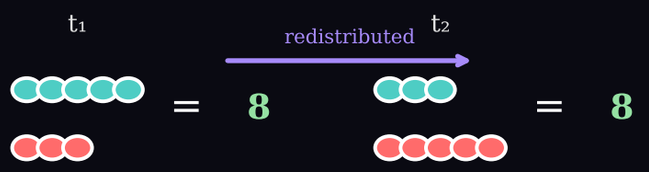
Conservation and the "Meaningless Victory"
Why Chemical Equilibrium Exists

A. Conservation Law

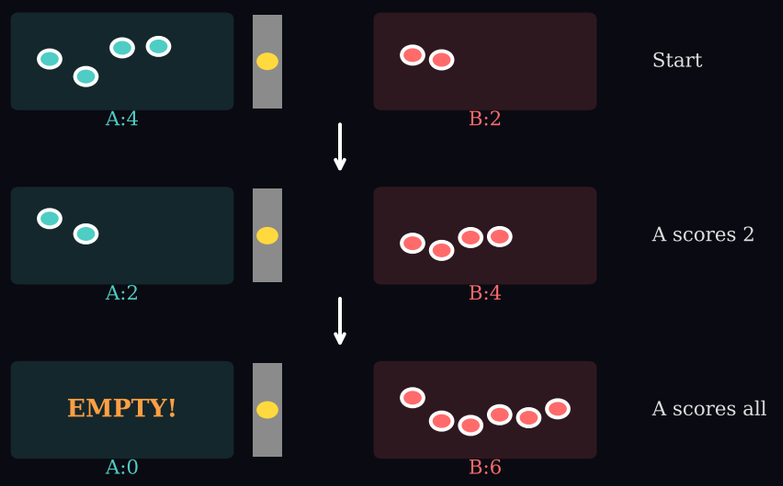
$$n_A(t) + n_B(t) = N$$

Total balls = constant

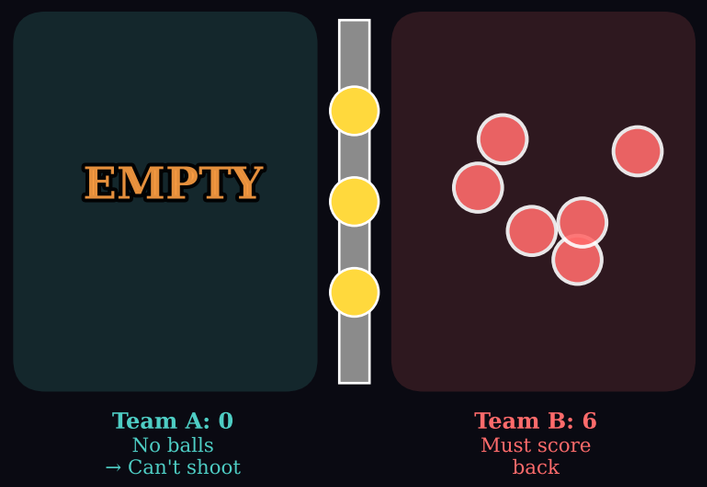


Distribution changes, total conserved

B. Team A Scores Repeatedly



GAME HALTED



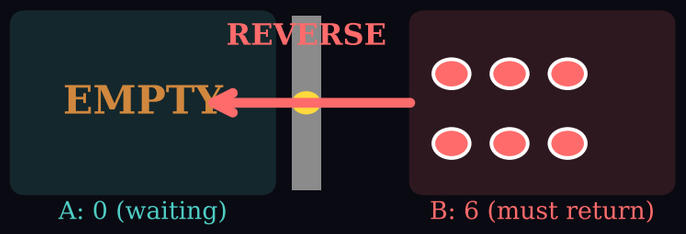
Team A: 0
No balls
→ Can't shoot

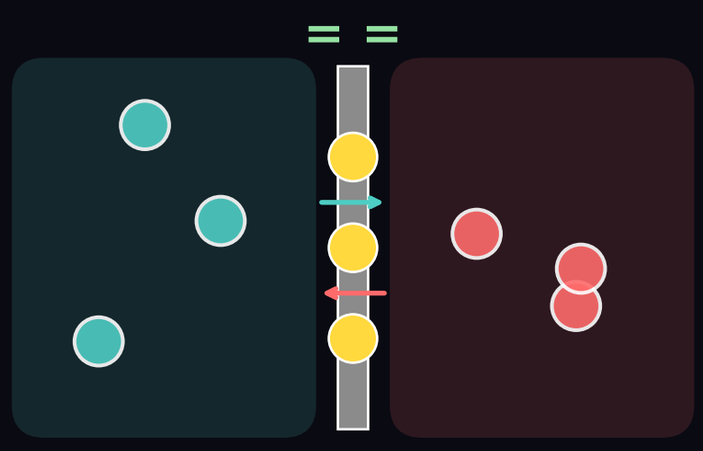
Team B: 6
Must score back

D. Forced Direction Reversal

$$Rate_A = f(n_A) = 0$$

Forward halts → Reverse proceeds





"Everybody plays, nobody wins"

F. Dynamic ≠ Static

STATIC VIEW [X]

"Reaction stops"

"Nothing happens"

DYNAMIC VIEW [OK]

"Both reactions continue"

"Rates are equal"

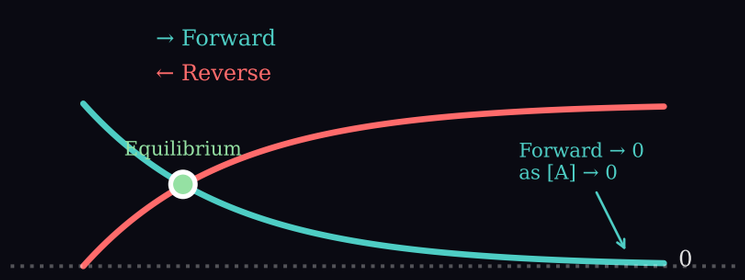
$Rate_{\rightarrow} = Rate_{\leftarrow}$

A ⇌ B at equilibrium:

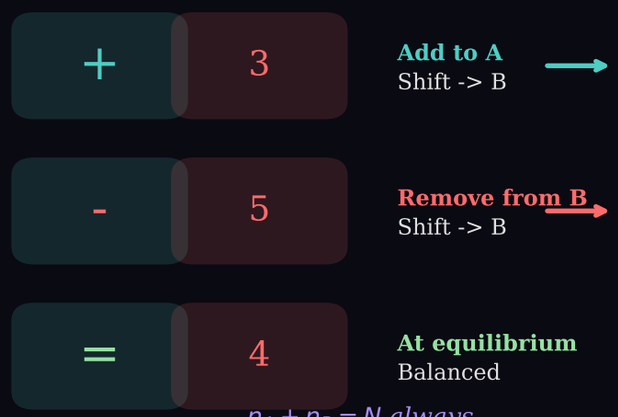
Both directions proceed continuously

G. Complete Conversion Impossible

[A] → 0 means Forward → 0



H. Le Chatelier from Conservation



$n_A + n_B = N$ *always*

I. The Meaningless Victory Theorem

THEOREM

If Team A scores all balls:

$$n_A = 0 \Rightarrow \text{Rate}_A = 0$$

"Victory" halts the game

Equilibrium = sustained play, not winning

Chemical: [A]→0 halts reaction → equilibrium required