**Temperature and Equilibrium Constant**

The value of the **equilibrium constant** is determined by just two variables:

* the reaction



Changing concentration and pressure can affect the equilibrium but DOES NOT affect the equilibrium constant.

* the temperature.

The equilibrium constant is **not** effected by concentrations, pressures or the use of a catalyst.

The effect of a temperature change depends on whether the reaction is **exothermic** (-ve ∆H) or **endothermic** (+ve ∆H). With higher temperatures favouring endothermic reactions, lower temperatures favouring exothermic reactions.

The change can be summarised as follows:

|  |  |  |
| --- | --- | --- |
| **Enthalpy Change** | **Temp ⇧** | **Temp ⇩** |
| -ve (exothermic) | More reactants K ⇩ | More products K ⇧ |
| +ve (endothermic) | More products K ⇧ | More reactants K ⇩ |

**Why does the equilibrium and K change?**

A change in temperature will effect both the forward and reverse both reaction rates, but does not affect both reaction directions evenly.

**Explanation (detailed)**

*Changing the temperature effects the rate of reaction of both forward and reverse directions, but has a greater effect on the direction with the larger activation energy, due to a greater change in the* ***proportion*** *of particles with sufficient activation energy.*

**Example**

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Raising the temperature from 20 to 30 oC for a reaction with an activation energy of 50 kJ mol-1 increases the fraction of collisions with enough energy to react by greater than 95%. The same increase in temperature for a reaction with an activation energy of only 40 kj mol-1 produces only a 75% increase in the fraction of collisions with enough energy to react.

* In an exothermic reaction increasing the temperature increases the rate of both the forward and the reverse reactions. But the reverse reaction increases more (the side with the larger activation energy). This results in an overall effect of favouring the left (reactants).
* The opposite is the case for and endothermic reaction

