

LeChatelier's Principle

LeChatelier's Principle:

If a closed system at equilibrium is subjected to a change, processes will occur that tend to counteract that change.

- "Counteract" usually mean that the equilibrium will shift to the right or to the left.
- "Processes" means that if you do something to a system at equilibrium, the system will shift in such a way as to try and undo what you just did. It will try and counteract the stress that has been applied.
- Remember, equilibrium only occurs in a closed system.

Examples of Stresses that upset the equilibrium:

Concentration, Temp., Pressure

Effects of Changes in Concentration

If the concentration of a substance in an equilibrium system is increased by us, the equilibrium will shift toward the opposite side of the equation, in order to counteract the change/relieve the stress.

Or

If the concentration of a substance in an equilibrium system is decreased by us, the equilibrium will shift toward the side of the equation with that substance, in order to counteract the change/relieve the stress.

Consider the equilibrium equation:



If we add some H_2 to a flask containing this mixture at equilibrium, the concentration of H_2 ($[\text{H}_2]$) will immediately increase. In order to counteract this change, the equilibrium will right in order to "use up" some of the extra H_2 . (In other words to decrease the $[\text{H}_2]$.)

Consider the equilibrium equation:



Let's say now that we somehow take away some I_2 . $[\text{I}_2]$ will immediately decrease.

In order to counteract this change, the equilibrium will shift left in order to increase $[\text{I}_2]$ again.

If we were to add some HI, the $[\text{HI}]$ would immediately increase in order to counteract this change, the equilibrium would shift to the left.

Some examples to try:

Given the equilibrium equation:



- If the $[\text{PCl}_5]$ is increased, the equilibrium will shift to the right.
- If the $[\text{PCl}_5]$ is decreased, the equilibrium will shift to the left.
- If the $[\text{PCl}_3]$ is increased, the equilibrium will shift to the left.