed{\rho = 1 - \alpha^{1-\gamma} = 1 - \frac{1}{\alpha^{\gamma-1}}}$$

avec $\gamma = 1,4$ $\alpha = 7$ } $\rho = 55\%$

2) Cycle de Diesel



$\alpha = \frac{V_A}{V_B}$	taux de compression
$\beta = \frac{V_A}{V_C}$	rapport de détente

$\mathcal{S} = \{n \text{ moles de GP}\}$

$Q_{AB} = Q_{CD} = 0$

$Q_{BC} = Q_{BC,P} = \Delta H_{BC} = \Delta H_{GP,BC} = C_p(T_C - T_B)$ > 0

$Q_{DA} = Q_{DA,V} = \Delta U_{DA} = \Delta U_{GP,DA} = C_V(T_A - T_D)$ < 0

Cl : pour un moteur

$Q_c = Q_{BC} > 0$

$Q_F = Q_{DA} < 0$

$$\rho = \frac{-W}{Q_c} \underset{1^{er}P}{=} 1 + \frac{Q_F}{Q_c} = 1 + \frac{Q_{DA}}{Q_{BC}} = 1 + \frac{C_V}{C_P} \frac{T_A - T_D}{T_C - T_B}$$

$$\boxed{\rho = 1 + \frac{1}{\gamma} \frac{T_A - T_D}{T_C - T_B}}$$

à exprimer en fonction de γ, α et β seulement

* $T°$ $A \to B$: adiabatique réversible d'1 GP. Loi de Laplace

$TV^{\gamma-1} = cte \Rightarrow T_A V_A^{\gamma-1} = T_B V_B^{\gamma-1} \Rightarrow \boxed{T_A = T_B \left(\frac{V_B}{V_A}\right)^{\gamma-1} = T_B \alpha^{1-\gamma}}$

* T° $C \rightarrow D$ adiabatique rév. d'1 GP : Loi de Laplace

$$T_C V_C^{\gamma-1} = T_D V_D^{\gamma-1} \Rightarrow T_D = T_C \left(\frac{V_C}{V_D}\right)^{\gamma-1} = T_C\left(\frac{V_C}{V_A}\right)^{\gamma-1}$$

$$\boxed{T_D = T_C \beta^{1-\gamma}}$$

$$\hookrightarrow \quad \rho = 1 + \frac{1}{\gamma} \frac{T_B \alpha^{1-\gamma} - T_C \beta^{1-\gamma}}{T_C - T_B}$$

Isobare $B \rightarrow C$:

$$P_C = P_B \Leftrightarrow \frac{nRT_C}{V_C} = \frac{nRT_B}{V_B}$$

$$\hookrightarrow \quad \boxed{\frac{T_C}{T_B} = \frac{V_C}{V_B} = \frac{V_C}{V_A}\frac{V_A}{V_B} = \frac{\alpha}{\beta}}$$

$$\hookrightarrow \quad \rho = 1 + \frac{1}{\gamma} \frac{T_B\left(\alpha^{1-\gamma} - \frac{T_C}{T_B}\beta^{1-\gamma}\right)}{T_B\left(\frac{T_C}{T_B} - 1\right)}$$

$$\rho = 1 + \frac{1}{\gamma} \frac{\alpha^{1-\gamma} - \alpha\beta^{-\gamma}}{\frac{\alpha}{\beta} - 1} = 1 + \frac{1}{\gamma} \frac{\alpha\left(\alpha^{-\gamma} - \beta^{-\gamma}\right)}{\alpha\left(\beta^{-1} - \alpha^{-1}\right)}$$

$$\boxed{\rho = 1 - \frac{1}{\gamma} \frac{\alpha^{-\gamma} - \beta^{-\gamma}}{\alpha^{-1} - \beta^{-1}}}$$

IV Exercices

voir excos