

Carnot engine: $\eta = \frac{W}{Q_2} = 1 - \frac{|Q_1|}{|Q_2|} = 1 - \frac{T_1}{T_2}$

$W = Q_1 + Q_2$
 $Q_1 = W - Q_2$

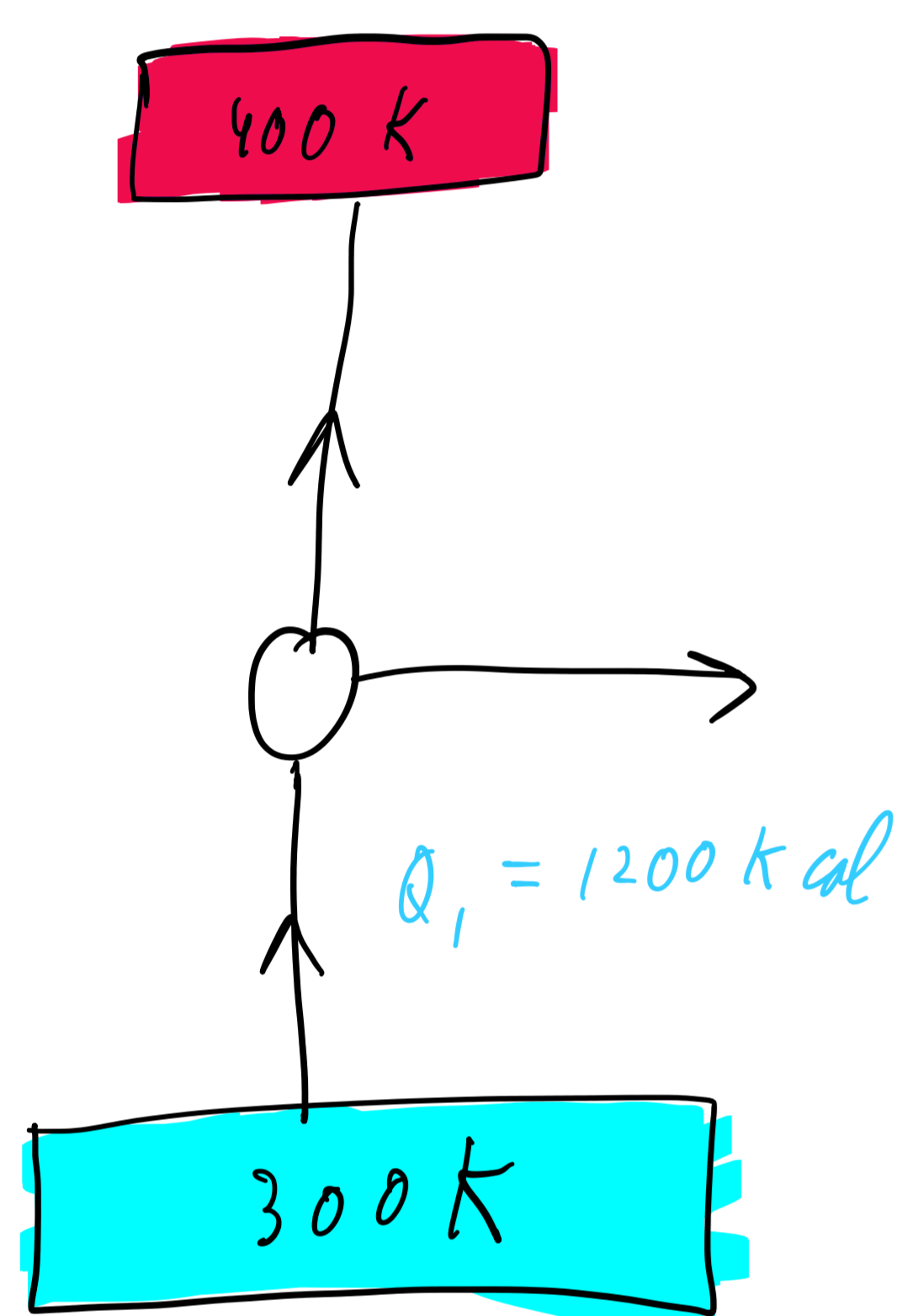
$Q_1 = -Q_2 + \eta Q_2 = (1 + \eta) Q_2 = -\left(1 - \left(1 - \frac{T_1}{T_2}\right)\right) Q_2 = -\frac{T_1}{T_2} Q_2$

$= -\frac{300}{400} \times 1200 \text{ kcal}$

$= -900 \text{ kcal}$

$W = Q_1 + Q_2 = 1200 - 900 = 300 \text{ kcal}$

$\eta = 1 - \frac{T_1}{T_2} = 1 - \frac{300}{400} = \frac{1}{4} = 0.25$



$C = -\frac{Q_1}{W} = \frac{T_1}{T_2 - T_1} = \frac{-Q_1}{Q_1 + Q_2}$

$Q_1 + Q_2 = \frac{-Q_1 (T_2 - T_1)}{T_1}$

$Q_2 = -\frac{T_2 - T_1}{T_1} Q_1 - Q_1$

$Q_2 = -\left(1 + \frac{T_2 - T_1}{T_1}\right) Q_1$

$= -\left(1 + \frac{400 - 300}{300}\right) \cdot 1200 \text{ kcal}$

$= -\left(1 + \frac{1}{3}\right) \cdot 1200 \text{ kcal}$

$= -1600 \text{ kcal}$

$W = Q_1 + Q_2 = 1200 - 1600 = -400 \text{ kcal}$

$C = \frac{T_1}{T_2 - T_1} = \frac{300}{400 - 300} = \frac{3}{1} = 3$