

Exercice 10 :

$$n = 1 \text{ moles}$$

①

V_1
 T_1
 P_1
chauffage
isochore
→

②

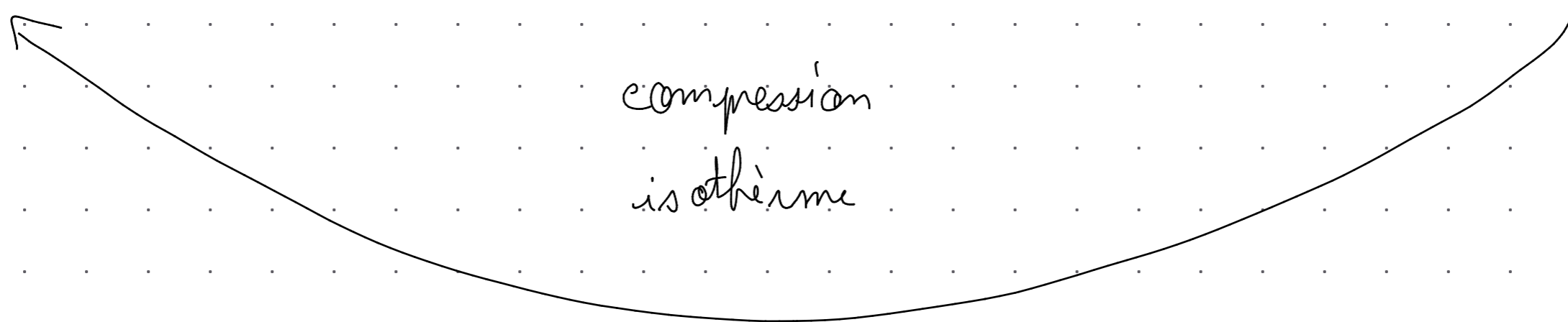
V_1
 T_2
 P_2
détente
isotherme
→

③

V_2
 T_2
 P_3
refroidissement
isochore
→

④

V_2
 T_1
 P_4



$$W_{12} = 0$$

$$Q_{12} = C_V (T_2 - T_1)$$

$$W_{23} = -nRT_2 \ln \frac{V_2}{V_1}$$

$$Q_{23} = -W_{23}$$

$$W_{34} = 0$$

$$Q_{34} = C_V (T_1 - T_2)$$

$$W_{41} = -nRT_1 \ln \frac{V_1}{V_2}$$

$$Q_{41} = -W_{41}$$

$$W_{\text{cycle}} = 0 - RT_2 \ln \frac{V_2}{V_1} + 0 - RT_1 \ln \frac{V_1}{V_2}$$
$$= \ln \frac{V_2}{V_1} R (T_1 - T_2)$$

$$Q_{\text{cycle}} = C_V (T_2 - T_1) + RT_2 \ln \frac{V_2}{V_1} + C_V (T_1 - T_2) + RT_1 \ln \frac{V_1}{V_2}$$
$$= C_V (T_2 - T_1 + T_1 - T_2) + \ln \frac{V_2}{V_1} R (T_1 - T_2)$$
$$= \ln \frac{V_2}{V_1} R (T_2 - T_1)$$

$$W_{\text{cycle}} + Q_{\text{cycle}} = 0$$

$W_{\text{cycle}} < 0$ donc cycle moteur, le système fournit du travail.

$Q_{\text{cycle}} > 0$ donc reçoit de la chaleur.