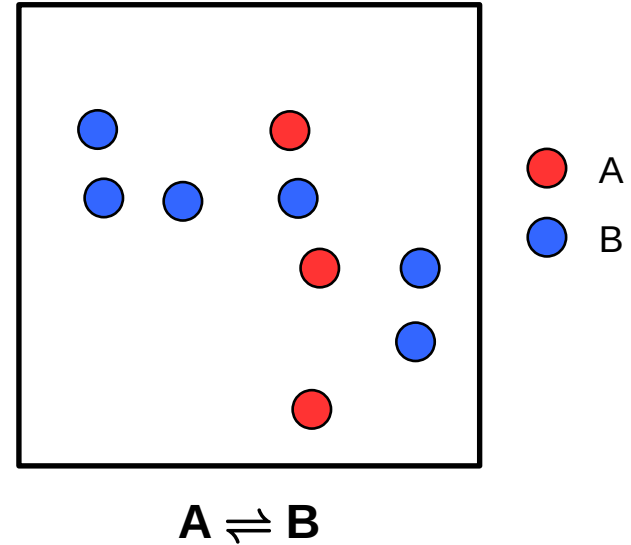


Essential Question

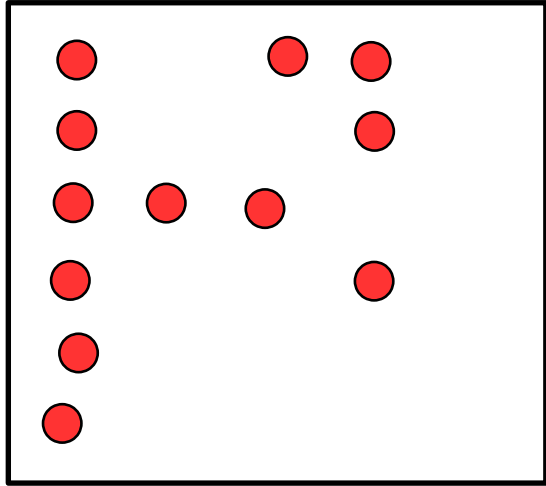
How can pictures show a reaction at equilibrium?

Particle Diagrams

- Each particle = one molecule
- Count particles to compare amounts
- Same box $\rightarrow$ counts act like concentrations

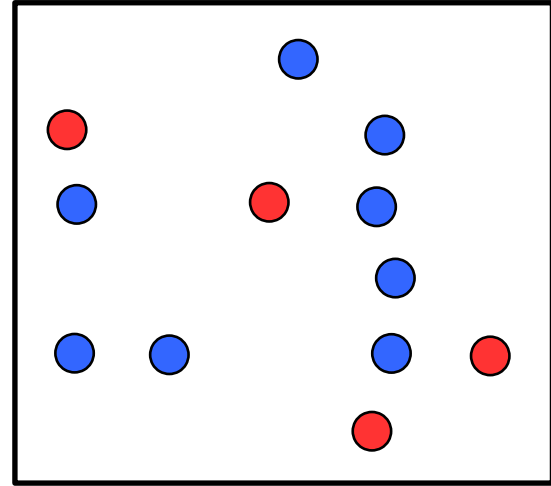


Before and At Equilibrium



Start: 12 A, 0 B

time →

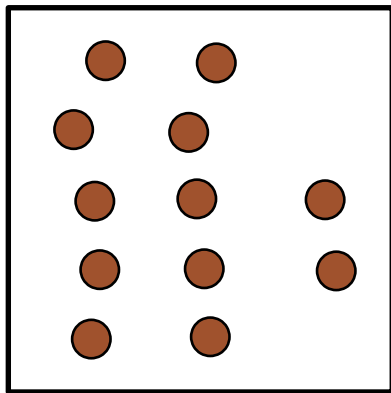


Equilibrium: 4 A, 8 B

Both A and B are present at equilibrium.

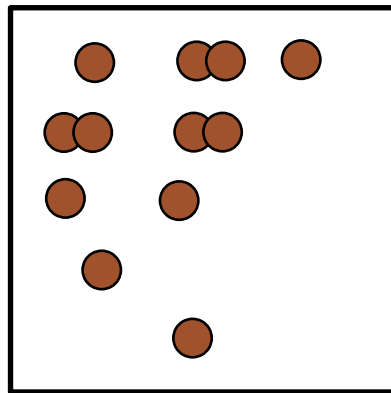
Representations of Equilibrium

Snapshots Over Time: $2\text{NO}_2 \rightleftharpoons \text{N}_2\text{O}_4$



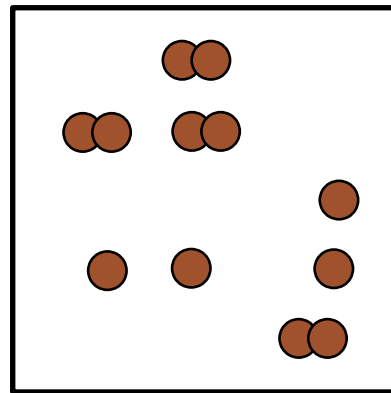
t_1

$12 \text{NO}_2, 0 \text{N}_2\text{O}_4$



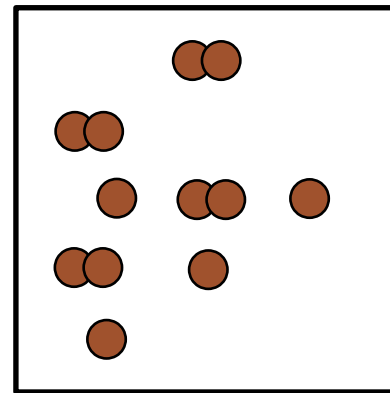
t_2

$6 \text{NO}_2, 3 \text{N}_2\text{O}_4$



t_3

$4 \text{NO}_2, 4 \text{N}_2\text{O}_4$



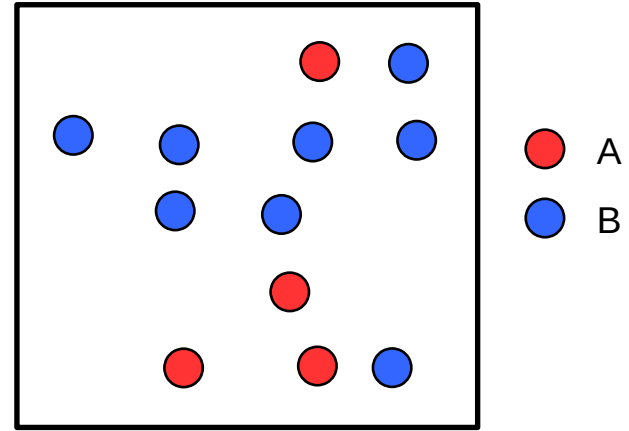
t_4

$4 \text{NO}_2, 4 \text{N}_2\text{O}_4$



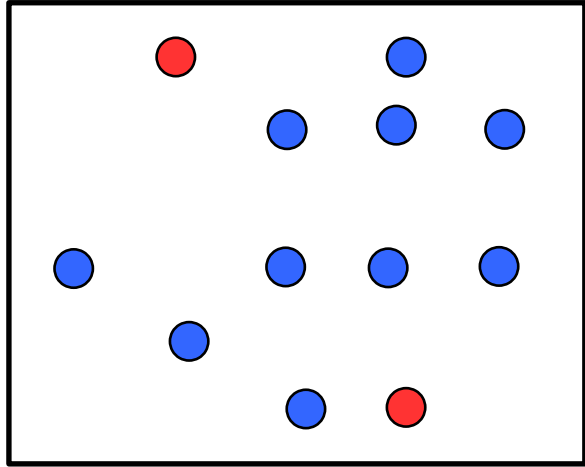
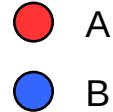
Finding K from a Picture

- Count each kind of particle
- Plug the counts into the K expression



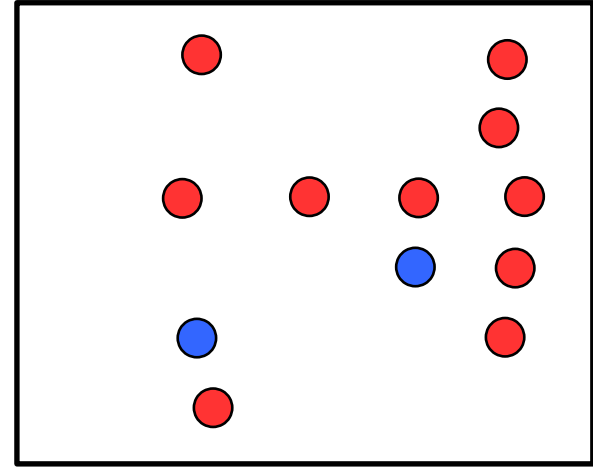
$$K = \frac{[B]}{[A]}$$

Pictures of Large and Small K



$$K = 10/2 = 5$$

$$K > 1$$

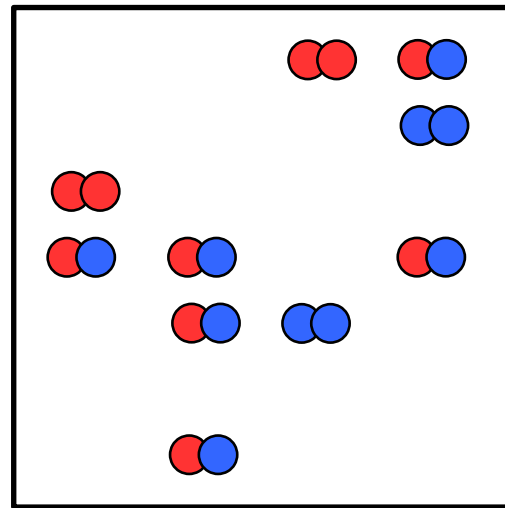
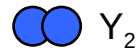


$$K = 2/10 = 0.2$$

$$K < 1$$

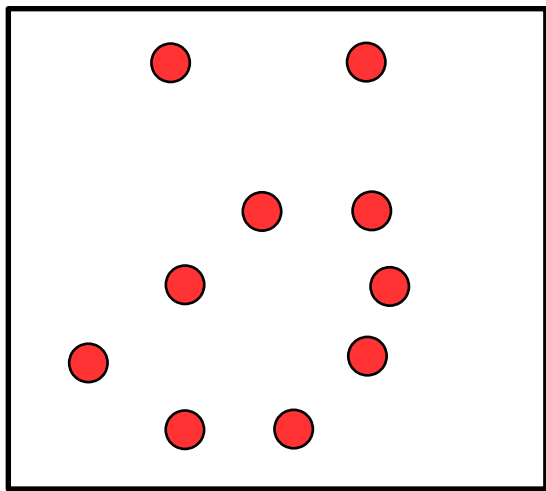
Example: K from a Particle Diagram

The box shows $X_2 + Y_2 \rightleftharpoons 2XY$ at equilibrium. Each particle represents 0.10 mol. The volume is 1.0 L. Calculate K_c .



Example: Draw the Equilibrium Mixture

For $A \rightleftharpoons B$, $K = 4.0$. The left box shows the starting mixture. Draw the mixture at equilibrium.



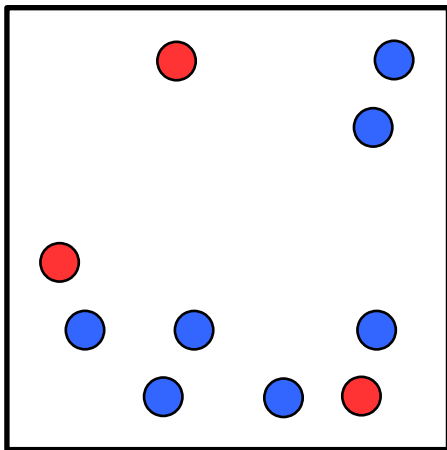
Start



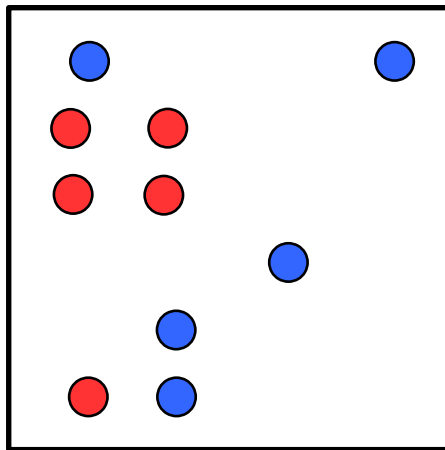
Equilibrium

Example: Which Box Has $K < 1$?

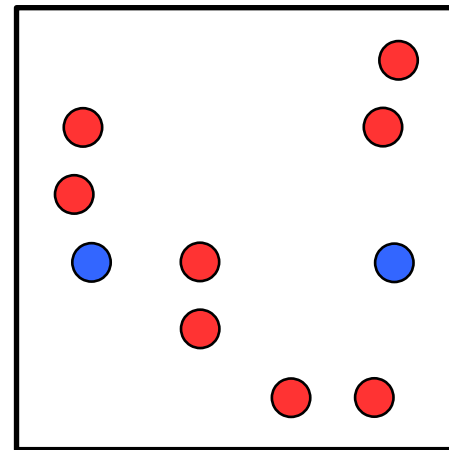
Each box shows $A \rightleftharpoons B$ at equilibrium. Which box represents a reaction with $K < 1$? Justify your answer.



Box 1



Box 2



Box 3

Big Ideas

- Count particles in each box
- Counts compare like concentrations
- Equilibrium: counts stop changing
- Plug counts (or M) into K

