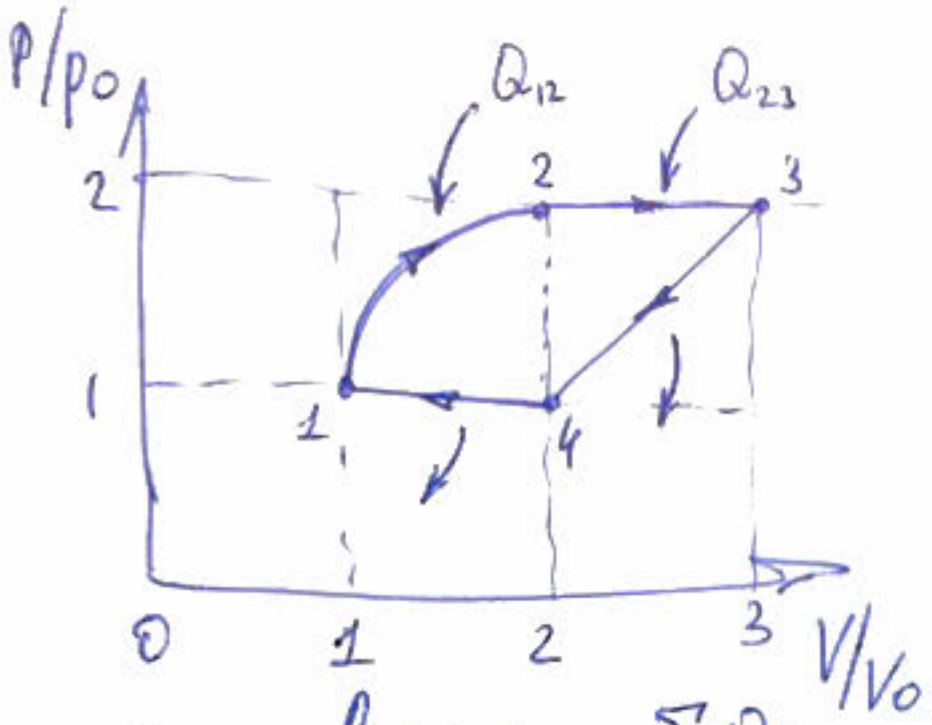
Задача 45 (МОШ, 2019, 11)

Гелий: $i = 3$

$\eta - ?$ (%)



$$\eta = \frac{A_{цикл}}{Q_н} = \frac{\sum Q_i}{Q_н}$$

$$A_ц = \pi p_0 V_0 \cdot \frac{1}{4} + p_0 V_0 \cdot \frac{1}{2}$$

$$Q_н = Q_{12} + Q_{23} = Q_{123} = \Delta U_{123} + A_{123} =$$

$$= \frac{i}{2} \nu R (T_3 - T_1) + 4 p_0 V_0 + \frac{1}{4} \pi p_0 V_0 =$$

$$= \frac{i}{2} (\nu R T_3 - \nu R T_1) + 4 p_0 V_0 + \frac{\pi}{4} p_0 V_0$$

$\nu R T_3 = 2 p_0 \cdot 3 V_0$ (Менд.-Клап.) $\Rightarrow$

$\nu R T_1 = p_0 V_0$ (М.-К.)

$$\Rightarrow Q_н = \frac{i}{2} (6 p_0 V_0 - p_0 V_0) + \left(4 + \frac{\pi}{4}\right) p_0 V_0 = \left(\frac{5}{2} i + 4 + \frac{\pi}{4}\right) p_0 V_0$$

$$\eta = \frac{A_ц}{Q_н} = \frac{p_0 V_0 \left(\frac{\pi}{4} + \frac{1}{2}\right)}{p_0 V_0 \left(\frac{5}{2} i + 4 + \frac{\pi}{4}\right)} = \frac{\left(\frac{\pi}{4} + \frac{1}{2}\right)}{\left(\frac{5}{2} \cdot 3 + 4 + \frac{\pi}{4}\right)} \approx 0{,}11 \text{ или } 11\%$$

Ответ: 11%