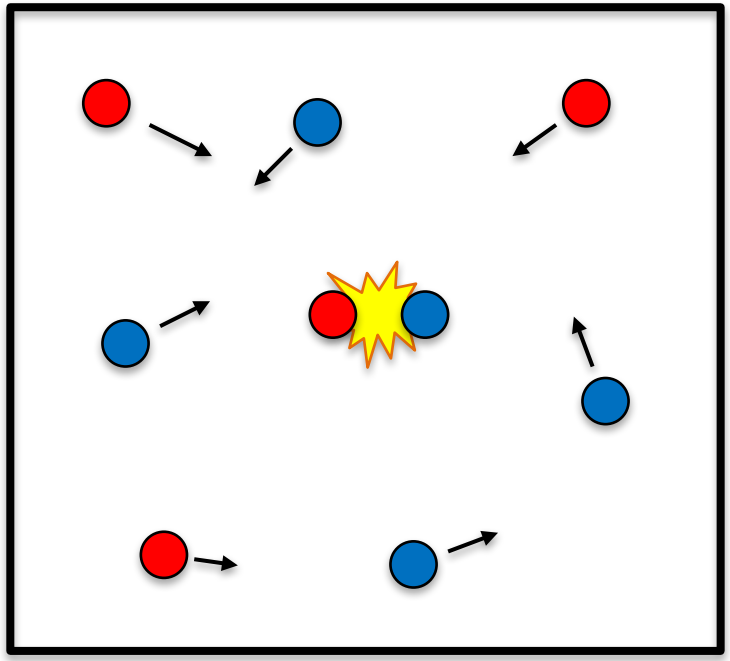
Essential Question

Why don't all collisions cause a reaction?

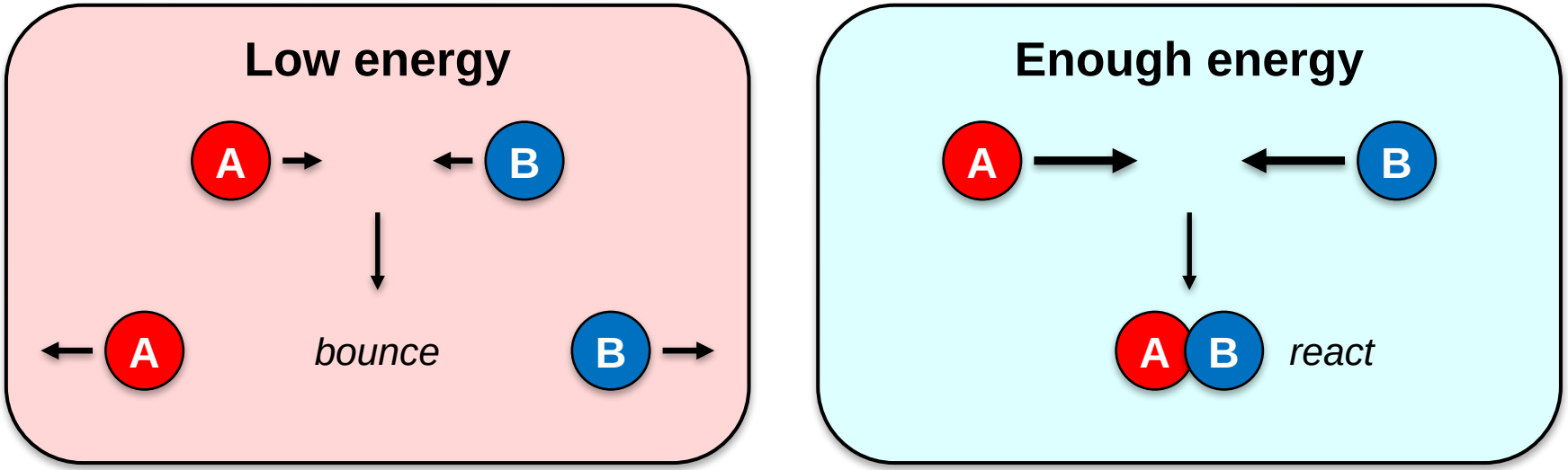
Particles Must Collide

- Bonds break and form during collisions
- More collisions per second → faster rate



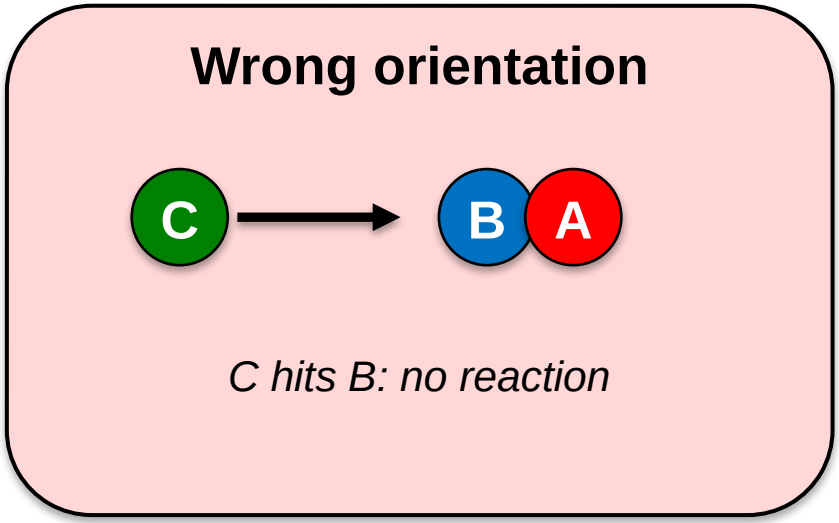
Enough Energy

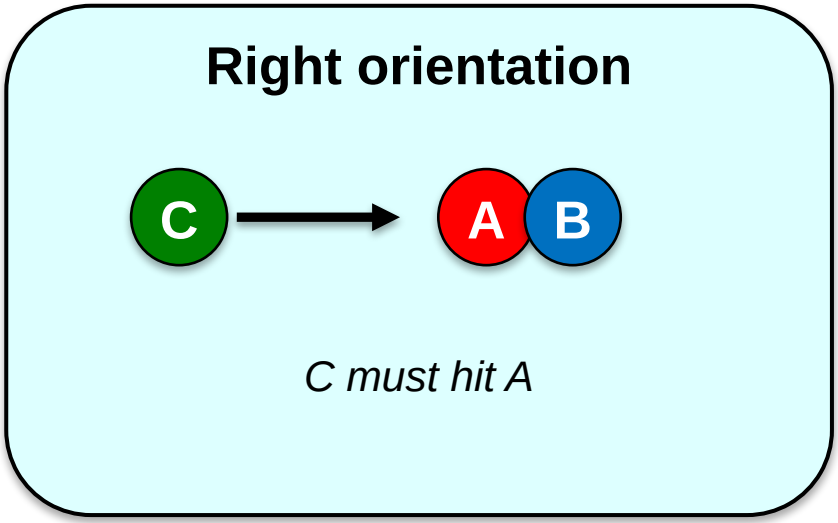
- Collision energy must be at least E_a
- Too little energy → particles bounce apart



Correct Orientation

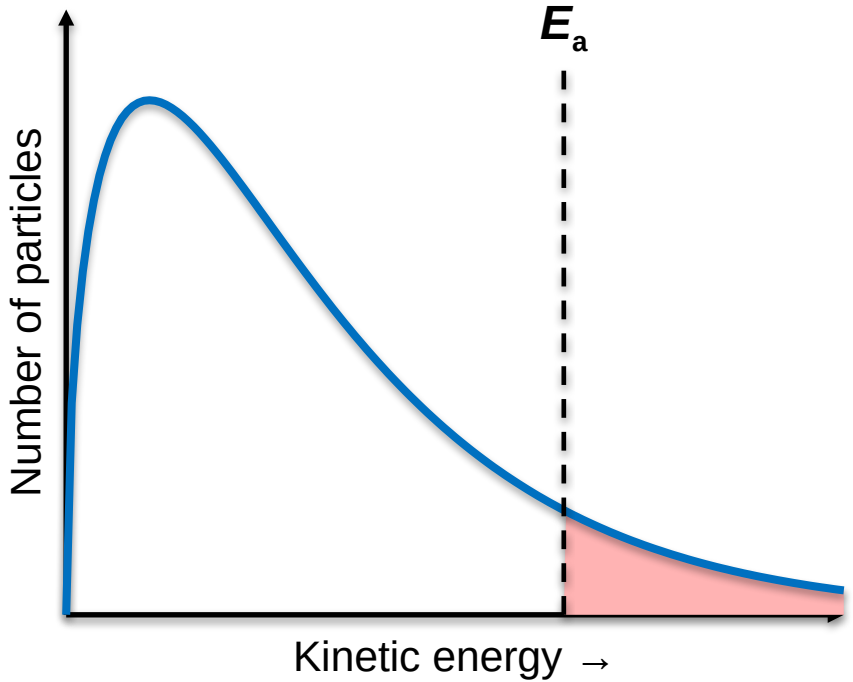
- Particles must hit in the right spot
- Wrong orientation → no reaction, even with enough energy





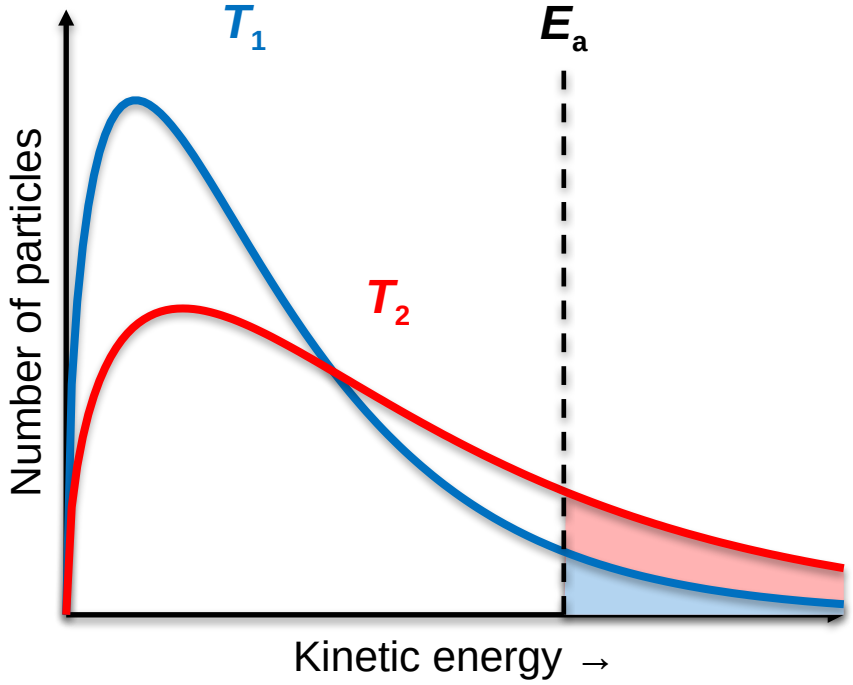
Energy of Collisions

- Particles have a range of energies
- Only those with $E \geq E_a$ can react
- Shaded area = fraction that can react



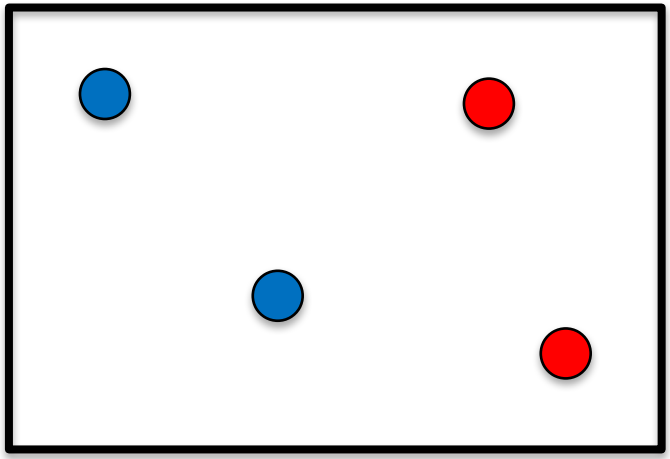
Effect of Temperature

- Higher T → more particles with $E \geq E_a$
- More successful collisions → faster rate

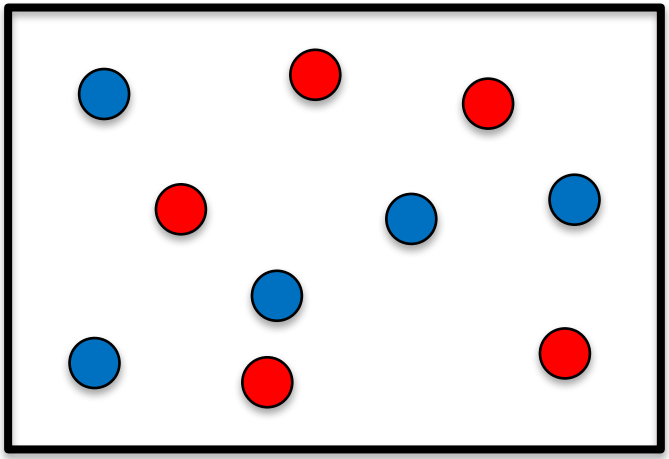


Effect of Concentration

- More particles in the same volume
- More collisions per second → faster rate



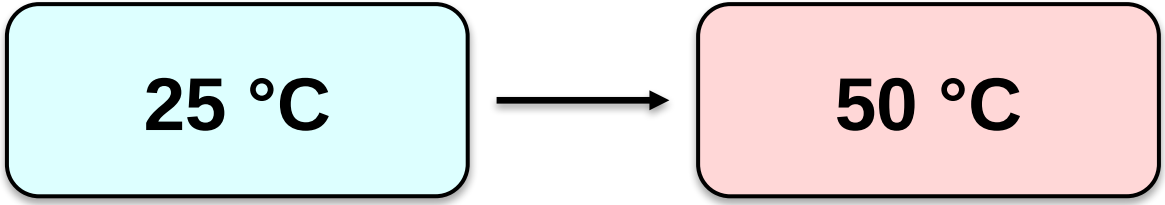
Low concentration



High concentration

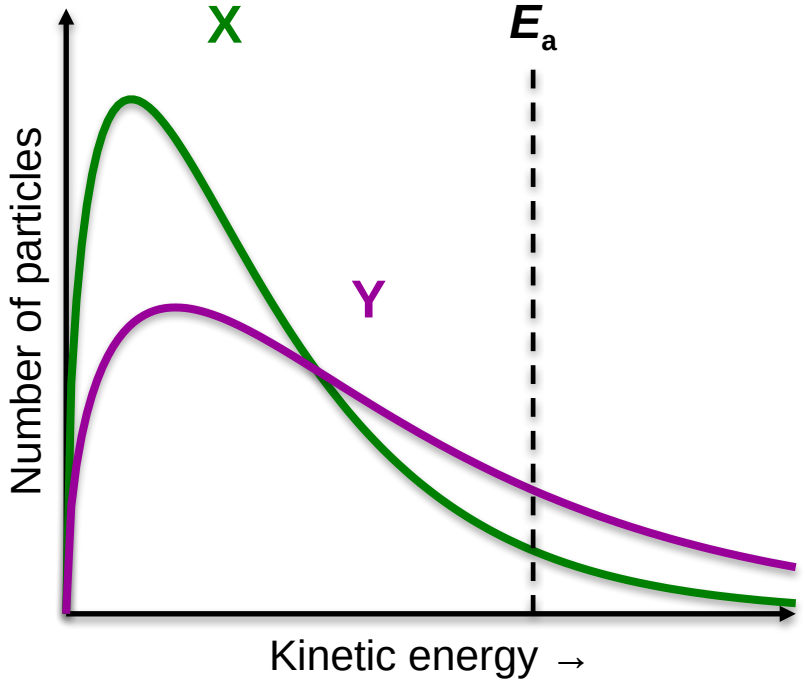
Example: Explaining Temperature

Use the collision model to explain why a reaction is faster at 50 °C than at 25 °C.



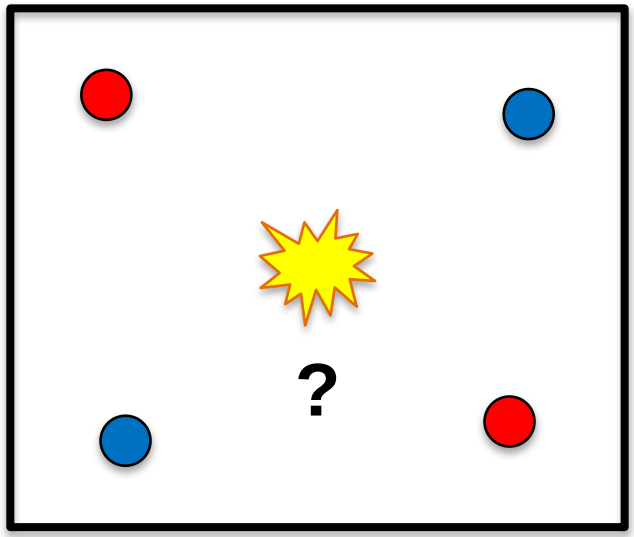
Example: Comparing Distributions

Curves X and Y show the same gas at two temperatures. Which curve is at the higher temperature? Which has more collisions that can react?



Example: Unsuccessful Collisions

In a gas, particles collide billions of times each second, but only a small fraction of collisions make products. Give two reasons a collision might not make products.



Collision Model

Big Ideas

- Particles must collide to react
- Collisions need $E \geq E_a$
- Collisions need the right orientation
- Higher $T \rightarrow$ more collisions with enough energy

