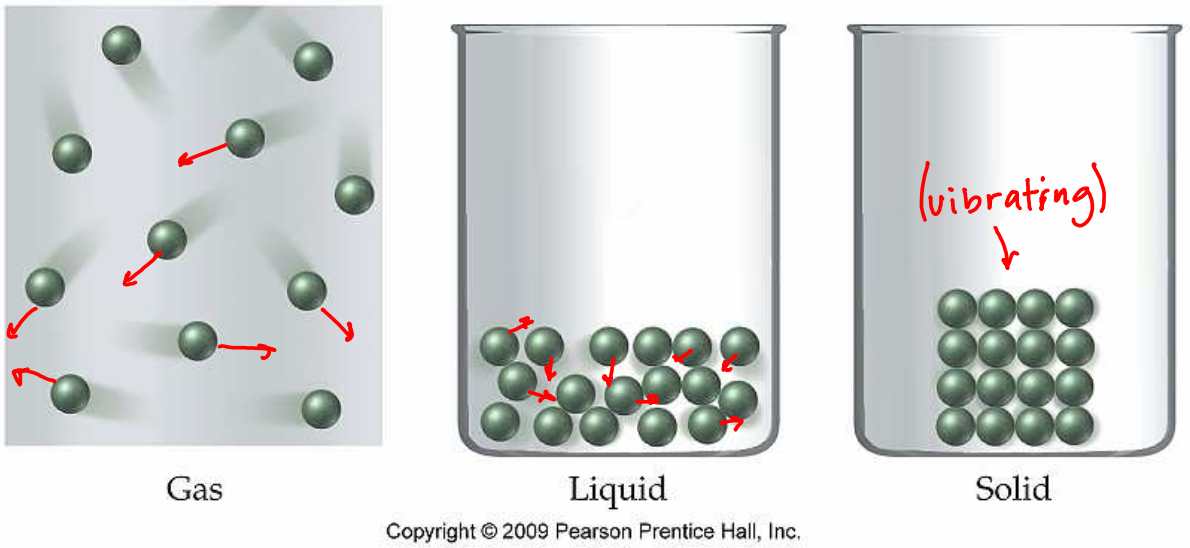
Phase	Density	Compressibility	Reason
(g)	low	yes	space between molecules
(l)	high	no	close together
(s)	high	no	close together



definite or indefinite

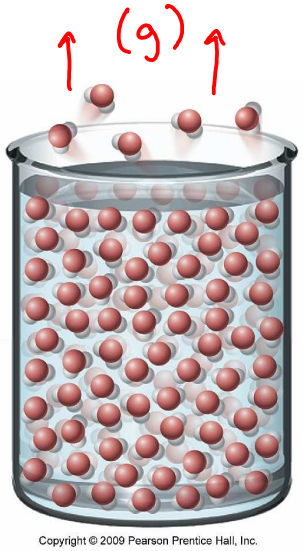
Phase	Shape	Fluid or rigid?	Reason
(g)	indefinite	fluid	fast molecular motion
(l)	indef	fluid	fast molecular motion
(s)	definite	rigid	locked in place vibrating

Intermolecular forces: forces that attract one molecule to other molecules around it

If there were no intermolecular forces, what phase would all molecular substances be?

In order to convert liquid to gas, the intermolecular forces that hold the molecules close to each other in the liquid must be overcome.

In a sample of room-temperature water, the molecules with the highest energy will move the fastest.



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When a faster molecule finds the surface, it launches into the gas phase - this process is called: evaporation

$H_2O(l) \rightarrow H_2O(g)$ absorbs heat, feels cold

Evaporation is **endothermic** - heat energy is absorbed into the liquid in order to overcome the intermolecular forces so a molecule can break away from the rest.

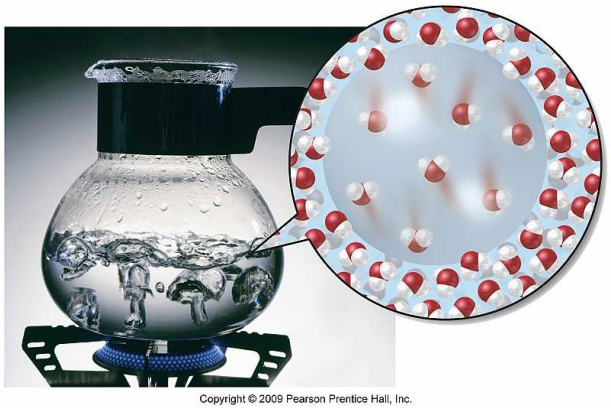
The opposite process, $H_2O(g) \rightarrow H_2O(l)$ is called: condensation

It gives off heat because the gas molecules slow down - this is an **exothermic** process.

Boiling and the heating curve

Heating a liquid makes it molecules move: faster

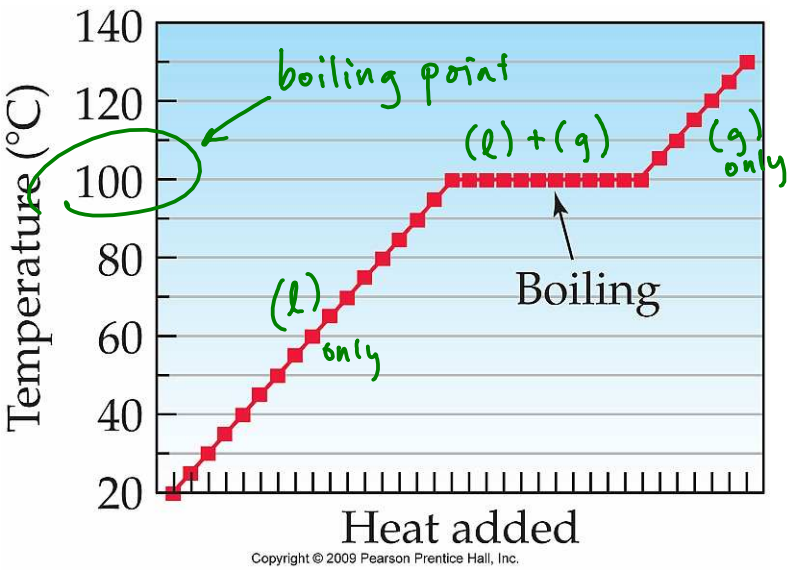
Eventually, they will all be moving fast enough to break free into the gas phase - even those in the interior of the liquid (not just at the surface like in evaporation).
This process is called: boiling (is endothermic)



Heat added to a liquid can do one of two things:

1. Raise the temperature
2. Perform a phase change

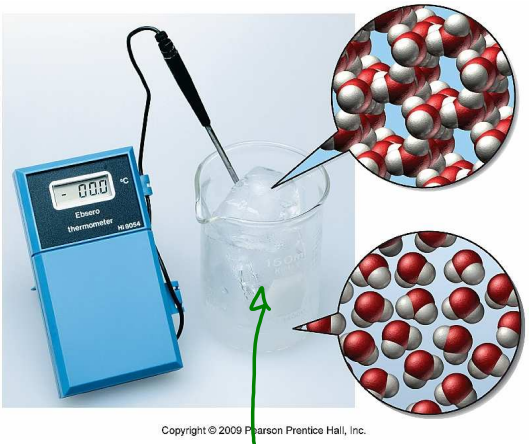
…but only one at a time!!



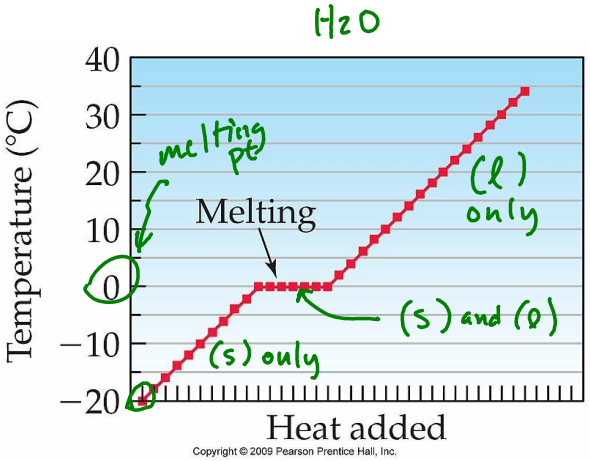
Is boiling endothermic or exothermic?

heating curve

Melting, freezing, sublimation



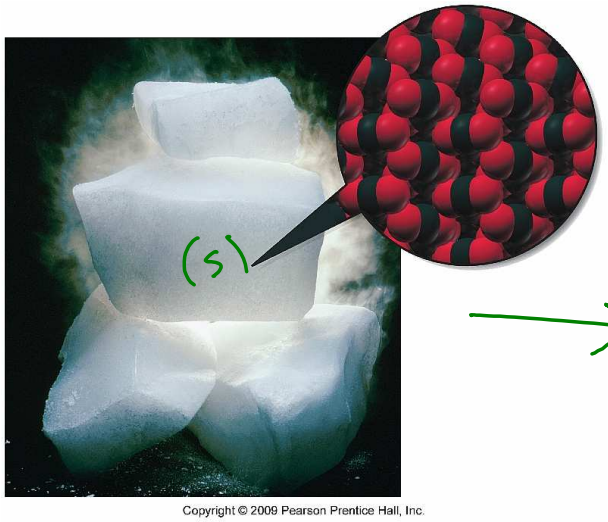
(s) + (ℓ)

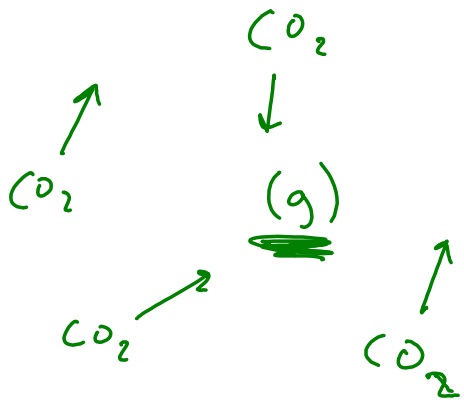


Melting: $H_2O(s) \rightarrow H_2O(\ell)$ endothermic *or* exothermic?

Freezing: $H_2O(\ell) \rightarrow H_2O(s)$ endothermic *or* exothermic?

Sublimation: $H_2O(s) \rightarrow H_2O(g)$ endothermic *or* exothermic?





$CO_2(s) \rightarrow CO_2(g)$

dry ice