

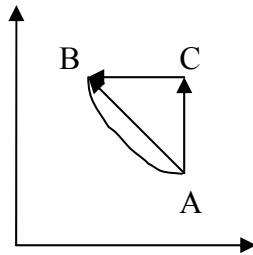
CORRIGE DU SUJET 1

Recul d'un fusil :

1. les 2 vitesses ont même direction mais ont des sens opposés.
2. $\vec{p}_i = \vec{0} \Rightarrow \vec{p}_f = \vec{0} \Rightarrow m\vec{v} + M\vec{V} = \vec{0} \Rightarrow \vec{V} = -\frac{m}{M}\vec{v}$; $V = 1,33 \text{ ms}^{-1}$
3. projectile : $E_c = (1/2)mv^2$; fusil : $E'_c = (1/2)MV^2 = (m/M)E_c$; $E_c / E'_c = M / m = 450$

Thermodynamique :

1. $V_A = nRT_A / P_A = 0,05 \text{ m}^3$; $P_B = 2 \cdot 10^5 \text{ Pa}$; $V_B = V_A/2 = 0,025 \text{ m}^3$; $T_C = 2T_A = 600 \text{ K}$
- 2.



3. $U = nC_v T_A$; $\Delta U_{AB} = 0$ car $T_A = T_B$ quelque soit le chemin suivi.
4. $W_1 = -nRT_A \ln(V_B / V_A) = nRT_A \ln 2 = 3450 \text{ J}$; $Q_1 = -W_1 = -3450 \text{ J}$
5. $W_2 = (2P_A + P_A)(V_A / 2) / 2 = 3P_A V_A / 4 = (3/4)nRT_A = 3750 \text{ J}$; $Q_2 = -W_2$
6. $W_3 = W_{AC} + W_{CB} = 0 - 2P_A(V_B - V_A) = P_A V_A = nRT_A = 5000 \text{ J}$
 $Q_3 = -W_3 = -nRT_A = -5000 \text{ J}$
 $Q_3 = Q_{AC} + Q_{CB} = nC_v(T_C - T_A) + nC_p(T_B - T_C) = (5/2)nRT_A + (7/2)nR(-T_A) = -nRT_A$

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

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

$$V_1 = 0,0846 \text{ m}^3 = 84,6 \text{ l} ; \quad V_2 = 0,1654 \text{ m}^3 = 165,4 \text{ l}$$

b) $Q_1 + Q_2 + Q_3 = 0$

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

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

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

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

$$V_1 = 0,0867 \text{ m}^3 = 86,7 \text{ l} ; \quad V_2 = 0,1633 \text{ m}^3 = 163,3 \text{ l}$$