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[例题7-2]一定量N_2, 绝热升压 $p\to 2p$, $\bar{v}$变为原几倍？

解： $\bar{v} = \sqrt{\frac{8RT}{\pi M_m}} \Rightarrow \frac{\bar{v}_2}{\bar{v}_1} = \sqrt{\frac{T_2}{T_1}} = 2^{1/7}$

$$\left.\begin{aligned} & p^{\gamma-1}T^{-\gamma} = c_2 \\ & \gamma \overset{def}{=} C_p/C_V = 7/5 \end{aligned}\right\} \Rightarrow \frac{T_2}{T_1} = \left(\frac{p_2}{p_1}\right)^{2/7} = 2^{2/7}$$

[讨论2]若上题为绝热压缩：$V \to V/2$，压缩前后$\bar{Z}$如何变化？

解：$\bar{Z} = \sqrt{2}\, n\pi d^2 \bar{v} = \sqrt{2}\,\frac{N}{V}\pi d^2 \sqrt{\frac{8RT}{\pi M_m}} = c_3\frac{\sqrt{T}}{V} \xrightarrow{TV^{\gamma-1} = c_4} \bar{Z} = c_5 V^{-\frac{1}{2}-\frac{\gamma}{2}}$

$\Rightarrow \frac{\bar{Z}_2}{\bar{Z}_1} = \left(\frac{V_2}{V_1}\right)^{-\frac{1}{2}-\frac{\gamma}{2}} = 2^{\frac{6}{5}}$ 若为H_2O蒸汽, $\bar{Z}$如何变化？ $\gamma = \frac{4}{3}$

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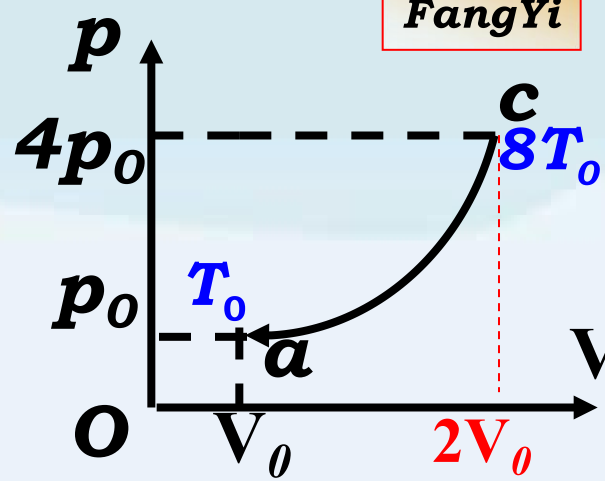
[例题7-3] **1mol**单原子理气, **ca**方程 $p=p_0V^2/V_0^2$, $T_a=T_0$, 以T_0,R表示A_{ca}和Q_{ca}



解: $c \to a$多方 $(4p_0)V_c^{-2} = p_0V_0^{-2} \Rightarrow V_c = 2V_0$

一定量 $\dfrac{p_0V_0}{T_0} = \dfrac{4p_0\,2V_0}{T_c} \Rightarrow T_c = 8T_0$

$$\boxed{A_{ca} = \frac{\upsilon R\Delta T}{1-n}} = \frac{R(T_0 - 8T_0)}{1-(-2)} = -\frac{7RT_0}{3}$$

or. $A_{ca} = \int_{2V_0}^{V_0} \dfrac{p_0}{V_0^2} V^2 dV = -\dfrac{7p_0V_0}{3}$

$$\boxed{Q_{多方} = \upsilon C_{多方}\Delta T = \frac{\gamma - n}{1-n} C_V \Delta T} = \frac{5/3-(-2)}{1-(-2)}\,\frac{3}{2}R(-7T_0) = \frac{-77RT_0}{6}$$

or. $Q_{多方} = \Delta E + A = (1-8)T_0\,3R/2 - 7RT_0/3$

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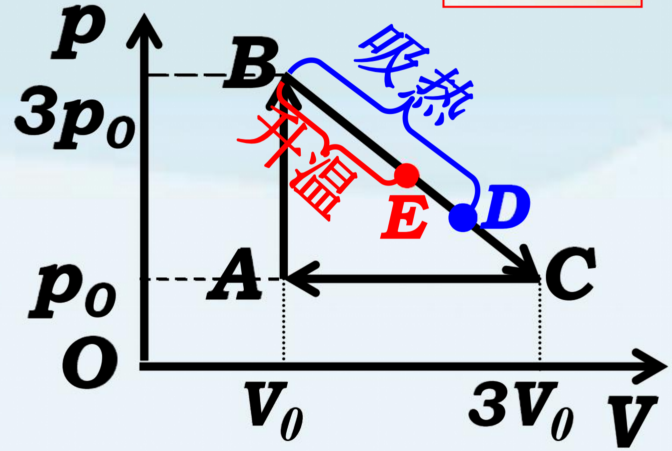
[思考4]1mol单原子理气作图示循环，分析BC过程温度变化及吸放热情况



解：$\begin{cases} p = -\dfrac{p_0}{V_0}V + 4p_0 \\ pV = \upsilon RT \end{cases} \Rightarrow T = \dfrac{1}{R}\left(4p_0V - \dfrac{p_0V^2}{V_0}\right)$

令 $T' = 0 \Rightarrow V = 2V_0$ $\begin{cases} BE: T \uparrow \\ EC: T \downarrow \end{cases}$

$$dQ = dE + dA = \upsilon C_V \frac{p_0}{R}\left(4 - \frac{2V}{V_0}\right)dV + \left(-\frac{p_0}{V_0}V + 4p_0\right)dV = 2p_0\left(5 - \frac{2V}{V_0}\right)dV$$

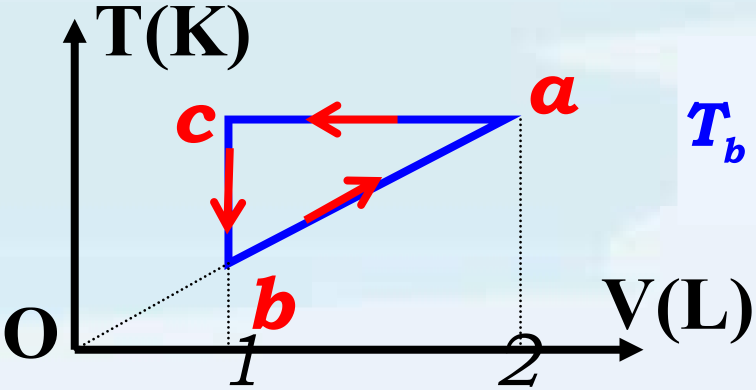
$\Rightarrow V = 2.5V_0$ $V < 2.5V_0 \Rightarrow dQ > 0$ $V > 2.5V_0 \Rightarrow dQ < 0$

$$Q_{BD} = \int_{V_0}^{2.5V_0} 2p_0(5 - 2V/V_0)dV = 4.5p_0V_0 > 0$$

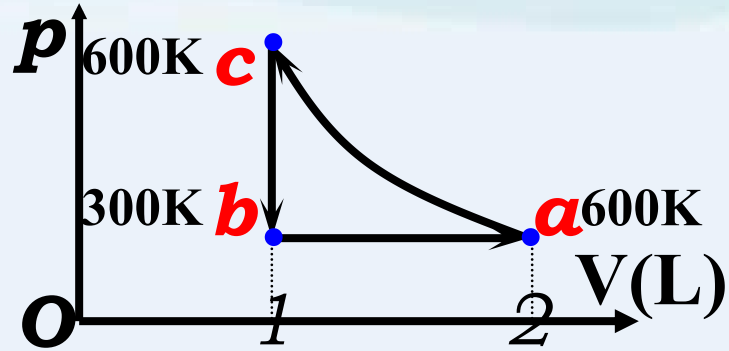
$$Q_{DC} = \int_{2.5V_0}^{3V_0} 2p_0(5 - 2V/V_0)dV = -0.5p_0V_0 < 0$$

[例题7－4]1mol单原子分子理气循环如T－V图, T_c=600K.

试求(1) Q_{ac}, Q_{cb}, Q_{ba} (2) 整个循环$A_{净}$ (3) η OR ω



$$T_b = \frac{V_b}{V_a} T_a$$



解(1) **ac**等温压缩 $Q_{ac} = A_{ac} = \upsilon RT \ln \frac{V_c}{V_a} = R(600 \ln \frac{1}{2}) = -416R$

cb等容降压(温) $Q_{cb} = \Delta E = \upsilon Cv \Delta T = 1 \times \frac{3R}{2}(300-600) = -450R$

ba等压膨胀 $Q_{ba} = \upsilon C_p \Delta T = 1 \times \frac{5R}{2}(600-300) = 750R$

(2) 由热一律 $A = Q_{ac} + Q_{cb} + Q_{ba} = -116R$

(3) $\omega = \frac{Q_{吸}}{|A_{net}|} = \frac{750R}{116R} = 6.47$