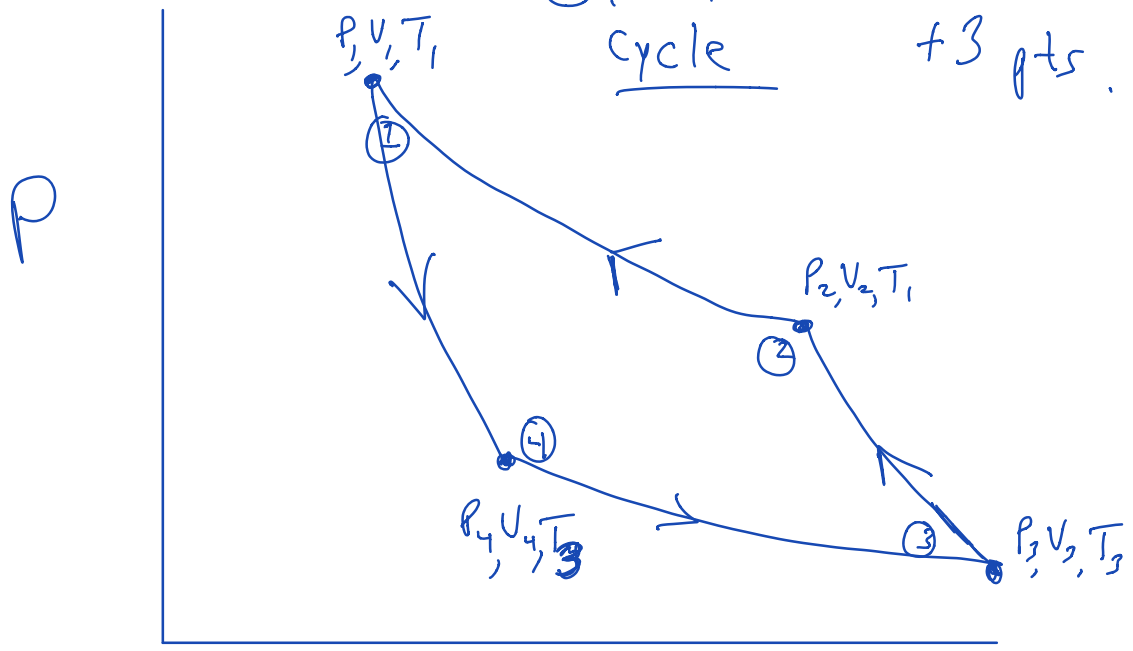
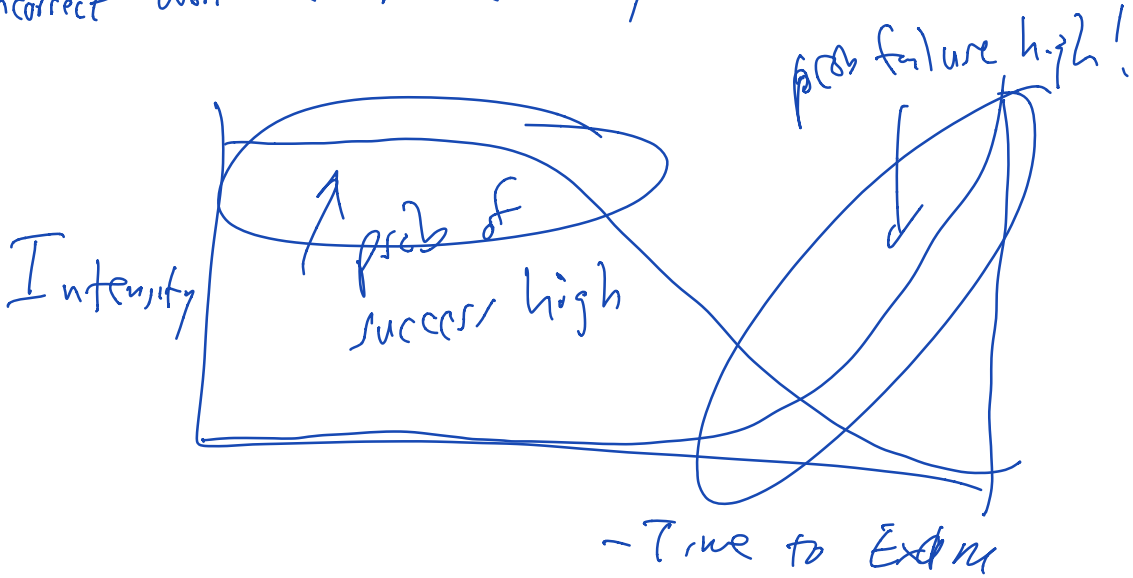
Carnot cycle +3 pts.



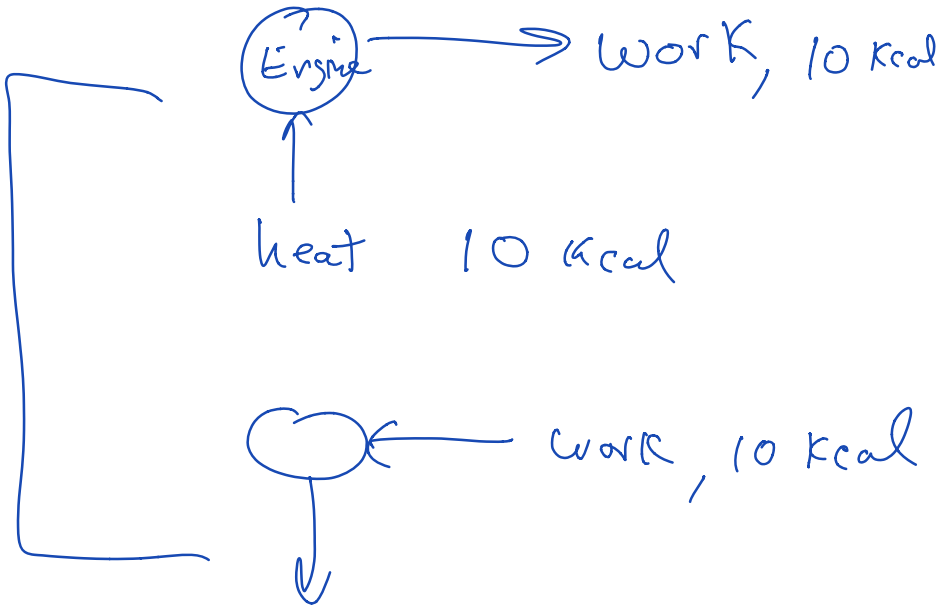
- express relations for:
  q_{14}, q_{43}, q_{32}, q_{21}, w_{14}, w_{43}, w_{32}, w_{21}
- show all work for full and partial credit
- Incorrect Work = No credit ; No work = No credit



$$dU = 0 = dq + dw$$

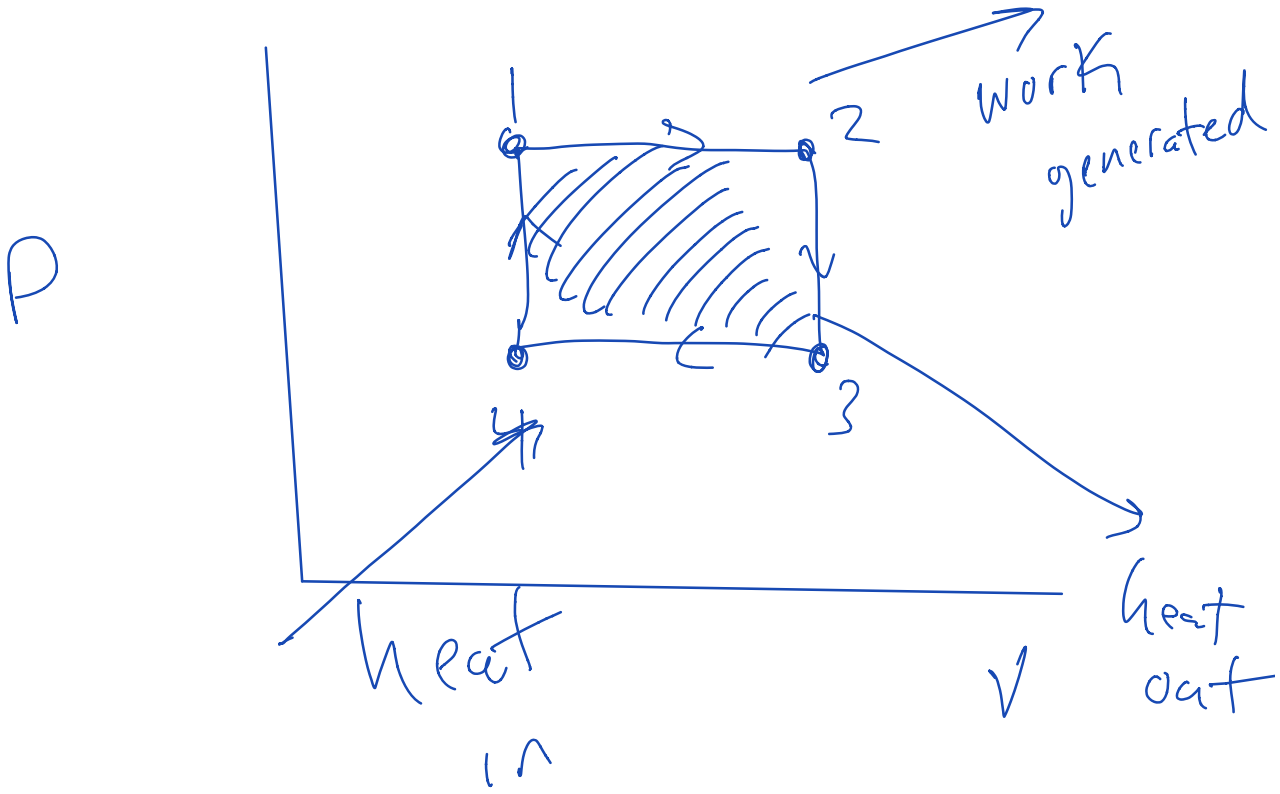
- Direction → quantify

- Engine



efficiency

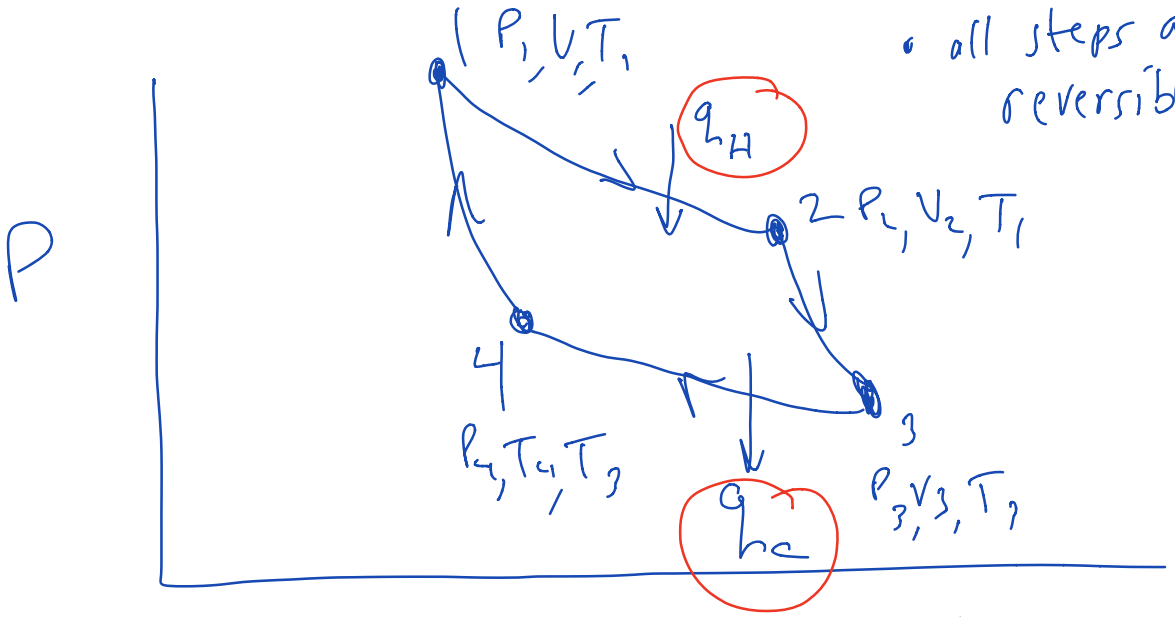
Carnot Cycle



Most ideal Case:

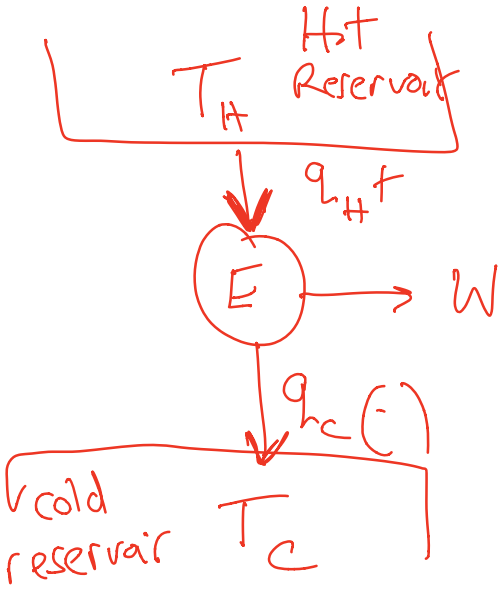
Carnot Cycle

- ideal gas fluid
- all steps are reversible



$T_1 > T_3$

$T_H > T_c$



Efficiency

$$\eta = \frac{\text{output}}{\text{input}} = \frac{-W}{q_H} = \frac{-W}{q_{in}}$$

$$\eta \geq 0$$

W for cycle: $W_{12}, W_{23}, W_{34}, W_{41}$

q_H

1st "Law": $dU = 0 = dq_H + dq_C + dW_{12} + dW_{23} + dW_{34} + dW_{41}$

$$-dW_{12} - dW_{23} - dW_{34} - dW_{41} = dq_H + dq_C$$

$$-W_{12} - W_{23} - W_{34} - W_{41} = q_H + q_C$$

$$-\underbrace{(W_{12} + W_{23} + W_{34} + W_{41})}_{W} = q_H + q_C$$

$$\boxed{-W = q_H + q_C}$$

$$\eta = \frac{q_H + q_C}{q_H} = 1 + \frac{q_C}{q_H}$$

$$\eta_{Carnot} = 1 + \frac{q_C}{q_H}$$

Sign of q_C = ?

$$q_C < 0$$

$$\therefore \eta_{Carnot} = 1 - \frac{|q_C|}{q_H} \quad ***$$