

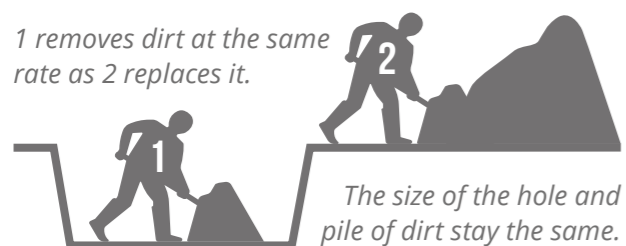
EQUILIBRIUM AND LE CHÂTELIER'S PRINCIPLE

Reversible chemical reactions reach equilibrium in closed systems (no substances added or lost). Here's how different conditions affect that equilibrium.

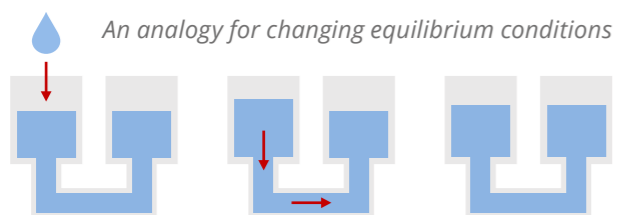
EQUILIBRIUM



In reversible reactions products of the reaction can react to produce the original reactants. At dynamic equilibrium the rates of the forwards and backwards reactions are equal; the concentrations of the reactants and products don't change.



LE CHÂTELIER'S PRINCIPLE



Le Chatelier's principle states that when a change is made to the conditions of a dynamic equilibrium, the system moves to counteract the change, causing changes in quantities of reactants and products.

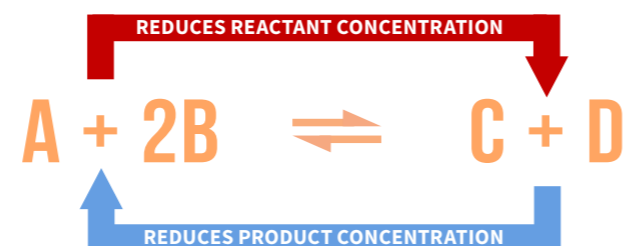
CONCENTRATION

REACTANT CONCENTRATION INCREASED

The equilibrium position shifts to reduce the reactant concentration.

REACTION FORMING PRODUCTS FAVOURED

In the example below the new equilibrium mixture will contain a higher concentration of C and D.



Increasing concentration of one side favours the other.

PRODUCT CONCENTRATION INCREASED

The equilibrium position shifts to reduce the product concentration.

REACTION FORMING REACTANTS FAVOURED

In the example above the new equilibrium mixture will contain a higher concentration of A and B.

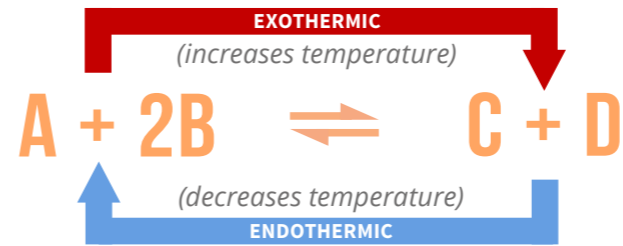
TEMPERATURE

TEMPERATURE INCREASED

The equilibrium position shifts to reduce the temperature.

THE ENDOTHERMIC REACTION WILL BE FAVOURED

In the example below the new equilibrium mixture will contain more A and B, and less C and D.



If the forward reaction is exothermic, the backward reaction will be endothermic, and vice versa.

TEMPERATURE DECREASED

The equilibrium position shifts to increase the temperature.

THE EXOTHERMIC REACTION WILL BE FAVOURED

In the example above the new equilibrium mixture will contain more C and D, and less A and B.

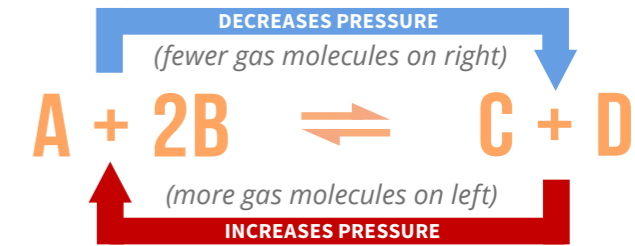
PRESSURE

PRESSURE INCREASED

The equilibrium position shifts to reduce the pressure.

SIDE OF REACTION WITH FEWER GAS MOLECULES FAVOURED

In the example below the new equilibrium mixture will contain more C and D, and less A and B.



If the number of gas molecules is the same on either side, then changing pressure will have no effect.

PRESSURE DECREASED

The equilibrium position shifts to increase the pressure.

SIDE OF REACTION WITH MORE GAS MOLECULES FAVOURED

In the example above the new equilibrium mixture will contain more A and B, and less C and D.

Note: using a catalyst increases the rate of both the forwards and backwards reactions but doesn't change the equilibrium position.

