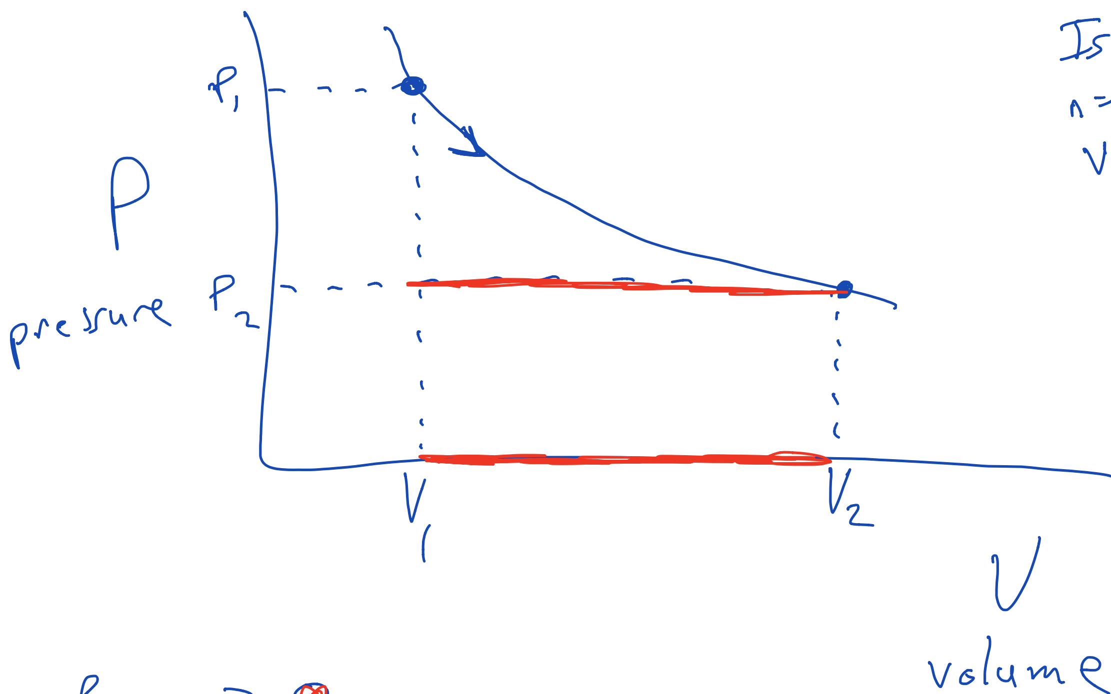
Reversible Processes
(paths)

I. G. $P = \frac{nRT}{V}$

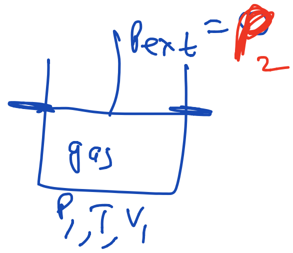
Iso T.

$n = \text{constant}$

$V_2 > V_1$



$P_{ext} = P_2$



$w = 0$

$dw = -\underbrace{P_{ext}}_{0} dV$

$\therefore dw = 0$

$\therefore \int dw = 0$
$= w$

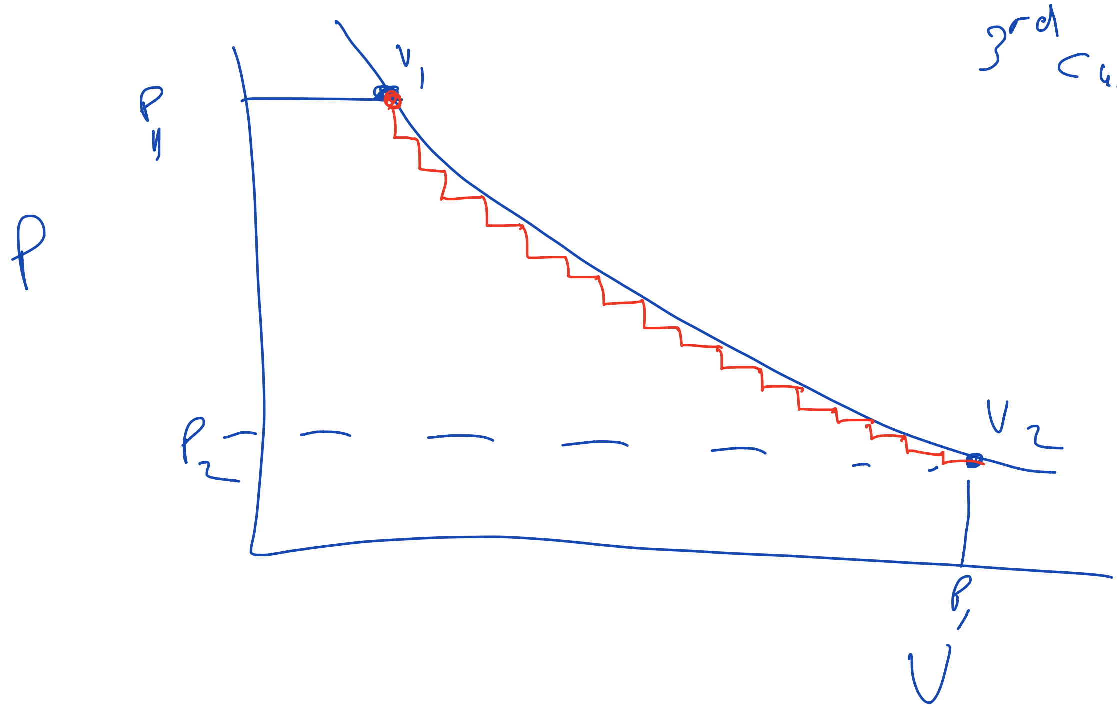
1st case

$dw = -P_{ext}\, dV$

$w = -\int P_{ext}\, dV = -P_2(V_2 - V_1)$

↑ 2nd case

3rd case



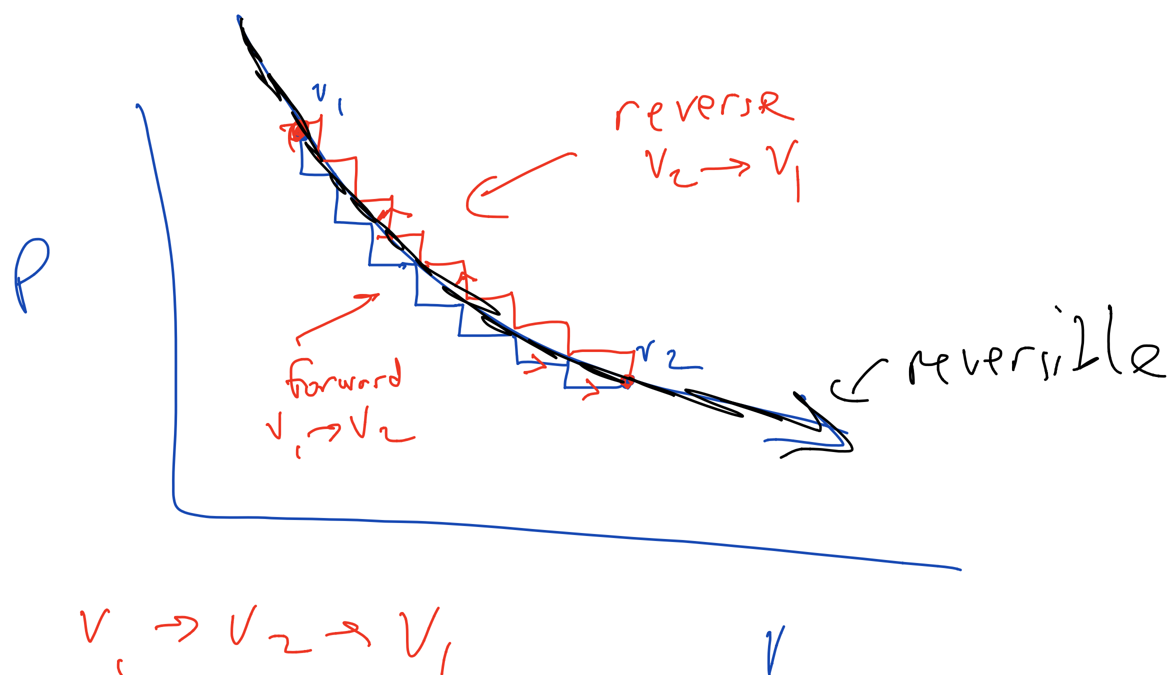
Reversible Process

→ isoT expansion of I.G.

→ $W = \underline{W_{max} \text{ done by system}}$

→ system is always infinitesimally away from equilibrium

→ effectively: system always at equilibrium !!!!!!



$V_1 \to V_2 \to V_1$

$\boxed{\text{environment did net work}}$

Implication:

consider: process $\underset{\text{equil}}{1} \longrightarrow \underset{\text{equil}}{2}$

$\Delta U = U_2 - U_1 \leftarrow$ state function

Reversible Process $1 \rightarrow 2$

Irreversible Process $1 \rightarrow 2$

$$dU_{rev} = \text{đ}q_{rev} + \text{đ}W_{rev}$$

$$dU_{irrev} = \text{đ}q_{irrev} + \text{đ}W_{irrev}$$

$$0 = \text{đ}q_{rev} - \text{đ}q_{irrev} + \text{đ}W_{rev} - \text{đ}W_{irrev}$$

$$\underline{\text{đ}W_{irrev}} - \underline{\text{đ}W_{rev}} = \text{đ}q_{rev} - \text{đ}q_{irrev}$$

$$0 < \text{đ}q_{rev} - \text{đ}q_{irrev}$$

$$\boxed{\text{đ}q_{rev} > \text{đ}q_{irrev}}$$