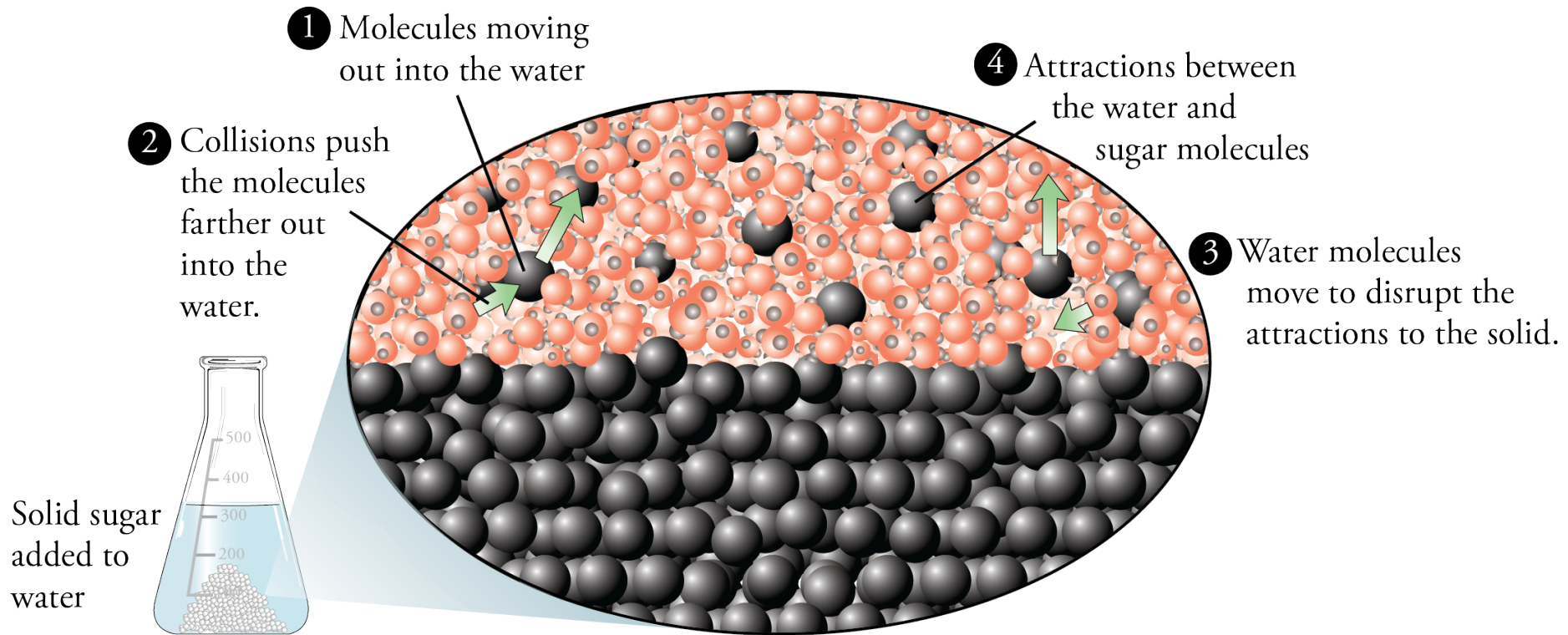


Questions to Answer



- What's happening at the molecular level as a solid dissolves in a liquid?
- Why is there a limit to the amount of solid that will dissolve in a given amount of solvent?
- What's going on when a mixture reaches the solubility limit?
- Why does powdered solid dissolve faster than solid with larger particles?
- How does agitation or stirring affect the process?
- How does temperature affect the process?
- Do particle size, agitation, or temperature change the solubility limit?

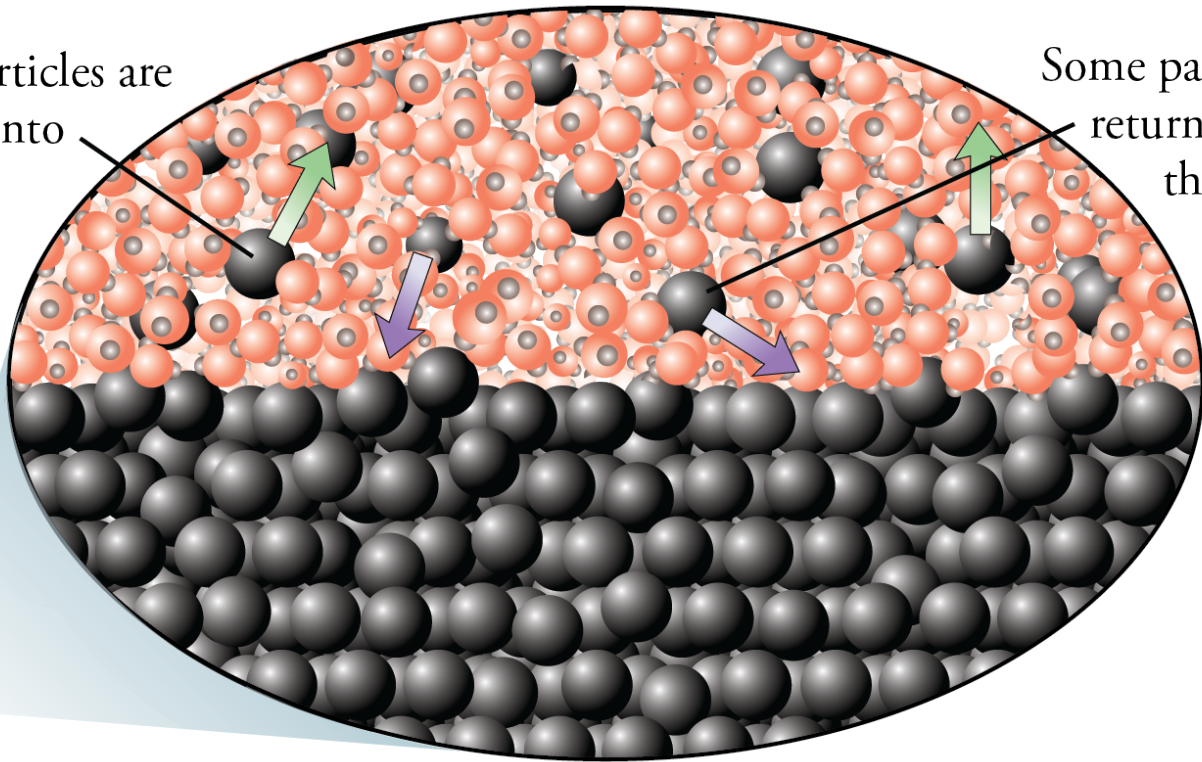
Particles into Solution



Particles Return to Solid

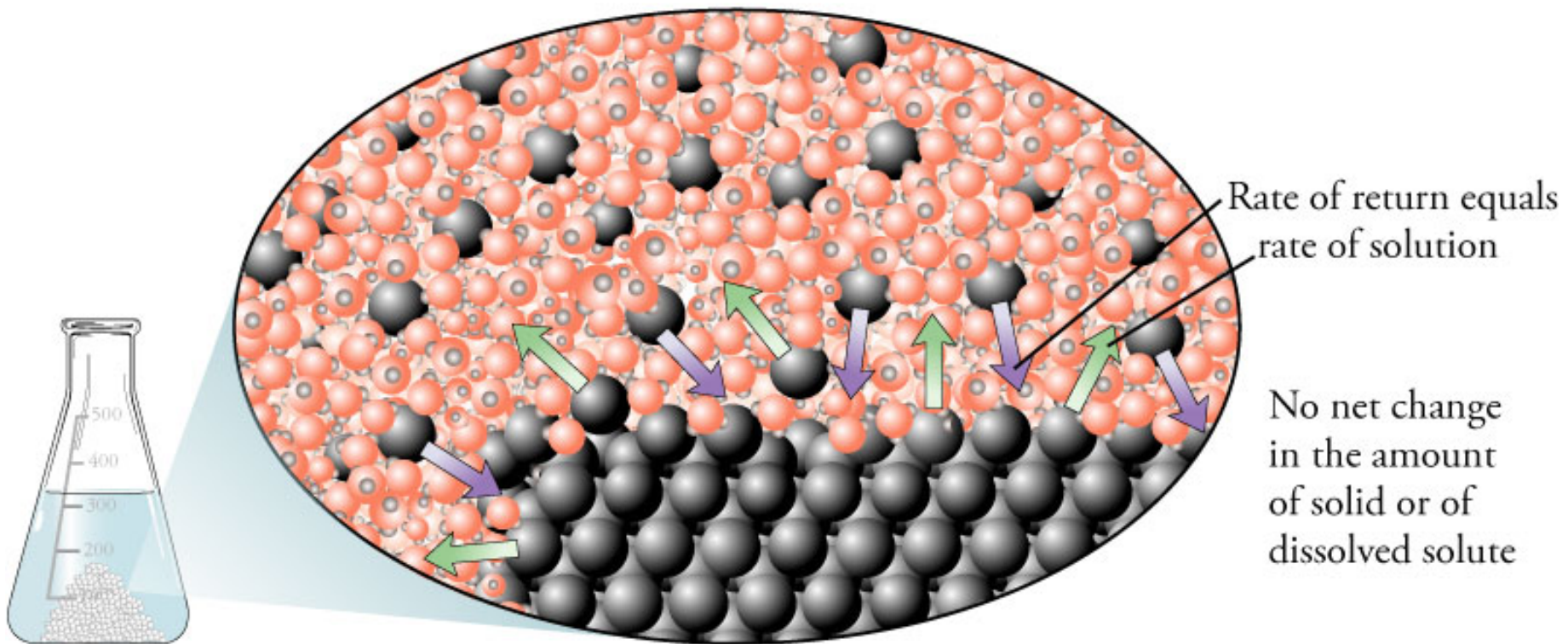
Some particles are moving into solution

Some particles are returning to the solid

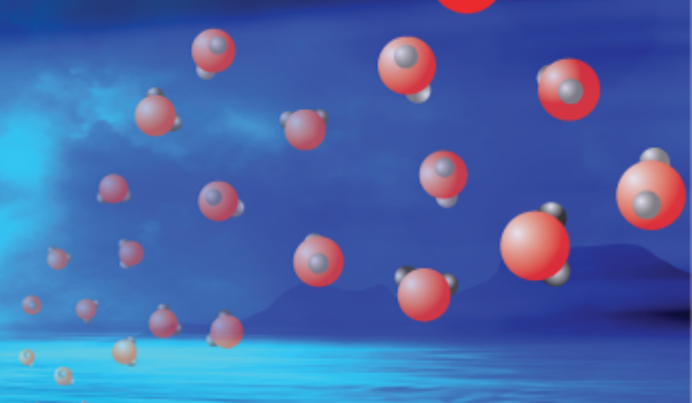


Solid sugar
added to
water

Dynamic Equilibrium in a Saturated Solution



Dynamic Equilibrium and Saturated Solutions



Addition of a large amount of solid to a liquid



Initially, rate of solution is greater than the rate of return



Net increase in number and concentration of particles in solution



Increased rate of collision between dissolved particles and solid



Increased rate of return...



...Until rate of return equals rate of solution



Constant changes from solid to dissolved solute and back,
but no net change in amounts of solid and dissolved solute



Saturated solution due to dynamic equilibrium

Saturated and Unsaturated Solutions

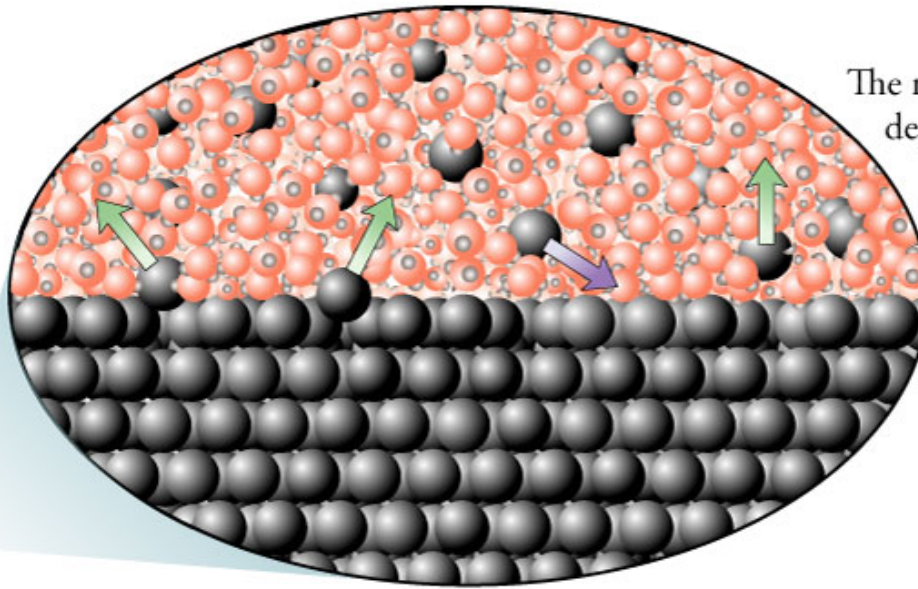
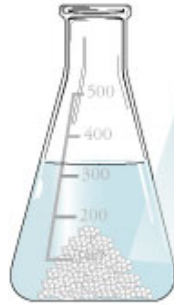
- A **saturated solution** is a solution that is at the solubility limit, either because
 - it contains an excess of solid with a dynamic equilibrium between the rate of solution and the rate of return
 - or it has reached the dynamic equilibrium and the excess solid has been filtered out.
- An **unsaturated solution** is a solution that has less solute than the solubility limit, either because
 - all the solid dissolves before the dynamic equilibrium is reached
 - or there just has not been enough time for the dynamic equilibrium to be reached.

Rate of Solution Dependent on:

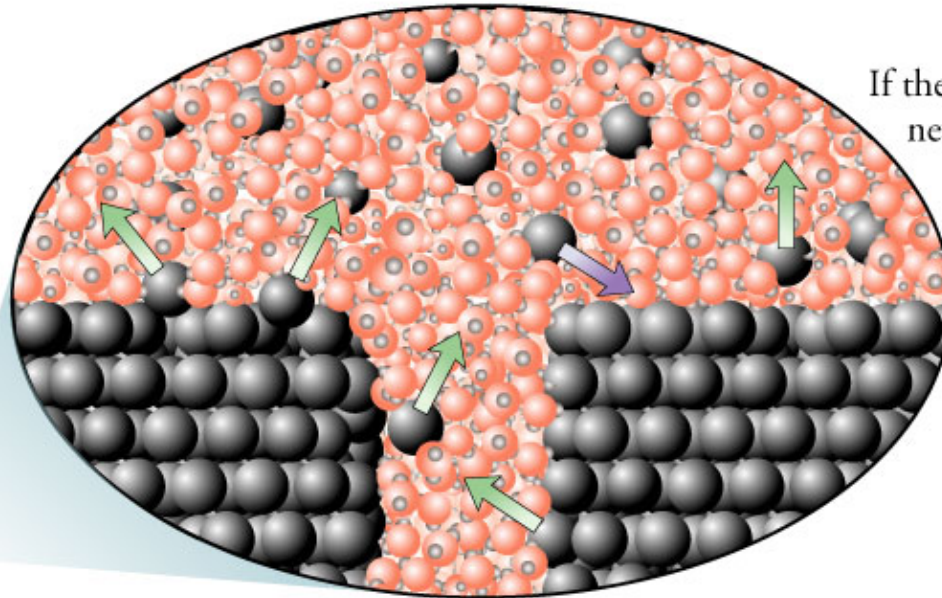
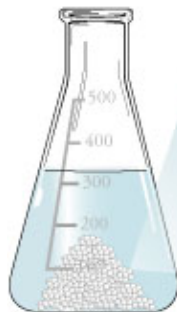


- Surface area of the solute
- Degree of agitation or stirring
- Temperature

Surface Area and Rate of Solution



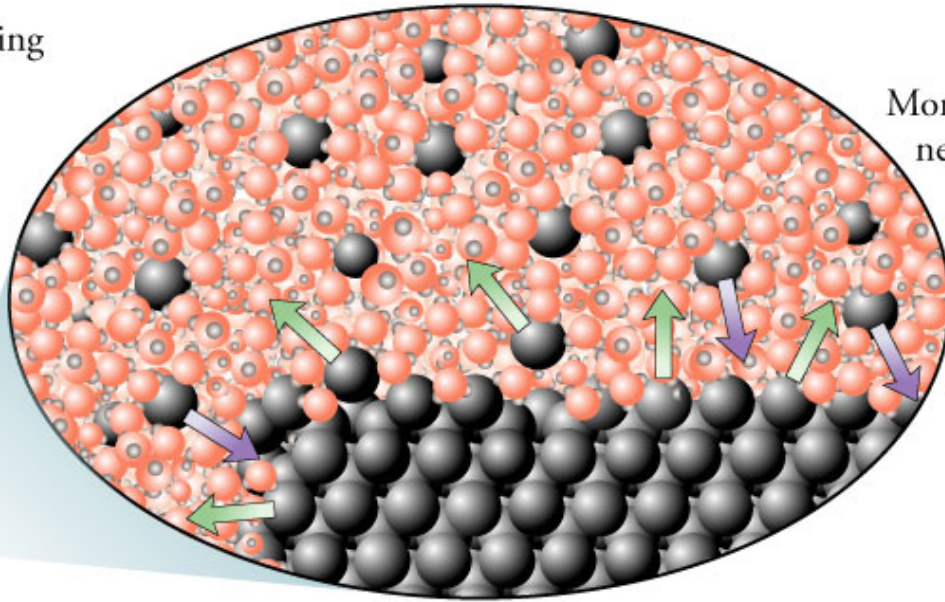
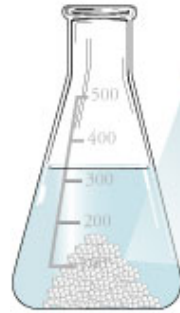
The rate of solution depends on the number of particles at the solid's surface.



If the solid is fragmented, new surfaces are exposed, allowing more particles to escape into solution.

Agitation and Rate of Solution

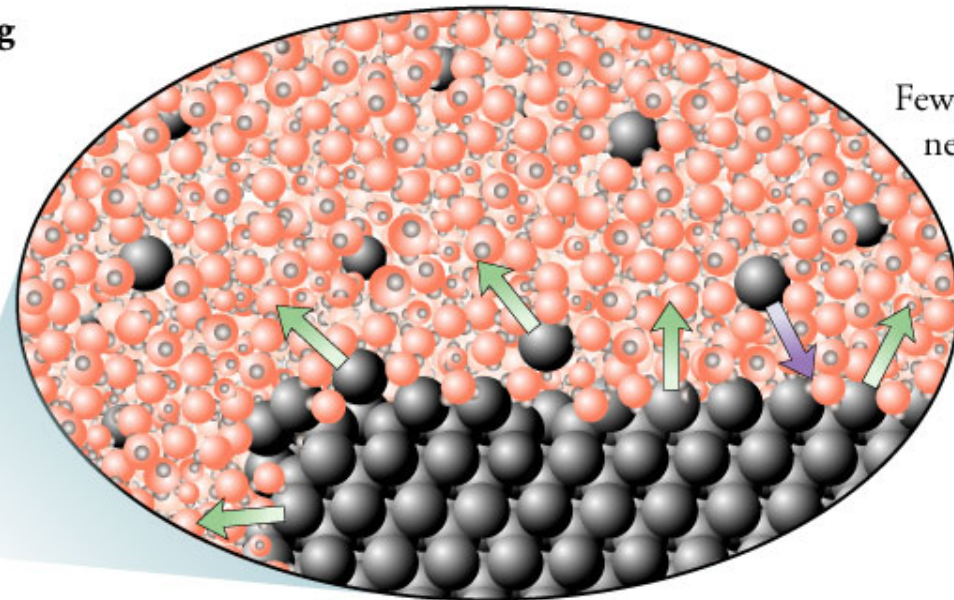
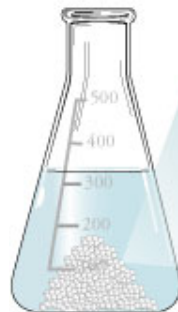
Without stirring



More particles near the solid leads to a higher rate of return.

Lower net rate of solution

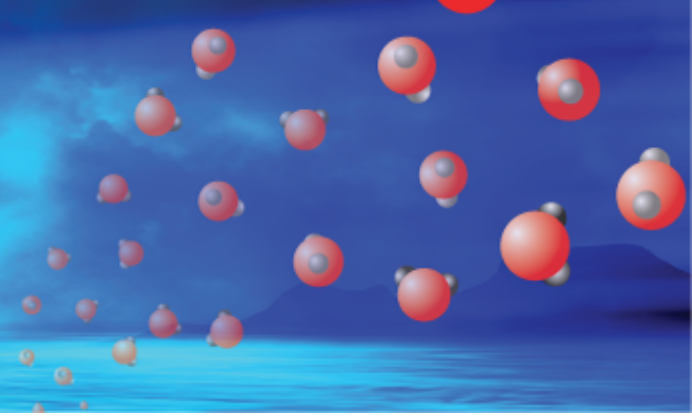
With stirring



Fewer particles near the solid leads to a lower rate of return.

Higher net rate of solution

Agitation and Rate of Solution



Increased agitation



Decreased concentration of dissolved solute particles near the solid



Decreased rate of return to the solid



Increased difference between the rate of solution and the rate of return



Increased net rate of solution

Temperature and Rate of Solution

Increased temperature



Increased velocity of particles



Particles in solution move away from the solid more rapidly



Increased net rate of solution

Temperature and Increased Solubility Limit

