

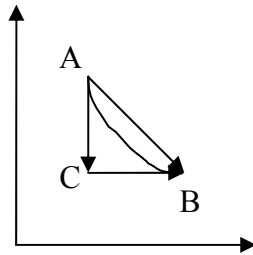
CORRIGE DU SUJET 2

Recul d'un fusil :

- les 2 vitesses ont même direction mais ont des sens opposés.
- $\vec{p}_i = \vec{0} \Rightarrow \vec{p}_f = \vec{0} \Rightarrow m_1 \vec{v}_1 + m_2 \vec{v}_2 = \vec{0} \Rightarrow \vec{v}_1 = -\frac{m_2}{m_1} \vec{v}_2$; $v_1 = 1,33 \text{ ms}^{-1}$
- projectile : $E_c = (1/2)m_2 v_2^2$; fusil : $E'_c = (1/2)m_1 v_1^2 = (m_2/m_1)E_c$; $E_c / E'_c = m_1 / m_2 = 450$

Thermodynamique :

- $V_A = nRT_A / P_A = 0,025 \text{ m}^3$; $P_B = 1.10^5 \text{ Pa}$; $V_B = 2V_A = 0,05 \text{ m}^3$; $T_C = T_A / 2 = 150 \text{ K}$
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- $U = nC_v T_A$; $\Delta U_{AB} = 0$ car $T_A = T_B$ quelque soit le chemin suivi.
- $W_1 = -nRT_A \ln(V_B / V_A) = -nRT_A \ln 2 = -3450 \text{ J}$; $Q_1 = -W_1 = 3450 \text{ J}$
- $W_2 = -((P_A/2) + P_A)(V_A) / 2 = -3P_A V_A / 4 = (3/4)nRT_A = -3750 \text{ J}$; $Q_2 = -W_2$
- $W_3 = W_{AC} + W_{CB} = 0 - (P_A/2)(V_B - V_A) = -P_A V_A / 2 = -nRT_A / 2 = -2500 \text{ J}$
 $Q_3 = -W_3 = nRT_A / 2 = 2500 \text{ J}$
 $Q_3 = Q_{AC} + Q_{CB} = nC_v(T_C - T_A) + nC_p(T_B - T_C) = (5/2)nR(-T_A/2) + (7/2)nR(T_A/2)$
 $= nRT_A / 2$

Echange thermique :

a) $Q_1 + Q_2 = 0$

$$c_e m_1 (t-t_1) + c_e m_2 (t-t_2) = 0 ; \quad m_1 = \rho V_1 ; \quad m_2 = \rho V_2$$

$$c_e \rho V_1 (t-t_1) + c_e \rho V_2 (t-t_2) = 0 ;$$

et $V_1 + V_2 = V \rightarrow V_2 = V - V_1$

$$\rightarrow V_1 (t-t_1) + (V-V_1) (t-t_2) = 0 \rightarrow V_1 = (t-t_2).V / (t_1-t_2) ;$$

$$V_1 = 0.0846 \text{ m}^3 = 84.6 \text{ l} ; \quad V_2 = 0.1654 \text{ m}^3 = 165.4 \text{ l}$$

b) $Q_1 + Q_2 + Q_3 = 0$

$$c_e m_1 (t-t_1) + c_e m_2 (t-t_2) + c m (t-t_3) = 0 ; \quad m_1 = \rho V_1 ; \quad m_2 = \rho V_2$$

$$c_e \rho V_1 (t-t_1) + c_e \rho V_2 (t-t_2) + c m (t-t_3) = 0 ; \quad \text{et } V_1 + V_2 = V \rightarrow V_2 = V - V_1$$

$$\rightarrow c_e \rho V_1 (t-t_1) + c_e \rho (V-V_1) (t-t_2) + c m (t-t_3) = 0$$

$$\rightarrow V_1 = (t-t_2).V / (t_1-t_2) + c.m.(t-t_3) / [c_e \rho .(t_1-t_2)] ;$$

$$V_1 = 0.0867 \text{ m}^3 = 86.7 \text{ l} ; \quad V_2 = 0.1633 \text{ m}^3 = 163.3 \text{ l}$$